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North Dakota's Forest Resources in 2004

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North Dakota's Forest Resources in 2004

The North Central Research Station's Forest Inventory and Analysis (NCFIA) program began fieldwork for the fourth forest inventory of North Dakota 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 2004, NCFIA continued the annual inventory effort with the fourth of five panels as part of the State inventory. Three previous periodic inventories of North Dakota were conducted in 1954, 1980, and 1994 (Warner and Chase 1956, Jakes and Smith 1982, Haugen *et al.* 1999). The current inventory of North Dakota's forest resources will be completed in 2005. However, because each year's panel represents a portion of the total inventory under the new systematic approach, estimates have been prepared from data gathered during the first 4 years of the inventory to provide timely information about North Dakota's forest resources. Data presented in this report represent 80 percent of the field plots (or four panels) within a complete inventory including panels from 2001, 2002, 2003, and 2004. An earlier report summarized data gathered during the 2001, 2002, and 2003 panels (Haugen *et al.* 2005). Results presented are estimates based on sampling techniques; estimates were compiled assuming the 2001, 2002, 2003, and 2004 data represent one sample. The precision of inventory estimates will increase as additional panels are completed and new data are incorporated.

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 portions of the 2004 data with those published for earlier inventories.

RESULTS

Area

Total land area of North Dakota is 44.1 million acres of which 1.6 percent or 733 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 2004, hardwoods dominated 92 percent of the forest land area while conifers accounted for 6 percent, with the remaining 2 percent falling into the nonstocked category (table 1, fig. 1). Of the six major forest type groups identified in the State, maple/beech/birch,

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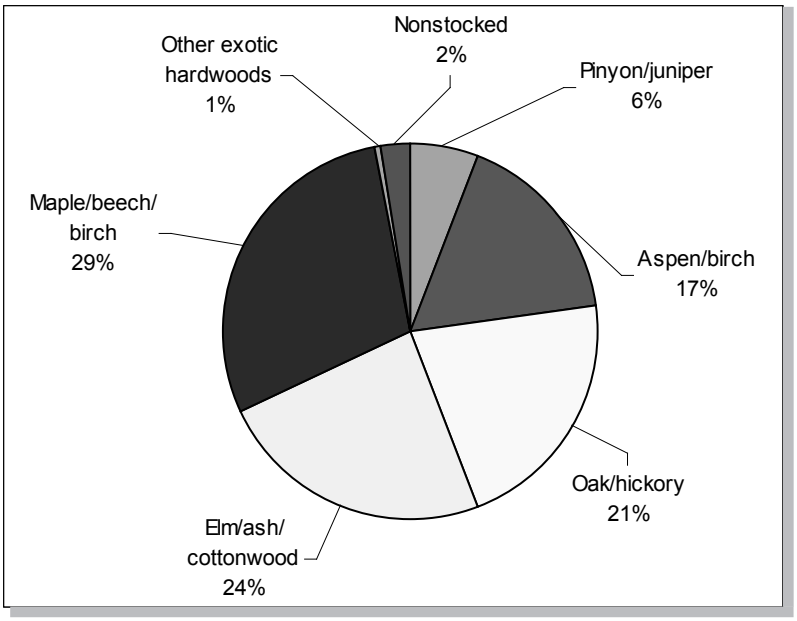

Figure 1. — *Area of forest land by forest type, North Dakota, 2004.*

elm/ash/cottonwood, and oak/hickory groups account for 74 percent or 545 thousand acres of forest land. The pinyon/juniper forest type group occupies about 42.1 thousand acres of forest land area, most of it scattered in the western part of the State.

Timberland, a component of forest land, has been increasing rapidly since the 1980s (fig. 2). In 2004, there were an estimated 547 thousand acres of timberland in North Dakota (table 2), compared to an estimated 367 thousand acres in the 1980s. Virtually all trees on timberland areas in North Dakota are of natural origin (table 2). Only an estimated 6 thousand acres of timberland area were planted.

