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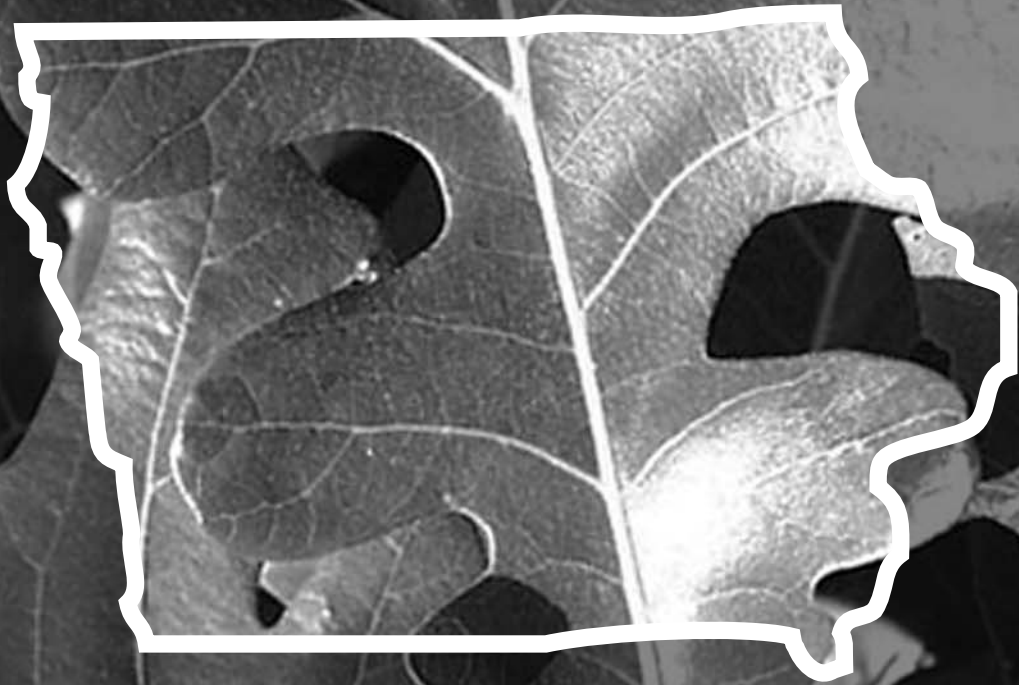
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# **Iowa's Forest Resources in 2004**

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# CONTENTS

<b>Results</b> .....	<b>1</b>
Area .....	1
Volume .....	4
Biomass .....	5
Growth, Removals, and Mortality .....	6
Forest Health .....	6
<b>Summary</b> .....	<b>8</b>
<b>Appendix</b> .....	<b>9</b>
Accuracy of the Inventory .....	9
Inventory Methods .....	9
Inventory Phases .....	10
Phase 1 .....	10
Phase 2 .....	11
Phase 3 .....	11
<b>Literature Cited</b> .....	<b>13</b>
<b>Table Titles</b> .....	<b>14</b>
<b>Tables</b> .....	<b>15</b>



# Iowa's Forest Resources in 2004

The Forest Service conducted and reported on periodic, statewide forest inventories of Iowa in 1954, 1974, and 1990 (Leatherberry *et al.* 1992, Spencer and Jakes 1980, Thornton and Morgan 1959). In 1999, field work for the fourth inventory began and the new nationwide, annual forest inventory system was initiated. Annual inventory in Iowa is conducted by the North Central Research Station's Forest Inventory and Analysis (NCFIA) program and is based on data from a set of field plots systematically located across the entire State. Each year, a panel that consists of one-fifth of the field plots will be measured. A complete inventory will consist of measuring, compiling, and reporting the data for all plots (or all five panels). The fourth inventory of Iowa was concluded in 2003; the results of those measurements are reported in Leatherberry *et al.* 2005. A more detailed analysis of the completed fourth inventory is being prepared.

In 2004, NCFIA continued the annual inventory with the first (annual) panel of the fifth inventory. The information presented in this report is based on moving average estimates that use the latest measurements from the five most recent panels (2000-2004) for estimates of current conditions: variables such as area, number of trees, volume, and biomass.

Estimates of change (growth, removals, and mortality) are based on re-measured plots; thus for this report alone, in which only one panel has been re-measured, estimates of growth, removals, and mortality are calculated using plots measured in 1999 and then re-measured in 2004. In 2005, another panel will be re-measured and estimates of change will be based on two panels of re-measured plots; by 2008 all

five panels will have been re-measured and will be included in change estimation. The results in this report are estimates based on sampling and estimation techniques presented by Bechtold and Patterson (2005).

Estimates from new inventories are often compared with estimates 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 Iowa periodic inventory in 1990 (Leatherberry *et al.* 1992). Although these changes will have little impact on statewide estimates of forest area, timber volume, and tree biomass, they may have significant impacts on plot classification variables such as forest type and stand-size class. Some of these changes make it inappropriate to directly compare portions of the 2000-2004 estimates with inventories published before 1999. Only comparisons that are appropriate and not impacted by changes in procedures are discussed in this report. All of the tables in this report and many others can be generated at our Web site (<http://www.fia.fs.fed.us>).

## RESULTS

### Area

There are 36 million acres of land in Iowa. The area of forest land<sup>1</sup> is more than 2.7 million acres, or 7.6 percent of the State's total land area (table 1).

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<sup>1</sup> Forest land is land at least 10 percent stocked with trees of any size, or having had such tree cover, and not currently developed for nonforest use. The minimum area for classification of forest land is 1 acre. In addition, strips of timber must have a crown width of at least 120 feet.

Forest land has three components:

- 1) Timberland<sup>2</sup>—forest land not restricted from harvesting by statute, administrative regulation, or designation and capable of growing trees at a rate of 20 cubic feet per acre per year
- 2) Reserved forest land—restricted from harvesting by statute, administrative regulation, or designation (e.g., national parks and lakeshores, and Federal wilderness areas)
- 3) Other forest land—land not capable of growing trees at a rate of 20 cubic feet per acre per year and not restricted from harvesting.

Timberland totals nearly 2.7 million acres and accounts for 98 percent of all forest land (table 2). The remaining 2 percent (61.6 thousand acres) is classified as reserved forest land or other forest land.

The area of timberland began to decline in the late 1950s and continued to decline through the early 1970s; a record low occurred in the 1974 inventory, when timberland was an estimated 1.4 million acres (fig. 1). Since that time, the area of Iowa

timberland has steadily increased. The rebound in timberland area coincided with the decline of the farm economy in the 1970s and 1980s; during that time, pastures and marginal agricultural lands reverted to timberland. Additionally, timberland area increased as the result of the re-establishment of trees in riparian zones and through the action of initiatives, such as the Conservation Reserve Program. The current (2004) estimate of timberland area shows an increase over the acreage present in 1954 (fig. 1).

Private owners hold nearly 9 of every 10 acres of timberland (table 2). The remaining area (298.8 thousand acres) is publicly owned. This ensures that people will have access to forest recreation opportunities, in addition to protecting wildlife habitat, and watershed quality.

Iowa's timberland is largely composed of hardwoods: 96.1 percent of timberland area is classified within hardwood forest type groups (table 2). The State's timberland is primarily oak/hickory (52.7 percent), although elm/ash/cottonwood (25.1 percent)

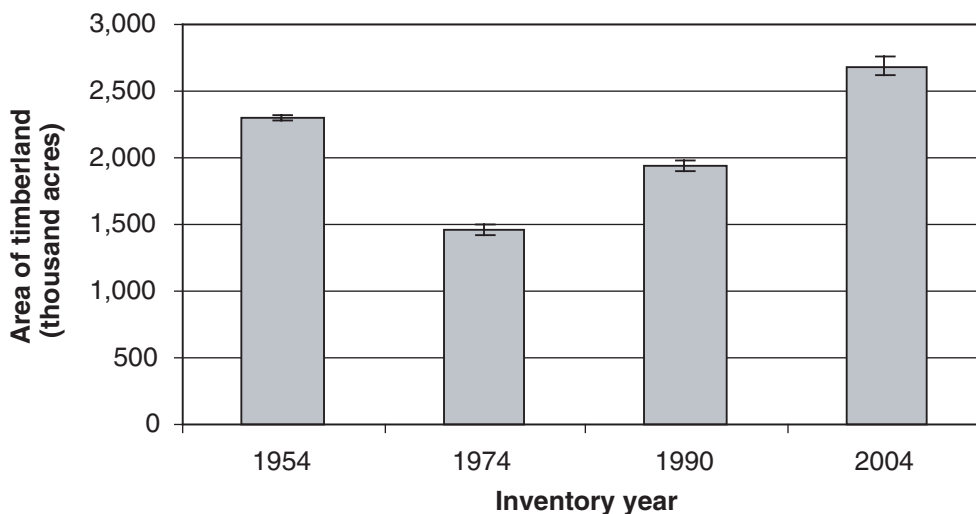


Figure 1.—Area of timberland by inventory year, Iowa, 1954-2004. (Note: The sampling error associated with an inventory estimate is represented by the vertical line at the top of its bar.)

