



United States Department of Agriculture

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# **New York Forests 2012 Statistics, Methods, and Quality Assurance**



Forest  
Service

Northern  
Research Station

This document supplements  
Resource Bulletin NRS-98

# FOREST INVENTORY METHODS

## Strategic Model

The Forest Inventory and Analysis program of the Northern Research Station (NRS-FIA) is part of the national enhanced FIA program that focuses on a set of six strategic objectives (McRoberts 2005):<sup>1</sup>

- A standard set of variables with nationally consistent meanings and measurements
- Field inventories of all forested lands
- Nationally consistent estimation
- Adherence to national precision standards
- Consistent reporting and data distribution
- Credibility with users and stakeholders

To ensure that these six strategic objectives are achieved, 10 strategic approaches have been prescribed:

- A national set of prescribed core variables with a national field manual
- that prescribes measurement procedures and protocols for each variable
- A nationally consistent plot configuration
- A nationally consistent sampling design
- Estimation using standardized formulas for sample-based estimators
- A national database of FIA data with core standards and user-friendly public access
- A national information management system
- A nationally consistent set of tables of estimates of prescribed core variables
- Publication of statewide tables with estimates of prescribed core variables at 5-year intervals
- Documentation of the technical aspects of the FIA program including procedures, protocols, and techniques
- Peer review and publication of the technical documentation for general access

The result of the strategic objectives and approaches is an inventory program with identifiably new features and a nationally consistent plot configuration, a nationally consistent sampling design for all lands, annual measurement of a proportion of plots in each state, nationally consistent estimation techniques and algorithms, and integration of the ground sampling components of the FIA inventory and the detection monitoring by the U.S. Forest Service's Forest Health Monitoring (FHM) program.

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<sup>1</sup> Citations available in New York Forests 2012, located at <http://dx.doi.org/10.2737/NRS-RB-98>.

## Forest Inventory

Historically, the Northern Research Station's Forest Inventory and Analysis (NRS-FIA) program conducted inventories of a state's forests on a periodic basis. Across New York, periodic inventories were completed in 1953 (reported in Armstrong and Bjorkbom 1956), 1968 (reported in Ferguson and Mayer 1970), 1980 (reported in Considine and Frieswyk 1982), and 1993 (reported in Alerich and Drake 1995). Since the 1993 inventory, several changes in FIA methods have improved the quality of the inventory. The most significant change between inventories has been the shift from periodic to annual inventory. Starting in the 1970s, FIA inventoried each state in the region on a 13-year cycle. However, the need for timely and consistent data across large geographical regions, along with national legislative mandates, resulted in FIA implementing an annual inventory program. Annual inventory was initiated in New York in 2002.

With the NRS-FIA annual inventory system, approximately one-fifth of all field plots are measured each year. The entire inventory is completed within 5 years. After this initial 5-year period, NRS-FIA will report and analyze results using a moving 5-year average. For example, NRS-FIA generated inventory results for New York for 2002 through 2007 (Widmann et al. 2012) and for 2008 through 2012, reported here.

Other significant changes between inventories include implementing new remote-sensing technology, a new field-plot configuration and sample design, and gathering additional remotely sensed and field data. The new remote-sensing technology allows NRS-FIA to use classifications of multi-resolution land characterization (MRLC) data and other remote-sensing products to stratify the total area of each State and to improve estimates.

New algorithms were used for the 2012 inventory to assign forest type and stand-size class to each condition observed on a plot. These algorithms are being used nationwide by FIA to provide consistency from state to state. As a result, changes in forest type and stand-size class will reflect actual changes in the forest and not changes due to differences between algorithms. The list of recognized forest types, groupings of these forest types for reporting purposes, models used to assign stocking values to individual trees, definition of nonstocked (stands with a stocking value of less than 10 percent for live trees), and names given to the forest types changed with the new algorithms. Consequently, comparisons between the published 2012 results and those published for earlier inventories may be invalid. Contact NRS-FIA for additional information on the algorithms used in both inventories.

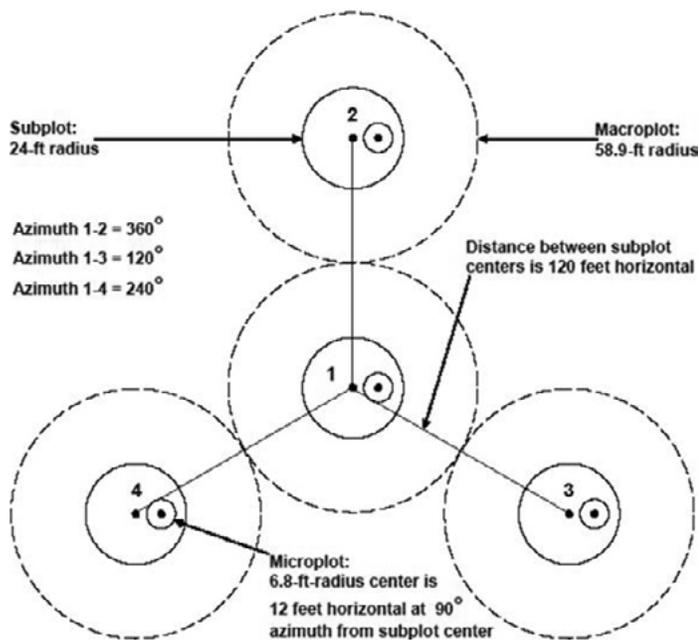


Figure 85.—FIA plot design (adapted from Bechtold and Patterson 2005).

## Plot Configuration

The national FIA plot design consists of four 24-foot-radius subplots configured as a central subplot and three peripheral subplots (Fig. 85). Centers of the peripheral subplots are located at distances of 120 feet from the central subplot at azimuths of 0°, 120°, and 240° from the center of the central subplot. Each tree with a diameter at breast height (d.b.h.) of 5 inches or greater is measured on these subplots. Each subplot contains a 6.8-foot-radius microplot with center located 12 feet east of the subplot center on which each tree with d.b.h. between 1 and 5 inches is measured. Forest conditions that occur on any of the four subplots are identified and recorded. If the area of the condition is 1 acre or greater, the condition is mapped on the subplot. Factors that differentiate forest conditions include forest type, stand-size class, stand origin, land use, ownership, and density.

## Sample Design

Historic sampling errors indicate that a sampling intensity of about one plot per 6,000 acres is required to satisfy national FIA precision guidelines. Therefore, FIA divided the area of the United States into nonoverlapping, 5,937-acre hexagons and established a plot in each hexagon as follows: (1) if an existing FHM plot was located in a hexagon, it was selected; (2) if no FHM plot existed in the hexagon, the existing FIA plot from the previous periodic inventory nearest the hexagon center was selected; and (3) if neither an FHM nor an FIA plot was located in the hexagon, a new FIA plot was established at a random location in the hexagon (Brand et al. 2000, McRoberts 1999). This array of field plots is designated the Federal base sample and is considered an equal probability sample; its measurement is funded by the Federal Government.

The Federal base sample was systematically divided into five interpenetrating, nonoverlapping panels or subsamples, each of which provides complete, systematic

coverage of a state. Each year, the plots in a single panel are measured, and panels are selected on a 5-year, rotating basis (McRoberts 1999). For estimation purposes, the measurement of each panel of plots is considered an independent, equal probability sample of all lands in a state.

## **Three-phase Inventory**

FIA conducts inventories in three phases. Phase 1 (P1) uses remotely sensed data to obtain initial plot land cover observations and to stratify land area in the population of interest to increase the precision of estimates. In Phase 2 (P2), field crews visit the physical locations of permanent field plots to measure traditional inventory variables such as tree species, diameter, and height. In Phase 3 (P3), field crews visit a subset of P2 plots to obtain measurements for an additional suite of variables associated with forest and ecosystem health. The three phases of the enhanced FIA program are discussed in greater detail in the following sections.

### **Phase 1**

Aerial photographs, digital orthoquads (DOQs: digitally scanned aerial photographs), and satellite imagery are used for initial plot measurement via remotely sensed data and stratification. P1 plot measurement consists of observations of conditions at the plot locations using aerial photographs or DOQs. Analysts determine a digitized geographic location for each field plot, and a human interpreter assigns the plot a land cover/use. Lands satisfying FIA's definition of forest land include commercial timberland, some pastured land with trees, forest plantations, unproductive forested land, and reserved, noncommercial forested land. In addition, forest land requires minimum stocking levels, a 1-acre minimum area, and a minimum bole-to-bole width of 120 feet with continuous canopy. Forest land excludes wooded strips, idle farmland with trees, and narrow windbreaks. All plot locations that could possibly contain accessible forest land are selected for further measurement during P2.

The combination of natural variability among plots and budgetary constraints prohibits measurement of a sufficient number of plots to satisfy national precision standards for most inventory variables unless the estimation process is enhanced using ancillary data. Thus, the land area is stratified by using remotely sensed data to facilitate stratified estimation. NRS-FIA uses canopy density classes to derive strata. Canopy density information was obtained from the 2001 National Land Cover Database (NLCD 2001) (Homer et al. 2007). The NLCD 2001 canopy density layer for the United States was produced through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium (<http://www.mrlc.gov/>). The layer characterizes subtle variations of forest canopy density as a percentage estimate of forest canopy cover (0 to 100) within every 30-m pixel over the United States. The method employed to map canopy density for NLCD 2001 is described in detail in Huang et al. (2001).

The current strata categorization was optimized for the entire NRS-FIA region. Using plot location information (center of the center subplot), we assigned a percent canopy density value was assigned to each plot. Plots were then aggregated into one of the five

strata based on the center of the center subplot. The percent canopy cover stratification scheme consists of five groupings: (1) 0 to 5 percent, (2) 6 to 50 percent, (3) 51 to 65 percent, (4) 66 to 80 percent, and (5) 81 to 100 percent. These groupings were based on observed natural clumping of pixel values. If there were not enough plots in each of these classes to create strata, then collapsing rules were used to combine classes until sufficient sample sizes were obtained.

In addition to being classified into one of the five canopy strata, each pixel was assigned to an ownership stratum. Ownership layers derived from the Protected Areas database (PAD) (USGS 2012) and U.S. Census Bureau TIGER data (U.S. Census Bureau, n.d.) were used to classify pixels into three ownership classes: (1) inland census water, (2) public, and (3) private. Every pixel was also assigned to a county based on pixel center location.

