



Forests of Pennsylvania, 2017

This resource update provides an overview of the forest resources in Pennsylvania based on inventories conducted by the USDA Forest Service, Forest Inventory and Analysis (FIA) program of the Northern Research Station. Estimates are based on field data collected using the FIA annualized sample design and are updated yearly.¹ Information about the national and regional FIA program is available online at <http://fia.fs.fed.us>. FIA began annual inventories in Pennsylvania in 2000. For the 2017 inventory, estimates of current resource attributes, such as area, volume, and biomass, are based on 4,520 (3,015 forested) plot samples collected from 2011 to 2017. Estimates of components of change, such as net growth, removals, and mortality, are based on 4,143 (2,666 forested) samples collected from 2006 to 2011 and revisited from 2011 to 2017. Estimates from earlier inventories are shown for comparison. See

¹One-fifth of the plots was measured annually from 2000 thru 2013 resulting in a full cycle every 5 years. In 2014, this changed to 7 years, wherein 1/7th (14.3 percent) of the plots are measured annually.

Bechtold and Patterson (2005), Gormanson et al. (2018), and Burrill et al. (2018) for definitions and technical details. A complete set of inventory tables is available at <https://doi.org/10.2737/FS-RU-175>.

Overview

Pennsylvania forest land remained stable at 16.8 million acres in 2017 and the proportion dominated by large diameter stands continued to rise. Net volumes increased as well, totaling 39 billion cubic feet, 6 percent over the 2012 estimate. Sawtimber volume on timberland increased 10 percent to 120 billion board feet.

Though forest area remained stable and volumes increased, net growth decreased 13 percent since 2012 and mortality increased 18 percent. Removals were also down compared to the 2012 estimate. Despite these differences in the components of annual volume change, the growth to removals ratio remained at 2.1 overall on timberland.

Table 1.—Pennsylvania forest statistics, 2017 and 2012. Volume estimates are for trees 5 inches and larger in diameter. Numbers of trees and biomass estimates are for trees 1 inch and larger in diameter. Sampling errors in tables and error bars in figures represent 68 percent confidence intervals.

	2017 Estimate	Sampling error (%)	2012 Estimate	Sampling error (%)	Change from 2012 (%)
Forest land					
Area (thousand acres)	16,790.0	0.6	16,748.4	0.7	0.2
Number of live trees (million trees)	8,076.1	1.7	8,168.8	1.7	-1.1
Aboveground biomass of live trees (million oven-dry tons)	1,107.1	1.0	1,052.8	1.0	5.2
Net volume of live trees on (million ft ³)	38,960.4	1.0	36,881.7	1.1	5.6
Annual net growth of live trees (thousand ft ³ /yr)	746,251.9	2.7	855,118.4	3.0	-12.7
Annual mortality of live trees (thousand ft ³ /yr)	382,317.2	3.6	324,790.3	4.0	17.7
Annual harvest removals of live trees (thousand ft ³ /yr)	331,116.1	7.9	387,699.1	7.2	-14.6
Annual other removals of live trees (thousand ft ³ /yr)	9,311.7	27.2	12,731.1	27.3	-26.9
Timberland					
Area (thousand acres)	16,178.5	0.7	16,146.0	0.8	0.2
Number of live trees (million trees)	7,821.9	1.8	7,919.4	1.8	-1.2
Aboveground biomass of live trees (million oven-dry tons)	1,060.1	1.0	1,009.1	1.1	5.0
Net volume of live trees (million ft ³)	37,304.6	1.1	35,350.0	1.2	5.5
Net volume of growing stock trees (million ft ³)	34,089.1	1.2	32,322.1	1.3	5.5
Annual net growth of growing stock trees (thousand ft ³ /yr)	629,007.3	2.6	703,617.7	2.7	-10.6
Annual mortality of growing stock trees (thousand ft ³ /yr)	265,748.3	4.1	233,380.0	4.5	13.9
Annual harvest removals of growing stock trees (thousand ft ³ /yr)	275,049.4	8.1	328,766.8	7.4	-16.3
Annual other removals of growing stock trees (thousand ft ³ /yr)	8,892.7	47.3	19,796.1	26.9	-55.1



