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Missouri's Forest Resources in 2001

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The North Central Research Station's Forest Inventory and Analysis (NCFIA) program began fieldwork for the fifth forest inventory of Missouri's forest resources in 1999. This inventory initiated the new annual inventory system in which one-fifth of the field plots (considered one panel) in the State are selected for measurement each year. A complete inventory consists of measuring and compiling the data for all plots (or five panels). Once all panels have been measured, each will be remeasured approximately every 5 years. For example, in Missouri, the field plots measured in 2000 will be remeasured in 2005.

In 2001, NCFIA continued the annual inventory effort with the third panel of the fifth Missouri forest inventory. Previous inventories of Missouri are dated 1947, 1959, 1972, and 1989 (Central States Forest Experiment Station 1948, Gansner 1965, Spencer and Essex 1976, Spencer *et al.* 1992). This fifth inventory of Missouri's forest resources will be completed in 2003. However, because each year's sample is a systematic sample of the State and because timely information is needed about Missouri's forest resources, estimates have been prepared from data gathered during the first 3 years of the inventory. Data presented in this report represent 60 percent of the field plots (or three panels) of a complete inventory. These data are a combination of the first year's panel from 1999, the second year's panel from 2000, and the third year's panel from 2001. An earlier report for the combined 1999 and 2000 panels (Leatherberry and Treiman 2002) was published. The results presented are estimates based on sampling techniques; estimates for this report were compiled assuming the 1999, 2000, and 2001 data represent one sample. As additional panels are completed, the precision of the estimates will increase and additional data will be released.

Data from new inventories are often compared with data from earlier inventories to determine trends in forest resources. However, for the comparisons to be valid, the procedures used in the two inventories must be similar. As a result of our ongoing efforts to improve the efficiency and reliability of the inventory, several changes in procedures and definitions have been made since the last Missouri inventory in 1989 (Hahn and Spencer 1991, Spencer *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 1999–2001 data with those published for earlier inventories.

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RESULTS

Area

Total forest land area was 14.7 million acres in 2001 (table 1). Eighteen percent of this area is owned by public agencies and 82 percent is owned by private landowners. In 2001, 4 percent of the area was dominated by conifers and the remaining 96 percent by hardwoods. Oak-hickory forests constituted almost three-fourths of the total hardwood area. The pinyon/juniper forest type group (primarily comprised of eastern redcedar)[1] constituted 73 percent of all forest land dominated by conifers.

[1] *Prior to 1999, pinyon/juniper was referred to as eastern redcedar in the inventories.*

Like forest land, timberland area has continued to increase since its low point in the 1972 inventory (fig. 1), but total area in 2001 was still less than the 15 million acres estimated in the 1947 survey (Central States Forest Experiment Station 1948). The oak component has stayed nearly constant, with the 1947 oak/pine, oak/hickory, and white oak forest type groups constituting 77.6 percent of the total timberland area, and the 1999-2001 oak/pine and oak/hickory groups making up 78 percent.

The area of timberland by forest type group was dominated by hardwoods (table 2), particularly oak/hickory in 2001 (table 3 and fig. 2). Hardwoods made up 96 percent of the total acreage, 95 percent of all public land acreage, and 96 percent of all private landholdings. Most of the acreage in forest type groups was in the sawtimber stand-size class, except for pinyon/juniper, oak/pine, and maple/beech/birch.

The acreage of timberland in the sawtimber class has increased by over 5 million acres since 1947 (fig. 3). When one combines the sawtimber acreage with the poletimber acreage, it appears Missouri's forests are composed of many large-diameter and, presumably, old trees.

Improved reforestation efforts, both natural and planting, appears to have resulted in a negligible number of acres in the nonstocked category.

The net volume of all live trees, which includes growing stock, rough, and rotten trees, was 17.8 billion cubic feet in 2001 (table 4). Hardwoods constituted 16.5 billion cubic feet and softwoods made up 1.3 billion cubic feet. Oaks were 11.1 billion cubic feet or 67 percent of all hardwoods. Select oaks (red and white) were 5.2 billion cubic feet or 47 percent of all oaks and 31.6 percent of all hardwoods. This represents a considerable increase over the 1972 inventory, which listed the total cubic foot volume of all live trees as 9 billion cubic feet, all hardwoods as 8.6 billion cubic feet, all oaks as 6.4 billion cubic feet, and all select oaks as 2.6 billion cubic feet (Spencer and Essex 1976).

For most forest type groups, except for loblolly/shortleaf pine, pinyon/juniper, and oak/pine, the percentage of total area owned by private companies and individuals has declined since 1959. The acreages in loblolly/shortleaf pine and oak/pine were similar between public and private ownerships in 1959 (fig. 4). The proportion of loblolly/shortleaf pine acreage on privately owned lands declined from over 40

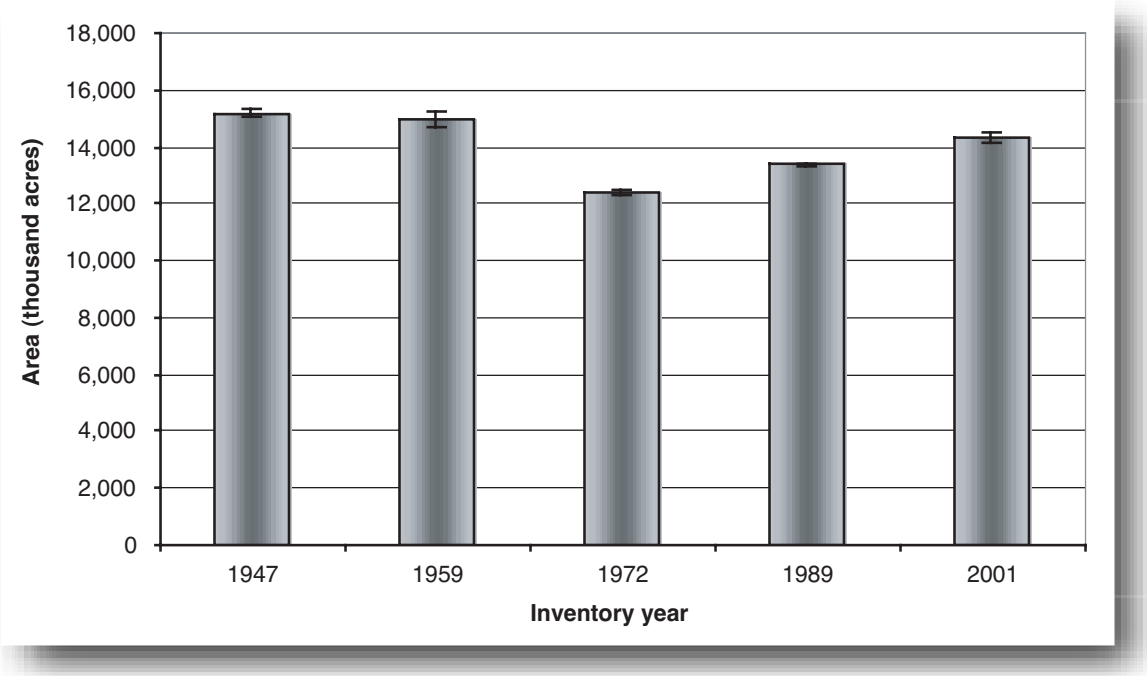


Figure 1.—*Area of timberland, Missouri, 1947-2001. (Note: The sampling error associated with an inventory estimate is represented by the vertical line at the top of each bar.)*

