



Forests of West Virginia, 2016

Overview

Currently, West Virginia is home to over 12 million acres of forest land (Table 1). Since the 1989 inventory, the estimate of forest land has been relatively stable (Fig. 1). However, the volume and biomass of trees has risen (Table 1). Average annual net growth, mortality, and removals have higher sampling errors, indicating higher uncertainty in trend estimates. The latest inventory shows a notable 14 percent decrease in average annual harvest removals on forest land since 2011 (Table 1), which highlights the impacts of the economic recession on timber harvesting. During that same period, average annual mortality on forest land increased by 24 percent while average annual net growth decreased by 25 percent. Although the ratio of net growth to mortality is positive at the State level, this is not the case on public land, where annual mortality exceeds annual net growth. Additionally, mortality is even higher relative to net growth on national forest land.

This publication provides an overview of forest resources in West Virginia based on inventories conducted by the U.S. Forest Service, Forest Inventory and Analysis (FIA) program of the Northern Research Station. For annual inventory years 2002-2013, the sample length was equal to 5 years. Beginning in 2014, the cycle length was changed to 7 years. For the 2016 inventory, estimates for current variables such as area, volume, and biomass are based on 2,430 plot samples (2,095 forested) collected from 2011-2016. Change variables, such as net growth, removals, and mortality, are based on 1,985 samples (1,659 forested) collected in 2005-2010 and resampled in 2011-2016. Estimates from earlier annual and periodic inventories are shown for comparison. See Bechtold and Patterson (2005), Gormanson et al (2017), and O’Connell et al. (2014) for definitions and technical details.

Table 1.—West Virginia forest statistics, 2016 and 2011. Volumes are for trees 5.0 inches and larger in diameter. Number of trees and biomass are for trees 1.0 inch and larger in diameter. Sampling errors and error bars shown in tables and figures in this report represent 68 percent confidence intervals.

	2016 Estimate	Sampling error (percent)	2011 Estimate	Sampling error (percent)	Change since 2011 (percent)
Forest Land					
Area (thousand acres)	12,046	0.6	12,155	0.7	-0.9
Number of live trees (million trees)	6,199	1.6	6,325	1.7	-2.0
Aboveground biomass of live trees (thousand oven-dry tons)	832,565	1.1	806,848	1.1	3.2
Net volume of live trees (million ft ³)	28,768	1.1	27,819	1.2	3.4
Annual net growth of live trees (thousand ft ³ /yr)	475,105	4.1	636,600	4.9	-25.4
Annual mortality of trees (thousand ft ³ /yr)	306,614	4.6	246,957	6.8	24.2
Annual harvest removals of live trees (thousand ft ³ /yr)	214,461	11.6	250,169	15.9	-14.3
Timberland					
Area (thousand acres)	11,691	0.7	11,789	0.7	-0.8
Number of live trees (million trees)	6,009	1.7	6,126	1.7	-1.9
Aboveground biomass of live trees (thousand oven-dry tons)	803,480	1.2	778,020	1.2	3.3
Net volume of live trees (million ft ³)	27,693	1.2	26,779	1.3	3.4
Net volume of growing stock trees (million ft ³)	25,661	1.3	25,073	1.3	2.3
Annual net growth of growing stock trees (thousand ft ³ /yr)	426,957	3.6	575,284	4.5	-25.8
Annual mortality of growing stock trees (thousand ft ³ /yr)	221,666	5.2	178,887	7.8	23.9
Annual harvest removals of growing stock trees (thousand ft ³ /yr)	179,884	11.8	214,849	16.1	-16.3



Forest Area

West Virginia’s area of forest land has been relatively stable since the late 1980s (Fig. 1). Timberland accounts for 97 percent of this forest land or 11.7 million acres. Less than 3 percent of forest land is reserved from timber production and less than 0.1 percent is other forest land identified as not being able to meet minimum productivity standards. Approximately 78 percent of the State’s total land area is made up of forest land.

The northeastern unit of West Virginia has the highest area of forest land at 4.5 million acres, and all units have more than 75 percent of land in forest (Fig. 2). The northeastern unit has triple the proportion of forest land in public ownership (24 percent) compared to the southern unit (8 percent) and nearly five times more than the northwestern unit (5 percent). Fifty-nine percent of the forest land in the southern unit is in corporate ownership.

