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North Dakota's Forest Resources in 2005

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CONTENTS

Results	1
Area	1
Volume	3
Biomass	4
Forest Health	4
Summary	6
Appendix	7
Inventory Methods	7
Inventory Phases	7
Phase 1	8
Phase 2	8
Phase 3	8
Literature Cited	10
Table Titles	10
Tables	11



North Dakota's Forest Resources in 2005

The North Central Research Station's Forest Inventory and Analysis Unit (NCFIA) began fieldwork for the fourth forest inventory of North Dakota's forest resources in 2001. The current inventory incorporates a new systematic approach in which one-fifth of the field plots (considered one panel) in the State are measured each year. A complete inventory consists of measuring, compiling, and reporting the data for plots in all five panels. Once the total inventory has been completed, panels will be remeasured every 5 years. For example, in North Dakota, the field plots measured in the 2001 panel will be remeasured in 2006.

In 2005, NCFIA completed measurement of the fifth panel of inventory plots in North Dakota. The 2005 panel, along with those surveyed in 2001, 2002, 2003, and 2004, completed data collection for the fourth inventory of North Dakota's forests. Previous periodic inventories of North Dakota's forest resources were completed in 1954, 1980, and 1994 (Haugen *et al.* 1999, Jakes and Smith 1982, Warner and Chase 1956). To expedite the reporting of findings from North Dakota's fourth inventory, this 2005 annual report contains summary information from the inventory, along with nine core tables. More tabular data from the inventory can be accessed through the FIA mapmaker program Web site at: <http://ncrs.fs.fed.us/4801>. A more comprehensive analytical report is being developed that will address important issues and identify trends in the State's forest resources.

Data from new inventories may be compared with data from earlier inventories to determine trends in forest resources. However, for the comparisons to be valid, the procedures used

in the two inventories must be similar. As a result of our ongoing efforts to improve the efficiency and reliability of the inventory, several changes in procedures and definitions have been made since the last North Dakota inventory in 1994 (Haugen *et al.* 1999) (see appendix). Some of these changes make it inappropriate to directly compare data presented here with those published for earlier inventories.

RESULTS

Area

The total land area of North Dakota is 44.1 million acres of which 1.6 percent or 724.2 thousand acres are forested (table 1). Seventy percent of forest land area is privately owned. Public agencies hold the remaining forest land area. Although forests cover less than 2 percent of the State's land area, they are an important resource. North Dakota's forests provide watershed protection; wildlife habitat; recreational opportunities; crop, soil, and livestock protection; and wood fiber for the State's forest industries.

In 2005, hardwoods dominated 92 percent of the forest land area, conifers accounted for 6 percent, and the remaining 2 percent fell into the nonstocked category (table 1, fig. 1). Of the six major forest type groups identified in the State, the maple/beech/birch, elm/ash/cottonwood, and oak/hickory groups account for 74 percent or 539 thousand acres of forest land. The pinyon/juniper forest type group occupies about 42.6 thousand acres of forest land area, most of it scattered in western North Dakota.

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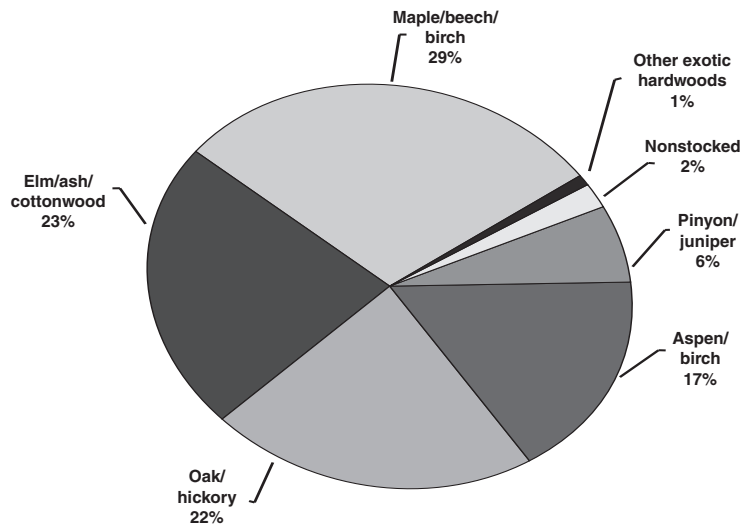


Figure 1.—Area of forest land by forest type, North Dakota, 2005.

On timberland, forest stands are categorized by size class. Stand-size class is a measure of the average diameter of the dominant trees in a stand. There are three stand-size classes: Sawtimber—large trees, softwoods at least 9 inches in diameter at breast height (d.b.h.) and hardwoods at least 11 inches d.b.h.; poletimber—medium trees 5 inches d.b.h. to sawtimber size; and sapling/seedling—small trees 1 to 5 inches d.b.h. Table 3 shows the distribution of timberland by stand-size class. In 2005,

percentages of the two largest size classes: sawtimber, 37 percent, and poletimber, 40 percent. The sapling/seedling class accounted for 21 percent and nonstocked stands accounted for 2 percent (fig 3).

The increase in saw- and pole-size stands and the decrease in sapling/seedling-size stands in North Dakota between inventories shows a lack of significant disturbance by either natural or human occurrence. So without any significant disturbance, North Dakota's forests will continue to mature and acreage in sapling and seedling size stands will decline.

