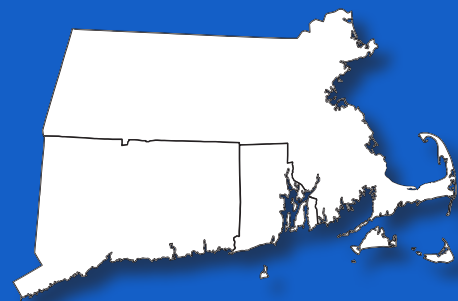


The Forests of Southern New England, 2012: Statistics, Methods, and Quality Assurance



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):

- 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.

Forest Inventory

Historically, the FIA program conducted inventories of a state's forests on a periodic basis. Across Southern New England, periodic inventories were completed in 1953 (Ferguson and Howard 1956, Ferguson and McGuire 1957, Griswold and Ferguson 1957), 1972 (Dickson and Bowers 1976; Peters and Bowers 1977b, 1977a), 1985 (Dickson and McAfee 1988a, 1988b, 1988c); Dickson and McAfee 1988c, 1988a), and 1998 (Alerich 2000c, 2000b, 2000a). Since the 1998 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 legislative U.S. Congressional mandates, resulted in FIA implementing an annual inventory program. Annual inventory was initiated in Southern New England in 2003.

With the Northern Research Station FIA (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 Southern New England for 2003 through 2007 (Butler et al. 2011) and for 2008 through 2012, reported here. These are referred to as the 2007 inventory and the 2012 inventory.

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, direct 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.

Plot Configuration

The national FIA plot design consists of four 24-foot-radius subplots configured as a central subplot and three peripheral subplots (See Figure 1). 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. In a couple of states, including Rhode Island, the base sampling intensity was deemed inadequate to meet the desired precisions. Therefore, Rhode Island was intensified and the hexagons in this state were half the size, roughly 3,000 acres, compared to other states.

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). 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 canopy density value (percent) 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 2014) 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 Phase 2 (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 (percentage 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 (P3) 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 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 1,519 forested and nonforested plots located across the region; 499 in Connecticut, 800 in Massachusetts, and 220 in Rhode Island. These plots are located within 23 unique strata (Table A) defined

by combinations of the five P1 canopy cover classes previously discussed, a land ownership classification created from the Protected Areas Database, 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 Southern New England. The 2012 panel along with those surveyed in 2008, 2009, 2010, and 2011 make up the dataset for the sixth full inventory of the region's forests.

To improve the efficiency and reliability of the inventory, several changes in procedures and definitions have been made since the last inventory in Southern New England in 2007 (Butler et al. 2011). Although these changes will have little impact on statewide and region-wide 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 (Butler et al. 2011) 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 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 "FIA Field Methods for Phase 3 Measurements" (U.S. Forest Service 2005) and Woodall and Monleon (2008).

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 FIA inventory of Southern New England is based on a sample of 1,519 plots located randomly across the region, 999 of these plots have some amount of forest on it.

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 had an inventory been taken of all forest land 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 65 presents sampling errors for these estimates at the county levels for each State.

Estimates for classifications smaller than the State totals presented in Table B will have larger sampling errors. For example, Table 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:

$$E = \frac{(SE) \sqrt{(\text{State total estimate})}}{\sqrt{(\text{Smaller estimate})}} \quad (1)$$

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.

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 percentage 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 Southern New England 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 conducted the FIA program between 2008 and 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 percentage 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 Southern New England inventory, 1,667 sample plots were selected to be observed. Of the total sample plots selected for observation, 1,519 are in the sample used for the estimation of current resources. There were 144 plots where crews were unable to obtain owner permission to measure the plot and 4 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 91 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 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 for the Southern New England 2012 inventory and for all FIA inventories conducted by the Northern Research Station over the same period.

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 also 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 built-up 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 nongrowing-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 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: O₃. 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 pulp mills 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 ¼-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 ≥ 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 pulpmill 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).

Table Captions

Sampling Table Captions

Table A.—Area and number of plots in each stratum used for stratification and estimation, Connecticut, Massachusetts, and Rhode Island, 2012

Table B.—State-level estimates of major forest resource attributes and their sampling errors, Connecticut, Massachusetts, and Rhode Island, 2012

Table C.—Compliance to measurement quality objectives (MQO) tolerances of variables based on blind check plots, Connecticut, Massachusetts, and Rhode Island, 2012

Table D.—Observed relative bias values (Average [Field crew – QA crew]) for measurement variables, blind check plots, Connecticut, Massachusetts, and Rhode Island, 2012

Table E.—FIA nonresponse by strata, Connecticut, Massachusetts, and Rhode Island, 2012

The summary tables, identically formatted but with alternative state abbreviations in the table numbering scheme, are available on the DVD for Connecticut, Massachusetts, and Rhode Island. The tables are available in separate folders labeled with a State name. A directory in each state folder provides the table names (as shown here) linked to the pdf table. From the directory, click on the table name and the table will open.

