United States
Department of
Agriculture

Forest
Service

North Central
Research
Station

Resource Bulletin
NC - 194

The Forest Resources of the Chequamegon-Nicolet National Forest

David E. Haugen, Phillip C. Freeman, and Mark A. Theisen

Contents

North Central Research Station
Forest Service—U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication November 21, 1998
1998

The Forest Resources of the Chequamegon-Nicolet National Forest

David E. Haugen, Phillip C. Freeman, and Mark A. Theisen

NOTE: *Because of different forest inventory techniques and forest definitions used by the North Central Forest Inventory and Analysis Program and the Chequamegon-Nicolet National Forest, some of the estimates shown in this report will not always match those in the Chequamegon-Nicolet's Land and Resource Management Plan.*

Statistics reported in this publication may not match statistics reported in other publications due to release dates of publications and the continued refinement of the statistical processes.

In 1998, the Chequamegon National Forest in northwestern Wisconsin and the Nicolet National Forest in northeastern Wisconsin (fig. 1) were officially designated as one Forest. Headquarters for the Forest are located in both Park Falls and Rhinelander. These two land bases are both within a day's drive of more than 7 million people in the Chicago, Duluth, Green Bay, Madison, Milwaukee, and the Twin Cities metropolitan areas. For the sake of comparison with earlier inventories, the two land bases will be discussed separately in some of the following text and tables.

David E. Haugen is a Forester in the Forest Inventory and Analysis Program at the North Central Research Station, St. Paul, Minnesota.

Phillip C. Freeman is a Forester and Interdisciplinary Land Use Planner on the Chequamegon-Nicolet National Forest at Park Falls, Wisconsin.

Mark A. Theisen is a Forest Silviculturist on the Chequamegon-Nicolet National Forest at Rhinelander, Wisconsin.

Figure 1.—*Location of the Chequamegon-Nicolet National Forest.*

HISTORY

Congress created the Chequamegon and Nicolet National Forests in 1933. The National Forest in Wisconsin is comprised of tax-forfeited land purchased from State and local governments, as well as land purchased from private individuals and timber companies. Much of the area was so degraded from extensive logging and ensuing fires that it was often referred to as "stump land." The Chequamegon and Nicolet have shown a remarkable recovery since their inception and are currently providing the wide variety of benefits envisioned when they were created. Today, the Chequamegon land base consists of 859 thousand acres in Ashland, Bayfield,

Price, Sawyer, and Taylor Counties, and the Nicolet land base consists of 662 thousand acres in Florence, Forest, Langlade, Oconto, Oneida, and Vilas Counties in Wisconsin.

CURRENT MANAGEMENT AND BENEFITS

Timber management is an important aspect of the overall management of the Chequamegon-Nicolet National Forest. Harvesting is used as a management tool to provide a variety of wildlife habitats, improve forest health, increase productivity, as well as supply a variety of forest products. From 1986 through 1995, the Chequamegon-Nicolet provided nearly 1.4 billion board feet of sawtimber and pulpwood valued at $37.5 million. This value is compounded by the number of jobs forest industry provides the State. Improving forest health, increasing pulpwood productivity, and providing a variety of wildlife habitats benefits many other forest users such as hunters, hikers, and bird watchers. While the amount of timber removed through timber sales was substantial between inventories, growth actually exceeded removals by more than 10 percent during the period.

There are many recreational opportunities on the Chequamegon-Nicolet. There are 47 developed campgrounds found throughout the Forest—most next to lakes, streams, and rivers. With 2,000 lakes and more than 1,300 miles of cold water trout streams, the Forest offers many opportunities for boating, fishing, swimming, and canoeing. The Nicolet land base, known as the "Cradle of Rivers," is the headwaters of the Wolf, Pine, Popple, Oconto, Peshtigo, Deerskin, and Wisconsin Rivers.

The road system on the Chequamegon-Nicolet gives visitors access to recreational areas and scenic attractions. The Lakewood Auto Tour, Heritage Scenic Byway, and the Great Divide Scenic Byway offer visitors a chance to enjoy the Forest's wildlife and scenic beauty.

Hunting opportunities abound. The area is known for its quality hunting that includes trophy-size deer, abundant black bear, duck, and grouse. In fact, Park Falls is known as the ruffed grouse capital of the world. Many miles of hunter walking trails provide access into prime habitat. For those who enjoy a wilderness experience, five designated wilderness areas amounting to 44 thousand acres are on the Forest.

Among the many hiking trails, the North Country Trail, the Franklin Lake Trail, and the Ice Age Trail offer some of the most beautiful scenery found in the North-central United States. The Anvil Trail Wildlife Area, Moquah Pine Barrens, and other unique areas offer great places to view wildlife. In total, there are more than 1,400 miles of trails for hiking, mountain biking, horseback riding, snowmobiling, cross-country skiing, and ATV's. All of these resources make the Chequamegon-Nicolet National Forest a prime area for outdoor recreation.

FOREST LAND CLASSES ON THE NATIONAL FOREST

Of the 1.5 million total acres of Chequamegon-Nicolet National Forest lands, 94 percent are forested. The remaining nonforest areas consist of natural openings such as lowland shrubs, wetlands, sedge meadows, and grasslands, as well as developed land such as roads and utility corridors. The Chequamegon land base currently has 786 thousand acres of forest land, an increase of 1 percent since 1983. The Nicolet land base currently has 637 thousand acres of forest land, an increase of 5 percent between the 1983 and 1996 inventories. The main reason forest land has increased is the conversion of nonforest land to forest land. Land that was classified nonforest land in the 1983 inventory later met the requirements to be classified as forest land in the 1996 inventory due to the substantial ingrowth of trees on these lands between inventories.

The Chequamegon-Nicolet is productive: 96 percent of all forest lands have the potential to annually produce 20 or more cubic feet of wood per acre per year. The forest land area can be divided into three major land classes: timberland, reserved timberland, and other forest land. The Chequamegon land base has 766 thousand acres in timberland, 7 thousand acres in reserved timberland, and 13 thousand acres in other forest land. The Nicolet land base has 599 thousand acres in timberland, 37 thousand acres in reserved timberland, and 1 thousand acres of other forest land.

FOREST COMPOSITION

The Chequamegon-Nicolet National Forest has an abundant variety of tree species that can be attributed to many factors including varied soil types, geological formations, climate, hydrological conditions, fire, and other natural/or human-caused disturbances. This variety of tree species contributes to the ecological diversity of the entire Forest.

Coniferous forest types on the Chequamegon-Nicolet decreased in area between inventories (fig. 2). In 1983, the Chequamegon had approximately 222 thousand acres of coniferous forest types. However, by 1996, the area in coniferous forest types had decreased by 18 percent to 182 thousand acres. In 1983, the Nicolet had approximately 163 thousand acres of coniferous forest types, but by 1996, the area in coniferous forest types had decreased by 4 percent to 156 thousand acres.

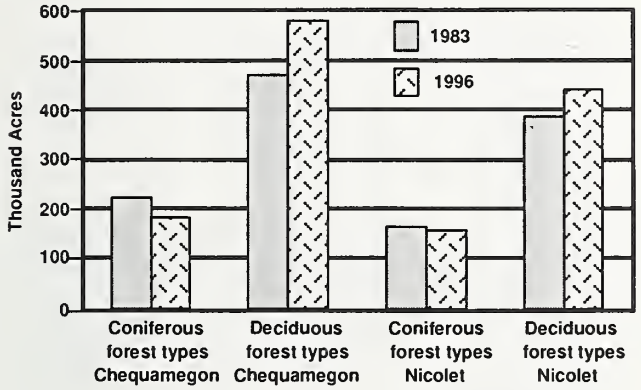

Figure 2.—*Area of timberland, by coniferous and deciduous forest types, on the Chequamegon-Nicolet National Forest, 1983 and 1996.*

Although both land bases showed decreases in many of the same coniferous forest types (jack pine, red pine, balsam fir, and northern white-cedar) the size of the decreases tended to be higher on the Chequamegon. Much of this can be attributed to the change in area due to forest harvesting levels, forest succession, and the Chequamegon's larger area in these forest types. For example, the jack pine forest type decreased by more than 51 percent on the Chequamegon, while the Nicolet showed a decrease of 32 percent. In 1983, the Chequamegon had an estimated 39 thousand acres and the Nicolet had 11 thousand acres of jack pine forest type. By 1996, the area of jack pine forest type had decreased to 19 thousand acres on the Chequamegon and to 7.5 thousand acres on the Nicolet.

Deciduous forest types increased in area between inventories (fig. 2). The Chequamegon had a 23-percent increase in deciduous forest types between inventories, rising from 472 thousand acres to 582 thousand acres. The Nicolet had a 14-percent increase, rising from 386 thousand to 441 thousand acres. The oak-hickory forest type was the only forest type to decrease in area of timberland on both the Chequamegon and Nicolet land bases. Although some of the decrease was due to harvesting, more was likely due to a change from oak-hickory forest type to maple-basswood forest type with oak-hickory as a major component of the maple-basswood type.

Decreases in area also occurred in white spruce on the Chequamegon and in aspen on the Nicolet between inventories. Examples of forest types that increased in area of timberland between the 1983 and 1996 inventories include white pine, black spruce, tamarack, and maple-basswood. In the 1983 inventory, balsam poplar was included in the aspen forest type, but in the 1996 inventory, balsam poplar was a separate forest type.

The changes occurring can be primarily attributed to the on-going successional processes taking place on forested lands. Besides natural succession, other factors such as forest pest outbreaks (i.e., spruce bud worm), animal damage (deer browse and beaver dams flooding northern white-cedar), harvesting patterns, and reductions in planting programs have affected forest composition.

One way to look at the forest resource is by analyzing stand-size class (fig. 3). We classify forest land into three size classes based on the average diameter at breast height (d.b.h.) of the predominant trees within the stand. The three size classes are sapling/seedling—trees between 1 and 5 inches d.b.h.; poletimber—trees between 5 and 9 inches d.b.h. for coniferous and 5 and 11 inches d.b.h. for deciduous; and sawtimber—trees more than 9 inches d.b.h. for coniferous and more than 11 inches d.b.h. for decicious.

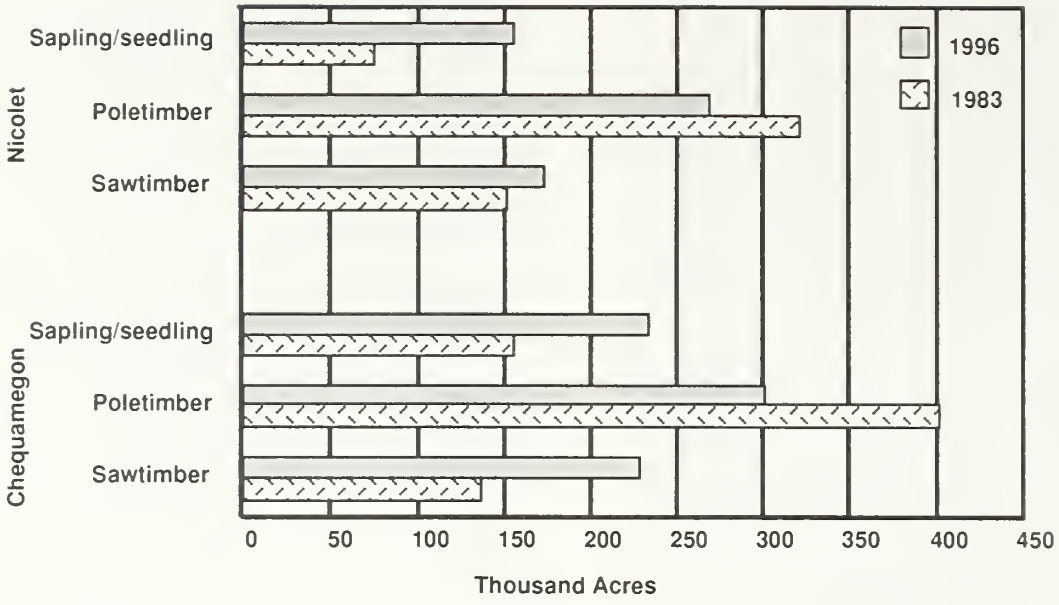

Figure 3.—*Area of timberland in 1983 and 1996 on the Chequamegon-Nicolet National Forest by stand-size class.*

Between inventories, the area of poletimber-size stands decreased, while sapling/seedling and sawtimber-size stands increased in area on both land bases. The decrease in poletimber-size stands can be attributed partly to the maturing of the forest. The area of poletimber-size stands decreased by 25 percent on the Chequamegon and by 17 percent on the Nicolet. Most of the decline in poletimber occurred in coniferous forest types. Between inventories, coniferous poletimber-size forest types decreased by 59 percent on the Chequamegon and by 46 percent on the Nicolet. Deciduous poletimber-size stands decreased in area by only 13 and 6 percent, respectively, between inventories.

The area of sawtimber-size stands increased by 68 percent on the Chequamegon and by 14 percent on the Nicolet. Most of the increases in sawtimber occurred in deciduous forest types—a 157-percent increase on the Chequamegon and a 43-percent increase on the Nicolet. Coniferous sawtimber-size stands on both land bases decreased between inventories. The Chequamegon decreased by 9 percent and the Nicolet decreased by 28 percent.

Between inventories, the area of sapling/seedling size stands increased by 50 percent on the Chequamegon and by 107 percent on the Nicolet. Both coniferous and deciduous forest types in the sapling/seedling stand-size classes increased between inventories. Sapling/seedling coniferous forest types increased by 65 percent on the Chequamegon and by 310 percent on the Nicolet. Sapling/seedling deciduous forest types increased by more than 44 percent on both the Chequamegon and Nicolet land bases.

In 1983, the Chequamegon-Nicolet had an estimated 877 million trees at least 1 inch in d.b.h. By 1996, the number of trees had increased to 968 million, approximately 10 percent of all the trees found in the State of Wisconsin.

The most prevalent conifer documented during the 1996 inventory was the balsam fir. Other coniferous species found in abundance include black spruce, white spruce, northern white-cedar, and red pine. White pine trees growing on the Chequamegon-Nicolet increased between inventories. In 1983, the Nicolet had an estimated 859 thousand white pine trees; by 1996, the number of white pine trees had increased to more than 2.1 million. Likewise, on the Chequamegon, white pine increased from an estimated 2.6 million trees in 1983 to 3.5 million trees in 1996.

Quaking aspen was the most prevalent deciduous tree species. Other abundant deciduous species include sugar maple, red maple, and black ash.

Growing-stock volume increased on the Chequamegon-Nicolet between inventories (fig. 4). In 1996, the Chequamegon had 1 billion cubic feet in growing-stock volume on timberland, an increase of 17 percent since the 1983 inventory. The Nicolet had an estimated 883 million cubic feet of growing-stock volume in 1996, an increase of 11 percent since the 1983 inventory.