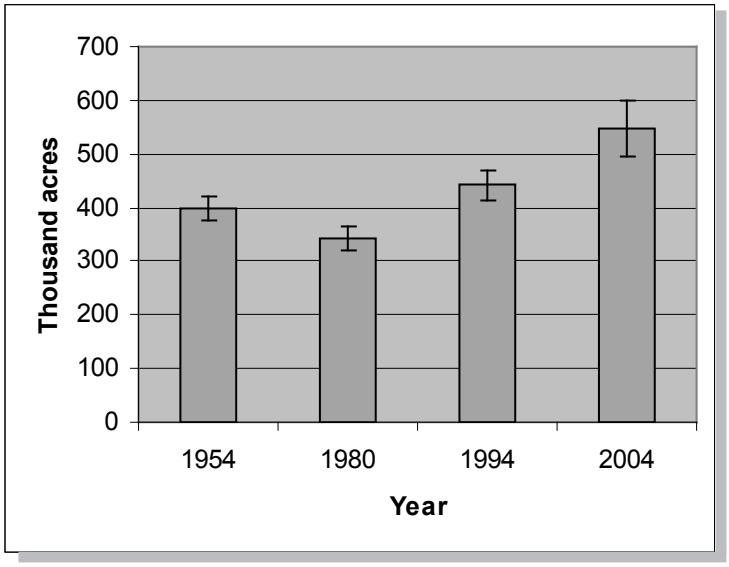

Figure 2. — *Area of timberland, North Dakota, 1954-2004. (Sampling error associated with each inventory is represented by the vertical line at the top of each bar.)*

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, trees 5 inches d.b.h. to sawtimber size; and sapling/seedling—small trees, trees 1 to 5 inches d.b.h. Table 3 shows the distribution of timberland by stand-size class. In 2004, timberland area contained almost the same percentages of the two largest size classes: sawtimber, 39 percent, and poletimber, 38 percent. The sapling/seedling class accounted for 21 percent, and nonstocked stands accounted for 2 percent (fig. 3).

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 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 2004, North Dakota had an estimated 737 million cubic feet of all live volume on its 733 thousand acres of forest land (table 4) or an average of more than 1,005 cubic feet of all live tree volume for each forest land acre. On the 547 thousand acres of timberland, there was an estimated 615 million cubic feet of all live tree volume (table 5) or the equivalent of 1,124 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 minimum 4-inch top diameter, with deductions made for poor form or defect. Growing-stock volume also has 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 358 million cubic feet in 2004 (table 6) or 654 cubic feet of growing-stock volume per timberland acre.

Most of North Dakota's growing-stock volume is in hardwood species. Three hardwood species groups accounted for 91 percent of all growing-stock volume in the State: the cottonwood/aspen group with 179 million cubic feet, the select white oak group with 76 million cubic feet, and the ash group with 71 million cubic

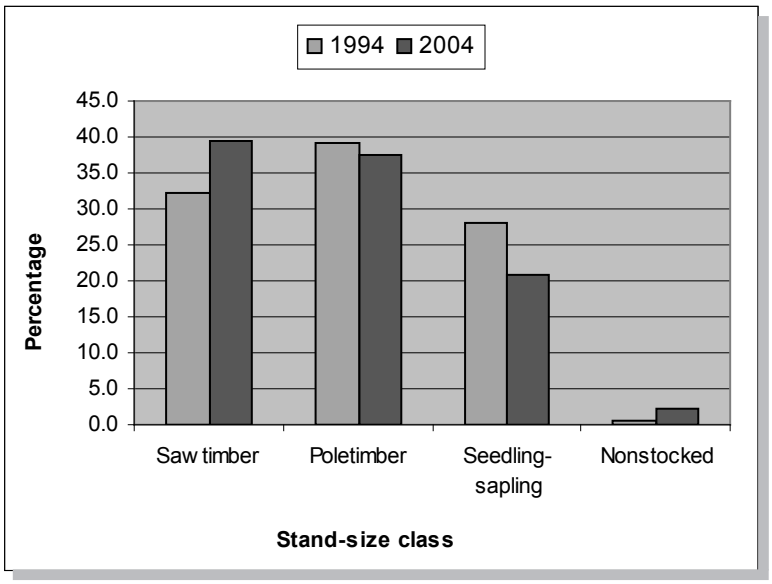

Figure 3. — *Stand-size class as a percentage of total timberland area, North Dakota, 1994 and 2004.*