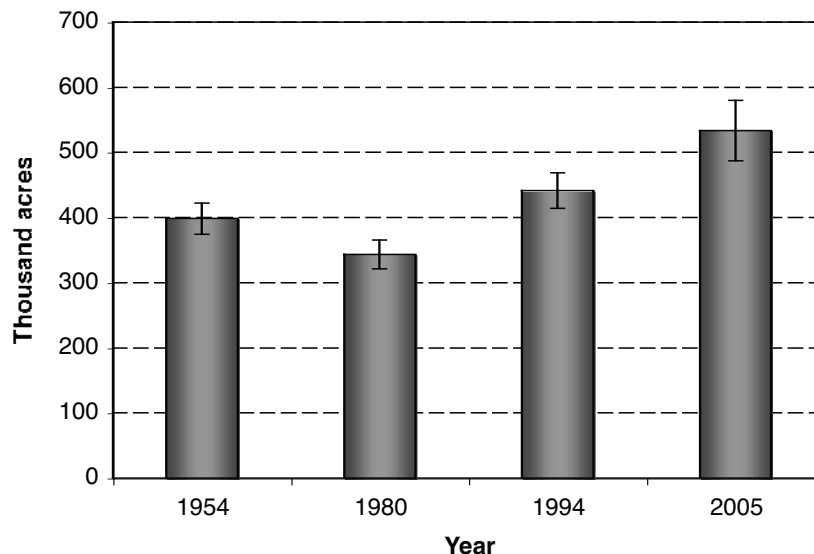


Figure 2.—Area of timberland, North Dakota, 1954-2005 (sampling error associated with each inventory is represented by the vertical line at the top of each bar).

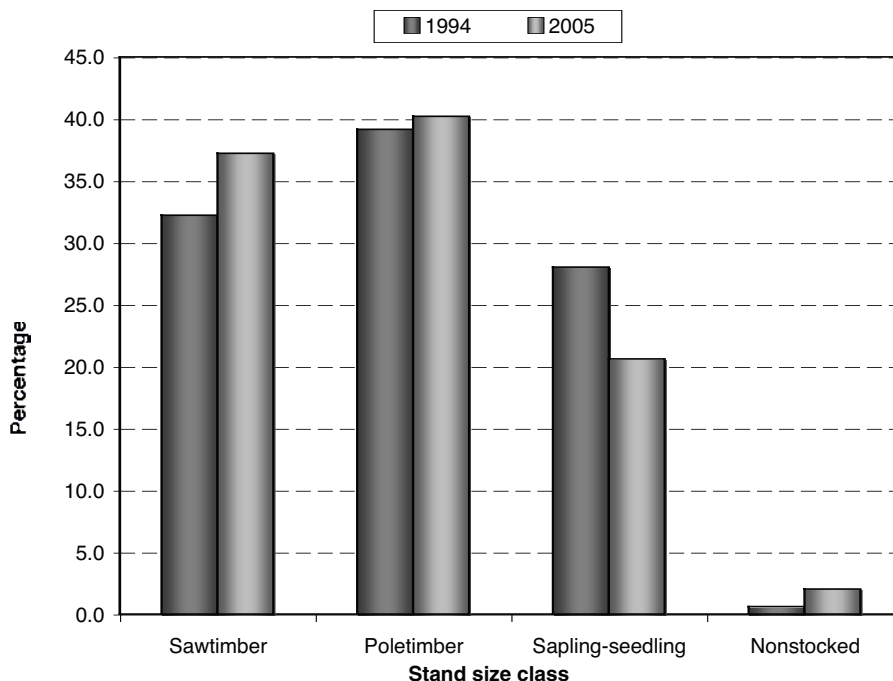


Figure 3.—Stand-size class as a percentage of total timberland area, North Dakota, 1994 and 2005.

Volume

Historically, volume has been reported as either growing stock or sawtimber. However, there are volumes in noncommercial trees, rotten trees, and rough trees that do not qualify as growing stock but that are used for wood fiber or fuelwood and are an important ecological component of these forests (e.g., wildlife habitat, and soil and water protection). With the annualized inventory system and increased interest in FIA data from an ecological perspective, a greater focus has been placed on all live volume. In 2005, North Dakota had an estimated 719 million cubic feet of all live volume on its 724 thousand acres of forest land (table 4), an average of more than 993 cubic feet of all live tree volume for each forest land acre. On the 533 thousand acres of timberland, there were an estimated 602 million feet of all live tree volume (table 5) or the equivalent of 1,130 cubic feet for each timberland acre in North Dakota.

Growing-stock volume is the amount of solid wood on timberland in trees 5 inches d.b.h. and larger, from 1 foot above ground to a min-

imum 4-inch top diameter with deductions made for poor form or defect. Growing-stock volume has also increased with the rise in timberland area since the 1980s (fig. 4). The net volume of growing stock on timberland in North Dakota was estimated at 366 million cubic feet in 2005 (table 6), or 687 cubic feet of growing-stock volume per timberland acre.

