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North Dakota's Forest Resources in 2003

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North Dakota's Forest Resources in 2003

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. This inventory initiated the 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 the data for plots in all five panels. Once all panels have been measured, each will be remeasured approximately every 5 years. For example, in North Dakota, the field plots measured in 2001 will be remeasured in 2006.

In 2003, NCFIA continued the annual inventory effort with the third panel of the fourth forest inventory. Previous inventories of North Dakota are dated 1954, 1980, and 1994 (Haugen *et al.* 1999, Jakes and Smith 1982, Warner and Chase 1956). This fourth inventory of North Dakota's forest resources will be completed in 2005. However, because each year's sample is a systematic sample of the State's forest and because timely information is needed about North Dakota's forest resources, estimates have been prepared from data gathered during the first 3 years of the inventory. Data presented in this report represent 60 percent of the field plots (or three panels) for a complete inventory. These data are a combination of the first year's panel from 2001, the second year's panel from 2002, and the third year's panel from 2003. An earlier report for the combined 2001 and 2002 panels (Haugen *et al.* 2004) was published. Results presented are estimates based on sampling techniques; estimates were compiled assuming the 2001, 2002, and 2003

data represent one sample. As additional annual panels are completed, the precision of the estimates will increase and additional data will be released.

Data from new inventories are often compared with data from earlier inventories to determine trends in forest resources. However, for the comparisons to be valid, the procedures used in the two inventories must be similar. As a result of our ongoing efforts to improve the efficiency and reliability of the inventory, several changes in procedures and definitions have occurred 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 2001–2003 data with those published for earlier inventories.

RESULTS

Area

Total land area of North Dakota consists of 44.1 million acres of which 1.6 percent or 743 thousand acres are forested (table 1). Twenty-four percent of forest land area is owned by public agencies, with the remaining forest land area in private ownership.

Timberland, a component of forest land, has been increasing since the 1980s (fig. 1). In 2003, there were an estimated 527 thousand acres of timberland in North Dakota (table 2) compared to an estimated 367 thousand acres in the 1980s. Virtually all timberland area in North Dakota is of natural origin (table 2). Only an estimated 8 thousand acres of timberland area were planted.

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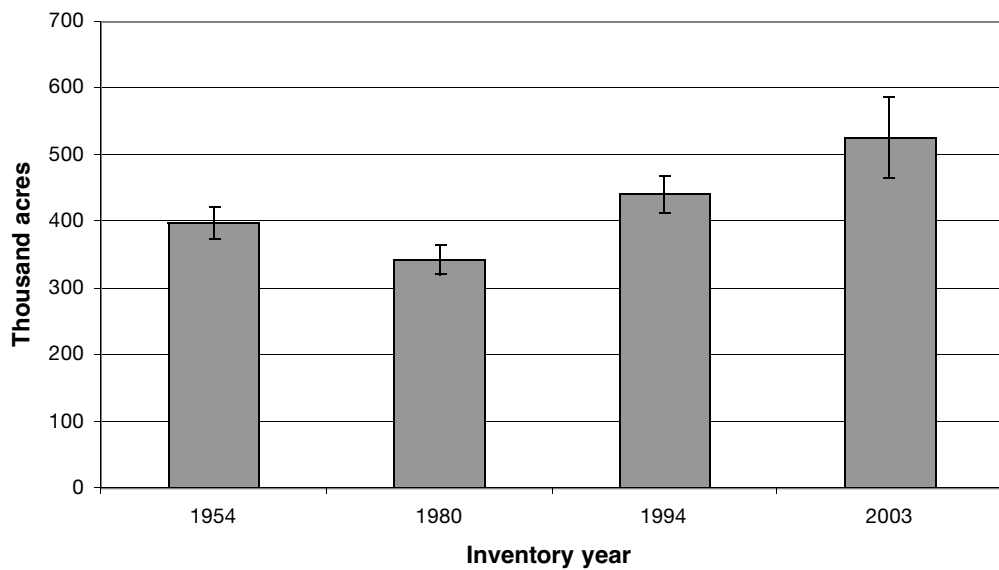


Figure 1.—Area of timberland in North Dakota, 1954-2003. The vertical line at the top of each bar represents the sampling error associated with each inventory.

In 2003, 93 percent of the forest land area was dominated by hardwoods and conifers accounted for 5 percent, with the remaining 2 percent falling into the nonstocked category (table 1, fig. 2).

The oak/hickory forest type, with 205.7 thousand acres, is the dominant hardwood forest type group in the State. Of the five

major forest type groups identified in the State, the oak/hickory, maple/beech/birch, elm/ash/cottonwood, and aspen/birch groups account for 88 percent or 682.4 thousand acres of forest land. The pinyon/juniper forest type group occupies about 39.7 thousand acres of forest land area, most of it scattered in western North Dakota.