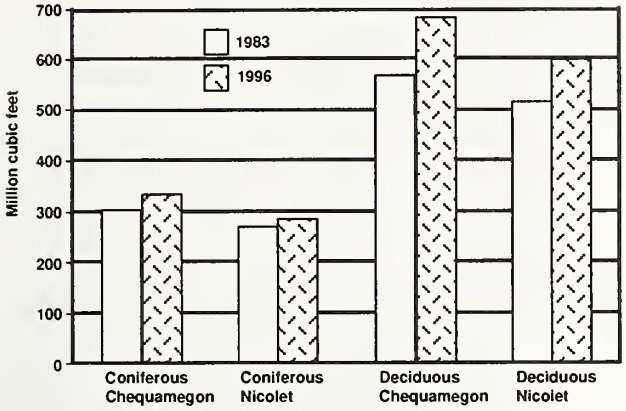

Figure 4.—*Growing-stock volume by coniferous and deciduous forest types on the Chequamegon-Nicolet National Forest, 1983 and 1996.*

Between inventories, both coniferous and deciduous growing-stock volume increased on both land bases. On the Chequamegon, growing-stock volume increased by 10 percent for coniferous species and by 20 percent for deciduous species. On the Nicolet, growing-stock volume increased by 6 percent for coniferous species and by 17 percent for deciduous species.

In 1983, on the Chequamegon, red pine, northern white-cedar, and white pine species groups made up 40 percent of the growing-stock volume for conifers; in 1996, the same species groups made up 52 percent. Although growing-stock volume increased between inventories for most of the conifer species found on the Chequamegon, jack pine (-61 percent) and white spruce (-43 percent) growing-stock volume decreased.

The decline in jack pine growing-stock volume may reflect the maturing of the Chequamegon land base.

In 1983, sugar maple, aspen, and red maple species groups made up 56 percent of all deciduous growing-stock volume on the Chequamegon. By 1996, sugar maple, aspen, and red maple species groups made up 62 percent of all deciduous growing-stock volume.

Volume of sawtimber on the Chequamegon increased by 73 percent between inventories, rising from an estimated 1.6 billion board feet in 1983 to 2.7 billion board feet in 1996. Coniferous sawtimber volume increased by 55 percent and deciduous sawtimber volume increased by 93 percent between inventories.

In 1996, on the Nicolet, red pine, northern white-cedar, and hemlock species groups made up 58 percent of the total volume in growing-stock for conifers, an increase of 5 percent from 1983, when the same species groups made up 53 percent of the total conifer volume. Between inventories, jack pine volume decreased by 49 percent and balsam fir decreased by 27 percent. These decreases may indicate that the Nicolet land base is maturing, going through successional change.

In 1996, on the Nicolet, sugar maple, aspen, and basswood species groups made up 72 percent of all deciduous growing-stock volume; this was not much of a change from 1983, when the same species groups made up 70 percent of all deciduous growing-stock volume. At -87 percent, the elm species group had the largest decrease of any deciduous species group, due in part to the devastation caused by Dutch elm disease over the past decade.

Volume of sawtimber on the Nicolet increased by 47 percent between inventories, rising from an estimated 1.6 billion board feet in 1983 to 2.3 billion board feet in 1996. Coniferous sawtimber volume increased by 26 percent and deciduous sawtimber volume increased by 67 percent.

The increase of sawtimber volume on both the Chequamegon and Nicolet land bases is a sign that the Forest is maturing as indicated by the stand-size class structure (i.e., poletimber growing into small sawtimber). The increase in sawtimber volume may also indicate a change in the harvesting levels on the Forest.

CAUSES OF CHANGE

Both internal and external forces shape and influence the characteristics of the Chequamegon-Nicolet National Forest. One of the main goals of a forest inventory is to collect and analyze data pertaining to changing factors related to growth, mortality, and removals.

Growth

On the Chequamegon and Nicolet, average annual net growth of growing stock was 23.7 million and 20.5 million cubic feet per year, respectively, between 1983 and 1996. On a per acre basis, the Chequamegon averaged 31 cubic feet per year in average annual net growth and the Nicolet averaged 34 cubic feet per year in average annual net growth on timberland. This compares to a statewide average for Wisconsin of 31 cubic feet per year in average annual net growth per acre on timberland.

Net annual growth of sawtimber on the Chequamegon and Nicolet averaged 98.9 and 79.1 million board feet per year, respectively. On a per acre basis, the Chequamegon averaged 129 board feet per acre per year and the Nicolet averaged 132 board feet per acre per year (the overall state-wide average for Wisconsin was 107 board feet per acre per year).

On the Chequamegon, conifer species groups averaged 7.5 million cubic feet and deciduous species groups averaged 16.2 million cubic feet of average annual net growth of growing stock per year between inventories (fig. 5). Red pine, white spruce, and white pine made up 73 percent of the average annual net growth for conifer species, while sugar maple, aspen, and red maple made up 72 percent of the average annual net growth for deciduous species groups.

On the Nicolet, coniferous species groups averaged 6.6 million cubic feet and deciduous species groups averaged 13.9 million cubic feet of average annual net growth of growing stock per year between inventories. Red pine, white spruce, and northern white-cedar made up 80 percent of the average annual net growth for conifer species, while sugar maple, aspen, red maple, and basswood made up 89 percent of all the average annual net growth for deciduous species groups.

On the Chequamegon, the annual net growth of coniferous and deciduous sawtimber averaged 41.0 million board feet and 57.9 million board feet, respectively. On the Nicolet, coniferous species groups averaged 30.6 million board feet and deciduous species groups averaged 48.5 million board feet of sawtimber annual net growth.

Red pine and white spruce species groups represented 60 percent of the coniferous sawtimber growth on the Chequamegon and 68 percent of the coniferous sawtimber growth on the Nicolet. Aspen, sugar maple, red maple, and basswood species groups represented 75 percent of all the deciduous sawtimber growth found on the Chequamegon and 84 percent on the Nicolet.

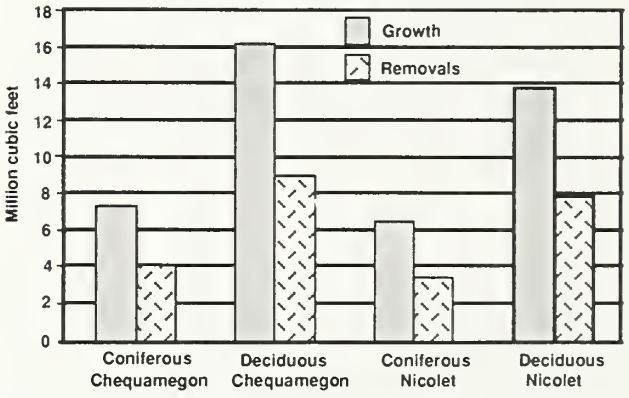

Figure 5.—*Average annual net growth and average annual removals of growing stock on timberland on the Chequamegon-Nicolet National Forest, 1983-1996.*

Mortality

Tree mortality has often been viewed as a loss of valuable wood fiber, but mortality plays an important role in how a forest ecosystem develops. Dead and dying trees provide valuable wildlife habitat. For example, many native longhorned wood-boring beetles in the larval stage use dead trees to live and feed on. The beetles play an important role as decomposers in the forest ecosystem.

The causes of mortality on the Chequamegon-Nicolet included diseases such as hypoxylon

canker, Dutch elm, verticillum wilt, and white trunk rot; insects such as budworm, bole borers, and ips beetle; animals such as beaver, deer, and porcupine; and weather-related factors such as wind, ice, and drought.

Between inventories, average annual mortality of growing stock on the Chequamegon and Nicolet was 9.5 and 9.2 million cubic feet, respectively. Deciduous species groups accounted for two-thirds of all mortality on both the Chequamegon and Nicolet. Aspen, balsam fir, and sugar maple accounted for more than 50 percent of all growing-stock mortality on the Chequamegon, and aspen, balsam fir, and paper birch accounted for more than 50 percent on the Nicolet.

Average annual sawtimber mortality was 22.3 million board feet on the Chequamegon and 19.5 million board feet on the Nicolet. Aspen, balsam fir, and northern white-cedar accounted for more than 45 percent of all sawtimber mortality on the Forest. What really is significant is that aspen accounts for more than 21 percent of all sawtimber mortality on the Chequamegon and more than 23 percent on the Nicolet.

Mortality provides a picture of the successional changes that take place as a forest matures (early-successional species being replaced by mid-successional to late-successional species). In general, higher rates of mortality can occur in the early-successional forest types like aspen, jack pine, and balsam fir if mortality is not captured; in other words, harvesting trees for wood fiber before they become overmature.

Removals

Total annual removals of growing stock from timberland averaged 13.2 million cubic feet on the Chequamegon and 11.5 million cubic feet on the Nicolet between inventories. Sawtimber removals for the Chequamegon and Nicolet averaged 23.5 and 30.2 million board feet per year, respectively.

Deciduous species accounted for 69 percent of all growing-stock removals on the Forest. The aspen species group accounted for 31 percent of all growing-stock removals on the Chequamegon and 28 percent on the Nicolet. Although aspen continues to be in high demand and Wisconsin's pulpwood market remains strong, aspen use is slowly declining in favor of pine as well as birch and other hardwoods (Hackett and Whipple 1995).

On the Chequamegon, the top five species for removals were aspen, red oak, white spruce, sugar maple, and red pine, which annually accounted for more than 8.6 million cubic feet or 65 percent of all growing-stock removals.

On the Nicolet, the top five species for removals were aspen, sugar maple, white pine, balsam fir, and paper birch, which annually accounted for more than 7.7 million cubic feet or 67 percent of all growing-stock removals.

Average annual sawtimber removals for deciduous species groups on the Chequamegon and Nicolet accounted for 51 percent and 62 percent of the total removals per year, respectively.

The aspen species group accounted for 24 percent of all sawtimber removals on the Chequamegon and 31 percent on the Nicolet (aspen sawtimber removals for the entire State averaged 21 percent).

On the Chequamegon, the top five species for sawtimber removals were aspen, red pine, white spruce, jack pine, and balsam fir, which annually accounted for more than 16.7 million board feet of sawtimber removals. Aspen made up 47 percent of all deciduous sawtimber removals, while red pine made up 26 percent of all coniferous sawtimber removals.

On the Nicolet, the top five species for sawtimber removals were aspen, white pine, sugar maple, red pine, and elm, annually accounting for more than 21.0 million board feet of sawtimber removals. Aspen made up half of all deciduous removals, while white pine made up 49 percent of all coniferous removals.

These numbers reflect the variety of wood fiber harvested from the Forest and the important role harvesting plays in forest management. The flow of wood fiber from the Chequamegon-Nicolet plays an important economic role both locally and regionally.

APPENDIX

RELIABILITY OF THE SURVEY

Forest Inventory and Analysis 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 (table A). These sampling errors mean that the chances are two out of three that if a 100-percent inventory had been made, using the same methods, the results would have been within the limits indicated.

For example, the estimated growing-stock volume on the Chequamegon in 1996, 1,015.8 million cubic feet, has a sampling error of ± 3.36 percent (± 34.1 million cubic feet). The growing-stock volume from a 100-percent inventory would be expected to fall between 981.7 million cubic feet and 1,049.9 million cubic feet (1,015.8 ± 34.1), there being a one in three chance that this is not the case.

Table A.—*Sampling errors for the 1996 inventory of the Chequamegon-Nicolet National Forests*

Item	Chequamegon totals	Sampling error
Growing stock	*Million cubic feet*	*Percent*
Volume (1996)	1,015.8	3.36
Average annual growth (1983-1995)	23.7	6.35
Average annual removals (1983-1995)	13.2	14.81
Sawtimber	*Million board feet*	
Volume (1996)	2,737.4	4.42
Average annual growth (1983-1995)	98.9	6.72
Average annual removals (1983-1995)	23.5	17.73
	Thousand acres	
Timberland area (1996)	766.0	1.43

Item	Nicolet totals	Sampling error
Growing stock	*Million cubic feet*	*Percent*
Volume (1996)	883.7	3.74
Average annual growth (1983-1995)	20.5	6.96
Average annual removals (1983-1995)	11.5	22.67
Sawtimber	*Million board feet*	
Volume (1996)	2,326.8	5.17
Average annual growth (1983-1995)	79.1	7.64
Average annual removals (1983-1995)	30.2	24.10
	Thousand acres	
Timberland area (1996)	599.4	1.65

As survey data are broken down into sections smaller than Forest totals, the sampling error increases. For example, the sampling error for timberland area in a particular forest type is higher than that for total timberland area in the Forest. To estimate sampling error for data smaller than Forest totals, use the following formula:

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

Where :

E = Sampling error in percent.

SE = Forest total error for volume or area.

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

1) Total area of maple-beech-birch type = 258.8 thousand acres.
2) Total Forest area of all timberland = 599.4 thousand acres.
3) Total Forest error for timberland area = 1.65 percent.
4) Using the above formula:

$$E = \frac{0.0165\sqrt{599.4}}{\sqrt{258.8}}$$

E = 0.0255 or 2.55 percent sampling error for the maple-beech-birch forest type on the Nicolet.

SURVEY PROCEDURES

The 1996 Wisconsin survey 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 feature of the new Wisconsin 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. 6). Detailed descriptions of the sampling and estimation procedures are presented by Hansen (1990). The growth model used in the Wisconsin survey design was the Lake States Stand and Tree Evaluation and Modeling System (STEMS) (Belcher *et al.* 1982).

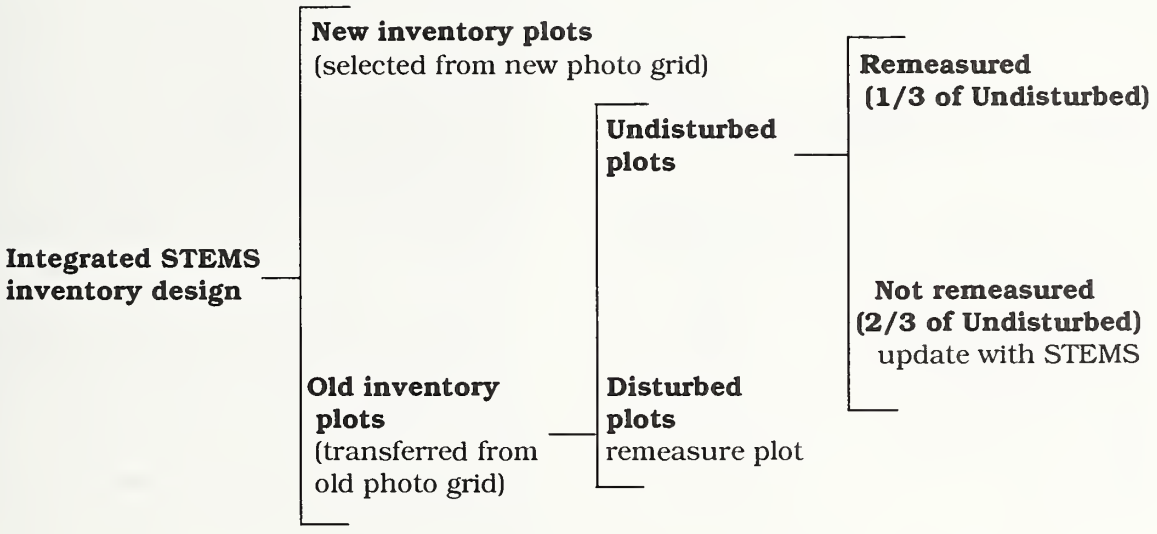

Figure 6.—*Overview of the Wisconsin sample design.*

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 photography. The first is a set of new photo plots and the second is a set of relocated old ground plot locations from the 1983 inventory. Phase 1 aerial photographs, taken from 1991 through 1993, were black and white, infrared at a scale of 1:15,840 for the Northeast, Northwest, and Central Survey Units and at a scale of 1:24,000 for the Southeast and Southwest Survey Units. The Wisconsin Department of Natural Resources contracted for this photography and loaned the photos to the Forest Service. The locations of plots used in the 1983 inventory were transferred to these 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 of these photo plots was examined by aerial photo interpretation specialists and classified stereoscopically based on land use. If trees were present, forest type and stand-size/density class were recorded. 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 1996 inventory were examined and were classified as shown in table B.

