Nebraska's Forests 2010

Resource Bulletin
NRS-68

United States Department of Agriculture

Forest Service

Abstract

The second full annual inventory of Nebraska's forests reports more than 1.5 million acres of forest land and 39 tree species. Forest land is dominated by the elm/ash/cottonwood and oak/hickory forest types, which occupy nearly half of the total forest land area. The volume of growing stock on timberland currently totals 1.1 billion cubic feet. The average annual net growth of growing stock from 2005 to 2010 is nearly 22 million cubic feet per year. This report includes additional information on forest attributes, land use change, carbon, timber products, and forest health. A DVD included in this report contains (1) descriptive information on methods, statistics, and quality assurance of data collection, (2) a glossary of terms, (3) tables that summarize quality assurance, (4) a core set of tabular estimates for a variety of forest resources, and (5) 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 analysis of Nebraska's forest resources. Primary field crew and QA staff over the 2006-2010 inventory cycle included Joshua Anderson, Todd Bixby, Tyler Camfield, Joshua Carron, Bryan Criswell, Michael Downs, Kevin Fehlburg, Thomas Goff, Matt Hake, Glenda Hefty, Brent Hummel, Mike Maki, Greg Pugh, Kirk Ramsey, Rick Sheehan, Joel Topham, and Brian Wall. Data management personnel included Carol Alerich, Charles Barnett, James Blehm, Gary Brand, Dale Gormanson, Mark Hatfield, Bob Ilgenfritz, Greg Liknes, Lisa Mahal, Richard McCullough, Kevin Nimerfro, Barbara O'Connell, Jay Solomakos, Cassandra Olson, and Jeffrey Wazenegger. Report reviewers included Rich Widmann (NRS-FIA) and Ralph Johnson (Nebraska Forest Service).

Cover: Nebraska National Forest, Bessey Ranger District

Manuscript received for publication February 2012

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

For additional copies:
U.S. Forest Service
Publications Distribution
359 Main Road
Delaware, OH 43015-8640

October 2012

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

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Contents

Highlights

On the Plus Side

- Forest land area has continued to increase statewide since 1983 and now exceeds 1.5 million acres.
- Nonforest lands with trees, an important ecological and economic resource, add 1.3 million acres of additional tree-covered land across the State.
- Nebraska's forests contain nearly 394 million live trees statewide and are made up of at least 39 species.
- Total live biomass continues to increase and is currently estimated at more than 44 million oven-dry tons.
- Nebraska's forests support a wide diversity of vascular plant species.

Areas of Concern

- Although forest land is increasing, that increase is largely due to the invasion of pasture and rangeland by eastern redcedar.
- Invasive plant species are found across the State.
- Removal rates are near that of the 1950s when much land clearing occurred and much forest land was lost by the time of the 1983 inventory. Furthermore, most growing-stock removals were associated with change from forest to nonforest land.
- The rate of mortality for ponderosa pine has increased due to large wildfires in the Pine Ridge area in the northwest part of the State, which also results in net negative growth.

Issues to Watch

- Most of Nebraska's forest land is privately owned and will change ownership in the future.
- Ash is a significant component of Nebraska's forests, and the introduction of emerald ash borer would have a detrimental effect on the State's forest resources.
- If bioenergy markets develop in Nebraska, there may be increased harvest activity and loss of forest land due to conversion to agriculture.
- The number of eastern redcedar trees continues to increase dramatically, especially sapling-size trees.
- Other threats to Nebraska's forests include thousand cankers disease and mountain pine beetle.

Nebraska National Forest, Bessey Ranger District

Background

Nebraska National Forest, Bessey Ranger District

An Overview of Forest Inventory

What is a tree?

Trees are perennial woody plants with central stems and distinct crowns. The Forest Inventory and Analysis (FIA) program of the U.S. Department of Agriculture, Forest Service, defines a tree as any perennial woody plant species 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 A in "Nebraska's Forests 2010: Statistics, Methods, and Quality Assurance," on the DVD at the back of this report.

What is a forest?

FIA defines forest land as land at least 10 percent stocked by trees of any size or formerly having had such tree cover and not currently developed for nonforest uses. The area with trees must be at least 1 acre in size, and roadside, streamside, and shelterbelt strips of trees must be at least 120 feet wide to qualify as forest land. Trees in narrow windbreaks, urban boulevards, orchards, and other nonforest situations are very valuable too, but are not part of the FIA inventory. However, they were inventoried as part of the Great Plains Tree and Forest Invasives Initiative (GPI) and are described in the Nonforest Trees section of this report. Note: the GPI was a one-time special effort and currently there are no plans to continue the program.

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 Nebraska, approximately 93 percent of forest land is timberland, less than 1 percent is reserved forest land, and 6.2 percent is other forest land.

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

In Nebraska's periodic inventories (1994 and before), only trees occurring on timberland plots were measured. Therefore, we cannot report the volume of trees on forest land for those inventories. The new annual inventory system facilitates the estimation and reporting of volume on all forest land, not just timberland. Because these annual plots were remeasured during the second annual inventory completed in 2010, we are now able to report current growth, removals, and mortality on all forest land. However, trend reporting since the 1950s may be limited here to timberland.

Where are Nebraska's forests and how many trees are in Nebraska?

Forest distribution, composition, and structure are greatly influenced by many factors including subsurface geology, topography, soil composition, and climate. The concept of an ecoregion (e.g., Bailey 1995) 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, ecosections) represent successively smaller geographic areas based on similarities in factors mentioned previously. Ecoprovinces are an appropriate level to broadly describe the ecology of Nebraska. The State is home to three ecoprovinces: the Prairie Parkland Province, the Great Plains Steppe, and the Great Plains Palouse Dry Steppe (Fig.1).

Figure 1.—Ecoprovinces of Nebraska (Bailey 1995).

In Nebraska, forest land area is concentrated along streams and rivers and contains nearly 394 million 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 320 forest plots (Fig. 2). For information on sampling errors, see "Nebraska's Forests 2010: Statistics, Methods, and Quality Assurance" on the DVD at the back of this report.

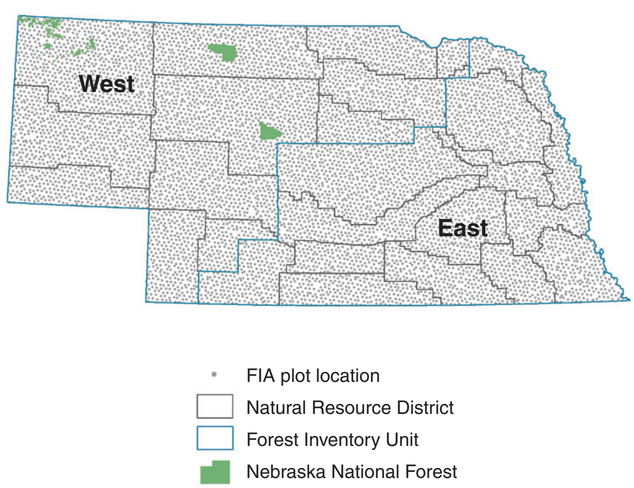


Figure 2.—Distribution of FIA plot locations, Nebraska, 2010. Depicted plot locations are approximate.

What is the climate of Nebraska?

Nebraska's climate can be described as continental, characterized by a wide annual variation in temperature, with the average July maximum temperature approaching 90 °F and the average January minimum temperature dipping to 10 °F. There is also a notable precipitation gradient from east to west across the State (Fig. 3). The eastern part of Nebraska typically receives 30 inches or more of total precipitation annually while the western panhandle on average receives fewer than 20 inches. A notable result of this east-west precipitation gradient is a significant difference in forest types across the State.

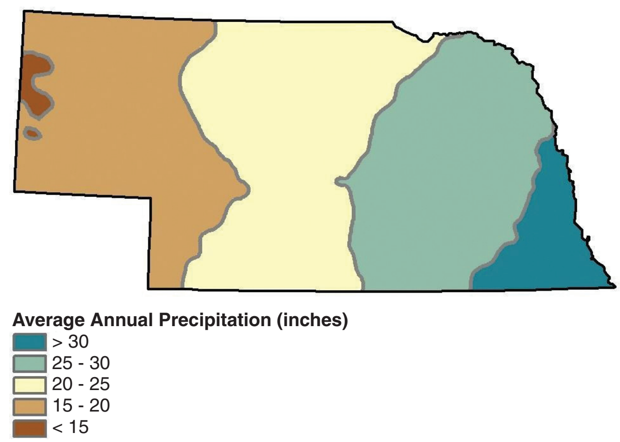


Figure 3.— Average annual precipitation in Nebraska. Map was created using generalized PRISM climate data.

In addition to large-scale impacts of climate resulting from phenomena such as the east/west precipitation gradient, small-scale climate (or microclimate) effects have a profound impact on trees in Nebraska. For example, it is typical to see differences in trees on north- and south-facing slopes in the hilly parts of the State due to the difference in sun exposure. Although these long-term, large- and small-scale climate effects are important, episodic and catastrophic climate events also impact the State's forests. Nebraska is prone to extended periods of drought such as the one experienced in much of the State from 2000 to 2005 (Burbach and Joeckel 2006). Periodic severe drought is believed to be a major reason why prairie areas are not forested (Changnon et al. 2002, Kunkel and Changnon 2003). Another notable weather/climate event is the flooding of the Missouri River that occurred in the spring of 2011. Communities along the river from South Sioux City to Rulo were affected. It is estimated that more than 20,000 acres were inundated, and there will likely be a long-term impact on trees along the river and urban trees in flooded communities.

How do we estimate a tree's volume?

Forest inventories typically express volume in cubic feet, but the reader may be more familiar with cords (a stack of wood 8 feet long, 4 feet wide, and 4 feet high). A cord of wood contains approximately 79 cubic feet of solid wood and 49 cubic feet of bark and air. Volume can be precisely determined by immersing a tree in a pool of water and measuring the amount of water displaced. Less precise, but much cheaper and easier to do with living trees, is a method adopted by the Northern Research Station. Through this method, several hundred trees were cut and detailed diameter measurements were taken along the tree to accurately determine their volumes (Hahn 1984). Statistical tools were used to model these data by species group. Using these models, we can produce individual tree volume estimates based on species, diameter, and tree site index.

This method was also used to calculate sawtimber volumes. FIA reports sawtimber volumes in International ¼-inch board-foot scale as well as Doyle rule. To convert to the Scribner board-foot scale, see Smith (1991).

How much does a tree weigh?

Building on previous work, the U.S. Forest Service's Forest Products Laboratory developed estimates of specific gravity for a number of tree species (U.S. Forest Service 1999). These specific gravities were applied to estimates of tree volume to determine merchantable tree biomass (the weight of the bole). To estimate live biomass, we have to add in the stump (Raile 1982), limbs, and bark (Hahn 1984). Forest inventories report biomass as green or oven-dry weight. Green weight is the weight of a freshly cut tree; oven-dry weight is the weight of a tree with zero percent moisture content. On average, 1 ton of oven-dry biomass is equal to 1.9 tons of green biomass.

How do we 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?

Data from new inventories are often compared with data from earlier inventories to determine trends in forest resources. For comparisons to be valid, the procedures used in the two inventories must be similar. As a result of ongoing efforts to improve the efficiency and reliability of the inventory, several changes in procedures and definitions have occurred since the 1994 inventory of Nebraska. Although these changes will have little effect on statewide estimates of forest area, timber volume, and tree biomass, they may have significant effects on plot classification variables such as forest type and stand-size class. Some of these changes make it inappropriate to directly compare annual inventory (2005 and 2010) data tables with those published for the 1994 or earlier inventories. Note that references to the periodic inventories each refer to a single year of inventory, but references to the 2010 annual inventory refer to the 5-year period, 2006-2010.

Recently, significant changes were made to the methods for estimating tree-level volume and biomass (dry weight) for northeastern states, and the calculation of change components (net growth, removals, and mortality) was modified for national consistency. Regression models were developed for tree height and percent cull to reduce random variability across datasets.

The Component Ratio Method (CRM) was implemented as a means to obtain biomass estimates for the live aboveground portion of trees, belowground coarse roots, standing deadwood, and down woody debris (Heath et al. 2009). Additionally, the midpoint method introduced some differences in methodology for determining growth, removals, and mortality to a specified sample of trees (Westfall et al. 2009). This approach involves calculating tree size attributes at the midpoint of the inventory cycle (2.5 years for a 5-year cycle) to obtain a better estimate for ingrowth, mortality, and removals. Although the overall net change component is equivalent under the previous and new evaluations, estimates for individual components will be different.

A word of caution on suitability and availability…

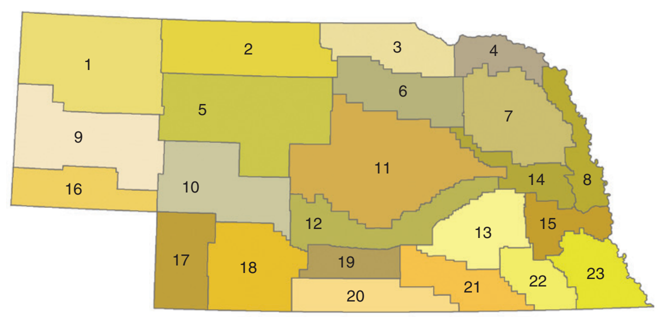
FIA does not attempt to identify which lands are suitable or available for timber harvesting, particularly because such suitability and availability is subject to changing laws, economic/market constraints, physical conditions, adjacency to human populations, and ownership objectives. The classification of land as timberland does not necessarily mean it is suitable or available for timber production. Forest inventory data alone are inadequate for determining the area of forest land available for timber production. Additional factors, like those provided above, need to be considered when estimating the timber base, and these factors may change with time.

How do we produce maps?

A geographic information system (GIS) and various geospatial datasets were used to produce the maps in this report. Unless otherwise indicated, forest resource data are from FIA and base map layers, e.g., state and county boundaries were obtained from the National Atlas of the United States (USDI 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 Nebraska maps are portrayed in UTM Zone 14N, North American Datum of 1983.

Nebraska's Natural Resource Districts

Nebraska contains 23 Natural Resource Districts (NRDs) that are based on watershed boundaries to more effectively manage and protect their natural resources (Fig. 4). This local management provides solutions for the unique challenges within each district. NRDs also encompass a variety of conservation projects and programs; for example, the NRD Conservation Tree Program helps the State's landowners plant more than one million trees each year (http://www.nrdnet.org//trees-and-wildlife.php). This report often shows NRD boundaries in many of its maps and provides data summaries by NRD in addition to county-level information.



Data Sources: Nebraska Natural Resources Commission and the U.S. Bureau of Census

1 Upper Niobrara White
2 Middle Niobrara
3 Lower Niobrara
4 Lewis and Clark
5 Upper Loup
6 Upper Elkhorn
7 Lower Elkhorn
8 Papio-Missouri River
9 North Platte
10 Twin Platte
11 Lower Loup
12 Central Platte
13 Upper Big Blue
14 Lower Platte North
15 Lower Platte South
16 South Platte
17 Upper Republican
18 Middle Republican
19 Tri-Basin
20 Lower Republican
21 Little Blue
22 Lower Big Blue
23 Nemaha

Figure 4.—Nebraska's Natural Resource Districts.

Forest Features

Nebraska National Forest, Bessey Ranger District

Forest Area

Background

Measuring forest land area is important for understanding the current status of Nebraska's forest ecosystems as well as trends occurring over time. Because most of the State's forest land is found in woodlots and in riparian areas along streams and rivers, forest land is relatively scarce. Therefore, assessing changes in the forest land base is critical because these may be signs of important changes in land use or forest health conditions.

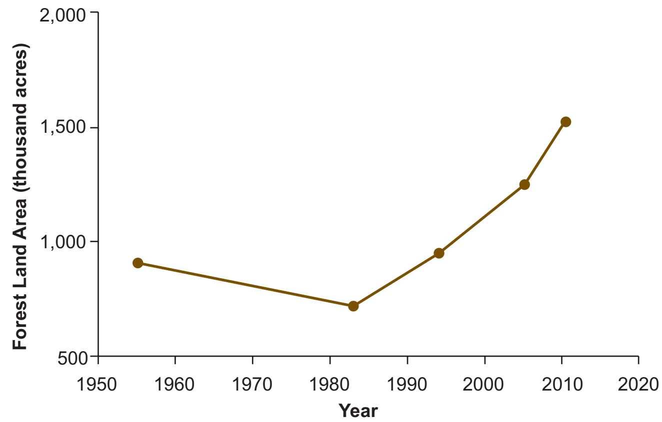


Figure 5.—Area of forest land by inventory year, Nebraska, 1955 to 2010.