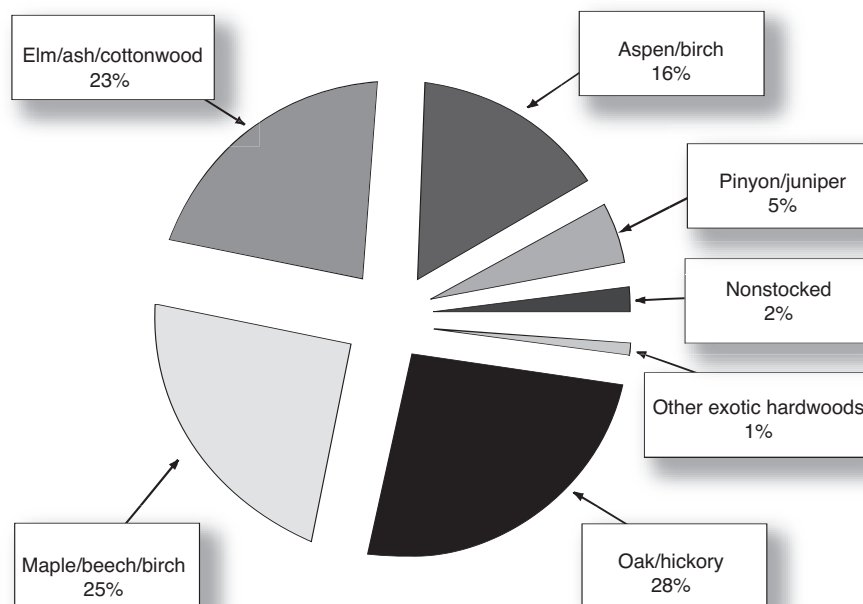


Figure 2.—Area of forest land in North Dakota by forest type, 2003.

Although forests cover only 1.6 percent of the State's land area, they are an important resource. North Dakota's forests provide watershed protection, wildlife habitat, recreational opportunities, crop and livestock protection, and wood fiber for the State's forest industries.

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 2003, timberland area was comprised of the following stand-size classes: sawtimber 38 percent, poletimber 36 percent, and sapling/seedling 24 percent. Nonstocked stands account for 2 percent of North Dakota's timberland area (fig. 3).

Volume

Historically, volume has been reported as either growing stock or sawtimber. However, volumes in noncommercial trees, rotten trees, and rough trees do not qualify as growing stock but are utilized for wood fiber (and/or fuelwood) and are an important ecological component of these forests (wildlife habitat, soil and water protection, etc.). 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 2003, North Dakota had an estimated 726 million cubic feet of all live volume on its 743 thousand acres of forest land (table 4), or an average of more than 977 cubic feet of all live tree volume for each forest land acre. On the 527 thousand acres of timberland there were an estimated 600 million cubic feet of all live tree volume (table 5) or the equivalent of 1,138 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.

