USDA
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RESOURCE UPDATE FS-66

Forests of Pennsylvania, 2014

This resource update provides an overview of the forest resources in Pennsylvania based on inventories conducted by the U.S. 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] (see footnote 1 on page 4). Information about the national and regional FIA program is available online at http://fia.fs.fed.us. Since 2000, FIA has implemented an annual inventory in Pennsylvania. For the 2014 inventory, estimates for current variables, such as area, volume, and biomass, are based on 3,023 forested plot samples collected from 2009-2014. Change variables, such as net growth, removals, and mortality, are based on 2,717 plots collected in 2005-2009 and resampled in 2009-2014. Estimates from earlier annual and periodic inventories are shown for comparison.

See Bechtold and Patterson (2005) and O'Connell et al. (2014) for definitions and technical details.

Overview

Pennsylvania's forest land area totals 16.9 million acres and occupies 58 percent of the State's land area (Table 1). Ninety-seven percent of Pennsylvania's forest land, 16.3 million acres, is classified as timberland. Three percent is in public reserve status (562,700 acres), where the commercial harvesting of trees is restricted by law or public policy. All reserved forest land is in public ownerships. Less than 1 percent is other forest land (24,000 acres). The most recent inventory shows the net volume of trees on forest land and timberland continues to increase, and annual growth continues to outpace annual removals. Annual mortality on timberland averaged 20 cubic feet per acre or 0.9 percent of the current inventory.

Table 1.—Pennsylvania forest statistics, 2014 and 2009. Volumes are for trees 5-inch and larger in diameter. Numbers of trees and biomass are for trees 1-inch and larger in diameter. Sampling errors and error bars shown in tables in this report represent 68 percent confidence intervals.

	2014 Estimate	Sampling error (percent)	2009 Estimate	Sampling error (percent)	Change since 2009 (percent)
Forest Land					
Area (thousand acres)	16,916	0.6	16,739	0.7	1.1
Number of live trees (million trees)	8,242	1.7	8,287	1.7	-0.5
Aboveground biomass of live trees (thousand oven-dry tons)	1,089,816	1.0	1,023,220	1.0	6.5
Net volume of live trees (million ft^3)	38,215	1.0	35,793	1.1	6.8
Annual net growth of live trees (thousand ft^3/yr)	815,416	2.8	860,821	2.8	-5.3
Annual mortality of live trees (thousand ft^3/yr)	336,935	4.0	314,978	4.0	7.0
Annual harvest removals of live trees (thousand ft^3/yr)	324,549	8.2	400,149	6.8	-18.9
Annual other removals of live trees (thousand ft^3/yr)	11,044	28.7	20,388	35.4	-45.8
Timberland					
Area (thousand acres)	16,330	0.7	16,125	0.8	1.3
Number of live trees (million trees)	7,992	1.7	8,034	1.7	-0.5
Aboveground biomass of live trees (thousand oven-dry tons)	1,044,908	1.0	981,644	1.1	6.4
Net volume of live trees (million ft^3)	36,641	1.1	34,347	1.2	6.7
Net volume of growing-stock trees (million ft^3)	33,440	1.2	32,069	1.2	4.3
Annual net growth of growing-stock (thousand ft^3/yr)	679,075	2.7	740,168	2.5	-8.3
Annual mortality of growing-stock trees (thousand ft^3/yr)	244,437	4.5	230,516	4.4	6.0
Annual harvest removals of growing-stock trees (thousand ft^3/yr)	275,163	8.4	338,058	6.9	-18.6
Annual other removals of growing-stock trees (thousand ft^3/yr)	11,453	31.3	23,913	30.2	-52.1

Forest Area

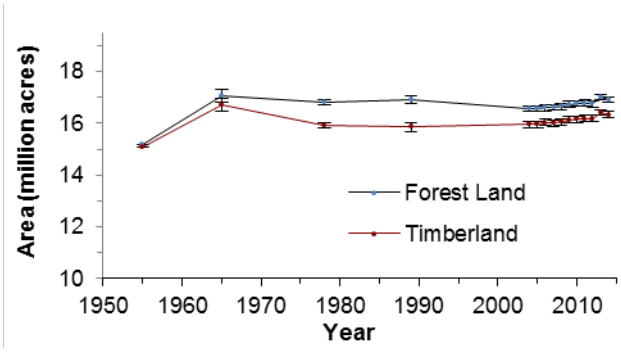

Figure 1.—Area of forest land and timberland by year, Pennsylvania. Error bars in this and other graphs represent a 68 percent confidence interval around the estimated mean.

