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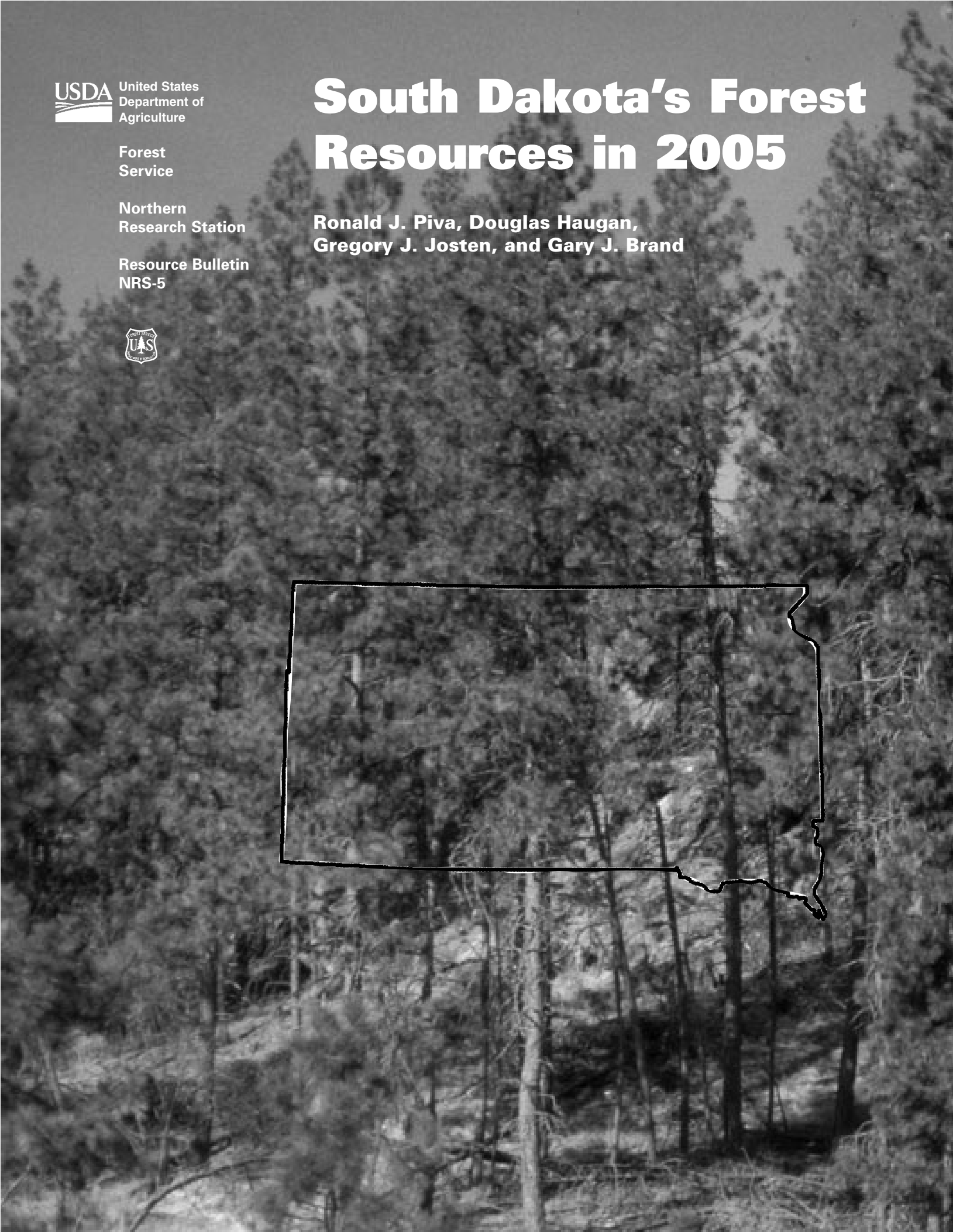
South Dakota's Forest Resources in 2005

Ronald J. Piva, Douglas Haugan, Gregory J. Josten, and Gary J. Brand



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Results of the 2005 annual inventory of South Dakota show 1.7 million acres of forest land in the State. Timberland accounted for more than 90 percent of the forest land area. More than 70 percent of the timberland is publicly owned. Eighty percent (1.2 billion cubic feet) of the growing-stock volume on timberland came from ponderosa pine. All live aboveground tree biomass on timberland totaled 30.3 million dry tons. Major insect problems in South Dakota's forests were the mountain pine beetle and the pine engraver beetle.

KEY WORDS: Annual inventory, forest land, timberland, forest type, volume, biomass, forest health, South Dakota.

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South Dakota's Forest Resources in 2005

The North Central Research Station's[1] Forest Inventory and Analysis program (NCFIA) began fieldwork for the fifth forest inventory of South Dakota's 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 all plots in all five panels. Once all panels have been measured, each will be remeasured approximately every 5 years. For example, in South Dakota, the field plots measured in 2005 will be remeasured in 2010.

In 2005, NCFIA completed the annual inventory effort with the last of five panels of the fifth forest inventory of South Dakota's forest resources. Data presented in this report represent 100 percent of the field plots (or all five panels) for a complete inventory and are a combination of the first year's panel from 2001 through the fifth year's panel from 2005. Earlier reports for the 2001 panel (Leatherberry and Haugan 2003), the 2002 panel (Piva et al. 2003), the 2003 panel (Piva et al. 2005), and the 2004 panel (Piva et al. 2006) have also been published and are available only on line at: http://www.ncrs.fs.fed.us. Results presented are estimates based on sampling techniques; estimates were compiled assuming the 2001, 2002, 2003, 2004, and 2005 data represent one sample.

