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Abstract

The third full annual inventory of Illinois' forests reports more than 4.9 million acres of forest land and 99 tree species. Forest land is dominated by oak/hickory and elm/ash/cottonwood forest types, which make up 92 percent of total forest area. The volume of growing stock on timberland has been rising since 1948 and currently totals 7.0 billion cubic feet. Average annual net growth of growing stock from 2010 to 2015 was about 146.1 million cubic feet per year. This report includes additional information on forest attributes, land-use change, carbon, timber products, and forest health. The following information is available online at https://doi.org/10.2737/NRS-RB-113: 1) detailed information on forest inventory methods, statistics, and quality assurance of data collection; 2) tables that summarize quality assurance; 3) a core set of tabular estimates for a variety of forest resources; and 4) a Microsoft® Access database that represents an archive of data used in this report, with tools that allow users to produce customized estimates.

Acknowledgments

The authors would like to thank the many individuals who contributed to both the inventory and the analysis of Illinois' forest resources. Primary field crew and quality assurance staff over the 2010-2015 inventory cycle were Todd Bixby, Tyler Camfield, Joshua Carron, Thomas Goff, Glenda Hefty, Katherine Johnson, Peter Koehler, Dominic Lewer, Adam Magnuson, Michael Maki, Ryan Nowak, Benjamin Nurre, Cassandra Olson, David Roth, Willard Smith, Krista Starn, Brian Wall, and Kris Williams. Data management personnel were Charles Barnett, James Blehm, Mark Hatfield, Bob Ilgenfritz, Daniel Kaisershot, Richard McCullough, Kevin Nimerfro, Barbara O'Connell, Jay Solomakos, and Paul Sowers. Thanks also to Thomas Albright for reviewing the manuscript and providing insightful, constructive comments.

Cover: Meacham Forest Preserve. Photo by Dave Jansen, used with permission.

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Foreword

We are pleased to present Illinois' statewide forest inventory report for 2015. 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 Department of Natural Resources representing Illinois' forest resource interests.

Illinois has seen a gradual increase of almost 1 million acres of forest over the last 70 years with nearly 50 percent of that gain coming in the last 10 years. That increase represents the hard work of many individuals, organizations, and landowners involved in championing and expanding our valuable forest resource. Foresters and natural resource managers across Illinois agree that additional forest protection and expansion through reforestation are also essential.

Our forests, on average, are increasing in volume and getting older. Though we are proud to announce that nearly 20 percent of forests are now managed by professionals, the forest resource is still subject to significant threats. Shade-tolerant species such as maples are gradually replacing predominantly oak forests. Nonnative, invasive species are negatively affecting forest functions and the natural regeneration of oak species and other native forest types. Markets and businesses to utilize our wood are at an all-time low.

In addition to these challenges, Illinois' forests, both rural and urban, face additional threats from forest pests, parcelization, disease, and land conversion. More than 80 percent of forest land in Illinois remains in private ownership. It is our responsibility to work with these landowners to devise and implement management strategies to address local and statewide threats at a significant scale.

We hope the results and summaries within Illinois Forests 2015 will generate discussion and help both advocates and managers of this valuable resource to implement active, strategic management of all forests. We invite you to evaluate these results and engage our constituents in thoughtful discussion and responsible decisions concerning forests.

Tom Wilson

Chief, Division of Forest Resources
Illinois Department of Natural Resources
Office of Resource Conservation

Contents

Picnic shelter. Photo by Steve Crumley, used with permission.

Highlights

On the Plus Side

- The area of forest land in Illinois continues to increase.
- Illinois timberland contains a tremendous amount of aboveground biomass—more than a quarter of a billion tons. State legislation and participation in programs to promote sustainability and regeneration have contributed to the rise in both forest area and biomass.
- With 99 different tree species, Illinois' forests support a diversity of trees.
- In recent decades, carbon stocks throughout the State have increased substantially. As the majority of carbon is maintained in middle-aged stands (41 to 80 years old), increases in forest carbon are likely to continue.
- Less than 1 percent of forest was lost or gained. However, when changes in land use have occurred, gains in forest land have outpaced losses.
- Forest growth continues to increase and exceeds volume losses from harvest, land-use change, and mortality.
- Statewide, removals appear to be in balance with forest growth and mortality, such that total volumes continue to increase.
- Wildlife habitat provided by standing dead trees has increased by 16 percent since 2005; most snags are elm species.

Areas of Concern

- Illinois' oak resource is characterized by an abundance of large, mature trees and a small seedling and sapling component. The declining number of oaks and preponderance of elm and maple seedlings could lead to a successional change in species composition that favors maple dominance.
- While the overall rate of growth has risen, the preponderance of growth is occurring within large diameter stands.
- Mortality is on the rise, particularly within large diameter stands and among black oak and white oak.
- Forest fragmentation is high in the northern two-thirds of the State; southern Illinois, and particularly the Shawnee National Forest, maintains the areas of most

continuous forest land. As the area within the wildland-urban interface increases, forest land will face increased pressures from nonnative species and development that may result in long-term or permanent loss of forest habitat.

- Invasive plant species, primarily multiflora rose and nonnative bush honeysuckles, are widely distributed across Illinois.
- Emerald ash borer, an exotic tree-killing bark beetle, continues to threaten the statewide ash resource. Ash mortality has increased by 24 percent since 2010.

Issues to Watch

- As demands for bioenergy and carbon continue to increase, monitoring forest biomass will become more critical. The bulk of Illinois biomass is found in tree boles; therefore, forest management is closely tied to carbon storage dynamics and future wood availability.
- Most forest land in Illinois is privately owned; therefore, it is important to understand landowner needs and desires in order to help protect forests for future generations.
- As growing-stock and sawtimber volume continues to rise, most forest stands are maturing and will eventually undergo density- and age-related issues.
- The management of forests to maximize carbon sequestration in concert with other land management objectives will require creative silviculture and planning.
- Under a variety of potential economic and climate scenarios, Illinois forest land is projected to decrease in area over the next 50 years. Nevertheless, knowledge of potential future trends will help land managers to manage for desired conditions.

Background

Borks Waterfall. Photo by Chris Evans, University of Illinois, via Bugwood.org.

An Overview of Forest Inventory

What is a tree?

The U.S. Forest Service's Forest Inventory and Analysis (FIA) program defines a tree as any perennial woody plant species with central stems and distinct crowns that can attain a height of 15 feet at maturity. A complete list of the tree species measured in this inventory can be found in Appendix 1. An electronic record of every tree measured in this inventory is available online at https://doi.org/10.2737/NRS-RB-113. Definitions for "tree" and many other terms used in this report are available in the FIA online glossary: https://www.nrs.fs.fed.us/fia/data-tools/state-reports/glossary/.

What is a forest?

The FIA program defines forest land as land that has at least 10 percent canopy cover of live tree species of any size or has had at least 10 percent canopy cover of live species in the past, based on the presence of stumps, snags, or other evidence, and not currently utilized for nonforest use(s) that prevent normal tree regeneration and succession. 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. Trees in narrow windbreaks, urban boulevards, orchards, and other "nonforest" situations are very valuable too, but they are not described in this report.

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, about 94 percent of forest land is timberland, 6 percent is reserved forest land, and less than 1 percent is other forest land.

- Reserved forest land is land withdrawn from timber utilization through legislation or administrative regulation.
- Timberland is unreserved forest land that meets the minimum productivity requirement of 20 cubic feet per acre per year at its peak.
- 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' periodic inventories (1998 and prior), only trees occurring on timberland plots were measured. Therefore, volume of trees on forest land cannot be reported for those inventories. Since the implementation of the annual inventory system, which in Illinois began with the 2001-2005 inventory, FIA has been able to report volume on all forest land. With the first remeasurement of annual plots completed, comparison of growth, mortality, and removals on forest land is now possible. Because periodic inventories reported only on timberland, trend reporting in this publication is primarily focused on timberland.

Where are Illinois' forests and how many trees are in Illinois?

Where trees grow, how they grow, and the types of forests they form are influenced by an array of ecological characteristics, such as terrain, soil type, geology, climate, and hydrology, which vary across the landscape. The concept of an ecoregion (e.g., McNab et al. 2007) integrates these factors in order to group areas that are likely to have similar natural communities. The ecoregion classification system is made up of several levels. At the broadest level, ecodomains use climate to identify ecologically uniform areas. Additional levels (e.g., ecodivisions, ecoprovinces, ecoregions, and ecosections) represent successively smaller geographic areas based on similarities in factors mentioned previously. Ecoprovinces, or ecological provinces, are an appropriate level to broadly describe the ecology of Illinois. The State is home to three ecological provinces: the Eastern Broadleaf Forest, the Prairie Parkland, and the Lower Mississippi Riverine Forest (Fig. 1).

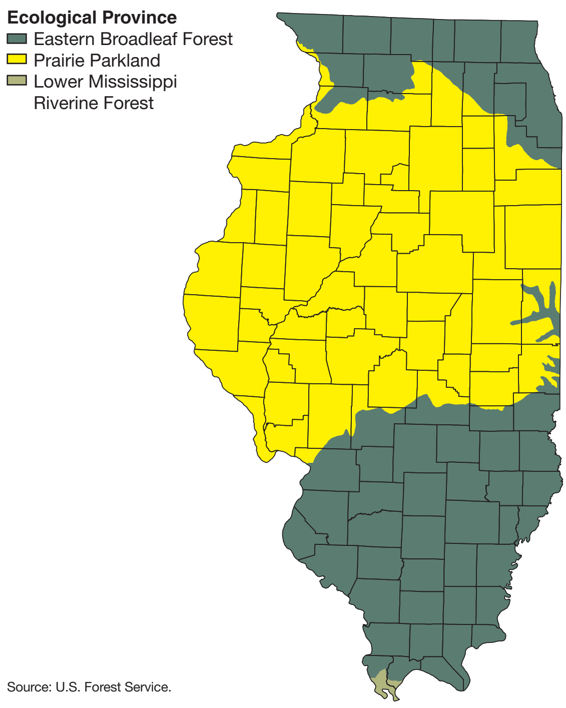
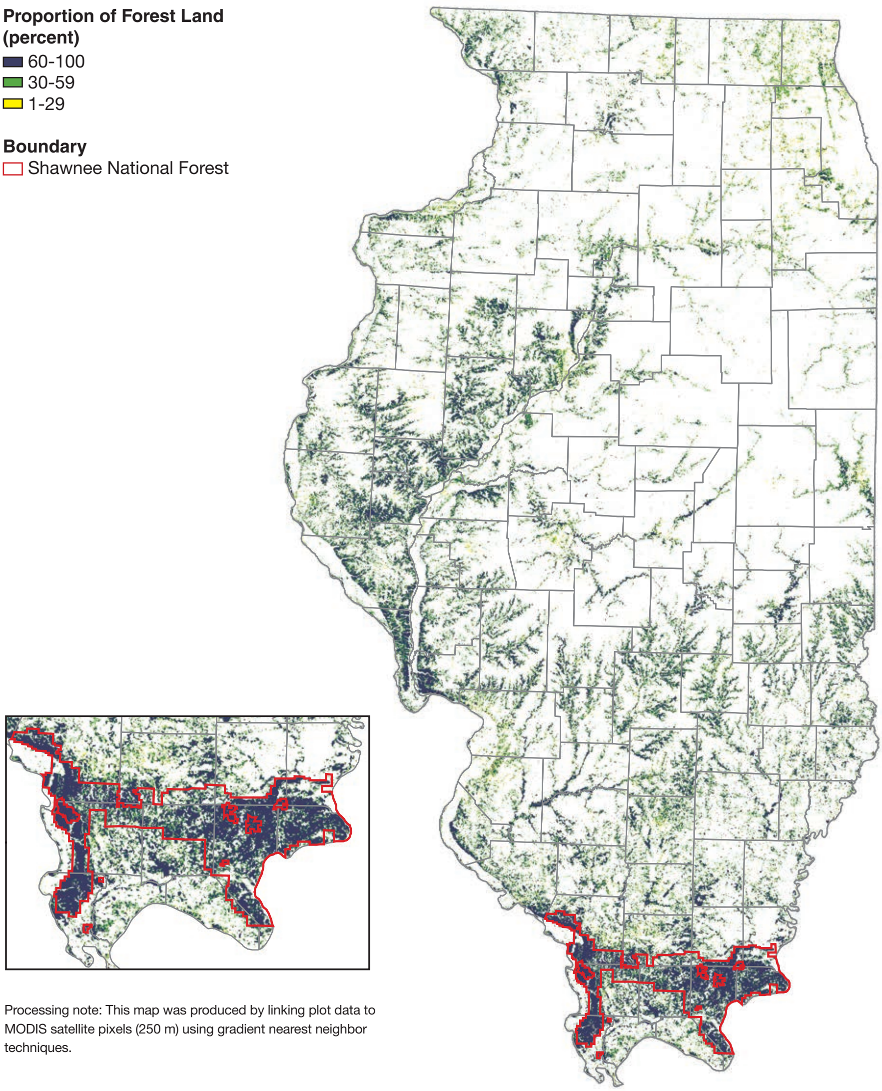


Figure 1.—Ecological provinces (McNab et al. 2007), Illinois.

Forest land is concentrated along rivers and streams in the northern two-thirds of the State and is found throughout the southern third of Illinois (Fig. 2). Illinois forest land contains nearly 2.1 billion trees that are at least 1 inch in diameter at breast height (d.b.h., 4.5 feet above the ground). We do not know the exact number of trees because the estimate is based on a sample of the total population. Trees were measured on 1,038 forested plots. Full details of sample design and estimation procedures are available in Bechtold and Patterson (2005) and a summary explanation is included in the Statistics, Methods, and Quality Assurance document available at https://doi.org/10.2737/NRS-RB-113.



Processing note: This map was produced by linking plot data to MODIS satellite pixels (250 m) using gradient nearest neighbor techniques.

Figure 2.—Distribution of forest land, Illinois, 2009.

How do we estimate a tree's volume?

Statistical models are used to predict volumes within a species group or for a specific species. Individual tree volumes are based upon species, diameter, and total height from trees within the region. Tree volumes are reported in cubic feet or board feet based on the International ¼-inch log-scale rule.

How much does a tree weigh?

Specific gravity values for each tree species or group of species were developed at the U.S. Forest Service's Forest Products Laboratory (Miles and Smith 2009) and were applied to FIA tree volume estimates to determine merchantable tree biomass (weight of tree bole). Total aboveground live-tree biomass is calculated by adding the biomass for stumps, limbs, and tops (Woodall et al. 2011). Live biomass for foliage is currently not reported. FIA inventories report biomass weights as oven-dry short tons. Oven-dry weight of a tree is the green weight minus the moisture content. Generally, 1 ton of oven-dry biomass is equal to 1.9 tons of green biomass.

How do we estimate all the forest carbon pools?

FIA does not directly measure the carbon in standing trees; it estimates forest carbon pools by assuming that half the biomass in standing live/dead trees consists of carbon. Additional carbon pools (e.g., soil, understory vegetation, belowground biomass) are modeled based on stand/site characteristics (e.g., stand age and forest type).

How do we compare data from different inventories?

Previous forest inventories in Illinois, completed in 1948 (Minckler et al. 1949), 1962 (Essex and Gansner 1965), 1985 (Raile and Leatherberry 1988), and 1998 (Schmidt et al. 2000), were collected under a different inventory system wherein states were visited periodically and all measurements were taken at one point in time with no measurements between visits.

An annualized system was implemented statewide in 2001 to provide updated forest inventory information every year based on a 5-year cycle; results of that survey are reported in Crocker et al. (2009). Between 2001 and 2013, the Northern Research Station (NRS) FIA collected data on 14 of the 70 subpanels (20 percent) every year over a 5-year period. In 2014, the annual sample changed to 10 subpanels (14 percent) per year, resulting in a 7-year cycle, with the first 7-year cycle being completed by 2021. All plots have been retained, and inventory estimates (both current and change) will continue to be based on the most recent measurements and remeasurements taken on these plots. As the 7-year cycle is phased in, the difference between the report year and average date of the recent data will increase from 2 years to 3 years. The difference between the report year and the average midpoint year for change will increase from 4.5 years to 6.5 years. Thus, estimates reported here are derived from field data collected between 2010 and 2015, referred to as the "2015 inventory year."

Estimates from new inventories are often compared with estimates from earlier inventories to determine trends in forest resources. However, comparisons between annual and periodic inventories are problematic because procedures for assigning stand characteristics such as forest type and stand size have changed as a result of FIA's ongoing efforts to improve the efficiency, reliability, and national consistency of the inventory. Although these changes will have minimal impact on statewide estimates of forest area, timber volume, and tree biomass, they may have significant impacts on plot classification variables such as forest type and stand-size class. Some of these changes make it inappropriate to directly compare the 2005, 2010, and 2015 annual data with tables published for the 1948, 1962, 1985, and 1998 periodic inventories.

Reserved status—improved implementation

FIA defines reserved forest land as forest land withdrawn by law(s) prohibiting the management of land for the production of wood products (not merely controlling or prohibiting wood-harvesting methods). All private forest lands, regardless of conservation easements that may restrict harvesting, are considered not reserved. Such lands are declared timberland if they meet minimum productivity requirements and "other forest" if they do not. Timberland does not include reserved forest land.

In an effort to increase consistency among states and across inventory years, a refined set of procedures for determining reserved status have been implemented with version 6.0 of the FIA field manual, which took effect with the 2013 inventory year (which began in October 2012). Furthermore, all previously collected annual inventory data (1999 to present) have been updated using the new standardized interpretation.

Starting with this report, timberland estimates generated for earlier annual inventories will differ from previously published estimates. The 2012 inventory was the last inventory in which all data were available under the previous and improved implementations. Small changes are associated with timberland acreage, number of trees, volume, and biomass. The changes associated with the remaining timberland estimates are minor given the inherent variability in the associated estimates. The improved implementation of the reserved status definition increases the spatial and temporal precision of timberland estimates, allowing for higher quality trend analyses and potentially better forest management decisions.

A word of caution on suitability and availability

FIA does not attempt to identify which lands are suitable or available for timber harvesting, and land classified by FIA as timberland is not necessarily suitable or available for timber production. Actual suitability and availability are subject to changing laws, economic and market constraints, physical conditions, adjacency to human populations, ownership objective, and other factors.

How do we produce maps?

Maps produced by FIA are for graphical display to meet general reporting requirements. A geographic information system (GIS) and various geospatial datasets were used to produce the maps in this report. Maps 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 (see Wilson et al. 2012 for more information on this technique), or (3) colored dots to represent plot attributes at approximate plot location.

Unless otherwise indicated, forest resource data are from FIA; base map layers, such as state and county boundaries, were obtained from the National Atlas of the United States (U.S. Geological Survey 2011). Depicted FIA plot locations are approximate. Additional FIA data are available at http://fia.fs.fed.us/tools-data/. Sources of other geospatial datasets are cited within individual figures. All Illinois maps are portrayed in the Universal Transverse Mercator Coordinate System, Zone 16N, North American Datum of 1983.

Forest Features

Middle Mississippi River Wildlife Refuge. Photo by U.S. Fish and Wildlife Service.

Forest Area

Background

Forest ecosystems play an important role in providing wildlife habitat, wood products, and clean air and water; therefore, information on the current status and trends is essential for assessing the quality and quantity of these resources. As fluctuations in estimates of forest land area may indicate changing land use or forest health conditions, monitoring these changes provides information necessary for management and decisionmaking.

What we found

The area of forest land in Illinois has been steadily rising since 1948 and currently totals an estimated 4.9 million acres, or 14 percent of the State's land base (Fig. 3). Although forest land occurs throughout most of Illinois, it is heavily concentrated in the western half and southern third of the State, particularly within the Shawnee National Forest (Fig. 2). Timberland accounts for 94 percent of forest land, and the remaining 6 percent of forest land is reserved or unproductive. Sawtimber stands predominate, making up 76 percent of forest area. Poletimber stands compose 15 percent of forest land. Eight percent of forest land contains seedling-sapling stands and 1 percent is nonstocked. The age of forest stands continues to increase; 49 percent of forest land is more than 60 years old (Fig. 4).

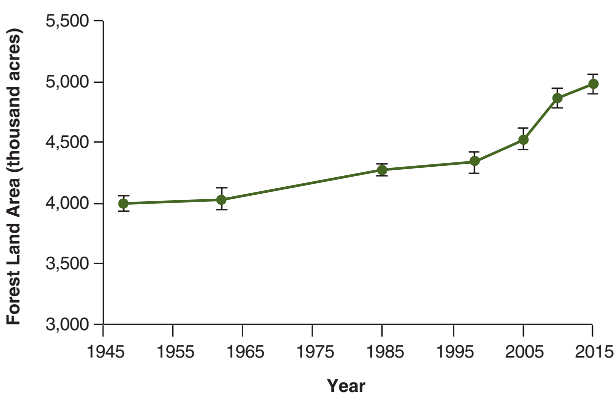


Figure 3.—Area of forest land by inventory year, Illinois. Error bars represent a 68 percent confidence interval.

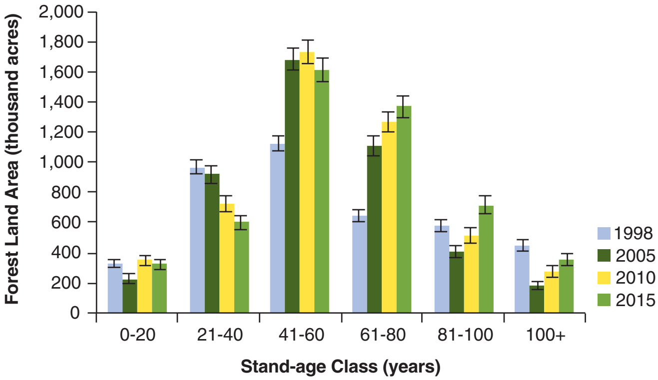


Figure 4.—Area of forest land by stand-age class and inventory year, Illinois. Error bars represent a 68 percent confidence interval.