Most of North Dakota's growing-stock volume is in hardwood species. In 2005, three hardwood species groups accounted for 92 percent of all growing-stock volume in the State: the cottonwood-aspen group, with 189 million cubic feet; the ash group, with 74 million cubic feet; and the select white oak group, with 73 million cubic feet (table 7). Softwood growing-stock volume was estimated at 435 thousand cubic feet in 2005.

The volume of sawtimber in North Dakota was estimated at more than 1.1 billion board feet in 2005 (table 8). The cottonwood and aspen species group accounted for 58 percent of all sawtimber volume in the State. Softwood sawtimber volume was estimated at 1.5 million board feet in 2005.

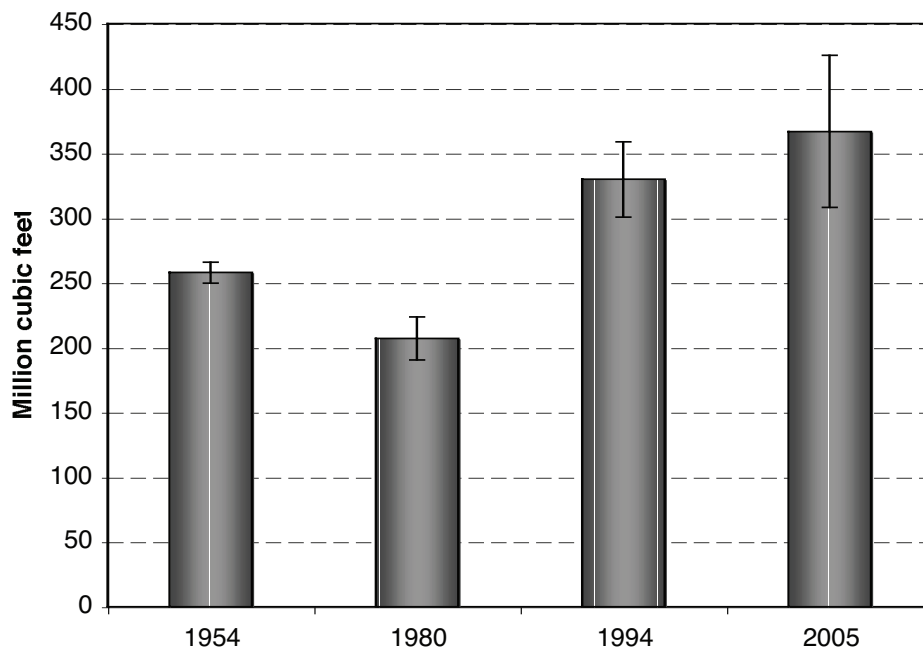


Figure 4.—Growing-stock volume, North Dakota, 1954-2005 (sampling error associated with each inventory is represented by the vertical line at the top of each bar).

Biomass

Biomass, measured as all live aboveground tree biomass on timberland in North Dakota, was estimated at more than 16.2 million dry tons in 2005 (table 9), an average of more than 30 dry tons per timberland acre. Dry tons, an estimate of biomass, is an important measure because it provides information useful in analyses related to carbon sequestration, wood fiber availability for fuel, and other matters. More than 52 percent of the total biomass was in growing-stock trees, 9.5 percent was in trees less than 5.0 inches d.b.h., and the remaining 38.5 percent was in non-growing-stock trees. More than 99 percent of the total biomass was composed of hardwood species. More than 81 percent of the total biomass, or 13.2 million dry tons, was on privately owned land. The remaining 3.0 million dry tons were located on public timberlands.

Forest Health

Despite their limited acreage and sparse distribution, North Dakota's forested resources (forest land, rural plantings, and community forests) are extremely valuable. These resources provide wildlife habitat, offer recreational opportunities, stabilize riverbanks, filter water runoff from adjacent agricultural

lands, provide wood products, protect agricultural land and homes from wind and snow, and contribute to the botanical diversity of the State.

The following narratives highlight forest pest conditions observed in North Dakota during 2005.

Gypsy moth

The North Dakota Forest Service, North Dakota Department of Agriculture, and USDA Animal and Plant Health Inspection Service conduct annual statewide gypsy moth detection surveys. In 2005, 419 detection traps were placed to encompass major forest types at risk of gypsy moth introduction. Despite two gypsy moth detections during 2004, there were no positive catches in 2005. As new risks of introduction are identified, future surveys will incorporate additional sites.

Emerald ash borer (not currently in North Dakota)

The Emerald ash borer (EAB) poses a serious threat to North Dakota's native and planted ash resources. In 2005, the North Dakota Forest Service and the North Dakota

Department of Agriculture coordinated sentinel trap tree surveys of five North Dakota communities where the risk of introduction is greatest. In addition to trap tree surveys, visual inspections were conducted at several parks and campgrounds throughout the State. No positive EAB detections were found during any surveys, but additional surveys and detection methods will be incorporated in future years. Education and outreach directed at city foresters, State agencies, and others are an important component of the State's ongoing preparation for the EAB threat.

Yellow-headed spruce sawfly

All species of spruce planted in North Dakota are susceptible to the yellow-headed spruce sawfly. Severe sawfly defoliation may cause tree mortality or predispose trees to other damaging agents. Every year small and medium-sized spruce trees are lost to this insect. This insect is particularly troublesome in rural plantings, where open growing conditions provide favorable egg-laying sites. Damage was most significant in Benson and Wells Counties during 2005.

