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Wisconsin's Forest Resources in 2001

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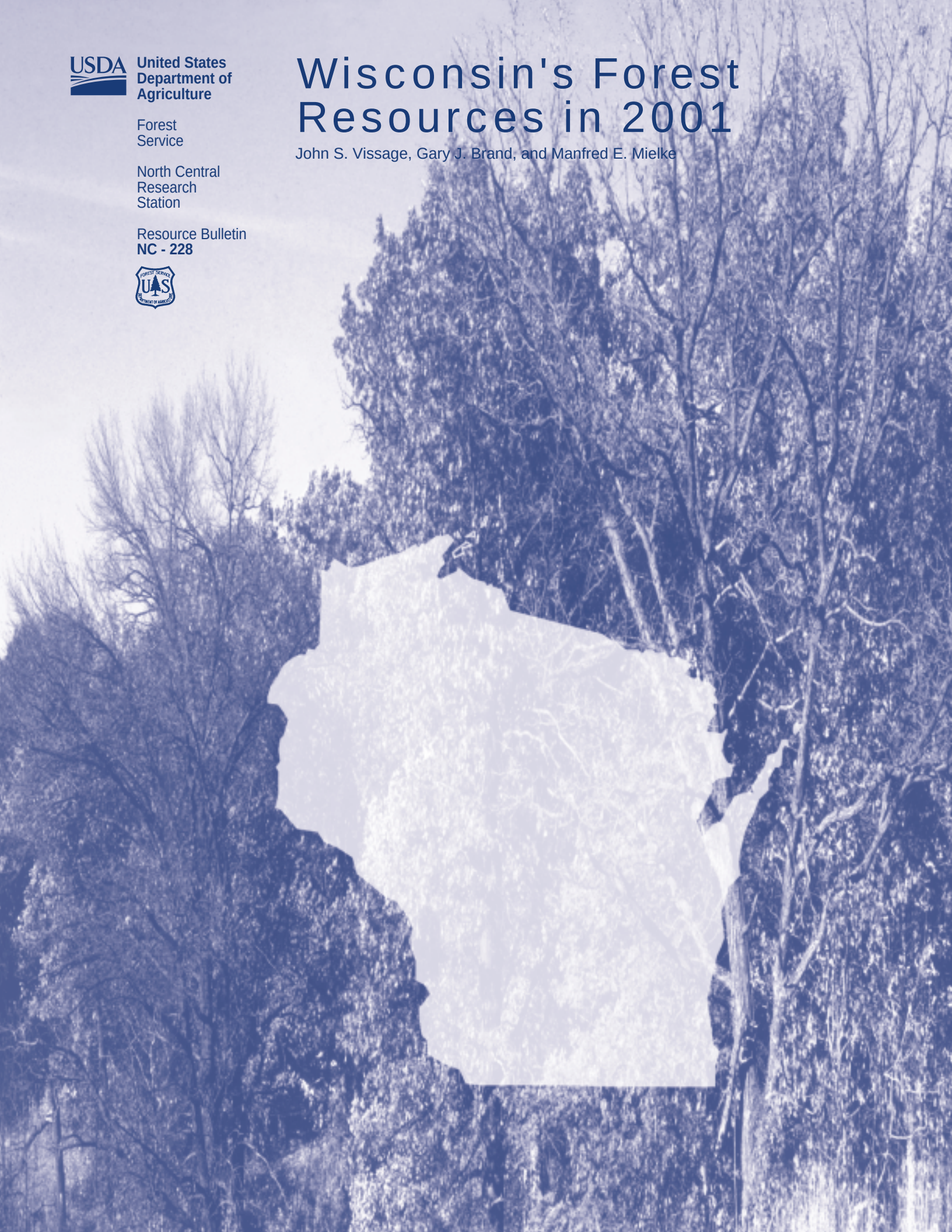

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Wisconsin's Forest Resources in 2001

The North Central Research Station's Forest Inventory and Analysis (NCFIA) program, in partnership with the Wisconsin Department of Natural Resources (DNR), began fieldwork for the sixth inventory of Wisconsin's forest resources in 2000. This initiated a new annual inventory system in which one-fifth of the field plots (considered one panel) in the State are measured each year. A complete inventory consists of measuring and compiling data for five panels. Once all five panels have been measured, plots in each panel will be remeasured approximately every 5 years. For example, the plots measured in Wisconsin in 2000 will be remeasured in 2005.

In 2001, fieldwork continued with the measurement of the second panel of the sixth inventory. The sixth inventory of Wisconsin's forest resources will be completed in 2005. However, because each year's panel is a systematic sample of the State's forest and timely information is needed about Wisconsin's forest resources, estimates have been prepared from data gathered in the first 2 years of the sixth inventory. Data and statistics prepared for this report represent 40 percent of the field plots (or two panels) for the complete inventory and are a combination of the first panel and second panel. Because of the limited number of field plots measured, sampling errors are large at this point, and the data in this report should be used with caution. Future estimates that incorporate data in this report are subject to change when ensuing annual inventories are completed and data are compiled. Results presented are estimates based on sampling techniques. As additional annual inventories are completed, the precision of the estimates will increase and additional data will be released.

Reports of previous inventories of Wisconsin are dated 1936, 1956, 1968, 1983, and 1996. Data from new inventories are often compared with data from earlier inventories to determine trends in forest resources. However, for the comparison to be valid, the procedures used in the two inventories must be similar. As a result of our ongoing efforts to improve the efficiency and reliability of the inventory, several changes in procedures and definitions have occurred since the last inventory of Wisconsin in 1996 (Schmidt 1998). Some of these changes make it inappropriate to directly compare portions of the 2001 data with data published for 1996.

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RESULTS

Area

The total land area of Wisconsin is 34.8 million acres. About 46 percent or 16.0 million acres were forested in the fifth inventory (Schmidt 1998). Forest land area has decreased slightly since 1996 to 15.8 million acres. Timberland area, forest land that is capable of growing at least 20 cubic feet of industrial wood per acre at the culmination of mean annual increment and that is not reserved by statute from timber harvest, followed a similar trend (fig. 1). The sampling errors associated with both the 1996 and 2001 estimates indicate that this decrease may not be statistically significant. In other words, the difference between these two estimates may be