What this means

For nearly 70 years, the area of Illinois' forest land has continued to expand. Major drivers of increasing forest land have included (1) a declining farm economy in the 1960s and 1970s, which led to a reduced need for agricultural land and resulted in a reversion of pastures and marginal agricultural lands to forest, and (2) the success of national and State programs, such as the Illinois Forestry Development Act of 1983, that were designed to promote well-managed forests and forest regeneration. Maintaining a diverse range of size and age classes will become increasingly important due to the largely mature forest resource, which faces increased risk of forest health and sustainability issues.

Forest Biomass

Background

Measurements of total biomass and its allocation among tree components, including saplings, tree boles, and tree limbs, help to further our understanding of the distribution of forest resources and their availability for different uses (e.g., carbon sequestration, wildlife habitat, or biofuels).

What we found

Illinois forest land supports an estimated 253.9 million dry tons of aboveground live-tree biomass, held predominantly by private owners (82 percent). Although biomass on private forest land is about four and a half times greater than biomass on public forest land, there is more biomass per acre on public forest land (55 tons per acre on public forest land versus 50 tons per acre on private forest land). The distribution of biomass is similar to that of forest area, with the greatest amounts of forest biomass located in the southern tier of the State, primarily in the Shawnee National Forest (Fig. 5). Fifty-eight percent of statewide biomass is contained in the boles of growing-stock trees; 16 percent is in growing-stock stumps, tops, and limbs; 5 percent is in saplings; and 21 percent is in nongrowing-stock trees (Fig. 6).

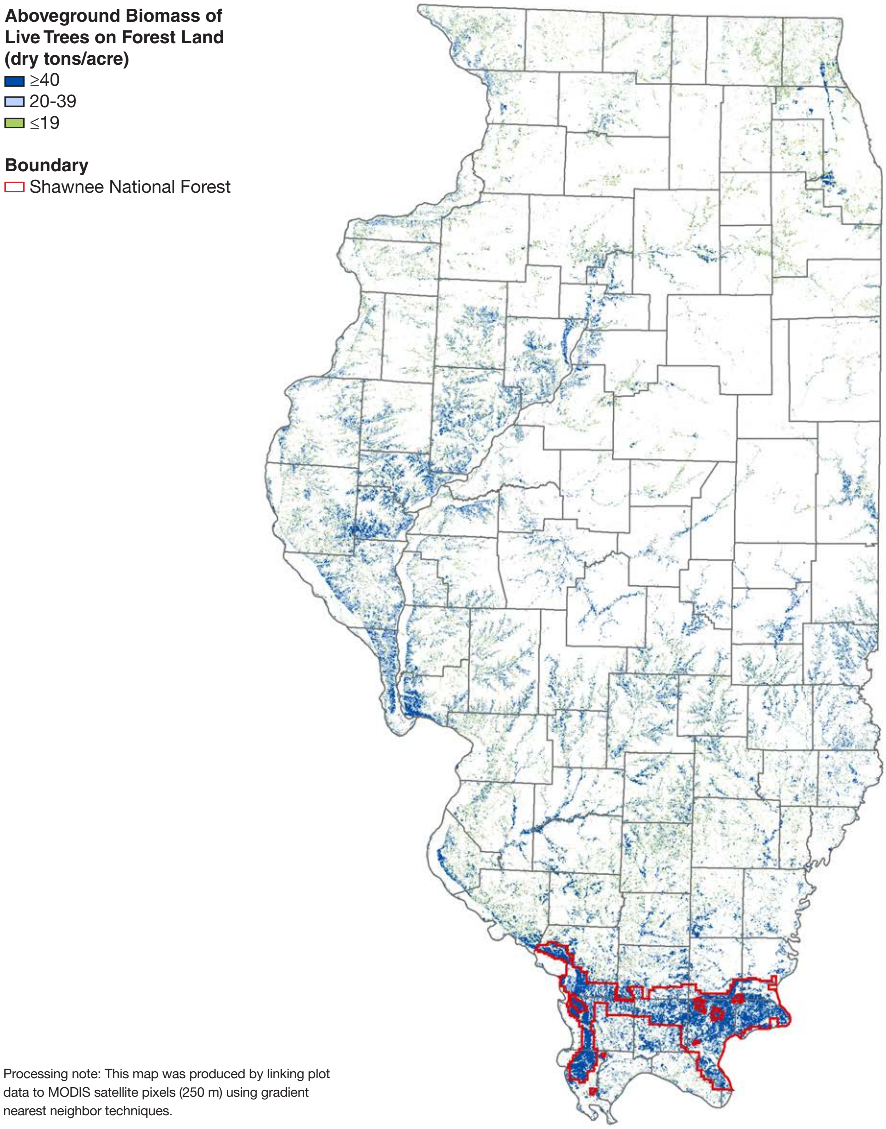


Figure 5.—Distribution of aboveground live-tree biomass on forest land, Illinois, 2009.

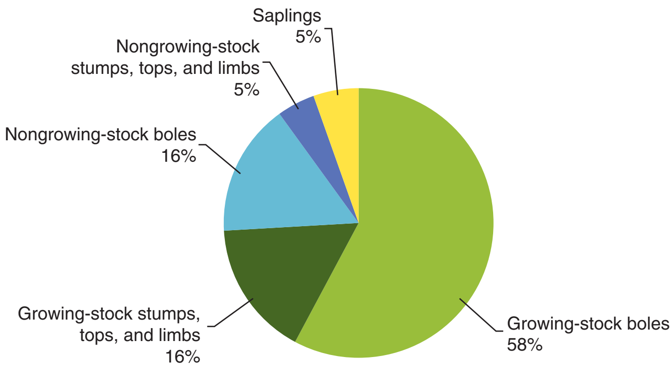


Figure 6.—Forest biomass on forest land by tree component, Illinois, 2015.

What this means

Public and private forest landholders play an important role in sustaining Illinois' forest biomass, which is a valuable resource with environmental and economic importance. Because tree boles contain the most biomass, forest management is closely tied to the dynamics of carbon storage and future wood availability. Given the increasing desire to manage biomass components for bioenergy and carbon, monitoring forest biomass will become more critical.

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 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 nearly 2.1 billion trees (1-inch d.b.h. or greater) representing 99 different tree species (common and scientific names of trees are found in Appendix 1). The total number of trees on forest land has remained consistent since 2005. American elm, hackberry, sugar maple, and black cherry are the most abundant species by number (Fig. 7); combined, they represent 28 percent of the total number of trees. Oaks are also prolific throughout Illinois. Twenty species of oaks were recorded on forest land across the State; these species account for 10 percent of total species abundance. Though tree abundance is stable, the volume of live trees on forest land has increased by 17 percent over the past 10 years. White oak, which represents 10 percent of total live-tree volume, remains the most voluminous species on forest land, followed by silver maple, black oak, and northern red oak (Fig. 8). Oaks make up 33 percent of total live volume. Several species have increased in volume since 2005, including silver maple, black oak, green ash, and black walnut.

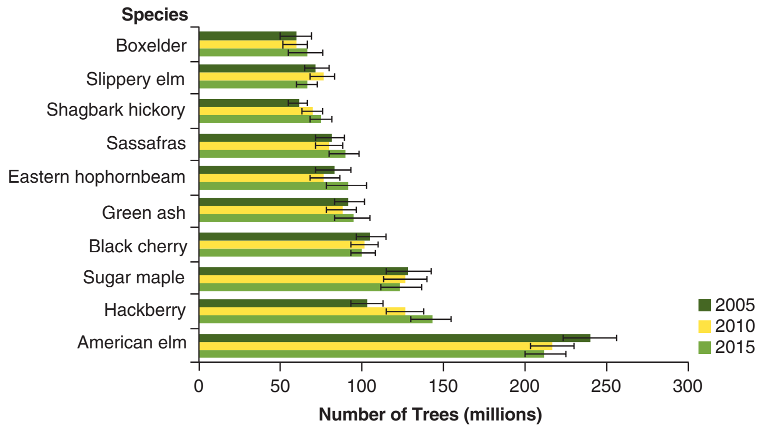


Figure 7.—Number of live trees on forest land for the 10 most numerous species in 2015, Illinois. Error bars represent a 68 percent confidence interval.

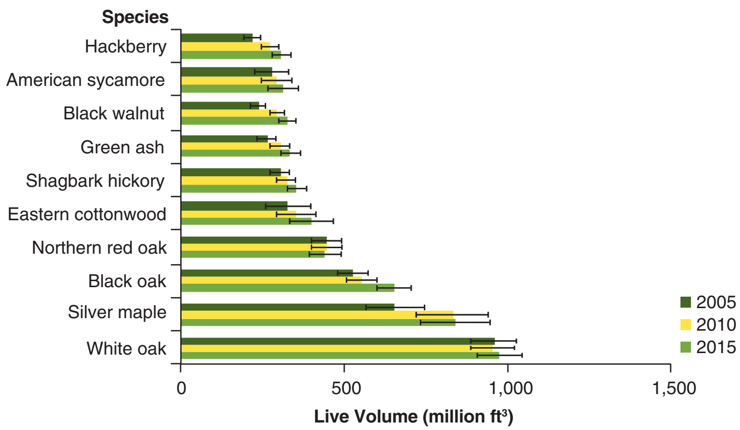


Figure 8.—Volume of live trees on forest land for the 10 most voluminous species in 2015, Illinois. Error bars represent a 68 percent confidence interval.

What this means

The composition of Illinois' forests and the dominance of individual tree species continue to evolve. Oaks are dominant in terms of volume, but American elm, sugar maple, and a host of predominantly understory species are the most abundant species by number. The difference in species composition by number and volume is reflective of oak dynamics, wherein large numbers of mature oak dominate the overstory and there is little oak regeneration in the understory. Disturbance, particularly from harvesting and fire management, promotes oak regeneration. The absence of disturbance has allowed shade-tolerant species to outcompete understory oaks. As oaks senesce, mortality will create canopy gaps that will most likely be filled by maples and elms, which now occupy the understory in large numbers.

Forest Density

Background

The density of a forest is an indication of the current phase of stand development and has implications for diameter growth, tree mortality, and yield. Density, a measure of a forest's current stocking of trees, 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

The density of trees in Illinois' forests has gradually decreased since 2005 (Fig. 9). In contrast, the average volume of live trees per acre of forest land continues to slowly increase; currently, total live-tree volume is an estimated 1,878 cubic feet per acre (Fig. 10). The level of stocking has remained fairly constant since 2005. Currently, overstocked stands, which contain too many trees to support adequate tree growth and development, represent 6 percent of forest land (Fig. 11). Most stands are fully stocked (42 percent) or moderately stocked (41 percent). Poorly stocked stands, which do not contain enough trees to fully utilize a site, represent 10 percent of forest land. One percent of stands are nonstocked.

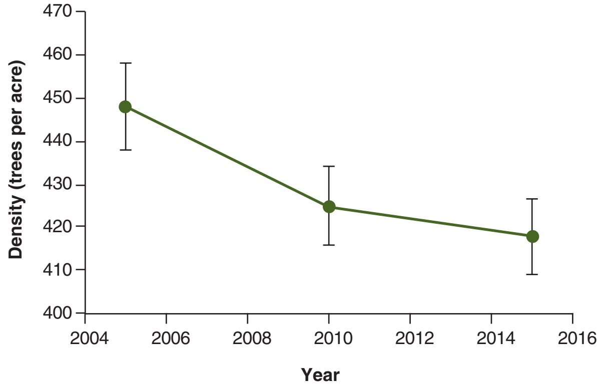


Figure 9.—Density of live trees on forest land by inventory year, Illinois. Error bars represent a 68 percent confidence interval.

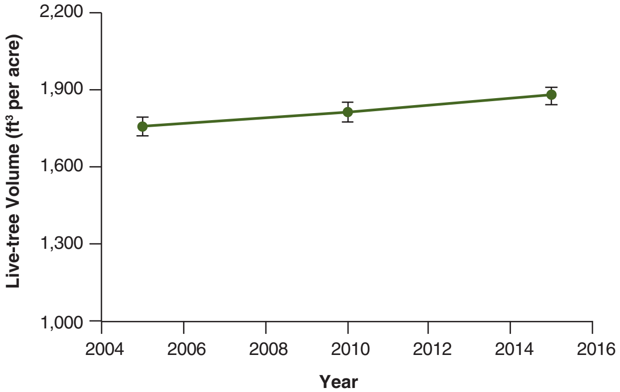


Figure 10.—Live-tree volume per acre on forest land by inventory year, Illinois. Error bars represent a 68 percent confidence interval.

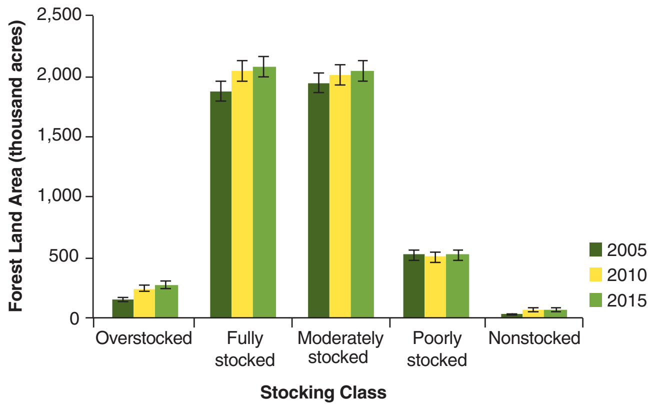


Figure 11.—Area of forest land by stocking class and inventory year, Illinois. Error bars represent a 68 percent confidence interval.

What this means

The decrease in tree numbers and increase in tree volume indicate that Illinois' forest resource is maturing. In the absence of natural or human disturbance, this trend can be expected to continue until stands reach a state of senescence. Current stocking levels indicate adequate growing conditions, but also show a preponderance of fully stocked stands. As trees continue to grow and add volume, these stands are expected to face an increased amount of stand stagnation issues, such as mortality.

Diminishing Oaks, Maple Replacement

Background

Illinois' forests are largely composed of oak/hickory forest types. The broad range of tree species and the structural variation within these forests contribute to their importance as a reservoir for biological diversity. Many wildlife species are dependent on oak/hickory forests for the food and habitat they provide. As oaks are the backbone of this forest type, changes in their structure and abundance will play an important role in the ecology of Illinois' forests.

What we found

Oak/hickory, which occupies 68 percent of total forest area, is the most dominant forest-type group in Illinois. While total area has risen, increasing from 3.1 million acres in 2005 to 3.3 million acres in 2015, the age distribution of oak/hickory stands has become increasingly uneven (Fig. 12). The area of older stands has increased in successive inventories, with 56 percent of stands 61 years of age or greater. The majority (77 percent) of the oak/hickory forest-type group is made up of large-diameter or sawtimber stands.

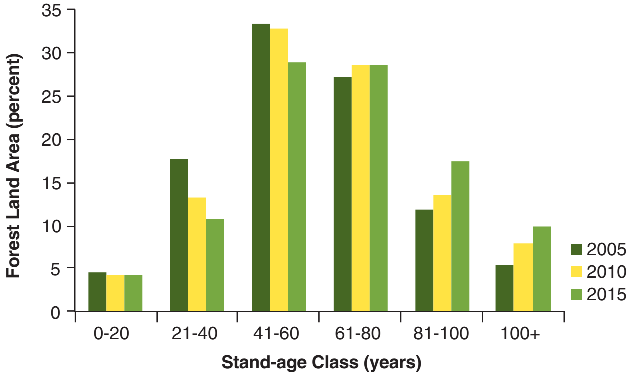


Figure 12.—Stand-age class distribution of the oak/hickory forest-type group by inventory year, Illinois.

Within the oak/hickory forest-type group, oaks represent a relatively small percentage of total tree abundance (12 percent). Ash, elm, and hackberry seedlings (19 percent, 16 percent, and 10 percent, respectively) are the most dominant species in the understory, while oak seedlings make up a much smaller component (7 percent) (Fig. 13). Among oak seedlings, white oak and black oak are most abundant. Since 2005, the number of American elm and sugar maple seedlings has significantly decreased, while hackberry and white ash have increased (Fig. 13). Species composition among saplings has changed little since 2005 and remains largely American elm, sugar maple, and eastern hophornbeam (Fig. 14). Shingle oak, white oak, and black oak are the most abundant oak saplings and represent 5 percent of total species. Oaks are more numerous in the large diameter classes; 48 percent of oaks (greater than or equal to 5 inches d.b.h.) in the oak/hickory forest-type group are 13 inches or greater (Fig. 15).

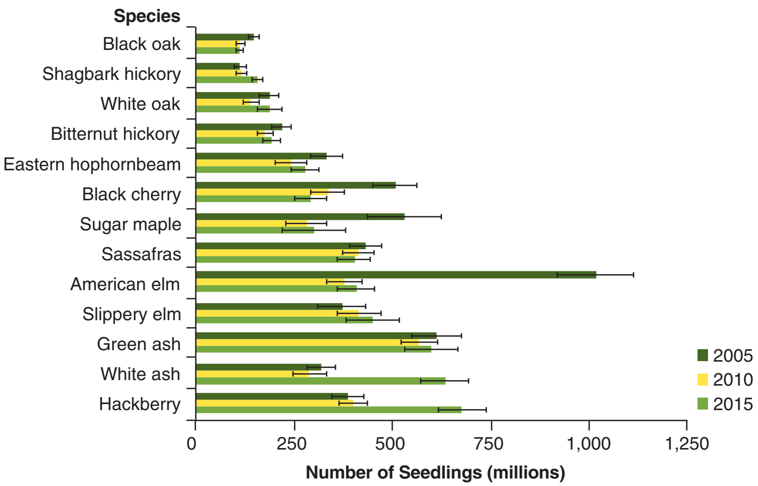


Figure 13.—Number of seedlings on forest land in the oak/hickory forest-type group by species and inventory year, Illinois. Error bars represent a 68 percent confidence interval.

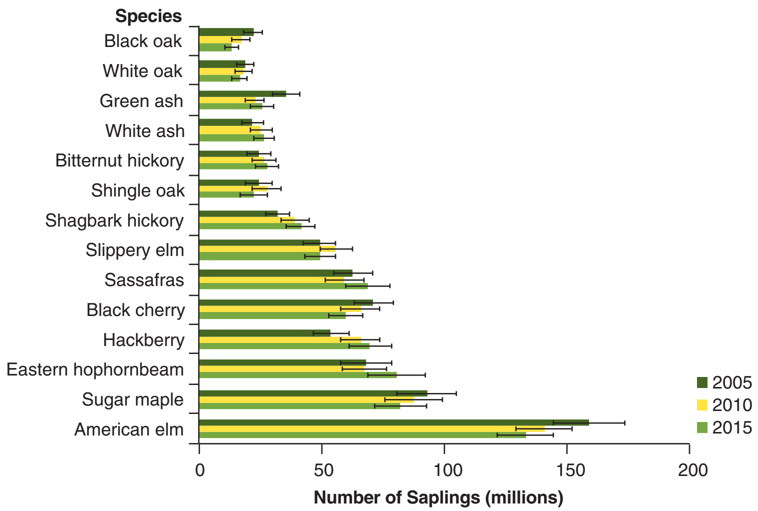


Figure 14.—Number of saplings on forest land in the oak/hickory forest-type group by species and inventory year, Illinois. Error bars represent a 68 percent confidence interval.

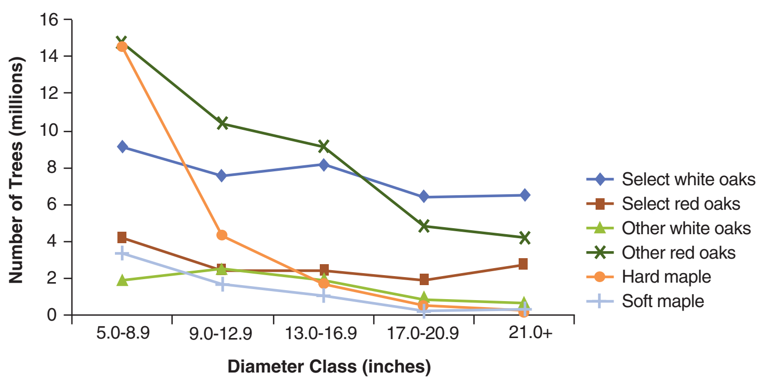


Figure 15.—Number of trees on forest land in the oak/hickory forest-type group by diameter class for selected species groups, Illinois, 2015.

In contrast to abundance, oak species dominate the oak/hickory forest-type group by volume, totaling 3.1 billion cubic feet (in live trees greater than or equal to 5 inches d.b.h.) or 33 percent of volume. Mortality of live trees was greatest for American elm (12.7 million cubic feet), black oak (9.8 million cubic feet), white oak (7.8 million cubic feet), and northern red oak (5.5 million cubic feet). Mortality of American elm was evenly distributed among diameter classes; in contrast, mortality of black, white, and northern red oak occurred primarily in large diameter trees, with 93 percent of mortality in trees 13 inches or greater.

What this means

The growing extent of Illinois' oak/hickory forests has been accompanied by an emerging disparity among age classes. Decreases in the frequency of 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, including hackberry and white ash, and 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. Maintaining a healthy oak resource will be dependent on successful seedling regeneration and sapling development.

Forest Carbon

Background

Among terrestrial ecosystems, forests contain the largest reserves of sequestered carbon. Forests sequester carbon from the atmosphere and thus help mitigate greenhouse gas emissions. The continuing increase in forest carbon stocks in Illinois contributes to the offset of total U.S. greenhouse gas emissions that result from forest fires and the burning of fossil fuels. Carbon accumulates in growing trees via the photosynthetically driven production of structural and energy-containing organic (carbon) compounds that primarily accumulate in trees as wood; roughly 50 percent of tree biomass is carbon (based on dry weight). Over time, this stored carbon also accumulates in dead trees, woody debris, litter, and forest soils. For most forests, the understory grasses, forbs, and nonvascular plants, as well as animals, represent minor pools of carbon stocks. Procedures for the estimation of carbon are detailed in U.S. Environmental Protection Agency (2016).