Dutch elm disease

Dutch elm disease has severely harmed native woodlands, rural plantings, and communities throughout North Dakota over the past 35 years. The American elm was once a major component of North Dakota's riparian forests and occupied a wide range of sites. Dutch elm disease has killed most of the dominant elms that once made up a large portion of these forests along the Red, James, Sheyenne, Pembina, and other rivers of the State. In addition, the disease continues to decimate elms in the wooded draws of western North Dakota. American elm persists as a small understory tree, occupies a small portion of the total basal area, and often dies before reaching maturity. The loss of American elm dominance in these systems has shifted the species composition toward green ash and box elder.

Diplodia shoot blight

Recently, Diplodia shoot blight has been confirmed in many ponderosa pine plantings

throughout the State. This disease is common throughout the Great Plains on Austrian, Scotch, and other pines planted outside of their natural range. Symptoms include shoot blight and twig dieback. Severely infected trees may be deformed and killed. Trees of all ages are susceptible, but older, cone-bearing trees appear to sustain the most damage.

Although Diplodia shoot blight has been found periodically throughout North Dakota in past years, the incidence and severity of this disease have increased recently. This trend may be attributed to moist conditions in recent years.

In addition, Diplodia shoot blight is abundant in the pine windbreaks surrounding Towner State Tree Nursery. The nursery annually produces 200,000 ponderosa pine seedlings, and this disease could limit the number of pine seedlings the nursery will be able to supply. A plan has been developed to prevent damage to nursery crops by monitoring the disease, systematically removing ponderosa pine tree rows and replacing them with nonhost species, applying preventive fungicides to nursery crops, and relocating ponderosa pine nursery crops to fields with minimum exposure to the disease. USDA Forest Service Forest Health Protection funds were used to remove infected pine windbreaks in 2002, 2003, 2004, and 2005 as part of the nursery's disease management plan.

Foliar Diseases of Deciduous Trees

Cool, wet conditions throughout the 2005 growing season were favorable for infection and disease development of several hardwood foliar diseases. Commonly observed diseases in 2005 included ash anthracnose, oak anthracnose, oak leaf blister, and Septoria leaf spot of *Populus* species.

Ice Storm

An early fall ice storm damaged community and forest trees in the western part of the State. Several communities reported boulevard trees that were windthrown or had large branches ripped off. In addition, many rural plantings and trees adjacent to forest edges were damaged

SUMMARY

The long-term trend data for North Dakota indicate a steady increase in forest area and volume. Forest area, along with volume, has shown increases since a low point in 1980. North Dakota's forests are generally in good health although several forest health concerns bear monitoring. For example, the condition of the State's aspen resource, riparian forests, Dutch elm disease, and reduction of cottonwood regeneration have created unique management challenges. As additional data become available from ensuing annual inventories and through forest health surveys, a clearer picture of the direction of North Dakota's forests will emerge. Additional data related to the three most recent inventories of North Dakota (1980, 1994, 2005) are available at: www.ncrs.fs.fed.us/4801



APPENDIX

Inventory Methods

Since the 1994 inventory of North Dakota, several changes have been made in NCFIA inventory methods to improve the quality of the inventory as well as to meet increasing demands for timely forest resource information. The most significant difference between inventories was the change from periodic inventories to annual inventories. Historically, NCFIA periodically inventoried each State on a cycle that averaged about 12 years. However, the need for timely and consistent data across large geographic regions, combined with national legislative mandates, resulted in NCFIA's implementation of an annual inventory system.

With the NCFIA annual inventory system, about one-fifth of all field plots are measured each year. After 5 years, an entire inventory cycle is completed. After the first 5 years, NCFIA will report and analyze results as a moving 5-year average. For example, NCFIA will be able to generate a report based on inventory results for 2001 through 2005 or for 2002 through 2006.

Sampling error estimates for the 2005 inventory results are 7.36 percent for area of forest land, 8.71 percent for area of timberland, 15.99 percent for volume of growing stock on timberland, and 23.26 percent for volume of sawtimber on timberland. These sampling error estimates are considerably higher than those for the last periodic inventory completed in 1994 (6.20 percent for timberland area and 8.80 percent for growing-stock volume) because of the smaller sample sizes. Thus, caution should be used when drawing conclusions based on this limited data set. As we complete ensuing measurements, we will have additional confidence in our results due to the increased number of field plots measured.

Other changes between inventories include the implementation of new remote sensing technology, use of a new sampling design, implementation of a new field plot configuration, and gathering of additional remotely

sensed and field data. The advent of remote sensing technology since the previous inventory in 1994 has allowed NCFIA to use Multi-Resolution Land Characterization data and other available remote sensing products to stratify the total area of the State and to improve the precision of estimates. Inventories in North Dakota before 2001 (1954, 1980, and 1994) used visual interpretation of aerial photos to stratify the sample.

New algorithms were used in 2001 to assign forest type and stand-size class to each condition observed on a plot. These algorithms are being used nationwide by FIA to increase consistency among States and will be used to reassign the forest type and stand-size class of every plot measured in the 1994 inventory when it is updated. This will be done so that changes in forest type and stand-size class will more accurately reflect actual changes in the forest and not changes in how values are computed. The list of recognized forest types, grouping of these forest types for reporting purposes, models used to assign stocking values to individual trees, definition of non-stocked, and names given to the forest types changed with the new algorithms. As a result, comparisons between the published 2004 inventory results and those published for the 1994 inventory may not be valid. For additional details about algorithms used in both inventories, please contact NCFIA.