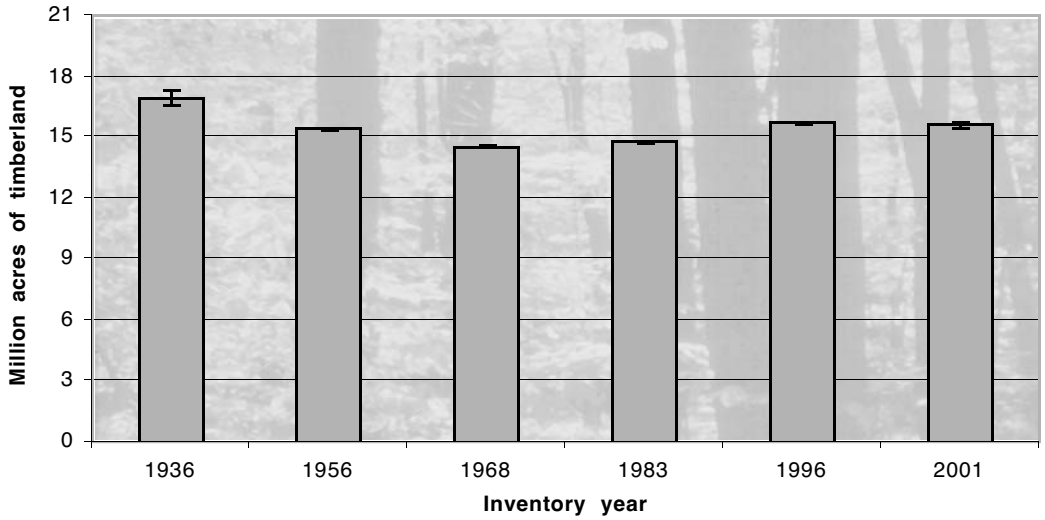

Figure 1. — Area of timberland in Wisconsin by inventory year. (Note: sampling errors associated with each inventory are represented by the vertical line at the top of each bar.)

due to statistical variation rather than an actual physical change. As additional data are collected, the precision of estimates made from the annual inventories will increase.

Covering over 5.3 million acres, the maple/beech/birch forest type group remains the dominant forest type group in the State (fig. 2). Together, hardwood forest types decreased by about 121 thousand acres since the 1996 inventory. The timberland area of softwood forest types has increased by almost 30 thousand acres since 1996.

Since 1996, the area of timberland owned by private individuals and corporations has decreased by about 247 thousand acres while the area under public control has increased by about 175 thousand acres (fig. 3). Despite this change, nearly 70 percent of Wisconsin's timberland is privately owned.

The timberland area occupied by the seedling-sapling stand-size class has decreased by 21 percent since 1996 (fig. 4). The area occupied by the poletimber stand-size class decreased by about 1 percent, while the area occupied by sawtimber increased by 26 percent.

While the changes in the timberland area occupied by the different stand-size classes and forest type groups seem dramatic, it is important to note that the procedures used to determine these important attributes have changed since the 1996 inventory. As additional panels of annual data are collected and current procedures are used to update the 1996 estimates, comparisons and trends will become clearer.

Volume

In previous inventories, the volume of all live trees greater than 5.0 inches diameter at 4.5 feet above the ground (d.b.h.) on timberland was classified and reported as growing stock and cull. The board foot volume of growing-stock trees exceeding minimum size requirements—9.0 inches d.b.h. for softwoods and 11.0 inches d.b.h. for hardwoods—was classified as sawtimber. Analyses focused on growing-stock and sawtimber volumes. The volume of all live trees on reserved and other forest land was not reported. With an increased interest in FIA data to address questions about wildlife habitat, soil and water protection, aesthetics, and other important forest values, greater importance has been placed on the live tree volume on all forested land. In 2001, the volume of all live trees on forest land in Wisconsin was 21.6 billion cubic feet. However, the all-live tree volume on forest land is not readily available for previous inventories. For this reason, trend comparisons for this report consider only growing-stock or sawtimber volume.

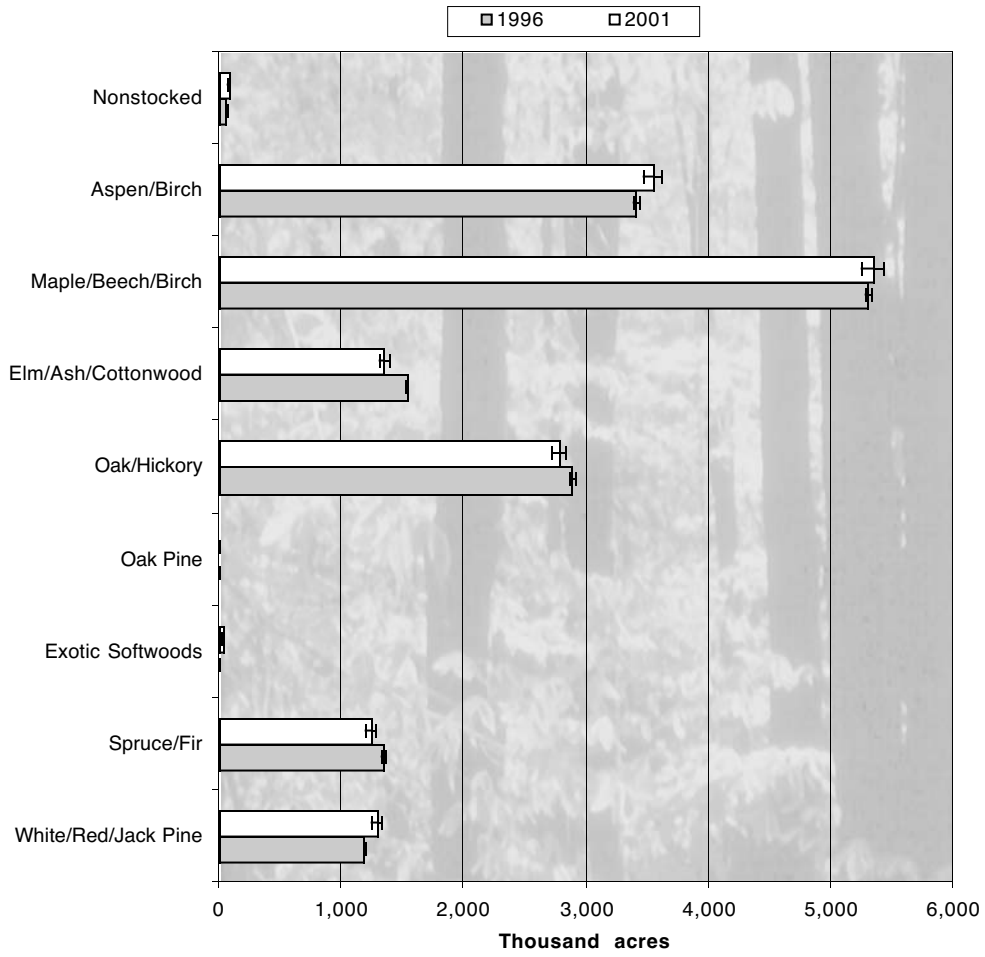

Figure 2. — *Area of timberland in Wisconsin in 1996 and 2001 by forest type group. (Note: sampling errors associated with each inventory are represented by the vertical line at the end of each bar.)*