<sup>2</sup> Timberland may not be equivalent to the area actually available for commercial timber harvesting or other access. The actual availability of land for various uses depends upon owner decisions that consider economic, environmental, and social factors.

and maple/beech/birch<sup>3</sup> forest type groups (15.6 percent) are also major components (table 3, fig. 2). In the oak/hickory forest type group, the white oak/red oak/hickory forest type (557 thousand acres), followed by the mixed upland hardwoods forest type (441 thousand acres) predominate. Within the elm/ash/cottonwood group, the sugarberry/hackberry/elm/green ash forest type (311 thousand acres) occupies the largest area. The sugar maple/beech/yellow birch (144 thousand acres) and hard maple/basswood (158 thousand acres) forest types dominate the maple/beech/birch group (table 3). Softwoods make up a smaller portion of the landscape—1.1 percent of total timberland area. Eastern redcedar is the principal coniferous species in Iowa forests. Although the eastern redcedar forest type accounts for only 1 percent (31 thousand acres) of total timberland area, eastern redcedar is often mixed in among hardwoods in the oak/pine forest type group. Overall, eastern redcedar has a significant presence: it can be found on an estimated 79 thousand acres of Iowa timberland (table 3). Nearly 3 percent of timberland is nonstocked<sup>4</sup>.

Stand-size class is a measure of the average diameter of the dominant trees in a stand and reflects a stand's size structure. There are three stand-size classes: sawtimber—large trees, softwoods at least 9 inches in diameter at breast height (d.b.h., 4.5 feet above ground level) and hardwoods at least 11 inches in d.b.h.; poletimber—medium trees, trees at least 5 inches in d.b.h., but smaller than sawtimber size; and seedling/sapling—small trees, live trees less than 1.0 inch in d.b.h. that are expected to survive or trees 1 to 5 inches in d.b.h., respectively. In 2004, the majority of timberland area was composed of large diameter trees—sawtimber stands accounted for 65 percent of timberland area (fig. 3, table 3). Poletimber and seedling/sapling stands represented 20 percent and 12 percent, respectively; again, the remainder of timberland was non-stocked.

The considerable area of sawtimber is indicative of a mature forest. However, the relatively high proportion of seedling/sapling acreage in the eastern redcedar and eastern redcedar/hardwood forest types suggests a growing eastern redcedar resource.

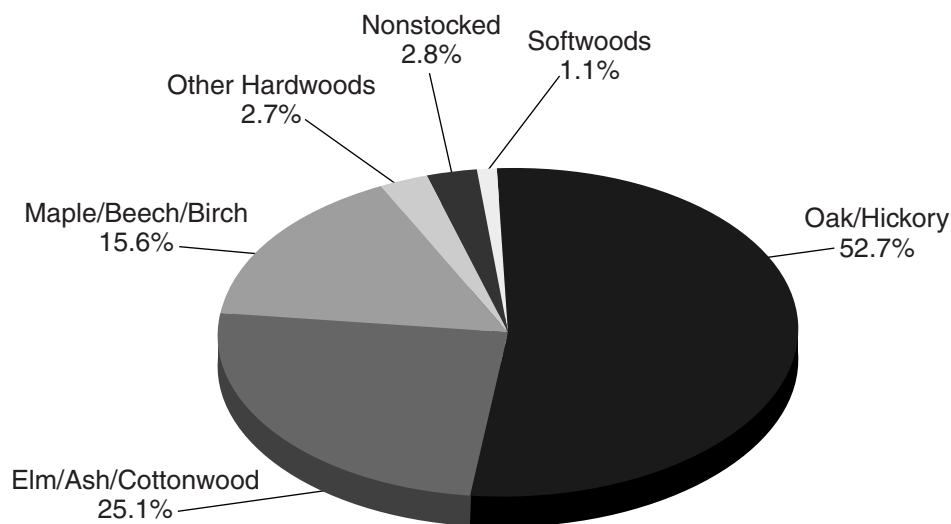


Figure 2.—Area of timberland by forest type group, Iowa, 2000-2004. (Note: Iowa is outside of the native range of beech, therefore the maple/beech/birch forest type group does not contain this species.)

<sup>3</sup> Although the forest type group, maple/beech/birch, implies presence of all species within the State, the native range of American beech does not extend into Iowa.

<sup>4</sup> Nonstocked land is timberland less than 10 percent stocked with all live trees.



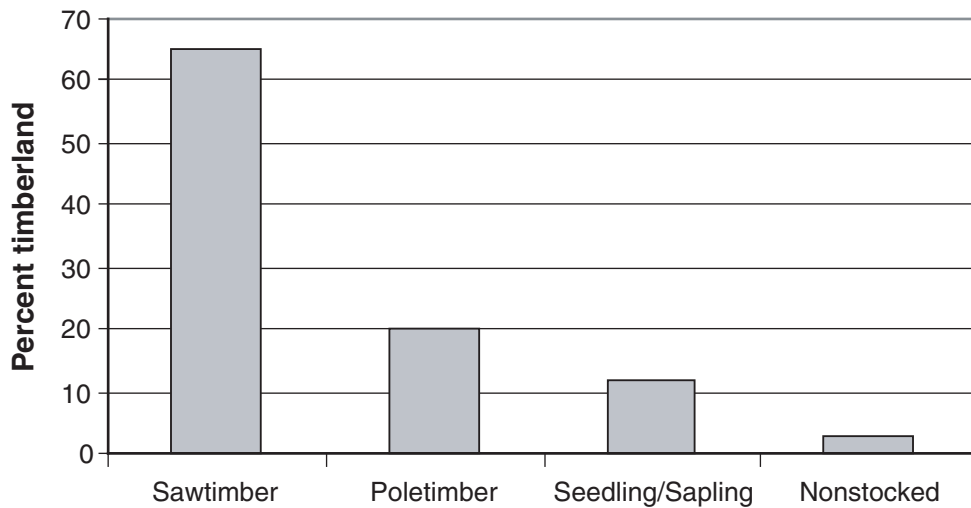


Figure 3.—Stand-size class as a percentage of total timberland area, Iowa, 2000-2004.

### Volume

Total net volume of all live trees on forest land is 3.9 billion cubic feet; or nearly 1,435 cubic feet per acre (table 4). Net volume is the gross volume less deductions for rot, sweep, or other defects affecting use for timber products, and it is computed from a 1-foot stump to a 4-inch diameter top (outside the bark) for live trees at least 5 inches in d.b.h. Eighty-six percent of live volume is on privately owned forest land (table 4). Virtually all—99 percent—of the net volume of all live trees on forest land is in hardwoods; 32 percent of that volume is found in oak species—primarily bur, white, and northern red oaks.

All live tree volume on timberland is slightly less than 3.9 billion cubic feet (table 5). The bulk of this volume (78 percent) is found in growing-stock trees. Growing-stock volume is a measure that has traditionally been used to ascertain wood volume useful for commercial purposes. Growing-stock volume is the amount of solid wood on timberland in commercial trees 5.0 inches in d.b.h. and greater, from 1 foot above ground (stump) to a minimum 4-inch diameter top, with deductions made for poor form or defect. It excludes rough, rotten, and dead trees, as well as trees of noncommercial species. Iowa's growing-stock volume totals 3 billion cubic feet (table 5).

Since the 1974 inventory, growing-stock volume on Iowa's timberland has been steadily rising (fig. 4). Between 1990 and 2004, the volume of growing stock nearly doubled, from 1.7 billion cubic feet to 3.0 billion cubic feet. The rise in growing-stock volume reflects a forest where larger trees continue to increase in volume.

Just over half of total growing-stock volume is in trees in the oak/hickory forest type group (table 6). When this group is combined with the elm/ash/cottonwood and maple/beech/birch forest type groups, 99 percent of all growing-stock volume is accounted for. Growing-stock volume present in softwood forest types amounts to less than one half of a percent (8.3 million cubic feet). However, this amount increases to a full percent (31.8 million cubic feet) when all softwood species volume is included (table 6). This increase occurred because softwoods are sometimes present in hardwood stands.

Seventy-eight percent of all growing-stock volume is in trees 11-inches in d.b.h. and larger (table 7). Nearly one-third of this volume (24 percent of total growing-stock volume) is in trees 21 inches in d.b.h. and larger; much of this volume is in various oak species. Eastern cottonwoods also have significant volume in large diameter trees; 71

percent of eastern cottonwood growing-stock volume and 32 percent of total growing-stock volume are in trees 21 inches in d.b.h. and larger (table 7).

Sawtimber volume, a subset of growing-stock volume, is the volume of the saw log portion of live sawtimber measured in board feet and is generally measured with the International 1/4-inch rule. Net sawtimber volume totals 11 billion board feet (table 8). Virtually all of Iowa sawtimber volume is in hardwood trees; 1 percent of sawtimber volume comes from softwoods. Six species account for 62 percent of the sawtimber volume in Iowa: eastern cottonwood with 1.5 billion board feet; white oak with 1.3 billion board feet; silver maple, northern red oak, and bur oak each with 1.1 billion board feet; and black walnut with 811 million board feet (table 8). Of total sawtimber volume, 29 percent is in trees with diameters of 21 inches in d.b.h. or larger. Among these trees, eastern cottonwood alone accounts for 33 percent of net volume of sawtimber on timberland.

