Indiana DNR State Forest Properties
Report of Continuous Forest Inventory (CFI)
Summary of years 2018-2022

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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 3,922 plots located randomly across those lands (a total area of 159,438 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, 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 2018-2022, a span that constitutes one entire cycle. With 20% of the plots measured annually, the 2022 plots were the same plots measured in 2017, thus the 2017 data were replaced with the 2022 data.

EXECUTIVE SUMMARY/HIGHLIGHTS

These are the annual reported results of the established continuous forest inventory (CFI). The goal of the first five years (2008-2012) was to install all 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 Appendix. Baseline resource estimates of state forest properties are:

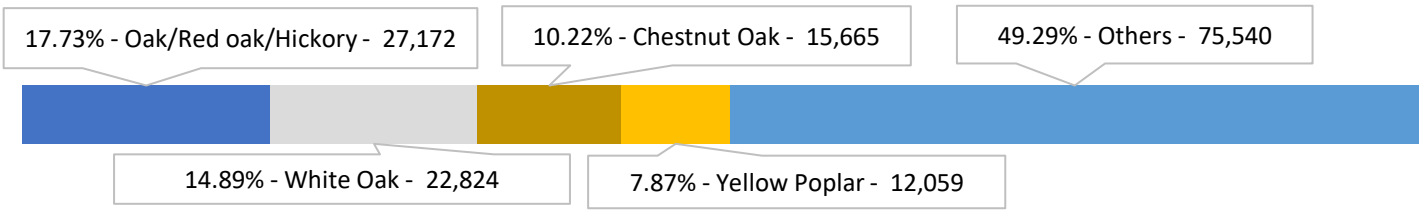
- There are 159,438 total acres; 153,260 forested acres, with the balance in non-forest (i.e., campgrounds) and water.
- 95% of the forested acres are hardwoods.
- 79% of the forested acres are sawlog-sized stands.
- Forests contain 62.9 million live trees.
- American beech trees and seedlings are more abundant than any other species, with sugar maple a close second (13.7 and 11.7 million trees, respectively).
- There is 349.4 million cubic feet of total live tree volume.
- There is 1.018 billion board feet (Doyle) of sawlog volume.
- White oaks, followed by yellow poplar and chestnut oak, are the species with the most sawlog volume.
- 72.2% of the sawlog volume is considered grade 1 or 2.
- Oaks constituted 4.9 million bdft Doyle or 50% of the sawlog volume (9.8 million bdft Doyle) lost via mortality annually. 9.8 million bdft Doyle annual mortality is around 1% of the total 1.0 billion bdft Doyle standing volume.
- Japanese honeysuckle, creeping jenny and glossy buckthorn are the most common invasive species present.
- There are 10.65 million short tons of forest carbon stocks.

FOREST COMPOSITION

Area

State forest lands comprise approximately 159,438 acres located primarily in the southern third of Indiana. An estimated 153,260 of these acres is 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 ~6,200 acres being non-forest (open fields, campgrounds, rights-of-way, etc.), census water (bodies of water >4.5 acres and permanent rivers/streams), and non-census water (bodies of water <4.5 acres and small streams). Like most of Indiana's forests, state forests are predominantly hardwoods, with 95% of the total forest area classified as hardwood forest types. The primary hardwood forest types are illustrated below (Figure A) (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).

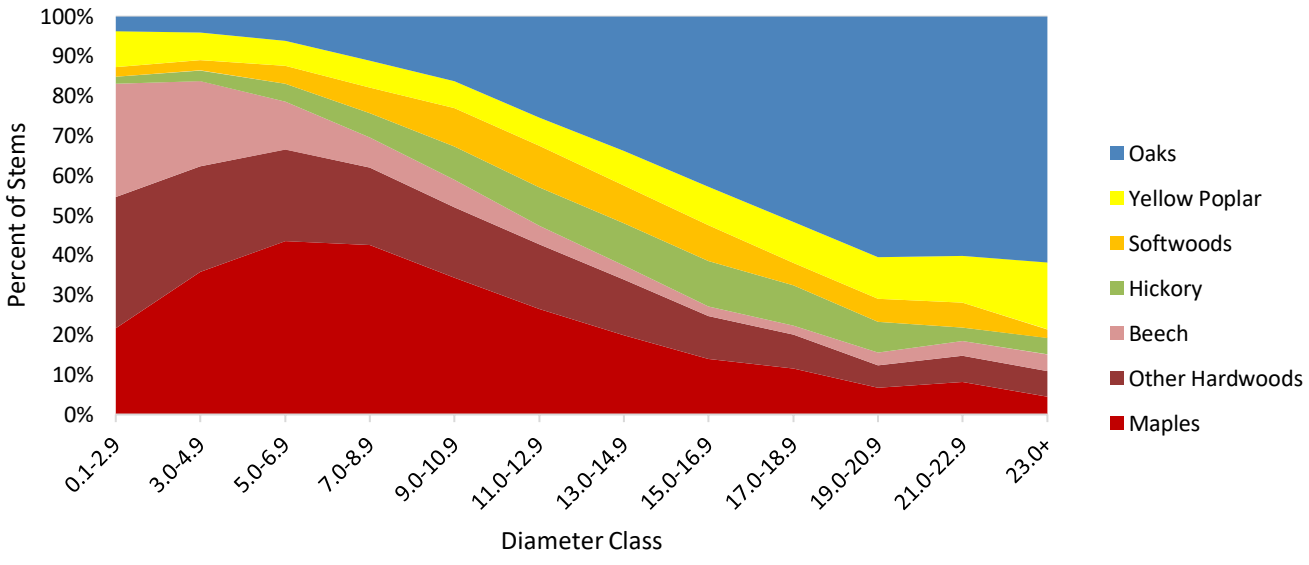
Figure A: Primary Hardwood Types (acres)



Number of Live Trees

It is estimated that there are 62.9 million live trees 1-inch d.b.h. and larger on state forest lands. In terms of the total number of live trees, beech and sugar maple are the most abundant species, at 13.7 million and 11.7 million trees, respectively (Table 2). More than half of the number of trees are less than 3 inches d.b.h., with 46.9 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 3.7% 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 and beech seedlings/saplings suggests a future decline of oak/hickory forest types as stands mature.

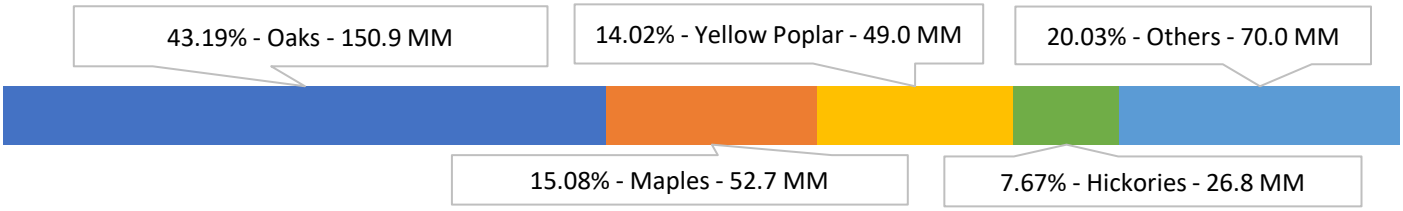
Figure 1: Number of Trees by Species and Diameter Class



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, is 349.4 million cubic feet (cuft). Hardwoods constitutes 328.2 million cuft (94%) and its distribution with respect to the total volume is illustrated below (Figure B) (Table 3).