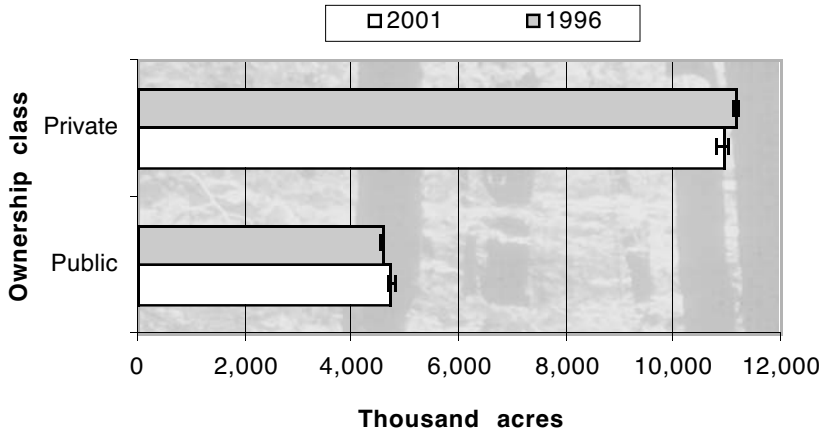

Figure 3. — *Area of timberland in Wisconsin by owner category. (Note: sampling errors associated with each inventory are represented by the vertical line at the end of each bar.)*

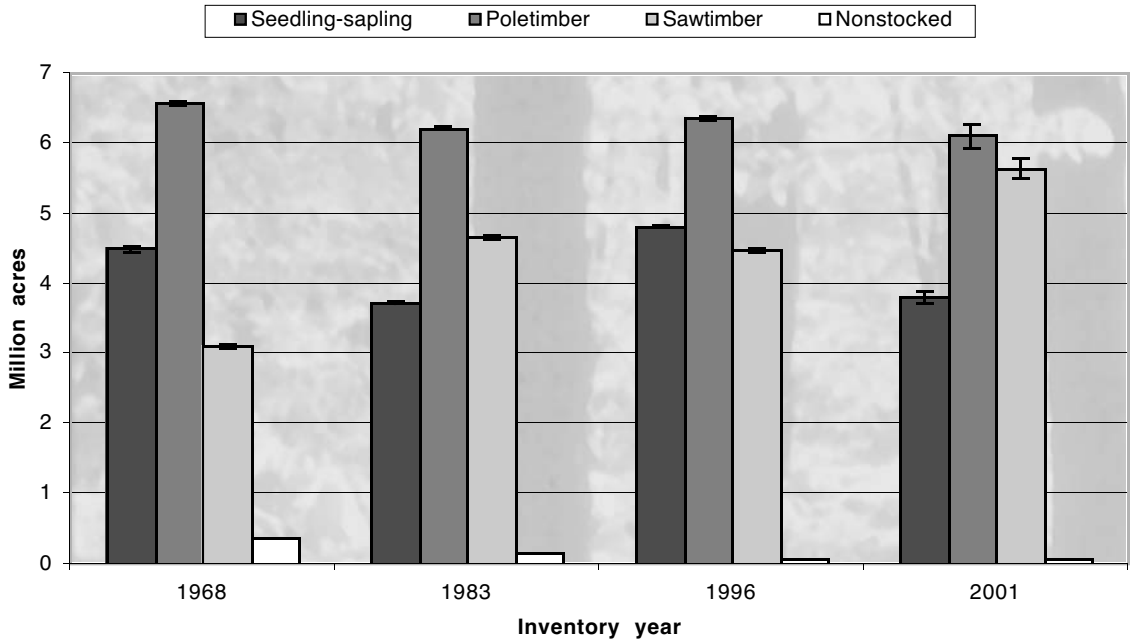

Figure 4. — Area of timberland in Wisconsin by stand-size class and inventory year. (Note: sampling errors associated with each inventory are represented by the vertical line at the top of each bar.)

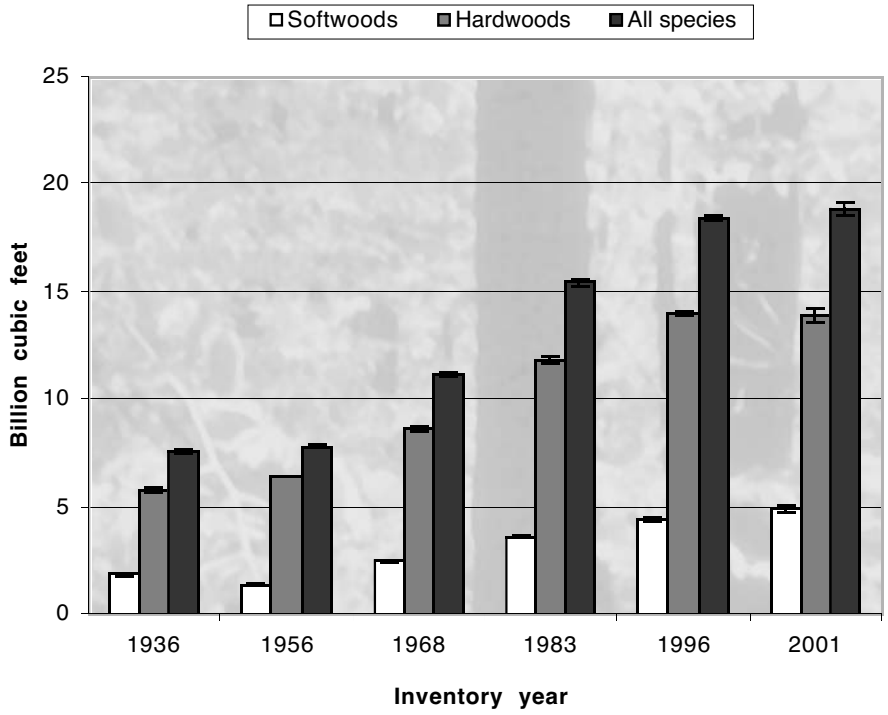

Figure 5. — Growing-stock volume in Wisconsin by inventory year. (Note: sampling errors associated with each inventory are represented by the vertical line at the top of each bar.)

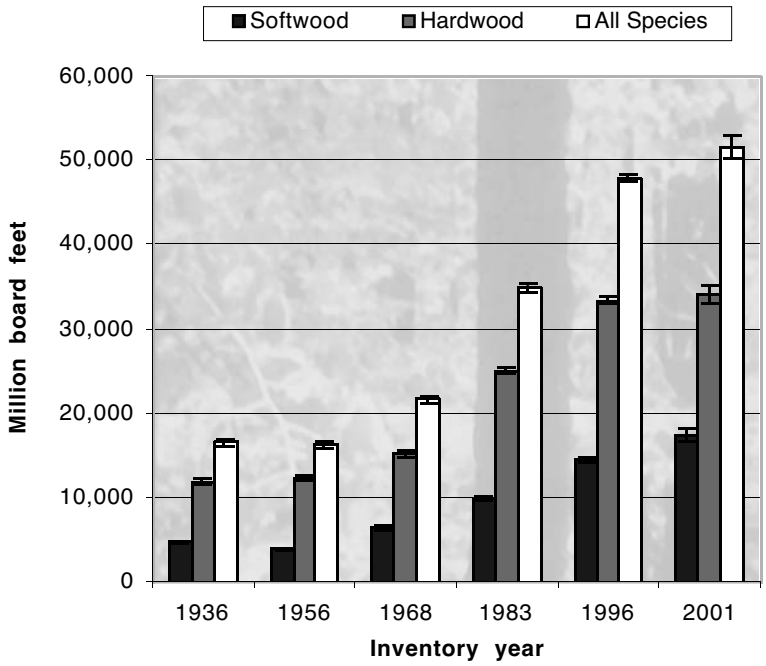

Figure 6. — *Sawtimber volume in Wisconsin by inventory year. (Note: sampling errors associated with each inventory are represented by the vertical line at the top of each bar.)*

In 2001, the volume of growing stock in Wisconsin was 18.9 billion cubic feet (fig. 5). Hardwoods species accounted for 73 percent of the growing-stock volume and 66 percent of the sawtimber volume (fig. 6). Cottonwood and aspen was the hardwood species group with the greatest growing-stock volume while select red oak group had the largest sawtimber volume.