What we found

Total forest ecosystem carbon stocks in Illinois are an estimated 324.4 million tons, a 5 percent increase since 2010. Live trees and soil organic carbon are the largest pools and account for 86 percent of forest carbon (Fig. 16). Most of Illinois' carbon stocks are in stands 41 to 80 years old (62 percent of total aboveground carbon). Considerably less carbon is found in stands 40 years or younger (11 percent); 27 percent of carbon is in stands 81 years of age or older. As a per acre estimate, average aboveground carbon increases with stand age and net accumulation is greater within biomass (live tree and understory) than in the aboveground non-living carbon pools (standing dead, down dead, and litter) (Fig. 17). Species composition can affect carbon stocks and the relative distribution among pools. Four forest-type groups contained at least 1 percent of forest carbon; forest types with less than 1 percent of carbon were pooled into an additional hardwoods or softwoods group. On a per acre basis, carbon density (tons per acre) was highest in the maple/beech/birch, oak/gum/cypress, and elm/ash/cottonwood forest-type groups (Fig. 18). However, the majority of total forest carbon is in the oak/hickory (64 percent) and elm/ash/cottonwood forest-type groups, as they cover a larger area of forest.

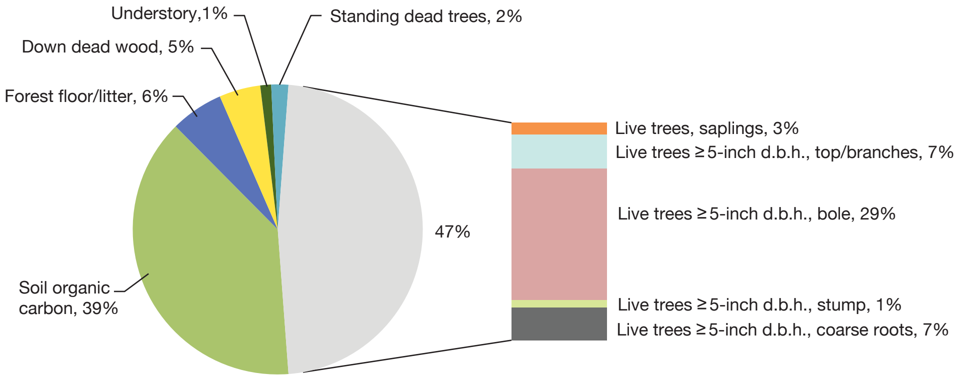


Figure 16.—Estimated carbon stocks on forest land by forest ecosystem component, Illinois, 2015.

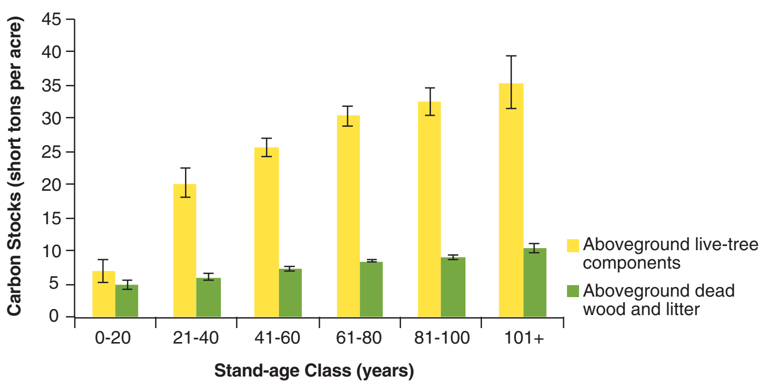


Figure 17.—Average carbon stocks per acre for aboveground components on forest land by stand-age class, Illinois, 2015. Error bars represent a 68 percent confidence interval.

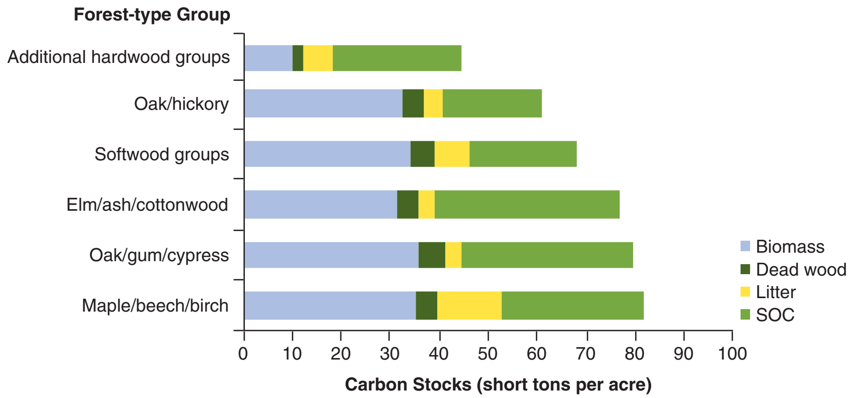


Figure 18.—Average carbon stocks per acre of forest land by selected forest-type group and carbon pool, Illinois, 2015. SOC indicates soil organic carbon.

What this means

Illinois' forest carbon stocks continue to rise as maturing stands accumulate carbon, particularly in aboveground components. Given age-class structure and species composition, this trend is likely to persist. Managing forest carbon to help offset U.S. greenhouse gas emissions has become increasingly important. Therefore, an understanding of trends in carbon storage will be an essential tool for forest managers.

Forest Ownership

Background

How land is managed is primarily the owner's decision. Therefore, landowners largely determine the availability and quality of forest resources, including recreational opportunities, timber, and wildlife habitat. By understanding their priorities, the forest conservation community can better help forest landowners meet their needs, and in so doing, help conserve Illinois' forests for future generations. The National Woodland Owner Survey (NWOS; www.fia.fs.fed.us/nwos), conducted by the FIA program, studies private forest landowners' attitudes, management objectives, and concerns. It focuses on the diverse and dynamic group of owners that is the least understood—families, individuals, and other unincorporated groups, collectively referred to as "family forest owners." The NWOS data reported here are based on the responses from 177 family forest ownerships in Illinois that participated between 2011 and 2013 (Butler et al. 2016).

What we found

The vast majority (83 percent, or 4.1 million acres) of Illinois forest land is privately owned (Fig. 19). Family forest owners hold the largest percentage of private forest land. Federal agencies manage the majority of public forest acres, most of which lie in the Shawnee National Forest.

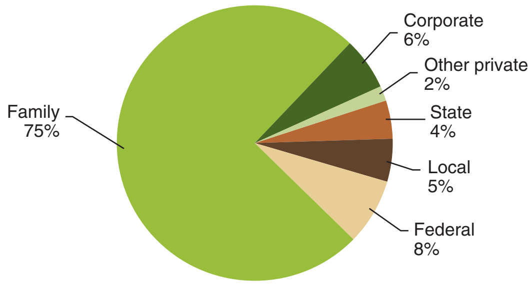


Figure 19.—Distribution of forest land by ownership category, Illinois, 2015.

Within private ownership, the majority of family owned forest land (3.4 million acres) is held by owners with at least 10 acres of forest land; the average forest holding size is 45 acres. Seventy-six percent of family forest owners have between 10 and 49 acres of forest land (Fig. 20). However, 60 percent of land owned by family forest owners is in holdings of 50 acres or more. The primary reasons for owning forest land are related to aesthetics, wildlife, and nature. The most common activities on family forest land are personal recreation, such as hunting and hiking, and cutting trees for personal use, such as firewood (Fig. 21). Most family forest owners have not participated in traditional forestry management and assistance programs in the past 5 years (Fig. 22); however, the most common type of participation is having received management advice (20 percent). The average age of family forest owners in Illinois is 61 years and 58 percent of family-owned forest land is held by people who are at least 65 years of age.

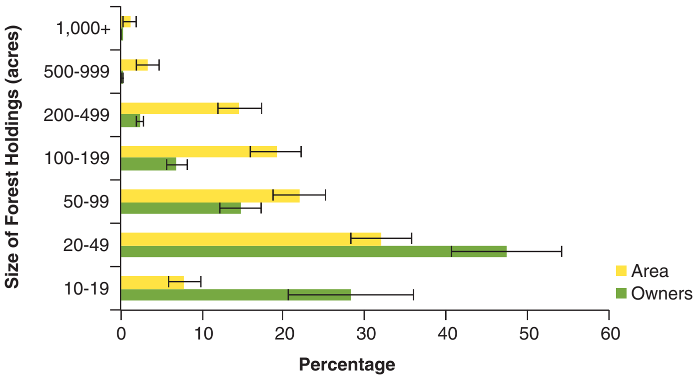


Figure 20.—Area of family forest land and number of family forest owners by size of forest landholdings, Illinois, 2015. Error bars represent a 68 percent confidence interval.

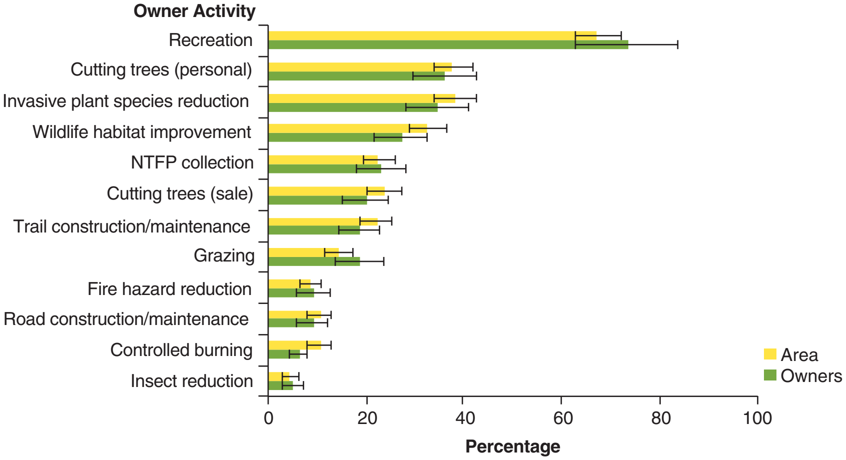


Figure 21.—Area of forest land and number of family forest owners by primary activity within the past 5 years, Illinois, 2015. Categories are not exclusive. NTFP indicates nontimber forest products. Error bars represent a 68 percent confidence interval.

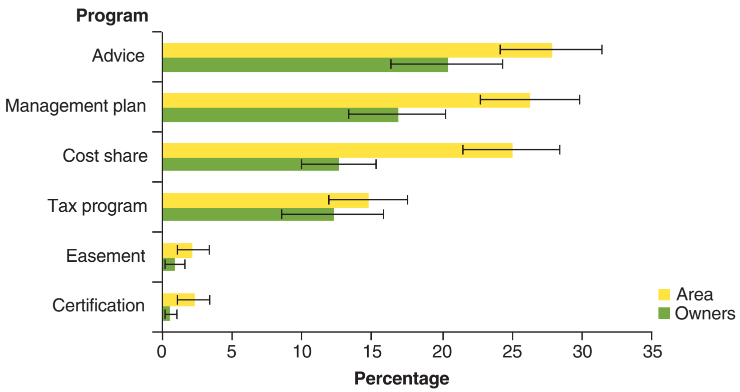


Figure 22.—Area of forest land and number of family forest owners by participation in forest management programs, Illinois, 2015. Categories are not exclusive. Error bars represent a 68 percent confidence interval.

What this means

The future of forests lies primarily in the hands of those who own and manage the land. It is therefore critical to understand forest owners and the policies and programs that can help them conserve forests for current and future generations. Family forest owners are the largest, yet least understood, forest ownership group and the fate of their land is arguably the most uncertain. More than three-quarters of family forest owners do not have a management plan and most have not participated in traditional forest management planning or assistance programs. Opportunities to help these owners increase their engagement and stewardship of their lands can be found in programs such as Tools for Engaging Landowners Effectively (http://www.engaginglandowners.org). As a substantial share of Illinois' private forest land is owned by individuals aged 65 years and older, much of private forest land in Illinois is at an increased likelihood of a change in ownership. Programs such as Your Land, Your Legacy (http://masswoods.net/monthly-update/your-land-your-legacy-deciding-future-your-land) and Ties to the Land (http://tiestotheland.org) are being implemented to help owners meet their bequest goals. However, it is uncertain who future forest owners will be and what they will do with their land.

Land-Use Change

Background

Although the total area of forest land in Illinois remained relatively stable between 2010 and 2015, gains and losses in forest area occurred in some areas. To better understand Illinois' forest land dynamics, it is important to explore underlying changes in land use occurring throughout the State. FIA characterizes land area using several use categories: forest, rangeland, agriculture, water, developed land, and other nonforest land. The conversion of forest land to nonforest and water uses is referred to as "gross forest loss" (or "diversion"), and the conversion of nonforest land and water to forest is known as "gross forest gain" (or "reversion"). The magnitude of the difference between gross loss and gross gain is defined as net forest change. By comparing the land use on current inventory plots with the land use recorded for the same plots during the previous inventory, we can characterize forest land-use change. Understanding land-use change dynamics is essential for monitoring the sustainability of Illinois' forest resources and helps land managers make informed policy decisions.

What we found

Little change in land use occurred between 2010 and 2015; only 1 percent of land had either a forest loss or forest gain. Instead, most of the land use in Illinois remained forest (13 percent) or stayed nonforest (86 percent). In areas where land-use change occurred, the amount of nonforest that reverted to new forest land (182,000 acres, or 3.7 percent) slightly exceeded the amount diverted from forest to nonforest (161,000 acres, or 3.3 percent), leading to a net gain of forest land (Fig. 23). Sixty-six percent of forest gain was from agricultural land, primarily cropland (32 percent) and pasture

(25 percent) that converted to forest land (Fig. 24A). More than half of the gross forest loss was due to diversion to agricultural land uses: cropland (28 percent), agricultural land including idle farmland (16 percent), and pasture (13 percent) (Fig. 24B).

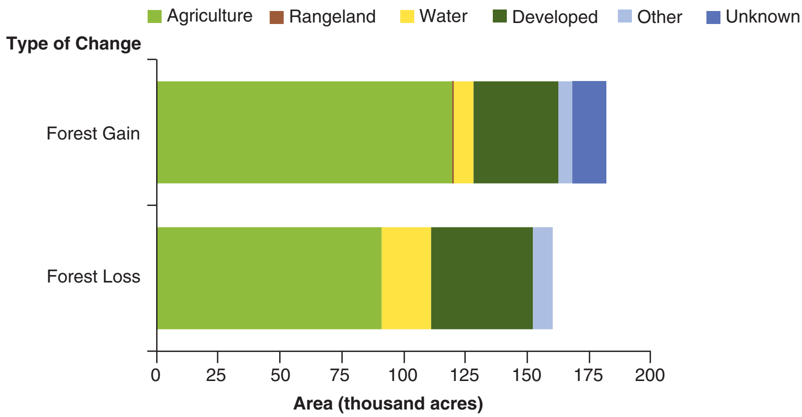


Figure 23.—Gross area of forest loss and forest gain by land-use category, Illinois, 2010-2015. Error bars represent a 68 percent confidence interval.

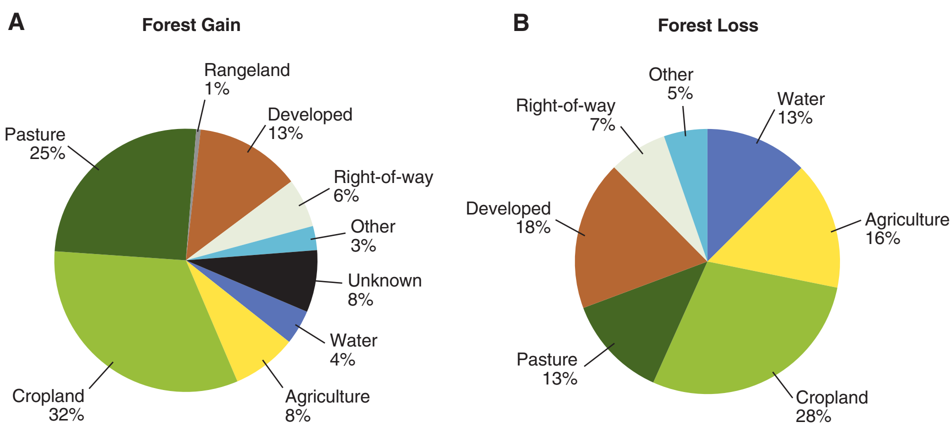


Figure 24.—Forest gain from previous land use (A) and forest loss to current land use (B), Illinois, 2010-2015.

Within the large diameter size class, more stands were lost (56 percent) than gained (39 percent) (Fig. 25). In contrast, a larger percentage of small diameter stands were gained (39 percent) than lost (27 percent). Nonstocked forests make up about 1 percent of Illinois forest land, but contributed about 3 percent of forest land gain and 2 percent of forest land loss (Fig. 25). Forest-type groups also show disproportionate rates of gain and loss. Gains exceed losses for elm/ash/cottonwood; losses exceed gains for oak/pine (Fig. 26).

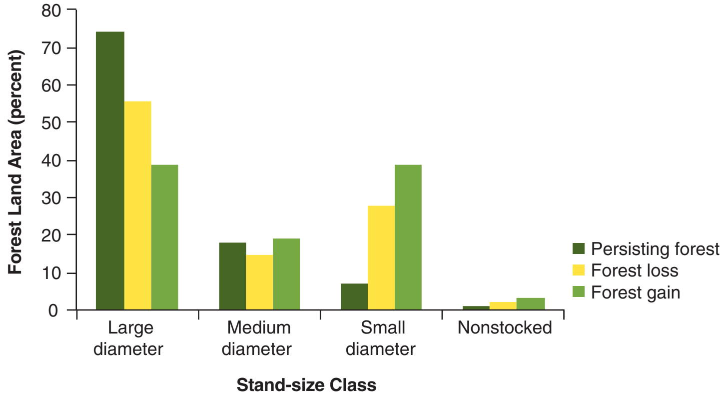


Figure 25.—Distribution of forest land area by diameter class for persisting forest, forest lost from previous size class, and forest gained to current size class, Illinois, 2010-2015.

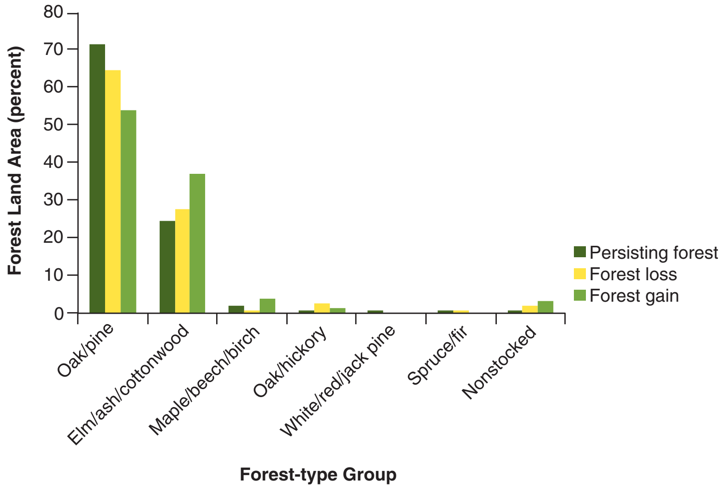


Figure 26.—Distribution of forest land area by forest-type group for persisting forest, forest lost from previous forest-type group, and forest gained to current forest-type group, Illinois, 2010-2015.

What this means

As agriculture is the dominant land use in Illinois, gains and losses in agriculture appear to drive land-use change dynamics in the State. Some of the diversion and reversion of forest land in Illinois is likely the result of marginal forest land moving into and out of the forest land base, as suggested by the high rate of change within nonstocked forest. Movement between forest and nonforest classifications may be a result of land meeting or not meeting FIA's definition of forest land due to small changes in understory disturbance, forest extent, or forest cover. Such changes are generally not permanent and may be more prevalent in stands of small diameter trees. Although similar rates of forest gain occur in both small and large diameter size classes, forest losses are greatest in the large diameter class, which is reflective of the abundance of mature stands. Overall, gains in forest land have outpaced forest losses and Illinois appears to be moving toward greater conservation and valuation of the State's forest resources.

Forest Growth

Background

A forest stand's capacity for growth, that is, 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 previous and current inventories for the individual tally trees before accounting for the impact of removals.

What we found

The overall rate of growing-stock growth on timberland has steadily increased since 1962; net growth of growing stock currently averages 146.1 million cubic feet per year (Fig. 27), representing a growth-to-volume ratio of 1.9 percent. Four species groups account for 50 percent of net growth: soft maple (primarily silver maple), other eastern soft hardwoods, hickory, and other red oaks (largely black oak) (Fig. 28). Statewide, most of the growth took place in the large diameter stand-size class (176.6 million cubic feet). A fraction of growth occurred in the small diameter class (2.8 million cubic feet), but this was offset by a net decrease in growth in the medium diameter class, with a loss of 33.5 million cubic feet of volume per year since 2010. While growth-to-volume ratios changed little for many species over the last 5 years, notable changes include a decrease in the growth-to-volume ratio for white oak and an increase for bigtooth aspen, red maple, and hackberry, which had ratios equal to or greater than 3 percent (Fig. 29).

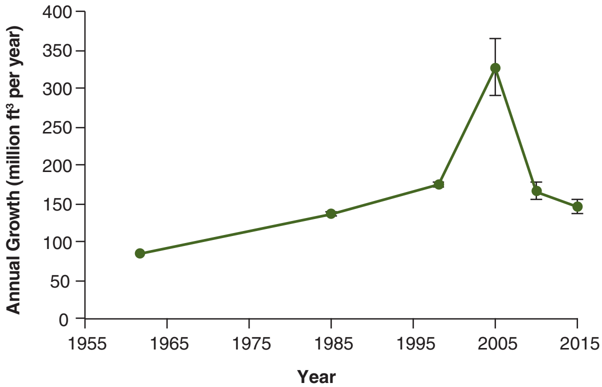


Figure 27.—Average annual net growth of growing stock on timberland by inventory year, Illinois. Error bars represent a 68 percent confidence interval.