What we found

The current estimate of forest land area in Nebraska is 1.52 million acres, or 3 percent of total land area, an increase of more than 200,000 acres since the last inventory in 2005 (Meneguzzo et al. 2008) (Fig. 5). The trend of increasing forest land area has occurred since the 1983 inventory. Before this, forest land had decreased by 185,000 acres between the first (1955) (see Stone and Bagley 1961) and second (1983) inventories as a result of forest lands being shifted to agricultural uses (Raile 1986). Figure 6 shows forest land area in the State using Moderate Resolution Imaging Spectroradiometer (MODIS) satellite pixels, which represent an area of approximately 15 acres on the ground; the value shown is the percent of the pixel that is forested. The top three Natural Resource Districts in forest land area are the Upper Niobrara White with nearly 231,000 acres, the Lower Niobrara (169,000 acres), and the Lower Loup (149,000 acres) (Fig. 7).

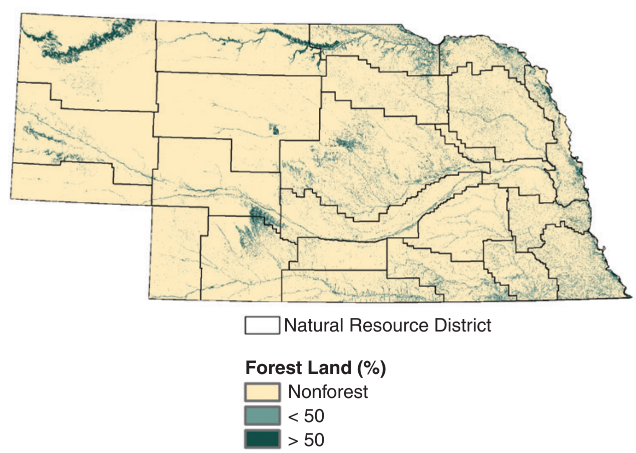


Figure 6.—Distribution of forest land, Nebraska, 2010.

What this means

The continuing trend of increasing forest land area seems to indicate that Nebraska will continue to gain forest land. The increase is primarily due to agricultural land converting to forest land (Land Use Change section). However, future demand for products derived from agriculture crops, e.g., ethanol and biodiesel fuels, could lead to another reduction in forest land area.

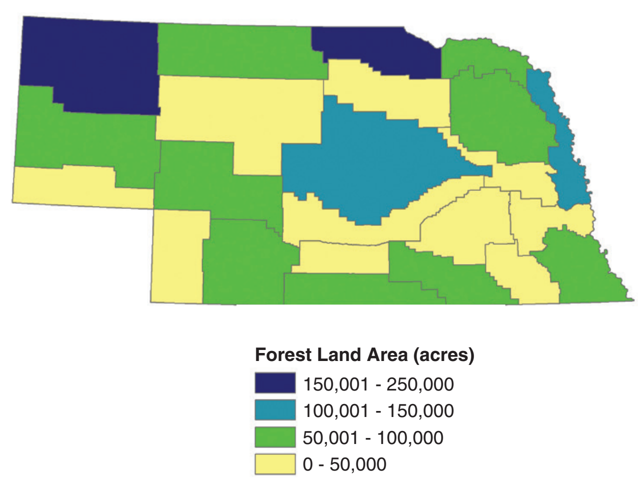


Figure 7.—Area of forest land by Natural Resource District, Nebraska, 2010.

Land Use Change

Background

Nebraska's land base changes over time and statewide estimates of forest land area represent only the net difference between additions and diversions of forest land. For example, reversion of agricultural land to forest land may be offset by conversion of forest land to urban development. Urban development is occurring at a rapid pace in the United States. Nowak and Walton (2005) predicted that the area of urban land in the United States would nearly triple from 2000 to 2050. Although the rates of development and population growth are below the national average in Nebraska, certain areas of the State, especially in the east, are under increasing pressure.

FIA characterizes land area using several broad land use categories, including forest, agriculture, and developed land. The conversion of forest land to other uses is referred to as gross forest loss, and the conversion of nonforest land to forest is known as gross forest gain. The magnitude of the difference between gross loss and gain is defined as net forest change. By comparing the land uses on current inventory plots with the land uses recorded for the same plots during the previous inventory, we can characterize forest land use change dynamics. Understanding land use change dynamics helps land managers make informed policy decisions, and is vital to scientists studying the carbon cycle and its relationship to climate change.

What we found

The land area in Nebraska is dominated by pasture and cropland. These agricultural land uses, along with urban and other nonforest land uses, cover 97 percent of the State's land area. Commercial and residential development is limited and is primarily concentrated in the eastern part of the State surrounding Lincoln and Omaha. Since the 2005 inventory, almost all (99 percent) of the FIA plots in Nebraska have remained forested or stayed in a nonforest land use, while only 1 percent of plots have experienced a forest loss or gain (Fig. 8).

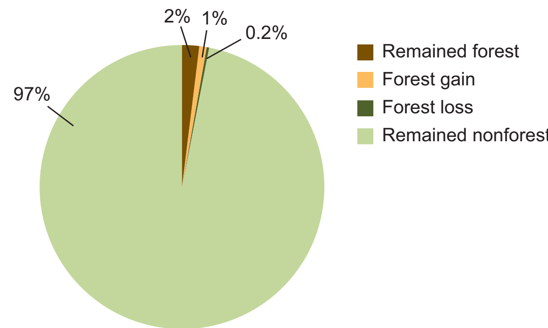


Figure 8.—Land use dynamics showing proportion of unchanged land, forest loss, and forest gain in Nebraska, 2005 to 2010.

According to the remeasurement plot data (Fig. 9), Nebraska lost more than 100,000 acres of forest land between 2005 and 2010, but this loss was offset by a gain of more than 300,000 acres (Fig. 10), which resulted in a net forest gain of more than 200,000 acres. More than three-fourths of forest gain is from agricultural land converting to forest. Only a small portion of the forest area lost was due to developed land uses. Unlike changes in and out of agricultural land uses, forest conversion to development is likely a permanent loss.

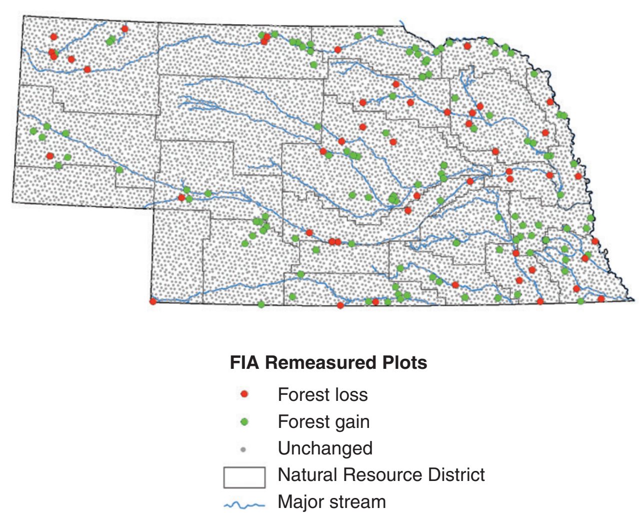


Figure 9.—Distribution of remeasurement inventory plots showing forest gains and losses, Nebraska, 2005 to 2010. (Depicted plot locations are approximate)

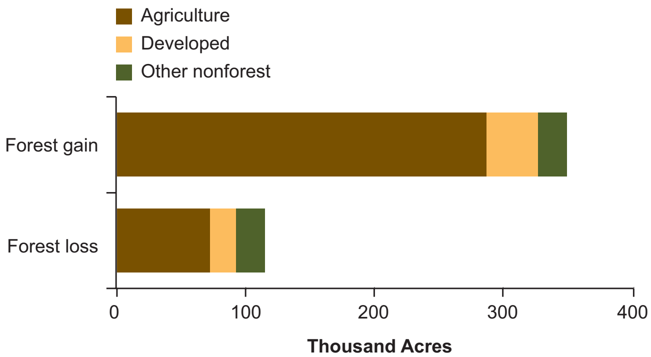


Figure 10.—Gross forest loss and forest gain by land use category, Nebraska, 2005 to 2010.

FIA data can also be used to characterize the forest land that has been lost or gained to see if it differs from the remaining forest land in the State. The forests of Nebraska are dominated by stands in the large-diameter size class, which were also the most prevalent among the forested areas that were converted to nonforest land. The forest land gained, however, had a greater proportion of small-diameter stands than the overall population. The newly acquired forest land also had a larger component of the eastern redcedar forest type.

What this means

Agriculture is the dominant land use in Nebraska, so gains and losses in pasture and cropland appear to drive land use change dynamics in the State. The gains in forest land often come from pasture and rangeland being invaded by eastern redcedar to the point where that land now meets FIA's definition of forest land. Other gains may come from planting projects. Agroforestry efforts promote the maintenance of tree cover in the form of windbreaks and forest buffers that help sustain a high agricultural output while conserving and protecting the State's soil and water resources. In addition, these forested areas also provide habitat for wildlife and serve as corridors for species movement.

Similar to forest gains, losses of forest land were primarily due to conversion to agricultural uses, which may be the result of increased demand for agricultural-based biofuels. Nebraska is one of the primary producers of ethanol in the U.S. More than 50 percent of the national production of ethanol is attributed to the top three Corn Belt States of Iowa, Nebraska, and Illinois (Schnepf 2010). With increased interest in domestic fuel sources, there could be increased demand for suitable cropland. Thus far, however, gains in forest land have outnumbered forest losses.

Nonforest Trees

Background

Areas of tree cover must be at least 1 acre in size and 120 feet wide to meet FIA's definition of forest land. Much of the tree cover in Nebraska, however, is configured in a way (e.g., narrow linear strips) that does not meet these requirements.

Despite their small size, these groupings of trees are a critical resource and offer a wide range of benefits, such as preventing erosion, serving as riparian buffers, providing wildlife habitat, and protecting structures and livestock from harsh weather. Recently, natural resource agencies have recognized the lack of available information on this important nonforest tree (NFT) resource.

In its assessments of forest health, the U.S. Forest Service has identified a number of concerns, including flood damage, ice storms, invasive species encroachment, and various insect and other plant diseases (U.S. Forest Service 2009a, b, c, d) that threaten tree and forest resources in the Plains States. Of particular concern is the spread of the emerald ash borer (EAB), which has been found throughout much of the north central and eastern portions of the U.S. and as far north as Quebec and Ontario, Canada (see the Emerald Ash Borer section for more information).

In response to these concerns, state forestry agencies in the Plains States, with funding assistance from the U.S. Forest Service's State & Private Forestry, began a project called the Great Plains Tree and Forest Invasives Initiative (GPI) (Lister et al. 2011). Objectives of the GPI included an inventory of the NFT resource, identification of EAB mitigation needs and utilization opportunities, and development of educational materials to help land managers and landowners cope with potential EAB impacts (Nebraska Forest Service 2007). To meet the first objective, FIA's National Inventory and Monitoring Applications Center (NIMAC) helped design the inventory, process the data, and create a reporting tool to quantify and characterize the NFT resource in order to supplement the information FIA already collects in forested areas. Data from 405 urban and 273 rural plots were collected in Nebraska during 2008 and 2009. Note: the definition of "urban" used in the GPI study was a minor modification to the U.S. Census Bureau's urban places definition (U.S. Census Bureau 1994), which includes places with at least 2,500 inhabitants. There can thus be large natural areas surrounding some of the smaller population centers designated by the U.S. Census Bureau as urban places.

What we found

Results from the GPI inventory indicate that the NFT resource occupies almost as much area as defined forest land, 1.3 million and 1.5 million acres, respectively. The land use associated with each NFT area was also identified and a summary is presented in Table 1. A comparison of forest and NFT area by NRD reveals that nine of Nebraska's Natural Resource Districts actually have more area of nonforest lands with trees than forest land (Fig. 11).

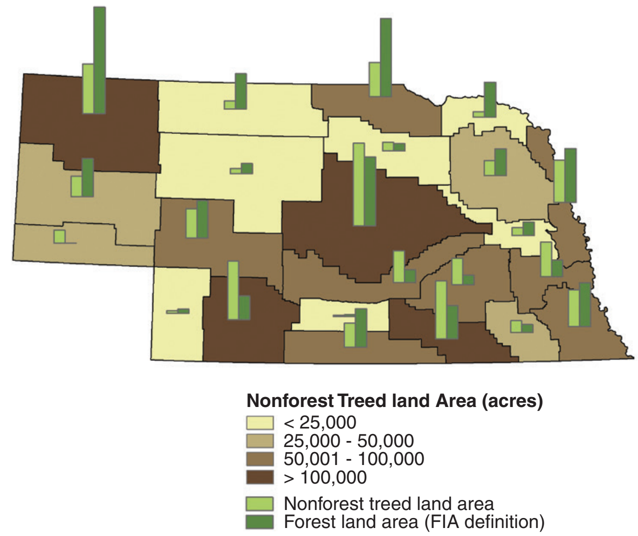


Figure 11—Comparison of treed land area versus forest land area by Natural Resource District, Nebraska, 2008-2009.

Table 1.—Area of nonforest treed land use, Nebraska, 2008-2009

Nonforest Treed Land Use	Area (acres)
Agriculture	612,000
Other rural nonforest	382,000
Residential	137,000
Farmstead or rural home site	89,000
Commercial-industrial	24,000
Park	20,000
Institutional-cemetery	16,000
Transportation-utility	11,000
Multifamily residential	8,000
Marsh-wetland	8,000
Open space-vacant	4,000
Golf course	4,000
Total	**1,314,000**

The species compositions of the forest and NFT areas are very different (Table 2). For example, ponderosa pine is a strong component of forest land areas but not nonforest areas, while ash trees make up similar proportions of the 10 most numerous species of all types of tree covered areas (Tables 2 and 3). Nonnative species, primarily Siberian elm and Russian olive, are more prevalent in NFT areas. When the total NFT area is divided into rural and urban nonforest land, more differences in species composition become apparent (Table 3). For example, on urban nonforest land, eastern redcedar finally becomes a less dominant species, while less common species in the State, such as hackberry, red mulberry, black walnut, and some evergreens, move to the top in terms of abundance.

Of the trees in nonforest areas, 68 million (57 percent) perform some kind of windbreak function; the distribution of the functions is shown in Figure 12. Species compositions of windbreak and nonwindbreak areas are similar, with a few notable exceptions. For example, eastern redcedar is much more prevalent in windbreak areas while boxelder and ash are more common in nonwindbreak areas. This is probably because eastern redcedar is a desirable species for windbreak planting due to its fast growth and ability to tolerate harsh conditions.

Table 2.—Distribution of the top 10 species in terms of percent on all forest land versus nonforest land, Nebraska, 2008-2009

Species	Forest land	Nonforest land
Eastern redcedar	41	23
Ponderosa pine	16	--
Green ash	11	11
Red mulberry	8	12
Bur oak	7	--
Hackberry	6	13
American elm	5	8
Plains cottonwood	3	4
Boxelder	3	--
Siberian elm	2	16
Unknown hardwood	--	4
Russian olive	--	4
Honeylocust	--	3

Table 3.—Distribution of the top 10 species in terms of percent on rural and urban nonforest land, Nebraska, 2008-2009

Species	Rural Nonforest land	Urban Nonforest land
Eastern redcedar	24	10
Siberian elm	16	16
Hackberry	12	20
Red mulberry	12	17
Green ash	11	9
American elm	8	8
Cottonwood and poplar spp.	4	--
Unknown hardwood	4	8
Russian-olive	4	--
Honeylocust	4	--
Black walnut	--	4
Spruce spp.	--	4
Scotch pine	--	3

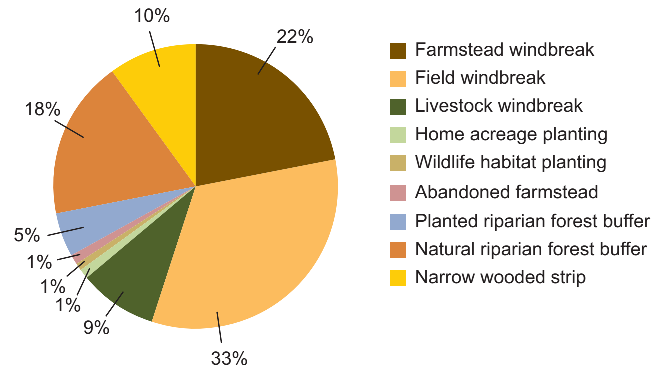


Figure 12—Distribution of windbreak function, Nebraska, 2008-2009.