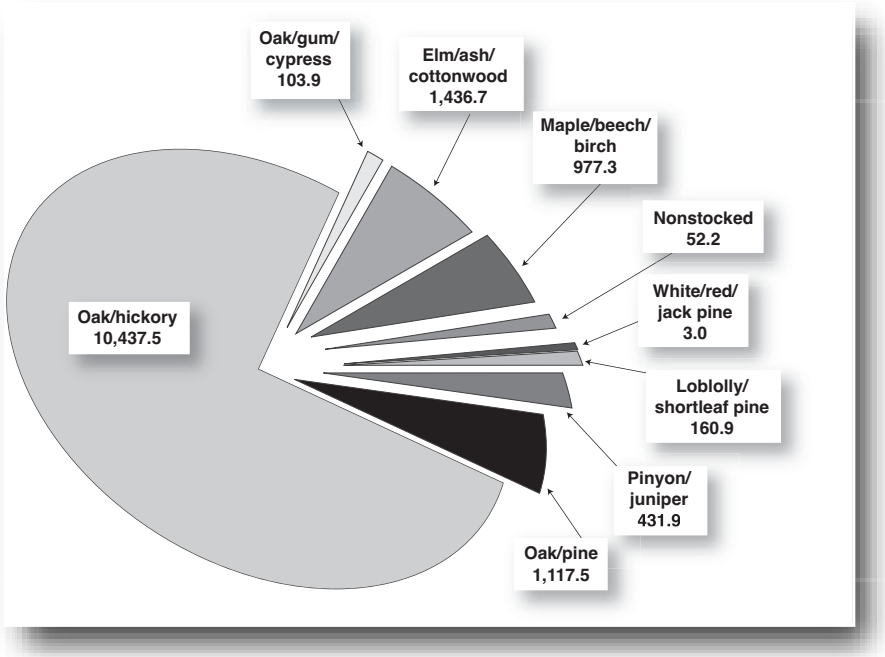


Figure 2.—*Area of timberland by forest type group, Missouri, in thousands of acres, 1999-2001.*

percent in the 1959 survey to less than 10 percent in the 1972 survey, and it has been steadily increasing since then. Since 1972, the percentage of pinyon/juniper on private lands has increased while the portion on public land has decreased significantly. Public agencies have aggressively re-introduced fire as a management tool and employed stand improvement cuttings, and perhaps this has resulted in the decrease of publicly owned acreage in the forest type group. While private landowners are not as proactive as public agencies in using fire as a management tool, the increase in pinyon/juniper acreage could also be due to conversion of former open lands (pastures, crop fields, and the like) by eastern redcedar invasion, and the reclassification of former "non-forest" lands, like wooded pastures, to "forest."

Volume

Net volume of all live trees and salvable dead trees on timberland was 17.6 billion cubic feet

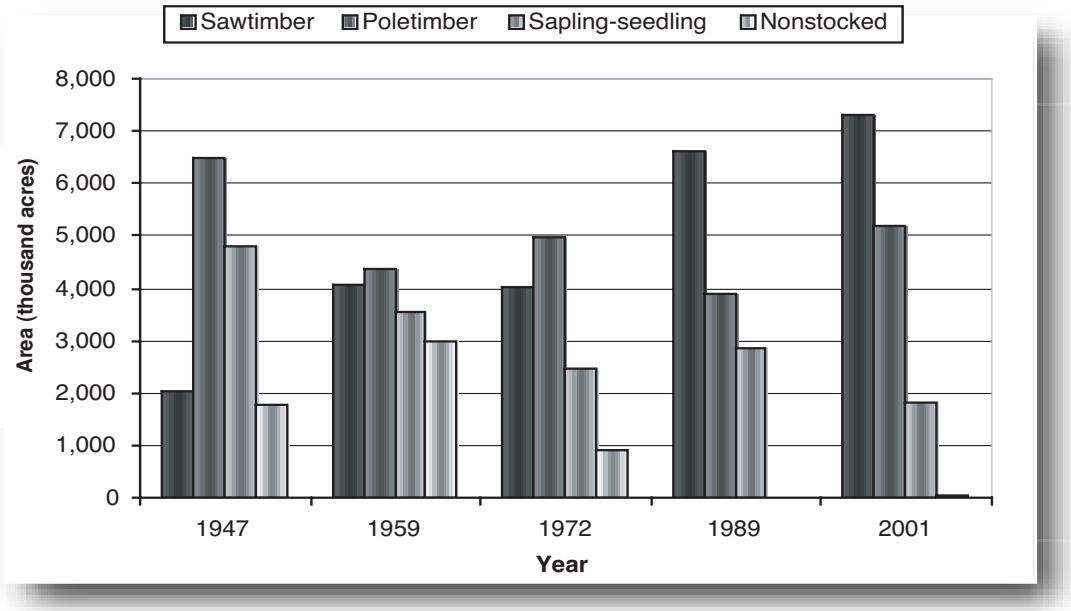


Figure 3.—*Area of timberland by stand-size class, Missouri, 1947-2001.*

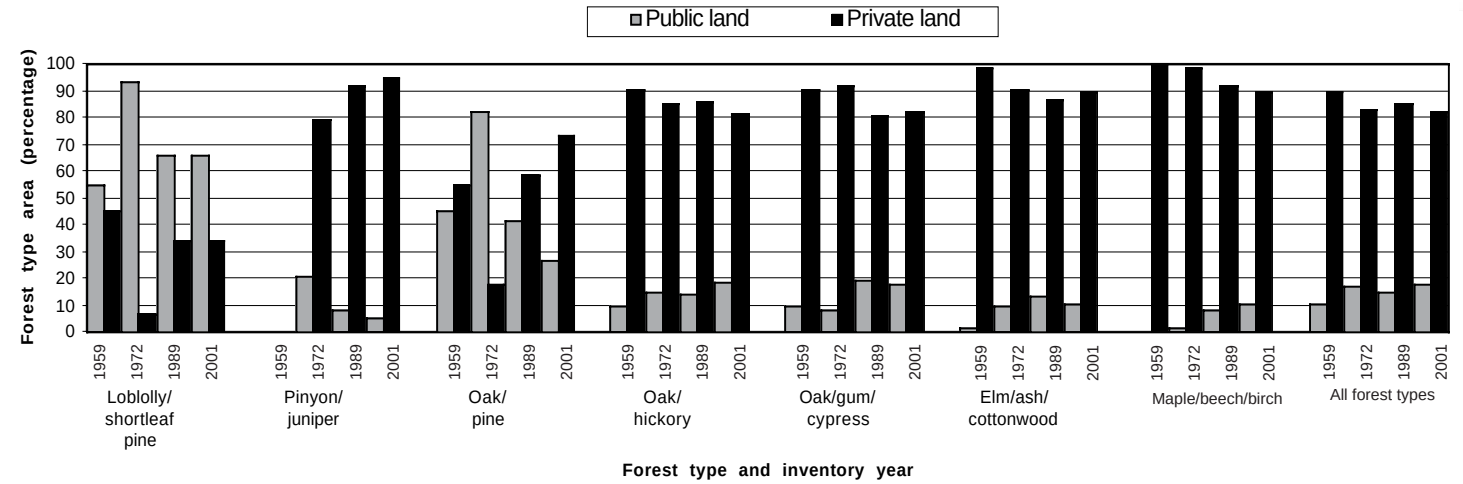


Figure 4.—*Percentage of total area by year, species group, and ownership class for Missouri, 1959 to 2001.*

in 2001 (table 5). All live trees made up 17.4 billion cubic feet or 99 percent. The difference between the total and the 17.8 billion cubic foot volume of all live trees on forest land (table 4) represents the 444 million cubic feet on land that is either of low productivity (incapable of growth greater than 20 cubic feet per acre per year at the culmination of mean annual increment) or reserved (e.g., parks, wilderness areas). Of the 14.1 billion cubic feet of growing-stock trees, 9.3 billion cubic feet or 66 percent was sawtimber. The sawtimber percentage breakdowns for softwoods (65 percent) and hardwoods (66 percent) were similar to the overall proportions.

