

IN DNR State Forest Properties Report of Continuous Forest Inventory (CFI) Summary of years 2014-2018



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FOREWORD

This report provides an overview of forest-resource attributes for State Forest land managed by the DNR Division of Forestry. The findings come from the continuous annual inventory conducted by the Forest Resource Information (FRI) Section of the Indiana DNR Division of Forestry (DoF). The CFI inventory of DoF State Forest property is based on a sample of 3,929 plots located randomly across those lands (a total area of 156,558 acres), a sampling rate of approximately one plot for every 40 acres. Information in this report is gathered from quantitative and qualitative measurements that describe forest-site attributes; stand characteristics; tree measurements on live and dead stems such as species, diameter, height, damage, and tree quality; counts of regeneration; and estimates of growth, mortality, and removals. All estimates in this assessment are estimates of a population based on a statistical sample derived from the expansion of plot data and therefore may differ slightly from complete censuses of the population (e.g., total acres). Given the multitude of estimates of forest-resource attributes, they are organized in “core tables” (e.g., forest land area vs. live tree volumes) that are updated annually.

This report is a summary of the five years of plot installation and data collection for the years 2014-2018, a span that constitutes one entire cycle. With 20% of the plots measured annually, the 2018 plots were the same plots measured in 2013, thus the 2013 data were replaced with the 2018 data.

EXECUTIVE SUMMARY/HIGHLIGHTS

This is the seventh reported result of the established continuous forest inventory (CFI). The goal of the first five years (2008-2012) was to install all of the plots within the CFI sample frame and produce baseline resource estimates. These baseline data/estimates are now being used as a monitoring baseline to compare to future re-measurement data in compilation of statistical-change estimates (e.g., tree growth/mortality). Details of the results are discussed below, and tabular results can be found in the additional “Part B” report. Baseline resource estimates of State Forest properties are:

- There are 156,558 total acres; 151,708 forested acres, with the balance in non-forest (i.e. campgrounds) and water.
- 94% of the forested acres are hardwoods.
- 79% of the forested acres are sawlog-sized stands.
- Forests contain 58.7 million live trees.
- Sugar maple trees and seedlings are more abundant than any other species, with American beech a close second (12.1 and 11.9 million trees, respectively).
- There is 340.3 million cubic feet of total live tree volume.
- There is 985 million board feet (Doyle) of sawlog volume.
- White oaks, followed by red oaks, are the species groups with the most sawlog volume.
- 63.6% of the sawlog volume is considered grade 1 or 2.
- Oaks constituted 5.1 million bdf Doyle or 50% of the total volume (10.2 million board feet Doyle) lost via mortality annually.
- Multiflora rose, Japanese honeysuckle and stiltgrass are the most common invasive species present.

FOREST COMPOSITION

Area

State Forest lands comprise approximately 156,558 acres located primarily in the southern third of Indiana. An estimated 151,708 acres are considered forest land (land considered stocked with trees or seedlings that is at minimum 1 acre in size and 120 feet in width), with the remaining ~5,000 acres being non-forest (open fields, campgrounds, rights-of-way, etc.), census water (bodies of water >5 acres and permanent rivers/streams), and non-census water (bodies of water <5 acres and small streams). Like most of Indiana’s forests, State Forests are predominantly hardwoods, with 94% of the total forest area classified as hardwood forest types. The primary hardwood forest types were white oak/red oak/hickory (26,691 acres, 17%), white oak (22,111 acres, 14%), chestnut oak (15,754 acres, 10%), and yellow poplar (10,129 acres, 6%) (Table 1). Seventy-nine percent of the area was considered sawlog-sized stands [large diameter or 11.0-inches diameter breast height (d.b.h.) and greater], with the remainder classified as poles (medium diameter or 5.0-10.9 inches d.b.h.) and seedling/saplings (small diameter or 1.0-4.9 inches d.b.h.) (Table 1).

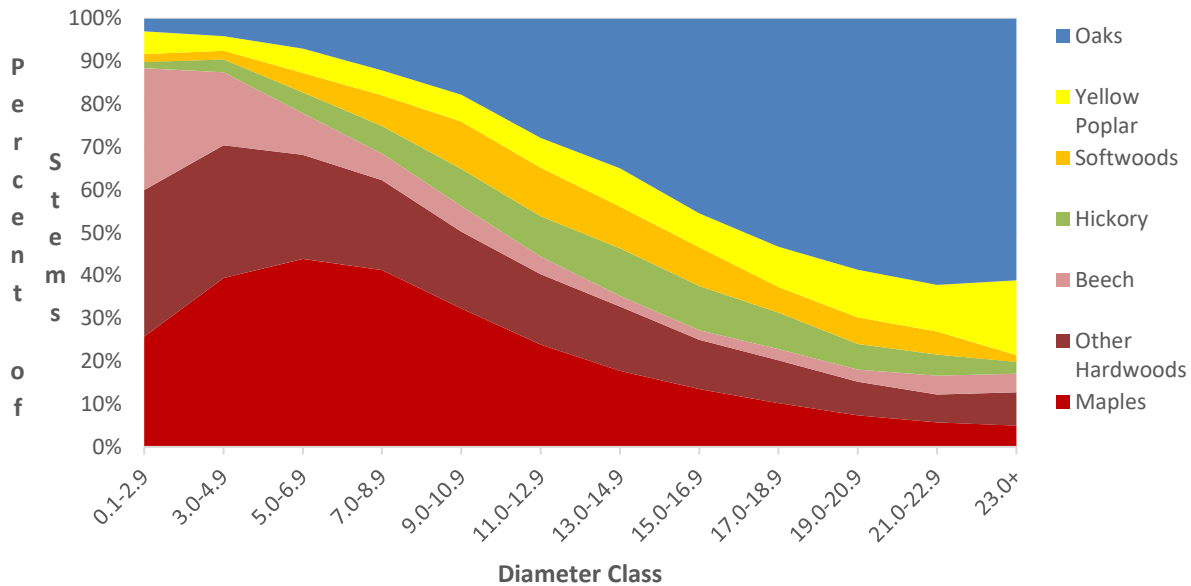
Number of Live Trees

It is estimated that there are 58.7 million live trees 1 inch d.b.h. and larger on State Forest lands. In terms of the total number of live trees, sugar maple and beech were the most abundant species, at 12.1 million and 11.9 million trees, respectively (Table 2). More than half of the number of trees were less than 3 inches d.b.h., with 42.7 million being less than 5 inches d.b.h. An item of concern is the non-uniform distribution of the number of

stems by diameter class for different species (Figure 1). In this sample, all oak species combined represented about 3.0% of all saplings 1 inch to less than 5 inches d.b.h. Without significant management intervention, the lack of oak seedlings/saplings and over-abundance of maple seedlings/saplings suggests a future decline of oak/hickory forest types as mature stands senesce.