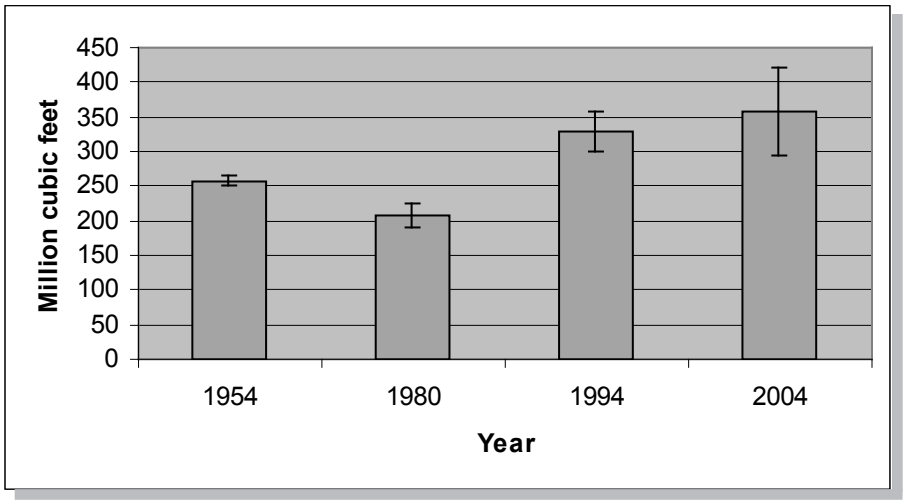

Figure 4. — *Growing-stock volume, North Dakota, 1954-2004. (Sampling error associated with each inventory is represented by the vertical line at the top of each bar.)*

feet (table 7). Softwood growing-stock volume was estimated at 543 thousand cubic feet in 2004.

The volume of sawtimber in North Dakota was estimated at more than 1 billion board feet in 2004 (table 8). The cottonwood and aspen species groups accounted for 57 percent of all sawtimber volume in the State. Softwood sawtimber volume was estimated at 2 million board feet in 2004.

Biomass

Biomass, measured as all live aboveground tree biomass on timberland in North Dakota, was estimated at more than 16.5 million dry tons in 2004 (table 9)—an average of more than 31 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 subjects. Roughly 50 percent of the total biomass was in growing-stock trees with an additional 10 percent in trees less than 5.0 inches d.b.h., and the remaining 40 percent was in non-growing-stock trees. More than 99 percent of the total biomass was composed of hardwood species. Almost 80 percent of the total biomass, or 13.3 million dry tons, was on privately owned land. The remaining 3.3 million dry tons were located on public timberlands.

Forest Health

Despite the 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, supply recreational opportunities, stabilize river banks, 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 2004.

Gypsy moth

The North Dakota Forest Service, the North Dakota Department of Agriculture, and the USDA Animal and Plant Health Inspection Service conduct annual statewide gypsy moth detection surveys. There were 363 detection traps placed in 2004 to encompass major forest types at risk of gypsy moth introduction. Two gypsy moths were detected during the 2004 trapping. One moth was caught near Jamestown (Stutsman County), and another was caught at the Grand Forks Air Force Base (Grand Forks County). Coupled with visual inspections, trapping will resume at these sites in 2005 to ensure that no gypsy moth

population is established. Despite these recent detections, no known established populations have been found in North Dakota. As trapping efforts continue, new areas of potential risk will be included in the surveys.

