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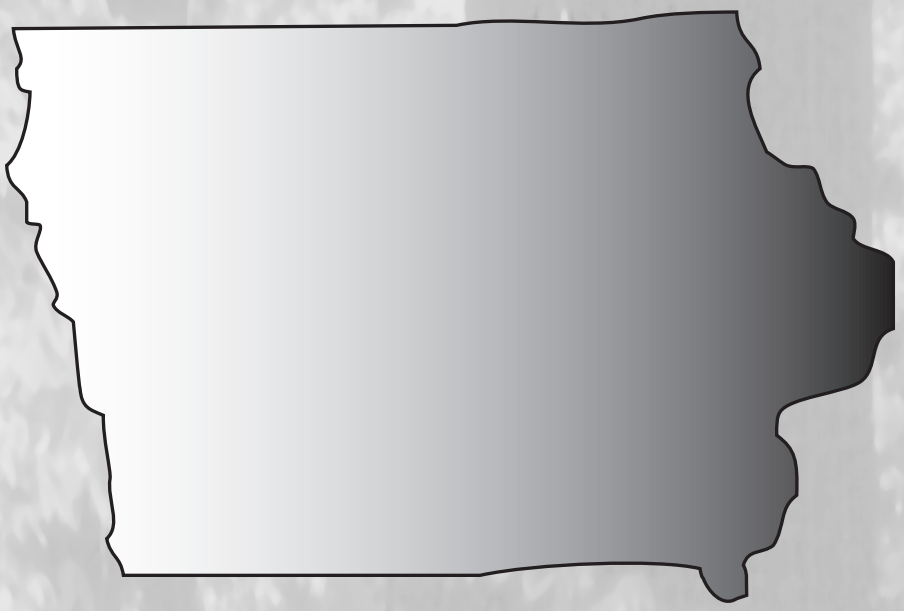
Iowa's Forest Resources in 2005

Susan J. Crocker, Gray J. Brand, and Aron Flickinger



Abstract

This report presents Iowa's annual inventory results for 2005. Estimates show that Iowa has more than 2.8 million acres of forest land. Total live-tree volume on forest land is 4.0 billion cubic feet (ft^3). Ninety-eight percent of forest land is classified as timberland. Oak/hickory is the predominant forest-type group, representing 54 percent of timberland area. Growing-stock volume has risen to an estimated 3.1 billion ft^3. Live-tree aboveground biomass is 112 million dry tons. In general, Iowa's forests are healthy. However, diseases, including white oak decline and Dutch elm disease, and the threat of invasion from exotic species such as emerald ash borer and nonnative plants are a concern when assessing the health of Iowa's forests.

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Iowa's Forest Resources, 2005

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INTRODUCTION

The forest resources of Iowa are annually inventoried by the Northern Research Station's Forest Inventory and Analysis (NRS-FIA) program. Annual inventory is based on data from a set of field plots that are systematically located across the entire state. Each year, a new panel consisting of one-fifth of the total field plots is measured and combined with four previously measured panels. From these "moving average" estimates, annual inventories are available for each year since 2003, providing yearly estimates for such variables as area, volume, and biomass. Estimates for components of change (growth, removals, and mortality) are based on remeasured plots. For this report, estimates of growth, removals, and mortality were calculated using two panels of plots measured in 1999 and 2000, and then remeasured in 2004 and 2005.

Reported estimates are based on sampling and estimation techniques of Bechtold and Patterson (2005). All of the tables in this report and many others can be generated at the Mapmaker Program at http://nrs.fs.fed.us/fia/data-tools/mapping-tools/default.asp.

RESULTS

Area

There are approximately 35.7 million acres of land in Iowa (U.S. Census Bureau 2006). Eight percent of the state's total land area, or more than 2.8 million acres, is forest land[1] (Table 1).

Forest land has three components:

1. Timberland[2]—land that is not restricted from harvesting by statute, administrative regulation, or designation and is capable of growing trees at a rate of 20 cubic feet (ft^3) per acre per year.

2. Reserved forest land—land that is restricted from harvesting by statute, administrative regulation, or designation (e.g., state parks, national parks and lakeshores, and federal wilderness areas).

3. Other forest land—land that is not capable of growing trees at a rate of 20 ft^3/ac/yr and is not restricted from harvesting.

Timberland totals 2.8 million acres and accounts for 98 percent of forest land (Table 2). The remaining 2 percent (55.2 thousand acres) of forest land is classified as reserved or other forest land.

Timberland area declined in the late 1950's and continued to do so through the early 1970's. A record low was recorded in 1974 when timberland was an estimated 1.4 million acres (Fig. 1). Since the 1974 inventory, the area of Iowa timberland has steadily increased. This rebound coincided with the decline of the farm economy in the 1970's and 1980's. During this time, pastures and marginal agricultural lands reverted to timberland. Timberland area also increased as a result of the reestablishment of trees in riparian zones and the action of initiatives such as the Conservation Reserve Program. In 2003, the area of timberland surpassed the acreage present in 1954 (Fig. 1). The expansion of timberland continues as the 2005 estimate shows an increase in total area since 2003.

[1] *Forest land is land that is at least 10-percent stocked with trees of any size, or that formerly had such tree cover and is not currently developed for a 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.*

[2] *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 on owner decisions that consider economic, environmental, and social factors.*

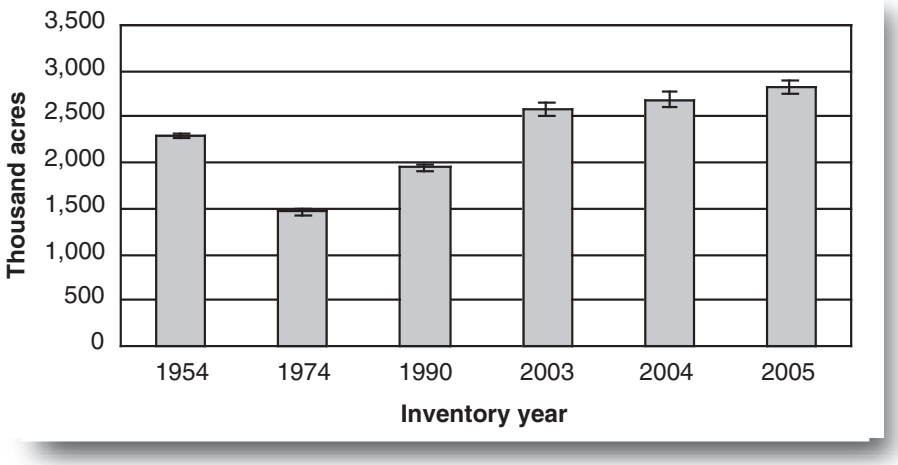

Figure 1.—*Area of timberland by inventory year, Iowa, 1954-2005 (the sampling error associated with each inventory estimate represents a 67-percent confidence interval and is depicted by the vertical line at the top of each bar).*

Private owners hold nearly 9 of every 10 acres of Iowa timberland (Table 2). The remaining area (312 thousand acres) is publicly owned. Public ownership ensures that people will have access to forest recreation opportunities and helps protect wildlife habitat and watershed quality.

Ninety-six percent of Iowa's timberland is composed of hardwoods (Table 2). The state's timberland is primarily oak/hickory (54 percent), though elm/ash/cottonwood (24 percent) and maple/basswood[3] forest-type groups (14 percent) are also large components of overall species composition (Table 3, Fig. 2). In the oak/hickory forest-type group, the white oak/red oak/hickory forest type (555 thousand acres) and the mixed upland hardwoods forest type (510 thousand acres) predominate. Within the elm/ash/cottonwood group, the sugarberry/ hackberry/elm/green ash forest type (324 thousand acres) occupies the largest area. The sugar maple/yellow birch[4] (148 thousand acres) and hard maple/basswood (149 thousand acres) forest types dominate the maple/basswood forest-type group (Table 3).