Table B.—*Photo plot classifications, 1996 inventory of Chequamegon-Nicolet forest resources*

Photo land class	Photo plots
Forest land	7,433
Reserved forest land	195
Questionable	81
Nonforest with trees	106
Nonforest reserved	-
Nonforest without trees	505
Water	-
All classes	8,320

A systematic sample of the aerial photo plots was selected to become ground plots in phase 2 of the procedure. Ground plots that definitely were not forest land were given a nonforest ground land-use classification and not sent to the field for measurement.

2. Plot measurements (Phase 2) —Overview of 1983 plot design

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 cluster of 10 subplots covering approximately 1 acre. At each subplot, trees 5.0 inches or more in d.b.h. were sampled on a 37.5 Basal Area Factor (BAF) variable-radius plot, and trees less than 5.0 inches d.b.h. were sampled on a 1/300-acre fixed-radius plot only at subplots 1, 2, and 3. Under the estimation procedures used in this inventory, the entire plot measurement represented a single land classification. Thus, if a subplot was located outside of the land classification for the plot, it was rotated back into the land classification. For example, if subplots 1 through 9 were located in a forest land classification and subplot 10 fell in a pasture, subplot 10 was rotated back into the forest land classification.

Plot measurements (Phase 2)—Overview of 1996 plot design

On plots of forest land (including reserved forest land, unproductive forest land, and timberland), wooded pasture, or windbreaks (at least 120 feet wide), a ground plot was established, remeasured, or modeled. Locating ground plots on all forest lands in 1996 represented a major change from the 1983 inventory.

In 1996, the overall plot layout consisted of 10 subplots arranged in a cluster with 70 feet between clusters. The basic location of plots and subplots was the same as in the 1983 plot layout. All trees less than 5 inches in d.b.h. were measured on ten 6.8-foot radius (1/300 acre) circular microplots located at the center of each subplot. (In 1983, this microplot was measured only on subplots 1, 2, and 3.) This radius was the maximum distance at which a 5-inch tree would be selected using a 37.5

BAF prism. Trees with diameters between 5 and 17 inches were selected at each of the 10 subplots with a BAF of 37.5. Trees greater than 17 inches d.b.h. were selected from a 24-foot fixed-radius macro-subplot centered at each of the 10 subplots. The macro subplots were mapped for forest conditions, and subplots were not rotated even if they fell into another condition. Factors that would determine a change in condition from subplot 1 were changes in forest type, stand-size class, land use, ownership, and density. Each condition that occurred anywhere on one of the subplots was identified, described, and mapped. Each condition was assigned a condition number, and condition information was recorded.

On remeasurement plots, the rotated subplots and all the trees measured on the 1983 plot design were also measured to obtain change data such as growth and mortality. On new plots, subplots were not rotated. Hahn *et al.* (1995) present further in-depth procedures.

a) New inventory plots

A systematic 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 established, monumented, and measured as part of the 1983 field inventory. The 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 plots were remeasured to obtain estimates of current condition and changes since the last inventory. All trees measured on these plots in 1983 were remeasured or otherwise accounted for, and all new trees were identified and measured.

All sample plots that were timberland at the time of the 1983 inventory and determined to be undisturbed until this inventory were projected to the current time using STEMS. This procedure gives projected estimates of current volume and growth for these undisturbed plots. The 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).

The undisturbed timberland plots that were not remeasured play a crucial role in the new survey design. These plots 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 refers to any change on a plot that can be detected on aerial photos and that the STEMS growth processor cannot predict, such as catastrophic mortality, cutting, regenerating stands, and 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 are remeasured or modeled. Table C summarizes the distribution of all ground plots for the new inventory design by type of plot.

Table C.—*Distribution of ground plots for the 1996 inventory of Chequamegon-Nicolet forest resources*

Ground land-use class	Old plots remeasured	Old plots updated	New plots	Total plots
Timberland	299	32	390	721
Reserved forest land	4	0	11	15
Other forest land	4	0	2	6
Nonforest with trees	3	4	4	11
Nonforest without trees	23	14	25	62
Water	0	2	1	3
Total	333	52	433	818

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).

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. Net cubic foot volumes were based on a modification of the method presented by Hahn (1984) for use in the Lake States. For the Wisconsin inventory, the merchantable height equation presented in Hahn (1984) was used in conjunction with Stone's equation (see Appendix I in 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, using the coefficients presented in Hahn (1984).

The Forest Service reports all board foot volume in International 1/4-inch rule. In Wisconsin, 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). The factors (multipliers) used to convert board foot International rule 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	0.8287	0.8317
13.0-14.9	0.8577	0.8611
15.0-16.9	0.8784	0.8827
17.0-18.9	0.8945	0.8999
19.0-20.9	0.9079	0.9132
21.0-22.9	0.9168	0.9239
23.0-24.9	0.9240	0.9325
25.0-26.9	0.9299	0.9396
27.0-28.9	0.9321	0.9454
29.0+	0.9357	0.9544

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. These estimates are based on the remeasurement of the 1983 inventory plots using the 1983 plot design. Growth reported as the average net annual growth between the two inventories (1983 and 1996) is computed from data on remeasured plots and modeled plots using methods presented by Van Deusen *et al.* (1986). Mortality is also average net annual for the remeasurement period. On new plots, 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 by Survey Unit 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 1995 was computed by using the adjusted STEMS model to grow all current inventory plots for 1 year.

6. Average annual removals estimates

Average annual growing-stock and sawtimber removals (1983 to 1995) were estimated only from the remeasured plots (these estimates are based on the remeasurement of the 1983 inventory plots using the 1983 plot design); new plots and STEMS-projected plots were not used to estimate removals. These estimates were obtained from trees measured in the last survey and cut or otherwise removed from the timberland base. Because remeasurement plots make up about one-half of the total ground plots and not all remeasurement plots had cutting, average annual removals estimates have greater sampling errors than volume and growth estimates.

TREE AND LOG GRADES

Log grades and tree grades are based on the classification of external characteristics as indicators of quality. Log grades and or tree grades were taken on approximately one-third of the sample plots in Wisconsin. All sawtimber softwood sample trees were graded for quality and assigned a butt log grade. All sawtimber hardwood sample trees were graded for quality and assigned a tree grade. The volume yield by log grade or tree 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 by Ostrander and Brisbin (1971). For all softwoods, the first merchantable 16-foot log, or shorter lengths down to 12 feet, was used for grading.

Hardwood Tree Grade for Factory Lumber [a]

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 [b] (feet)	Best 12	Best 12	Best 12
D.b.h., minimum (inches)	16[c]	13	11
D.i.b., minimum at top of grading section (inches)	13[c] 16 20	11[d] 12	8
Clear cuttings (on the 3 best faces)[e]			
Length, minimum (feet)	7 5 3	3 3	2
Number on face (maximum)	2	2 3	Unlimited
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	f	50

[a] Hanks (1976)

[b] 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 such as diameter and cull deduction.

[c] In basswood and ash, d.i.b. at top of grading section must be 12 inches and d.b.h. must be 15 inches.

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

[e] 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.

[f] Fifteen percent crook and sweep or 40 percent total cull deduction are permitted in grade 2 trees, 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, b]

Position in tree	Butts and uppers
Minimum diameter, small end	8 inches
Minimum length without trim	8 feet
Clear cuttings	No requirements
Sweep allowance	One-fourth of the diameter at the small end for each 8 feet of length.
Sound surface defects:	
Single knots	Any number, if no one 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, provided none has a diameter over one-third of the log diameter at point of occurrence and none extends more than 3 inches into included timber[c].
Unsound surface defects:	Same requirements as for sound defects if they extend into included timber. No limit if they do not.

[a] Rast et al. (1973).

[b] 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.

[c] Included timber is always square, and dimension is judged from small end.

Eastern White Pine Saw Log Grade Specifications [a]

Grading factor	Log grade 1	Log grade 2	Log grade 3	Log grade 4
1. Minimum scaling diameter (inches)	14[b]	6	6	6
2. Minimum log length (feet)	10[c]	8	8	8
3. Maximum weevil injury (number)	None	None	2 injuries [d]	No limit
4. Minimum face requirements	Two full length or four 50%[e] length good faces (in addition, log knots on balance of faces shall not exceed 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 not to exceed 1/3 scaling diameter and 5" maximum **OVERGROWN/DEAD/BLACK KNOTS** not to exceed 1/12 scaling diameter and 1 1/2" max. not to exceed 1/6 scaling diameter and 2 1/2" max.		Includes all logs not qualifying for No. 3 or better and having 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 grade is established from face examination, the grade will be reduced whenever the following defects are evident:

7. Conks, punk knots, and pine borer damage on bark surface. [f]
   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. [f] 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. Ostrander and Brisbin (1971)
b. 12- and 13-inch logs with four full-length good faces are acceptable.
c. 8-foot logs with four full-length good faces are acceptable.
d. 8-foot Number 3 logs limited to one weevil injury.
e. Minimum 50% length good face must be at least 6 feet.
f. Factors 7 and 8 are not cumulative (total degrade based on more serious of the two). No log is to be degraded below grade 4 if net scale is at least one-third of gross scale.

Log Grades for Jack Pine and Red Pine [a]

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

After the tentative grade is established from above, the tree will be reduced one grade for each of the following, except that no tree can be reduced below grade 3, provided the total scaling deductions for sweep and/or rot do not exceed two-thirds of the gross scale of the tree.

Sweep. Degrade any tentative grade 1 or 2 tree one grade if sweep in the lower 12 feet of grading sections amounts to 3 or more inches and equals or exceeds one-fourth of the diameter at breast height.

Heart rot. Degrade any tentative grade 1 or 2 tree one grade if conk, punk knots, massed hyphae, or other evidence of advanced heart rot is found anywhere on the main tree stem.

[a] Campbell (1964)

[b] A face is one-fourth of the circumference in width extending full length of the grading section. 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 on the grading section.

Log Grades for All Other Softwood Logs

Grade 1

1. Trees must be 16 inches in diameter or larger, grading section 12 feet in length or longer, and with deduction for defect not over 30 percent of gross scale.

2. Trees 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. Trees must be 12 inches in diameter or larger, grading section 12 feet in length or longer, and with a net scale after deduction for defect of at least 50 percent of the gross scale deducted for defect.

2. Trees must be at least 50 percent clear on each of three faces or 75 percent clear on two faces.

Grade 3

1. Trees must be 6 inches in diameter or larger, grading section 12 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 diameter inside bark (d.i.b.) at small end of grading section. 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 kilograms.
1 ton = 0.907 metric tons.

TREE SPECIES GROUPS IN WISCONSIN
(Little 1981)

Hardwoods

Select white oaks[1]
- White oak ..... *Quercus alba*
- Bur oak ..... *Q. macrocarpa*
- Chinkapin oak ..... *Q. muehlenbergii*
- Swamp white oak ..... *Q. bicolor*

Other white oaks[1]
- Chestnut oak ..... *Q. prinus*

Select red oak[1]
- Northern red oak ..... *Q. rubra*

Other red oaks[1]
- Scarlet oak ..... *Q. coccinea*
- Northern pin oak ..... *Q. ellipsoidalis*
- Pin oak ..... *Q. palustris*
- Black oak ..... *Q. velutina*

Hickories[1]
- Shagbark hickory ..... *Carya ovata*
- Shellbark hickory ..... *C. laciniosa*
- Bitternut hickory ..... *C. cordiformis*
- Mockernut hickory ..... *C. tomentosa*
- Pignut hickory ..... *C. glabra*

Hard maples[1]
- Black maple ..... *Acer nigrum*
- Sugar maple ..... *A. saccharum*

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

American beech[1] ..... *Fagus grandifolia*

Ashes
- White ash[1] ..... *Fraxinus americana*
- Black ash[2] ..... *F. nigra*
- Green ash[1] ..... *F. pennsylvanica*

Balsam poplar[2] ..... *Populus balsamifera*

Aspens[2]
- Bigtooth aspen ..... *P. grandidentata*
- Quaking aspen ..... *P. tremuloides*

Eastern cottonwood[2] ..... *P. deltoides*

American basswood[2] ..... *Tilia americana*
Yellow-poplar[2] ..... *Liriodendron tulipifera*
Black walnut[1] ..... *Juglans nigra*
Black cherry[2] ..... *Prunus serotina*
Butternut[2] ..... *Juglans cinerea*
Sycamore[2] ..... *Platanus occidentalis*

Elms
- American elm[2] ..... *Ulmus americana*
- Siberian elm[2] ..... *U. pumila*
- Slippery elm[2] ..... *U. rubra*
- Rock elm[1] ..... *U. thomasii*

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

Hackberry[2] ..... *Celtis occidentalis*
Black willow[2] ..... *Salix nigra*
Black tupelo[2] ..... *Nyssa sylvatica* var. *sylvatica*

Other hardwoods
- Boxelder[2] ..... *Acer negundo*
- Sweet birch[2] ..... *Betula lenta*
- Black locust[1] ..... *Robinia pseudoacacia*
- Red mulberry[2] ..... *Morus rubra*
- Honeylocust[1] ..... *Gleditsia triacanthos*
- Northern catalpa[2] ..... *Catalpa speciosa*
- Ohio buckeye[2] ..... *Aesculus glabra*
- Flowering dogwood[1] ..... *Cornus florida*
- Sassafras[2] ..... *Sassafras albidum*

Noncommercial species
- Striped maple ..... *Acer pensylvanicum*
- Mountain maple ..... *A. spicatum*
- Ailanthus ..... *Ailanthus altissima*
- American hornbeam ..... *Carpinus caroliniana*
- Hawthorn ..... *Crataegus* spp.
- Osage-orange ..... *Maclura pomifera*
- Apple ..... *Malus* spp.
- Eastern hophornbeam ..... *Ostrya virginiana*
- Pincherry ..... *Prunus pennsylvanica*
- Wild plum ..... *P.* spp.
- Chokecherry ..... *P. virginiana*
- Peachleaf willow ..... *Salix amygdaloides*
- Diamond willow ..... *S. bebbiana*
- American mountain ash .... *Sorbus americana*

Softwoods[2]

Eastern white pine ..... *Pinus strobus*
Red pine ..... *P. resinosa*
Jack pine ..... *P. banksiana*
White spruce ..... *Picea glauca*
Black spruce ..... *P. mariana*
Balsam fir ..... *Abies balsamea*
Eastern hemlock ..... *Tsuga canadensis*
Tamarack ..... *Larix laricina*

[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 or softwood, with an average specific gravity of less than 0.50.*

Northern white-cedar ..... *Thuja occidentalis*
Other softwoods:
Eastern redcedar ..... *Juniperus virginiana*
Norway spruce ..... *Picea abies*
Engelmann spruce ..... *P. engelmannii*
Blue spruce ..... *P. pungens*
Austrian pine ..... *Pinus nigra*
Scotch pine ..... *P. sylvestris*
Ponderosa pine ..... *P. ponderosa*
Douglas-fir ..... *Pseudotsuga menziesii*

DEFINITION OF TERMS

Average annual mortality of growing stock.—The average cubic foot volume of sound wood in growing-stock trees that died in 1 year. Average annual mortality is the average for the years between inventories (1983 to 1995 in this report).