Forest Area

Forest area in the Commonwealth has been relatively stable for five decades (Fig. 1). Estimates of forest land since the beginning of annual inventories in Pennsylvania fluctuated between 16.6 million acres and 17.0 million acres. The 2017 total of 16.8 million is only 42,000 acres higher than 2012, a change that is not statistically significant. Timberland is 96 percent of forest land and 4 percent (592,000 acres) is reserved forest land (Fig. 2), i.e. public forest land prohibited by law from active management. Family ownership makes up 51 percent of forest land. Private ownership together accounts for 70 percent of forest land.

Steady increases in large diameter stands² have led to 71 percent of timberland being dominated by sawtimber, a rise of five percentage points since 2012 (Fig. 3). During the same time period, small diameter stands dropped from 10 percent to 8 percent of timberland area.

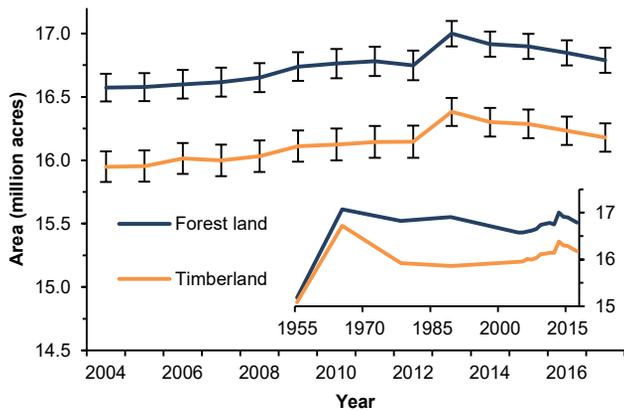


Figure 1.—Area of forest land and timberland by year, Pennsylvania, 1955 to 2017.

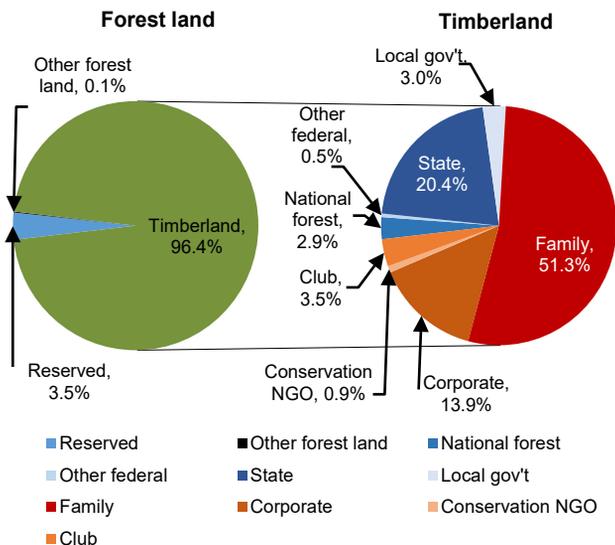


Figure 2.—Proportion of forest land by ownership class and land use, Pennsylvania, 2017.

Of the 15 forest-type groups identified in Pennsylvania, oak/hickory and maple/beech/birch account for the majority of timberland with 53 and 32 percent, respectively. The percentage of oak/hickory stands in the large diameter class rose from 67 percent in 2012 to 72 percent in 2017 (Fig. 4). Large diameter maple/beech/birch stands are 77 percent of the total timberland area in the forest-type group. Most of the gains in large diameter maple/beech/birch were offset by decreases in small diameter. Decreases in medium diameter oak/hickory were greater than decreases in the area of small diameter stands.