[3] *The maple/basswood forest-type group is regionally specific and equivalent to the maple/beech/birch forest-type group found in the core tables. Forest-type groupings in the core tables are nationally standardized to maintain consistency and allow comparisons across states.*

[4] *The sugar maple/yellow birch forest type is equivalent to the sugar maple/beech/yellow birch forest-type group found in the core tables. Forest types in the core tables are nationally standardized to maintain consistency and allow comparisons across states.*

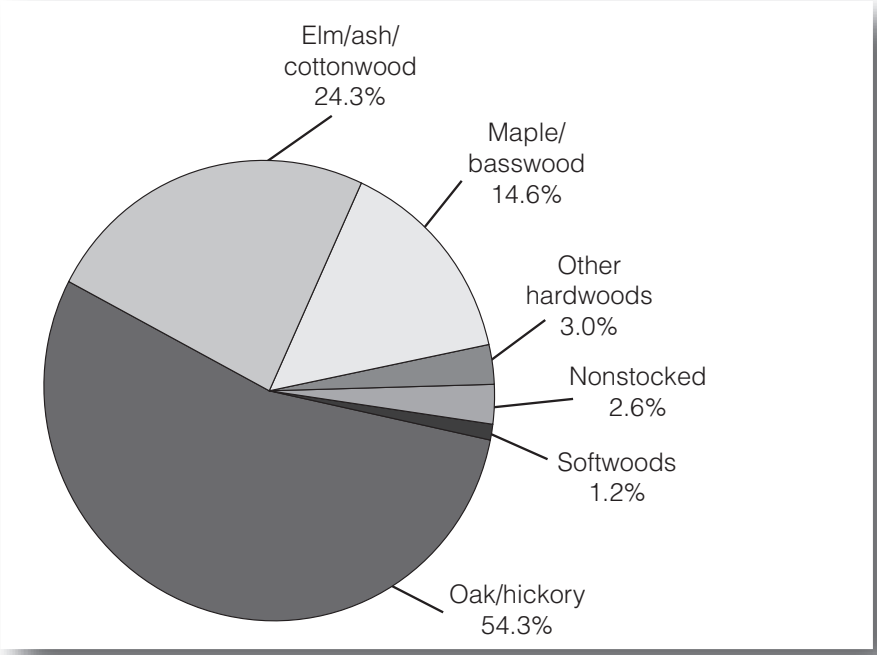

Figure 2.—*Percentage of timberland by forest-type group, Iowa, 2001-2005 (the maple/basswood forest-type group is regionally specific and is equivalent to the maple/beech/birch forest-type group; Iowa is outside of the native range of beech).*

Softwood forest types make up only 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 (33.1 thousand acres) of total timberland area, this species is often mixed with hardwoods in the eastern redcedar/hardwood forest type. Overall, eastern redcedar has a significant presence as it is found on an estimated 95.1 thousand acres of Iowa timberland (Table 3). The remaining 3 percent of timberland is nonstocked.[5]

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 classes: sawtimber—large trees, softwoods at least 9 inches in diameter at breast height (d.b.h.) and hardwoods at least 11 inches in d.b.h.; poletimber—medium trees, 5 inches in d.b.h. to sawtimber size; and sapling/seedling—small trees, 1 to 5 inches in d.b.h., or live trees less than 1 inch in d.b.h. that are expected to survive. In 2005, most of Iowa's timberland area was composed of large diameter trees. Sawtimber stands accounted for 64 percent of timberland area (Fig. 3, Table 3). Poletimber and sapling/seedling stands represented 21 and 12 percent, respectively; remaining timberland was nonstocked.

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

Volume

Total net volume of live trees on forest land is 4.0 billion ft^3, or 1,424 ft^3/ac of forest land (Table 4). Net volume is gross volume less deductions for rot, sweep, or other defects affecting use for timber products, and 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 volume of live trees on forest land is in hardwoods; 31 percent of live-tree volume is in oak species, primarily bur, white, and northern red oaks (Table 4).

Ninety-eight percent of live-tree volume is on timberland (Table 5); 77 percent of this volume is in growing-stock trees. Growing-stock volume has traditionally been used to ascertain wood volume that is useful for commercial

[5] *Nonstocked land is timberland that is less than 10-percent stocked with live trees.*

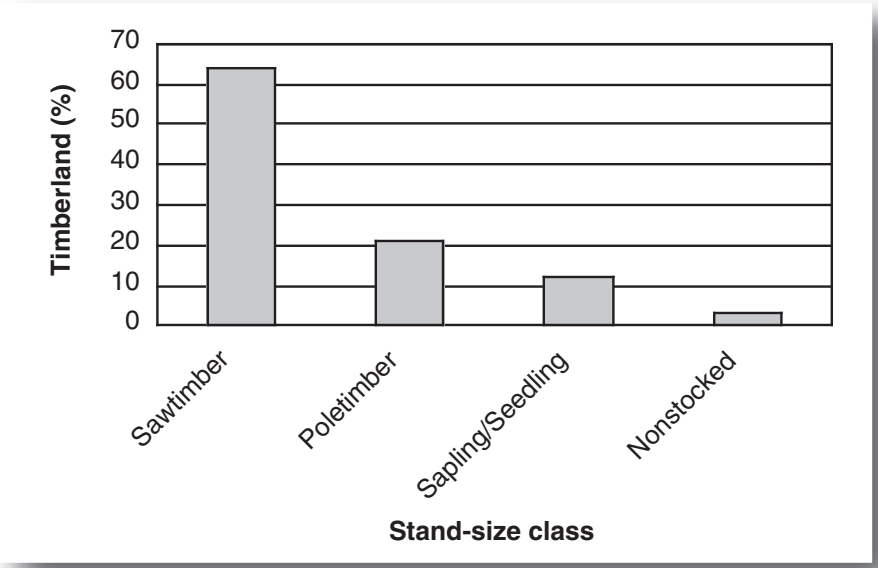

Figure 3.—*Stand-size class as a percentage of total timberland area, Iowa, 2001-2005.*

purposes. It is the amount of solid wood in commercial trees 5 inches in d.b.h. or larger, measured from a 1-foot stump to a minimum 4-inch diameter top, with deductions for poor form or defect. Excluded are rough, rotten, and dead trees, and trees of noncommercial species.

Growing-stock volume on Iowa's timberland has been on the rise since 1974, gradually increasing each year since 2003 (Fig. 4). Nearly doubling from 1.6 billion ft^3 in 1990, the estimate of growing-stock volume for 2005 is 3.1 billion ft^3 (Fig. 4). This increase reflects a forest in which larger trees continue to increase in volume.

Slightly more than half of total growing-stock volume is in the oak/hickory forest-type group (Table 6). The oak/hickory, elm/ash/cottonwood, and maple/basswood forest-type groups account for 99 percent of all growing-stock volume. Growing-stock volume present in softwood forest types is 5.7 million ft^3, or less than 0.2 percent of total growing-stock volume. However, growing-stock volume for all softwood species is 18.1 million ft^3 (slightly more than 0.5 percent of Iowa's total growing-stock volume) because softwoods sometimes make up a portion of hardwood stands.

Seventy-eight percent of total growing-stock volume is in trees that are 11 inches or larger in d.b.h. (Table 7). Twenty-four percent of total growing-stock volume is in trees that are greater than or equal to 21 inches in d.b.h.; 38 percent of this volume is in various oak species. Sixty-six percent of eastern cottonwood growing-stock volume is in trees 21 inches d.b.h. or larger. Additionally, cottonwood volume is 30 percent of total growing-stock volume in trees 21 inches or larger in d.b.h. (Table 7).

Sawtimber volume is the volume of the sawlog portion of growing-stock trees of sawtimber size expressed in board feet (International 1/4-inch rule). Iowa sawtimber volume totals 11.3 billion board feet (Table 8). Virtually all of Iowa sawtimber volume is in hardwood trees; less than 1 percent of sawtimber volume comes from softwoods. Six species account for 62 percent of the sawtimber volume in Iowa: eastern cottonwood (1.4 billion board feet); silver maple, white oak, and bur oak (1.2 billion board feet each); northern red oak (1.0 billion board feet); and black walnut (864 million board feet) (Table 8). Of total sawtimber volume, 29 percent is in trees 21 inches or larger in d.b.h. Eastern cottonwood accounts for 31 percent of volume of sawtimber trees 21 inches or larger in d.b.h. (Table 8).