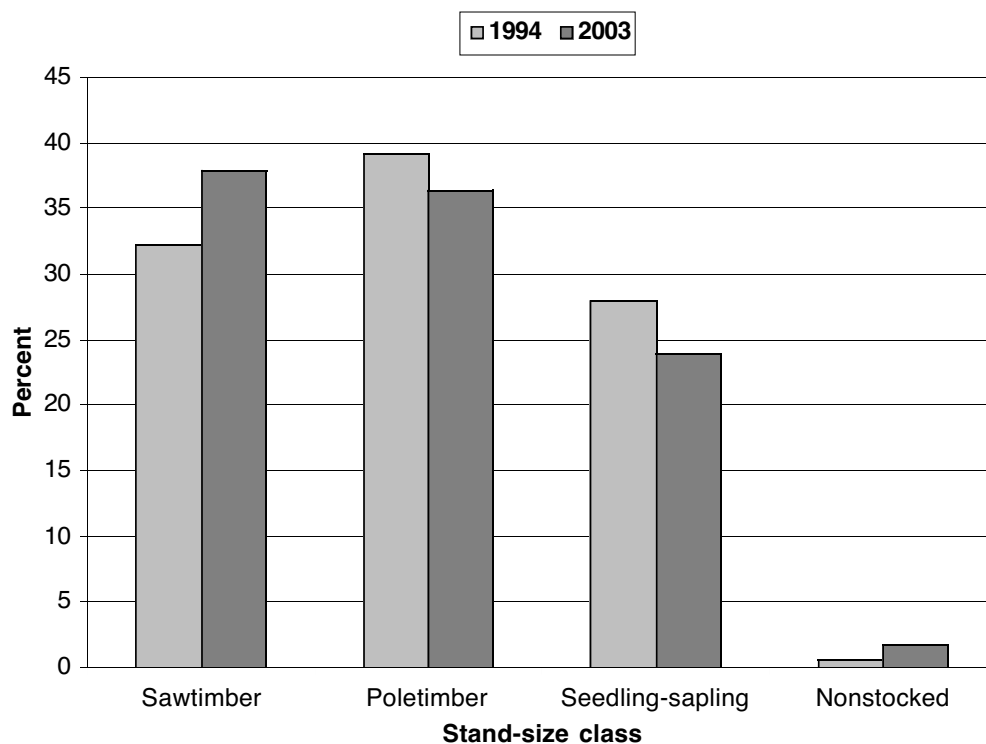


Figure 3.—Stand-size class in North Dakota as a percentage of total timberland area, 1994 and 2003.

and larger, from 1 foot above ground to a minimum 4-inch top diameter with deductions made for poor form or defect. With increases in timberland area since the 1980s, growing-stock volume has also increased (fig. 4). The net volume of growing stock on timberland in North Dakota was estimated at 329 million cubic feet in 2003 (table 6), which equates to 624 cubic feet of growing-stock volume per acre.

Most of North Dakota's growing-stock volume is in hardwood species. Three hardwood species groups accounted for 89 percent of all growing-stock volume in the State: the cottonwood/aspen group, 129 million cubic feet; select white oak group, 97 million cubic feet; and ash group, 69 million cubic feet (table 7). Softwood growing-stock volume was estimated at 731 thousand cubic feet in 2003.

The volume of sawtimber in North Dakota was estimated at 1 billion board feet in 2003 (table 8). The select white oak group, and cottonwood/aspen species group accounted for 76 percent of all sawtimber volume in the State. Softwood sawtimber volume was estimated at 2.6 million board feet in 2003.

Biomass

Biomass, measured as all live aboveground tree biomass on timberland in North Dakota, was estimated at more than 16 million dry tons in 2003 (table 9)—an average of over 31 dry tons per acre. Dry tonnage, an estimate of biomass, is an important measure because it provides information that can be used for analyses related to carbon sequestration, wood fiber availability for fuel, and other matters.

More than 48 percent of the total biomass was in growing-stock trees, 10 percent was in trees less than 5.0 inches d.b.h., and the remaining 42 percent was in non-growing-stock trees. Over 99 percent of the total biomass is composed of hardwood species. Roughly 85 percent of the total biomass was on private ownership (14 million dry tons), with the remaining amount—2 million dry tons—on public timberlands.

Forest Health

Despite the limited acreage and sparse distribution, North Dakota's forest resources (forest land, rural plantings, and community forests) provide a multitude of benefits

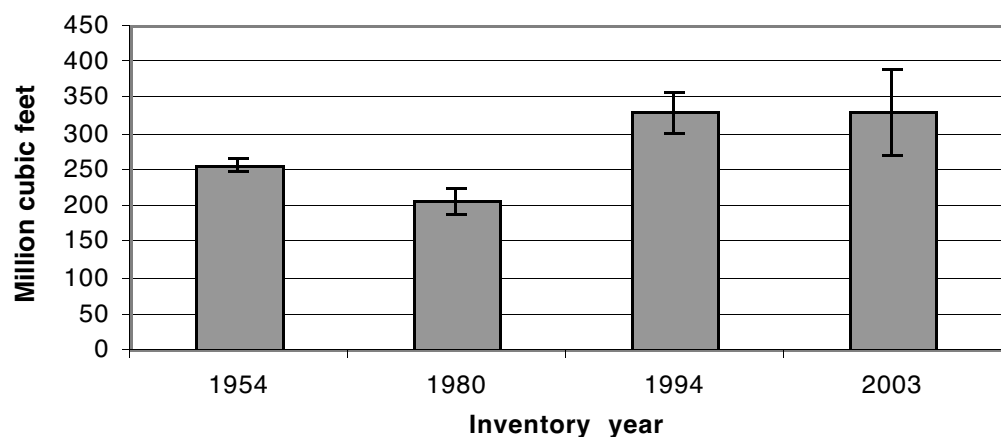


Figure 4.—Growing-stock volume in North Dakota, 1954-2003. The vertical line at the top of each bar represents the sampling error associated with each inventory.

to the people of the State. The unique objectives placed upon these resources such as stabilization of banks along rivers, protection of agricultural land and homes from wind and snow, and beautification of residential areas produce unique forest health issues within North Dakota.