The remaining 22 percent of net volume of all live trees on timberland (862.1 million cubic feet) is in live cull trees (table 5). Cull volume is often used for commercial purposes. For instance, rough trees are sometimes harvested

for chipping or to make pallets. Salvable dead trees, standing or down dead trees that are considered merchantable by regional standards, make up an estimated 70.5 million cubic feet of wood volume (table 5). Salvable dead trees have commercial applications and are an important source of firewood. They also play an important role in overall species diversity, providing habitat for a wealth of wildlife species, including cavity nesting birds and mammals that require den sites.

**Biomass**

Biomass estimates are becoming increasingly important in analyses of questions relating to carbon sequestration, wood fiber availability for fuels, and assessment of fuel loads in forest stands. All live aboveground tree biomass is estimated for growing-stock trees, non-growing-stock trees, and all live trees, 1 to 5 inches in d.b.h. (table 9). Currently (2000-2004), live aboveground tree biomass on Iowa’s timberland is estimated to be 108.2 million dry tons (an average of 40 dry tons per acre of timberland). Ninety-nine percent (107 million dry tons) of this biomass is in hardwood species. Seventy percent of all live aboveground tree biomass is in growing-stock trees, 24.5 percent is in non-growing-stock trees, and 5.5 percent is in trees 1 to 5 inches in d.b.h. For both growing-stock and non-growing-stock trees,

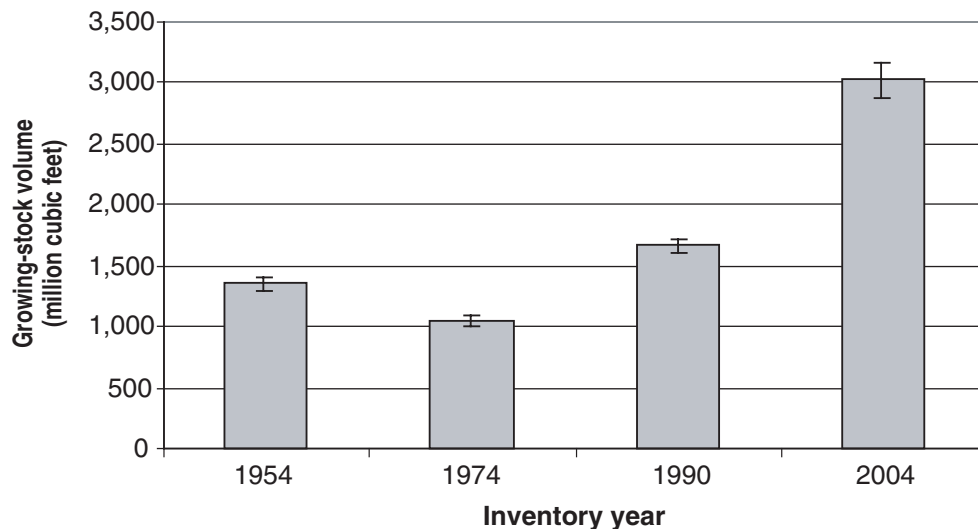


Figure 4.—Growing-stock volume on timberland, Iowa, 1954-2004. (Note: sampling errors associated with each inventory estimate are represented by the vertical lines at the top of each bar.)

nearly three-fourths of total aboveground tree biomass is in the boles of trees (table 9). The remaining aboveground biomass is in stumps, tops, and limbs.

### **Growth, Removals, and Mortality**

Estimates of inventory change are based on remeasured plots. In this report, the estimates for growth, removals, and mortality are based on changes between plot measurements from the first panel of the annual inventory (1999) and remeasurements from the first panel of the second (current) annual inventory (2004). Because these estimates are based on only one panel of remeasurement (or one-fifth of the plots for the inventory), the sampling errors for growing-stock growth, removals, and mortality on timberland are relatively high (15.87 percent, 48.70 percent, and 27.01 percent, respectively).

Between 1999 and 2004, growing-stock volume on Iowa's timberland increased by an average of 159.6 million cubic feet per year (table 10). Hardwood growth accounted for virtually all (99.5 percent, or 158.9 million cubic feet) of the total average annual net growth of growing stock on timberland. The remaining one-half of a percent of growth occurred in softwoods on private land. Public lands had a decrease of 123 thousand cubic feet per year in softwood growth (table 10). Therefore, while softwoods increased by 870 thousand cubic feet per year on private land, total softwood net growth was 748 thousand cubic feet per year. Overall, 83 percent of net annual growth for all species groups occurred on private land. The majority of growth took place in the select white oaks species group, which had a growth rate of 32.7 million cubic feet per year. Two of the other fastest growing species groups in Iowa are the soft maples at 19.5 million cubic feet per year and the other eastern soft hardwoods at 18.9 million cubic feet per year (table 10).

Average annual removals of growing stock on timberland between 1999 and 2004 totaled 6.6 million cubic feet per year (table 11). The other eastern soft hardwoods

species group had the highest average removals at 3.9 million cubic feet per year or 60 percent of total average annual removals. Twenty-eight percent (1.8 million cubic feet per year) of annual removals occurred within the select red oaks (table 11). These reported estimates may not fully represent all removals on Iowa timberland. The completion of additional panels will yield more comprehensive results.

Growing stock on timberland had an average annual mortality rate of 25.9 million cubic feet per year between 1999 and 2004 (table 12). More than 99 percent of total mortality or 25.8 million cubic feet per year was among hardwoods. The remaining 80 thousand cubic feet of mortality per year occurred in softwoods. The other eastern soft hardwoods had the highest mortality at 17.1 million cubic feet per year, or 66 percent of total mortality (table 12). The vast amount of mortality in the other eastern soft hardwoods group is likely the result of Dutch elm disease, which has spread throughout the State. The oak species groups accounted for 9 percent of total average annual mortality (table 12). Oak mortality in Iowa is generally caused by oak wilt and oak decline. The forest health discussion below provides more information about the causes of tree mortality in Iowa.

### **Forest Health**

The following information about the pathogens and insects affecting Iowa's forests was obtained from the national Forest Health Monitoring (FHM) program Web page at: <http://fhm.fs.fed.us/>. Additional information was gathered from the 2004 Insect and Disease Conditions Report (<http://www.na.fs.fed.us/fhp/pcond/>) and the Central States Forest Health Watch newsletter (<http://na.fs.fed.us/spfo/pubs/newsletters/csflhw/index.shtml>), both of which are published by the USDA Forest Service, Northeastern Area, State and Private Forestry. Several issues of concern in 2004 are highlighted below. For more information on the health of Iowa's forests, contact the Iowa Department of Natural Resources.

### **White oak decline**

In recent years the amount of mature standing-dead white oak has increased in northeastern Iowa woodlands. The cause of this phenomenon, known as white oak decline, is currently under investigation in a joint study by the Iowa Department of Natural Resources (IADNR) and the USDA Forest Service. Crown and stem samples have been collected and are being analyzed for various fungi at the plant diagnostic laboratory at Iowa State University. Similarly, samples from boles and roots have been collected for analysis of starch content and presence of pathogens. White oak decline was identified as the most serious forest health concern in the region. Aerial surveys in 2004 detected an increase in white oak decline in Iowa. *Ganoderma* spp. and oak wilt were not present in 2003 laboratory analyses; the absence of these pathogens has helped narrow the focus for potential causal factors.

### **Oak wilt**

Oak wilt continues to be an important source of oak mortality, especially in southeastern Iowa. Oak wilt is caused by a fungus, *Ceratocystis fagacearum* (Bretz) Hunt, which enters the vascular system of trees and disrupts the translocation of water from the roots to the canopy. This disruption causes the foliage to wilt and die. Rapid progression of the disease causes tree mortality within a year. The fungus can be spread through root grafts or may be transported from a diseased to a healthy tree by bark beetles carrying fungal spores. All species of oak are susceptible to oak wilt; however, the disease occurs more frequently and progresses more rapidly in red oak species. There is no cure for oak wilt. Therefore, prevention and early detection are important in sustaining tree health. Breaking natural root grafts between diseased and healthy trees, either mechanically or through the use of chemicals, i.e., soil fumigants and fungicides, will inhibit the spread of the fungus through the root system. Overland spread can be reduced by removing dead or dying oaks before spores are produced. Spores will form only in the spring following infection; for that reason, standing dead trees left longer

than 1 year may be left without posing further risk of spread. Injury and fresh pruning wounds attract beetles; therefore, unnecessary pruning, and pruning between April 15 and July 1, should be avoided because that is the time when beetles are active and spore mats are present. For more information on the biology and control of oak wilt, see O'Brien *et al.* 2000 (online at [http://www.na.fs.fed.us/spfo/pubs/howtos/ht\\_oakwilt/toc.htm](http://www.na.fs.fed.us/spfo/pubs/howtos/ht_oakwilt/toc.htm)).

### **Sudden oak death**

Sudden Oak Death (SOD) is a fungal disease that was recently introduced to the U.S. and is currently having devastating effects on oaks and other herbaceous plants in California and southwest Oregon. Transportation of infected host plants is a concern; however, all surveys in Iowa have tested negative for SOD. Additional information can be found in O'Brien *et al.* 2002 ([http://www.na.fs.fed.us/spfo/pubs/pest\\_al/sodeast/sodeast.htm](http://www.na.fs.fed.us/spfo/pubs/pest_al/sodeast/sodeast.htm)).

