

Illinois' Forests

2005



Resource Bulletin
NRS-29
2009



United States
Department of Agriculture



Forest
Service



Northern
Research Station

Acknowledgments

The authors thank the following individuals whose dedication and hard work contributed to both the inventory and analysis of Illinois' forest resources.

Chris Albion	Barb Johnson	David Oaks
Tara Bauer	Daniel Johnson	Stephen Ochs
James Blehm	Travis Jones	Cassandra Olson
Brady Boyce	Dan Kaisershot	Shane Olson
Joseph Boykin	Barb Knight	Joe Perrone
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Gianna Evans	Greg Liknes	Paul Richards
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Trenton Girard	Sean Maiers	Travis Rymal
Dale Gormanson	Lisa Mahal	Jay Solomakos
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Hollister Hunt	Kevin Nimerfro	Lacey Whitehouse
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Note: Information including core tables, glossary, and sample/QA/QC methods will be included in a companion document, Illinois' Forests 2005: Statistics and Quality Assurance, Resource Bulletin NRS-30, to be released as an Internet publication in tandem with this 5-year report. Data from the Illinois forest inventory can be accessed electronically at: <http://www.nrs.fs.fed.us/fia/>.

COVER PHOTO: Illinois landscape. Photo by Susan Crocker, U.S. Forest Service.

Manuscript received for publication 11 April 2008.

Published by:
USDA FOREST SERVICE
11 CAMPUS BLVD., SUITE 200
NEWTOWN SQUARE, PA 19073-3294

January 2009

For additional copies:
USDA Forest Service
Publications Distribution
359 Main Road
Delaware, OH 43015-8640
Fax: 740-368-0152

Visit our homepage at: <http://www.nrs.fs.fed.us/>

Illinois' Forests

2005

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Foreword

It is with satisfaction that we present Illinois' statewide forest inventory report. This inventory was a cooperative effort led by the Forest Inventory and Analysis program of the Forest Service, U.S. Department of Agriculture, and the Illinois Council on Forestry Development representing Illinois' forest resource interests.

Illinois has seen an increase of approximately 200,000 forested acres since the last inventory was conducted in 1998 and a gradual increase of roughly 500,000 acres over the last 60 years. A full 40 percent of that gain has come in the last 10 years. This increase represents the hard work of the many organizations and landowners involved in expanding this valuable resource.

Concurrent to an evolving forest resource, many challenges have been identified. Our forests are increasing in volume and getting older. As these forests age, they face significant successional change. Shade tolerant species such as maples are gradually replacing predominantly oak forests, and non-native invasive species are negatively impacting natural regeneration of oak species and other native forest types. The challenge begins when trying to identify management techniques to address these changes and adapt to new ones.

In addition to these challenges, Illinois' forests face numerous threats, including those in the form of forest pests, parcelization, disease, and land conversion. With more than 90 percent of forest land in Illinois in private ownership, it is our responsibility to work with these landowners to devise and implement management strategies to address these developing threats across the entirety of Illinois' forest resources.

The results of *Illinois' Forests 2005* will generate discussion and help the managers of this valuable resource to make responsible management decisions. We invite you to evaluate these results and engage our constituents in thoughtful discussion.

A handwritten signature in black ink, reading "Michael R. Mason". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Michael R. Mason, Chief
Division of Forest Resources,
Office of Resource Conservation

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Highlights

On the Plus Side

- Since reaching an all-time low in 1924, the area of forest land has increased by 1.5 million acres.
- State legislation and participation in programs designed to promote sustainability and regeneration have contributed to the rise in the annual rate of increase in forest area.
- Trees cover 15 percent of the total land area in Illinois.
- With over 2 billion trees representing nearly 100 different species, Illinois' forests support a wide diversity of tree species.
- The State's forests are growing at their highest rates since 1962.
- Average growing-stock volume per acre of timberland has increased threefold since 1948 and now totals 1,576 cubic feet per acre.
- As the volume of sawtimber continues to increase, sawtimber quality remains high.
- Illinois' forests sequester an estimated 343 million tons of carbon.
- The condition of Illinois' tree crowns indicates good forest health.
- Efforts to control the Asian longhorned beetle continue to be successful; no new infestations were found in 2004 or 2005.

⊖ Areas of Concern

- Between 1998 and 2005, the number of trees on forest land decreased by 25 percent, or about a half billion trees, and live volume decreased by 36 percent.
- Illinois' oak resource is characterized by an abundance of large, mature trees and a comparatively small sapling/seedling component.
- Thirty percent of total growing-stock mortality occurred in riparian forests.
- Disease and old age were large contributors to the high mortality of American elm and black oak.
- Wildlife habitat provided by coarse woody debris is minimal due to a lack of large pieces of debris.
- Forest fragmentation is high throughout most of Illinois; the majority of interior forest land is within the Shawnee National Forest.
- Nonnative invasive plants, including multiflora rose, garlic mustard, and bush honeysuckles, were found on 40 percent of sampled plots.
- Forest insects, disease, and drought continue to affect the health of Illinois' forests.
- Oak species are growing at a slower rate than non-oak species.

Issues to Watch

- High oak mortality, decreasing oak sapling/poletimber density, low oak regeneration, and understory maple dominance are indicative of a future shift in forest composition from oak/hickory dominated stands to maple dominated stands.
- Forest land will soon undergo intergenerational transfers in ownership that may change future forest characteristics.
- The emerald ash borer could have a significant impact on the health, structure, and composition of Illinois' forests.
- Illinois' forest product market appears to be shifting from high utilization of oak to increased demand for cottonwood.

Background



Above: Root structure; photo by Cassandra Olson, U.S. Forest Service.
Inset: Common blue violet; photo by Susan Crocker, U.S. Forest Service.

A Beginner's Guide to Forest Inventory

What is a tree?

We know a tree when we see one and we can agree on some common tree attributes. Trees are perennial woody plants with central stems and distinct crowns. In general, the Forest Inventory and Analysis (FIA) Program, of the Forest Service, U.S. Department of Agriculture, defines a tree as any perennial woody plant species that can attain a height of 15 feet at maturity. In Illinois, the problem is deciding which species should be classified as shrubs and which should be classified as trees. A complete list of the tree species measured in this inventory can be found in "Illinois' Forests 2005: Statistics and Quality Assurance" (Resource Bulletin NRS-30), the companion to this document.

What is a forest?

We know what a forest is, but where does the forest stop and the prairie begin? It's an important question. Often, the gross area of forest land or rangeland determines the allocation of funding for certain State or Federal programs. Forest managers want more land classified as forest land and range managers want more land classified as prairie, but you have to draw the line somewhere.

FIA defines forest land as land at least 10 percent stocked by trees of any size or formerly having had such tree cover and not currently developed for nonforest uses. The area with trees must be at least 1 acre in size, and roadside, streamside, and shelterbelt strips of trees must be at least 120 feet wide to qualify as forest land.

What is the difference between timberland, reserved forest land, and other forest land?

From an FIA perspective, there are three types of forest land: timberland, reserved forest land, and other forest land. In Illinois, approximately 96 percent of forest land is timberland and 4 percent is reserved forest land.

- Timberland is unreserved forest land that meets minimum productivity requirements.
- Reserved forest land is land withdrawn from timber utilization through legislation or administrative regulation.
- Other forest land is commonly found on low-lying sites with poor soils where the forest is incapable of producing 20 cubic feet per acre per year at its peak.

In Illinois inventories prior to 1998, only trees occurring on timberland plots were measured. Therefore, we cannot report volume on forest land for those inventories. The new annual inventory system facilitates the estimation and reporting of volume on all forest land, not just timberland. As these annual plots are remeasured in the coming years, we will also be able to report growth, removals, and mortality on all forest land.

Trend reporting in this publication is necessarily limited to timberland except for the area of forest land on which individual tree measurements are not required.

How many trees are in Illinois?

Illinois forest land contains approximately 570 million live trees that are at least 5 inches in diameter at breast height (d.b.h., 4.5 feet above the ground). We do not know the exact number because only a sample of trees was measured, roughly 1 out of every 26,000 trees, or a total of 21,513 trees. These trees were measured on 1,004 forest plots (Fig. 1). For information on sampling errors, see the companion document, “Illinois’ Forests 2005: Statistics and Quality Assurance” (Resource Bulletin NRS-30).

How do we estimate a tree’s volume?

Forest inventories typically express volume in cubic feet, but the reader may be more familiar with cords (a stack of wood 8 feet long, 4 feet wide, and 4 feet high). A cord of wood contains approximately 79 cubic feet of solid wood and 49 cubic feet of bark and air.

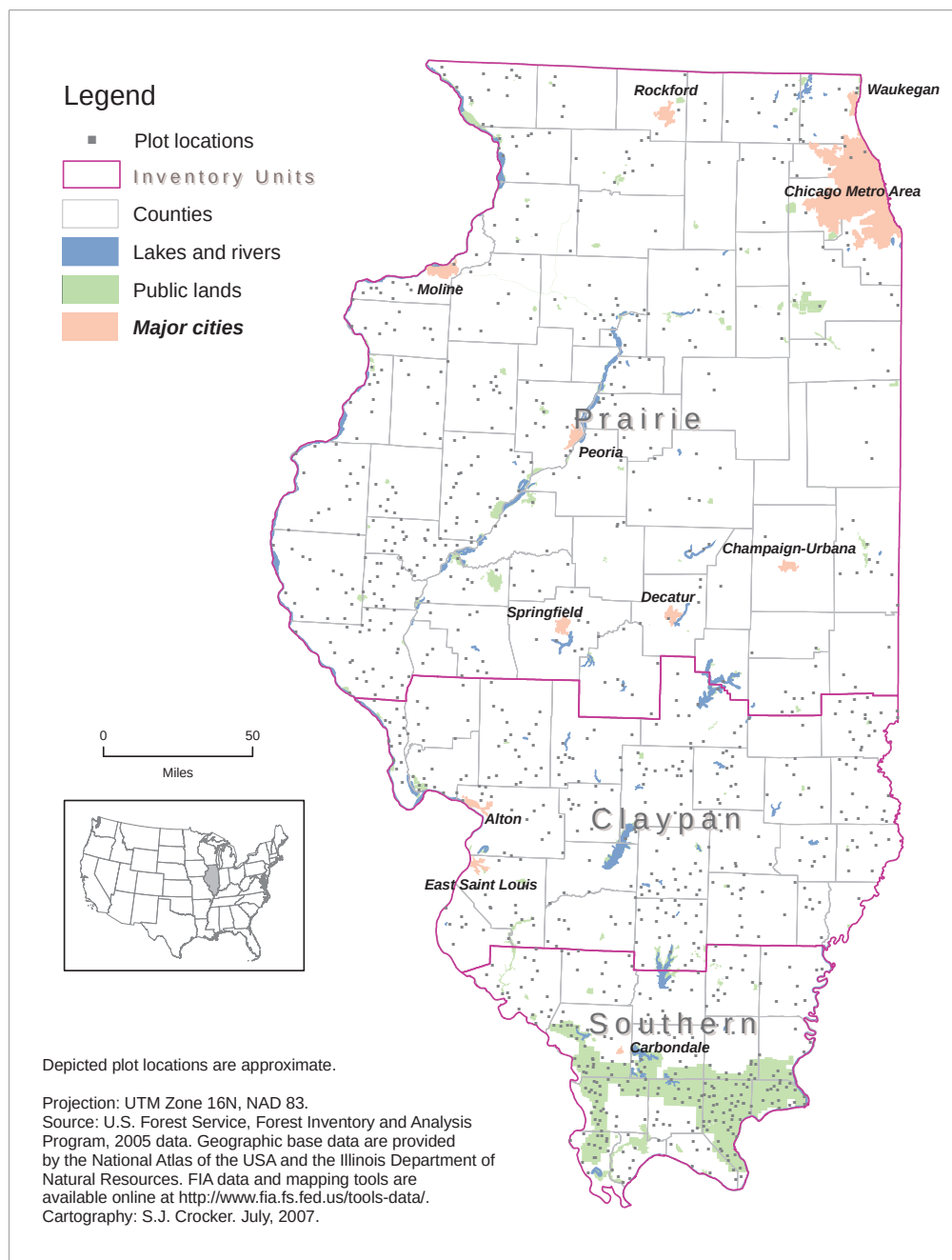
Volume can be precisely determined by immersing a tree in a pool of water and measuring the amount of water displaced. Less precise, but much cheaper and easier to do with living trees, is a method adopted by the Northern Research Station. In this method, several hundred trees were cut and detailed diameter measurements were taken along their lengths to accurately determine their volumes (Hahn 1984). Statistical tools were used to model this data by species group. Using these models, we can produce individual tree volume estimates based on species, diameter, and tree site index.

This method was also used to calculate sawtimber volumes. FIA reports sawtimber volumes in International 1/4-inch board foot scale as well as Doyle rule. To convert to the Scribner board foot scale, see Smith (1991).

How much does a tree weigh?

Building on previous work, the U.S. Forest Service’s Forest Products Laboratory developed estimates of specific gravity for a number of tree species (U.S. For. Serv. 1999). These specific gravities were applied to estimates of tree volume to determine merchantable tree biomass (the weight of the bole). To estimate live biomass, we have to add in the stump (Raile 1982), limbs, and bark (Hahn 1984). We do not currently report the live biomass of roots or foliage.

Figure 1.—Plot locations and inventory units associated with the current forest inventory, Illinois, 2005.



Forest inventories report biomass as green or oven-dry weight. Green weight is the weight of a freshly cut tree; oven-dry weight is the weight of a tree with zero percent moisture content. On average, 1 ton of oven-dry biomass is equal to 1.9 tons of green biomass.

How do we compare data from different inventories?

Data from new inventories is often compared with data from earlier inventories to determine trends in forest resources. However, for comparisons to be valid, the procedures used in the two inventories must be similar. As a result of FIA's ongoing efforts to improve the efficiency and reliability of the inventory, several changes in procedures and definitions have occurred since the last Illinois inventory in 1998. While these changes will have little effect on statewide estimates of forest area, timber volume, and tree biomass, they may have significant effects on plot classification variables such as forest type and stand-size class. Some of these changes make it inappropriate to directly compare 2005 data tables with those published for the 1998 inventory.

The biggest change between the two inventories was the change in plot design. A fixed-radius subplot design was used in both the 1998 and 2005 inventories. However, the 1998 inventory also included modeled plots, i.e., plots measured in 1985 and projected forward using the STEMS (Belcher et al. 1982) growth model. This process increases cost efficiency by reducing the number of undisturbed plots that are sent to the field for remeasurement. Disturbance was determined by comparing aerial photographs of the plots and looking for reductions in canopy cover. The idea was that parameters for the STEMS growth model could be fine-tuned using the measured, undisturbed plots and then applied to the remaining unmeasured, undisturbed plots. Unfortunately, the use of modeled plots introduced biased errors, so the current inventory includes full remeasurements. In other words, only field-measured plots are used for comparisons with the 1998 inventory in this publication.

A word of caution on suitability and availability

FIA does not attempt to identify which lands are suitable or available for timber harvesting, particularly since such suitability and availability is subject to changing laws, economic/market constraints, physical conditions, adjacency to human populations, and ownership objectives. The classification of land as timberland does not necessarily mean it is suitable or available for timber production.

Nor is it safe to assume that forest owners plan regular harvests or intend to harvest at all. In response to FIA's National Woodland Owner Survey, only 6 percent of landowners, owning 16 percent of Illinois' private forest land, stated that they intend to harvest saw logs or pulpwood over the next 5 years. Many of Illinois' private landowners own forest land for the aesthetic value it provides. Although most family forest owners in Illinois plan to do relatively little with their forest land in the near future, one in every ten acres is owned by someone who plans to either transfer their land to an heir or sell it within the next 5 years.

Thus, forest inventory data alone are inadequate for determining the area of forest land available for timber production. Additional factors, like those provided above, need to be considered when estimating the timber base, and these factors may change with time.

Where are Illinois Forests?

Ecological Provinces of Illinois

Illinois spans three ecological provinces: the Eastern Broadleaf Forest, the Prairie Parkland, and the Lower Mississippi Riverine Forest (Fig. 2).

The rolling hills and flat expanses of the Eastern Broadleaf Forest Province are dominated by a diverse mixture of broadleaf deciduous species. Relatively low precipitation in the area favors the drought resistance of the oak/hickory forest-type group (Bailey 1995). Major species include: white oak, red oak, black oak, shagbark hickory, and bitternut hickory. Maple, beech, and basswood increase in dominance in the northern portions of the province. In this area, sugar maple and American basswood dominate the maple/basswood forest type (Bailey 1995).



Forest floor. Photo by Susan Crocker, U.S. Forest Service

The Prairie Parkland Province is characterized by an alternating pattern of prairie and deciduous forest. Forested portions of the province consist of uplands dominated by oak and hickory, and moist slopes and floodplains where eastern cottonwood and American elm are common species. Grasses are the predominant vegetation in prairies (Bailey 1995).

Broad floodplains and low terraces typify the land form of the Lower Mississippi Riverine Forest Province (Bailey 1995). Vegetation is classified as bottomland deciduous forest and the primary forest-type groups are oak/gum/cypress and oak/hickory. Major species include Nuttall oak, water oak, cherrybark oak, cottonwood, sycamore, and baldcypress in the oak/gum/cypress group, and post oak, bur oak, and northern red oak in the oak/hickory group. Pecan, green ash, sweetgum and water tupelo are also present (Bailey 1995; McNab and Avers 1996).



Illinois hardwood stand. Photo by Susan Crocker, U.S. Forest Service

The greatest percentage of Illinois' forest land is in southern Illinois, most of which is in the Shawnee National Forest (Fig. 3). There is also significant forest area in the western portion of the State along the borders of the Illinois and Mississippi Rivers.

Figure 2.—Ecological provinces of Illinois (Bailey 1995).

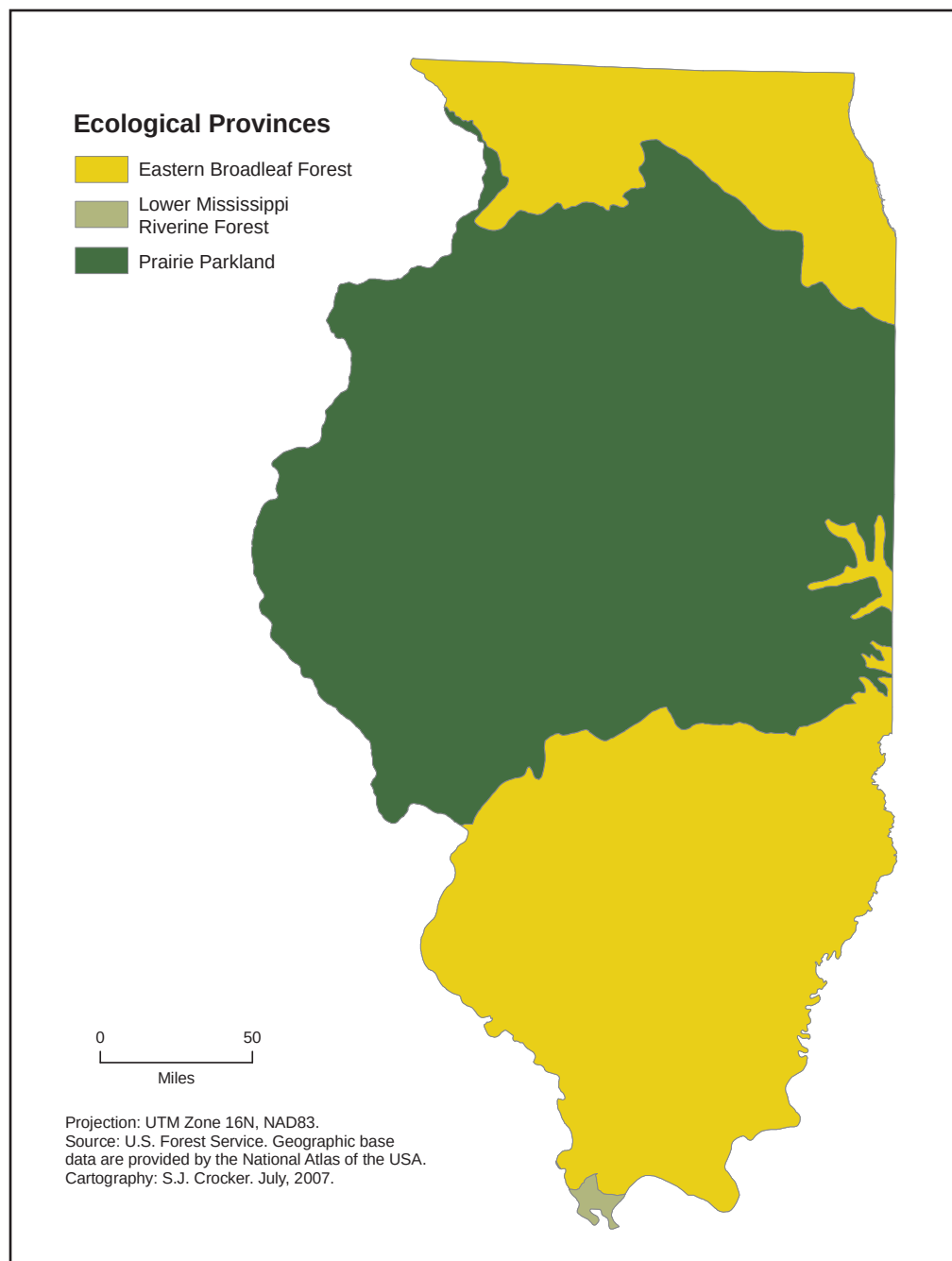
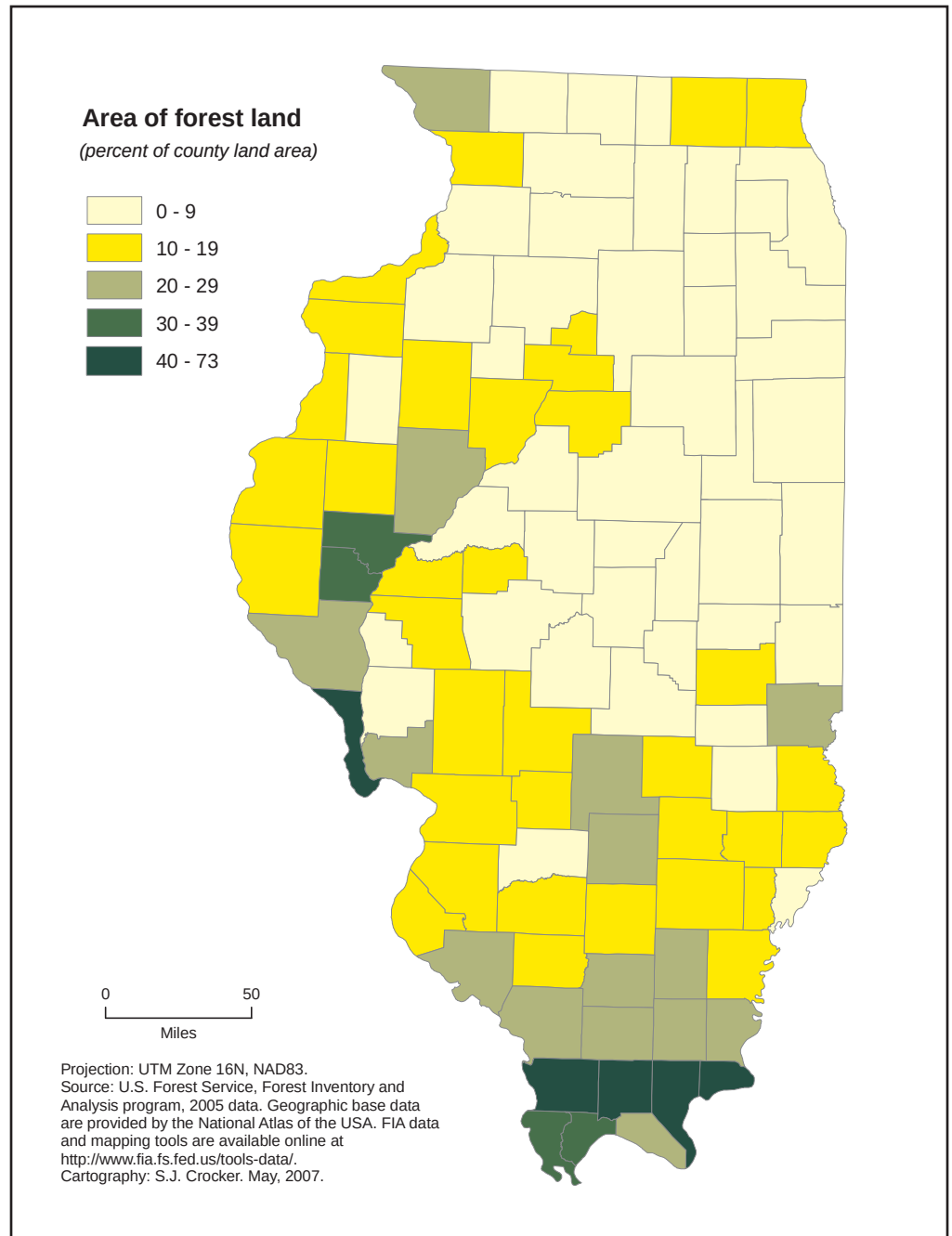


Figure 3.—Area of forest land as a percentage of county land area, Illinois, 2005.



Distribution of Forest Land by Forest Type and Stand Size

Occupying 65 percent of forest land, oak/hickory is the predominant forest-type group in Illinois (Fig. 4; see Appendix for estimates of forest land area by county and forest-type group). Though oak/hickory is found throughout the State, this forest-type group is highly concentrated in west-central and southern Illinois. Elm/ash/cottonwood, which makes up 23 percent of forest land, is the second largest forest-type group. The top five forest types account for 71 percent of forest land (Fig. 5). The most common forest type in the State is white oak/red oak/hickory.

Forest land in Illinois consists largely of stands with sawtimber-size trees. Sawtimber occupies 3.3 million acres, or 72 percent of forest land (Fig. 6). Twenty percent of forest land is made up of poletimber and 8 percent contains sapling/seedlings. Mature oak/hickory stands are the most prominent feature on Illinois forest land.



White oak buds. Photo by Paul Bolstad, University of Minnesota, bugwood.org

Figure 4.—Distribution of forest land by forest-type group, Illinois, 2005.

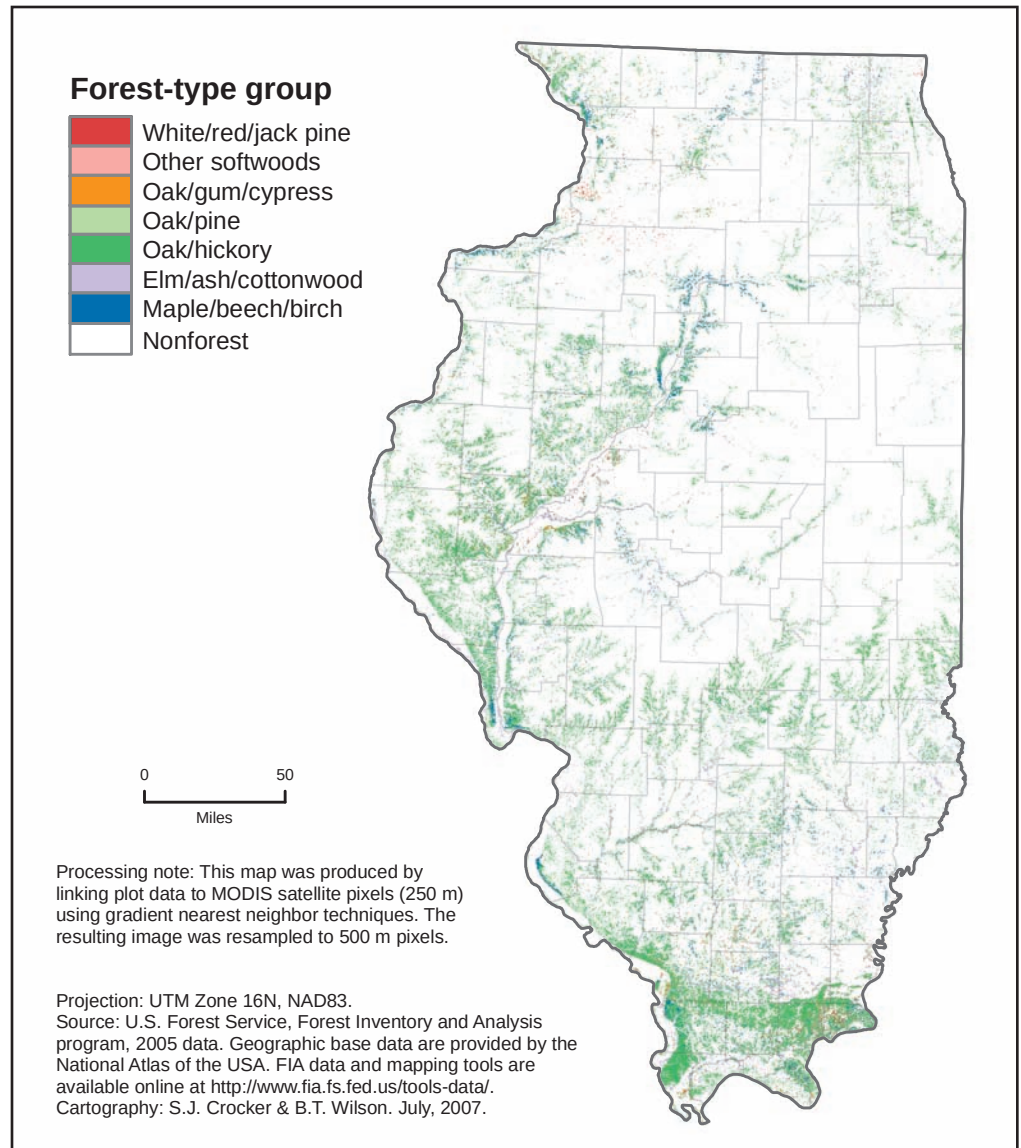


Figure 5.—Distribution of forest land by forest type, Illinois, 2005.

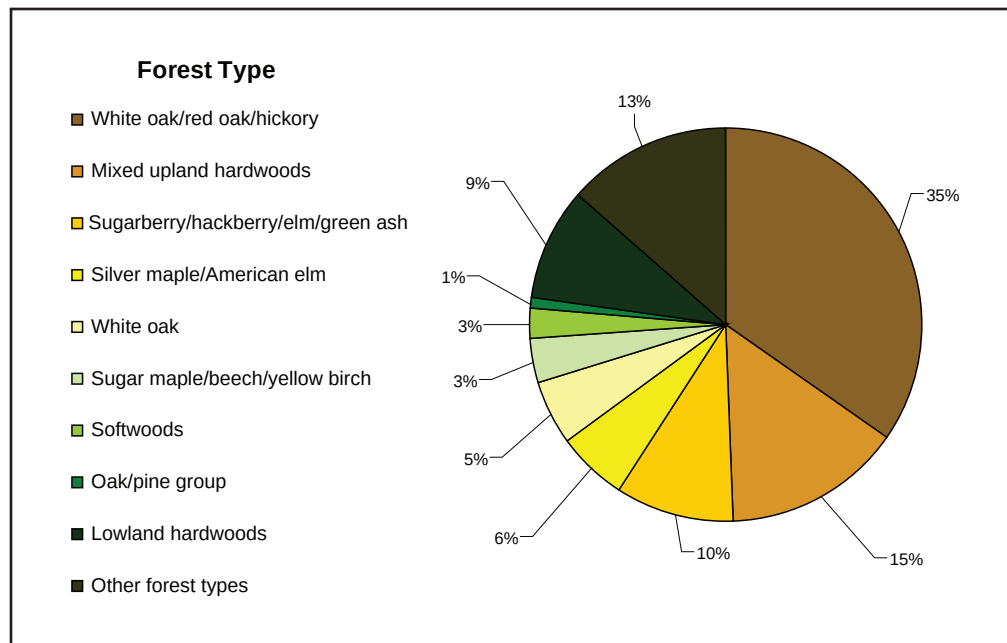
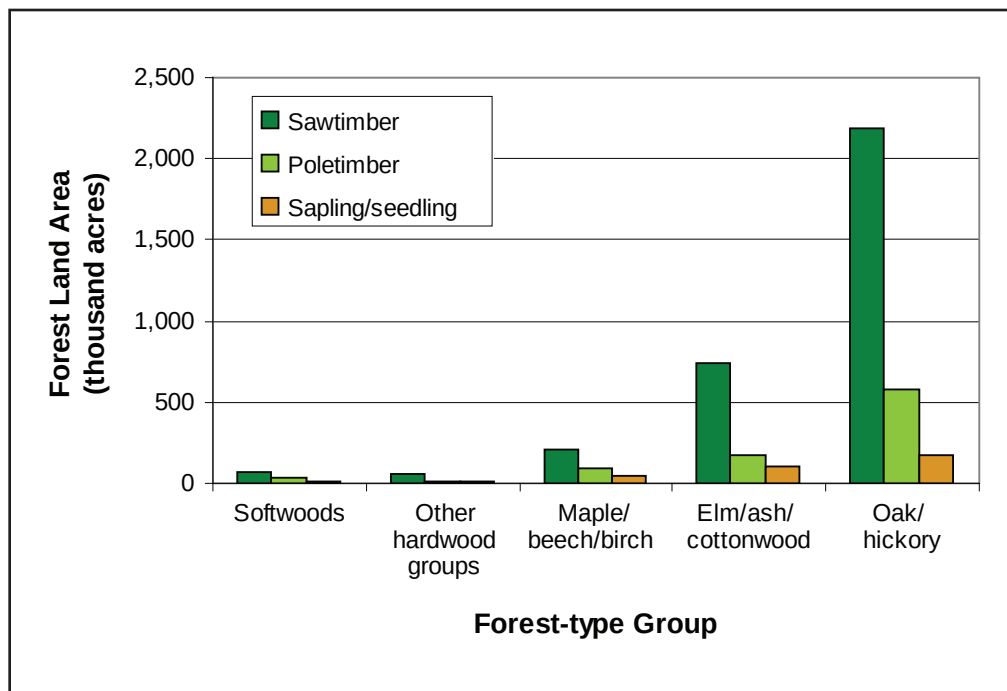


Figure 6.—Area of forest land by forest-type group and stand-size class, Illinois, 2005.



Forest Features



Above: Shawnee National Forest; photo by Susan Crocker, U.S. Forest Service.
Inset: Monarch butterfly; photo by David Cappaert, Michigan State University, bugwood.org

Forest Area

Background

Estimates of forest area offer information on current status and trends. Fluctuations in area may indicate changing land use and/or forest health conditions. Monitoring these changes provides information essential for management and decisionmaking.