List of Estimate Tables

Area

Table CT-1.—Percentage of area by land status, Connecticut, 2012

Table CT-2.—Area of forest land, in thousand acres, by owner class and forest-land status, Connecticut, 2012

Table CT-3.—Area of forest land, in thousand acres, by forest-type group and site productivity class, Connecticut, 2012

Table CT-4.—Area of forest land, in thousand acres, by forest-type group, ownership group, and forest-land status, Connecticut, 2012

Table CT-5.—Area of forest land, in thousand acres, by forest-type group and stand-size class, Connecticut, 2012

Table CT-6.—Area of forest land, in thousand acres, by forest-type group and stand-age class, Connecticut, 2012

Table CT-7.—Area of forest land, in thousand acres, by forest-type group and stand origin, Connecticut, 2012

Table CT-8.—Area of forest land, in thousand acres, by forest-type group and disturbance class, Connecticut, 2012

Table CT-9.—Area of timberland, in thousand acres, by forest-type group and stand-size class, Connecticut, 2012

Number

Table CT-10.—Number of live trees (at least 1 inch d.b.h./d.r.c.), in thousand trees, on forest land by species group, species, and diameter class, Connecticut, 2012

Table CT-11.—Number of growing-stock trees (at least 1 inch d.b.h./d.r.c.), in thousand trees, on timberland by species group, species, and diameter class, Connecticut, 2012

Volume

Table CT-12.—Net volume of live trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, by owner class and forest-land status, Connecticut, 2012

Table CT-13.—Net volume of live trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on forest land by forest-type group and stand-size class, Connecticut, 2012

Table CT-14.—Net volume of live trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on forest land by species group, species, and ownership group, Connecticut, 2012

Table CT-15.—Net volume of live trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on forest land by species group, species, and diameter class, Connecticut, 2012

Table CT-16.—Net volume of live trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on forest land by forest-type group and stand origin, Connecticut, 2012

Table CT-17.—Net volume of growing-stock trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on timberland by species group, species, and diameter class, Connecticut, 2012

Table CT-18.—Net volume of growing-stock trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on timberland by species group, species, and ownership group, Connecticut, 2012

Table CT-19.—Net volume of sawtimber trees, in million board feet (International ¼-inch rule), on timberland by species group, species, and diameter class, Connecticut, 2012

Table CT-19a.—Net volume of sawtimber trees, in million board feet (Doyle rule), on timberland by species group, species, and diameter class, Connecticut, 2012

Table CT-19b.—Net volume of sawtimber trees, in million board feet (Scribner rule), on timberland by species group, species, and diameter class, Connecticut, 2012

Table CT-20.—Net volume of saw-log portion of sawtimber trees (International ¼-inch rule), in million cubic feet, on timberland by species group and ownership group, Connecticut, 2012

Table CT-20a.—Net volume of saw-log portion of sawtimber trees (Doyle rule), in million cubic feet, on timberland by species group, species, and ownership group, Connecticut, 2012

Table CT-20b.—Net volume of saw-log portion of sawtimber trees (Scribner rule), in million cubic feet, on timberland by species group, species, and ownership group, Connecticut, 2012

Growth, Mortality, and Removals

Table CT-21.—Average annual net growth of live trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, by owner class and forest-land status, Connecticut, 2012

Table CT-22.—Average annual net growth of live trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on forest land by forest-type group and stand-size class, Connecticut, 2012

Table CT-23.—Average annual net growth of live trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on forest land by species group, species, and ownership group using the accounting method (O’Connell et al. 2013), Connecticut, 2012

Table CT-23a.—Average annual net growth of live trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on forest land by species group, species, and ownership group, Connecticut, 2012

Table CT-24.—Average annual net growth of growing-stock trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on forest land by species group, species, and ownership group using the accounting method (O’Connell et al. 2013), Connecticut, 2012

Table CT-24a.—Average annual net growth of growing-stock trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on timberland by species group, species, and ownership group, Connecticut, to 2012

Table CT-25.—Average annual mortality of trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, by owner class and forest-land status, Connecticut, 2012

Table CT-26.—Average annual mortality of trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on forest land by forest-type group and stand-size class, Connecticut, 2012