Figure B: Hardwood Volume distribution (cubic feet - cuft)



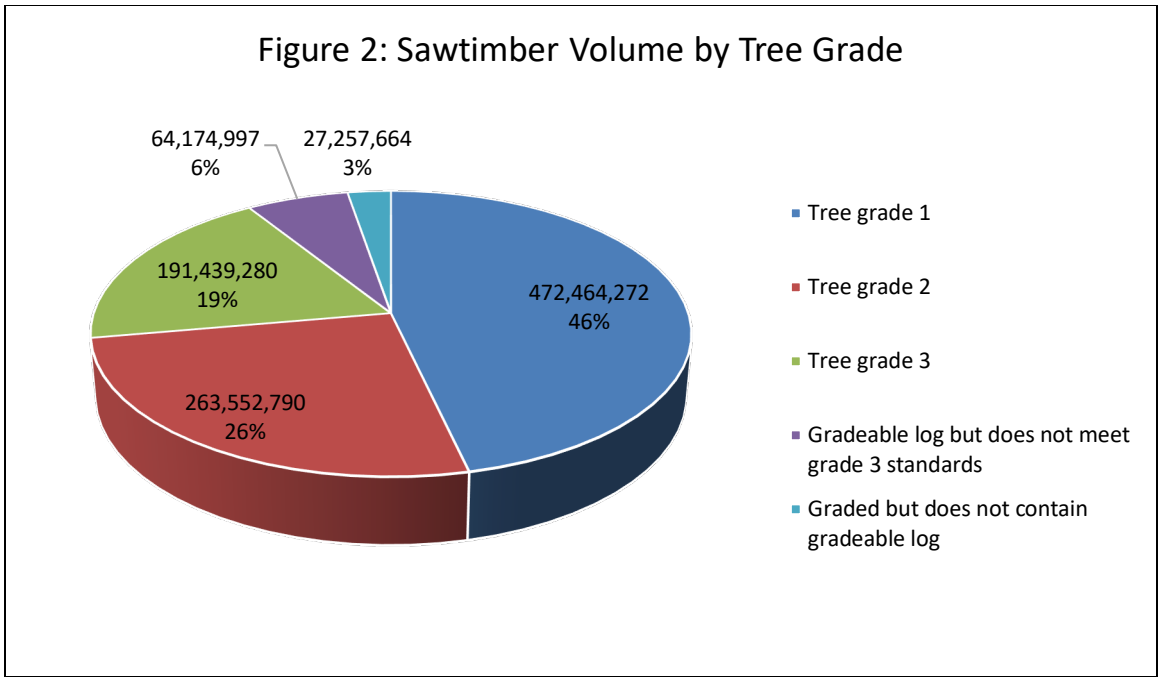
Approximately 42.5 million cuft or 12% of the volume is in pole-sized trees (trees <11 inches d.b.h.), with the remainder being sawlog-sized (11 inches and greater d.b.h.). 89.2 million cuft or 26% is 23 inches or greater d.b.h. (Table 3). It is estimated that 335.1 million cuft of the total volume is 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 is 1.018 billion board feet Doyle scale (6,606 bdft/acre). White oak and yellow poplar are the most voluminous species, with 176.9 million board feet (MMBF) and 176.6 MMBF or 17% each, followed by chestnut oak and black oak, with 123.1 and 108.2 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 is estimated that 472.5 MMBF of the total net sawtimber volume is grade 1 and 263.6 and 191.4 MMBF in grades 2 and 3, respectively (Figure 2). Ninety-nine percent of the sawtimber volume of trees had 0-10% cull deductions.



Standing Dead Trees

There are an estimated 1.6 million standing dead trees 5 inches d.b.h. and greater. The individual species with the largest number of standing dead trees is sassafras, with 252,501 stems. Ashes are second, with 199,374 standing dead trees, with Chestnut oak, White oak, and Eastern redcedar following with 155,345, 128,983, and 121,351 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 1.6 million standing dead trees, 793,086 had a diameter from 5-9 inches d.b.h., 546,032 are from 9-15 inches d.b.h., 179,514 are from 15-19 inches d.b.h., and the remaining 111,367 are 19 inches d.b.h. and greater (Table 11).

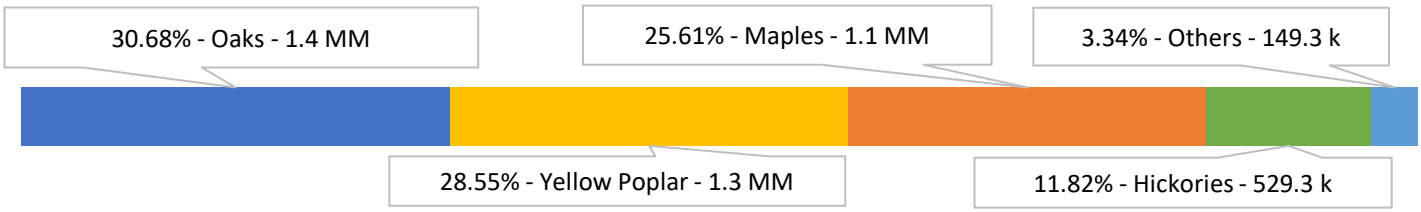
CHANGE ATTRIBUTES

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 and except for an occasional new install plot (due to land acquisition), most plots are now being re-measured.

Growth

Net growth is defined as the gross or total growth minus the 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, is 4.48 million cubic feet per year. Hardwoods grew 4.28 million cuft/year (96%) of the total growth, while cedar and pines merely netted 193,576 cuft/year. The hardwood growth distribution with respect to total growth is illustrated below (Figure C) (Table 5).

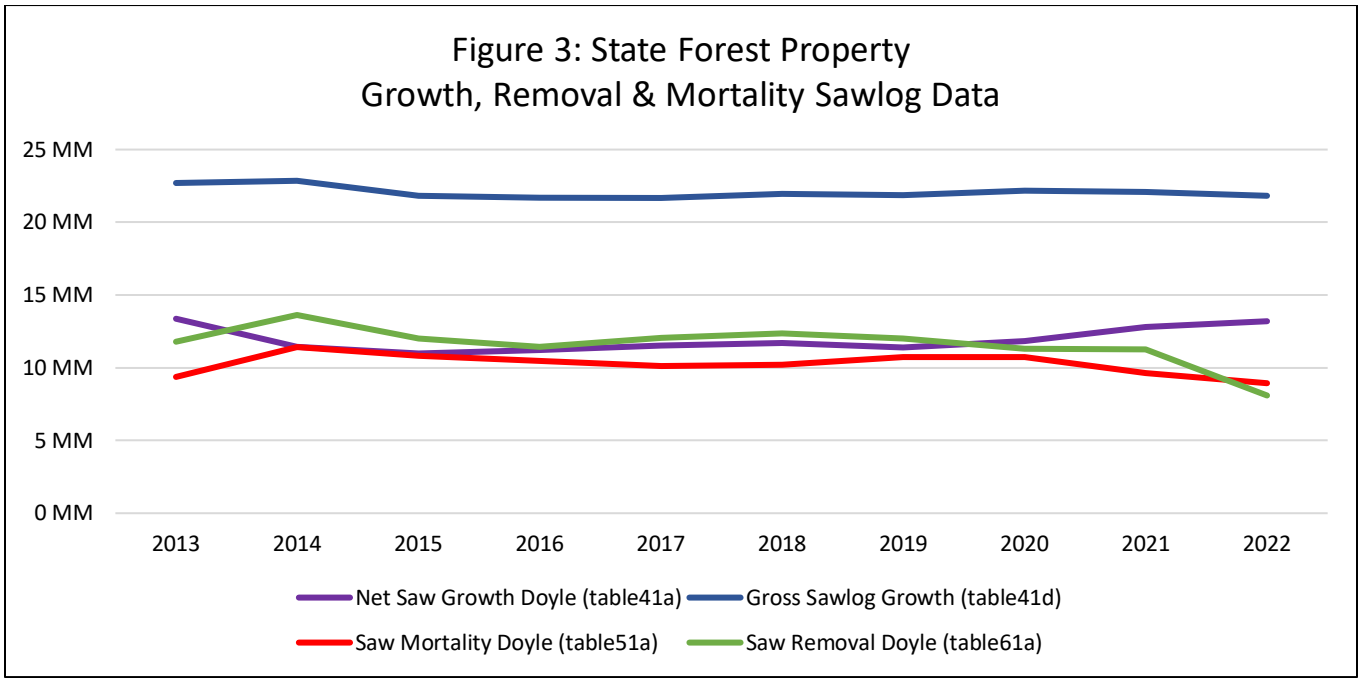
Figure C: Hardwood Growth distribution (cubic feet - cuft)