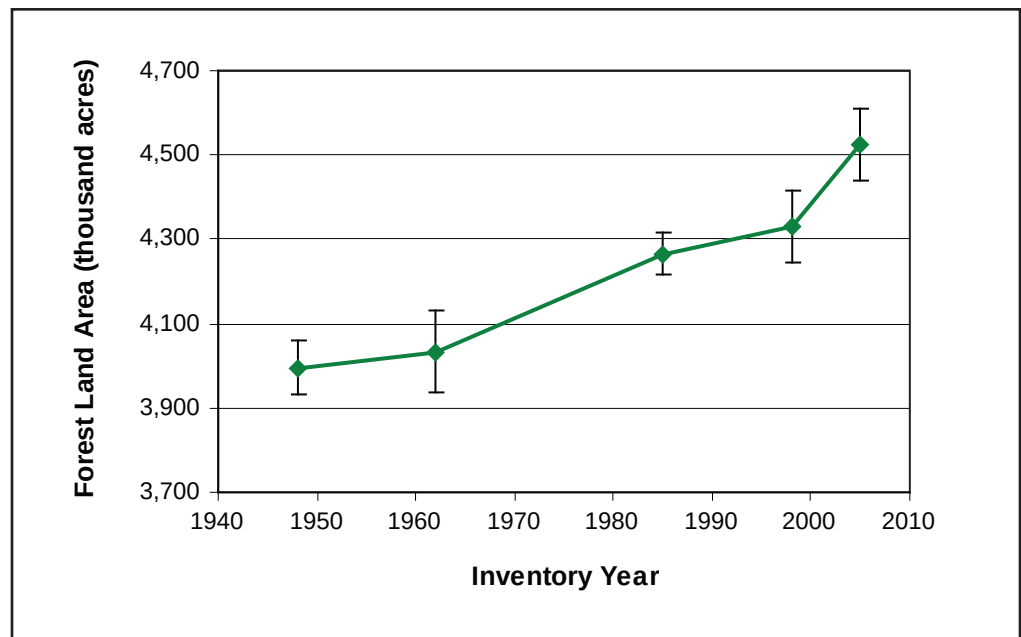
What we found

In the early 1800s, prior to European settlement, tall grass prairie and eastern deciduous forests were the dominant features on the Illinois landscape (Illinois State Nat. Surv. Div. 1960). Forests during this period spanned an estimated 13.8 million acres, approximately 40 percent of the total land area. For nearly 120 years (from 1800 to the 1920s), forest area declined and in 1924 reached its lowest point with only 3 million acres of forest land (Telford 1926). A survey of Illinois' forest resources in 1948 revealed an increase to 4 million acres. Since 1948, forest land has steadily risen and is currently an estimated 4.5 million acres, or about 13 percent of total land area (Fig. 7). The net gain in forest land has not occurred uniformly across the State. Rather, changes in forest area have varied by county; in some cases, counties have experienced losses greater than 5 percent (Fig. 8).

What this means

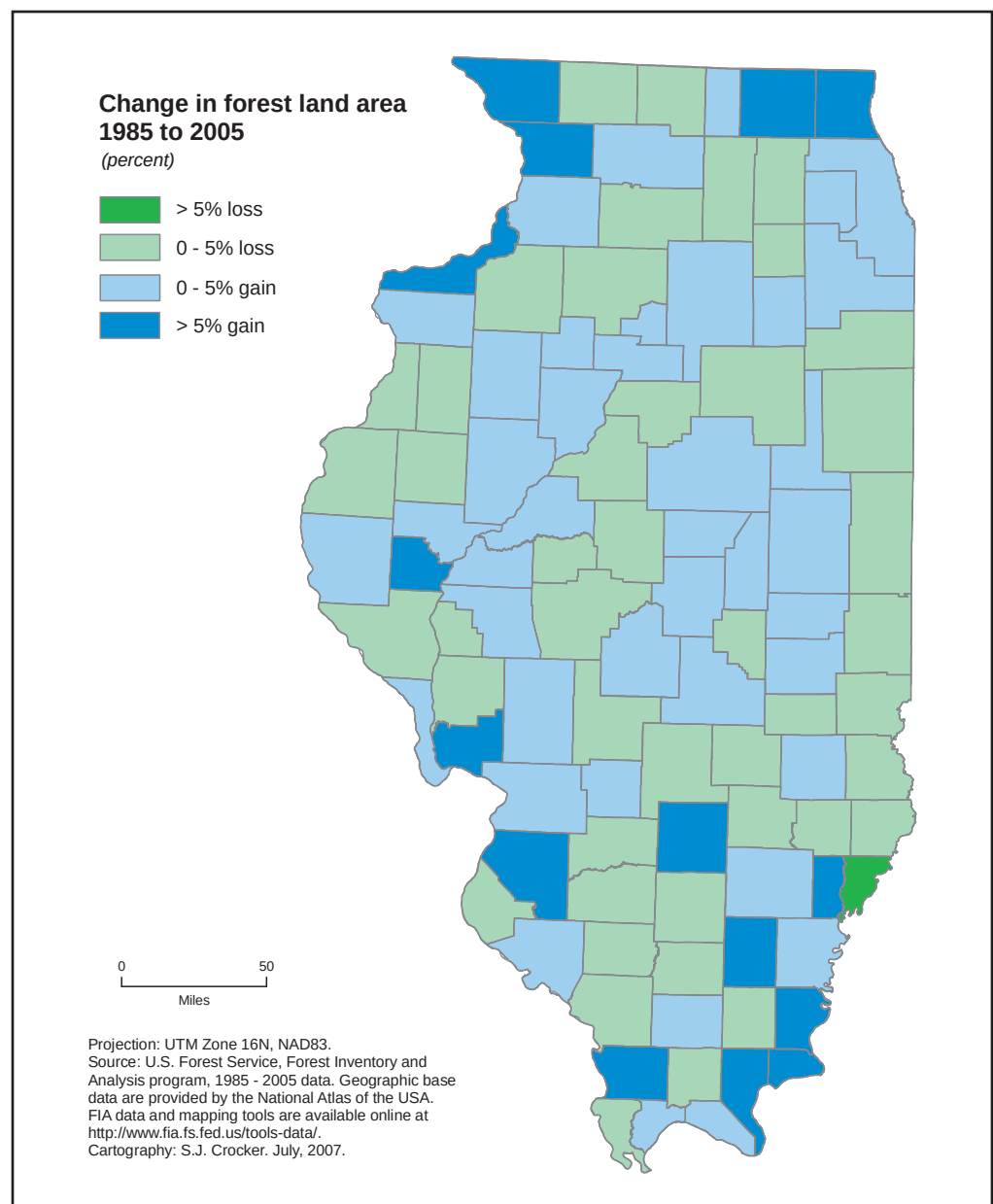
Illinois' forest land began to increase in the 1960s and 1970s as a result of a declining farm economy. The reduced need for agricultural land fueled a reversion of pastures and marginal agricultural lands to forest land. A second increase in forest area occurred

Figure 7.—Area of forest land by inventory year, Illinois, 2005 (error bars represent a 66-percent confidence interval).



during the latter half of the 1980s. This was due in large part to the success of state and national programs designed to promote well managed forests and forest regeneration. Since the Illinois Forestry Development Act of 1983, which granted cost-share assistance and favorable tax treatment for timber-producing forested lands with a forest management plan, the annual rate of increase in forest area has nearly doubled from 0.2 percent between 1948 and 1985 to 0.3 percent between 1985 and 2005. The greatest increase occurred between 1998 and 2005, when the annual rate of increase was 0.6 percent.

Figure 8.—Change in the area of forest land by county, Illinois, 1985-2005.



Trees on Nonforest Land

Background

Many conditions that do not meet the definition of forest land also contain trees. While trees on nonforest conditions are not measured by FIA, the area of nonforest land with trees is mapped and recorded to generate estimates of the total area of treed land.

What we found

Nonforest land with trees accounts for 2 percent of Illinois' total land base (Fig. 9). The greatest percentages of nonforest land with trees are within the northern and southern tiers of the State (Fig. 10). There are several classes of nonforest land that contain trees. In Illinois, the urban and other with trees class has the largest area of nonforest land with trees (Fig. 11). However, a substantial portion is also found in pasture and rangeland with trees, and in wooded strips. Nonforest land with trees adds an additional 858,900 acres of land to the total area of land with tree cover, or the area of treed land. Thus, nonforest land with trees and forest land form a combined total 5.3 million acres of treed land, which is equivalent to 15 percent of the total land area in the State. Even with the addition of nonforest land with trees, the southern tier remains the most heavily treed portion of Illinois (Fig. 10). Most counties show a net increase in the area of treed land when forest land and nonforest land with trees are combined. Counties with the greatest percent increase are concentrated in the northern half of the State, particularly in the Chicago metro area.

Figure 9.—Distribution of total land area by land use, Illinois, 2005.

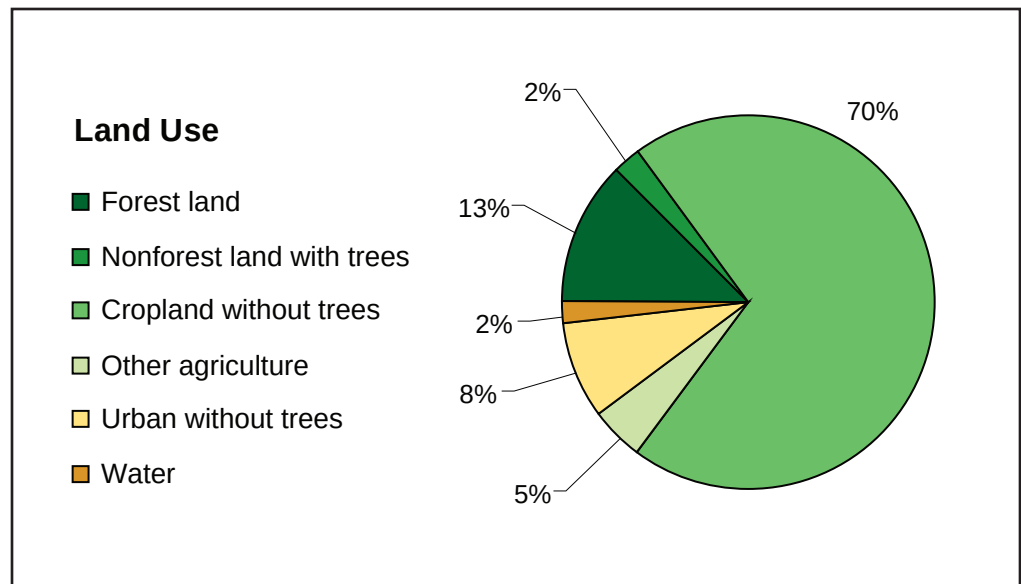


Figure 10.—Area of nonforest land with trees, total area of land with tree cover, and percent increase in area of tree cover by county, Illinois, 2005.

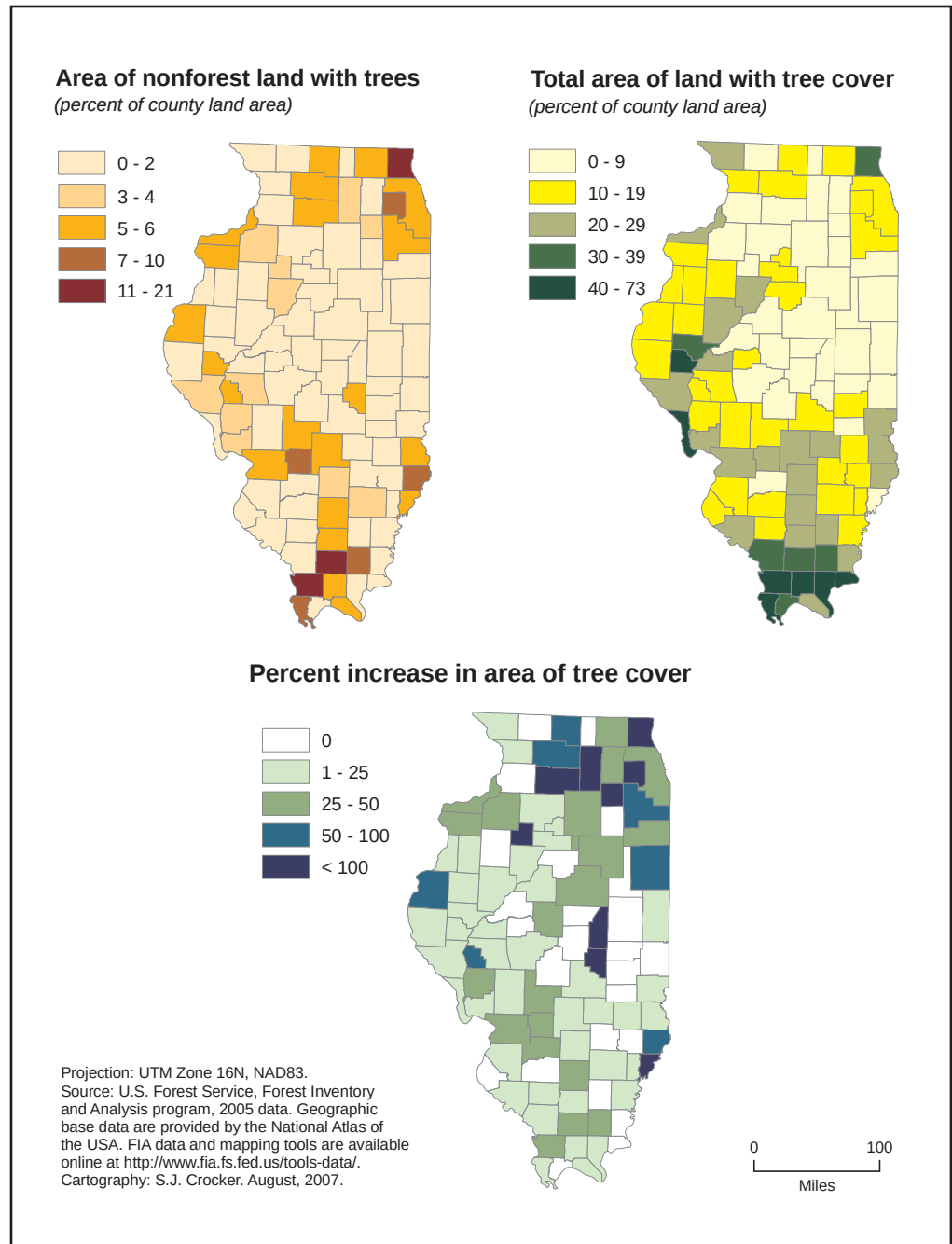
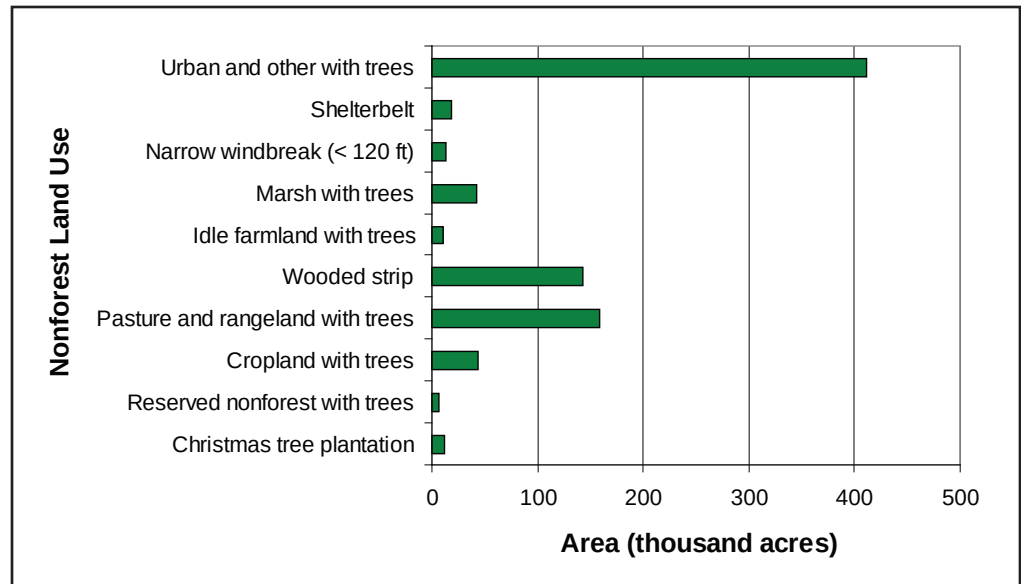


Figure 11.—Area of nonforest land with trees by land-use class, Illinois, 2005.



What this means

Despite classification as nonforest, areas such as cropland, pastures, windbreaks, and urban areas often contain trees. While the number of trees on these nonforest conditions is insufficient to warrant classification as forest land, estimates of the area of nonforest land with trees provide additional information on the extent and distribution of treed land. Trees on nonforest conditions may be sparse, but they constitute a valuable resource that provides beneficial contributions to wildlife habitat, erosion control, protection from wind, improved water quality, carbon sequestration, aesthetics, and recreation.

Biomass

Background

Biomass is a measure of the aboveground weight of live trees that is allocated among tree boles, stumps, tops, and limbs. Measurements of biomass provide estimates of the quantity and distribution of forest resources. Estimates of biomass are useful in analyses of questions related to carbon sequestration, meeting emissions reduction targets, fuel loadings in forest stands, and the availability and production of biofuels.

What we found

Illinois biomass has been increasing since 1985 (Fig. 12). Currently estimated at 210.6 million dry tons, an average of 48 dry tons per acre, the distribution of biomass is similar to that of forest area. The majority of biomass is found in the southern tier of the State, primarily within the Shawnee National Forest (Fig. 13). Biomass on private timberland is currently about five times greater than biomass on public timberland; however, public timberland contains more biomass per acre (Fig. 12). Growing-stock trees contain 84 percent of biomass; 11 percent is in nongrowing-stock trees, and 5 percent is in saplings (Fig. 14).

Illinois' forests sequester 343 million tons of carbon. Live trees, which sequester 44 percent of total carbon, are the State's largest source of forest carbon (Fig. 15). Soil is another substantial carbon pool (33 percent). Additional carbon pools include live trees, below ground (8 percent); the forest floor (7 percent); down and dead wood (4 percent); standing dead trees (3 percent); and understory vegetation (1 percent).

Figure 12.—Live biomass per acre of timberland by ownership and inventory year, Illinois, 1985 - 2005 (error bars represent a 66-percent confidence interval).

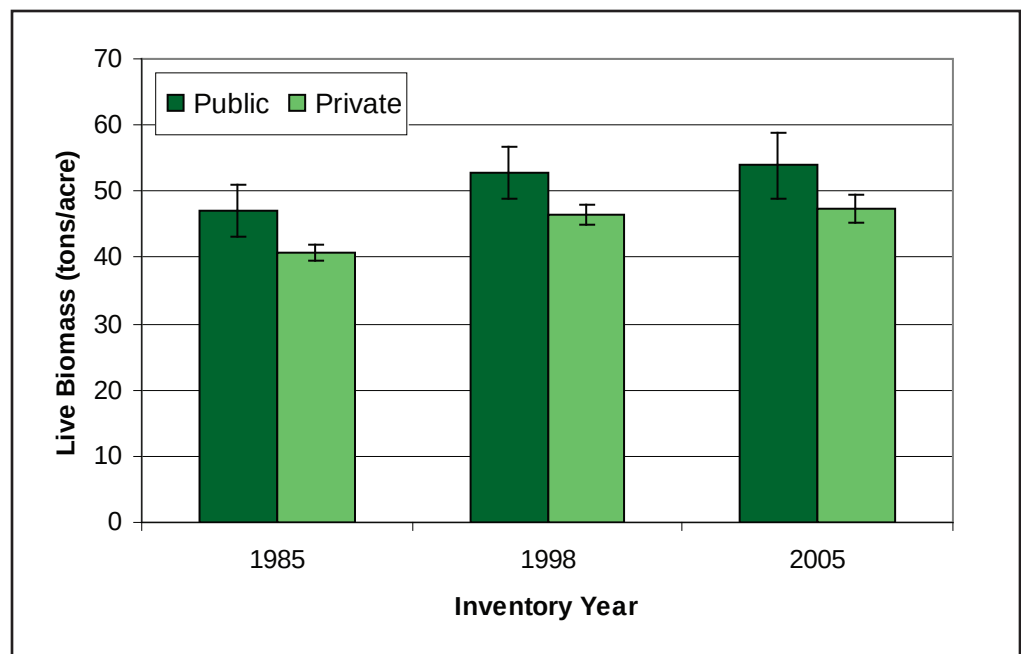


Figure 13.—Distribution of live biomass on forest land, Illinois, 2005.

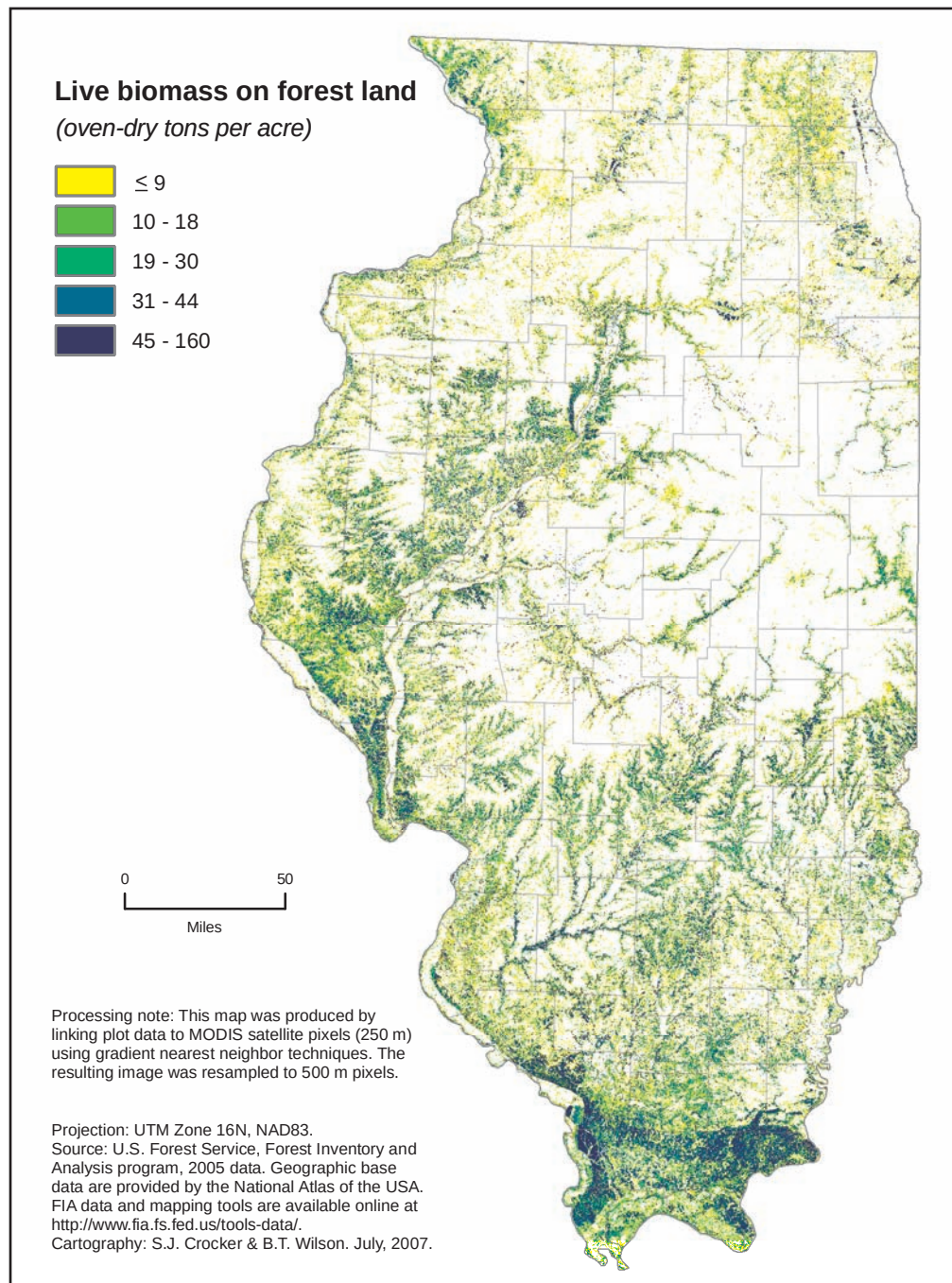


Figure 14.—Distribution of live biomass on timberland by tree component, Illinois, 2005.

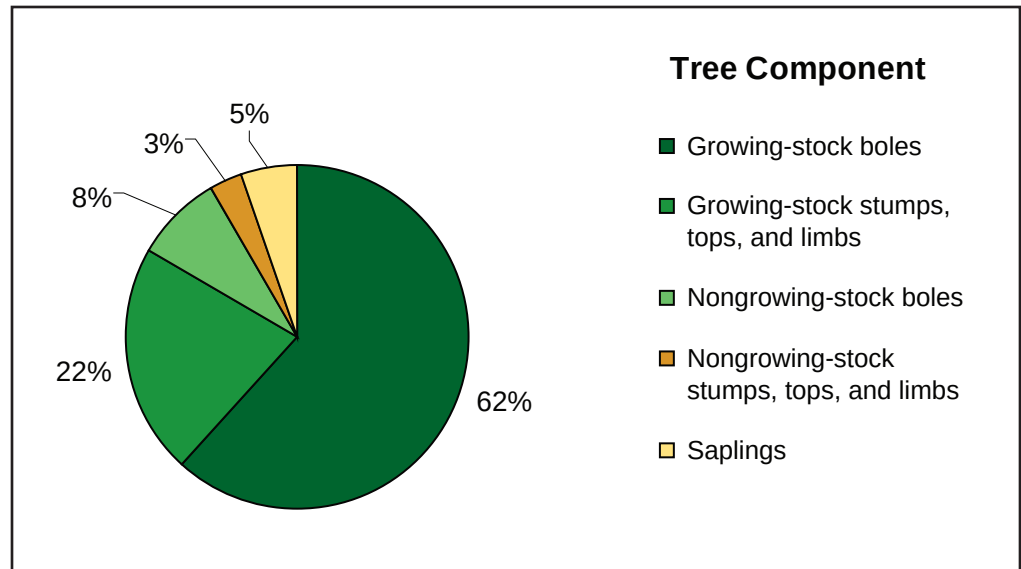
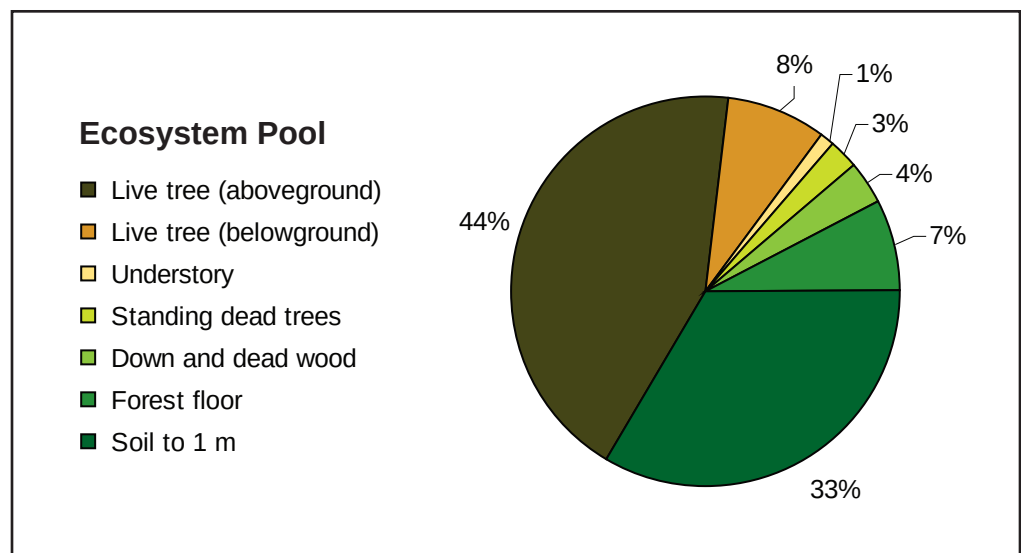


Figure 15.—Distribution of total carbon stock on timberland, Illinois, 2005.



What this means

The Illinois Forestry Development Act, participation in the Conservation Reserve Program, and reversion of agricultural lands to forest, have contributed to the statewide increase in total biomass. As holders of the majority of Illinois' biomass, private forest landowners play an important role in sustaining this resource. The management of both public and private forest land has a strong effect on Illinois' carbon sinks. As Illinois continues to become more involved in carbon trading, estimates of biomass and carbon sequestration by forests will become increasingly important.

Species Composition

Background

Forest composition is constantly evolving. Influenced by the presence or absence of disturbances, such as timber management, recreation, wildfire, prescribed burning, extreme weather, and invasive species, the current state of tree species composition is a reflection of historical and environmental trends within a forest. As a result, the composition of species in a forest is an indicator of forest health, growth, succession, and the need for stand improvement, i.e., management. Knowledge of the distribution of species within a stand allows for the measurement and prediction of change.

What we found

Illinois' forest land contains just over 2 billion trees (greater than 1 inch in d.b.h.) from nearly 100 different species. This number represents a 25 percent decrease in the number of trees between 1998 and 2005, equivalent to a loss of about a half billion trees. American elm, sugar maple, and black cherry are the most abundant species by number (Fig. 16).

Live volume on forest land is an estimated 8 billion cubic feet. Most of this volume is found in the large-diameter size classes (Fig. 17). White oak remains the most dominant species (Fig. 18). Between 1998 and 2005, there were significant volume increases in silver maple, green ash, and American elm and a significant decrease in black oak volume.

Figure 16.—Top 10 species on forest land by number of live trees, Illinois, 1998-2005.

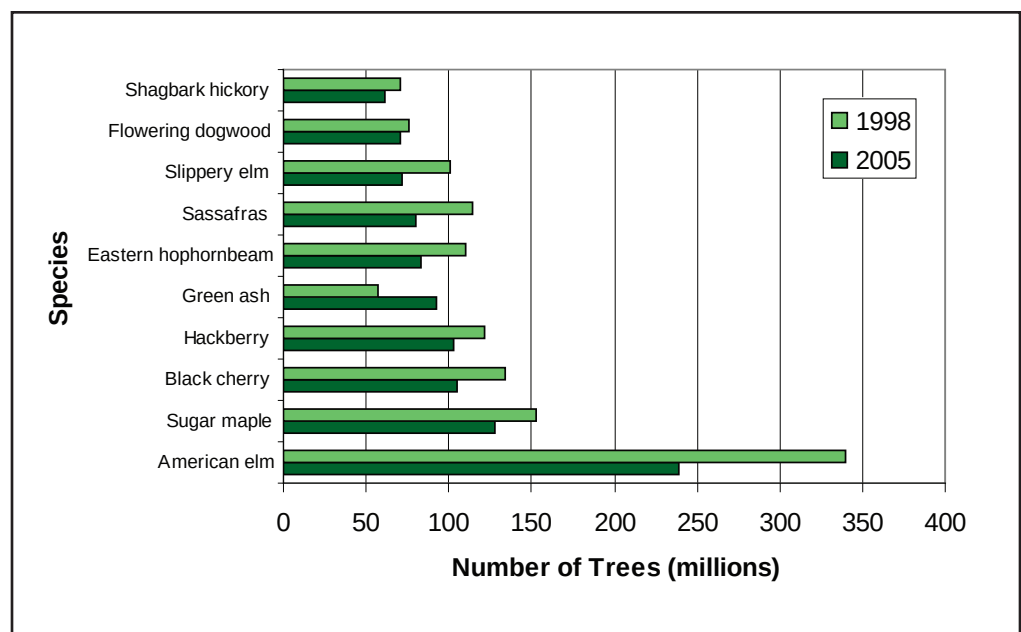


Figure 17.—Live volume on forest land by stand-size class and inventory year, Illinois, 1998-2005.

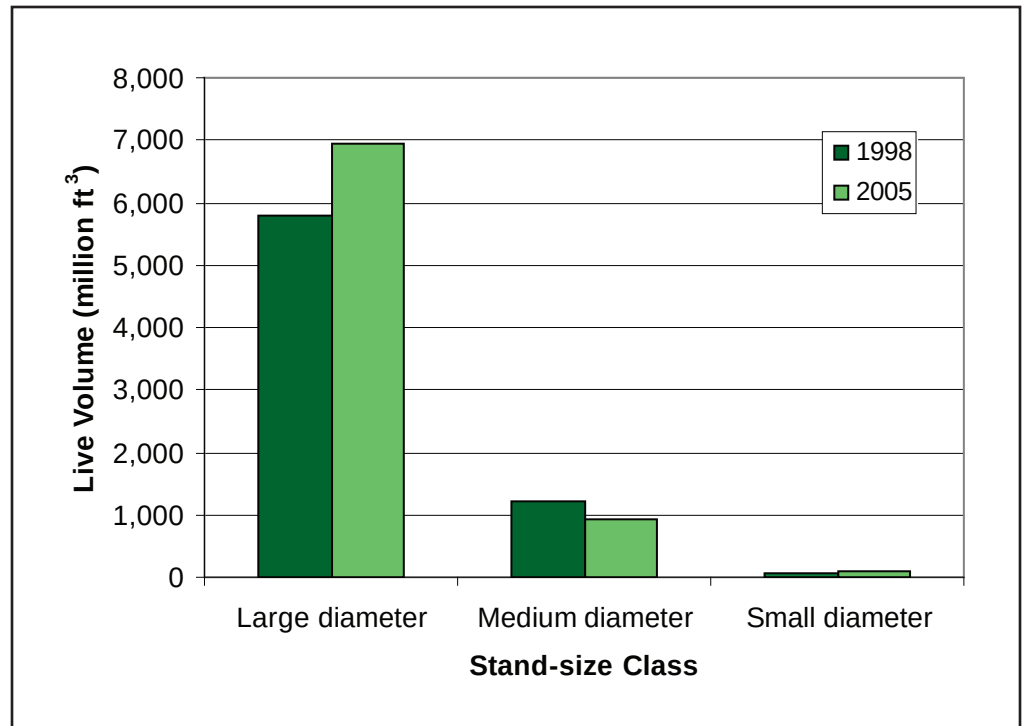
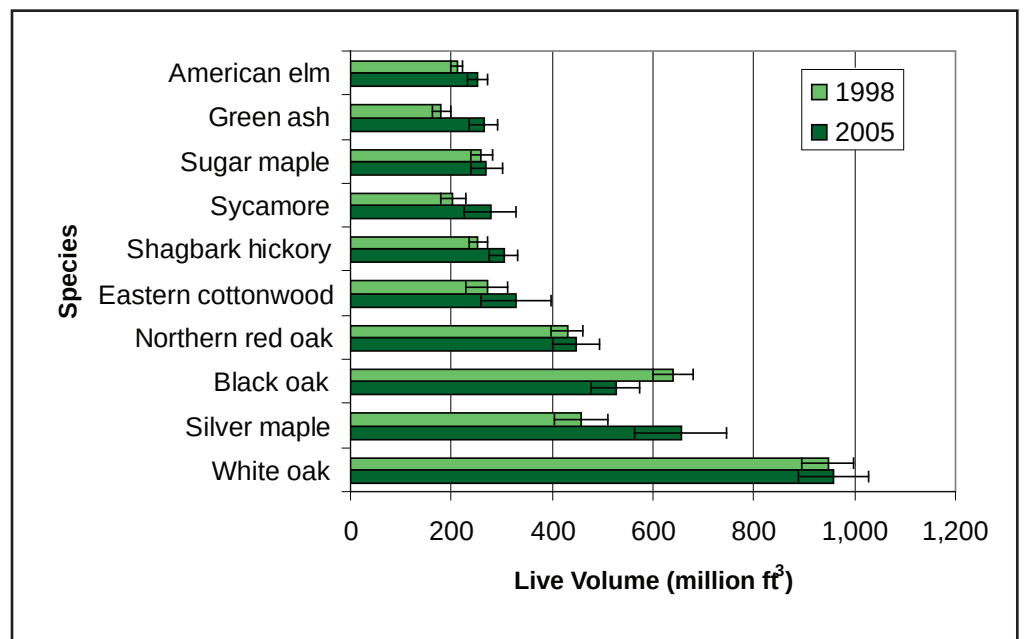


Figure 18.—Live volume on forest land for the 10 most voluminous species, Illinois, 1998-2005 (error bars represent a 66-percent confidence interval).



What this means

Illinois' forests are composed of a diverse array of tree species. White oak, black oak, northern red oak, and silver maple are the most voluminous species in the State. The most abundant species, in terms of total number, are American elm and sugar maple, along with a host of predominantly understory species. While this is a reflection of variation in ecological roles, where species such as hackberry, eastern hophornbeam, and flowering dogwood are typically understory species and oaks and maples are dominant overstory species, it is also a sign of changing understory dynamics. Disturbance, particularly from harvesting and fire management, promotes oak regeneration. The absence of such disturbances has allowed shade-tolerant species to out-compete understory oaks. Thus, although oaks are fewer in number, their dominance in volume is due to high numbers of mature trees in the overstory. As these oaks continue to senesce, oak mortality will create gaps in the overstory that will likely be filled by maples and elms that now represent the majority of understory species.