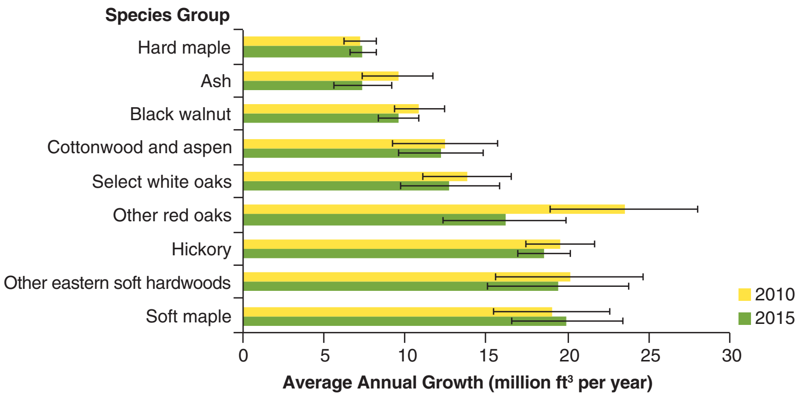


Figure 28.—Average annual net growth of growing stock on timberland for the nine species groups with the highest growth in 2015, Illinois. Error bars represent a 68 percent confidence interval.

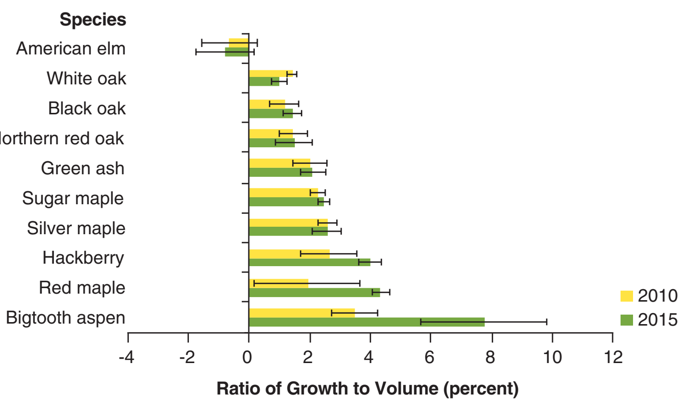


Figure 29.—Average annual net growth expressed as a percentage of total growing-stock volume on timberland for 10 selected species, Illinois. Error bars represent a 68 percent confidence interval.

What this means

Although the overall rate of growth on Illinois' forests is generally increasing, the rise in the 2005 estimate of net growth is due in part to a lag in the detection of lands that reverted from nonforest to forest during the late 1990s and early 2000s. This lag largely resulted from NRS-FIA's use of enhanced imagery and geographic information systems technology that began in 2005, which allowed for better detection of potentially forested plots in the office and increased the number of plots that were sent to the field for measurement. As a result, additional forested plots were identified and higher estimates of growth were recorded.

Even though the rate of growth has risen, the preponderance of growth is occurring within large diameter stands, which indicates that mature trees are continuing to add volume. While sustained growth of large diameter oaks increases its availability for commercial wood products, growth of other species in a variety of size classes suggests that the oak resource may not continue its current dominance.

Tree 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, alone or in combination. 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.

What we found

The rate of growing-stock mortality on timberland has continued to increase since 1962 (Fig. 30). Average annual mortality of growing stock is currently an estimated 96.8 million cubic feet per year, or 1.4 percent of total growing-stock volume. Eighty-eight percent of mortality occurred within large diameter stands. The other eastern soft hardwoods species group, which includes American and slippery elm, had the highest mortality, followed by the other red oaks (e.g., black and shingle oak) and select white oaks (e.g., white oak) (Fig. 31). Since 2010, mortality has increased in the other red oaks and select white oaks species groups. Mortality-to-volume ratios remained fairly consistent between 2010 and 2015; however, mortality rates increased for shingle oak and white oak, and decreased for red maple (Fig. 32).

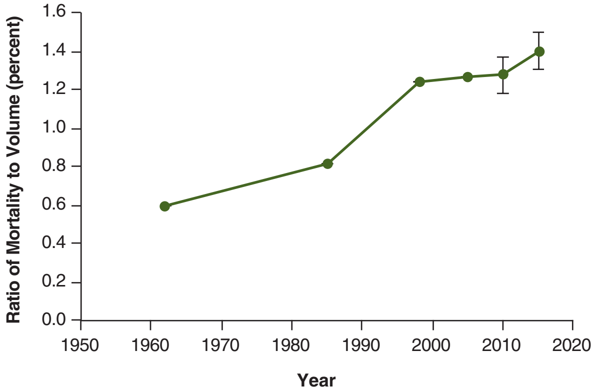


Figure 30.—Average annual mortality of growing stock as a percentage of total growing-stock volume on timberland by inventory year, Illinois. Error bars represent a 68-percent confidence interval.

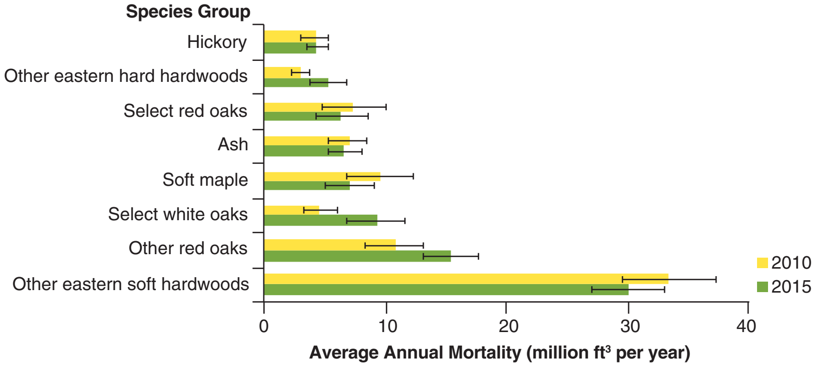


Figure 31.—Average annual mortality of growing stock on timberland for the eight species groups with the highest mortality in 2015, Illinois. Error bars represent a 68 percent confidence interval.

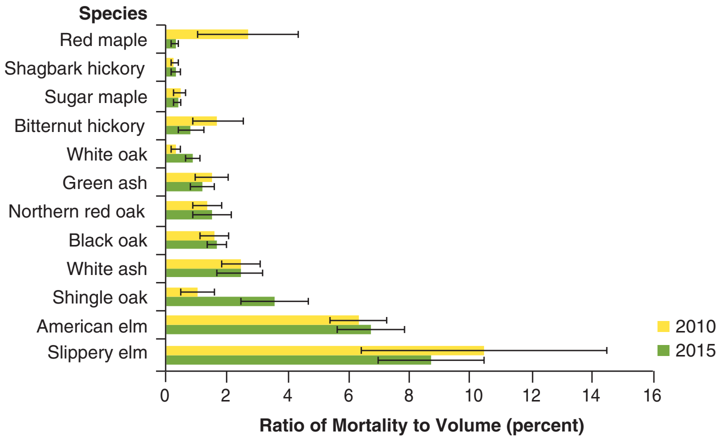


Figure 32.—Average annual mortality of growing stock as a percentage of total growing-stock volume on timberland for 12 selected species by inventory year, Illinois. Error bars represent a 68-percent confidence interval.

What this means

Although mortality is a natural process in forest stands as they develop and change over time, the steadily increasing mortality rate and high mortality in large diameter stands are indicative of a maturing forest resource. High mortality of elm species, shingle oak, and white ash indicate a yearly loss greater than 2 percent of statewide volume. Ash mortality likely reflects emerald ash borer activity. As tree mortality is a crucial component of overall forest health, continued monitoring will help to identify future areas of concern.

Tree Removals

Background

One way to analyze forest sustainability is to assess change in tree volume as a result of removals. Removals include harvested trees and trees lost due to a change in land use, in other words, living trees previously on land classified as forest land now on land classified as nonforest land. Changes in the quantity of growing stock removed help to identify trends in land-use change and forest management. Because removals are usually 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 previous and current inventories.

What we found

The ratio of growing-stock removals to volume has declined since 1982 and the statewide removals rate is 0.5 percent (Fig. 33). Growing stock is currently removed from timberland at an average of 53.9 million cubic feet per year; of this, 26 percent of removals occurred as a result of a change in land use. Total removals were highest in the other red oaks, select white oaks, soft maple, and hickory species groups (Fig. 34). Although removals of hickory and hard maple have increased since 2010, removals of other eastern soft hardwoods have decreased. Removals-to-volume ratios increased for many species, including bigtooth aspen, red maple, sugar maple, and shagbark hickory (Fig. 35).

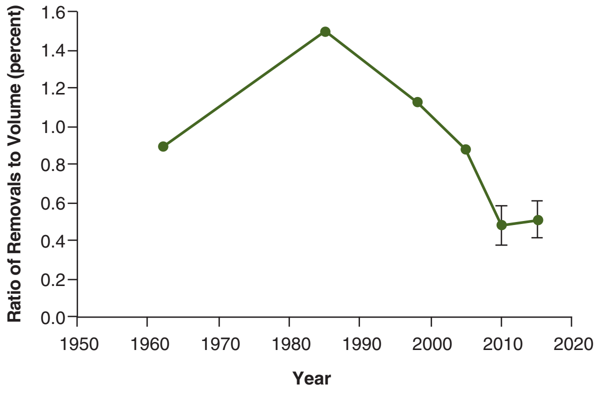


Figure 33.—Average annual removals of growing stock as a percentage of total growing-stock volume on timberland by inventory year, Illinois. Error bars represent a 68 percent confidence interval.

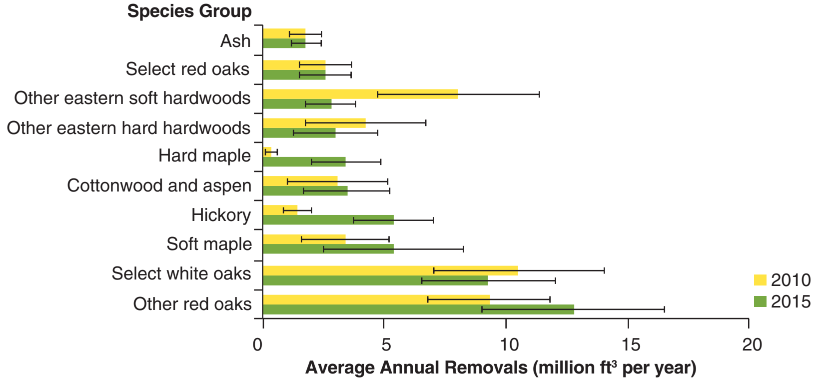


Figure 34.—Average annual removals of growing stock on timberland for the 10 species groups with the highest removals in 2015, Illinois. Error bars represent a 68 percent confidence interval.

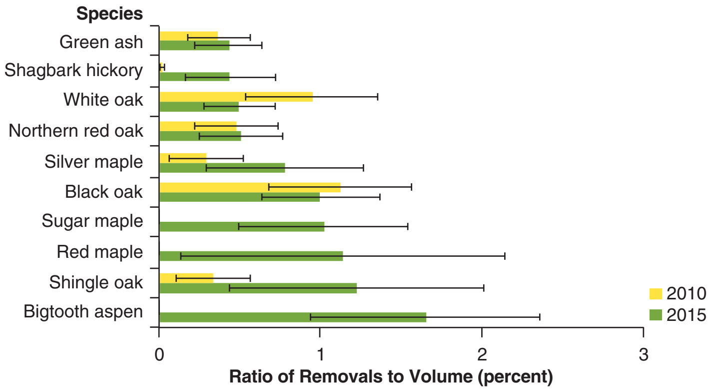


Figure 35.—Average annual removals of growing stock as a percentage of total growing-stock volume on timberland for 10 selected species by inventory year, Illinois. Error bars represent a 68 percent confidence interval.

What this means

Removals rates are indicative of both harvest and land-use change. The rate of removals (0.5 percent) is far less than mortality (1.4 percent). On the other hand, the rate of growth averages 1.9 percent, exceeding both removals and mortality. From a statewide perspective, removals appear to be in balance with forest growth and mortality, such that total volumes continue to increase. However, this may not be the case at smaller scales (e.g., county) or for specific species. In these cases, removals rates should be monitored and evaluated on a case-by-case basis.

Forest Health Indicators

Tornado damage on white oak. Photo by Paul Deizman, Illinois Department of Natural Resources, used with permission.

Down Woody Materials

Background

Down woody materials, in the form of fallen trees and shed branches, fulfill a critical ecological niche in the forests of Illinois. These materials provide valuable wildlife habitat, structural diversity, tree regeneration substrate, and a store of carbon/biomass. They also contribute to forest fire hazards via surface woody fuels. Down woody materials include fine woody debris (diameter less than 3 inches), coarse woody debris (diameter greater than or equal to 3 inches), and woody piles remaining from harvests.

What we found

The total carbon stored in down woody materials on Illinois forest land exceeds 50.3 million tons (Fig. 36). Down woody debris carbon is irregularly distributed by stand-age class with 61- to 80-year-old stands having the highest total carbon (37.0 million tons). The down dead wood biomass across the State is dominated by piles at about 66.1 million tons, representing nearly 66 percent of statewide totals (Fig. 37). The total volume of coarse woody debris is highest in the private ownership category at 1.6 billion cubic feet, followed by the Shawnee National Forest at 278.1 million cubic feet. As a per acre estimate, however, the Shawnee National Forest contains the largest amount of coarse woody volume (903 cubic feet per acre) (Fig. 38).

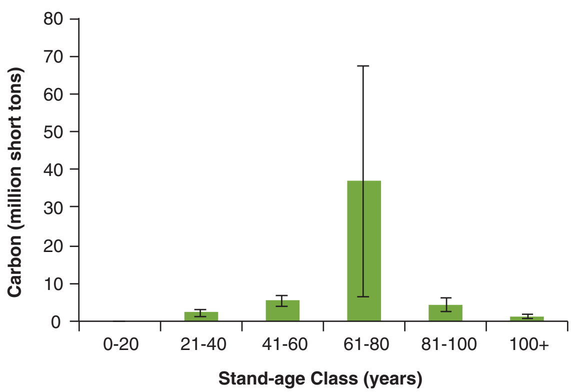


Figure 36.—Carbon in down woody materials by stand-age class on forest land in Illinois, 2012-2015. Error bars represent a 68 percent confidence interval.

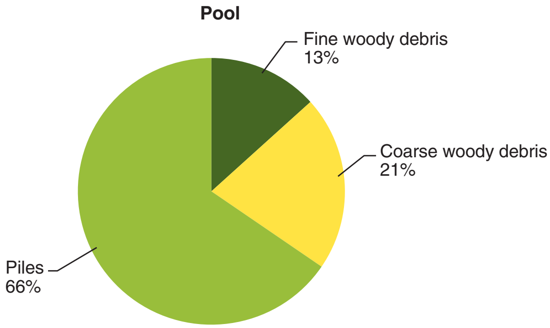


Figure 37.—Proportion of down woody biomass on forest land by dead wood component, Illinois, 2012-2015.

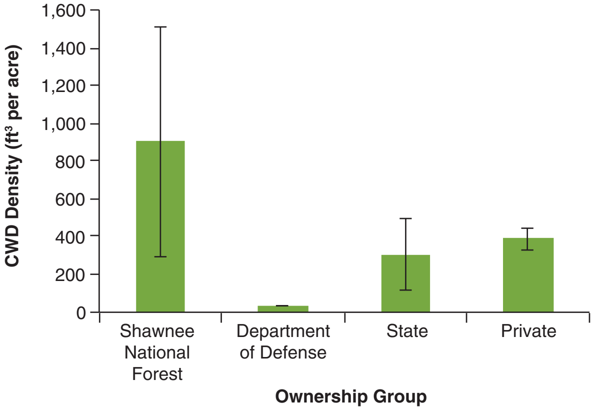


Figure 38.—Total volume of coarse woody debris (CWD) per acre of forest land by ownership group, Illinois, 2012-2015. Error bars represent a 68 percent confidence interval.

What this means

Although carbon stocks of down woody materials are small compared to those of soils and standing live biomass statewide, they are a critical component of the carbon cycle, serving as a transitional stage between live biomass and other detrital pools such as litter. Beyond transition of dead wood carbon to other pools, these carbon stocks may be reduced due to increased rates of decay if future temperature and precipitation patterns change (Russell et al. 2014a, 2014b). This is an important consideration because of the reduced amount of coarse woody debris in Illinois. The loss of dead wood carbon stocks could mean the reduction of other pools in the future in addition to greater challenges to forest management systems that rely on natural regeneration. Considering that the vast majority of coarse woody debris volume is estimated to be in private ownership, management of Illinois' private forests may affect the future of down woody material contributions to statewide forest carbon stocks and wildlife habitat (i.e., stand structure).

Tree Damage and Crown Health

Background

Tree damage is assessed for all trees with a d.b.h. of 5.0 inches or greater (U.S. Forest Service 2013). Up to three of the following types of damage can be recorded: insect damage, cankers, decay, fire, animal damage, weather, and logging damage. In general, a recorded damage is likely to: (1) prevent the tree from surviving more than 1 to 2 years, (2) reduce the growth of the tree in the near term, or (3) negatively affect a tree's marketable products. If there are more than three damage agents observed, the most important ones are recorded based on the preceding list of impacts (i.e., agents threatening survival are more important than agents that reduce wood quality). In general, agents that affect the roots or bole tend to be the most threatening because they have the capacity to affect the entire tree; damage to peripheral parts of the tree may be temporary because leaves, shoots, and reproductive structures can be replaced.

Tree crown condition is influenced by various biotic (e.g., insects, diseases, invasive plants, and animals) and abiotic stressors (e.g., drought, flooding, cold temperatures, nutrient deficiencies, soil moisture and aeration, and pollutants). Crown dieback is defined as recent mortality of branches with fine twigs and reflects the severity of recent stresses on a tree. A crown was labeled as "poor" if crown dieback was greater than 20 percent. This threshold is based on findings by Steinman (2000) that associated crown ratings with tree mortality. Additionally, crown dieback has been shown to be the best crown variable to use for predicting tree survival (Morin et al. 2015).

What we found

Damage was recorded on 29 percent of Illinois trees, but there was considerable variation between species (Fig. 39). The most frequent damage on all species was decay (12 percent), which ranged from 5 percent on American elm to 21 percent on silver maple. Weather damage was observed on 8 percent of silver maple trees; the occurrence of all other injury types was very low (Fig. 39).

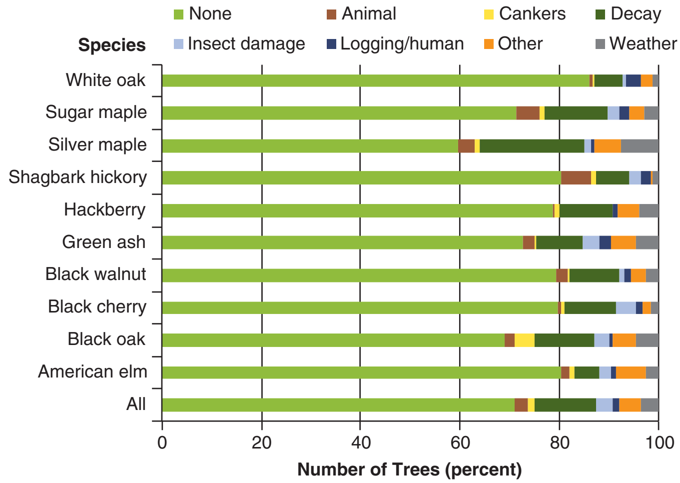


Figure 39.—Percentage of trees with damage by species and damage type, Illinois, 2015.

The incidence of poor crown condition is somewhat common across Illinois (Fig. 40). While plots containing less than 20 percent of basal area with poor crowns are distributed across the State, plots with greater than 20 percent of poor crown basal area are typically located in sparsely forested areas. Silver maple and green ash have the highest percentage of basal area with poor crowns (11 percent and 10 percent, respectively); all other species have less than 6 percent (Table 1). For silver maple, the proportion of basal area with poor crowns increased substantially since 2010. Mean crown dieback ranges from 3 percent for black walnut to 9 percent for green ash (Table 2).

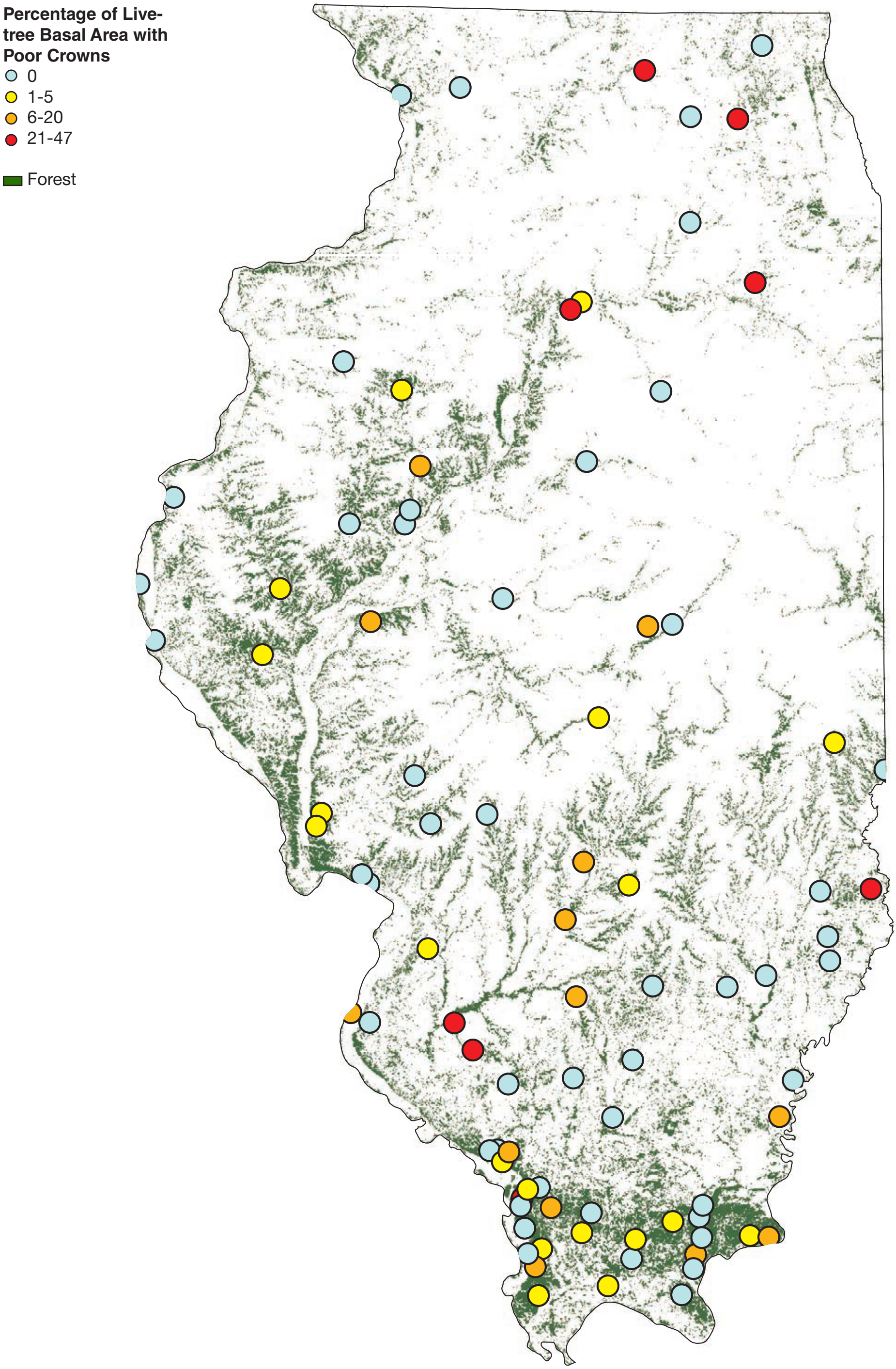


Figure 40.—Distribution of plots by percentage of live-tree basal area with poor crowns, Illinois, 2015. Depicted plot locations are approximate.