Twenty-three percent of live-tree volume on timberland (930 million ft^3) is in cull trees (Table 5). Cull trees are unsuitable for use as wood products due to poor form, rot, defect, or because they are considered an undesirable species. Cull volume is often used for commercial purposes. For instance, rough trees are sometimes harvested for chipping or making pallets. Salvable dead trees, standing or down

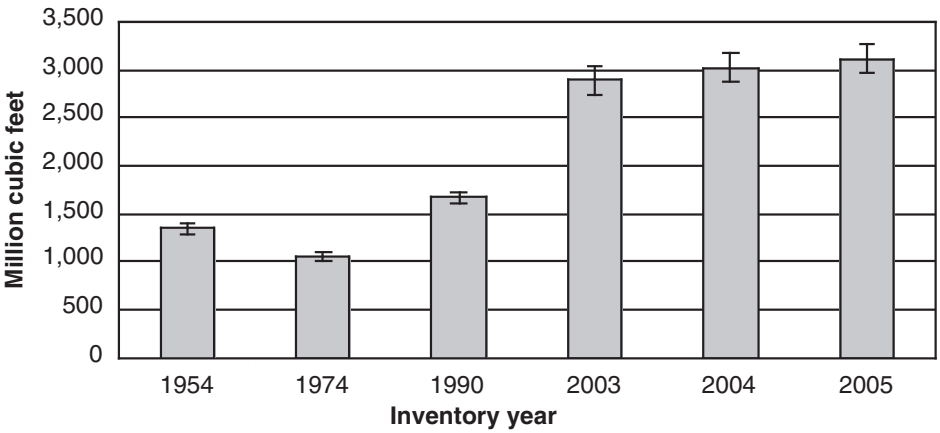

Figure 4.—*Growing-stock volume on timberland, Iowa, 1954-2005 (the sampling error associated with each inventory estimate represents a 67-percent confidence interval and is depicted by the vertical line at the top of each bar).*

dead trees that are considered merchantable by regional standards, make up an estimated 57.4 million ft^3 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 related to carbon sequestration, wood fiber availability for fuels, and assessment of fuel loads in forest stands. Live-tree aboveground biomass was estimated for growing-stock and nongrowing-stock trees, and live trees 1 to 5 inches in d.b.h. (Table 9). In 2005, live-tree aboveground biomass on Iowa's timberland was an estimated 112 million dry tons (an average of 39 dry tons/ac of timberland). Ninety-nine percent or 111 million dry tons of biomass was in hardwood species. Sixty-nine percent of live-tree aboveground biomass was in growing-stock trees, 26 percent in nongrowing-stock trees, and 5 percent in trees 1 to 5 inches in d.b.h. For both growing-stock and nongrowing-stock trees, nearly 75 percent of total aboveground biomass was in the boles of trees; the remainder was in stumps, tops, and limbs (Table 9).

Growth, Removals, and Mortality

Estimates of growth, removals, and mortality provide information on changes and trends in forest resources over time.

Net growth (gross growth minus mortality) of growing stock on Iowa's timberland increased by an average of 141 million ft^3/yr (Table 10). Virtually all (99 percent or 139 million ft^3) of annual net growth was in hardwoods. The majority of hardwood growth occurred in the select white oaks (24.7 million ft^3/yr) and other eastern soft hardwoods species groups (23.3 million ft^3/yr) (Table 10). Softwoods accounted for the remaining 1 percent of net growth. Seventy-nine percent of net annual growth for all species groups was on private land (Table 10).

Average annual removals of growing stock on timberland totaled 18.2 million ft^3/yr, or 13 percent of annual net growth (Table 11). Eighty-five percent of annual removals occurred within five species groups: black walnut (4.2 million ft^3/yr), select red oaks (3.3 million ft^3/yr), select white oaks (3.2 million ft^3/yr), other eastern soft hardwoods (2.4 million ft^3/yr), and other red oaks (2.3 million ft^3/yr) (Table 11). The reported estimates may not yet provide a true depiction of removals because only two inventory panels have been remeasured. The remeasurement of additional panels will yield more definitive results.

Making up 16 percent of annual net growth, average annual mortality of growing stock on timberland was 23.1 million ft^3/yr (Table 12). Nearly 100 percent of total mortality was among hardwoods. The other eastern soft hardwoods group had the highest mortality at 11.9 million ft^3/yr, or 51 percent of total mortality (Table 12). Most of the mortality in the other eastern soft hardwoods group is likely due to a statewide outbreak of Dutch elm disease. The oak species groups accounted for 20 percent of total average annual mortality; within oak species groups, select white oaks had the highest mortality at 3.1 million ft^3/yr (Table 12). Oak mortality in Iowa is generally caused by oak wilt and white oak decline.

FOREST HEALTH

The following information about the pathogens and insects affecting Iowa's forests was obtained from staff at the Iowa Department of Natural Resources (DNR) and the Forest Service's Northeastern Area, State and Private Forestry. Additional information was gathered from the national Forest Health Monitoring (FHM) program webpage (http://fhm.fs.fed.us/), 2005 Insect and Disease Conditions Report (http://www.na.fs.fed.us/fhp/pcond/), and Central States Forest Health Watch newsletter (http://www.na.fs.fed.us/fhp/fhw/csfhw/). Several issues of concern in 2005 are highlighted below. For more information on the health of Iowa's forests, contact the Iowa DNR.

Dutch Elm Disease

Dutch elm disease (DED) continues to affect the structure and health of Iowa forests. Aerial surveys conducted along the Des Moines, Iowa, Cedar, and Mississippi Rivers detected DED on 1,362 acres in 27 counties in central and western Iowa. The highest incidences were in Black Hawk, Louisa, Clinton, and Buchanan Counties. DED affects all species of elm, but American elm is particularly susceptible; trees are often killed before reaching sawtimber size, so maturing stands present a future health risk.

DED is caused by the fungi *Ophiostoma ulmi* and *O. novo-ulmi.* Infected tree branches clog water-conducting tissues in an attempt to stop fungal growth and as a result, prevent water from reaching the crown. Leaves then wilt and die, causing tree death. The DED fungus is spread to healthy trees in two ways. Long-distance dispersal occurs when elm bark beetles pick up fungal spores in diseased trees and carry them to healthy trees. Spores are deposited as beetles feed in twig crotches or as they bore through the inner bark and sapwood. Local spread occurs through root grafts, which allow the fungus to readily move between neighboring trees. For more information on DED, see Haugen (1998) or http://www.na.fs.fed.us/spfo/pubs/howtos/ht_ded/ht_ded.htm.

Gypsy Moth

Since its introduction to North America in 1869, gypsy moth has become widespread in the Eastern United States. Its distribution stretches south from Massachusetts to Virginia and west to Wisconsin and Illinois (USDA Animal and Plant Health Inspection Service 2006). A pest of numerous species of trees and shrubs, including oaks, basswood, cottonwood, and willow, gypsy moth defoliates nearly 1 million acres a year (McManus et al. 1992). Iowa does not have an established gypsy moth population, but concern is increasing as recent surveys have identified established moth populations in neighboring Wisconsin. In response to the growing threat of gypsy moth invasion, monitoring has been intensified through the collaborative efforts of the Iowa Department of Agriculture and Land Stewardship, USDA Animal and Plant Health Inspection Service, Iowa DNR, Eastern Iowa City Foresters, and numerous volunteers. In 2005, approximately 5,000 insect traps placed throughout the state yielded 4 moths. The 2005 trap catch represents a dramatic decrease since the 2003 capture of 159 moths and the fewest moths captured in Iowa in 16 years. Decreases in the number of gypsy moth captured in Iowa are likely due to a combination of environmental factors and the recent success of the national "Slow the Spread" program in Wisconsin and Illinois.

Oak Wilt

A significant contributor to oak mortality, especially in southeastern Iowa, oak wilt has been identified as the most serious disease affecting Central States forests. All species of oak are susceptible to oak wilt, but the disease occurs more frequently and progresses more rapidly in red oak species. Oak wilt is caused by the fungus *Ceratocystis fagacearum*. As with DED, the fungus enters the vascular system of trees. In an attempt to block fungal growth, the tree plugs water-conducting tissues, which disrupts the translocation of water from the roots to the crown. This disruption causes the foliage to wilt and die. Rapid progression of the disease results in tree mortality within a year of initial infection. As there is no cure for oak wilt, prevention and early detection are important means of sustaining tree health.