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 spruce trees are lost to this insect. The sawfly is particularly troublesome in rural plantings, where open growing conditions provide favorable egg-laying sites. Sawfly damage has been most significant in the north central and northeast parts of the State in recent years.

Dutch elm disease

Dutch elm disease has severely affected 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. Although the American elm has not been eliminated entirely from these forests, the species persists as a small understory tree, occupies a small portion of the total basal area, and often succumbs to mortality 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 the concern is that 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, and 2004 as part of the nursery's disease management plan.

Forest Tent Caterpillar

The Turtle Mountains of the north central region of the State encompass over 125,000 forested acres that are subject to periodic defoliation by the forest tent caterpillar (FTC). The insect defoliated an estimated 17,800 acres in 2003, representing a fourfold increase from the previous year.

Based on egg mass surveys conducted in October 2003, FTC defoliation was expected to increase in 2004. However, a sudden hard spring frost occurred during larval emergence, killing the majority of young larvae and causing the FTC population to collapse in 2004. As a result, local land managers, natural resource professionals, and private landowners did not report any defoliation during 2004.

Forest Tent Caterpillar Defoliation in the Turtle Mountains

Year	Defoliation (Acres)
2002	4,300
2003	17,800
2004	No Reports

Foliar Diseases of Deciduous Trees

Cool, wet conditions throughout the 2004 growing season were favorable for infection and development of several hardwood foliar diseases. Commonly observed diseases in 2004 included ash anthracnose, oak anthracnose, oak leaf blister, and Septoria leaf spot of *Populus* spp.

Wildfire

The Deep Creek Fire burned through portions of the native ponderosa pine stands of southwestern North Dakota (Slope County) in September 2004. This fire damaged approximately 800 acres of privately owned pine. Mortality may reach 100 percent in areas where high fire intensity caused extensive needle scorching and stem charring. Estimations of tree mortality within areas exposed to lower fire intensity are subjective at this time.

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 the low point in 1980. North Dakota's forests are generally in good health although several forest health concerns bear monitoring and control. For example, the state of the aspen resource, riparian forest health, Dutch elm disease, and cottonwood regeneration are persistent problems. As additional data become available from ensuing annual inventories and through forest health monitoring, a clearer picture of the direction of North Dakota's forests will emerge. Additional data related to the most recent three inventories of North Dakota (1980, 1994, 2004) are available at: www.ncrs2.fs.fed.us/4801/fiadb/index.htm.

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 will be completed. After the first 5 years, NCFIA will report and analyze results as a moving 5-year average. For example, NCFIA will be able to generate a report based on inventory results for 2001 through 2005 or for 2002 through 2006. Although there are great advantages to an annual inventory, one difficulty is reporting on results for fewer than 5 years. With the 2001-2004 panels, only 80 percent of all field plots have been measured. Sampling error estimates for the 2004 inventory results are 8.15 percent for area of forest land; 9.54 percent for area of timberland; 17.85 percent for volume of growing stock on timberland; and 24.80 percent for volume of sawtimber on timberland. These sampling error estimates are much 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, the use of a new sampling design, the implementation of a new field plot configuration, and the 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 nonstocked, 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.

Sampling Phases

The 2004 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 21 denied access plots out of 233 field plots between 2001 and 2004.

Phase 1

The 2004 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 nonforest edge stratum. The estimated population total for a variable is the sum across all strata of the product of each stratum's estimated area and the variable's estimated mean per unit area for the stratum.

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). An array of field plots was developed by establishing a plot 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, nonoverlapping subsamples or panels. Each year the plots in a single panel are measured, and panels are selected on a 5-year, rotating basis (McRoberts 1999). For estimation purposes, the measurement of each panel of plots may be considered an independent quasisystematic 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. We anticipate that in North Dakota the complete 5-year annual inventory will include measurement of about 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. In North Dakota, the complete 5-year annual inventory is expected to include measurement of about 7,150 phase 2 plots. The 2001-2004 annual inventory results represent field measures on 99 timberland plots, 37 other forest land plots, and 76 non-forest land 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 inventory 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 (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 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 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.

