Maryland's Forest Resources, 2007

Research Note NRS-68

This publication provides an overview of forest resource attributes for Maryland based on an annual inventory (2004-2007) conducted by the Forest Inventory and Analysis (FIA) program at the Northern Research Station of the U.S. Forest Service. These estimates, along with web-posted core tables, will be updated annually. For more information please refer to the last page of this report.

Table 1. – Annual estimates and uncertainty, 2004-2007.

	Estimate	Sampling error (%)
Forest Land Estimates		
Area (1,000 acres)	2,453	2.6
Number of live trees 1-inch diameter or larger (million trees)	1,447	6.0
Dry biomass of live trees 1-inch diameter or larger (1,000 tons) **	172,899	3.5
Net volume in live trees (1,000,000 ft^3)	6,356	3.7
Annual net growth of live trees (1,000 ft^3/year)	N/A*	N/A*
Annual mortality of live trees (1,000 ft^3/year)	N/A*	N/A*
Annual removals of live trees (1,000 ft^3/year)	N/A*	N/A*
Timberland Estimates		
Area (1,000 acres)	2,330	2.9
Number of live trees 1-inch diameter or larger (million trees)	1,403	6.3
Dry biomass of live trees 1-inch diameter or larger (1,000 tons) **	164,436	3.8
Net volume in live trees (1,000,000 ft^3)	6,051	4.1
Net volume of growing-stock trees (1,000,000 ft^3)	5,830	4.2
Annual net growth of growing-stock trees (1,000 ft^3/year)	N/A*	N/A*
Annual mortality of growing-stock trees (1,000 ft^3/year)	N/A*	N/A*
Annual removals of growing-stock trees (1,000 ft^3/year)	N/A*	N/A*

*Growth, removals and mortality are available for the 2008 data.

**Carbon values can be estimated by halving the dry biomass estimate.

Note: When available, sampling errors/bars provided in figures and tables represent 68 percent confidence intervals.

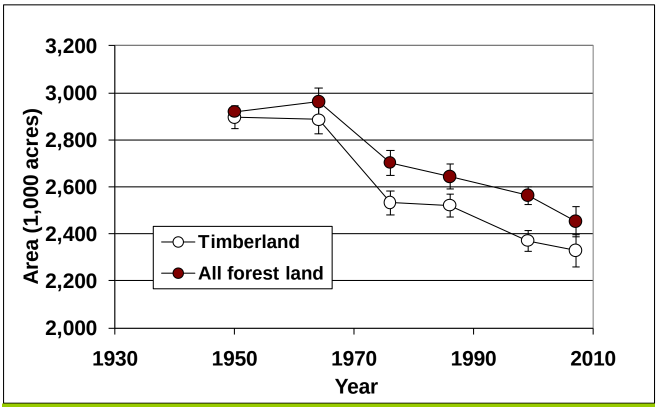

Figure 1. – Area of timberland and forest land by year. Percent forest land for the 1964, 1976, 1986, 1999, and 2007 inventories are 47, 42, 42, 41, and 39 percent respectively.

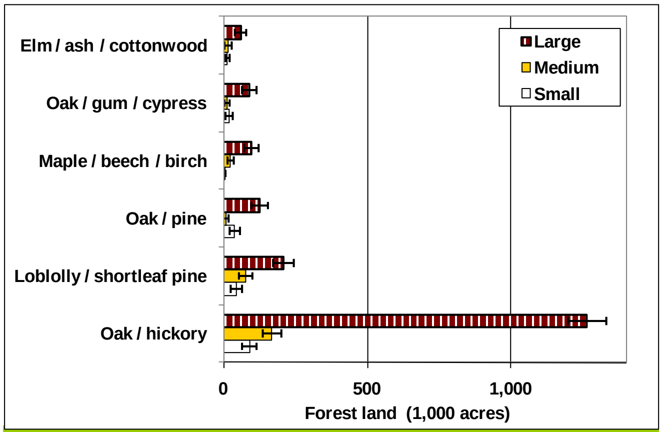

Figure 2. – Area of forest land by forest type group and stand size, Maryland, 2004-2007. (Small diameter = 1 - 4.9 in. d.b.h.; medium diameter = 5 - 9 in. d.b.h. for softwood, 5 - 11 in. d.b.h. for hardwood; and large diameter = tree larger than medium)

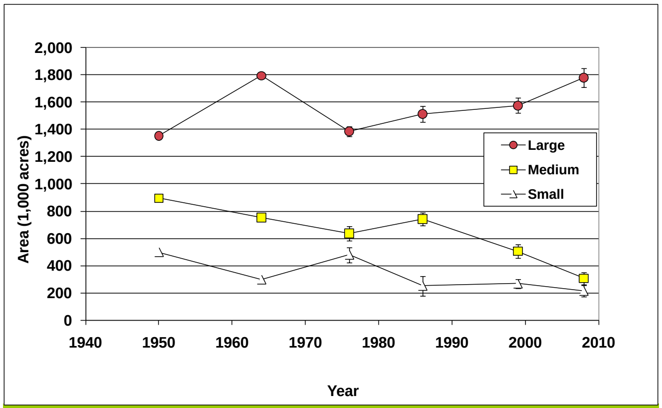

Figure 3. – Area of timberland by stand size class and year.