Species or species groups showing negative growth (a negative growth value would mean that mortality is larger than the gross growth) included ashes, black cherry, elms, aspens, and sassafras. Approximately 1.26 million cuft or 28% of the growth is in pole-size trees (trees <11 inches d.b.h.), with the remainder being sawlog-size (11 inches and greater d.b.h.).

Looking at sawlog-size average annual *total* volume growth, trees collectively grew an average of 21.8 million board feet Doyle annually. Hardwoods grew 20.3 million bdft/year, while cedar and pines grew 1.6 million bdft/year. Oaks constitutes 9.0 million bdft (41%), Yellow poplar is 4.4 million bdft (20%), Maples are 2.4 million bdft (11%), and Hickories are 1.7 million bdft (8%) of the total growth (Table 6).

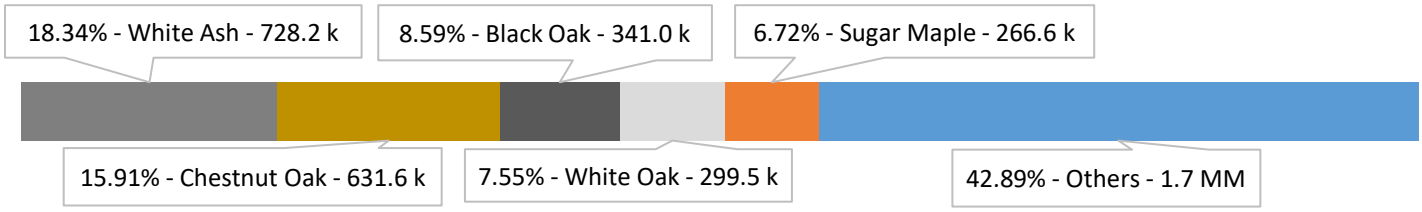
Historically sawlog growth was about 23 million bdft/year prior to the onset of EAB and the 2012 drought. Since then, this increased mortality (discussed below – Figure 3) has diminished growth until recently as depicted in Figure 3. It can be observed that there is an increase in the saw growth as saw mortality and removal has decreased.



Mortality

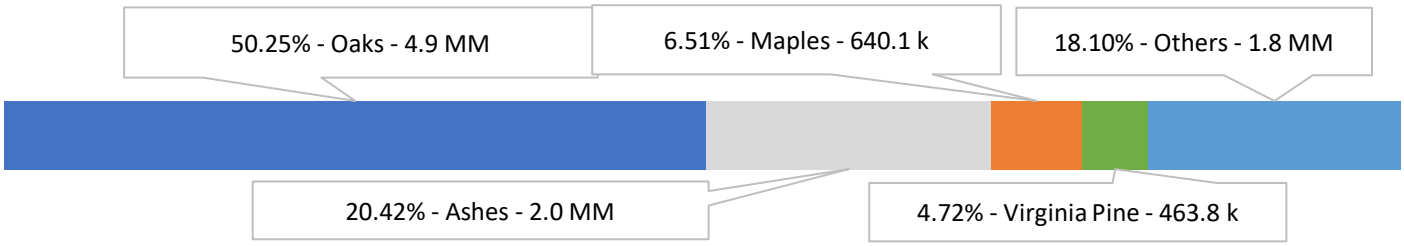
The average annual volume mortality of all trees is 3.97 million cuft per year. Hardwoods accounted for 3.7 million cuft/year (92%) of the total mortality with Oak species accounting for 1.61 million cuft (40%). The hardwood mortality distribution with respect to total mortality is illustrated below (Figure D.1) (Table 7).

Figure D.1: Hardwood Mortality distribution (cubic feet - cuft)



Similarly, looking at sawlog-sized volume mortality, forests lost an average of 9.8 million board feet Doyle annually. Hardwoods accounted for 9 million bdft/year (92%) and its distribution is illustrated below (Figure D.2) (Table 8).

Figure D.2: Sawlog Volume Mortatility distribution (board feet - bdft)



Mortality would 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 emerald ash borer. Ash will continue to increase in mortality loss as this invasive pest continues to spread. Other high mortalities, however, are more complex.

Several possible factors such as intermittent droughts over the last 20 years (with the latest severe drought 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.

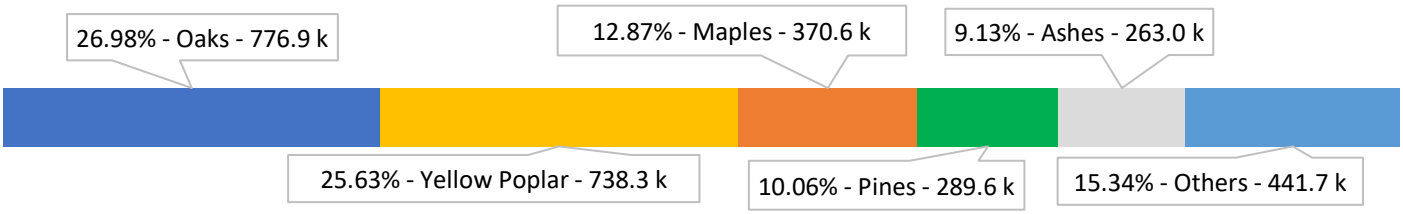
Softwoods, planted in the past for quick soil stability of eroded and abandoned farm fields, are at or past their age of maturity and will continue to decline. Yellow poplar will always be susceptible to extreme drought conditions on certain sites. Many of our oaks are nearing their maturity age. Trees 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 around half 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

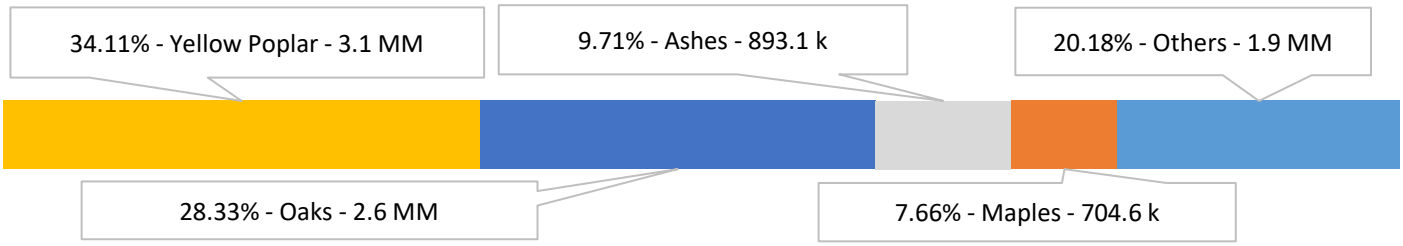
The average annual volume removals of all trees are 2.9 million cuft per year. Hardwoods accounts for nearly 2.6 million cuft/year (90%) of the total removals and the removal distribution is illustrated below (Figure E) (Table 9).