Average annual mortality of sawtimber.—The average board foot volume of sound wood in sawtimber trees that died in 1 year. Average annual mortality is the average for the years between inventories (1983 to 1995 in this report).

Average annual removals from growing stock.—The average net growing-stock volume in growing-stock trees removed annually for roundwood forest products, in addition to the volume of logging residues, and the volume of other removals. Average annual removals of growing stock are the average for the years between inventories (1983 to 1995 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 roundwood forest products, in addition to the volume of logging residues, and the volume of other removals. Average annual removals of sawtimber are the average for the years between inventories (1983 to 1995 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 cubic foot volume of sound wood in live sawtimber and poletimber trees, and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes. Average net annual growing stock is the average for the years between inventories (1983 to 1995 in this report).

Average net annual growth of sawtimber.—The annual change in the board foot volume of live sawtimber trees, and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes. Average net annual growth of sawtimber is the average for the years between inventories (1983 to 1995 in this report).

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.

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

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

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

1- to 5-inch trees.—Total aboveground biomass of a tree from 1 to 5 inches in diameter at breast height.

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

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.)

Cord.—One standard cord is 128 cubic feet of stacked wood, including bark and air space. Cubic feet can be converted to solid wood standard cords by dividing by 79.

Corporate.—Lands owned by a private corporation not in the business of operating primary wood-using plants.

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

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

Current 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, reported for a single year (1995 in this report). Current growth is based on an estimate of the current annual increment of each growing-stock tree in the inventory.

Current 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, reported for a single year (1995 in this report). Current growth is based on an estimate of the current annual increment of each growing-stock tree in the inventory.

Current annual removals from growing stock.—The current net growing-stock volume in growing-stock trees removed annually for roundwood forest products, in addition to the volume of logging residues, and the volume of other removals. Current annual removals of growing stock are reported for a single year (1995 in this report); they are based on a survey of primary wood processing mills to determine removals for products and on information from remeasurement plots (see Survey Procedures in Appendix) to determine removals due to land-use change.

Current annual removals from sawtimber.—The current net board foot sawtimber volume of live sawtimber trees removed annually for roundwood forest products, in addition to the volume of logging residues, and the volume of other removals. Current annual removals of sawtimber are reported for a single year (1995 in this report); they are based on a survey of primary wood processing mills to determine removals for products and on information from remeasurement plots (see Survey Procedures in Appendix) to determine removals due to land-use change.

Diameter class.—A classification of trees based on diameter outside bark, measured at breast height 4.5 feet above the ground. (Note d.b.h. is the common abbreviation for diameter at breast height.) 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.

Farm.—Any place from which $1,000 or more of agricultural products were produced and sold during the year.

Farmer-owned land.—(See Individual private land.)

Forest industry land.—Land owned by companies or individuals operating primary 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 Tree, 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. The associated species for each forest type are based on net volume of growing stock and all live biomass by species group. Major forest types in the State are:

Jack pine.—Forests in which jack pine comprises a plurality of the stocking. Species commonly associated with the jack pine forest type in Wisconsin include red pine, select red oaks, aspen, and eastern white pine.

Red pine.—Forests in which red pine comprises a plurality of the stocking. Species commonly associated with the red pine forest type in Wisconsin include eastern white pine, jack pine, and aspen.

Eastern white pine.—Forests in which eastern white pine comprises a plurality of the stocking. Species commonly associated with the eastern white pine forest type in Wisconsin include red pine, aspen, red maple, paper birch, red oak, white spruce, and balsam fir.

Balsam fir.—Forests in which balsam fir and white spruce comprise a plurality of stocking, with balsam fir the most common. Species commonly associated with the balsam fir forest type in Wisconsin include white spruce, aspen, northern white-cedar, paper birch, red maple, black spruce, and eastern white pine.

White spruce.—Forests in which white spruce and balsam fir comprise a plurality of the stocking, with white spruce the most common. Species commonly associated with the white spruce forest type in Wisconsin include aspen, paper birch, balsam fir, eastern white pine, red maple, and northern white-cedar.

Black spruce.—Forests in which swamp conifers comprise a plurality of the stocking, with black spruce the most common. Species commonly associated with the black spruce forest type in Wisconsin include tamarack, balsam fir, eastern white pine, northern white-cedar, aspen, jack pine, and paper birch.

Northern white-cedar.—Forests in which swamp conifers comprise a plurality of the stocking, with northern white-cedar the most common. Species commonly associated with the northern white-cedar forest type in Wisconsin include balsam fir, paper birch, black spruce, red maple, and aspen.

Tamarack.—Forests in which swamp conifers comprise a plurality of the stocking, with tamarack the most common. Species commonly associated with the tamarack forest type in Wisconsin include northern white-cedar, black spruce, balsam fir, and paper birch.

Oak-hickory.—Forests in which northern red oak, white oak, bur oak, or hickories, singly or in combination, comprise a plurality of the stocking. Species commonly associated with the oak-hickory forest type in Wisconsin include red maple, aspen, and black cherry.

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. Species commonly associated with the elm-ash-soft maple forest type in Wisconsin include northern white-cedar, aspen, cottonwood, and balsam fir.

Maple-beech-birch.—Forests in which sugar maple, yellow birch, American elm, and red maple, singly or in combination, comprise a plurality of the stocking. Species commonly associated with the maple-beech-birch forest type in Wisconsin include basswood, eastern hemlock, green and white ash, aspen, black cherry, and select red oaks.

Aspen.—Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. Species commonly associated with the aspen forest type in Wisconsin include red maple, paper birch, balsam fir, and select red oaks.

Paper birch.—Forests in which paper birch comprises a plurality of the stocking. Species commonly associated with the paper birch forest type in Wisconsin include aspen, red maple, balsam fir, northern white-cedar, sugar maple, and balsam poplar.

Balsam poplar.—Forests in which balsam poplar comprises a plurality of the stocking. Species commonly associated with the balsam poplar forest type in Wisconsin include balsam fir, aspen, northern white-cedar, paper birch, black ash, and white spruce.

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, hickories, and ash.

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

Improved pasture.—Land currently improved for grazing by cultivating, seeding, irrigating, or clearing trees or brush and less than 16.7 percent stocked with trees.

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

Individual private land.—Privately owned land not owned by forest industry. This class includes the formerly used Farmer and Miscellaneous private classes.

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 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. Log grade was assigned to a sample of conifer sawtimber trees throughout the State during the 1996 inventory. Also see Tree grade. (See Appendix for specific grading factors used.)

Logging residue.—The unused portions of cut trees, plus unused trees killed by logging.

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.—(See Individual private land.)

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.

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

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

Nonstocked land.—Timberland 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. Many of these sites contain tree species that are not currently used for industrial wood production or trees of poor form, small size, or inferior quality that are unfit for most 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 used 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 and land clearing, and the standing volume on land classified originally as timberland but later designated as reserved from timber harvesting (such as a newly established State park).

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.

Plant byproducts.—Plant residues used for products such as mulch, pulp chips, and fuelwood.

Plantation.—An artificially reforested area sufficiently productive to qualify as timberland. The planted species is not necessarily predominant. Christmas tree plantations, which are considered cropland, are not included.

Plant residues.—Wood and bark materials generated at manufacturing plants during production of other products.

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

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

Potential productivity class.—A classification of forest land 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 use through statute, administrative regulation, designation. Note: Historically, Christmas tree plantations were classified as reserved forest land. However, Christmas tree plantations are now classified as cropland.

Rotten tree.—Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough tree.—(a) Live trees of commercial species that do not contain at least one merchantable 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial 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, including logs at least 8 feet long, sound and straight

and with a minimum diameter outside bark (d.o.b.) for softwoods of 7.0 inches (9.0 inches for hardwoods) or 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 live tree of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. Hardwoods must be at least 11.0 inches 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 stump to a minimum 7.0 inches top d.o.b. for softwoods and a minimum 9.0 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).—A sawtimber-size tree of commercial species that contains at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Shrub.—A woody, perennial plant differing from a perennial herb in its persistent and woody stem(s) and less definitely from a tree in its lower stature and/or the general absence of a well-defined main stem. For this report, shrubs were separated somewhat arbitrarily into tall and low shrubs as follows:

Tall shrubs.—Normally taller than 1.6 to 3.2 feet.

Low shrubs.—Normally shorter than 1.6 to 3.2 feet. (Woody perennial vines, such as grape, were included with low shrubs.)

Shrub and tree seedling biomass.—The total aboveground weight of trees less than 1.0 inch in diameter and all shrubs.

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 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.—A classification based on age of the 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.

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

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

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

State land.—Land owned by the State of Wisconsin or leased to it 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 use the growth potential of the land; that is, the stocking standard. A stocking percent of 100 indicates full use 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 133.0 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.

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

Timberland.—Forest land that is producing, or is capable of producing, more than 20 cubic feet per acre per year of industrial wood crops under natural conditions, that is not withdrawn from timber use, and that is not associated with urban or rural development. Currently inaccessible and inoperable areas are included. (Timberland was formerly called commercial forest land.)

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 biomass.—The total aboveground weight (including the bark but excluding the foliage) of all trees from 1 to 5 inches in d.b.h., and the total aboveground weight (including the bark but excluding the foliage) from a 1-foot stump for trees more than 5 inches in diameter.

Tree grade.—A classification of the lower 16 feet of the bole of standing trees based on external characteristics as indicators of the quality and quantity of lumber that could be produced from the tree. Tree grade was assigned to a sample of hardwood sawtimber trees during the 1996 inventory. Also see Log grade. (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.

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 d.o.b. or to the point where the central stem breaks into limbs.

Urban and other areas.—Areas within the legal boundaries of cities and towns; suburban areas developed for residential, industrial, or recreational purposes; school yards; cemeteries; roads; railroads; airports; beaches; powerlines and other rights-of-way; or other nonforest land not included in any other specified land-use class.

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

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 other evidence of grazing.

Wooded strip.—An acre or more of natural continuous forest land that would otherwise meet survey standards for timberland except that it is less than 120 feet wide.

LITERATURE CITED

Belcher, D.W.; Holdaway, M.R.; Brand, G.J. 1982. **A description of STEMS the stand and tree evaluation and modeling system**. Gen. Tech. Rep. NC-79. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 18 p.

Campbell, R.A. 1964. **Forest Service log grades for southern pine**. Res. Pap. SE-11. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 17 p.

Hackett, R.L.; Whipple, J.T. 1995. **Wisconsin timber industry—an assessment of timber product output and use**. Resour. Bull. NC-164. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 64 p.

Hahn, J.T. 1984. **Tree volume and biomass equations for the Lake States**. Res. Pap. NC-250. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 10 p.

Hahn, J.T.; MacLean, C.D.; Arner, S.L.; Bechtold, W.A. 1995. **Procedures to handle FIA cluster plots that straddle two or more conditions**. Forest Science Monograph. 31(41):12-25.

Hanks, L.F. 1976. **Hardwood tree grades for factory lumber**. Res. Pap. NE-333. Broomall PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 81 p.

Hansen, M.H. 1990. **A comprehensive sampling system for forest inventory based on an individual tree growth model**. St. Paul, MN: University of Minnesota, College of Natural Resources. 256 p. Ph.D. dissertation.

Little, E.L. 1981. **Check list of native and naturalized trees of the United States**. Agric. Handb. 541. Washington, DC: U.S. Department of Agriculture, Forest Service. 385 p.

Loetsch, F.; Haller, K.E. 1964. **Forest inventory, volume 1, Statistics of forest inventory and information from aerial photographs**. BLV Verlagsgesellschaft Munch Basle Vienna. 436 p.

Ostrander, M.D.; Brisbin, R.L. 1971. **Sawlog grades for eastern white pine**. Res. Pap. NE-205. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 24 p.

Rast, E.D.; Sonderman, D.L.; Gammon, G.L. 1973. **A guide to hardwood log grading**. Gen. Tech. Rep. NE-1. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 31 p.

Smith, W.B. 1983. **Adjusting the STEMS regional growth models to improve local predictions**. Res. Note NC-297. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 5 p.

Van Deusen, P.C.; Dell, T.R.; Thomas, C.E. 1986. **Volume growth estimation from permanent horizontal points**. Forest Science. 32: 415-422.

Wiant, H.V., Jr.; Castenaeda, F. 1977. **Mesavage and Girard's volume tables formulated**. BLM4. Denver, CO: U.S. Department of the Interior, Bureau of Land Management, Denver Service Center: 1- 4.