### **Dutch elm disease**

Dutch elm disease (DED) is still present and continues to impact forest health and structure throughout Iowa. Caused by the fungus *Ophiostoma ulmi/novo-ulmi*, DED occurs in all species of elm. In particular, American elm is highly susceptible and trees are often killed before they reach sawtimber size; thus aging stands present a future health risk. Once the fungus is introduced to a tree, it clogs water-conducting tissues and prevents water from reaching the crown. This causes leaves to wilt and die, eventually leading to tree mortality. DED is spread overland by elm bark beetles that pick up fungal spores in diseased trees and deposit them in healthy trees as they bore through the inner bark and sapwood. Local spread is facilitated by root grafts, which allow the fungus to move readily between trees. Further information about DED can be found online. See Haugen 1998 ([http://na.fs.fed.us/spfo/pubs/howtos/ht\\_ded/ht\\_ded.htm#intro](http://na.fs.fed.us/spfo/pubs/howtos/ht_ded/ht_ded.htm#intro)).

### **Gypsy moth**

The gypsy moth, an exotic tree and shrub defoliator, was first introduced to North America in 1869 and initially established in

Massachusetts. The gypsy moth has since progressed south and west, defoliating close to a million forested acres per year (McManus *et al.* 1992). Currently, Iowa does not have an established population of gypsy moth; however, insects are beginning to move into northeastern portions of the State. Monitoring is conducted through the collaborative effort of the USDA Animal and Plant Health Inspection Service (APHIS), the IADNR, the Eastern Iowa City Foresters, and the Iowa Department of Agriculture and Land Stewardship (IDALS), with the help of numerous volunteers. In 2004, approximately 5,000 insect traps placed throughout the State yielded 27 moths. Eighteen of these moths were captured in Allamakee County, located in the extreme northeast corner of Iowa. The 2004 trap catch represents a major decrease from 2003, when 159 moths were captured. Traps are concentrated in nurseries, cities, sawmills, and recreation areas.

### ***Emerald ash borer***

The emerald ash borer (EAB) is an exotic insect that to date has not been found in Iowa, although it has the potential to become a major threat. Following the discovery of this wood-boring beetle in southeast Michigan in 2002, extensive survey efforts were launched to determine areas of potential risk and identify the extent of EAB's current geographic distribution. The core of the EAB infestation is in the Detroit-metropolitan area; however, outlier populations have been established in Ohio and Indiana. The EAB attacks many species of ash, including black, green, and white ash. Larvae girdle trees by feeding on and producing galleries in the phloem and cambial tissues. Tree mortality occurs 1 to 3 years after infestation. Since its discovery, the EAB has killed millions of ash trees. Spread of the EAB has been enhanced by human transportation of infested

firewood and nursery stock. In 2004, the first Iowa detection monitoring programs were initiated. Transects were established in 32 cities having forest production facilities. Ash showing signs of insect activity were thoroughly inspected. Additionally, newly landscaped industrial sites, large public recreation sites, and more than 2,000 ash in over 200 cities were inspected. Surveys did not detect EAB at any site; however, native borers were detected on several occasions.

### ***Invasive plants***

Invasive plant species continue to be a forest health problem in Iowa. Garlic mustard, buckthorn, bush honeysuckle, and multiflora rose are the State's primary woodland invaders. To a lesser extent, oriental bittersweet is also a problem. Invasive species are a concern because they compete with native plant species for limited resources. In general, invasive species threaten ecological diversity and alter natural communities. The goal of invasive species programs is to limit the spread of these nonnative plants.

## **SUMMARY**

The area of Iowa's timberland continues to increase, as it has done since the 1970s. Oak/hickory forest types characterize the majority of the landscape. As forests have matured, growing-stock volume has increased. The current state of Iowa's forests shows they are reasonably healthy. However, there is concern for the future as the dispersal of exotic insects and fungal pathogens continues and forest resources age. Continuation of the annual inventory system will yield a more clearly defined picture of the status and trends of Iowa's forest resources. Additional data related to the most recent inventories of Iowa are available at <http://www.fia.fs.fed.us>.

## APPENDIX

### Accuracy of the Inventory

Sampling errors measure the uncertainty in estimates derived from a portion of a population rather than from the population as a whole. The 2000-2004 Iowa forest inventory includes a total sample of 6,066 plots over the entire State. Sampling errors for the estimates of statewide totals in this report are

	Estimate	Sampling error (%)
Area of forest land ( <i>thousand acres</i> )	2,748.7	2.70
Area of timberland ( <i>thousand acres</i> )	2,687.1	2.78
All live volume on forest land ( <i>thousand cubic feet</i> )	3,945,016	4.19
All live volume on timberland ( <i>thousand cubic feet</i> )	3,886,486	4.27
Growing-stock volume on timberland ( <i>thousand cubic feet</i> )	3,024,390	4.93
Sawtimber volume on timberland ( <i>thousand board feet</i> )	11,031,850	5.70
All live aboveground biomass on timberland ( <i>dry tons</i> )	108,216,757	3.81
Growing-stock growth on timberland ( <i>thousand cubic feet per year</i> )	159,639	15.87
Growing-stock mortality on timberland ( <i>thousand cubic feet per year</i> )	25,889	27.01
Growing-stock removals on timberland ( <i>thousand cubic feet per year</i> )	6,591	48.70

These sampling errors indicate the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the results would have been within the limits indicated. For example, the estimated growing-stock volume in the State is 3,024.4 million cubic feet with a sampling error of +/- 4.93 percent (+/- 149 million cubic feet).

### Inventory Methods

Since the 1990 inventory of Iowa, several changes have been made to 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 has

been the change from periodic 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. Iowa was one of the first States in the North Central region, and in the Nation, to be inventoried using this new system. The first Iowa plots to be measured under the annual system were measured in 1999.

With the NCFIA annual inventory system, about one-fifth of all field plots are measured each year. In 2003, the first, annual inventory

cycle was completed, with all of the plots in the State measured under the new system. These measurements (1999-2003) are summarized in a previous report (Leatherberry *et al.* 2005) and a more detailed analysis of the data is being prepared. With the completion of the 2004 measurements, we now have measurements from 6,066 plots taken over a 5-year period, 2000 to 2004, which includes the 2004 remeasurement of the 1,205 plots that were measured in 1999. All of the plots provide information for estimates of current conditions (area, number of trees, volume, and biomass), but only the re-measured plots provide information for estimates of change (growth, removals, and mortality) from 1999 to 2004. Over the next 4 years (2005-2008), all of the panels will be re-measured and current information will be updated with new measurements each year. The number of plots in change estimates will increase with additional panels of re-measured plots. The smaller number of sample plots available for change estimation is reflected in the sampling errors presented in this report. Sampling errors for growing-stock growth, removals, and mortality on timberland (15.87 percent, 48.70 percent, and 27.01 percent, respectively) are much higher than those for timberland area and growing-stock volume on timberland (2.78 percent and 4.93 percent, respectively). A smaller sample size in change estimation has led to other differences between current and change estimates. For example, table 7 reports growing-stock volume in the other yellow pines species group; however, table 10 does not report any growth in this species group. The other yellow pines species group is relatively uncommon in the State, and the plots where it has been measured have not yet been re-measured.

Other significant changes between the annual inventory system and past periodic inventories include the implementation of new remote sensing technology, and a new sampling design and plot configuration. The advent of remote sensing technology since the 1990 inventory has allowed NCFIA to use classifications of Multi-Resolution Land

Characterization (MRLC) data and other available remote sensing and GIS products to stratify the total area of the State and improve the precision of estimates.

Under the annual inventory system, new algorithms are being used 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. 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 have changed with the new algorithms. As a result, comparisons between the published 2004 inventory results and those published for the 1990 inventory may not be valid. For additional details about algorithms used in both inventories, please contact NCFIA.

### **Inventory Phases**

The annual inventory system is based on a three-phase inventory. In the first phase, classified satellite images and ancillary data are used to stratify the State, while aerial photographs are used to determine if plots could contain forest land and need to be measured. The second phase involves measurement of a traditional FIA suite of mensurational variables (basic tree and stand attributes), and the third phase focuses on measurement of a suite of variables related to forest health.

The only plots that could not be measured were (1) on 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.

#### **Phase 1**

This inventory used a classification of satellite imagery and ancillary data for stratification. 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. In addition, all strata were divided into public or private ownership based on information available in the Protected Lands Database (DellaSala *et al.* 2001). The estimated population total for a variable is the sum across all strata of the product of each stratum's area (from the pixel count) and the variable's mean per unit area (from plot measurements) for the stratum.

### Phase 2

Phase 2 of the inventory consisted of the measurement of 6,066 field plots throughout the State. 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 established by selecting one plot from each hexagon based on the following rules: (1) if a Forest Health Monitoring (FHM) plot (Mangold 1998) fell within a hexagon, it was selected; (2) if no FHM plot fell within a hexagon, the existing NCFIA plot from the most recent periodic inventory nearest the hexagon center was selected; and (3) if neither FHM nor existing NCFIA plots fell within the hexagon, 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 is funded by the Federal government. Of the 6,066 phase 2 field plots measured in the 2000-2004 annual inventory, 585 plots contained forest land.

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; 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 forested at the time of the last inventory and on plots currently classified as forest by trained photointerpreters using aerial photos or digital orthoquads.

### Phase 3

NCFIA has two categories of field plot measurements—phase 2 field plots (standard FIA plots) and phase 3 field plots (forest health plots). Both types of plots are uniformly 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 the additional measurement of nonwoody, understory vegetation; ground cover; soils; and other variables. The five panels of measurements that make up this inventory include 373 phase 3 plots, of which 37 contained forest land.