The growing-stock volume of softwood species totaled 4.9 billion cubic feet in 2001. Eastern white and red pines accounted for 51 percent of the softwood growing-stock volume and 61 percent of the softwood sawtimber volume.

Biomass

Biomass, the aboveground weight of live trees 1.0 inch d.b.h. and larger on timberland, is an important estimate used to address questions related to wildlife habitat, carbon sequestration, wood fiber availability for fuel, and other important values. The aboveground weight of tree biomass on timberland in Wisconsin was estimated at nearly 585 million dry tons. Eighty-three percent of the total biomass was hardwood species and 17 percent was softwood species. Fifty-six percent of the total biomass was in the boles of growing-stock trees. Private lands accounted for 71 percent of the total biomass in Wisconsin while public lands contained 29 percent.

Forest Health

Insects, pathogens, weather, and fire cause damage to Wisconsin's forests each year. These are among the most serious threats.

Gypsy moth (*Lymantria dispar*)—The gypsy moth threat to Wisconsin's forests continues to grow. The population is increasing in eastern Wisconsin, and a few communities have begun to experience defoliation, particularly in oak-dominated parkland. Patches of defoliation greater than 5 acres were seen in 12 counties (including new defoliation in central and southern Wisconsin), with 2,700 acres of heavy defoliation in Marinette and Menominee Counties. In 2001, statewide

defoliation was approximately 3,700 acres, nearly all of which was in Marinette County.

Trap catch of males indicates populations continue to increase in eastern counties. Numbers are particularly high in north-central and shoreline Marinette County, in the Fox River Cities, and northwest of Milwaukee.

Forest tent caterpillar (*Melanocarpa disstria*)—Scattered heavy defoliation on oak, aspen, ash, birch, and crabapple trees was observed in Lincoln, Oneida, and Vilas Counties. Reports of migrating caterpillars were also received from Florence, Forest, and Langlade Counties. Some areas have been infested since 1998. By 2001, over 5 million acres were defoliated in Wisconsin. Defoliated trees produced a second set of leaves by early summer, using valuable nutrient reserves and causing stress to trees.

Twolined chestnut borer (*Agrilus bilineatus*)—A native beetle, the twolined chestnut borer, has killed mature oaks throughout northern Wisconsin, especially in Vilas, Oneida, and Lincoln Counties in the northeast; and in Douglas, Sawyer, Bayfield, and northern Washburn Counties in the northwest. Normally a weak secondary invader of oaks injured by drought or defoliation, the twolined chestnut borer attacked trees this year that had been defoliated by the forest tent caterpillar. Multiple years of defoliation, coupled with dry weather and sandy soils, can make defoliated trees much more vulnerable to attack. The larvae of this flat-headed beetle mines the cambium of stressed oaks, eventually killing them. Infested trees often show browning and dieback of leaves starting in the upper crown and progressing downward.

The population of forest tent catepillar has been dramatically reduced due to predation by friendly flies. This is expected to reduce the mortality caused by the twolined chestnut borer.

Bronze birch borer (*Agrilus anxius*)—Dieback and mortality of birch were also noticed in Lincoln, Oneida, and Vilas Counties. Many of these trees were infested by the bronze birch borer. Adult beetles primarily attack birches that are weakened or stressed by drought, old age, insect defoliation, soil compaction, or a stem or root injury. Attacked birches in northern Wisconsin were weakened by repeated years of heavy defoliation by the forest tent caterpillar. As with the twolined chestnut borer, the drop in forest tent caterpillar populations after 2002 will probably mean increased survival of birches.

Oak wilt (*Ceratocystis fagacearum*)—More oak wilt pockets were found this summer in Spread Eagle, Florence County. All of the new sites were located within 1 mile of the sites detected in 1999. The presence of oak wilt in Florence County was first confirmed in 1999. Barron County sustained its first confirmed report of oak wilt in 2002. Approximately 10 trees in a wooded residential lot on the west shore of Prairie Lake showed symptoms of oak wilt.

Tubakia leaf disease (*Tubakia dryina*)—A leaf disease caused by the fungus *Tubakia dryina* was recently observed infecting bur and white oak throughout southern Wisconsin. Bur oaks are more commonly infected; white oaks are only occasionally infected. This disease has been observed on an annual basis for many decades but has increased in incidence and severity since 1999. Infected bur oaks have been observed throughout southern Wisconsin and as far north as Portage County. Symptoms first appear in late July and consist of small, necrotic spots on leaves in the lower crown. Throughout August, spots expand, coalesce, and can eventually turn the whole leaf brown. Infected trees often have full crowns of shriveled, necrotic leaves in middle to late August. Bur oaks on a wide variety of sites and of all ages have been infected. Bur oaks that are

already under stress from drought or compaction are showing signs of dieback. Samples collected from declining trees have revealed the presence of the twolined chestnut borer. If these high levels of infection continue, further pressure by the twolined chestnut borer is expected and that could lead to mortality.

Ash yellows (*phytoplasma*)—Ash yellows was confirmed in two new locations in the forests of Wisconsin this year. This disease was observed initiating decline and killing large pole to small saw log white ash trees in a 5-acre woodlot in Ozaukee County and on the Chippewa County Forest. Brooms or masses of densely clustered branches were common on infected trees. The presence of these brooms has not been a common sign of infection in Wisconsin's forests. Ash yellows was also confirmed in Calumet County. This stand was a privately owned woodlot with a mix of ash, sugar maple, and black cherry. Symptoms such as thin crowns, chlorotic leaves, epicormic branches, and brooms were common in the stand. Ash yellows is a relatively recently discovered disease and is caused by a phytoplasma. This organism invades the tree's phloem, causes dieback, and eventually kills the tree. These two new locations bring the total observations to six. Ash yellows has now been confirmed in the following counties: Calumet, Chippewa, Marathon, Manitowoc, Ozaukee, Sheboygan, and Waukesha.

White pine blister rust—The question of the validity of risk zone maps for white pine blister rust was addressed this year in a comparison study of disease incidence across Wisconsin's four risk zones (Van Arsdel 1968). Stem cankers occurred on an average of 4.8 percent of surveyed trees, while branch cankers were observed on another 3 percent. Levels of rust were significantly higher for trees bordering the edge of plantations where the alternate host, *Ribes*, was present in adjacent woods or fencerows. The proximity of *Ribes* proved to be the most significant determinant of rust levels, whereas risk zone was not significant. The average incidence of blister rust was significantly higher in risk zone 4 but varied widely within each of the three lower risk zones. Habitat type was a good predictor of rust incidence. This is probably due to the occurrence of *Ribes* on predominantly mesic sites and its almost total absence on drier sites.