What this means

Nebraska contains a significant amount of lands with trees that do not meet FIA's definition of forest land but are nonetheless an important resource. It is important that these areas continue to be monitored and protected because they are vital for protecting soil, wildlife, domestic animals, homes, roads, water sources, and recreational areas. The results obtained from the GPI provide useful information for the carefeul management of the NFT resource as well as the ecosystem services these trees provide. For example, the data can be used to promote wise windbreak stewardship, which may include monitoring them for EAB infestation, removing dead or dying trees, and replacing them with non-susceptible species. In addition, a clear understanding of differences in urban and rural tree species composition can help guide managers in their efforts to design sustainable landscapes that offer multiple benefits, such as wildlife habitat windbreak functions, energy savings, and forest product development.

Differences in relative abundance of nonnative and potentially invasive species between forested and NFT areas are not too surprising because fragmented areas often have higher proportions of nonnative and/or invasive species. This finding is shown by the prevalence of eastern redcedar, Siberian elm, and Russian olive in NFT areas compared to forest land. Although these species are useful for conservation trees, it is important that they be monitored because they can tolerate conditions where other species struggle to grow and they can easily displace native vegetation.

Forest Ownership

Background

The owners of the forest land ultimately control its fate and decide if and how it will be managed. By understanding forest owners, the forestry and conservation communities can better help the owners meet their needs, and in so doing, help conserve the region's forests for future generations. FIA conducts the National Woodland Owner Survey (NWOS) to better understand who owns the forests, why they own it, and how they use it (Butler 2008). Due to small samples for individual states, data for Kansas, Nebraska, North Dakota, and South Dakota are combined for this section.

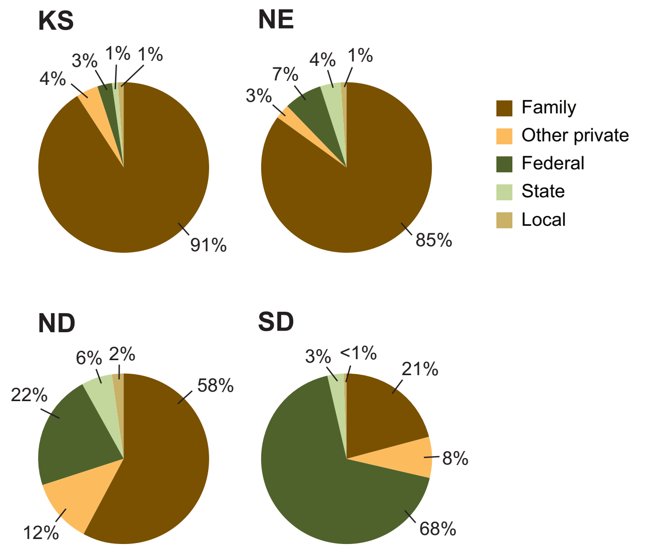


Figure 13.—Forest ownership, Kansas, Nebraska, North Dakota, and South Dakota, 2006.

What we found

Most forests across the Great Plains are privately owned, ranging from 95 percent of the forest area in Kansas to 29 percent in South Dakota (Fig. 13). Of these private acres, most (91 percent) are owned by families, individuals, and other unincorporated groups, collectively referred to as family forest owners. In Nebraska, family forest owners are responsible for 88 percent of the State's forest land and government agencies own 12 percent (Fig. 13).

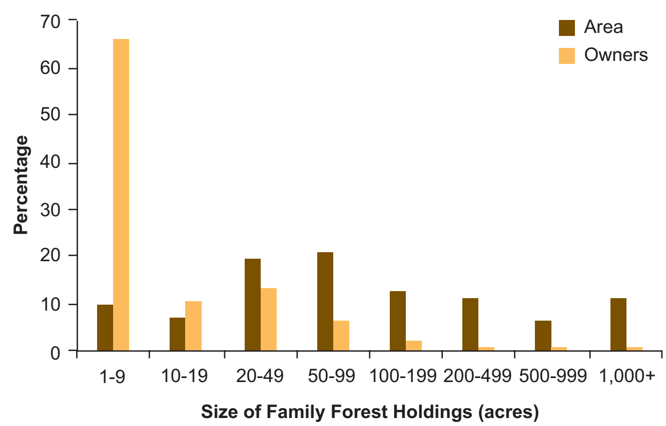


Figure 14.—Size of family forest holdings, Plains States, 2006.

A total of 191,000 family forest owners control 3.7 million forested acres across the region. Two-thirds of these owners have between 1 and 9 acres of forest land, but two-thirds of the forest land is in holdings of 50 acres or more (Fig. 14). The average holding size is 19 acres in Kansas, 20 acres in Nebraska, 18 acres in North Dakota, and 29 acres in South Dakota. The primary reasons for owning forest land are related to the land being part of the farm, aesthetics, family legacy, and protection of nature (Fig. 15).

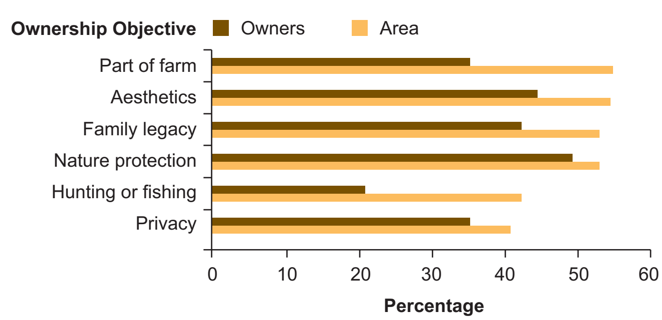


Figure 15.—Primary ownership objectives of family forest owners, Plains States, 2006.

Although timber production is not a primary ownership objective for most owners, 25 percent of the family forest land is owned by people who have commercially harvested trees. Four percent of the land is owned by people who have a written management plan, and 20 percent of the land is owned by people who have received management advice.

What this means

Most forest land in the Great Plains is privately owned and much of the land will soon change hands. One in six acres is owned by someone who plans to pass the land onto heirs or sell it in the near future. Family legacy is a major ownership objective and it is also a major concern. What can be done to help the forest owners and the land? It is clear that timber production is not on the forefront of forest owners' minds, but it is also clear that many owners are not adverse to harvesting and other activities in the woods. It is important to provide programs that meet the owners' needs.

Biomass

Background

Biomass is the aboveground total dry weight of all live components of forest trees, including stumps, boles, limbs, and tops but excluding foliage. Estimates of total biomass and its distribution among stand components provide an indication of forest health trends and the sustainability of forest management practices. These estimates also provide important information for analyzing carbon sequestration and for determining the amount of wood or fiber available for fuel.

What we found

Total live-tree biomass on forest land has increased steadily since 1983, and the current estimate is 44.3 million dry tons. Privately owned forest land contains most (88 percent) of the State's total aboveground biomass. On forest land, hardwood and softwood species contain 77 and 23 percent, respectively, of live-tree biomass. The cottonwood and aspen species group alone makes up nearly one-fourth of all aboveground biomass in live trees. On timberland, the boles of trees contain three-fourths of the total biomass (Fig. 16). The distribution of live biomass (oven-dry tons) on forest land across Nebraska is shown in Figure 17.

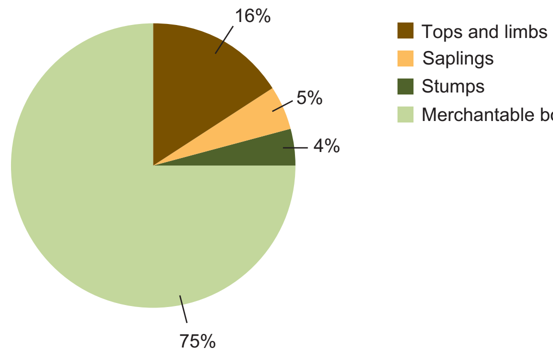


Figure 16.—Distribution of live biomass on forest land by tree part, Nebraska, 2010.

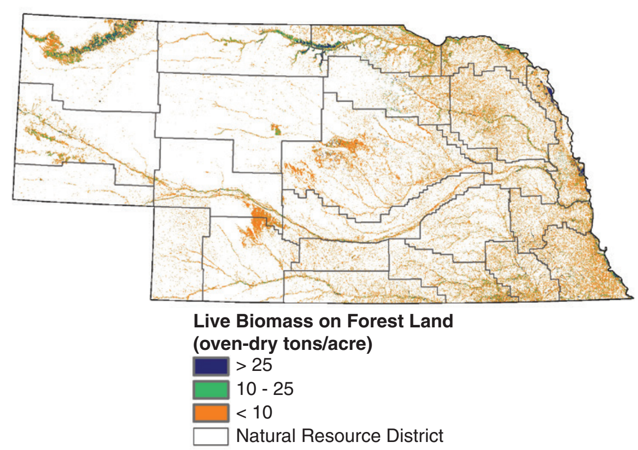


Figure 17.—Distribution of aboveground live biomass on forest land, Nebraska, 2010.

What this means

Most of the total live-tree biomass is on private land in the boles of hardwood trees. Large hardwood trees are of commercial importance so a significant portion of biomass and, consequently, carbon sinks, could be at risk from excessive harvesting. Related to this is management by private landowners because they own most of the total biomass. Their management objectives and decisions will have an important impact on the amount of biomass present on the forested landscape.

Tree Species Composition

Background

The dynamics of a forest stand's growth, development, and ecosystem function is influenced by its species composition. Changing conditions such as management practices, recreational activities, wildfire, extreme weather events, and invasive species determine which trees are present in forests and how abundant they are. Monitoring changes in species composition provides important information for effective forest management and acts as an indicator of forest health, growth, and succession. Assessing forest ecosystems with respect to species composition measures provides information on current and potential forest conditions.

What we found

Nebraska's forest lands include at least 39 tree species and nearly 394 million live trees, or an average of 259 trees per acre. These live trees contain approximately 2 billion cubic feet of total volume. The distribution of this live-tree density on forest land is shown in Figure 18.

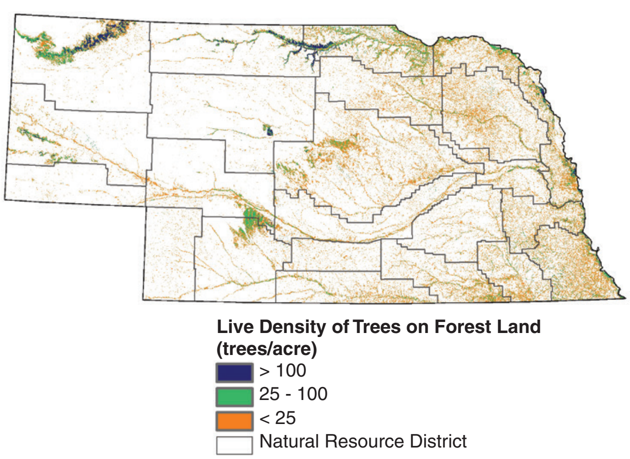


Figure 18.—Distribution of live trees 5 inches d.b.h. or larger on forest land, Nebraska, 2010.

Eastern redcedar is by far the most numerous tree species, followed by ponderosa pine and green ash (Fig. 19). Notable changes since the 2005 inventory are shown in Table 4. Among trees 5 inches d.b.h. or larger, three species (eastern redcedar, ponderosa pine, and bur oak) make up more than half (53 percent) of the total number (Fig. 20). Of the sapling-size trees, however, eastern redcedar alone makes up nearly half (46 percent) of the total, followed by ponderosa pine (11 percent) and green ash (10 percent) (Fig. 21). Of the 10 most abundant species in 2010, which make up 83 percent of the total number of trees, the top 7 were also the most abundant in 2005; black willow, Rocky Mountain juniper, and eastern cottonwood are currently outnumbered by plains cottonwood, boxelder, and Siberian elm, respectively.

What this means

The total number of trees in Nebraska has increased since 2005. Eastern redcedar is, by far, the most abundant tree species due to its prolific regeneration (Fig. 19). Eastern redcedar, ponderosa pine, and green ash continue to be the three most abundant species in the State. Large losses of some species, such as Rocky Mountain juniper, black willow, and eastern cottonwood were more than offset by gains in eastern redcedar, green ash, and plains cottonwood trees. However, there have been some notable changes that need to be monitored. For example, the continued expansion of eastern redcedar, Russian olive, and Siberian elm trees is a concern because they are aggressive invaders that can displace native vegetation. In addition, introduction of emerald ash borer would have a devastating effect on Nebraska's forests due to the prevalence of green ash.

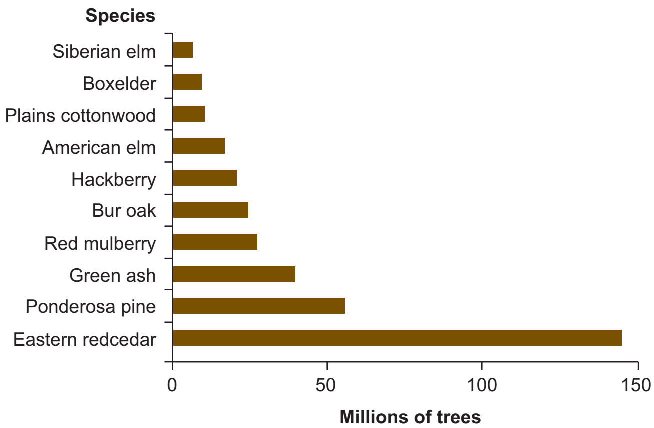


Figure 19.—Top 10 species in terms of number (million) of live trees on forest land, Nebraska, 2010.

Table 4.—Tree species with the largest increase/decrease in number of live trees (5 inches d.b.h. or larger) and percent change between the 2005 and 2010 inventories

Population change	Species	Percent change	2005 millions of trees	2010 millions of trees
Increase				
	Russian olive	1,083	0.2	2.1
	Plains cottonwood	489	1.8	10.4
	Green ash	48	26.6	39.6
	Eastern redcedar	44	100.4	144.5
	Hackberry	32	15.3	20.3
	Red mulberry	26	21.6	27.1
Decrease				
	Rocky Mountain juniper	-70	12.6	3.7
	Black willow	-69	14.5	4.5
	Eastern cottonwood	-63	8.9	3.3
	Slippery elm	-58	4.9	2.1

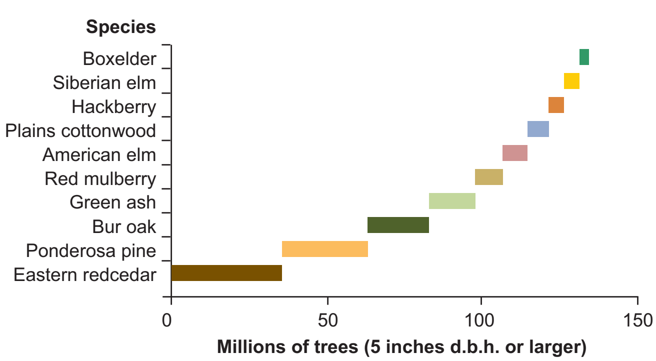


Figure 20.—Distribution of top 10 species (5.0 inches d.b.h. or larger) on forest land, Nebraska, 2010.