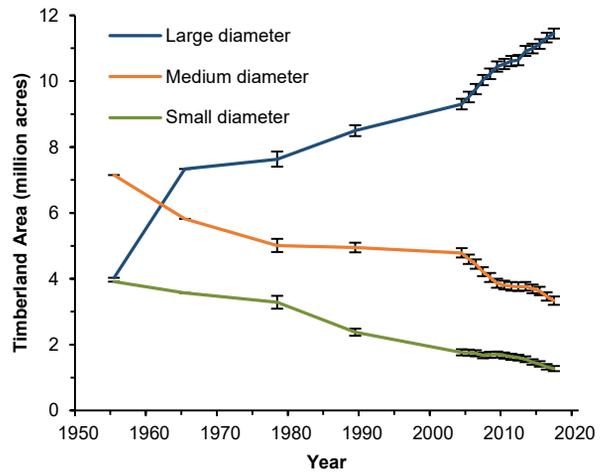


Figure 3.—Area of timberland by stand-size class and inventory year, Pennsylvania, 1955 to 2017.

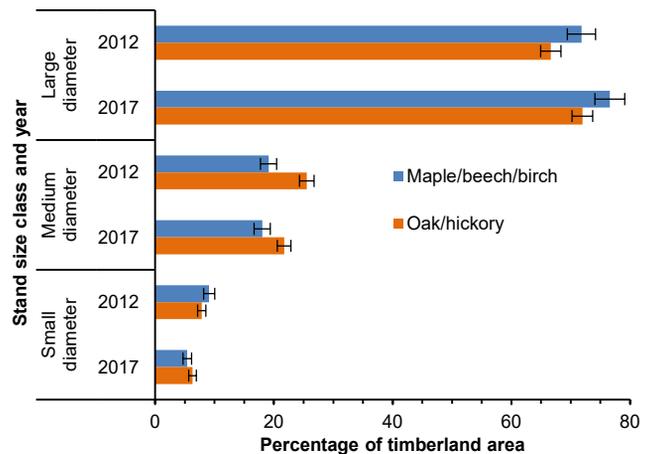


Figure 4.—Area of timberland by stand-size class² for the top two forest-type groups by inventory year, Pennsylvania, 2012 and 2017.

² Small diameter (seedling/sapling) stands: dominated by trees less than 5.0 inches d.b.h.; Medium (poletimber): 5.0 to 8.9 inches d.b.h. for softwoods and 5.0 to 10.9 inches d.b.h. for hardwoods; Large (sawtimber): ≥ 9.0 inches for softwoods and ≥ 11.0 d.b.h. for hardwoods.

Volume, Biomass, and Trends

Net volume on forest land totals 39.0 billion cubic feet, a 5.6 percent increase over the 2012 estimate (Table 2). The 10 species having the most net volume remained unchanged from 2012, though shifts of rank within the top 10 occurred. A 13 percent increase in the net volume of sweet birch moved the species from the tenth spot in 2012 to eighth in 2017. White ash was the only species that decreased in net volume (-7 percent). Mortality, likely caused by emerald ash borer throughout most of the Commonwealth, led to white ash falling to the tenth most voluminous species.

Overall, the 2017 estimate of 120.5 billion board feet (bdft.) is 9.8 percent higher than 2012. All species had higher percentage increases in sawtimber volume than cubic foot volume. Red maple increased 13 percent in sawtimber volume over 2012 and has the highest volume at 18.5 billion bdft. Sawtimber increases among other species were greatest for sweet birch (17 percent), and white oak (13 percent). Additionally, other softwood species (all softwoods except eastern hemlock) had an increase in sawtimber volume of 22 percent since 2012.

Increases in aboveground biomass on forest land followed increases in net cubic foot volume. The 2017 estimate of 1.1 billion tons is 5 percent higher than the 2012 total.

While there were changes in the components of annual volume change, the overall net growth to removals ratio (G:R) on timberland remained at 2.1, the same as 2012. An 18 percent increase in annual mortality contributed to a 13 percent decrease in net growth, since 2012.