Table CT-27.—Average annual mortality of live trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on forest land by species group, species, and ownership group, Connecticut, 2012

Table CT-28.—Average annual mortality of growing-stock trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on timberland by species group, species, and ownership group, Connecticut, 2012

Table CT-29.—Average annual removals of live trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on forest land by species group, species, and ownership group, Connecticut, 2012

Table CT-30.—Average annual removals of growing-stock trees (at least 5 inches d.b.h./d.r.c.), in million cubic feet, on timberland by species group, species, and ownership group, Connecticut, 2012

Weight

Table CT-31.—Aboveground dry weight of live trees (at least 1 inch d.b.h./d.r.c.), in thousand dry short tons, by owner class and forest-land status, Connecticut, 2012

County-Level

Table CT-54.—Area of forest land, in thousand acres, by county and forest-land status, Connecticut, 2012

Table CT-55.—Area of forest land, in thousand acres, by county, ownership group, and forest-land status, Connecticut, 2012

Table CT-57.—Area of timberland, in thousand acres, by county and stand-size class, Connecticut, 2012

Table CT-58.—Area of timberland, in thousand acres, by county and stocking class, Connecticut, 2012

Table CT-59.—Net volume of growing-stock trees (at least 5 inches d.b.h.), in million cubic feet, and sawtimber trees, in million board feet (International ¼-inch rule) on timberland by county and major species group, Connecticut, 2012

Table CT-59a.—Net volume of growing-stock trees (at least 5 inches d.b.h.), in million cubic feet, and sawtimber trees, in million board feet (Doyle rule), on timberland by county and major species group, Connecticut, 2012

Table CT-59b.—Net volume of growing-stock trees (at least 5 inches d.b.h.), in million cubic feet, and sawtimber trees, in million board feet (Scribner rule), on timberland by county and major species group, Connecticut, 2012

Table CT-60.—Average annual net growth of growing-stock trees (at least 5 inches d.b.h.), in million cubic feet, and sawtimber trees, in million board feet (International ¼-inch rule) on timberland by county and major species group, Connecticut, 2012

Table CT-60a.—Average annual net growth of growing-stock trees (at least 5 inches d.b.h.), in million cubic feet, and sawtimber, in million board feet (Doyle rule), on timberland by county and major species group, Connecticut, 2012

Table CT-60b.—Average annual net growth of growing-stock trees (at least 5 inches d.b.h.), in million cubic feet, and sawtimber trees, in million board feet (Scribner rule), on timberland by county and major species group, Connecticut, 2012

Table CT-61.—Average annual removals of growing-stock trees (at least 5 inches d.b.h.), in million cubic feet, and sawtimber trees, in million board feet (International ¼-rule), on timberland by county and major species group, Connecticut, 2012

Table CT-61a.—Average annual removals of growing stock trees (at least 5 inches d.b.h.) in million board feet, and sawtimber trees, in million board feet (Doyle rule) on timberland by county and major species group, Connecticut, 2012

Table CT-61b.—Average annual removals of growing-stock trees (at least 5 inches d.b.h.), in million cubic feet and sawtimber trees, in million board feet (Scribner rule), on timberland by county and major species group, Connecticut, 2012

Table CT-65.—Sampling errors, in percent, for net volume, average annual net growth, average annual removals, and average annual mortality on timberland, and forest area and timberland area by county, Connecticut, 2012

**Gaps in enumeration of tables are placeholders for future tables such as forest health indicator population estimates (e.g., down woody material)

Table A. — Area and number of plots in each stratum used for stratification and estimation, Connecticut, Massachusetts, and Rhode Island, 2012