Stratified estimation requires two tasks. First, each plot must be assigned to a single stratum. Next, the proportion of each detailed stratum must be calculated (TM land-cover classification, ownership, and county group delineation). The first task is done by assigning each plot to the stratum assigned to the pixel containing the center of the center subplot. The second task is done by calculating the proportion of pixels in each stratum. The population estimate for a variable is calculated as the sum across all strata of the product of each stratum's observed proportion (from P1) and the variable's estimated mean per unit area for the stratum (from P2).

## **Phase 2**

In P2, field crews record a variety of data for plot locations determined in P1 to include accessible forest land. Before visiting plot locations, field crews consult county land records to determine the ownership of plots and then seek permission from private landowners to measure plots on their lands. Field crews determine the location of the geographic center of the center subplot using geographic positioning system (GPS) receivers. They record subplot-level observations that include land cover, forest type, stand origin, stand age, stand-size class, site productivity class, forest disturbance history, slope, aspect, physiographic class, and ground land use conditions. For each tree, field crews record a variety of observations and measurements including species, live/dead status, lean, diameter, height, crown ratio (percent of tree height represented by crown), crown class (e.g., dominant, co-dominant, suppressed), damage, and decay status. Office staff use statistical models based on field crew measurements to calculate values for additional variables including individual tree volume, per unit area estimates of number of trees, volume, and biomass by subplot, by species groups, and by live/dead status.

## **Phase 3**

The third phase of the enhanced FIA program focuses on forest health. P3 is administered cooperatively by the FIA program, other Forest Service programs, other Federal agencies, State natural resource agencies, and universities, and it is partially integrated with the Forest Health Monitoring (FHM) program. The FHM program consists of four interrelated and complementary activities: detection

monitoring, evaluation monitoring, intensive site ecosystem monitoring, and research on monitoring techniques. Detection monitoring consists of systematic aerial and ground surveys designed to collect baseline information on the current condition of forest ecosystems and to detect changes from those baselines over time. Evaluation monitoring studies examine the extent, severity, and probable causes of changes in forest health identified through the detection monitoring surveys. The intensive site ecosystem monitoring program conducts research into regionally specific ecological processes at a network of sites located in representative forested ecosystems. Finally, research on monitoring techniques focuses on developing and refining indicator measurements to improve the efficiency and reliability of data collection and analysis at all levels of the program.

The ground survey portion of the FHM detection monitoring program was integrated into the FIA program as P3 in 1999. The P3 sample consists of a 1:16 subset of the P2 plots with one P3 plot for approximately every 96,000 acres. P3 measurements are obtained by field crews during the growing season and include an extended suite of ecological data: lichen diversity and abundance, soil quality (erosion, compaction, and chemistry), vegetation diversity and structure, and down woody material. The incidence and severity of ozone injury for selected bioindicator species also are monitored as part of an associated sampling scheme. Because each P3 plot is also a P2 plot, all P2 measurements are made on each P3 plot at the same time as the P3 measurements.

P3 variables were selected to address specific criteria outlined by the Montreal Process working group (Montreal Process 1995) for the conservation and sustainable management of temperate and boreal forests and are based on the concept of indicator variables. Observations of an indicator variable represent an index of ecosystem functions that can be monitored over time to assess trends. Indicator variables are used in conjunction with each other, P2 data, data from FHM evaluation monitoring studies, and ancillary data to address ecological issues such as vegetation diversity, fuel loading, regional air quality gradients, and carbon storage. The P2 and P3 data of the enhanced FIA program serve as the Nation's environmental report card and are a primary source of reporting data for the Montreal Process Criteria and Indicators (for more information, see Woodall et al. 2011).

## **Estimation**

Most of the estimates and analysis presented in this report (including all the estimate tables) are based on averages observed on 4,786 forested and nonforested plots located across New York. These plots are located within 64 unique strata (Table A; see page x of this document) defined by combinations of the five P1 canopy cover classes: (1) 0 to 5 percent, (2) 6 to 50 percent, (3) 51 to 65 percent, (4) 66 to 80 percent, and (5) 81 to 100 percent, a land ownership classification created from PAD (USGS 2012), and county groups. Nationally consistent algorithms were used to assign forest type and stand-size class to each condition observed on a plot. For NRS-FIA, panels are measured on an annual basis so that five panel estimates are equivalent to 5-year

moving average estimates. Field plot measurements are combined with P1 estimates in the compilation process and table production. Procedures described in Bechtold and Patterson (2005) for stratified estimation with observed stratum areas were used in conjunction with the strata presented in Table A to produce all estimates. Table A shows the total area and number of plots within each stratum.

## **Integration with Previous Inventories**

In 2012, NRS-FIA completed measurement of the fifth panel of inventory plots in New York. The 2012 panel along with those surveyed in 2008, 2009, 2010, and 2011 make up the data set for the sixth full inventory of the region's forests. For simplicity, the sixth inventory often is called the 2012 inventory of New York. Data from new inventories are often compared with data from earlier inventories to determine trends in forest resources. However, for the comparisons to be valid, the procedures used in the two inventories must be similar.

To improve the efficiency and reliability of the inventory, several changes in procedures and definitions have been made since the last inventory in New York in 2007 (Widmann et al. 2012). Although these changes will have little impact on statewide and regionwide estimates of forest area, timber volume, and tree biomass, they may significantly impact plot classification variables such as forest type and stand-size class. For estimating growth, removals, and mortality, the 2007 inventory (Widmann et al. 2012) was processed using estimation/summary routines for the 2012 inventory. Although these changes allow limited comparison of inventory estimates among separate inventories in this report, it is inappropriate to directly compare all portions of the 2008–2012 data with those published for earlier inventories.

For further information about the sample protocols and estimation procedures for the first two phases of the FIA program, see Bechtold and Patterson (2005). For more information on P3 indicator sampling protocols, see U.S. Forest Service (2005) and Woodall and Monleon (2008).

## **Reserve Status—Improved Implementation**

FIA defines reserved forest land as forest land withdrawn by law(s) prohibiting the management of land for the production of wood products (not merely controlling or prohibiting wood-harvesting methods). All private forest land, regardless of conservation easements that may restrict harvesting, is classified as not reserved. Timberland does not include reserved forest land.

In an effort to increase consistency among states and across inventory years, a refined set of procedures determining reserve status have been implemented with version 6.0 of the FIA field manual which took effect with the 2013 inventory year (began October 2012). Furthermore, all previously collected annual inventory data (1999 to present) have been updated using the new standardized interpretation. This report for New York 2012 is based upon these updated estimates.

**Table 15.—Comparison of timberland estimates calculated using previous and improved reserve status implementations, New York 2012, Volumes are for 5-inch and larger diameter trees**

Timberland	2012 Estimate improved	2012 Estimate previous	Difference	Difference (percent)
Area (1,000 acres)	15,905	15,967	-62	-0.4
Number of live trees 1-inch diameter or larger (million trees)	9,713	9,738	-25	-0.3
Aboveground biomass of live trees 1-inch diameter or larger (1,000 oven-dry tons)	907,995	911,145	-3,150	-0.3
Net volume in live trees (million ft <sup>3</sup> )	33,150	33,269	-119	-0.4
Net volume of growing-stock trees (million ft <sup>3</sup> )	29,768	29,876	-109	-0.4
Annual net growth of growing-stock trees (1,000 ft <sup>3</sup> /year)	617,005	630,352	-13,347	-2.1
Annual mortality of growing-stock trees (1,000 ft <sup>3</sup> /year)	257,952	260,503	-2,551	-1.0
Annual harvest removals of growing-stock trees (1,000 ft <sup>3</sup> /year)	243,070	245,873	-2,803	-1.1
Annual other removals of growing-stock trees (1,000 ft <sup>3</sup> /year)	16,306	25,501	-9,195	-36.1

Starting in 2012, timberland estimates generated for earlier annual inventories can differ from previously published estimates. The 2012 inventory was the last inventory in which all data were available under the previous and improved implementations (Table 15). Changes shown are small and all are well within the margin of error represented by one standard deviation.

The improved implementation of the reserve status definition increases the spatial and temporal precision of timberland estimates allowing for higher quality trend analyses and potentially better forest management decisions.

## Quality of the Estimates

The four primary sources of error common to all sample-based estimates are sampling, measurement, prediction, and nonresponse error. For each of these sources of error, a definition within the context of the FIA inventory is provided along with a discussion of methods used to quantify and reduce this error.

### Sampling Error

The process of sampling (selecting a random subset of a population and calculating estimates from this subset) causes estimates to contain error they would not have if every member of the population had been observed and included in the estimate. The 2012 New York inventory is based on a sample of 4,786 plots located randomly across the State.

The procedures for statistical estimation outlined in the previous section and described in detail in Bechtold and Patterson (2005) provide the estimates of the population totals and means presented in this report. Along with every estimate is an associated sampling error that is typically expressed as a percentage of the estimated value but that can also be expressed in the same units as the estimate or as a confidence interval (the estimated value plus or minus the sampling error). This sampling error is the primary measure of the reliability of an estimate. A sampling error can be interpreted to mean that if a 100-percent inventory been taken using these methods, the chances are two out of three that the results would have been within the limits indicated (i.e., 68-percent confidence interval).

The sampling errors for state-level estimates of the major attributes presented in this report are shown in Table B. Table NY-65<sup>2</sup> presents sampling errors for these estimates at the inventory unit and county group levels for each State.

Estimates for classifications smaller than the State totals presented in Table B<sup>2</sup> will have larger sampling errors. For example, Table NY- 65 shows that the sampling error for timberland area in any county is higher than that for total timberland area in the State. To compute an approximate sampling error for an estimate that is smaller than a State total, use the following formula:

$$E = \frac{(SE)\sqrt{(\text{State total estimate})}}{\sqrt{(\text{Smaller estimate})}}$$

Where

E = approximate sampling error for smaller estimate

SE = sampling error for State total estimate

This approximation works well for estimates of area, volume, number of trees, and biomass. It is less effective for estimates of growth, removals, or mortality. Individuals seeking more accurate sampling errors should use Forest Inventory Data Online (FIDO), available at <http://fiatools.fs.fed.us>.

The estimators used by FIA are unbiased under the assumptions that the sample plots are a random sample of the total population and the observed value for any plot is the true value for that plot. Deviations from these basic assumptions are not reflected in the computation of sampling errors. The following sections on measurement, prediction, and nonresponse error address possible departures from these basic assumptions.