Total removals for all species decreased 16 percent from 2012 to 345 million cubic feet.

The majority of the 12 most voluminous species had G:R ratios similar to those in 2012. A notable exception is black cherry for which net growth outpaced removals by a factor of 1.8 (Fig. 5), down from 3.0 in 2012, driven by a 58 percent increase in mortality and a 22 percent increase in removals. Yellow-poplar G:R increased to 6.0 from 2.8 in 2012. White ash and beech both had removals exceeding net growth with G:Rs of 0.3 and 0.5, respectively. Sweet birch and white pine were the only species of the top 12 to have increases in both net growth and G:R ratios.

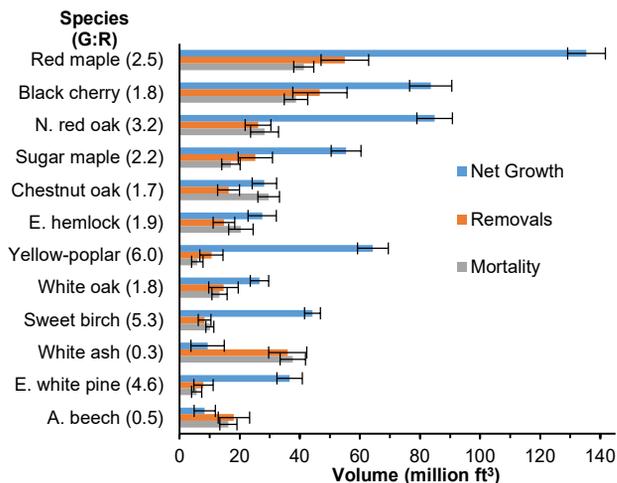


Figure 5.—Average annual net growth, removals, and mortality volume on timberland, with growth to removals ratios (G:R) in parentheses, for the top 12 species ranked by total net volume, Pennsylvania, 2017.

Table 2.—Net volume and percentage change on forest land; sawtimber volume and percentage change on timberland, and aboveground biomass on forest land, Pennsylvania, 2017, (top 10 species by net volume). Volume estimates are for trees 5 inches and larger in diameter. Biomass estimates are for trees 1 inch and larger in diameter.

	Net volume of live trees (million ft³)	Sampling error (percent)	Percent change since 2012	Net volume of sawtimber (million bd.ft.)	Sampling error (percent)	Percent change since 2012	Aboveground biomass (million dry tons)	Sampling error (percent)
Red maple (<i>Acer rubrum</i>)	7,225.0	2.5	7.2	18,504.4	3.6	12.9	195.6	2.4
Black cherry (<i>Prunus serotina</i>)	4,128.3	3.9	2.5	13,512.1	5.1	5.1	105.7	3.7
N. red oak (<i>Quercus rubra</i>)	3,842.1	3.8	6.8	15,521.0	4.4	10.5	122.8	3.7
Sugar maple (<i>Acer saccharum</i>)	2,866.8	4.8	6.8	8,839.5	5.9	9.5	90.3	4.6
Chestnut oak (<i>Quercus prinus</i>)	2,653.2	4.4	5.3	7,493.6	5.3	11.2	86.3	4.4
E. hemlock (<i>Tsuga canadensis</i>)	1,965.5	5.9	3.2	5,880.3	6.7	6.1	37.3	5.8
Y-poplar (<i>Liriodendron tulipifera</i>)	1,941.5	7.5	9.5	8,392.2	8.5	10.1	40.1	7.3
Sweet birch (<i>Betula lenta</i>)	1,756.9	4.4	12.7	3,302.4	6.2	16.8	63.3	4.0
White oak (<i>Quercus alba</i>)	1,714.3	5.2	6.3	6,063.1	6.4	12.9	55.4	5.2
W. ash (<i>Fraxinus americana</i>)	1,627.3	5.3	-6.9	5,333.2	7	-2.5	48.5	5.2
Other softwood species	1,869.4	6.7	12.8	6,554.0	7.7	22.1	35.3	6.4
Other hardwood species	7,370.0	2.3	4.4	21,060.5	3.3	8.7	226.4	2.2
All species	38,960.4	1	5.6	120,456.4	1.6	9.8	1,107.1	1.0