Inventory Phases

The 2005 North Dakota survey was conducted in three phases. The first phase used classified satellite imagery to stratify the State and aerial photographs to select plots for measurement. The second phase measured the traditional FIA suite of mensurational variables, and the third phase focused on a suite of variables related to the health of the forest.

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

was denied or hazardous. There were 25 denied access plots out of 280 field plots between 2001 and 2005.

Phase 1

The 2005 inventory used classified satellite imagery to form two initial strata—forest and nonforest. Pixels within 60 m (2 pixel widths) of a forest/nonforest boundary formed two additional strata—forest edge and nonforest edge. Forest pixels within 60 m on the forest side of a forest/nonforest boundary were classified into the forest edge stratum. Pixels within 60 m of the boundary on the nonforest side were classified into the non-forest edge stratum. The estimated population total for a variable is the sum across all strata of the product of each stratum's estimated area and the variable's estimated mean per unit area for the stratum.

In North Dakota, final estimation of area by stratum was based on three strata—nonforest, nonforest edge, and the combined forest and forest edge strata—because there were not enough plots in the forest stratum.

Phase 2

Phase 2 of the inventory consisted of the measurement of the annual sample of field plots in North Dakota. Current FIA precision standards for annual inventories require a sampling intensity of one plot for approximately every 6,000 acres. FIA has divided the entire area of the United States into nonoverlapping hexagons, each of which contains 5,937 acres (McRoberts 1999). A field plot was established in each hexagon. This array of plots is designated the Federal base sample and is considered an equal probability sample; its measurement in North Dakota is funded by the Federal government.

Fieldwork for this inventory was expedited through the cooperation and assistance of the North Dakota Forest Service.

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 quasi-systematic sample of all land in a State. Field crews

measure vegetation on plots currently classified as forest by trained photointerpreters using aerial photos or digital orthoquads.

Phase 3

NCFIA has two categories of field measurements—phase 2 field plots (standard FIA plots) and phase 3 plots (forest health plots). Both types of plot are systematically distributed both geographically and temporally. Phase 3 plots are measured with the full suite of FHM vegetative and health variables (Mangold 1998) collected as well as the full suite of measures associated with phase 2 plots. Phase 3 plots must be measured between June 1 and August 30 to accommodate measurement of nonwoody understory vegetation, ground cover, and other variables. The completed North Dakota 5-year annual inventory included measurements on roughly 472 phase 3 plots. On the remaining plots, referred to as phase 2 plots, only variables that can be measured throughout the entire year are collected. The complete North Dakota 5-year annual inventory included measurement of 7,150 phase 2 plots. The 2001-2005 annual inventory results represent field measures on 118 timberland plots, 45 other forest land plots, and 92 nonforest land plots, the rest being nonforest plots.

The new national FIA plot configuration with four subplots (fig. 5) was first used for data collection during the 2001 inventory of North Dakota. This design was also used in the 2002-2005 inventories and will be used in subsequent years. In North Dakota, because all plots in the annualized inventory are newly established, remeasurement data will not be available until the sixth year of the annual inventory. Those measurements will form the basis for change estimates between the first five-panel cycle and the second five-panel cycle for characteristics such as average annual net growth, mortality, and removals. The national plot configuration also requires mapping forest conditions on each plot. Due to the small sample size (20 percent) each year, the precision associated with change factors such as mortality will be relatively low. Consequently, change estimates will not be reported until at least three annual inventories have been completed in the second five-panel cycle, and even then we anticipate that estimates of change will be limited in detail. When the complete second five-panel cycle of the annual

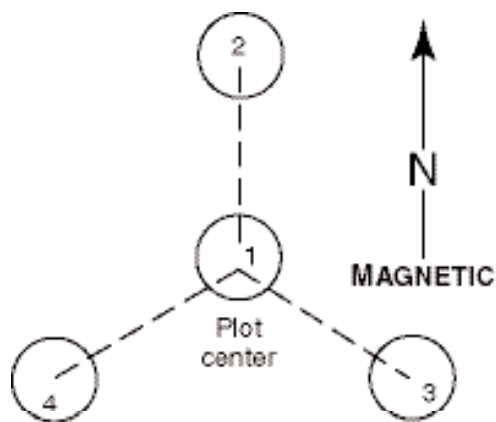


Figure 5.—Current NCFIA field plot configuration.

inventory has been implemented in 2010, (if the anticipated 20 percent of the State is sampled each year), estimates for the full range of change variables 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. Trees with a d.b.h of 5 inches and larger are measured on a 24-foot-radius (1/24 acre) circular subplot. All trees less than 5 inches d.b.h. are measured on a 6.8-foot-radius (1/300 acre) circular microplot located at 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, stand origin, reserved status, ownership, and density. Each condition that occurs anywhere on any of the subplots is identified, described, and mapped if the area of the condition meets or exceeds 1 acre in size.