The following narratives highlight some of the current forest health issues observed in North Dakota over the past 3 years (USDA 2003).

Gypsy moth (non-native)

Gypsy moth detection surveys are conducted each year in North Dakota. There were 403, 365, and 312 gypsy moth detection traps placed in 2001, 2002, and 2003, respectively. These traps were distributed throughout the State to sample major forest types and risk of gypsy moth introductions. One gypsy moth was captured near Jamestown in 2003, the first positive detection since 1998. Future trapping efforts will sample new areas of potential risk as established North American range of the moth expands.

Yellow-headed spruce sawfly

All species of spruce planted in North Dakota are susceptible to the yellow-headed spruce sawfly. Every year small and medium spruce trees are lost to this insect. This insect is particularly troublesome in rural plantings where spruce is often used, and open growing conditions provide favorable egg-laying sites. Sawfly damage has been most significant in the north-central and northeast parts of the State over the past 3 years. The defoliation caused by the sawfly may lead to tree mortality or predispose trees to other damaging agents, resulting in an overall reduction of windbreak efficiency.

Dutch elm disease (non-native)

Dutch elm disease has been detected in nearly all native woodlands, rural plantings, and municipalities throughout the State. This disease is of great concern because of the American elm's status as the State tree, because

it is one of relatively few species that is hardy and tolerant of the high pH soils that occur in the State, and because of its use in various agroforestry and landscape plantings.

Dutch elm disease has caused substantial damage in the riparian forests of the Red, Sheyenne, and James River Valleys. The disease has greatly reduced the elm component and has shifted the species composition toward green ash and box elder in these forests. The pathogen has eliminated nearly all plantings where the American elm was historically used and continues to decimate wooded draws of western North Dakota.

The disease is a chronic problem in residential areas given the high value of community forests. Larger communities such as Fargo, Grand Forks, and Bismarck conduct annual street surveys and are able to reduce the impact of this disease. Unfortunately, smaller communities that have limited budgets and personnel have been severely impacted by Dutch elm disease.

Sphaeropsis (Diplodia) shoot blight

Sphaeropsis sapinea continues to cause problems in ponderosa pine windbreaks at Towner State Nursery. The nursery annually produces 200,000 ponderosa pine seedlings, and there is concern that this disease could reduce the supply of pine seedlings the nursery will provide in the future.

The incidence and severity of the disease have gradually increased over a 15-year period at Towner State Nursery. Since 2000, the incidence of the disease in windbreak ponderosa pines has increased by 15 percent. 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 other species, applying preventive fungicides to nursery crops, and relocating ponderosa pine nursery crops to fields with minimum exposure to the disease. Forest Health Protection funds were used to remove windbreaks in 2002 and 2003.

Aspen Health

North Dakota's aspen resource is in a general state of overmaturity. Unlike Lake States and Western Aspen forest types, these stands lack replacement by conifers in the absence of stand-replacing disturbances. Harniss (1981) described this successional scenario as: Senescent aspen stands characterized by high stem mortality, exhibit minimal vegetative regeneration, lack replacement by conifers, and eventual succession to shrub land. Pathogens and defoliating insects contribute to the deterioration and mortality of the aspen overstory and may facilitate the successional shift to shrub land. The most significant of these forest pests are forest tent caterpillar and aspen trunk rot.

Forest tent caterpillar

The Turtle Mountains of north-central North Dakota encompass over 125,000 forested acres and annually experience some defoliation by the forest tent caterpillar. An estimated 17,800 acres were defoliated by the forest tent

caterpillar in 2003 (table A, fig.5). This estimate represents a substantial increase since 2002 when 4,300 acres were defoliated. Defoliation and caterpillar larvae in campgrounds and State parks present a nuisance to campers in this popular summer recreation area. In addition, repeated defoliation may speed the decline of these generally overmature stands.

Table A.—Forest tent caterpillar
defoliation by year

Year	Defoliation (acres)
2001	3,045
2002	4,300
2003	17,800

Phellinus stem decay of aspen

Aspen stem decay caused by the fungus *Phellinus tremulae* is common in mature aspen stands throughout North Dakota. Although the stem decay may not kill the tree, the reduced structural soundness increases the probability of top breakage and discourages utilization of aspen for wood products. The incidence of *P. tremulae* tends to increase with