The new national FIA plot configuration (fig. 5) was first used for data collection in Iowa in 1999, the first annual inventory year. This configuration will be used in subsequent years. The national plot configuration requires mapping forest conditions on each plot.

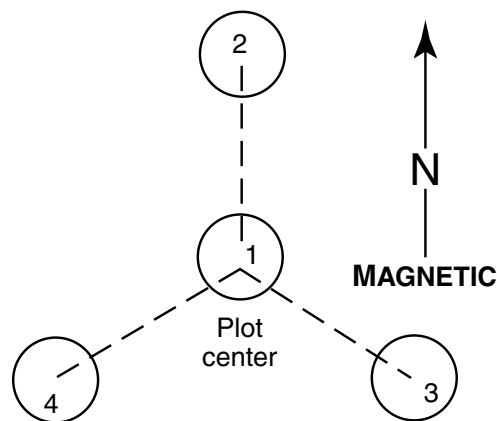


Figure 5.—Current NCFIA field plot configuration.



The overall plot layout for the new configuration 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, from the center of subplot 1. Trees with a d.b.h. 5 inches and larger are measured on a 24-foot-radius (1/24 acre) circular subplot. All trees with a d.b.h. 1 inch or larger but less than 5 inches are measured on a 6.8-foot-radius (1/300 acre) circular microplot located 12 feet east of the center of each of the four subplots. Seedlings [trees less than 1 inch in d.b.h. and at least 6 inches tall for softwood species and 12 inches tall for hardwood species] are counted but not individually measured on this same microplot. 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 tables presented here is limited. However, other tabular data can be generated at:  
<http://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, Iowa, 2000-2004*

Table 2.—*Area of timberland by major forest type group, stand origin, and owner category, Iowa, 2000-2004*

Table 3.—*Area of timberland by forest type group, forest type, and stand-size class, Iowa, 2000-2004*

Table 4.—*Net volume of all live trees on forest land by species group, species, and owner category, Iowa, 2000-2004*

Table 5.—*Net volume of all live trees and salvageable dead trees on timberland by class of timber and softwood/hardwood species category, Iowa, 2000-2004*

Table 6.—*Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, Iowa, 2000-2004*

Table 7.—*Net volume of growing stock on timberland by species group, species, and diameter class, Iowa, 2000-2004*

Table 8.—*Net volume of sawtimber on timberland by species group, species, and diameter class, Iowa, 2000-2004*

Table 9.—*All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree biomass component, Iowa, 2000-2004*

Table 10.—*Average annual net growth of growing stock on timberland by species group and owner category, Iowa, 1999 to 2004*

Table 11.—*Average annual removals of growing stock on timberland by species group and owner category, Iowa, 1999 to 2004*

Table 12.—*Average annual mortality of growing stock on timberland by species group and owner category, Iowa, 1999 to 2004*

## **TABLES**

Table 1. -- Area of forest land by forest type group, forest type, and owner category, Iowa, 2000-2004

(In thousand acres)

Forest type group/ forest type	Owner category			
	All owners	Public	Private	Unidentified owner
<b>Softwood type groups</b>				
Pinyon / juniper group				
Eastern redcedar	37.3	1.9	35.4	--
All forest types	37.3	1.9	35.4	--
All softwood groups	37.3	1.9	35.4	--
<b>Hardwood type groups</b>				
Oak / pine group				
Eastern redcedar / hardwood	54.5	9.7	44.8	--
All forest types	54.5	9.7	44.8	--
Oak / hickory group				
Oak / hickory group	1.9	--	1.9	--
Post oak / blackjack oak	11.0	--	11.0	--
White oak / red oak / hickory	575.7	48.5	527.2	--
White oak	163.3	39.4	124.0	--
Northern red oak	46.8	17.7	29.1	--
Bur oak	128.4	2.5	125.8	--
Black walnut	68.8	19.3	49.6	--
Black locust	11.6	--	11.6	--
Mixed upland hardwoods	444.4	18.1	426.4	--
All forest types	1,452.0	145.4	1,306.5	--
Elm / ash / cottonwood group				
Elm / ash / cottonwood group	1.5	--	1.5	--
Black ash / American elm / red maple	11.6	3.9	7.7	--
River birch / sycamore	46.4	--	46.4	--
Cottonwood	80.5	14.6	65.9	--
Willow	16.5	5.7	10.7	--
Sycamore / pecan / American elm	14.1	1.6	12.4	--
Sugarberry / hackberry / elm / green ash	311.4	27.3	284.1	--
Silver maple / American elm	168.7	28.9	139.8	--
Cottonwood / willow	24.0	--	24.0	--
All forest types	674.7	82.1	592.5	--
Maple / beech / birch group				
Maple / beech / birch group	1.5	1.5	--	--
Sugar maple / beech / yellow birch	144.4	16.7	127.7	--
Black cherry	5.4	1.5	4.0	--
Cherry / ash / yellow-poplar	19.1	1.6	17.5	--
Hard maple / basswood	157.8	25.9	131.8	--
Elm / ash / locust	91.3	18.0	73.4	--
All forest types	419.5	65.1	354.3	--
Aspen / birch group				
Aspen	13.0	--	13.0	--
All forest types	13.0	--	13.0	--
Exotic hardwoods group				
Other exotic hardwoods	11.1	4.8	6.3	--
All forest types	11.1	4.8	6.3	--
All hardwood groups	2,624.7	307.2	2,317.5	--
Nonstocked	86.8	12.0	74.7	--
<b>All forest groups</b>	<b>2,748.7</b>	<b>321.1</b>	<b>2,427.6</b>	<b>--</b>

(Table 1 continued on next page)

(Table 1 continued)

Forest type group/ forest type	Owner category		
	All owners	Public	Private Unidentified owner

**Hardwood type groups**

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, Iowa, 2000-2004

(In thousand acres)

Major forest type group and stand origin	Owner category			
	All owners	Public	Private	Unidentified owner
<b>Softwood type groups</b>				
Natural	30.8	1.9	28.9	--
All softwood types	30.8	1.9	28.9	--
<b>Hardwood type groups</b>				
Natural	2,565.1	291.4	2,273.8	--
Planted	16.9	--	16.9	--
All hardwood types	2,582.1	291.4	2,290.7	--
Nonstocked	74.3	5.5	68.8	--
<b>All groups</b>	2,687.1	298.8	2,388.3	--

All table cells without observations in the inventory sample are indicated by --. Table value of 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, Iowa, 2000-2004

(In thousand acres)

Forest type group/ forest type	Stand-size class				Non- stocked
	All stands	Sawtimber	Poletimber	Sapling- seedling	
<b>Softwood type groups</b>					
Pinyon / juniper group					
Eastern redcedar	30.8	4.6	5.4	20.8	--
All forest types	30.8	4.6	5.4	20.8	--
All softwood groups	30.8	4.6	5.4	20.8	--
<b>Hardwood type groups</b>					
Oak / pine group					
Eastern redcedar / hardwood	48.6	20.6	8.0	19.9	--
All forest types	48.6	20.6	8.0	19.9	--
Oak / hickory group					
Oak / hickory group	1.9	--	1.2	0.7	--
Post oak / blackjack oak	11.0	9.6	1.5	--	--
White oak / red oak / hickory	557.0	369.8	126.3	60.9	--
White oak	163.3	153.4	9.9	--	--
Northern red oak	46.8	45.2	1.6	--	--
Bur oak	113.8	108.6	3.9	1.3	--
Black walnut	68.8	58.2	7.3	3.3	--
Black locust	11.6	5.1	6.5	--	--
Mixed upland hardwoods	441.0	216.9	158.0	66.1	--
All forest types	1,415.3	966.7	316.2	132.4	--
Elm / ash / cottonwood group					
Elm / ash / cottonwood group	1.5	--	1.5	--	--
Black ash / American elm / red maple	11.6	8.5	2.2	0.9	--
River birch / sycamore	46.4	34.7	5.9	5.8	--
Cottonwood	80.5	69.1	4.6	6.9	--
Willow	16.5	4.0	6.4	6.1	--
Sycamore / pecan / American elm	14.1	13.7	0.3	--	--
Sugarberry / hackberry / elm / green ash	311.4	190.6	87.0	33.8	--
Silver maple / American elm	168.7	149.3	13.4	6.0	--
Cottonwood / willow	24.0	13.0	11.0	--	--
All forest types	674.7	483.0	132.3	59.4	--
Maple / beech / birch group					
Maple / beech / birch group	1.5	1.5	--	--	--
Sugar maple / beech / yellow birch	144.4	70.2	47.4	26.8	--
Black cherry	5.4	1.6	1.5	2.3	--
Cherry / ash / yellow-poplar	19.1	--	--	19.1	--
Hard maple / basswood	157.8	142.4	14.0	1.4	--
Elm / ash / locust	91.3	47.0	17.6	26.7	--
All forest types	419.5	262.6	80.4	76.4	--
Aspen / birch group					
Aspen	13.0	13.0	--	--	--
All forest types	13.0	13.0	--	--	--
Exotic hardwoods group					
Other exotic hardwoods					
All forest types	11.1	6.3	--	4.8	--
All hardwood groups	2,582.1	1,752.2	536.9	292.9	--
Nonstocked	74.3	--	--	--	74.3
<b>All forest groups</b>	<b>2,687.1</b>	<b>1,756.9</b>	<b>542.3</b>	<b>313.6</b>	<b>74.3</b>