Field plot measurements are combined with phase 1 estimates in the compilation process and table production. The number of published tables generated from less than five panels of data is limited. However, at <http://ncrs.fs.fed.us/4801> other tabular data can be generated.

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TABLE TITLES

- Table 1.—Area of forest land by forest type group, forest type, and owner category, North Dakota, 2001-2005
- Table 2.—Area of timberland by major forest type group, stand origin, and owner category, North Dakota, 2001-2005
- Table 3.—Area of timberland by forest type group, forest type, and stand-size class, North Dakota, 2001-2005
- Table 4.—Net volume of all live trees on forest land by species group, species, and owner category, North Dakota, 2001-2005
- Table 5.—Net volume of all live trees and salvageable dead trees on timberland by class of timber and softwood/hardwood species category, North Dakota, 2001-2005
- Table 6.—Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, North Dakota, 2001-2005
- Table 7.—Net volume of growing stock on timberland by species group, species, and diameter class, North Dakota, 2001-2005
- Table 8.—Net volume of sawtimber on timberland by species group, species, and diameter class, North Dakota, 2001-2005
- Table 9.—All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree biomass component, North Dakota, 2001-2005

TABLES

Table 1. -- Area of forest land by forest type group, forest type, and owner category, North Dakota, 2001-2005

(In thousand acres)

Forest type group/ forest type	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
Pinyon / juniper group				
Rocky Mountain juniper	42.6	42.3	0.3	--
All forest types	42.6	42.3	0.3	--
All softwood groups	42.6	42.3	0.3	--
Hardwood type groups				
Oak / hickory group				
Bur oak	77.0	15.5	61.5	--
Mixed upland hardwoods	79.2	5.9	73.3	--
All forest types	156.2	21.4	134.7	--
Elm / ash / cottonwood group				
Black ash / American elm / red maple	3.0	--	3.0	--
Cottonwood	55.1	19.8	35.3	--
Willow	6.5	5.0	1.5	--
Sugarberry / hackberry / elm / green ash	99.5	31.4	68.1	--
Cottonwood / willow	1.0	--	1.0	--
All forest types	165.1	56.2	108.9	--
Maple / beech / birch group				
Hard maple / basswood	15.6	4.9	10.7	--
Elm / ash / locust	202.2	61.5	140.8	--
All forest types	217.9	66.4	151.5	--
Aspen / birch group				
Aspen	116.0	25.8	90.2	--
Paper birch	1.7	--	1.7	--
Balsam poplar	5.4	--	5.4	--
All forest types	123.1	25.8	97.3	--
Exotic hardwoods group				
Other exotic hardwoods	4.2	--	4.2	--
All forest types	4.2	--	4.2	--
All hardwood groups	666.4	169.7	496.6	--
Nonstocked	15.2	2.3	12.9	--
All forest groups	724.2	214.4	509.8	--

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

Table 2. -- Area of timberland by major forest type group, stand origin, and owner category, North Dakota, 2001-2005

(In thousand acres)

Major forest type group and stand origin	Owner category		
	All owners	Public	Unidentified owner
Hardwood type groups			
Natural	517.9	120.0	397.9
Planted	5.1	--	5.1
All hardwood types	522.9	120.0	402.9
Nonstocked	10.7	2.3	8.4
All groups	533.7	122.3	411.4

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

Table 3. -- Area of timberland by forest type group, forest type, and stand-size class, North Dakota, 2001-2005

(In thousand acres)

Forest type group/ forest type	Stand-size class			
	All stands	Sawtimber	Poletimber	Sapling- seedling
All softwood groups	--	--	--	--
Hardwood type groups				
Oak / hickory group				
Bur oak	43.1	21.3	15.9	5.9
Mixed upland hardwoods	46.8	5.8	28.0	13.1
All forest types	89.9	27.1	43.9	18.9
Elm / ash / cottonwood group				
Black ash / American elm / red maple	3.0	--	1.7	1.3
Cottonwood	55.1	43.0	5.9	6.2
Willow	6.5	6.5	--	--
Sugarberry / hackberry / elm / green ash	85.4	44.1	11.6	29.7
Cottonwood / willow	1.0	1.0	--	--
All forest types	151.0	94.6	19.2	37.2
Maple / beech / birch group				
Hard maple / basswood	10.7	10.7	--	--
Elm / ash / locust	152.7	44.0	87.5	21.3
All forest types	163.4	54.6	87.5	21.3
Aspen / birch group				
Aspen	109.1	22.2	57.1	29.8
Balsam poplar	5.4	--	5.4	--
All forest types	114.5	22.2	62.4	29.8
Exotic hardwoods group				
Other exotic hardwoods	4.2	--	1.2	3.0
All forest types	4.2	--	1.2	3.0
All hardwood groups	522.9	198.5	214.3	110.2
Nonstocked	10.7	--	--	--
All forest groups	533.7	198.5	214.3	110.2

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

Table 4. -- Net volume of all live trees on forest land by species group, species, and owner category, North Dakota, 2001-2005