Illinois fall colors. Photo by Susan Crocker, U.S. Forest Service

Forest Density

Background

The density of a forest indicates the current phase of stand development and has implications for diameter growth, tree mortality, and yield. Density is typically measured in terms of number of trees or basal area per unit area. Stocking, a relative measure of density, represents the degree of tree occupancy required to fully utilize the growth potential of the land.

What we found

An average acre of Illinois timberland contains 459 trees. Although the number of trees per acre of timberland increased from 1985 to 1998, the current estimate represents a significant decrease in density between 1998 and 2005 (Fig. 19). In contrast, live volume per acre of timberland has steadily increased since 1985 and now totals an estimated 1,751 cubic feet per acre (Fig. 20). Most of Illinois timberland is fully (40 percent) or moderately stocked (44 percent) (Fig. 21).

Overstocked stands, which represent 3 percent of timberland, contain too many trees to support adequate tree growth and development. Poorly stocked stands that do not contain enough trees to fully utilize a site represent 12 percent of timberland area.



Central hardwoods, Illinois. Photo by Susan Crocker, U.S. Forest Service

Figure 19.—Number of live trees per acre of timberland by inventory year, Illinois, 1985-2005 (error bars represent a 66-percent confidence interval).

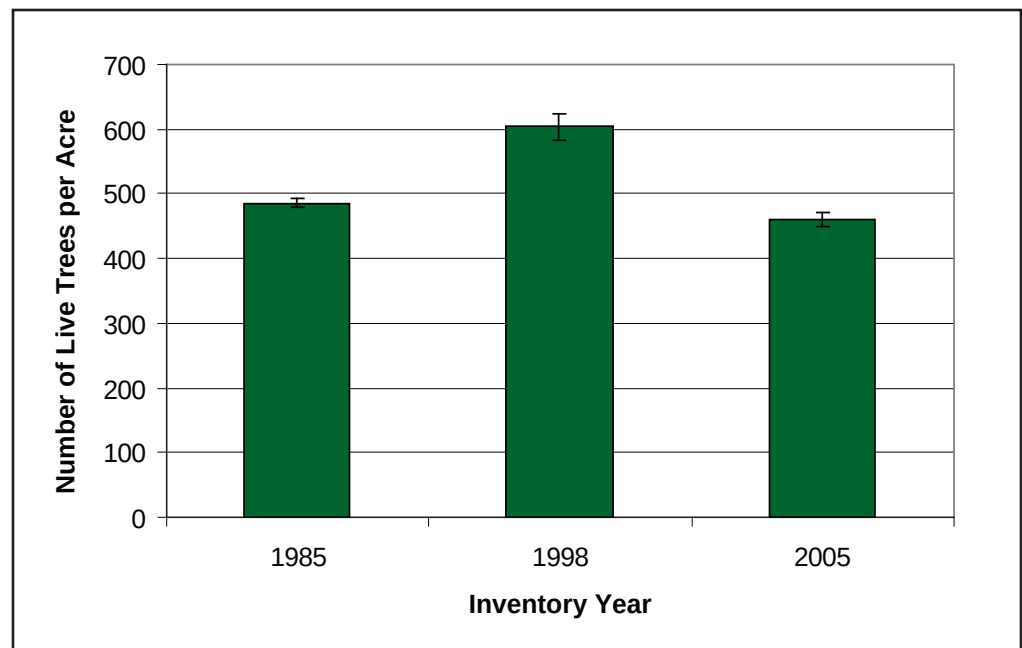


Figure 20.—Live volume per acre of timberland by inventory year, Illinois, 1985-2005 (error bars represent a 66-percent confidence interval).

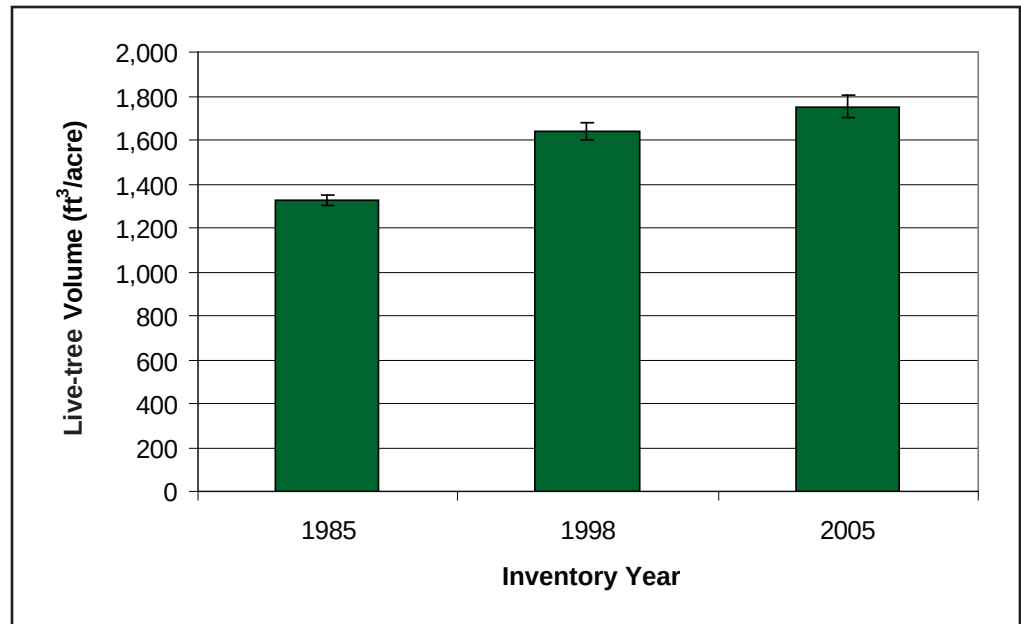
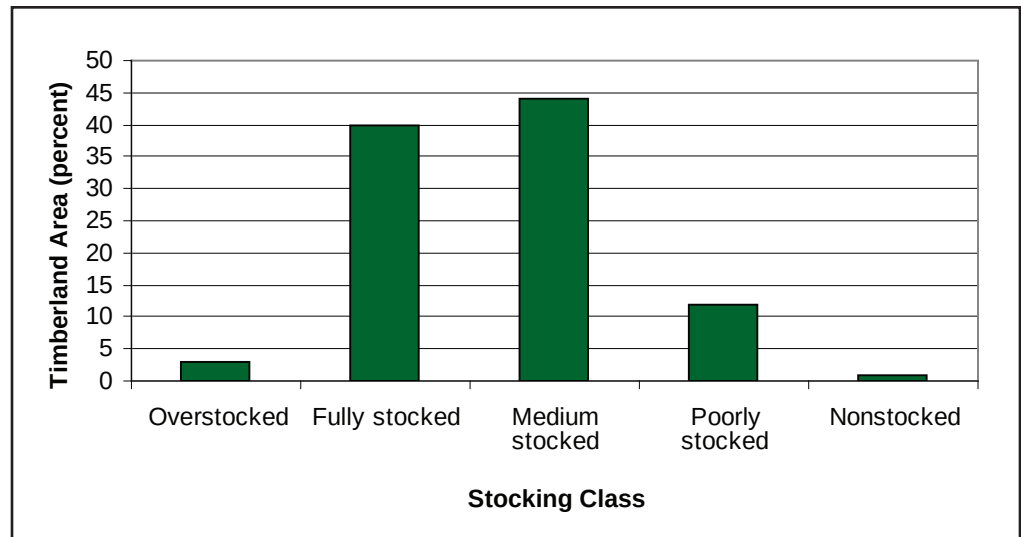


Figure 21.—Area of timberland by stocking class, Illinois, 2005.



Illinois' overstory is currently dominated by oak, maple, hickory, and ash sawtimber (Table 1A). As a group, oaks make up the largest percentage of sawtimber density (28 percent), but represent only 7 percent of sapling/poletimber density (Fig. 22). In comparison, maple species make up a smaller percentage of sawtimber density (14 percent) and a larger portion of sapling/poletimber density (12 percent). Overall, there is much higher density in the smaller sapling and poletimber trees. American elm, sugar maple, black cherry, hackberry, and green ash have the highest sapling/poletimber densities.

Table 1A.—Sawtimber density, expressed as number of live trees per acre on timberland, by inventory year, Illinois, 1985-2005 (Sampling errors [SE] represent a 66-percent confidence interval. Sawtimber density estimates for a given species are not significantly different from one another if followed by the same letter).

Species	Sawtimber density [†]					
	1985		1998		2005	
	estimate	SE	estimate	SE	estimate	SE
Boxelder	0.5 a	± 0.08	0.6 ab	± 0.10	0.9 b	± 0.14
Red maple	0.4 a	± 0.07	0.7 b	± 0.11	0.5 b	± 0.12
Silver maple	1.4 a	± 0.16	2.2 b	± 0.24	3.0 c	± 0.39
Sugar maple	0.9 a	± 0.09	1.2 b	± 0.11	1.2 ab	± 0.15
Pignut hickory	0.8 a	± 0.07	1.1 b	± 0.10	1.3 b	± 0.14
Shagbark hickory	1.0 a	± 0.08	1.3 b	± 0.10	1.6 c	± 0.16
Mockernut hickory	0.6 a	± 0.06	0.8 b	± 0.08	0.4 c	± 0.08
Hackberry	0.5 a	± 0.07	0.8 b	± 0.09	1.2 c	± 0.13
White ash	0.9 a	± 0.08	1.1 b	± 0.10	0.8 a	± 0.12
Green ash	0.6 a	± 0.08	1.0 b	± 0.10	1.5 c	± 0.17
E. hophornbeam	0.0 a	n/a	0.0 a	n/a	0.0 a	n/a
Black cherry	0.5 a	± 0.05	0.8 b	± 0.08	1.0 c	± 0.12
White oak	4.1 a	± 0.22	5.0 b	± 0.27	4.8 b	± 0.36
Shingle oak	0.4 a	± 0.05	0.8 b	± 0.08	0.9 b	± 0.12
Bur oak	0.6 a	± 0.08	0.7 a	± 0.10	0.8 b	± 0.14
Northern red oak	1.6 a	± 0.11	2.1 b	± 0.15	1.9 b	± 0.19
Black oak	3.0 a	± 0.19	3.5 b	± 0.22	2.9 a	± 0.25
Sassafras	0.1 a	± 0.03	0.2 ab	± 0.04	0.3 b	± 0.06
American elm	0.7 a	± 0.06	1.0 b	± 0.08	1.2 c	± 0.13
Slippery elm	0.4 a	± 0.04	0.4 a	± 0.05	0.5 a	± 0.08
All other species	9.4 a	± 0.38	12.2 b	± 0.49	13.6 c	± 0.71
Total	29.5 a	± 0.53	37.5 b	± 0.63	40.1 c	± 0.87

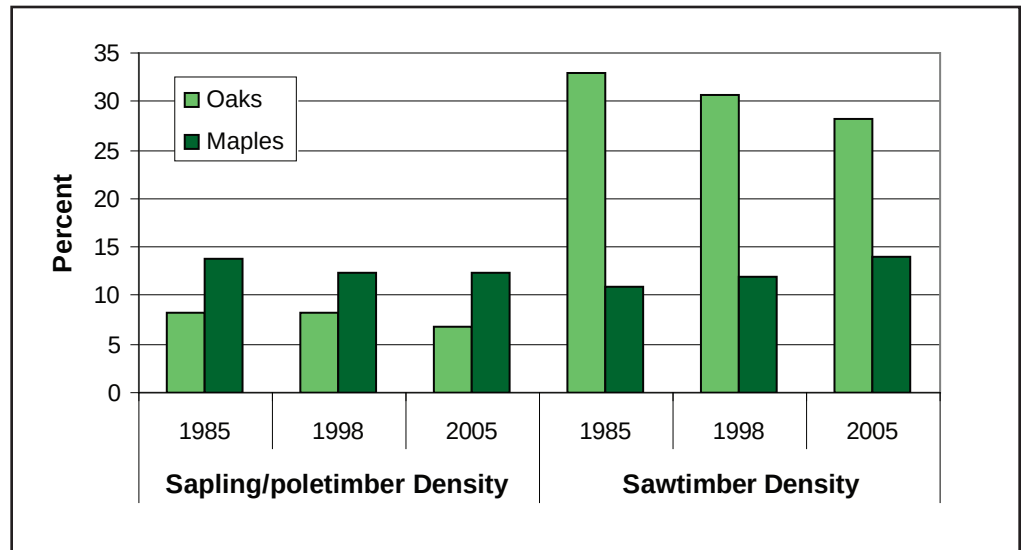
[†]Sawtimber trees must be greater than 9 inches d.b.h. for softwoods and greater than 11 inches d.b.h. for hardwoods.

Table 1B.—Sapling/poletimber density, expressed as number of live trees per acre on timberland, by inventory year, Illinois, 1985-2005 (Sampling errors [SE] represent a 66-percent confidence interval. Sapling/poletimber density estimates for a given species are not significantly different from one another if followed by the same letter).

Species	Sapling/poletimber density [†]					
	1985		1998		2005	
	estimate	SE	estimate	SE	estimate	SE
Boxelder	13.5 a	± 1.30	18.0 b	± 2.84	12.1 a	± 2.30
Red maple	7.9 a	± 1.30	10.2 a	± 3.40	4.6 b	± 0.96
Silver maple	12.8 a	± 1.41	7.9 b	± 1.52	7.3 b	± 1.28
Sugar maple	28.0 a	± 2.13	32.0 a	± 4.20	26.6 a	± 3.00
Pignut hickory	15.1 a	± 1.05	12.0 ab	± 2.92	9.5 b	± 1.13
Shagbark hickory	8.5 a	± 0.93	15.7 b	± 1.98	12.1 c	± 1.28
Mockernut hickory	11.0 a	± 1.07	8.2 b	± 1.70	3.8 c	± 0.68
Hackberry	15.6 a	± 1.18	28.6 b	± 3.49	22.3 c	± 2.22
White ash	15.2 a	± 1.14	16.9 a	± 2.19	7.7 b	± 1.15
Green ash	11.0 a	± 1.21	12.0 a	± 1.95	18.6 b	± 2.18
E. hophornbeam	18.1 a	± 1.58	25.0 b	± 3.53	19.0 ab	± 2.60
Black cherry	16.0 a	± 1.34	29.4 b	± 3.30	22.1 c	± 2.02
White oak	12.4 a	± 0.92	9.1 b	± 1.07	7.1 b	± 0.84
Shingle oak	7.1 a	± 0.72	15.7 b	± 3.90	8.1 a	± 1.36
Bur oak	1.1 a	± 0.22	1.6 ab	± 0.86	1.8 b	± 0.46
Northern red oak	4.1 a	± 0.47	3.6 a	± 0.81	3.2 a	± 0.50
Black oak	12.4 a	± 1.01	15.1 a	± 2.19	7.7 b	± 1.07
Sassafras	22.4 a	± 1.62	26.9 a	± 3.73	17.7 b	± 1.91
American elm	50.0 a	± 2.38	78.5 b	± 6.23	51.3 a	± 3.59
Slippery elm	28.0 a	± 1.55	23.5 a	± 2.94	15.3 b	± 1.69
All other species	140.3 a	± 4.28	159.3 b	± 9.46	129.5 c	± 6.36
Total	450.3 a	± 6.93	549.4 b	± 20.99	407.4 c	± 10.71

[†]Sapling/poletimber trees range from 1.0 to 8.9 inches d.b.h. for softwoods and from 1.0 to 10.9 inches d.b.h. for hardwoods.

Figure 22.—Sapling/poletimber and sawtimber density for selected species on timberland by inventory year, Illinois, 1985-2005.



For the past 20 years, oaks have made up a large portion of the overstory. Presently, the density of American elm, silver maple, shagbark hickory, and green ash sawtimber is increasing, while the density of oak sawtimber is decreasing (Table 1A, Fig. 22). Individually, the density of most oak saplings and poletimber has remained fairly constant. Black oak, whose sapling/poletimber density dramatically fell between 1998 and 2005, is a major exception (Table 1B). As a group, the density of oak saplings and poletimber has slowly decreased over time.

What this means

The decrease in the number of trees per acre and the increase in live volume per acre are indicative of mature stands with adequate spacing and good growth. This is a result of the increased availability of growing space following a reduction in the overall number of trees. The stems that remain then face less competition for growing space and are able to grow more quickly. The existence of quality growth conditions is mirrored in the current levels of stocking, which show that the growing space available for tree development is fully utilized on the majority of forest acreage.

Evidence of possible succession to maple forest types is reflected in the changes in forest density among Illinois' saplings, poletimber, and sawtimber trees. The density of oak sawtimber appears to be leveling off and it does not appear that oak will replace itself in the overstory. A lack of increasing oak density in the sapling/poletimber size classes coupled with decreasing oak sawtimber density and high maple sapling/poletimber density is an indication that future stands may include fewer oaks and more maples.

Diminishing Oaks, Maple Replacement

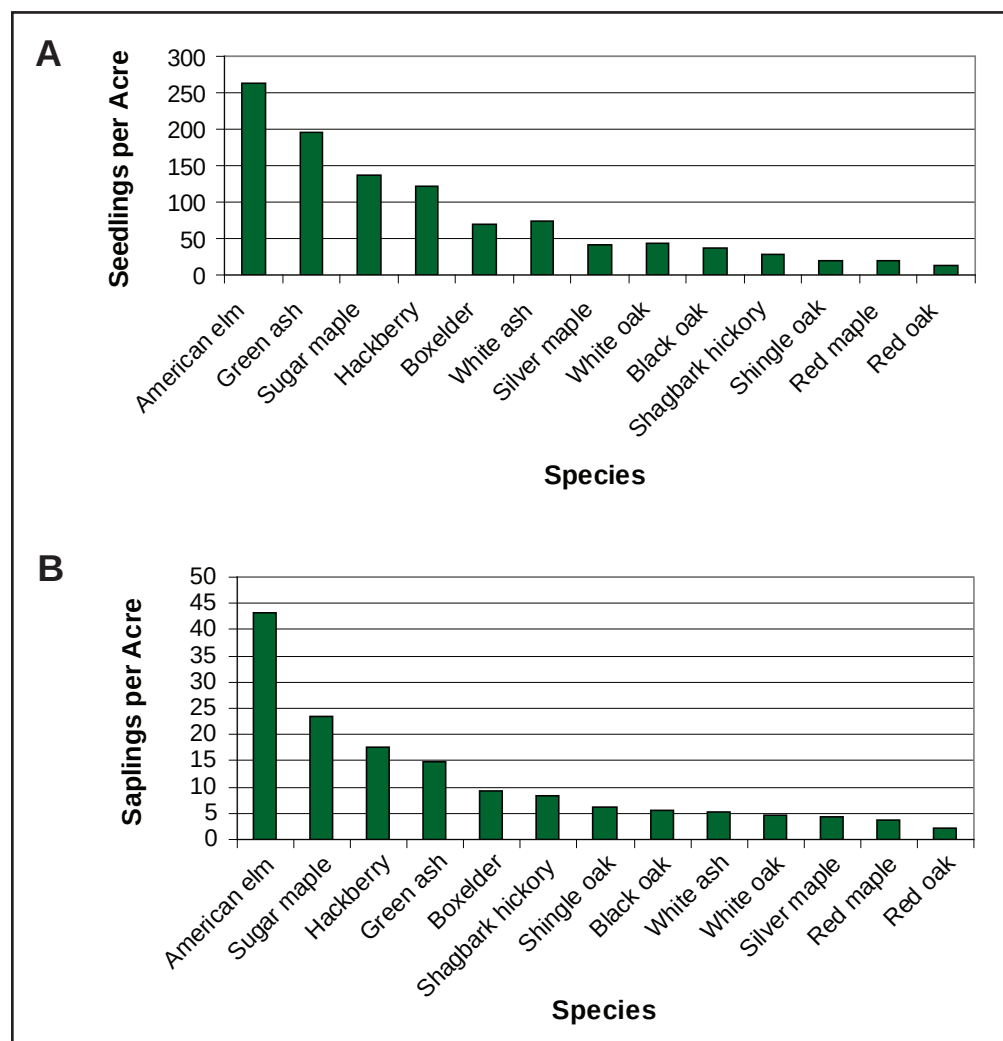
Background

Oak/hickory forests are the predominant forest type on the Illinois landscape. The broad range of tree species and the structural variation within these forests contributes to their importance as a reservoir for biological diversity. Home to a number of mast-producing trees, many wildlife species are dependent on oak/hickory forests for the food and habitat they provide.

What we found

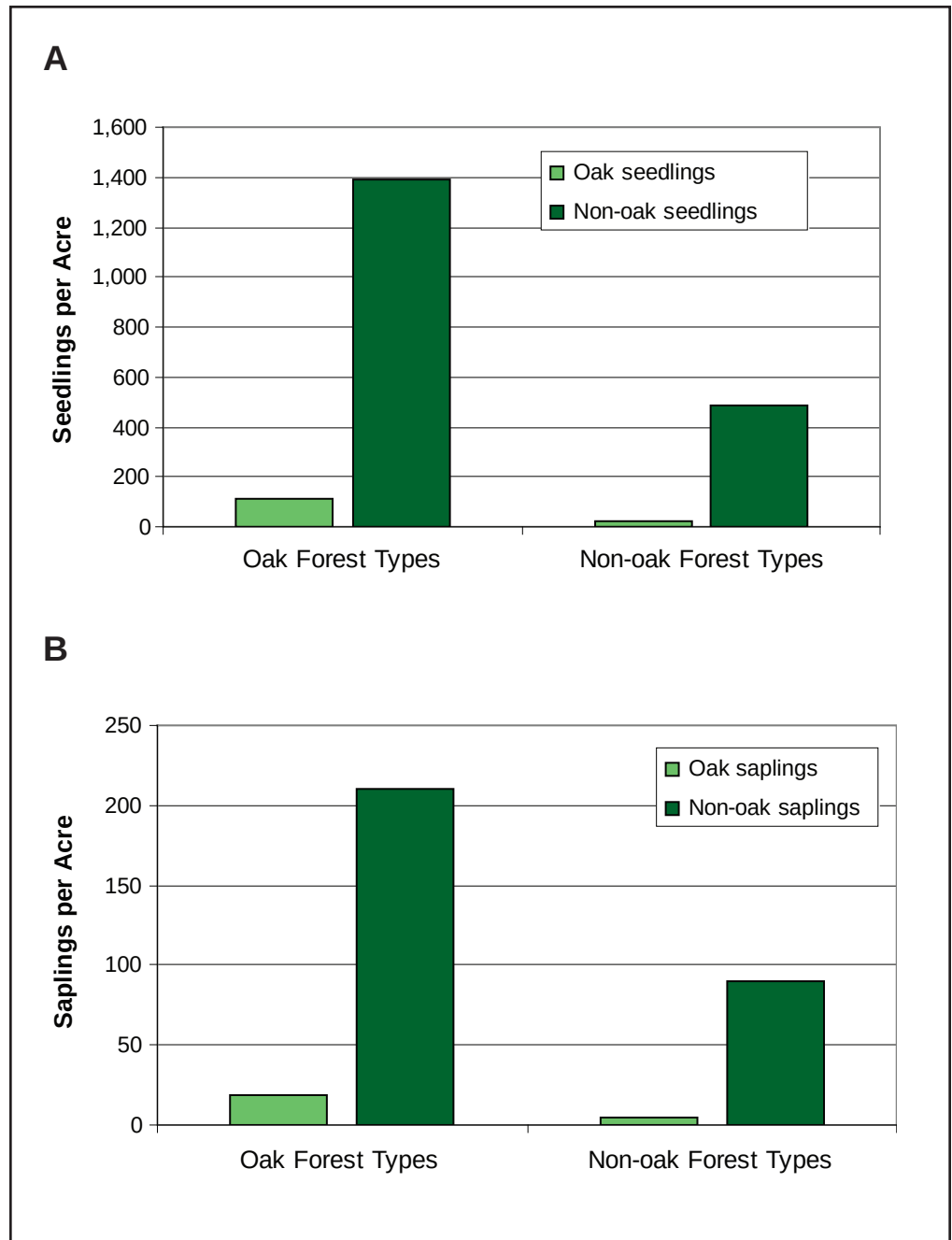
With an average of fewer than 45 seedlings per acre of forest land, oaks represent a small component (7 percent) of the understory (Fig. 23A). Of all oak species, white and black oak seedlings are the most abundant, occurring over three times more often than red oak seedlings. Elm, ash, and maple have substantially more seedlings per acre than oaks. Similarly, oak saplings (which average fewer than seven saplings per acre of forest land) are far less abundant than other hardwood species (Fig. 23B). Regeneration of oak

Figure 23.—Number of seedlings (A) and saplings (B) per acre of forest land for selected species, Illinois, 2005.



within oak forests is poor (Fig. 24A, B). On average, the ratio of oak to non-oak species is 1 to 13 for both seedlings and saplings.

Figure 24.—Number of seedlings (A) and saplings (B) per acre for oak and non-oak species on oak and non-oak forest types, Illinois, 2005.



A comparison of oaks and maples by diameter shows that the small-diameter classes are dominated by hard maples (primarily sugar maple), while the large-diameter classes consist mainly of black and shingle oaks in the other red oaks species group (Fig. 25). Not surprisingly, the other red oak species group is the largest contributor to oak mortality; within this group, black oak has the highest mortality rate (Table 2). Ninety-three percent of oak growing-stock mortality occurred in trees where the d.b.h. was 11 inches or greater.

Figure 25.—Number of trees on forest land by diameter class for selected species groups, Illinois, 2005.

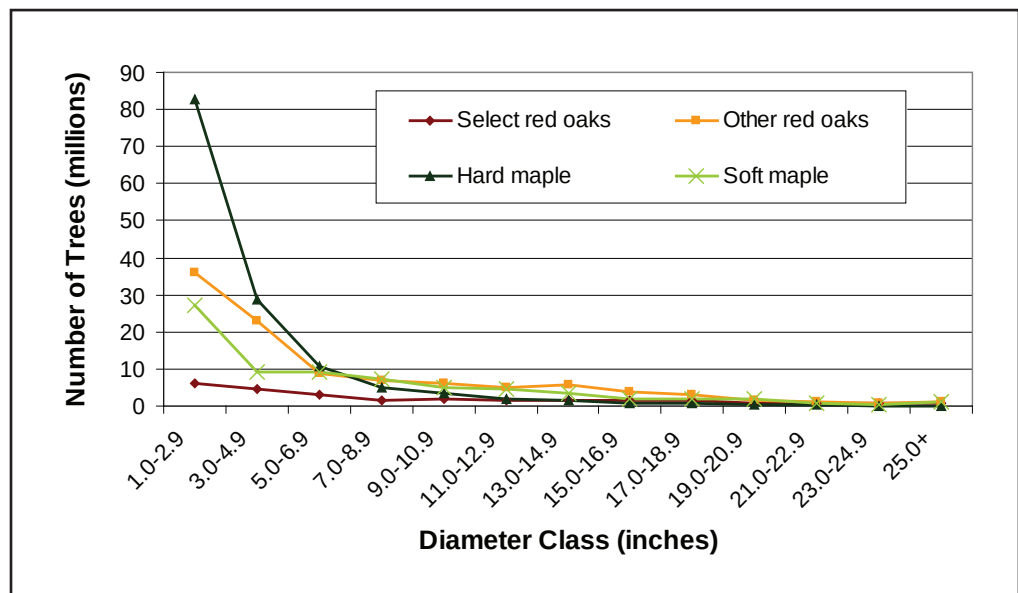


Table 2.—Average annual mortality for growing stock and sawtimber on timberland by selected species group, Illinois, 2005

Species group	Average annual growing-stock mortality (in thousand cubic feet/year)	Average annual sawtimber mortality (in thousand board feet/year)
Select white oaks	2,846	9,863
Select red oaks	1,971	8,497
Other white oaks	924	4,079
Other red oaks	12,228	50,849
Hard maple	2,153	9,296
Soft maple	12,724	48,876

What this means

Illinois' oak resource is characterized by numerous large, mature trees and a comparatively small sapling/seedling component. Decreases in the frequency of beneficial disturbances including timber management and prescribed fire have contributed to suppression of oak seedlings and an increase in the abundance of non-oak seedlings and saplings. With an understory dominated by non-oak species such as sugar maple and with relatively few oak saplings available to move into the medium-diameter classes, it is likely that there will be a successional change in species dominance. Oak stands may eventually be dominated by more shade-tolerant species such as maples. With a largely mature oak resource, the future of oak in Illinois is uncertain. Maintaining a healthy oak resource will be dependent on successful seedling regeneration and sapling development.



White oak. Photo by Paul Wray, Iowa State University, bugwood.org

Ownership

Background

FIA conducts the National Woodland Owner Survey (NWOS) to increase our understanding of who owns forest land, why they own it, and what they intend to do with it. It serves as the social complement to the inventory of the State's biophysical forest resources and provides a more holistic understanding of the forest resources and the factors affecting them.

What we found

Illinois' forest land is predominantly held by private landowners. An estimated 206,000 families and individuals own a total of 3.5 million acres, or 77 percent of forest land (Fig. 26). An additional 265,000 acres are owned by other private groups (e.g., corporations, associations, etc.). Collectively, private owners hold 82 percent of the State's forests. Family forest owners generally own less than 10 acres of forest land (Fig. 27). However, family forest owners with landholdings greater than 10 acres own more than 55 percent of private forest land. The most common reasons for owning forest land are related to beauty and scenery, forest land as part of a farm, privacy, and as a family asset or legacy to pass on to heirs. Timber has been harvested on 11 percent of privately owned forest land in the past 5 years (Fig. 28). Four percent of family forest owners reported having a written forest management plan and 15 percent have sought management advice. Trespassing was rated as a significant concern by 46 percent of family forest owners. Other prevalent concerns were related to vandalism, dumping, property taxes, and owners' abilities to keep their land intact for heirs. One in 10 acres of forest land is owned by someone who plans to transfer or sell it within the next 5 years. This is related, in part, to owner age; 49 percent of family forest land is owned by people 65 or older (Fig. 29).

Figure 26.—Area of forest land by ownership group, Illinois, 2002-2004.

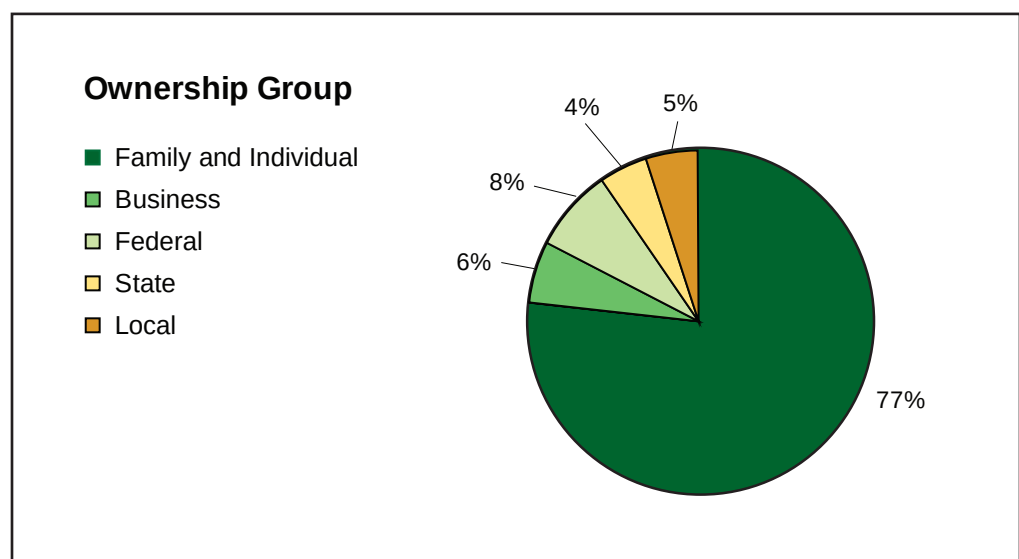


Figure 27.—Area of family owned forests and number of family forest owners by size of landholdings, Illinois, 2002-2004.

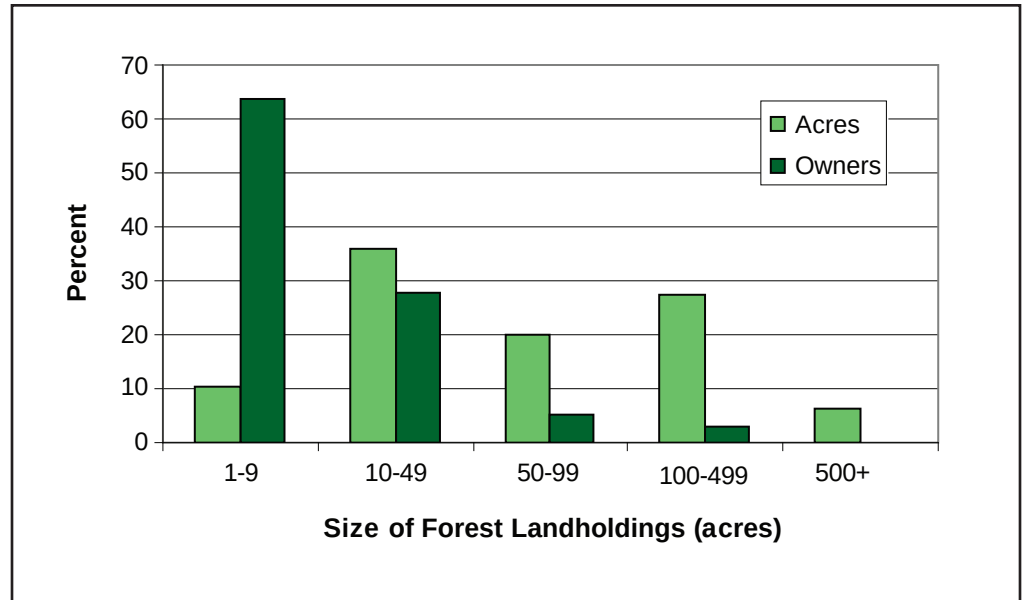


Figure 28.—Area of family owned forests by recent (past 5 years) forestry activity, Illinois, 2002-2004 (NTFPs are nontimber forest products; error bars represent a 66-percent confidence interval).