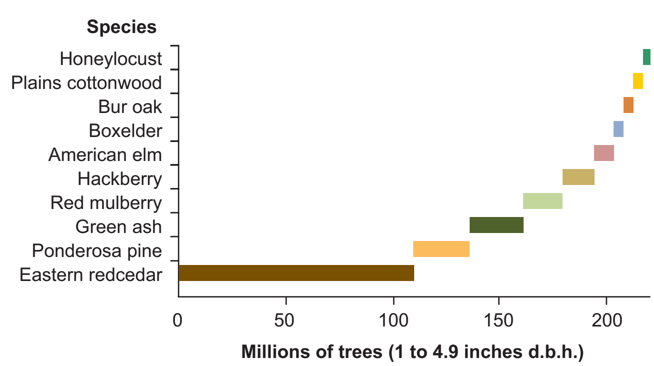


Figure 21.—Distribution of top 10 species (1 to 4.9 inches d.b.h.) on forest land, Nebraska, 2010.

Forest Growth

Background

The growth of a forest stand provides an indication of the overall condition of the forest and more specifically of tree vigor, forest health, and successional stage. Forest growth is reported as net growth, where net growth is equivalent to gross growth minus mortality. Average annual net growth represents an average for the annual change in volume between the two most recent inventories, 2005 and 2010.

What we found

The average annual net growth of growing-stock trees on Nebraska's timberland has increased since 1955, and the current estimate is nearly 22 million cubic feet per year (Fig. 22). Plains and eastern cottonwood species account for more than half (58 percent) of this growth with more than an estimated 12 million cubic feet per year statewide (Fig. 23). Hackberry and green ash are the next closest species with an average of approximately 2 million cubic feet of growth per year. Ponderosa pine had a net decrease in growth and lost an average of more than 2 million cubic feet, or about 1 percent, of volume per year since 2005. Average annual growing-stock volume growth as a percent of total growing-stock volume by species on timberland (Fig. 24) ranges from -1 percent for ponderosa pine to 9 percent for northern red oak, but this is likely an overestimate due to high sampling error.

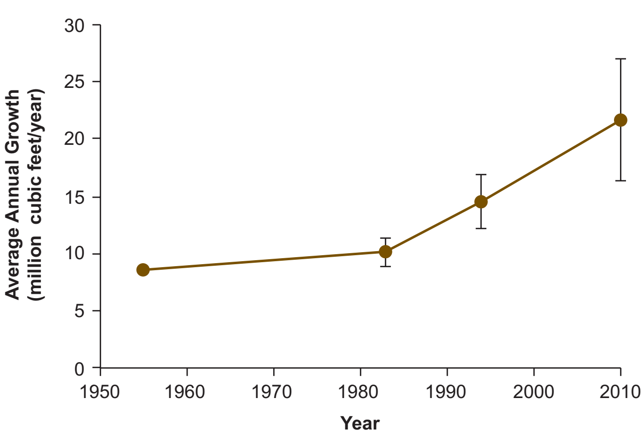


Figure 22.—Average annual net growth of growing stock on timberland, Nebraska, 1955 to 2010. Error bars represent 68-percent confidence intervals around the estimate.

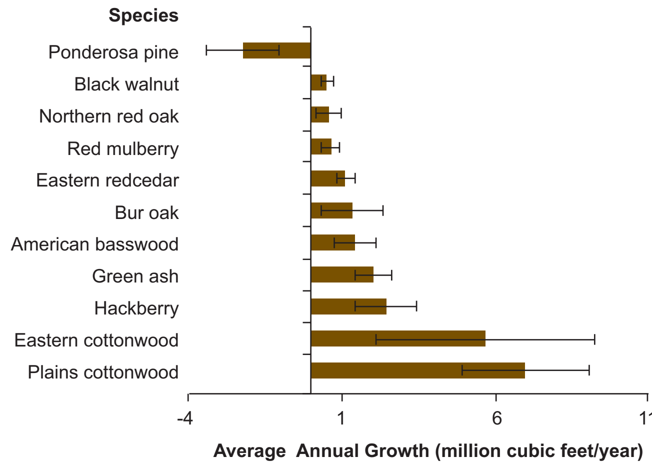


Figure 23.—Average annual net growth of growing stock on timberland for selected species, Nebraska, 2010. Error bars represent 68-percent confidence intervals around the estimate.

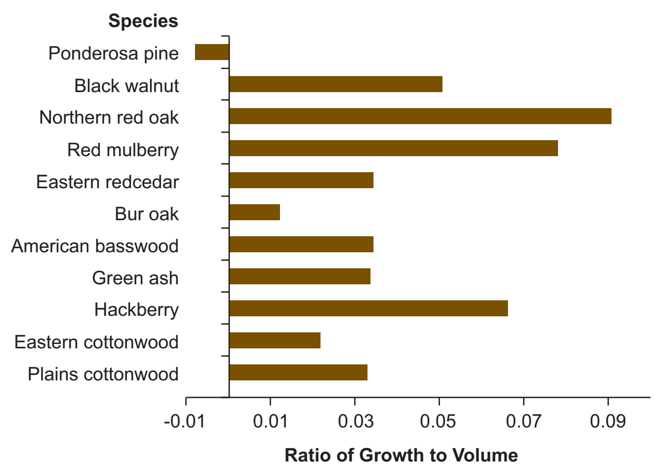


Figure 24.—Average annual net growth of growing stock expressed as a percent of total growing-stock volume on timberland for selected species, Nebraska, 2010.

What this means

The net growth of Nebraska's forests as a whole continues to increase, which indicates an overall sustainable resource. On average, cottonwoods make up more than half of all yearly growth. Hackberry and ash species accrue more yearly growth than the remaining tree species, but this would change if emerald ash borer invades Nebraska. Although the majority of species had positive net annual growth, ponderosa pine had a net decrease in growth. Because net growth reflects the volume of growth after accounting for mortality, the negative growth of ponderosa pine is likely due to the high rate of mortality caused by wildfires in the Pine Ridge region in the northwestern part of the State.

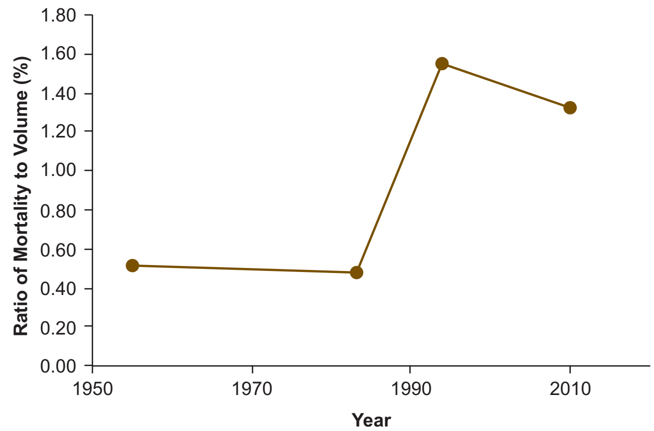


Figure 25.—Average annual mortality of growing stock as a percentage of total growing-stock volume on timberland, Nebraska, 1955-2010.

Mortality

Background

Tree mortality influences the overall health and structure of a forest. It can be caused by any one of a combination of factors, such as insects, disease, adverse weather, succession, competition, or human or animal activities. 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, 2005 and 2010.

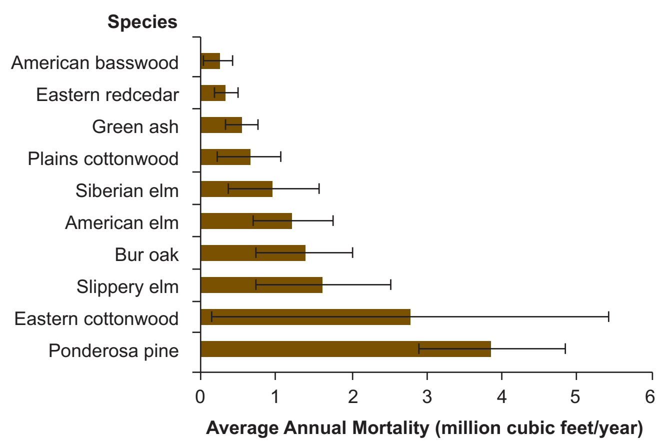


Figure 26.—Average annual mortality of growing stock on timberland for selected species, Nebraska, 2010.

What we found

Although the rate of mortality of growing stock has declined since 1994, it remains higher than the 1955 and 1983 levels (Fig. 25). Average annual mortality of growing stock on timberland is currently an estimated 15.2 million cubic feet per year, or 1.3 percent of total growing-stock volume. Ponderosa pine accounted for one-fourth of mortality, or nearly 4 million cubic feet per year (Fig. 26). Elm species and bur oak also had high rates of mortality. Another metric indicative of mortality is growing-stock mortality volume as a percentage of total statewide growing-stock volume on timberland by species group (Fig. 27). Species groups with higher percentages have had higher rates of mortality since 2005.

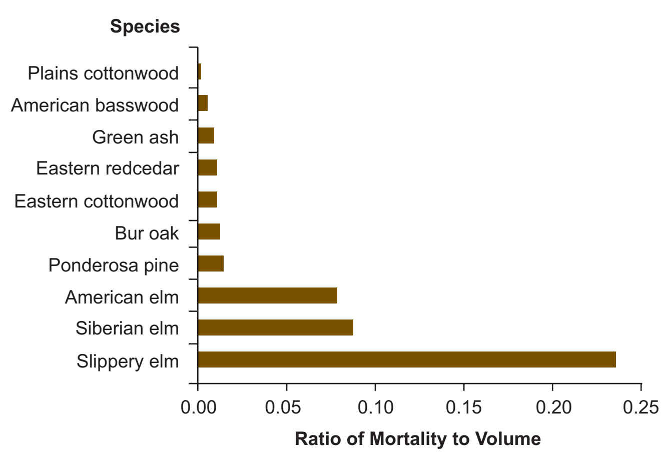


Figure 27.—Average annual mortality of growing stock as a percentage of total growing-stock volume on timberland for selected species, Nebraska, 2010.

What this means

Although mortality is a natural process in forest stands as they mature and change over time, very high rates of mortality could indicate a serious forest health issue or a substantial decline due to aging or other factors. Overall, the statewide rate of mortality has stabilized or may even be decreasing but still remains higher than historic levels. A more detailed look reveals that ponderosa pine accounted for a significant proportion of mortality, which is primarily due to the large wildfires that have burned nearly 84,000 forested acres in the State, mostly in the Pine Ridge area where there is a high concentration of ponderosa pine. In addition, mountain pine beetle is responsible for causing scattered mortality. Bur oak and American elm also show high rates of mortality, which may be due to oak wilt and/or bur oak blight; Dutch elm disease continues to affect American elm. It is important to continue to monitor these species.

Removals

Background

Trees are removed from timberland to meet various management objectives or during land use changes. Quantifying change in growing-stock trees due to removals aids in identifying trends in land use change and forest management. However, because removals are generally recorded on a limited number of plots, the estimates for removals show greater variance than those for other attributes, such as growth, mortality, or area. Like forest growth, the rate at which trees are removed represents the average annual growing-stock removals that occurred between 2005 and 2010.

There are three types of removals: harvest; mortality, trees killed during the harvesting process and left on the land; and diversion removals, living trees previously on land classified as forest land that are now on land classified as nonforest land. Basically, diversion removals are trees removed from the forest land base due to land use change.

What we found

After some large fluctuations in the past, growing-stock removal rates are now slightly higher than the 1955 estimate (Fig. 28). Growing stock is currently removed from timberland at an average of 14.2 million cubic feet per year. The ratio of all annual removals to total growing-stock volume is 1.2 percent. The largest amount of removals occurred in the cottonwood and aspen species group, where removals averaged 9 million cubic feet per year. Eastern cottonwood accounted for approximately 3 million cubic feet per year, or 22 percent of total removals, but there is much error associated with the estimate (Fig. 29). Average annual growing-stock removals as a percent of total volume ranged from less than 1 percent for ponderosa pine, hackberry, and bur oak to 16 percent for Siberian elm (Fig. 30). Examination of removals by land use shows that more removals were associated with land use change from forest to nonforest than with timber harvesting.

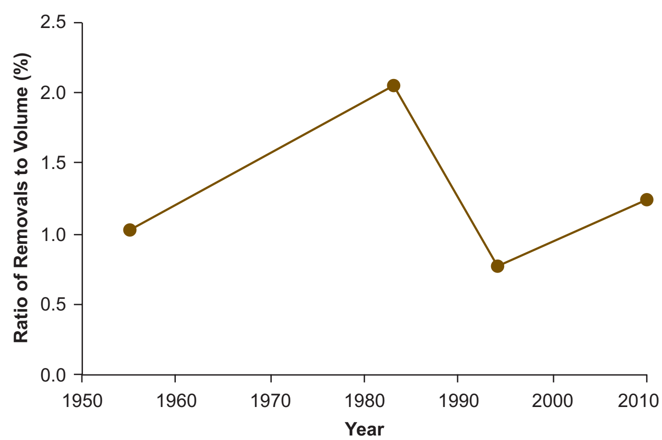


Figure 28.—Average annual removals of growing stock as a percentage of total growing-stock volume on timberland, Nebraska, 1955-2010.

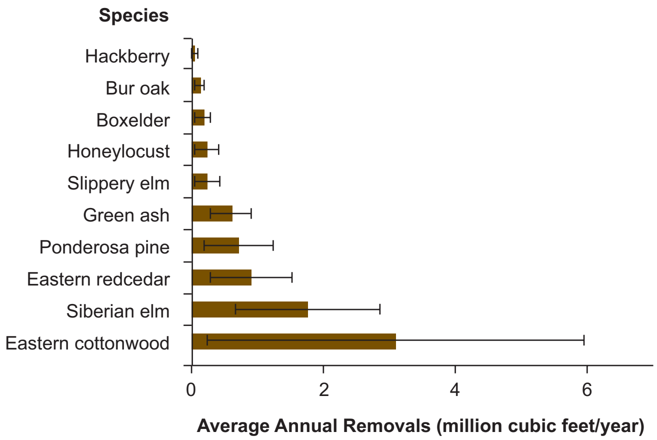


Figure 29.—Average annual removals of growing stock on timberland for selected species, Nebraska, 2010. Error bars represent 68-percent confidence intervals around the estimate.

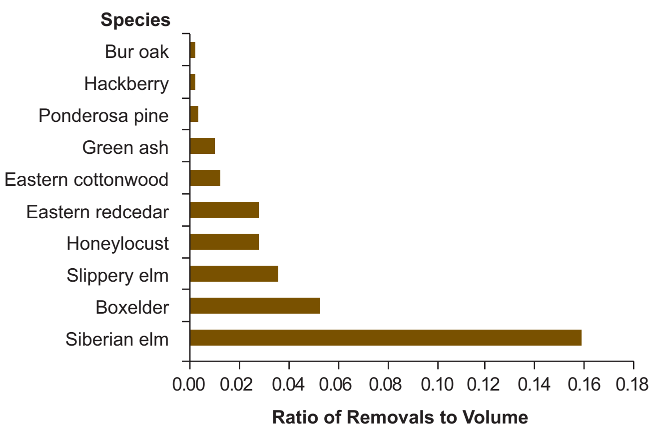


Figure 30.—Average annual removals of growing stock as a percentage of total growing-stock volume on timberland for selected species, Nebraska, 2010.

What this means

Overall, the statewide removals rate has increased since 1994 and is now slightly higher than the rate in 1955. Removal rates were more highly associated with land use change (from forest to nonforest), but that does not necessarily mean the change was to a developed land use. The average rate of removals for all species combined is 1.2 percent of total growing-stock volume whereas net growth averages 1.9 percent; the result is an annual net increase of 0.7 percent for growing-stock volume. From a statewide perspective, it appears as though removals are in balance with forest growth and mortality such that total volumes remain fairly stable. Removal rates should be monitored and evaluated on a case-by-case basis, especially at smaller scales (e.g., county) or for a specific species.

Forest Indicators

Riparian forest along the North Loup River in Nebraska

Down Woody Materials

Background

Down woody materials, including fallen trees and branches, fill a critical ecological niche in Nebraska's forests. They provide valuable wildlife habitat in the form of coarse woody debris, contribute to forest fire hazards via surface woody fuels, and store carbon in the form of slowly decaying large logs.