C. fagacearum can spread through root grafts or be transported from a diseased tree to a healthy tree by sap-feeding beetles carrying fungal spores. Spread of the fungus through the root system is inhibited by mechanically breaking natural root grafts that have formed between diseased and healthy trees. Overland spread can be reduced by removing dead or dying oaks before fungal mats, which contain spores, are produced. Effective fungal mats only form during the first spring following tree death, and only if there is adequate moisture in the bark; for this reason, dead trees should be removed and treated before fungal mats form. Standing dead trees left longer than 1 year can be left without posing further risk of fungal spread. Injury and fresh pruning

wounds attract sap-feeding beetles, so unnecessary pruning, and pruning between April 15 and July 1 should be avoided. Additional information on the biology and control of oak wilt can be found in O'Brien et al. (2000), available at http://www.na.fs.fed.us/spfo/pubs/howtos/ht_oakwilt/toc.htm.

White Oak Decline

In recent years there has been an increase in the amount of mature standing-dead white oak in northeastern Iowa woodlands. The cause of this white oak decline and mortality has yet to be identified. Researchers from the Iowa DNR and the Forest Service are investigating this decline complex. Aerial surveys conducted in 2005 revealed that the combined area affected by white oak decline and oak wilt totaled 1,422 acres.

Sudden Oak Death

Phytophthora ramorum is the causal agent of sudden oak death (SOD). Hosts of *P. ramorum* include many species of oaks, Douglas-fir, *Rhododendron* spp., and a variety of other trees and shrubs. On oaks, *P. ramorum* causes bleeding cankers along the stem. Cankered trees can survive for several years after infection. However, mortality occurs within weeks of the onset of crown dieback (O'Brien et al. 2002). SOD was identified in the United States in 1995. While transported via nursery stock to states outside of the West Coast, established populations of *P. ramorum* are known to occur only in California and southwestern Oregon. Because transportation of infected nursery stock is a major threat to central and eastern hardwood forests (O'Brien et al. 2002), the Iowa DNR targeted nurseries that have received California nursery stock that may have been infected, and established transects in forested areas to monitor for established populations. All samples collected in Iowa tested negative for the SOD pathogen. For more information, please visit the California Oak Mortality Task Force webpage, www.suddenoakdeath.org.

Emerald Ash Borer

Emerald ash borer (EAB), an exotic inner bark-boring beetle, was discovered in the United States in 2002. From its introduction point in southeastern Michigan, this insect has spread throughout Lower Michigan and into Ohio and Indiana; in 2006, during the writing of this report, EAB was positively identified in Maryland and northeastern Illinois. EAB attacks and kills all species of ash, including green, white, and black ash. Larval feeding and gallery production in the phloem and outer sapwood sever the flow of nutrients and girdle the tree, causing tree death. Mortality occurs within 1 to 3 years of initial infestation. Since its discovery, EAB has killed millions of ash trees. Natural spread of EAB has been enhanced by human-assisted transportation of infested firewood and nursery stock. Detection monitoring programs for EAB were initiated in Iowa in 2004. Continued in 2005, visual surveys conducted in all 99 Iowa counties and trap tree inspection failed to detect EAB. More information about EAB can be found at http://www.emeraldashborer.info.

Invasive Plants

Invasive plant species continue to threaten the health of Iowa forests. Garlic mustard, buckthorn, bush honeysuckle, and multiflora rose are the state's primary woodland invaders. In the battle for limited resources, invasive species often outcompete native plants and thus achieve greater reproductive success. Invasive species are a major concern because they threaten overall ecological diversity and alter natural communities. Efforts to monitor the presence and severity of invasive species in Iowa are under way.

SUMMARY

The area of Iowa timberland is increasing. Growing-stock volume is also rising, having nearly doubled since 1990. While Iowa forests are reasonably healthy, the dispersal of exotic insects and fungal pathogens continues to threaten forest health.

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 following are sampling errors for the estimates of statewide totals in this report. These sampling errors represent a 67-percent confidence interval.

Table no.	Variable	Estimate	Sampling error
			Percent
1	Area of forest land (thousand acres)	2,879	2.67
2	Area of timberland (thousand acres)	2,824	2.74
4	All-live volume on forest land (thousand ft^3)	4,099,569	4.10
5	All-live volume on timberland (thousand ft^3)	4,045,090	4.17
6	Growing-stock volume on timberland (thousand ft^3)	3,114,499	4.84
8	Sawtimber volume on timberland (thousand board feet)	11,380,405	5.58
9	All-live aboveground biomass on timberland (thousand dry tons)	112,598	3.72
10	Growing-stock growth on timberland (thousand ft^3/yr)	141,249	14.66
11	Growing-stock removals on timberland (thousand ft^3/yr)	18,281	38.34
12	Growing-stock mortality on timberland (thousand ft^3/yr)	23,179	18.88

Inventory Methods

With the NRS-FIA annual inventory system, about one-fifth of all field plots are measured each year. The first annual inventory cycle was completed in 2003. Measurements from the 2003 inventory were summarized in Leatherberry et al. (2005); for a more detailed analysis of the data see Leatherberry et al. (2006). Each panel measured after 2003 represents a complete sample of the forest resources of Iowa. Therefore, changes in estimates of area, volume, and biomass can be compared for 2003, 2004, and 2005.

The 2005 Iowa forest inventory includes a total sample of 6,067 plots over the entire state from 2001 to 2005. All of the plots provide information for estimates of current conditions (area, volume, and biomass), but only the remeasured plots provide information for estimates of change (growth, removals, and mortality).

Current estimates for growth, removals, and mortality are based on remeasurement of plots established in the first and second panels of the annual inventory (1999 and 2000). Over the next 3 years, the remaining panels will be remeasured and estimates of change will be annually updated with new measurements. The smaller number of sample plots currently available for estimation of change components is reflected in the sampling errors presented in this report. Sampling errors for growing-stock growth, removals, and mortality on timberland (14.66 percent, 38.34 percent, and 18.88 percent, respectively) are considerably higher than those for timberland area and growing-stock volume on timberland (2.74 percent and 4.84 percent, respectively).

The annual inventory system includes new remote sensing technology, and a new sampling design and plot configuration. The advent of remote-sensing technology has allowed NRS-FIA to use classifications of Multi-Resolution Land Characterization data and other available remote sensing and GIS products to stratify the total area of the state and improve the precision of estimates. Additionally, new algorithms have been used to assign forest type and stand-size class to each condition observed on a plot. These algorithms are employed nationwide by FIA to increase consistency among states.

Inventory Phases

The annual inventory system is based on a three-phase inventory. In the first phase, classified satellite images are used to stratify the state and aerial photographs are used to select plots for measurement. The second phase involves measuring of a traditional FIA suite of mensurational variables (basic tree and stand attributes), while the third phase focuses on measuring a suite of variables related to forest health.

The only plots that could not be measured were on: (1) private land where field personnel were unable to obtain permission from the owner to measure the field plot, and (2) plots that were inaccessible because of a hazard or danger to field personnel. The methods used in preparing this report were adjusted 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 in a forest edge stratum. Pixels within 60 m of the boundary on the nonforest side were classified in 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 measuring 6,067 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 for phase 2 plots. 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 an FHM plot (Mangold 1998) fell within a hexagon, it was selected; (2) if no FHM plot fell within a hexagon, the existing NRS-FIA plot from the most recent periodic inventory nearest the hexagon center was selected; and (3) if neither FHM nor existing NRS-FIA plots fell within the hexagon, a new NRS-FIA 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 6,067 phase 2 field plots measured for the 2005 annual inventory, 618 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 can 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

One of every 16 phase 2 plots is also a phase 3 plot. Using a sampling intensity of one plot for approximately every 96,000 acres, phase 3 plots are measured with the full suite of FHM vegetative and health variables (Mangold 1998) collected as well as the full array 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 374 phase 3 plots, of which 40 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, and will continue to be used in subsequent years. The national plot configuration requires mapping forest conditions on each plot.

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 or 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 on all 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 subplot 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://nrs.fs.fed.us/fia/data-tools/mapping-tools/default.asp.