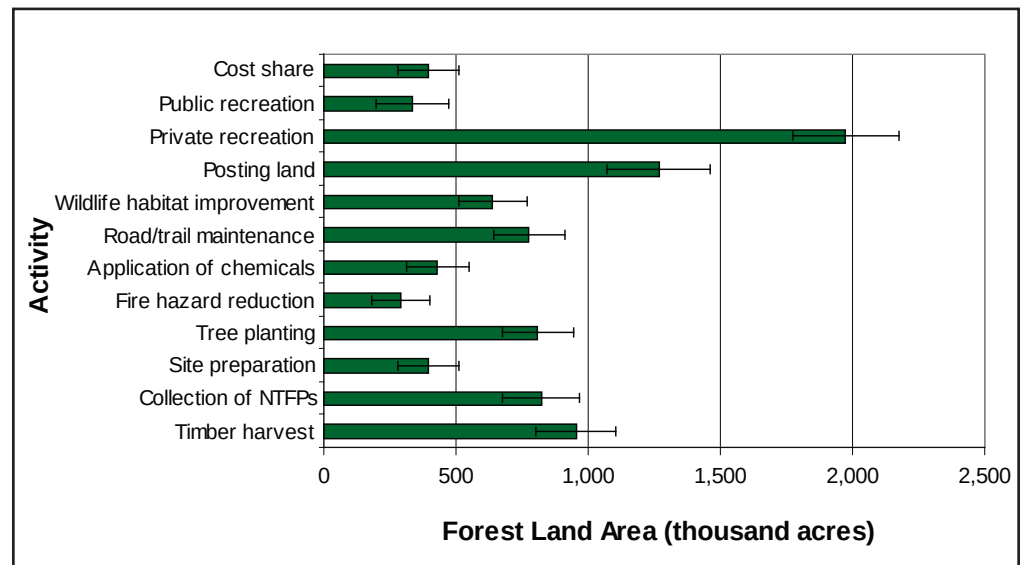
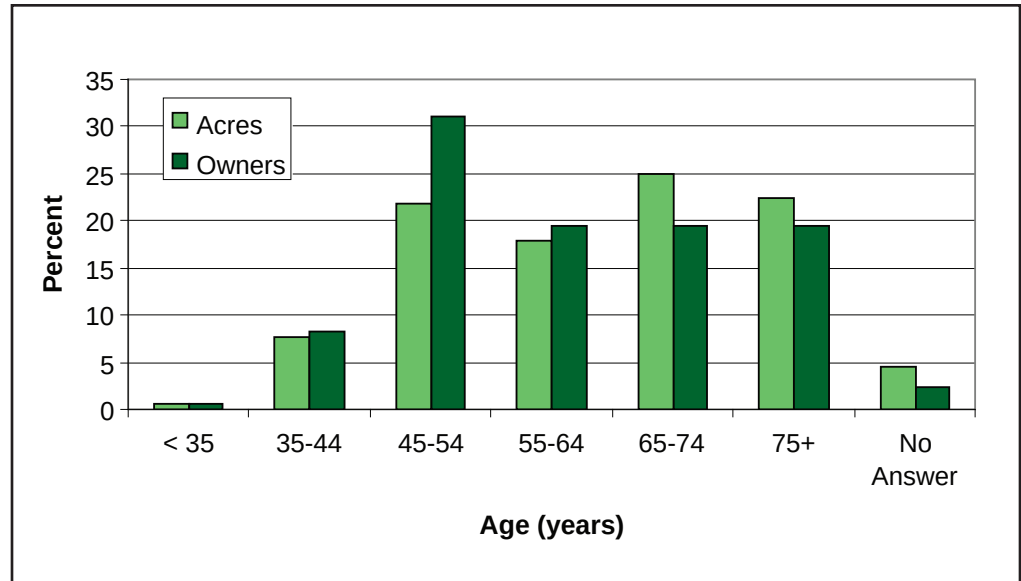


Figure 29.—Area and number of family owned forests by age, Illinois, 2002-2004.



What this means

Private landholders are an important, diverse, and dynamic group of forest owners. Holding the majority of forest land, they have a substantial influence on the status, structure, and composition of Illinois' forest resources. Based on the current age of family forest owners and their intended plans, forest land will soon undergo an intergenerational shift in ownership that will transfer a large portion of forest area to a new cohort of landowners. This change will influence how owners view, interact, and relate to their land, and may alter future forest characteristics.

Riparian Forests

Background

Largely located along river and stream borders, many riparian forests are oriented in long and narrow strips that do not meet FIA's definition of forest land and are therefore not measured. However, there are a number of riparian forests that do meet the FIA definition of forest land. By combining a portion of mesic physiographic classes (narrow flood plains/bottomlands, broad flood plains/bottomlands, other mesic) and all hydric classes (swamps/bogs, etc.), we can derive coarse estimates of the size, structure, and composition of Illinois' riparian forests.



Riparian forest along the Cache River, Illinois. Photo by Susan Crocker, U.S. Forest Service

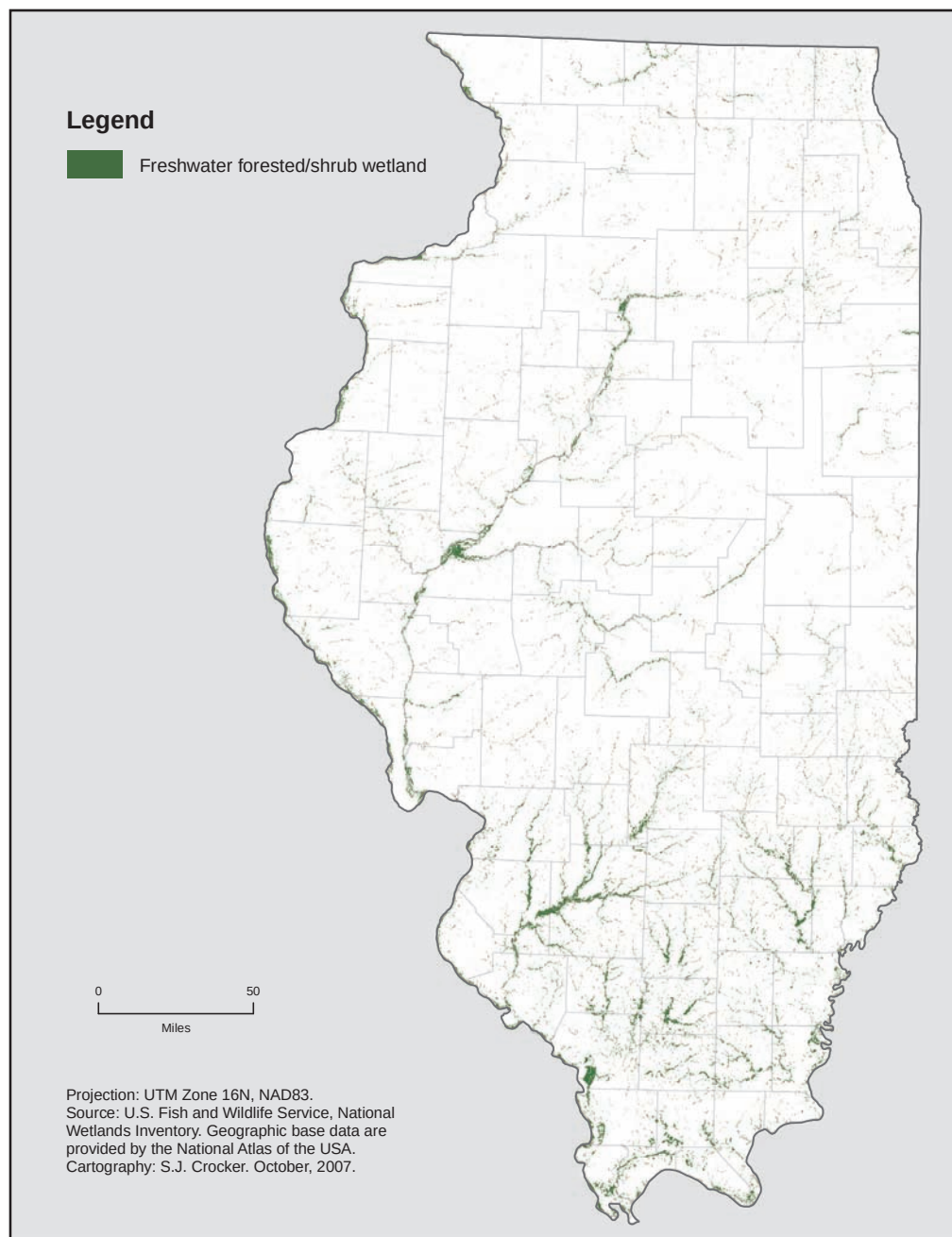
What we found

Riparian forests total an estimated 992,500 acres and account for 22 percent of Illinois' forest land (Table 3). A mapped distribution of riparian forests using U.S. Fish and Wildlife Service's National Wetlands Inventory data shows that much of these forests are concentrated along rivers and streams in the southern tier of Illinois (Fig. 30). FIA data indicates that 74 percent of riparian forest land is in narrow floodplains and bottomlands that are less than a quarter mile wide.

Table 3.—Area of forest land (in acres) in riparian physiographic classes by stand size, Illinois, 2005

Physiographic class	Stand-size class				Total
	Large diameter	Medium diameter	Small diameter	Non-stocked	
Narrow flood plains/bottomlands	443,184	128,700	53,432	1,674	626,991
Broad flood plains/bottomlands	199,212	29,019	8,564	1,569	238,364
Other mesic	23,635	0	6,017	1,504	31,156
Swamps/bogs	14,025	8,347	0	0	22,372
Small drains	43,959	11,374	7,841	1,490	64,665
Bays and wet pocosins	9,032	0	0	0	9,032
Total	733,047	177,440	75,854	6,237	992,580

Figure 30.—Distribution of riparian forest types (from the U.S. Fish and Wildlife Service's National Wetlands Inventory), Illinois, 2005.



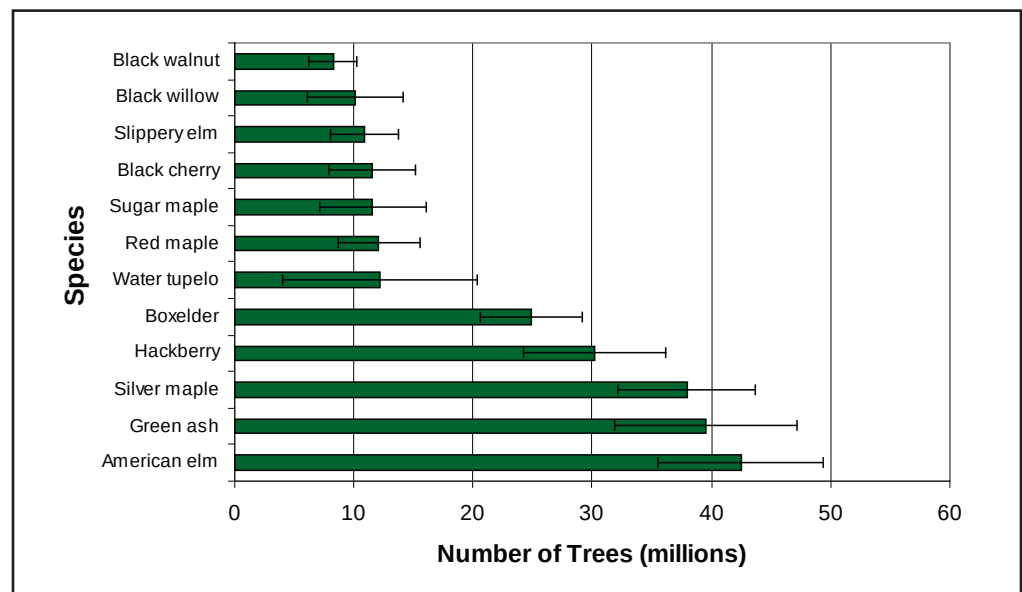
Illinois' riparian forests currently contain an estimated 352.3 million live trees, an average of 355 trees per acre of riparian forest land. Nearly 70 tree species were identified; the most commonly observed species were American elm, green ash, silver maple, hackberry, and boxelder (Fig. 31). These five species account for half of the total number of trees on riparian forest land. Estimates of volume show that riparian forests contain 2.1 billion cubic feet, or 26 percent of the State's total live volume on forest land. Silver maple (29 percent of total riparian volume), eastern cottonwood (9 percent), green ash (7 percent), hackberry and sycamore (5 percent each) have the greatest percentage of volume in riparian forests.



Bald cypress swamp, Cache River State Natural Area, Illinois. Photo by Susan Crocker, U.S. Forest Service.

Thirty-eight percent of total mortality of growing stock on timberland occurred in riparian forests. Species with considerable mortality include: red maple (6.3 million cubic feet), silver maple (3.6 million cubic feet), American elm (3.3 million cubic feet), hackberry (2 million cubic feet), green ash (1.3 million cubic feet), and pin oak (474,500 cubic feet).

Figure 31.—Top 12 species, by number of trees, in riparian physiographic classes on forest land, Illinois, 2005 (error bars represent a 66-percent confidence interval).



What this means

Riparian forests contain a diverse number of species, but only a handful of those species are dominant. Surprisingly, many of these dominant species, e.g. American elm, green ash, silver maple, and hackberry, are experiencing high mortality. Some of this mortality can be attributed to severe flooding, particularly from the Mississippi flood of 1993. However, insects and diseases are also important contributors. For example, much of the mortality of American elm is due to Dutch elm disease (DED). Additionally, the emerald ash borer (EAB) is a major threat to green ash, the second most abundant species in volume and number of trees. Riparian forest corridors may play an important role in the dispersal of EAB. In combination with adverse weather and old age, continued spread of DED and EAB could change the structure and composition of riparian forests.

Average Annual Growth

Background

A stand's capacity for growth, i.e., for trees to increase in volume, is an indication of the overall condition of the stand and more specifically of tree vigor, forest health, and successional stage. Forest growth is measured as average annual net growth, where net growth is equivalent to gross growth minus mortality. Average annual net growth represents an average for the annual change in volume between the two most recent inventories, 1998 and 2005 for this report.

What we found

Since 1962, average annual net growth of growing stock has been on the rise (Fig. 32). Net growth averaged 327 million cubic feet per year between 1998 and 2005. Nearly all of that growth (98 percent) was in hardwoods. Silver maple had the highest growth rate, followed by eastern cottonwood, white oak, and northern red oak (Fig. 33). Collectively, Illinois' major oak species (white, northern red, bur, and black oak) account for 23 percent of total growth. The bulk of growth occurred in large-diameter stands (Fig. 34). Ninety-four percent of net growth in white, northern red, bur and black oaks was in large-diameter stands.



Understory vegetation. Photo by Susan Crocker, U.S. Forest Service

Figure 32.—Average annual net growth of growing stock on timberland by inventory year, Illinois, 1962 to 2005.

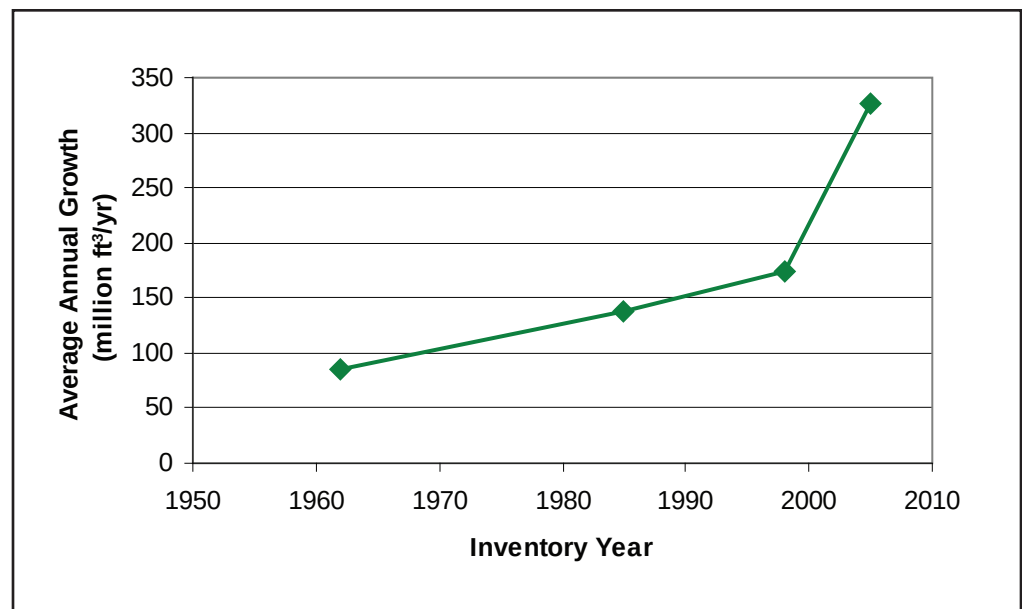


Figure 33.—Average annual net growth of growing stock on timberland for the top 12 species, Illinois, 1998 to 2005.

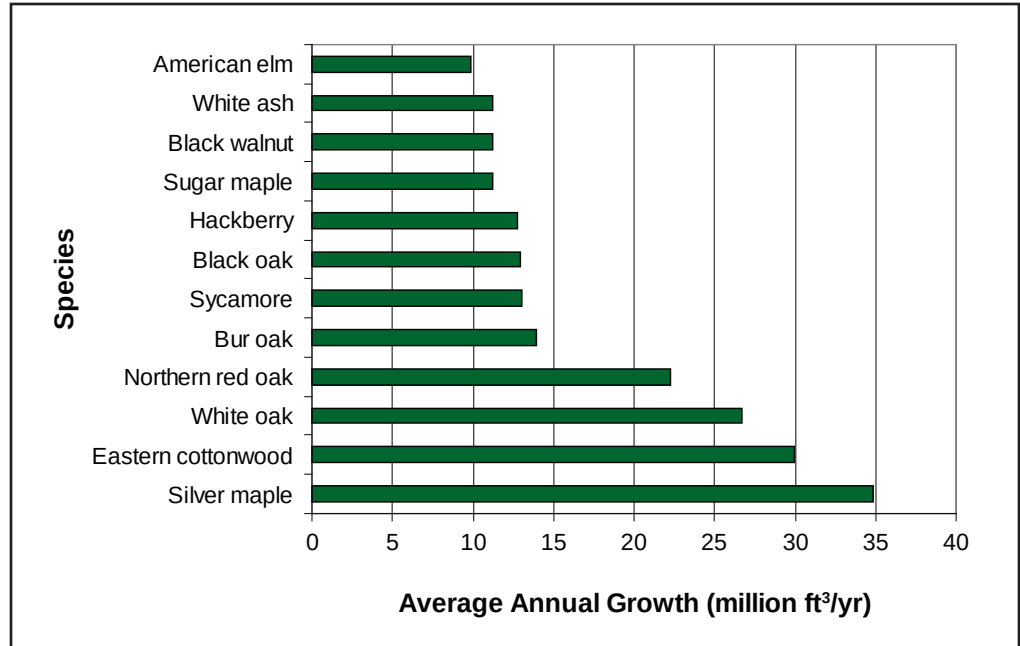
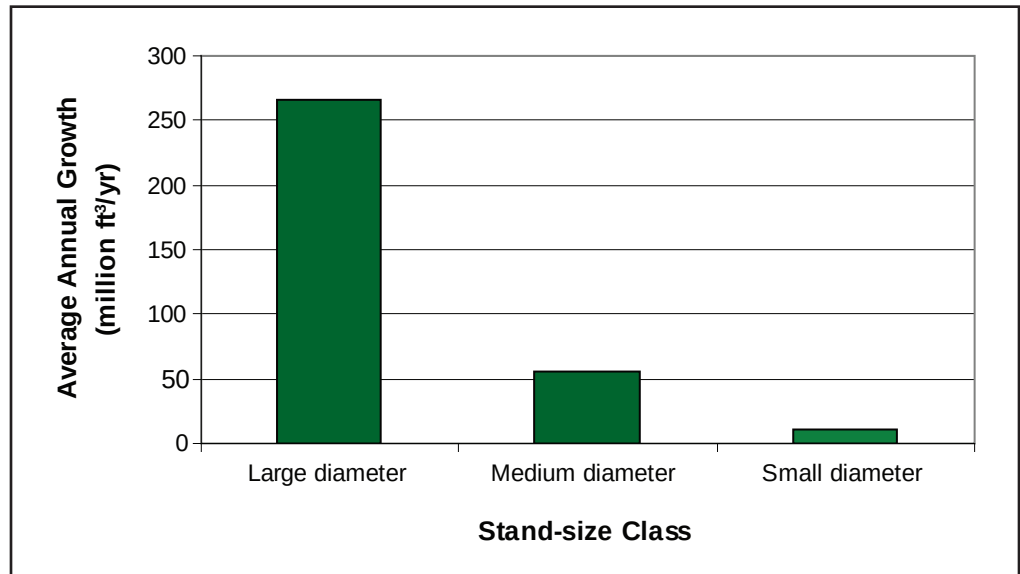


Figure 34.—Average annual net growth of growing stock on timberland by stand-size class, Illinois, 1998 to 2005.



What this means

Illinois' forests are growing at their highest rates since 1962. The preponderance of this growth is occurring within large-diameter stands, which indicates that mature trees are continuing to increase in volume. While sustained growth of large-diameter oak increases its availability for commercial wood products, growth of other species in a variety of size classes suggests that in the future oak may not be as dominant as it is today.

Growth, removals, and mortality data are collected only on trees 5 inches in d.b.h. or greater. As a result, growth rates reported here provide information on trends in the overstory, but do not reflect potential changes in understory growth.



Field crew member measuring tree diameter.
Photo by Cassandra Olson, U.S. Forest Service



Height measurement. Photo by Cassandra Olson,
U.S. Forest Service

Average Annual Removals

Background

Trees are removed from timberland to meet a variety of management objectives. Changes in the quantity of growing stock removed helps to identify trends in land use change and forest management. Because removals are generally recorded on a limited number of plots, the estimates for removals show greater variance than those for growth, mortality, or area. Like forest growth, the rate at which trees are removed represents the annual average of removals that occurred between 1998 and 2005.



Tree felling. Photo by U.S. Forest Service, Northeastern Area archives, bugwood.org

What we found

Growing-stock removal rates began a rapid climb during the 1960s, reaching a peak in the early 1980s (Fig. 35). Since 1985, the rate at which growing stock was removed from timberland has decreased. Currently, growing stock is removed at an average of 60.6 million cubic feet per year. Eighty-seven percent of growing-stock removals occurred on private land. Hardwoods account for virtually all of total removals; softwood removals total 43,000 cubic feet per year and represent less than 0.1 percent of total removals. White oak and eastern cottonwood had the highest annual removals, each averaging 8.9 million cubic feet per year (Fig. 36). Oak species account for 36 percent of annual removals.

Figure 35.—Average annual removals of growing stock on timberland by inventory year, Illinois, 1962 to 2005 (error bars represent a 66-percent confidence interval).

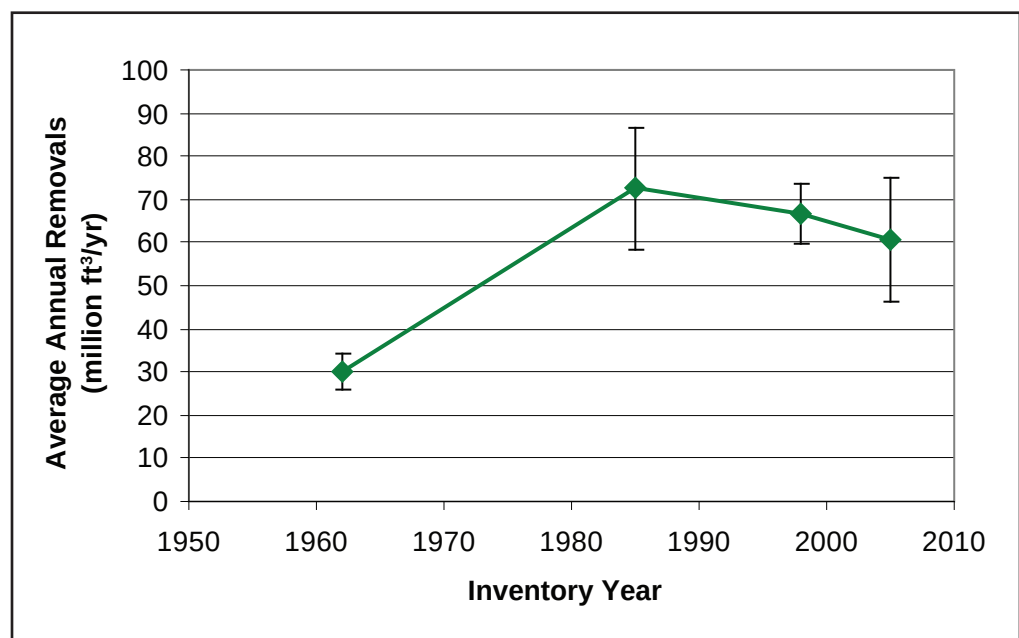
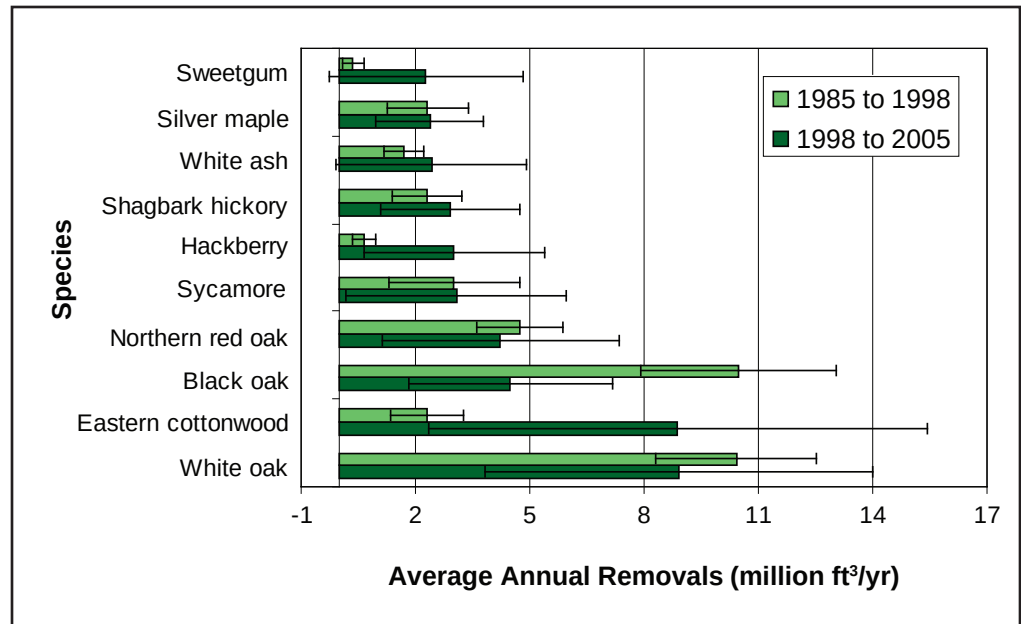


Figure 36.—Average annual removals of growing stock on timberland for the top 10 species by inventory year, Illinois, 1985 to 2005 (error bars represent a 66-percent confidence interval).



What this means

Wood products represent an important industry in Illinois. Changing market demands and market values can influence the rate of tree removals and the species being removed. Black oak was the only species to show a significant change (decrease) in removals between inventory cycles. Perhaps the most important trend is an apparent change in which species are being removed. Illinois' forest products market seems to be moving away from high utilization of oak and the demand for cottonwood is increasing.

Average Annual Mortality

Background

Forest health, vigor, and the rate of accretion and depletion are all influenced by tree mortality. Mortality can be caused by insects, disease, adverse weather, succession, competition, fire, old age, or human or animal activity, and is often the result of a combination of these factors. Tree volume lost as a result of land clearing or harvesting is not included in mortality estimates. Growing-stock mortality estimates represent the average cubic-foot volume of sound wood in growing-stock trees that died each year as an average for the years between inventories (1998 and 2005 in this report).

What we found

Since the 1960s, the rate of growing-stock mortality has continued to grow with each inventory (Fig. 37). Average annual mortality of growing stock on timberland is currently an estimated 86.7 million cubic feet per year, roughly 1.3 percent of total growing stock volume. American elm, black oak, and red maple have the highest rates of mortality; all three species experienced significant increases in mortality since 1998 (Fig. 38). A closer look at elm mortality shows that 27 percent of elms were infected with disease; 72 percent of elm damage agents were unknown/other.

What this means

Increasing mortality reflects the growing maturity of Illinois' forests. As the bulk of the State's forests are made up of large-diameter stands, much of the mortality may be the result of senescence. However, elm mortality is largely due to the continued spread of DED. Black oak mortality is related to oak wilt and old age. As oak is a major overstory component and does not appear to be replacing itself in the overstory, oak mortality has implications for the future composition of Illinois' forests. As American elm and maples now occupy the majority of the poletimber density, high elm mortality makes maples likely candidates to replace oaks in the overstory.

Figure 37.—Average annual mortality of growing stock on timberland by inventory year, Illinois, 1962 to 2005.

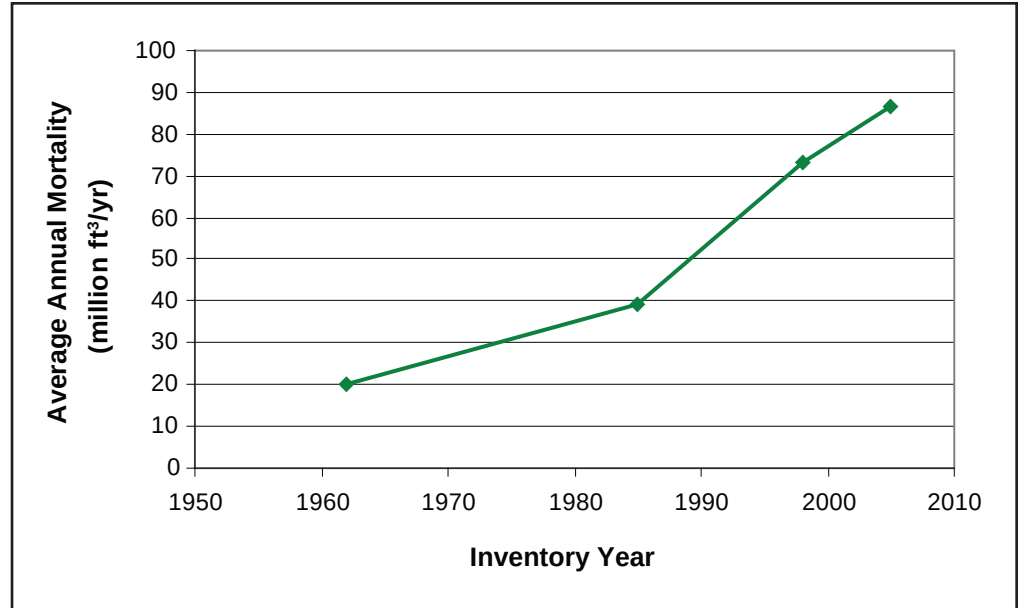
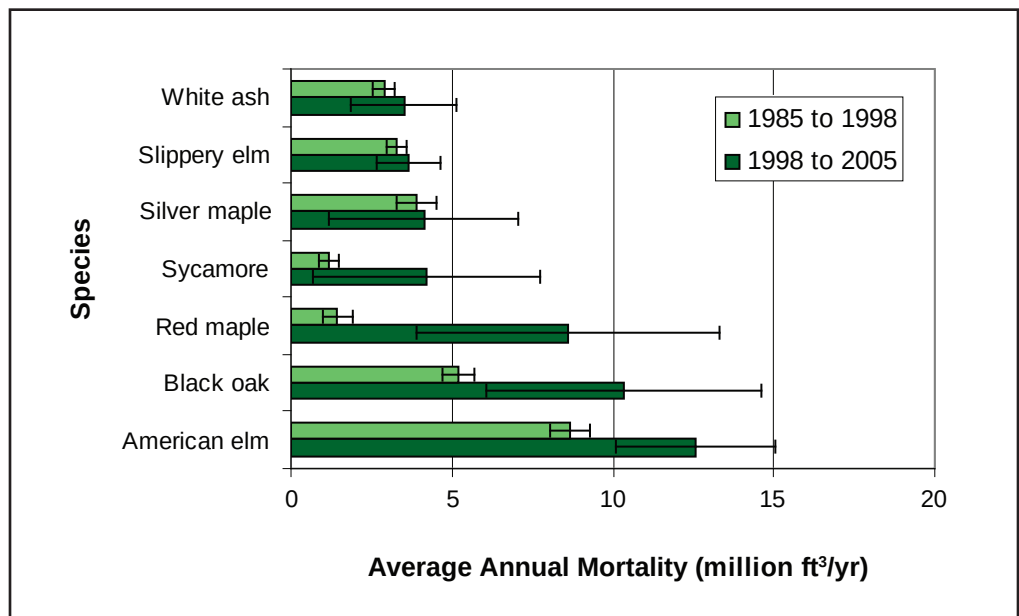


Figure 38.—Average annual mortality of growing stock on timberland for the top seven species by inventory year, Illinois, 1985 to 2005 (error bars represent a 66-percent confidence interval).



Forest Health



Above: Flowering dogwood; photo by Susan Crocker, U.S. Forest Service.
Inset: White-tailed deer; photo by U.S. Forest Service archives, bugwood.org.

Down Woody Materials

Background

Down woody materials including fallen trees and branches fulfill a critical ecological niche in Illinois' forests. They provide valuable wildlife habitat in the form of coarse woody debris and contribute to forest fire hazards via surface woody fuels.

What we found

In Illinois, the fuel loadings of down woody materials (fuel-hour classes) are not exceedingly high and are not significantly different from fuel loadings in neighboring states; for fuel-hour definitions, see Woodall and Monleon (2008) (Fig. 39). The distribution of coarse woody debris by size class seems to be heavily skewed (76 percent) towards pieces less than 8 inches in diameter at point of intersection with plot sampling transects (Fig. 40A). Decay class distribution appears to be fairly uniform across the State, except for decay class 3 logs (33 percent) (Fig. 40B). Coarse woody pieces in decay class 3 are typified by moderately decayed logs that are structurally sound, missing most of their bark, and have extensive sapwood decay. There is no strong trend in coarse woody debris volume per acre among classes of live density (basal area per acre). However, stands with the highest coarse woody debris volumes also had the lowest standing live density (Fig. 41).

Figure 39.—Estimates of mean fuel loadings by fuel-hour class on forest land for Illinois, Indiana, and Iowa, 2005 (error bars represent a 66-percent confidence interval).