What we found

The fuel loadings and subsequent fire hazards of dead and down woody material in Nebraska's forests are relatively low, especially when compared with the nearby states of Iowa and South Dakota (Fig. 31). The size distribution of coarse woody debris (diameter larger than 3 inches) is overwhelmingly dominated (77 percent) by pieces less than 8 inches in diameter (Fig. 32A). Moderately decayed coarse woody pieces (decay classes 2, 3, and 4) constituted 91 percent of the decay class distribution (Fig. 32B). The largest carbon stocks of coarse woody debris (> 1 ton/acre) appear to be in highly stocked stands (live tree basal area > 90 ft^2/acre), although with tremendous variability (Fig. 33).

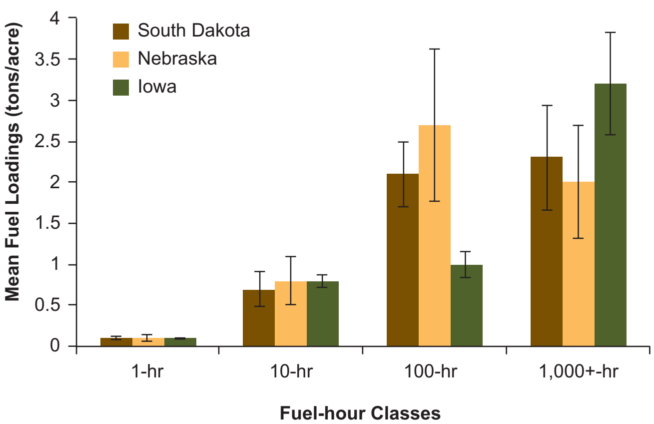


Figure 31.—Estimates of mean fuel loadings by fuel-hour class on forest land for South Dakota, Nebraska, and Iowa, 2008. Error bars represent 68-percent confidence intervals around the estimate.

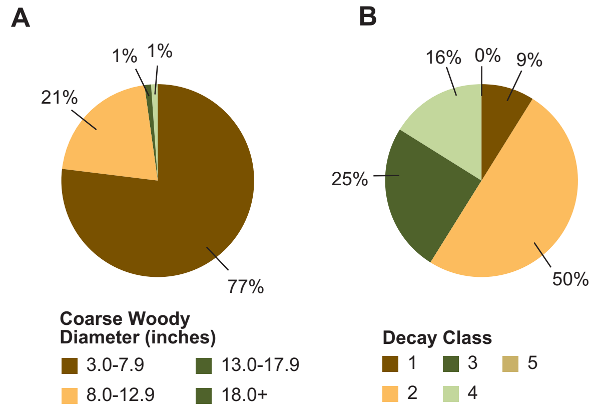


Figure 32.—Mean distribution of coarse woody debris (pieces per acre) by size class (inches) on forest land, Nebraska, 2008 (A). Mean distribution of coarse woody debris (pieces per acre) by decay class (1 = least decayed, 5 = most decayed) on forest land, Nebraska, 2008 (B).

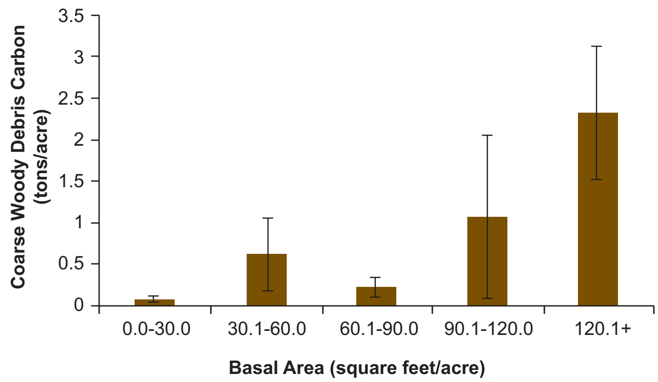


Figure 33.—Estimates of coarse woody debris carbon stocks by stand density on forest land, Nebraska, 2008. Error bars represent 68-percent confidence intervals around the estimate.

What this means

The fuel loadings of downed woody material can be considered a forest health hazard only in times of drought or in isolated stands with excessive tree mortality. The ecosystem services (e.g., habitat for fauna or shade for tree regeneration) provided by down woody materials exceed any negative forest health aspects. The population of coarse woody debris across Nebraska consists mostly of small pieces that are moderately decayed. Therefore, coarse woody debris constitutes a small, but important carbon stock and source of wildlife habitat across Nebraska's forests. The population of down woody materials in Nebraska's forests appears consistent with nearby states.

Carbon Stocks

Background

Collectively, forest ecosystems represent the largest terrestrial carbon sink on earth. The accumulation of carbon in forests through sequestration helps to mitigate emissions of carbon dioxide to the atmosphere from sources such as forest fires and burning of fossil fuels. The FIA program does not directly measure forest carbon stocks in Nebraska. Instead, a combination of empirically derived carbon estimates (e.g., standing live trees) and models (e.g., carbon in soil organic matter is based on stand age and forest type) are used to estimate Nebraska's forest carbon. Estimation procedures are detailed by Smith et al. (2006).

What we found

Nebraska forests currently contain more than 88 million tons of carbon. Soil organic matter (SOM) represents the largest forest ecosystem carbon stock in the State at more than 47 million tons, followed by live trees and saplings at more than 27 million tons (Fig. 34). Within the live tree and sapling pool, merchantable boles contain the bulk of the carbon (~ 17 million tons) followed by roots (~ 4 million tons) and tops and limbs (~ 4 million tons). The majority of Nebraska's forest carbon stocks are found in relatively young stands, 41 to 80 years old (Fig. 35). Early in stand development most of the forest ecosystem carbon is in the SOM and belowground tree components. As forest stands mature, the ratio of aboveground to belowground carbon slowly shifts as carbon accumulates in live and dead aboveground components. A look at carbon by forest-type group on a per unit area basis found that eight of the nine types have between 43 and 73 tons of carbon per acre (Fig. 36). Despite the similarity in per acre estimates, the distribution of forest carbon stocks by forest type is quite variable. In the pinyon/juniper group, for example, 28 percent (~ 15 tons per acre) of the forest carbon is in the litter layer, whereas in the elm/ash/cottonwood group only 4 percent is in the litter layer.

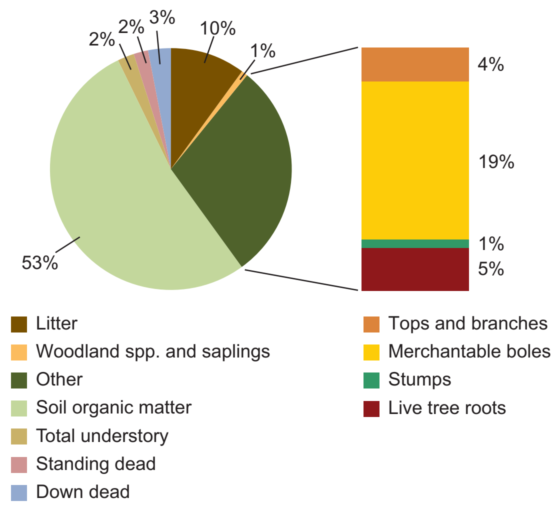


Figure 34.—Estimated total carbon stocks on forest land by forest ecosystem component, Nebraska, 2010.

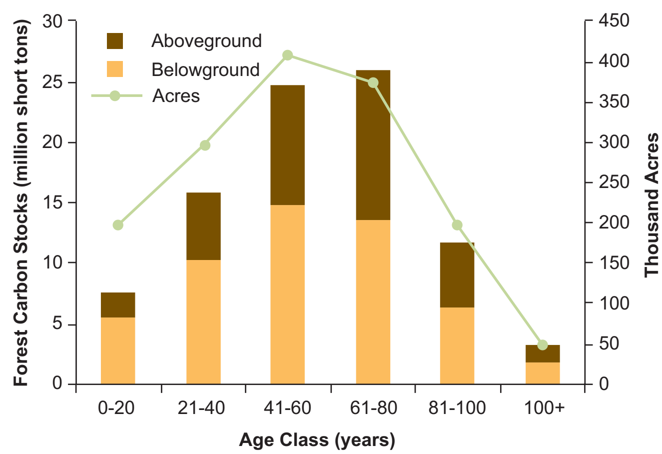


Figure 35.—Estimated aboveground and belowground carbon stocks on forest land by stand age class, Nebraska, 2010.

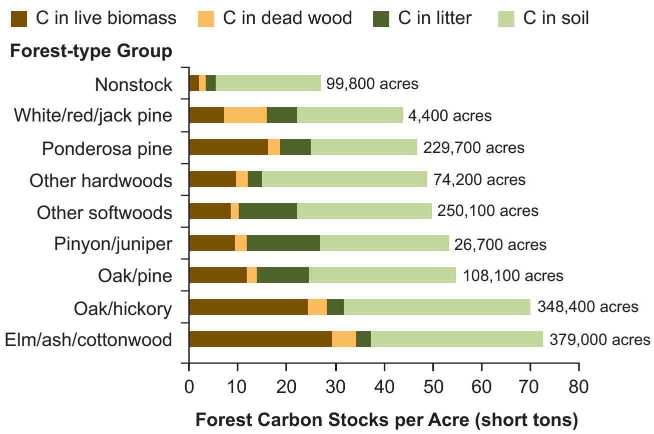


Figure 36.—Estimated carbon stocks on forest land by forest-type group and carbon pool per acre, Nebraska, 2010. Note: the "other softwoods" group includes the other eastern softwoods and exotic softwoods forest-type groups, and the "other hardwoods" group includes the other hardwoods and exotic hardwoods forest-type groups.

What this means

Carbon stocks in Nebraska's forests have increased substantially over the last several decades. The majority of forest carbon in the State is found in relatively young stands dominated by relatively long-lived species, which suggests that Nebraska's forest carbon will continue to increase as stands mature and accumulate carbon in aboveground and belowground components. Given the age class structure and species composition of forests in Nebraska, there are many opportunities to increase forest carbon stocks. However, managing for carbon in combination with other land management objectives will require careful planning and creative silvicultural practices beyond simply managing to maximize growth and yield.

Emerald Ash Borer

Background

The emerald ash borer (*Agrilus planipennis*; EAB) is a wood-boring beetle native to Asia (Poland and McCullough 2006). In North America, EAB has been identified as a pest only of ash and at least 16 native species of ash appear to be susceptible (Cappaert et al. 2005, McCullough and Siegert 2007). Trees and branches as small as 1 inch in diameter have been attacked, and while stressed trees may be initially preferred, healthy trees are also susceptible (Cappaert et al. 2005). In areas with a high density of EAB, tree mortality generally occurs 1 to 2 years after infestation for small trees and after 3 to 4 years for large trees (Poland and McCullough 2006). Spread of EAB has been facilitated by human transportation of infested material. EAB was not found in Nebraska during the 2010 inventory, but the threat of EAB introduction increased with the discovery of this pest in Missouri and Iowa.

What we found

Nebraska's forest land contains an estimated 40 million ash trees (greater than 1 inch d.b.h.); this number represents a significant increase from the 26.6 million ash trees present in 2005 (Fig. 37). In addition, the results of the GPI inventory conducted in 2008-2009 indicate an additional 49.4 million ash trees in other tree-covered areas such as windbreaks and in urban settings. Most of the gain in ash numbers is the result of an increase in the number of saplings. Green ash was the only ash species observed on Nebraska's forest land. It is the third most abundant species by number and ranks sixth by estimate of total volume. Total live volume of green ash is 124.8 million cubic feet, or 6 percent of the total volume on forest land. Ash is distributed across much of the State; however, the majority of ash is concentrated in eastern Nebraska (Fig. 38). Present on approximately 535,000 acres, or 35 percent of the State's forest land, green ash generally makes up less than 25 percent of total live-tree basal area (Fig. 39).

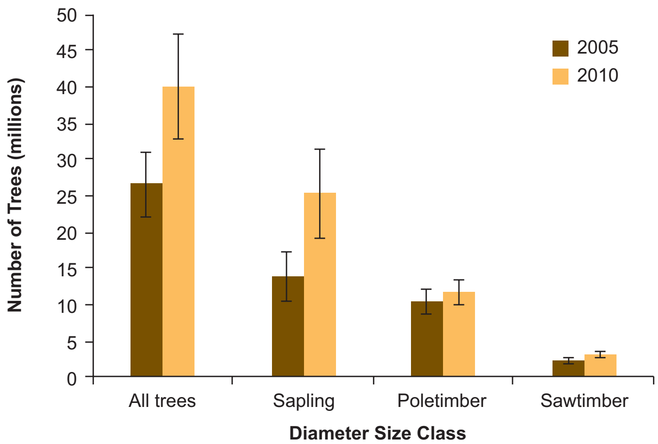


Figure 37.—Number of ash trees on forest land by inventory year and diameter size class, Nebraska, 2005 and 2010. Error bars represent 68-percent confidence intervals around the estimate.

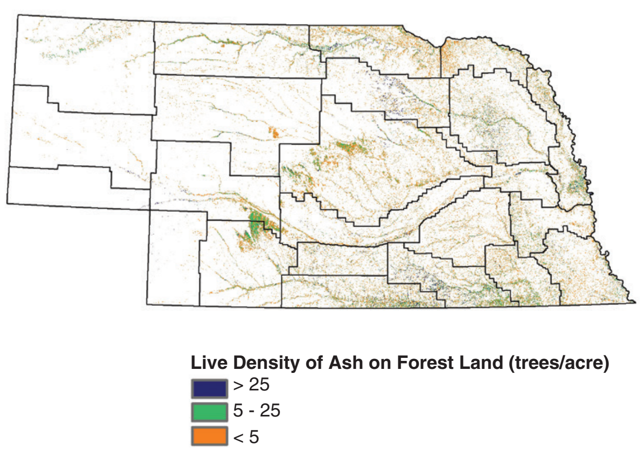


Figure 38.—Ash density on forest land, Nebraska, 2010.

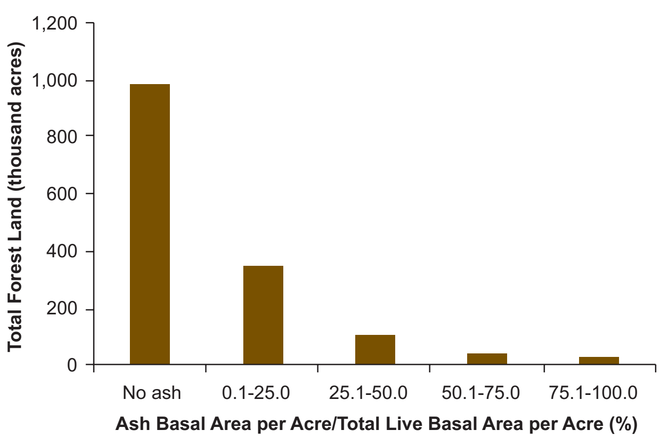


Figure 39.—Presence of ash on forest land, as a percentage of total live-tree basal area, Nebraska, 2010.

What this means

Ash is an important component of Nebraska's forests as well as other lands with trees. Because EAB has caused extensive decline and mortality of ash throughout the north-central United States, it similarly represents a significant threat to the forested and urban ash tree resource across Nebraska. Continued monitoring of ash resources will help identify the long-term impacts of EAB in forested settings. Efforts to slow the spread of EAB will be enhanced by discontinuing the transportation of firewood.

Thousand Cankers Disease

Background

Thousand cankers disease (TCD) is a newly described disease complex that is considered endemic to the western United States (USDA APHIS 2011). Affecting walnut species, TCD results from the interaction between the *Geosmithia morbida* fungus and the walnut twig beetle, *Pityophthorus juglandis*. Fungal spores are introduced into the phloem by the beetles as they construct galleries. Numerous cankers develop along the galleries, which ultimately girdle the tree (Seybold et al. 2011). TCD occurs in many western states, including neighboring Colorado, and it has been introduced to Tennessee, Virginia, and Pennsylvania. Although it was not found in Nebraska during the 2010 inventory, natural and artificial spread increases the risk of TCD introduction to the State (USDA APHIS 2011).

What we found

Black walnut is primarily found on forest land in eastern Nebraska, especially along the Missouri River (Fig. 40). It is also an important component of riparian forests and is present in many communities in western Nebraska. There are an estimated 1.3 million black walnut trees greater than 1 inch in diameter on forest land, which account for 19.7 million cubic feet of volume. In addition, the results of the GPI inventory conducted in 2008-2009 indicate an additional 25 million black walnut trees in other tree-covered areas, such as riparian corridors and urban settings.