Table 2. – Top 10 tree species by statewide volume estimates, 2004-2007.

Rank	Species	Volume of live trees on forest land (1,000,000 ft^3)	Sampling error (%)	Volume of sawtimber trees on timberland (1,000,000 bdft)	Sampling error (%)
1	Yellow-poplar ***	1,222	11.4	5,730	12.6
2	Red maple	747	8.7	2,223	12.4
3	Loblolly pine	570	12.9	1,883	14.5
4	Sweetgum	436	12.7	1,255	16.0
5	White oak	435	11.3	1,688	13.6
6	Northern red oak	258	17.4	924	23.2
7	Chestnut oak	255	16.9	752	19.6
8	Black cherry	242	18.3	601	23.1
9	Black oak	211	16.0	861	17.3
10	American beech	192	18.3	577	23.4
	Other softwood species	286	22.0	825	21.4
	Other hardwood species	1,502	6.3	4,840	8.3
	All species	**6,356**	**3.7**	**22,158**	**5.2**

*** Yellow-poplar ranks 6th among species in total number of live trees in Maryland and is generally associated with the oak/hickory forest type group.

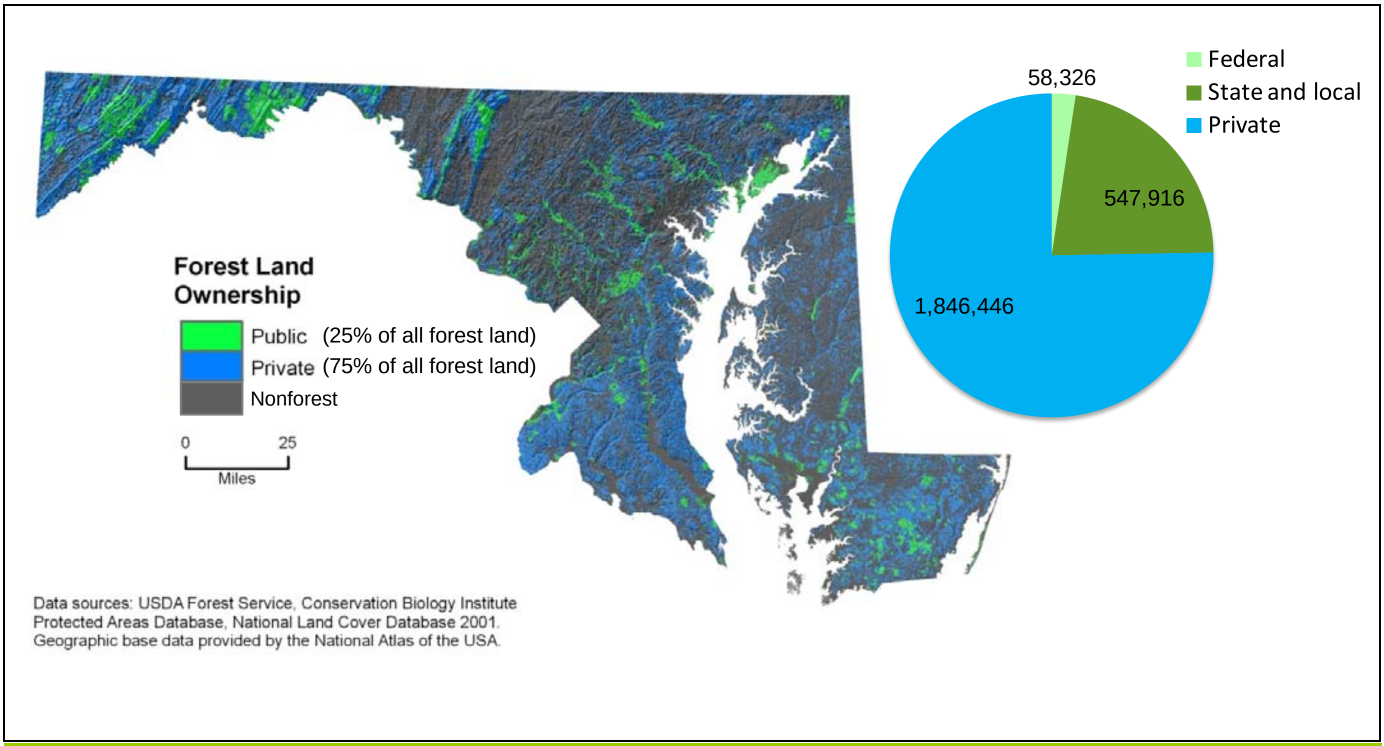

Figure 4. – Distribution of ownerships and area of forest land (acres) by ownership group.