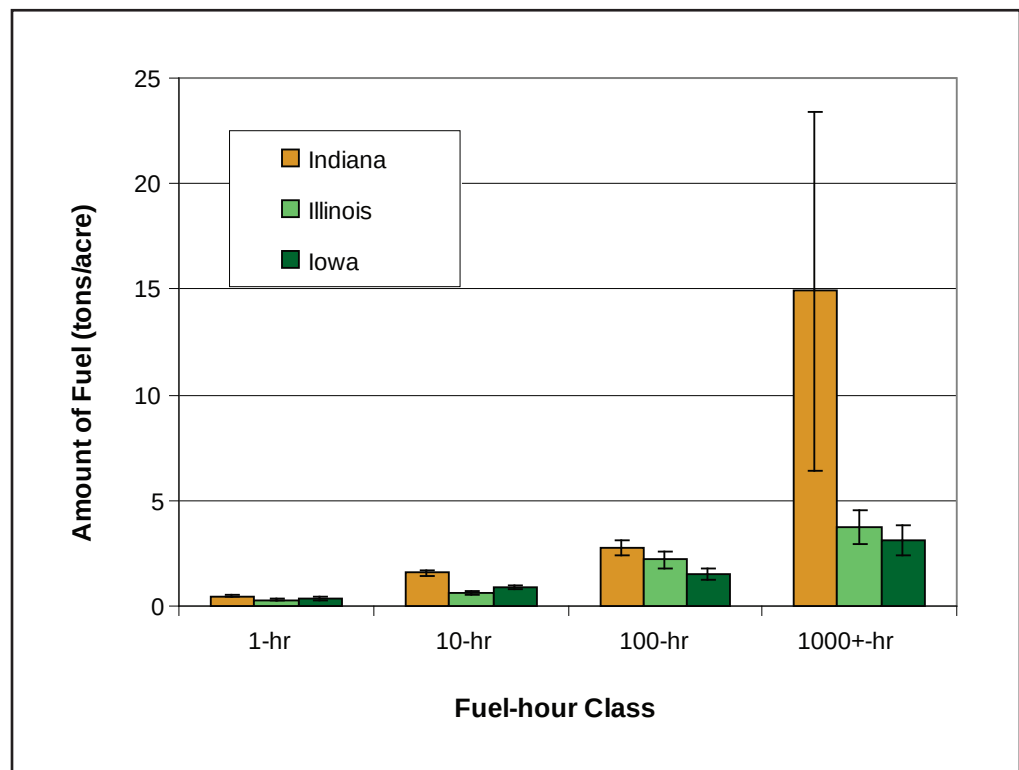
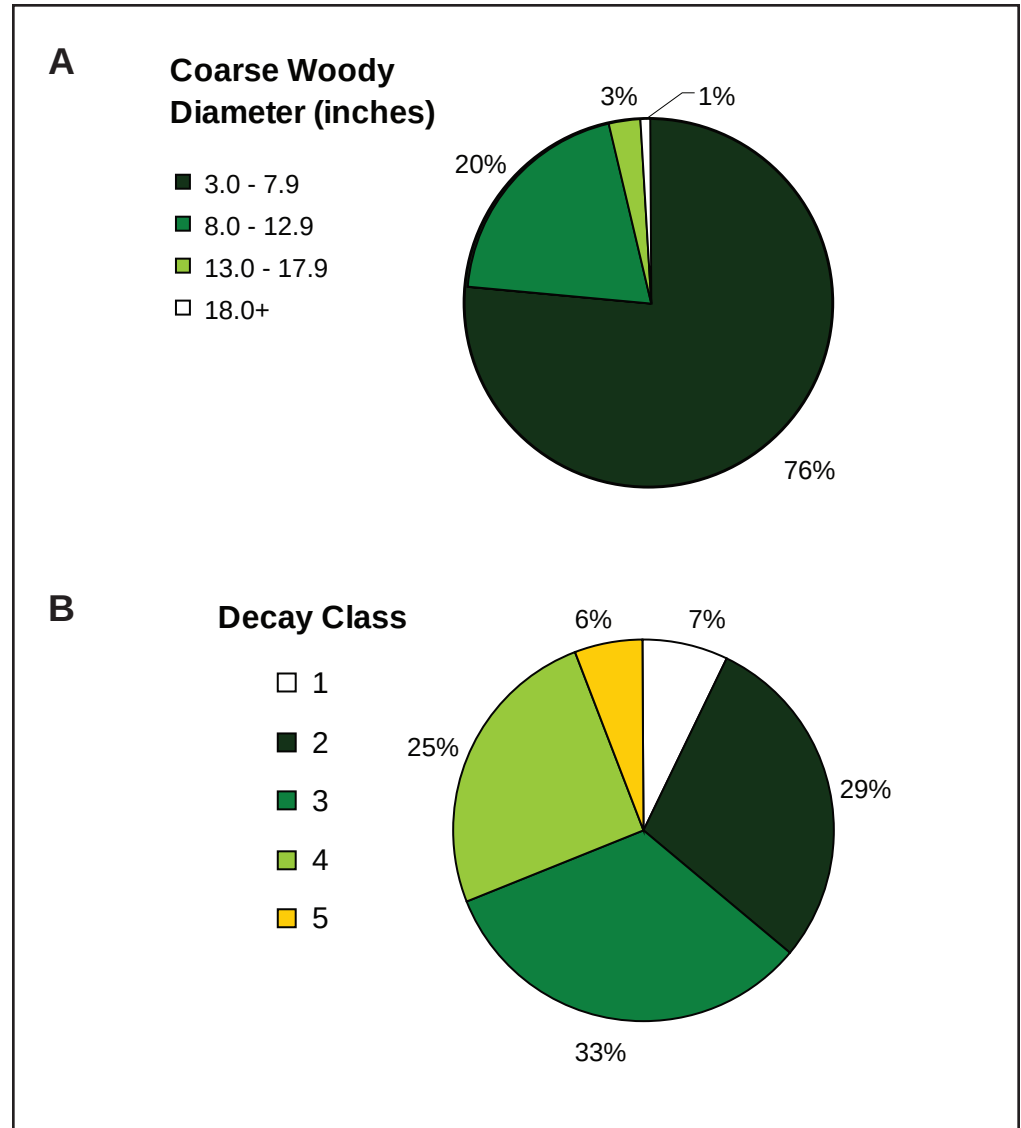
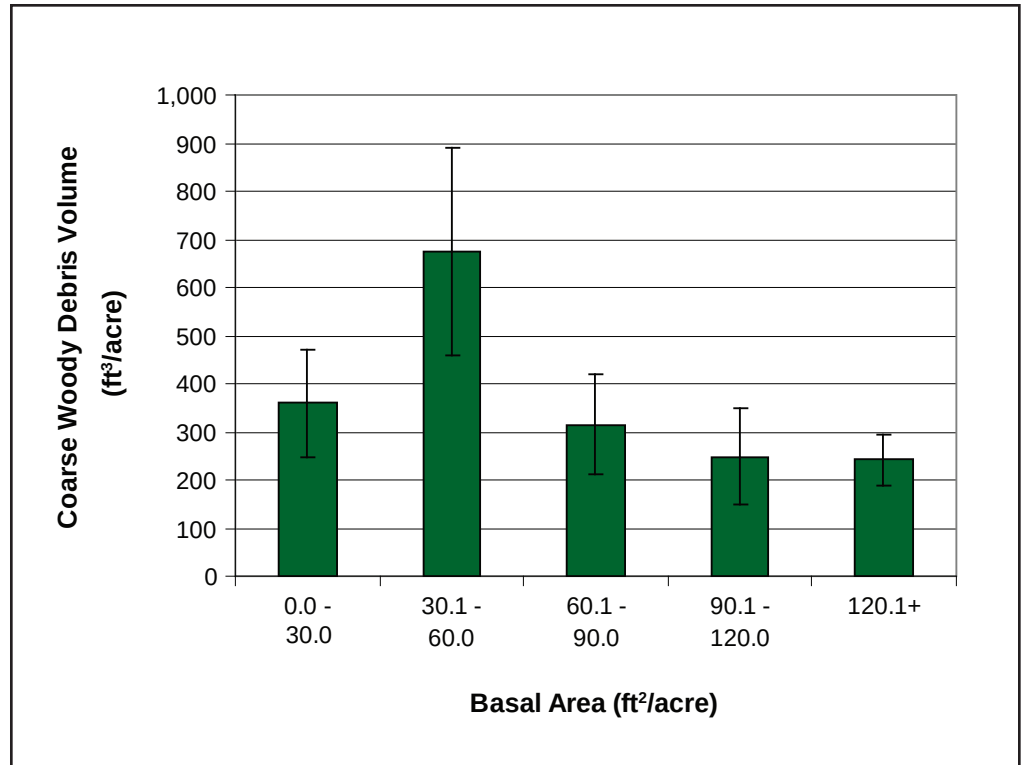


Figure 40.—Mean distribution of coarse woody debris (pieces per acre) by (A) size class (inches) and (B) decay class (1 – least decayed, 5 – most decayed) on forest land, Illinois, 2005.



Coarse woody debris. Photo by David Stephens, bugwood.org

Figure 41.—Estimates of mean coarse woody debris volumes by stand density on forest land, Illinois, 2005 (error bars represent a 66-percent confidence interval).



What this means

Down woody fuel loadings in Illinois' forests are low and, in general, they are not very different from those in neighboring states. Only in times of extreme drought would these low fuel amounts pose a hazard. Coarse woody debris volumes are also relatively low and are represented by small, moderately decayed pieces. The lack of large pieces of debris is a good indication that coarse woody debris is not a significant source of wildlife habitat. Because fuel loadings are not exceedingly high across Illinois, the danger of wildfire is outweighed by the benefit of down woody material for wildlife habitat and carbon sinks.

Soils

Background

Rich soils are the foundation of productive forest land. The soil inventory illustrates the unique niches that different forests now occupy to maximize their competitive advantage. As an initial inventory, the collected data also provide critical baseline information to document changes in forest health resulting from natural or human influences.

What we found

Field data were collected from 2001 to 2005. Only forest-type groups with more than five samples are considered. The forest floor is thicker under the oak/hickory forest-type group than under elm/ash/cottonwood (3.38 and 2.67 cm, respectively, Fig. 42), but the elm/ash/cottonwood forest-type group occurs in soils with greater depths to restrictive layers.

Differences in the coarse fragment content and bulk density of soils under elm/ash/cottonwood and oak/hickory stands were also found. Oak/hickory forest-type groups are found over more coarse subsoil (10 to 20 cm) than subsoil found under elm/ash/cottonwood stands (4.79 and 1.40 percent coarse fragments, respectively). The bulk density of mineral soil in both the 0 to 10 and 10 to 20 cm layer is higher under the oak/hickory forest-type group.

The pH of the surface mineral soil is higher under elm/ash/cottonwood than under oak/hickory (Table 4). Additionally, the Ca^{2+} , Mg^{2+} , K^{+} and Na^{+} content of the soil is significantly higher under elm/ash/cottonwood than under oak/hickory. This consistency leads to higher amounts of exchangeable cations (ECEC) under the elm/ash/cottonwood forest-type group. This is true in both samples (0 to 10 and 10 to 20 cm). Interestingly, Al^{3+} stocks are lower in elm/ash/cottonwood than in oak/hickory.

The adjusted Soil Quality Index (SQI) is a new metric that combines the distinct physical and chemical properties of the soil into a single, integrative assessment that ranges from 0 to 100 (Amacher et al. 2007). By linking SQI values to plot locations, it is possible to evaluate the influence of parent material on soil quality. In Illinois, the lowest quality soils are found on soils formed from colluvium (Fig. 43); this is true in both the 0 to 10 and 10 to 20 cm layers.

Figure 42.—Forest-floor thickness by forest-type group, Illinois, 2005 (error bars represent a 66-percent confidence interval).

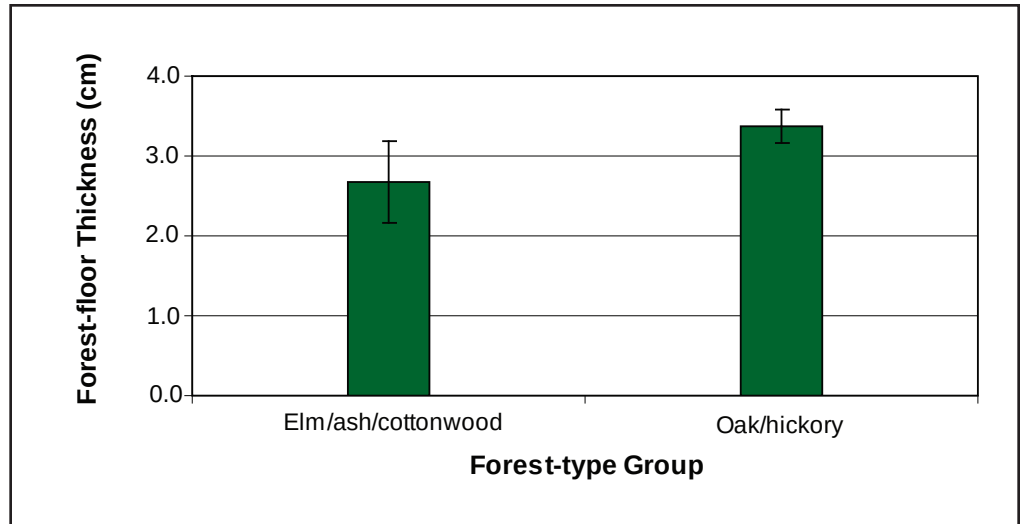
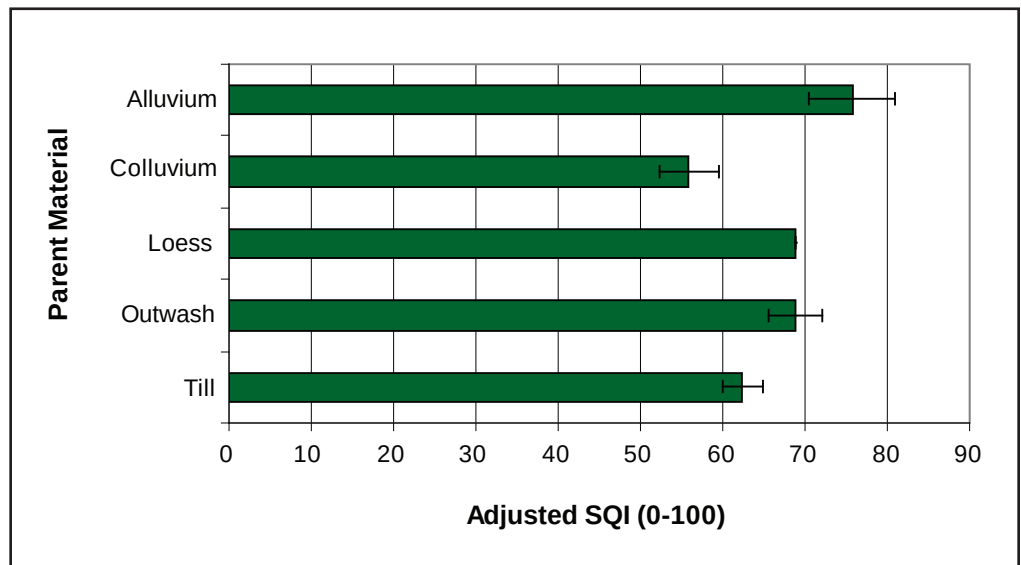


Table 4.—Selected chemical properties of forest soils, Illinois, 2005

Soil layer and forest-type group	No. of samples	pH in H ₂ O	Ca ²⁺ -----	Mg ²⁺ -----	K ⁺ (mg/kg)	Na ⁺ -----	S -----	Al ³⁺ -----	ECEC (cmol(+)/kg)
0 - 10 cm									
Elm/ash/cottonwood	11	6.5	3,032	485	175	56	18	22	20
Oak/hickory	29	5.7	1,574	276	112	11	8	36	11
10 - 20 cm									
Elm/ash/cottonwood	11	6.6	2,800	440	148	76	12	31	19
Oak/hickory	28	5.5	1,115	249	78	12	8	88	9

Figure 43.—Adjusted Soil Quality Index (SQI) for the 0 to 10 cm layer, Illinois, 2005 (error bars represent a 66-percent confidence interval).



What this means

The forest floor results from the slow accumulation of organic matter. Carbon, the primary component of soil organic matter, has a number of important functions including increasing water holding capacity, retaining nutrients by cation exchange (e.g., Ca^{2+} , Mg^{2+} , K^{+}), releasing other nutrients as it decays (e.g., N, P, and S), and capturing potential toxic agents (e.g., Hg) (McBride 1994). Carbon is also inventoried to track the sequestration of certain greenhouse gases. It traps nutrients and improves water holding capacity. Thicker forest floors indicate greater carbon storage and can also be viewed as a fire hazard. The differences in forest-floor thickness are likely related to the greater amount of moisture available to support decomposition in elm/ash/cottonwood stands. There may also be differences in tissue quality. Hill et al. (1992) observed that cottonwood leaves decayed more quickly than the oak species they sampled.

Bulk density, which measures the mass of dry soil in a fixed volume, is an important physical property of soil. Trees have greater difficulty rooting in soils with higher bulk densities, and there is less pore space available for air and water exchange. Soil texture affects bulk density; sandy soils tend to have higher bulk densities than finer textured soils like silts, clays, and loams.

Effective cation exchange capacity (ECEC) is the sum of five key mineral elements: Na^{+} , K^{+} , Ca^{2+} , Mg^{2+} , and Al^{3+} . High ECEC values are associated with higher fertility. In Illinois, the oak-hickory forest-type group was found on sites with low relative fertility.



Soil profile. Photo by Phil Crawl, U.S. Forest Service, bugwood.org

Tree Crowns

Background

Crown condition is an indicator of general tree health. Vigorous tree growth is associated with full, dense crowns (Schomaker 2003). Conversely, sparse crowns suggest poor growth conditions resulting from disturbances such as disease, insect activity, and adverse weather, or from unfavorable site conditions such as nutrient deficiency, overcrowding, and moisture stress or excess.



Tree crowns. Photo by Susan Crocker, U.S. Forest Service

Five of the main components of crown condition are crown density, foliar transparency, uncompacted live crown ratio, crown dieback, and crown vigor. Crown density is an estimate of crown fullness and represents the amount of branches, foliage, and reproductive structures that block light through the crown (U.S. For. Serv. 2007a). The amount of light visible through the live, normally foliated portion of the crown is defined as foliar transparency. Uncompacted crown ratio is the percentage of total tree height that supports live foliage. Dieback is a measure of twig and branch mortality within the crown. Crown vigor is an estimate of the crown condition and health of saplings. Determination of crown vigor is based on estimates of crown ratio, dieback, and condition of foliage (U.S. For. Serv. 2007a).

What we found

Overall, Illinois' tree crowns are in good condition. The majority of trees have high crown ratios and crown densities, low foliar transparencies, and relatively little dieback. Established critical thresholds for crown condition show that trees are most susceptible to mortality within 1 year when hardwoods have greater than 30 percent dieback (20 percent for softwoods), and crown densities less than 30 percent (for both hardwoods and softwoods) (Steinman 2000). In Illinois, 5 percent of trees have more than 30 percent dieback and only 6 percent of trees have a crown density lower than 30 percent. Additionally, trees are considered to be generally unhealthy when foliar transparency exceeds 40 percent (Coulston 2005). Estimates of transparency show that 4 percent of trees have greater than 40 percent transparency. Crown density, which serves as an indicator of expected tree growth, was more than 30 percent for 94 percent of the trees in Illinois.

While the majority of trees were healthy, some species did exhibit notable trends in crown condition. Sugar maple, hackberry, and pignut hickory have some of the highest mean crown ratios. White ash, black cherry, and American elm have some of the highest mean transparencies and the greatest amounts of dieback (Fig. 44).

The severity of dieback is categorized as none (0 to 5 percent), light (6 to 20 percent), moderate (21 to 50 percent), or severe (51 to 100 percent). Eighty-six percent of trees had no dieback, 11 percent had light dieback, and only 3 percent of crowns had moderate or severe dieback. Black cherry, silver maple, white ash, and sugar maple had the greatest proportion of dieback in the moderate and severe classes (Fig. 45).

Sixty-five percent of saplings are in vigor class 1 (good), 33 percent are in vigor class 2 (average), and 2 percent are in vigor class 3 (poor) (Fig. 46).

Figure 44.—Mean crown ratio, mean foliar transparency and mean crown dieback for selected species (calculated for trees 5 inches d.b.h. or larger), Illinois, 2005.

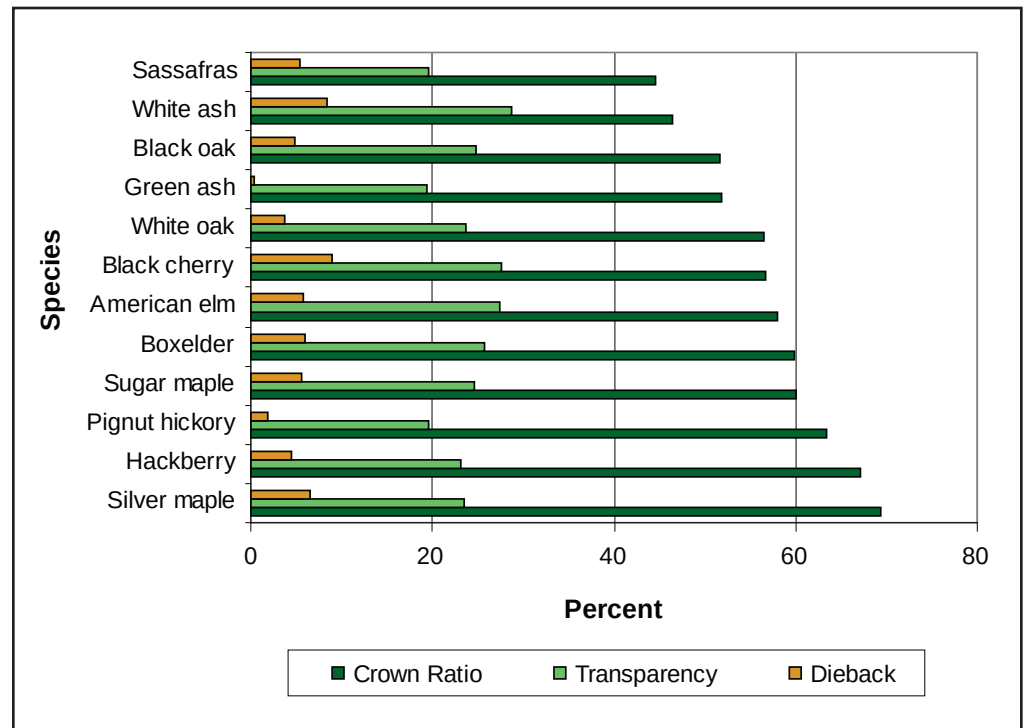


Figure 45.—Percentage of species dieback by severity for selected species (calculated for trees 5 inches d.b.h. or larger), Illinois, 2005.

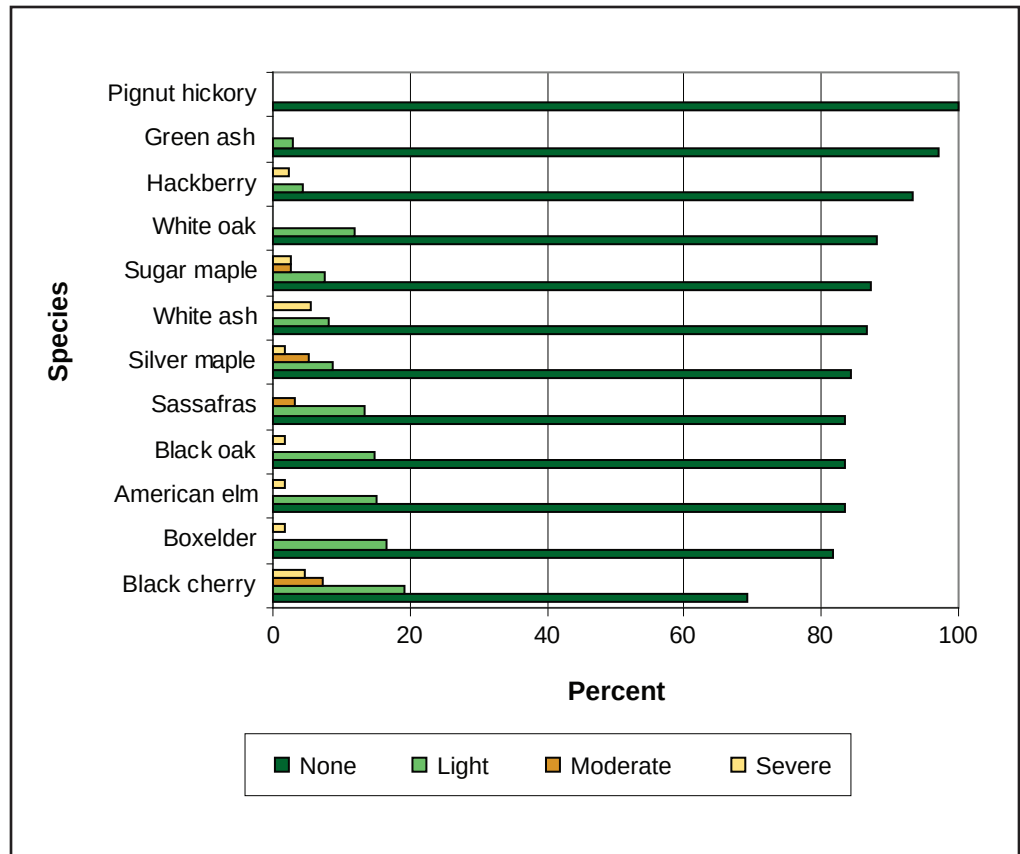
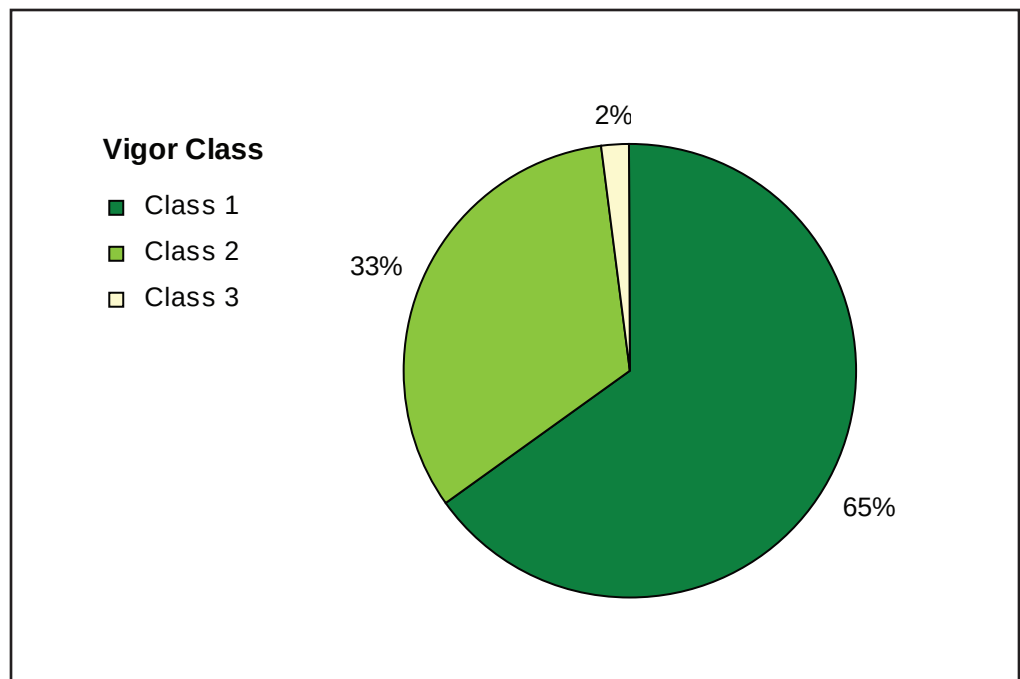


Figure 46.—Distribution of saplings by vigor class, Illinois, 2005.



What this means

Crown condition is an assessment of current tree conditions, but it also serves as a measure of site quality, stand density, and the degree and influence of external stresses. Measurements from crown variables indicate that there are no major problems affecting tree condition in Illinois. Moreover, high density and crown ratio, and low transparency and dieback show that most of Illinois' trees exhibit increased potential for survival, reproduction, nutrient storage, and carbon fixation (U.S. For. Serv. 2007a).



Yellow-poplar. Photo by Susan Crocker,
U.S. Forest Service

Ozone Damage

Background

Ozone is a naturally occurring component of both the upper and lower atmosphere. Ground level ozone pollution results largely from industrial processes and automotive engines (U.S. For. Ser. 2007b). As a result, ozone levels are often higher in and downwind of major industrial and urban centers, and when temperatures are warm.

Elevated concentrations of ground-level ozone can adversely affect forested landscapes, causing direct foliar injury and reduced photosynthetic activity (Coulston et al. 2004). Prolonged exposure to high levels of ozone reduces tree growth, weakens tree defenses (increasing vulnerability to insects and disease), and may lead to changes in forest composition, regeneration, and productivity.

Plant response to ozone is monitored using bioindicator plants (biomonitoring) that exhibit increased sensitivity to ambient levels of pollution (Coulston et al. 2003). The use of bioindicator plants provides an indirect measure of air quality, identifying conditions that are favorable for the occurrence of ozone injury. In 1994, as part of a national ozone biomonitoring program, FIA and the Forest Service's Forest Health Monitoring (FHM) Program initiated bioindicator surveys. Ozone bioindicator data was first collected in Illinois in 1997. The national ozone grid that instituted permanent biosite plots was established in 2002.

What we found

During the 2005 inventory, 153 biosites were sampled for ozone injury; 44 percent of these plots contained plants with injury (Table 5). Only 2 percent of evaluated bioindicator plants had ozone damage. For each biosite, the severity and amount of ozone damage was used to calculate a biosite index. Index values are grouped into four categories that describe plant response and identify the degree of risk or possible impacts to a forest due to ambient ozone exposure (Table 6) (Smith et al. 2007). Ninety-two percent of biosites fall into the no risk category, 6 percent show light risk, and just over 1 percent of biosites are in the moderate or high risk categories (Fig. 47).

Eight species of bioindicator plants were evaluated in Illinois: black cherry, white ash, sassafras, sweetgum, yellow-poplar, milkweed, blackberry, and spreading dogbane. Ozone damage was recorded on all species except sweetgum. Milkweed had the greatest percentage of recorded damage.

Table 5.—Ozone bioindicator data, Illinois, 2005

Parameter	2001	2002	2003	2004	2005
Biosites (no.)	43	27	27	28	28
Biosites with injury (%)	33	19	56	61	61
Plants evaluated (no.)	2,919	2,703	1,951	2,205	2,436
Plants with injury (no.)	64	22	66	73	44

Table 6.—Classification scheme for Biosite Index^a (Smith et al. 2007)

Biosite Index	Bioindicator response	Assumption of risk	Possible impact	Relative air quality ^b
0 to < 5	Little or no foliar injury	None	Visible injury to highly sensitive species, e.g., black cherry	Good
5 to < 15	Light foliar injury	Low	Visible injury to moderately sensitive species, e.g., yellow poplar	Moderate
15 to < 25	Moderate foliar injury	Moderate	Visible and invisible injury. Tree-level response ^c	Unhealthy for sensitive species
≥ 25	Severe foliar injury	High	Visible and invisible injury. Ecosystem-level response ^c	Unhealthy

^aThe categorizations of the biosite index are subjective and based solely on expert opinion.

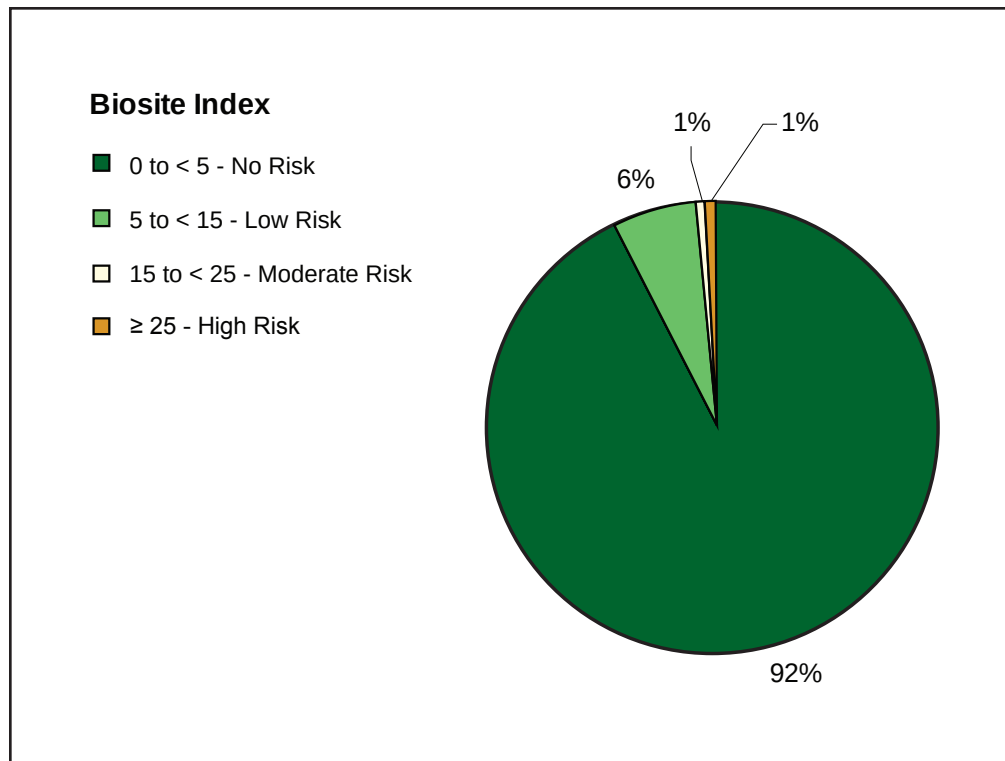
^bRelative ozone air quality from a plant's perspective. See EPA-456/F-99-002 July 1999; <http://www.airnow.gov>.

^cAccording to the EPA's Proposed Guidelines for Ecological Risk Assessment (Federal Register 61(175): 47552-47631).



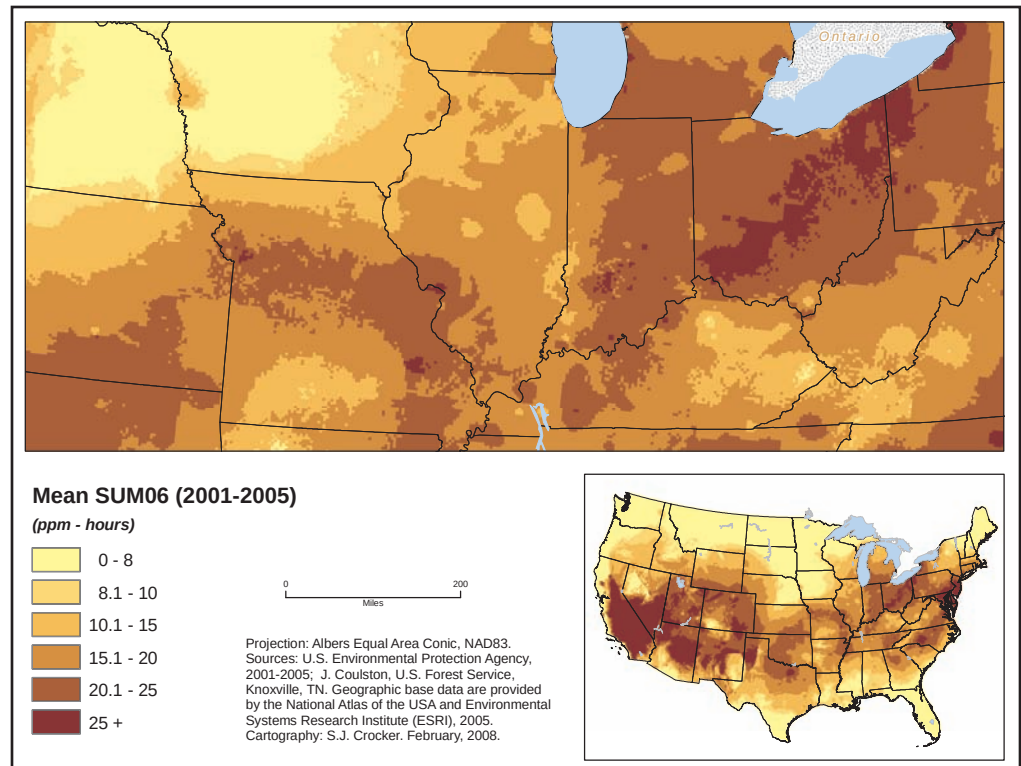
Ozone damage on yellow-poplar. Photo by U.S. Forest Service, Region 8 archives, bugwood.org

Figure 47.—Number of biosites by biosite index value, Illinois, 2005.



Ground-level ozone exposure is reported using the SUM06 index. This index, recorded for a 24-hour period over a 3-month growing season, represents the sum of all average, hourly ozone concentrations greater than 0.06 parts per million (ppm) (Coulston et al. 2004). Leaf damage can occur after exposure to ozone levels above 8 ppm-hours. Seedling growth (in natural forest stands) can be affected at levels between 10 and 15 ppm-hours (Heck and Cowling 1997). Yearly SUM06 values were averaged for the survey period. Most of Illinois was exposed to ozone levels between 10 and 20 ppm-hours (Fig. 48). The highest ozone concentrations were recorded over southwestern Illinois, from the greater St. Louis metro to portions of the Shawnee National Forest.

Figure 48.—Mean observed ground-level ozone exposure reported as SUM06, Illinois, 2005.



What this means

The majority of Illinois' forests are exposed to moderate concentrations of ground-level ozone. With relatively few recorded plant injuries and light damage severity, the risk from ozone is considered low throughout most of the State. Forests in southwestern Illinois have the highest exposure to elevated concentrations of ozone and are at higher risk of ozone damage. The potential for reduced growth and decreased forest health increases with continued exposure to high ozone levels. Ozone-induced stress will have the greatest impact on ozone-sensitive species (e.g., black cherry and yellow-poplar), particularly those down wind of major urban areas. Adverse effects on more dominant species such as oaks and maples will be less severe as a result of increased tolerance to ozone.