For additional information, contact: Program Manager, Forest Inventory and Analysis, Northern Research Station, 1992 Folwell Avenue, St. Paul, MN 55108 or Bureau Chief of Forestry, Iowa Department of Natural Resources, Bureau of Forestry, Wallace State Office Building, 502 East 9th Street, Des Moines, IA 50319-0034 (http://www.iowadnr.com).

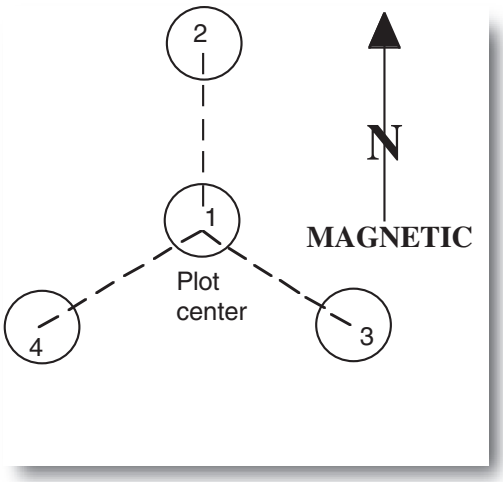

Figure 5.—*Current NRS-FIA field plot design.*

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TABLES

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

(In thousand acres)

Forest type group/ forest type	Owner category: All owners	Public	Private	Unidentified owner
Softwood type groups				
Pinyon / juniper group				
Eastern redcedar	39.7	1.8	38.0	- -
All forest types	39.7	1.8	38.0	- -
All softwood groups	39.7	1.8	38.0	- -
Hardwood type groups				
Oak / pine group				
Eastern redcedar / hardwood	67.9	9.7	58.2	- -
All forest types	67.9	9.7	58.2	- -
Oak / hickory group				
Post oak / blackjack oak	11.2	- -	11.2	- -
White oak / red oak / hickory	569.7	51.7	518.0	- -
White oak	159.8	35.9	123.9	- -
Northern red oak	48.8	18.6	30.2	- -
Bur oak	163.3	2.5	160.8	- -
Black walnut	90.5	16.3	74.2	- -
Black locust	11.7	- -	11.7	- -
Mixed upland hardwoods	509.6	18.1	491.6	- -
All forest types	1,564.6	143.0	1,421.6	- -
Elm / ash / cottonwood group				
Elm / ash / cottonwood group	1.5	- -	1.5	- -
Black ash / American elm / red maple	11.5	3.6	7.8	- -
River birch / sycamore	36.8	- -	36.8	- -
Cottonwood	80.8	16.0	64.8	- -
Willow	18.2	5.7	12.4	- -
Sycamore / pecan / American elm	8.7	1.7	7.0	- -
Sugarberry / hackberry / elm / green ash	323.7	29.4	294.4	- -
Silver maple / American elm	182.1	32.7	149.4	- -
Cottonwood / willow	24.0	- -	24.0	- -
All forest types	687.1	89.1	598.0	- -
Maple / beech / birch group				
Sugar maple / beech / yellow birch	148.3	13.0	135.3	- -
Black cherry	17.8	9.0	8.7	- -
Cherry / ash / yellow-poplar	11.1	- -	11.1	- -
Hard maple / basswood	149.1	25.9	123.2	- -
Elm / ash / locust	84.9	16.9	67.9	- -
All forest types	411.2	64.9	346.3	- -
Aspen / birch group				
Aspen	13.0	- -	13.0	- -
All forest types	13.0	- -	13.0	- -
Exotic hardwoods group				
Other exotic hardwoods	9.9	4.8	5.1	- -
All forest types	9.9	4.8	5.1	- -
All hardwood groups	2,753.8	311.6	2,442.2	- -
Nonstocked	85.4	13.8	71.6	- -
All forest groups	2,878.9	327.2	2,551.8	- -

(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, 2001-2005

(In thousand acres)

Major forest type group and stand origin	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
Natural	33.1	1.8	31.3	- -
All softwood types	33.1	1.8	31.3	- -
Hardwood type groups				
Natural	2,697.7	299.9	2,397.7	- -
Planted	20.0	3.2	16.8	- -
All hardwood types	2,717.7	303.2	2,414.5	- -
Nonstocked	72.9	7.3	65.6	- -
All groups	2,823.7	312.3	2,511.4	- -

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

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

(In thousand acres)

Forest type group/ forest type	Stand-size class				
	All stands	Sawtimber	Poletimber	Sapling-seedling	Non-stocked
Softwood type groups					
Pinyon / juniper group					
Eastern redcedar	33.1	1.8	5.3	26.0	- -
All forest types	33.1	1.8	5.3	26.0	- -
All softwood groups	33.1	1.8	5.3	26.0	- -
Hardwood type groups					
Oak / pine group					
Eastern redcedar / hardwood	62.0	20.7	9.5	31.8	- -
All forest types	62.0	20.7	9.5	31.8	- -
Oak / hickory group					
Post oak / blackjack oak	11.2	9.8	1.4	- -	- -
White oak / red oak / hickory	555.2	381.9	105.9	67.4	- -
White oak	153.3	143.3	10.0	- -	- -
Northern red oak	48.8	48.8	- -	- -	- -
Bur oak	154.0	130.4	14.5	9.1	- -
Black walnut	90.5	67.8	8.3	14.4	- -
Black locust	11.7	5.1	6.6	- -	- -
Mixed upland hardwoods	509.6	257.3	172.8	79.6	- -
All forest types	1,534.5	1,044.4	319.6	170.4	- -
Elm / ash / cottonwood group					
Elm / ash / cottonwood group	1.5	- -	1.5	- -	- -
Black ash / American elm / red maple	11.5	8.7	2.2	0.6	- -
River birch / sycamore	36.8	25.0	11.8	- -	- -
Cottonwood	80.8	69.2	4.7	6.9	- -
Willow	18.2	8.8	6.5	2.8	- -
Sycamore / pecan / American elm	8.7	8.4	0.3	- -	- -
Sugarberry / hackberry / elm / green ash	323.7	178.0	117.0	28.8	- -
Silver maple / American elm	182.1	162.8	13.3	6.0	- -
Cottonwood / willow	24.0	13.3	10.7	- -	- -
All forest types	687.1	474.1	167.9	45.1	- -
Maple / beech / birch group					
Sugar maple / beech / yellow birch	148.3	79.6	44.2	24.5	- -
Black cherry	17.8	7.6	1.5	8.8	- -
Cherry / ash / yellow-poplar	11.1	- -	- -	11.1	- -
Hard maple / basswood	149.1	133.7	14.0	1.4	- -
Elm / ash / locust	84.9	38.9	23.5	22.4	- -
All forest types	411.2	259.7	83.2	68.2	- -
Aspen / birch group					
Aspen	13.0	13.0	- -	- -	- -
All forest types	13.0	13.0	- -	- -	- -
Exotic hardwoods group					
Other exotic hardwoods	9.9	5.1	- -	4.8	- -
All forest types	9.9	5.1	- -	4.8	- -
All hardwood groups	2,717.7	1,817.0	580.3	320.3	- -
Nonstocked	72.9	- -	- -	- -	72.9
All forest groups	2,823.7	1,818.8	585.6	346.3	72.9

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, 2001-2005

(In thousand cubic feet)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other yellow pines				
Scotch pine	150	- -	150	- -
All species	150	- -	150	- -
Eastern white and red pines				
Red pine	849	393	455	- -
Eastern white pine	236	- -	236	- -
All species	1,085	393	692	- -
Other eastern softwoods				
Eastern redcedar	38,845	5,982	32,862	- -
Larch spp.	460	- -	460	- -
Tamarack (native)	247	- -	247	- -
All species	39,552	5,982	33,569	- -
Ponderosa and Jeffrey pines				
Ponderosa pine	3,461	552	2,910	- -
All species	3,461	552	2,910	- -
Total softwoods	44,248	6,927	37,321	- -
Hardwoods				
Select white oaks				
White oak	369,496	72,095	297,400	- -
Swamp white oak	4,301	69	4,232	- -
Bur oak	468,143	12,770	455,373	- -
Chinkapin oak	3,933	1,957	1,977	- -
All species	845,872	86,891	758,982	- -
Select red oaks				
Northern red oak	272,706	64,261	208,445	- -
All species	272,706	64,261	208,445	- -
Other white oaks				
Post oak	683	- -	683	- -
All species	683	- -	683	- -
Other red oaks				
Northern pin oak	30,641	2,336	28,305	- -
Shingle oak	34,882	80	34,802	- -
Pin oak	21,755	8,548	13,207	- -
Black oak	86,911	11,179	75,732	- -
All species	174,190	22,144	152,046	- -
Hickory				
Bitternut hickory	81,450	7,306	74,144	- -
Pignut hickory	2,251	1,092	1,159	- -
Shagbark hickory	162,354	15,755	146,599	- -
Mockernut hickory	2,326	604	1,722	- -
All species	248,381	24,757	223,624	- -
Hard maple				
Black maple	61,381	4,425	56,955	- -
Sugar maple	37,395	12,905	24,489	- -
All species	98,775	17,331	81,445	- -