Reports of previous inventories of South Dakota are dated 1935, 1962, 1984, and 1996. As a result of our ongoing efforts to improve the efficiency and reliability of the inventory, several procedures and definitions have changed since the last South Dakota inventory in 1996 (Leatherberry et al. 2000). The most important change is the border-to-border inventory of forest resources in South Dakota. Before 1996, both the NCFIA and the Interior West FIA (IWFIA) (formerly the Intermountain FIA program) in Ogden, UT, inventoried South Dakota's forest resources. NCFIA inventoried that portion of the State east of the 103rd meridian. IWFIA inventoried western South Dakota (west of the 103rd meridian), including the Black Hills National Forest (BHNF). In 1996, NCFIA inventoried all of South Dakota except for the BHNF, which was inventoried by IWFIA in 1999 (DeBlander 2002). The portion of the Custer National Forest that is in South Dakota was inventoried again by IWFIA in 1997 (DeBlander 2001).

Because different designs and methods have been employed in various South Dakota inventories, a comparison of the 2005 data with data from earlier inventories should be interpreted with caution. Where comparisons are made with data from past inventories, they are done only to suggest the direction of change. For this report, the information for South Dakota's previous inventory is a combination of the 1996 inventory by NCFIA of all lands outside the BHNF and the 1999 inventory by IWFIA of the BHNF. The combined information was obtained from the Forest Inventory Mapmaker Web site located at: http://www.ncrs2.fs.fed.us/4801/FIADB/index.htm.

RESULTS

Area

In 2005, there were an estimated 1.7 million acres of forest land in South Dakota, accounting for a little more than 3 percent of the State's total land area. Forest land is land at

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least 10 percent stocked by forest trees of any size or formerly having had such tree cover and not currently developed for nonforest use. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Seventy-one percent, or almost 1.2 million acres, of the forest land in the State was publicly owned (table 1). Most of the public land in the State is west of the Missouri River.

There are three major areas of natural forests in South Dakota (Ball and Erickson 1998). The Black Hills forest is the largest area of forest land in the State. This forested area is composed primarily of ponderosa pine, but also includes quaking aspen, Black Hills spruce (a variety of white spruce), paper birch, and bur oak. The second largest area is the flood plain forests along the Missouri River. American elm and green ash are the major species found in these forests. Bur oak forests along the upper terraces and draws of rivers and in the northern Black Hills account for the third largest area in the State. Other forested areas in South Dakota are the cottonwood forests scattered along the rivers and streams throughout the State and the maple and basswood forests of the upland forests on the eastern side of the State.

Timberland accounted for 92 percent, or 1.6 million acres, of the forest land in South Dakota in 2005. Timberland is forest land that is producing, or is capable of producing, 20 cubic feet of wood per acre per year under natural conditions and is not restricted from harvest. Throughout most of the 20th century, the area of timberland in South Dakota remained relatively stable, rising and falling between 1.5 and 1.7 million acres (fig. 1).

Seventy-two percent of the timberland in the State is publicly owned (table 2). The USDA Forest Service, through the Black

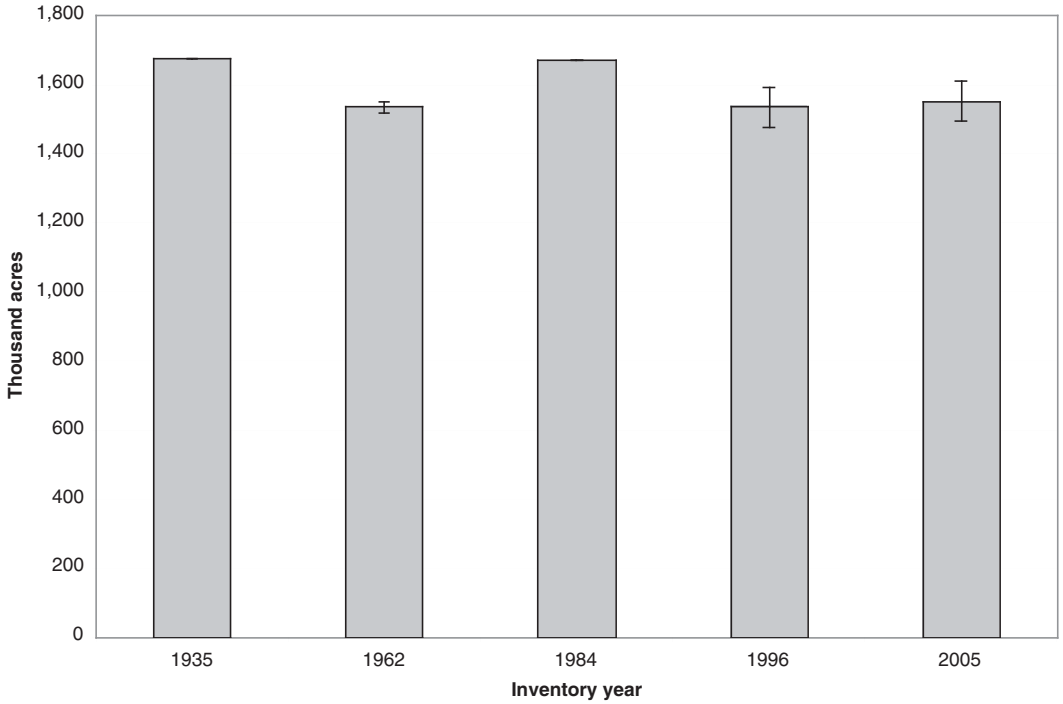

Figure 1.—Area of timberland, South Dakota, 1935-2005. (Note: The 1935 area may contain some area of forest land that is not timberland. Sample errors and confidence intervals are not provided for the 1935 and 1984 inventories because no single statewide sample error is available for those inventories. The 1962 and 2005 estimates are for total timberland area; the sample error associated with the 1996 estimate is calculated for timber area outside of the BHNF. Confidence intervals are represented by the vertical line at the top of each bar and represent the 67-percent confidence level.)

Hills and Custer National Forests, holds the majority of public timberland. Private forest landowners account for 28 percent of the timberland ownership. This privately owned timberland is dominated by parcels of less than 100 acres in size (Leatherberry et al. 2000). Those holdings are generally associated with farms or ranches. Native American tribal groups own an estimated 93 thousand acres of timberland held as tribal trust land within the boundaries of reservations in South Dakota (Haugen and Hansen 2002).