Figure 1

Number of Trees by Species and Diameter Class



Volume of All Live Trees

The net volume of all live trees, which includes growing stock, rough, and rotten trees, 5 inches d.b.h. and more, was 340.3 million cubic feet. Hardwoods constituted 318.7 million cubic feet (cuft) or 94%. Oaks made up 147.1 million cuft or 43%. Maples were 49.7 million cuft or 15%. Yellow poplar was 46.0 million cuft or 13%. Hickories were 24.9 million cuft or 7% of the total volume (Table 3). Approximately 42.1 million cuft or 12% of the volume is in pole-sized trees (trees <11 inches d.b.h.), with the remainder being sawlog-sized (11 inches and greater d.b.h.). 78.5 million cuft or 23% is 23 inches or greater d.b.h. (Table 3). It was estimated that 329.1 million cuft of the total volume was in growing stock trees, with the remainder in rough cull and rotten cull trees. These volumes are presented in cubic feet because board foot volume estimates are only calculated on sawtimber-sized trees (hardwoods 11 inches d.b.h. and greater, softwoods 9 inches d.b.h. and greater).

Volume of Sawtimber-sized Trees

The total net sawtimber volume was 985 million board feet Doyle scale (6,491 bdf/acre). Yellow poplar and white oak were the most voluminous species, with 165.5 million board feet (MMBF) or 17% each, followed by chestnut oak and black oak, with 121.6 and 107.5 MMBF respectively (Table 4).

Grade of Sawtimber-sized Trees

Trees are graded using the Forest Service tree-grading system. It grades the best 12-foot section in the butt 16 feet for hardwoods. Grade 1 must yield 10 feet clear of defects, grade 2 must yield 8 feet clear, grade 3 must yield 6 feet clear, grade 4 must only be sound (tie grade), and grade 5 has a non-gradable butt log (due to form or rot) but has a gradable upper log (above the butt 16 foot log). It was estimated that 388.9 MMBF of the total net sawtimber volume was grade 1 and 236.9 and 229.9 MMBF in grades 2 and 3, respectively (Figure 2). Ninety-nine percent of the sawtimber volume of trees had 0-10% cull deductions.

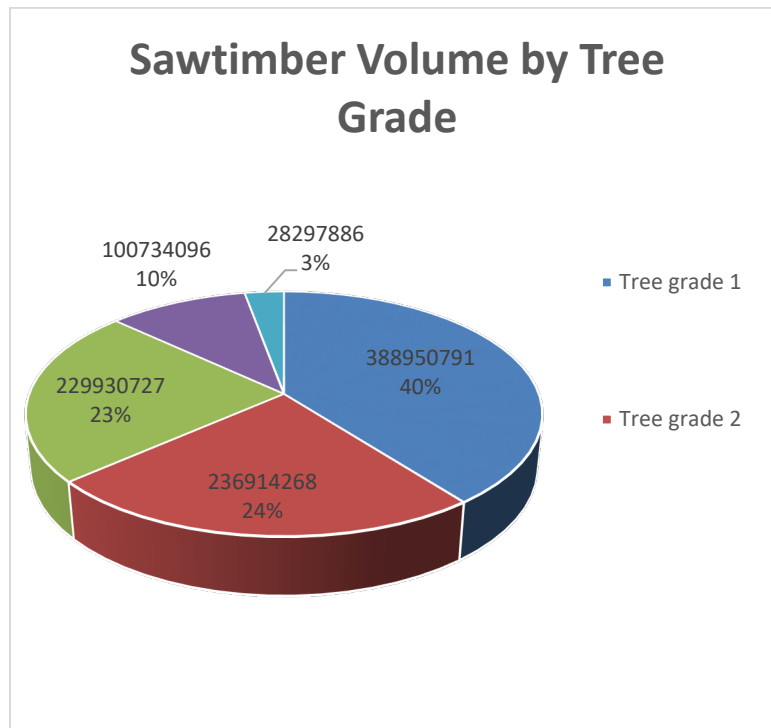


Figure 2

CHANGE ATTRIBUTES AND ANCILLARY DATA ITEMS

Change attributes are determined by looking at the same data at two different points in time. We continued to re-measure plots, beginning in 2013, and completed the total sample re-measure in 2017. Except for an occasional new install plot (due to land acquisition) the majority of plots are now being remeasured.

Growth

Net growth is defined as the gross or total growth, less mortality. The average annual net volume growth of all live trees, which includes growing stock, rough, and rotten trees, 5 inches d.b.h. and more, was 3.60 million cubic feet per year. Hardwoods actually grew 3.57 million cuft/yr. or 99% of the total growth, while cedar and

pinus merely netted 33,000 cuft/yr. Oaks constituted 1.14 million cuft or 32%, maples were 937,000 cuft or 26%, yellow poplar was 710,000 cuft or 20%, and hickories were 531,000 cuft or 15% of the total growth (Table 5). Species or species groups showing negative growth (a negative growth value would mean that mortality was larger than the gross growth) included ashes, elms, Virginia pine, red pine, sassafras, and aspen. Approximately 629,000 cuft or 17% of the growth is in pole-sized trees (trees <11 inches d.b.h.), with the remainder being sawlog sized (11 inches and greater d.b.h.).

Looking at sawlog-sized average annual net volume growth, trees collectively grew an average of 11.7 million board feet Doyle annually. Hardwoods grew 11.2 million bdf/yr., while cedar and pines grew 488,000 bdf/yr. Oaks constituted 3.8 million bdf or 32%, yellow poplar was 2.9 million bdf or 25%, maples were 1.8 million bdf or 16%, and hickories were 1.5 million bdf or 13% of the total growth (Table 6). Species or species groups showing negative growth (a negative growth value would mean that mortality was larger than the gross growth) included ashes, elms, Virginia pine, and scarlet oak.

Mortality

The average annual volume mortality of all trees was 4.36 million cuft per year. Hardwoods accounted for 3.9 million cuft/yr. or 89% of the total mortality. Chestnut oak was 576,000 cuft or 13%, and yellow poplar was 526,000 cuft or 12%. The next individual species with the most volume lost to mortality was black oak, losing 424,000 cuft, white ash, losing 408,000 cuft, and white oak, losing 336,000 cuft. Collectively, all of the oak species accounted for 1.71 million cuft or 39% of all mortality (Table 7).

Looking at sawlog-sized volume mortality, forests lost an average of 10.2 million board feet Doyle annually. Hardwoods accounted for 9.1 million bdf/yr. or 89% of the total mortality. Oaks constituted 5.1 million bdf or 50%, yellow poplar was 1.1 million bdf or 11%, ashes were 957,000 bdf or 9%, and maples were 701,000 bdf or 7% of the total mortality (Table 8).

Mortality would actually be higher than reported; however, the DoF has made a concerted effort to salvage harvest recently deceased trees (especially ash, oak, and yellow poplar). These trees and their associated volume would be captured and reported as removals rather than mortality.