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<sup>2</sup> Tables labeled with the State abbreviation (NY) followed by a number (e.g., Table NY-1) are located in a supplementary file titled “New York forest inventory summary tables” located at <http://dx.doi.org/10.2737/NRS-RB-98>. Tables labeled with letters (e.g., Table A) are located on pg 25.

## **Measurement Error**

Errors associated with the methods and instruments used to observe and record the sample attributes are called measurement errors. On FIA plots, attributes such as the diameter and height of a tree are measured with different instruments, and other attributes such as species and crown class are observed without the aid of an instrument. On a typical FIA plot, 30 to 70 trees are observed with 15 to 20 attributes recorded on each tree. In addition, many attributes that describe the plot and conditions on the plot are observed. Errors in any of these observations affect the quality of the estimates. If a measurement is biased (such as tree diameter consistently taken at an incorrect place on the tree), then the estimates that use this observation (such as volume) will reflect this bias. Even if measurements are unbiased, high levels of random error in the measurements will add to the total random error of the estimation process.

To ensure that all FIA observations are made to the highest standards possible, a regular program of quality assurance and quality control is an integral part of all FIA data collection efforts. This program begins with the documentation of protocols and procedures used in the inventory followed by intensive crew training. To assess the quality of the data collected by these trained crews, a random sample of at least 4 percent of all plots are measured independently by a different expert crew. These independent measurements are referred to as blind checks. The purpose of these blind checks is to assess the quality of field measurements. The second measurement on these blind check plots is done by a quality assurance (QA) crew. In all cases, QA crews have as much or more experience and training in FIA field measurements than standard FIA crews.

The quality of field measurements is assessed nationally through a set of measurement quality objectives (MQOs) that are set for every data item we collect. Each MQO consists of two parts: a tolerance or acceptable level of measurement error, and an objective in terms of the percent of measurements within tolerance. The blind check measurements are used to observe how often individual field crews are meeting these objectives and to assess the overall compliance among all crews. Table C shows the compliance rates for various measurements used to compute the estimates included in this report and in other NRS-FIA reports. The columns labeled New York come from blind check measurements of plots used in this report, and the columns labeled All NRS-FIA States come from all measurements made by FIA crews within the entire 24-state area where the Northern Research Station implemented the FIA program over 2008-2012. Training and supervision of crews is a regional effort and crews often work in more than one state. Regional data quality observations reflect the overall measurement quality of all data collected by FIA in the NRS region.

In addition to the percent compliance to measurement quality objectives, the blind check observations were used to test for relative bias in the field crew measurements. Relative bias is defined here as a tendency for the standard field crew measurements to be higher or lower than those measurements taken by the QA crews. The estimated

relative bias and limits of 95-percent confidence intervals (based on parametric bootstrap estimates) for the relative bias are presented in Table D.

The blind check measurements do not provide direct observations of true bias in field measurements (average difference between field measurements and true values) because they are paired observations of two field measurements. The QA crew in these blind checks typically has more training and experience with FIA field measurements than the first crew, but both crews use the same methods and instruments to obtain the measurements. These methods were the best available and were selected for use nationwide by FIA; they are commonly used by other similar natural resource inventories. A basic assumption is that the methods, when correctly applied, provide unbiased observations of the attribute they are designed to measure. Under this assumption, relative bias observations in Table D provide observations of bias due to the difference in experience and training between the field and QA crews. In most cases there is no significant bias.

### **Prediction Error**

Errors associated with using mathematical models (such as volume models) to provide observations of the attributes of interest based on sample attributes are referred to as prediction errors. Area, number of trees, volume, biomass, growth, removals, and mortality are the primary attributes of interest presented in this report. Area and number of trees estimates are based on direct observation and do not involve the use of prediction models; however, FIA estimates of volume, biomass, growth, removals, and mortality use model-based predictions in the estimation process. Models are used to predict volume and biomass estimates of individual tree volumes. Change estimates such as growth, mortality, and removals are based on these model-based predictions of volume from both the current plot measurements and the measurements taken in the previous inventory.

In comparing FIA estimates to other data sources, users need to be aware of the prediction models used in both estimates. If both estimates are based on the same prediction models with matching fitted parameter values, then the prediction bias of one estimate should cancel out that of the other estimate. If the estimates are based on different prediction models, then the user should be aware of the prediction error of both models.

### **Nonresponse Error**

Nonresponse error refers to the error caused by not being able to observe some of the elements in the sample. In FIA, nonresponse occurs when crews are unable to measure a plot (or a portion of a plot) at a selected location. Nonresponse falls into the following three classes:

- Denied access—Entire plots or portions of plots where the field crew is unable to obtain permission from the landowner and is therefore unable to measure the trees on the plot.

- Hazardous/inaccessible—Entire plots or portions of plots where the conditions present prevent a crew from safely getting to the plot or measuring the trees on the plot.
- Other—Plots where the field crew is unable to obtain a valid measurement for a variety of reasons other than those stated above.

Nonresponse has two effects on the sample. First, it reduces the sample size. The reduced sample size is reflected in the sampling errors discussed in that section. Second, nonresponse can bias the estimates if the portion of the population not being sampled differs from the portion being sampled.

In FIA, unlike many survey samples, nonresponse rates are relatively low. In the 2012 New York inventory, a total of 5,296 sample plots were selected to be observed. Of the total sample plots selected for observation, 4,786 are in the sample used for the estimation of current resources. There were 497 plots where crews were unable to obtain owner permission to measure the plot and 13 plots where hazardous conditions or other issues prevented the crew from measuring all or part of the plot.

Even though an overall response rate of 90 percent is very high, it can cause considerable bias if not properly accounted for. The major source of nonresponse is denied access to plots. Denied access plots primarily occur on lands in private ownership. Also, the observations needed for plots on nonforest and water land classes do not usually require crews to physically enter the land and permission is not needed to obtain the observation because it can be obtained from aerial photos or other remotely sensed information sources.

The stratified estimation process used by FIA with strata defined by three ownership classes (inland census water, public, and private) and five canopy cover classes reduces the possible effects of bias caused by nonresponse. Under the stratified estimation process used by FIA, nonresponses are removed from the sample, and stratum estimates (means, totals, and sampling errors) are obtained from only those plots with valid observations. The net effect in the estimates of means and totals is that the average of the observed plots within the stratum (ownership class-forest cover class) becomes the estimate for all nonresponses within that stratum. The nonresponse rate in one stratum does not affect the estimate in other strata. The response rate within each stratum is presented in Table E.

The nonresponse plots in this inventory were not permanently removed from the FIA system of plots. In future inventories, we will again attempt to measure these plots. At that time we may be able to obtain permission to access these plots, the hazardous conditions may have changed, or other circumstances that caused us to drop plots from a specific inventory cycle will probably be different.

## GLOSSARY

**Accretion:** The estimated net growth on trees that were measured during the previous inventory (divided by the number of growing seasons between surveys to produce average annual accretion). It does not include growth on trees cut during the period or those trees that died. This component uses the incremental change in volume between two inventories.

**Average annual mortality of growing stock:** The average annual change in cubic-foot volume of sound wood in growing-stock trees that died over a defined measurement cycle.

**Average annual mortality of sawtimber:** The average annual change in board-foot volume of sound wood in sawtimber trees that died over a defined measurement cycle.

**Average annual net growth of growing stock:** The average annual change in cubic-foot volume of sound wood in live growing-stock trees, and the total volume of trees entering diameter classes greater than 5.0 inches d.b.h., through ingrowth, less volume losses resulting from natural causes. Natural causes include mortality except that due to logging damage, timber stand improvement, or conversion to a nonforest land use.

**Average annual net growth of sawtimber:** The average annual change in the board-foot volume of live sawtimber trees, and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes. Natural causes include mortality except that due to logging damage, timber stand improvement, or conversion to a nonforest land use.

**Average annual removals from growing stock:** The average cubic-foot volume of wood in live growing-stock trees removed annually for roundwood forest products, in addition to the volume in logging residues or mortality due to logging damage (harvest removals). This component of change also includes the volumes of growing-stock trees removed due to land use changes (other removals).

**Average annual removals from sawtimber:** The average board-foot volume of wood in live sawtimber trees removed annually for roundwood forest products, in addition to the volume of logging residues or mortality due to logging damage (harvest removals). This component of change also includes the volumes of sawtimber trees removed due to land use changes (other removals).

**Basal area:** Tree area in square feet of the cross section at breast height of a single tree. When the basal areas of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

**Bioindicator species:** A tree, woody shrub, or nonwoody herb species that responds to ambient levels of ozone pollution with distinct visible foliar symptoms that are easy to diagnose.

**Board foot:** A unit of lumber measuring 1-foot long, 1-foot wide, and 1-inch thick, or its equivalent. International ¼-inch rule is used as the U.S. Forest Service standard log rule in the eastern United States.

**Bulk density:** The mass of soil per unit of volume. A measure of the ratio of pore space to solid materials in a given soil. It is expressed in units of grams per cubic centimeter of oven-dry soil.

**Census water:** Lakes, reservoirs, ponds, and similar bodies of water 4.5 acres in size or larger; and rivers or canals more than 200 feet wide (U.S. Census definition).

**Coarse woody debris (CWD):** Dead branches, twigs, and wood splinters 3.0 inches in diameter and larger measured at the smallest end.

**Commercial species:** Tree species currently or prospectively suitable for industrial wood products; excludes species of typically small size, poor form, or inferior quality, e.g., hawthorn and sumac.

**Compacted live crown ratio:** The percent of the total length of the tree that supports a full, live crown. To determine compacted live crown ratio for trees that have uneven length crowns, lower branches are visually transferred to fill holes in the upper portions of the crown, until a full, even crown is created.

**Condition:** A delineation of a land area based upon land use, forest type, stand size, regeneration status, reserved status, tree density, and owner class.

**Corporate:** An ownership class of private lands owned by corporations.

**County and municipal:** A class of public lands owned by counties or local public agencies, or lands leased by these governmental units for more than 50 years.

**Cropland:** Land under cultivation within the last 24 months, including cropland harvested, crop failures, cultivated summer fallow, idle cropland used only for pasture, orchards, active Christmas tree plantations indicated by annual shearing, nurseries, and land in soil improvement crops, but excluding land cultivated in developing improved pasture.

**Crown:** The part of a tree or woody plant bearing live branches or foliage.

**Crown dieback:** Recent mortality of branches with fine twigs, which begins at the terminal portion of a branch and proceeds toward the trunk. Dieback is considered only when it occurs in the upper and outer portions of the tree. When whole branches are dead in the upper crown, without obvious signs of damage such as breaks or animal injury, it is assumed the branches died from the terminal portion of the branch. Dead branches in the lower portion of the live crown are assumed to have died from competition and shading.