Table 1.—Percentage of live-tree basal area with poor crowns for 10 selected species by inventory year, Illinois

Species	Percentage of Live-tree Basal Area with Poor Crowns 2010	2015
Silver maple	2.3	11.0
Green ash	8.4	10.4
Black oak	0.6	5.5
Hackberry	4.1	2.6
American elm	4.2	2.3
White oak	3.0	2.2
Black walnut	0.0	1.8
Black cherry	2.8	1.8
Sugar maple	0.2	0.9
Shagbark hickory	3.7	0.3

Table 2.—Mean crown dieback and other statistics for live trees (5-inch d.b.h. or greater) on forest land by species, Illinois, 2015

Species	Trees	Mean	SE	Minimum	Median	Maximum
	number	---------------------------- *percent* ----------------------------				
Green ash	90	8.7	1.7	0	5	95
Black oak	65	7.1	1.5	0	5	99
Silver maple	83	7.0	1.5	0	5	80
White oak	105	6.5	1.0	0	5	80
American elm	76	5.4	1.3	0	5	99
Hackberry	64	5.3	1.5	0	5	99
Sugar maple	110	4.7	0.8	0	5	60
Black cherry	63	4.2	0.7	0	5	40
Shagbark hickory	32	3.6	1.3	0	0	40
Black walnut	34	2.9	0.8	0	0	20

What this means

Overall, Illinois' trees are generally in good health. As in most eastern forests, decay is the most commonly observed damage across the State. This is not unusual given that the majority of Illinois' forests are large diameter stands composed of mature trees. High occurrence of unhealthy crowns in green ash may be due to emerald ash borer activity. In silver maple, the high occurrence of rot/decay and weather damage is likely related to its brittle wood.

Fragmentation and Urbanization of Forest Land

Background

Forest fragmentation is the process by which contiguous tracts of forest land are broken down into smaller, more isolated forest patches that are surrounded by nonforest land uses, such as urban development or agriculture (Wilcox and Murphy 1985). This results in a reduction of continuous or core forest land and an increase in edge habitat. Fragmentation often has negative effects, including the loss of wildlife habitat and biodiversity, and the increased prevalence of invasive species (Honnay et al. 2005). To compare changing forest conditions and the degree of fragmentation across the landscape, an adaptation of the spatial integrity index (SII) developed by Kapos et al. (2000) was used to create a single fragmentation metric that integrates measures of patch size, local forest density, and patch connectivity[1]. SII classes range from core forest to unconnected forest fragments (Fig. 41). Forest parcels that did not meet the definition of core forest or unconnected forest fragment were scaled into low, medium, and high integrity classes.

Urbanization is a major cause of fragmentation, particularly when housing development occurs in or near forest land (Radeloff et al. 2005). Because the SII is calculated using forest canopy data and does not consider underlying housing density or proximity to roads, parcels identified as core forest may not represent completely intact forest conditions. The zone where undeveloped wildland vegetation intermingles with human development (with at least one house per 40 acres) is called the wildland-urban interface (WUI). Not only does housing development that takes place in the WUI contribute to the effects of fragmentation, but homes and structures built within the WUI face significant risk from wildfire (Radeloff et al. 2005). Additionally, roads are a major contributor to fragmentation as they have cumulative ecological impacts, including hydrological, chemical, and sediment effects; vectoring invasive species; facilitating human access; habitat fragmentation; and wildlife mortality (Riitters and Wickham 2003).

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[1] Riemann, R. Adaptation of a spatial integrity index to 30 m and 250 m scales, and its application across the northeastern United States. Unpublished paper on file at U.S. Forest Service, Northern Research Station, Forest Inventory and Analysis Program, Troy, NY.

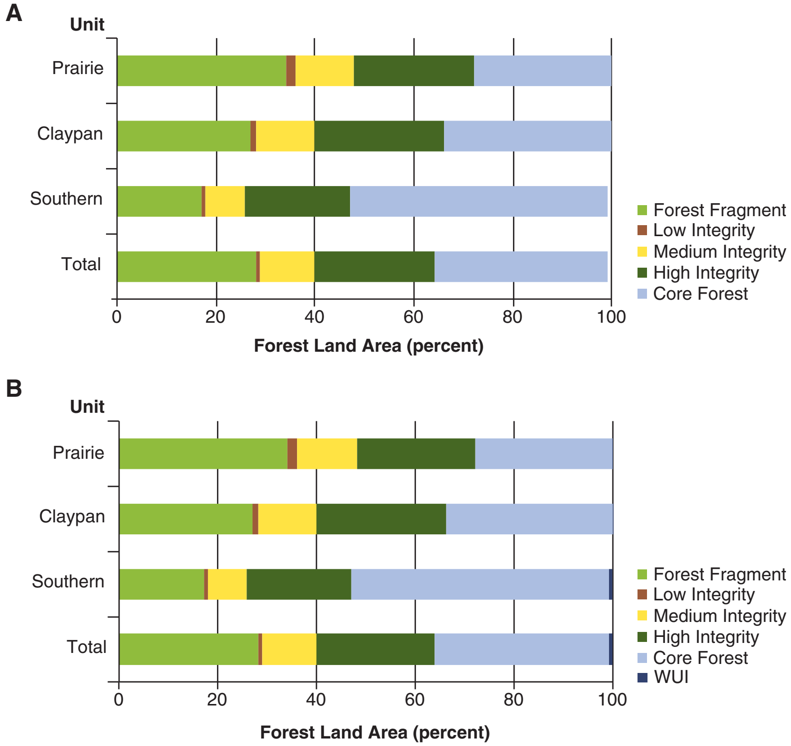

Figure 41.—Forest land by spatial integrity class and unit, without (A) and with (B) the wildland-urban interface (WUI), Illinois, 2006.

What we found

Core forest conditions, which represent 35 percent of forest area, make up the largest percentage of Illinois' forest land (Figs. 41 and 42). Twenty-four percent of forest area has high spatial integrity, 28 percent is in unconnected fragments, and 12 percent has medium or low integrity. Forest connectivity is highest in the Southern unit, particularly within the Shawnee National Forest (Fig. 42).

The area of WUI is slowly growing, increasing from 7 percent in 1990 to 9 percent in 2010. WUI areas are primarily clustered around major cities, including Chicago, Peoria, Mount Vernon, and St. Louis, MO, and the Shawnee National Forest (Fig. 43). When the area of WUI is combined with the SII estimates, the proportion of core forest land decreases from 35 percent to 32 percent statewide (Fig. 41). Roads intersect with forest land across Illinois (U.S. Census Bureau 2001); 39 percent of forest area in the Claypan unit was within 650 feet of a road, followed by 38 percent in the Prairie unit, and 34 percent in the Southern unit (Table 3).

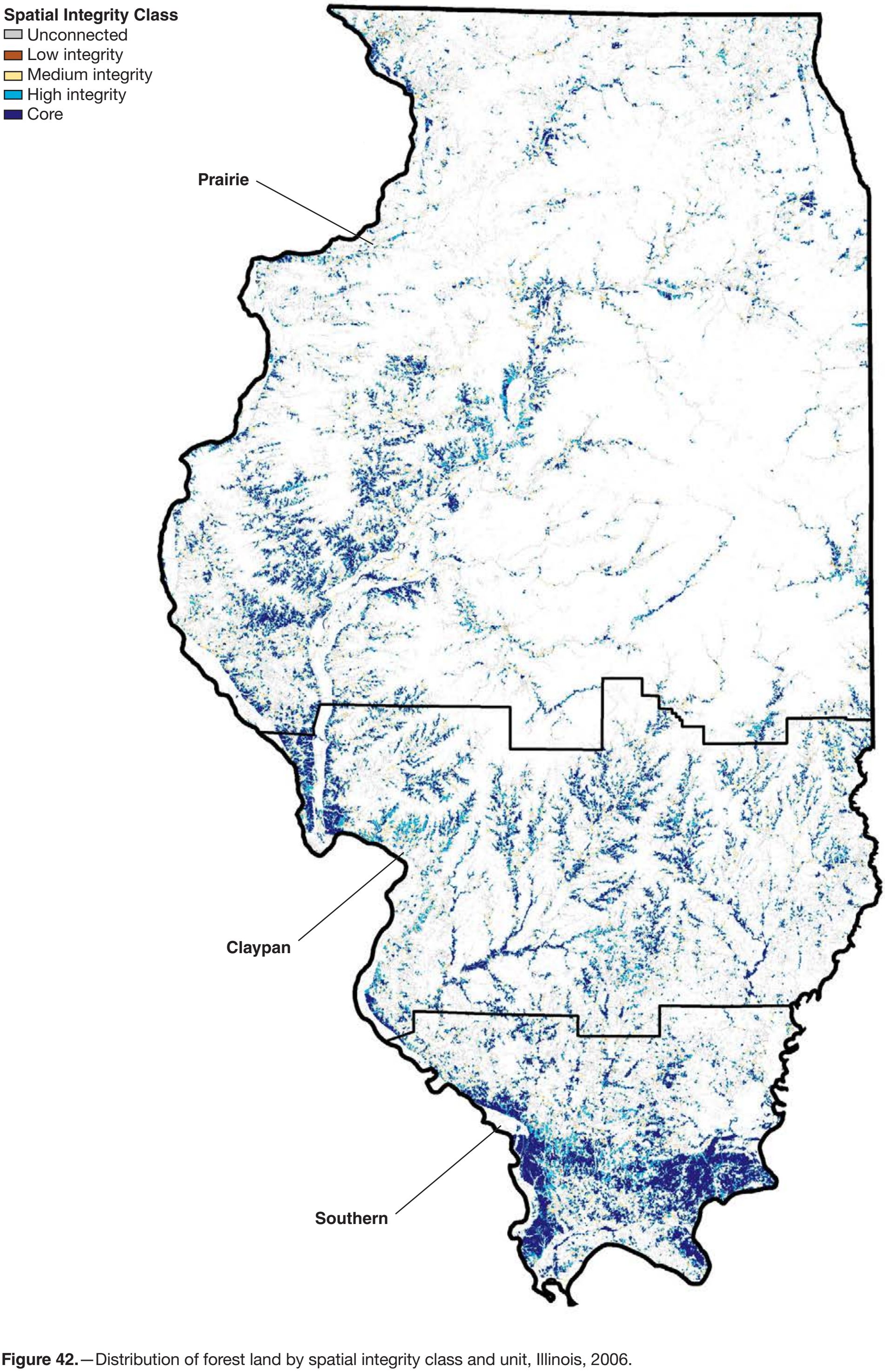

Figure 42.—Distribution of forest land by spatial integrity class and unit, Illinois, 2006.

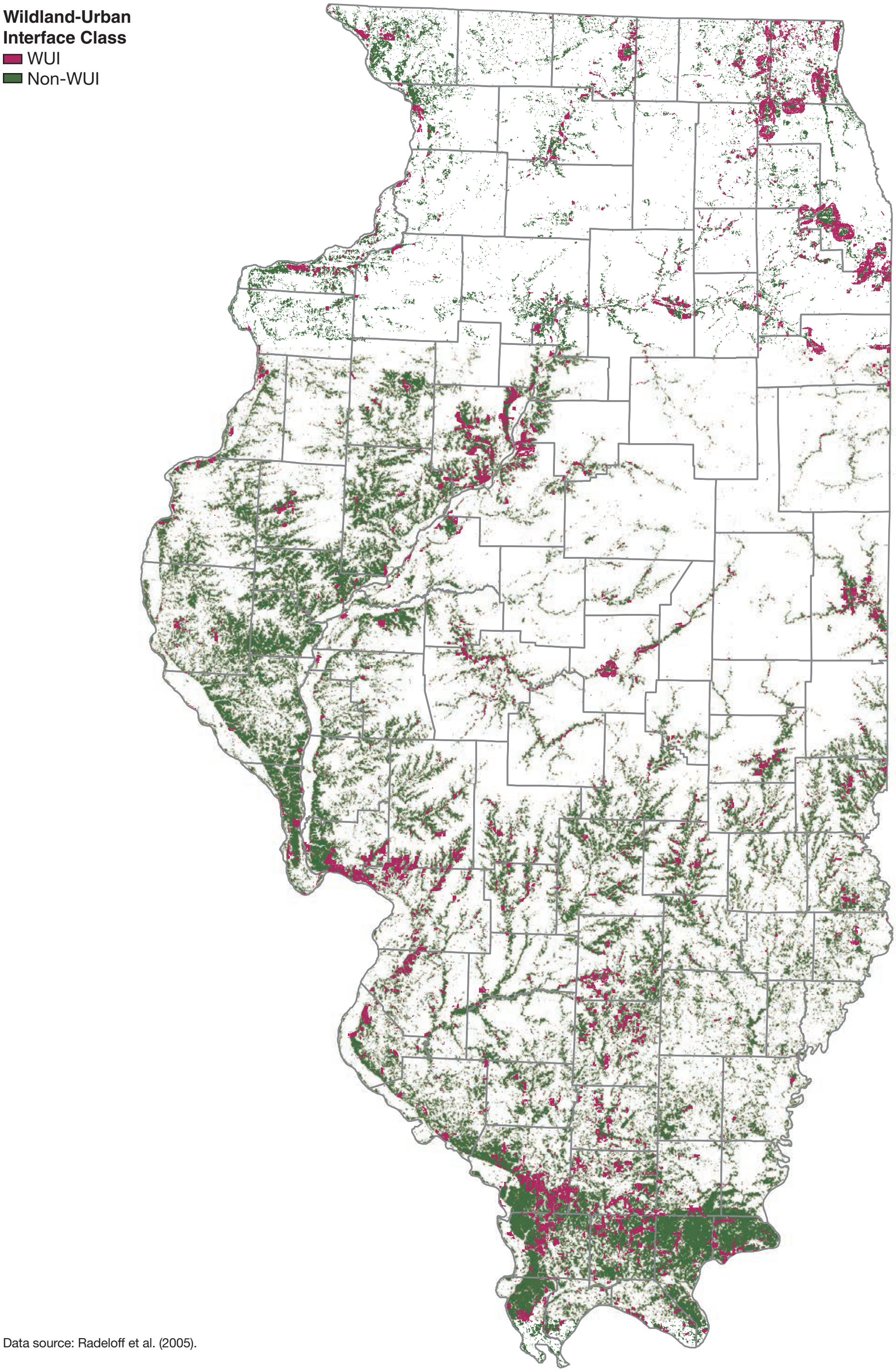

Figure 43.—Distribution of forest land by wildland-urban interface status, Illinois, 2009.

Table 3.—Area of forest land by urbanization/fragmentation category and unit, Illinois

Unit	Area of forest land[a] (percent)	Area of forest land in WUI[b] (percent)	Area of forest land <650 ft from a road[c] (percent)
Prairie	10	8	38
Claypan	20	8	39
Southern	34	10	34
Illinois	17	9	37

[a] The estimate of forest area is derived from NLCD 2011 (Homer et al. 2015).

[b] Wildland-urban interface (WUI) data are from Radeloff et al. (2005).

[c] Road density data are from Census 2000 (U.S. Census Bureau 2001).

What this means

Fragmentation and urbanization continue to influence the function and health of Illinois' forests. Rising population and housing density, particularly with increases in the number of second homes and expansion in suburban rings, in rural areas, and within the WUI, will increase the pressures on forest land. Continued development will further fragment existing forest land and result in long-term or permanent loss of forest habitat, elevated risk of invasion by nonnative species, and reductions in native species diversity.

Forest Insects

Background

Emerald ash borer.—Emerald ash borer (*Agrilus planipennis;* EAB) was first detected in northeastern Illinois in 2006; however, it was likely to have been present in the State for 3 to 5 years prior. Although EAB shows some preference for stressed trees, all trees 1 inch in diameter or greater are susceptible regardless of vigor (Herms and McCullough 2014). **Gypsy moth.**—European gypsy moth (*Lymantria dispar*) was first detected in Lake County, IL in 2000. As of yet, very little defoliation has occurred in the State. To quantify the potential impacts of gypsy moth defoliation, tree species were split into preferred and nonpreferred suitability classes based on field and laboratory tests by Liebhold et al. (1995). Species in suitability class 1 were considered preferred and all others were considered nonpreferred.

What we found

Emerald ash borer.—Five species of ash (green, white, pumpkin, blue, and black ash) are present in Illinois, comprising an estimated 146.2 million ash trees (greater than or equal to 1-inch diameter) on forest land. Green ash is the most abundant ash species (64 percent), followed by white ash (33 percent). Approximately 67 percent of green ash volume is found in riparian and hydric physiographic classes. Average annual mortality of ash on forest land is an estimated 10.2 million cubic feet, a 24 percent increase since 2010. Counties with the highest ash mortality are concentrated in northeastern Illinois, where EAB has been present the longest (Fig. 44). **Gypsy moth.**—About 42 percent of Illinois' live-tree volume is preferred by gypsy moth. Oaks and sweetgum are the most abundant preferred species in the State. Most forest land in Illinois has a relatively high density of species that gypsy moth prefers (Fig. 45).

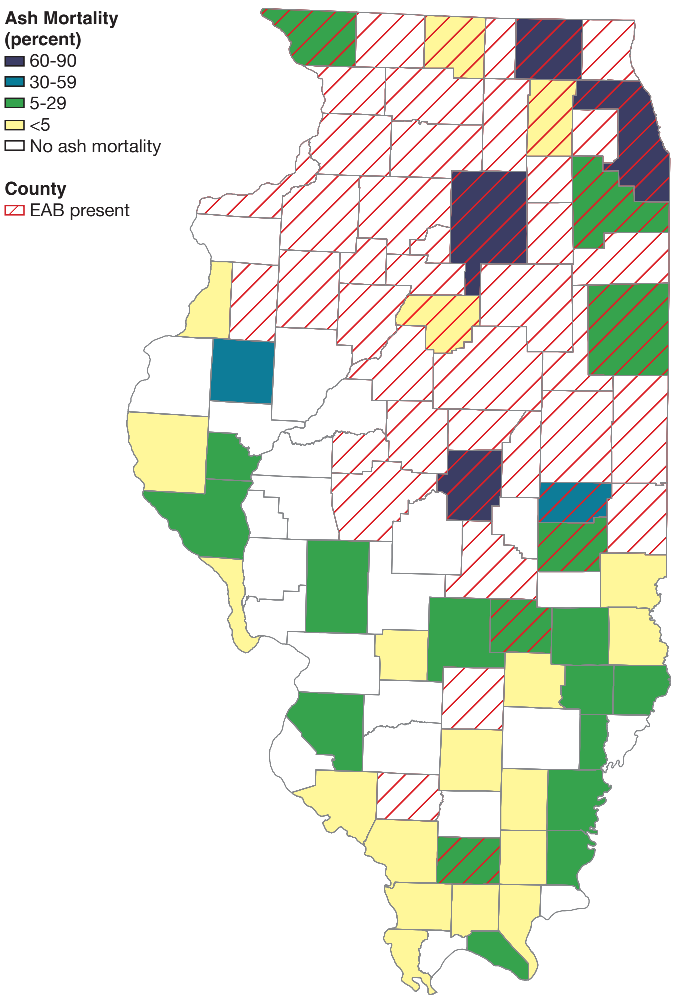

Figure 44.—Ash mortality expressed as a percentage of total tree mortality on forest land by county, Illinois.

Figure 45.—Density of host trees preferred by gypsy moth on forest land, Illinois, 2009.

What this means

Emerald ash borer.—Extensive ash mortality throughout the eastern United States makes EAB a significant threat to the ash resource in Illinois. Mortality of ash is expected to increase as EAB persists and spreads. The loss of ash in forested ecosystems will affect species composition and alter community dynamics. Additionally, the abundance of ash in riparian areas throughout the State will particularly affect soil stability, and water temperature and quality. Continued monitoring will help to identify the long-term impacts of EAB in forested settings. **Gypsy moth.**—Although gypsy moth has been present in Illinois for more than 15 years, outbreaks that resulted in defoliation have been uncommon. The Illinois Department of Agriculture has a comprehensive suppression program to reduce the impacts of gypsy moth which includes aerial spray treatments when gypsy moth population cycles peak.