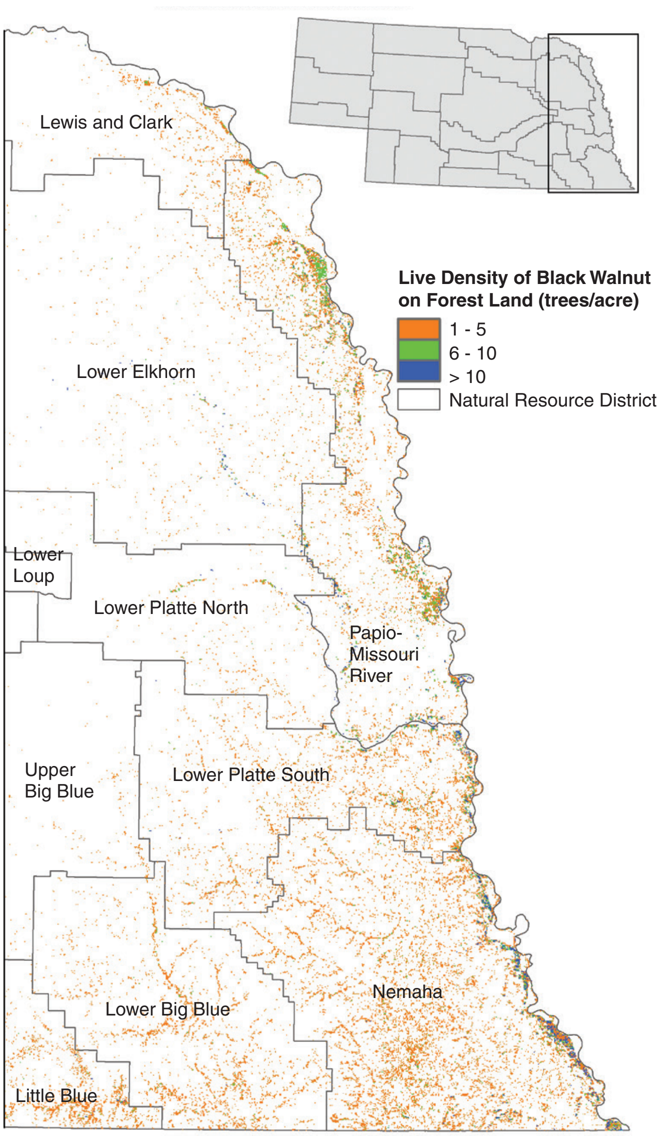


Figure 40.—Walnut density on forest land, Nebraska, 2010.

What this means

Although black walnut is not one of the most common tree species in Nebraska, it is considered an important species. Black walnut is valued by wildlife as well as by people in urban areas and serves as an important component of riparian forests. In addition, it is an economically important commercial species. Introduction of TCD to the State could cause extensive walnut mortality and dramatically impact Nebraska's forest ecosystems, urban landscape, and timber industry.

Vegetative Diversity

Background

Vascular plant diversity and abundance are important for healthy forest ecosystems. Different species play different and critical roles in forest sustainability. The overall species composition and structure of forest stands often reflects current environmental conditions, both favorable and unfavorable. Studying the status and trends in plant species richness and abundance provides information on the availability of wildlife habitat, carbon sequestration, fuel loadings, and chronic stresses such as site degradation, climate change, and pollution. Such disturbances may lead to an increase in opportunistic species, including nonnative invasive plants and even native species that can become aggressive invaders.

What we found

FIA identified all vascular plant species on P3 plots in Nebraska between 2007 and 2010. On 21 field plots, 353 different species were recorded. The number of species on each plot ranged from 9 to 77 with an average of 39 per plot. The most common species are listed in Table 5. Of the recorded species, 83 percent are native to Nebraska (Fig. 41). Forbs/herbs are the most common growth forms followed by graminoids (Fig. 42).

Table 5.—Most common species by growth habit, origin, and invasive status, Nebraska, 2007-2010

Species	Growth Habit	Origin	Invasive
Kentucky bluegrass	Graminoid	Native and introduced	No
Common dandelion	Forb/herb	Native and introduced	No
Common hackberry	Tree, shrub	Native	No
Eastern redcedar	Tree	Native	No
Green ash	Tree	Native	No
Virginia creeper	Vine	Native	No
Eastern poison ivy	Shrub, forb/herb, subshrub, vine	Native	No

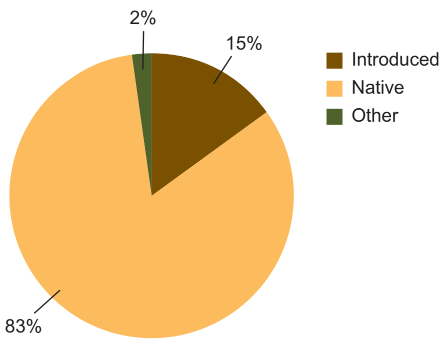


Figure 41.—Distribution of vascular plant species by origin, Nebraska, 2007-2010.

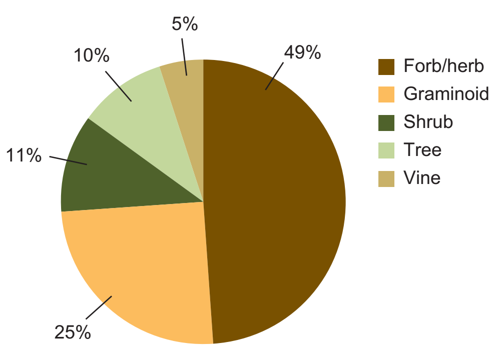


Figure 42.—Distribution of vascular plant species by growth habit, Nebraska, 2007-2010.

What this means

Nebraska's forests support a wide variety of vascular plant species. At least nine species were present on all plots, but higher averages indicate high species diversity across the State. Most species that were identified were native to Nebraska, but invasive plant species were also a factor. Furthermore, some of the common species are not officially listed as invasive by the Forest Service, but may be considered to be invasive in certain areas of the State. For example, the extensive and rapid expansion of eastern redcedar has become problematic so it may be viewed as an invasive species. Future inventories will reveal more information about the status and trends of forest vegetation and the impacts of invasive species.

Invasive Plants

Background

Invasive plants can be detrimental to native forest ecosystems and are becoming more prevalent. Because they are able to establish and grow quickly, these plants often outcompete and displace native vegetation in a short amount of time. As a result, ecological diversity is threatened and forest management costs increase as these plants impact forest tree regeneration and growth. FIA monitors invasive plants in three ways. First, data on all vascular plants, including invasives, are collected on P3 plots. Secondly, the presence/absence of the 23 most common invasive plant species is recorded on 20 percent of P2 plots. Lastly, information on invasive trees is collected on all P2 field plots.

What we found

At least one invasive species was found on 21 P2 and P3 plots across Nebraska (Fig. 43) and a total of 10 different species were observed (Table 6). Most plots (71 percent) had only one invasive species present (Fig. 44). Siberian elm and reed canarygrass were the two most commonly occurring invasives (Fig. 45). These two species account for 44 percent of occurrences.

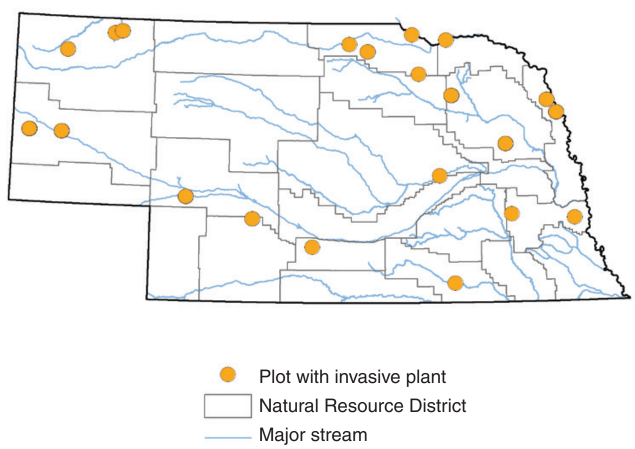


Figure 43.—Approximate location of plots with invasive plant species on forest land, Nebraska, 2007-2010.

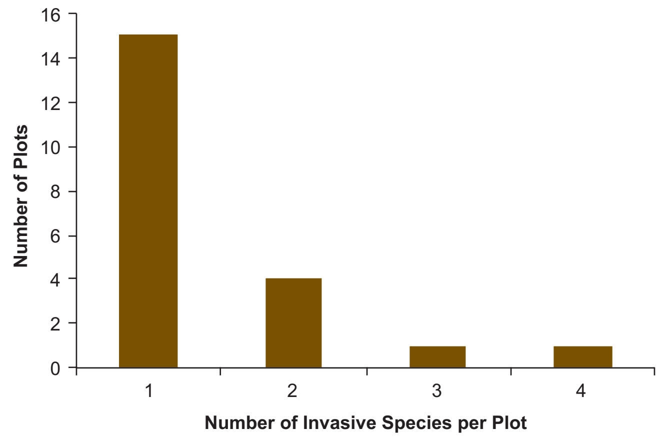


Figure 44.—Distribution of invasive plants observed on P2 and P3 plots (n=21), Nebraska, 2007-2010.

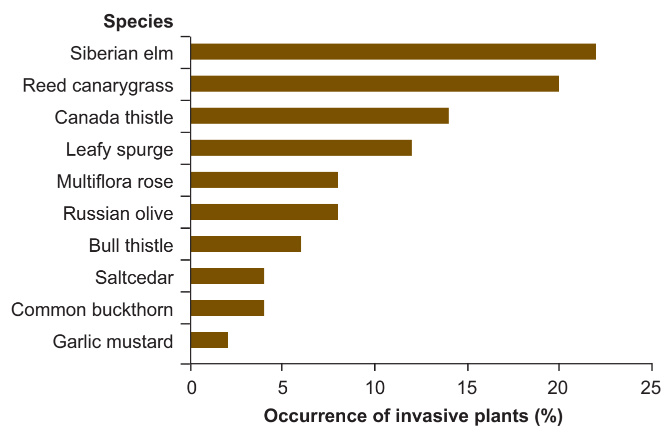


Figure 45.—Distribution of occurrence of recorded invasive plants on P2 and P3 plots, Nebraska, 2007-2010.

Table 6.—List of invasive plants surveyed on forest land in order of occurrence, Nebraska, 2007-2010

Common Name	Genus species	Number of occurrences
Siberian elm	*Ulmus pumila*	11
Reed canarygrass	*Phalaris arundinacea*	10
Canada thistle	*Cirsium arvense*	7
Leafy spurge	*Euphorbia esula*	6
Russian olive	*Elaeagnus angustifolia*	4
Multiflora rose	*Rosa multiflora*	4
Bull thistle	*Cirsium vulgare*	3
Common buckthorn	*Rhamnus cathartica*	2
Saltcedar	*Tamarix ramosissima*	2
Garlic mustard	*Alliaria petiolata*	1

What this means

The presence of at least 10 invasive species has been confirmed in Nebraska. Their ability to spread quickly and widely is a serious threat to the ecosystems in which they are found. Forest edges are more highly susceptible to invasion, placing much of the State's forest land at risk. Furthermore, the fact that many of these plants are found in or near some type of riparian type of habitat is especially alarming because riparian forests are a vital resource in Nebraska. The loss of native vegetation and the inability of native tree species to regenerate due to the competition from invasive plants could lead to the decline and eventual loss of the State's riparian forests.

Forest Habitats

Introduction

Forests, woodlands, and savannas provide habitats for many species of Nebraska birds (207), mammals (60), and amphibians and reptiles (40) (NatureServe: Lists of Vertebrate Species in the Contiguous U.S., February 17, 2011). Like all states, Nebraska has developed a State Wildlife Action Plan (SWAP) that identifies wildlife species of greatest conservation need (SGCN), and threats to their habitats. Also known as "The Nebraska Legacy Project" (2011, 2nd edition), the plan presents a systematic approach to conservation at two scales: the coarse filter and the fine filter.

The "coarse filter" focuses conservation at the scale of natural communities (habitats), e.g., different forest types at different structural stages. Rare, imperiled, or wide-ranging wildlife species may not be fully served by the coarse filter approach, so a "fine filter" approach is used to identify species-specific conservation needs. The National Vegetation Classification System (NCVS) was used to define 83 terrestrial community types in Nebraska. Twenty-two of these are forest and woodland communities, three of which are listed in the plan as critically imperiled: Peachleaf Willow Woodland, Mesic Bur Oak Forest and Woodland, and Paper Birch Springbranch Canyon Forest. The plan lists "Tier I" wildlife species as "…those that are globally or nationally at-risk" of extinction and that occur in Nebraska. These include species in mature deciduous forests (cerulean warbler, wood thrush, southern flying squirrel), deciduous/riparian woodlands (timber rattlesnake), and ponderosa pine woodlands and forests (pinyon jay, fringe-tailed myotis, Bailey's eastern woodrat—a subspecies found only in middle Niobrara River valley woodlands).

In addition to considering scales of conservation, the plan also addresses spatial scales of habitat patches within three categories: matrix (>1,000 acres), large patch (100 to 1,000 acres), and small patch (<100 acres). Many of Nebraska's forest and woodland communities are characterized as large patches. The plan also reports that "Nebraska's forests are threatened by garlic mustard and other plants that competitively exclude native species." Similarly "…the planting of trees in native grasslands can negatively impact grassland-dependent species and some invasive trees like eastern red cedar can rapidly spread into adjacent habitats, fragmenting prairie landscapes. The rapid expansion of eastern red cedar trees across Loess Hills region has degraded and fragmented natural communities and is leading to declines in native species and reduced livestock forage." Invasive species are addressed in detail in other sections of this report. And, specific habitat features (e.g., snags, riparian forest strips) represent an intermediate or "meso-filter" scale of conservation. This report characterizes habitats both at the coarse-filter scale (forest age/size) and meso-filter scale (standing dead trees).

Forest Age and Size

Background

Some species of wildlife depend upon early successional forests made up of smaller, younger trees, while others require older, interior forests containing large trees with complex canopy structure. Yet other species inhabit the ecotone (edge) between different forest stages, and many require multiple structural stages of forests to meet different phases of their life history needs. Abundance and trends in these structural and successional stages serve as indicators of population carrying capacity for wildlife species (Hunter et al. 2001). Historical trends in Nebraska's forest habitats are published here for timberland, which makes up more than 93 percent of all forest land in the State. For current habitat conditions, estimates are reported for all forest land.

What we found

Abundance of the large-diameter stand-size class has remained fairly stable since the 1980s (about 60 percent), which is a substantial increase from 1955 (Fig. 46). The majority of Nebraska forest land is in stand-age classes over 40 years, with virtually none estimated to exceed 150 years of age (Fig. 47). The small-diameter stand-size class predominates young forests (0 to 20 years), decreasing in relative abundance with increasing stand age. The opposite trend is seen for the large-diameter stand-size class, which increases in relative abundance with increasing stand age, becoming predominant at 41 to 60 years.

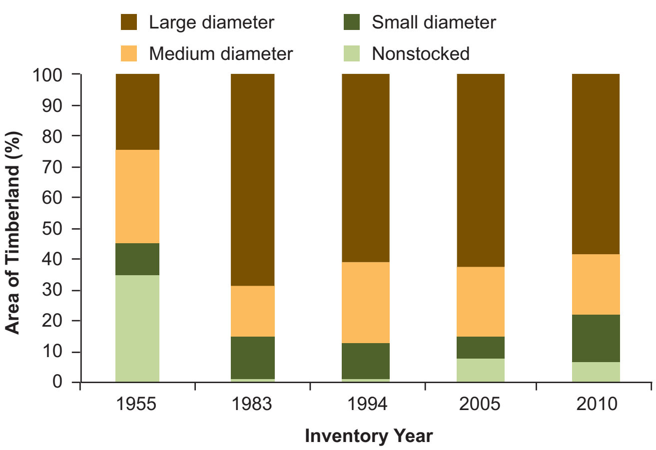


Figure 46.—Area (percent) of timberland by stand-size class, Nebraska, 1955-2010.