**Cull decrement:** The net volume of rough and rotten cull trees in the previous inventory that are classified as growing-stock trees in the current inventory (divided by the number of growing seasons between inventories to compute average annual cull decrement).

**Cull increment:** The net volume of growing-stock trees in the previous inventory that are classified as rough and rotten cull trees in the current inventory (divided by the number of growing seasons between inventories to compute average annual cull increment).

**Cull tree:** A live tree, 5.0 inches in d.b.h. or larger, that is unmerchantable for saw logs now or prospectively because of rot, roughness, or species. (See definitions for rotten and rough trees.)

**Decay class:** Qualitative assessment of stage of decay (five classes) of coarse woody debris based on visual assessments of color of wood, presence/absence of twigs and branches, texture of rotten portions, and structural integrity.

**Diameter at breast height (d.b.h.):** The diameter outside bark of a standing tree measured 4.5 feet above the ground.

**Diameter class:** A classification of trees based on diameter outside bark measured at breast height (4.5 feet above ground). With 2-inch diameter classes, the 6-inch class, for example, includes trees 5.0 through 6.9 inches diameter at breast height (d.b.h).

**Dry ton:** A unit of measure of dry weight equivalent to 2,000 pounds or 907.1848 Kg.

**Dry weight:** The weight of wood and bark as it would be if it had been oven dried; usually expressed in pounds or tons.

**Down woody material (DWM):** Woody pieces of trees and shrubs that have been uprooted (no longer supporting growth) or severed from their root system, not self-supporting, and lying on the ground.

**Duff:** A soil layer dominated by organic material derived from the decomposition of plant and animal litter and deposited on either an organic or a mineral surface. This layer is distinguished from the litter layer in that the original organic material has undergone sufficient decomposition that the source of this material (e.g., individual plant parts) can no longer be identified.

**Effective cation exchange capacity (ECEC):** The sum of cations that a soil can adsorb in its natural pH. Expressed in units of centimoles of positive charge per kilogram of soil.

**Federal:** An ownership class of public lands owned by the U.S. Government.

**Fiber products:** Products derived from wood and bark residues, such as pulp, composition board products, and wood chips.

**Fine materials:** Wood residues not suitable for chipping, such as planer shavings and sawdust.

**Fine woody debris (FWD):** Dead branches, twigs, and wood splinters 0.1 to 2.9 inches in diameter.

**Forest industry:** An ownership class of private lands owned by companies or individuals operating wood-using plants.

**Forest land:** Land at least 10 percent stocked by forest trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated. Forest land includes transition zones, such as areas between heavily forested and nonforested lands that are at least 10 percent stocked with forest trees and forest areas adjacent to urban and builtup lands. Also included are pinyon-juniper and chaparral areas in the West and afforested areas. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of trees must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas are classified as forest if less than 120 feet wide.

**Forest type:** A classification of forest land based on the species presently forming a plurality of the live-tree stocking.

**Forest-type group:** A combination of forest types that share closely associated species or site requirements and are generally combined for brevity of reporting.

**Major eastern forest-type groups:**

***White-red-jack pine:*** Forests in which eastern white pine, red pine, or jack pine, singly or in combination, comprise a plurality of the stocking. Common associates include hemlock, aspen, birch, and maple.

***Oak-pine:*** Forests in which hardwoods (usually upland oaks) comprise a plurality of the stocking, but in which pine or eastern redcedar comprises 25 to 50 percent of the stocking. Common associates include gum, hickory, and yellow-poplar.

***Oak-hickory:*** Forests in which upland oaks or hickory, singly or in combination, comprise a plurality of the stocking except where pines comprise 25 to 50 percent, in which case the stand is classified as oak-pine. Common associates include yellow-poplar, elm, maple, and black walnut.

***Oak-gum-cypress:*** Bottomland forests in which tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, comprise a plurality of the stocking except where pines comprise 25 to 50 percent, in which case the stand is classified as oak-pine. Common associates include cottonwood, willow, ash, elm, hackberry, and maple.

***Elm-ash-cottonwood:*** Forests in which elm, ash, or cottonwood, singly or in combination, comprise a plurality of the stocking. Common associates include willow, sycamore, beech, and maple.

***Maple-beech-birch:*** Forests in which maple, beech, or yellow birch, singly or in combination, comprise a plurality of the stocking. Common associates include hemlock, elm, basswood, and white pine.

***Aspen-birch:*** Forests in which aspen, balsam poplar, paper birch, or gray birch, singly or in combination, comprise a plurality of the stocking. Common associates include maple and balsam fir.

**Gross growth:** The sum of accretion and ingrowth.

**Growing stock:** A classification of timber inventory that includes live trees of commercial species meeting specified standards of quality or vigor. Cull trees are excluded. When associated with volume, this includes only trees 5.0 inches d.b.h. and larger.

**Growing-stock volume:** Net or gross volume in cubic feet of growing-stock trees 5.0 inches and larger d.b.h. measured from the 1-foot stump to a minimum 4.0-inch top diameter outside bark on the central stem, or to the point where the central stem splits into limbs. Net volume equals gross volume minus deduction for cull defects.

**Hardwood:** A dicotyledonous tree, usually broad-leaved and deciduous.

***Soft hardwoods:*** A category of hardwood species with wood generally of low specific gravity (less than 0.5). Notable examples include red maple, paper birch, quaking aspen, and American elm.

***Hard hardwoods:*** A category of hardwood species with wood generally of high specific gravity (greater than 0.5). Notable examples include sugar maple, yellow birch, black walnut, and oaks.

**Industrial wood:** All commercial roundwood products except fuelwood.

**Ingrowth:** The estimated net volume of trees that became 5.0 inches and larger d.b.h. during the period between inventories (divided by the number of growing seasons between surveys to produce average annual ingrowth). Also, the estimated net volume of trees 5.0 inches and larger d.b.h. that are growing on land that was reclassified from noncommercial forest land or nonforest land to timberland.

**Introduction:** The intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity. “Introduced” is not synonymous and should not be confused with the term “invasive” (USDA definition).

**Invasive species:** Those species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health. For the purpose of this policy only, a plant species is considered “invasive” only when it occurs on the Federal or State-specific noxious weed list or a list developed by the State-specific Department of Agriculture with their partners and approved by the State Technical Committee which prohibits or cautions its use due to invasive qualities (USDA definition).

**Land area:** The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, estuaries, and canals less than 200 feet wide; and lakes, reservoirs, and ponds less than 4.5 acres in area.

**Land use:** A classification of land that indicates the primary use at the time of the inventory. Major categories are forest land and nonforest land.

**Litter:** Undecomposed or only partially decomposed organic material that can be readily identified (e.g., plant leaves, twigs).

**Live aboveground biomass:** The aboveground volume of live trees (including bark but excluding foliage) reported in dry tons (dry weight). Biomass has four components:

**Bole:** Biomass of a tree from 1 foot above the ground to a 4-inch top outside bark or to a point where the central stem breaks into limbs.

**Tops and limbs:** Total biomass of a tree from a 1-foot stump minus the bole.

**Saplings:** Total aboveground biomass of a tree from 1.0 to 4.9 inches d.b.h.

**Stump:** Biomass of a tree 5 inches d.b.h. and larger from the ground to a height of 1 foot.

**Live cull:** A classification that includes live, cull trees. When associated with volume, it is the net volume in live, cull trees that are 5.0 inches d.b.h. and larger.

**Logging residues:** The unused portions of growing-stock and non-growing-stock trees cut or killed by logging and left in the woods.

**Merchantable:** Refers to a pulpwood or saw log section that meets pulpwood or saw log specifications, respectively.

**National Forest:** An ownership class of Federal lands, designated by Executive order or statute as National Forests or purchase units, and other lands under the administration of the Forest Service including experimental areas.

**Net cubic-foot volume:** The gross volume in cubic feet less deductions for rot, roughness, and poor form. Volume is computed for the central stem from a 1-foot stump to a minimum 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs.

**Net board-foot volume:** The gross volume in board feet less the deductions for rot, roughness, and poor form. Volume is computed from the 1-foot stump to a minimum 7.0-inch diameter outside bark for softwoods and a minimum 9.0-inch outside bark for hardwoods on the central stem. This estimate includes all softwoods 9.0 inches d.b.h. and larger, and all hardwoods 11.0 inches d.b.h. and larger.

**Noncensus water:** Streams/rivers 120 to 200 feet wide and bodies of water 1 to 4.5 acres in size, where the U.S. Bureau of the Census (1990) classifies such water as land.

**Noncommercial species:** Tree species of typically small size, poor form, or inferior quality, which normally do not develop into trees suitable for industrial wood products.

**Nonforest land:** Land that has never supported forests and lands formerly forested where use of timber management is precluded by development for other uses. (Note: Includes area used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 4.5-acre areas of water classified by the U.S. Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and clearings, etc., must be more than 1 acre in area to qualify as nonforest land.)

**Nonindustrial private:** An ownership class of private lands where the owner does not operate wood-using plants.

**Nonnative species:** Within a particular ecosystem, any species (including its seeds, eggs, spores, or other biological material capable of propagating that species;) that is not native to that ecosystem (USDA definition).

**Nonstocked areas:** Timberland less than 10 percent stocked with all live trees.

**Ownership unit:** A classification of ownership encompassing all types of legal entities having an ownership interest in land, regardless of the number of people involved. A unit may be an individual; a combination of persons; a legal entity such as a corporation, partnership, club, or trust; or a public agency. An ownership unit has control of a parcel or group of parcels of land.

**Owner class:** A classification of land into categories of ownership.

***Forest industry:*** Land owned by private companies that operate primary wood-using mills.

***Nonindustrial private:*** Land owned by other corporate, individuals, or trusts (NGOs) and who do not operate primary wood-using mills.

***Other corporate:*** Land owned by timber investment or real estate companies.

***Public:*** Land owned by federal, state, county, or municipal government.

**Ozone:** O<sub>3</sub>. A regional, gaseous air pollutant produced primarily through sunlight-driven chemical reactions of nitrogen dioxide and hydrocarbons in the atmosphere and causing foliar injury to deciduous trees, conifers, shrubs, and herbaceous species.

**Ozone bioindicator site:** An open area used for ozone injury evaluations on ozone-sensitive species. The area must meet certain site selection guidelines on size, condition, and plant counts to be used for ozone injury evaluations in FIA.