Some of the high mortality is easily explained. The ash decline can be contributed to the emerald ash borer. Ash will continue to increase in mortality loss as this invasive pest continues to spread. Others, however, are more complex.

Several possible factors such as intermittent droughts over the last 20 years (with the latest severe in 2012), an outbreak of tulip scale attacking yellow poplar a few years ago, other possible insects and diseases, and natural age progression of many individual tree species, could be contributing to the volume lost to mortality.

Softwoods, planted in the past for quick soil stability of eroded and abandoned farm fields, are at or past their age of maturity and will continue to decline. Yellow poplar will always be susceptible to extreme drought conditions on certain sites. Many of our oaks are nearing their maturity age. Trees show less vigorous growth attributes with age and therefore are potentially more likely to succumb to issues brought about by insects, diseases, drought, etc. In a younger, more vigorous growth stage these oak trees would normally overcome such attacks. With 50% of the mortality volume occurring in the oak species, this will continue to be an issue without serious management efforts to promote younger oak trees to replace the aging stands of oak we now enjoy.

Removals

The average annual volume removals of all trees was 3.8 million cuft per year. Hardwoods accounted for 3.4 million cuft/yr. or 89% of the total removals. Yellow poplar was 903,000 cuft or 24%, followed by black oak at 604,000 cuft, ashes at 259,000 cuft, and white oak at 241,000 cuft (Table 9).

Looking at sawlog-sized volume removals, 12.4 million board feet Doyle was removed annually. Hardwoods accounted for 11.1 million bdft/yr., Oaks and yellow poplar each were 3.8 million bdft or 31% of the removals, while ashes and maples followed at 797,000 bdft or 6% and 727,000 bdft or 6%, respectively (Table 10).

Standing Dead Trees

There were an estimated 1.8 million standing dead trees 5 inches d.b.h. and greater. The individual species with the largest number of standing dead trees was sassafras, with 268,000 stems. Chestnut oak was second, with 165,000 standing dead trees, with Virginia pine, white oak, and yellow poplar following with 154,000, 149,000, and 148,000 standing dead trees, respectively (Table 11). As with the number of live trees, the number of standing dead trees decreased as the diameter increased. Of the 1.8 million standing dead trees, 961,000 had a diameter from 5-9 inches d.b.h., 598,000 were from 9-15 inches d.b.h., 171,000 were from 15-19 inches d.b.h., and the remaining 122,000 were 19 inches d.b.h. and greater (Table 11).

Invasive Species

If present, crews identify any invasive species found on plot and measure the area of the plot that those species occupy. These area estimates are then expanded to the entire 151,708 forested acres to estimate a total area that each invasive species occupies. Some plots may have multiple species present, while the majority of plots are free from invasive species. There were an estimated 5,789 cumulative acres (about 3.8%) with invasive species present. Multiflora rose, Japanese (vine) honeysuckle, and stiltgrass are the most prevalent invasive species, covering approximately 1,689, 1,623, and 1,180 acres respectively.

SUMMARY

The establishment of a statistically rigorous forest-resource monitoring program modeled after many aspects of the nation's forest inventory program (FIA) on Indiana's State Forests is already yielding a baseline of resource information. Estimates from this baseline compare favorably to prior estimates available from the FIA program and previous inventories conducted on State Forest properties. As estimates of State Forest land resource attributes were either sampled at a lower plot intensity (FIA) or using inconsistent methodologies (stand-exams), estimates from Indiana's State Forest land CFI program may be considered as a superior baseline. Change estimates (growth, mortality, and removals) have become statistically stronger as all plots have now been remeasured to provide reliable estimates.

INVENTORY METHODS AND TECHNIQUES

In order to better understand Indiana's public forests, to assist in providing public disclosure for forest management, and with third-party certification from SFI and FSC in mind, DoF began designing a Continuous Forest Inventory (CFI) system in 2007. The CFI system mirrored the USDA Forest Service Forest Inventory and Analysis (FIA) program for several reasons. The Indiana DNR began to negotiate with FIA to build the CFI system to meet the certification audit requirements and yet coincide with the existing FIA standards. A unique system was designed, and implementation of plot establishment on the forest began in calendar year 2008. The plots were spaced such that approximately an equal number of plots per year per State Forest property (an annual panel) would be completed. Annually, these panels can stand alone as an independent survey and therefore some results of significant value can be analyzed and reported on an annual basis. In 2013, we began to re-measure the plots that were established and measured in 2008. Therefore, now all annual panels of plots (100% of the total sample) have been updated with 2014-2018 data and the 2008-2013 data has been dropped from the total estimate calculations. Subsequent years will follow the same protocol.

Quality Assurance/Quality Control

The CFI program is the key program that provides the information needed to assess the status and trends of the DoF's managed forest lands. The goal of the CFI is to assure the production of complete, accurate and unbiased forest information of known quality. Specific measurement quality objectives (MQO) for precision are designed to provide a window of performance that we are striving to achieve for every field measurement (quality assurance or QA). Quality control (QC) procedures include direct feedback to field staff to provide continual real-time assessment and improvements or refinements of field-staff performance. These data-quality goals were adapted from the USFS FIA program goals, which were developed from knowledge of measurement processes in forestry and forest ecology.

At the heart of CFI quality is extensive staff training and expertise. Field staff meets minimum forest inventory requirements of a forestry education and background. In addition, each field-staff member begins with an extensive on-the-job training program. Once field staff members have a comfort level for what is expected of them, they begin production data collection on their own.

To quantify and evaluate how the field staff is performing, a second measurement (quality check) taken on a sample of completed field plots is performed by a trained and certified QA staff member. This technique is done blindly, or without the production-crew data on hand, and then the two sets of data are compared, analyzed, and scored to the given MQO standards. Three percent of the plots are pre-selected and considered mandatory quality check plots. The field staff does not have knowledge of which plots are mandatory checks. Field staff turn in completed data at given time intervals, and if no mandatory check plots are in that batch of production plots, then a random plot (non-mandatory) is picked to perform a quality check so that timely feedback can continuously be provided to the production field staff.

Each datum measured in the field has an associated MQO for precision. This is an assigned tolerance or acceptable level of measurement error, and measures the ability of field staff to make repeatable measurements or observations within the assigned tolerances. In the analysis of QA data, an observation is within tolerance when the difference between the production field staff data and the quality-check data do not exceed the assigned tolerance or MQO for that data element. For some data elements, the tolerance is "no error," thus only observations that are identical are within tolerance. For example, the tolerance for measurement of tree d.b.h. is +/- 0.1 inch for each 20.0 inches of diameter of a live tree with the MQO for d.b.h. set at 95%. The quality of

the data is evaluated by comparing the desired rate of differences within tolerance (as a percent of observations) to the MQO. In the example above, the objective for d.b.h. would be that 95% or more of the d.b.h. observations are within +/- 0.1 inch for each 20 inches of diameter for all trees measured by both production field staff and QA staff.