TABLE TITLES

Table 1.—Area of land and major land-use class, Chequamegon-Nicolet National Forest, 1996

Table 1. -- Area of land and major land-use class, Chequamegon-Nicolet National Forest, 1996

(In thousand acres)

Land base	Total land area	Forest land				Other land
		Total forest	Timberland	Reserved forest land	Other forest land	
Chequamegon	852.0	785.9	766.0	7.2	12.7	66.1
Nicolet	667.4	637.4	599.4	36.8	1.2	30.0
Total	1,519.4	1,423.3	1,365.4	44.0	13.9	96.1

Table 2. -- Area of timberland by forest type group/local type and stand-size class, Chequamegon, 1983 and 1996

(In thousand acres)

Forest type group/	All stands		Sawtimber		Poletimber		Sapling/seedling		Nonstocked	
local type	1983	1996	1983	1996	1983	1996	1983	1996	1983	1996
Jack pine	39.4	19.0	3.0	6.9	36.4	3.2	--	8.9	--	--
Red pine	57.0	48.0	28.2	21.9	7.8	12.2	21.0	13.9	--	--
White pine	7.3	9.4	7.3	8.2	--	1.2	--	--	--	--
Balsam fir	34.3	21.4	13.0	7.4	19.3	4.9	2.0	9.1	--	--
White spruce	18.7	12.0	10.0	3.3	8.7	5.5	--	3.2	--	--
Black spruce	18.8	30.5	--	--	--	6.3	18.8	24.2	--	--
Northern white-cedar	33.6	24.4	11.2	16.2	21.7	8.2	0.7	--	--	--
Tamarack	12.9	17.3	--	2.0	11.5	2.2	1.4	13.1	--	--
Oak-hickory	34.5	17.9	--	1.6	32.2	12.8	2.3	3.5	--	--
Elm-ash-soft maple	23.1	59.2	4.5	7.2	15.2	30.3	3.4	21.7	--	--
Maple-basswood	206.1	284.6	55.6	124.9	141.9	135.7	8.6	24.0	--	--
Aspen	180.8	190.7	3.4	26.0	85.3	58.2	92.1	106.5	--	--
Paper birch	27.0	29.4	--	3.2	21.7	20.3	5.3	5.9	--	--
Nonstocked	--	2.2	--	--	--	--	--	--	--	2.2
All types	693.5	766.0	136.2	228.8	401.7	301.0	155.6	234.0	--	2.2

Table 2a. -- Area of timberland by forest type group/local type and stand-size class, Nicolet, 1983 and 1996

(In thousand acres)

Forest type group/	All stands		Sawtimber		Poletimber		Sapling/seedling		Nonstocked	
local type	1983	1996	1983	1996	1983	1996	1983	1996	1983	1996
Jack pine	10.9	7.5	2.2	0.3	8.2	3.9	0.5	3.3	--	--
Red pine	46.4	38.7	41.4	30.1	2.5	1.9	2.5	6.7	--	--
White pine	2.3	4.4	2.3	4.4	--	--	--	--	--	--
Balsam fir	34.3	25.6	6.9	2.2	22.7	4.4	4.7	19.0	--	--
White spruce	12.5	15.4	2.7	2.6	6.6	5.8	3.2	7.0	--	--
Black spruce	17.7	28.8	--	--	15.7	11.8	2.0	17.0	--	--
Northern white-cedar	35.0	29.2	4.2	4.6	27.8	17.7	3.0	6.9	--	--
Tamarack	4.0	6.3	2.0	--	2.0	1.0	--	5.3	--	--
Oak-hickory	10.7	9.8	--	1.8	10.7	8.0	--	--	--	--
Elm-ash-soft maple	2.9	24.3	0.3	2.1	2.6	12.5	--	9.7	--	--
Maple-basswood	228.8	258.8	69.5	101.2	154.5	144.1	4.8	13.5	--	--
Aspen	131.6	127.9	20.1	21.9	57.0	43.0	54.5	63.0	--	--
Paper birch	11.7	20.2	0.3	2.1	11.4	14.4	--	3.7	--	--
Balsam poplar	--	0.2	--	--	--	--	--	0.2	--	--
Nonstocked	--	2.3	--	--	--	--	--	--	--	2.3
All types	548.8	599.4	151.9	173.3	321.7	268.5	75.2	155.3	--	2.3

Table 3. -- Area of timberland by forest type and potential productivity class, Chequamegon, 1996

(In thousand acres)

Forest type and stand-size class	All classes	Potential productivity class (cubic feet of growth per acre per year)				
		165+	120-164	85-119	50-84	20-49
Jack pine	19.0	--	--	--	15.0	4.0
Red pine	48.0	--	12.5	26.7	6.8	2.0
White pine	9.4	--	--	7.6	1.5	0.3
Balsam fir	21.4	--	3.5	9.3	6.7	1.9
White spruce	12.0	--	--	6.8	2.0	3.2
Black spruce	30.5	--	--	4.5	9.0	17.0
Northern white-cedar	24.4	--	--	--	3.5	20.9
Tamarack	17.3	--	--	--	3.5	13.8
Oak-hickory	17.9	--	--	2.4	14.0	1.5
Elm-ash-soft maple	59.2	--	--	0.1	8.5	50.6
Maple-basswood	284.6	--	3.6	58.7	154.3	68.0
Aspen	190.7	3.8	3.4	93.2	86.3	4.0
Paper birch	29.4	--	--	3.2	20.1	6.1
Nonstocked	2.2	--	--	--	--	2.2
All types	766.0	3.8	23.0	212.5	331.2	195.5

Table 3a. -- Area of timberland by forest type and potential productivity class, Nicolet, 1996

(In thousand acres)

Forest type and stand-size class	All classes	Potential productivity class (cubic feet of growth per acre per year)				
		165+	120-164	85-119	50-84	20-49
Jack pine	7.5	--	2.0	1.7	3.8	--
Red pine	38.7	3.0	21.1	8.8	5.8	--
White pine	4.4	--	1.7	1.6	1.1	--
Balsam fir	25.6	--	5.8	8.2	4.1	7.5
White spruce	15.4	--	--	7.4	8.0	--
Black spruce	28.8	--	--	--	4.1	24.7
Northern white-cedar	29.2	--	--	--	2.4	26.8
Tamarack	6.3	--	--	1.4	1.6	3.3
Oak-hickory	9.8	--	--	1.8	8.0	--
Elm-ash-soft maple	24.3	--	--	--	4.1	20.2
Maple-basswood	258.8	--	--	74.2	151.7	32.9
Aspen	127.9	2.0	3.6	95.4	21.2	5.7
Paper birch	20.2	--	--	4.2	14.3	1.7
Balsam poplar	0.2	--	--	0.2	--	--
Nonstocked	2.3	--	--	--	2.3	--
All types	599.4	5.0	34.2	204.9	232.5	122.8

Table 4. -- Area of timberland and stocking class of growing-stock trees [1], Chequamegon-Nicolet National Forest, 1996

(In thousand acres)

National Forest	All classes	Stocking class of growing-stock trees				
		Non-stocked [2]	Poorly stocked	Moderately stocked	Fully stocked	Over-stocked
Chequamegon	766.0	3.0	62.5	179.6	440.8	80.1
Nicolet	599.4	2.3	29.0	110.0	400.0	58.1
Total	1,365.4	5.3	91.5	289.6	840.8	138.2

[1] This table is based on the stocking percent of growing-stock trees, rather than that of "live" trees. For this table, to use the definition of stocking found in the appendix, replace the term "live trees" with "growing-stock trees."
[2] Area of nonstocked in this table may differ from that of other tables in this report because this table includes land stocked with only growing-stock trees, rather than with all live trees.

Table 5. -- Number of all live trees on timberland by species group and diameter class, Chequamegon, 1983 and 1996

(In thousand trees)

1983 Chequamegon

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	13,366	--	3,239	3,794	4,309	1,496	426	102	--	--	--	--	--
Red pine	7,288	330	--	1,392	2,661	2,076	725	50	30	9	10	5	--
White pine	2,626	200	200	193	634	557	344	206	145	88	23	36	--
White spruce	16,426	4,680	2,560	3,190	3,880	1,441	520	133	17	5	--	--	--
Black spruce	11,216	6,530	2,780	1,359	430	114	--	--	--	3	--	--	--
Balsam fir	36,661	22,640	6,770	4,420	1,791	853	83	72	32	--	--	--	--
Hemlock	2,182	--	--	704	455	319	236	227	92	108	19	22	--
Tamarack	7,498	3,280	2,330	783	1,025	65	15	--	--	--	--	--	--
Northern white-cedar	7,679	--	570	2,636	2,236	1,183	851	83	80	31	9	--	--
Total softwoods	104,942	37,660	18,449	18,471	17,421	8,104	3,200	873	396	244	61	63	--
Hardwoods													
Select white oak	1,466	620	--	355	428	63	--	--	--	--	--	--	--
Select red oak	19,240	1,960	4,940	5,372	3,819	2,067	671	241	75	42	32	21	--
Other red oak	1,081	390	380	304	--	7	--	--	--	--	--	--	--
Other hickory	122	--	--	--	72	19	31	--	--	--	--	--	--
Basswood	7,369	2,490	480	1,445	861	953	802	235	79	4	17	3	--
Yellow birch	13,435	5,020	3,300	2,393	1,013	982	422	140	71	49	13	29	3
Hard maple	73,542	39,280	15,530	9,903	5,198	2,198	852	366	106	62	22	25	--
Soft maple	95,840	58,905	21,840	8,334	3,966	1,466	690	387	150	37	55	10	--
Elm	1,866	730	360	314	223	70	97	42	19	5	6	--	--
Black ash	15,422	8,240	3,600	2,048	708	596	186	33	11	--	--	--	--
White & green ash	1,976	790	--	138	297	406	141	129	62	--	13	--	--
Bigtooth aspen	24,858	15,900	2,270	1,633	2,250	1,723	784	217	42	32	7	--	--
Quaking aspen	71,242	53,947	4,859	5,509	3,745	1,802	1,018	252	78	32	--	--	--
Paper birch	22,592	7,350	5,320	4,028	3,764	1,601	401	121	7	--	--	--	--
Black cherry	3,546	3,510	--	36	--	--	--	--	--	--	--	--	--
Other hardwoods	303	270	--	--	--	33	--	--	--	--	--	--	--
Total hardwoods	353,900	199,402	62,879	41,812	26,344	13,986	6,095	2,163	700	263	165	88	3
Noncommercial spp.	6,281	5,580	490	128	60	--	23	--	--	--	--	--	--
All species	465,123	242,642	81,818	60,411	43,825	22,090	9,318	3,036	1,096	507	226	151	3

(Table 5 continued)

(In thousand trees)

1996 Chequamegon

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	7,150	3,216	1,257	645	955	644	297	121	9	--	6	--	--
Red pine	12,504	3,339	2,232	1,868	1,765	1,256	1,215	460	201	113	38	17	--
White pine	3,525	1,188	672	414	216	148	181	205	172	132	112	73	12
White spruce	11,487	4,287	3,135	1,701	1,061	591	401	184	53	48	12	14	--
Black spruce	23,372	13,761	6,321	2,324	695	183	44	7	21	5	11	--	--
Balsam fir	62,220	43,750	11,820	3,629	1,757	887	273	83	17	--	4	--	--
Hemlock	3,932	1,026	114	580	429	385	432	319	262	147	122	112	4
Tamarack	9,785	4,236	2,637	1,131	1,146	377	203	21	17	13	4	--	--
Northern white-cedar	13,149	624	1,932	2,496	3,009	2,558	1,622	656	131	66	31	17	7
Other softwoods	48	48	--	--	--	--	--	--	--	--	--	--	--
Total softwoods	147,172	75,475	30,120	14,788	11,033	7,029	4,668	2,056	883	524	340	233	23
Hardwoods													
Select white oak	325	120	--	69	95	31	10	--	--	--	--	--	--
Select red oak	10,414	4,425	708	983	1,528	1,153	721	486	197	115	34	64	--
Other red oak	3,260	2,046	759	222	196	29	--	8	--	--	--	--	--
Other hickory	261	198	--	25	--	9	17	12	--	--	--	--	--
Basswood	7,385	2,949	1,022	606	575	758	744	432	182	84	24	9	--
Yellow birch	11,540	5,967	1,452	1,601	720	662	492	357	160	60	38	31	--
Hard maple	65,963	28,238	14,845	9,297	5,980	4,181	1,836	899	377	172	92	46	--
Soft maple	67,002	35,600	13,407	7,632	5,018	2,719	1,413	691	268	158	34	57	5
Elm	3,354	2,481	507	165	38	51	58	33	--	11	5	3	2
Black ash	23,632	12,417	5,340	3,180	1,582	619	336	112	35	5	6	--	--
White & green ash	5,726	3,369	615	312	270	437	335	213	94	72	5	4	--
Bigtooth aspen	30,920	22,935	3,972	716	856	1,029	724	410	205	59	14	--	--
Quaking aspen	121,297	86,482	21,698	5,306	2,972	2,345	1,348	693	292	103	48	10	--
Paper birch	17,096	6,417	2,420	2,864	2,985	1,401	756	177	50	26	--	--	--
Black cherry	10,973	9,063	1,509	305	51	38	7	--	--	--	--	--	--
Other hardwoods	78	66	--	--	--	--	12	--	--	--	--	--	--
Total hardwoods	379,226	222,773	68,254	33,283	22,866	15,462	8,809	4,523	1,860	865	300	224	7
Noncommercial spp.	31,734	28,897	2,530	143	164	--	--	--	--	--	--	--	--
All species	558,132	327,145	100,904	48,214	34,063	22,491	13,477	6,579	2,743	1,389	640	457	30

Table 5a. -- Number of all live trees on timberland by species group and diameter class, Nicolet, 1983 and 1996

(In thousand trees)

1983 Nicolet

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	5,410	3,390	100	616	890	278	103	27	6	--	--	--	--
Red pine	10,229	500	970	2,968	1,904	2,293	1,303	169	42	28	32	20	--
White pine	859	270	--	108	25	40	132	28	67	127	24	38	--
White spruce	11,327	3,969	2,680	1,902	1,571	680	402	70	53	--	--	--	--
Black spruce	12,307	4,319	4,588	2,762	443	168	17	10	--	--	--	--	--
Balsam fir	34,837	17,609	8,237	5,717	1,616	1,086	416	86	70	--	--	--	--
Hemlock	1,918	--	30	369	238	264	384	258	174	118	65	17	1
Tamarack	3,152	800	600	1,236	464	12	40	--	--	--	--	--	--
Northern white-cedar	22,632	4,039	6,286	6,974	3,477	1,341	445	48	22	--	--	--	--
Total softwoods	102,671	34,896	23,491	22,652	10,628	6,162	3,242	696	434	273	121	75	1
Hardwoods													
Select white oak	32	--	--	32	--	--	--	--	--	--	--	--	--
Select red oak	3,647	300	280	1,780	535	488	172	53	32	--	--	7	--
Other red oak	770	710	--	--	--	60	--	--	--	--	--	--	--
Basswood	19,697	4,210	5,050	4,632	2,638	2,003	719	259	110	35	29	12	--
Beech	115	--	--	--	--	115	--	--	--	--	--	--	--
Yellow birch	7,311	2,039	2,859	1,125	513	297	148	120	71	79	38	19	3
Hard maple	94,200	44,508	25,279	12,913	6,921	2,870	786	316	195	195	106	108	3
Soft maple	18,412	9,020	4,179	2,840	1,417	585	316	19	27	2	--	7	--
Elm	10,111	5,330	1,380	2,003	599	393	232	97	34	29	3	11	--
Black ash	7,362	3,040	2,810	770	687	21	4	30	--	--	--	--	--
White & green ash	1,108	--	--	229	445	182	164	75	--	13	--	--	--
Balsam poplar	224	--	--	84	30	78	--	25	--	--	7	--	--
Bigtooth aspen	9,547	6,380	--	783	1,358	557	352	99	8	10	--	--	--
Quaking aspen	104,019	81,594	9,515	3,905	4,214	2,711	1,323	418	268	52	12	7	--
Paper birch	11,224	2,400	3,230	2,328	1,880	931	252	124	78	--	--	1	--
Black cherry	14,953	7,927	4,509	1,178	801	245	69	211	13	--	--	--	--
Other hardwoods	418	--	350	--	27	--	40	1	--	--	--	--	--
Total hardwoods	303,150	167,458	59,441	34,602	22,065	11,536	4,577	1,847	836	415	195	172	6
Noncommercial spp.	6,421	3,989	1,800	440	181	11	--	--	--	--	--	--	--
All species	412,242	206,343	84,732	57,694	32,874	17,709	7,819	2,543	1,270	688	316	247	7