**Physiographic class:** A measure of soil and water conditions that affect tree growth on a site. The physiographic classes are:

**Xeric:** Very dry soils where excessive drainage seriously limits both growth and species occurrence. These sites are usually on upland and upper half slopes.

**Xeromesic:** Moderately dry soils where excessive drainage limits growth and species occurrence to some extent. These sites are usually on the lower half slopes.

**Mesic:** Deep, well-drained soils. Growth and species occurrence are limited only by climate. These include all cove sites and bottomlands along intermittent streams.

**Hydromesic:** Moderately wet soils where insufficient drainage or infrequent flooding limits growth and species occurrence to some extent.

**Hydric:** Very wet sites where excess water seriously limits both growth and species occurrence.

**Poletimber trees:** Live trees at least 5.0 inches d.b.h. but smaller than sawtimber trees.

**Primary wood-using mill:** A mill that converts roundwood products into other wood products. Common examples are sawmills that convert saw logs into lumber and pulpmills that convert pulpwood into paper.

**Productivity class:** A classification of forest land in terms of potential annual cubic-foot volume growth per acre at culmination of mean annual increment in fully stocked natural stands.

**Pulpwood:** Roundwood, whole-tree chips, or wood residues used for the production of wood pulp.

**Reserved forest land:** Forest land withdrawn from timber utilization through statute, administrative regulation, or designation without regard to productive status. Examples include national forest wilderness areas, national parks, and national monuments.

**Residues:** Bark and woody materials that are generated in primary wood-using mills when roundwood products are converted to other products. Examples are slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and pulp screenings. Includes bark residues and wood residues (both coarse and fine materials) but excludes logging residues.

**Rotten tree:** A live tree of commercial species that does not contain a saw log now or prospectively primarily because of rot (that is, when rot accounts for more than 50 percent of the total cull volume).

**Rough tree:** (a) A live tree of commercial species that does not contain a saw log now or prospectively primarily because of roughness (that is, when sound cull due to such factors as poor form, splits, or cracks accounts for more than 50 percent of the total cull volume); or (b) a live tree of noncommercial species.

**Roundwood products:** Logs, bolts, and other round timber generated from harvesting trees for industrial or consumer use. Roundwood products include saw logs, veneer, cooperage logs, bolts, pulpwood logs, fuelwood, pilings, poles posts, ties, mine timbers, and various other round or split products.

**Salvable dead tree:** A downed or standing dead tree considered currently or potentially merchantable by regional standards.

**Saplings:** Live trees 1.0 inch through 4.9 inches d.b.h.

**Saw log:** A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight, and with a minimum diameter inside bark of 6 inches for softwoods and 8 inches for hardwoods, or meeting other combinations of size and defect specified by regional standards.

**Sawtimber tree:** A live tree of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. Hardwoods must be at least 11.0 inches diameter outside bark (d.o.b.).

**Sawtimber volume:** Net or gross volume in board-foot (International  $\frac{1}{4}$ -inch rule) or cubic-foot of the saw log portion of live sawtimber trees measured from the 1-foot stump to a minimum 7.0-inch top diameter outside bark (for softwoods) or a 9.0-inch top diameter outside bark (for hardwoods), on the central stem, or to the point where the central stem splits into smaller limbs. Net volume equals gross volume minus deduction for rough and rotten cull.

**Seedling:** Live tree smaller than 1.0 inch d.b.h. / d.r.c. and at least 6.0 inches in height for softwoods and 12.0 inches in height for hardwoods.

**Site index:** An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

**Snag:** A standing dead tree. In the current inventory, a snag must be 5.0 inches d.b.h./d.r.c. and 4.5 feet tall, and have a lean angle less than 45 degrees from vertical. A snag may be either self-supported by its roots or supported by another tree or snag.

**Softwood:** A coniferous tree, usually evergreen, having needles or scale-like leaves.

**Sound dead:** The net volume in salvable dead trees.

**Species group:** A combination of tree species that share closely associated understory plants or site requirements.

**Stand:** A group of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

**Standing dead tree:** A standing dead tree must be at least 5 inches d.b.h. or larger, at least 4.5 feet in height, and have a lean of less than 45 degrees from the vertical. A snag should be self-supported or supported by another tree.

**Stand-size class:** A classification of forest land based on the size class of live trees in the area. The classes include

**Nonstocked:** Forest land stocked with less than 10 percent of full stocking with live trees. Examples are recently cutover areas or recently reverted agricultural fields.

**Sapling-seedling:** Forest land stocked with at least 10 percent of full stocking with live trees with half or more of such stocking in seedlings or saplings or both.

**Poletimber:** Forest land stocked with at least 10 percent of full stocking with live trees with half or more of such stocking in poletimber or sawtimber trees or both, and in which the stocking of poletimber exceeds that of sawtimber.

**Sawtimber:** Forest land stocked with at least 10 percent of full stocking with live trees with half or more of such stocking in poletimber or sawtimber trees or both, and in which the stocking of sawtimber is at least equal to that of poletimber.

**State:** An ownership class of public lands owned by states or lands leased by states for more than 50 years.

**Stocking:** The degree of occupancy of land by trees, measured by basal area or number of trees by size and spacing, or both, compared to a stocking standard; that is, the basal area or number of trees, or both, required to fully utilize the growth potential of the land.

**Stocking class:** At the tree level, stocking is the density expressed as a percent of total tree density required to fully utilize the growth potential of the land. At the stand level it is expressed as the sum of the stocking values of all trees sampled. The classes include:

**Overstocked:** Forest stand with stocking  $\geq 100$  percent

**Fully stocked:** Forest stand that contains 60 to 99 percent of full stocking

**Moderately stocked:** Forest stand that contains 35 to 59 percent of full stocking

**Poorly stocked:** Forest stand that contains only 10 to 34 percent of full stocking

**Nonstocked:** Forest stand with less than 10 percent of full stocking.

**Timberland:** Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. (Note: Areas qualifying as timberland are capable of producing in excess of 20 cubic feet per acre per year of industrial wood in natural stands. Currently inaccessible and inoperable areas are included.)

**Timber products output:** All timber products cut from roundwood and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edging, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

**Tree:** A woody plant usually having one or more erect perennial stems, a stem diameter at breast height of at least 3 inches, a more or less definitely formed crown of foliage, and a height of at least 15 feet at maturity.

**Tree class:** A classification of tree quality or condition of the tree for saw log production. Tree class for sawtimber-size trees is based on current conditions. Tree class for poletimber-size trees is based on the prospected determination or forecast of the potential tree quality when the tree reaches sawtimber size.

**Tree size class:** A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings, and seedlings.

**Tops:** The wood of a tree above the merchantable height (or above the point on the stem 4.0 inches diameter outside bark (d.o.b.) or to the point where the central stem breaks into limbs). It includes the usable material in the uppermost stem.

**Total live tree biomass:** The total mass of live trees and associated saplings expressed in pounds or tons (dry weight) per unit area. The total tree and sapling biomass (excluding foliage) has five components:

**Bole:** Biomass of a tree from 1 foot above the ground to a 4-inch top outside bark or to a point where the central stem splits into smaller limbs. This includes protruding twigs from the central stem.

**Tops and limbs:** Total biomass of a tree from the 12-inch stump minus the bole. This does not include any twigs protruding from the central stem below the 4-inch top.

**Sapling trees:** Total biomass of a tree from 1 to 4.9 inches diameter measured at the root collar d.b.h. or d.r.c.

**Stump:** Total biomass of a tree 5 inches d.b.h. and larger from the ground to a height of 1 foot.

**Belowground:** Total biomass of the belowground portion of the stump and the coarse roots of all trees and saplings.

**Urban forest land:** Land that would otherwise meet the criteria for timberland but is in an urban-suburban area surrounded by commercial, industrial, or residential development and not likely to be managed for the production of industrial wood products on a continuing basis. Wood removed would be for land clearing, fuelwood, or esthetic purposes. Such forest land may be associated with industrial, commercial, residential subdivision, industrial parks, golf course perimeters, airport buffer strips, and public urban parks that qualify as forest land.

**Unreserved forest land:** Forest land not withdrawn from harvest by statute or administrative regulation. Includes forest lands that are not capable of producing in excess of 20 cubic feet per acre per year of industrial wood in natural stands.

**Veneer log:** A roundwood product from which veneer is sliced or sawn and that usually meets certain standards of minimum diameter and length and maximum defect.

**Weight:** The weight of wood and bark, oven-dry basis (approximately 12 percent moisture content).

## **TABLES**

Tables A through E referenced in this report are published in this document on subsequent pages. These tables report data related to sampling, measurement variables, and measurement quality objectives.

Tables labeled with the State abbreviation followed by a number (e.g., Table NY-1) report estimates of forest characteristics collected during this inventory period, including estimates of forested area, number of trees, volume, growth, etc. These tables can be found in a supplemental file labeled “New York forest inventory summary tables” at <http://dx.doi.org/10.2737/NRS-RB-98>.