Forest Fragmentation

Background

Forest fragmentation has been called “the most serious threat to biological diversity” (Wilcox and Murphy 1985). Forman (1995) defines fragmentation as “the breaking up of large habitat or land areas into smaller parcels.” This results in a loss of interior forest and an increase in edge habitat, which has many negative effects on the remaining vegetation and wildlife. Some of the harmful consequences of fragmentation are a loss of biodiversity, increased populations of invasive and nonnative species, and changes in biotic and abiotic conditions (Haynes 2003).

Fragmentation occurs naturally from disturbances such as wildfire, wind, and flooding, or as the result of human activities such as conversion to agriculture or urban development/sprawl (Haynes 2003). Human disturbance has a more severe impact on the remaining forest because it occurs more frequently and results in more permanent land-use changes than natural disturbance events (Haynes 2003). Conversion to agriculture is primarily responsible for the small size and fragmented condition of the remaining forest in Illinois (Heske et al. 1999). For example, in the east-central part of the State, most forest remnants are small woodlots on farms; the largest areas of forest are found along rivers (Heske et al. 1999).

What we found

National Land Cover Dataset (NLCD) imagery from 2001 (Vogelmann et al. 2001) was used to create a fragmentation map of Illinois using techniques developed by Riitters et al. (2002). Riitters et al. used NLCD imagery to produce maps of forest versus nonforest cover, forest density, and forest connectivity, and then analyzed the corresponding pixel values from each map to create a fragmentation map. During the analysis, an output pixel was assigned to one of five classes:

- Interior forest – continuous forest canopy
- Edge – junction between forest and nonforest areas
- Patch – small forest area surrounded by mostly or all nonforest area
- Nonforest – nonforest land cover
- Water/barren land – open water or naturally barren land

Forested pixels from the forest versus nonforest cover map were placed in one of three forest classes (interior, edge, or patch); nonforested pixels were assigned to a “nonforest” class. In addition, pixels classified as “open water” or “bare rock/sand/clay” in the original NLCD imagery were placed in a “water/barren land” class in the fragmentation map and were not considered a cause of fragmentation.

Using this method, 81 percent of pixels were classified as nonforest, 17 percent fell in a forested class, and the remaining 2 percent were identified as “water/barren land” (Fig. 49). Further breakdown of all pixels shows that 7 percent were classified as interior forest, 7 percent as edge, and 3 percent as patch.

What this means

Results show that interior and edge classes have the same proportion of forest. This implies that forest land in Illinois is heavily fragmented. Again, this is primarily due to agriculture; however, nonforest wetland and urban development are also causes of fragmentation according to land-cover data. The majority of interior forest land is concentrated in the southern tip of the State, or in riparian areas along rivers (Fig. 50). The remaining landscape contains a high proportion of edge habitat and many small, isolated patches of forest land. This type of fragmented landscape lacks the continuous forest habitat required by many species of plants and wildlife, and can result in loss of biodiversity and even extinction (Forman 1995). While edge habitat may benefit certain species, it also has many negative effects, such as increased predation of bird nests and prey species (Heske et al. 1999), and declines in native plant and wildlife populations (Collinge 1996).

Figure 49.—Distribution of landscape patterns derived from National Land Cover Dataset classification, Illinois, 2001.

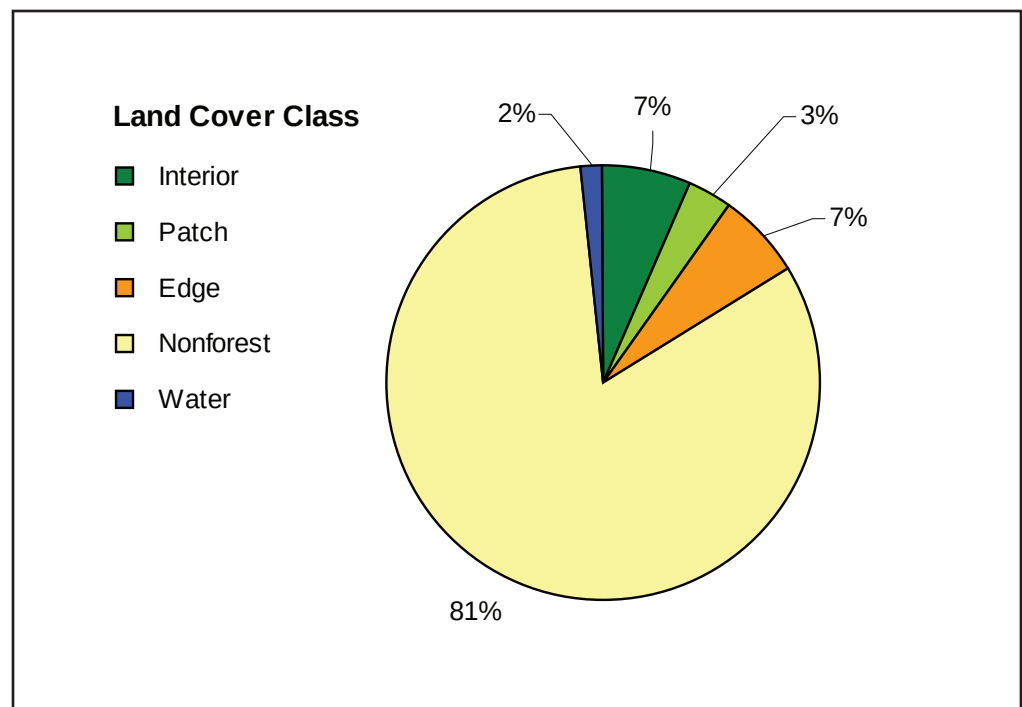
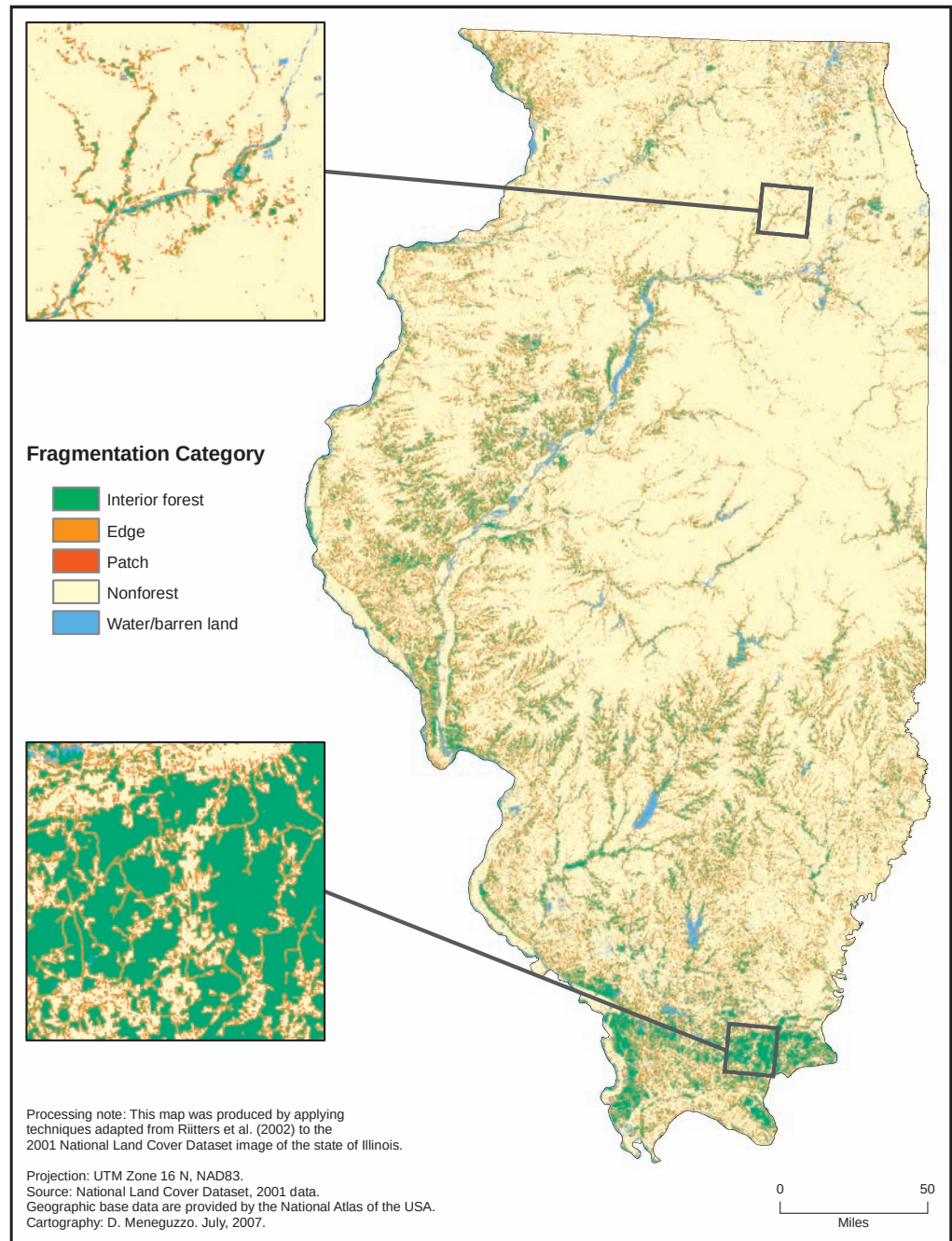


Figure 50.—Map of landscape patterns derived from National Land Cover Dataset classification, Illinois, 2001.



Forest Invaders: Nonnative Invasive Plants

Background

Nonnative invasive plants are becoming increasingly abundant in native forest ecosystems. Their abundance in introduced environments can be attributed to high adaptability, the availability of disturbed habitats, and a lack of natural enemies, which allows them to outcompete and displace native species (Pimentel et al. 2000). Nonnative invasive plants are a major concern because they alter natural plant communities and processes, threaten biodiversity, and contribute to a decrease in sustainability, productivity, and wildlife habitat.

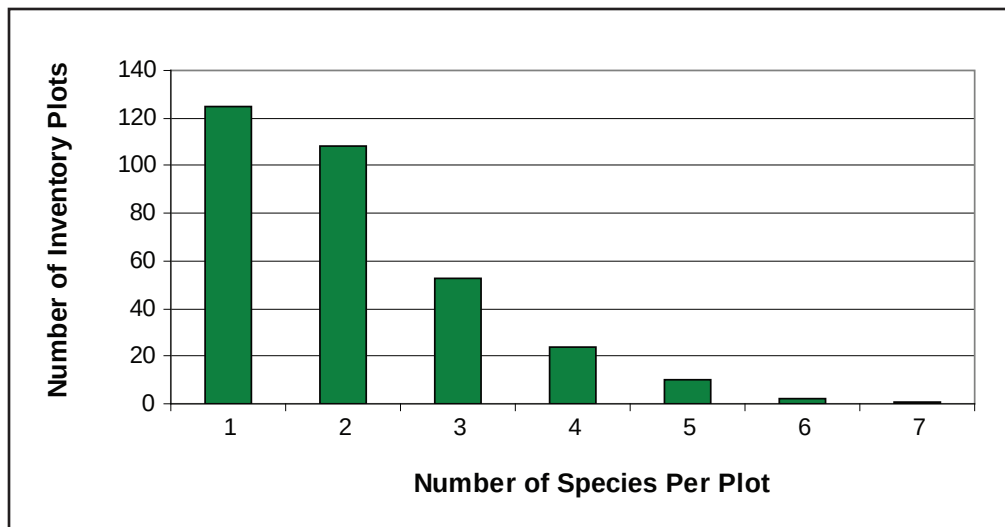
What we found

Data on nonnative invasive understory plants was collected on 731 Phase 2 plots sampled between 2004 and 2006, and 46 vegetative diversity (Phase 3) plots sampled between 2001 and 2004. Nonnative invasive understory plants were identified on 296 Phase 2 plots and 27 Phase 3 plots. Information on invasive tree species was collected on all 1,004 forested Phase 2 plots sampled between 2001 and 2005. Sixteen different nonnative invasive species were found in Illinois (Table 7). Some plots had as many as seven different species; however, 72 percent of plots had one or two species per plot (Fig. 51).

Table 7.—Occurrence of invasive plants on forest land, Illinois, 2001-2006

Species	Scientific name	Number of occurrences
Multiflora rose	<i>Rosa multiflora</i>	498
Nonnative bush honeysuckles	<i>Lonicera</i> spp.	276
Japanese honeysuckle	<i>Lonicera japonica</i>	196
Garlic mustard	<i>Alliaria petiolata</i>	135
Common buckthorn	<i>Rhamnus cathartica</i>	58
Common/Lesser burdock	<i>Arctium minus</i>	40
Autumn olive	<i>Elaeagnus umbellata</i>	39
Japanese barberry	<i>Berberis thunbergii</i>	33
Reed canary grass	<i>Phalaris arundinacea</i>	32
Japanese stiltgrass	<i>Microstegium vimineum</i>	8
Ailanthus	<i>Ailanthus altissima</i>	3
Amur honeysuckle	<i>Lonicera maackii</i>	3
Dame's rocket	<i>Hesperis matronalis</i>	3
Phragmites	<i>Phragmites australis</i>	3
Oriental bittersweet	<i>Celastrus orbiculatus</i>	1
Glossy buckthorn	<i>Frangula alnus</i>	1
Total		1,329

Figure 51.—Distribution of nonnative invasive understory plants observed on Phase 2 and Phase 3 plots (n=323), Illinois, 2001-2006.



Multiflora rose (*Rosa multiflora*), nonnative bush honeysuckles (*Lonicera* spp.), Japanese honeysuckle (*Lonicera japonica*), and garlic mustard (*Alliaria petiolata*) were the most commonly observed invasive plants (Table 7). Multiflora rose (Fig. 52) and nonnative bush honeysuckles (Fig. 53) are widely distributed across the entire State. By contrast, the distribution of garlic mustard and Japanese honeysuckle is narrow (Fig. 54). Garlic mustard was generally limited to the northern half of Illinois, while Japanese honeysuckle dominated the lower half of the State.

On each Phase 2 plot where a nonnative invasive plant species was identified, the percentage of invasive plant cover on the forested portion of the subplot was recorded. The majority of invasive species encountered represented less than 10 percent of the plant cover (Fig. 55).



Phase 3 vegetation sampling. Photo by Cassandra Olson, U.S. Forest Service

Figure 52.—Distribution of plots containing multiflora rose (*Rosa multiflora*), Illinois, 2001-2006.

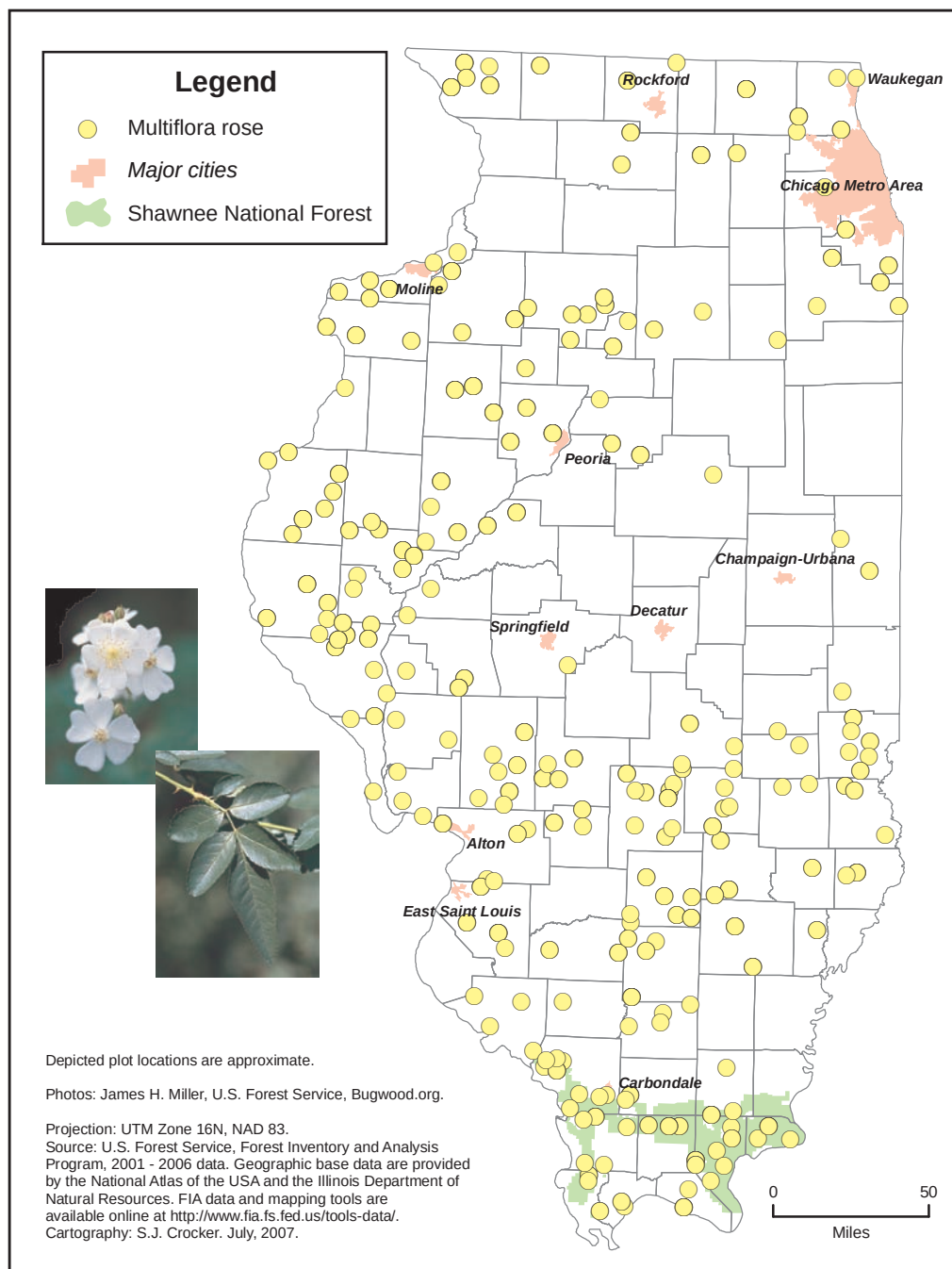


Figure 53.—Distribution of plots containing nonnative bush honeysuckles (*Lonicera* spp.), Illinois, 2001-2006.

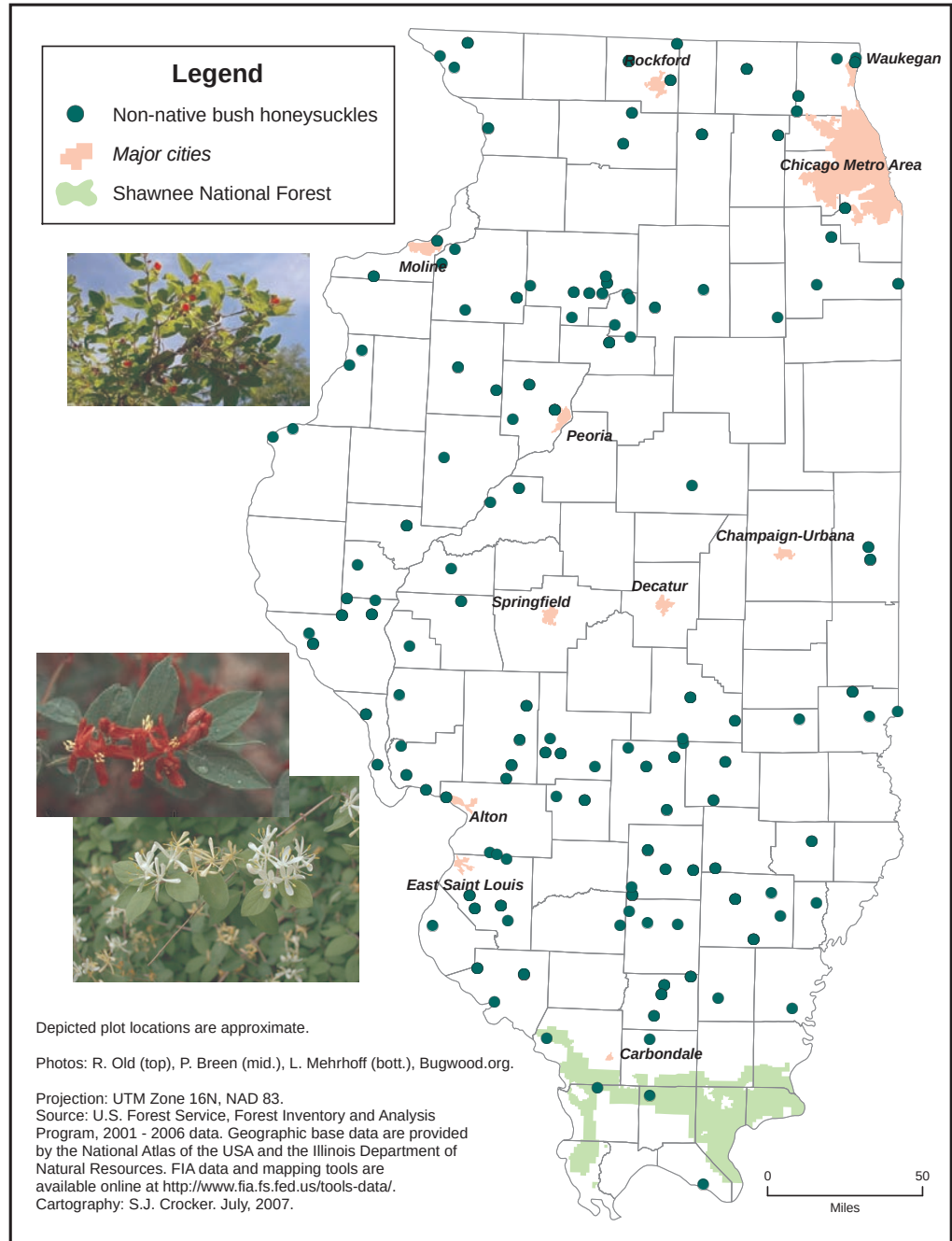


Figure 54.—Distribution of plots containing garlic mustard (*Alliaria petiolata*) and Japanese honeysuckle (*Lonicera japonica*), Illinois, 2001-2006.

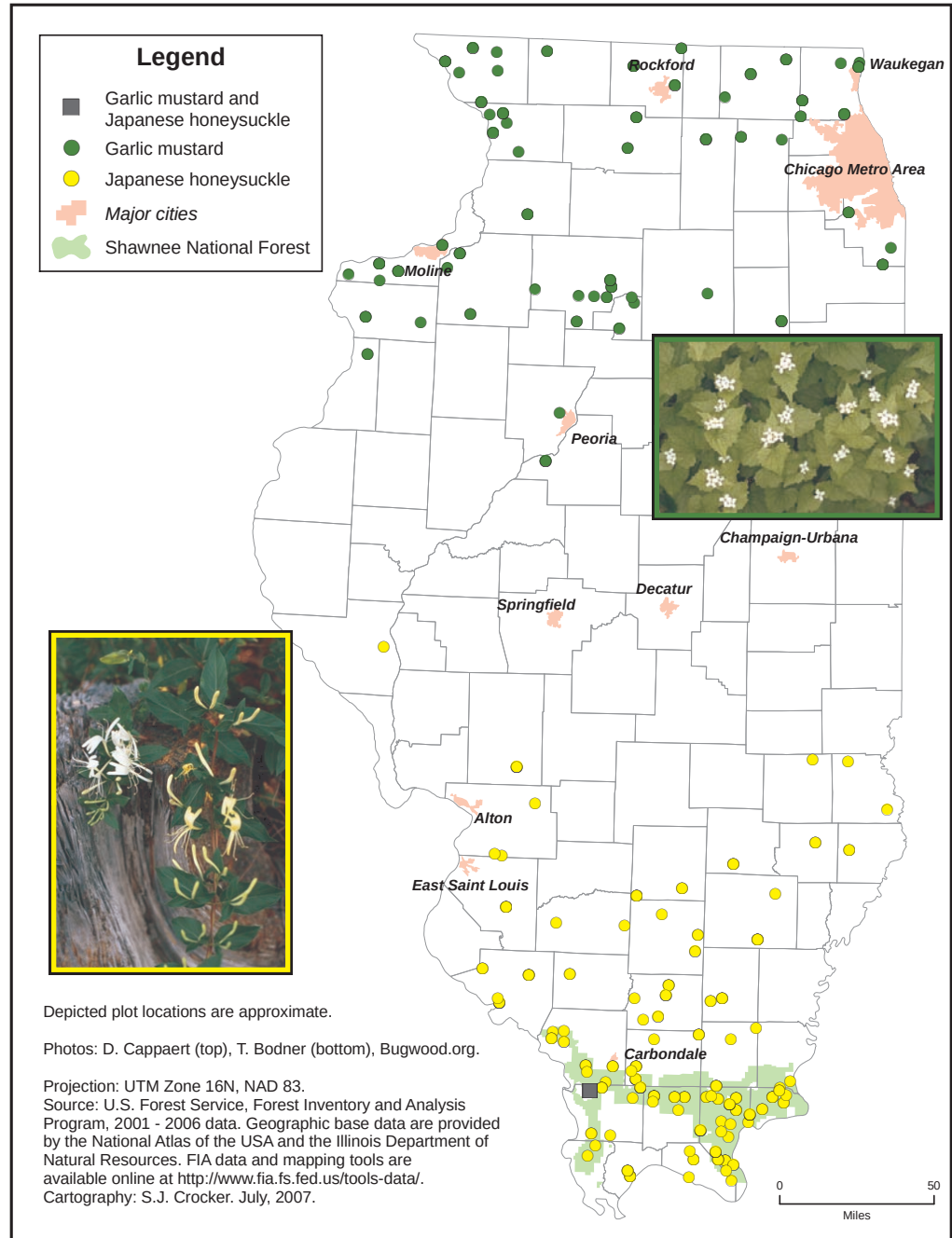
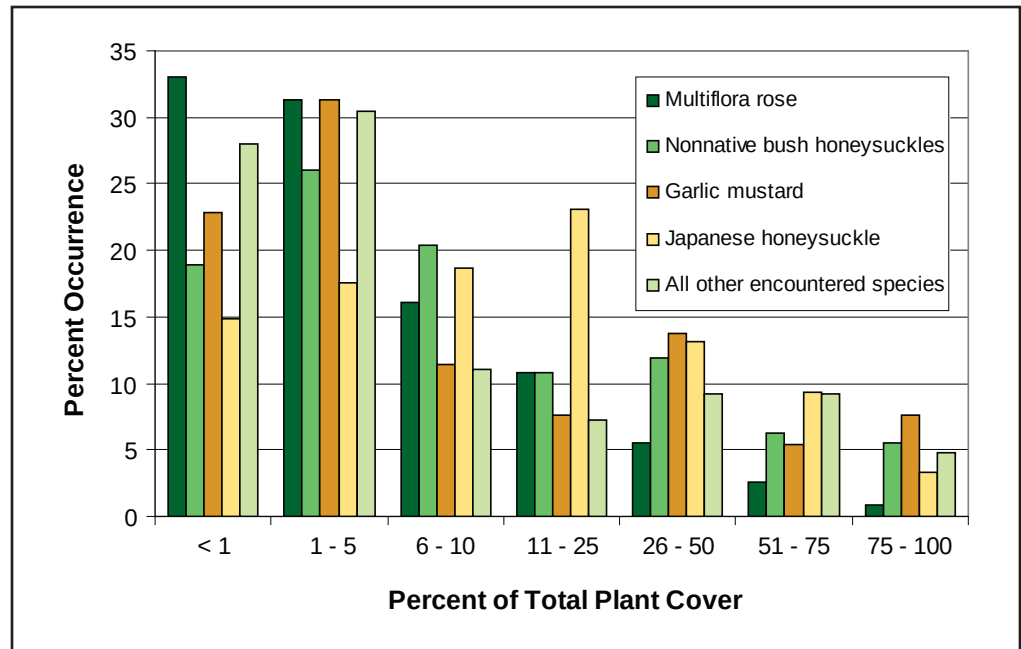


Figure 55.—Occurrence of the top four nonnative invasive plants (as a percentage of total occurrence by species) by percentage of total plant cover on a subplot, Illinois, 2001-2006.



What this means

Preliminary data shows that nonnative invasive plants are widely distributed across Illinois. The extent to which these species cause harm has not yet been determined. However, as the spread of nonnative species continues, the number and abundance of native plant species will decline, resulting in a loss of overall species diversity and a reduction in the value and health of Illinois' forests.



Common buckthorn. Photo by Chris Evans, River to River CWMA, bugwood.org

Insects and Diseases

Background

Insect and disease activity helps shape the structure and composition of forests. Monitoring the status of these organisms is an important part of assessing the current state of and changing trends in Illinois' forests, and also provides a valuable means of maintaining healthy, vigorous forests and managing future forest resources.

What we found

Native Insects

A number of native insects were active during the survey period. Eastern tent caterpillar (*Malacosoma americanum*) caused heavy defoliation of black cherry trees in many counties throughout Illinois in 2001 and 2002 (Fig. 56). After a wet spring and an increase in parasitic insect density, caterpillar populations crashed in 2003. Eastern tent caterpillar began to build again in 2005, causing heavy defoliation in Illinois' southern tier. In contrast, a viral infection caused populations of the forest tent caterpillar (*Malacosoma disstria*) to remain at low levels from 2003 to 2005, following a 2002 outbreak that resulted in heavy defoliation in southeastern Illinois. Moderate to heavy infestations of the bagworm moth (*Thyridopteryx ephemeraeformis*) damaged white pine, spruce, and juniper trees across the central and southern thirds of Illinois between 2002 and 2004. Populations of the fall webworm (*Hyphantria cunea*) declined in 2005, following 3 years of heavy infestation in west-central and south-central Illinois.



Eastern tent caterpillar. Photo by Susan Crocker, U.S. Forest Service

Nonnative Insects

Populations of Japanese beetle (*Popillia japonica*) increased dramatically in 2002. By 2005, infestations of this beetle were heavy throughout most counties in the northern two-thirds of the State. Since the first moth catch in 1973, gypsy moth (*Lymantria dispar*) populations have varied from year to year. Though gypsy moth has become established in northeastern counties of Illinois, there was little discernable defoliation between 2001 and 2005 (Fig. 57). Over the course of the survey period, eradication efforts targeted at the Asian longhorned beetle (*Anoplophora glabripennis*) yielded a continual decrease in the number of new infestations; no new infestations were identified in 2005. Asian longhorned beetle was declared eradicated from Illinois in 2008.

Figure 56.—Counties with eastern tent caterpillar infestations, Illinois, 2001-2002.

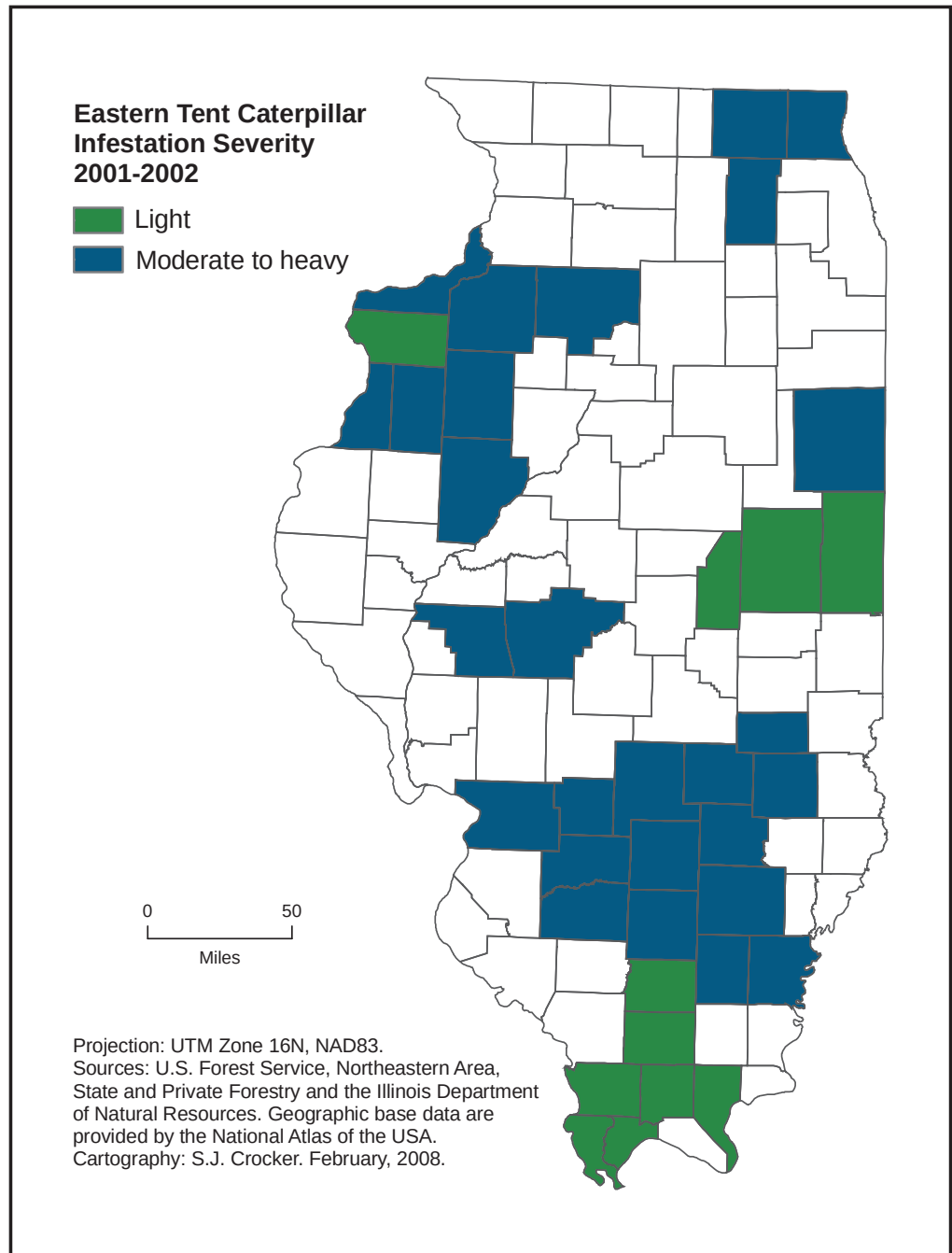
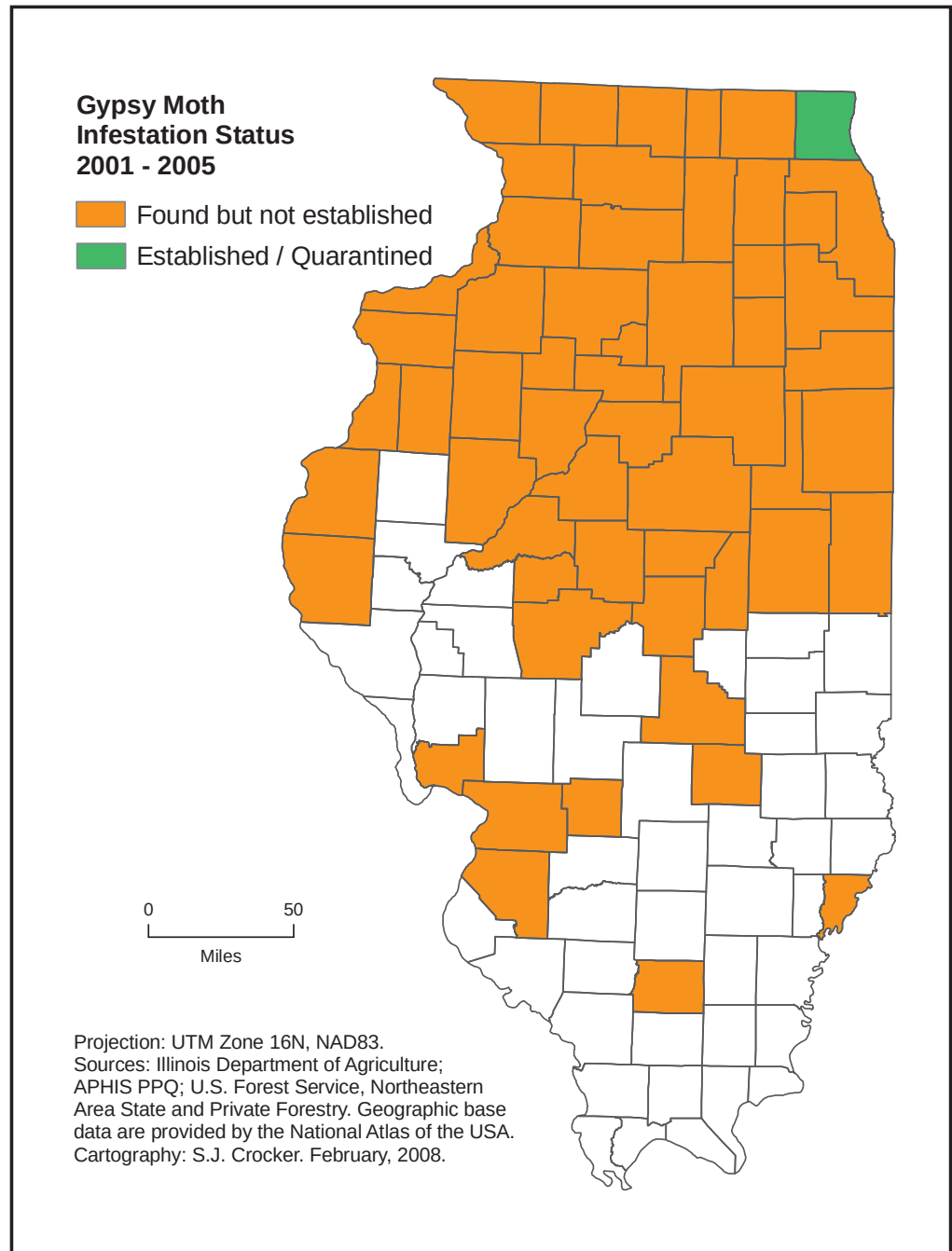


Figure 57.—Distribution of gypsy moth based on positive trap catch, Illinois, 2001-2005.