Spotted Lanternfly

Spotted lanternfly (SLF, *Lycorma delicatula*) is a planthopper native to China and first discovered in North America on the border of Pike and District Townships, Berks County in September 2014. Currently found in 13 counties of southeastern Pennsylvania, a quarantine is in place to slow further spread of this invasive insect (Fig. 6).

The adults and all nymphal stages pierce the outer bark to feed from the phloem of a large variety of plants including trees common to Pennsylvania. SLF adults are known to prefer an invasive tree species, ailanthus (tree-of-heaven, *Ailanthus altissima*), as a host (PA Dept. of Agriculture 2018) and some evidence suggests that ailanthus may be necessary for successful completion of the life cycle. Additional research into alternative hosts has shown that species of grape (*Vitis spp.*) may serve as an substitute host in the absence of ailanthus (Pugh et al. 2016). Thus, SLF is a potential threat to the over \$134 million in annual grape and orchard production of Pennsylvania (PA Dept. of Agriculture 2018).

SLF feeding produces honeydew secretions and weeping wounds that subsequently attract ancillary insects to wound sites. Though widespread mortality is unknown at

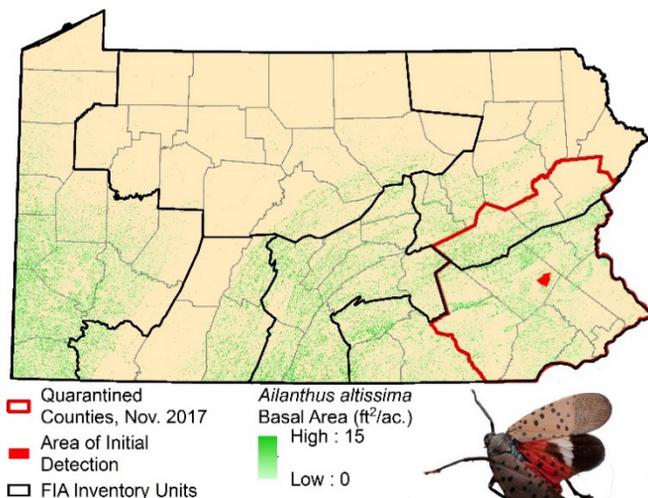


Figure 6.—Spotted lanternfly distribution and quarantine with *Ailanthus altissima* basal area (2009) and photo of adult individual. Photo by Tom Albright, USDA Forest Service.

this early stage of the infestation, SLF is known to feed on many genera of hardwoods including maples, oaks, hickories, black walnut, and yellow-poplar that make up 60 percent of net tree volume statewide and 70 percent in the quarantine zone. There are an estimated 4 million ailanthus trees on forest land within the quarantine, a figure that does not include trees in backyards, rights-of-way, etc. for which FIA does not currently account and where ailanthus is adept at colonizing. Adjacent to the quarantine, ailanthus accounts for over 1 percent of trees in the South Central unit (Fig. 6), providing a pathway for SLF to spread and threaten a major fruit-producing region of the State. Additionally, SLF will lay eggs on nearly any available surface outdoors, making artificial transport by people a real possibility. Continued study and monitoring of this invasive forest pest with a high potential for impacts on Pennsylvania's fruit and timber industries will inform management strategies into the future.

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How to Cite This Publication

Albright, Thomas A. 2018.
Forests of Pennsylvania, 2017.
 Resource Update FS-175. Newtown Square, PA:
 U.S. Department of Agriculture, Forest Service,
 Northern Research Station. 4 p.
<https://doi.org/10.2737/FS-RU-175>.

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The published report is available online at <https://doi.org/10.2737/FS-RU-175>