This information contributed to the rewriting of the management guidelines for white pine blister rust in the DNR silviculture handbook. Further work is planned in the upcoming field season and will focus on risk zone 3.

Annosus root rot (*Heterobasidion annosum*)—This root disease was first reported in 1993 as a cause of mortality in a red pine plantation in Adams County. Now, 10 counties are confirmed to have this root rot. The disease has also been confirmed in Buffalo, Green, Iowa, La Crosse, Marquette, Richland, Saulk, Trempealeau, and Walworth Counties.

Red pine pocket decline—Red pine pocket decline was first reported in Wisconsin in 1975 but was a relatively insignificant problem until about 5 years ago. This disease is actually a complex involving several species of root and lower stem-feeding insects along with their fungal symbiants. A sequence of events is initiated that creates circumscribed areas or "pockets" of progressive mortality of one to several trees.

As for geographic distribution, there does seem to be an important difference in disease incidence and severity between northern and southern Wisconsin. The number of pockets, as well as the average and maximum size of pockets per stand, is lower in northern Wisconsin. The red turpentine beetle (*Dendroctonus valens*) and *Leptographium* spp. co-occur in the vast majority of pockets. *D. valens* and *L. terebrantis* may play an aggressive role in pocket expansion and possibly in pocket initiation. Thinning of stands may play

a role in this disease. For instance, a primary feeding site for these beetles is freshly cut stumps as well as healthy trees nearby. Pockets are almost nonexistent in unthinned stands, and there are very high numbers of *D. valens* in recently thinned stands.

European buckthorn (*Rhamnus cathartica*)—This exotic brush species continues to invade oak woodlots in the southeastern and south central counties where it displaces many species of native wild flowers and understory shrubs and prevents reproduction of native tree species

Wind and hail storms—On May 12, 2000, a wind and hailstorm hit southern Waushara, northern Marquette, and central Manitowoc Counties. Meteorologists called it a **thunderstorm super cell moist micro burst**. Golf ball-size hail and winds up to 110 mph were reported. Damage to oak, aspen, sugar maple, red and white pine, and bottomland hardwoods was scattered throughout approximately 167,000 acres. Injuries caused by the large hailstones included multiple wounds and stripping of the bark. Seedling and sapling-size trees were typically injured so badly that they died within 2 months following the storm. Ten- to twenty-year-old conifers also suffered significantly and started to die late in the summer. Pole and sawtimber-size trees of all species also incurred a significant number of hail wounds. Red pines desiccated quickly and browning foliage was commonly observed 2 months after the storm. Many of the affected red pines are expected to die within the next year. White pines appeared to have faired the multiple injuries better. Some browning of foliage was observed, but more white pines than red pines are expected to survive through the winter.

The fungus, *Sphaeropsis sapinea*, known to proliferate on hail-damaged red pine, was observed in Waushara County approximately 2 months after the storm. Red pines that do survive will be faced with the threat of dieback and cankers initiated by *S. sapinea*. The frequent rains that came throughout the summer helped prevent the buildup of bark beetles. No outbreaks or significant damage from bark beetles were observed.

Surveys conducted in 2001 in storm damaged areas showed that overstory trees on both the lowland and hardwood sites sustained an average 30 percent increase in crown dieback, but a similar decrease in transparency. Apparently most new growth was concentrated on the few healthy branches with badly damaged limbs dying off. Only 1 in 30 trees had died on the lowland plot and 2 of 30 had died on the hardwood site.

In a Waushara County red and white pine stand, tree health improved dramatically. Lateral branches had taken over in 92 percent of trees with dead leaders in 2001. Height growth had improved significantly as well, about 66 percent higher overall with an increase of over 230 percent for white pine. Dieback, which had averaged about 40 percent in 2000, was 25 percent in 2001. This stand seems to have recovered quite well. In Douglas County, much of the damaged area was harvested.

High-speed straight-line winds also ripped through central Juneau County, just north of New Lisbon, on June 1, 2000. Hardwoods, including oak and aspen were damaged through main stem breakage or uprooting. Approximately 90 percent of the damaged trees were hardwoods and 10 percent were conifers (white and red pine). The path of the storm covered approximately 6,215 acres. Damage was discontinuous throughout the affected area.

On August 14, 2000, a similar storm, also with golf ball-size hail, damaged timber on approximately 25,500 acres in Douglas County. Winds as high as 60 mph were recorded. The damage was scattered throughout the 25,500 acres, and injured species

include red, jack, white pine, and aspen. Since this storm hit later in the growing season, buds were tougher and damage to the buds appeared to be less severe than from the spring storm. Other injuries included multiple stem wounds on all affected species, loss of foliage, and some branch breakage.

Summary

The forest resources in Wisconsin appear to be in good condition. As additional data become available from ensuing annual inventories, a clearer picture of the direction of Wisconsin forest will emerge. Additional data related to Wisconsin inventories in 1996 and 1983 are available at: http://www.ncrs.fs.fed.us/4801/fiadb/index.htm .

APPENDIX

Inventory Methods

Wisconsin's Forest Resources in 2000 (Vissage 2002) provides a full description of the annualized inventory methods for Wisconsin. Since the 1996 inventory of Wisconsin, several changes have been made in the NCFIA inventory methods to improve the quality of the inventory as well as meet the increasing demands for timely forest resource information. The most significant change between the inventories is the change from periodic to annual inventory systems. Historically, the NCFIA inventoried each State on a cycle that averaged about 12 years. However, the need for timely and consistent data across large geographical regions, combined with national legislative mandates, resulted in NCFIA's implementation of an annual inventory system. The annual inventory system began in Wisconsin in 2000.

With an annual inventory system, approximately one-fifth of all field plots are measured in any single year. After 5 years, the entire inventory will be completed. After the initial 5-year period, NCFIA will report and analyze results as a moving 5-year average. For example, NCFIA will be able to generate inventory results for 2000 through 2005 or for 2001 through 2006. While there are great advantages for an annual inventory, one difficulty is reporting on results in the first 4 years. With the 2001 inventory, only 40 percent of all field plots have been measured. Sampling error estimates for the 2000 inventory are 0.94 percent for timberland area and 1.79 percent for growing-stock volume. Thus, caution should be used when drawing conclusions based on this limited data set. As ensuing measurements are completed, we will have additional confidence in our results because of the increased number of field plots measured. As each measurement year is completed, the quantity and quality of the results will expand.