Diseases

Oak wilt, caused by the fungus *Ceratocystis fagacearum*, continues to be an important source of oak mortality. All species of oak are susceptible to oak wilt, but the disease occurs more frequently and progresses more rapidly in red oak species. The incidence of DED continues to increase each year. Forty-five counties in Illinois reported moderate to heavy elm mortality in 2005. Trees are often killed before they reach sawtimber-size; consequently, aging stands present a future health risk (Haugen 1998). Leaf tatters, a sporadic problem in Illinois for approximately 15 years, continued to plague white oak and hackberry fairly consistently throughout the survey period. This condition, which halts the development of leaf tissue between major veins, is believed to be caused by herbicidal drift. In 2005, a cool, wet spring contributed to moderate to severe sycamore anthracnose (*Apiognomonia veneta*) in 23 northern counties. Ash decline, in moderate to high severity, was reported in eight counties in 2005.

Emerging Threats

In addition to existing pest problems, Illinois' forests are at risk for exotic introductions of EAB and sudden oak death. Sudden oak death is caused by the fungal-like pathogen *Phytophthora ramorum*. Susceptible species include a variety of oaks, Douglas-fir, and *Rhododendron* spp. (O'Brien et al. 2002). Established populations of *P. ramorum* are known to occur only on the West Coast; however, transportation of infected nursery stock has introduced the pathogen to nurseries in a number of eastern and southern states. All Illinois samples collected during the survey period tested negative for *P. ramorum*.

Abiotic Factors

Extreme drought stretched across west-central and northwestern Illinois in 2005; during this period, southern Illinois experienced moderate to severe drought conditions. By the fall of 2005, drought conditions in the northern portion of the State were severe to extreme.

What this means

During the survey period, Illinois' forests were affected by native and nonnative insects, disease, and drought. These stressors create weakened trees that are vulnerable to secondary attack by other insects and diseases or are the direct cause of tree mortality. In combination, there may be significant impacts to tree growth and increased risk of forest fire. While efforts to eradicate Asian longhorned beetle have proven successful, Illinois' forests face serious risk from other exotic introductions, primarily EAB which could have dramatic implications for the future composition of Illinois' forests.

Emerald Ash Borer

Background

Emerald ash borer (EAB) (*Agilus planipennis*) has been the source of widespread decline and mortality of ash trees in the north-central region of the U.S. since its discovery in Michigan in 2002. An exotic wood-boring beetle, EAB is a pest of all major species of ash, including green, white, black, and blue ash, and all ash cultivars (Cappaert et al. 2005). Although surveys conducted in 2005 did not reveal evidence of the beetle, EAB was detected in northeastern Illinois in 2006. EAB is believed to have been present in Illinois for 3 to 5 years prior to its discovery there.

What we found

Illinois forest land contains an estimated 130.1 million ash trees (greater than 1 inch in diameter). Total live ash volume on forest land is 424.3 million cubic feet. Ash is widely distributed across the State (Fig. 58). Dense pockets of ash are located in northeastern corner and in the southern tier. Ash is present on nearly 2 million acres, or 44 percent of Illinois forest land (Fig. 59). It is rarely the most abundant species in a stand; in general, ash makes up less than 25 percent of total live-tree basal area. Nearly 30 percent of ash trees are in floodplains (Fig. 60).

Twenty-five percent of Illinois forest land is dominated by ash forest types. The understory of these stands is composed largely of American elm, boxelder, hackberry, and green ash saplings, and silver maple, green ash and American elm poletimber (Fig. 61). The majority of understory volume in ash dominated stands is in silver maple (Fig. 62).



Emerald ash borer. Photo by David Cappaert, Michigan State University, bugwood.org

Figure 58.—Ash density on forest land, Illinois, 2005.

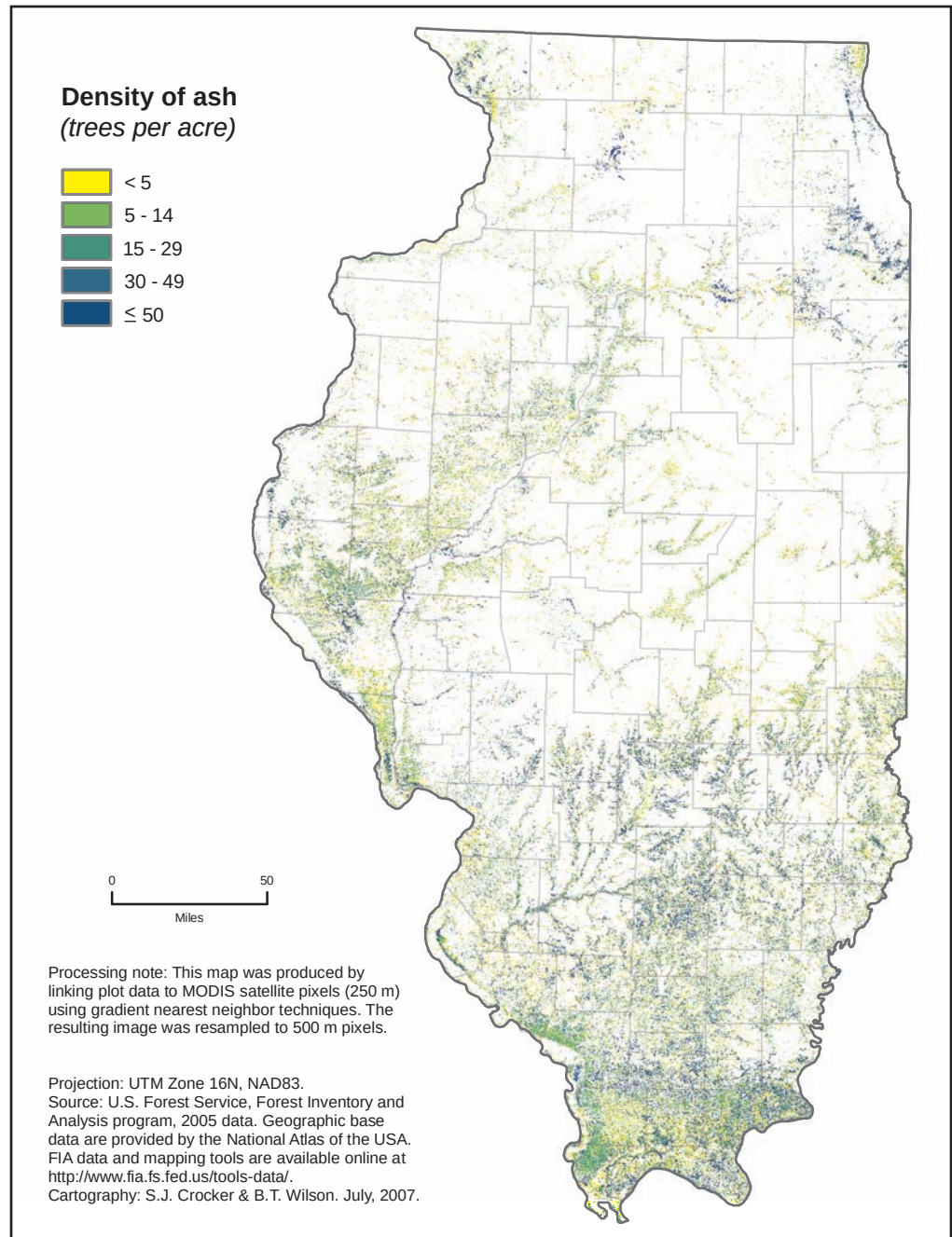


Figure 59.—Presence of ash on forest land, as a percentage of stand basal area (BA), Illinois, 2005.

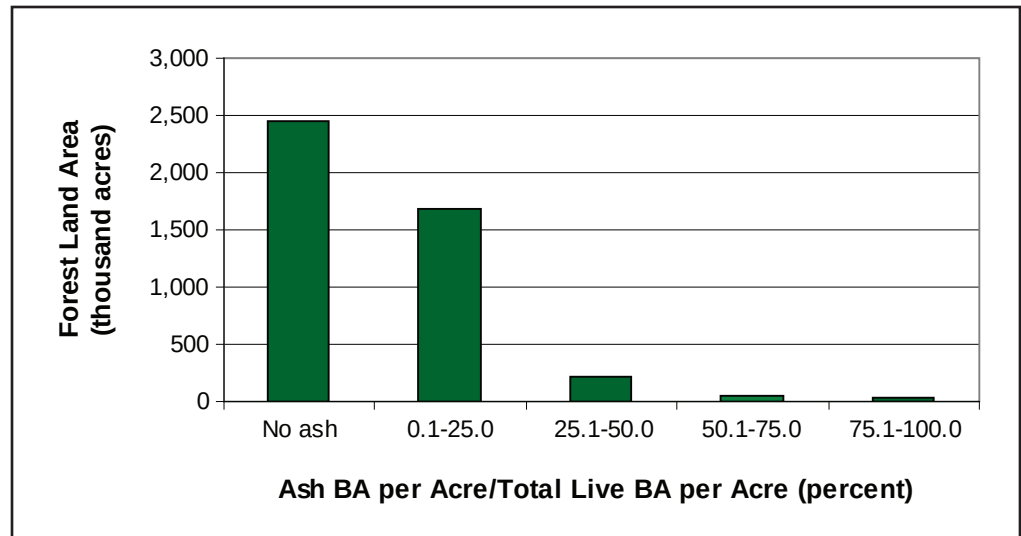


Figure 60.—Number of live ash on forest land by species and physiographic condition class, Illinois, 2005.

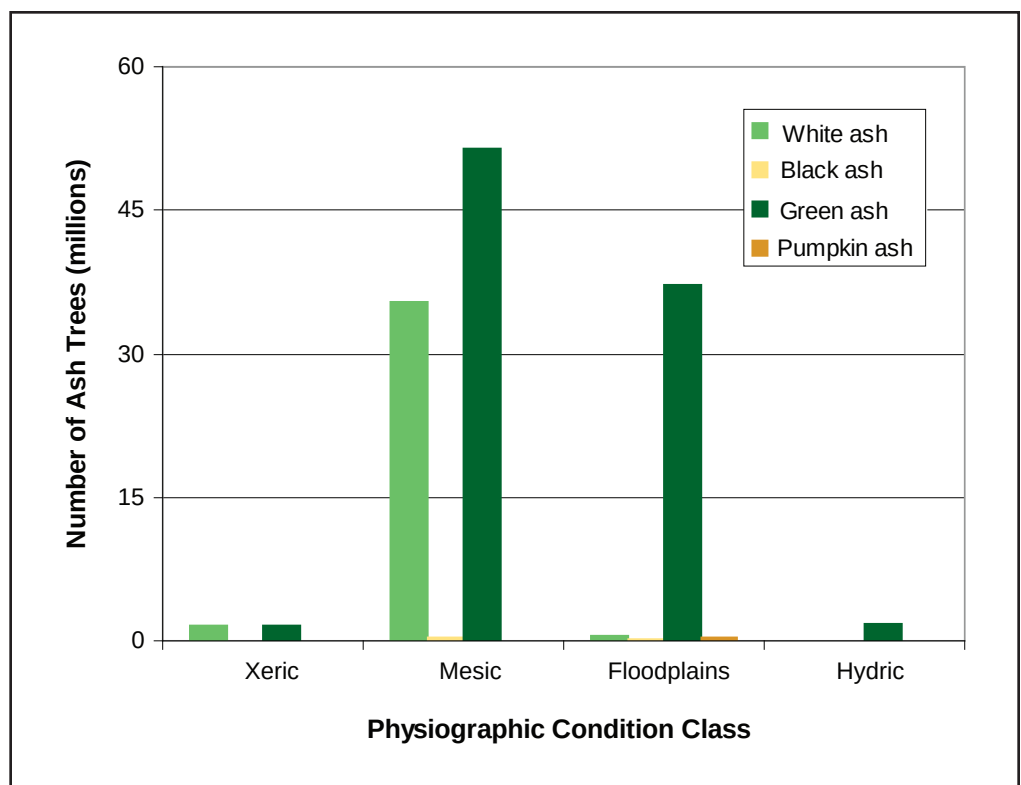


Figure 61.—Top eight understory species in stands with an ash forest type by number of trees and diameter class, Illinois, 2005.

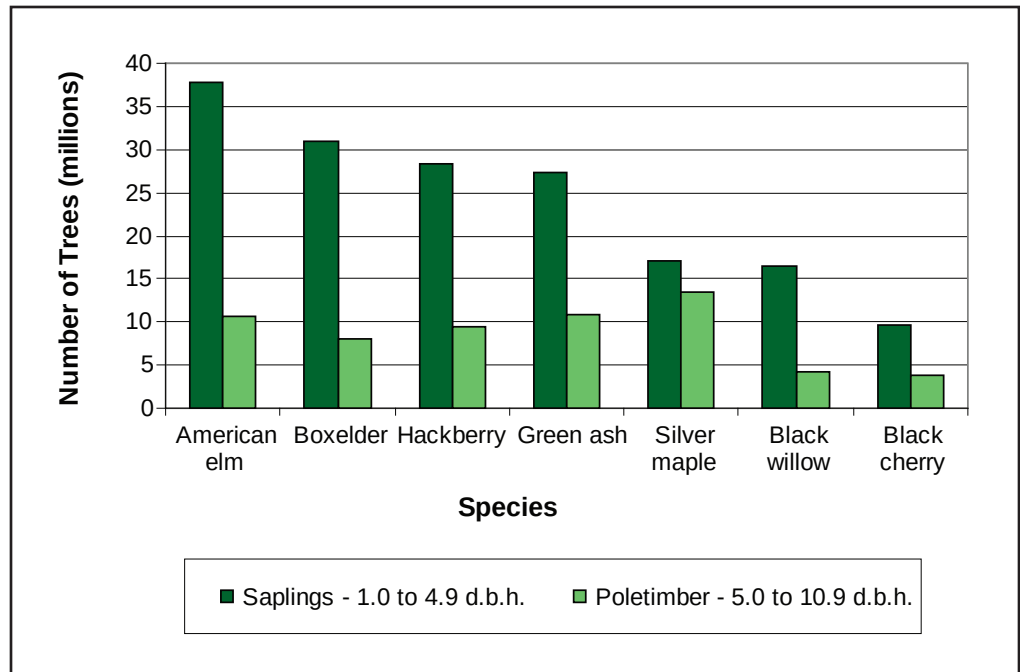
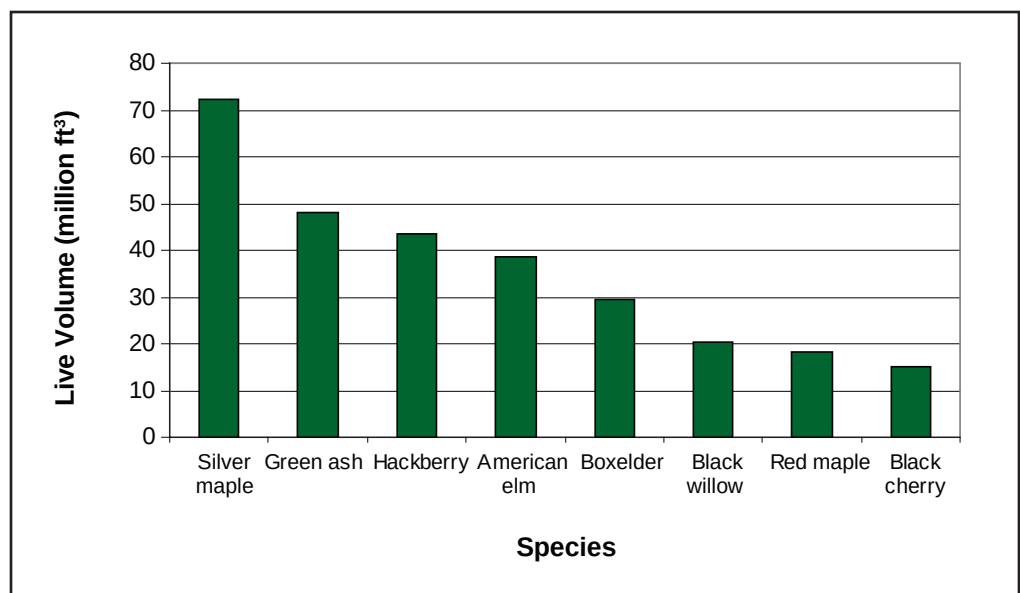


Figure 62.—Live volume of understory species (trees 5.0 to 10.9 inches d.b.h.) in stands with an ash forest type, Illinois, 2005.



What this means

Ash is an important component of Illinois' forest resource. An abundant species in woodland and riparian forests, ash is also widely planted in urban and suburban areas. The entirety of Illinois' ash resource is at risk for widespread mortality related to EAB. Substantial mortality of ash would have a significant impact on statewide forest resources and related industries such as timber, wood products, recreation, and nurseries. Species composition and forest structure would likely undergo change as ash stands give way to maple stands. Sanitation and removal of ash in non-ash forest types may result in similar conversions. Additionally, the loss of ash in riparian zones would have a major effect on species diversity, erosion, water quality, and food and habitat availability for macroinvertebrates. Overall, EAB may have an impact similar to that of DED or chestnut blight.

Forest Products



Above and inset: Log pile in a mixed oak stand; photo by Eli Sagor, University of Minnesota, bugwood.org

Growing-stock Volume

Background

Growing-stock volume is the amount of sound wood in live, commercial tree species; trees must be at least 5 inches in d.b.h. or greater and free of defect. This measure has traditionally been used to ascertain wood volume available for commercial use. Estimates of the volume of growing stock are important considerations in economic planning and when evaluating forest sustainability.

What we found

Growing-stock volume has risen steadily since 1948 with the sharpest increase occurring between 1998 and 2005. The current estimate of growing-stock volume on timberland is 6.8 billion cubic feet (Fig. 63). More than one-fourth of this volume is in trees that are 21 inches in d.b.h. or larger. Average growing-stock volume per acre has also increased; the current average of 1,576 cubic feet per acre is nearly three times the average in 1948 (Fig. 64). White oak, which accounts for more than 12 percent of growing-stock volume, is the most voluminous species on Illinois timberland (Fig. 65). Silver maple, black oak, and red oak also have significant volume in growing stock. Most species have experienced a net gain in volume since 1985. Black oak, which significantly decreased between the 1998 and 2005 inventories, is an exception. Volume increases were most significant in the middle diameter classes and in trees 29 inches or greater (Fig. 66).

Figure 63.—Growing-stock volume on timberland by inventory year, Illinois, 1948-2005 (error bars represent a 66-percent confidence interval).

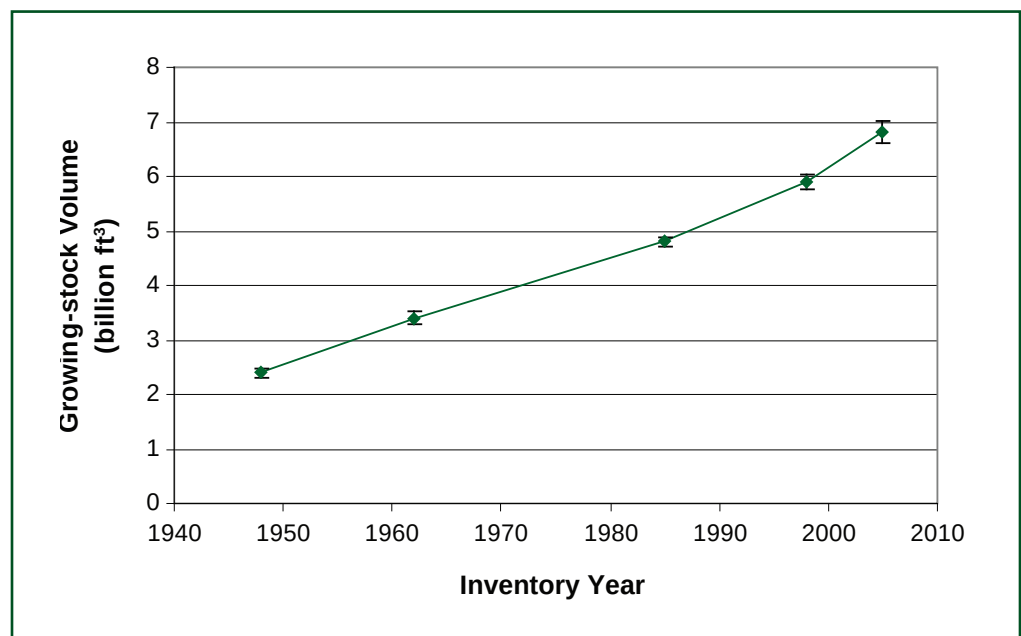


Figure 64.—Growing-stock volume per acre of timberland by inventory year, Illinois, 1948-2005.

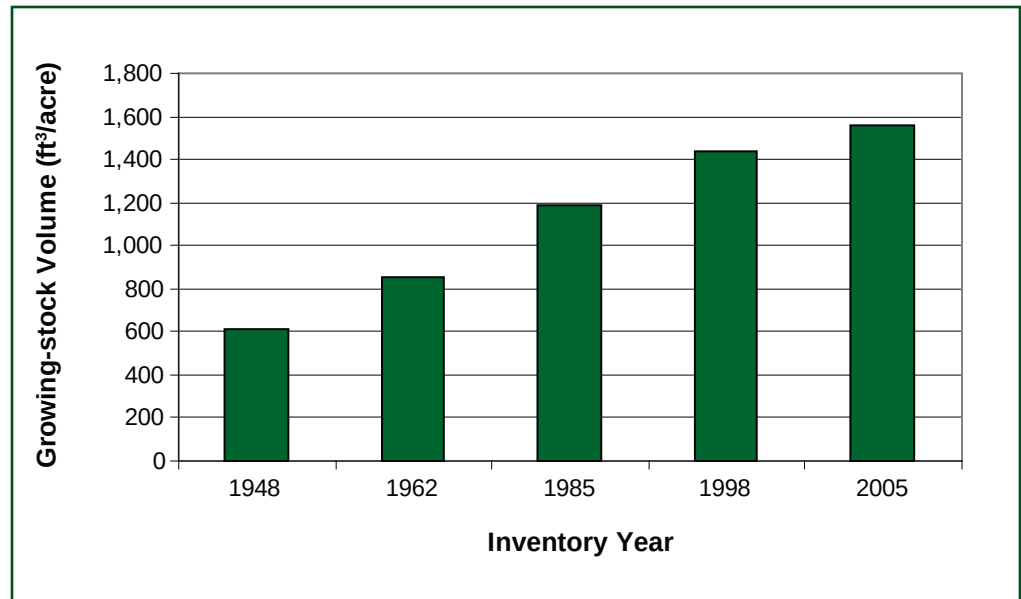


Figure 65.—Growing-stock volume on timberland for the top 12 species by inventory year, Illinois, 1985-2005 (error bars represent a 66-percent confidence interval).

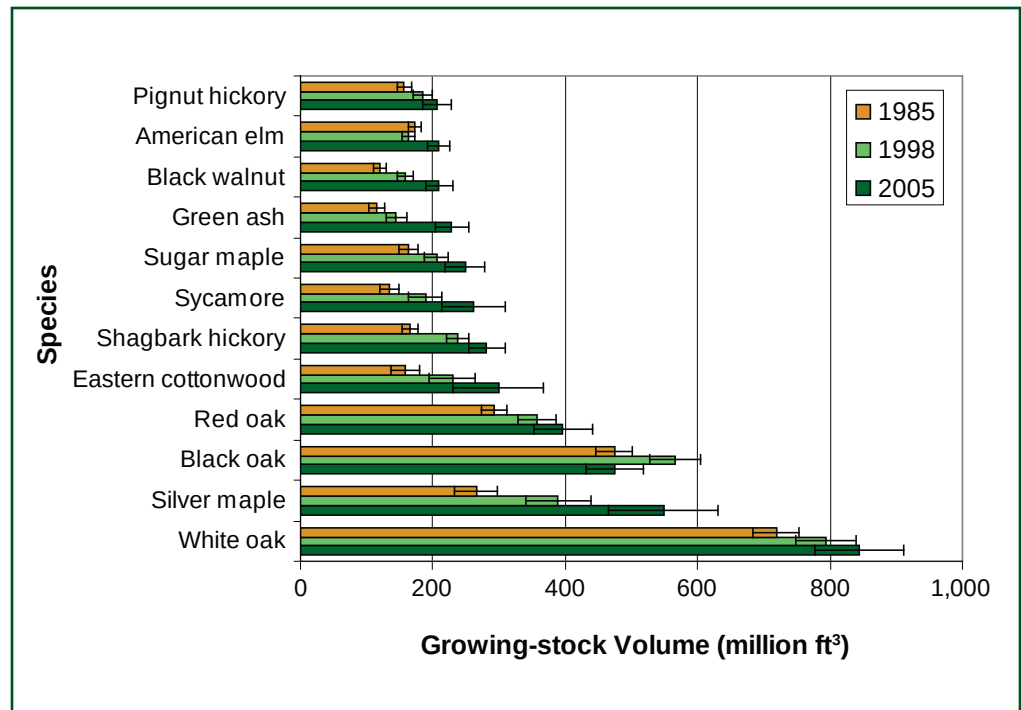
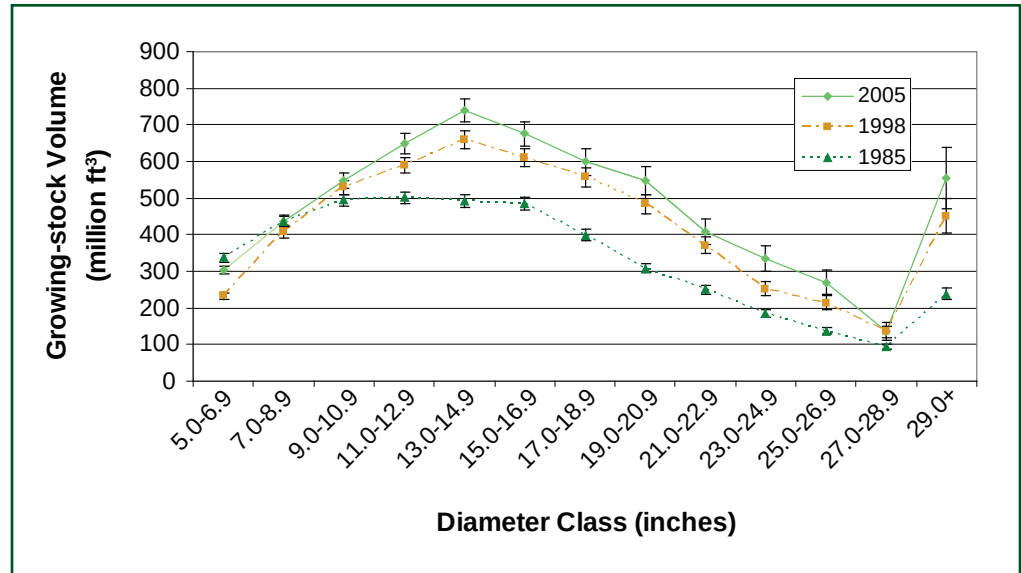


Figure 66.—Growing-stock volume on timberland by diameter class and inventory year, Illinois, 1985-2005 (error bars represent a 66-percent confidence interval).



What this means

Rising growing-stock volume can be attributed to the growth of current hardwood stands, increasing timberland area, relatively low mortality rates (particularly between 1962 and 1985), and decreasing removal rates. The majority of timberland is dominated by mature oaks. Therefore, significant volume in oak growing stock is not a surprise. While Illinois' growing-stock volume appears healthy and stable, the future of Illinois timberland is likely to include an increase in mortality as mature stands senesce.

Sawtimber Volume and Quality

Background

Sawtimber trees are live trees of commercial species that contain either one 12-foot or two noncontiguous 8-foot logs that are free of defect. Hardwoods must be at least 11 inches d.b.h. and softwoods must be 9 inches d.b.h. to qualify as sawtimber. Sawtimber volume is defined as the net volume of the saw log portion of live sawtimber, measured in board feet, from a 1-foot stump to minimum top diameter (9 inches for hardwoods and 7 inches for softwoods). Estimates of sawtimber volume are used to determine the monetary value of wood volume and to identify the quantity of merchantable wood availability.

What we found

Sawtimber volume has more than tripled since 1962 and is currently estimated at 25.3 billion board feet (Fig. 67). Half of the volume of sawtimber is in seven hardwood species: white oak, black oak, silver maple, northern red oak, eastern cottonwood, shagbark hickory, and American sycamore (Fig. 68). Collectively, almost 30 percent of sawtimber volume is made up of mature oaks. Species like American elm and green ash account for a relatively small percentage of sawtimber volume.

Most species groups increased in sawtimber volume between 1998 and 2005 (Fig. 69). Oaks showed the least growth in sawtimber. Volume in the select white oaks and the select red oaks increased by less than 10 percent and declined in the other white oaks and the other red oaks groups, which contain post oak and black oak, respectively.

Figure 67.—Sawtimber volume on timberland by inventory year, Illinois, 1948-2005 (error bars represent a 66-percent confidence interval).

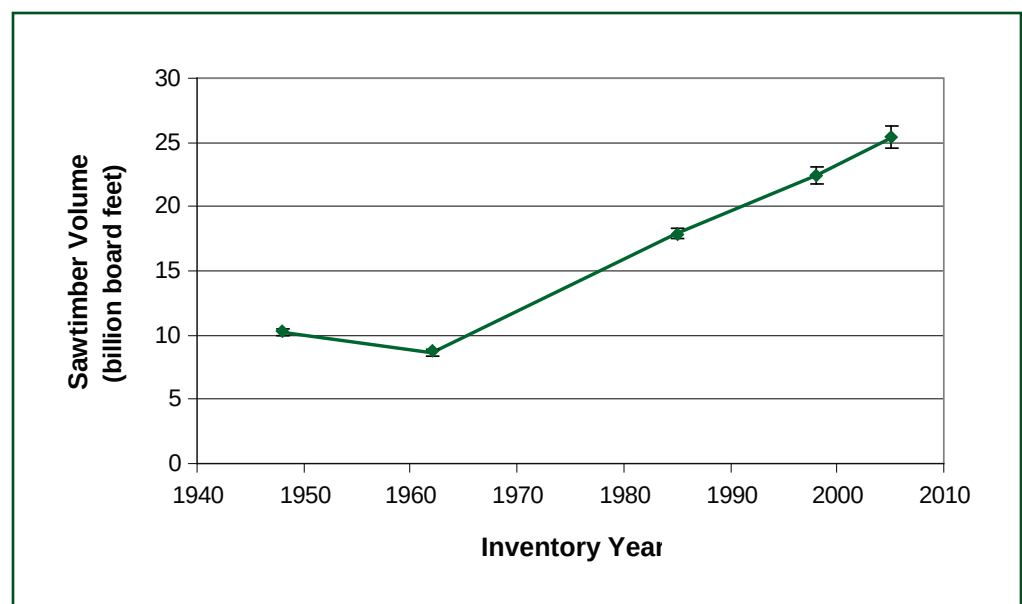


Figure 68.—Sawtimber volume on timberland by species, Illinois, 2005.

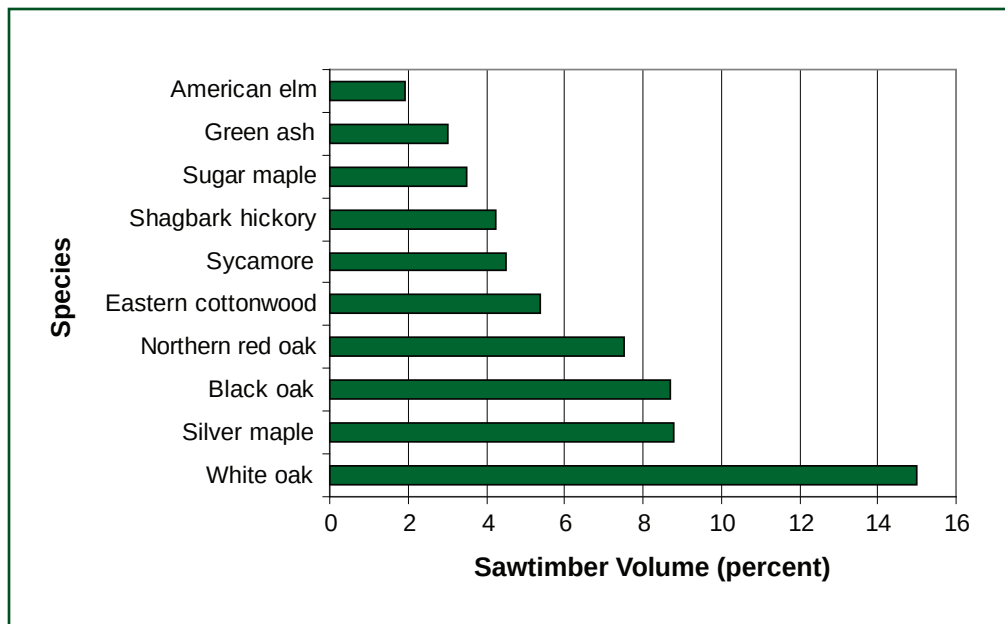
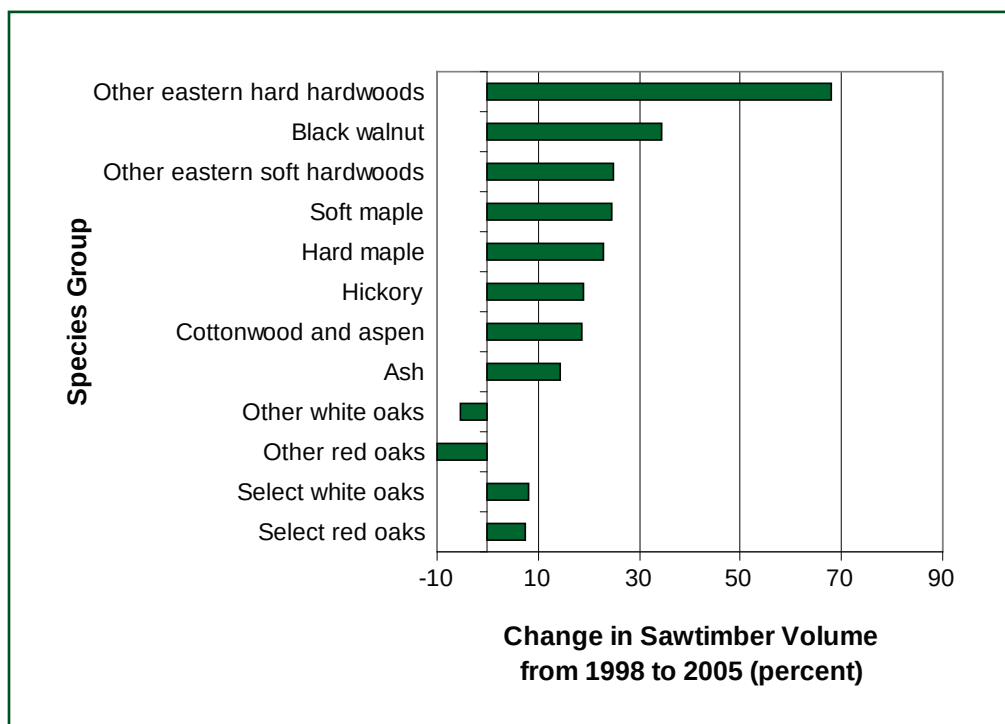


Figure 69.—Changes in sawtimber volume on timberland for major species groups, Illinois, 1998 to 2005.