Cull trees, at 3.2 billion cubic feet made up 18.8 percent of all live trees. The softwood cull tree volume represented only 8.8 percent of the total softwood live tree volume, whereas hardwood culls represented 19.6 percent of the total hardwood volume. Given the phototropic (sun-following) growth habit of hardwoods, the poor stem form resulting from inadequate self-pruning, the history of high grading in hardwood stands, and high stocking levels, the disparity in the cull percentage is not surprising.

The net volume of growing stock on timberland totaled 14.1 billion cubic feet in 2001 (table 6). Over 96 percent (13.6 billion cubic feet) were hardwood forest types and 3.6 percent (505 million cubic feet) were conifers. In this table, the volumes were calculated for softwoods and hardwoods for each forest type group. For example, the oak/pine forest type group had 450 million cubic feet of softwoods and 442 million cubic feet of hardwoods. The lack of a value in a cell of table 6 does not mean that there is no volume of that species in Missouri, but only that the inventory has not detected it. An example of this anomaly is the lack of softwood volume in the oak/gum/cypress forest type group. There are certainly cypress stands in Missouri that may be detected in subsequent panels.

Growing-stock volume has been steadily increasing in Missouri over the last 50 years (fig. 5). Table 7 shows net volume of growing stock on timberland by species group and diameter class. The totals for softwood and hardwood volumes, 1.2 billion cubic feet and 12.9 billion cubic feet, respectively, are the same as the totals at the bottom of the columns in table 6, and should not be confused with the forest type group totals. For example, there are hardwood and softwood *species* and volumes in some oak/hickory or loblolly/shortleaf pine (forest type group) stands.

The net volume of sawtimber on timberland was 44.9 billion board feet (table 8). As with

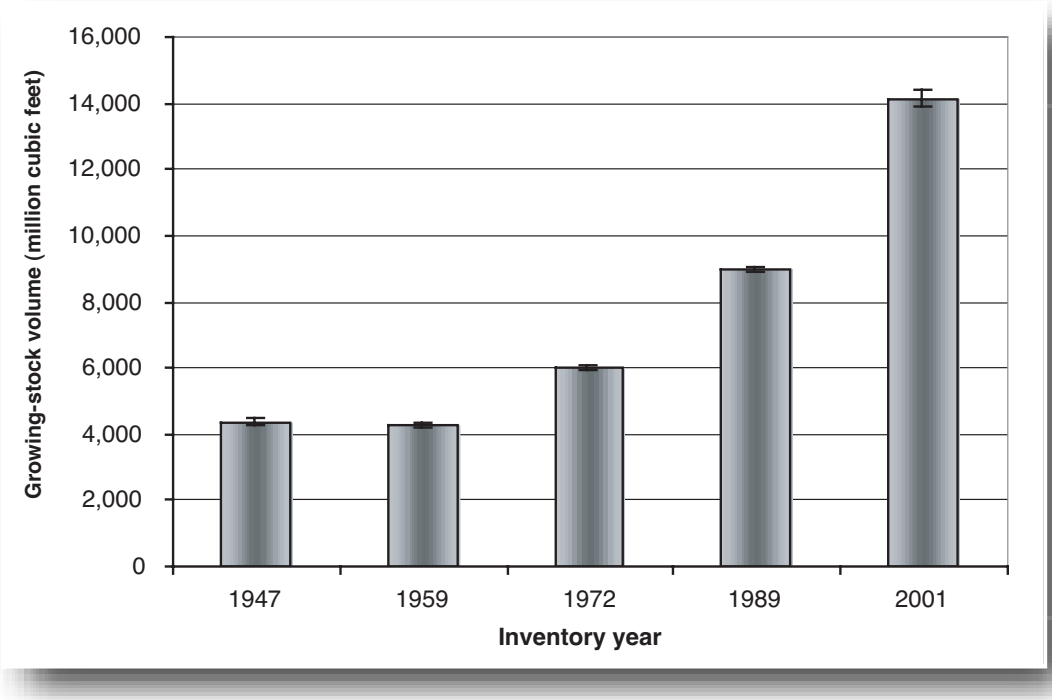


Figure 5.—*Growing-stock volume on timberland, Missouri, 1947-2001. (Note: The sampling error associated with an inventory estimate is represented by the vertical line at the top of each bar.)*

many other measures of coverage and abundance in Missouri, hardwoods constituted the preponderance of the volume (91 percent or 40.9 billion board feet). Red and white oaks totaled 29.9 billion board feet or 73 percent of the hardwood sawtimber total. Trees that were 19 or more inches in diameter were 5.2 percent of the softwood volume (209 million board feet) and 21.2 percent of the hardwood volume (8.7 billion board feet). In 1989, the proportions were 3.6 percent and 16.8 percent, respectively (Spencer *et al.* 1992).

Biomass

The live aboveground biomass on timberland in Missouri totaled 557.8 million dry tons (table 9). Almost 9 percent of that total was in the 1- to 5-inch trees, 70.9 percent was in growing-stock trees, and 20.2 percent was in non-growing-stock trees. Private landowners held 81.8 percent or 456.1 million tons, while public owners held 18.2 percent (101.6 million dry tons). Of the 395.2 million dry tons in growing-stock trees, 80.5 percent is on private land and 19.5 percent is on public land. Among non-growing-stock trees, 87 percent of the biomass is on private land and 13 percent is on public land (fig. 6).

Almost 72 percent of the total biomass of the growing-stock trees was in the boles, and the remaining 28.1 percent was in stumps, tops, and limbs. Approximately the same proportions existed for the 112.6 million dry tons of non-growing-stock trees: 72.6 percent was in bolewood and 27.4 percent was in stumps, tops, and limbs. The only apparent deviation was the percentage of biomass in publicly owned growing-stock softwoods: 83.3 percent of the biomass was made up of tree boles, and the remaining 16.7 percent constituted the stumps, tops, and limbs. This difference could reflect management activities, or perhaps the stands were made up mainly of younger, more densely stocked pine plantings and natural regeneration. Non-growing-stock softwoods on public land, a relatively small 265.3 thousand dry tons, also had a slightly higher percentage in the boles, 76 percent, than did the total ownership, non-growing-stock percentage of 72.6 percent.

An interesting facet of these data is the relatively small proportion of aboveground biomass in non-growing-stock softwood trees (8.8 percent of all softwood biomass) vs. non-growing-stock hardwood trees (20.9 percent of

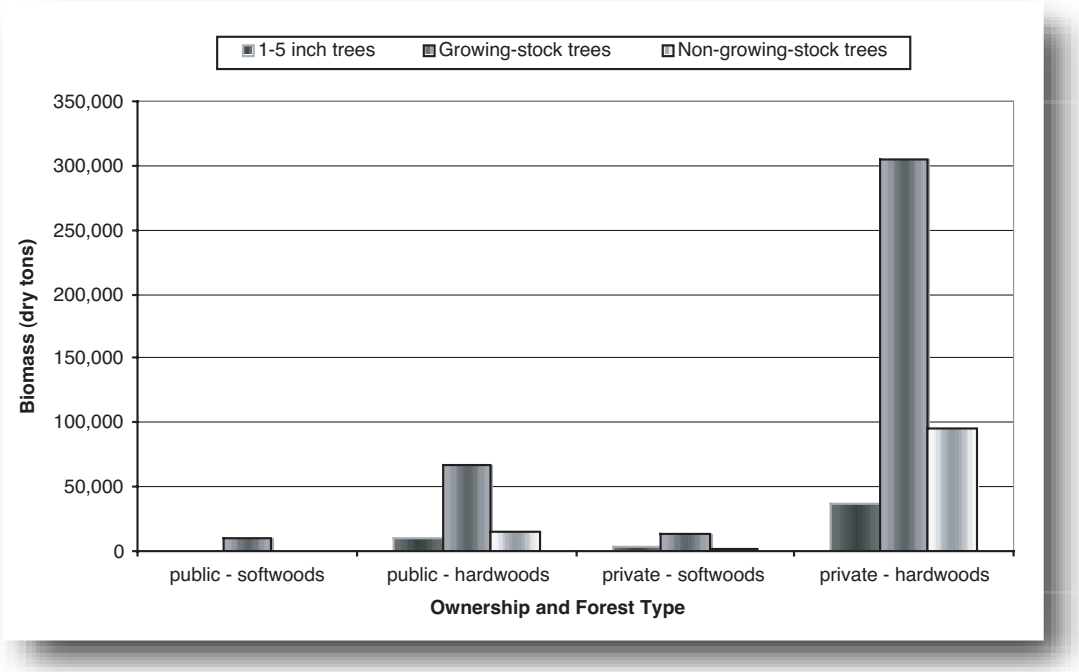


Figure 6.—*Live aboveground biomass, in million dry tons, by ownership type and forest type, for Missouri, 1999-2001.*

all hardwood biomass). This disparity no doubt reflects the higher proportion of hardwood volume made up of species of little or no commercial value and/or the higher likelihood of hardwoods that have fire and mechanical defects that result in quality degrades to the point of being economically without value. It should be pointed out, however, that degrade-causing defects are often opportunities for wildlife habitat (cavities and the like), so such trees are hardly useless from an ecological standpoint.