The ponderosa pine forest type accounted for 70 percent of the total timberland area in South Dakota in 2005 (fig. 2). Overall, softwood forest types accounted for 77 percent of the total timberland area in the State. The elm/ash/cottonwood forest type group occupied the second largest area of timberland, but accounted for only 7 percent of the total.

Although virtually all of the timberland area in South Dakota is of natural origin, South Dakota residents have a long history of planting trees. Most of these plantings are associated with windbreaks, shelterbelts, or farmstead plantings and do not meet the area or width requirements to be classified as timberland. Many of the earlier efforts to establish tree plantations failed or were later abandoned.

As South Dakota's forests mature and are affected by natural and human-caused events, they take on certain stand-size characteristics. Stand-size class is a measure of the average diameter of the dominant trees in a stand. There are four stand-size classes: (1) sawtimber—large trees, softwoods at least 9 inches in diameter at breast height (diameter at 4.5 feet above ground level, commonly referred to as d.b.h.) and hardwoods at least 11 inches d.b.h.; (2) poletimber—medium trees 5 inches in d.b.h. to sawtimber size; (3) sapling-seedling—small trees, softwoods at least 6 inches tall and hardwoods at least 1 foot tall, to poletimber size; and (4) nonstocked stands—timberland less than 10 percent stocked in all-live trees. In 2005, sawtimber stands occupied 1 million acres of timberland, or 66 percent

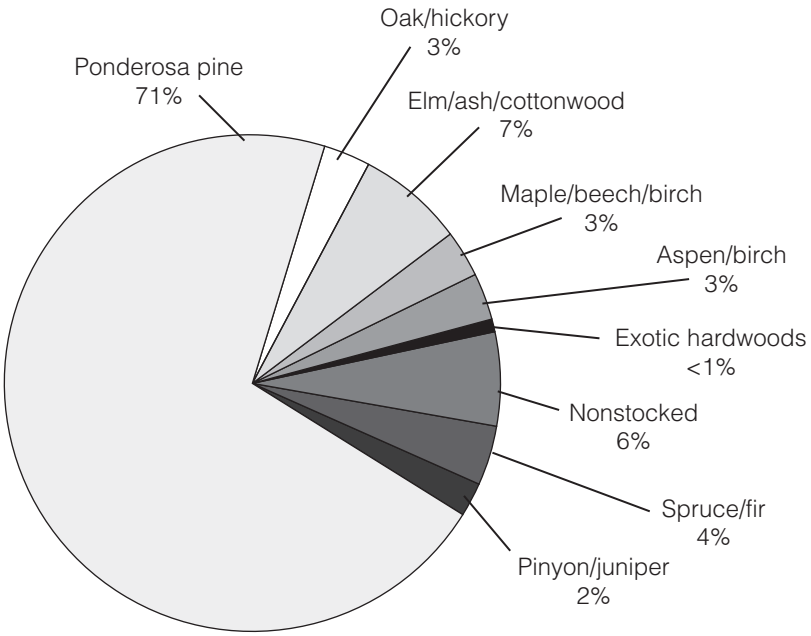

Figure 2.—Area of timberland by forest type group, South Dakota, 2005.

of the timberland area (table 3). Poletimber-size stands accounted for 15 percent of the timberland area, followed by sapling/seedling stands on 12 percent of timberland area. Nonstocked timberland occupied more than 6 percent of the total timberland area, mainly in the Black Hills area of the State. The predominance of sawtimber-size stands reflects the presence of larger diameter ponderosa pine in the BHNF and older, large-diameter bottomland hardwood stands.

Since South Dakota's forest inventory in 1996 and the BHNF inventory in 1999, the area of sawtimber-size stands has increased by 160 thousand acres (fig. 3). The area of poletimber-size stands and seedling-sapling-size stands has decreased by more than 50 thousand acres and almost 165 thousand acres, respectively. The area of nonstocked stands has increased by almost 75 thousand acres. Many of these nonstocked areas are the result of recent forest fires.

Volume

South Dakota's net volume of all-live trees on forest land totaled 1.7 billion cubic feet (table 4). Almost three-fourths of this volume is ponderosa pine. All the hardwood species combined accounted for only 20 percent of the total volume of all-live trees on forest land. Net cubic and board foot volumes are based on tree measurements (d.b.h., tree class, and site index) and volume models presented by Hahn and Hansen (1991). The models were regionally adjusted by applying cull factors computed from trees measured in the 1996 inventories of the Plains States.

Growing-stock trees on timberland accounted for more than 85 percent (1.5 billion cubic feet) of the live-tree volume on forest land. A growing-stock tree is a 5.0-inch d.b.h. or larger, live tree of commercial species that meets specified standards of size, quality, and merchantability. Besides growing-stock volume, there were an additional 122 million cubic feet