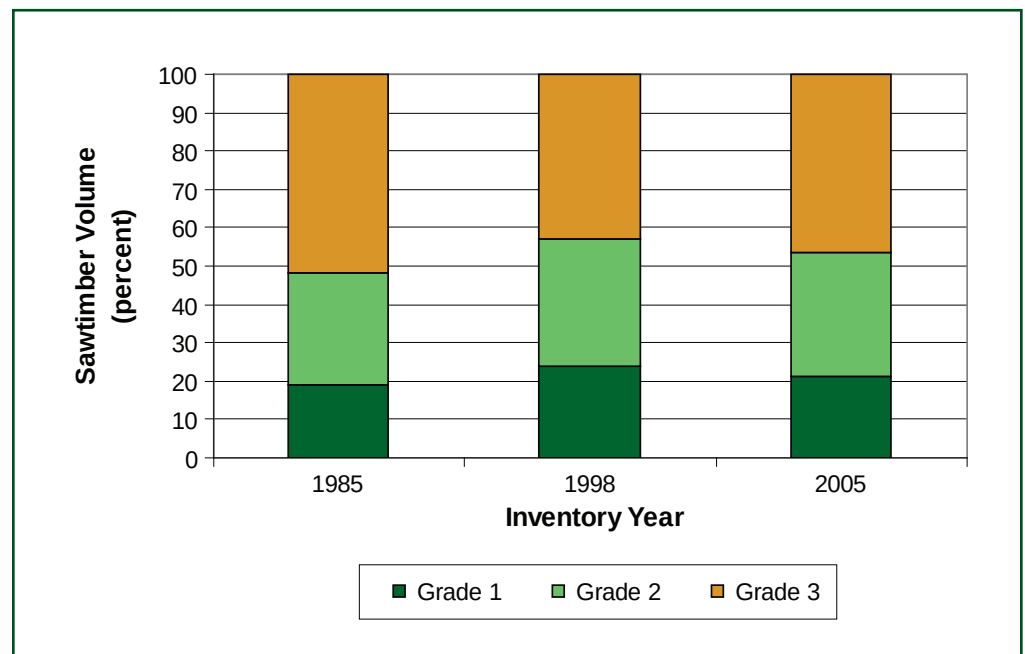
The quality of Illinois' sawtimber has remained constant over the past 20 years (Fig. 70). Sawtimber quality is determined using a grading system that incorporates factors including diameter, log length, and the cull portion of the saw log. Tree grade is based on a scale of 1 to 3, with grade 1 representing the highest quality and grade 3 the lowest. Generally, around 20 percent of Illinois sawtimber is in grade 1.

What this means

The majority of Illinois' forests are maturing. Mature stands are more likely to succumb to windthrow, insects, and disease pathogens. The relatively small area of poletimber and sapling/seedling stands may be related to how timber is harvested in much of the State. Often, mature timber is removed as single, scattered trees or in small groups. The lack of significant disturbance may not open hardwood stands to progressive seedling development because smaller trees in the understory are generally outcompeted by larger, canopy-dominant trees. Exceptions include species such as sugar maple, which are tolerant of understory conditions and can take advantage of small gaps in the canopy.

The current trend in changing sawtimber volume indicates that oaks have lower growth rates than species like maple, walnut, and sycamore. Relatively large increases in these non-oak species reflect the likely species mixture for the next generation of overstory trees.

Figure 70.—Sawtimber volume on timberland by tree grade, Illinois, 2005.



Timber Products Output

Background

The harvesting and processing of timber products produces a stream of income shared by timber owners, managers, marketers, loggers, truckers, and processors. Illinois' forest-related manufacturing industries employ over 32,000 people, with gross annual payroll earnings of more than \$1.1 billion (U.S. Census Bur. 2005). Wood products, according to the Illinois Department of Commerce and Economic Opportunity, form the State's 24th largest export sector, grossing more than \$37 million in 2004 (Little 2007). Not included in this figure are logs or sawn materials that were grown in Illinois and were shipped from other states to foreign markets. To better manage the State's forests, it is important to know the species, amounts, and locations of timber being harvested.

What we found

Surveys of Illinois' wood-processing mills are conducted periodically to estimate the amount of wood volume that is converted into products. The last survey was conducted in 2003 and, for this report, is supplemented by the most recent surveys conducted in surrounding states that processed wood harvested from Illinois. Thirty-four million cubic feet of industrial roundwood was harvested from Illinois. The majority of this volume, almost 23 million cubic feet, was processed in-state by 89 saw mills and 1 handle mill. One million cubic feet of the industrial roundwood processed in Illinois came from other States. Almost one-third, or 11 million cubic feet, of the industrial roundwood harvested from Illinois was exported to other states for processing.

Saw logs accounted for 91 percent of the total industrial roundwood harvested, followed by pulpwood at 4 percent and mine timbers at 2 percent (Fig. 71). Other industrial roundwood products harvested included veneer, handles, and cooperage. The red oak and white oak groups combined made up 55 percent of the total industrial roundwood harvest (Fig. 72). Other important species groups harvested were soft maple, cottonwood, hickory, and ash. Softwoods made up less than 1 percent of the total volume harvested; most of this was shipped to out-of-state pulp mills.

In the process of harvesting industrial roundwood, 26 million cubic feet of harvest residues were left on the ground. Without a prominent pulpwood market in the State, much of the upper tree bole goes unused as it is too small for saw logs or veneer logs. The processing of industrial roundwood in the State's primary wood-using mills generated another 15 million cubic feet of wood and bark residues. Only 6 percent of the mill residues were not used for fiber products, fuelwood, mulch, small dimension lumber, or other uses (Fig. 73).

Figure 71.—Industrial roundwood production by product, Illinois, 2005.

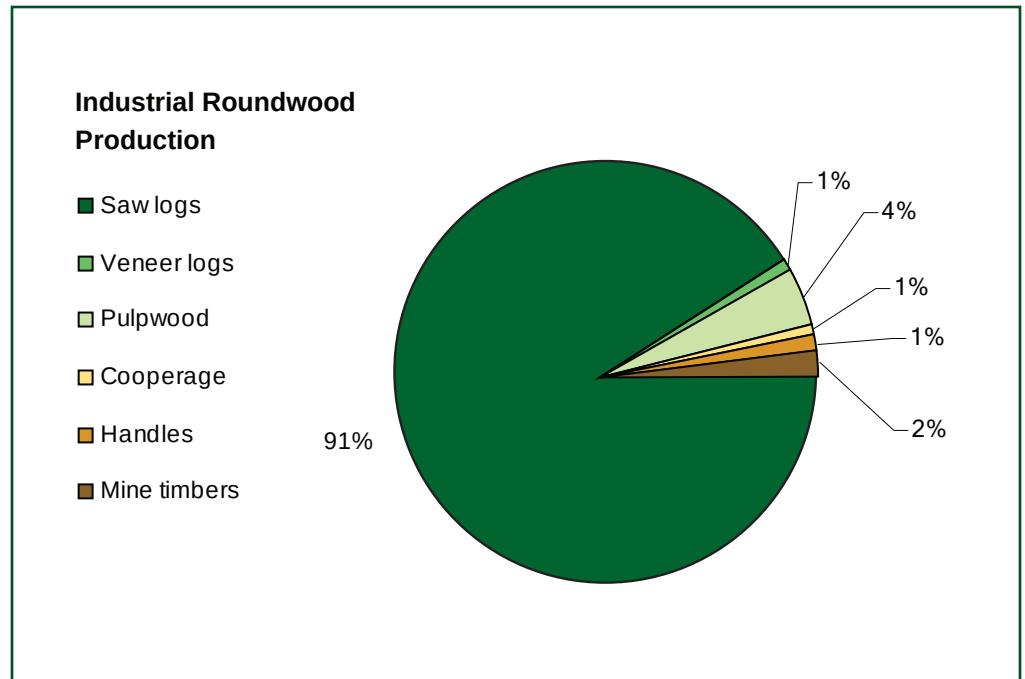


Figure 72.—Industrial roundwood production by species group, Illinois, 2005.

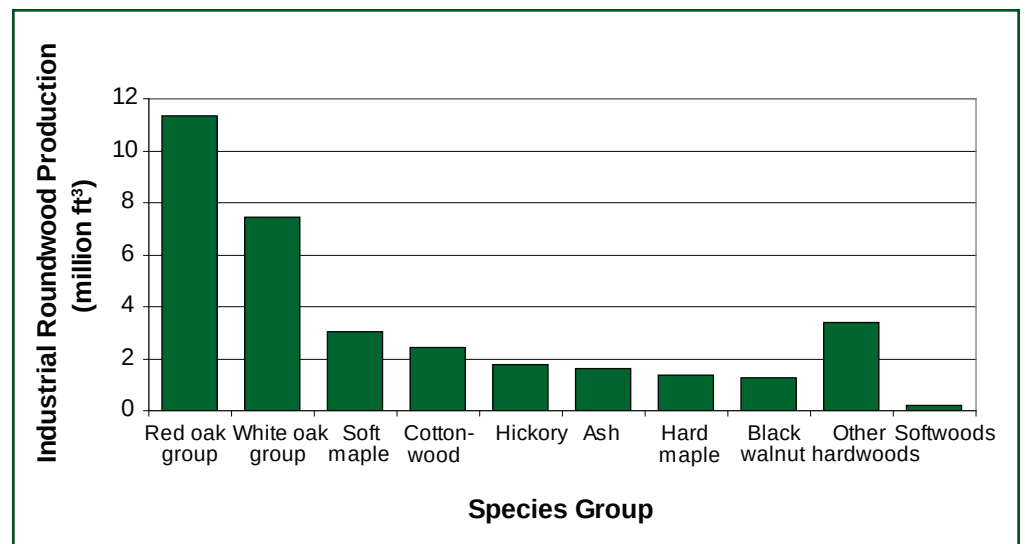
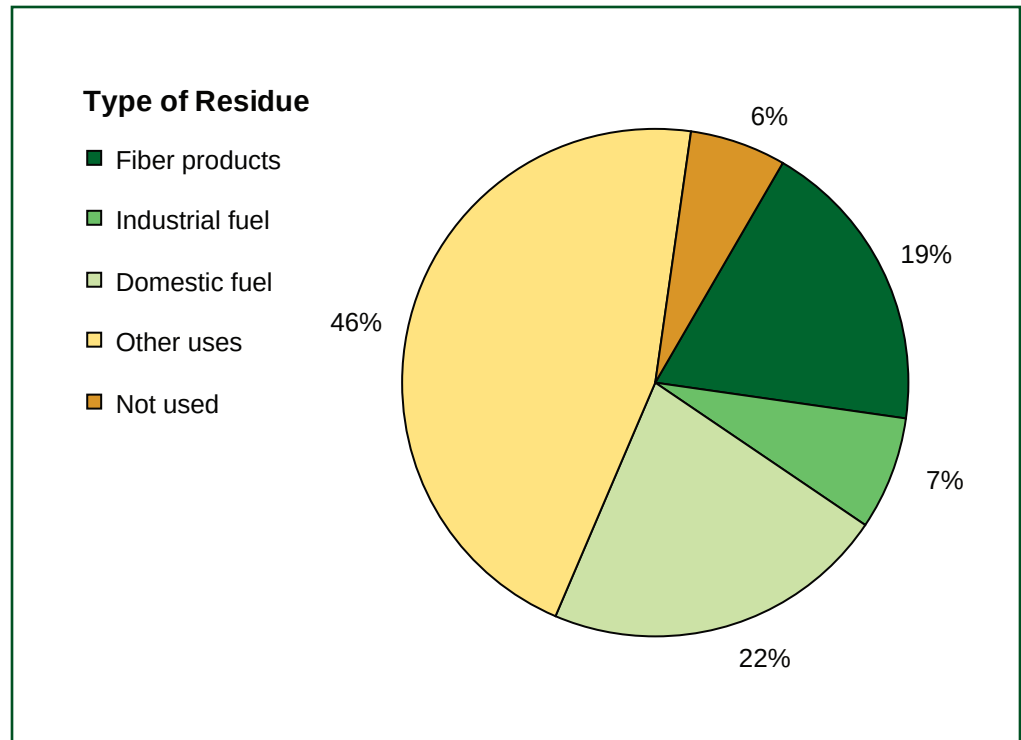


Figure 73.—Disposition of mill residues generated by primary wood-using mills, Illinois, 2005.



What this means

Nearly all of the wood-processing facilities in Illinois are sawmills processing state-grown saw logs. These mills offer woodland owners an outlet to sell timber and provide jobs in some of the State's rural areas. The demand for wood products is likely to increase, placing a greater demand on the resource. An important consideration for the future of Illinois' primary wood-products industry is its ability to retain and process the industrial roundwood harvested, leading to value-added production in the State. Currently, almost one-third of the industrial roundwood harvested in Illinois is sent to other states for processing, providing less benefit to the Illinois economy. Another important issue is the volume of residues that are generated in the State that go unused. Better utilization of the resource and the use of logging slash and mill residues for industrial fuelwood at cogeneration facilities are possible solutions for this problem.

Data Sources and Techniques



Above: Illinois fall colors; photo by Susan Crocker, U.S. Forest Service.
Inset: Northern cardinal; photo by Johnny N. Dell, bugwood.org

Forest Inventory

Information on the condition and status of forests in Illinois was obtained from the Northern Research Station's Forest Inventory and Analysis (NRS-FIA) Program. Previous inventories of Illinois' forest resources were completed in 1948, 1962, 1985, and 1998.

Since the 1998 inventory, several changes in FIA methods have improved the quality of the inventory. The most significant change between inventories has been the shift from periodic to annual inventory. Historically, FIA inventoried each state on a cycle that averaged about 12 years. However, the need for timely and consistent data across large geographical regions along with national legislative mandates resulted in FIA implementing an annual inventory program. Annual inventory was initiated in Illinois in 2001.

With the NRS-FIA annual inventory system, approximately one-fifth of all field plots are measured each year. The entire inventory is completed within 5 years. After this initial 5-year period, NRS-FIA will report and analyze results using a moving 5-year average. For example, NRS-FIA will be able to generate inventory results for 2002 through 2006 or for 2003 through 2007.

Other significant changes between inventories include implementing new remote-sensing technology, a new field-plot configuration and sample design, and gathering additional remotely sensed and field data. The use of new remote-sensing technology allows NRS-FIA to use classifications of Multi-Resolution Land Characterization (MRLC) data and other remote-sensing products to stratify the total area of Illinois and to improve estimates.

New algorithms were used for the 2005 inventory 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 from state to state. As a result, changes in forest type and stand-size class will reflect actual changes in the forest and not changes due to differences between algorithms. The list of recognized forest types, groupings of these forest types for reporting purposes, models used to assign stocking values to individual trees, definition of nonstocked (stands with a stocking value of less than 10 percent for live trees), and names given to the forest types changed with the new algorithms. As a result, comparisons between the published 2005 results and those published for the 1998 inventory may be invalid. Contact NRS-FIA for additional information on the algorithms used in both inventories.

Sampling Phases

The 2005 Illinois inventory was conducted in three phases. In the first phase, satellite imagery was used to stratify the State and aerial photography was used to select plots for measurement. The second phase entailed measuring the traditional suite of mensurational variables and the third phase focused on a suite of variables related to forest health.

Land that could not be sampled included private tracts where field personnel were unable to obtain permission to measure a plot and 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 such sites.

Phase 1

For the Illinois inventory, FIA used a classification of satellite imagery for stratification. The imagery was used 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 of the boundary on the forest side were classified as forest edge and pixels within 60 m of the boundary on the nonforest side were classified as nonforest edge. All strata were divided into public or private ownership based on information available in the Protected Lands Database (DellaSala et al. 2001). The estimated population total for a variable is the sum across all strata of the product of each stratum's area (from the pixel count) and the variable's mean per unit area (from plot measurements) for the stratum.

Phase 2

Phase 2 of the inventory consisted of the measurement of the annual sample of Illinois field plots. Current FIA precision standards for annual inventories require a sampling intensity of one plot for approximately every 6,000 acres. FIA has divided the entire area of the United States into nonoverlapping hexagons, each of which contains 5,937 acres (McRoberts 1999). An array of field plots was established by selecting one plot from each hexagon based on the following rules: 1) if a 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 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 in Illinois is funded by the Federal Government.

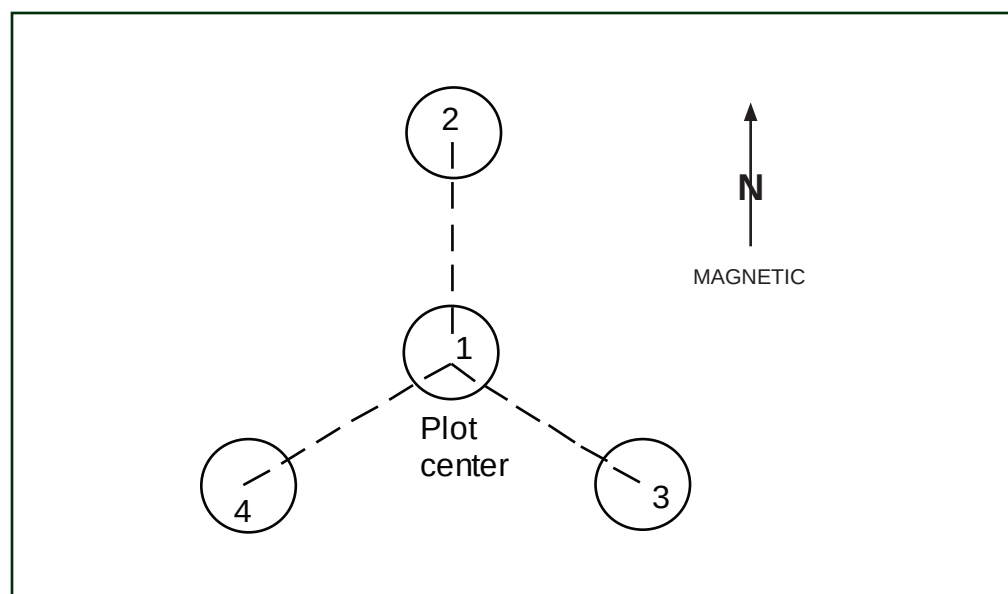
The total Federal base sample of plots was systematically divided into five interpenetrating, nonoverlapping subsamples or panels. Each year, the plots in a single panel are measured; panels are selected on a 5-year, rotating basis (McRoberts 1999). For estimation purposes, the measurement of each panel 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 photographs or digital orthoquads.

Phase 3

NRS-FIA 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 plots are uniformly distributed geographically and temporally. Phase 3 plots are measured with the full suite of FHM vegetative and health variables (Mangold 1998) as well as the full suite of measures associated with Phase 2 plots. Phase 3 plots must be measured between June 1 and August 30 to accommodate the additional measurement of nonwoody, understory vegetation; ground cover; soils; and other variables. On Phase 2 plots, only variables that can be measured throughout the year are collected. Results of the 2005 annual inventory are based on field measurement of 1,004 forested Phase 2 plots and 84 forested Phase 3 plots.

The national FIA four-subplot cluster configuration (Fig. 74) was first used for data collection in Illinois in 2001 and will be used in subsequent years. The national plot

Figure 74.—Current NRS-FIA field-plot design.



configuration requires mapping all forest conditions on each plot. Due to the small sample size each year, precision associated with estimates of components of change such as mortality will be relatively high. Consequently, we report estimates of components of change only after multiple annual panels have been measured. With completion of the annual inventory in 2005, the full range of change estimates is now available.

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. The center of the new plot is located at the same point as the center of the previous plot if a previous plot existed at the same location. Trees with a d.b.h. of 5 inches or larger are measured on a 24-foot-radius (1/24 acre) circular subplot. All trees 1 to 4.9 inches in diameter 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 d.b.h. and at least 6 inches tall [softwood species] or 12 inches tall [hardwood species]) are counted but not individually measured on this same microplot. Forest conditions on the four subplots are recorded. Factors that differentiate forest conditions are changes in forest type, stand-size class, land use, ownership, and density. Each condition that occurs anywhere on any 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 data compilation and table production process. However, other tabular data can be generated at the Forest Inventory and Analysis Data Center webpage at <http://www.fia.fs.fed.us/tools-data/>. For additional information, contact: Program Manager, Forest Inventory and Analysis, Northern Research Station, 1992 Folwell Avenue, St. Paul, MN 55108 or State Forester, Illinois Department of Natural Resources, Office of Resource Conservation, Division of Forest Resources, 1 Natural Resource Way, Springfield, IL 62702-1271.

National Woodland Owner Survey

Information about family forest owners is collected annually through the U.S. Forest Service's National Woodland Owner Survey (NWOS). The NWOS was designed to increase our understanding of owner demographics and motivation (Butler et al 2005). Individuals and private groups identified as woodland owners by FIA are invited to participate in the NWOS. Each year, questionnaires are mailed to 20 percent of private owners, with more detailed questionnaires sent out in years that end in 2 or 7 to coincide with national census, inventory, and assessment programs. Data presented here are based on survey responses from 201 randomly selected families and individuals who own forest land in Illinois. For additional information about the NWOS, visit: www.fia.fs.fed.us/nwos.

Insects and Disease

Information about the insects and diseases affecting Illinois' forests was gathered from the U.S. Forest Service, Northeastern Area State and Private Forestry (www.na.fs.fed.us), the national Forest Health Monitoring (FHM) program (fhm.fs.fed.us/), and the Illinois Department of Agriculture (www.agr.state.il.us/index.html).

Timber Products Output Inventory

This study was a cooperative effort of the Illinois Department of Natural Resources, Southern Illinois University (SIU), and NRS-FIA. Using a questionnaire designed to determine the size and composition of Illinois' forest products industry, its use of roundwood (round sections cut from trees), and its generation and disposition of wood residues, SIU personnel contacted via mail and telephone all primary wood-using mills in the State. Completed questionnaires were sent to NRS-FIA for editing and processing. As part of data editing and processing, all industrial roundwood volumes reported on the questionnaires were converted to standard units of measure using regional conversion factors.

National Land Cover Data Imagery

Derived from Landsat Thematic Mapper satellite data (30-m pixel), the National Land Cover Dataset (NLCD) is a land cover classification scheme (21 classes) applied across the United States by the U.S. Geological Survey (USGS) and the U.S. Environmental Protection Agency (EPA). The NLCD was developed from data acquired by the MRLC Consortium, a partnership of Federal agencies that produce or use land-cover data. Partners include the USGS, EPA, U.S. Forest Service, and National Oceanic and Atmospheric Administration.

Mapping Procedures

Maps in this report were constructed using (1) categorical coloring of Illinois counties according to forest attributes (such as forest land area); (2) a variation of the k-nearest-neighbor (KNN) technique to apply information from forest inventory plots to remotely sensed MODIS imagery (250 m pixel size) based on the spectral characterization of pixels and additional geospatial information; or (3) colored dots to represent plot attributes at approximate plot locations.

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Appendix

Area of Forest Land (in acres) by County and Forest-Type Group, Illinois, 2005.

County	Total	Forest-type Group											Non-stocked
		White/red/jack pine	Loblolly/shortleaf pine	Pinyon/juniper	Exotic soft-woods	Oak/pine	Oak/hickory	Oak/gum/cypress	Elm/ash/cotton-wood	Maple/beech/birch	Aspen/birch	Exotic hard-woods	
Adams	87,032	0	0	7,127	0	0	73,538	0	6,367	0	0	0	0
Alexander	55,049	0	0	0	0	0	35,470	2,382	17,197	0	0	0	0
Bond	44,558	0	0	0	0	0	26,100	0	18,458	0	0	0	0
Boone	3,177	0	0	0	0	0	0	0	3,177	0	0	0	0
Brown	64,925	0	0	0	0	5,893	50,027	0	7,436	0	0	0	1,569
Bureau	32,534	0	0	0	0	0	21,776	0	7,194	3,563	0	0	0
Calhoun	69,930	0	0	0	0	0	38,699	0	25,215	6,017	0	0	0
Carroll	52,887	6,659	0	0	0	0	23,284	0	14,617	6,836	0	0	1,490
Cass	45,518	7,127	0	0	0	0	18,673	4,419	13,825	0	0	0	1,473
Champaign	5,893	0	0	0	0	0	4,419	0	1,473	0	0	0	0
Christian	19,334	0	0	0	0	0	1,065	0	16,468	1,801	0	0	0
Clark	69,466	0	0	0	0	0	51,524	0	17,942	0	0	0	0
Clay	38,184	0	0	0	0	0	30,620	0	6,017	1,548	0	0	0
Clinton	20,526	0	0	0	0	0	6,017	6,017	8,493	0	0	0	0
Coles	39,729	0	0	0	0	0	36,166	0	3,563	0	0	0	0
Cook	57,144	0	0	0	0	0	41,105	0	8,934	3,966	0	0	3,139
Crawford	56,083	0	0	0	0	0	27,444	0	15,247	13,393	0	0	0
Cumberland	7,550	0	0	0	0	0	6,046	0	0	0	0	0	1,504
DeKalb	2,982	0	0	0	0	0	2,982	0	0	0	0	0	0
De Witt	11,300	0	0	0	0	0	8,163	0	3,137	0	0	0	0
Douglas	13,019	0	0	0	0	0	7,933	0	5,086	0	0	0	0
DuPage	11,121	0	0	0	0	0	8,059	0	3,062	0	0	0	0
Edgar	4,451	0	0	0	0	0	1,490	0	0	1,480	0	0	1,480
Edwards	19,800	0	0	0	0	0	5,154	0	10,152	4,494	0	0	0
Effingham	51,217	0	0	0	0	6,017	36,380	0	1,533	7,286	0	0	0
Fayette	101,640	0	0	0	0	0	59,142	0	39,668	2,830	0	0	0
Franklin	49,909	0	0	0	0	0	33,192	0	10,020	6,696	0	0	0
Fulton	127,189	0	0	0	0	0	114,839	0	9,369	2,981	0	0	0
Gallatin	43,255	0	1,832	0	0	0	10,197	0	31,226	0	0	0	0
Greene	34,416	0	0	0	0	0	20,779	0	8,480	5,157	0	0	0
Grundy	8,372	0	0	0	0	0	1,490	0	6,881	0	0	0	0
Hamilton	65,009	0	0	0	0	0	41,548	0	16,960	6,501	0	0	0
Hancock	53,909	0	0	0	0	0	42,049	0	7,366	4,494	0	0	0
Hardin	60,794	0	6,111	0	0	0	46,204	0	903	7,576	0	0	0
Henderson	45,079	0	0	0	0	1,155	32,427	0	11,497	0	0	0	0
Henry	31,283	0	0	0	0	0	21,908	0	8,426	949	0	0	0
Iroquois	20,517	0	0	0	0	0	7,127	0	13,390	0	0	0	0
Jackson	107,853	0	2,037	0	0	4,673	73,883	2,997	24,263	0	0	0	0
Jasper	26,124	0	0	0	0	0	24,590	0	1,533	0	0	0	0
Jefferson	71,511	0	0	0	0	0	42,805	938	27,768	0	0	0	0
Jersey	57,822	0	0	0	0	0	47,491	0	1,248	9,083	0	0	0
Jo Daviess	75,047	0	0	9,527	0	6,278	39,201	0	6,354	12,197	0	0	1,490
Johnson	101,379	0	0	7,329	0	0	69,364	0	15,684	7,329	0	0	1,674
Kane	16,858	0	0	0	1,782	0	10,489	0	4,588	0	0	0	0
Kankakee	18,724	0	0	0	0	0	13,379	0	5,345	0	0	0	0
Kendall	4,526	0	0	0	0	0	4,472	0	54	0	0	0	0
Knox	54,696	0	0	0	0	0	41,865	0	5,591	7,239	0	0	0
Lake	33,162	6,278	0	0	0	0	14,995	0	10,399	1,490	0	0	0
La Salle	49,432	0	0	0	0	0	21,876	0	8,644	18,912	0	0	0
Lawrence	30,925	0	0	0	0	0	14,438	0	16,487	0	0	0	0
Lee	10,461	0	0	0	0	0	5,116	0	5,345	0	0	0	0

(Continued on next page)

Area of Forest Land (in acres) by County and Forest-Type Group, Illinois, 2005. (Continued from previous page)

County	Total	Forest-type Group											Non-stocked
		White/red/jack pine	Loblolly/shortleaf pine	Pinyon/juniper	Exotic soft-woods	Oak/pine	Oak/hickory	Oak/gum/cypress	Elm/ash/cotton-wood	Maple/beech/birch	Aspen/birch	Exotic hard-woods	
Livingston	12,407	0	0	0	0	0	12,407	0	0	0	0	0	0
Logan	13,963	0	0	0	0	0	12,472	0	0	0	0	0	1,490
McDonough	35,602	0	0	0	0	0	35,602	0	0	0	0	0	0
McHenry	54,992	0	0	0	5,345	0	32,855	0	16,792	0	0	0	0
McLean	17,990	0	0	0	0	0	7,383	0	7,334	3,272	0	0	0
Macon	23,984	0	0	0	0	0	7,326	0	16,657	0	0	0	0
Macoupin	94,126	0	0	0	0	0	83,076	0	11,050	0	0	0	0
Madison	67,808	0	0	0	0	0	46,965	0	20,844	0	0	0	0
Marion	92,216	0	0	0	0	0	70,523	0	15,755	5,939	0	0	0
Marshall	27,065	0	0	0	0	0	11,724	0	1,087	14,254	0	0	0
Mason	22,433	7,933	0	0	0	0	5,893	0	7,127	0	0	1,480	0
Massac	36,995	0	0	0	0	2,997	24,995	7,329	1,674	0	0	0	0
Menard	20,480	0	0	0	0	0	13,276	0	333	6,872	0	0	0
Mercer	36,746	0	0	0	5,345	0	20,925	0	7,127	3,349	0	0	0
Monroe	42,869	0	0	0	0	0	22,564	0	20,305	0	0	0	0
Montgomery	50,510	0	0	0	0	336	43,602	0	0	6,573	0	0	0
Morgan	49,087	0	0	0	0	0	37,231	0	11,856	0	0	0	0
Moultrie	5,345	0	0	0	0	0	5,345	0	0	0	0	0	0
Ogle	44,117	4,472	0	0	0	0	30,141	0	0	9,504	0	0	0
Peoria	68,881	0	0	0	0	0	60,605	0	2,384	5,893	0	0	0
Perry	49,929	0	7,107	0	0	0	31,924	0	7,329	3,570	0	0	0
Piatt	5,893	0	0	0	0	0	0	0	5,893	0	0	0	0
Pike	130,368	0	0	0	0	0	106,392	0	23,977	0	0	0	0
Pope	172,051	3,746	11,981	2,811	0	5,994	121,085	6,696	10,794	8,944	0	0	0
Pulaski	50,044	0	0	0	0	0	25,692	0	20,900	3,452	0	0	0
Putnam	16,125	0	0	0	0	0	5,910	0	10,215	0	0	0	0
Randolph	102,370	0	0	0	0	6,696	62,187	0	29,081	4,405	0	0	0
Richland	29,623	0	0	0	0	0	23,489	0	6,134	0	0	0	0
Rock Island	46,538	0	0	0	0	0	21,044	0	10,282	13,828	1,383	0	0
St. Clair	62,945	0	0	0	0	0	23,574	0	39,372	0	0	0	0
Saline	54,814	0	190	0	0	0	45,890	0	8,734	0	0	0	0
Sangamon	43,285	0	0	0	0	0	13,232	0	24,160	5,893	0	0	0
Schuyler	104,848	0	0	0	0	0	63,375	0	16,854	24,619	0	0	0
Scott	8,874	0	0	0	0	0	8,874	0	0	0	0	0	0
Shelby	49,337	0	0	0	0	0	43,065	0	4,768	1,504	0	0	0
Stark	5,606	0	0	0	0	0	0	0	5,606	0	0	0	0
Stephenson	27,273	0	0	0	0	0	27,273	0	0	0	0	0	0
Tazewell	25,063	0	0	0	0	0	10,570	0	5,893	8,600	0	0	0
Union	106,747	0	0	1,626	0	0	81,165	0	6,121	17,835	0	0	0
Vermilion	40,252	0	0	0	0	0	30,518	0	5,315	4,419	0	0	0
Wabash	349	0	0	0	0	0	349	0	0	0	0	0	0
Warren	27,719	0	0	0	0	0	19,056	0	2,770	1,029	0	0	4,864
Washington	42,605	0	0	0	0	0	29,626	0	12,979	0	0	0	0
Wayne	75,152	0	0	0	0	0	36,579	6,191	20,232	12,150	0	0	0
White	52,603	0	0	0	0	994	25,792	0	19,937	5,881	0	0	0
Whiteside	21,737	3,263	0	0	0	0	4,472	0	6,619	5,893	0	0	1,490
Will	36,412	0	0	0	0	0	17,918	0	18,494	0	0	0	0
Williamson	80,832	0	313	3,035	0	3,348	38,641	5,536	29,959	0	0	0	0
Winnebago	19,537	0	0	0	0	0	7,127	0	5,345	7,065	0	0	0
Woodford	35,385	0	0	0	0	0	5,893	0	8,909	20,583	0	0	0
Total	4,525,231	39,478	29,570	31,454	12,472	44,379	2,932,619	42,504	1,019,078	349,147	1,383	1,480	21,666

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Crocker, Susan J.; Brand, Gary J.; Butler, Brett J.; Haugen, David E.; Little, Dick C.; Meneguzzo, Dacia M.; Perry, Charles H.; Piva, Ronald J.; Wilson, Barry T.; Woodall, Christopher W. 2009. **Illinois' Forests 2005**. Resour. Bull. NRS-29. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 114 p.

The first full, annualized inventory of Illinois' forests reports more than 4.5 million acres of forest land with an average of 459 trees per acre. Forest land is dominated by oak/hickory forest types, which occupy 65 percent of total forest land area. Seventy-two percent of forest land consists of sawtimber, 20 percent contains poletimber, and 8 percent contains sapling/seedlings. The volume of growing stock on timberland has been rising since 1948 and currently totals 6.8 billion cubic feet. The average annual net growth of growing stock from 1998 to 2005 is 327 million cubic feet per year. Additional information on forest attributes, changing land use patterns, timber products, and forest health is included in this report.

KEY WORDS: inventory, forest statistics, forest land, volume, biomass, riparian, growth, removals, mortality, forest health, Illinois

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