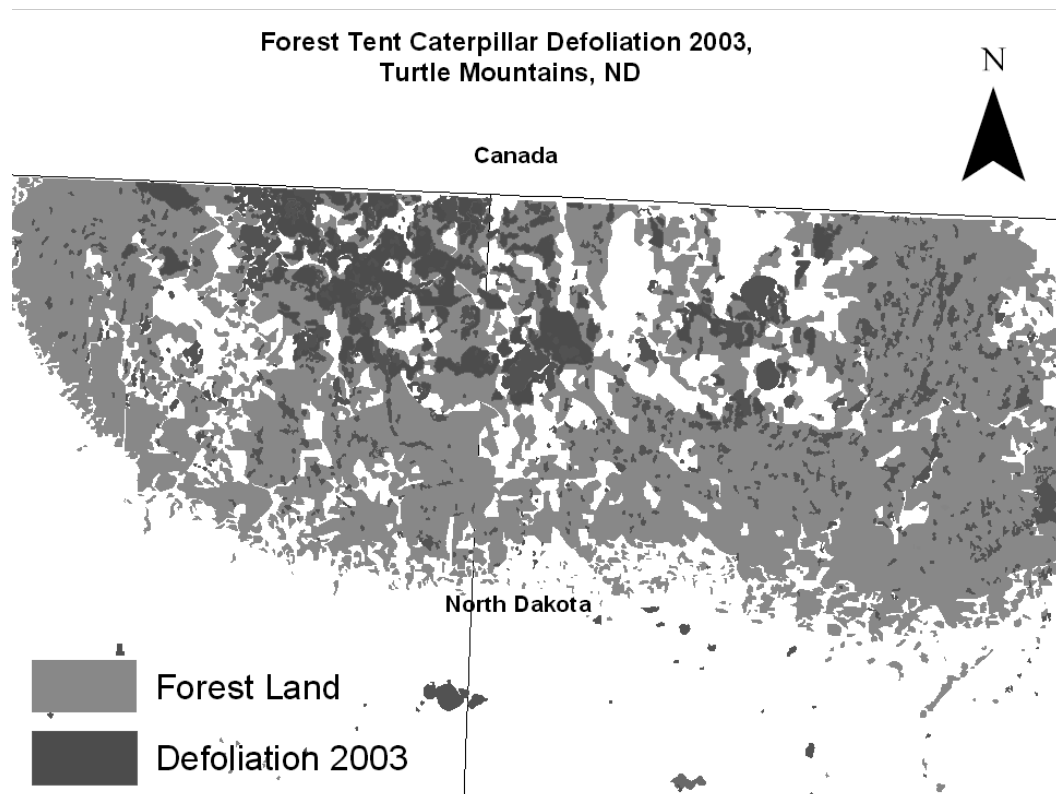
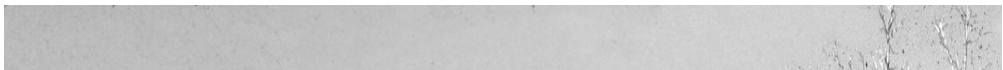


Figure 5. — Forest tent caterpillar defoliation in North Dakota, 2003.

stand age, and aspen stands are often harvested before significant volume losses. However, the pathological rotation age on North Dakota's aspen is not well understood. Surveys are currently underway to determine stem decay relative to stand age.

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. Overall, North Dakota's forests are generally in good health. However, several concerns related to forest health bear monitoring and control. For example, the status 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 three most recent inventories of North Dakota (1980, 1994, 2003) are available at:
www.ncrs.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 meet increasing demands for timely forest resource information. The most significant difference between inventories is 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 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 in any one 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 for an annual inventory, one difficulty is reporting on results for fewer than 5 years. With the 2001–2003 panels, only 60 percent of all field plots have been measured. Sampling error estimates for the 2003 inventory results are area of forest land, 9.62 percent; area of timberland, 11.54 percent; number of growing-stock trees on timberland, 17.53 percent; volume of growing stock on timberland, 17.99 percent; and volume of sawtimber on timberland, 22.89 percent. 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. As each measurement year is completed, the precision of estimates will improve.

Other significant changes between inventories include new remote sensing technology, a new sampling design, a new field plot configuration, and additional remotely sensed and field data. The advent of remote sensing technology since the previous inventory in 1994 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 the precision of estimates. Inventories in North Dakota before 2001 (1954, 1980, and 1994) used manual 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 2003 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 2003 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 only 3 denied access plots in 2003 (out of 64 field plots), 6 denied access plots in 2002 (out of 57 field plots), and 3 denied access plots in 2001 (out of 63 field plots).

Phase 1

The 2003 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 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 a forest edge stratum. Pixels within 60 m of the boundary on the nonforest side were classified into a 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.

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 non-overlapping hexagons, each of which contains 5,937 acres (McRoberts 1999). An array of field plots was established by selecting one 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 of hexagonal grid plots 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 random 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 2001–2003 annual inventory results represent field measurements on 72 timberland plots, 31 other forest land plots, and 69 nonforest land plots.