(Table 5a continued)

(In thousand trees)

1996 Nicolet

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	3,569	1,083	1,659	305	268	170	73	10	1	--	--	--	--
Red pine	9,820	2,121	1,254	1,770	1,081	1,349	1,274	687	150	65	34	35	--
White pine	2,183	1,320	99	209	148	60	71	60	52	21	33	106	4
White spruce	10,697	3,738	2,715	1,499	1,390	688	400	137	70	41	11	8	--
Black spruce	16,084	8,148	4,260	2,442	1,019	152	17	22	13	5	6	--	--
Balsam fir	55,663	38,716	10,098	3,889	2,013	615	281	40	11	--	--	--	--
Hemlock	2,577	273	72	118	303	349	480	325	260	168	129	94	6
Tamarack	6,234	2,832	1,749	987	365	179	73	36	7	--	6	--	--
Northern white-cedar	14,403	1,578	3,282	3,739	3,170	1,365	935	255	48	23	--	8	--
Total softwoods	121,230	59,809	25,188	14,958	9,757	4,927	3,604	1,572	612	323	219	251	10
Hardwoods													
Select white oak	147	--	81	--	16	50	--	--	--	--	--	--	--
Select red oak	3,722	1,698	294	246	535	274	233	285	68	50	30	8	1
Other red oak	423	255	54	102	--	--	--	--	--	12	--	--	--
Basswood	12,514	3,204	1,681	1,783	1,891	1,855	1,195	528	270	46	32	29	--
Beech	470	309	--	53	76	20	--	--	--	--	8	4	--
Yellow birch	3,619	1,503	549	419	384	239	160	135	96	62	38	30	4
Hard maple	74,472	31,477	17,128	10,486	7,298	4,317	1,883	709	409	357	198	196	14
Soft maple	22,436	11,148	4,395	3,463	1,636	1,059	442	181	82	13	13	4	--
Elm	6,067	4,027	1,482	350	126	44	22	--	13	3	--	--	--
Black ash	14,756	6,277	5,494	2,107	693	114	38	29	4	--	--	--	--
White & green ash	4,893	3,039	654	333	293	186	123	178	39	40	8	--	--
Balsam poplar	1,023	315	255	127	154	47	25	76	9	15	--	--	--
Bigtooth aspen	13,154	9,210	2,241	352	204	386	336	284	106	27	4	4	--
Quaking aspen	97,171	66,763	18,060	4,920	2,801	2,277	1,290	647	246	104	51	12	--
Paper birch	11,208	4,378	1,861	1,693	1,824	938	312	100	70	32	--	--	--
Black cherry	10,554	7,372	1,557	640	474	271	111	91	30	8	--	--	--
Other hardwoods	22	--	--	--	--	13	--	--	5	4	--	--	--
Total hardwoods	276,651	150,975	55,786	27,074	18,405	12,090	6,170	3,243	1,447	773	382	287	19
Noncommercial spp.	12,017	10,286	876	725	100	20	10	--	--	--	--	--	--
All species	409,898	221,070	81,850	42,757	28,262	17,037	9,784	4,815	2,059	1,096	601	538	29

Table 6. -- Net volume of growing stock on timberland by species group and diameter class, Chequamegon, 1983 and 1996

(In thousand cubic feet)

1983 Chequamegon

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	51,879	9,682	22,131	14,049	5,865	152	--	--	--	--	--
Red pine	56,760	4,294	15,646	21,727	11,417	1,223	1,069	424	557	403	--
White pine	32,366	483	3,599	5,658	5,496	5,211	4,644	4,101	1,328	1,846	--
White spruce	61,978	7,465	24,969	15,676	9,689	3,388	562	229	--	--	--
Black spruce	7,414	3,872	2,164	1,251	--	--	--	127	--	--	--
Balsam fir	33,681	10,659	10,421	8,701	1,353	1,628	919	--	--	--	--
Hemlock	17,728	792	758	2,322	2,252	3,657	2,478	3,350	504	1,444	171
Tamarack	8,392	2,384	5,369	402	237	--	--	--	157	--	--
Northern white-cedar	31,194	5,706	9,123	6,170	7,214	1,307	935	582	--	--	--
Total softwoods	301,392	45,337	94,180	75,956	43,523	16,566	10,607	8,813	2,546	3,693	171
Hardwoods											
Select white oak	3,758	914	2,206	638		--	--	--	--	--	--
Select red oak	76,219	14,218	20,119	19,314	10,257	5,377	2,081	1,297	1,862	1,694	--
Other red oak	168	168	--	--	--	--	--	--	--	--	--
Other hickory	1,139	--	377	244	518	--	--	--	--	--	--
Basswood	46,120	3,650	6,061	12,143	14,321	6,022	2,783	--	919	221	--
Yellow birch	25,390	2,933	4,279	7,788	4,506	1,646	1,407	1,501	417	913	--
Hard maple	103,512	26,049	30,391	21,178	12,052	7,253	2,833	1,529	950	1,277	--
Soft maple	80,434	21,422	20,359	13,133	9,085	7,633	4,190	1,544	2,711	357	--
Elm	5,297	705	1,075	476	975	949	598	185	334	--	--
Black ash	19,002	5,201	4,052	5,969	2,696	867	217	--	--	--	--
White & green ash	14,395	340	1,864	4,392	2,256	2,708	2,065	--	770	--	--
Bigtooth aspen	55,479	4,769	13,470	18,678	11,423	4,253	990	1,406	490	--	--
Quaking aspen	78,925	14,971	23,034	18,144	14,569	5,005	1,790	1,412	--	--	--
Paper birch	56,106	10,962	20,676	15,676	6,056	2,450	286	--	--	--	--
Other hardwoods	422	--	--	422	--	--	--	--	--	--	--
Total hardwoods	566,366	106,302	147,963	138,195	88,714	44,163	19,240	8,874	8,453	4,462	0
All species	867,758	151,639	242,143	214,151	132,237	60,729	29,847	17,687	10,999	8,155	171

(Table 6 continued)

(In thousand cubic feet)

1996 Chequamegon

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	20,297	1,281	4,974	5,924	4,785	2,791	209	--	333	--	--
Red pine	72,450	4,531	9,816	12,257	19,382	10,803	6,711	5,210	2,352	1,388	--
White pine	39,108	823	918	1,441	2,856	4,924	5,545	6,201	7,116	7,162	2,122
White spruce	35,139	4,525	6,520	6,613	7,276	4,683	1,957	1,835	764	966	--
Black spruce	14,976	6,152	4,021	2,097	794	221	742	275	674	--	--
Balsam fir	34,157	9,199	10,012	8,132	4,401	1,679	520	--	214	--	--
Hemlock	38,255	699	1,091	2,440	4,162	5,493	6,461	4,738	5,151	7,135	885
Tamarack	18,387	3,600	6,935	3,921	2,654	499	194	373	211	--	--
Northern white-cedar	61,118	4,299	11,780	15,951	15,761	8,576	1,916	1,572	750	513	--
Total softwoods	333,887	35,109	56,067	58,776	62,071	39,669	24,255	20,204	17,565	17,164	3,007
Hardwoods											
Select white oak	1,158	218	498	283	159	--	--	--	--	--	--
Select red oak	59,554	2,104	8,535	10,837	10,396	11,113	5,874	4,623	1,736	4,336	--
Other red oak	1,181	492	536	153	--	--	--	--	--	--	--
Other hickory	677	87	--	139	141	310	--	--	--	--	--
Basswood	50,329	1,912	3,316	9,396	13,349	10,900	6,171	3,772	728	785	--
Yellow birch	28,829	2,928	2,815	4,675	5,143	5,724	2,976	1,767	1,418	1,383	--
Hard maple	165,617	22,850	33,356	40,260	26,246	18,366	11,295	6,230	3,986	3,028	--
Soft maple	116,094	16,594	24,558	23,926	20,177	13,011	6,774	4,947	1,537	3,689	881
Elm	3,906	469	101	339	957	770	--	489	291	198	292
Black ash	34,185	8,466	9,549	6,333	5,615	2,638	1,021	204	359	--	--
White & green ash	23,599	997	1,401	4,436	4,996	5,001	3,065	3,019	327	357	--
Bigtooth aspen	45,614	1,926	5,096	10,683	11,463	8,027	5,914	1,690	815	--	--
Quaking aspen	92,592	12,619	16,151	22,079	18,605	13,279	5,434	3,129	1,296	--	--
Paper birch	57,873	7,110	17,744	14,745	11,810	4,133	1,411	920	--	--	--
Black cherry	527	191	184	--	152	--	--	--	--	--	--
Other hardwoods	179	--	--	--	179	--	--	--	--	--	--
Total hardwoods	681,914	78,963	123,840	148,284	129,388	93,272	49,935	30,790	12,493	13,776	1,173
All species	1,015,801	114,072	179,907	207,060	191,459	132,941	74,190	50,994	30,058	30,940	4,180

Table 6a. -- Net volume of growing stock on timberland by species group and diameter class, Nicolet, 1983 and 1996

(In thousand cubic feet)

1983 Nicolet

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	10,500	1,610	4,431	2,107	1,480	673	199	--	--	--	--
Red pine	69,638	5,928	11,164	22,729	19,839	4,009	1,522	1,319	1,788	1,340	--
White pine	17,616	170	92	398	2,298	790	2,580	5,946	1,603	3,739	--
White spruce	30,912	5,137	8,417	6,869	6,744	1,902	1,843	--	--	--	--
Black spruce	12,465	7,874	2,472	1,538	278	292	--	11	--	--	--
Balsam fir	45,915	13,742	10,198	10,842	6,388	2,161	2,584	--	--	--	--
Hemlock	27,037	513	963	2,231	4,387	4,942	4,980	4,385	3,086	1,446	104
Tamarack	7,644	3,370	3,319	173	782	--	--	--	--	--	--
Northern white-cedar	46,543	15,456	16,283	8,805	4,434	976	576	13	--	--	--
Total softwoods	268,270	53,800	57,339	55,692	46,630	15,745	14,284	11,674	6,477	6,525	104
Hardwoods											
Select white oak	83	83	--	--	--	--	--	--	--	--	--
Select red oak	16,571	4,655	2,465	4,747	2,832	598	719	--	--	555	--
Basswood	77,596	11,924	16,205	22,296	12,322	6,716	3,717	1,677	1,692	1,047	--
Yellow birch	16,254	1,906	1,777	1,817	2,348	1,789	1,679	3,017	1,383	439	99
Hard maple	149,659	36,001	41,353	28,559	10,061	6,596	6,267	8,139	5,228	7,089	366
Soft maple	27,464	7,528	8,805	5,638	3,461	265	881	77	--	809	--
Elm	19,824	4,657	2,886	3,935	3,365	2,056	1,102	1,172	147	504	--
Black ash	6,874	1,884	3,940	241	69	740	--	--	--	--	--
White & green ash	10,452	568	2,737	1,944	2,559	1,999	--	645	--	--	--
Balsam poplar	2,558	293	214	845	--	773	--	--	433	--	--
Bigtooth aspen	23,856	2,496	5,545	6,231	6,240	2,536	337	471	--	--	--
Quaking aspen	110,984	11,423	27,334	29,246	20,765	10,384	9,419	1,659	754	--	--
Paper birch	36,294	6,456	11,430	10,132	3,738	2,460	1,961	--	--	117	--
Black cherry	15,301	2,938	4,050	2,299	1,424	4,188	402	--	--	--	--
Other hardwoods	1,012	--	226	--	786	--	--	--	--	--	--
Total hardwoods	514,782	92,812	128,967	117,930	69,970	41,100	26,484	16,857	9,637	10,560	465
All species	783,052	146,612	186,306	173,622	116,600	56,845	40,768	28,531	16,114	17,085	569

(Table 6a continued)

(In thousand cubic feet)

1996 Nicolet

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	5,398	761	1,374	1,792	1,165	262	44	--	--	--	--
Red pine	73,362	4,600	6,490	13,691	20,706	15,767	4,668	2,762	2,047	2,631	--
White pine	19,316	424	542	447	1,036	1,450	1,328	992	2,019	10,396	682
White spruce	35,570	4,046	8,079	7,194	6,947	3,768	2,502	1,785	686	563	--
Black spruce	16,135	6,939	5,643	1,641	325	577	432	228	350	--	--
Balsam fir	33,683	10,277	11,064	6,433	4,749	786	374	--	--	--	--
Hemlock	42,402	219	1,445	2,568	5,955	6,739	6,484	5,868	6,139	6,119	866
Tamarack	10,515	3,360	2,445	1,863	1,314	1,008	211	--	314	--	--
Northern white-cedar	47,540	7,884	13,758	10,055	10,045	4,221	770	437	--	370	--
Total softwoods	283,921	38,510	50,840	45,684	52,242	34,578	16,813	12,072	11,555	20,079	1,548
Hardwoods											
Select white oak	546	--	94	452	--	--	--	--	--	--	--
Select red oak	23,384	689	2,914	2,685	3,542	6,230	2,247	2,340	1,762	975	--
Other red oak	646	275	--	--	--	--	--	371	--	--	--
Basswood	89,787	5,112	12,403	22,093	21,234	13,385	9,275	2,103	1,844	2,338	--
Beech	1,157	178	196	214	--	--	--	--	569	--	--
Yellow birch	17,307	847	2,204	2,041	1,994	2,092	2,494	2,460	1,624	1,551	--
Hard maple	215,856	28,568	43,904	45,030	28,899	15,419	12,656	14,303	10,586	15,057	1,434
Soft maple	40,984	7,898	9,684	10,181	6,542	3,498	1,941	194	658	388	--
Elm	2,606	879	636	344	328	--	282	137	--	--	--
Black ash	11,924	5,221	4,247	992	609	697	158	--	--	--	--
White & green ash	13,867	776	1,659	1,821	2,040	4,077	1,176	1,825	493	--	--
Balsam poplar	5,662	407	1,164	576	408	2,053	353	701	--	--	--
Bigtooth aspen	24,681	1,132	993	3,463	6,313	7,354	3,752	1,383	291	--	--
Quaking aspen	101,460	13,574	16,807	23,183	20,563	14,292	7,540	3,427	1,674	400	--
Paper birch	37,572	5,182	11,637	10,468	4,412	2,276	2,348	1,249	--	--	--
Black cherry	11,788	1,598	2,817	2,355	1,628	2,152	830	408	--	--	--
Other hardwoods	572	--	--	213	--	--	172	187	--	--	--
Total hardwoods	599,799	72,336	111,359	126,111	98,512	73,525	45,224	31,088	19,501	20,709	1,434
All species	883,720	110,846	162,199	171,795	150,754	108,103	62,037	43,160	31,056	40,788	2,982

Table 7. -- Net volume of all live trees, growing stock, and sawtimber on timberland by Forest and major species group, Chequamegon-Nicolet National Forest, 1996

(In thousand cubic feet)

Land base	All live trees					Growing-stock trees				
		Major species group					Major species group			
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other Softwoods	Soft hardwoods	Hard hardwoods
Chequamegon	1,122,245	133,800	220,872	452,641	314,932	1,015,801	131,855	202,032	401,120	280,794
Nicolet	932,056	98,844	192,175	347,615	293,422	883,720	98,076	185,845	325,932	273,867
Total	2,054,301	232,644	413,047	800,256	608,354	1,899,521	229,931	387,877	727,052	554,661

(In thousand board feet) [1]

Land base	Sawtimber				
		Major species group			
	All species	Pine	Other Softwoods	Soft hardwoods	Hard hardwoods
Chequamegon	2,737,480	572,807	693,411	828,927	642,335
Nicolet	2,326,828	443,498	574,732	669,526	639,072
Total	5,064,308	1,016,305	1,268,143	1,498,453	1,281,407

[1] International 1/4-inch rule.