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**Table A.—Area and number of plots in each stratum used for stratification and estimation, New York, 2008-2012**

Unit code	Estimation unit description <sup>a</sup>	Canopy cover stratum <sup>b</sup>	Acres	Selected <sup>c</sup>	Office selected <sup>d</sup>	Field selected <sup>e</sup>	Field sampled <sup>f</sup>	Field sampled forested <sup>g</sup>	Total plots sampled for change <sup>h</sup>	Field sampled plots for change <sup>i</sup>	Not measured <sup>j</sup>
1	Public Unit 1	Canopy cover 81 - 100	194,000	25	1	24	22	22	23	22	2
4	NY Adirondacks Unit 4	Canopy cover 81 - 100	1,408,000	209	0	209	207	207	206	206	2
8	NY Catskills Unit 8	Canopy cover 0 - 100	249,000	35	0	35	34	34	34	34	1
7	Private Unit 7	Canopy cover 0 - 5	914,000	159	93	66	57	48	151	59	9
8	Private Unit 8	Canopy cover 66 - 80	252,000	49	19	30	23	19	43	25	7
7	Private Unit 7	Canopy cover 51 - 65	66,000	11	3	8	7	5	10	7	1
4	Public Private Unit 4	Canopy cover 6 - 80	97,000	20	4	16	16	15	20	16	0
4	Public Private Unit 4	Canopy cover 81 - 100	1,102,000	201	1	200	178	176	186	185	22
8	Private Unit 8	Canopy cover 0 - 5	1,204,000	206	140	66	54	42	190	54	12
5	Private Unit 5	Canopy cover 0 - 5	944,000	161	85	76	62	48	146	62	14
6	Finger Lakes NF	Canopy cover 0 - 100	17,000	5	0	5	5	5	3	3	0
7	Inland Censur Water Public Unit 7	Canopy cover 0 - 100	141,000	11	1	10	10	10	10	9	0
7	Private Unit 7	Canopy cover 81 - 100	1,282,000	225	5	220	186	182	194	189	34
3	Private Unit 3	Canopy cover 6 - 65	150,000	28	1	27	21	21	26	25	6
7	NY Adirondacks Unit 7	Canopy cover 0 - 100	39,000	5	0	5	5	5	5	5	0
5	Public Unit 5	Canopy cover 0 - 80	41,000	11	1	10	10	9	11	10	0
5	Public Unit 5	Canopy cover 81 - 100	174,000	32	0	32	32	32	32	32	0
5	Inland Censur Water Unit 5	Canopy cover 0 - 100	33,000	8	7	1	1	1	8	1	0
8	Private Unit 8	Canopy cover 51 - 65	173,000	27	12	15	14	11	26	14	1
3	Private Unit 3	Canopy cover 81 - 100	1,065,000	184	0	184	163	162	171	171	21
5	Private Unit 5	Canopy cover 81 - 100	1,268,000	195	0	195	176	171	167	167	19
1	Private Unit 1	Canopy cover 0 - 5	1,068,000	175	86	89	83	75	168	83	6
1	Public Unit 1	Canopy cover 0 - 80	97,000	20	6	14	13	11	18	12	1
8	Private Unit 8	Canopy cover 6 - 50	262,000	51	23	28	25	20	47	24	3
8	Inland Censur Water Unit 8	Canopy cover 0 - 100	360,000	50	48	2	2	2	50	2	0
7	Private Unit 7	Canopy cover 6 - 50	106,000	14	8	6	6	5	13	5	0
4	Inland Censur Water Unit 4	Canopy cover 0 - 100	172,000	28	25	3	3	3	27	3	0
2	Private Unit 2	Canopy cover 66 - 80	361,000	57	12	45	38	34	54	42	7
2	Inland Censur Water Unit 2	Canopy cover 0 - 100	199,000	33	32	1	1	1	33	1	0
6	Private Unit 6	Canopy cover 66 - 80	229,000	35	2	33	26	26	30	28	7
3	Inland Censur Water Unit 3	Canopy cover 0 - 100	91,000	14	12	2	2	2	14	2	0
6	Private Unit 6	Canopy cover 81 - 100	1,877,000	315	3	312	257	254	273	270	55
2	Private Unit 2	Canopy cover 0 - 5	3,060,000	509	351	158	141	95	494	144	17
5	Private Unit 5	Canopy cover 66 - 80	212,000	36	3	33	27	26	31	28	6
2	Public Unit 2	Canopy cover 81 - 100	162,000	32	2	30	30	30	32	30	0
1	Private Unit 1	Canopy cover 51 - 65	104,000	25	4	21	20	18	24	20	1
4	Public Private Unit 4	Canopy cover 0 - 5	114,000	27	8	19	17	15	26	18	2
5	Private Unit 5	Canopy cover 6 - 50	274,000	50	8	42	41	38	48	40	1
6	Public Unit 6	Canopy cover 0 - 100	269,000	42	0	42	42	42	41	41	0

continued on next page

**Table A.—continued**

Unit code	Estimation unit description <sup>a</sup>	Canopy cover stratum <sup>b</sup>	Acres	Selected <sup>c</sup>	Office selected <sup>d</sup>	Field selected <sup>e</sup>	Field sampled <sup>f</sup>	Field sampled forested <sup>g</sup>	Total plots sampled for change <sup>h</sup>	Field sampled plots for change <sup>i</sup>	Not measured <sup>j</sup>
3	Public Unit 3	Canopy cover 0 - 100	193,000	30	0	30	30	30	30	30	0
2	Private Unit 2	Canopy cover 51 - 65	312,000	62	19	43	36	33	54	35	7
1	Private Unit 1	Canopy cover 6 - 50	150,000	24	4	20	18	17	24	20	2
6	Private Unit 6	Canopy cover 6 - 50	232,000	49	10	39	35	32	48	38	4
8	Private Unit 8	Canopy cover 81 - 100	2,124,000	360	24	336	248	243	304	280	88
8	Public Unit 8	Canopy cover 6 - 80	48,000	14	3	11	11	11	13	11	0
1	Inland Census Water Unit 1	Canopy cover 0 - 100	248,000	34	30	4	4	3	33	3	0
6	Inland Census Water Unit 6	Canopy cover 0 - 100	54,000	10	9	1	1	1	9	1	0
6	NY Catskills Unit 6	Canopy cover 0 - 100	39,000	5	0	5	5	5	5	5	0
4	NY Adirondacks Unit 4	Canopy cover 0 - 80	86,000	17	4	13	13	12	17	13	0
1	NY Adirondacks Unit 1	Canopy cover 0 - 100	460,000	77	0	77	77	77	75	75	0
8	Public Unit 8	Canopy cover 81 - 100	294,000	41	0	41	41	41	41	41	0
5	Private Unit 5	Canopy cover 51 - 65	156,000	34	3	31	28	27	30	27	3
1	Private Unit 1	Canopy cover 81 - 100	1,945,000	334	2	332	311	310	320	318	21
2	Private Unit 2	Canopy cover 81 - 100	1,610,000	261	8	253	220	216	239	231	33
3	NY Adirondacks Unit 3	Canopy cover 0 - 100	482,000	66	0	66	65	65	62	62	1
6	Private Unit 6	Canopy cover 0 - 5	1,209,000	198	104	94	77	55	185	82	17
3	Private Unit 3	Canopy cover 66 - 80	140,000	27	0	27	24	23	26	26	3
3	Private Unit 3	Canopy cover 0 - 5	783,000	142	61	81	72	63	135	74	9
1	Private Unit 1	Canopy cover 66 - 80	225,000	39	3	36	31	30	36	33	5
7	Private Unit 7	Canopy cover 66 - 80	113,000	26	5	21	19	17	22	17	2
2	Private Unit 2	Canopy cover 6 - 50	353,000	66	15	51	44	34	58	43	7
8	Public Unit 8	Canopy cover 0 - 5	82,000	14	7	7	7	4	13	7	0
6	Private Unit 6	Canopy cover 51 - 65	155,000	35	5	30	25	24	29	24	5
2	Public Unit 2	Canopy cover 0 - 80	110,000	11	4	7	7	7	11	7	0
				5296	1326	3970	3506	3302	4904	3592	464

<sup>a</sup> Description of the sub-population undergoing post-stratification. County groups are defined by one or more contiguous counties used for population estimation.

<sup>b</sup> A stratum within each estimation unit defined by partitioning the full range of percent canopy (0 - 100%) into 5 strata

<sup>c</sup> Total plots selected to be sampled

<sup>d</sup> Plots determined to have no chance of being forested during a prefield interpretation procedure. These plots are withheld from field sampling and considered remotely sampled.

<sup>e</sup> Plots determined to have some chance of being forested or that were forested on a previous visit.

<sup>f</sup> Field selected plots that were successfully sampled in the field.

<sup>g</sup> Field selected plots that were successfully sampled in the field and found to intersect forest land.

<sup>h</sup> Plots in the sample that were successfully sampled in the previous cycle.

<sup>i</sup> Plots in the sample that were successfully sampled in the previous cycle and that were sent to the field for sampling.

<sup>j</sup> Plots selected as part of the sample, but completely non-sampled.

**Table B.—State-level estimates of major forest resource attributes and their sampling errors, New York, 2008-2012**

Item	State total	Sampling error
Growing stock:	<i>million cubic feet</i>	<i>percent</i>
Volume	29,767.7	1.36
Average annual net growth	617.0	2.51
Average annual removals	274.9	7.53
Average annual mortality	258.0	3.76
Sawtimber:	<i>million board feet<sup>a</sup></i>	
Volume	93,605.2	1.80
Average annual net growth	2,824.6	2.66
Average annual removals	1,013.2	8.15
Average annual mortality	679.3	6.54
Area:	<i>thousand acres</i>	
Forest land	19,005.5	0.67
Timberland	7,864.9	0.83
Biomass (aboveground live trees and saplings):	<i>million dry tons</i>	
Forest land	1,120.9	1.01
Timberland	908.0	1.02

<sup>a</sup> International 1/4-inch rule.

All results for timberland except where indicated.

**Table C.—Compliance to measurement quality objectives (MQO) tolerances of variables based on blind check plots, New York, 2008-2012**

Variable	Tolerance	Objective	New York		All NRS states	
			Data within tolerance	Observations	Data within tolerance	Observations
Plot Level		percent		number	percent	number
Distance to Road	No Tolerance	90.0	83.5	158	81.9	2,265
Water on Plot	No Tolerance	90.0	87.3	158	86.2	2,265
Elevation	±50 feet	99.0	82.1	168	88.1	2,082
Latitude - decimal degrees	±0.0001 degree	99.0	100.0	169	100.0	2,085
Longitude - decimal degrees	±0.0001 degree	99.0	81.7	169	88.0	2,085
Number of plots				170		2,371
Condition Level						
Condition Status	No Tolerance	99.0	99.2	356	98.5	5,845
Reserve Status	No Tolerance	99.0	99.2	356	99.6	5,845
Owner Group	No Tolerance	99.0	98.7	228	97.5	3,153
Forest Type (Type)	No Tolerance	95.0	93.0	228	89.4	3,153
Forest Type (Group)	No Tolerance	99.0	96.9	228	94.0	3,153
Stand Size	No Tolerance	99.0	92.1	228	90.6	3,153
Regeneration Status	No Tolerance	99.0	99.1	228	98.4	3,153
Tree Density	No Tolerance	99.0	99.1	228	96.4	3,153
Owner Class	No Tolerance	99.0	96.1	228	94.9	3,153
Owner Status	No Tolerance	99.0	98.7	228	98.9	3,153
Regeneration Species	No Tolerance	99.0	99.1	228	98.4	3,153
Stand Age	±10 percent	95.0	77.6	228	86.0	3,153
Disturbance 1	No Tolerance	99.0	93.8	226	90.7	3,093
Disturbance Year 1	±1 year	99.0	94.4	18	89.2	306
Disturbance 2	No Tolerance	99.0	100.0	31	88.8	556
Disturbance Year 2	±1 year	99.0	.	.	78.6	28
Disturbance 3	No Tolerance	99.0	.	.	98.8	82
Disturbance Year 3	±1 year	99.0	.	.	50.0	2
Treatment 1	No Tolerance	99.0	98.2	226	97.8	3,093
Treatment Year 1	±1 year	99.0	100.0	15	97.0	199
Treatment 2	No Tolerance	99.0	100.0	19	84.7	261
Treatment Year 2	±1 year	99.0	.	.	98.1	52
Treatment 3	No Tolerance	99.0	.	.	96.7	90
Treatment Year 3	±1 year	99.0	.	.	75.0	4
Physiographic Class	No Tolerance	80.0	93.0	228	84.6	3,153
Present Nonforest Use	No Tolerance	99.0	92.7	356	89.1	5,845
Number of conditions				356		5,845
Boundary Level						
Boundary Change	No Tolerance	99.0	96.4	56	82.2	794
Constrasting Condition	No Tolerance	99.0	98.2	56	95.3	794
Left Azimuth	±10 degrees	90.0	100.0	56	87.4	794
Corner Mapped	No Tolerance	90.0	100.0	56	95.5	794
Corner Azimuth	±10 degrees	90.0	100.0	3	94.1	68