Figure E.1: Removal distribution (cubic feet - cuft)



Similarly, looking at average sawlog-sized volume removals over the 5-year period, 9.2 million board feet Doyle is removed annually. Hardwoods accounts for 8.3 million bdft/year and its distribution is illustrated below (Figure E.2) (Table 10).

Figure E.2: Sawlog Volume Removal distribution (board feet - bdft)



ANCILLARY DATA ITEMS

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 153,260 forested acres to estimate a total area that each invasive species occupies. Some plots may have multiple species present, while most plots are free from invasive species. There are an estimated 9,364 cumulative acres (about 6.1%) with invasive species present. Japanese (vine) honeysuckle, creeping jenny, and glossy buckthorn are the most prevalent invasive species, covering approximately 2,920 (1.9%), 1705 (1.1%), and 1,517 (1.0%) acres, respectively.

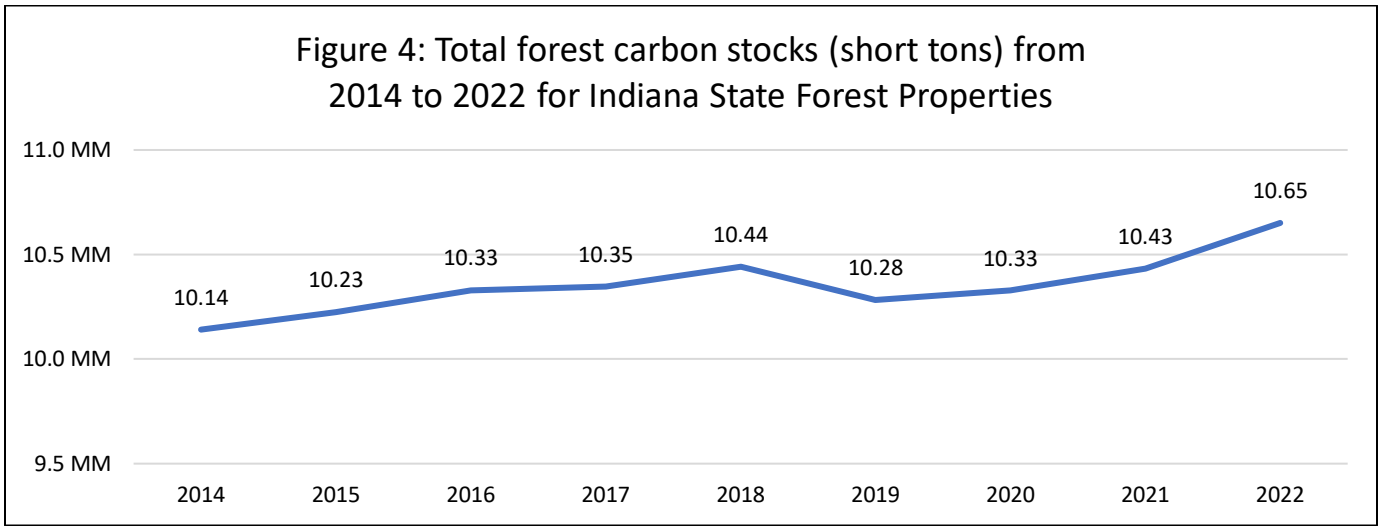
Carbon

Carbon uptake and storage are a few of the many ecosystem services provided by forests. Carbon cycles through living organisms. Carbon dioxide (CO_2) is a gaseous component of the earth's atmosphere that plays several vital roles in the environment. Being a carbon source for plants is one of those roles. Through a process called photosynthesis, plants and photosynthetic algae and bacteria use energy from sunlight to combine CO_2 from the atmosphere with water to form carbohydrates. These carbohydrates are carbon-based sugars necessary for tree functioning and to make wood for growth. Every part of a tree stores carbon, including the trunks, branches, leaves, and roots. While the chemical composition of trees varies from species to species, by weight, trees are about 50% carbon.

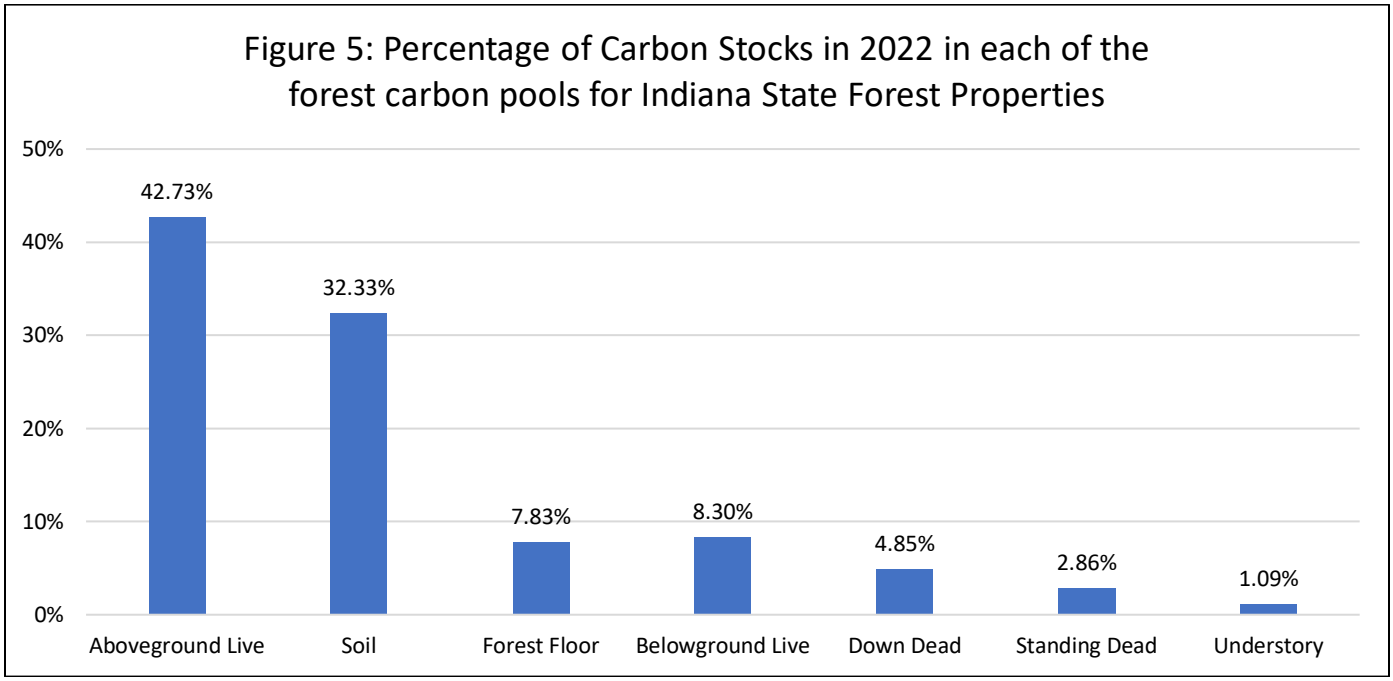
Carbon is also found in soils. Carbon in soils come from the organic matter from trees and other vegetation in varying degrees of decomposition. In fact, soil carbon represents about 50% of the total carbon stored in forest systems in the United States. Soils release carbon dioxide when soil microbes break down organic matter. Some soil carbon can decompose in hours or days, but most resides in soils for decades or centuries. In some conditions, carbon resides in soils for thousands of years before fully decomposing. Soil carbon is generally considered very stable, meaning it does not change much or quickly in response to vegetation dynamics.