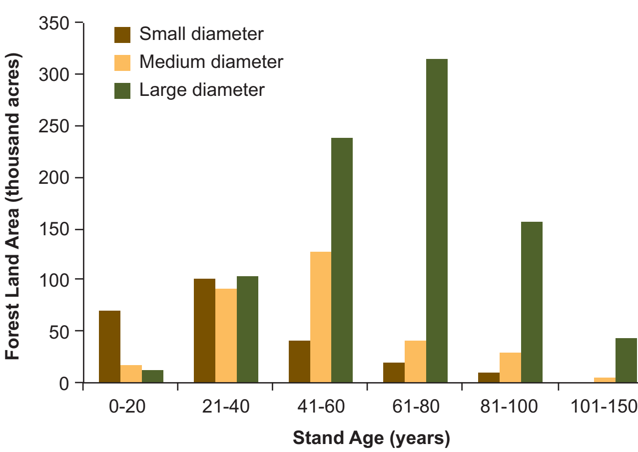


Figure 47.—Area of forest land by age class, Nebraska, 2006-2010.

What this means

A relatively stable abundance of large-diameter stand-size classes is evident over the past few decades. However, more than three-fourths of the large-diameter class is younger than 80 years, with less than 5 percent older than 100 years. The small-diameter stand-size class has increased substantially since the previous inventory, but still represents only 15 percent of forest land area. Although both stand-size class and stand-age class are strongly related indicators of forest successional stage, it is interesting to see the presence of some small-diameter forest in older stand ages and the occurrence of some large-diameter forest in younger stand ages. These odd combinations can happen when a few huge trees and numerous smaller trees occur in the same vicinity, providing diverse vegetative structure that may improve habitat quality, although rare coding anomalies also may result in unexpected combinations. Although seemingly contradictory, there is a need to maintain forest conditions in both smaller and larger structural stages to maintain earlier and later successional habitats for all forest-associated species. Managing forest composition and structure in a variety of conditions should 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 (at least 5 inches d.b.h.) 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.” According to one definition, “for wildlife habitat purposes, a snag is sometimes regarded as being at least 10 in (25.4 cm) in diameter at breast height and at least 6 ft (1.8 m) tall” (The Dictionary of Forestry: http://dictonaryofforestry.org/—last accessed 9 February 2012). Lewis’s woodpecker (*Melanerpes lewis*)—

named after Meriwether Lewis of the Lewis and Clark expedition—prefers habitats containing many snags, along edges of pine forests and streamside cottonwood groves of western Nebraska. Standing dead trees serve as important indicators not only of wildlife habitat, but also of past mortality events and carbon storage. And, they serve as sources of down woody material (Down Woody Materials section), which also provides 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 Nebraska forests.

What we found

FIA collects data on standing dead trees of numerous species and sizes in varying stages of decay. According to current inventory data (2006-2010), more than 16 million standing dead trees are present on Nebraska forest land. This total equates to an overall density of 10.8 standing dead trees per acre of forest land, with similar densities on public (10.3) and private (10.8) forest land. Five species groups each contributed more than one million standing dead trees, with the top group, "other eastern soft hardwoods" (predominately hackberry and American elm), exceeding 5 million (Fig. 48). Relative to the total number of live trees in each species group, 14 species groups exceeded 2 standing dead trees per 100 live trees, with the jack pine species group and other yellow pines (Scotch pine) group topping the list at more than 100 standing dead trees per 100 live trees (Fig. 49). The great majority (73 percent) of standing dead trees were smaller than 11 inches d.b.h., with 36 percent between 5 and 6.9 inches d.b.h. (Fig. 50). More than 62 percent of all standing dead trees were in the two classes of least decay; the class of most decay ('no evidence of branches remain') contained the fewest standing dead trees (5 percent).

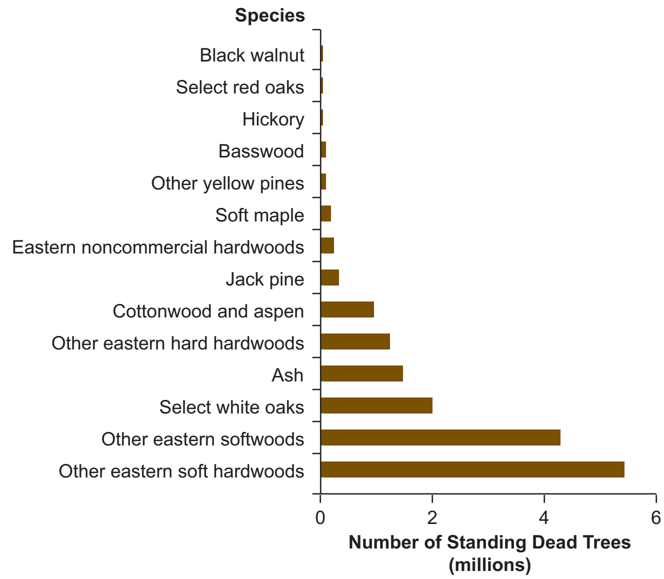


Figure 48.—Number of standing dead trees at least 5 inches d.b.h. by species group, Nebraska, 2006-2010.

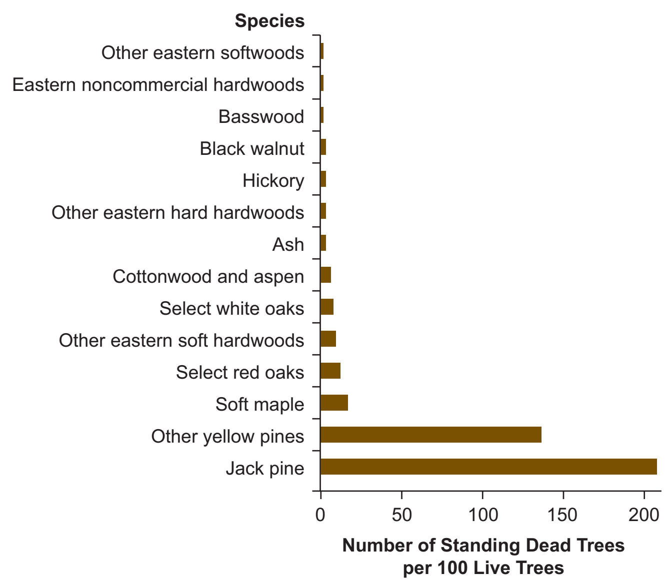


Figure 49.—Number of standing dead trees at least 5 inches d.b.h. per 100 live trees by species group, Nebraska, 2006-2010.

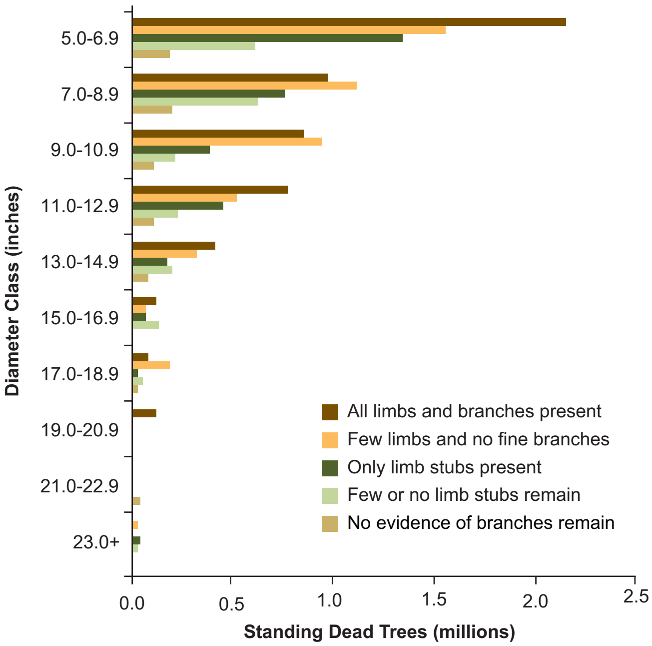


Figure 50.—Distribution of standing dead trees by decay and diameter classes for all dead trees, Nebraska, 2006-2010.

What this means

Snags and smaller standing dead trees result from a variety of potential causes, including diseases and insects, weather damage, fire, flooding, drought, competition, and other factors. Other eastern soft hardwoods (predominately elms) and other eastern softwoods (predominately ponderosa pine) species groups contained the largest number of standing dead trees, but jack pine, other yellow pines, soft maple, and select red oaks species group had the highest density of standing dead trees per 100 live trees. Compared to live trees, the number of standing dead trees is small, but they contain significantly more cavities than do live trees (Fan et al. 2003). Standing dead trees provide areas for foraging, nesting, roosting, hunting perches, and cavity excavation for wildlife, from primary colonizers such as insects, bacteria, and fungi to birds, mammals, and reptiles. Most cavity nesting birds are insectivores that help to control insect populations. Providing a variety of forest structural stages and retaining specific features like snags on both private and public lands are ways that forest managers maintain the abundance and quality of habitat for forest-associated wildlife species in Nebraska.

Forest Products

Windbreak

Growing-Stock Volume

Background

Growing-stock volume is the amount of sound wood in live, commercial tree species; trees must be at least 5 inches in d.b.h. or greater and free of defect. This measure has traditionally been used to determine wood volume available for commercial use. Estimates of the volume of growing stock are important considerations in economic planning and evaluations of forest sustainability. Note: due to changes in field procedures during the 2005 and 2010 inventories, trend information will be shown only for net volume of live trees (>= 5.0 inches d.b.h.) on timberland and growing-stock values will be reported only for the 2010 inventory.

What we found

Live volume in Nebraska has increased steadily since 1983 with a current estimate of more than 1.9 billion cubic feet (Fig. 51), or an average of nearly 1,380 cubic feet per acre of timberland. Growing-stock trees make up more than half (59%) of the total volume with an estimated 1.1 billion cubic feet. Four species account for three-fourths of all growing-stock volume: plains and eastern cottonwood together account for 471 million cubic feet, followed by ponderosa pine (279 million cubic feet) and bur oak (105 million cubic feet).

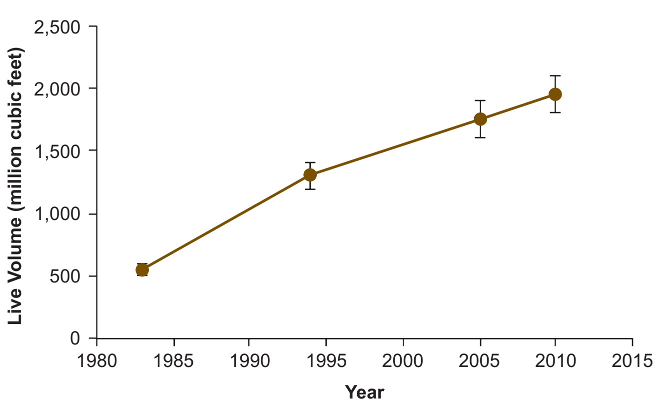


Figure 51.—Total live volume (millions of cubic feet) on timberland, Nebraska, 1983 to 2010. Error bars represent 68-percent confidence intervals around the estimate.

Examination of the growth and removals data for growing-stock species in Nebraska indicates that while the growth rate continues to outpace the rate of removals, the result is a less than 1 percent annual net increase in growing-stock volume. Ponderosa pine and American elm, however, had annual losses in growing-stock volume, with average annual net changes of -1.1 and -1.2 percent, respectively. Although it does not show growing-stock volume specifically, Figure 52 reflects these changes by showing the change in net volume of live trees at least 5.0 inches in d.b.h. on timberland from past inventories.

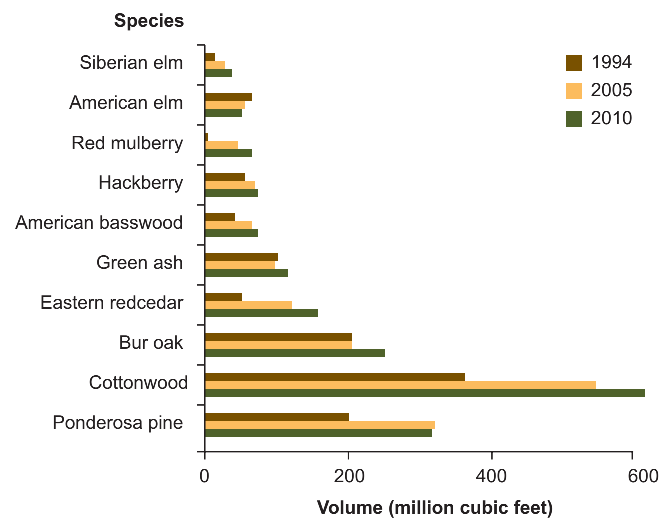


Figure 52.—Total volume of live trees (>= 5.0 inches d.b.h.) on timberland for selected species, Nebraska, 1983-2010.

What this means

Since Nebraska's statewide inventory in 1983, the volume of economically important and other species has continued to increase. Growth and removals data for growing-stock species show a minor annual net increase in growing-stock volume as a whole and for all major species except ponderosa pine and American elm. The loss in ponderosa pine volume is partly the result of large wildfires that have burned nearly 84,000 forested acres in Nebraska since 2000. The losses in volume for these two species indicate the potential for problems for sustainability of economically important forest resources, which should be monitored into the future. In addition, declines in major species may lead to changes in future species compostion.

Sawtimber Quantity and Quality

Background

Sawtimber trees are live trees of commercial species that contain either a 12-foot log or two noncontiguous 8-foot logs that are free of defect. To qualify as sawtimber, softwood trees must be at least 9.0 inches d.b.h. and hardwoods must be at least 11.0 inches d.b.h. 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 (7 inches for softwoods and 9 inches for hardwoods). Estimates of sawtimber volume, expressed as board feet (International ¼-inch rule), are used to determine the monetary value of wood volume and to identify the quantity of merchantable wood availability.

The quality of live sawtimber volume is rated using tree grades 1 to 3 that are based on diameter and the presence or absence of defects such as knots, decay, and curvature of the bole. Grade 1 indicates the highest quality. Softwood sawtimber is valued primarily for lumber while hardwood sawtimber is valued for other products like flooring and furniture.

What we found

Total sawtimber volume on timberland had increased significantly in Nebraska since the 1983 inventory but has begun to slow or possibly decline since 2005 (Fig. 53). Currently, there is an estimated 4.7 billion board feet of sawtimber volume on timberland in the State; most of the volume (42 percent) is grade 3. Of all sawtimber volume, 12 percent meets the requirements for grade 1 and 10 percent meets the requirements for grade 2. Hardwoods contain 76 percent of the total sawtimber volume with nearly 3.6 billion board feet. Softwood sawtimber volume exceeds 1.1 billion board feet.

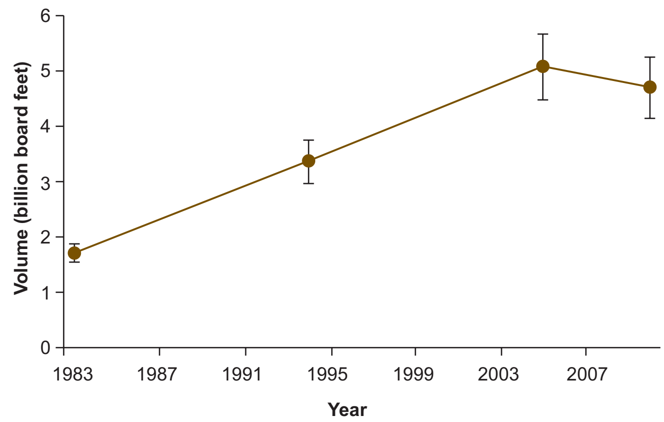
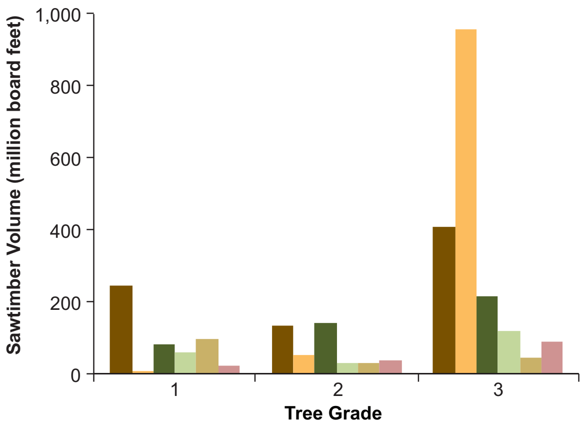


Figure 53.—Sawtimber volume on timberland by inventory year, Nebraska, 1983 to 2010. Error bars represent 68-percent confidence intervals around the estimate.