Analysis of this QA dataset assures two things for the program: (1) a measurement of the accuracy of the data being collected and (2) an indicator of future training needs and refinement of the production field staff. With continuous program monitoring and productive feedback to field staff, the QAQC portion of the CFI program should continually improve the quality of the data over time.

Field Production Protocols

With the annual inventory system, about one-fifth of all field plots are measured each year. After five years, an entire inventory cycle is completed. After the first five years, results can be analyzed and reports created as a moving five-year average. For example, Indiana CFI will be able to generate a report based on inventory results for 2013 through 2017 (last year's report), 2014 through 2018 (this year's report) and so on.

Field plots of the inventory consist of installing and measuring the annual sample of field plots (panel) on each State Forest. It was determined for desired CFI precision standards that the sampling intensity would be one plot for approximately every 40 acres. For efficiency, it was also determined that an entire compartment of a State Forest property would be established and measured within the same panel. INCFI used the FIA non-overlapping hexagonal method to assist with establishing plot locations using Arc Map.

Field crews measure vegetation on plots based on FIA standards and protocols, with few exceptions. Instead of the four subplot design that FIA uses, Indiana CFI only uses one 24-foot-radius (1/24th acre) circular subplot with the offset 6.8-foot-radius (1/300th acre) microplot. Trees with a d.b.h. of 5 inches and larger are measured on the 24-foot-radius circular subplot. All trees 1 inch d.b.h. and larger are measured on the 6.8-foot-radius circular microplot located 12 feet east of the center of the subplot. Both tree and forest measurements are collected. Some measurements include:

- General stand characteristics such as forest type, stand size and age, slope and aspect, and any recent disturbances
- Tree species, diameter, several different heights, damage, amount of rotten or missing wood, crown measurements, and tree quality
- Counts of tree regeneration
- Presence of identified invasive plants

Specific field protocols can be found in the Indiana CFI Field Data Collection Procedures for Plots Field Manual (internal document). With few exceptions, the FIA field manual (version 4.0) will suffice and is readily available online at http://www.fia.fs.fed.us/library/field-guides-methods-proc/docs/core_ver_4-0_10_2007_p2.pdf.

Estimation Errors or Quality of the Estimates

The four primary sources of error common to all sample-based estimates are sampling, measurement, prediction, and non-response error. For each of these sources of error, a definition within the context of the CFI 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 CFI inventory of DoF State Forest property is based on a sample of 3,941 plots located randomly across those lands managed by the Division of Forestry (a total area of 156,042 acres), a sampling rate of approximately one plot for every 40 acres. Along with every estimate is an associated sampling error that is typically expressed as a percentage of the estimated value, but 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 the chances are two out of three that if a 100-percent inventory been taken using these methods, the results would have been within the limits indicated (i.e., 67% confidence interval).

The sampling errors for State-level estimates of the major attributes presented in this report are shown in the Part B tabular data report. The estimators used by CFI 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 nonresponsive 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 CFI 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 CFI plot, six to 12 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 CFI observations are made to the highest standards possible, a regular program of quality assurance and quality control is an integral part of all CFI data-collection efforts. That program was described above.

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, CFI 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. In the future, change estimates such as growth, mortality, and removals will be based on these

model-based predictions of volume from both the future plot re-measurements and the measurements taken in this first inventory.

Users of CFI estimates should be aware of the possible prediction errors in CFI estimates. In comparing CFI estimates to those from 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.

Non-response Error

Non-response error refers to the error caused by not being able to observe some of the elements in the sample. In CFI, non-response occurs when crews are unable to measure a plot (or a portion of a plot) at a selected location. Non-response 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. This is not applicable in the CFI system on State Forest properties, but could apply to the CFI system on the classified forest program.
- 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 earlier.

Non-response 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, non-response can create bias in the estimates, if the portion of the population not being sampled differs from the portion being sampled. Fortunately, in CFI, unlike many survey samples, non-response rates are relatively low. The non-response plots in this inventory were not permanently removed from the CFI 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 (for the Classified Forest system), the hazardous conditions may have changed, or other circumstances that caused us to not measure plots could be different.

Data Management

This collected data is then imported, housed, and processed using a sophisticated Oracle database system. This Oracle system consists of three different but linked databases: MIDAS, NIMS and FIADB. Midas is the pre-field database and historical data housing unit. NIMS is the post-field housing and processing database. FIADB is the database housing the presentation tables. So this Oracle system not only houses the data but also processes and readies the data for distribution. “Processing” the data combines certain measurements to determine some calculated estimates (e.g., using tree diameter, tree height, site-index measurements, tree species, etc., to estimate tree volume using a volume equation).

Distribution is accomplished by eventually loading the post-processed data (FIADB tables) into a customized Access database that is very similar in functionality to the USFS FIA EVALIDator online tool. This Access database is used to assist with the analysis and interpretation of data. One can create customized tables with error estimates using this EVALIDator Access database.

Oracle processing protocols are documented as well (several internal documents). Most protocols are scripts written in sequel programming code or are instructions for the processing of the data and are intended for the database manager or advanced user only. An Access EVALIDator user guide was created (beta version – work in progress) with the intent of being used as a reference guide after a training session of how to use EVALIDator has been attended.

APPENDIX

Table 1.—Area of forest land by forest type group and stand size class, State Forest properties, 2014-2018.

Table 2.—Number of all live trees by species and diameter class, State Forest properties, 2014-2018.

Table 3.—Net volume of all live trees by species and diameter class, State Forest properties, 2014-2018.

Table 4.—Sawtimber volume of all live trees by species and diameter class, State Forest properties, 2014-2018.

Table 5.—Net growth of all live trees by species and diameter class, State Forest properties, 2014-2018.

Table 6.—Net growth of sawtimber by species and diameter class, State Forest properties, 2014-2018.

Table 7.—Mortality of all live trees by species and diameter class, State Forest properties, 2014-2018.

Table 8.—Mortality of sawtimber by species and diameter class, State Forest properties, 2014-2018.

Table 9.—Removals of all live trees by species and diameter class, State Forest properties, 2014-2018.

Table 10.—Removals of sawtimber by species and diameter class, State Forest properties, 2014-2018.

Table 11.—Number of standing dead trees 5 inches d.b.h. and greater by species and diameter class, State Forest properties, 2014-2018.

Table 1.—Area of forest land by forest type group and stand size class, State Forest properties, 2014-2018.