Because forests are naturally dynamic systems, the carbon contained within forests is always changing. On the scale of minutes, forests can simultaneously take up and store carbon through photosynthesis and release carbon as cells in trees respire, and soils release carbon through decomposition by soil microbes. Over months and years, the balance uptake and loss of carbon in a forest determines whether the forest is gaining or losing carbon stocks. The amount of carbon uptake and storage depends on the growing conditions and species of the trees in each system. For example, in some temperate forests, a warm and wet climate can support forests that grow quickly and store a great deal of carbon. The opposite might be true of forests with a cold and dry climate. Younger forests generally take up and store carbon at greater rates than older forests.

CFI data has begun to provide carbon estimates for the Indiana State Forest system lands. We will be able to use this as baseline data and monitor carbon estimate trends over time. Early data indicates that annual carbon stock estimates are consistent or perhaps even showing a slight steady increase since the inception of carbon measurements (2014) at 10.5 million short tons (Figure 4).



In 2022 about 42.73% of the forest carbon stocks on the Indiana State Forests are stored in the aboveground portion of live trees, which includes all live woody vegetation at least 1 inch in diameter (Figure 5). The soil carbon pool, which consists of organic material in the mineral soil to a depth of 1 meter (excluding roots), is the second largest carbon pool, storing another 32.33% of the forest carbon stocks. The remaining forest carbon stocks can be found in the forest floor (litter), belowground portion of live trees, down dead material, standing dead trees, and the understory.



For further discussion of carbon stocks on Indiana State Forests, explore the report titled Forest Carbon Assessment for Indiana State Forest Properties at https://www.in.gov/dnr/forestry/files/fw-carbon_assessment.pdf

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 USDA Forest Service Forest Inventory and Analysis (FIA) program was chosen to mirror 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 2018-2022 data, and the 2012-2017 data has been dropped from the total estimate calculations, however, are still used in the change data (growth, removal, and mortality). 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. 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 20.0 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 2017 through 2021 (last year's report), 2018 through 2022 (this year's report) and so on.

Field plots of the inventory consist of installing and measuring of 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 ($1/24^{th}$ acre) circular subplot with the offset 6.8-foot-radius (1/300 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 9.1) will suffice and is readily available online at https://www.fia.fs.usda.gov/library/field-guides-methods-proc/docs/2022/core_ver9-2_9_2022_SW_HW%20table_rev_12_13_2022.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 3,922 plots located randomly across those lands managed by the DoF (a total area of 159,146 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 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 the chances are two out of three that if a 100% inventory has 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, which 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 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

Disclaimer:

All the above tables have estimates which are rounded to the nearest value due to which the values may not add up to the total value as shown in the tables.

Table 1 - Area of forest land (acres) by forest type group and stand size class, State Forest properties, 2018-2022.

Forest type	Stand-size	Large diameter	Medium diameter	Small diameter	Nonstocked
All	153,260	120,676	11,485	17,069	4,030
Other miscellaneous hardwood forest types	27,908	14,903	3,412	5,562	4,030
White oak / red oak / hickory	27,172	23,011	1,917	2,244	-
White oak	22,824	22,619	123	82	-
Chestnut oak	15,665	15,170	326	170	-
Yellow-poplar	12,059	8,336	1,471	2,251	-
Hard maple / basswood	7,458	5,851	1,005	602	-
Mixed upland hardwoods	7,359	4,661	1,028	1,670	-
Sugar maple / beech / yellow birch	7,067	5,723	809	535	-
Cherry / white ash / yellow-poplar	6,445	2,260	645	3,539	-
Miscellaneous softwood forest types	5,783	5,459	200	123	-
Chestnut oak / black oak / scarlet oak	5,782	5,351	266	165	-
Northern red oak	5,345	5,345	-	-	-
Pine/Hardwood	2,394	1,988	282	123	-

Table 2 - Number of all live trees (trees) by species and diameter class, State Forest properties, 2018-2022.

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	62,945,644	36,760,378	10,148,317	4,168,168	2,740,373	1,933,525	1,639,405	1,364,635	1,122,637	984,427	719,850	554,377	809,554
American beech	13,723,052	10,458,052	2,172,707	501,074	205,763	132,728	76,219	49,136	27,473	22,485	22,577	20,568	34,269
sugar maple	11,745,486	5,761,192	2,697,069	1,274,419	802,000	474,900	300,894	183,910	100,463	76,611	32,663	24,570	16,795
other hardwood species	6,035,207	4,334,303	844,127	266,851	145,660	105,685	89,572	79,479	50,292	39,190	20,281	26,532	33,234
yellow-poplar	5,345,636	3,337,866	707,622	263,593	183,603	131,785	116,628	118,393	109,040	100,974	75,173	65,166	135,794
red maple	4,494,799	2,131,171	932,129	536,422	359,784	184,001	130,745	85,713	51,076	34,644	12,905	19,548	16,663
sassafras	2,580,849	1,689,957	452,253	160,619	90,293	82,711	57,972	27,494	9,804	7,806	979	-	960
redcedar and pine species	2,230,993	864,700	266,430	187,571	176,334	184,861	171,545	129,584	99,498	55,974	41,835	34,775	17,886
other oaks	2,299,539	810,641	243,542	94,391	96,817	87,324	106,098	118,826	127,282	146,265	133,438	114,434	220,472
eastern hophornbeam	2,056,128	1,882,533	148,161	20,545	3,904	984	-	-	-	-	-	-	-
white oak	1,908,779	360,251	61,327	87,761	115,272	127,561	156,547	160,053	181,305	179,530	168,583	120,343	190,245
blackgum	1,653,605	869,621	359,062	196,404	112,653	39,599	30,083	17,710	10,693	11,820	974	2,900	2,087
chestnut oak	1,531,235	159,901	98,588	72,681	91,465	98,808	153,096	181,029	171,769	182,929	133,109	98,245	89,614
ash species	1,471,342	1,193,820	111,411	54,693	25,395	17,629	12,857	13,018	16,436	5,694	11,604	2,883	5,902
flowering dogwood	1,309,613	966,035	296,008	43,651	3,919	-	-	-	-	-	-	-	-
pignut hickory	1,266,593	381,266	180,868	107,036	96,053	112,207	103,294	73,758	74,569	64,260	35,259	14,722	23,300
American elm	931,905	455,700	296,372	86,191	47,735	23,377	11,879	4,805	2,957	1,977	911	-	-
other hickories	813,843	273,987	85,031	77,074	75,037	51,538	56,096	71,999	54,307	34,299	20,882	3,887	9,708
black cherry	676,530	355,965	110,546	54,763	46,482	31,186	37,893	16,971	6,987	4,910	4,896	2,004	3,927
other elms	519,697	342,175	61,158	56,083	27,962	12,672	8,791	4,965	2,903	2,003	-	-	986
black walnut	350,813	131,240	23,906	26,349	34,242	33,969	19,195	27,791	25,781	13,055	3,780	3,797	7,709

Table 3 - Net volume (cuft) of all live trees by species and diameter class, State Forest properties, 2018-2022.