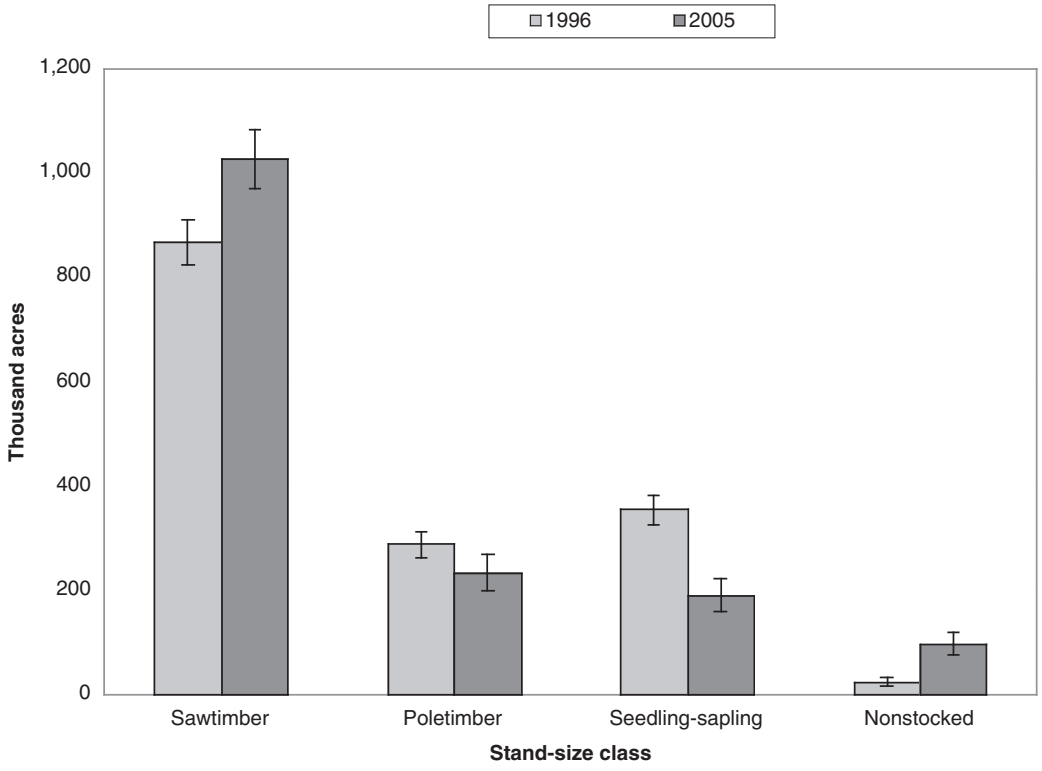

Figure 3.—Area of timberland by stand-size class, South Dakota, 1996 and 2005. (Confidence intervals are represented by the vertical line at the top of each bar and represent the 67-percent confidence level.)

in live cull trees (trees 5.0 inches d.b.h. or larger and unmerchantable for saw logs now or prospectively because of rot, roughness, or species) and 5 million cubic feet of salvable dead trees (trees downed or standing dead that were 5.0 inches d.b.h. or larger and contained at least one 8-foot section that was at least 50 percent sound) on timberland in South Dakota in 2005 (table 5). More than 70 percent of the live cull volume on timberland came from hardwood species. All of the salvable dead volume on timberland came from softwood species.

The softwood forest type groups contained more than 85 percent of the State's growing-stock volume (table 6). Ponderosa pine accounted for 80 percent (1.2 billion cubic feet) of the growing-stock volume on timberland (fig. 4 and table 7). Between 1996 and 2005, ponderosa pine and spruce growing-stock volumes decreased in South Dakota because of disturbances such as insect infestations, wildfires, and severe weather. As eastern redcedar becomes established on rangeland and farmland set aside for conservation, the volume of growing stock appears to be increasing.

There were 5.6 billion board feet of sawtimber in South Dakota (table 8). Sawtimber volume is the volume of wood in the saw log portion of sawtimber-size trees. Fifty-five percent of the sawtimber volume came from sawtimber-size trees less than 15 inches d.b.h.

Biomass

All live aboveground tree biomass on timberland in South Dakota was estimated at 30.3 million dry tons in 2005 (table 9) or an average of almost 20 dry tons of biomass per acre. Biomass is the amount of total wood and bark (excluding foliage) of trees 1.0 inch in d.b.h or larger, including all tops and limbs. The dry tons 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 uses. In 2005, 85 percent of the total biomass came from growing-stock trees, 5 percent came from saplings between 1.0 and 5.0 inches d.b.h., and 10 percent came from non-growing-stock trees (cull trees and noncommercial species).

Forest Health

Although South Dakota is mostly prairie and cropland, forests are an important component of the landscape. Currently, the primary forest health concerns for South Dakota's forests are

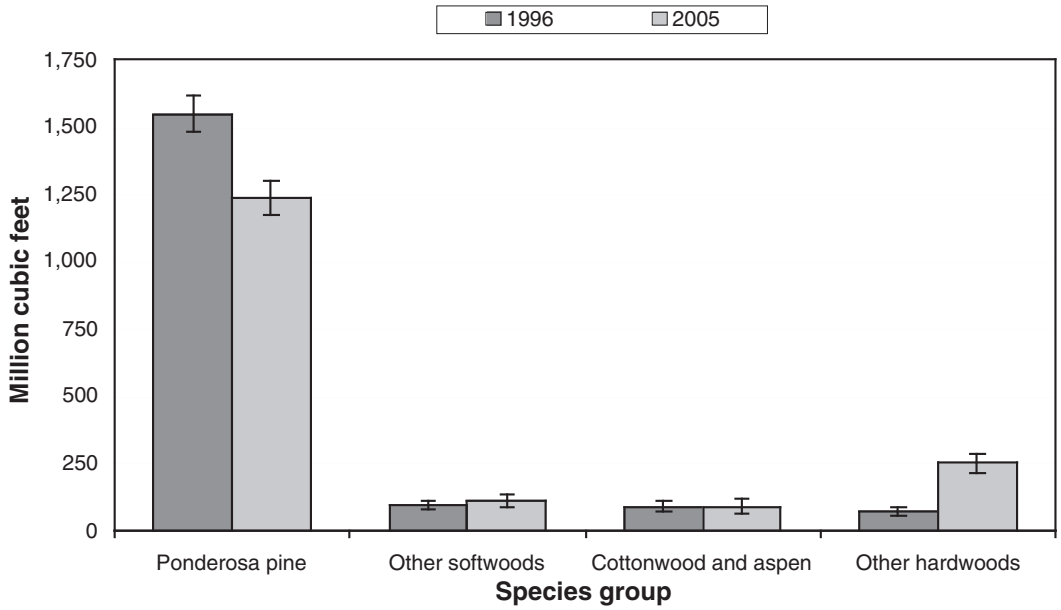

Figure 4.—Net volume of growing stock on timberland by species group, South Dakota, 1996 and 2005. (Confidence intervals are represented by the vertical line at the top of each bar and represent the 67-percent confidence level.)

drought, mountain pine beetle, pine engraver beetle, banded elm beetle, two-lined chestnut borer, and the establishment of the nonnative salt cedar plant. More information about forest health issues that have affected South Dakota forests since the last complete forest inventory and more information about current events are available at the National Forest Health Monitoring (FHM) Web site at http://fhm.fs.fed.us/ and at the Rocky Mountain Forest Health Monitoring Web site at http://www.fs.fed.us/r2/fhm/.