State	Estimation unit description ^a	Canopy cover stratum ^b	Acres	Selected ^c	Office selected ^d	Field selected ^e	Field sampled ^f	Field sampled forested ^g	Total plots sampled for change ^h	Field sampled plots for change ⁱ	Not measured ^j	
Connecticut	Private Unit 1	Canopy cover 0 - 5	736000	118	86	32	26	17	113	29	6	
	Private Unit 1	Canopy cover 6 - 50	133000	19	9	10	10	9	19	10	0	
	Private Unit 1	Canopy cover 51 - 65	117000	22	9	13	12	10	21	12	1	
	Private Unit 1	Canopy cover 66 - 80	236000	43	13	30	27	25	39	26	3	
	Private Unit 1	Canopy cover 81 - 100	1558000	271	19	252	227	222	244	227	25	
	Public Unit 1	Canopy cover 0 - 80	82000	11	6	5	5	4	11	5	0	
	Public Unit 1	Canopy cover 81 - 100	240000	33	0	33	33	33	33	33	0	
	Inland Census Water Unit 1	Canopy cover 0 - 100	103000	20	19	1	1	1	16	1	0	
	Massachusetts	Private Unit 1	Canopy cover 0 - 5	1239000	199	118	81	75	54	190	74	6
		Private Unit 1	Canopy cover 6 - 50	233000	33	11	22	20	16	29	18	2
		Private Unit 1	Canopy cover 51 - 65	172000	38	13	25	24	19	37	24	1
		Private Unit 1	Canopy cover 66 - 80	320000	50	12	38	34	31	47	35	4
		Private Unit 1	Canopy cover 81 - 100	2066000	352	9	343	295	285	311	302	48
Public Unit 1		Canopy cover 0 - 5	150000	23	16	7	7	7	23	7	0	
Public Unit 1		Canopy cover 6 - 80	116000	18	1	17	17	17	18	17	0	
Public Unit 1		Canopy cover 81 - 100	723000	123	0	123	120	120	119	119	3	
Inland Census Water Unit 1		Canopy cover 0 - 100	271000	36	32	4	4	4	34	3	0	
Rhode island		Private Unit 1	Canopy cover 0 - 5	211000	83	52	31	28	20	76	26	3
		Private Unit 1	Canopy cover 6 - 65	61000	17	4	13	10	8	13	9	3
		Private Unit 1	Canopy cover 66 - 80	55000	21	0	21	12	11	14	14	9
		Private Unit 1	Canopy cover 81 - 100	257000	81	2	79	60	57	63	61	19
	Public Unit 1	Canopy cover 0 - 100	86000	31	2	29	29	29	30	28	0	
	Inland Census Water Unit 1	Canopy cover 0 - 100	112000	25	25	0	0	0	25	0	0	

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

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

^c Total plots selected to be sampled

^d 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.

^e Plots determined to have some chance of being forested or that were forested or non-sampled on a previous visit.

^f Field selected plots that were successfully sampled in the field.

^g Field selected plots that were successfully sampled in the field and found to intersect forest land.

^h Plots in the sample that were successfully sampled in the previous cycle.

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

^j 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, Connecticut, Massachusetts, and Rhode Island, 2012

State	Item	State total	Sampling error	
Connecticut	All live trees on forest land:			
	Volume	<i>thousand cubic feet</i> 4,387.2	<i>percent</i> 3.40	
	Average annual net growth	103,048.0	7.20	
	Average annual mortality	27,328.9	14.70	
	Average annual harvest removals	19,452.5	31.30	
	Average annual other removals	4,032.0	60.10	
	Growing stock on timberland:			
	Volume	<i>thousand cubic feet</i> 4,052.2	<i>percent</i> 3.60	
	Average annual net growth	95,818.8	8.00	
	Average annual mortality	17,859.0	17.90	
	Average annual harvest removals	15,544.0	33.00	
	Average annual other removals	2367.7	73.5	
	Area:	<i>thousand acres</i>	<i>percent</i>	
	Forest land	1,735.9	2.60	
	Timberland	1,726.3	2.60	
	Biomass (aboveground live trees and saplings):			
	Forest land	<i>thousand dry tons</i> 127,479.5	<i>percent</i> 3.20	
	Timberland	127,450.6	3.20	
	Massachusetts	All live trees on forest land:		
		Volume	<i>thousand cubic feet</i> 8,137.5	<i>percent</i> 2.60
Average annual net growth		164,583.9	7.20	
Average annual mortality		66,510.2	9.00	
Average annual harvest removals		33,879.7	24.60	
Average annual other removals		11,194.9	30.50	
Growing stock on timberland:				
Volume		<i>thousand cubic feet</i> 7,267.7	<i>percent</i> 2.80	
Average annual net growth		158,045.5	7.00	
Average annual mortality		46,837.4	9.40	
Average annual harvest removals		27,832.5	25.00	
Average annual other removals		8847.2	34.6	
Area:		<i>thousand acres</i>	<i>percent</i>	
Forest land		3,028.0	1.80	
Timberland		2,951.5	1.90	

(Table B continued on next page)

(Table B continued)