continued

**Table C.—continued**

Variable	Tolerance	Objective	New York		All NRS states	
			Data within tolerance	Observations	Data within tolerance	Observations
Corner Distance	±1 foot	90.0	100.0	3	91.2	68
Right Azimuth	±10 degrees	90.0	94.6	56	87.2	794
Number of boundaries				56		794
Subplot Level						
Subplot Center Condition	No Tolerance	99.0	99.9	680	98.2	9,484
Microplot Center Condition	No Tolerance	99.0	99.7	680	98.0	9,484
Slope	±10 percent	90.0	99.1	569	98.5	8,051
Aspect	±10 degrees	90.0	92.1	559	93.7	7,838
Snow/Water Depth	±0.5 foot		70.3	596	69.3	8,276
Number of subplots				680		9,484
Tree Level						
DBH	±0.1 inch per 20 inches	95.0	93.9	2,645	95.6	35,321
DRC	±0.1 inch per 20 inches	95.0	.	.	72.3	47
Azimuth	±10 degrees	90.0	99.8	2,916	99.3	39,772
Horizontal Distance	±0.2 foot per 1.0 foot	90.0	98.9	2,916	98.7	39,772
Species	No Tolerance	95.0	99.2	2,957	98.4	40,057
Tree Genus	No Tolerance	99.0	99.8	2,956	99.6	40,013
Tree Status	No Tolerance	95.0	98.9	2,957	98.9	40,080
Rotten/Missing Cull	±10 percent	90.0	98.3	1,990	98.3	25,851
Total Length	±10 percent	90.0	86.4	1,965	79.2	25,599
Actual Length	±10 percent	90.0	75.4	272	73.3	3,218
Compacted Crown Ratio	±10 percent	80.0	84.0	2,437	83.5	32,802
Uncompacted Crown Ratio (P3)	±10 percent	90.0	.	.	66.7	15
Crown Class	No Tolerance	85.0	82.8	2,437	81.7	32,802
Decay Class	±1 class	90.0	97.0	433	95.8	5,989
Cause of Death	No Tolerance	80.0	82.4	433	83.9	5,989
Condition	No Tolerance	99.0	99.9	2,957	98.4	40,080
Crown Position	No Tolerance		.	.	71.4	14
Crown Light Exposure	±1 class	85.0	.	.	73.3	15
Sapling Crown Vigor Class	No Tolerance	85.0	.	.	100.0	1
Crown Density	±10 percent	90.0	.	.	57.1	14
Crown Dieback	±10 percent	90.0	.	.	100.0	14
Transparency	±10 percent	90.0	.	.	71.4	14
Tree Class	No Tolerance	90.0	93.3	2,676	92.0	35,658
Damage Agent 1	No Tolerance	90.0	83.0	2,437	87.3	32,802
Damage Agent 2	No Tolerance	90.0	75.2	802	78.9	8,106
Tree Grade	No Tolerance	90.0	76.8	633	74.3	7,695
DBH-Live & Trees with Decay Code 1 or 2	±0.1 inch per 20 inches	95.0	93.7	2,544	95.4	33,668
DBH-Trees with Decay Codes 3, 4 or 5	±1 inch per 20 inches	95.0	100.0	101	99.5	1,648
Total Length-trees 40 feet and greater	±10 percent	90.0	88.2	1,633	81.0	20,300
Total Length-trees less than 40 feet	±10 percent	90.0	77.4	332	72.4	5,299
Total Length-trees less than 5 inches DBH	±10 percent	90.0	47.1	51	65.3	288

continued

**Table C.—continued**

Variable	Tolerance	Objective	New York		All NRS states	
			Data within tolerance	Observations	Data within tolerance	Observations
Number of trees				2,957		40,057
Seedling Level						
Species	No Tolerance	85.0	95.7	486	92.6	8,215
Genus	No Tolerance	90.0	97.7	486	96.7	8,215
Seedling Count	±20 percent	90.0	70.2	486	63.8	8,215
Seedling Count (coded)	No Tolerance	90.0	75.3	486	69.4	8,215
Number of microplots				227		3,349
Site Tree Level						
Condition List	No Tolerance	99.0	87.0	46	93.4	2,810
Diameter	±0.1 inch per 20 inches	95.0	93.5	46	97.7	2,810
Species	No Tolerance	95.0	100.0	46	99.3	2,810
Genus	No Tolerance	99.0	100.0	46	100.0	2,810
Azimuth	±10 degrees	90.0	97.8	46	98.9	2,810
Distance	±5 feet	90.0	97.8	46	99.1	2,810
Total Length	±10 percent	90.0	95.7	46	98.4	2,810
Diameter Age	±5 years	95.0	100.0	46	97.7	2,810
Number of site trees				46		2,810

**Table D.—Observed relative bias values (Average [field crew - QA crew]) for measurement variables based on blind check plots, New York, 2008-2012**

Variable	Unit of measure	New York				All NRS states			
		Relative bias	95% CI limits		Observations	Relative bias	95% CI limits		Observations
			Lower	Upper			Lower	Upper	
Plot Level					<i>number</i>				<i>number</i>
Distance to Road	code	0.03	-0.06	0.12	158	-0.02	-0.06	0.00	2,265
Water on Plot	code	-0.06	-0.26	0.18	158	0.08	0.01	0.14	2,265
Elevation	foot	589.34	-6.86	1,775.59	168	284.94	93.90	499.18	2,082
Latitude - decimal degrees	degree	0.00	0.00	0.00	169	0.00	0.00	0.00	2,085
Longitude - decimal degrees	degree	-0.00	-0.02	0.02	169	-0.00	-0.01	0.00	2,085
Number of plots					170				2,371
Condition Level									
Condition Status	code	0.02	-0.01	0.05	356	-0.00	-0.01	0.00	5,845
Reserve Status	code	-0.01	-0.02	0.00	356	-0.00	-0.00	-0.00	5,845
Owner Group	code	0.04	-0.50	0.57	228	0.15	-0.03	0.33	3,153
Forest Type (Type)	code	-1.71	-11.96	9.07	228	2.27	-1.40	6.14	3,153
Forest Type (Group)	code	-1.32	-11.62	9.43	228	2.32	-1.47	6.17	3,153
Stand Size	code	0.04	-0.00	0.10	228	0.01	-0.01	0.02	3,153
Regeneration Status	code	-0.01	-0.02	0.00	228	-0.00	-0.01	0.00	3,153
Tree Density	code	0.00	-0.01	0.01	228	0.00	-0.00	0.01	3,153
Owner Class	code	0.05	-0.59	0.63	228	0.14	-0.05	0.33	3,153
Owner Status	code	-0.00	-0.02	0.01	228	0.00	-0.00	0.00	3,153
Regeneration Species	code	-0.95	-2.64	0.00	228	-0.55	-2.14	1.03	3,153
Stand Age	year	-0.89	-2.17	0.56	228	-0.55	-1.31	0.08	3,153
Disturbance 1	code	0.69	-0.50	2.25	226	-0.75	-1.20	-0.32	3,093
Disturbance Year 1	year	-443.89	-1,331.67	0.00	18	313.35	39.18	574.47	306
Disturbance 2	code	0.00	0.00	0.00	31	-2.37	-3.62	-1.03	556
Disturbance Year 2	year	.	.	.	.	-570.43	-1,712.07	285.89	28
Disturbance 3	code	.	.	.	.	0.24	0.00	0.73	82
Disturbance Year 3	year	.	.	.	.	1.00	0.00	2.00	2
Treatment 1	code	0.09	-0.04	0.27	226	-0.00	-0.10	0.11	3,093
Treatment Year 1	year	0.00	0.00	0.00	15	0.06	-0.02	0.12	199
Treatment 2	code	0.00	0.00	0.00	19	2.11	0.56	3.83	261
Treatment Year 2	year	.	.	.	.	-0.02	-0.21	0.13	52
Treatment 3	code	.	.	.	.	-0.78	-2.39	0.22	90
Treatment Year 3	year	.	.	.	.	-0.50	-1.50	0.00	4
Physiographic Class	code	-0.07	-0.38	0.23	228	0.07	-0.03	0.22	3,153
Present Nonforest Use	code	-0.21	-0.57	0.11	356	0.04	-0.06	0.14	5,845
Number of conditions					356				5,845
Boundary Level									
Boundary Change	code	-0.07	-0.18	0.00	56	-0.05	-0.09	0.00	794
Constrasting Condition	cond	0.02	0.00	0.05	56	0.02	-0.00	0.03	794
Left Azimuth	degree	0.00	-0.63	0.51	56	1.18	-1.79	4.08	794
Corner Mapped	code	0.00	0.00	0.00	56	-0.01	-0.02	0.00	794
Corner Azimuth	degree	0.00	0.00	0.00	3	-0.21	-2.08	1.54	68
Corner Distance	foot	0.00	0.00	0.00	3	0.15	-0.14	0.55	68