The new national FIA plot configuration (fig. 6) 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 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 panels 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, land use, 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 www.ncrs.fs.fed.us/4801/fiadb/index.htm other tabular data can be generated.

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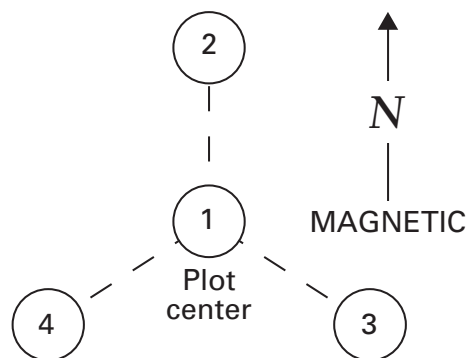


Figure 6.—Current NCFIA field plot design.

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TABLE TITLES

Table 1.—*Area of forest land by forest type group, forest type, and owner category, North Dakota, 2001–2003*

Table 2.—*Area of timberland by major forest type group, stand origin, and owner category, North Dakota, 2001–2003*

Table 3.—*Area of timberland by forest type group, forest type, and stand-size class, North Dakota, 2001–2003*

Table 4.—*Net volume of all live trees on forest land by species group, species, and owner category, North Dakota, 2001–2003*

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, 2001–2003*

Table 6.—*Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, North Dakota, 2001–2003*

Table 7.—*Net volume of growing stock on timberland by species group, species, and diameter class, North Dakota, 2001–2003*

Table 8.—*Net volume of sawtimber on timberland by species group, species, and diameter class, North Dakota, 2001–2003*

Table 9.—*All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree biomass component, North Dakota, 2001–2003*



TABLES

Table 1. -- Area of forest land by forest type group, forest type, and owner category, North Dakota, 2001-2003

(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	39.7	39.2	0.5	--
All forest types	39.7	39.2	0.5	--
All softwood groups	39.7	39.2	0.5	--
Hardwood type groups				
Oak / hickory group				
Bur oak	85.9	6.6	79.3	--
Mixed upland hardwoods	119.8	9.9	109.9	--
All forest types	205.7	16.6	189.2	--
Elm / ash / cottonwood group				
Black ash / American elm / red maple	4.8	--	4.8	--
Cottonwood	48.8	21.3	27.4	--
Willow	2.6	--	2.6	--
Sugarberry / hackberry / elm / green ash	114.7	43.3	71.3	--
Cottonwood / willow	1.6	--	1.6	--
All forest types	172.4	64.7	107.8	--
Maple / beech / birch group				
Hard maple / basswood	9.2	--	9.2	--
Elm / ash / locust	173.3	37.3	136.0	--
All forest types	182.5	37.3	145.1	--
Aspen / birch group				
Aspen	110.2	19.6	90.6	--
Paper birch	3.2	--	3.2	--
Balsam poplar	8.4	--	8.4	--
All forest types	121.8	19.6	102.2	--
Exotic hardwoods group				
Other exotic hardwoods	5.0	--	5.0	--
All forest types	5.0	--	5.0	--
All hardwood groups	687.4	138.2	549.2	--
Nonstocked	16.8	4.3	12.5	--
All forest groups	743.9	181.7	562.2	--

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 2. -- Area of timberland by major forest type group, stand origin, and owner category, North Dakota, 2001-2003

(In thousand acres)

Major forest type group and stand origin	Owner category		
	All owners	Public	Unidentified owner
Hardwood type groups			
Natural	509.7	88.3	421.5
Planted	8.1	--	8.1
All hardwood types	517.9	88.3	429.6
Nonstocked	9.4	4.3	5.1
All groups	527.2	92.5	434.7

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 totals due to rounding.

Table 3. -- Area of timberland by forest type group, forest type, and stand-size class, North Dakota, 2001-2003

(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	41.8	25.8	16.0	--
Mixed upland hardwoods	61.5	15.6	24.8	21.1
All forest types	103.3	41.4	40.7	21.1
Elm / ash / cottonwood group				
Black ash / American elm / red maple	4.8	--	2.6	2.2
Cottonwood	48.8	39.6	9.2	--
Willow	2.6	2.6	--	--
Sugarberry / hackberry / elm / green ash	102.3	54.5	16.5	31.4
Cottonwood / willow	1.6	1.6	--	--
All forest types	160.1	98.3	28.2	33.6
Maple / beech / birch group				
Hard maple / basswood	9.2	9.2	--	--
Elm / ash / locust	129.1	20.8	78.0	30.3
All forest types	138.3	30.0	78.0	30.3
Aspen / birch group				
Aspen	102.8	29.9	36.4	36.4
Balsam poplar	8.4	--	8.4	--
All forest types	111.2	29.9	44.8	36.4
Exotic hardwoods group				
Other exotic hardwoods	5.0	--	--	5.0
All forest types	5.0	--	--	5.0
All hardwood groups	517.9	199.7	191.7	126.4
Nonstocked	9.4	--	--	--
All forest groups	527.2	199.7	191.7	126.4