Estimate: Total-Area of forestland (acres)

Forest type	Stand-size	Large diameter	Medium diameter	Small diameter	Nonstocked
All	151,708	119,837	11,481	15,040	5,350
White oak / red oak / hickory	26,691	22,377	2,275	2,039	-
Mixed upland hardwoods	7,473	4,821	870	1,781	-
White oak	22,111	21,783	288	40	-
Chestnut oak	15,754	15,348	283	123	-
Yellow-poplar	10,129	7,751	1,137	1,241	-
Pine/Hardwood	2,992	2,422	368	201	-
Chestnut oak / black oak / scarlet oak	6,337	5,683	284	370	-
Sugar maple / beech / yellow birch	6,837	5,538	688	611	-
Hard maple / basswood	6,811	5,374	889	548	-
Northern red oak	5,613	5,491	81	40	-
Cherry / white ash / yellow-poplar	5,766	2,896	607	2,263	-
Other miscellaneous hardwood forest types	29,094	14,705	3,468	5,571	5,350
Miscellaneous softwood forest types	6,100	5,644	245	212	-

Table 2.—Number of all live trees by species and diameter class, State Forest properties, 2014-2018.

Estimate: Total-Number of all live trees on forestland (trees)

Species	Diameter class	0.1-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0+
All	58,675,194	33,025,010	9,687,188	3,993,034	2,723,734	1,963,114	1,748,833	1,389,404	1,187,821	1,005,964	716,960	515,299	718,833
sugar maple	12,092,728	6,178,016	2,801,897	1,219,874	760,424	442,861	282,086	170,134	102,697	69,224	30,266	20,597	14,654
American beech	11,942,654	9,384,269	1,651,236	389,156	168,320	116,265	72,231	34,212	26,381	26,342	20,465	22,587	31,188
other hardwood species	5,560,050	3,810,743	923,792	223,690	154,874	102,241	92,324	71,460	58,773	44,861	26,607	17,993	32,692
red maple	4,702,187	2,276,537	1,018,120	528,954	356,851	183,702	131,807	74,897	54,183	28,651	21,719	8,925	17,840
yellow poplar	3,270,182	1,732,348	332,295	226,570	158,354	123,334	122,314	124,618	94,667	94,206	79,766	56,157	125,553
sassafras	2,345,988	1,437,325	415,166	180,697	118,975	83,429	60,591	26,398	12,682	7,820	1,952	-	954
other oaks	2,045,626	504,079	232,171	99,538	108,950	104,051	126,908	122,670	139,334	170,931	130,550	117,528	188,917
redcedar and pine species	1,990,688	615,574	196,072	182,286	194,880	217,906	197,651	134,394	107,386	60,552	44,510	27,736	11,742
eastern hophornbeam	1,860,883	1,641,949	195,526	17,558	5,850	-	-	-	-	-	-	-	-
white oak	1,874,616	295,755	61,112	96,587	125,055	129,883	173,242	169,259	198,703	190,507	154,258	110,145	170,111
blackgum	1,691,504	942,450	355,398	192,063	93,584	42,147	24,708	14,707	13,677	7,850	973	1,946	1,999
chestnut oak	1,638,279	183,245	98,020	83,948	95,010	114,068	186,243	193,522	201,693	174,478	135,341	92,659	80,052
flowering dogwood	1,604,138	1,148,898	404,709	48,560	1,971	-	-	-	-	-	-	-	-
ash species	1,553,642	1,083,023	158,763	83,518	39,158	37,623	34,606	35,317	25,727	19,622	17,695	6,861	11,733
pignut hickory	1,192,179	293,475	194,653	116,148	100,027	118,058	100,994	80,522	71,500	56,022	28,479	17,546	14,756
American elm	1,024,680	529,234	320,074	81,882	56,974	17,934	8,785	5,803	1,982	986	1,026	-	-
other hickories	744,782	195,268	97,603	76,485	76,283	52,080	64,553	74,776	50,953	29,340	14,718	7,822	4,899
black cherry	624,376	317,553	84,459	60,538	45,349	34,294	35,644	17,945	7,890	7,925	4,849	1,998	5,933
other elms	635,815	393,979	121,961	54,815	34,496	8,844	10,825	4,008	3,906	1,998	-	-	983
black walnut	280,197	61,293	24,158	30,166	28,348	34,397	23,321	34,763	15,689	14,649	3,787	4,799	4,827

Table 3.—Net volume of all live trees by species and diameter class, State Forest properties, 2014-2018.

Estimate: Total-Volume of all live on forestland (cuft)

Species	Diameter class	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0+
All	340,300,067	9,402,205	14,035,687	18,660,368	26,986,377	32,102,694	38,677,342	44,205,916	40,752,959	36,923,196	78,553,324
white oak	53,354,136	225,235	642,801	1,188,346	2,523,452	3,659,711	6,018,058	7,830,641	8,117,254	7,276,342	15,872,297
yellow poplar	45,984,015	601,797	927,831	1,369,812	2,233,880	3,455,827	3,715,677	5,168,265	5,714,649	5,092,331	17,703,944
chestnut oak	39,497,946	191,606	441,760	991,714	2,552,850	3,919,855	5,745,286	6,590,913	6,597,017	5,671,089	6,795,856
sugar maple	32,639,258	3,156,551	4,170,202	4,430,843	4,689,015	4,245,803	3,626,300	3,278,175	1,873,844	1,594,243	1,574,283
black oak	30,168,314	86,190	174,800	352,129	800,050	1,108,422	2,288,588	3,752,821	4,246,679	5,163,801	12,194,831
redcedar and pine species	21,644,624	399,411	950,857	1,991,704	2,981,420	3,000,863	3,566,954	2,778,233	2,642,237	2,108,471	1,224,474
northern red oak	17,132,274	82,047	181,046	369,969	547,348	861,792	1,224,504	2,051,893	2,248,555	2,540,424	7,024,695
red maple	15,621,153	1,292,802	1,863,788	1,801,722	2,053,783	1,719,448	1,783,901	1,292,736	1,267,392	673,953	1,871,629
pignut hickory	15,593,887	269,230	535,964	1,153,151	1,646,659	1,989,103	2,608,353	2,693,455	1,738,969	1,401,192	1,557,812
American beech	13,091,835	882,809	844,514	1,075,992	1,114,621	765,677	857,854	1,186,168	1,227,313	1,633,604	3,503,282
other hardwood species	11,945,022	815,986	958,602	946,045	1,257,336	1,487,061	1,586,764	1,390,871	993,375	706,607	1,802,375
other hickories	9,263,677	178,228	410,629	513,270	1,086,674	1,862,226	1,770,745	1,447,085	910,209	627,080	457,533
ash species	6,743,703	182,747	187,017	347,213	511,699	851,353	868,111	908,714	1,006,710	501,476	1,378,663
American sycamore	6,909,676	85,207	106,335	185,721	376,139	465,953	779,008	821,967	598,405	823,460	2,667,481
other oaks	6,915,177	72,049	211,617	268,530	546,825	766,291	866,690	1,445,343	808,129	621,159	1,308,545
sassafras	3,771,074	359,757	548,809	703,560	811,507	531,001	365,677	307,269	100,942	-	42,553
black walnut	3,664,353	69,220	136,683	307,153	338,466	749,280	445,822	582,260	207,826	337,183	490,460
black cherry	3,128,425	119,441	202,377	288,685	485,095	368,744	262,026	324,742	292,243	150,782	634,290
elms	1,835,360	280,047	415,371	230,908	259,887	212,312	166,427	113,664	53,317	-	103,425
other maples	1,396,154	51,841	124,683	143,900	169,667	81,974	130,598	240,699	107,896	-	344,896

Table 4.—Sawtimber volume of all live trees by species and diameter class, State Forest properties, 2014-2018.