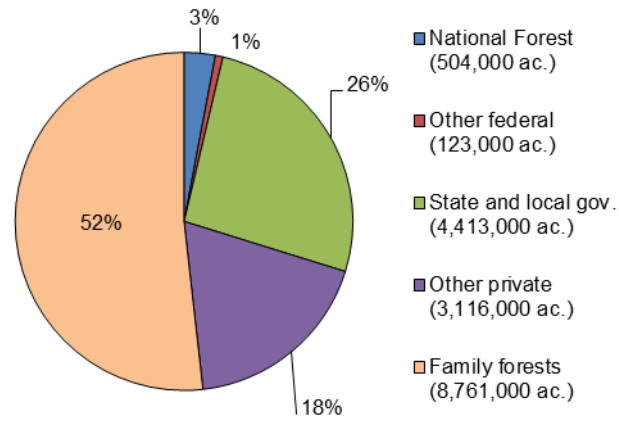

Figure 2.—Area of forest land ownership, Pennsylvania, 2014.

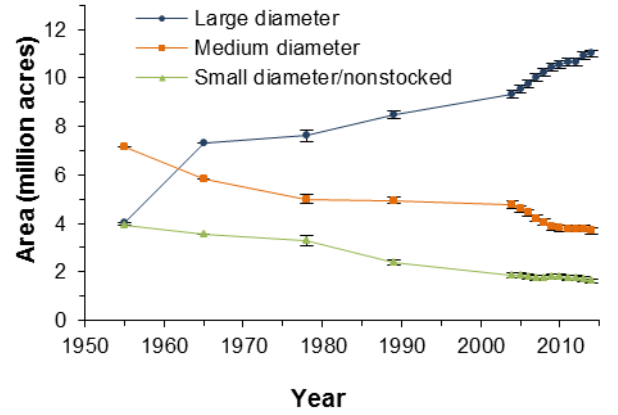

Figure 3.—Area of timberland by stand-size class and inventory year, Pennsylvania.

Pennsylvania's forest land area has been very stable since 1965, with small change over the last 49 years well within the range of sampling error (Fig. 1). Over this period, losses of forest land to development and other nonforest uses have been about equal to that of agricultural and other nonforest land reverting to forest. Public ownerships hold 30 percent of the Commonwealth's forest land. Seventy percent is in private ownerships that include family, corporate, club, and other entities (Fig. 2).

The area of timberland in large diameter stands[2] has steadily increased since the 1950s (Fig. 3). Currently, 67 percent of the Commonwealth's timberland is in large diameter stands and 9 percent of forest land is in small diameter stands. Forest types dominated by oak species have even lower percentages in small diameter stands than other types (Fig. 4). The chestnut oak/black oak/scarlet oak and the chestnut oak types each have less than 1 percent of their area in small diameter stands, and the white oak/red oak/hickory type has a mere 2.3 percent, whereas the cherry/white ash/yellow-poplar and red maple/oak types each have over 10 percent of their area in small diameter stands. The lack of small diameter stands in oak forest types, illustrates the difficulty in regenerating oak forest types in Pennsylvania.

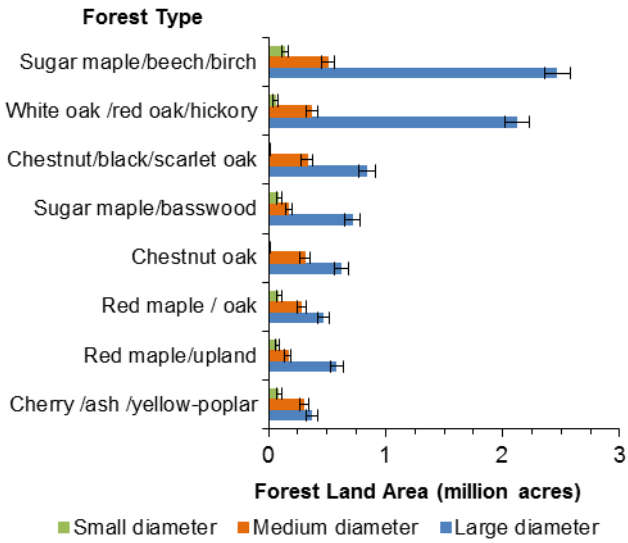

Figure 4.— Area of forest land by stand-size class[2] (based on small, medium, and large trees) for the top eight forest types ranked by acres, Pennsylvania, 2014.