Oak/hickory is the dominant forest-type group, covering 74 percent of the forest land (Fig. 3). In fact, the oak/hickory group makes up more than 50 percent of the forest land area in all but five counties in the State.

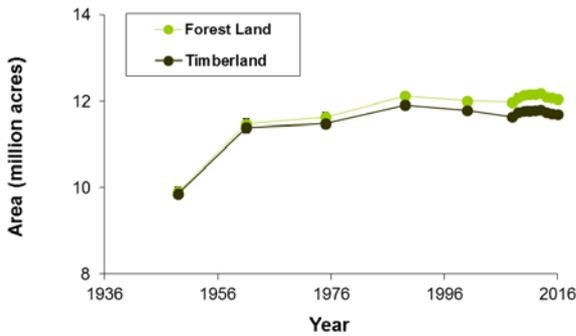


Figure 1.—Forest land and timberland by year, West Virginia.

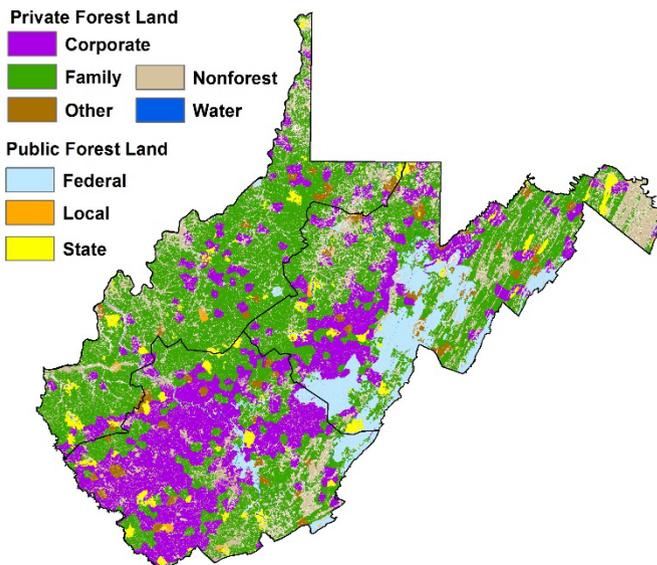


Figure 2.—FIA unit boundary (black lines) and distribution of forest land by owner class, West Virginia, 2014.

Pitch/Virginia pine is the most abundant softwood forest-type group. It accounts for nearly 2 percent of the forest land in the State (Fig. 3).

The maple/beech/birch forest-type group, which is more widely distributed in the northeastern unit, has the highest proportion of area in public ownership of all major forest-type groups. Families and individuals, corporations, and other private entities own the majority of forest land (52, 34, and 1 percent, respectively). The U.S. Forest Service, State of West Virginia, and other public entities own the remainder (9, 3, and 2 percent, respectively).

West Virginia’s forests have been maturing as illustrated in the distribution of timberland by stand-size class (Fig. 4). Since the 1975 inventory, the acreage of large-diameter stands has been steadily increasing. The acreage of small- and medium-diameter stands has been declining since the 1989 inventory.

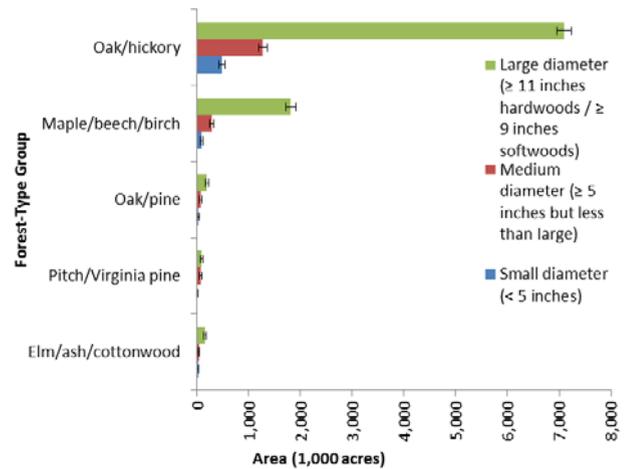


Figure 3.—Forest land by stand-size class (based on small, medium, and large trees) for top five forest-type groups by acres, West Virginia, 2016.