(Table 4 continued on next page)

(Table 4 continued)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Hardwoods				
Soft maple				
Red maple	665	665	- -	- -
Silver maple	445,353	81,305	364,048	- -
All species	446,018	81,970	364,048	- -
Ash				
White ash	57,288	4,260	53,028	- -
Black ash	4,408	1,208	3,201	- -
Green ash	73,452	17,909	55,543	- -
All species	135,149	23,377	111,772	- -
Cottonwood and aspen				
Eastern cottonwood	338,956	90,314	248,641	- -
Bigtooth aspen	14,976	- -	14,976	- -
Quaking aspen	3,715	- -	3,715	- -
All species	357,647	90,314	267,333	- -
Basswood				
American basswood	174,115	29,814	144,300	- -
All species	174,115	29,814	144,300	- -
Black walnut				
Black walnut	249,351	25,285	224,065	- -
All species	249,351	25,285	224,065	- -
Other eastern soft hardwoods				
Boxelder	118,751	6,720	112,030	- -
Ohio buckeye	9,918	126	9,792	- -
River birch	4,545	- -	4,545	- -
Paper birch	2,918	- -	2,918	- -
Northern catalpa	815	- -	815	- -
Hackberry	185,000	9,086	175,913	- -
Butternut	778	- -	778	- -
American sycamore	3,776	313	3,463	- -
Black cherry	61,268	8,247	53,021	- -
Black willow	50,929	2,653	48,276	- -
White willow	475	- -	475	- -
American elm	240,013	27,224	212,790	- -
Siberian elm	9,361	1,048	8,314	- -
Slippery elm	106,662	10,679	95,983	- -
All species	795,210	66,096	729,113	- -
Other eastern hard hardwoods				
Honeylocust	125,026	17,710	107,316	- -
White mulberry	460	- -	460	- -
Red mulberry	40,937	6,343	34,595	- -
Black locust	42,674	6,530	36,143	- -
All species	209,097	30,583	178,514	- -

(Table 4 continued on next page)

(Table 4 continued)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Hardwoods				
Eastern noncommercial hardwoods				
Ailanthus	162	- -	162	- -
Serviceberry spp.	117	117	- -	- -
Eastern redbud	564	23	540	- -
Hawthorn spp.	917	- -	917	- -
Cockspur hawthorn	788	- -	788	- -
Downy hawthorn	69	- -	69	- -
Osage-orange	27,634	175	27,459	- -
Apple spp.	336	- -	336	- -
Eastern hophornbeam	14,791	1,382	13,409	- -
American plum	260	- -	260	- -
Willow spp.	239	239	- -	- -
Peachleaf willow	243	- -	243	- -
Russian-olive	2,008	- -	2,008	- -
All species	48,128	1,936	46,192	- -
Total hardwoods	4,055,320	564,759	3,490,561	- -
All species groups	4,099,569	571,687	3,527,882	- -

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, 2001-2005

(In thousand cubic feet)

Class of timber	All species	Softwood species	Hardwood species
Live trees			
Growing-stock trees			
Sawtimber			
Saw log portion	2,165,489	16,219	2,149,270
Upper stem portion	292,547	2,360	290,187
Total	2,458,036	18,579	2,439,457
Poletimber	656,464	10,473	645,991
All growing-stock trees	3,114,499	29,051	3,085,448
Cull trees			
Rough trees[1]			
Sawtimber size	616,258	8,088	608,170
Poletimber size	242,471	6,902	235,569
Total	858,729	14,990	843,740
Rotten trees[1]			
Sawtimber size	60,830	- -	60,830
Poletimber size	11,032	116	10,916
Total	71,862	116	71,745
All live cull trees	930,591	15,106	915,485
All live trees	4,045,090	44,157	4,000,933
Salvable dead trees			
Sawtimber size	35,763	654	35,109
Poletimber size	21,676	295	21,380
All salvable dead trees	57,438	949	56,489
All classes	4,102,528	45,106	4,057,422

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, Iowa, 2001-2005

(In thousand cubic feet)

Forest type group/ forest type	All species	Softwood species	Hardwood species
Softwood type groups			
Pinyon / juniper group			
Eastern redcedar	5,702	3,006	2,696
All forest types	5,702	3,006	2,696
All softwood groups	5,702	3,006	2,696
Hardwood type groups			
Oak / pine group			
Eastern redcedar / hardwood	12,438	6,262	6,176
All forest types	12,438	6,262	6,176
Oak / hickory group			
Post oak / blackjack oak	22,565	- -	22,565
White oak / red oak / hickory	647,179	6,781	640,398
White oak	282,454	520	281,933
Northern red oak	84,942	117	84,824
Bur oak	203,655	- -	203,655
Black walnut	89,429	108	89,321
Black locust	3,336	- -	3,336
Mixed upland hardwoods	352,011	3,420	348,591
All forest types	1,685,569	10,946	1,674,623
Elm / ash / cottonwood group			
Black ash / American elm / red maple	16,646	- -	16,646
River birch / sycamore	33,969	- -	33,969
Cottonwood	257,220	552	256,668
Willow	4,788	- -	4,788
Sycamore / pecan / American elm	9,549	- -	9,549
Sugarberry / hackberry / elm / green ash	213,819	1,173	212,646
Silver maple / American elm	348,635	2,665	345,971
Cottonwood / willow	41,974	- -	41,974
All forest types	926,600	4,390	922,211
Maple / beech / birch group			
Sugar maple / beech / yellow birch	133,531	2,977	130,554
Black cherry	9,460	- -	9,460
Cherry / ash / yellow-poplar	1,400	- -	1,400
Hard maple / basswood	259,185	747	258,438
Elm / ash / locust	62,182	- -	62,182
All forest types	465,759	3,724	462,035
Aspen / birch group			
Aspen	13,830	170	13,660
All forest types	13,830	170	13,660

(Table 6 continued on next page)

(Table 6 continued)

Forest type group/ forest type	All species	Softwood species	Hardwood species
Hardwood type groups			
Exotic hardwoods group			
Other exotic hardwoods	2,370	146	2,224
All forest types	2,370	146	2,224
All hardwood groups	3,106,566	25,638	3,080,928
Nonstocked	2,231	407	1,824
All forest groups	3,114,499	29,051	3,085,448

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, 2001-2005

(In thousand cubic feet)