[2] Small diameter stands: dominated by trees less than 5.0 inches d.b.h.; Medium: 5.0 to 8.9 inches d.b.h. for softwoods and 5.0 to 10.9 inches d.b.h. for hardwoods; Large:≥ 9.0 inches for softwoods and 11.0 d.b.h. for hardwoods.

Volume, Biomass, and Trends

Across all forest land, the net volume of trees increased by 6.8 percent, since 2009, to 38.2 billion cubic feet. Red maple continued to be the most voluminous species followed by black cherry, northern red oak, and sugar maple (Table 2). Changes in volume since 2009 were inconsistent across species. All major species exhibited increases in net volume. Northern red oak, hemlock, sweet birch, and yellow-poplar each had increases larger than 10 percent; while white oak and white ash increased by less than 3 percent.

Sawtimber volume on timberland increased by 11.0 percent to 115.4 billion board feet. Red maple is the leading sawtimber species by volume, followed by northern red oak, black cherry, and sugar maple. Since 2009, northern red oak, hemlock, and yellow-poplar had the largest increases in board-foot volume, 14.6, 14.5, and 12.1 percent, respectively.

Aboveground biomass on forest land totaled 1.1 billion dry tons. This was a 6.5 percent increase since 2009. On timberland, aboveground biomass averaged 64 dry tons per acre for all live trees 1 inch and larger in diameter.

In terms of average annual growth and removals of net volume on timberland, red maple had the largest annual net growth and the removals volume expressed as cubic-foot volume on timberland (Fig. 5).

Red maple dominated both net growth and removals, accounting for 18 percent of total net growth and 16 percent of removals. Total annual net growth outpaced total removals by a ratio of 2.4:1, although ratios varied considerably between species. Yellow-poplar had a growth-to-removals ratio of 4.2:1, whereas the ratio for white oak was 1.5:1. As a percentage of current net volume, annual mortality averaged 0.9 percent on timberland. Beech had the highest mortality rate, averaging 1.4 percent per year.

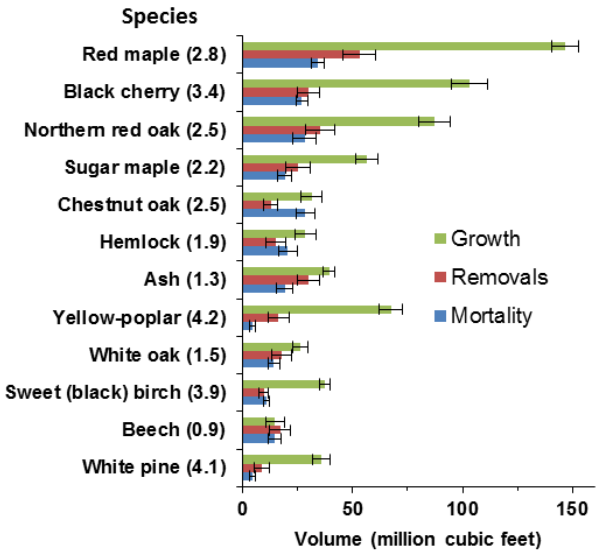

Figure 5.—Average annual net growth, removals, and mortality of net volume on timberland, and growth to removals ratios (G/R) in parentheses, for the top 12 species ranked by total net volume, Pennsylvania, (2005-2009 to 2009-2014).

Table 2.—Net volume, and percent change in net volume on forest land; sawtimber volume and percent change on timberland, and biomass on forest land, Pennsylvania, 2014, (top 10 species by net volume)

Species	Volume of live trees on forest land (million ft^3)	Sampling error (pecent)	Percent change since 2009	Volume of sawtimber trees on timberland (million bd.ft.)	Sampling error (percent)	Percent change since 2009	Aboveground biomass on forest land (million tons)	Sampling error (percent)
Red maple	7,011	2.5	5.3	17,446	3.7	10.3	191	2.4
Black cherry	4,060	3.9	9.0	13,066	5.2	11.5	105	3.7
Northern red oak	3,782	3.8	11.0	14,859	4.5	14.6	121	3.8
Sugar maple	2,791	4.7	8.1	8,415	5.9	11.9	88	4.6
Chestnut oak	2,631	4.3	1.5	7,229	5.1	5.4	86	4.3
Hemlock	1,962	5.8	10.4	5,759	6.6	14.5	37	5.7
Yellow-poplar	1,845	7.6	10.1	7,874	8.5	12.1	38	7.5
White ash	1,750	5.1	2.7	5,494	6.8	5.2	52	4.9
White oak	1,684	5.2	2.3	5,815	6.5	9.6	54	5.2
Sweet (black) birch	1,662	4.4	10.4	3,050	6.4	8.3	60	4.1
Other softwoods	1,739	6.6	6.6	5,844	7.6	13.4	33	6.6
Other hardwoods	7,298	2.3	5.9	20,534	3.2	10.9	224	2.3
All Species	38,215	1.0	6.8	115,384	1.6	11.0	1090	1.0