Growth, Removals, and Mortality

The growing stock on Missouri's timberland grew, on average, 606 million cubic feet per year (table 10). Softwood growth was 44.9 million cubic feet per year. Hardwood growth was 561 million cubic feet per year. Hardwood growth was 92.6 percent of the total growth, while the hardwood growing stock in 1989 was 90.4 percent of the total volume. The fastest growing species groups, compared to the 1989 inventory, were other eastern softwoods, increasing by 43.0 million cubic feet per year, and hard maple at 10.8 million cubic feet per year. Select oaks (white and red) grew 166.4 million cubic feet per year.

Average annual removals of growing stock on timberland (table 11) totaled 119.5 million cubic feet per year. Softwood removals were 12.0 million cubic feet per year or 10 percent of the total. Hardwood removals were 107.5 million cubic feet per year. Removals from private property totaled 105.4 million cubic feet per year, 88.2 percent of all removals. Public land removals averaged 14.1 million cubic feet per year. The species group category "other red oaks" had the highest average annual removals, at 40.6 million cubic feet per year or 37.8 percent of the total average hardwood removal. The next highest species group was "select white oaks," at 29.2 million cubic feet per year (27.1 percent), followed by "other eastern soft hardwoods" at 9.5 million cubic feet per year or 8.8 percent of the hardwood total.

Total average annual removals (hardwood and softwood) were 22.0 percent of net annual growth, while softwood removals alone were 29.9 percent. This latter percentage may reflect

a slowing of growth in mature stands, replacement of softwoods by hardwoods as the softwoods are harvested, higher than average timber harvests, or some combination of these. In all, however, the average annual net growth far outpaced average annual removals.

Average annual mortality of all growing stock on timberland, 1989 through 1999-2001, was 80 million cubic feet per year (table 12). Ninety-four percent of the total, or 75.3 million cubic feet per year, was from hardwoods, while the remaining 4.8 million cubic feet per year was from conifers. Across all species groups, 20.5 percent or 16.4 million cubic feet per year occurred on public lands. If one looks at hardwoods alone, 19.1 percent or 14.4 million cubic feet per year of mortality was on public lands, while average annual mortality of public land softwood totaled 2 million cubic feet per year or 42.2 percent of all softwood mortality. Among hardwood species groups, the other red oaks category had the highest mortality at 22.3 million cubic feet per year or 29.6 percent of all hardwood mortality. This species group also had the highest mortality on public lands, 6.3 million cubic feet per year. The 28.3 percent of other red oak's mortality that occurred on public lands was the highest percentage for all hardwoods and no doubt reflected the impact of the oak decline complex on the dense, overmature timber disproportionately represented on such lands (Lawrence *et al.* 2002).

Forest Health

The following information about pathogens and insects affecting Missouri forests comes from the National Forest Health Monitoring Program (FHM) Web site at: http://www.na.fs.fed.us/spfo/fhm/fhh/fhh-01/mo/mo_01.htm.

Drought—The drought of the past couple of years has eased in some sections of Missouri. Precipitation in 2001 tended to be average or above average in the northern and western sections of the State. However, many other areas have not recovered from past droughts. Precipitation in 2001 tended to be below average in southern and southeastern Missouri, areas that had some of the most severe drought in recent years.

February 2001 was the wettest February on record for Missouri as a whole. This was followed by below average precipitation in March and April for much of the State, particularly southern Missouri. June and July were wetter than normal in most areas, particularly in western Missouri. Precipitation was adequate to maintain foliage color throughout the summer in most parts of Missouri. No widespread foliar scorch was observed as in past years.

Nevertheless, the effects of drought-related stress in trees, particularly in red oaks, are becoming more obvious across southern Missouri with wood borer damage and evidence of oak decline becoming more common. Increased activity has been reported for several wood borers including the red oak borer (*Enaphalodes rufulus*), carpenterworms (*Prionoxystus* sp.), twolined chestnut borer (*Agrilus bilineatus*), prionus root borers (*Prionus* sp.), and a variety of other Cerambycid and Buprestid borers.

Oak Decline—Oak decline reports in Missouri increased in 2001, especially in stands with a large, old red oak component, growing in shallow, rocky soils, and occurring on upper slopes. Armillaria root rot, Hypoxylon canker, red oak borers, and carpenterworms are commonly associated with stands affected by oak decline. The oak decline situation in Missouri is not as serious as that in Arkansas. However, all of the risk factors causing severe oak decline in Arkansas are present throughout much of the Ozark Highlands in southern Missouri. In the next few years, widespread oak mortality in Missouri could reach levels that will have a major impact on forest and wildlife resources.

Oak Wilt—There were 12 confirmed cases of oak wilt caused by *Ceratocystis fagacearum* in 2001. These positives were collected from the following counties: Platt, Clay, Jackson, Howard, Boone, Audrain, Callaway, Marion, Montgomery, Lincoln, St. Charles, and St. Louis. Five positives were recovered from pin oak, three from shingle oak, and four from northern red oak. Oak wilt mats or pads were observed in at least one FIA plot located in Howard County.

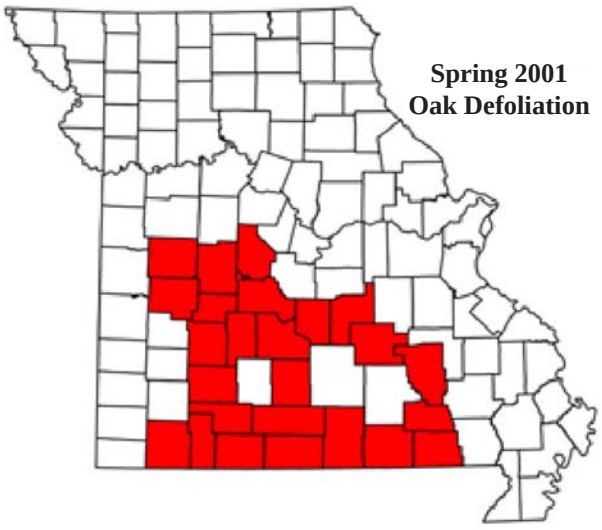
White Pine Decline—White pines 20-30 years of age continued to have wilt-like stress associated with sunken bark on the main stems. The cause cannot be attributed to a single fungal agent on 10 trees sampled randomly across Missouri, but may be related to xylem cavitation that results from transpiration-induced water stress during prolonged drought.

Fire Blight—Fire blight reports were high through June and July over much of Missouri. The increase was likely due to a severe hail storm centered in mid-Missouri 'Bradford' pear, a normally tolerant tree, ha many reports of tip dieback, although mos trees recovered by the end of the growing season.