State	Item	State total	Sampling error
Rhode Island	Biomass (aboveground live trees and saplings):		
	Forest land	211,047.4 <i>thousand dry tons</i>	2.40 <i>percent</i>
	Timberland	208,343.3	2.40
	All live trees on forest land:		
	Volume	865.2 <i>thousand cubic feet</i>	5.50 <i>percent</i>
	Average annual net growth	21,401.4	15.10
	Average annual mortality	4,406.4	15.80
	Average annual harvest removals	525.2	62.80
	Average annual other removals	2,100.5	75.20
	Growing stock on timberland:		
	Volume	776.2 <i>thousand cubic feet</i>	6.10 <i>percent</i>
	Average annual net growth	19,502.7	13.50
	Average annual mortality	3,237.2	18.80
	Average annual harvest removals	467.5	62.60
	Average annual other removals	1411.7	71.8
	Area:		
	Forest land	363.6 <i>thousand acres</i>	4.00 <i>percent</i>
	Timberland	358.7	4.10
	Biomass (aboveground live trees and saplings):		
	Forest land	24,679.9 <i>thousand dry tons</i>	5.10 <i>percent</i>
Timberland	24,439.8	5.20	
Timberland	277.3	1.71	

Table C. — Compliance to measurement quality objectives (MQO) tolerances of variables based on blind check plots, Connecticut, Massachusetts, and Rhode Island, 2008-2012

Variable	Tolerance	Objective	Southern New England		All NRS states	
			Data within tolerance	Observations	Data within tolerance	Observations
		percent		number	percent	number
Plot Level						
Distance to Road	No Tolerance	90.0	93.9	49	81.9	2,265
Water on Plot	No Tolerance	90.0	87.8	49	86.2	2,265
Elevation	±50 feet	99.0	94.0	50	88.1	2,082
Latitude - decimal degrees	±0.0001 degree	99.0	100.0	50	100.0	2,085
Longitude - decimal degrees	±0.0001 degree	99.0	94.0	50	88.0	2,085
Number of plots				51		2,371
Condition Level						
Condition Status	No Tolerance	99.0	100.0	96	98.5	5,845
Reserve Status	No Tolerance	99.0	99.0	96	99.6	5,845
Owner Group	No Tolerance	99.0	100.0	59	97.5	3,153
Forest Type (Type)	No Tolerance	95.0	91.5	59	89.4	3,153
Forest Type (Group)	No Tolerance	99.0	94.9	59	94.0	3,153
Stand Size	No Tolerance	99.0	98.3	59	90.6	3,153
Regeneration Status	No Tolerance	99.0	100.0	59	98.4	3,153
Tree Density	No Tolerance	99.0	100.0	59	96.4	3,153
Owner Class	No Tolerance	99.0	100.0	59	94.9	3,153
Owner Status	No Tolerance	99.0	100.0	59	98.9	3,153
Regeneration Species	No Tolerance	99.0	100.0	59	98.4	3,153
Stand Age	±10 percent	95.0	98.3	59	86.0	3,153
Disturbance 1	No Tolerance	99.0	93.2	59	90.7	3,093
Disturbance Year 1	±1 year	99.0	87.5	8	89.2	306
Disturbance 2	No Tolerance	99.0	70.0	10	88.8	556
Disturbance Year 2	±1 year	99.0	50.0	2	78.6	28
Disturbance 3	No Tolerance	99.0	100.0	4	98.8	82
Disturbance Year 3	±1 year	99.0	.	.	50.0	2
Treatment 1	No Tolerance	99.0	100.0	59	97.8	3,093
Treatment Year 1	±1 year	99.0	.	.	97.0	199
Treatment 2	No Tolerance	99.0	.	.	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	94.9	59	84.6	3,153
Present Nonforest Use	No Tolerance	99.0	95.8	96	89.1	5,845
Number of conditions				96		5,845

(Table C continued on next page)

(Table C continued)