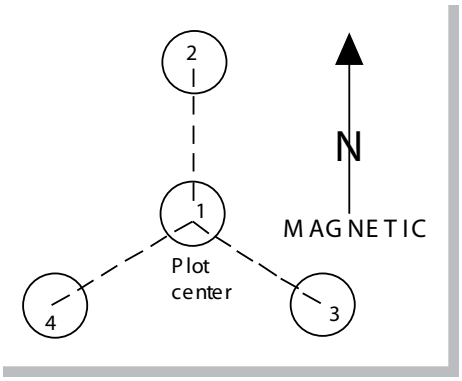

Figure 5. — *Current NCFIA field plot design.*

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, other tabular data can be generated at: www.ncrs2.fs.fed.us/4801/fiadb/index.htm.

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TABLE TITLES

Table 1.—*Area of forest land by forest type group, forest type, and owner category, North Dakota, 2001-2004*

Table 2.—*Area of timberland by major forest type group, stand orgin, and owner category, North Dakota, 2001-2004*

Table 3.—*Area of timberland by forest type group, forest type, and stand-size class, North Dakota, 2001-2004*

Table 4.—*Net volume of all live trees on forest land by species group, species, and owner category, North Dakota, 2001-2004*

Table 5.—*Net volume of all live trees and salvable dead trees on timberland by class of timber and softwood/hardwood species category, North Dakota, 2001-2004*

Table 6.—*Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, North Dakota, 2001-2004*

Table 7.—*Net volume of growing stock on timberland by species group, species, and diameter class, North Dakota, 2001-2004*

Table 8.—*Net volume of sawtimber on timberland by species group, species, and diameter class, North Dakota, 2001-2004*

Table 9.—*All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree biomass component, North Dakota, 2001-2004*

TABLES

Table 1. -- Area of forest land by forest type group, forest type, and owner category, North Dakota 2001 - 2004

(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	42.1	41.8	0.4	- -
All forest types	42.1	41.8	0.4	- -
All softwood groups	42.1	41.8	0.4	- -
Hardwood type groups				
Oak / hickory group				
Bur oak	76.9	12.3	64.5	- -
Mixed upland hardwoods	80.8	7.4	73.4	- -
All forest types	157.7	19.7	137.9	- -
Elm / ash / cottonwood group				
Black ash / American elm / red maple	3.6	- -	3.6	- -
Cottonwood	54.3	16.9	37.4	- -
Willow	7.7	5.7	1.9	- -
Sugarberry / hackberry / elm / green ash	108.3	33.1	75.3	- -
Cottonwood / willow	1.2	- -	1.2	- -
All forest types	175.1	55.7	119.4	- -
Maple / beech / birch group				
Hard maple / basswood	17.8	6.3	11.5	- -
Elm / ash / locust	194.8	60.3	134.5	- -
All forest types	212.6	66.6	146.0	- -
Aspen / birch group				
Aspen	116.5	30.5	86.0	- -
Paper birch	1.9	- -	1.9	- -
Balsam poplar	6.1	- -	6.1	- -
All forest types	124.5	30.5	94.0	- -
Exotic hardwoods group				
Other exotic hardwoods	3.8	- -	3.8	- -
All forest types	3.8	- -	3.8	- -
All hardwood groups	673.6	172.5	501.1	- -
Nonstocked	17.8	2.7	15.1	- -
All forest groups	733.5	217.0	516.6	- -

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 - 2004

(In thousand acres)

Major forest type group and stand origin	Owner category			
	All owners	Public	Private	Unidentified owner
Hardwood type groups				
Natural	528.9	124.1	404.8	- -
Planted	6.2	- -	6.2	- -
All hardwood types	535.1	124.1	411.0	- -
Nonstocked	12.2	2.7	9.5	- -
All groups	547.3	126.8	420.5	- -

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, forest type, and stand-size class, North Dakota 2001 - 2004

(In thousand acres)