Spring Defoliators—Several oak defoliators caused scattered damage across southern and western Missouri during May 2001. The common oak moth (*Phoberia atomaria*), a Noctuid looper, caused defoliation primarily on post oaks in two tiers of counties along the southern edge of the State. A complex of several defoliator species was active in west central Missouri, defoliating a variety of oaks.

Summer Defoliators—Defoliation by the variable oakleaf caterpillar (*Lochmaeus manteo*) was less in 2001 than in the past few years. One small pocket of heavy defoliation by this insect (less than 2,000 acres) was observed in late summer in southern Iron County, approximately 50 miles east of where defoliation occurred in Texas and Dent Counties in 1999 and 2000. Oak defoliation by grasshoppers was also observed in middle to late summer in several scattered stands in southeastern Missouri.

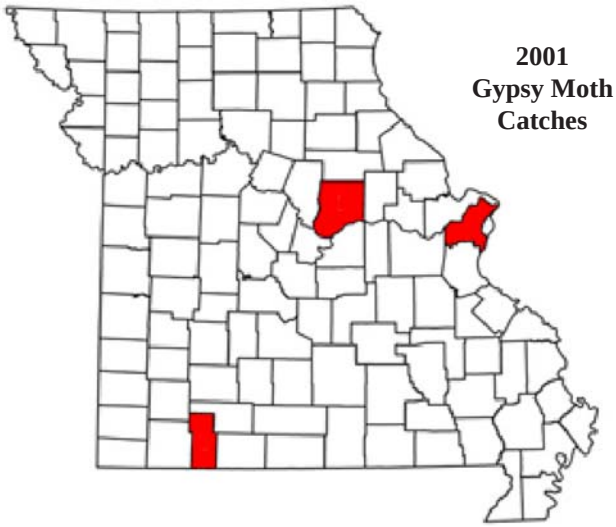
Jumping Oak Gall—Foliar damage from the jumping oak gall wasp (*Neuroterus* sp.) was minimal in 2001. Very light infestations were observed in a handful of forest stands, primarily in eastern Missouri. This light damage represents a sharp decrease from the widespread foliar damage that occurred in eastern Missouri during 1998-2000.



Horned and Gouty Oak Galls—Heavy branch galling by the horned oak gall wasp (*Callirhytis cornigera*), and possibly also the gouty oak gall wasp (*C. quercuspunctata*), was observed on individual shingle oaks and other species of oaks throughout central and eastern Missouri in 2001. Heavy damage by these galls can cause significant branch dieback and, in severe cases, tree mortality, if populations repeatedly attack the same trees over several years.

Gypsy Moth—The Missouri Cooperative Gypsy Moth Survey continued its annual effort to detect gypsy moths by placing and monitoring approximately 12,000 traps throughout Missouri in 2001. A total of six moths were captured statewide: four moths from St. Louis County, one from Stone County, and one from Callaway County. Captures in the first two counties represent the same general areas where moths have been caught for the past several years in the St. Louis urban area and the popular recreation area of Branson and Table Rock Lake in southwestern Missouri, respectively. Large volumes of interstate traffic traveling to those areas provide opportunity for gypsy moths to repeatedly hitchhike into the State.

In spite of repeated moth captures in some areas, there are no known populations of gypsy moths in Missouri at this time. Sites where gypsy moths were captured one year are surveyed with an increased trap density in the following year. In most cases, survey results in the vicinity of past captures have been negative within 1 or 2 years following the original capture. Despite these favorable past results, the risk of gypsy moths establishing in Missouri continues to increase as infested areas in nearby States expand. Statewide gypsy moth monitoring efforts will continue annually in Missouri.



2001 Gypsy Moth Catches

Summary

As long-term trends continue in Missouri, most measures of forested area and volume show increases. Area has increased steadily since a low point in 1972, while standing volume has continued to increase since 1947. By and large, Missouri's forests are healthy, but there are more and more indications of problems, particularly with respect to oak decline. The severity of oak decline in neighboring Arkansas suggests that Missouri forests are at risk.

As additional data become available from ensuing panels, a more precise picture of the direction of Missouri forests will emerge. Additional data related to the two most recent inventories of Missouri (1989 and 1999-2001) are available at: http://www.ncrs.fs.fed.us/4801/fiadb/index.htm.

APPENDIX

Inventory Methods

Since the 1989 inventory of Missouri, several changes have been made in NCFIA inventory methods to improve the quality of the inventory as well as to meet increasing demands for timely forest resource information. The most significant difference between inventories is the change from periodic inventories to annual inventories. Historically, NCFIA periodically inventoried each State on a cycle that averaged about 12 years. However, the need for timely and consistent data across large geographical regions, combined with national legislative mandates, resulted in NCFIA's implementation of an annual inventory system. Missouri was one of the first States in the North Central region, and in the Nation, to be inventoried with this new system, beginning with the 1999 inventory.

With an annual inventory system, about one-fifth of all field plots are measured each year. After 5 years, an entire inventory cycle will be completed. After the first 5 years, NCFIA will report and analyze results as a moving 5-year average. For example, NCFIA will be able to generate a report based on inventory results for 1999 through 2004 or for 2001 through 2006. While there are great advantages for an annual inventory, one difficulty is reporting results before an entire cycle is completed. With the 2001 annual measurements, 60 percent of all field plots have been measured. Sampling error estimates for the 2001 inventory results are area of forest land, 1.04 percent; area of timberland, 1.11 percent; number of growing-stock trees on timberland, 1.89 percent; volume of growing stock on timberland, 1.81 percent; and volume of sawtimber on timberland, 2.32 percent. These sampling error estimates are higher than those for the last periodic inventory completed in 1989 (i.e., 0.53 percent for timberland area and 1.04 percent for growing-stock volume) because of the smaller sample sizes. Thus, caution should be used when drawing conclusions based on this limited data set. As we complete ensuing measurements, we will have additional confidence in our results due to the increased number of field plots measured. As each measurement year is completed, the precision of estimates will improve.

Other significant changes between inventories include new remote sensing technology, a new field plot design, and the gathering of additional remotely sensed and field data. The advent of remote sensing technology since the previous inventory in 2001 has allowed NCFIA to use computer-assisted classifications of Multi-Resolution Land Characterization (MRLC) data and other available remote sensing products to stratify the total area of the State and to improve the precision of estimates. Previous inventories in Missouri (1947, 1959, 1972, and 1989) used manual interpretation of aerial photos to stratify the State.

New algorithms were used in 1999-2001 to assign forest type and stand-size class to each condition observed on a plot. These algorithms are being used nationwide by FIA to provide consistency among States and will be used to reassign the forest type and stand-size class of every plot measured in the 1989 inventory when it is updated. This will be done so that changes in forest type and stand-size class will more accurately reflect actual changes in the forest and not changes in how values are computed. The list of recognized forest types, grouping of these forest types for reporting purposes, models used to assign stocking values to individual trees, definition of nonstocked, and names given to the forest types changed with the new algorithms. As a result, comparisons between the published 2001 inventory results and those published for the 1989 inventory may not be valid. For additional details about algorithms used in both inventories, please contact NCFIA.

Sampling Phases

The 2001 Missouri survey was based on a three-phase inventory. The first phase used classified satellite imagery to stratify the State and aerial photographs to select plots for measurement. The second phase entailed measurement of the traditional FIA suite of mensurational variables, while the third phase focused on a suite of variables related to the health of the forest.

The only land that could not be sampled was private land where field personnel could not obtain permission from the owner to measure the field plot and 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

The 2001 inventory used a computer-assisted classification of satellite imagery. FIA used the imagery to form two initial strata—forest and nonforest. Pixels within 60 m (2 pixel widths) of a forest/nonforest edge formed two additional strata—forest/nonforest and nonforest/forest. Forest pixels within 60 m on the forest side of a forest/nonforest boundary were classified into a forest edge stratum. Pixels within 60 m of the boundary on the nonforest side were classified into a nonforest edge stratum. The estimated population total for a variable is the sum across all strata of the product of each stratum's estimated area and the variable's estimated mean per unit area for the stratum.