SUMMARY

In summary, estimates of South Dakota's forest resources indicate timberland area has remained relatively stable at about 3 percent of the total land area. Ponderosa pine, found mostly in the Black Hills region, is the predominant forest type group. Eastern redcedar appears to be expanding in the State, but it is still a minor portion of the total area and volume. As additional data become available from ensuing annual inventories, a clearer picture of the direction of South Dakota's forests will emerge. Additional data related to the two most recent inventories of South Dakota (1980 and 1996) are available at: www.ncrs2.fs.fed.us/4801/fiadb/index.htm.

APPENDIX

Inventory Methods

Since the 1996 inventory of South Dakota's forest outside the BHNF, 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. The annual inventory system began in South Dakota in 2001. At that time, the NCFIA program assumed responsibility for inventorying all forest lands in South Dakota.

With the NCFIA annual inventory system, approximately one-fifth of all field plots are measured each year. After 5 years, the entire inventory cycle will be completed. After the initial 5-year cycle, 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 area of forest land, 3.3 percent; area of timberland, 3.6 percent; volume of growing stock on timberland, 5.1 percent; and volume of sawtimber on timberland, 5.8 percent. All conclusions based on this inventory must be tempered by the sampling errors that correspond with all estimates from this inventory.

Other significant changes between inventories include new remote sensing technology, use of a new sampling design, and a new field plot configuration. The advent of remote sensing technology since the previous inventory in 1996 has allowed NCFIA to use 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. Previous inventories used manual interpretation of aerial photos to stratify the sample.

New algorithms were used in 2005 to assign forest type and stand-size class to each condition observed on a plot (Bechtold and Patterson 2005). FIA is using these algorithms nationwide to increase consistency among States. 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 have all changed. As a result, some comparisons between the 1996 inventory results and those published for the 2005 inventory may not be valid. For additional details about algorithms used in both inventories, please contact NCFIA.

Sampling Phases

The 2005 South 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 field measurement. The second phase measured the traditional FIA suite of mensurational variables, and the third phase focused on a suite of variables related to forest health.

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 field 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 17 denied access or hazardous plots encountered in the first five inventory panels.

Phase 1

The 2005 South Dakota inventory used a classification of 30-m Landsat Thematic Mapper satellite imagery to form two initial strata—forest and nonforest. Pixels within 60 m (2 pixel widths) of a forest/nonforest edge formed two additional strata—forest 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. Stratification and estimation were conducted at the NCFIA Forest Survey Unit level. All private land and the BHNF were stratified into one of the four strata: (1) nonforest, (2) nonforest edge, (3) forest, or (4) forest edge. The Custer National Forest was stratified into one of two strata: (1) nonforest and nonforest edge combined, or (2) forest and forest edge combined. All the other public land in South Dakota was stratified into one of three strata: (1) nonforest, (2) nonforest edge, or (3) forest and forest edge combined.

In the 1996 South Dakota inventory outside the BHNF, photointerpreters at NCFIA assembled aerial photographs into township mosaics, and a systematic grid of 121 one-acre photo plots (each dot representing approximately 190.4 acres on the ground) was overlaid on each township mosaic. Each of these photo plots was stereoscopically examined and classified based on land use, forest type, standsize, and density. From these photo plots, a systematic sample of plots (without regard to their aerial photo classification) were selected as ground plots and further examined by survey crews to verify the classification and to take further measurements. Additional information related to the procedures for the 1996 South Dakota inventory can be found in Leatherberry et al. (2000), and procedures for the 1999 BHNF inventory by IWFIA can be found in DeBlander (2002) and USDA Forest Service (1999).

The move to satellite imagery changed NCFIA's phase 1 sample from being based on one photo plot for every 190.4 acres to a sample based on a classified pixel every 0.22 acres. The increased intensity of the phase 1 sample greatly improved estimates of the area within each stratum, particularly at the county level. Additionally, because the classification was conducted across the entire State, biases in the photo plot sampling method that resulted from differences in photo quality, age of photography, and experience of the photointerpreter were minimized and classification was consistent across the entire State.

Phase 2

Phase two of the inventory consisted of the measurement of the first annual sample of field plots in South Dakota and the remeasurement of inventory plots from the 1999 BHNF inventory (DeBlander 2002). Current FIA precision standards for annual inventories require a sampling intensity of one plot for approximately every 6,000 acres. FIA has established a plot array that divides the entire area of the United States into nonoverlapping hexagons, each of which contains approximately 5,937 acres (McRoberts 1999). An array of field plots was established by selecting one plot from each hexagon based on the following rules: (1) if an IWFIA plot from the 1999 inventory of the BHNF fell within a hexagon, it was selected; (2) if more than one IWFIA plot from the 1999 inventory of the BHNF fell within a hexagon, the plot nearest the hexagon center was selected; and (3) if no existing IWFIA plots fell within the hexagon, and for all area outside the BHNF, a new NCFIA plot was established in the hexagon (McRoberts 1999). This array of plots is designated the Federal base sample and is considered an equal probability sample; its measurement in South Dakota is funded by the Federal government.

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 systematic sample of all land in a State. Field crews measure vegetation on plots currently classified as forested or forest edge by trained photointerpreters using aerial photos or digital orthophotoquads. A sample of plots classified as nonforest was checked to ensure correct classification.

Phase 3

NCFIA has two categories of field plot measurements—phase 2 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 array 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 the additional measurement of nonwoody understory vegetation, ground cover, soils, and other variables. In South Dakota, the complete 5-year annual inventory included the classification of 520 phase 3 plots, of which 26 had field measurements. On the remaining plots, referred to as phase 2 plots, only variables that can be measured throughout the entire year were collected. The complete 5-year annual inventory of South Dakota included the classification of 8,303 phase 2 plots. The 2001-2005 annual panel results represent field measures on 297 timberland plots, 28 other forest land plots, 17 denied access and hazardous plots, and 7,961 non-forest land plots.