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

New algorithms were used in 2000 to assign forest type and stand-size class to each condition observed on a plot. These algorithms are being used nationwide by FIA to provide consistency from State to State and will be used to reassign the forest type and stand-size class of every plot in the 1996 inventory when it is updated. This will be done so that changes in forest type and stand-size class will reflect actual changes in the forest and not changes due to algorithms. The list of recognized forest types, groupings of these forest types for reporting purposes, equations used to assign stocking values to individual trees, definition of nonstocked (stands with a stocking value of less than 10 percent for all live trees), and names given to the forest types changed with the new algorithms. As a result, comparisons between the published 2000-2001 results and those published for the 1996 inventory may not be valid. For additional details about algorithms used in both inventories, please contact NCFIA.

Sampling Phases

The 2001 Wisconsin survey used a three-phase sample for stratification that included remeasuring inventory plots from the 1996 inventory and measuring new field plots. Two-phase sampling, also called double sampling, consists of a phase 1 sample used to

estimate area by strata and a phase 2 sample used to estimate the average value of parameters of interest within the strata. The estimated population total is the sum across all strata of each stratum's estimated area multiplied by its estimated mean per unit area.

The only land that could not be sampled was private land where field personnel could not obtain permission to measure a phase 2 plot and plots that could not be accessed because of a hazard or danger to field personnel. The methods used in the preparation of this report make the necessary adjustments to account for sites where access was denied or hazardous. Fortunately, there were only 41 denied access or hazardous plots in 2000 and 58 denied access or hazardous plots in 2001.

Phase 1

The Wisconsin inventory used a computer-assisted classification of satellite imagery. FIA used the imagery to form two initial strata—forest and nonforest. Pixels within 60 m (2 pixel widths) of a forest/nonforest edge formed two additional strata—forest/nonforest and nonforest/forest. Forest pixels within 60 m of the boundary on the forest side were classified as forest/nonforest. Pixels within 60 m of the boundary on the nonforest side were classified into the nonforest/forest strata. An overlay of all national forest land was used to identify all lands owned by the Chequamegon and Nicolet National Forests. These national forest lands were treated separately but were also put into one of the above four strata. Stratification and estimation were conducted at the State level for national forest lands and at the FIA Inventory Unit level for other lands. In the national forest stratum, forest and forest/nonforest strata were combined.

Phase 2

Phase 2 of the inventory consisted of the measurement of an annual sample of field plots in Wisconsin. Current FIA precision standards for annual inventories require a sampling intensity of one plot for approximately every 6,000 acres. FIA has established a grid that divides the entire United States into non-overlapping hexagons, each of which contains 5,937 acres (McRoberts 1999). A grid of field plots was established by selecting one plot from each hexagon based on the following rules: (1) if a Forest Health Monitoring (FHM) plot (Mangold 1998) fell within a hexagon, it was selected as the grid plot; (2) if no FHM plot fell within the hexagon, the existing NCFIA plot nearest the hexagon center was selected as the grid plot; and (3) if neither FHM nor existing NCFIA plots fell within the hexagon, a new NCFIA grid plot was established near the hexagon center (McRoberts 1999). This grid of plots is designated the Federal base sample and is considered an equal probability sample; its measurement in Wisconsin is funded by the Federal government.

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

Phase 3

NCFIA has two categories of field measurements—phase 3 (FHM plots) and phase 2 field plots—to optimize our ability to collect data when available for measurement. Both types of plots are systematically distributed both geographically and temporally. Phase 3 plots are measured with the full array of FHM vegetative and health variables as well as the full suite of measures associated with phase 2 plots. Phase 3 plots must be measured between June 1 and August 30 to accommodate measurement of non-woody

understory vegetation, ground cover, soils, and other variables. We anticipate that in Wisconsin the complete 5-year annual inventory will involve about 160 phase 3 plots. On the remaining plots, only variables that can be measured throughout the entire year are collected. In Wisconsin, the complete 5-year annual inventory is expected to involve about 4,830 phase 2 forested plots. In the 2000/2001 inventory, measurements were made on 1,247 timberland, 7 other forest land, 12 reserved forest land, and 2,351 nonforest plots. This intensification was accomplished with additional resources provided by the State of Wisconsin.

The national FIA 4-point cluster plot design (fig. 7) was first used for data collection in Wisconsin 2000 and will be used in subsequent years. The national plot design requires mapping of all forest conditions found at each plot. Due to the small sample size each year, precision associated with components of change such as mortality will be relatively low. Consequently, we will report estimates of components of change only after at least three annual panels have been measured. Even then, we anticipate that estimates of change will be limited in detail. When the complete annual inventory has been implemented in 2005, the full range of change estimates will be available.

The overall plot layout for the new design consists of four subplots. The centers of subplots 2, 3, and 4 are located 120 feet from the center of subplot 1. The azimuths to subplots 2, 3, and 4 are 0, 120, and 240 degrees, respectively. The center of the new plot is located at the same point as the center of the previous plot if a previous plot existed within the sample unit. Trees with diameter at breast height (d.b.h. or 4.5 feet above ground level) 5.0 inches and larger are measured on a 24-foot radius (1/24 acre) circular subplot. All trees less than 5.0 inches d.b.h. are measured on a 6.8-foot radius (1/300 acre) circular microplot located 12.0 feet due east of the center of each of the four subplots. Forest conditions that occur on any of the four subplots are recorded. Factors that differentiate forest conditions are changes in forest type, stand-size class, land use, regeneration status, reserved status, ownership, and density. Each condition that occurs anywhere on one of the subplots is identified, described, and mapped if the area of the condition meets or exceeds 1 acre in size.

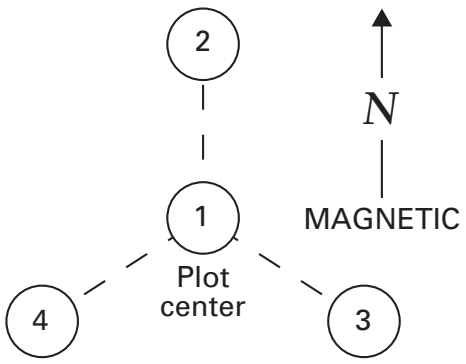

Figure 7. — *Current NCFIA field plot design.*

Field plot measurements are combined with phase 1 estimates in the compilation process and table production. The number of tables generated from a single year's data is limited. However, as additional annual inventories are completed, the number of tables will increase until year 5, when all statewide inventory summary tables will be available in both printed and electronic formats. For additional information, contact:

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TABLE TITLES

TABLES

Table 1. -- Area of forest land by forest type group and owner category, Wisconsin, 2000 - 2001

(In thousand acres)

Forest type group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
White / red / jack pine group	1,303.1	526.5	776.6	--
Spruce / fir group	1,291.1	535.4	755.7	--
Exotic softwood group	30.3	7.3	22.9	--
All softwood types	2,624.4	1,069.2	1,555.2	--
Hardwood type groups				
Oak / pine group	4.3	1.4	2.9	--
Oak / hickory group	2,807.8	446.1	2,361.6	--
Elm / ash / cottonwood group	1,352.9	347.0	1,005.9	--
Maple / beech / birch group	5,410.1	1,581.6	3,828.5	--
Aspen / birch group	3,551.8	1,407.6	2,144.2	--
All hardwood types	13,126.9	3,783.6	9,343.2	--
Nonstocked	77.5	22.2	55.3	--
All forest types	15,828.7	4,875.0	10,953.7	--