Continuous Improvement Process for Volume, Biomass, and Carbon Estimation

Implementation of the annual inventory requires ongoing evaluation of existing methods and implementation of improved system components as they become available. 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. These changes have focused on improving the ability to report consistent estimates across time and space--a primary objective for FIA.

Tree-level Volume Estimation

As the remeasurement phase of the annual inventory was implemented, “noise” (random variation in the data) began to outweigh the signal (detectable change in volumetric variables); thus limiting the ability to track real change over time. Sources of noise include: measurement variability, field protocol changes, field crew cohort changes, definition changes, processing algorithm changes, and model error. This noise impacts estimates of volume, biomass, carbon, and associated change component estimates.

Volume estimation is critically important because individual tree volume estimates form the basis for biomass and carbon estimates. In the past, estimates of individual tree gross volumes (cubic foot and board foot) were estimated using equations based on field-measured diameters and lengths (bole and saw log). Net volume of the tree was computed by subtracting field-measured cull (Scott 1981, Scott 1979). Over time, it was found that noise in the measurements of tree lengths and cull outweighed the true signal. To ameliorate this, a taper model was used to estimate length (Westfall in press). In addition, a model was developed for determining the percent of total tree volume represented by cull. The modeled length and cull estimates are used in conjunction with Scott’s volume equations, thus providing a consistent estimation procedure across the Northeast. In general, the new volume estimates will be higher because previous estimates were based on length measurements that included reductions based on merchantability, e.g., prior to 2007, the measurement of the top of the bole may have been below the 4-inch top due to form deficiencies that prevent use for pulpwood. In 2007, the merchantability limits were removed from the field protocols. In conjunction with the removal of merchantability limits, changes in cull measurements were implemented, such that net tree volume would continue to represent only the merchantable portion of the tree. The modeled lengths and culls are aligned with these new measurement protocols.

Component Ratio Method (CRM) for Biomass/Carbon Estimation

Biomass and carbon have become increasingly important to FIA clients as demand for bioenergy has increased and carbon sequestration has emerged as a vital component of climate change analyses. As such, a method for harmonizing volume, biomass, and carbon estimates was needed. Prior to implementation of the CRM method, volume and biomass were estimated using separate sets of equations. The CRM method is comprised of the following steps (Heath et al. 2009):

- Conversion of sound-wood volume in the merchantable bole to biomass using species-level specific gravities (dry mass per unit of green volume)
- Calculation of bark biomass using a set of percent bark and bark specific gravities
- Calculation of biomass in tops and limbs as a proportion of merchantable bole biomass based on component proportions using equations from Jenkins and others (2003)
- Calculation of stump biomass using equations from Raile (1982)
- Summation of biomass components to obtain total aboveground biomass

Estimates of carbon are derived through simple conversion of the biomass variables.

Continuous Improvement Process for Volume, Biomass, and Carbon Estimation

Change Component Estimation

Change components are perhaps the most important volumetric variables reported by FIA because they are indicative of sustainability (net growth-to-removals ratio) and forest health (mortality). To summarize, gross growth is equal to ingrowth (volume of trees reaching the 5.0-inch minimum diameter threshold for merchantable volume) plus accretion (growth of surviving trees that were above the threshold at previous measurement). Net growth is equal to gross growth minus mortality (volume of trees meeting the threshold at previous measurement that died). Removals are equal to the volume of trees meeting the threshold at the previous measurement that were harvested or on forest land that changed to nonforest land. Net change in inventory is equal to net growth minus removals.

The National Inventory Management System (NIMS) is the compilation system for all FIA estimates. Implementation of NIMS has included some adjustments to regional change-component algorithms to achieve national consistency. A new method, termed the “midpoint method,” has introduced some fundamental changes in methods (Westfall et al. 2009). Essentially, the new approach uses models to “grow” trees to the midpoint of the inventory cycle (2.5 years for a 5-year cycle). Although the overall net changes are equivalent under the previous and new evaluation methods, estimates for individual components will be different. For ingrowth, the midpoint method produces a smaller estimate because volumes are calculated at the 5.0-inch threshold instead of using the actual diameter measurement, which may be larger. The estimate for accretion is higher because growth on ingrowth, mortality, and removal trees are included. As such, the removals and mortality estimates will also be higher than before.

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