Forest type group/ forest type	Stand-size class				
	All stands	Sawtimber	Poletimber	Sapling-seedling	Non-stocked
All softwood groups	- -	- -	- -	- -	- -
Hardwood type groups					
Oak / hickory group					
Bur oak	43.8	17.4	19.8	6.7	- -
Mixed upland hardwoods	43.0	6.2	21.0	15.8	- -
All forest types	86.8	23.5	40.7	22.5	- -
Elm / ash / cottonwood group					
Black ash / American elm / red maple	3.6	- -	1.9	1.7	- -
Cottonwood	54.3	46.9	7.4	- -	- -
Willow	7.7	7.7	- -	- -	- -
Sugarberry / hackberry / elm / green ash	96.6	52.4	13.8	30.4	- -
Cottonwood / willow	1.2	1.2	- -	- -	- -
All forest types	163.4	108.3	23.1	32.1	- -
Maple / beech / birch group					
Hard maple / basswood	12.5	12.5	- -	- -	- -
Elm / ash / locust	154.3	43.9	90.1	20.4	- -
All forest types	166.8	56.4	90.1	20.4	- -
Aspen / birch group					
Aspen	108.3	27.9	45.9	34.4	- -
Balsam poplar	6.1	- -	6.1	- -	- -
All forest types	114.4	27.9	52.0	34.4	- -
Exotic hardwoods group					
Other exotic hardwoods	3.8	- -	- -	3.8	- -
All forest types	3.8	- -	- -	3.8	- -
All hardwood groups	535.1	216.1	205.9	113.1	- -
Nonstocked	12.2	- -	- -	- -	12.2
All forest groups	547.3	216.1	205.9	113.1	12.2

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 - 2004

(In thousand cubic feet)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other eastern softwoods				
Rocky Mountain juniper	46,943	44,075	2,868	- -
Eastern redcedar	637	- -	637	- -
All species	47,580	44,075	3,504	- -
Total softwoods	47,580	44,075	3,504	- -
Hardwoods				
Select white oaks				
Bur oak	167,627	28,222	139,404	- -
All species	167,627	28,222	139,404	- -
Ash				
Black ash	971	62	909	- -
Green ash	133,599	34,440	99,160	- -
All species	134,570	34,501	100,069	- -
Cottonwood and aspen				
Balsam poplar	8,927	206	8,721	- -
Eastern cottonwood	170,904	44,466	126,438	- -
Quaking aspen	94,635	8,709	85,926	- -
All species	274,466	53,380	221,086	- -
Basswood				
American basswood	13,630	4,653	8,977	- -
All species	13,630	4,653	8,977	- -
Other eastern soft hardwoods				
Boxelder	52,741	7,491	45,250	- -
Paper birch	643	- -	643	- -
Black willow	213	- -	213	- -
White willow	3,252	- -	3,252	- -
American elm	31,287	2,325	28,962	- -
Siberian elm	4,122	878	3,244	- -
Slippery elm	641	- -	641	- -
All species	92,898	10,694	82,204	- -
Eastern noncommercial hardwoods				
Serviceberry spp.		- -		- -
Hawthorn spp.		- -		- -
Eastern hophornbeam	37	- -	37	- -
Pin cherry		- -		- -
Chokecherry		- -	- -	- -
Willow spp.	4,493	4,493	- -	- -
Peachleaf willow	1,223	154	1,070	- -
Russian-olive	470	- -	470	- -
All species	6,224	4,647	1,577	- -
Total hardwoods	689,416	136,098	553,318	- -
All species groups	736,995	180,173	556,822	- -

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

Table 5. -- Net volume of all live trees and salvable dead trees on timberland by class of timber and softwood/hardwood species category, North Dakota 2001 - 2004

(In thousand cubic feet)