Invasive Plants

Background

Invasive plant species (IPS), native and nonnative species that can cause negative ecological effects, are becoming more prevalent in forest ecosystems. Their abundance in introduced environments can be attributed to high adaptability, the availability of disturbed habitats, or a lack of natural enemies, which allows them to outcompete and displace native species (Pimentel et al. 2005). IPS are a concern because they can form dense monocultures that alter natural plant communities and processes, threaten biodiversity, and contribute to a decrease in sustainability, productivity, and wildlife habitat quality. Inspection, management, and mitigation of IPS cost billions of dollars annually.

During the 2015 inventory, 166 forested P2 invasive plots in Illinois were monitored for the presence of 39 IPS and one undifferentiated genus (nonnative bush honeysuckles) as part of the regional invasive plant monitoring protocol (Appendix 2).

What we found

Eighty-six percent of all plots contained invasive plants; on these plots, 17 species were observed (Table 4). As many as 10 IPS were found per plot. The most commonly observed species was multiflora rose (67 percent of plots), followed by the nonnative bush honeysuckles (46 percent of plots). Both species are distributed throughout

Illinois (Figs. 46 and 47). In comparison to neighboring states, Illinois had fewer IPS than Indiana, where 25 different species were recorded, and more IPS than Iowa, where 15 species were recorded. Since 2010, multiflora rose remained the most commonly observed invasive species. While all species found in 2015 were present in 2010, Russian-olive, bull thistle, glossy buckthorn, ailanthus, and European privet, present in 2010, were not found in 2015.

Table 4.—Number of occurrences and percentage of plots containing invasive plant species by species, Illinois, 2015

Name	Occurrences	Percentage of plots
Multiflora rose	111	66.9
Nonnative bush honeysuckles	77	46.4
Japanese honeysuckle	60	36.1
Garlic mustard	35	21.1
Autumn-olive	31	18.7
Reed canarygrass	14	8.4
Common buckthorn	12	7.2
Black locust	9	5.4
Nepalese browntop	7	4.2
Oriental bittersweet	7	4.2
Creeping jenny	5	3.0
European cranberrybush	5	3.0
Japanese barberry	5	3.0
Dames rocket	2	1.2
Siberian elm	2	1.2
Canada thistle	1	0.6
Norway maple	1	0.6

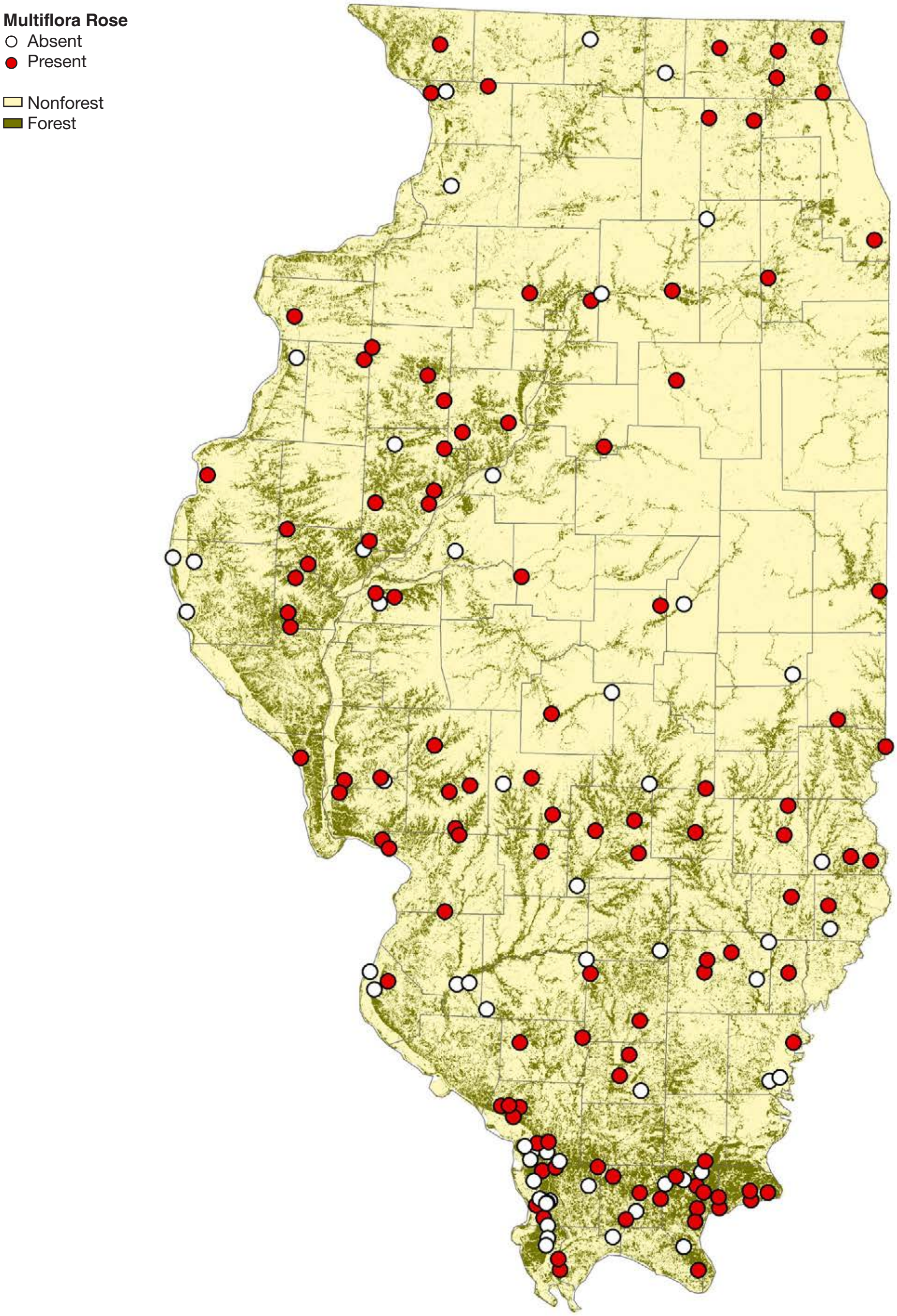

Figure 46.—Distribution of multiflora rose by plot, Illinois, 2015. Depicted plot locations are approximate.

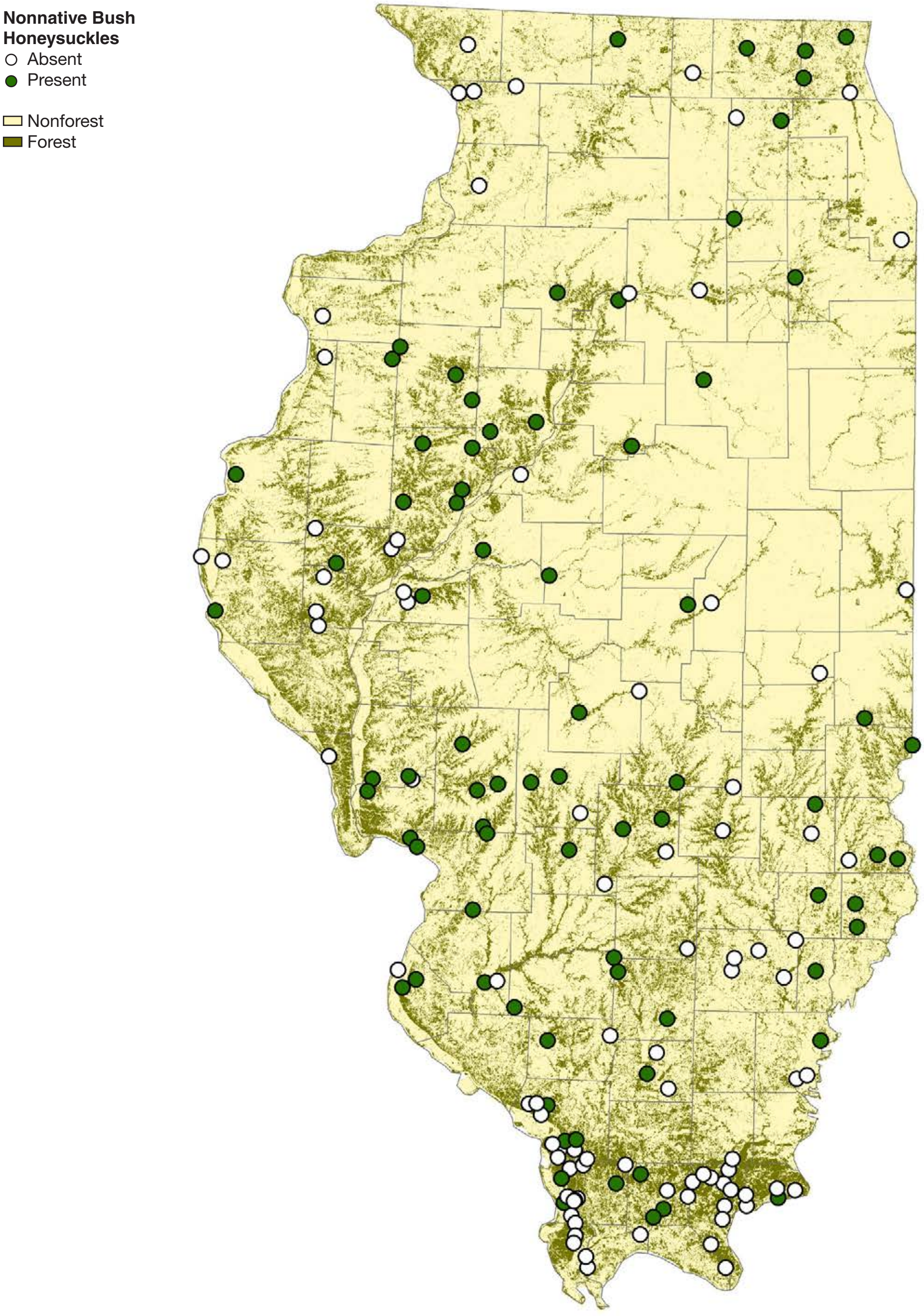

Figure 47.—Distribution of nonnative bush honeysuckles by plot, Illinois, 2015. Depicted plot locations are approximate.

What this means

The presence of IPS within Illinois' forests is troublesome, and it is important that these species are monitored over time to ensure that managers and the public are aware of their occurrence and spread. Further investigation of inventory data may help to reveal influential site and regional trends as well as how the forest changes in response to changes in the plant community.

Forest Age and Size

Background

Forests provide habitat for many species of birds, mammals, amphibians, and reptiles. Forest composition and structure affect the suitability of habitat for each species. Some species depend on early successional forests or the ecotone (edge) between different forest stages. Yet other species require old-growth forests or interior forests. Many species require multiple structural stages of forests to meet different phases of their life history needs. Species (and habitats) of Greatest Conservation Need (SGCN) are listed in Illinois' Wildlife Action Plan (WAP) (Illinois Department of Natural Resources 2005). Species representative of various habitats include: (1) forest—broad-winged hawk (*Buteo platypterus*), wood thrush (*Hylocichla mustelina*); (2) bottomland forest—red-shouldered hawk (*Buteo lineatus*); riparian forest—Indiana bat (*Myotis sodalis*); (3) successional forest—whip-poor-will (*Caprimulgus vociferus*), gray fox (*Urocyon cinereoargenteus*); (4) forest ecotones—bobcat (*Lynx rufus*); and (5) savanna—red-headed woodpecker (*Melanerpes erythrocephalus*). Abundance and trends in these structural and successional stages serve as indicators of population carrying capacity for wildlife species (Hunter et al. 2001).

What we found

The majority of Illinois timberland is made up of large diameter stands (76 percent); 15 percent of stands are medium diameter stand-size and 8 percent are small diameter (Fig. 48). Since 1985, the abundance of timberland in the youngest age classes (0 to 20, 21 to 40 years) and in the oldest age classes (81 to 100, 100+ years) has decreased, while intermediate age classes (41 to 80 years) have increased (Fig. 49). The large diameter forests are found in all age classes, though they are predominantly 41 to 80 years old (Fig. 50). In contrast, the medium stand-size class includes five age classes and is dominated by forests 21 to 60 years of age. The majority of the small diameter class is less than 20 years old.

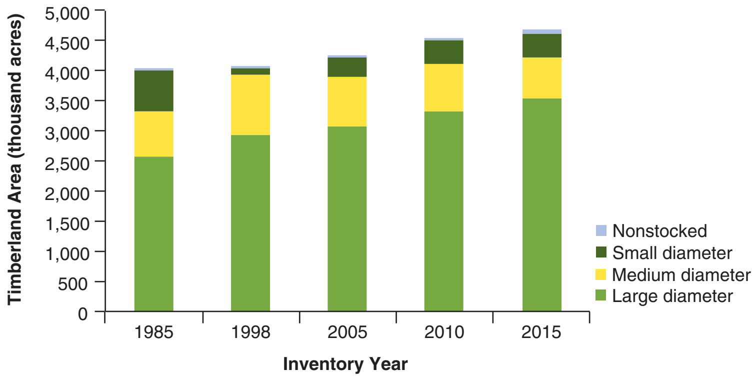

Figure 48.—Area of timberland by stand-size class and inventory year, Illinois.

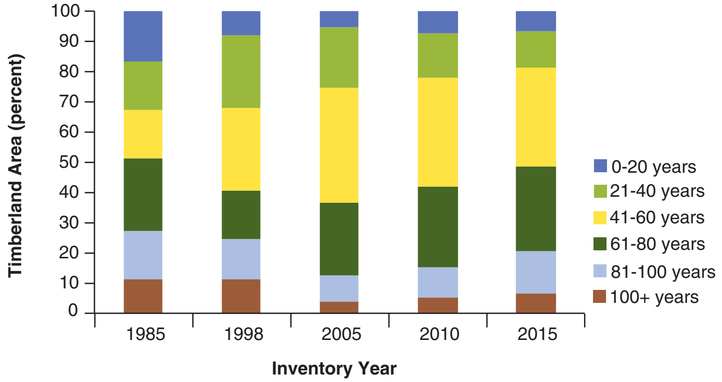

Figure 49.—Area of timberland by stand-age class and inventory year, Illinois.

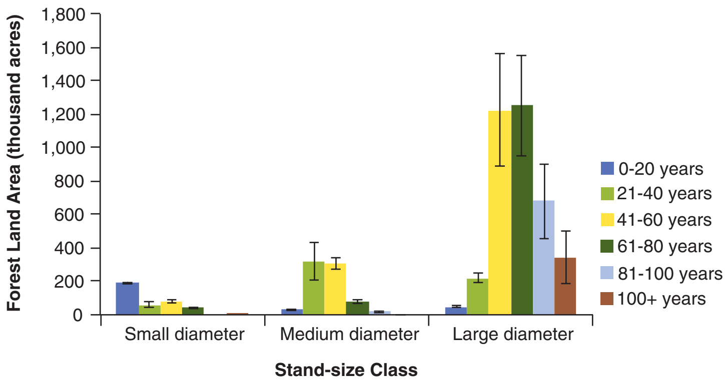

Figure 50.—Area of forest land by stand-age class and stand-size class, Illinois, 2015. Error bars represent a 68 percent confidence interval.

What this means

Stand size and stand age are indicators of forest structural/successional stage. The smallest stand-size class and youngest age class (0 to 20 years) are consistent with one another, but stands become progressively more heterogeneous as they become larger and older. Such mixtures of different aged or sized trees provide a vertical diversity of vegetation structure that can enhance habitat conditions for some species. Managing forest conditions in both younger and older age classes (and smaller and larger structural stages) to maintain both early and late successional habitats for a diversity of forest-associated species may conserve habitat and viable populations of many forest-associated wildlife species.

Standing Dead Trees

Background

Specific habitat features like nesting cavities and standing dead trees (5-inch d.b.h. or greater) provide critical habitat components for many forest-associated wildlife species. Standing dead trees that are large enough to meet habitat requirements for wildlife are referred to as "snags." When considered for the purpose of wildlife habitat, snags are generally defined as being 10 inches d.b.h. or greater with a minimum height of 6 feet (Helms 1998). Standing dead trees serve as important indicators of wildlife habitat, past mortality events, and carbon storage. Further, they serve as sources of down woody materials, which also provide habitat features for wildlife. The number and density of standing dead trees, together with decay classes, species, and sizes, define an important wildlife habitat feature across Illinois' forests.

What we found

Illinois forest land contained an estimated 65.3 million standing dead trees (5-inch d.b.h. or greater) in 2015; this represents a 16 percent increase since 2010. This equates to an overall density of 13 standing dead trees per acre of forest land, with slightly higher densities on public than on private ownership classes (16 and 13 standing dead trees per acre, respectively). The density of standing dead trees per acre was lower on timberland than on reserved forest and other forest land (13, 16, and 23 standing dead trees per acre, respectively). Eleven species groups contributed more than 1 million standing dead trees; the top four groups had more than 5 million standing dead trees (Fig. 51). The other eastern soft hardwoods species group, which includes American and slippery elm, had the greatest number of standing dead trees (23.6 million standing dead trees), 13.2 million of which were elms.

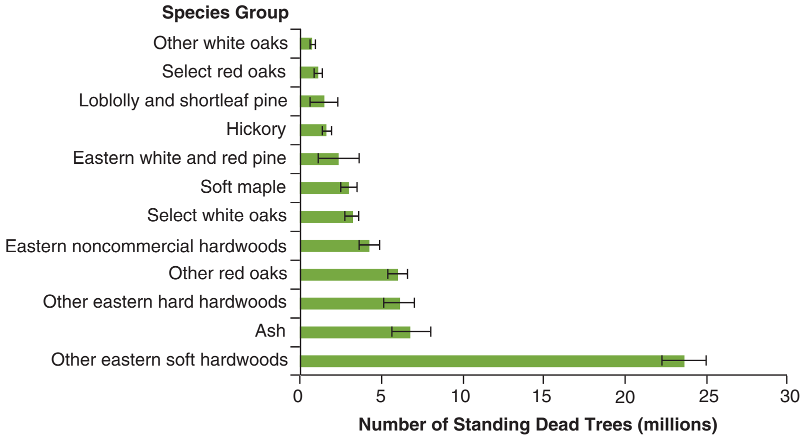

Figure 51.—Number of standing dead trees on forest land for 12 selected species groups, Illinois, 2015. Error bars represent a 68 percent confidence interval.

Statewide, there was an average of 10 standing dead trees per 100 live trees (5-inch d.b.h. or greater). Eight species groups exceeded this threshold; the eastern white and red pine species group had the largest average, with 35 standing dead trees per 100 live trees (Fig. 52). Over 75 percent of standing dead trees were smaller than 11 inches d.b.h.; 37 percent of standing dead trees were between 5 and 6.9 inches d.b.h. Only 6 percent of standing dead trees were 17 inches d.b.h. or larger (Fig. 53); in contrast, 10 percent of live trees exceed this size threshold. The intermediate decay class, "only limb stubs present," comprised 38 percent of all standing dead trees; the class of most decay ("no evidence of branches remains") comprised only 4 percent of standing dead trees (Fig. 53). The other eastern soft hardwoods species group contained the largest total number of standing dead trees.

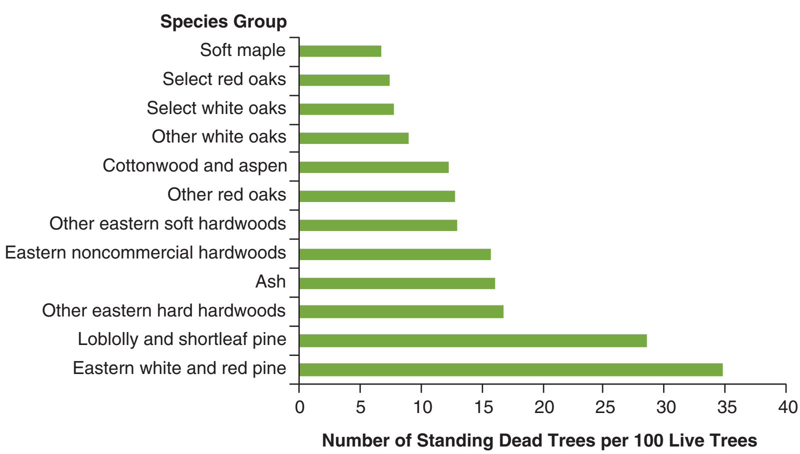

Figure 52.—Number of standing dead trees per 100 live trees on forest land for 12 selected species groups, Illinois, 2015.

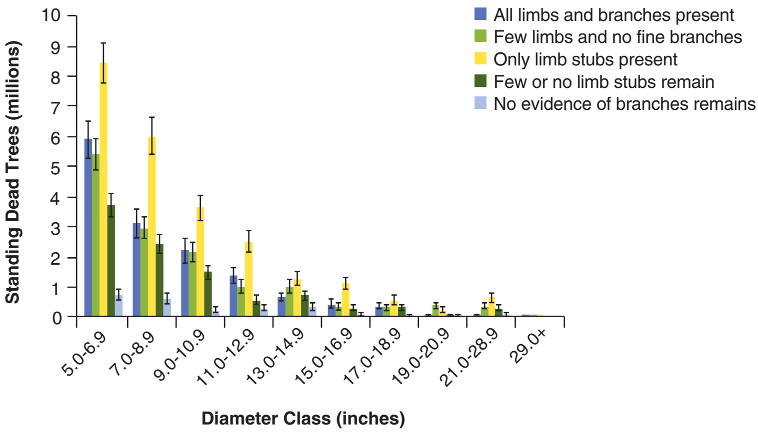

Figure 53.—Number of standing dead trees on forest land by diameter and decay class, Illinois, 2015. Error bars represent a 68 percent confidence interval.

What this means

Snags and smaller standing dead trees result from a variety of potential causes, including diseases, insects, weather damage, fire, flooding, drought, and competition. Dead trees may contain significantly more cavities per tree than live trees (Fan et al. 2003). These cavities provide habitat features for foraging, nesting, roosting, hunting, and excavation for wildlife—from primary colonizers such as insects, bacteria, and fungi to birds, mammals, and reptiles. Providing a variety of forest structural stages and retaining specific features like snags on both private and public lands in Illinois are ways that forest managers maintain the abundance and quality of habitat for forest-associated wildlife species.