Estimate: Total-All live net sawtimber volume on forestland (bdf - FIA Doyle)

Species	Diameter class	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0 +
All	984,827,768	2,414,061	52,393,294	77,582,544	110,678,755	140,289,050	141,281,610	135,741,817	324,446,637
yellow poplar	165,473,159	-	4,596,529	8,860,689	11,227,659	17,671,894	21,180,520	19,926,966	82,008,902
white oak	165,460,505	-	5,131,027	8,877,759	16,704,773	23,892,010	26,133,381	25,269,590	59,451,965
chestnut oak	121,628,859	-	5,088,879	9,664,768	16,592,735	20,378,144	22,216,681	20,725,214	26,962,438
black oak	107,485,530	-	1,580,116	2,731,729	6,530,885	12,104,983	14,690,998	19,169,910	50,676,909
northern red oak	61,517,071	-	1,103,126	2,194,422	3,594,689	6,705,656	7,963,314	9,695,122	30,260,743
sugar maple	56,242,717	-	9,052,372	9,791,104	9,912,547	10,034,525	6,165,907	5,400,816	5,885,445
pignut hickory	42,999,768	-	3,351,223	5,001,785	7,655,506	8,673,917	6,215,250	5,446,823	6,655,266
other hardwood species	36,405,518	-	4,028,689	4,994,998	5,893,403	6,108,604	4,188,290	2,339,259	8,852,276
eastern white pine	33,448,730	335,483	991,917	2,021,628	4,972,489	6,006,653	6,788,561	8,185,968	4,146,030
American beech	33,262,862	-	2,178,881	1,818,708	2,411,799	3,505,480	4,178,425	5,366,894	13,802,675
red maple	26,495,465	-	3,500,651	3,549,371	4,281,980	3,613,364	3,714,697	2,286,726	5,548,677
American sycamore	22,561,383	-	717,827	1,110,397	2,150,580	2,377,517	1,877,829	2,807,438	11,519,794
Virginia pine	21,626,212	1,089,052	3,416,436	3,848,338	5,342,874	3,344,087	4,115,657	-	469,767
other oaks	20,070,031	-	1,034,062	1,723,871	2,387,312	4,500,239	2,784,920	2,303,538	5,336,085
ash species	19,253,258	-	877,170	1,923,479	2,323,515	2,839,823	3,449,174	1,870,131	5,969,966
shagbark hickory	16,025,325	-	1,531,640	3,197,923	3,274,736	3,067,789	2,296,364	1,827,100	829,773
other pines and redcedar	11,231,814	989,526	2,057,093	2,236,595	1,807,168	1,281,751	800,952	835,836	1,222,894
black walnut	9,366,339	-	684,027	1,815,013	1,262,626	1,825,059	698,073	1,203,323	1,878,217
other hickories	7,544,766	-	643,508	1,411,737	1,724,140	1,581,600	890,460	565,712	727,610
black cherry	6,728,459	-	828,124	808,228	627,339	775,953	932,158	515,453	2,241,205

Table 5.—Net growth of all live trees by species and diameter class, State Forest properties, 2014-2018.

Estimate: Total-Net growth of all live on forestland (cuft per year)

Species	Diameter class	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0+
All	3,604,481	235,660	197,936	195,742	317,890	338,944	364,086	449,196	368,612	258,851	877,566
yellow poplar	710,372	3,632	6,328	25,093	67,214	65,949	22,626	84,395	106,969	94,219	233,948
white oak	600,764	1,147	-5,769	6,447	28,864	46,967	58,514	112,482	106,812	83,839	161,463
sugar maple	590,980	119,517	121,140	94,694	78,654	41,086	63,195	43,712	-13,388	20,270	22,100
red maple	347,379	43,794	51,505	45,055	53,993	32,711	52,266	30,832	36,266	12,915	-11,959
pignut hickory	337,093	6,044	8,667	30,906	36,451	46,323	64,848	40,548	49,081	24,023	30,203
black oak	226,939	567	3,722	4,406	264	17,851	8,191	35,136	40,530	7,914	108,358
northern red oak	223,149	738	813	1,623	11,546	1,737	11,850	23,333	8,071	23,510	139,928
American sycamore	155,429	1,136	2,883	6,627	9,564	11,758	22,958	21,348	18,110	16,939	44,104
chestnut oak	54,516	1,404	-3,901	-1,837	1,221	-28,684	10,705	9,055	-4,268	27,784	43,035
other hardwood species	94,665	12,358	9,532	8,212	5,538	18,502	42,207	4,854	-1,760	-28,920	24,146
American beech	201,936	49,767	36,920	39,961	18,897	6,110	11,723	23,209	-124	-21,497	36,970
shagbark hickory	117,353	2,621	5,276	5,689	16,941	38,478	28,528	19,478	-12,393	8,321	4,415
black walnut	69,038	2,328	2,830	6,543	9,511	22,192	7,155	-5,631	6,116	9,390	8,603
other hickories	76,249	1,986	2,093	4,962	9,625	16,322	17,591	11,741	4,837	415	6,677
black cherry	40,060	1,459	1,737	2,114	10,227	2,580	-1,556	-1,919	7,881	3,871	13,667
other oaks	44,183	1,593	933	1,150	7,344	4,557	1,054	12,664	4,374	6,948	3,565
other maples	-713	1,147	3,280	-4,305	-484	-6,292	-10,783	8,966	2,019	0	5,739
scarlet oak	-8,516	-11	861	-1,138	2,221	85	-10,957	-8,224	12,261	-23,091	19,478
elms	-46,292	1,593	6,429	-3,419	1,488	-11,292	-5,290	-5,161	-11,492	-20,853	1,704
sassafras	-28,610	-6,477	-9,652	-11,488	3,488	11,997	-10,852	-2,541	3,388	823	-7,298
redcedar and pine species	33,090	-4,013	-28,503	-41,532	-26,011	3,299	-569	32,627	36,286	34,967	26,538
ash species	-234,583	-6,669	-19,191	-24,020	-28,666	-3,295	-19,319	-41,707	-30,962	-22,936	-37,820

Table 6.—Net growth of sawtimber by species and diameter class, State Forest properties, 2014-2018.