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	349,394,919	9,778,263	14,221,213	18,447,378	25,398,573	31,628,119	36,790,900	43,302,505	40,913,186	39,754,063	89,160,720
white oak	55,987,386	204,620	599,709	1,172,287	2,326,469	3,496,319	5,553,158	7,380,812	8,928,430	7,987,319	18,338,263
yellow-poplar	49,025,602	690,074	1,070,414	1,432,690	2,090,762	3,306,606	4,291,515	5,502,120	5,435,058	5,873,736	19,332,627
chestnut oak	39,328,833	167,674	440,091	864,744	2,093,258	3,640,732	4,833,201	6,910,595	6,580,654	6,013,721	7,784,163
sugar maple	35,067,957	3,300,315	4,449,476	4,856,237	5,038,641	4,633,128	3,550,172	3,589,316	2,049,427	1,901,350	1,699,894
black oak	30,416,409	68,261	149,156	248,455	712,081	1,095,122	1,897,655	3,104,010	4,180,140	4,739,642	14,221,887
redcedar and pine species	21,191,739	406,128	852,605	1,640,908	2,521,295	2,911,859	3,299,530	2,493,228	2,529,384	2,650,702	1,886,101
northern red oak	17,961,406	76,420	180,763	285,514	382,959	853,420	1,066,542	1,963,972	2,181,074	2,440,203	8,530,538
pignut hickory	16,919,987	247,249	493,077	1,116,768	1,702,130	1,804,170	2,673,723	3,126,940	2,193,978	1,162,341	2,399,611
red maple	16,192,773	1,289,844	1,910,233	1,757,032	2,063,402	1,957,516	1,696,807	1,546,797	776,876	1,381,258	1,813,008
American beech	14,131,893	1,129,717	1,024,416	1,255,132	1,173,141	1,095,827	851,309	982,980	1,322,651	1,520,855	3,775,864
other hardwood species	11,970,239	880,995	988,267	975,304	1,296,158	1,690,150	1,183,061	1,507,285	448,605	1,207,911	1,792,504
other hickories	9,866,041	193,031	412,451	518,687	924,231	1,781,356	1,865,496	1,615,598	1,313,440	302,923	938,825
American sycamore	7,614,854	103,218	126,211	199,636	316,187	532,829	758,684	869,219	639,537	1,007,201	3,062,130
other oaks	7,243,839	79,943	172,200	283,518	488,283	701,429	1,100,968	1,168,450	988,640	825,770	1,434,636
black walnut	3,885,121	59,160	168,024	308,205	295,835	603,106	744,347	522,606	188,453	251,860	743,525
sassafras	3,410,248	309,595	395,480	672,780	770,286	547,294	291,257	324,529	56,211	-	42,816
ash species	3,161,298	117,091	120,234	170,682	208,790	323,899	551,410	270,375	625,811	216,664	556,341
black cherry	2,698,519	111,392	206,230	263,951	532,453	364,292	217,885	191,481	287,738	155,758	367,338
elms	1,900,892	283,385	351,636	291,869	289,110	219,611	171,373	146,300	35,246	-	112,360
other maples	1,419,887	60,153	110,537	132,977	173,101	69,453	192,806	85,891	151,831	114,851	328,287

Table 4 - Sawtimber volume (bdft – Doyle) of all live trees by species and diameter class, State Forest properties, 2018-2022.

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	1,018,889,004	1,875,269	47,797,868	75,562,289	103,639,945	136,365,374	141,044,217	145,227,154	367,376,888
yellow-poplar	176,608,832	-	4,101,965	8,420,465	12,851,789	18,557,254	20,360,582	23,219,350	89,097,426
white oak	176,958,562	-	4,657,408	8,415,286	15,308,614	22,437,416	28,920,752	27,654,449	69,564,635
chestnut oak	123,098,508	-	4,079,867	8,855,808	13,683,974	21,215,523	22,039,446	21,924,524	31,299,366
black oak	108,235,786	-	1,372,786	2,614,911	5,405,903	9,867,724	13,933,962	17,728,635	57,311,865
northern red oak	66,833,462	-	773,178	2,157,476	3,111,118	6,389,828	7,706,227	9,305,358	37,390,277
sugar maple	59,390,121	-	9,458,615	10,705,597	9,436,100	10,818,464	6,935,270	6,254,003	5,782,072
pignut hickory	48,433,843	-	3,396,669	4,487,749	7,800,826	10,199,053	7,817,466	4,512,202	10,219,878
other hardwood species	35,487,809	-	3,958,560	5,406,125	4,604,653	6,163,289	2,064,425	4,574,698	8,716,062
eastern white pine	35,066,395	196,339	948,732	1,805,326	4,677,482	4,730,605	6,132,063	10,354,423	6,221,425
American beech	32,662,424	-	2,199,781	2,639,611	2,201,935	2,860,396	4,368,233	4,417,848	13,974,621
red maple	26,993,776	-	3,386,255	3,898,747	3,886,411	4,022,600	2,431,451	3,917,776	5,450,535
American sycamore	26,434,213	-	592,105	1,265,087	2,074,823	2,728,652	1,918,654	3,766,868	14,088,025
other oaks	21,298,602	-	910,298	1,451,317	3,052,132	3,588,337	3,400,394	3,065,057	5,831,068
Virginia pine	19,619,899	831,668	2,191,983	4,037,809	4,503,286	3,515,765	3,404,042	659,724	475,622
shagbark hickory	17,751,215	-	1,270,769	3,056,837	3,688,146	3,511,087	2,913,168	572,619	2,738,590
other pines and redcedar	12,219,188	847,262	2,068,169	2,164,996	1,644,245	1,243,415	1,417,067	474,412	2,359,618
black walnut	9,994,625	-	591,109	1,436,353	2,043,489	1,539,318	636,437	905,345	2,842,574
ash species	8,529,086	-	372,443	716,350	1,520,443	842,859	2,043,413	806,580	2,226,998
other hickories	8,227,839	-	578,617	1,269,933	1,637,343	1,648,851	1,683,458	584,606	825,031
black cherry	5,044,819	-	888,560	756,506	507,232	484,938	917,707	528,677	961,199

Table 5 - Net growth (cuft per year) of all live trees by species and diameter class, State Forest properties, 2018-2022.