Variable	Southern New England			All NRS states		
	Tolerance	Objective	Data within tolerance Observations	Tolerance	Data within tolerance Observations	Observations
Boundary Level						
Boundary Change	No Tolerance	99.0	76.9	13	82.2	794
Constraining Condition	No Tolerance	99.0	100.0	13	95.3	794
Left Azimuth	±10 degrees	90.0	100.0	13	87.4	794
Corner Mapped	No Tolerance	90.0	100.0	13	95.5	794
Corner Azimuth	±10 degrees	90.0	100.0	3	94.1	68
Corner Distance	±1 foot	90.0	100.0	3	91.2	68
Right Azimuth	±10 degrees	90.0	100.0	13	87.2	794
Number of boundaries				13		794
Subplot Level						
Subplot Center Condition	No Tolerance	99.0	99.0	204	98.2	9,484
Microplot Center Condition	No Tolerance	99.0	99.0	204	98.0	9,484
Slope	±10 percent	90.0	100.0	174	98.5	8,051
Aspect	±10 degrees	90.0	95.9	172	93.7	7,838
Snow/Water Depth	±0.5 foot		59.8	179	69.3	8,276
Number of subplots				204		9,484
Tree Level						
DBH	±0.1 inch per 20 inches	95.0	96.9	843	95.6	35,321
DRC	±0.1 inch per 20 inches	95.0			72.3	47
Azimuth	±10 degrees	90.0	99.8	894	99.3	39,772
Horizontal Distance	±0.2 foot per 1.0 foot	90.0	99.6	894	98.7	39,772
Species	No Tolerance	95.0	99.2	909	98.4	40,057
Tree Genus	No Tolerance	99.0	99.9	909	99.6	40,013
Tree Status	No Tolerance	95.0	99.3	909	98.9	40,080
Rotten/Missing Cull	±10 percent	90.0	96.9	672	98.3	25,851
Total Length	±10 percent	90.0	77.8	667	79.2	25,599
Actual Length	±10 percent	90.0	70.8	96	73.3	3,218
Compacted Crown Ratio	±10 percent	80.0	88.1	759	83.5	32,802
Uncompacted Crown Ratio (P3)	±10 percent	90.0			66.7	15
Crown Class	No Tolerance	85.0	83.9	759	81.7	32,802
Decay Class	±1 class	90.0	98.6	148	95.8	5,989
Cause of Death	No Tolerance	80.0	95.9	148	83.9	5,989
Condition	No Tolerance	99.0	97.7	909	98.4	40,080
Crown Position	No Tolerance				71.4	14

(Table C continued on next page)

(Table C continued)

Variable	Southern New England			All NRS states		
	Tolerance	Objective	Data within tolerance	Observations	Data within tolerance	Observations
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	94.7	847	92.0	35,658
Damage Agent 1	No Tolerance	90.0	88.0	759	87.3	32,802
Damage Agent 2	No Tolerance	90.0	79.5	185	78.9	8,106
Tree Grade	No Tolerance	90.0	73.0	237	74.3	7,695
DBH-Live & Trees with Decay Code 1 or 2	±0.1 inch per 20 inches	95.0	96.7	777	95.4	33,668
DBH-Trees with Decay Codes 3, 4 or 5	±1 inch per 20 inches	95.0	100.0	66	99.5	1,648
Total Length-trees 40 feet and greater	±10 percent	90.0	79.6	560	81.0	20,300
Total Length-trees less than 40 feet	±10 percent	90.0	68.2	107	72.4	5,299
Total Length-trees less than 5 inches DBH	±10 percent	90.0	75.0	4	65.3	288
Number of trees				909		40,057
Seedling Level						
Species	No Tolerance	85.0	98.9	89	92.6	8,215
Genus	No Tolerance	90.0	100.0	89	96.7	8,215
Seedling Count	±20 percent	90.0	86.5	89	63.8	8,215
Seedling Count (coded)	No Tolerance	90.0	88.8	89	69.4	8,215
Number of microplots				50		3,349
Site Tree Level						
Condition List	No Tolerance	99.0	92.0	25	93.4	2,810
Diameter	±0.1 inch per 20 inches	95.0	100.0	25	97.7	2,810
Species	No Tolerance	95.0	100.0	25	99.3	2,810
Genus	No Tolerance	99.0	100.0	25	100.0	2,810
Azimuth	±10 degrees	90.0	100.0	25	98.9	2,810
Distance	±5 feet	90.0	100.0	25	99.1	2,810
Total Length	±10 percent	90.0	100.0	25	98.4	2,810
Diameter Age	±5 years	95.0	100.0	25	97.7	2,810
Number of site trees				25		2,810

Table D.—Observed relative bias values (Average [field crew - QA crew]) for measurement variables based on blind check plots, Connecticut, Massachusetts, and Rhode Island, 2008-2012