(Table 3 continued on next page)



(Table 3 continued)

Forest type group/ forest type	Stand-size class			
	All stands	Sawtimber	Poletimber	Sapling-seedling

**Hardwood type groups**

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, Iowa, 2000-2004

(In thousand cubic feet)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
<b>Softwoods</b>				
Other yellow pines				
Scotch pine	50	--	50	--
All species	50	--	50	--
Eastern white and red pines				
Red pine	846	393	452	--
All species	846	393	452	--
Other eastern softwoods				
Eastern redcedar	39,358	5,887	33,471	--
Larch spp.	462	--	462	--
Tamarack (native)	247	--	247	--
Ponderosa pine	3,509	552	2,958	--
All species	43,578	6,439	37,139	--
Total softwoods	44,474	6,832	37,642	--
<b>Hardwoods</b>				
Select white oaks				
White oak	380,179	77,158	303,021	--
Swamp white oak	4,108	69	4,038	--
Bur oak	426,218	11,732	414,486	--
Chinkapin oak	4,307	1,970	2,338	--
All species	814,812	90,929	723,883	--
Select red oaks				
Northern red oak	281,255	67,636	213,619	--
All species	281,255	67,636	213,619	--
Other white oaks				
Post oak	715	--	715	--
All species	715	--	715	--
Other red oaks				
Northern pin oak	30,644	3,115	27,529	--
Shingle oak	32,173	80	32,093	--
Pin oak	22,484	8,548	13,936	--
Black oak	95,389	11,576	83,813	--
All species	180,690	23,319	157,371	--
Hickory				
Bitternut hickory	81,251	7,604	73,647	--
Pignut hickory	2,089	970	1,120	--
Shellbark hickory		--		--
Shagbark hickory	160,602	10,507	150,095	--
Mockernut hickory	1,677	604	1,073	--
All species	245,619	19,685	225,935	--
Yellow birch				
Yellow birch		--		--
All species		--		--
Hard maple				
Black maple	46,180	3,194	42,986	--
Sugar maple	55,907	15,061	40,846	--
All species	102,088	18,255	83,832	--

(Table 4 continued on next page)

(Table 4 continued)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
<b>Hardwoods</b>				
Soft maple				
Red maple	2,606	665	1,942	--
Silver maple	414,381	64,680	349,701	--
All species	416,987	65,345	351,642	--
Ash				
White ash	56,720	4,140	52,579	--
Black ash	3,408	1,156	2,252	--
Green ash	70,221	17,863	52,358	--
All species	130,349	23,159	107,190	--
Cottonwood and aspen				
Eastern cottonwood	337,432	89,489	247,943	--
Bigtooth aspen	16,175	--	16,175	--
Quaking aspen	3,534	--	3,534	--
All species	357,141	89,489	267,652	--
Basswood				
American basswood	165,787	30,005	135,781	--
All species	165,787	30,005	135,781	--
Black walnut				
Black walnut	234,888	27,679	207,209	--
All species	234,888	27,679	207,209	--
Other eastern soft hardwoods				
Boxelder	103,509	3,343	100,166	--
Ohio buckeye	10,632	124	10,508	--
River birch	4,136	--	4,136	--
Paper birch	2,877	--	2,877	--
Northern catalpa	333	--	333	--
Hackberry	172,091	9,081	163,010	--
Butternut	2,453	--	2,453	--
American sycamore	3,763	313	3,450	--
Black cherry	49,716	1,416	48,300	--
Black willow	41,913	1,648	40,265	--
White willow	481	--	481	--
American elm	229,588	27,197	202,391	--
Siberian elm	13,391	1,055	12,335	--
Slippery elm	106,486	11,983	94,503	--
All species	741,370	56,160	685,209	--
Other eastern hard hardwoods				
Common persimmon		--		--
Honeylocust	112,822	15,833	96,989	--
White mulberry	456	--	456	--
Red mulberry	31,360	5,395	25,966	--
Black locust	38,639	5,868	32,772	--
Rock elm	115	--	115	--
All species	183,393	27,095	156,297	--

(Table 4 continued on next page)

(Table 4 continued)

Species group/ species	Owner category			Unidentified owner
	All owners	Public	Private	
<b>Hardwoods</b>				
Eastern noncommercial hardwoods				
Ailanthus	162	--	162	--
Serviceberry spp.	117	117	--	--
American hornbeam, musclewood		--	--	--
Eastern redbud	506	--	506	--
Hawthorn spp.	2,611	--	2,611	--
Cockspur hawthorn	789	--	789	--
Downy hawthorn	66	--	66	--
Osage-orange	23,286	175	23,111	--
Apple spp.	323	--	323	--
Eastern hophornbeam	15,011	1,424	13,587	--
Chokecherry		--		--
American plum		--		--
Willow spp.	390	239	151	--
Peachleaf willow	241	--	241	--
Russian-olive	1,947	--	1,947	--
All species	45,448	1,955	43,493	--
Total hardwoods	3,900,542	540,712	3,359,830	--
<b>All species groups</b>	3,945,016	547,544	3,397,472	--

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, Iowa, 2000-2004

(In thousand cubic feet)

Class of timber	All species	Softwood species	Hardwood species
<b>Live trees</b>			
<b>Growing-stock trees</b>			
Sawtimber			
Saw log portion	2,092,344	17,482	2,074,862
Upper stem portion	282,948	2,709	280,239
Total	2,375,292	20,191	2,355,101
Poletimber	649,098	11,572	637,526
<b>All growing-stock trees</b>	<b>3,024,390</b>	<b>31,763</b>	<b>2,992,627</b>
<b>Cull trees</b>			
Rough trees <sup>1</sup>			
Sawtimber size	595,351	7,457	587,894
Poletimber size	205,959	5,048	200,911
Total	801,311	12,505	788,806
Rotten trees <sup>1</sup>			
Sawtimber size	51,932	--	51,932
Poletimber size	8,854	114	8,740
Total	60,785	114	60,671
<b>All live cull trees</b>	<b>862,096</b>	<b>12,619</b>	<b>849,477</b>
<b>All live trees</b>	<b>3,886,486</b>	<b>44,383</b>	<b>3,842,103</b>
<b>Salvable dead trees</b>			
Sawtimber size	43,930	684	43,246
Poletimber size	26,599	356	26,243
<b>All salvable dead trees</b>	<b>70,530</b>	<b>1,040</b>	<b>69,490</b>
<b>All classes</b>	<b>3,957,016</b>	<b>45,423</b>	<b>3,911,593</b>

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.

<sup>1</sup> Includes noncommercial species.

Table 6. -- Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, Iowa, 2000-2004

(In thousand cubic feet)

Forest type group/ forest type	All species	Softwood species	Hardwood species
<b>Softwood type groups</b>			
Pinyon / juniper group			
Eastern redcedar	8,263	5,355	2,908
All forest types	8,263	5,355	2,908
All softwood groups	8,263	5,355	2,908
<b>Hardwood type groups</b>			
Oak / pine group			
Eastern redcedar / hardwood	11,540	5,740	5,800
All forest types	11,540	5,740	5,800
Oak / hickory group			
Oak / hickory group	1,663	--	1,663
Post oak / blackjack oak	22,017	--	22,017
White oak / red oak / hickory	637,582	6,641	630,941
White oak	289,392	517	288,876
Northern red oak	92,073	115	91,958
Bur oak	165,029	--	165,029
Black walnut	80,272	104	80,168
Black locust	3,281	--	3,281
Mixed upland hardwoods	280,474	4,042	276,432
All forest types	1,571,783	11,419	1,560,364
Elm / ash / cottonwood group			
Black ash / American elm / red maple	16,184	--	16,184
River birch / sycamore	43,375	--	43,375
Cottonwood	258,160	552	257,609
Willow	3,985	--	3,985
Sycamore / pecan / American elm	16,287	--	16,287
Sugarberry / hackberry / elm / green ash	221,844	1,404	220,440
Silver maple / American elm	329,819	2,717	327,102
Cottonwood / willow	41,643	--	41,643
All forest types	931,298	4,672	926,626
Maple / beech / birch group			
Maple / beech / birch group		--	
Sugar maple / beech / yellow birch	135,102	2,459	132,643
Black cherry	1,477	--	1,477
Cherry / ash / yellow-poplar	1,515	--	1,515
Hard maple / basswood	275,686	1,019	274,668
Elm / ash / locust	65,443	--	65,443
All forest types	479,222	3,478	475,745
Aspen / birch group			
Aspen	13,830	170	13,660
All forest types	13,830	170	13,660

(Table 6 continued)

Forest type group/ forest type	All species	Softwood species	Hardwood species
<b>Hardwood type groups</b>			
Exotic hardwoods group			
Other exotic hardwoods	5,748	530	5,217
All forest types	5,748	530	5,217
All hardwood groups	3,013,421	26,009	2,987,412
Nonstocked	2,707	399	2,307
<b>All forest groups</b>	<b>3,024,390</b>	<b>31,763</b>	<b>2,992,627</b>

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, Iowa, 2000-2004

(In thousand cubic feet)