The new national FIA plot configuration with four subplots (fig. 5) was first used for data collection in South Dakota in the BHNF in 1999 and for the rest of the State during the 2001 panel. This design was used for the remaining four panels, 2002-2005 and will be used in subsequent years. On forest land outside the BHNF, all plots in the annualized inventory are newly established; therefore, some remeasurement data will not be available until the sixth year of the annual inventory. These measurements 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 design requires mapping forest conditions on each plot. Due to the small sample size (20 percent) each year, precision associated with change factors such as mortality will be relatively low. Consequently, change estimates outside the BHNF may not be reported until at least the third annual panel of the second five-panel cycle of inventory has been implemented, and even then we anticipate that detailed estimates of change will be subject to high sampling error. When the second cycle of plots has been completed in 2010, the full range of change variables will be available for the entire State.

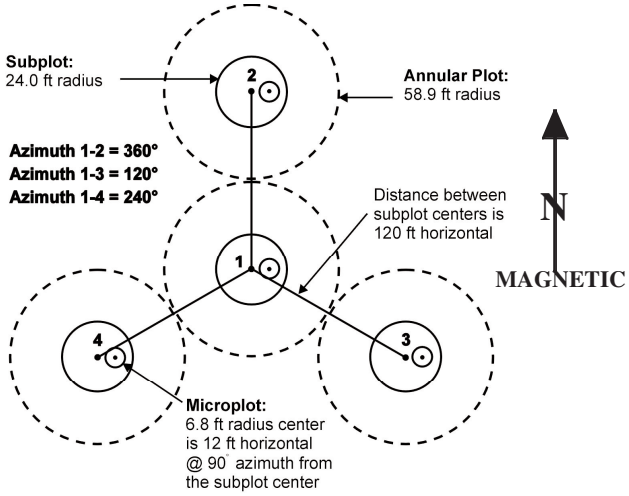

Figure 5.—Current NCFIA field plot configuration.

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. For remeasurement plots from the 1999 inventory of the BHNF, the center of the plot is located at the same point as the center of the previous plot. Trees with diameter at breast height or diameter at the root collar (d.r.c) at least 5 inches for woodland species such as Rocky Mountain juniper, are measured on a 24-foot-radius (1/24 acre) circular subplot. All trees less than 5 inches d.b.h/d.r.c. are measured on a 6.8-foot-radius (1/300 acre) circular microplot located 12.0 feet due east of the center of each of the four subplots. Forest conditions that occur on any of the four subplots are recorded. Factors that differentiate forest conditions are changes in forest type, stand-size class, land use, ownership, and density.

Each condition 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 tables generated for this report is limited. However, at http://ncrs2.fs.fed.us/4801/fiadb/fim17/wcfim17.asp other tabular data can be generated. For additional information, contact:

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TABLE TITLES

TABLES

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

(In thousand acres)

Forest type group/ forest type	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
Spruce / fir group				
White spruce	56.0	56.0	- -	- -
All forest types	56.0	56.0	- -	- -
Pinyon / juniper group				
Eastern redcedar	17.1	- -	17.1	- -
Rocky Mountain juniper	18.5	18.5	- -	- -
All forest types	35.6	18.5	17.1	- -
Ponderosa pine group				
Ponderosa pine	1,154.3	947.2	207.1	- -
All forest types	1,154.3	947.2	207.1	- -
All softwood groups	1,246.0	1,021.8	224.2	- -
Hardwood type groups				
Oak / hickory group				
Bur oak	42.7	16.0	26.7	- -
Mixed upland hardwoods	28.8	1.5	27.3	- -
All forest types	71.5	17.5	54.0	- -
Elm / ash / cottonwood group				
Black ash / American elm / red maple	0.7	- -	0.7	- -
Cottonwood	37.6	4.3	33.2	- -
Sugarberry / hackberry / elm / green ash	66.8	5.8	61.0	- -
Cottonwood / willow	4.3	- -	4.3	- -
All forest types	109.3	10.1	99.2	- -
Maple / beech / birch group				
Elm / ash / locust	68.4	4.8	63.6	- -
All forest types	68.4	4.8	63.6	- -
Aspen / birch group				
Aspen	52.0	44.8	7.2	- -
Paper birch	4.3	4.3	- -	- -
All forest types	56.4	49.1	7.2	- -
Exotic hardwoods group				
Other exotic hardwoods	10.8	- -	10.8	- -
All forest types	10.8	- -	10.8	- -
All hardwood groups	316.4	81.5	234.8	- -
Nonstocked	119.8	87.0	32.8	- -
All forest groups	1,682.1	1,190.3	491.8	- -

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, South Dakota, 2001-2005

(In thousand acres)

Major forest type group and stand origin	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
Natural	1,186.7	968.2	218.4	- -
Planted	5.8	5.8	- -	- -
All softwood types	1,192.4	974.0	218.4	- -
Hardwood type groups				
Natural	248.9	62.2	186.6	- -
Planted	12.6	- -	12.6	- -
All hardwood types	261.5	62.2	199.2	- -
Nonstocked	98.5	81.1	17.5	- -
All groups	1,552.4	1,117.3	435.2	- -

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

(In thousand acres)