Table 8. -- Net volume of all live trees on timberland by species group and forest type, Chequamegon, 1996

(In thousand cubic feet)

Species group	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-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods																
Jack pine	21,256	14,527	1,626	1,036	--	--	316	--	--	--	408	186	3,157	--	--	--
Red pine	72,684	1,944	61,677	2,641	--	--	--	--	--	--	--	283	6,139	--	--	--
White pine	39,860	--	4,899	12,957	51	--	329	--	1,000	--	1,714	12,674	4,782	737	--	717
White spruce	35,431	--	73	--	2,761	21,954	149	215	--	--	850	3,132	5,856	327	--	114
Black spruce	14,976	--	--	--	1,525	580	6,790	1,923	858	--	242	878	1,727	453	--	--
Balsam fir	34,905	--	108	1,531	6,542	375	500	2,079	--	--	4,712	8,663	9,452	943	--	--
Hemlock	42,085	--	--	--	199	--	37	803	--	--	2,329	38,057	392	268	--	--
Tamarack	20,039	--	--	--	1,555	558	4,495	489	9,605	--	443	922	1,125	773	--	74
Northern white-cedar	73,436	--	--	268	4,058	--	1,263	36,647	157	--	10,953	18,187	784	1,119	--	--
Total softwoods	354,672	16,471	68,383	18,433	16,691	23,467	13,879	42,156	11,620	--	21,651	82,982	33,414	4,620	--	905
Hardwoods																
Select white oak	1,158	--	--	--	--	--	--	--	--	1,158	--	--	--	--	--	--
Select red oak	62,590	--	387	129	--	265	--	--	--	16,830	883	34,444	6,772	2,880	--	--
Other red oak	1,969	51	649	138	--	--	--	--	--	946	--	46	139	--	--	--
Other hickory	805	--	--	--	--	--	--	--	--	--	--	805	--	--	--	--
Basswood	52,475	212	217	--	--	112	--	--	--	--	149	50,319	1,466	--	--	--
Yellow birch	36,615	--	--	--	445	--	220	426	--	--	3,377	31,335	812	--	--	--
Hard maple	186,678	133	--	--	99	195	--	--	--	793	1,095	178,347	3,920	2,096	--	--
Soft maple	132,246	--	618	--	906	129	362	--	--	1,999	17,027	94,016	10,300	6,889	--	--
Elm	4,174	--	--	--	--	--	--	--	--	--	283	3,367	463	61	--	--
Black ash	35,129	--	--	--	1,291	--	--	922	--	321	15,725	15,953	917	--	--	--
White & green ash	24,874	--	--	--	--	--	--	--	--	--	1,969	21,963	471	471	--	--
Bigtooth aspen	53,451	--	1,544	--	--	1,903	--	--	--	859	--	10,367	36,433	2,345	--	--
Quaking aspen	108,936	735	1,423	205	2,549	1,892	403	314	--	2,454	4,332	20,395	70,663	3,571	--	--
Paper birch	64,078	--	214	879	315	848	413	950	--	2,390	1,375	23,812	13,823	19,059	--	--
Black cherry	1,294	58	--	--	278	60	--	--	--	--	--	631	267	--	--	--
Other hardwoods	179	--	--	--	--	--	--	--	--	--	--	179	--	--	--	--
Total hardwoods	766,651	1,189	5,052	1,351	5,883	5,404	1,398	2,612	--	27,750	46,215	485,979	146,446	37,372	--	--
Noncommercial spp.	922	--	--	--	--	--	--	--	--	--	79	763	80	--	--	--
All species	1,122,245	17,660	73,435	19,784	22,574	28,871	15,277	44,768	11,620	27,750	67,945	569,724	179,940	41,992	--	905

Table 8a. -- Net volume of all live trees on timberland by species group and forest type, Nicolet, 1996

(In thousand cubic feet)

Species group	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-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods																
Jack pine	5,493	5,010	483	--	--	--	--	--	--	--	--	--	--	--	--	--
Red pine	73,463	3,471	64,578	1,136	--	--	392	--	--	--	--	511	3,375	--	--	--
White pine	19,888	302	200	6,084	874	--	1,117	278	--	--	647	4,467	4,803	1,116	--	--
White spruce	36,099	313	1,877	266	3,063	17,901	--	1,302	--	--	726	5,180	4,500	971	--	--
Black spruce	16,365	535	166	144	1,821	--	8,996	2,503	673	--	--	167	1,360	--	--	--
Balsam fir	34,020	--	1,065	104	6,680	545	287	1,476	343	--	3,540	8,005	9,637	2,338	--	--
Hemlock	44,223	--	--	200	146	335	--	607	--	--	498	39,976	1,738	723	--	--
Tamarack	10,678	--	--	--	1,715	--	3,309	1,143	3,507	--	841	163	--	--	--	--
Northern white-cedar	50,790	--	--	--	2,640	--	370	33,714	--	--	5,616	6,356	1,217	877	--	--
Total softwoods	291,019	9,631	68,369	7,934	16,939	18,781	14,471	41,023	4,523	--	11,868	64,825	26,630	6,025	--	--
Hardwoods																
Select white oak	546	--	--	--	--	--	--	--	--	348	--	198	--	--	--	--
Select red oak	23,976	--	2,151	222	--	--	--	--	--	8,964	--	6,245	4,976	1,418	--	--
Other red oak	646	--	371	--	--	--	275	--	--	--	--	--	--	--	--	--
Basswood	91,453	--	361	--	--	400	--	--	--	--	--	87,842	2,850	--	--	--
Beech	1,666	--	--	--	--	--	--	--	--	--	--	1,593	73	--	--	--
Yellow birch	19,860	--	--	--	177	--	47	614	--	--	1,387	17,380	211	44	--	--
Hard maple	231,063	--	2,124	--	--	739	--	--	--	--	--	220,640	7,310	250	--	--
Soft maple	44,669	--	211	322	516	--	215	336	--	1,418	3,154	29,365	5,839	3,293	--	--
Elm	2,929	--	606	--	--	384	--	--	--	--	290	1,331	318	--	--	--
Black ash	12,136	--	--	--	914	--	--	1,504	--	--	6,765	2,405	548	--	--	--
White & green ash	14,561	--	214	--	--	--	--	--	--	--	502	13,283	243	319	--	--
Balsam poplar	5,662	--	--	--	333	--	--	188	--	--	141	3,721	1,169	110	--	--
Bigtooth aspen	26,106	--	--	--	--	--	--	--	--	1,533	153	6,798	17,622	--	--	--
Quaking aspen	109,606	1,959	4,526	141	2,979	2,976	2,108	556	--	417	2,337	34,948	54,360	2,299	--	--
Paper birch	39,849	--	221	260	111	616	280	1,819	--	365	821	17,232	5,994	12,130	--	--
Black cherry	13,608	--	453	--	295	865	--	295	--	--	35	8,658	3,007	--	--	--
Other hardwoods	572	--	--	--	--	--	--	--	--	--	--	572	--	--	--	--
Total hardwoods	638,908	1,959	11,238	945	5,325	5,980	2,925	5,312	--	13,045	15,585	452,211	104,520	19,863	--	--
Noncommercial spp.	2,129	--	--	--	--	--	--	--	--	--	--	1,933	86	110	--	--
All species	932,056	11,590	79,607	8,879	22,264	24,761	17,396	46,335	4,523	13,045	27,453	518,969	131,236	25,888	--	--

Table 9. -- Area of timberland by forest type and stand-age class, Chequamegon-Nicolet National Forest, 1996

(In thousand acres)

Land base forest type	All classes	Stand-age class (years) 1 - 20	21 - 40	41 - 60	61 - 80	81 - 100	101 -120	121 -140	141+
Chequamegon									
Jack pine	19.0	4.7	5.2	7.9	1.2	--	--	--	--
Red pine	48.0	12.8	12.6	20.5	2.1	--	--	--	--
White pine	9.4	--	--	6.4	1.5	1.5	--	--	--
Balsam fir	21.4	7.1	1.7	5.7	5.6	--	--	1.3	--
White spruce	12.0	--	1.7	10.3	--	--	--	--	--
Black spruce	30.5	1.5	2.6	17.4	7.9	1.1	--	--	--
Northern white-cedar	24.4	--	0.0	1.9	4.0	5.7	10.8	--	2.0
Tamarack	17.3	2.4	2.8	4.5	4.9	2.7	--	--	--
Oak-hickory	17.9	3.2	0.3	11.0	3.4	--	--	--	--
Elm-ash-soft maple	59.2	1.6	5.6	20.2	20.7	6.4	2.4	2.3	--
Maple-beech-birch	284.6	15.1	17.4	86.4	112.7	32.2	9.8	7.6	3.4
Aspen	190.7	79.8	42.3	53.0	15.6	--	--	--	--
Paper birch	29.4	2.3	2.9	20.8	1.0	2.4	--	--	--
Nonstocked	2.2	--	--	--	2.2	--	--	--	--
All forest types	766.0	130.5	95.1	266.0	182.8	52.0	23.0	11.2	5.4
Nicolet									
Jack pine	7.5	1.6	1.7	4.2	--	--	--	--	--
Red pine	38.7	3.4	8.9	25.6	0.3	0.5	--	--	--
White pine	4.4	--	--	1.6	--	1.1	1.7	--	--
Balsam fir	25.6	4.5	7.7	4.7	6.6	--	2.1	--	--
White spruce	15.4	0.8	3.2	9.4	2.0	--	0.0	--	--
Black spruce	28.8	3.1	3.6	19.2	1.7	--	1.2	--	--
Northern white-cedar	29.2	--	--	3.2	8.0	11.1	6.4	--	0.5
Tamarack	6.3	--	2.3	1.6	2.4	--	0.0	--	--
Oak-hickory	9.8	--	--	8.0	1.8	--	0.0	--	--
Elm-ash-soft maple	24.3	4.6	3.8	6.9	3.3	3.9	1.8	--	--
Maple-beech-birch	258.8	8.7	14.2	124.0	71.0	25.9	12.3	0.8	1.9
Aspen	127.9	42.6	32.4	40.7	12.2	--	--	--	--
Paper birch	20.2	3.6	3.7	9.5	3.4	--	--	--	--
Balsam poplar	0.2	0.2	--	--	--	--	--	--	--
Nonstocked	2.3	0.4	--	--	--	--	--	--	1.9
All forest types	599.4	73.5	81.5	258.6	112.7	42.5	25.5	0.8	4.3
Total	1365.4	204.0	176.6	524.6	295.5	94.5	48.5	12.0	9.7

Table 10. -- Net volume of sawtimber on timberland by species group and diameter class, Chequamegon, 1996

(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	68,871	28,116	23,484	14,239	1,135	--	1,897	--	--
Red pine	306,068	62,114	99,749	57,102	36,469	29,051	13,445	8,138	--
White pine	197,868	6,605	13,436	24,244	28,363	32,749	38,733	41,062	12,676
White spruce	127,992	33,399	37,786	25,216	10,937	10,464	4,453	5,737	--
Black spruce	26,317	10,956	4,268	1,238	4,230	1,603	4,022	--	--
Balsam fir	73,240	38,970	21,712	8,615	2,751	--	1,192	--	--
Hemlock	193,096	11,868	20,159	27,397	33,454	25,367	28,390	40,961	5,500
Tamarack	40,458	19,640	13,770	2,667	1,059	2,109	1,213	--	--
Northern white-cedar	232,308	80,916	80,666	44,745	10,218	8,637	4,195	2,931	--
Total softwoods	1,266,218	292,584	315,030	205,463	128,616	109,980	97,540	98,829	18,176
Hardwoods									
Select white oak	644	--	644	--	--	--	--	--	--
Select red oak	168,812	--	41,675	48,288	26,696	21,813	8,419	21,921	--
Other hickory	1,746	--	512	1,234	--	--	--	--	--
Basswood	158,436	--	55,377	48,754	28,601	18,067	3,604	4,033	--
Yellow birch	87,504	--	22,347	26,984	14,582	8,957	7,274	7,360	--
Hard maple	308,581	--	108,532	82,272	52,709	29,959	19,689	15,420	--
Soft maple	225,702	--	82,219	57,518	31,360	23,646	7,599	18,619	4,741
Elm	13,056	--	3,706	3,292	--	2,238	1,368	950	1,502
Black ash	44,205	--	24,350	12,131	4,911	997	1,816	--	--
White & green ash	74,300	--	20,425	22,041	14,060	14,362	1,600	1,812	--
Bigtooth aspen	124,879	--	48,264	36,208	28,063	8,279	4,065	--	--
Quaking aspen	184,991	--	78,216	59,754	25,482	15,086	6,453	--	--
Paper birch	77,006	--	48,080	18,072	6,507	4,347	--	--	--
Black cherry	652	--	652	--	--	--	--	--	--
Other hardwoods	748	--	748	--	--	--	--	--	--
Total hardwoods	1,471,262	--	535,747	416,548	232,971	147,751	61,887	70,115	6,243
All species	2,737,480	292,584	850,777	622,011	361,587	257,731	159,427	168,944	24,419

[1]International 1/4-inch rule.