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	4,477,626	609,358	333,587	317,589	374,308	434,727	461,648	318,998	515,381	512,307	890,682
yellow-poplar	1,278,351	73,527	61,694	49,625	72,249	98,312	115,451	159,733	135,180	150,808	358,957
white oak	698,408	6,240	7,129	15,964	31,674	59,366	101,345	95,697	133,027	59,214	196,219
sugar maple	676,876	186,471	129,438	137,110	109,197	78,571	51,555	14,083	-23,932	26,399	-16,991
red maple	438,742	91,429	59,614	43,635	53,356	40,942	48,961	41,214	19,319	29,029	27,469
pignut hickory	371,810	8,050	6,421	28,357	41,290	49,082	61,630	69,400	42,111	23,774	41,472
black oak	309,080	3,087	2,511	5,092	14,824	11,824	17,691	5,332	101,616	57,060	126,671
American beech	299,670	118,332	48,166	46,183	33,342	35,356	15,555	-11,290	20,343	-3,527	15,140
northern red oak	202,874	2,337	5,811	4,612	-9,962	-4,116	11,789	16,147	30,961	46,732	134,999
redcedar and pine species	193,576	19,114	-3,400	-11,489	4,722	9,519	33,345	8,553	49,838	62,340	42,751
American sycamore	171,898	8,037	6,691	6,943	7,045	16,466	20,542	25,035	15,811	21,774	61,140
other hardwood species	132,716	51,564	19,483	15,221	25,210	29,346	12,493	-10,143	-6,563	14,307	3,686
shagbark hickory	118,206	4,007	5,736	8,742	7,856	27,703	28,131	22,391	2,016	2,771	10,810
other oaks	82,091	5,518	4,499	4,370	13,063	3,763	18,583	11,170	22,686	1,957	3,224
chestnut oak	81,501	1,820	2,128	1,438	-483	1,780	494	39,900	20,790	16,056	48,181
black walnut	61,457	2,703	6,924	9,003	7,581	8,401	18,654	1,867	4,367	6,986	-773
other hickories	39,326	2,759	1,701	4,016	6,978	8,336	-2,742	1,803	8,746	1,452	6,279
other maples	31,014	4,835	2,008	-3,199	4,744	1,763	5,929	1,018	3,942	6,026	4,421
elms	-179	17,025	-2,219	899	-537	1,308	-3,860	956	-13,535	0	2,003
sassafras	-12,261	6,817	-12,379	-5,353	-3,203	15,222	-8,593	6,529	1,937	-	-7,152
black cherry	-27,527	2,583	3,731	7,447	9,925	2,840	-7,159	-15,313	8,535	2,063	-38,160
ash species	-669,997	-6,897	-22,098	-51,025	-54,561	-61,054	-78,143	-165,085	-61,813	-12,915	-129,663

Table 6 - Total growth (bdft per year – DOYLE) of sawtimber by species and diameter class, State Forest properties, 2018-2022.

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	21,898,305	82,343	3,095,523	1,972,586	2,409,039	2,875,310	2,876,024	2,865,652	5,721,828
yellow-poplar	4,444,610	-	425,321	330,176	439,039	558,377	507,014	606,217	1,578,466
white oak	2,939,819	-	235,214	182,047	298,124	414,254	491,019	444,645	874,518
chestnut oak	2,183,451	-	250,012	170,455	258,573	340,947	378,380	332,735	452,350
black oak	1,985,702	-	105,761	63,712	128,347	207,480	282,748	323,373	874,281
sugar maple	1,499,132	-	594,148	244,335	188,402	175,436	107,929	105,768	83,114
northern red oak	1,444,619	-	83,901	72,350	85,021	161,456	183,596	217,261	641,034
pignut hickory	1,155,223	-	218,413	122,948	178,913	224,123	148,413	90,125	172,287
eastern white pine	880,562	11,845	20,880	36,845	95,902	99,472	222,108	249,900	143,611
red maple	866,947	-	278,989	133,316	110,932	101,571	56,740	100,049	85,350
other hardwood species	864,794	-	259,375	141,376	85,532	112,781	51,041	112,971	101,715
American beech	700,158	-	207,254	90,272	51,626	56,626	74,893	71,566	147,920
American sycamore	582,598	-	38,547	40,451	58,215	81,252	44,176	76,988	242,968
other oaks	461,697	-	55,187	34,154	68,403	78,413	73,263	60,700	91,577
Virginia pine	409,522	33,316	53,066	92,502	103,637	61,264	51,976	12,953	807
shagbark hickory	376,576	-	58,446	66,509	78,820	70,044	48,740	10,282	43,735
other pines and redcedar	292,075	37,181	30,351	39,764	36,299	37,475	47,429	7,393	56,183
black walnut	218,377	-	24,500	42,425	50,054	28,460	13,444	22,026	37,469
other hickories	184,576	-	36,029	24,409	35,901	34,726	30,538	5,441	17,531
ash species	179,625	-	14,199	15,081	32,765	17,600	37,195	8,896	53,887
black cherry	155,923	-	63,736	18,295	14,059	11,002	25,380	6,363	17,089
elm species	72,318	-	42,191	11,165	10,472	2,552	0	0	5,937

Table 7 - Mortality (cuft per year) of all live trees by species and diameter class, State Forest properties, 2018-2022.

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	3,969,687	152,762	206,238	271,416	310,898	370,705	414,882	634,999	361,452	263,858	635,543
white ash	728,152	14,733	26,952	50,819	55,156	67,562	89,437	156,717	73,492	14,794	147,001
chestnut oak	631,584	5,481	8,251	18,364	47,908	69,862	96,396	78,111	98,872	78,224	77,562
black oak	341,029	2,745	3,074	1,715	5,793	15,282	29,977	69,471	-	38,200	133,590
white oak	299,543	5,116	8,446	10,827	17,051	20,140	11,043	52,207	33,715	56,338	75,813
other hardwood species	275,539	19,179	16,775	17,046	16,605	28,945	7,797	51,093	20,691	15,141	34,877
sugar maple	266,586	18,109	14,485	14,595	20,686	19,773	21,128	46,118	59,334	-	33,511
northern red oak	241,345	3,373	-	4,931	23,049	34,932	18,982	37,317	24,627	15,306	39,463
Virginia pine	152,500	2,715	11,569	12,384	20,941	23,124	27,936	35,962	11,641	-	-
sassafras	121,523	17,113	29,934	25,705	22,194	-	15,582	-	-	-	-
American beech	115,769	3,592	1,559	6,681	4,770	-	-	27,677	-	29,228	23,416
black cherry	115,533	7,759	3,287	3,634	7,843	6,092	15,082	20,187	-	-	46,223
yellow-poplar	113,453	10,428	13,068	31,162	12,179	18,237	28,379	-	-	-	-
red maple	111,748	16,852	25,916	12,303	9,146	15,860	-	-	-	-	-
elms	81,272	10,685	16,607	11,833	11,951	5,102	8,771	-	13,725	-	-
eastern white pine	92,754	1,087	1,335	4,262	12,005	24,866	8,103	9,023	12,826	-	-
scarlet oak	64,322	-	2,283	-	-	8,297	7,092	16,511	-	-	24,088
other ashes	63,324	4,764	3,470	9,434	9,109	4,698	6,006	25,181	-	-	-
redcedar and pine species	53,753	5,769	11,049	22,825	10,033	3,476	-	-	-	-	-
hickories	52,704	2,300	4,708	-	4,477	-	16,099	9,425	12,527	-	-
other oaks	27,037	471	757	3,496	-	4,456	-	-	-	16,626	-
other maples	20,218	492	2,711	9,400	-	-	7,073	-	-	-	-

Table 8 – Mortality (bdft per year – DOYLE) of sawtimber by species and diameter class, State Forest properties, 2018-2022.