(In thousand cubic feet)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other eastern softwoods				
Rocky Mountain juniper	45,911	43,276	2,634	--
Eastern redcedar	975	411	564	--
All species	46,886	43,687	3,198	--
Total softwoods	46,886	43,687	3,198	--
Hardwoods				
Select white oaks				
Bur oak	163,366	28,069	135,296	--
All species	163,366	28,069	135,296	--
Ash				
Black ash	895	117	779	--
Green ash	131,311	30,932	100,379	--
All species	132,206	31,048	101,158	--
Cottonwood and aspen				
Balsam poplar	11,858	181	11,677	--
Eastern cottonwood	161,157	36,395	124,762	--
Quaking aspen	100,685	7,376	93,309	--
All species	273,700	43,952	229,749	--
Basswood				
American basswood	12,009	3,619	8,390	--
All species	12,009	3,619	8,390	--
Other eastern soft hardwoods				
Boxelder	48,316	6,937	41,379	--
Paper birch	571	--	571	--
Black willow	169	--	169	--
White willow	2,584	--	2,584	--
American elm	29,261	2,019	27,243	--
Siberian elm	4,267	670	3,597	--
Slippery elm	522	--	522	--
All species	85,689	9,626	76,064	--
Eastern noncommercial hardwoods				
Serviceberry spp.	--	--	--	--
Hawthorn spp.	--	--	--	--
Eastern hophornbeam	35	--	35	--
Pin cherry	--	--	--	--
Chokecherry	--	--	--	--
American plum	--	--	--	--
Willow spp.	3,898	3,898	--	--
Peachleaf willow	1,047	124	923	--
Russian-olive	374	--	374	--
All species	5,354	4,022	1,332	--
Total hardwoods	672,325	120,335	551,990	--
All species groups	719,210	164,022	555,188	--

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

Table 5. -- Net volume of all live trees and salvageable dead trees on timberland by class of timber and softwood/hardwood species category, North Dakota, 2001-2005

(In thousand cubic feet)

Class of timber	All species	Softwood species	Hardwood species
Live trees			
Growing-stock trees			
Sawtimber			
Saw log portion	202,686	245	202,442
Upper stem portion	27,633	52	27,580
Total	230,319	297	230,022
Poletimber	136,554	138	136,417
All growing-stock trees	366,873	435	366,439
Cull trees			
Rough trees ¹			
Sawtimber size	139,078	--	139,078
Poletimber size	74,560	126	74,434
Total	213,639	126	213,512
Rotten trees ¹			
Sawtimber size	13,525	--	13,525
Poletimber size	8,218	--	8,218
Total	21,743	--	21,743
All live cull trees	235,381	126	235,255
All live trees	602,255	561	601,694
Salvageable dead trees			
Sawtimber size	2,185	--	2,185
Poletimber size	2,120	--	2,120
All salvageable dead trees	4,305	--	4,305
All classes	606,560	561	605,999

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

¹Includes noncommercial species.

Table 6. -- Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, North Dakota, 2001-2005

(In thousand cubic feet)

Forest type group/ forest type	All species	Softwood species	Hardwood species
All softwood groups	--	--	--
Hardwood type groups			
Oak / hickory group			
Bur oak	32,671	--	32,671
Mixed upland hardwoods	33,388	--	33,388
All forest types	66,059	--	66,059
Elm / ash / cottonwood group			
Black ash / American elm / red maple	1,313	--	1,313
Cottonwood	111,767	--	111,767
Willow	53	--	53
Sugarberry / hackberry / elm / green ash	38,370	--	38,370
All forest types	151,503	--	151,503
Maple / beech / birch group			
Hard maple / basswood	8,817	--	8,817
Elm / ash / locust	63,428	435	62,994
All forest types	72,246	435	71,811
Aspen / birch group			
Aspen	71,502	--	71,502
Balsam poplar	3,842	--	3,842
All forest types	75,344	--	75,344
Exotic hardwoods group			
Other exotic hardwoods	926	--	926
All forest types	926	--	926
All hardwood groups	366,078	435	365,643
Nonstocked	796	--	796
All forest groups	366,873	435	366,439

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

Table 7. -- Net volume of growing stock on timberland by species group, species, and diameter class, North Dakota, 2001-2005

(In thousand cubic feet)

Species group/ species	All classes	Diameter class (inches at breast height)										
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+	
Softwoods												
Other eastern softwoods												
Eastern redcedar	435	--	138	297	--	--	--	--	--	--	--	--
All species	435	--	138	297	--	--	--	--	--	--	--	--
Total softwoods	435	--	138	297	--	--	--	--	--	--	--	--
Hardwoods												
Select white oaks												
Bur oak	73,361	7,060	8,163	9,750	3,658	3,873	3,910	11,076	10,647	9,968	5,257	5,257
All species	73,361	7,060	8,163	9,750	3,658	3,873	3,910	11,076	10,647	9,968	5,257	5,257
Ash												
Black ash	383	383	--	--	--	--	--	--	--	--	--	--
Green ash	74,082	10,352	15,271	12,263	10,922	10,809	9,381	1,274	3,811	--	--	--
All species	74,465	10,735	15,271	12,263	10,922	10,809	9,381	1,274	3,811	--	--	--
Cottonwood and aspen												
Balsam poplar	8,664	1,189	1,704	2,527	--	--	--	--	--	3,244	--	--
Eastern cottonwood	109,834	1,690	3,475	5,460	5,293	5,328	6,742	14,378	4,381	41,525	21,562	21,562
Quaking aspen	71,309	13,300	15,040	14,888	14,958	10,191	2,932	--	--	--	--	--
All species	189,807	16,179	20,219	22,875	20,251	15,519	9,675	14,378	4,381	44,769	21,562	21,562
Basswood												
American basswood	2,955	255	139	--	409	2,152	--	--	--	--	--	--
All species	2,955	255	139	--	409	2,152	--	--	--	--	--	--
Other eastern soft hardwoods												
Boxelder	4,018	197	544	1,929	484	864	--	--	--	--	--	--
American elm	20,430	3,203	3,106	3,966	2,172	2,215	--	--	2,266	3,501	--	--
Siberian elm	1,174	--	--	336	--	838	--	--	--	--	--	--
Slippery elm	227	113	114	--	--	--	--	--	--	--	--	--
All species	25,849	3,513	3,765	6,231	2,657	3,917	--	--	2,266	3,501	--	--
Total hardwoods	366,439	37,742	47,557	51,117	37,897	36,269	22,966	26,728	21,105	58,238	26,820	26,820
All species groups	366,873	37,742	47,695	51,414	37,897	36,269	22,966	26,728	21,105	58,238	26,820	26,820