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 4. -- Net volume of all live trees on forest land by species group, species, and owner category, North Dakota, 2001-2003

(In thousand cubic feet)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other eastern softwoods				--
Rocky Mountain juniper	38,175	34,490	3,685	--
Eastern redcedar	853	--	853	--
All species	39,028	34,490	4,538	--
Total softwoods	39,028	34,490	4,538	--
Hardwoods				
Select white oaks				--
Bur oak	206,460	21,778	184,682	--
All species	206,460	21,778	184,682	--
Ash				--
Black ash	1,198	--	1,198	--
Green ash	130,559	26,065	104,494	--
All species	131,757	26,065	105,693	--
Cottonwood and aspen				--
Balsam poplar	10,764	--	10,764	--
Eastern cottonwood	138,698	56,474	82,225	--
Quaking aspen	100,079	1,648	98,431	--
All species	249,542	58,122	191,420	--
Basswood				--
American basswood	4,932	--	4,932	--
All species	4,932	--	4,932	--
Other eastern soft hardwoods				--
Boxelder	46,129	7,668	38,461	--
Paper birch	1,123	--	1,123	--
Black willow	282	--	282	--
White willow	4,306	--	4,306	--
American elm	40,751	2,433	38,318	--
Siberian elm	211	--	211	--
All species	92,802	10,101	82,701	--
Eastern noncommercial hardwoods				--
Serviceberry spp.		--		--
Hawthorn spp.		--		--
Eastern hophornbeam		--		--
Pin cherry		--		--
Chokecherry		--	--	--
Peachleaf willow	1,524	191	1,333	--
Russian-olive	625	--	625	--
All species	2,150	191	1,959	--
Total hardwoods	687,643	116,257	571,386	--
All species groups	726,672	150,747	575,925	--

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 salvageable dead trees on timberland by class of timber and softwood/hardwood species category, North Dakota, 2001-2003

(In thousand cubic feet)

Class of timber	All species	Softwood species	Hardwood species
Live trees			
Growing-stock trees			
Sawtimber			
Saw log portion	182,600	412	182,188
Upper stem portion	26,471	88	26,383
Total	209,071	500	208,571
Poletimber	120,781	232	120,549
All growing-stock trees	329,851	731	329,120
Cull trees			
Rough trees ¹			
Sawtimber size	164,196	--	164,196
Poletimber size	82,967	186	82,782
Total	247,163	186	246,978
Rotten trees ¹			
Sawtimber size	18,172	--	18,172
Poletimber size	5,512	--	5,512
Total	23,685	--	23,685
All live cull trees	270,848	186	270,662
All live trees	600,699	917	599,783
Salvageable dead trees			
Sawtimber size	3,669	--	3,669
Poletimber size	3,691	--	3,691
All salvageable dead trees	7,360	--	7,360
All classes	608,059	917	607,142

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.

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, 2001-2003

(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	45,842	--	45,842
Mixed upland hardwoods	48,003	--	48,003
All forest types	93,845	--	93,845
Elm / ash / cottonwood group			
Black ash / American elm / red maple	2,051	--	2,051
Cottonwood	55,713	--	55,713
Sugarberry / hackberry / elm / green ash	52,724	--	52,724
All forest types	110,488	--	110,488
Maple / beech / birch group			
Hard maple / basswood	5,393	--	5,393
Elm / ash / locust	49,462	731	48,731
All forest types	54,854	731	54,123
Aspen / birch group			
Aspen	64,663	--	64,663
Balsam poplar	6,001	--	6,001
All forest types	70,665	--	70,665
All hardwood groups	329,851	731	329,120
Nonstocked	--	--	--
All forest groups	329,851	731	329,120