Characteristics of Pennsylvania's Family Forest Owners

The National Woodland Owner Survey (NWOS), conducted by the U.S. Forest Service's Forest Inventory and Analysis program, studies private forest landowners' attitudes, management objectives, and concerns (Butler et al., in press). The NWOS has most recently focused on family forest owners with 10 acres or more of forest land. The NWOS (2011-2013) found that there are an estimated 166,000 family forest owners holding 10 acres or more of forest land, totaling 7.6 million acres of forest land in Pennsylvania. This represents 64 percent of privately owned forest land in the Commonwealth. See Table 3 for the characteristics of these 166,000 ownerships with 10+ acres. Owners tend to be fairly old and many have owned their land for decades. Half the owners are retired and two-thirds list passing land on to their heirs as important or very important. Major concerns are high property taxes and trespassing. Nearly three-fourth of the acreage has been posted. A low percentage of owners have written management plans, and when compared to those who have a plan to harvest trees for sale, suggests that many harvests are not part of a long-term management plan. Because over half of Pennsylvania's forest land is held by thousands of private landowners, decisions by these owners will have a great influence on Pennsylvania's future forest. More information on the NWOS can be found at: http://www.fia.fs.fed.us/nwos.

Table 3.—Summary of responses to National Woodland Owner Survey, family forest land ownerships with 10+ acres in Pennsylvania, 2011-2013

Owner:	Owners (percent)	Acres (percent)
Is retired.	50	55
Is 55 years old or older.	66	75
Is 65 years old or older.	39	47
Has owned land for more than 25 years.	41	47
Has an annual income below $100,000.	80	74
Receives no annual income from woodland owned.	92	79
Woodland property is within 1 mile of primary residence.	66	65
Has posted land to restrict public access.	58	74
Is concerned about trespassing or poaching*	77	79
Is concerned about high property taxes*	78	77
Is enrolled in forestry related property tax program	51	39
Felt getting advice on more favorable tax policies would be helpful or very helpful.*	63	70
"Wants their wooded land to stay wooded" agree or strongly agree*.	92	93
Felt that passing land on to children or other heirs was important or very important*	67	72
Is likely or extremely likely to give away land in the next 5 years. *	11	17
Felt getting advice on how to transfer land to next generation would be helpful or very helpful .*	47	55
Felt that timber production was an important or very important reason for owning forest land.*	21	35
Has not received forest management advice in past 5yrs.	88	75
Does not have a written management plan.	90	86
Has cut trees for sale (logs).	32	47
Has cut trees for personal use (firewood).	60	61
Has cut or removed trees for sale in past 5 years.	21	32
Plans to cut trees for sale in next 5 years.	19	34
Plans to improve wildlife haitat in next 5 years	50	57
Is not familiar with cost share programs.	76	65
Felt getting advice on woodland management would be helpful or very helpful. *	50	60

*includes two highest responses on a five-point Likert scale.

[1]One-fifth of the plots was measured annually from 2007 thru 2013 resulting in a complete set of samples for every 5 years of data collection. In 2014, this 5-year cycle was changed to 7 years, wherein 1/7th (14.3 percent) of the plots are measured annually.

Literature Cited

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

Butler, Brett J.; Hewes, Jaketon H. [et al.]. In press. **U.S. Forest Service National Woodland Owner Survey: National, Regional, and State Statistics for Family Forest and Woodland Ownerships with 10+ acres, 2011-2013.** Resource Bulletin. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station.

O'Connell, B.M.; LaPoint, E.B.; Turner, J.A.; et al. 2014. **The Forest Inventory and Analysis database: Database description and user guide version 6.0.1 for Phase 2**. Washington, DC: U.S. Department of Agriculture, Forest Service. 748 p. (http://www.fia.fs.fed.us/library/database-documentation/)

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