Class of timber	All species	Softwood species	Hardwood species
Live trees			
Growing-stock trees			
Sawtimber			
Saw log portion	204,410	306	204,104
Upper stem portion	29,020	65	28,955
Total	233,429	371	233,059
Poletimber	124,220	172	124,048
All growing-stock trees	357,649	543	357,107
Cull trees			
Rough trees[1]			
Sawtimber size	148,155	- -	148,155
Poletimber size	83,889	146	83,744
Total	232,044	146	231,899
Rotten trees[1]			
Sawtimber size	15,702	- -	15,702
Poletimber size	9,143	- -	9,143
Total	24,845	- -	24,845
All live cull trees	256,890	146	256,744
All live trees	614,539	688	613,851
Salvable dead trees			
Sawtimber size	2,739	- -	2,739
Poletimber size	2,556	- -	2,556
All salvable dead trees	5,295	- -	5,295
All classes	619,834	688	619,146

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

[1] Includes noncommercial species.

Table 6. -- Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, North Dakota 2001 - 2004

(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	33,739	- -	33,739
Mixed upland hardwoods	25,443	- -	25,443
All forest types	59,182	- -	59,182
Elm / ash / cottonwood group			
Black ash / American elm / red maple	1,494	- -	1,494
Cottonwood	107,797	- -	107,797
Willow	62	- -	62
Sugarberry / hackberry / elm / green ash	43,583	- -	43,583
All forest types	152,935	- -	152,935
Maple / beech / birch group			
Hard maple / basswood	10,604	- -	10,604
Elm / ash / locust	62,226	543	61,684
All forest types	72,831	543	72,288
Aspen / birch group			
Aspen	67,428	- -	67,428
Balsam poplar	4,372	- -	4,372
All forest types	71,800	- -	71,800
All hardwood groups	356,748	543	356,205
Nonstocked	902	- -	902
All forest groups	357,649	543	357,107

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

Table 7. -- Net volume of growing stock on timberland by species group, species, and diameter class, North Dakota 2001 - 2004

(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	543	- -	172	371	- -	- -	- -	- -	- -	- -	- -
All species	543	- -	172	371	- -	- -	- -	- -	- -	- -	- -
Total softwoods	543	- -	172	371	- -	- -	- -	- -	- -	- -	- -
Hardwoods											
Select white oaks											
Bur oak	76,008	7,395	8,072	9,383	3,616	2,953	4,336	11,851	11,540	10,666	6,195
All species	76,008	7,395	8,072	9,383	3,616	2,953	4,336	11,851	11,540	10,666	6,195
Ash											
Black ash	365	365	- -	- -	- -	- -	- -	- -	- -	- -	- -
Green ash	71,402	10,009	14,060	10,462	10,901	10,848	9,265	1,603	4,253	- -	- -
All species	71,767	10,374	14,060	10,462	10,901	10,848	9,265	1,603	4,253	- -	- -
Cottonwood and aspen											
Balsam poplar	5,254	1,033	1,869	2,352	- -	- -	- -	- -	- -	- -	- -
Eastern cottonwood	109,310	1,906	4,295	6,772	6,566	6,609	8,383	11,764	5,478	28,724	28,812
Quaking aspen	64,495	4,860	12,401	14,428	18,262	10,829	3,715	- -	- -	- -	- -
All species	179,059	7,799	18,565	23,553	24,828	17,438	12,098	11,764	5,478	28,724	28,812
Basswood											
American basswood	3,735	293	149	- -	526	2,766	- -	- -	- -	- -	- -
All species	3,735	293	149	- -	526	2,766	- -	- -	- -	- -	- -
Other eastern soft hardwoods											
Boxelder	3,338	80	190	1,573	571	924	- -	- -	- -	- -	- -
American elm	22,507	3,498	3,598	4,309	2,047	2,696	- -	- -	2,613	3,746	- -
Siberian elm	421	- -	- -	421	- -	- -	- -	- -	- -	- -	- -
Slippery elm	273	129	143	- -	- -	- -	- -	- -	- -	- -	- -
All species	26,538	3,708	3,931	6,303	2,618	3,620	- -	- -	2,613	3,746	- -
Total hardwoods	357,107	29,570	44,777	49,701	42,489	37,626	25,699	25,218	23,884	43,135	35,007
All species groups	357,649	29,570	44,949	50,072	42,489	37,626	25,699	25,218	23,884	43,135	35,007