Forest type group/ forest type	Stand-size class				
	All stands	Sawtimber	Poletimber	Sapling-seedling	Non-stocked
Softwood type groups					
Spruce / fir group					
White spruce	56.0	42.4	6.1	7.5	--
All forest types	56.0	42.4	6.1	7.5	--
Pinyon / juniper group					
Eastern redcedar	11.3	11.3	--	--	--
Rocky Mountain juniper	18.5	10.9	1.0	6.7	--
All forest types	29.9	22.3	1.0	6.7	--
Ponderosa pine group					
Ponderosa pine	1,106.5	853.1	141.2	112.3	--
All forest types	1,106.5	853.1	141.2	112.3	--
All softwood groups	1,192.4	917.8	148.2	126.5	--
Hardwood type groups					
Oak / hickory group					
Bur oak	20.0	10.4	9.6	--	--
Mixed upland hardwoods	28.8	4.3	5.4	19.1	--
All forest types	48.8	14.7	15.0	19.1	--
Elm / ash / cottonwood group					
Cottonwood	36.1	30.1	5.9	--	--
Sugarberry / hackberry / elm / green ash	66.8	45.1	8.4	13.4	--
Cottonwood / willow	4.3	4.3	--	--	--
All forest types	107.2	79.5	14.3	13.4	--
Maple / beech / birch group					
Elm / ash / locust	44.3	11.1	21.6	11.6	--
All forest types	44.3	11.1	21.6	11.6	--
Aspen / birch group					
Aspen	46.1	5.8	24.8	15.5	--
Paper birch	4.3	--	--	4.3	--
All forest types	50.4	5.8	24.8	19.8	--
Exotic hardwoods group					
Other exotic hardwoods	10.8	--	10.8	--	--
All forest types	10.8	--	10.8	--	--
All hardwood groups	261.5	111.1	86.5	63.8	--
Nonstocked	98.5	--	--	--	98.5
All forest groups	1,552.4	1,028.9	234.7	190.3	98.5

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

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

(In thousand cubic feet)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Spruce and balsam fir				
White spruce	82,236	80,171	2,065	- -
All species	82,236	80,171	2,065	- -
Other eastern softwoods				
Rocky Mountain juniper	24,575	21,028	3,547	- -
Eastern redcedar	7,522	793	6,729	- -
Ponderosa pine	1,240,066	1,049,522	190,544	- -
All species	1,272,163	1,071,343	200,819	- -
Total softwoods	1,354,398	1,151,514	202,884	- -
Hardwoods				
Select white oaks				
Bur oak	97,007	18,046	78,961	- -
All species	97,007	18,046	78,961	- -
Hard maple				
Sugar maple	776	- -	776	- -
All species	776	- -	776	- -
Soft maple				
Silver maple	3,150	- -	3,150	- -
All species	3,150	- -	3,150	- -
Ash				
Green ash	72,185	1,734	70,451	- -
All species	72,185	1,734	70,451	- -
Cottonwood and aspen				
Eastern cottonwood	68,075	11,871	56,205	- -
Quaking aspen	25,570	23,376	2,194	- -
All species	93,645	35,246	58,399	- -

(Table 4 continued on next page)

(Table 4 continued)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Hardwoods				
Basswood				
American basswood	615	- -	615	- -
All species	615	- -	615	- -
Other eastern soft hardwoods				
Boxelder	25,876	- -	25,876	- -
Paper birch	2,415	2,236	180	- -
Hackberry	3,231	- -	3,231	- -
White willow	3,900	- -	3,900	- -
American elm	35,984	2,728	33,255	- -
Siberian elm	4,018	- -	4,018	- -
All species	75,425	4,964	70,461	- -
Other eastern hard hardwoods				
Red mulberry	324	324	- -	- -
All species	324	324	- -	- -
Eastern noncommercial hardwoods				
Prairie crab apple	130	- -	130	- -
Eastern hophornbeam	1,379	277	1,102	- -
Chokecherry	40	- -	40	- -
Willow spp.	780	- -	780	- -
All species	2,330	277	2,052	- -
Total hardwoods	345,457	60,592	284,865	- -
All species groups	1,699,855	1,212,106	487,749	- -

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 salvable dead trees on timberland by class of timber and softwood/hardwood species category, South 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	1,004,635	894,278	110,358
Upper stem portion	143,394	130,023	13,371
Total	1,148,030	1,024,301	123,729
Poletimber	314,811	233,647	81,164
All growing-stock trees	1,462,840	1,257,948	204,893
Cull trees			
Rough trees[1]			
Sawtimber size	86,933	24,829	62,104
Poletimber size	26,819	8,067	18,752
Total	113,752	32,897	80,856
Rotten trees[1]			
Sawtimber size	6,498	544	5,955
Poletimber size	1,400	- -	1,400
Total	7,898	544	7,355
All live cull trees	121,650	33,440	88,210
All live trees	1,584,491	1,291,388	293,103
Salvable dead trees			
Sawtimber size	2,608	2,608	- -
Poletimber size	2,154	2,154	- -
All salvable dead trees	4,762	4,762	- -
All classes	1,589,253	1,296,150	293,103

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.

[1] Includes noncommercial species.

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

(In thousand cubic feet)

Forest type group/ forest type	All species	Softwood species	Hardwood species
Softwood type groups			
Spruce / fir group			
White spruce	72,607	69,401	3,206
All forest types	72,607	69,401	3,206
Pinyon / juniper group			
Eastern redcedar	4,164	4,164	- -
Rocky Mountain juniper	244	244	- -
All forest types	4,408	4,408	- -
Ponderosa pine group			
Ponderosa pine	1,177,354	1,159,734	17,620
All forest types	1,177,354	1,159,734	17,620
All softwood groups	1,254,369	1,233,543	20,826
Hardwood type groups			
Oak / hickory group			
Bur oak	21,372	1,804	19,568
Mixed upland hardwoods	22,641	9,355	13,287
All forest types	44,013	11,159	32,855
Elm / ash / cottonwood group			
Cottonwood	61,528	55	61,473
Sugarberry / hackberry / elm / green ash	40,716	- -	40,716
Cottonwood / willow	10,638	- -	10,638
All forest types	112,882	55	112,827
Maple / beech / birch group			
Elm / ash / locust	23,217	1,169	22,048
All forest types	23,217	1,169	22,048
Aspen / birch group			
Aspen	19,283	7,475	11,808
Paper birch	1,236	1,236	- -
All forest types	20,519	8,711	11,808
Exotic hardwoods group			
Other exotic hardwoods	4,529	- -	4,529
All forest types	4,529	- -	4,529
All hardwood groups	205,160	21,093	184,067
Nonstocked	3,311	3,311	- -
All forest groups	1,462,840	1,257,948	204,893