Estimate: Total-Net growth of sawtimber on forestland (bdft per year - DOYLE)

Species	Diameter class	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0+
All	11,722,595	-582	2,916,809	866,769	1,048,751	1,447,719	1,201,544	950,093	3,291,491
yellow poplar	2,883,899	-	427,433	179,012	105,480	298,802	393,774	357,464	1,121,934
white oak	1,863,988	-	262,977	107,087	157,160	311,185	311,374	251,930	462,274
sugar maple	1,151,162	-	651,369	92,970	180,334	128,128	-50,939	80,002	69,299
pignut hickory	1,037,263	-	213,084	118,115	186,962	129,191	172,476	90,114	127,323
northern red oak	786,340	-	88,682	5,160	34,251	71,962	20,479	75,732	490,073
black oak	724,926	-	91,091	42,016	23,464	101,727	116,522	9,897	340,209
red maple	658,803	-	328,014	84,624	119,365	81,879	100,532	40,087	-95,698
American sycamore	535,984	-	61,832	28,818	64,563	75,151	57,700	64,374	183,547
eastern white pine	490,904	-4,334	-20,754	6,426	94,662	112,115	72,721	124,969	105,100
American beech	456,779	-	166,486	15,001	56,860	68,945	9,571	-32,752	172,668
other hardwood species	423,234	-	199,506	59,497	73,833	34,575	12,932	-63,854	106,744
shagbark hickory	321,522	-	80,829	94,036	79,993	60,859	-42,529	30,854	17,480
chestnut oak	292,703	-	171,323	-70,817	-287	-8,634	-41,263	74,052	168,329
other hickories	199,571	-	34,053	43,970	49,502	37,645	16,878	1,083	16,440
black walnut	164,669	-	38,381	52,049	18,997	-18,362	19,071	29,717	24,815
black cherry	145,179	-	78,794	7,158	-8,281	-6,485	23,443	12,057	38,492
other oaks	136,703	-	30,461	21,435	-1,259	37,064	14,024	23,417	11,559
other pines and redcedar	-2,681	3,752	-47,475	-8,678	-105,514	19,403	93,655	23,721	18,454
scarlet oak	-20,097	-	21,376	-1,650	-31,950	-29,942	39,810	-85,915	68,174
elm species	-98,988	-	39,783	-9,757	-14,531	-15,500	-34,829	-69,340	5,187
ash species	-429,267	-	-437	297	-34,849	-41,991	-103,857	-87,519	-160,912

Table 7.—Mortality of all live trees by species and diameter class, State Forest properties, 2014-2018.

Estimate: Total-Mortality of all live on forestland (cuft per year)

Species	Diameter class	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0+
All	4,363,862	265,080	327,447	388,821	408,492	460,531	520,390	496,135	480,271	491,072	525,623
chestnut oak	576,136	5,971	13,539	21,956	41,898	86,148	88,166	88,701	100,460	59,958	69,339
yellow-poplar	526,321	56,642	56,612	41,956	23,539	51,485	92,154	45,050	25,332	42,184	91,366
black oak	423,810	2,837	3,281	7,592	24,169	8,843	45,557	58,529	55,347	100,736	116,919
white ash	408,410	16,401	23,579	36,876	35,408	22,896	42,920	67,561	53,114	30,589	79,066
white oak	336,126	7,047	21,083	18,161	22,631	30,215	34,281	37,275	50,394	40,859	74,181
other hardwood species	307,477	38,091	39,756	38,717	42,772	25,139	7,669	46,627	22,238	46,469	-
sugar maple	278,363	35,177	30,017	42,878	41,888	54,081	8,780	9,091	45,861	10,591	-
northern red oak	255,256	2,521	6,072	10,978	8,239	23,820	27,402	33,980	49,092	45,576	47,577
Virginia pine	238,411	7,423	21,355	37,324	48,132	44,909	61,217	18,051	-	-	-
red maple	151,595	29,282	24,468	16,494	13,310	20,864	-	-	-	-	47,176
sassafras	134,808	22,681	30,247	36,700	14,153	2,484	19,661	8,881	-	-	-
elms	123,204	12,894	11,366	14,934	8,972	24,803	8,242	7,033	13,257	21,702	-
American beech	114,274	3,557	4,138	4,403	13,309	13,306	5,863	10,501	12,688	46,509	-
eastern white pine	107,419	2,856	7,368	13,512	16,065	14,377	9,288	-	27,977	15,976	-
scarlet oak	91,634	316	1,897	2,179	3,699	4,851	20,647	28,124	-	29,922	-
hickories	85,243	3,592	6,091	1,609	7,165	6,467	6,607	29,200	24,511	-	-
red pine	63,957	2,138	13,640	14,383	20,597	-	5,668	7,531	-	-	-
redcedar and pine species	49,384	11,939	5,276	15,409	5,889	4,032	6,838	-	-	-	-
other maples	41,571	374	1,010	7,468	7,164	8,488	17,066	-	-	-	-
other oaks	32,131	1,750	4,760	5,291	-	7,966	12,363	-	-	-	-
other ashes	18,331	1,587	1,895	-	9,493	5,356	-	-	-	-	-

Table 8.—Mortality of sawtimber by species and diameter class, State Forest properties, 2014-2018.

Estimate: Total-Mortality of sawtimber on forestland (bdft per year - DOYLE)

Species	Diameter class	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0+
All	10,209,896	129,988	739,215	1,093,589	1,474,588	1,487,295	1,610,841	1,659,814	2,014,566
chestnut oak	1,606,570	-	82,103	194,774	250,488	277,057	308,530	218,474	275,143
black oak	1,403,527	-	44,080	22,111	130,884	185,077	189,359	368,556	463,459
yellow poplar	1,108,484	-	50,488	134,242	263,206	153,166	92,749	172,716	241,917
white oak	934,262	-	41,743	74,093	94,297	111,575	162,776	141,275	308,503
white ash	931,309	-	59,562	46,949	98,077	117,760	179,228	112,282	317,451
northern red oak	828,872	-	16,857	59,769	79,448	109,494	171,486	171,539	220,278
Virginia pine	620,588	64,105	116,794	140,333	225,815	73,541	-	-	-
other hardwoods	531,552	-	78,071	78,457	45,675	141,035	69,444	118,872	-
sugar maple	401,715	-	67,103	130,720	24,541	27,004	152,346	-	-
eastern white pine	315,476	21,131	36,849	40,937	30,842	-	118,083	67,634	-
scarlet oak	277,452	-	7,535	12,108	59,450	89,190	-	109,169	-
red maple	241,988	-	18,034	36,141	-	-	-	-	187,814
American beech	225,302	-	7,899	33,519	-	33,181	43,168	107,536	-
elms	205,541	-	12,789	38,759	21,927	20,517	39,788	71,761	-
pignut hickory	143,782	-	14,737	16,260	19,018	93,768	-	-	-
red pine	119,174	23,102	47,557	-	19,191	29,324	-	-	-
sassafras	87,291	-	9,921	-	51,765	25,605	-	-	-
shagbark hickory	83,882	-	-	-	-	-	83,882	-	-
other pines and redcedar	72,380	21,650	14,113	11,396	25,222	-	-	-	-
other oaks	45,178	-	-	10,434	34,744	-	-	-	-
other ashes	25,568	-	12,981	12,587	-	-	-	-	-

Table 9.—Removals of all live trees by species and diameter class, State Forest properties, 2014-2018.