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

Table 2. -- Area of timberland by major forest type group, stand origin, and owner category, Wisconsin, 2000 - 2001

(In thousand acres)

Major forest type group and stand origin	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
Natural	1,828.9	703.7	1,125.2	- -
Planted	724.3	316.3	408.0	- -
All softwood types	2,553.3	1,020.1	1,533.2	- -
Hardwood type groups				
Natural	12,814.3	3,598.4	9,215.9	- -
Planted	187.1	82.9	104.2	- -
All hardwood types	13,001.4	3,681.3	9,320.1	- -
Nonstocked	75.5	20.2	55.3	- -
All groups	15,630.2	4,721.6	10,908.5	- -

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

Table 3. -- Area of timberland by forest type group and stand-size class, Wisconsin, 2000 - 2001

(In thousand acres)

Forest type group	All stands	Stand-size class			
		Sawtimber	Poletimber	Sapling-seedling	Non-stocked
Softwood type groups					
White / red / jack pine group	1,286.3	656.7	345.7	283.9	- -
Spruce / fir group	1,236.7	192.3	497.7	546.8	- -
Exotic softwood group	30.3	15.4	13.0	2.0	- -
All softwood types	2,553.3	864.3	856.3	832.6	- -
Hardwood type groups					
Oak / pine group	4.3	0.9	1.6	1.9	- -
Oak / hickory group	2,771.6	1,689.1	668.9	413.6	- -
Elm / ash / cottonwood group	1,344.2	322.6	663.0	358.6	- -
Maple / beech / birch group	5,340.3	2,297.6	2,308.0	734.8	- -
Aspen / birch group	3,541.0	466.9	1,611.9	1,462.2	- -
All hardwood types	13,001.4	4,777.1	5,253.3	2,971.0	- -
Nonstocked	75.5	- -	- -	- -	75.5
All forest types	15,630.2	5,641.4	6,109.6	3,803.7	75.5

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

Table 4. -- Net volume of all live trees on forest land by species group and owner category, Wisconsin, 2000 - 2001

(In thousand cubic feet)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other yellow pines	22,824	3,116	19,708	--
Eastern white and red pines	2,622,238	1,023,099	1,599,139	--
Jack pine	311,887	98,965	212,923	--
Spruce and balsam fir	881,884	418,720	463,165	--
Eastern hemlock	443,514	165,705	277,810	--
Other eastern softwoods	968,660	350,630	618,030	--
Total softwoods	5,251,008	2,060,234	3,190,774	--
Hardwoods				
Select white oaks	1,273,009	106,561	1,166,448	--
Select red oaks	1,754,487	435,504	1,318,983	--
Other red oaks	904,675	165,439	739,236	--
Hickory	268,025	6,951	261,074	--
Yellow birch	383,078	144,185	238,894	--
Hard maple	2,423,688	921,761	1,501,927	--
Soft maple	2,388,920	798,387	1,590,533	--
Beech	21,039	2,634	18,405	--
Ash	1,239,048	333,735	905,313	--
Cottonwood and aspen	2,667,711	971,587	1,696,124	--
Basswood	1,168,500	360,596	807,904	--
Black walnut	98,084	1,623	96,461	--
Other eastern soft hardwoods	1,712,478	369,433	1,343,045	--
Other eastern hard hardwoods	28,546	2,094	26,452	--
Eastern noncommercial hardwoods	62,814	5,196	57,619	--
Total hardwoods	16,394,103	4,625,686	11,768,416	--
All species groups	21,645,111	6,685,921	14,959,190	--

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

Table 5. -- Net volume of all live trees and salvable dead trees on timberland by class of timber and softwood/hardwood categories, Wisconsin, 2000 - 2001

(In thousand cubic feet)

Class of timber	All species	Softwood species	Hardwood species
Live trees			
Growing-stock trees			
Sawtimber			
Saw log portion	8,396,110	2,952,455	5,443,655
Upper stem portion	2,524,390	415,474	2,108,916
Total	10,920,500	3,367,928	7,552,571
Poletimber	7,937,011	1,559,481	6,377,530
All growing-stock trees	18,857,511	4,927,410	13,930,102
Cull trees			
Rough trees [1]			
Sawtimber size	1,563,838	154,404	1,409,434
Poletimber size	707,800	50,427	657,373
Total	2,271,639	204,831	2,066,807
Rotten trees [1]			
Sawtimber size	164,020	21,254	142,767
Poletimber size	36,515	4,446	32,070
Total	200,535	25,699	174,836
All live cull trees	2,472,174	230,531	2,241,643
All live trees	21,329,685	5,157,940	16,171,745
Salvable dead trees			
Sawtimber size	154,509	49,634	104,875
Poletimber size	139,162	33,364	105,798
All salvable dead trees	293,672	82,998	210,674
All classes	21,623,357	5,240,938	16,382,419

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

[1] Includes noncommercial species.

Table 6. -- Net volume of growing stock on timberland by forest group and softwood/hardwood species categories, Wisconsin, 2000 - 2001

(In thousand cubic feet)

Forest type group	All species	Softwood species	Hardwood species
Softwood type groups			
White / red / jack pine group	2,109,647	1,930,045	179,601
Spruce / fir group	1,058,681	930,824	127,856
Exotic softwood group	30,354	27,077	3,277
All softwood types	3,198,681	2,887,946	310,734
Hardwood type groups			
Oak / hickory group	3,550,011	228,043	3,321,968
Elm / ash / cottonwood group	1,326,008	239,287	1,086,720
Maple / beech / birch group	7,628,704	1,016,857	6,611,847
Aspen / birch group	3,150,406	553,517	2,596,888
All hardwood types	15,655,128	2,037,704	13,617,424
Nonstocked	3,702	1,759	1,943
All forest types	18,857,511	4,927,410	13,930,102

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

Table 7. -- Net volume of growing stock on timberland by species group and diameter class, Wisconsin, 2000 - 2001