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, 2001-2003

(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	731	--	232	500	--	--	--	--	--	--	--	--
All species	731	--	232	500	--	--	--	--	--	--	--	--
Total softwoods	731	--	232	500	--	--	--	--	--	--	--	--
Hardwoods												
Select white oaks												
Bur oak	97,118	7,583	6,132	7,390	2,422	2,220	4,484	19,332	17,954	19,868	9,733	9,733
All species	97,118	7,583	6,132	7,390	2,422	2,220	4,484	19,332	17,954	19,868	9,733	9,733
Ash												
Black ash	416	416	--	--	--	--	--	--	--	--	--	--
Green ash	68,691	9,621	13,660	9,235	7,915	8,798	14,173	2,123	3,167	--	--	--
All species	69,108	10,038	13,660	9,235	7,915	8,798	14,173	2,123	3,167	--	--	--
Cottonwood and aspen												
Balsam poplar	5,804	1,227	1,840	2,737	--	--	--	--	--	--	--	--
Eastern cottonwood	58,032	2,375	4,598	4,784	4,939	1,431	5,181	5,930	7,059	21,736	--	--
Quaking aspen	65,586	6,113	10,531	15,346	17,785	11,529	4,281	--	--	--	--	--
All species	129,422	9,716	16,969	22,867	22,724	12,960	9,462	5,930	7,059	21,736	--	--
Basswood												
American basswood	481	260	221	--	--	--	--	--	--	--	--	--
All species	481	260	221	--	--	--	--	--	--	--	--	--
Other eastern soft hardwoods												
Boxelder	3,642	119	298	882	--	2,342	--	--	--	--	--	--
American elm	29,350	4,707	5,006	5,466	2,803	2,415	--	--	3,389	5,564	--	--
All species	32,992	4,826	5,304	6,348	2,803	4,757	--	--	3,389	5,564	--	--
Total hardwoods	329,120	32,422	42,287	45,841	35,864	28,735	28,119	27,384	31,569	47,167	9,733	9,733
All species groups	329,851	32,422	42,518	46,341	35,864	28,735	28,119	27,384	31,569	47,167	9,733	9,733

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, 2001-2003

(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	2,679	2,679	--	--	--	--	--	--	--	--	
Eastern redcedar	2,679	2,679	--	--	--	--	--	--	--	--	
All species	2,679	2,679	--	--	--	--	--	--	--	--	
Total softwoods	2,679	2,679	--	--	--	--	--	--	--	--	
Hardwoods											
Select white oaks											
Bur oak	380,440	--	11,525	10,602	21,563	95,016	89,303	100,648	51,783	51,783	
All species	380,440	--	11,525	10,602	21,563	95,016	89,303	100,648	51,783	51,783	
Ash											
Green ash	160,705	--	32,803	38,275	64,448	9,861	15,319	--	--	--	
All species	160,705	--	32,803	38,275	64,448	9,861	15,319	--	--	--	
Cottonwood and aspen											
Eastern cottonwood	229,238	--	21,007	6,508	24,193	29,680	35,614	112,236	--	--	
Quaking aspen	164,994	--	84,412	57,915	22,667	--	--	--	--	--	
All species	394,232	--	105,419	64,423	46,859	29,680	35,614	112,236	--	--	
Other eastern soft hardwoods											
Boxelder	10,162	--	--	10,162	--	--	--	--	--	--	
American elm	65,334	--	12,398	10,875	--	--	15,606	26,455	--	--	
All species	75,496	--	12,398	21,038	--	--	15,606	26,455	--	--	
Total hardwoods	1,010,874	--	162,145	134,337	132,871	134,557	155,841	239,340	51,783	51,783	
All species groups	1,013,553	2,679	162,145	134,337	132,871	134,557	155,841	239,340	51,783	51,783	

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.

¹International 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, 2001-2003

(In 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	1,436	--	--	--	--	1,436	889	547
Hardwoods	2,525,221	178,891	1,198,777	890,219	308,558	1,147,553	846,725	300,827
Total	2,526,657	178,891	1,198,777	890,219	308,558	1,148,989	847,614	301,374
Private								
Softwoods	18,407	--	15,539	11,037	4,502	2,868	1,890	978
Hardwoods	14,067,565	1,541,497	6,801,855	4,920,544	1,881,310	5,724,213	4,153,042	1,571,171
Total	14,085,971	1,541,497	6,817,393	4,931,581	1,885,812	5,727,081	4,154,932	1,572,150
All ownerships								
Softwoods	19,843	--	15,539	11,037	4,502	4,304	2,779	1,525
Hardwoods	16,592,785	1,720,388	8,000,631	5,810,763	2,189,869	6,871,766	4,999,767	1,871,999
Total	16,612,628	1,720,388	8,016,170	5,821,800	2,194,370	6,876,070	5,002,546	1,873,524

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.

2005. **North Dakota's forest resources in 2003.** Resour. Bull. NC-248. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 21 p.

Reports the results of the first through third annual panels (2001-2003) of the fourth inventory of North Dakota. Includes information on forest area; volume; biomass; growth, removals, and mortality; and forest health.

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

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