The top six species in sawtimber volume are eastern cottonwood, ponderosa pine, plains cottonwood, bur oak, American basswood, and green ash (Fig. 54). Eastern and plains cottonwood species combined dominate in total sawtimber volume, accounting for nearly half (48 percent) of all sawtimber volume. These species make up 57 and 56 percent of all grades 1 and 2 sawtimber volume, respectively. Ponderosa pine accounts for 48 percent of all grade 3 sawtimber volume and is the second most voluminous species. However, 91 percent of the volume of this species is in the lowest quality category (grade 3). American basswood and bur oak make up 17 and 11 percent, respectively, of all grade 1 sawtimber volume.



	1	2	3
Eastern cottonwood	250,300,000	134,400,000	406,800,000
Ponderosa pine	9,100,000	55,400,000	961,300,000
Plains cottonwood	84,000,000	145,700,000	216,000,000
Bur oak	64,100,000	29,900,000	123,500,000
American basswood	98,000,000	30,400,000	48,800,000
Green ash	23,600,000	36,200,000	93,600,000

Figure 54.—Sawtimber volume by tree grade for the six most voluminous species on timberland, Nebraska, 2010.

What this means

Total sawtimber volume continued to increase significantly and steadily in Nebraska until the 2005 inventory. Since then, increases in volume have slowed or may be starting to decline. However, the average annual net growth rate of sawtimber trees is slightly higher than the rate of removals so volume should continue to hold steady or increase. The appearance of a possible decrease could also be due in part to changes in field procedures.

Ponderosa pine contains a significant amount of sawtimber volume, but most of it is low quality. Cottonwood species are the most important with respect to high-quality sawtimber. Other species that contain a notable proportion of saw logs that meet grade 1 requirements are American basswood, bur oak, eastern redcedar, green ash, and hackberry. Because cottonwood is an aging resource with little regeneration, the eventual decline in its volume will have a significant impact on the State's timber products industry.

Timber Products Output

Background

The harvesting and processing of timber products produces a stream of income shared by timber owners, managers, marketers, loggers, truckers, and processors. In 2007, the wood products and paper manufacturing industries in Nebraska employed 3,760 people, with an average annual payroll of $126.5 million and total value of shipments of $852.6 million (U.S. Census Bureau 2007.) To better manage the State's forests, it is important to know the species, amounts, and locations of timber being harvested.

Note: the results in this section are based on mill survey responses for one point in time (i.e., 2009) and include only data on tree removals due to timber harvesting and not those associated with land use change or those killed during the process of harvesting. Therefore, the estimates presented here do not match those reported in the Removals section.

What we found

Surveys of Nebraska's wood-processing mills are conducted periodically to estimate the amount of wood volume that is processed into products. The results are supplemented with the most recent surveys conducted in surrounding states that processed wood harvested from Nebraska. In 2009, there were 62 active primary wood-processing mills that were surveyed to determine what species were processed and where the wood material came from. These mills processed 4.1 million cubic feet of saw logs, veneer logs, posts, and other wood products.

In 2009, 4.1 million cubic feet of industrial roundwood was harvested from Nebraska's forest land. Saw logs accounted for 72 percent of the total industrial roundwood harvested, and excelsior/shavings accounted for 20 percent (Fig. 55). Other products harvested were posts, cabin logs, and other miscellaneous products. Cottonwood accounted for three-fourths of the total industrial roundwood harvest in 2009 (Fig. 56). Other important species groups harvested included ponderosa pine, eastern redcedar, white oaks, and black walnut.

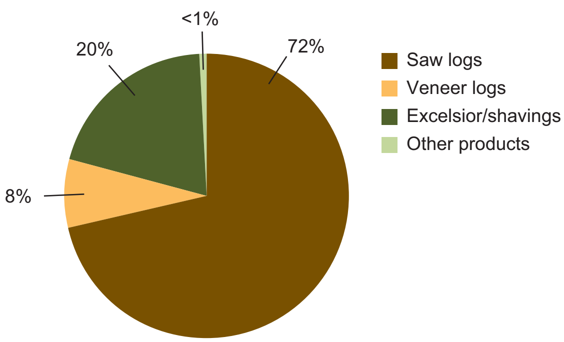


Figure 55.—Industrial roundwood production by product, Nebraska, 2009.

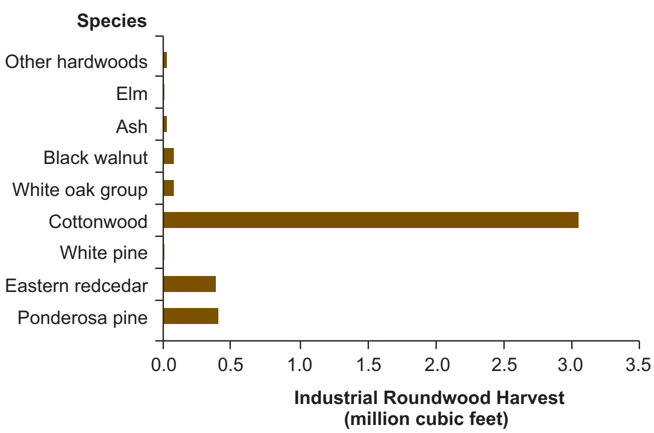


Figure 56.—Industrial roundwood harvested by species group, Nebraska, 2009.

Figure 57.—Total harvest removals from industrial roundwood harvesting by growing stock and non-growing stock, use for product and harvest residue, and softwoods and hardwoods, Nebraska, 2009.

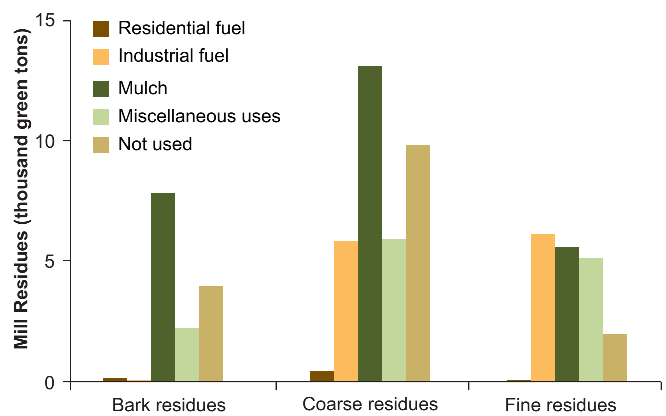


Figure 58.—Disposition of mill residues generated by primary wood-using mills, Nebraska, 2009.

In the process of harvesting industrial roundwood, 1.5 million cubic feet of harvest residues were left on the ground (Fig. 57). Two-thirds of the harvest residues came from non-growing-stock sources such as crooked or rotten trees, tops and limbs, and dead trees. The processing of industrial roundwood in the State's primary wood-using mills generated 68,000 green tons of wood and bark residues. Almost 40 percent of the mill residues generated were used for mulch and 20 percent were used for livestock bedding, small dimension products, and other uses. Other secondary products from Nebraska's primary mill residues include industrial and residential fuelwood. Twenty-three percent of the mill residues were not used for other products (Fig. 58).

What this means

The poor economy has led to the idling and closure of an increased number of primary wood-processing facilities. An important consideration for the future of the primary wood-products industry is its ability to retain industrial roundwood processing facilities. The loss of processing facilities is important not only for the number of jobs lost, but also for the greater difficulty in finding markets for the timber harvested from the landowners' forest land.

A third of the residue generated during the harvest is from growing-stock sources (wood material that could be used to make products). In addition, nearly a quarter of the mill residues that are produced are currently not being used for other secondary products. Industrial fuelwood or wood pellets could be possible markets for this unused material, and thus could lead to better utilization of forest resources.

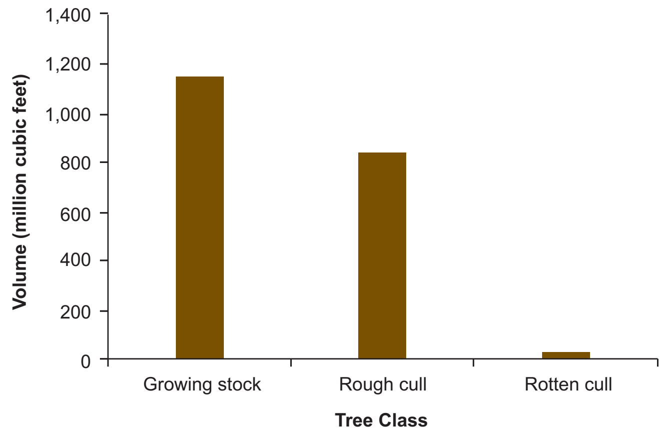


Figure 59.—Live volume on forest land by tree class, Nebraska, 2010.

Low-quality Trees: an Important Source of Biofuel

Background

Poor quality trees that are unsuitable for manufacturing wood products can provide an important source of renewable energy. FIA uses a tree class code to indicate the general quality of a tree. Growing-stock trees are live commercial species that meet minimum merchantability statndards whereas rough cull and rotten cull trees do not. Estimates of volume by tree class can be used to determine the amount of wood available for both manufactured products and biofuels. Note: sampling error rates by county are often very high so these estimates should be used with caution.

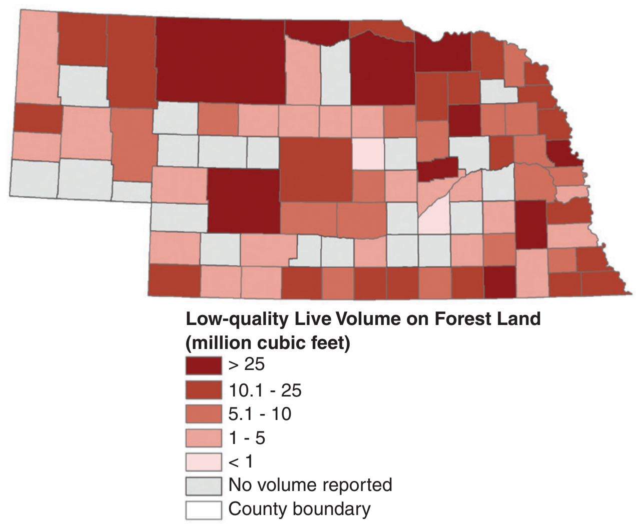


Figure 60.—Low-quality live volume on forest land by county, Nebraska, 2010.

What we found

Nebraska's forest land contains approximately 2 billion cubic feet of wood volume in live trees that are 5 inches or more in diameter, which equates to more than 42 million short tons of aboveground biomass, or 95 percent of the State's total biomass. Currently, there is more than 860 million cubic feet of volume in poor quality trees (Fig. 59), accounting for 43 percent of the total volume.

Low-quality volume and biomass are concentrated in the northern part of the State, but areas with high concentrations are found across Nebraska (Fig. 60). Figure 61 shows the percent of a county's volume that is in rough and rotten cull trees. Thirty-nine counties have more than half of their total live volume in poor quality trees and five counties have 100 percent (Cuming, Fillmore, Gage, Hooker, and Red Willow).

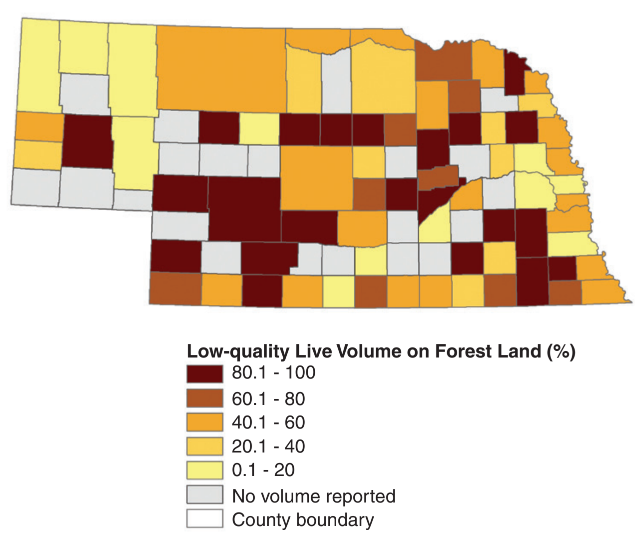


Figure 61.—Percentage of low-quality live volume on forest land by county, Nebraska, 2010.

What this means

Nebraska's forests contain an important source of renewable energy. A significant proportion of the total live volume is in trees that do not meet merchantability standards, which indicates an adequate supply of biofuels. Counties with a high proportion of their total volume in low-quality trees are particularly good candidates for thinning operations to obtain this resource and help concentrate growth on the remaining trees. However, it is important to note that not all trees are available for harvest, and proper harvesting should be used to maintain this renewable resource.

Data Sources

Forest land near the Missouri River

Forest Inventory

Information on the condition and status of forests in Nebraska was obtained from the Northern Research Station's Forest Inventory and Analysis (NRS-FIA) program. Previous inventories of Nebraska's forest resources were completed in 1955 (Stone and Bagley 1961), 1983 (Raile 1986), 1994 (Schmidt and Wardle 1998), and 2005 (Meneguzzo et al. 2008). Data from Nebraska's forest inventories can be accessed electronically on the DVD included with this report, or at: http://www.nrs.fs.fed.us/fia. For detailed information on inventory methods, see the "Statistics and Quality Assurance" section on the DVD.

National Woodland Owner Survey

Information about family forest owners is collected annually through the U.S. Forest Service's National Woodland Owner Survey (NWOS). The NWOS was designed to increase our understanding of owner demographics and motivation (Butler et al. 2005). Data presented here are based on survey responses from 35 randomly selected families and individuals who own forest land in Nebraska plus additional information from family forest owners in adjoining survey units from North Dakota, South Dakota, and Kansas. For additional information about the NWOS, visit: www.fia.fs.fed.us/nwos.

Timber Products Output Inventory

This study was a cooperative effort between the Nebraska Forest Service (NFS) and the Northern Research Station of the U.S. Forest Service. Using a questionnaire designed to determine the size and composition of Nebraska's forest products industry, its use of roundwood (round sections cut from trees), and its generation and disposition of wood residues, NFS personnel contacted via mail and telephone all primary wood-using mills in the State. Completed questionnaires were sent to NRS for processing. As part of data processing, all industrial roundwood volumes reported were converted to standard units of measure using regional conversion factors.

National Land Cover Data Imagery

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

Mapping Procedures

Maps in this report were constructed using (1) categorical coloring of Nebraska Natural Resource Districts or 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 locations.

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DVD Contents

Nebraska's Forests 2010 (PDF)

Nebraska's Forests: Statistics, Methods, and Quality Assurance (PDF)

Nebraska Inventory Database (CSV file folder)

Nebraska Inventory Database (Access file)

Field guides that describe inventory procedures (PDF)

Database User Guides (PDF)

Meneguzzo, Dacia M; Crocker, Susan J.; Nelson, Mark D.; Barnett, Charles J.; Butler, Brett J.; Domke, Grant M.; Hansen, Mark H.; Hatfield, Mark A.; Liknes, Greg C.; Lister, Andrew J.; Lister, Tonya W.; Piva, Ronald J.; Wilson, Barry T. (Ty); Woodall, Christopher W. 2012. **Nebraska's Forests 2010**. Resour. Bull. NRS-68 . Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 47 p. [DVD included]

The second full annual inventory of Nebraska's forests reports more than 1.5 million acres of forest land and 39 tree species. Forest land is dominated by the elm/ash/cottonwood and oak/hickory forest types, which occupy nearly half of the total forest land area. The volume of growing stock on timberland currently totals 1.1 billion cubic feet. The average annual net growth of growing stock from 2005 to 2010 is nearly 22 million cubic feet per year. This report includes additional information on forest attributes, land use change, carbon, timber products, and forest health. A DVD included in this report contains (1) descriptive information on statistics and quality assurance of data collection, (2) a glossary of terms, (3) tables that summarize quality assurance, (4) a core set of tabular estimates for a variety of forest resources, and (5) 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, Nebraska

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