Regeneration

Background

The composition and abundance of tree seedlings drive the sustainability of forest ecosystems in the early years of stand development and set the stage for future composition and structure, as well as the viability of timber and ecosystem services provided. Young forests, which support many species of wildlife including the golden-winged warbler (*Vermivora chrysoptera*), American woodcock (*Scolopax minor*), and eastern cottontail (*Sylvilagus floridanus*), are dependent on the condition of seedling regeneration (Gilbart 2012, Wildlife Management Institute 2014). Stressors such as herbivory, invasive plants, insects, diseases, and changing climate, can affect forest condition. As stands mature and undergo replacement, it is imperative to know the condition of the regeneration component, as regeneration affects subsequent forest composition. In most situations, establishing desirable regeneration is the key to replacing stands to meet management objectives.

Between 2012 and 2015, regeneration information was collected for all seedlings less than 1 inch in diameter and at least 2 inches tall on 82 plots in Illinois; measurements include seedling height class and a browse impact assessment for the area surrounding the sample location (McWilliams et al. 2015).

What we found

As Illinois' forests continue to age, young forest is becoming scarce. Since 1985, the area of young forest (0 to 20 years old) decreased from 16 percent to 7 percent, a loss of 360,441 acres. The area of forest 61 years and older remained consistent, while the area of middle-aged forest (21 to 60 years) increased by 44 percent, or 929,258 acres. Oak/hickory was the dominant forest-type group, making up two-thirds of forest land; however, only 4 percent of oak/hickory area is in the youngest age class, a decrease of one-third since 1985. The impact of browse across Illinois is considerable; 80 percent of understory plants had moderate levels of browse and 8 percent had high levels of browse (Fig. 54). Examination of browse impact across the State reveals that samples with moderate and high browse impact appear to be randomly distributed.

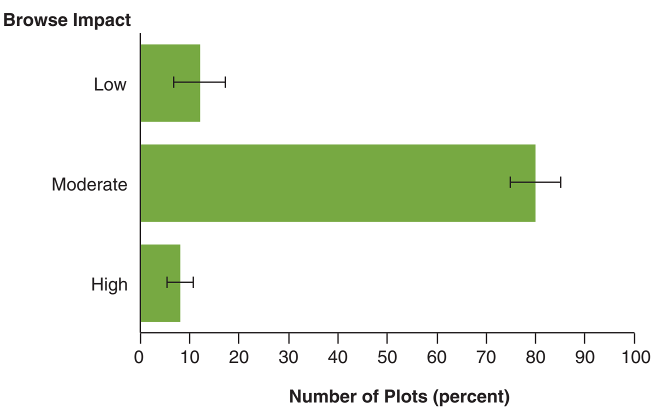

Figure 54.—Browse impact level by plot, Illinois, 2012-2015. Error bars represent a 68 percent confidence interval.

Forest land contains an estimated 20.4 billion seedlings, or 4,377 seedlings per acre. Half of the seedlings are less than 1 foot tall, 42 percent are 1.0 to 4.9 feet, and 8 percent are 5.0 feet and taller (Fig. 55). High seedling densities were most common in southern Illinois. Fifty-four species were identified; hackberry (17 percent), green ash (12 percent), and slippery elm (9 percent) were the most commonly observed (Fig. 56). By genera, ash (20 percent), elm (16 percent), and maple (11 percent) were most abundant. Ash, elm, maple, and the "other" category (largely consisting of understory species), which have relatively high percentages of seedlings and saplings, are prospective gainers in terms of developing future canopy dominant trees (Fig. 57). With little abundance in the seedling and sapling classes, red oak, white oak, and hickories have a smaller pool of trees available to move into the larger diameter classes and are less likely to develop future canopy dominants.

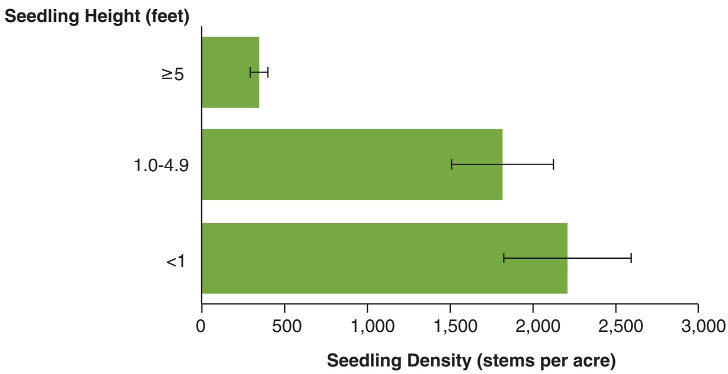

Figure 55.—Seedling density on forest land by height class, Illinois, 2012-2015. Error bars represent a 68 percent confidence interval.

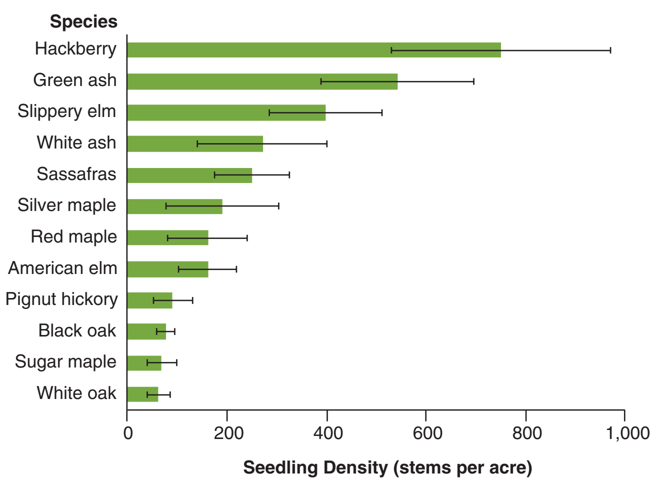

Figure 56.—Average seedling density on forest land for selected species with at least 1 percent of the total number of seedlings, Illinois, 2012-2015. Error bars represent a 68 percent confidence interval.

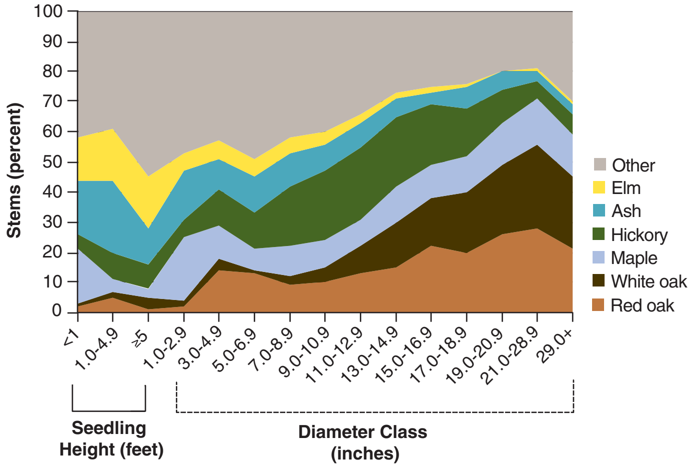

Figure 57.—Number of seedlings, saplings, and dominant/codominant growing-stock trees on forest land for selected species/species groups, Illinois. Seedling estimates are for 2012-2015. Sapling and tree estimates are for 2010-2015. Black walnut, butternut, and pecan are included in hickory species.

What this means

Illinois' forests face a variety of health concerns, including invasive plants, insects and diseases, and fragmentation. Therefore, establishing desired regeneration is an integral factor in maintaining a preferred species composition into the future. While the abundance of ash, elm, maple, and a host of predominantly understory species in the seedling and sapling classes is a reflection of a variation in ecological roles, it is also a sign of changing understory dynamics. Disturbance, particularly from harvesting and fire, promotes oak regeneration. The absence of such disturbance, in addition to an increase in deer browse, has allowed shade-tolerant and moderate moisture requiring species to outcompete understory oaks. Ultimately, the long-term future of oak-dominated forests will depend on management strategies that establish oak seedlings and foster development of saplings (Abrams 1992, Dey 2014).

Forest Economics

Illinois landscape. Photo by Steve Crumley, used with permission.

Growing-stock Volume

Background

Growing-stock volume is the amount of sound wood in live, commercial tree species (5-inch d.b.h. or greater) that is 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 on timberland has risen steadily since 1948 and currently totals an estimated 7.0 billion cubic feet (Fig. 58). Six species groups account for more than two-thirds of growing-stock volume; the other eastern soft hardwoods, which consists mainly of elms, is the largest source of growing-stock volume, followed by select white oaks and other red oaks (Fig. 59). Since 2005, there has been little change in volume among species groups. Growing-stock volume continues to increase in the middle diameter classes (Fig. 60). Correspondingly, median tree diameter grows larger with successive inventories.

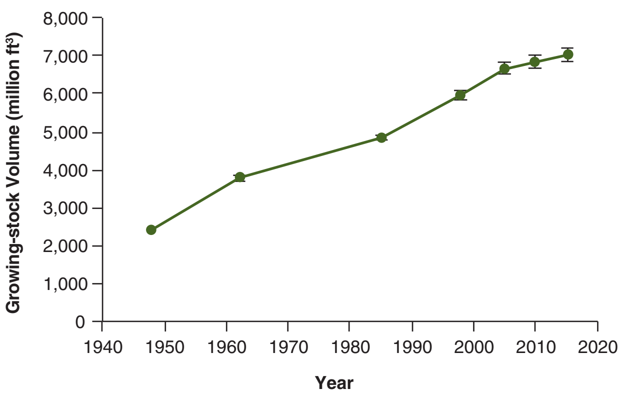

Figure 58.—Growing-stock volume on timberland by inventory year, Illinois.

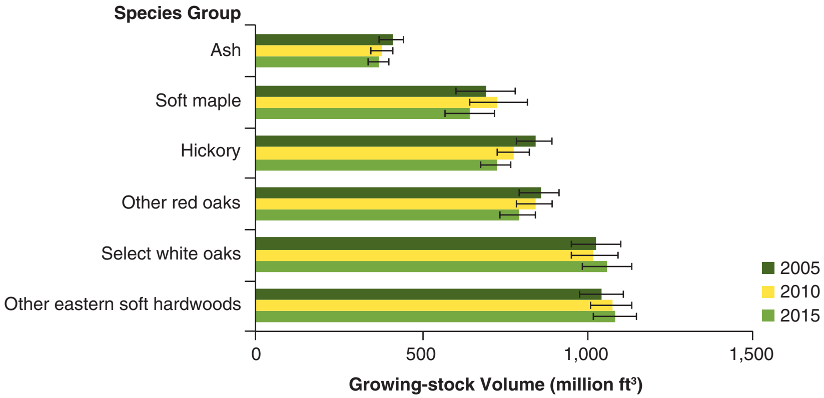

Figure 59.—Growing-stock volume on timberland for the six most voluminous species groups in 2015 by inventory year, Illinois. Error bars represent a 68 percent confidence interval.

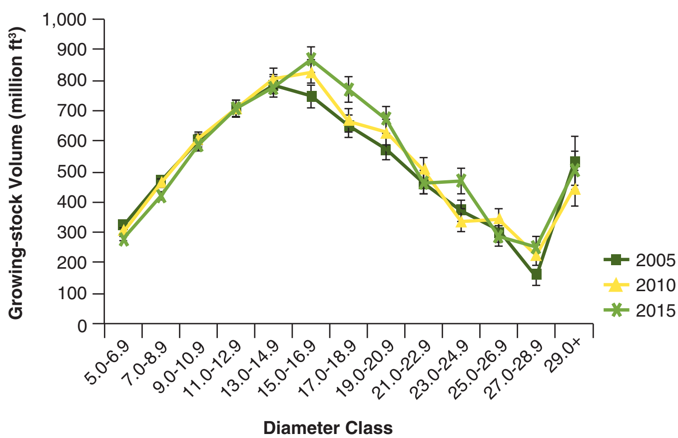

Figure 60.—Growing-stock volume on timberland by diameter class and inventory year, Illinois. Error bars represent a 68 percent confidence interval.

What this means

Even though growing-stock volume continues to rise, the rate of increase may be slowing. Statewide, the increase in growing-stock volume can be attributed to tree growth, moderate mortality of high-volume species, and an aging forest. Illinois' growing-stock volume appears to be stable; however, as stands mature, sustainability issues (e.g., regeneration and oak mortality) should continue to be monitored.

Sawtimber Volume and Quality

Background

Sawtimber trees are live trees of commercial species that contain either one 12-foot log or two noncontiguous 8-foot logs that meet regional specifications for freedom from defect. Hardwoods must be 11 inches d.b.h. or greater and softwoods must be 9 inches d.b.h. or greater 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 the quantity of merchantable wood available.

What we found

The volume of sawtimber on Illinois timberland has more than tripled since 1962, reaching an estimated 27.0 billion board feet in 2015 (Fig. 61). Most species groups had large gains in sawtimber volume since 2010 (Fig. 62). Yellow-poplar had the greatest increase in the amount of sawtimber volume (25 percent), followed by black walnut (19 percent), cottonwood and aspen (18 percent), and the other white oaks (18 percent). In contrast, the volume of hard maple and soft maple sawtimber has decreased since 2010. 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 4, with grade 1 representing the highest quality and grade 4 the lowest. Although the amount of the highest quality Illinois sawtimber (grade 1) has remained consistent over the past decade, there has been an increase in the amount of lower quality (grade 4) sawtimber (Fig. 63). Currently, 63 percent, or 14.8 billion board feet of sawtimber, is in grades 3 and 4, a 23 percent increase since 2005.

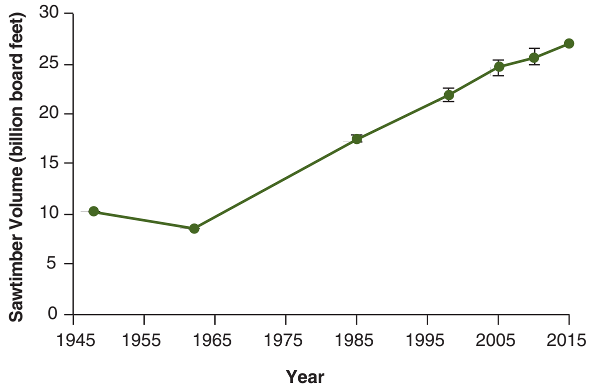

Figure 61.—Sawtimber volume on timberland by inventory year, Illinois. Error bars represent a 68 percent confidence interval.

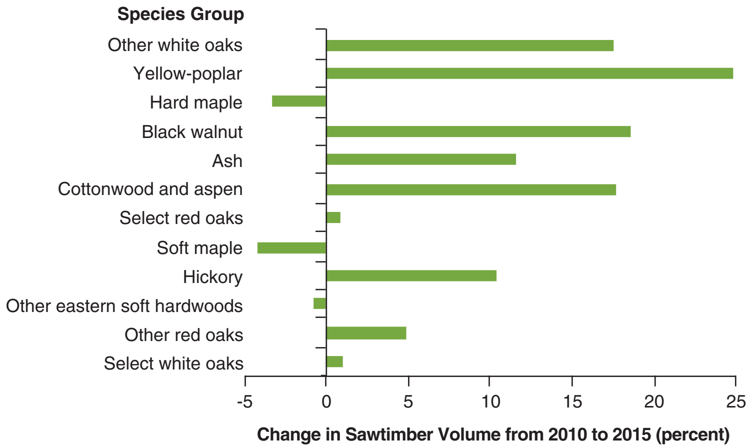

Figure 62.—Percent change in sawtimber volume on timberland for 12 selected species groups, Illinois. Species groups are listed in descending order of volume.

Figure 63.—Sawtimber volume for hardwood species on timberland by tree grade and inventory year, Illinois.

What this means

Illinois' forests have been maturing for the last few decades. Mature stands are more likely to succumb to windthrow, insects, and disease pathogens. The abundance of these stands may be related to reduced timber harvest and a lack of significant disturbance that would allow for increased regeneration, particularly of oak species. The current trend in sawtimber volume is an indication that mature oaks continue to add volume and are likely to be replaced by non-oak species, including maples, in the future.

Future Forests

Pounds Lake, Pounds Hollow Recreation Area, Shawnee National Forest. Photo by U.S. Forest Service.

Future Forest Projections

Background

Analysis of anticipated changes to the forests of Illinois, between 2010 and 2060, is derived from the Northern Forest Futures study and is based on annual data from 2008 (Shifley and Moser 2016). A large component of future forest change will be the result of normal forest growth, aging, natural regeneration, and species succession. External forces, such as the following examples, will also influence forest change:

- Population increases will cause roughly 453,000 acres of forest land to be converted to urban land from 2000 to 2050 (Nowak and Walton 2005);
- Economic conditions will affect forest products consumption, production, and harvest rates;
- Spread of invasive species will affect forest composition and structure;
- Changes in human population, the economy, energy consumption, and energy production will affect future climate conditions; and
- Changes in climatic conditions will affect patterns of forest growth and species succession.

A range of different assumptions about the economy, population, climate, and other driving forces that will affect the future conditions of forests, were incorporated into analytical models to estimate how northern forests are likely to change under seven alternative scenarios. Each scenario has been grouped by climate model (developed by the Canadian Centre for Climate Modelling and Analysis), storyline, and storyline variation (Canadian Centre for Climate Modelling and Analysis n.d.) (Table 5). The three storylines, as developed by the Intergovernmental Panel on Climate Change [IPCC], are characterized as follows (IPCC 2000):

1) A1B—Moderate population growth and rapid economic growth
2) A2—Rapid population growth and moderate economic growth
3) B2—A trend toward low population growth and low economic growth.

Variations of storyline are described as follows:

1) C—Standard
2) BIO—Increased harvest and utilization of woody biomass for energy
3) EAB—Total ash mortality within a range where emerald ash borer is projected to spread.

Table 5.—Scenarios used to project future forest conditions for Illinois

Climate model[a]	IPCC[b] Storyline A1B	IPCC Storyline A2	IPCC Storyline B2
CGCM3.1	Scenario A1B-C	Scenario A2-C	
	Scenario A1B-BIO	Scenario A2-BIO	
		Scenario A2-EAB	
CGCM2			Scenario B2-C
			Scenario B2-BIO

[a] Source: Canadian Centre for Climate Modelling and Analysis (n.d.).
[b] Intergovernmental Panel on Climate Change.

What we found

Between 2010 and 2060, the area of forest land is expected to decline under all scenarios. Specifically, forest area is estimated to decrease from 4.8 million acres in 2010 to 4.5 million acres (-7 percent) in 2060 under scenario A1B-C and 4.6 million acres (-5 percent) in 2060 under scenarios A2-C and B2-C (Fig. 64). Note that only standard storylines affect the area of forest land, as they consider changes in demographics and economic activity. Expected changes to live-tree volume on forest vary by scenario (Fig. 65). Under the A2-EAB scenario, ash volume is projected to fall to zero by 2030. As ash currently totals 5 percent of total volume, the resulting loss of ash is projected to have a short-term impact on total live volume. In contrast, the impacts of high biomass utilization on total live-tree volume are much more pronounced due to expectations of removals (Fig. 65). While growing-stock removals are estimated to remain fairly constant in the low biomass utilization scenarios, high levels of removals are anticipated in the high biomass utilization scenarios (Fig. 66). As a result, the impact to live-tree volume on forest land is a projected decrease under all three high biomass utilization scenarios: A1B-BIO (-11 percent), B2-BIO (-5 percent), and A2-BIO (-10 percent) (Fig. 65).

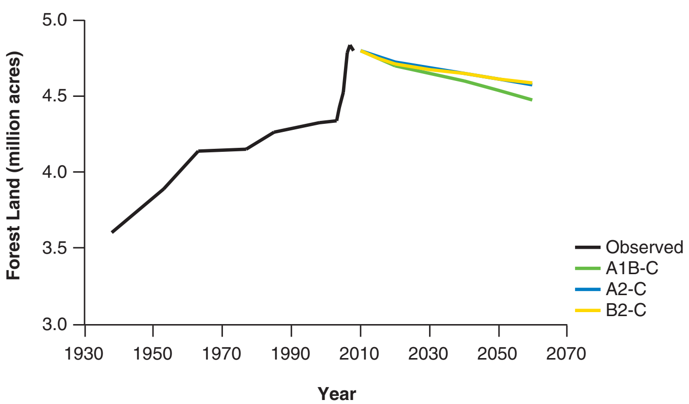

Figure 64.—Historical area of forest land and projected area of forest land by scenario, Illinois, 1938-2060.

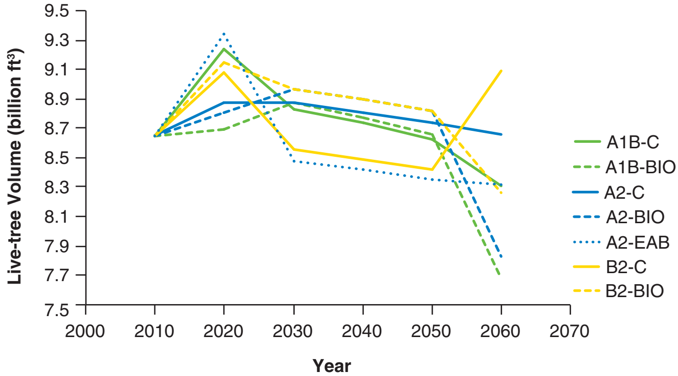

Figure 65.—Live tree volume on forest land by scenario, Illinois, 2010-2060.

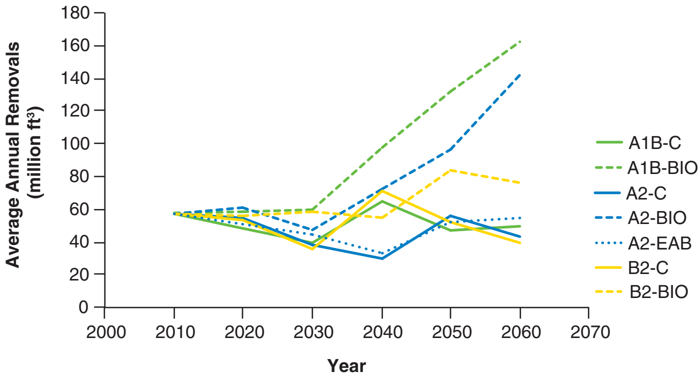

Figure 66.—Average annual removals of growing stock on timberland by scenario, Illinois, 2010-2060.