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

Table 8. -- Net volume of sawtimber on timberland by species group, species, and diameter class, North Dakota 2001 - 2004

(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	1,988	1,988	- -	- -	- -	- -	- -	- -	- -
All species	1,988	1,988	- -	- -	- -	- -	- -	- -	- -
Total softwoods	1,988	1,988	- -	- -	- -	- -	- -	- -	- -
Hardwoods									
Select white oaks									
Bur oak	254,361	- -	17,111	14,056	20,908	58,221	57,299	53,807	32,959
All species	254,361	- -	17,111	14,056	20,908	58,221	57,299	53,807	32,959
Ash									
Green ash	162,646	- -	45,368	47,285	42,075	7,447	20,472	- -	- -
All species	162,646	- -	45,368	47,285	42,075	7,447	20,472	- -	- -
Cottonwood and aspen									
Eastern cottonwood	484,559	- -	27,722	29,454	38,747	58,157	27,617	149,669	153,194
Quaking aspen	160,111	- -	86,183	54,264	19,664	- -	- -	- -	- -
All species	644,670	- -	113,905	83,718	58,411	58,157	27,617	149,669	153,194
Basswood									
American basswood	17,256	- -	2,705	14,551	- -	- -	- -	- -	- -
All species	17,256	- -	2,705	14,551	- -	- -	- -	- -	- -
Other eastern soft hardwoods									
Boxelder	6,401	- -	2,392	4,009	- -	- -	- -	- -	- -
American elm	51,072	- -	9,062	12,168	- -	- -	12,031	17,810	- -
All species	57,473	- -	11,455	16,177	- -	- -	12,031	17,810	- -
Total hardwoods	1,136,406	- -	190,544	175,787	121,394	123,824	117,418	221,286	186,152
All species groups	1,138,394	1,988	190,544	175,787	121,394	123,824	117,418	221,286	186,152

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 - 2004

(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	1,166	- -	- -	- -	- -	1,166	722	444
Hardwoods	3,340,270	302,992	1,593,257	1,148,277	444,981	1,444,021	1,050,424	393,597
Total	3,341,437	302,992	1,593,257	1,148,277	444,981	1,445,187	1,051,146	394,041
Private								
Softwoods	13,743	- -	11,532	8,191	3,341	2,211	1,457	754
Hardwoods	13,332,729	1,336,028	6,696,500	4,874,447	1,822,053	5,300,201	3,803,567	1,496,635
Total	13,346,473	1,336,028	6,708,033	4,882,638	1,825,394	5,302,412	3,805,023	1,497,389
All ownerships								
Softwoods	14,910	- -	11,532	8,191	3,341	3,377	2,179	1,198
Hardwoods	16,673,000	1,639,020	8,289,758	6,022,724	2,267,034	6,744,222	4,853,991	1,890,231
Total	16,687,909	1,639,020	8,301,290	6,030,915	2,270,375	6,747,599	4,856,170	1,891,430

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.

Haugen, David; Brand, Gary; Kangas, Michael.
2006. **North Dakota's forest resources in 2004.** Resour. Bull. NC-258. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 20 p.

Results of the combined 2001-2004 annual forest inventory panels for North Dakota show more than 733 thousand acres of forest land that contain an estimated 737 million cubic feet of all live tree volume or approximately 1,005 cubic feet per forest land acre. Timberland area in North Dakota was estimated at 547 thousand acres, with an estimated 358 million cubic feet of growing-stock volume or approximately 654 cubic feet per timberland acre. All live aboveground tree biomass on timberland is estimated at 16 million dry tons or approximately 32 tons per timberland acre. Forest pests that are damaging North Dakota's forested resources include yellow-headed spruce sawfly, forest tent caterpillar, and Dutch elm disease.

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

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

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