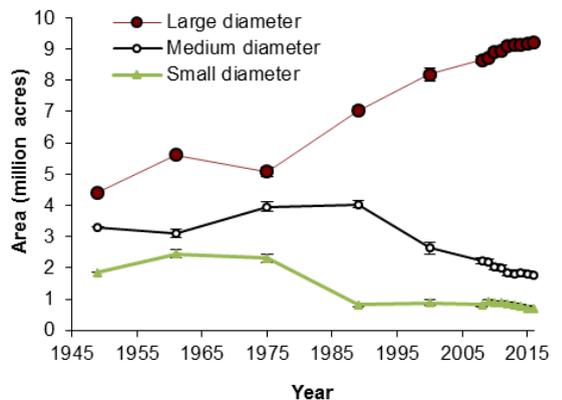


Figure 4.—Timberland by stand-size class and year, West Virginia.

Volume, Biomass, and Trends

Red maple (*Acer rubrum*) continues to be the most numerous tree in West Virginia, but yellow-poplar (*Liriodendron tulipifera*) is the most voluminous (Table 2). Red maple also has a relatively high net growth-to-harvest removals ratio of 3.4:1 (Fig. 5). A ratio of 1:1 would indicate that the amount of volume added annually is equal to that which was harvested. Most of the important species in the State have net growth-to-harvest removals ratios above 2:1. By contrast, white oak (*Quercus alba*), black birch (*Betula lenta*), and ash spp. (*Fraxinus* spp.) have net growth-to-harvest removals ratios below 2:1, and American beech (*Fagus grandifolia*) has a ratio of 0.02:1, indicating that very little net growth is occurring to offset harvesting. Additionally, mortality of American beech is elevated due to beech bark disease.

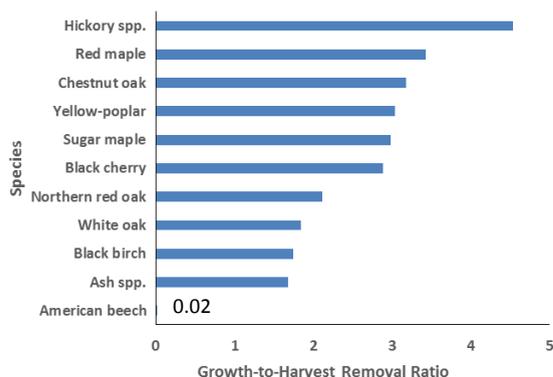


Figure 5.—Net growth-to-harvest removal ratio by species, West Virginia, 2016.

Forest ecosystems sequester more carbon annually than any other terrestrial land cover. This accumulation of carbon helps offset the emissions of carbon dioxide from sources like burning of fossil fuels. Estimates of forest carbon storage and annual uptake of carbon are updated annually as a part of the national forest carbon inventory (Woodall et al. 2015).

The 2016 data for West Virginia show that forests store nearly 1,100 million metric tons of carbon (Fig. 6) which amounts to over 223 metric tons per hectare of forest land (Fig. 7). The trends are similar in Figures 6 and 7, but both are provided so that total and per unit area carbon estimates can be cited. The largest pool is stored in soils followed by aboveground (tree) biomass.

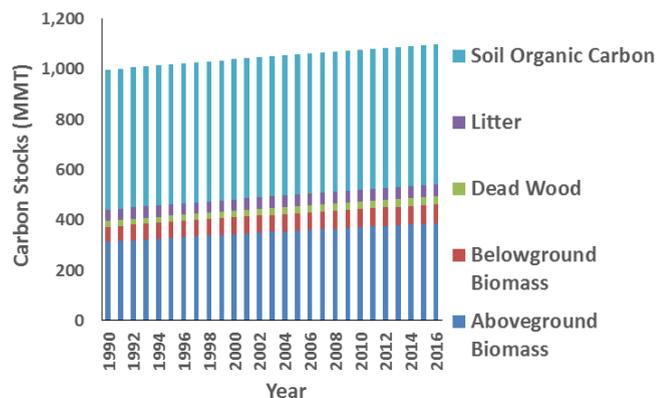


Figure 6.—Trend in carbon stored (million metric tons) in West Virginia forests, 1990-2016.