Phase 2

Phase 2 of the inventory consisted of the measurement of the annual sample of field plots in Missouri. Current FIA precision standards for annual inventories require a sampling intensity of one plot for approximately every 6,000 acres. FIA has divided the entire area of the United States into non-overlapping hexagons, each of which contains 5,937 acres (McRoberts 1999). An array of field plots was established by selecting one plot 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 1989 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 in Missouri is funded by the Federal government. In addition, the Missouri Department of Conservation contributed personnel and equipment that allowed for intensified sampling in several regions of the State.

The total Federal base sample of plots was systematically divided into five interpenetrating, non-overlapping subsamples or panels. Each year the plots in a single panel are measured, and panels are selected on a 5-year, rotating basis (McRoberts 1999). For estimation purposes, the measurement of each panel of plots may be considered an independent systematic sample of all land in a State. Field crews measure vegetation on plots forested at the time of the last inventory and on plots currently classified as forest by trained photointerpreters using aerial photos or digital ortho-quads.

Phase 3

NCFIA has two categories of field plot measurements—phase 2 field plots (standard FIA plots) and phase 3 plots (forest health plots)—to optimize our ability to collect data when available for measurement. Both types of plot 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 non-woody

understory vegetation, ground cover, soils, and other variables. We anticipate that in Missouri the complete 5-year annual inventory will involve about 220 phase 3 plots. On the remaining plots, referred to as phase 2 plots, only variables that can be measured throughout the entire year are collected. In Missouri, the complete 5-year annual inventory is expected to involve about 4,633 phase 2 forested plots. The 2000–2001 annual inventory results represent field measures on 985 phase 2 forested plots and 43 phase 3 plots.

The new national FIA plot design (fig. 7) was first used for data collection in Missouri in 1999, the first annual inventory year. This design was also used in the 2000 and 2001 inventories and will be used in subsequent years. The national plot design requires mapping forest conditions on each plot. Due to the small sample size (20 percent) each year, precision associated with change factors such as mortality will be relatively low. When the complete annual inventory has been completed in 2003, the full range of change data will be available.

The overall plot layout for the new design consists of four subplots. The centers of subplots 2, 3, and 4 are located 120 feet from the center of subplot 1. The azimuths to subplots 2, 3, and 4 are 0, 120, and 240 degrees, respectively. The center of the new plot is located at the same point as the center of the previous plot if a previous plot existed within the sample unit. Trees with a d.b.h. 5 inches and larger are measured on a 24-foot-radius (1/24 acre) circular subplot. All trees less than 5 inches d.b.h. are measured on a 6.8-foot-radius (1/300 acre) circular microplot located 12 feet east of the center of each of the four subplots. Forest conditions that occur on any of the four subplots are recorded. Factors that differentiate forest conditions are changes in forest type, stand-size class, reserved status, 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.

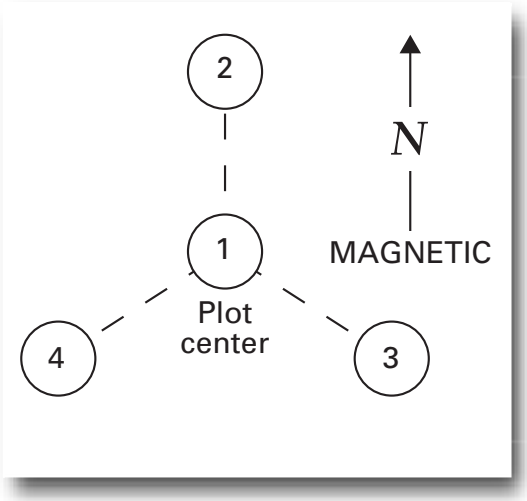


Figure 7.—*Current NCFIA field plot design.*

Field plot measurements are combined with phase 1 estimates in the compilation process and table production. The number of published tables generated from less than five panels of data is limited. Additional data related to the most recent inventories of Missouri are available at: http://www.ncrs.fs.fed.us/4801/fiadb/index.htm.

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TABLE TITLES

TABLES

Table 1. -- Area of forest land by forest type group and owner category, Missouri, 1999 - 2001

(In thousand acres)

Forest type group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
White / red / jack pine	3.0	3.0	- -	- -
Loblolly / shortleaf pine	160.9	105.9	55.0	- -
Pinyon / juniper	431.9	22.0	409.9	- -
All softwood types	595.8	130.9	464.9	- -
Hardwood type groups				
Oak / pine	1,117.5	300.2	817.4	- -
Oak / hickory	10,437.5	1,945.4	8,492.1	- -
Oak / gum / cypress	103.9	18.6	85.3	- -
Elm / ash / cottonwood	1,436.7	154.1	1,282.7	- -
Maple / beech / birch	977.3	100.7	876.6	- -
All hardwood types	14,073.0	2,519.0	11,554.0	- -
Nonstocked	52.2	7.5	44.7	- -
All forest types	14,721.0	2,657.4	12,063.6	- -

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

Table 2. -- Area of timberland by major forest type group, stand origin, and owner category, Missouri, 1999 - 2001

(In thousand acres)

Major forest type group and stand origin	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
Natural	536.5	91.7	444.8	- -
Planted	38.2	33.2	5.0	- -
All softwood types	574.7	124.9	449.8	- -
Hardwood type groups				
Natural	13,696.0	2,292.1	11,403.9	- -
Planted	23.7	8.3	15.4	- -
All hardwood types	13,719.7	2,300.4	11,419.3	- -
Nonstocked	52.2	7.5	44.7	- -
All groups	14,346.6	2,432.8	11,913.8	- -

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

Table 3. -- Area of timberland by forest type group and stand-size class, Missouri, 1999 - 2001

(In thousand acres)

Forest type group	All stands	Stand-size class			
		Sawtimber	Poletimber	Sapling-seedling	Non-stocked
Softwood type groups					
White / red / jack pine	3.0	3.0	- -	- -	- -
Loblolly / shortleaf pine	160.9	98.4	56.3	6.2	- -
Pinyon / juniper	410.8	78.7	182.5	149.6	- -
All softwood types	574.7	180.0	238.9	155.8	- -
Hardwood type groups					
Oak / pine	1,070.5	378.9	454.1	237.5	- -
Oak / hickory	10,180.9	5,539.6	3,766.2	875.1	- -
Oak / gum / cypress	103.9	74.6	15.2	14.1	- -
Elm / ash / cottonwood	1,397.9	717.9	404.6	275.4	- -
Maple / beech / birch	966.4	401.0	292.7	272.7	- -
All hardwood types	13,719.7	7,112.0	4,932.9	1,674.8	- -
Nonstocked	52.2	- -	- -	- -	52.2
All forest types	14,346.6	7,292.0	5,171.8	1,830.6	52.2

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

Table 4. -- Net volume of all live trees on forest land by species group and owner category, Missouri, 1999 - 2001

(In thousand cubic feet)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Loblolly and shortleaf pines	803,675	497,556	306,119	- -
Other yellow pines	755	238	517	- -
Eastern white and red pines	8,938	7,335	1,602	- -
Cypress	540	- -	540	- -
Other eastern softwoods	532,139	51,853	480,286	- -
Total softwoods	1,346,046	556,982	789,064	- -
Hardwoods				
Select white oaks	4,133,170	873,768	3,259,402	- -
Select red oaks	1,078,923	220,431	858,491	- -
Other white oaks	1,843,964	272,823	1,571,141	- -
Other red oaks	4,047,766	905,098	3,142,667	- -
Hickory	1,579,603	268,552	1,311,051	- -
Hard maple	262,900	31,653	231,248	- -
Soft maple	416,643	83,665	332,978	- -
Beech	12,985	9,138	3,847	- -
Sweetgum	35,768	11,166	24,602	- -
Tupelo and blackgum	100,163	26,463	73,700	- -
Ash	377,002	28,182	348,820	- -
Cottonwood and aspen	177,109	34,868	142,241	- -
Basswood	36,924	3,719	33,205	- -
Yellow-poplar	19,158	6,214	12,944	- -
Black walnut	454,738	60,539	394,200	- -
Other eastern soft hardwoods	1,357,549	144,221	1,213,329	- -
Other eastern hard hardwoods	438,376	34,657	403,719	- -
Eastern noncommercial hardwoods	121,151	4,093	117,058	- -
Total hardwoods	16,493,892	3,019,250	13,474,642	- -
All species groups	17,839,939	3,576,232	14,263,707	- -