Table 10a. -- Net volume of sawtimber on timberland by species group and diameter class, Nicolet, 1996

(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	15,646	8,389	5,683	1,339	235	--	--	--	--
Red pine	327,299	69,355	106,831	83,354	25,338	15,395	11,695	15,331	--
White pine	100,553	2,110	4,948	7,228	6,788	5,271	10,992	59,169	4,047
White spruce	124,620	36,626	36,324	20,341	13,904	10,124	3,988	3,313	--
Black spruce	19,338	8,553	1,753	3,192	2,438	1,328	2,074	--	--
Balsam fir	60,062	30,634	23,421	4,004	2,003	--	--	--	--
Hemlock	213,170	12,187	28,600	33,644	33,467	31,367	33,772	34,880	5,253
Tamarack	24,467	9,305	6,826	5,368	1,159	--	1,809	--	--
Northern white-cedar	133,075	51,137	51,291	22,017	4,124	2,394	--	2,112	--
Total softwoods	1,018,230	228,296	265,677	180,487	89,456	65,879	64,330	114,805	9,300
Hardwoods									
Select red oak	76,075	--	14,265	26,954	10,287	11,016	8,509	5,044	--
Other red oak	1,781	--	--	--	--	1,781	--	--	--
Basswood	222,981	--	88,234	60,010	43,463	10,111	9,112	12,051	--
Beech	2,913	--	--	--	--	--	2,913	--	--
Yellow birch	59,894	--	8,808	9,786	12,228	12,405	8,358	8,309	--
Hard maple	452,824	--	119,163	68,960	59,068	68,812	52,221	76,911	7,689
Soft maple	57,182	--	26,662	15,379	8,962	928	3,243	2,008	--
Elm	3,113	--	1,238	--	1,257	618	--	--	--
Black ash	6,627	--	2,657	3,204	766	--	--	--	--
White & green ash	42,787	--	8,400	17,903	5,395	8,672	2,417	--	--
Balsam poplar	15,716	--	1,683	9,122	1,595	3,316	--	--	--
Bigtooth aspen	86,260	--	26,877	33,477	17,714	6,742	1,450	--	--
Quaking aspen	212,431	--	85,637	64,575	35,266	16,670	8,255	2,028	--
Paper birch	44,319	--	17,910	9,906	10,661	5,842	--	--	--
Black cherry	21,954	--	6,742	9,469	3,823	1,920	--	--	--
Other hardwoods	1,741	--	--	--	818	923	--	--	--
Total hardwoods	1,308,598	--	408,276	328,745	211,303	149,756	96,478	106,351	7,689
All species	2,326,828	228,296	673,953	509,232	300,759	215,635	160,808	221,156	16,989

[1]International 1/4-inch rule.

Table 11.--Net volume of all live trees and salvable dead trees on timberland by class of timber and major species group, Chequamegon, 1996

(In thousand cubic feet)

	All species	Major species group			
		Pine	Other softwoods	Soft hardwoods	Hard hardwoods
Live trees					
Growing stock trees					
Sawtimber					
Sawlog portion	448,646	97,577	116,083	132,669	102,317
Upper stem portion	124,892	11,935	17,116	54,964	40,877
Total	573,538	109,512	133,199	187,633	143,194
Poletimber	442,263	22,343	68,833	213,487	137,600
All growing-stock trees	1,015,801	131,855	202,032	401,120	280,794
Cull trees					
Short-log trees	16,894	258	4,392	5,942	6,302
Rough trees [1]					
Sawtimber size	27,383	605	5,045	12,183	9,550
Poletimber size	39,291	964	3,549	20,924	13,854
Total	66,674	1,569	8,594	33,107	23,404
Rotten trees [1]					
Sawtimber size	16,201	118	5,100	8,320	2,663
Poletimber size	6,675	--	754	4,152	1,769
Total	22,876	118	5,854	12,472	4,432
All cull trees	106,444	1,945	18,840	51,521	34,138
All live trees	1,122,245	133,800	220,872	452,641	314,932
Salvable dead trees					
Sawtimber size	7,837	418	2,086	4,506	827
Poletimber size	8,187	180	1,538	5,215	1,254
All salvable dead trees	16,024	598	3,624	9,721	2,081
All classes	1,138,269	134,398	224,496	462,362	317,013

[1] Includes all noncommercial species.

Table 11a.--Net volume of all live trees and salvable dead trees on timberland by class of timber and major species group, Nicolet, 1996

(In thousand cubic feet)

	All species	Major species group			
		Pine	Other softwoods	Soft hardwoods	Hard hardwoods
Live trees					
Growing stock trees					
Sawtimber					
Sawlog portion	381,325	75,969	96,626	107,704	101,026
Upper stem portion	103,239	7,916	14,060	43,467	37,796
Total	484,564	83,885	110,686	151,171	138,822
Poletimber	399,156	14,191	75,159	174,761	135,045
All growing-stock trees	883,720	98,076	185,845	325,932	273,867
Cull trees					
Short-log trees	12,484	177	1,680	4,942	5,685
Rough trees [1]					
Sawtimber size	10,369	380	1,774	3,069	5,146
Poletimber size	15,310	183	1,363	7,370	6,394
Total	25,679	563	3,137	10,439	11,540
Rotten trees [1]					
Sawtimber size	7,189	28	1,320	4,058	1,783
Poletimber size	2,984	--	193	2,244	547
Total	10,173	28	1,513	6,302	2,330
All cull trees	48,336	768	6,330	21,683	19,555
All live trees	932,056	98,844	192,175	347,615	293,422
Salvable dead trees					
Sawtimber size	10,983	580	3,447	5,618	1,338
Poletimber size	12,585	--	2,857	7,648	2,080
All salvable dead trees	23,568	580	6,304	13,266	3,418
All classes	955,624	99,424	198,479	360,881	296,840

[1]Includes all noncommercial species.

Table 12. -- Average net annual growth of growing stock and sawtimber on timberland by Forest and major species group, Chequamegon-Nicolet National Forest, 1983-1995

Land base	Growing stock					Sawtimber				
		Major species group					Major species group			
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
	(In thousand cubic feet)					*(In thousand board feet)* [1]				
Chequamegon	23,761	3,742	3,727	9,754	6,538	98,985	21,906	19,099	33,913	24,067
Nicolet	20,509	3,340	3,255	6,649	7,265	79,179	16,860	13,782	24,748	23,789
Total	44,270	7,082	6,982	16,403	13,803	178,164	38,766	32,881	58,661	47,856

[1] International 1/4-inch rule.

Table 13. -- Average net annual removals of growing stock and sawtimber on timberland by Forest and major species group, Chequamegon-Nicolet National Forest, 1983-1995

Land base	Growing stock					Sawtimber				
		Major species group					Major species group			
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
	(In thousand cubic feet)					*(In thousand board feet)* [1]				
Chequamegon	13,254	1,972	2,165	6,405	2,712	23,594	5,814	5,769	9,545	2,466
Nicolet	11,543	2,155	1,375	5,713	2,300	30,271	8,635	2,796	14,546	4,294
Total	24,797	4,127	3,540	12,118	5,012	53,865	14,449	8,565	24,091	6,760

[1] International 1/4-inch rule.

Table 14. -- Average net annual growth, average annual mortality, and average annual removals of growing stock and sawtimber on timberland by species group, Chequamegon, 1983-1995

Species group	Growing stock			Sawtimber		
	Average net annual growth	Average annual mortality	Average annual removals	Average net annual growth	Average annual mortality	Average annual removals
	(In thousand cubic feet)			*(In thousand board feet)* [1]		
Softwoods						
Jack pine	171	561	915	2,389	2,051	2,689
Red pine	2,666	24	1,017	14,074	126	3,014
White pine	905	149	40	5,443	701	111
White spruce	1,865	105	1,071	7,569	433	2,988
Black spruce	260	266	218	230	473	415
Balsam fir	257	1,461	699	3,171	3,015	2,366
Hemlock	453	209	--	2,630	1,129	--
Tamarack	270	129	--	1,323	347	--
Northern white-cedar	622	489	177	4,176	2,271	--
Total softwoods	7,469	3,393	4,137	41,005	10,546	11,583
Hardwoods						
Select white oak	24	316	--	47	549	--
Select red oak	1,337	61	1,390	6,316	--	468
Other red oak	25	1	29	--	2	--
Other hickory	16	247	35	223	599	--
Basswood	869	353	529	4,745	1,109	776
Yellow birch	196	494	85	1,049	674	108
Hard maple	4,208	695	1,041	12,961	974	1,603
Soft maple	3,289	249	671	8,528	689	1,757
Elm	-69	322	177	-39	607	506
Black ash	790	42	439	1,300	105	568
White & green ash	744	555	132	3,417	1,609	287
Bigtooth aspen	1,122	1,935	2,098	6,680	3,588	3,504
Quaking aspen	3,077	916	2,010	10,748	1,282	2,139
Paper birch	617	13	481	1,936	2	295
Black cherry	47	--	--	15	--	--
Other hardwoods	--	--	--	54	--	--
Total hardwoods	16,292	6,199	9,117	57,980	11,789	12,011
All species	23,761	9,592	13,254	98,985	22,335	23,594

[1]International 1/4-inch rule.

Table 14a. -- Average net annual growth, average annual mortality, and average annual removals of growing stock and sawtimber on timberland by species group, Nicolet, 1983-1995

Species group	Growing stock			Sawtimber		
	Average net annual growth	Average annual mortality	Average annual removals	Average net annual growth	Average annual mortality	Average annual removals
	(In thousand cubic feet)			*(In thousand board feet)* [1]		
Softwoods						
Jack pine	66	137	711	665	313	1,346
Red pine	2,797	74	370	13,715	316	1,645
White pine	477	70	1,074	2,480	372	5,644
White spruce	1,733	171	169	7,157	881	720
Black spruce	-102	517	165	-460	690	--
Balsam fir	321	1,465	928	781	3,078	1,509
Hemlock	454	172	108	2,969	914	567
Tamarack	114	141	--	360	418	--
Northern white-cedar	735	337	5	2,975	1,492	--
Total softwoods	6,595	3,084	3,530	30,642	8,474	11,431
Hardwoods						
Select white oak	18	--	--	--	--	--
Select red oak	703	108	83	3,757	278	105
Other red oak	25	3	--	57	4	
Basswood	1,254	639	212	7,921	1,183	725
Beech	29	2	--	67	6	--
Yellow birch	-21	282	265	-42	666	857
Hard maple	6,122	514	1,703	18,218	1,107	2,815
Soft maple	1,369	207	628	2,028	227	685
Elm	-436	703	545	-869	1,222	1,547
Black ash	287	105	--	248	174	--
White & green ash	488	13	190	1,930	34	407
Balsam poplar	146	82	84	451	293	402
Bigtooth aspen	582	318	313	2,910	1,173	999
Quaking aspen	2,990	2,059	2,914	9,508	3,430	8,399
Paper birch	172	930	815	1,615	1,071	1,344
Black cherry	244	101	261	912	34	555
Other hardwoods	-58	65	--	-174	193	--
Total hardwoods	13,914	6,131	8,013	48,537	11,095	18,840
All species	20,509	9,215	11,543	79,179	19,569	30,271

[1]International 1/4-inch rule.

Table 15.--Volume of sawtimber on timberland by species group and butt log grade or tree grade, Chequamegon, 1996

Species	Total	Log grade 1	2	3	4
Softwoods					
Jack pine	68,871	--	477	68,394	--
Red pine	306,068	10,890	12,994	282,184	--
White pine	197,868	50,200	51,926	89,766	5,975
White spruce	127,992	--	5,242	122,750	--
Black spruce	26,317	--	1,684	24,633	--
Balsam fir	73,240	--	--	73,240	--
Hemlock	193,096	53,792	43,369	95,935	--
Tamarack	40,458	--	--	40,458	--
Northern white-cedar	232,308	1,158	37,269	193,881	--
Total	1,266,218	116,041	152,961	991,241	5,975

Species	Total	Tree grade 1	2	3	Tie & timber
Hardwoods					
Select white oak	644	--	--	644	--
Select red oak	168,812	41,668	70,687	55,527	930
Other hickory	1,746	--	612	1,134	--
Basswood	158,436	45,674	61,393	49,467	1,903
Yellow birch	87,504	17,162	32,613	36,013	1,716
Hard maple	308,581	46,913	86,083	156,739	18,846
Soft maple	225,702	24,818	80,155	109,378	11,351
Elm	13,056	--	--	13,056	--
Black ash	44,205	4,913	9,641	23,246	6,405
White & green ash	74,300	22,243	28,430	20,222	3,405
Bigtooth aspen	124,879	5,158	47,767	69,687	2,267
Quaking aspen	184,991	9,037	44,972	120,053	10,929
Paper birch	77,006	--	27,110	48,380	1,516
Black cherry	652	--	652	--	--
Other hardwood	748	--	--	748	--
Total	1,471,262	217,586	490,115	704,292	59,269
All species	2,737,480	333,627	643,076	1,695,533	65,244

★ U.S. Government Printing Office 1999 756-282/80032

Table 15a.--Volume of sawtimber on timberland by species group and butt log grade or tree grade, Nicolet, 1996

Species	Total	Log grade 1	2	3	4
Softwoods					
Jack pine	15,646	--	--	15,646	--
Red pine	327,299	28,584	6,727	291,988	--
White pine	100,553	13,088	21,341	53,844	12,279
White spruce	124,620	--	2,686	121,934	--
Black spruce	19,338	--	--	19,338	--
Balsam fir	60,062	--	--	60,062	--
Hemlock	213,170	4,308	60,027	148,836	--
Tamarack	24,467	--	--	24 467	--
Northern white-cedar	133,075	--	10,683	122,392	--
Total softwoods	1,018,230	45,980	101,464	858,507	12,279

Species	Total	Tree grade 1	2	3	Tie & timber
Hardwoods					
Select red oak	76,075	5,405	41,841	22,100	6,729
Other red oak	1,781	--	--	--	1,781
Basswood	222,981	61,439	86,428	75,114	--
Beech	2,913		2,913	--	--
Yellow birch	59,894	14,986	17,240	24,383	3,285
Hard maple	452,824	133,848	134,714	160,752	23,511
Soft maple	57,182	2,122	16,548	34,522	3,990
Elm	3,113	796	--	2,317	--
Black ash	6,627	1,279	5,348	--	--
White & green ash	42,787	9,263	24,971	7,651	901
Balsam poplar	15,716	--	--	7,982	7,734
Bigtooth aspen	86,260	8,141	43,884	32,262	1,973
Quaking aspen	212,431	9,039	44,131	131,368	27,894
Paper birch	44,319	4,476	17,669	21,247	927
Black cherry	21,954	2,526	11,011	8,417	--
Other hardwood	1,741	818	--	923	--
Total hardwoods	1,308,598	254,137	446,699	529,038	78,724
All species	2,326,828	300,117	548,163	1,387,544	91,003

Haugen, David E.; Freeman, Phillip C.; Theisen, Mark A.
1998. **The forest resources of the Chequamegon-Nicolet National Forest, 1996.** Resour. Bull. NC-194. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 55 p.

The inventory of the forest resources of the Chequamegon-Nicolet National Forest reports 1.5 million acres of land, of which 1.4 million acres are forested. This bulletin presents statistical highlights and contains detailed tables of forest area as well as of timber volume, growth, removals, and mortality.

KEY WORDS: Forest area, timber volume, growth, removals, mortality.

Our job at the North Central Forest Experiment Station is discovering and creating new knowledge and technology in the field of natural resources and conveying this information to the people who can use it. As a new generation of forests emerges in our region, managers are confronted with two unique challenges: (1) Dealing with the great diversity in composition, quality, and ownership of the forests, and (2) Reconciling the conflicting demands of the people who use them. Helping the forest manager meet these challenges while protecting the environment is what research at North Central is all about.