Variable	Unit of measure	Southern New England					All NRS States				
		Relative bias	95% CI limits			Observations <i>number</i>	Relative bias	95% CI limits			Observations <i>number</i>
			Lower	Upper	Observations <i>number</i>			Lower	Upper	Observations <i>number</i>	
Plot Level											
Distance to Road	code	-0.04	-0.14	0.04	49	-0.02	-0.06	0.00	0.00	2,265	
Water on Plot	code	-0.18	-0.51	0.06	49	0.08	0.01	0.14	0.14	2,265	
Elevation	foot	-3.18	-12.65	4.22	50	284.94	93.90	499.18	499.18	2,082	
Latitude - decimal degrees	degree	0.00	0.00	0.00	50	0.00	0.00	0.00	0.00	2,085	
Longitude - decimal degrees	degree	0.00	0.00	0.00	50	0.00	-0.01	0.00	0.00	2,085	
Number of plots					51					2,371	
Condition Level											
Condition Status	code	0.00	0.00	0.00	96	0.00	-0.01	0.00	0.00	5,845	
Reserve Status	code	0.01	0.00	0.03	96	0.00	0.00	0.00	0.00	5,845	
Owner Group	code	0.00	0.00	0.00	59	0.15	-0.03	0.33	0.33	3,153	
Forest Type (Type)	code	-3.37	-18.97	7.84	59	2.27	-1.40	6.14	6.14	3,153	
Forest Type (Group)	code	-3.39	-18.64	7.63	59	2.32	-1.47	6.17	6.17	3,153	
Stand Size	code	-0.02	-0.06	0.00	59	0.01	-0.01	0.02	0.02	3,153	
Regeneration Status	code	0.00	0.00	0.00	59	0.00	-0.01	0.00	0.00	3,153	
Tree Density	code	0.00	0.00	0.00	59	0.00	0.00	0.01	0.01	3,153	
Owner Class	code	0.00	0.00	0.00	59	0.14	-0.05	0.33	0.33	3,153	
Owner Status	code	0.00	0.00	0.00	59	0.00	0.00	0.00	0.00	3,153	
Regeneration Species	code	0.00	0.00	0.00	59	-0.55	-2.14	1.03	1.03	3,153	
Stand Age	year	0.29	0.00	1.01	59	-0.55	-1.31	0.08	0.08	3,153	
Disturbance 1	code	1.19	-0.98	4.55	59	-0.75	-1.20	-0.32	-0.32	3,093	
Disturbance Year 1	year	998.88	0.00	2,996.63	8	313.35	39.18	574.47	574.47	306	
Disturbance 2	code	-1.40	-13.00	8.75	10	-2.37	-3.62	-1.03	-1.03	556	
Disturbance Year 2	year	-3,995.50	-7,991.00	0.00	2	-570.43	-1712.07	285.89	285.89	28	
Disturbance 3	code	0.00	0.00	0.00	4	0.24	0.00	0.73	0.73	82	
Disturbance Year 3	year	0.00	0.00	0.00	59	1.00	0.00	2.00	2.00	2	
Treatment 1	code	0.00	0.00	0.00	59	0.00	-0.10	0.11	0.11	3,093	
Treatment Year 1	year					0.06	-0.02	0.12	0.12	199	
Treatment 2	code					2.11	0.56	3.83	3.83	261	
Treatment Year 2	year					-0.02	-0.21	0.13	0.13	52	
Treatment 3	code					-0.78	-2.39	0.22	0.22	90	
Treatment Year 3	year					-0.50	-1.50	0.00	0.00	4	
Physiographic Class	code	-0.07	-0.14	0.00	59	0.07	-0.03	0.22	0.22	3,153	
Present Nonforest Use	code	0.24	0.01	0.63	96	0.04	-0.06	0.14	0.14	5,845	
Number of conditions					96					5,845	

(Table D continued on next page)

(Table D continued)