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

Table 8. -- Net volume of sawtimber on timberland by species group, species, and diameter class, North Dakota, 2001-2005

(In thousand board feet)¹

Species group/ species	All classes	Diameter class (inches at breast height)								
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+	
Softwoods										
Other eastern softwoods										
Eastern redcedar	1,592	1,592	--	--	--	--	--	--	--	--
All species	1,592	1,592	--	--	--	--	--	--	--	--
Total softwoods	1,592	1,592	--	--	--	--	--	--	--	--
Hardwoods										
Select white oaks										
Bur oak	240,101	--	17,293	18,416	18,848	54,414	52,873	50,288	27,970	27,970
All species	240,101	--	17,293	18,416	18,848	54,414	52,873	50,288	27,970	27,970
Ash										
Green ash	159,468	--	45,459	47,216	42,535	5,918	18,340	--	--	--
All species	159,468	--	45,459	47,216	42,535	5,918	18,340	--	--	--
Cottonwood and aspen										
Balsam poplar	15,997	--	--	--	--	--	--	15,997	--	--
Eastern cottonwood	498,059	--	22,348	23,744	31,160	70,174	22,080	213,907	114,646	114,646
Quaking aspen	137,375	--	70,520	51,329	15,526	--	--	--	--	--
All species	651,431	--	92,868	75,074	46,686	70,174	22,080	229,904	114,646	114,646
Basswood										
American basswood	13,422	--	2,104	11,317	--	--	--	--	--	--
All species	13,422	--	2,104	11,317	--	--	--	--	--	--
Other eastern soft hardwoods										
Boxelder	5,777	--	2,030	3,747	--	--	--	--	--	--
American elm	46,664	--	9,586	9,996	--	--	10,436	16,646	--	--
Siberian elm	3,778	--	--	3,778	--	--	--	--	--	--
All species	56,219	--	11,616	17,521	--	--	10,436	16,646	--	--
Total hardwoods	1,120,641	--	169,340	169,544	108,070	130,505	103,728	296,837	142,616	142,616
All species groups	1,122,233	1,592	169,340	169,544	108,070	130,505	103,728	296,837	142,616	142,616

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

¹ International 1/4-inch rule.

Table 9. -- All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree biomass component, North Dakota, 2001-2005
(In thousand dry tons)

Owner category and softwood/hardwood category	All components	All live 1-5 inch trees	Tree biomass component					
			Growing-stock trees			Non-growing-stock trees		
			Total	Boles	Stumps, tops, and limbs	Total	Boles	Stumps, tops, and limbs
Public								
Softwoods	1	--	--	--	--	1	1	0
Hardwoods	3,006	282	1,390	998	392	1,334	968	366
Total	3,007	282	1,390	998	392	1,335	969	366
Private								
Softwoods	11	--	9	7	3	2	1	1
Hardwoods	13,259	1,279	7,092	5,155	1,937	4,887	3,510	1,377
Total	13,270	1,279	7,101	5,162	1,939	4,889	3,511	1,378
All ownerships								
Softwoods	12	--	9	7	3	3	2	1
Hardwoods	16,265	1,562	8,482	6,153	2,328	6,222	4,478	1,743
Total	16,277	1,562	8,491	6,160	2,331	6,224	4,480	1,744

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

Haugen, David E.; Brand, Gary J.; Kangas, Michael.

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This report completes the first 5 years of the annual forest inventory in North Dakota and presents estimates of forest area, volume, and biomass for 2005. It is part of the national effort of annual forest inventory authorized by the 1998 Farm Bill. Since the third forest inventory, in 1994, total forest land area has increased by 51,000 acres. Private forest land ownership represents more than two-thirds of the total forest land area. Hardwoods make up the majority of forest land acreage within the State, and softwoods represent approximately 5.8 percent of the total forested acreage. The net volume of growing stock on timberland is estimated at 366.8 million cubic feet—a 50-percent increase since the 1980 estimate of 243.7 million cubic feet.

KEY WORDS: Annual inventory, forest area, forest type, volume, biomass, North Dakota.

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