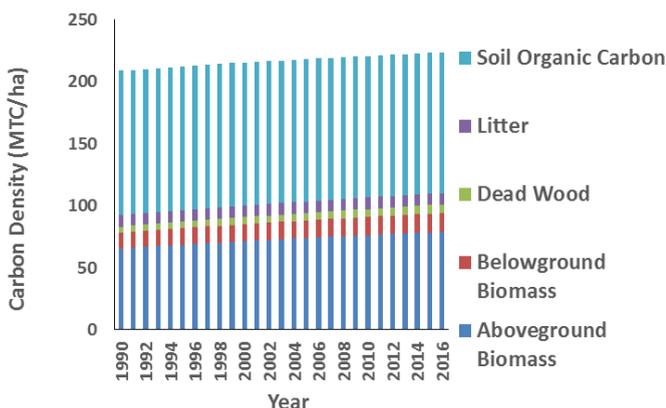


Figure 7.—Trend in per hectare estimates of carbon stored (metric tons/hectare) in West Virginia forests, 1990-2016.

Table 2.—Number, net volume, oven-dry biomass, net growth, mortality, harvest removals, and growth-to-harvest removals ratio of live trees on forest land, West Virginia, 2016, for selected prominent species

Species	Trees ^a (millions)	Net volume ^a (million ft ³)	Aboveground biomass ^b (thousand tons)	Net growth ^a (thousand ft ³ /yr)	Mortality ^a (thousand ft ³ /yr)	Harvest removals ^a (thousand ft ³ /yr)
Red maple	237	2,685	75,598	60,666	17,759	17,666
Sugar maple	164	2,016	67,316	50,509	15,609	16,942
Chestnut oak	152	2,722	88,084	45,043	14,303	14,186
Yellow-poplar	147	4,247	88,430	100,746	23,489	33,153
White oak	117	2,380	76,789	35,164	21,560	19,126
Hickory spp.	128	1,890	65,891	36,968	12,350	8,141
American beech	76	1,070	34,542	123	17,642	5,473
Northern red oak	70	2,303	73,583	49,539	20,039	23,442
Black cherry	59	1,235	31,434	24,572	9,687	8,509
Black birch	51	509	17,345	7,377	5,410	4,221
Ash spp.	42	746	22,314	5,311	15,772	3,158

^aTrees at least 5-inch diameter. ^bTrees at least 1-inch diameter.

Forest Carbon Assessment

Forest carbon storage has increased steadily between 1990 and 2015 (Fig. 6, Table 3). However, the annual rate of carbon uptake has decreased from -15.39 MMTCO₂e per year to -12.39 MMTCO₂e. Note that the negative numbers are used to indicate negative emissions (i.e., uptake or sequestration).

Forest carbon stocks should continue to increase as stands mature and accumulate carbon in aboveground and belowground components. Management that encourages carbon sequestration and accumulation will require careful planning and creative silviculture, particularly with other competing land management objectives.

Table 3.—Comparison of West Virginia’s forest carbon storage and annual uptake (net sequestration) pools in 1990 versus 2015. Units are: MMTC=million metric tons of carbon; MMTCO₂e=million metric tons of carbon dioxide equivalents; and MTC/hectare=metric tons of carbon per hectare. Negative values are used with MMTCO₂e to mean negative emissions, or rather, uptake of CO₂.

Forest Carbon Pool	Carbon Storage (MMTC)		Net Sequestration (MMTCO ₂ e)		Carbon Per Hectare (MTC/hectare)	
	1990	2015	1990	2015	1990	2015
Aboveground biomass	312.8	384.6	-11.93	-9.00	65.5	78.4
Belowground biomass	60.6	74.3	-2.30	-1.71	12.7	15.2
Dead wood	23.6	33.6	-1.09	-1.69	4.9	6.9
Litter	44.5	44.8	-0.08	-0.03	9.3	9.1
Soil Organic Carbon	556.9	557.1	0.00	0.04	116.5	113.6
Total	998.3	1094.5	-15.39	-12.39	208.9	223.2

References

- 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.
- Gormanson, D.D.; Pugh, S.A.; Barnett, C.J. [et al.]. 2017. **Statistics and quality assurance for the Northern Research Station Forest Inventory and Analysis Program, 2016**. Gen. Tech. Rep. NRS-166. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 23 p. <https://doi.org/10.2737/NRS-GTR-166>.
- Morin, R.S.; Cook, G.W.; Barnett, C.J. [et al.]. 2016. **West Virginia’s Forests 2013**. Resour. Bull. NRS-105. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. In press.
- 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/>.
- Woodall, C.W.; Coulston, J.W.; Domke, G.M. [et al.]. 2015. **The U.S. forest carbon accounting framework: stocks and stock change, 1990-2016**. Gen. Tech. Rep. NRS-154. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 49 p.



View from Seneca Rocks. Photo by Randall Morin, U.S. Forest Service.

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