What this means

Projected trends reflect the combined effects of population and economic growth, which are expected to lean heavily toward continually maturing forests with decreasing forest area. These projections are considered to be possible trends, and they will be influenced by actual future climatic conditions, demographic changes, and economic policies relative to the assumptions. Knowledge of potential trends in future forest conditions helps elucidate the impacts to forest land given a variety of circumstances. This knowledge also provides valuable information on future directions of and associated impacts on long-term forest health and sustainability. An understanding of the implications of potential changes will allow managers to make informed decisions and manage for desired future conditions.

Data Sources and Techniques

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 forest inventories of Illinois' forest resources were completed in 1948 (Minckler et al. 1949), 1962 (Essex and Gansner 1965), 1985 (Raile and Leatherberry 1988), 1998 (Schmidt et al. 2000), 2005 (Crocker et al. 2009), and 2010 (Crocker et al. 2013). Data from Illinois' forest inventories can be found online at http://www.nrs.fs.fed.us/fia. For detailed information on inventory methods (Gormanson et al. 2017), see the Statistics, Methods, and Quality Assurance section online at https://doi.org/10.2737/NRS-RB-113.

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. 2016). 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 randomly selected families and individuals who own forest land in Illinois. For additional information about the NWOS, visit www.fia.fs.fed.us/nwos.

Literature Cited

Abrams, M.D. 1992. **Fire and the development of oak forests.** Bioscience. 42(5): 346-353. https://doi.org/10.2307/1311781.

Bechtold, W.A.; Patterson, P.L., eds. 2005. **The enhanced Forest Inventory and Analysis program—national sampling design and estimation procedures.** Gen. Tech. Rep. SRS-80. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 85 p. https://doi.org/10.2737/SRS-GTR-80.

Butler, B.J.; Hewes, J.H.; Dickinson, B.J.; Andrejczyk, K.; Butler, S.M.; Markowski-Lindsay, M. 2016. **USDA Forest Service National Woodland Owner Survey: national, regional, and state statistics for family forest and woodland ownerships with 10+ acres, 2011-2013.** Resour. Bull. NRS-99. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 39 p. https://doi.org/10.2737/nrs-rb-99.

Canadian Centre for Climate Modelling and Analysis. [N.d.]. **CGCM3.1-coupled global climate model (CGCM3), medium resolution (T47).** [Ottawa, ON]: Environment Canada. http://www.ec.gc.ca/ccmac-cccma (accessed July 27, 2012).

Crocker, S.J.; Brand, G.J.; Butler, B.J.; Haugen, D.E.; Little, D.C.; Meneguzzo, D.M.; Perry, C.H.; Piva, R.J.; Wilson, B.T.; Woodall, C.W. 2009. **Illinois' Forests 2005.** Resour. Bull. NRS-29. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 114 p. https://doi.org/10.2737/nrs-rb-29.

Crocker, S.J.; Nelson, M.D.; Barnett, C.J.; Butler, B.J.; Domke, G.M.; Hansen, M.H.; Hatfield, M.A.; Lister, T.W.; Meneguzzo, D.M.; Piva, R.J.; Wilson, B.T.; Woodall, C.W. 2013. **Illinois' forests 2010.** Resour. Bull. NRS-86. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 52 p. [DVD included]. https://doi.org/10.2737/nrs-rb-86.

Dey, D.C.; 2014. **Sustaining oak forests in eastern North America: regeneration and recruitment, the pillars of sustainability.** Forest Science. 60(5): 926-942. https://doi.org/10.5849/forsci.13-114.

Essex, B.L; Gansner, D.A. 1965. **Illinois' timber resources.** Resour. Bull. LS-3. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Lakes States Forest Experiment Station. 56 p.

Fan, Z.; Shifley, S.R.; Spetich, M.A.; Thompson, F.R., III; Larsen, D.R. 2003. **Distribution of cavity trees in midwestern old-growth and second-growth forests.** Canadian Journal of Forest Research. 33: 1481-1494. https://doi.org/10.1139/x03-068.

Gilbart, M. 2012. **Under cover: wildlife of shrublands and young forest.** Cabot, VT: Wildlife Management Institute. 87 p. http://youngforest.org/sites/default/files/Under_Cover-010412_FINAL.pdf (accessed October 2016).

Gormanson, D.D.; Pugh, S.A.; Barnett, C.J.; Miles, P.D.; Morin, R.S.; Sowers, P.A.; Westfall, J.A. 2017. **Statistics and quality assurance for the Northern Research Station Forest Inventory and Analysis program, 2016.** Gen. Tech. Rep. NRS-166. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 23 p. https://doi.org/10.2737/nrs-gtr-166.

Helms, J.A., ed. 1998. **The dictionary of forestry.** Bethesda, MD: Society of American Foresters. 210 p.

Herms, D.A.; McCullough, D.G. 2014. **Emerald ash borer invasion on North America: history, biology, ecology, impacts and management.** Annual Review of Entomology. 59(1): 13-30. https://doi.org/10.1146/annurev-ento-011613-162051.

Homer, C.G.; Dewitz, J.A.; Yang, L.; Jin, S.; Danielson, P.; Xian, G.; Coulston, J.W.; Herold, N.D.; Wickham, J.D.; Megown, K.A. 2015. **Completion of the 2011 National Land Cover Database for the conterminous United States—representing a decade of land cover change information.** Photogrammetric Engineering & Remote Sensing. 81(5): 345-354.

Honnay, O.; Jacquemyn, H.; Bossuyt, B.; Hermy, M. 2005. **Forest fragmentation effects on patch occupancy and population viability of herbaceous plant species.** New Phytologist. 166(3): 723-736. https://doi.org/10.1111/j.1469-8137.2005.01352.x.

Hunter, W.C.; Buehler, D.A.; Canterbury, R.A.; Confer, J.L.; Hamel, P.B. 2001. **Conservation of disturbance-dependent birds in eastern North America.** Wildlife Society Bulletin. 29(2): 440-455.

Illinois Department of Natural Resources. 2005. **Illinois Wildlife Action Plan.** Springfield, IL. Available at https://www.dnr.illinois.gov/conservation/IWAP/Documents/WildlifeActionPlanFinal.pdf (accessed December 2016).

Illinois Forestry Development Act of 1983. 525 ILCS 15.

Intergovernmental Panel on Climate Change [IPCC]. 2000. **Summary for policymakers: emissions scenarios.** Geneva, Switzerland. 21 p. Available at https://www.ipcc.ch/pdf/special-reports/spm/sres-en.pdf (accessed July 31, 2014).

Kapos, V.; Lysenko, I.; Lesslie, R. 2000. **Assessing forest integrity and naturalness in relation to biodiversity.** On behalf of FAO as part of the Global Forest Resources Assessment 2000. Working Paper 54. Rome, Italy: Food and Agriculture Organization of the United Nations/UNEP-World Conservation Monitoring Centre. 65 p.

Liebhold, A.M.; Gottschalk, K.W.; Muzika, R.; Montgomery, M.E.; Young, R.; O'Day, K.; Kelley, B. 1995. **Suitability of North American tree species to the gypsy moth: a summary of field and laboratory tests.** Gen. Tech. Rep. NE-211. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 34 p.

McNab, W.H.; Cleland, D.T.; Freeouf, J.A.; Keys, J.E., Jr.; Nowacki, G.J.; Carpenter, C.A. 2007. **Description of ecological subregions: sections of the conterminous United States.** Gen. Tech. Rep. WO-76B. Washington, DC: U.S. Department of Agriculture, Forest Service. 80 p. [CD-ROM]. https://doi.org/10.2737/wo-gtr-76b.

McWilliams, W.H.; Westfall, J.A.; Brose, P.H.; Dey, D.C.; Hatfield, M.; Johnson, K.; Laustsen, K.M.; Lehman, S.L.; Morin, R.S.; Nelson, M.D.; Ristau, T.E.; Royo, A.A.; Stout, S.L.; Willard, T; Woodall, C.W. 2015. **A regeneration indicator for Forest Inventory and Analysis: history, sampling, estimation, analytics, and potential use in the Midwest and Northeast USA.** Gen. Tech. Rep. NRS-148. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 74 p. https://doi.org/10.2737/nrs-rb-20.

Miles, P.D.; Smith, W.B. 2009. **Specific gravity and other properties of wood and bark for 156 tree species found in North America.** Res. Note NRS-38. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 35 p. https://doi.org/10.2737/nrs-rn-38.

Minckler, L.S.; Fassnacht, D.L.; Train, R.K. 1949. **Forest resources of Illinois.** For. Survey Release 7. Columbus, OH: U.S. Department of Agriculture, Forest Service, Central States Forest Experiment Station. 53 p.

Morin, R.S.; Randolph, K.C.; Steinman, J. 2015. **Mortality rates associated with crown health for eastern forest tree species.** Environmental Monitoring and Assessment. 187: 87. https://doi.org/10.1007/s10661-015-4332-x.

Nowak, D.J.; Walton, J. 2005. **Projected urban growth (2000–2050) and its estimated impact on the US forest resource.** Journal of Forestry. 103(8): 383-389.

Pimentel, D.; Zuniga, R.; Morrison, D. 2005. **Update on the environmental and economic costs associated with alien-invasive species in the United States.** Ecological Economics. 52(3): 273-288. https://doi.org/10.1016/j.ecolecon.2004.10.002.

Radeloff, V.C.; Hammer, R.B.; Stewart, S.I.; Fried, J.S.; Holcomb, S.S.; McKeefry, J.F. 2005. **The wildland urban interface in the United States.** Ecological Applications. 15: 799-805. https://doi.org/10.1890/04-1413.

Raile, G.K.; Leatherberry, E.C. 1988. **Illinois' forest resources.** Resour. Bull. NC-105. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 113 p.

Riitters, K.H.; Wickham, J.D. 2003. **How far to the nearest road?** Frontiers in Ecology and the Environment. 1(3): 125-129. https://doi.org/10.2307/3867984.

Russell, M.B.; Woodall, C.W.; D'Amato, A.W.; Fraver, S.; Bradford, J.B. 2014a. **Linking climate change and downed woody debris decomposition across forests of the eastern United States.** Biogeosciences. 11: 6417-6425. https://doi.org/10.5194/bg-11-6417-2014.

Russell, M.B.; Woodall, C.W.; Fraver, S.; D'Amato, A.W.; Domke, G.M.; Skog, K.E. 2014b. **Residence time and rate of decay for downed woody debris biomass/carbon in eastern US forests.** Ecosystems. 17: 765-777. https://doi.org/10.1007/s10021-014-9757-5.

Schmidt, T.L.; Hansen, M.H.; Solomakos, J.A. 2000. **Illinois' forests in 1998.** Resour. Bull. NC-198. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 133 p. https://doi.org/10.2737/nc-rb-198.

Shifley, S.R.; Moser, W.K., eds. 2016. **Future forests of the northern United States.** Gen. Tech. Rep. NRS-151. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 388 p. https://doi.org/10.2737/nrs-gtr-151.

Steinman, J. 2000. **Tracking the health of trees over time on forest health monitoring plots.** In: Hansen, M.; Burk, T., eds. Integrated tools for natural resources inventories in the 21st century; 1998 August 16-20; Boise, ID. Gen. Tech. Rep. NC-212. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station: 334-339.

U.S. Census Bureau. 2001. **TIGER/Line Files, Census 2000.** Washington, DC: U.S. Department of Commerce, Census Bureau. https://www.census.gov/geo/maps-data/data/tiger-line.html (accessed August 2017).

U.S. Environmental Protection Agency. 2016. **Inventory of U.S. greenhouse gas emissions and sinks: 1990-2014.** EPA 430-R-16-002. Washington, DC: U.S. Environmental Protection Agency, Office of Atmospheric Programs. https://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html.

U.S. Forest Service. 2013. **Forest inventory and analysis national core field guide: field data collection procedures for Phase 2 plots, ver. 6.0.1.** Washington, DC: U.S. Department of Agriculture, Forest Service. Available at http://www.fia.fs.fed.us/library/field-guides-methods-proc/ (accessed April 18, 2015).

U.S. Forest Service. 2014. **Gypsy moth digest.** St. Paul, MN: U.S. Department of Agriculture, Forest Service, Forest Health Protection. http://na.fs.fed.us/fhp/gm/ (accessed May 18, 2016).

U.S. Geological Survey. 2011. **The national atlas of the United States.** Washington, DC: U.S. Department of the Interior, U.S. Geological Survey. Available at www.nationalatlas.gov (accessed June 24, 2011).

Wilcox, B.A.; Murphy, D.D. 1985**. Conservation strategy: the effects of fragmentation on extinction.** American Naturalist. 125(6): 879-887. https://doi.org/10.1086/284386.

Wildlife Management Institute. 2014. **The young forest, helping wildlife through stewardship and science.** Washington, DC: Wildlife Management Institute. 58 p. Available at http://youngforest.org/sites/default/files/research_documents/The%20Young%20Forest%20Project-FINAL-011314-SPREADS%20NO%20DS.pdf (accessed February 2015).

Wilson, B.T.; Lister, A.J.; Riemann, R.I. 2012. **A nearest-neighbor imputation approach to mapping tree species over large areas using forest inventory plots and moderate resolution raster data.** Forest Ecology and Management. 271: 182-198. https://doi.org/10.1016/j.foreco.2012.02.002.

Woodall, C.W.; Amacher, M.C.; Bechtold, W.A.; Coulston, J.W.; Jovan, S.; Perry, C.H.; Randolph, K.C.; Schulz, B.K.; Smith, G.C.; Tkacz, B.; Will-Wolf, S. 2011. **Status and future of the forest health indicators program of the USA.** Environmental Monitoring and Assessment. 177(1-4): 419-436. https://doi.org/10.1007/s10661-010-1644-8.

Appendixes

Appendix 1.—List of tree species, Illinois, 2015

Common name	Genus	Species
boxelder	*Acer*	*negundo*
black maple	*Acer*	*nigrum*
Norway maple	*Acer*	*platanoides*
red maple	*Acer*	*rubrum*
silver maple	*Acer*	*saccharinum*
sugar maple	*Acer*	*saccharum*
Ohio buckeye	*Aesculus*	*glabra*
ailanthus	*Ailanthus*	*altissima*
serviceberry spp.	*Amelanchier*	spp.
pawpaw	*Asimina*	*triloba*
river birch	*Betula*	*nigra*
American hornbeam, musclewood	*Carpinus*	*caroliniana*
mockernut hickory	*Carya*	*alba*
bitternut hickory	*Carya*	*cordiformis*
pignut hickory	*Carya*	*glabra*
pecan	*Carya*	*illinoinensis*
shellbark hickory	*Carya*	*laciniosa*
shagbark hickory	*Carya*	*ovata*
black hickory	*Carya*	*texana*
northern catalpa	*Catalpa*	*speciosa*
sugarberry	*Celtis*	*laevigata*
hackberry	*Celtis*	*occidentalis*
eastern redbud	*Cercis*	*canadensis*
flowering dogwood	*Cornus*	*florida*
cockspur hawthorn	*Crataegus*	*crus-galli*
downy hawthorn	*Crataegus*	*mollis*
hawthorn spp.	*Crataegus*	spp.
common persimmon	*Diospyros*	*virginiana*
Russian-olive	*Elaeagnus*	*angustifolia*
American beech	*Fagus*	*grandifolia*
white ash	*Fraxinus*	*americana*
black ash	*Fraxinus*	*nigra*
green ash	*Fraxinus*	*pennsylvanica*
pumpkin ash	*Fraxinus*	*profunda*
blue ash	*Fraxinus*	*quadrangulata*
honeylocust	*Gleditsia*	*triacanthos*
Kentucky coffeetree	*Gymnocladus*	*dioicus*

(Appendix continued on next page.)

(Appendix 1. continued)

Common name	Genus	Species
butternut	*Juglans*	*cinerea*
black walnut	*Juglans*	*nigra*
eastern redcedar	*Juniperus*	*virginiana*
larch spp.	*Larix*	spp.
sweetgum	*Liquidambar*	*styraciflua*
yellow-poplar	*Liriodendron*	*tulipifera*
Osage-orange	*Maclura*	*pomifera*
cucumbertree	*Magnolia*	*acuminata*
prairie crab apple	*Malus*	*ioensis*
apple spp.	*Malus*	spp.
white mulberry	*Morus*	*alba*
red mulberry	*Morus*	*rubra*
water tupelo	*Nyssa*	*aquatica*
blackgum	*Nyssa*	*sylvatica*
eastern hophornbeam	*Ostrya*	*virginiana*
Norway spruce	*Picea*	*abies*
white spruce	*Picea*	*glauca*
jack pine	*Pinus*	*banksiana*
shortleaf pine	*Pinus*	*echinata*
red pine	*Pinus*	*resinosa*
eastern white pine	*Pinus*	*strobus*
Scotch pine	*Pinus*	*sylvestris*
loblolly pine	*Pinus*	*taeda*
American sycamore	*Platanus*	*occidentalis*
balsam poplar	*Populus*	*balsamifera*
eastern cottonwood	*Populus*	*deltoides*
bigtooth aspen	*Populus*	*grandidentata*
quaking aspen	*Populus*	*tremuloides*
American plum	*Prunus*	*americana*
black cherry	*Prunus*	*serotina*
cherry and plum spp.	*Prunus*	spp.
chokecherry	*Prunus*	*virginiana*
Douglas-fir	*Pseudotsuga*	*menziesii*
white oak	*Quercus*	*alba*
swamp white oak	*Quercus*	*bicolor*
scarlet oak	*Quercus*	*coccinea*
northern pin oak	*Quercus*	*ellipsoidalis*
southern red oak	*Quercus*	*falcata*
shingle oak	*Quercus*	*imbricaria*
overcup oak	*Quercus*	*lyrata*

(Appendix continued on next page.)

(Appendix 1. continued)

Common name	**Genus**	**Species**
bur oak	*Quercus*	*macrocarpa*
blackjack oak	*Quercus*	*marilandica*
swamp chestnut oak	*Quercus*	*michauxii*
chinkapin oak	*Quercus*	*muehlenbergii*
cherrybark oak	*Quercus*	*pagoda*
pin oak	*Quercus*	*palustris*
willow oak	*Quercus*	*phellos*
chestnut oak	Quercus	*prinus*
northern red oak	*Quercus*	*rubra*
Shumard oak	*Quercus*	*shumardii*
post oak	*Quercus*	*stellata*
Texas red oak	*Quercus*	*texana*
black oak	*Quercus*	*velutina*
black locust	*Robinia*	*pseudoacacia*
black willow	*Salix*	*nigra*
sassafras	*Sassafras*	*albidum*
baldcypress	*Taxodium*	*distichum*
American basswood	*Tilia*	*americana*
winged elm	*Ulmus*	*alata*
American elm	*Ulmus*	*americana*
Siberian elm	*Ulmus*	*pumila*
slippery elm	*Ulmus*	*rubra*

Appendix 2.—List of invasive plant species monitored by NRS-FIA on P2 invasive plots, 2007 to present. An asterisk indicates species found in the inventory.

Tree Species

ailanthus (*Ailanthus altissima*)

black locust (*Robinia pseudoacacia*)*

chinaberry (*Melia azedarach*)

Chinese tallowtree (*Triadica sebifera*)

Norway maple (*Acer platanoides*)*

paulownia, princesstree (*Paulownia tomentosa*)

punktree, melaleuca (*Melaleuca quinquenervia*)

Russian-olive (*Elaeagnus angustifolia*)

saltcedar (*Tamarix ramosissima*)

Siberian elm (*Ulmus pumila*)*

silktree, mimosa (*Albizia julibrissin*)

Shrub Species

autumn-olive (*Elaeagnus umbellata*)*

common barberry (*Berberis vulgaris*)

common buckthorn (*Rhamnus cathartica*)*

European cranberrybush (*Viburnum opulus*)*

European privet (*Ligustrum vulgare*)

glossy buckthorn (*Frangula alnus*)

Japanese barberry (*Berberis thunbergii*)*

Japanese meadowsweet (*Spiraea japonica*)

multiflora rose (*Rosa multiflora*)*

nonnative bush honeysuckles (*Lonicera* spp.)*

Vine Species

English ivy (*Hedera helix*)

Japanese honeysuckle (*Lonicera japonica*)*

Oriental bittersweet (*Celastrus orbiculatus*)*

Herbaceous Species

Bohemian knotweed (*Polygonum ×bohemicum*)

bull thistle (*Cirsium vulgare*)

Canada thistle (*Cirsium arvense)**

creeping jenny (*Lysimachia nummularia*)*

dames rocket (*Hesperis matronalis*)*

European swallow-wort (*Cynanchum rossicum*)

garlic mustard (*Alliaria petiolata*)*

giant knotweed (*Polygonum sachalinense*)

Japanese knotweed (*Polygonum cuspidatum*)

leafy spurge (*Euphorbia esula*)

Louise's swallow-wort (*Cynanchum louiseae*)

purple loosestrife (*Lythrum salicaria*)

spotted knapweed (*Centaurea stoebe* ssp. *micranthos*)

Grass Species

common reed (*Phragmites australis*)

Nepalese browntop (*Microstegium vimineum*)*

reed canarygrass (*Phalaris arundinacea*)*

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The third full annual inventory of Illinois' forests reports more than 4.9 million acres of forest land and 99 tree species. Forest land is dominated by oak/hickory and elm/ash/cottonwood forest types, which make up 92 percent of total forest area. The volume of growing stock on timberland has been rising since 1948 and currently totals 7.0 billion cubic feet. Average annual net growth of growing stock from 2010 to 2015 was about 146.1 million cubic feet per year. This report includes additional information on forest attributes, land-use change, carbon, timber products, and forest health. The following information is available online at https://doi.org/10.2737/NRS-RB-113: 1) detailed information on forest inventory methods, statistics, and quality assurance of data collection; 2) tables that summarize quality assurance; 3) a core set of tabular estimates for a variety of forest resources; and 4) a Microsoft® Access database that represents an archive of data used in this report, with tools that allow users to produce customized estimates.

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

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