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

Table 5. -- Net volume of all live trees and salvable dead trees on timberland by class of timber and softwood/hardwood categories, Missouri, 1999 - 2001

(In thousand cubic feet)

Class of timber	All species	Softwood species	Hardwood species
Live trees			
Growing-stock trees			
Sawtimber			
Saw log portion	7,875,309	692,852	7,182,457
Upper stem portion	1,450,632	90,979	1,359,654
Total	9,325,942	783,830	8,542,111
Poletimber	4,798,766	414,829	4,383,937
All growing-stock trees	14,124,707	1,198,660	12,926,048
Cull trees			
Rough trees [1]			
Sawtimber size	1,981,753	67,548	1,914,205
Poletimber size	909,778	46,298	863,480
Total	2,891,531	113,846	2,777,685
Rotten trees [1]			
Sawtimber size	343,101	732	342,369
Poletimber size	37,037	392	36,645
Total	380,138	1,124	379,014
All live cull trees	3,271,669	114,970	3,156,699
All live trees	17,396,377	1,313,630	16,082,747
Salvable dead trees			
Sawtimber size	107,101	4,603	102,498
Poletimber size	94,403	4,785	89,618
All salvable dead trees	201,504	9,388	192,117
All classes	17,597,881	1,323,018	16,274,863

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

1 Includes noncommercial species.

Table 6. -- Net volume of growing stock on timberland by forest group and softwood/hardwood species categories, Missouri, 1999 - 2001

(In thousand cubic feet)

Forest type group	All species	Softwood species	Hardwood species
Softwood type groups			
White / red / jack pine	6,481	6,109	372
Loblolly / shortleaf pine	302,373	258,882	43,491
Pinyon / juniper	195,930	136,892	59,037
All softwood types	504,784	401,884	102,900
Hardwood type groups			
Oak / pine	891,734	450,205	441,528
Oak / hickory	10,609,477	326,328	10,283,148
Oak / gum / cypress	185,822	- -	185,822
Elm / ash / cottonwood	1,261,210	2,858	1,258,352
Maple / beech / birch	669,778	17,229	652,549
All hardwood types	13,618,020	796,620	12,821,399
Nonstocked	1,904	155	1,748
All forest types	14,124,707	1,198,660	12,926,048

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

Table 7. -- Net volume of growing stock on timberland by species group and diameter class, Missouri, 1999 - 2001

(In thousand cubic feet)

Species group	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											
Loblolly and shortleaf pines	789,166	61,002	115,855	162,656	162,670	131,196	77,258	42,018	30,422	6,089	- -
Other yellow pines	238	43	195	- -	- -	- -	- -	- -	- -	- -	- -
Eastern white and red pines	7,583	- -	704	743	2,147	3,989	- -	- -	- -	- -	- -
Cypress	540	- -	- -	- -	540	- -	- -	- -	- -	- -	- -
Other eastern softwoods	401,132	128,408	108,622	86,069	39,566	28,504	6,174	1,112	- -	2,678	- -
Total softwoods	1,198,660	189,454	225,375	249,468	204,923	163,690	83,432	43,130	30,422	8,766	- -
Hardwoods											
Select white oaks	3,388,247	222,945	339,380	473,963	557,302	551,727	456,521	327,989	196,397	246,299	15,725
Select red oaks	898,837	41,031	67,879	88,097	101,594	130,105	119,935	108,088	97,450	126,950	17,709
Other white oaks	1,375,273	139,760	224,577	256,724	233,240	210,157	144,837	71,690	42,766	27,308	24,215
Other red oaks	3,403,863	217,847	332,112	470,788	583,868	566,053	453,386	308,179	198,790	228,534	44,306
Hickory	1,335,537	175,517	233,699	228,583	232,357	169,974	129,258	63,772	38,220	64,158	- -
Hard maple	187,309	31,865	28,453	36,452	27,163	15,568	11,856	15,124	15,449	5,379	- -
Soft maple	243,702	13,919	19,956	16,002	19,851	17,591	39,584	18,327	26,147	64,563	7,762
Beech	1,102	- -	180	299	- -	624	- -	- -	- -	- -	- -
Sweetgum	29,971	1,307	3,072	4,106	3,806	3,268	5,887	6,519	2,007	- -	- -
Tupelo and blackgum	82,716	12,719	12,847	12,443	8,879	10,793	11,828	3,884	6,704	2,621	- -
Ash	265,414	24,454	37,304	38,723	39,077	39,314	41,178	17,206	12,164	15,994	- -
Cottonwood and aspen	160,826	1,300	670	1,614	8,148	943	12,964	16,748	22,722	21,658	74,060
Basswood	26,842	592	3,026	4,237	4,411	2,789	1,793	2,592	3,346	4,056	- -
Yellow-poplar	19,046	427	245	1,316	2,124	6,125	4,706	1,679	2,423	- -	- -
Black walnut	346,150	17,868	33,500	42,742	66,302	53,854	43,011	43,957	26,062	18,854	- -
Other eastern soft hardwoods	949,885	119,302	133,065	126,179	121,948	108,465	92,707	98,425	54,939	73,964	20,891
Other eastern hard hardwoods	211,325	26,188	33,072	31,592	27,443	33,423	7,340	18,255	22,924	2,699	8,389
Total hardwoods	12,926,048	1,047,041	1,503,035	1,833,860	2,037,512	1,920,772	1,576,789	1,122,435	768,510	903,037	213,056
All species	14,124,707	1,236,495	1,728,411	2,083,329	2,242,435	2,084,462	1,660,221	1,165,565	798,932	911,803	213,056

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

Table 8. -- Net volume of sawtimber on timberland by species group and diameter class, Missouri, 1999 - 2001

(In thousand board feet)[1]

Species group	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
Loblolly and shortleaf pines	3,169,465	811,823	833,933	686,364	411,110	227,547	165,304	33,383	- -
Eastern white and red pines	32,891	3,453	10,163	19,275	- -	- -	- -	- -	- -
Cypress	2,238	- -	2,238	- -	- -	- -	- -	- -	- -
Other eastern softwoods	864,098	476,891	204,288	138,631	28,531	4,945	- -	10,812	- -
Total softwoods	4,068,692	1,292,167	1,050,622	844,270	439,641	232,492	165,304	44,195	- -
Hardwoods									
Select white oaks	11,062,978	- -	2,721,922	2,649,395	2,155,364	1,516,814	890,425	1,066,393	62,665
Select red oaks	3,467,425	- -	503,750	650,350	600,857	539,800	483,822	612,989	75,857
Other white oaks	3,620,042	- -	1,133,374	1,014,572	697,595	341,423	202,984	125,838	104,256
Other red oaks	11,721,019	- -	2,898,319	2,819,456	2,253,103	1,520,210	968,290	1,081,560	180,082
Hickory	3,419,321	- -	1,138,067	833,425	635,047	312,211	187,442	313,128	- -
Hard maple	427,599	- -	128,942	73,980	56,525	71,140	72,351	24,660	- -
Soft maple	835,319	- -	86,124	77,030	173,823	80,392	114,177	274,062	29,709
Beech	3,149	- -	- -	3,149	- -	- -	- -	- -	- -
Sweetgum	97,350	- -	17,347	14,990	26,789	29,259	8,963	- -	- -
Tupelo and blackgum	203,809	- -	41,117	49,555	54,014	17,633	29,944	11,546	- -
Ash	768,800	- -	176,905	181,998	193,812	81,877	58,022	76,187	- -
Cottonwood and aspen	748,489	- -	38,385	4,714	64,358	84,191	115,436	111,853	329,553
Basswood	94,338	- -	22,311	14,047	8,979	12,881	16,438	19,682	- -
Yellow-poplar	86,967	- -	10,385	30,634	24,598	8,574	12,776	- -	- -
Black walnut	1,185,775	- -	316,691	256,733	203,416	207,015	120,501	81,418	- -
Other eastern soft hardwoods	2,590,567	- -	559,070	495,297	418,893	445,738	249,771	327,913	93,885
Other eastern hard hardwoods	545,897	- -	126,608	154,252	33,494	82,912	103,144	11,882	33,605
Total hardwoods	40,878,845	- -	9,919,318	9,323,579	7,600,668	5,352,070	3,634,487	4,139,114	909,611
All species	44,947,538	1,292,167	10,969,940	10,167,849	8,040,309	5,584,562	3,799,791	4,183,308	909,611