continued

Table D.—continued

Variable	Unit of measure	New York				All NRS states			
		Relative bias	95% CI limits		Observations	Relative bias	95% CI limits		Observations
			Lower	Upper			Lower	Upper	
Right Azimuth	degree	-7.25	-20.04	-0.05	56	0.24	-2.87	3.42	794
Number of boundaries					56				794
Subplot Level									
Subplot Center Condition	code	-0.00	-0.01	0.00	680	0.00	-0.00	0.00	9,484
Microplot Center Condition	code	-0.00	-0.01	0.00	680	-0.00	-0.00	0.00	9,484
Slope	percent	-0.06	-0.62	0.51	569	0.06	-0.03	0.17	8,051
Aspect	degree	-0.17	-2.49	1.87	559	0.46	-0.28	1.11	7,838
Snow/Water Depth	foot	0.09	-0.21	0.34	596	-0.21	-0.29	-0.09	8,276
Number of subplots					680				9,484
Tree Level									
DBH	inch	0.01	-0.00	0.02	2,645	-0.00	-0.00	0.00	35,321
DRC	inch	.			.	0.03	-0.20	0.23	47
Azimuth	degree	-0.24	-0.38	-0.11	2,916	-0.02	-0.08	0.05	39,772
Horizontal Distance	foot	0.00	-0.01	0.02	2,916	0.00	-0.00	0.01	39,772
Species	code	0.00	-0.27	0.20	2,957	0.15	-0.07	0.38	40,057
Tree Genus	code	-0.01	-0.22	0.20	2,956	0.13	-0.04	0.36	40,013
Tree Status	code	0.01	0.01	0.02	2,957	0.00	0.00	0.00	40,080
Rotten/Missing Cull	percent	-0.23	-0.38	-0.07	1,990	-0.15	-0.19	-0.09	25,851
Total Length	foot	-0.79	-1.23	-0.40	1,965	0.30	0.14	0.44	25,599
Actual Length	foot	-0.36	-1.66	1.02	272	-2.06	-3.23	-1.12	3,218
Compacted Crown Ratio	percent	0.72	0.24	1.17	2,437	0.01	-0.10	0.12	32,802
Uncompacted Crown Ratio (P3)	percent				.	6.33	-4.83	12.67	15
Crown Class	code	-0.06	-0.08	-0.03	2,437	-0.02	-0.02	-0.01	32,802
Decay Class	code	-0.10	-0.16	-0.04	433	-0.03	-0.05	-0.01	5,989
Cause of Death	code	4.13	2.64	5.70	433	2.26	1.91	2.66	5,989
Condition	code	-0.00	-0.00	0.00	2,957	0.00	0.00	0.00	40,080
Crown Position	code				.	0.07	-0.32	0.36	14
Crown Light Exposure	code				.	-0.40	-1.07	0.23	15
Sapling Crown Vigor Class	code				.	0.00	0.00	0.00	1
Crown Density	percent				.	-0.36	-9.11	7.86	14
Crown Dieback	percent				.	-1.43	-3.21	-0.36	14
Transparency	percent				.	-4.29	-8.75	0.36	14
Tree Class	code	-0.03	-0.05	-0.02	2,676	0.00	-0.00	0.01	35,658
Damage Agent 1	code	9.53	4.93	13.92	2,437	5.53	4.35	6.77	32,802
Damage Agent 2	code	14.01	2.24	25.03	802	20.31	16.73	24.00	8,106
Tree Grade	code	-0.06	-0.16	0.03	633	-0.02	-0.05	0.01	7,695
DBH-Live & Trees with Decay Code 1 or 2	inch	0.01	-0.00	0.02	2,544	-0.00	-0.00	0.00	33,668
DBH-Trees with Decay Codes 3, 4 or 5	inch	-0.00	-0.03	0.02	101	-0.02	-0.03	-0.01	1,648
Total Length-trees 40 feet and greater	foot	-0.41	-0.79	-0.01	1,633	0.82	0.68	0.95	20,300
Total Length-trees less than 40 feet	foot	-2.64	-4.04	-1.28	332	-1.71	-2.41	-1.18	5,299
Total Length-trees less than 5 inches DBH	foot	-1.97	-7.28	2.39	51	-1.45	-2.88	0.23	288
Number of trees					2,957				40,057

continued

**Table D.—continued**

Variable	Unit of measure	New York				All NRS states			
		Relative bias	95% CI limits		Observations	Relative bias	95% CI limits		Observations
			Lower	Upper			Lower	Upper	
<b>Seedling Level</b>									
Species	code	-0.01	-0.03	0.01	486	-0.00	-0.01	0.00	8,215
Genus	code	-0.01	-0.03	-0.00	486	-0.00	-0.01	0.00	8,215
Seedling Count	number	-9.42	-14.60	-4.73	486	-15.39	-20.09	-11.80	8,127
Seedling Count (coded)	number	-0.01	-0.09	0.05	486	-0.01	-0.03	0.01	8,215
Number of microplots					227				3,349
<b>Site Tree Level</b>									
Condition List	code	-61.04	-178.09	45.13	46	1.28	-4.47	7.39	2,810
Diameter	inch	-0.05	-0.19	0.03	46	0.00	-0.01	0.01	2,810
Species	code	0.00	0.00	0.00	46	0.01	-0.07	0.08	2,810
Genus	code	0.00	0.00	0.00	46	0.03	0.00	0.09	2,810
Azimuth	degree	-3.57	-10.76	0.05	46	0.05	-0.37	0.41	2,810
Distance	foot	-0.35	-1.04	0.01	46	0.04	-0.00	0.09	2,810
Total Length	foot	-0.43	-2.31	0.80	46	-0.06	-0.30	0.12	2,810
Diameter Age	year	0.09	0.00	0.30	46	0.04	-0.06	0.13	2,810
Number of site trees					46				2,810

**Table E—FIA nonresponse by strata, New York, 2008-2012**

Owner	Strata(um) code	Number of plots selected	Sampled	Denied access	Hazardous	Other	Percent response rate
----- <i>number of plots</i> -----							
Finger Lakes NF	12345	5	5	0	0	0	100
Inland Census Water Public Unit 7	12345	11	11	0	0	0	100
Inland Census Water Unit 1	12345	34	34	0	0	0	100
Inland Census Water Unit 2	12345	33	33	0	0	0	100
Inland Census Water Unit 3	12345	14	14	0	0	0	100
Inland Census Water Unit 4	12345	28	28	0	0	0	100
Inland Census Water Unit 5	12345	8	8	0	0	0	100
Inland Census Water Unit 6	12345	10	10	0	0	0	100
Inland Census Water Unit 8	12345	50	50	0	0	0	100
NY Adirondacks Unit 1	12345	77	76.5	0	0.5	0	99.4
NY Adirondacks Unit 3	12345	66	65	1	0	0	98.5
NY Adirondacks Unit 4	5	209	205.8	0	3.3	0	98.4
NY Adirondacks Unit 4	1234	17	17	0	0	0	100
NY Adirondacks Unit 7	12345	5	5	0	0	0	100
NY Catskills Unit 6	12345	5	5	0	0	0	100
NY Catskills Unit 8	12345	35	33.8	1.3	0	0	96.4
Private Unit 1	2	24	22	2	0	0	91.7
Private Unit 1	4	39	34	5	0	0	87.2
Private Unit 1	3	25	23.1	1.9	0	0	92.5
Private Unit 1	5	334	310.8	23.2	0	0	93
Private Unit 1	1	175	168.4	6.6	0	0	96.3
Private Unit 2	2	66	58.5	7.5	0	0	88.6
Private Unit 2	5	261	223.6	36.9	0.5	0	85.7
Private Unit 2	4	57	48.5	8.5	0	0	85.1
Private Unit 2	1	509	488.5	20.5	0	0	96
Private Unit 2	3	62	54.8	7	0.3	0	88.3
Private Unit 3	1	142	133	9	0	0	93.7
Private Unit 3	23	28	22	5	1	0	78.6
Private Unit 3	5	184	162.3	21.3	0.5	0	88.2
Private Unit 3	4	27	22.8	3.5	0.8	0	84.3
Private Unit 5	5	195	171.4	23.6	0	0	87.9
Private Unit 5	1	161	146.3	14.8	0	0	90.8
Private Unit 5	2	50	48.8	1.3	0	0	97.5
Private Unit 5	4	36	29	6	1	0	80.6
Private Unit 5	3	34	30.2	3.8	0	0	88.9
Private Unit 6	2	49	44.5	4.5	0	0	90.8
Private Unit 6	1	198	180.9	17.1	0	0	91.4
Private Unit 6	4	35	28	7	0	0	80
Private Unit 6	3	35	29.3	5.8	0	0	83.6
Private Unit 6	5	315	255.9	57.9	1.3	0	81.2
Private Unit 7	2	14	13.8	0.3	0	0	98.2

continued

**Table E—continued**

Owner	Strata(um) code	Number of plots selected	Sampled	Denied access	Hazardous	Other	Percent response rate
Private Unit 7	1	159	149.8	9.3	0	0	94.2
Private Unit 7	3	11	10	1	0	0	90.9
Private Unit 7	5	225	186.5	38.2	0.3	0	82.9
Private Unit 7	4	26	23.8	2.3	0	0	91.3
Private Unit 8	3	27	25.4	1.6	0	0	94.2
Private Unit 8	5	360	268.4	90.6	1	0	74.5
Private Unit 8	1	206	192.8	13	0.3	0	93.6
Private Unit 8	2	51	47.5	3.5	0	0	93.1
Private Unit 8	4	49	42	7	0	0	85.7
Public Private Unit 4	234	20	19.9	0	0.1	0	99.5
Public Private Unit 4	5	201	176.4	24	0.5	0	87.8
Public Private Unit 4	1	27	25	2	0	0	92.6
Public Unit 1	1234	20	19	0	1	0	95
Public Unit 1	5	25	23	1	1	0	92
Public Unit 2	5	32	32	0	0	0	100
Public Unit 2	1234	11	11	0	0	0	100
Public Unit 3	12345	30	29.8	0.3	0	0	99.2
Public Unit 5	5	32	32	0	0	0	100
Public Unit 5	1234	11	11	0	0	0	100
Public Unit 6	12345	42	42	0	0	0	100
Public Unit 8	234	14	14	0	0	0	100
Public Unit 8	5	41	40.3	0.8	0	0	98.2
Public Unit 8	1	14	14	0	0	0	100
Total		5,296	4,787	497	13	0	90.4

## Strata codes:

- 1: Canopy cover 0 - 5
- 2: Canopy cover 6 - 50
- 3: Canopy cover 51 - 65
- 4: Canopy cover 66 - 80
- 5: Canopy cover 81 - 100