Species group/ species	Diameter class (inches at breast height)											
	All classes	5.0-5.9	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+	
<b>Softwoods</b>												
Other yellow pines												
Scotch pine	50	50	--	--	--	--	--	--	--	--	--	--
All species	50	50	--	--	--	--	--	--	--	--	--	--
Eastern white and red pines												
Red pine	846	--	142	251	452	--	--	--	--	--	--	--
All species	846	--	142	251	452	--	--	--	--	--	--	--
Other eastern softwoods												
Eastern redcedar	26,984	5,843	5,296	7,202	3,945	3,635	1,062	--	--	--	--	--
Larch spp.	374	--	--	374	--	--	--	--	--	--	--	--
Ponderosa pine	3,509	104	136	587	444	2,237	--	--	--	--	--	--
All species	30,867	5,947	5,432	8,164	4,390	5,872	1,062	--	--	--	--	--
Total softwoods	31,763	5,998	5,574	8,415	4,842	5,872	1,062	--	--	--	--	--
<b>Hardwoods</b>												
Select white oaks												
White oak	327,649	5,560	12,275	32,853	36,121	48,815	38,408	40,382	43,592	60,730	6,913	--
Swamp white oak	3,446	155	230	391	607	--	--	2,063	--	--	--	--
Bur oak	263,558	3,877	9,859	12,482	21,861	26,372	19,835	28,604	41,323	79,456	19,888	--
Chinkapin oak	2,218	320	476	992	430	--	--	--	--	--	--	--
All species	596,872	9,912	22,841	46,718	61,018	75,188	58,243	71,049	84,915	140,186	26,801	--
Select red oaks												
Northern red oak	251,298	4,356	4,212	14,090	25,033	26,730	29,799	36,854	24,002	68,794	17,430	--
All species	251,298	4,356	4,212	14,090	25,033	26,730	29,799	36,854	24,002	68,794	17,430	--
Other white oaks												
Post oak	715	--	382	333	--	--	--	--	--	--	--	--
All species	715	--	382	333	--	--	--	--	--	--	--	--
Other red oaks												
Northern pin oak	26,730	580	771	1,035	5,827	1,626	5,047	2,719	1,895	7,230	--	--
Shingle oak	26,166	3,550	4,211	4,622	1,682	2,733	2,453	5,039	1,876	--	--	--
Pin oak	22,484	431	624	327	1,631	752	--	4,947	2,698	3,671	7,404	--
Black oak	82,305	2,144	3,663	7,899	9,058	17,918	14,420	9,616	9,976	7,611	--	--
All species	157,685	6,705	9,269	13,884	18,198	23,028	21,919	22,320	16,445	18,512	7,404	--
Hickory												
Bitternut hickory	69,096	7,850	12,616	11,352	11,516	11,321	2,597	5,983	2,369	3,491	--	--
Pignut hickory	1,843	--	454	418	--	970	--	--	--	--	--	--
Shagbark hickory	146,153	14,512	23,041	24,333	26,678	23,582	14,089	7,181	6,591	6,146	--	--
Mockernut hickory	1,677	589	--	483	--	604	--	--	--	--	--	--
All species	218,768	22,951	36,111	36,587	38,194	36,477	16,686	13,164	8,959	9,637	--	--
Yellow birch												
Yellow birch	--	--	--	--	--	--	--	--	--	--	--	--
All species	--	--	--	--	--	--	--	--	--	--	--	--
Hard maple												
Black maple	35,451	2,200	3,527	6,516	8,672	3,586	5,076	5,875	--	--	--	--
Sugar maple	51,056	2,754	5,759	4,229	5,336	2,623	6,383	7,278	7,617	9,076	--	--
All species	86,507	4,954	9,286	10,745	14,008	6,209	11,459	13,153	7,617	9,076	--	--
Soft maple												
Red maple	1,382	--	--	665	717	--	--	--	--	--	--	--
Silver maple	295,665	5,062	10,656	21,497	29,708	40,433	35,608	30,716	44,490	44,917	32,578	--
All species	297,046	5,062	10,656	22,162	30,425	40,433	35,608	30,716	44,490	44,917	32,578	--
Ash												
White ash	45,924	2,672	5,665	9,259	4,056	11,324	3,180	--	2,459	--	7,308	--
Black ash	2,947	329	410	--	--	1,052	--	1,156	--	--	--	--
Green ash	59,278	5,175	7,763	10,688	5,876	10,178	9,570	5,595	4,432	--	--	--
All species	108,149	8,176	13,838	19,947	9,932	22,554	12,751	6,751	6,891	--	7,308	--

(Table 7 continued on next page)



(Table 7 continued)

Species group/ species	Diameter class (inches at breast height)											29.0+
	All classes	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		
<b>Hardwoods</b>												
Cottonwood and aspen												
Eastern cottonwood	324,835	531	3,146	7,260	12,765	17,223	8,954	18,006	26,189	103,744	127,018	
Bigtooth aspen	16,175	434	476	1,958	3,747	1,631	6,019	1,910	--	--	--	
Quaking aspen	3,218	341	1,732	440	704	--	--	--	--	--	--	
All species	344,228	1,307	5,354	9,657	17,216	18,854	14,973	19,916	26,189	103,744	127,018	
Basswood												
American basswood	146,548	5,411	10,998	11,901	11,794	16,656	15,782	25,130	10,403	38,472	--	
All species	146,548	5,411	10,998	11,901	11,794	16,656	15,782	25,130	10,403	38,472	--	
Black walnut												
Black walnut	205,130	5,547	9,701	17,672	27,577	38,694	38,559	29,429	11,246	26,706	--	
All species	205,130	5,547	9,701	17,672	27,577	38,694	38,559	29,429	11,246	26,706	--	
Other eastern soft hardwoods												
Boxelder	22,100	2,666	3,372	5,007	3,639	2,496	2,195	--	--	2,725	--	
Ohio buckeye	8,128	796	370	1,106	582	2,095	1,156	2,023	--	--	--	
River birch	3,389	316	835	288	--	773	1,177	--	--	--	--	
Paper birch	2,804	358	--	284	--	920	1,242	--	--	--	--	
Northern catalpa	217	217	--	--	--	--	--	--	--	--	--	
Hackberry	143,682	10,323	14,586	24,239	14,147	21,015	22,573	14,230	6,384	16,186	--	
Butternut	1,179	61	290	--	--	828	--	--	--	--	--	
American sycamore	3,763	327	346	313	--	--	--	--	--	2,778	--	
Black cherry	34,909	3,980	5,092	7,584	5,896	6,056	4,472	1,831	--	--	--	
Black willow	14,916	346	843	1,561	536	1,930	--	5,067	2,315	2,319	--	
White willow	145	--	145	--	--	--	--	--	--	--	--	
American elm	167,699	23,524	30,132	26,099	17,243	22,617	20,539	10,084	5,449	12,013	--	
Siberian elm	5,877	445	939	304	--	--	1,321	--	--	2,867	--	
Slippery elm	78,006	8,584	10,050	11,009	10,873	14,703	8,342	4,831	2,219	7,395	--	
All species	486,812	51,943	66,998	77,794	52,914	73,432	63,015	38,066	16,366	46,282	--	
Other eastern hard hardwoods												
Common persimmon	--	--	--	--	--	--	--	--	--	--	--	
Honeylocust	58,925	4,458	5,904	8,369	8,250	11,966	7,976	4,895	7,107	--	--	
Red mulberry	3,237	1,054	443	667	1,073	--	--	--	--	--	--	
Black locust	30,591	1,728	2,750	4,580	2,714	5,120	6,343	2,453	2,111	2,792	--	
Rock elm	115	115	--	--	--	--	--	--	--	--	--	
All species	92,868	7,355	9,097	13,616	12,038	17,086	14,319	7,348	9,218	2,792	--	
Total hardwoods	2,992,627	133,679	208,743	295,104	318,347	395,340	333,115	313,897	266,743	509,120	218,539	
All species groups	3,024,390	139,677	214,317	303,519	323,189	401,212	334,177	313,897	266,743	509,120	218,539	