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand 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, Missouri, 1999 - 2001

(In dry tons)

Owner category and softwood/hardwood category	All components	Tree biomass component						
		All live 1-5 inch trees	Growing-stock trees			Non-growing-stock trees		
			Total	Boles	Stumps, tops, and limbs	Total	Boles	Stumps, tops, and limbs
Public								
Softwoods	11,044,735	694,602	10,084,817	8,397,537	1,687,280	265,315	201,666	63,649
Hardwoods	90,584,485	9,271,904	66,923,091	47,942,968	18,980,123	14,389,490	10,459,331	3,930,159
Total	101,629,220	9,966,506	77,007,908	56,340,506	20,667,402	14,654,806	10,660,998	3,993,808
Private								
Softwoods	20,094,079	3,806,966	13,821,510	10,477,889	3,343,621	2,465,602	1,757,986	707,616
Hardwoods	436,091,554	36,116,069	304,459,383	217,290,946	87,168,437	95,516,102	69,343,810	26,172,292
Total	456,185,633	39,923,036	318,280,893	227,768,834	90,512,059	97,981,704	71,101,796	26,879,908
All ownerships								
Softwoods	31,138,814	4,501,569	23,906,327	18,875,426	5,030,901	2,730,918	1,959,653	771,265
Hardwoods	526,676,039	45,387,973	371,382,474	265,233,914	106,148,560	109,905,592	79,803,141	30,102,451
Total	557,814,853	49,889,542	395,288,801	284,109,340	111,179,461	112,636,510	81,762,794	30,873,716

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

Table 10. -- Average annual net growth of growing-stock on timberland by species group and owner category, Missouri, 1989 to 1999 - 2001

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Loblolly and shortleaf pines	17,997	10,074	7,922	- -
Other yellow pines	- -	- -	- -	- -
Eastern white and red pines	785	785	- -	- -
Other eastern softwoods	26,109	2,781	23,328	- -
Total softwoods	44,891	13,640	31,251	- -
Hardwoods				
Select white oaks	138,285	22,932	115,354	- -
Select red oaks	28,106	4,476	23,629	- -
Other white oaks	58,367	7,681	50,686	- -
Other red oaks	158,558	22,902	135,656	- -
Hickory	54,050	5,647	48,404	- -
Hard maple	10,842	641	10,201	- -
Soft maple	11,650	1,704	9,946	- -
Beech	- -	- -	- -	- -
Sweetgum	1,420	241	1,179	- -
Tupelo and blackgum	1,940	172	1,769	- -
Ash	12,232	694	11,538	- -
Cottonwood and aspen	7,321	459	6,862	- -
Basswood	2,651	45	2,606	- -
Yellow-poplar	-65	- -	-65	- -
Black walnut	17,598	280	17,318	- -
Other eastern soft hardwoods	42,955	1,654	41,301	- -
Other eastern hard hardwoods	16,024	444	15,580	- -
Eastern noncommercial hardwoods	- -	- -	- -	- -
Total hardwoods	561,934	69,971	491,964	- -
All species groups	606,825	83,611	523,214	- -

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

Table 11. -- Average annual removals of growing stock on timberland by species group and owner category, Missouri, 1989 to 1999 - 2001

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Loblolly and shortleaf pines	8,571	2,975	5,596	- -
Other eastern softwoods	3,399	- -	3,399	- -
Total softwoods	11,970	2,975	8,995	- -
Hardwoods				
Select white oaks	29,169	2,139	27,030	- -
Select red oaks	5,530	721	4,809	- -
Other white oaks	9,784	762	9,022	- -
Other red oaks	40,615	6,855	33,760	- -
Hickory	5,109	491	4,618	- -
Hard maple	520	- -	520	- -
Soft maple	1,626	- -	1,626	- -
Tupelo and blackgum	- -	- -	- -	- -
Ash	1,662	- -	1,662	- -
Cottonwood and aspen	2,094	- -	2,094	- -
Basswood	601	- -	601	- -
Yellow-poplar	546	- -	546	- -
Black walnut	596	- -	596	- -
Other eastern soft hardwoods	9,454	141	9,313	- -
Other eastern hard hardwoods	243	- -	243	- -
Total hardwoods	107,550	11,109	96,441	- -
All species groups	119,520	14,083	105,436	- -

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

Table 12. -- Average annual mortality of growing stock on timberland by species group and owner category, Missouri, 1989 to 1999 - 2001

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Loblolly and shortleaf pines	2,788	1,304	1,483	- -
Other yellow pines	- -	- -	- -	- -
Eastern white and red pines	146	146	- -	- -
Other eastern softwoods	1,875	580	1,295	- -
Total softwoods	4,809	2,030	2,779	- -
Hardwoods				
Select white oaks	9,019	1,156	7,863	- -
Select red oaks	5,399	1,275	4,124	- -
Other white oaks	5,355	600	4,755	- -
Other red oaks	22,279	6,294	15,985	- -
Hickory	6,981	1,433	5,548	- -
Hard maple	180	180	- -	- -
Soft maple	2,081	- -	2,081	- -
Sweetgum	- -	- -	- -	- -
Tupelo and blackgum	175	175	- -	- -
Ash	1,746	- -	1,746	- -
Cottonwood and aspen	3,266	- -	3,266	- -
Basswood	250	- -	250	- -
Yellow-poplar	266	- -	266	- -
Black walnut	4,142	1,488	2,654	- -
Other eastern soft hardwoods	12,895	1,690	11,205	- -
Other eastern hard hardwoods	1,222	102	1,120	- -
Total hardwoods	75,257	14,393	60,864	- -
All species groups	80,065	16,423	63,643	- -

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

The Forest and Analysis web site is:
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Moser, W. Keith; Treiman, Thomas; Moltzan, Bruce; Lawrence, Robert; Brand, Gary J.

2003. **Missouri's forest resources in 2001.** Resour. Bull. NC-226. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 26 p.

Results of the 2001 fifth annual inventory of Missouri's forest resources show an estimated 14.7 million acres of forest land in the State. The oak-hickory type is the predominant forest type on the landscape, making up over 70 percent of all forested land. Between 1989 and 1999-2001, the net volume of all live trees on timberland increased by 29 percent, from 13.8 billion cubic feet to 17.8 billion cubic feet. The continued drought, along with the mature age of many of the oak forests and overstocked forest stands, may worsen oak decline.

KEY WORDS: Annual inventory, forest area, forest type, volume, biomass, Missouri

Mission Statement

We believe the good life has its roots in clean air, sparkling water, rich soil, healthy economies and a diverse living landscape. Maintaining the good life for generations to come begins with everyday choices about natural resources. The North Central Research Station provides the knowledge and the tools to help people make informed choices. That's how the science we do enhances the quality of people's lives.

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