Species group/ species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods											
Other yellow pines											
Scotch pine	150	--	150	--	--	--	--	--	--	--	--
All species	150	--	150	--	--	--	--	--	--	--	--
Eastern white and red pines											
Red pine	849	--	142	251	455	--	--	--	--	--	--
All species	849	--	142	251	455	--	--	--	--	--	--
Other eastern softwoods											
Eastern redcedar	24,221	5,459	4,477	5,702	4,020	3,548	1,015	--	--	--	--
Larch spp.	371	--	--	371	--	--	--	--	--	--	--
All species	24,591	5,459	4,477	6,072	4,020	3,548	1,015	--	--	--	--
Ponderosa and Jeffrey pines											
Ponderosa pine	3,461	108	137	576	436	2,205	--	--	--	--	--
All species	3,461	108	137	576	436	2,205	--	--	--	--	--
Total softwoods	29,051	5,567	4,906	6,899	4,912	5,753	1,015	--	--	--	--
Hardwoods											
Select white oaks											
White oak	311,299	4,757	11,576	30,487	42,819	46,598	35,631	39,374	40,521	59,536	--
Swamp white oak	3,621	378	228	426	618	--	--	1,971	--	--	--
Bur oak	301,710	4,328	10,478	14,091	23,288	26,602	20,100	34,487	43,470	85,133	39,732
Chinkapin oak	1,744	261	725	274	484	--	--	--	--	--	--
All species	618,373	9,724	23,007	45,277	67,209	73,200	55,731	75,833	83,992	144,668	39,732
Select red oaks											
Northern red oak	240,748	4,344	3,737	13,360	21,825	29,164	33,252	34,627	19,592	63,162	17,684
All species	240,748	4,344	3,737	13,360	21,825	29,164	33,252	34,627	19,592	63,162	17,684
Other white oaks											
Post oak	683	--	365	318	--	--	--	--	--	--	--
All species	683	--	365	318	--	--	--	--	--	--	--
Other red oaks											
Northern pin oak	26,488	588	770	1,462	5,058	1,668	5,075	2,692	1,895	7,279	--
Shingle oak	27,692	3,638	4,016	5,833	1,677	3,049	2,499	5,104	1,876	--	--
Pin oak	21,755	431	624	327	1,652	--	--	5,068	2,578	3,671	7,404
Black oak	70,805	1,720	3,969	7,060	8,673	17,025	11,977	5,657	9,969	4,754	--
All species	146,740	6,377	9,380	14,683	17,060	21,742	19,551	18,521	16,319	15,703	7,404
Hickory											
Bitternut hickory	68,453	7,424	12,625	11,298	11,504	10,794	2,547	5,922	2,414	3,924	--
Pignut hickory	2,003	--	467	444	--	1,092	--	--	--	--	--
Shagbark hickory	147,051	14,281	21,635	25,500	26,903	23,480	15,111	7,254	6,693	6,195	--
Mockernut hickory	2,326	662	--	462	598	604	--	--	--	--	--
All species	219,833	22,367	34,727	37,703	39,005	35,970	17,658	13,177	9,108	10,119	--
Hard maple											
Black maple	47,714	2,735	3,377	7,825	9,368	6,227	7,535	7,610	--	3,036	--
Sugar maple	31,711	1,990	3,938	2,193	620	1,900	3,522	5,703	2,770	9,076	--
All species	79,425	4,724	7,315	10,018	9,988	8,127	11,057	13,313	2,770	12,113	--
Soft maple											
Red maple	665	--	--	665	--	--	--	--	--	--	--
Silver maple	318,606	4,805	11,179	21,952	30,925	45,481	41,274	34,984	42,305	48,236	37,465
All species	319,271	4,805	11,179	22,616	30,925	45,481	41,274	34,984	42,305	48,236	37,465
Ash											
White ash	46,591	2,215	6,351	9,338	3,847	10,574	4,608	--	2,350	--	7,308
Black ash	3,272	445	619	--	--	1,052	--	1,156	--	--	--
Green ash	60,050	5,426	6,940	9,572	5,953	11,052	9,547	7,099	4,460	--	--
All species	109,913	8,087	13,910	18,909	9,800	22,678	14,156	8,255	6,810	--	7,308
Cottonwood and aspen											
Eastern cottonwood	326,117	550	2,548	7,642	13,797	18,444	7,562	21,062	27,048	100,087	127,376
Bigtooth aspen	14,976	516	484	2,008	3,830	950	5,008	--	2,180	--	--
Quaking aspen	3,551	197	1,638	1,018	697	--	--	--	--	--	--
All species	344,644	1,264	4,671	10,669	18,324	19,393	12,570	21,062	29,228	100,087	127,376

(Table 7 continued)

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+
Hardwoods											
Basswood											
American basswood	154,591	6,206	11,093	14,498	13,558	15,921	17,946	28,751	6,298	40,320	--
All species	154,591	6,206	11,093	14,498	13,558	15,921	17,946	28,751	6,298	40,320	--
Black walnut											
Black walnut	219,447	6,710	11,214	18,385	29,204	39,005	47,198	33,159	11,495	23,077	--
All species	219,447	6,710	11,214	18,385	29,204	39,005	47,198	33,159	11,495	23,077	--
Other eastern soft hardwoods											
Boxelder	26,773	3,142	3,976	6,469	4,340	2,529	3,592	--	--	2,725	--
Ohio buckeye	6,506	626	385	--	1,174	963	1,179	--	2,179	--	--
River birch	3,779	395	1,079	294	--	798	1,214	--	--	--	--
Paper birch	2,844	253	146	284	--	920	1,242	--	--	--	--
Hackberry	156,418	10,126	15,538	23,720	15,491	24,990	21,607	15,933	12,538	16,476	--
Butternut	357	62	294	--	--	--	--	--	--	--	--
American sycamore	3,776	333	353	313	--	--	--	--	--	2,778	--
Black cherry	43,604	3,775	5,413	7,477	6,391	6,047	5,541	4,813	4,147	--	--
Black willow	26,352	551	853	1,579	540	1,949	1,492	5,102	2,315	11,972	--
White willow	142	--	142	--	--	--	--	--	--	--	--
American elm	167,848	24,450	30,580	27,953	18,318	20,608	18,902	11,737	5,490	9,810	--
Siberian elm	3,324	451	332	557	--	803	1,182	--	--	--	--
Slippery elm	79,984	8,897	9,686	11,770	11,951	15,519	6,091	6,594	2,176	7,299	--
All species	521,706	53,060	68,776	80,415	58,205	75,125	62,041	44,179	28,845	51,060	--
Other eastern hard hardwoods											
Honeylocust	71,790	4,335	5,998	7,778	8,709	14,010	12,668	11,254	7,036	--	--
Red mulberry	4,274	1,449	706	1,056	1,063	--	--	--	--	--	--
Black locust	34,010	2,117	3,108	5,551	3,053	6,083	6,519	2,453	2,393	2,733	--
All species	110,073	7,901	9,812	14,385	12,826	20,093	19,187	13,708	9,429	2,733	--
Total hardwoods	3,085,448	135,568	209,186	301,237	327,931	405,899	351,619	339,570	266,190	511,277	236,971
All species groups	3,114,499	141,135	214,092	308,136	332,843	411,652	352,634	339,570	266,190	511,277	236,971