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, Iowa, 2000-2004

(In thousand board feet)<sup>1</sup>

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+	
<b>Eastern white and red pines</b>										
Red pine	3,416	1,247	2,169	--	--	--	--	--	--	--
All species	3,416	1,247	2,169	--	--	--	--	--	--	--
<b>Other eastern softwoods</b>										
Eastern redcedar	82,550	39,813	20,248	17,589	4,901	--	--	--	--	--
Larch spp.	1,790	1,790	--	--	--	--	--	--	--	--
Ponderosa pine	16,269	2,819	2,183	11,268	--	--	--	--	--	--
All species	100,610	44,422	22,431	28,856	4,901	--	--	--	--	--
Total softwoods	104,026	45,669	24,600	28,856	4,901	--	--	--	--	--
<b>Hardwoods</b>										
<b>Select white oaks</b>										
White oak	1,282,313	--	187,114	235,052	182,052	187,873	198,334	266,403	25,485	--
Swamp white oak	12,669	--	2,997	--	--	9,672	--	--	--	--
Bur oak	1,064,532	--	106,707	126,604	93,192	132,793	187,609	339,532	78,096	--
Chinkapin oak	2,090	--	2,090	--	--	--	--	--	--	--
All species	2,361,604	--	298,908	361,657	275,244	330,337	385,942	605,935	103,581	--
<b>Select red oaks</b>										
Northern red oak	1,114,887	--	124,029	133,386	149,119	183,948	118,974	328,660	76,780	--
All species	1,114,887	--	124,029	133,386	149,119	183,948	118,974	328,660	76,780	--
<b>Other red oaks</b>										
Northern pin oak	118,327	--	28,913	8,086	25,007	13,558	9,258	33,505	--	--
Shingle oak	67,802	--	8,278	13,556	12,091	24,791	9,085	--	--	--
Pin oak	94,638	--	8,025	3,717	--	24,219	12,905	16,906	28,867	--
Black oak	338,613	--	45,098	89,125	71,532	47,154	48,998	36,706	--	--
All species	619,380	--	90,314	114,485	108,630	109,721	80,248	87,117	28,867	--
<b>Hickory</b>										
Bitternut hickory	185,484	--	57,255	56,426	12,918	29,772	11,714	17,399	--	--
Pignut hickory	4,838	--	--	4,838	--	--	--	--	--	--
Shagbark hickory	408,411	--	129,009	114,351	68,225	34,880	32,047	29,899	--	--
Mockernut hickory	2,922	--	--	2,922	--	--	--	--	--	--
All species	601,655	--	186,264	178,537	81,143	64,652	43,761	47,298	--	--
<b>Hard maple</b>										
Black maple	110,408	--	41,284	16,934	24,208	27,982	--	--	--	--
Sugar maple	179,322	--	25,501	12,468	30,439	34,475	35,630	40,809	--	--
All species	289,730	--	66,786	29,402	54,648	62,456	35,630	40,809	--	--
<b>Soft maple</b>										
Red maple	3,113	--	3,113	--	--	--	--	--	--	--
Silver maple	1,112,082	--	128,828	177,048	156,383	134,767	194,389	192,336	128,321	--
All species	1,115,195	--	131,941	177,048	156,383	134,767	194,389	192,336	128,321	--
<b>Ash</b>										
White ash	127,120	--	18,294	52,510	14,983	--	11,733	--	29,600	--
Black ash	10,385	--	--	4,895	--	5,490	--	--	--	--
Green ash	166,677	--	26,591	47,268	45,040	26,626	21,152	--	--	--
All species	304,182	--	44,885	104,673	60,022	32,116	32,885	--	29,600	--
<b>Cottonwood and aspen</b>										
Eastern cottonwood	1,476,632	--	59,704	82,969	43,946	89,967	132,811	516,580	550,656	--
Bigtooth aspen	64,604	--	17,311	7,922	29,831	9,540	--	--	--	--
Quaking aspen	3,423	--	3,423	--	--	--	--	--	--	--
All species	1,544,659	--	80,438	90,891	73,776	99,506	132,811	516,580	550,656	--
<b>Basswood</b>										
American basswood	582,553	--	59,684	83,860	78,858	124,345	51,042	184,764	--	--
All species	582,553	--	59,684	83,860	78,858	124,345	51,042	184,764	--	--
<b>Black walnut</b>										
Black walnut	811,414	--	132,833	187,130	184,714	137,757	52,165	116,815	--	--
All species	811,414	--	132,833	187,130	184,714	137,757	52,165	116,815	--	--

(Table 8 continued on next page)

(Table 8 continued)

Species group/ species	Diameter class (inches at breast height)									
	All classes	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+	
<b>Hardwoods</b>										
Other eastern soft hardwoods										
Boxelder	50,232	--	16,764	11,470	10,040	--	--	11,958	--	
Ohio buckeye	26,666	--	2,672	9,588	5,295	9,112	--	--	--	
River birch	8,950	--	--	3,538	5,412	--	--	--	--	
Paper birch	9,949	--	--	4,247	5,701	--	--	--	--	
Hackberry	417,802	--	66,086	96,113	102,031	62,305	27,195	64,072	--	
Butternut	3,840	--	--	3,840	--	--	--	--	--	
American sycamore	12,443	--	--	--	--	--	--	12,443	--	
Black cherry	83,546	--	27,183	27,771	20,375	8,217	--	--	--	
Black willow	52,830	--	2,343	8,476	--	22,620	10,225	9,166	--	
American elm	394,471	--	80,831	103,634	92,374	44,721	23,209	49,702	--	
Siberian elm	17,800	--	--	--	5,885	--	--	11,915	--	
Slippery elm	218,168	--	50,622	67,902	37,644	21,029	9,568	31,402	--	
All species	1,296,697	--	246,500	336,579	284,758	168,005	70,196	190,658	--	
Other eastern hard hardwoods										
Honeylocust	182,640	--	37,916	54,657	36,377	22,093	31,597	--	--	
Red mulberry	4,977	--	4,977	--	--	--	--	--	--	
Black locust	98,242	--	12,516	23,604	29,086	11,187	9,500	12,349	--	
All species	285,858	--	55,408	78,260	65,463	33,280	41,097	12,349	--	
Total hardwoods	10,927,824	--	1,517,989	1,875,909	1,572,757	1,480,892	1,239,151	2,323,321	917,806	
<b>All species groups</b>	<b>11,031,850</b>	<b>45,669</b>	<b>1,542,589</b>	<b>1,904,765</b>	<b>1,577,658</b>	<b>1,480,892</b>	<b>1,239,151</b>	<b>2,323,321</b>	<b>917,806</b>	

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.

<sup>1</sup> 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, Iowa, 2000-2004  
(in thousand dry tons)

Owner category and softwood/hardwood category	Tree biomass component											
	All components			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	Total	Boles	Stumps, tops, and limbs
<b>Public</b>												
Softwoods	201	54	85	62	23	44	62	44	17			
Hardwoods	13,918	850	10,992	8,179	2,812	569	2,077	1,508	569			
Total	14,118	904	11,076	8,241	2,835	586	2,138	1,552	586			
<b>Private</b>												
Softwoods	916	103	574	415	158	69	239	170	69			
Hardwoods	93,183	4,978	64,042	46,898	17,144	6,365	24,163	17,797	6,365			
Total	94,098	5,081	64,615	47,313	17,302	6,434	24,401	17,967	6,434			
<b>All ownerships</b>												
Softwoods	1,116	157	658	477	181	86	301	214	86			
Hardwoods	107,100	5,828	75,033	55,077	19,956	6,934	26,239	19,305	6,934			
Total	108,217	5,985	75,692	55,554	20,137	7,021	26,540	19,519	7,021			

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

Table 10. -- Average annual net growth of growing stock on timberland by species group and owner category, Iowa, 1999 to 2004

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
<b>Softwoods</b>				
Other eastern softwoods	748	-123	870	--
Total softwoods	748	-123	870	--
<b>Hardwoods</b>				
Select white oaks	32,722	3,464	29,257	--
Select red oaks	6,141	682	5,459	--
Other red oaks	10,765	3,338	7,426	--
Hickory	10,178	1,789	8,389	--
Hard maple	2,210	97	2,114	--
Soft maple	19,474	5,064	14,411	--
Ash	9,408	2,170	7,239	--
Cottonwood and aspen	14,271	2,051	12,220	--
Basswood	9,342	4,298	5,044	--
Black walnut	14,985	217	14,768	--
Other eastern soft hardwoods	18,924	3,731	15,193	--
Other eastern hard hardwoods	10,471	4	10,467	--
Total hardwoods	158,891	26,904	131,987	--
<b>All species groups</b>	159,639	26,781	132,858	--

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 11. -- Average annual removals of growing stock on timberland by species group and owner category, Iowa, 1999 to 2004

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
<b>Hardwoods</b>				
Select red oaks	1,840	--	1,840	--
Soft maple	--	--	--	--
Black walnut	701	--	701	--
Other eastern soft hardwoods	3,939	--	3,939	--
Other eastern hard hardwoods	112	--	112	--
Total hardwoods	6,591	--	6,591	--
<b>All species groups</b>	6,591	--	6,591	--

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 12. -- Average annual mortality of growing stock on timberland by species group and owner category, Iowa, 1999 to 2004

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
<b>Softwoods</b>				
Other eastern softwoods	80	--	80	--
Total softwoods	80	--	80	--
<b>Hardwoods</b>				
Select white oaks	683	90	593	--
Select red oaks	683	--	683	--
Other red oaks	924	--	924	--
Hickory	1,480	--	1,480	--
Soft maple	--	--	--	--
Ash	158	158	--	--
Cottonwood and aspen	3,364	--	3,364	--
Basswood	639	--	639	--
Black walnut	735	--	735	--
Other eastern soft hardwoods	17,144	289	16,855	--
Other eastern hard hardwoods	--	--	--	--
Total hardwoods	25,809	536	25,273	--
<b>All species groups</b>	25,889	536	25,353	--

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.

Crocker, Susan J.; Moser, W. Keith; Brand, Gary J.; Flickinger, Aron.

2006. Iowa's forest resources in 2004. Resour. Bull. NC-263. St. Paul, MN: U.S.

Department of Agriculture, Forest Service, North Central Research Station. 34 p.

Reports analysis of data for five annual panels (2000–2004) of inventory of Iowa's forest resources and one panel (1999 to 2004) of growth, removals, and mortality. Includes information on forest area, number of trees, volume, biomass, growth, removals, mortality, and forest health.

**KEY WORDS:** Annual inventory, forest land, timberland, forest type, volume, biomass, growth, removals, mortality, forest health, Iowa







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