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, South 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											
Spruce and balsam fir											
White spruce	81,304	4,806	9,451	14,109	11,283	17,568	13,739	4,967	5,380	--	--
All species	81,304	4,806	9,451	14,109	11,283	17,568	13,739	4,967	5,380	--	--
Other eastern softwoods											
Rocky Mountain juniper	2,748	777	1,313	658	--	--	--	--	--	--	--
Eastern redcedar	6,326	696	936	2,145	1,536	1,013	--	--	--	--	--
Ponderosa pine	1,167,571	66,580	149,088	196,933	190,826	177,249	138,263	113,203	65,856	61,536	8,037
All species	1,176,644	68,053	151,336	199,736	192,362	178,262	138,263	113,203	65,856	61,536	8,037
Total softwoods	1,257,948	72,859	160,788	213,845	203,646	195,829	152,003	118,169	71,235	61,536	8,037
Hardwoods											
Select white oaks											
Bur oak	44,583	7,965	9,321	5,132	5,903	3,624	3,068	3,123	1,954	4,493	--
All species	44,583	7,965	9,321	5,132	5,903	3,624	3,068	3,123	1,954	4,493	--
Hard maple											
Sugar maple	776	--	--	294	482	--	--	--	--	--	--
All species	776	--	--	294	482	--	--	--	--	--	--
Soft maple											
Silver maple	931	--	253	677	--	--	--	--	--	--	--
All species	931	--	253	677	--	--	--	--	--	--	--
Ash											
Green ash	41,999	4,206	6,356	9,065	5,368	5,745	3,703	1,397	--	6,159	--
All species	41,999	4,206	6,356	9,065	5,368	5,745	3,703	1,397	--	6,159	--
Cottonwood and aspen											
Eastern cottonwood	66,601	272	736	1,265	1,095	4,684	5,414	5,005	6,967	19,034	22,131
Quaking aspen	21,165	6,779	8,269	4,055	1,386	675	--	--	--	--	--
All species	87,766	7,050	9,006	5,320	2,481	5,359	5,414	5,005	6,967	19,034	22,131
Basswood											
American basswood	615	271	118	226	--	--	--	--	--	--	--
All species	615	271	118	226	--	--	--	--	--	--	--
Other eastern soft hardwoods											
Boxelder	5,203	164	477	545	--	--	880	1,256	1,881	--	--
Paper birch	2,167	1,326	841	--	--	--	--	--	--	--	--
Hackberry	286	--	--	286	--	--	--	--	--	--	--
White willow	3,900	--	--	--	--	--	--	--	--	3,900	--
American elm	12,858	2,394	3,163	2,898	1,908	1,400	1,095	--	--	--	--
Siberian elm	3,754	850	1,678	1,226	--	--	--	--	--	--	--
All species	28,168	4,734	6,159	4,956	1,908	1,400	1,975	1,256	1,881	3,900	--
Other eastern hard hardwoods											
Red mulberry	55	55	--	--	--	--	--	--	--	--	--
All species	55	55	--	--	--	--	--	--	--	--	--
Total hardwoods	204,893	24,281	31,212	25,671	16,142	16,127	14,161	10,781	10,802	33,586	22,131
All species groups	1,462,840	97,140	192,000	239,516	219,787	211,957	166,164	128,950	82,037	95,122	30,168

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, South 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									
Spruce and balsam fir									
White spruce	283,099	59,030	47,610	73,849	58,210	21,145	23,255	--	--
All species	283,099	59,030	47,610	73,849	58,210	21,145	23,255	--	--
Other eastern softwoods									
Rocky Mountain juniper	3,233	3,233	--	--	--	--	--	--	--
Eastern redcedar	24,427	11,490	7,878	5,059	--	--	--	--	--
Ponderosa pine	4,696,287	916,461	916,168	874,016	697,460	583,189	343,814	322,532	42,646
All species	4,723,947	931,184	924,046	879,076	697,460	583,189	343,814	322,532	42,646
Total softwoods	5,007,046	990,214	971,655	952,924	755,671	604,334	367,070	322,532	42,646
Hardwoods									
Select white oaks									
Bur oak	107,035	--	27,870	17,181	14,756	15,171	9,680	22,377	--
All species	107,035	--	27,870	17,181	14,756	15,171	9,680	22,377	--
Hard maple									
Sugar maple	2,292	--	2,292	--	--	--	--	--	--
All species	2,292	--	2,292	--	--	--	--	--	--
Ash									
Green ash	101,818	--	22,333	25,139	16,687	6,503	--	31,155	--
All species	101,818	--	22,333	25,139	16,687	6,503	--	31,155	--
Cottonwood and aspen									
Eastern cottonwood	312,302	--	4,485	20,888	25,130	23,580	35,396	97,166	105,658
Quaking aspen	9,557	--	6,300	3,257	--	--	--	--	--
All species	321,859	--	10,785	24,145	25,130	23,580	35,396	97,166	105,658
Other eastern soft hardwoods									
Boxelder	18,355	--	--	--	3,896	5,695	8,764	--	--
White willow	18,687	--	--	--	--	--	--	18,687	--
American elm	19,411	--	8,292	6,205	4,914	--	--	--	--
All species	56,452	--	8,292	6,205	8,810	5,695	8,764	18,687	--
Total hardwoods	589,455	--	71,572	72,669	65,382	50,950	53,840	169,385	105,658
All species groups	5,596,501	990,214	1,043,228	1,025,594	821,052	655,283	420,909	491,917	148,304

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, South Dakota, 2001-2005

(In thousand 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	18,770	747	17,534	14,444	3,090	489	368	121
Hardwoods	1,565	361	1,045	746	299	160	115	44
Total	20,335	1,108	18,578	15,190	3,389	649	484	165
Private								
Softwoods	3,521	162	3,234	2,679	555	125	97	28
Hardwoods	6,439	414	3,815	2,741	1,074	2,210	1,610	600
Total	9,960	576	7,049	5,421	1,629	2,335	1,707	628
All ownerships								
Softwoods	22,291	908	20,768	17,123	3,645	615	466	149
Hardwoods	8,004	775	4,860	3,488	1,372	2,369	1,725	644
Total	30,295	1,683	25,628	20,611	5,017	2,984	2,191	793

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 tons. Columns and rows may not add to their totals due to rounding.

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