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods											
Other yellow pines	19,575	1,487	2,125	1,895	2,686	3,339	3,166	1,965	2,910	--	--
Eastern white and red pines	2,506,388	157,307	294,474	380,918	346,878	294,618	250,776	193,242	171,178	350,812	66,185
Jack pine	302,234	51,212	88,368	79,882	54,936	18,703	9,134	--	--	--	--
Spruce and balsam fir	863,998	267,113	249,514	151,440	77,495	57,791	28,113	19,181	10,256	3,096	--
Eastern hemlock	408,113	15,277	28,771	38,630	52,544	52,588	55,765	69,984	26,000	68,554	--
Other eastern softwoods	827,102	177,652	226,181	174,896	119,744	68,428	38,488	9,485	4,013	8,216	--
Total softwoods	4,927,410	670,048	889,433	827,660	654,283	495,467	385,442	293,857	214,357	430,679	66,185
Hardwoods											
Select white oaks	1,064,373	40,010	79,186	110,115	138,011	170,537	129,150	120,329	73,411	183,080	20,544
Select red oaks	1,550,024	44,407	90,733	173,562	220,736	261,956	215,635	212,952	106,149	172,953	50,940
Other red oaks	672,554	38,369	80,501	109,820	128,917	109,655	71,617	61,854	43,794	28,026	--
Hickory	240,467	31,674	42,016	51,717	37,401	37,349	19,107	7,438	10,254	3,511	--
Yellow birch	281,382	33,306	41,346	56,392	41,178	35,758	20,709	11,021	12,297	23,660	5,715
Hard maple	2,088,709	233,211	363,161	451,997	350,567	204,634	166,188	120,670	83,795	114,486	--
Soft maple	2,015,712	304,775	410,986	421,371	302,127	244,188	126,616	73,552	56,030	66,482	9,585
Beech	18,105	2,509	2,020	3,581	2,862	2,978	4,156	--	--	--	--
Ash	1,132,062	171,665	212,551	221,247	171,735	132,234	90,352	51,768	39,728	40,784	--
Cottonwood and aspen	2,406,314	360,558	421,623	473,238	430,440	345,506	208,419	81,516	31,053	47,906	6,056
Basswood	1,048,771	66,498	132,146	221,997	214,288	154,826	92,749	77,687	30,930	57,649	--
Black walnut	88,453	5,807	8,781	9,926	10,838	20,303	11,241	13,405	1,857	6,293	--
Other eastern soft hardwoods	1,302,543	218,654	309,418	313,202	179,248	116,414	78,153	44,224	30,755	12,476	--
Other eastern hard hardwoods	20,633	3,460	5,441	4,556	487	1,717	1,848	3,125	--	--	--
Total hardwoods	13,930,102	1,554,902	2,199,907	2,622,722	2,228,835	1,838,056	1,235,939	879,540	520,055	757,306	92,841
All species	18,857,511	2,224,949	3,089,340	3,450,382	2,883,118	2,333,523	1,621,380	1,173,398	734,411	1,187,985	159,025

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

Table 8. -- Net volume of sawtimber on timberland by species group and diameter class, Wisconsin, 2000 - 2001

(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									
Other yellow pines	84,206	9,203	13,432	17,216	17,013	10,756	16,586	--	--
Eastern white and red pines	10,813,156	1,870,088	1,737,019	1,510,509	1,315,480	1,042,584	942,299	1,995,588	399,588
Jack pine	794,860	381,418	269,338	95,476	48,628	--	--	--	--
Spruce and balsam fir	1,797,135	748,153	398,109	308,620	156,461	109,059	59,076	17,656	--
Eastern hemlock	1,902,808	186,897	253,535	262,775	288,827	375,279	143,553	391,942	--
Other eastern softwoods	2,160,797	867,846	608,434	357,028	205,856	51,658	22,457	47,519	--
Total softwoods	17,552,961	4,063,606	3,279,866	2,551,624	2,032,265	1,589,336	1,183,970	2,452,705	399,588
Hardwoods									
Select white oaks	3,839,838	--	560,153	743,238	585,754	566,034	353,316	923,220	108,123
Select red oaks	5,695,498	--	893,888	1,141,777	985,498	1,005,057	515,806	878,104	275,368
Other red oaks	1,995,956	--	530,589	484,008	329,862	295,674	213,442	142,381	--
Hickory	473,954	--	139,374	153,366	82,398	33,895	48,091	16,830	--
Yellow birch	724,104	--	178,838	168,773	101,091	55,485	63,279	124,808	31,831
Hard maple	4,728,262	--	1,450,647	917,369	777,613	582,768	414,906	584,959	--
Soft maple	3,896,018	--	1,230,963	1,076,657	582,387	349,482	271,196	334,235	51,098
Beech	47,192	--	12,688	13,910	20,595	--	--	--	--
Ash	2,386,720	--	723,015	592,901	421,162	249,498	194,819	205,325	--
Cottonwood and aspen	5,205,245	--	1,829,871	1,571,678	984,142	395,522	152,624	239,885	31,524
Basswood	2,864,275	--	904,131	700,327	435,547	376,005	153,412	294,854	--
Black walnut	303,298	--	47,124	94,312	54,323	65,894	9,550	32,095	--
Other eastern soft hardwoods	2,003,446	--	724,683	507,146	354,968	207,460	147,625	61,564	--
Other eastern hard hardwoods	33,340	--	1,882	7,512	8,833	15,113	--	--	--
Total hardwoods	34,197,148	--	9,227,844	8,172,975	5,724,174	4,197,886	2,538,065	3,838,261	497,943
All species	51,750,108	4,063,606	12,507,710	10,724,599	7,756,440	5,787,222	3,722,035	6,290,966	897,531

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

[1] International 1/4-inch rule.

Table 9. -- All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree biomass component, Wisconsin, 2000 - 2001

(In dry tons)

Owner category and softwood/hardwood category	All components	Tree biomass component						
		All live 1-5 inch trees	Growing-stock trees			Non-growing-stock trees		
			Total	Boles	Stumps, tops, and limbs	Total	Boles	Stumps, tops, and limbs
Public								
Softwoods	39,463,924	4,731,344	32,519,330	25,922,928	6,596,402	2,213,249	1,684,993	528,256
Hardwoods	131,509,191	15,364,793	99,082,162	71,211,775	27,870,386	17,062,236	12,461,962	4,600,274
Total	170,973,115	20,096,138	131,601,492	97,134,704	34,466,788	19,275,485	14,146,955	5,128,530
Private								
Softwoods	63,618,617	7,104,260	53,636,057	42,867,135	10,768,922	2,878,299	2,209,033	669,266
Hardwoods	350,370,632	32,863,920	263,211,351	190,103,795	73,107,556	54,295,362	39,817,536	14,477,826
Total	413,989,250	39,968,180	316,847,408	232,970,930	83,876,478	57,173,661	42,026,569	15,147,092
All ownerships								
Softwoods	103,082,541	11,835,605	86,155,387	68,790,064	17,365,324	5,091,549	3,894,026	1,197,522
Hardwoods	481,879,823	48,228,713	362,293,513	261,315,570	100,977,943	71,357,598	52,279,498	19,078,100
Total	584,962,364	60,064,318	448,448,900	330,105,634	118,343,266	76,449,146	56,173,524	20,275,622

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

Vissage, John S.; Brand, Gary J.; Mielke, Manfred E.

2003. **Wisconsin's forest resources in 2001.** Resour. Bull. NC-228. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 23 p.

Results of the 2001 annual inventory of Wisconsin show about 15.8 million acres of forest land, more than 21.6 billion cubic feet of live volume on forest land, and nearly 584 million dry tons of all live aboveground tree biomass on timberland. Gypsy moth, forest tent caterpillar, twolined chestnut borer, bronze birch borer, ash yellows, and white pine blister rust are among the pests of Wisconsin forest.

KEY WORDS: Annual inventory, forest area, forest type, volume, biomass, Wisconsin

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