Estimate: Total-Removals of all live on forestland (cuft per year)

Species	Diameter class	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0+
All	3,792,614	76,611	91,779	109,931	243,979	313,706	464,961	383,957	416,362	421,796	1,269,532
yellow poplar	903,494	9,358	13,501	8,581	14,477	18,897	22,922	43,238	58,924	88,465	625,131
black oak	604,189	653	2,427	2,170	6,401	30,535	34,508	54,264	53,156	104,925	315,151
other hardwood species	346,945	15,547	12,627	12,015	25,248	43,116	70,451	29,786	50,585	32,055	55,516
white oak	241,356	537	4,250	2,115	5,741	9,343	28,200	14,375	42,073	71,779	62,941
sugar maple	235,754	20,745	22,162	19,121	32,837	39,046	31,559	12,483	24,897	-	32,904
white ash	224,720	409	2,051	1,752	15,556	26,818	46,863	50,499	36,504	11,586	32,682
chestnut oak	194,420	579	-	4,099	6,483	26,531	23,477	65,083	9,929	14,041	44,198
American beech	175,574	2,198	2,560	9,895	8,653	10,459	6,973	7,668	25,065	45,461	56,641
eastern white pine	161,237	522	-	8,568	7,825	38,753	37,956	18,324	21,088	28,202	-
pignut hickory	132,947	376	5,075	5,654	7,654	9,636	13,498	29,654	40,706	-	20,694
Virginia pine	128,578	1,963	4,140	3,740	30,475	21,303	45,738	7,840	-	13,380	-
red maple	120,138	15,290	4,761	5,968	13,952	20,705	39,113	20,349	-	-	-
redcedar and pine species	117,588	3,989	10,780	14,793	35,653	12,167	18,826	7,890	13,491	-	-
sassafras	115,445	3,910	7,445	9,171	20,435	6,397	27,978	-	28,207	11,903	-
northern red oak	90,230	537	-	2,292	12,587	-	16,899	22,505	11,736	-	23,674

Table 10.—Removals of sawtimber by species and diameter class, State Forest properties, 2014-2018.

Estimate: Total-Removals of sawtimber on forestland (bdft per year - DOYLE)

Species	Diameter class	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0+
All	12,369,899	42,837	483,697	778,365	1,316,697	1,207,008	1,416,363	1,468,764	5,656,168
yellow poplar	3,814,823	-	29,288	49,438	69,117	144,885	224,996	280,093	3,017,006
black oak	2,218,581	-	13,025	65,555	98,654	172,175	156,628	384,420	1,328,125
other hardwood species	960,856	-	49,328	90,490	186,101	65,419	169,011	110,148	290,360
white oak	748,983	-	11,726	22,837	77,743	43,947	115,856	248,651	228,222
white ash	654,112	-	23,789	63,198	128,097	155,468	123,161	-	160,399
chestnut oak	608,463	-	13,241	67,219	66,378	204,768	33,946	53,185	169,727
eastern white pine	553,485	11,598	17,768	111,953	128,822	69,949	90,681	122,714	-
American beech	500,648	-	17,945	26,356	20,016	24,376	85,647	166,939	159,370
sugar maple	487,866	-	59,837	95,223	87,944	38,509	82,318	-	124,035
Virginia pine	408,405	6,186	73,780	66,915	167,704	31,838	-	61,982	-
pignut hickory	383,122	-	15,680	24,134	21,277	95,386	142,955	-	83,691
redcedar and pine species	295,091	25,053	77,540	34,945	64,566	30,865	62,123	-	-
northern red oak	275,286	-	17,637	-	49,087	72,423	40,905	-	95,234
sassafras	234,267	-	38,215	14,646	52,637	-	88,136	40,633	-
red maple	225,910	-	24,898	45,456	98,555	57,002	-	-	-

Table 11.—Number of standing dead trees 5” d.b.h. and greater by species and diameter class, State Forest Properties, 2014-2018.

Estimate: Total-Number of standing dead trees 5”+ dbh on forestland (trees)

Species	Diameter class	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0+
All	1,851,467	546,708	414,095	281,038	188,660	128,470	103,219	67,589	52,852	28,531	40,305
sassafras	268,394	136,174	67,781	40,918	11,757	3,934	6,847	983	-	-	-
chestnut oak	165,060	17,643	19,395	25,480	27,288	24,290	17,666	11,687	10,790	4,869	5,952
Virginia pine	154,309	24,759	37,544	25,782	30,650	18,757	10,881	3,957	989	-	989
white oak	148,888	27,772	32,536	16,692	14,844	15,802	13,787	7,924	9,743	1,943	7,845
yellow poplar	147,727	44,036	40,021	15,625	10,730	8,738	10,781	5,923	2,925	3,911	5,037
eastern redcedar	123,106	69,007	27,611	18,728	2,925	3,863	-	-	-	-	973
sugar maple	108,611	36,186	27,481	20,629	9,773	8,728	986	1,907	954	986	983
ashes	102,092	27,577	19,753	13,748	12,771	6,932	4,868	7,803	3,801	1,978	2,861
other hardwoods	94,093	31,878	25,702	13,891	12,809	5,878	983	1,969	-	983	-
black oak	91,090	6,893	8,777	6,815	12,769	5,821	12,747	11,779	10,761	6,890	7,839
red pine	81,735	11,806	33,777	20,643	11,652	1,939	986	932	-	-	-
eastern white pine	63,158	14,744	12,719	17,727	3,960	4,078	3,924	986	5,020	-	-
red maple	54,260	23,558	13,896	9,832	3,041	1,967	954	-	-	-	1,013
elms	49,127	21,408	8,853	6,878	2,944	5,007	1,026	1,013	973	1,026	-
northern red oak	47,110	5,886	4,900	6,902	2,938	2,948	5,902	6,846	3,939	2,988	3,861
other oaks	36,434	6,875	10,874	6,875	2,964	3,926	2,952	983	986	-	-
black locust	34,925	20,000	6,977	3,981	2,982	986	-	-	-	-	-
black cherry	34,160	14,644	6,782	4,869	2,982	2,904	1,980	-	-	-	-
American beech	28,571	2,948	3,914	4,011	5,938	989	2,926	954	983	2,958	2,952
hickories	15,608	2,912	4,804	-	1,962	986	2,012	1,943	989	-	-
other softwoods	3,009	-	-	1,013	983	-	1,013	-	-	-	-