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, 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+
Eastern white and red pines									
Red pine	3,432	1,247	2,185	--	--	--	--	--	--
All species	3,432	1,247	2,185	--	--	--	--	--	--
Other eastern softwoods									
Eastern redcedar	73,715	31,357	20,511	17,165	4,683	--	--	--	--
Larch spp.	1,773	1,773	--	--	--	--	--	--	--
All species	75,488	33,130	20,511	17,165	4,683	--	--	--	--
Ponderosa and Jeffrey pines									
Ponderosa pine	16,009	2,764	2,141	11,103	--	--	--	--	--
All species	16,009	2,764	2,141	11,103	--	--	--	--	--
Total softwoods	94,928	37,142	24,836	28,268	4,683	--	--	--	--
Hardwoods									
Select white oaks									
White oak	1,231,641	--	210,065	224,323	169,053	183,131	184,572	260,497	--
Swamp white oak	12,297	--	3,056	--	--	9,242	--	--	--
Bur oak	1,208,429	--	113,536	127,636	94,437	159,915	197,087	364,187	151,631
Chinkapin oak	2,410	--	2,410	--	--	--	--	--	--
All species	2,454,777	--	329,067	351,958	263,490	352,287	381,660	624,684	151,631
Select red oaks									
Northern red oak	1,069,718	--	108,055	145,510	166,420	172,770	97,079	301,990	77,893
All species	1,069,718	--	108,055	145,510	166,420	172,770	97,079	301,990	77,893
Other red oaks									
Northern pin oak	114,957	--	25,089	8,298	25,147	13,424	9,258	33,740	--
Shingle oak	69,885	--	8,252	15,119	12,317	25,112	9,085	--	--
Pin oak	91,044	--	8,131	--	--	24,809	12,332	16,906	28,867
Black oak	287,073	--	43,105	84,661	59,386	27,937	48,970	23,013	--
All species	562,959	--	84,577	108,078	96,850	91,283	79,646	73,659	28,867
Hickory									
Bitternut hickory	184,657	--	57,266	53,799	12,669	29,471	11,941	19,511	--
Pignut hickory	5,446	--	--	5,446	--	--	--	--	--
Shagbark hickory	415,074	--	130,019	113,809	73,280	35,237	32,547	30,183	--
Mockernut hickory	5,807	--	2,885	2,922	--	--	--	--	--
All species	610,985	--	190,171	175,976	85,949	64,708	44,488	49,694	--
Hard maple									
Black maple	160,554	--	44,646	29,731	35,811	36,249	--	14,117	--
Sugar maple	109,498	--	2,917	9,124	16,844	26,910	12,894	40,809	--
All species	270,053	--	47,563	38,855	52,655	63,159	12,894	54,926	--
Soft maple									
Silver maple	1,208,038	--	134,143	199,156	181,269	153,500	184,833	206,736	148,401
All species	1,208,038	--	134,143	199,156	181,269	153,500	184,833	206,736	148,401
Ash									
White ash	128,966	--	17,349	49,069	21,736	--	11,211	--	29,600
Black ash	10,385	--	--	4,895	--	5,490	--	--	--
Green ash	178,194	--	26,941	51,295	44,921	33,752	21,285	--	--
All species	317,545	--	44,290	105,260	66,657	39,242	32,496	--	29,600
Cottonwood and aspen									
Eastern cottonwood	1,483,155	--	64,769	89,641	37,393	106,125	136,605	497,888	550,734
Bigtooth aspen	57,790	--	17,697	4,716	24,737	--	10,640	--	--
Quaking aspen	3,389	--	3,389	--	--	--	--	--	--
All species	1,544,335	--	85,855	94,358	62,129	106,125	147,245	497,888	550,734
Basswood									
American basswood	604,691	--	68,583	80,156	89,704	142,299	30,897	193,053	--
All species	604,691	--	68,583	80,156	89,704	142,299	30,897	193,053	--
Black walnut									
Black walnut	864,925	--	140,702	188,666	226,140	155,901	53,324	100,192	--
All species	864,925	--	140,702	188,666	226,140	155,901	53,324	100,192	--

(Table 8 continued on next page)

(Table 8 continued)

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+
Hardwoods									
Other eastern soft hardwoods									
Boxelder	59,953	- -	19,979	11,624	16,392	- -	- -	11,958	- -
Ohio buckeye	24,927	- -	5,381	4,404	5,398	- -	9,744	- -	- -
River birch	9,235	- -	- -	3,650	5,584	- -	- -	- -	- -
Paper birch	9,949	- -	- -	4,247	5,701	- -	- -	- -	- -
Hackberry	472,033	- -	72,069	113,802	96,295	70,426	54,205	65,236	- -
American sycamore	12,443	- -	- -	- -	- -	- -	- -	12,443	- -
Black cherry	122,759	- -	29,487	27,735	25,333	21,724	18,479	- -	- -
Black willow	98,070	- -	2,360	8,561	6,682	22,774	10,225	47,468	- -
American elm	380,399	- -	85,990	94,418	84,897	52,158	23,385	39,552	- -
Siberian elm	9,036	- -	- -	3,658	5,378	- -	- -	- -	- -
Slippery elm	224,198	- -	55,594	71,816	27,449	28,965	9,384	30,991	- -
All species	1,423,000	- -	270,859	343,915	279,110	196,047	125,421	207,647	- -
Other eastern hard hardwoods									
Honeylocust	243,781	- -	39,894	64,071	57,692	50,839	31,284	- -	- -
Red mulberry	4,929	- -	4,929	- -	- -	- -	- -	- -	- -
Black locust	105,740	- -	14,073	27,963	29,798	11,187	10,654	12,065	- -
All species	354,451	- -	58,897	92,034	87,491	62,027	41,938	12,065	- -
Total hardwoods	11,285,476	- -	1,562,762	1,923,922	1,657,864	1,599,349	1,231,921	2,322,532	987,127
All species groups	11,380,405	37,142	1,587,598	1,952,189	1,662,547	1,599,349	1,231,921	2,322,532	987,127

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, Iowa, 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	210	62	85	62	23	64	46	18
Hardwoods	14,636	842	11,172	8,301	2,871	2,622	1,910	711
Total	14,846	904	11,257	8,363	2,893	2,686	1,956	730
Private								
Softwoods	916	105	515	374	141	296	210	86
Hardwoods	96,836	5,194	65,873	48,286	17,588	25,768	18,934	6,834
Total	97,752	5,300	66,388	48,660	17,729	26,064	19,144	6,920
All ownerships								
Softwoods	1,126	167	600	436	164	360	256	104
Hardwoods	111,472	6,036	77,046	56,587	20,458	28,390	20,844	7,546
Total	112,598	6,203	77,645	57,023	20,622	28,750	21,100	7,650

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.

Table 10. -- Average annual net growth of growing stock on timberland by species group and owner category, Iowa, 1999-2000 to 2004-2005

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other yellow pines	68	- -	68	- -
Other eastern softwoods	1,385	35	1,350	- -
Total softwoods	1,452	35	1,418	- -
Hardwoods				
Select white oaks	24,747	2,389	22,358	- -
Select red oaks	7,924	1,198	6,726	- -
Other red oaks	6,043	1,248	4,796	- -
Hickory	6,245	1,050	5,194	- -
Hard maple	2,965	163	2,802	- -
Soft maple	15,877	7,568	8,309	- -
Ash	6,696	1,415	5,281	- -
Cottonwood and aspen	12,204	1,778	10,426	- -
Basswood	6,385	2,925	3,460	- -
Black walnut	15,694	730	14,965	- -
Other eastern soft hardwoods	23,331	5,855	17,476	- -
Other eastern hard hardwoods	11,686	3,356	8,330	- -
Total hardwoods	139,797	29,674	110,123	- -
All species groups	141,249	29,709	111,540	- -

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, 1999-2000 to 2004-2005

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other eastern softwoods	86	- -	86	- -
Total softwoods	86	- -	86	- -
Hardwoods				
Select white oaks	3,201	- -	3,201	- -
Select red oaks	3,325	- -	3,325	- -
Other red oaks	2,388	- -	2,388	- -
Hickory	336	- -	336	- -
Ash	447	- -	447	- -
Basswood	1,406	- -	1,406	- -
Black walnut	4,207	- -	4,207	- -
Other eastern soft hardwoods	2,468	- -	2,468	- -
Other eastern hard hardwoods	417	- -	417	- -
Total hardwoods	18,195	- -	18,195	- -
All species groups	18,281	- -	18,281	- -

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, 1999-2000 to 2004-2005

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other eastern softwoods	33	- -	33	- -
Total softwoods	33	- -	33	- -
Hardwoods				
Select white oaks	3,104	946	2,158	- -
Select red oaks	941	- -	941	- -
Other red oaks	604	- -	604	- -
Hickory	1,194	- -	1,194	- -
Soft maple	42	- -	42	- -
Ash	505	147	358	- -
Cottonwood and aspen	2,352	- -	2,352	- -
Basswood	2,071	- -	2,071	- -
Black walnut	293	- -	293	- -
Other eastern soft hardwoods	11,946	168	11,777	- -
Other eastern hard hardwoods	94	- -	94	- -
Total hardwoods	23,146	1,261	21,885	- -
All species groups	23,179	1,261	21,917	- -

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.; Brand, Gary J.; Flickinger, Aron.
2007. **Iowa's forest resources, 2005.** Resour. Bull. NRS-14. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 31 p

Report presents Iowa's annual inventory results for 2005. Estimates show that Iowa has more than 2.8 million acres of forest land. Total live-tree volume on forest land is 4.0 billion cubic feet (ft^3). Ninety-eight percent of forest land is classified as timberland. Oak/hickory is the predominant forest-type group, representing 54 percent of timberland area. Growing-stock volume has risen to an estimated 3.1 billion ft^3. Live-tree aboveground biomass is 112 million dry tons. In general, Iowa's forests are healthy. However, diseases, including white oak decline and Dutch elm disease, and the threat of invasion from exotic species such as emerald ash borer and nonnative plants are a concern when assessing the health of Iowa's forests.

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

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