Variable	Unit of measure	Southern New England				All NRS States				
		95% CI limits		Relative bias	Observations	95% CI limits		Relative bias	Observations	
		Lower	Upper			Lower	Upper			
Boundary Level										
Boundary Change	code	0.08	0.85	0.38	13	-0.05	0.00	-0.09	0.00	794
Constrasting Condition	cond	0.00	0.00	0.00	13	0.02	0.00	0.00	0.03	794
Left Azimuth	degree	-2.31	0.46	-0.62	13	1.18	1.79	-1.79	4.08	794
Corner Mapped	code	0.00	0.00	0.00	13	-0.01	0.00	-0.02	0.00	794
Corner Azimuth	degree	0.00	5.00	1.67	3	-0.21	1.54	-2.08	1.54	68
Corner Distance	foot	0.00	0.00	0.00	3	0.15	0.55	-0.14	0.55	68
Right Azimuth	degree	0.00	1.15	0.38	13	0.24	3.42	-2.87	3.42	794
Number of boundaries					13					794
Subplot Level										
Subplot Center Condition	code	-0.02	0.00	-0.01	204	0.00	0.00	0.00	0.00	9,484
Microplot Center Condition	code	-0.02	0.00	-0.01	204	0.00	0.00	0.00	0.00	9,484
Slope	percent	-0.30	0.01	-0.13	174	0.06	0.17	-0.03	0.17	8,051
Aspect	degree	-0.14	6.96	2.36	172	0.46	1.11	-0.28	1.11	7,838
Snow/Water Depth	foot	-0.61	0.74	0.09	179	-0.21	-0.09	-0.29	-0.09	8,276
Number of subplots					204					9,484
Tree Level										
DBH	inch	-0.02	0.01	-0.01	843	0.00	0.00	0.00	0.00	35,321
DRC	inch					0.03	0.23	-0.20	0.23	47
Azimuth	degree	-0.24	-0.10	-0.17	894	-0.02	0.05	-0.08	0.05	39,772
Horizontal Distance	foot	0.00	0.01	0.01	894	0.00	0.01	0.00	0.01	39,772
Species	code	-0.04	2.05	0.69	909	0.15	0.38	-0.07	0.38	40,057
Tree Genus	code	0.00	1.98	0.66	909	0.13	0.36	-0.04	0.36	40,013
Tree Status	code	0.00	0.01	0.00	909	0.00	0.00	0.00	0.00	40,080
Rotten/Missing Cull	percent	-0.58	0.05	-0.25	672	-0.15	-0.09	-0.19	-0.09	25,851
Total Length	foot	-1.07	0.60	-0.14	667	0.30	0.44	0.14	0.44	25,599
Actual Length	foot	-5.29	-0.56	-2.83	96	-2.06	-1.12	-3.23	-1.12	3,218
Compacted Crown Ratio	percent	-0.02	1.27	0.52	759	0.01	0.12	-0.10	0.12	32,802
Uncompacted Crown Ratio (P3)	percent					6.33	12.67	-4.83	12.67	15
Crown Class	code	-0.02	0.06	0.03	759	-0.02	-0.01	-0.02	-0.01	32,802
Decay Class	code	0.01	0.18	0.09	148	-0.03	-0.01	-0.05	-0.01	5,989
Cause of Death	code	-0.34	2.50	0.88	148	2.26	2.66	1.91	2.66	5,989
Condition	code	-0.03	-0.01	-0.02	909	0.00	0.00	0.00	0.00	40,080
Crown Position	code					0.07	0.36	-0.32	0.36	14

(Table D continued on next page)

Table E—FIA nonresponse by strata, Connecticut, Massachusetts, and Rhode Island, 2012

State	Owner and strata (um)	Number of plots selected	Sampled	Denied access	Hazardous	Other	Percent response rate
<i>----- number of plots -----</i>							
Connecticut	Private:						
	1	118.0	111.5	6.3	0.3	0.0	94.5
	2	19.0	18.3	0.8	0.0	0.0	96.1
	3	43.0	40.0	3.0	0.0	0.0	93.0
	4	22.0	21.0	1.0	0.0	0.0	95.5
	5	271.0	244.5	26.5	0.0	0.0	90.2
	Public						
	1, 2, 3, 4	11.0	11.0	0.0	0.0	0.0	100.0
	5	33.0	32.3	0.0	0.8	0.0	97.7
	Census Water:						
1, 2, 3, 4, 5	20.0	20.0	0.0	0.0	0.0	100.0	
Total	537.0	498.6	37.6	1.1	0.0	92.8	
Massachusetts	Private:						
	1	199.0	191.7	7.3	0.0	0.0	96.3
	2	33.0	31.0	2.0	0.0	0.0	93.9
	3	38.0	37.0	1.0	0.0	0.0	97.4
	4	50.0	45.3	4.8	0.0	0.0	90.5
	5	352.0	298.8	52.0	1.2	0.0	84.9
	Public:						
	1	23.0	23.0	0.0	0.0	0.0	100.0
	2, 3, 4	18.0	18.0	0.0	0.0	0.0	100.0
	5	123.0	119.5	3.3	0.3	0.0	97.2
Census Water:							
1, 2, 3, 4, 5	36.0	36.0	0.0	0.0	0.0	100.0	
Total	872.0	800.3	70.4	1.5	0.0	91.8	
Rhode Island	Private:						
	1	83.0	79.0	2.5	1.5	0.0	95.2
	2, 3	17.0	13.0	3.8	0.0	0.3	76.5
	4	21.0	11.8	9.3	0.0	0.0	56.0
	5	81.0	60.5	20.3	0.3	0.0	74.7
	Public:						
	1, 2, 3, 4, 5	31.0	30.8	0.0	0.3	0.0	99.2
	Census Water:						
	1, 2, 3, 4, 5	25.0	25.0	0.0	0.0	0.0	100.0
	Total	258.0	220.1	35.9	2.1	0.3	85.3

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



Northern Research Station

www.nrs.fs.fed.us