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	9,826,494	67,959	565,103	921,394	1,158,392	2,082,021	1,266,130	1,006,313	2,759,181
white ash	1,884,429	-	91,217	145,796	244,444	428,343	247,972	54,374	672,283
chestnut oak	1,873,125	-	97,265	166,518	271,654	290,051	334,396	333,544	379,696
black oak	1,150,298	-	17,400	49,891	85,274	219,586	-	140,887	637,260
white oak	874,281	-	30,689	49,269	30,562	184,653	108,622	194,797	275,689
northern red oak	755,433	-	40,949	87,829	55,113	120,218	86,176	114,760	250,387
sugar maple	560,235	-	40,949	54,150	48,349	116,393	150,357	-	150,036
other hardwoods	548,751	-	34,829	81,626	22,716	191,438	106,644	60,121	51,379
Virginia pine	463,752	24,059	51,412	85,797	101,982	146,536	53,966	-	-
eastern white pine	296,536	6,700	27,378	72,483	27,676	108,278	54,021	-	-
American beech	266,447	-	-	-	-	87,578	-	107,830	71,040
black cherry	260,532	-	9,862	13,878	39,051	27,735	-	-	170,006
scarlet oak	213,113	-	-	20,787	37,941	52,981	-	-	101,405
yellow-poplar	143,420	-	25,057	47,529	70,835	-	-	-	-
other ashes	121,936	-	17,015	10,961	16,346	77,615	-	-	-
red maple	79,907	-	5,158	34,882	-	-	39,866	-	-
bitternut hickory	77,402	-	-	-	46,785	30,618	-	-	-
sassafras	72,878	-	37,139	-	35,738	-	-	-	-
elms	71,616	-	6,498	-	23,924	-	41,193	-	-
shagbark hickory	51,806	-	8,890	-	-	-	42,916	-	-
red pine	47,075	29,303	17,773	-	-	-	-	-	-
other pines and redcedar	13,520	7,898	5,622	-	-	-	-	-	-

Table 9 - Removals (cuft per year) of all live trees by species and diameter class, State Forest properties, 2018-2022.

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	2,880,161	52,388	62,055	82,740	127,148	214,082	256,068	200,646	383,723	196,188	920,587
yellow-poplar	738,279	914	8,453	13,251	8,269	33,249	16,152	21,550	42,534	35,321	43,119
black oak	305,653	-	-	2,142	3,207	-	33,006	33,770	20,710	67,529	49,676
white ash	254,962	1,517	2,273	4,193	12,178	30,100	27,835	17,997	26,055	-	52,812
other hardwood species	241,390	5,554	7,366	3,283	-	22,718	21,541	27,282	58,273	23,260	582,734
sugar maple	221,403	20,607	14,837	21,482	27,378	23,858	13,818	18,046	10,700	-	37,680
chestnut oak	178,420	473	1,575	1,751	5,488	10,600	41,824	13,725	55,396	23,240	8,139
white oak	157,931	-	3,334	-	8,474	20,329	29,829	7,249	31,226	-	22,467
red maple	149,163	12,501	13,210	7,945	8,305	20,128	15,687	10,989	11,759	-	18,579
Virginia pine	123,435	1,860	2,970	8,672	24,815	16,241	14,846	8,357	11,426	-	34,247
northern red oak	91,396	-	-	-	-	-	-	11,970	-	29,593	17,271
sassafras	88,342	3,591	5,245	3,512	6,061	15,832	14,147	9,801	13,960	-	16,193
redcedar and pine species	85,591	1,198	1,788	6,432	10,744	5,182	12,442	-	25,739	-	-
pignut hickory	85,411	-	1,004	6,313	3,144	5,793	6,811	-	28,271	-	34,075
eastern white pine	80,617	494	-	-	4,096	4,444	8,129	8,781	35,110	-	-
American beech	78,170	3,678	-	3,765	4,989	5,608	-	11,130	12,563	17,245	3,596

Table 10 - Removals (bdft per year – DOYLE) of sawtimber by species and diameter class, State Forest properties, 2018-2022.

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	9,193,787	39,532	284,871	578,486	809,483	701,571	1,361,555	933,575	4,484,716
yellow-poplar	3,135,976	-	17,820	72,554	50,485	71,901	159,236	205,406	2,558,574
black oak	1,103,131	-	6,529	-	94,506	107,711	71,596	334,881	487,908
white ash	864,149	-	18,077	70,790	76,303	29,599	87,980	55,835	525,565
other hardwood species	631,202	-	16,741	63,393	76,177	108,504	194,674	80,914	90,798
chestnut oak	549,554	-	10,950	26,024	115,794	67,026	184,050	83,178	62,531
white oak	456,264	-	17,268	39,556	98,501	72,097	101,133	-	127,709
sugar maple	405,705	-	48,756	82,262	59,605	55,505	35,189	-	124,387
Virginia pine	354,341	28,621	82,154	49,151	104,403	35,358	54,654	-	-
northern red oak	348,442	-	-	-	-	38,413	-	110,427	199,602
eastern white pine	319,219	-	9,150	12,491	27,303	32,884	149,262	-	88,129
red maple	298,878	-	6,072	54,461	39,578	30,726	35,466	-	132,575
pignut hickory	243,281	-	6,437	28,340	42,651	25,595	140,259	-	-
redcedar and pine species	230,483	10,911	34,557	55,579	24,178	-	105,259	-	-
American beech	130,221	-	10,360	14,131	-	-	42,796	62,933	-
black cherry	122,941	-	-	9,752	-	26,253	-	-	86,936

Table 11 - Number of standing dead trees (trees) 5 inches d.b.h. and greater by species and diameter class, State Forest properties, 2018-2022.

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	1,629,999	447,144	345,942	248,896	169,031	128,105	103,157	76,357	48,333	22,696	40,338
sassafras	252,501	118,633	67,194	35,156	12,799	9,889	6,859	986	986	-	-
ashes	199,374	44,427	27,516	29,500	26,592	21,561	14,461	19,751	7,771	1,986	5,811
chestnut oak	155,345	13,773	17,707	23,533	26,467	20,712	17,592	9,842	11,788	7,881	6,050
white oak	128,983	23,189	25,866	12,759	15,725	10,934	10,956	11,958	6,791	2,937	7,868
eastern redcedar	121,351	67,178	26,689	17,717	3,927	4,867	-	-	-	-	974
Virginia pine	103,757	8,782	24,719	23,728	22,902	12,759	8,914	1,953	-	-	-
other hardwoods	79,412	32,133	15,614	15,790	3,894	4,082	1,997	2,944	0	986	1,970
yellow-poplar	79,308	15,617	19,413	12,739	6,854	6,844	9,928	3,066	1,964	-	2,883
sugar maple	78,902	24,767	14,756	12,939	11,693	5,792	2,937	1,944	1,121	984	1,970
red pine	67,985	10,128	26,022	19,020	7,973	3,922	920	-	-	-	-
black oak	65,016	5,868	4,920	4,818	4,934	6,791	10,795	9,922	6,991	4,068	5,907
eastern white pine	48,852	8,051	11,102	11,715	2,947	5,100	2,956	2,913	4,066	-	-
elms	45,767	17,345	14,784	4,837	4,889	1,018	1,929	0	966	0	0
red maple	42,660	16,859	13,977	5,949	1,944	1,939	-	974	-	-	1,018
northern red oak	33,495	2,944	1,969	984	4,927	4,902	4,887	4,084	3,903	1,969	2,927
black locust	29,884	13,043	7,965	3,966	3,926	984	-	-	-	-	-
other oaks	27,460	3,845	11,821	4,904	0	1,963	2,961	986	0	0	979
black cherry	27,125	10,935	6,178	2,943	911	2,924	1,121	1,121	-	-	993
American beech	24,471	6,899	2,943	4,882	1,952	-	979	2,952	993	1,885	986
hickories	14,417	2,732	4,789	0	1,877	1,121	1,946	960	993	0	0
other softwoods	3,934	0	0	1,018	1,897	0	1,018	0	0	0	0

Table 12 – Invasive Cover (acres) by invasive species and site productivity, State Forest properties, 2018-2022.

	Site productivity	225+	165-224	120-164	85-119	50-84	20-49	0-19
Invasive species	9,364	140	88	1,193	3,853	2,792	1,167	97
Japanese honeysuckle	2,920	40	3	379	1,192	930	367	2
creeping jenny	1,705	66	27	260	804	385	160	1
glossy buckthorn	1,517	20	50	181	584	419	194	66
Nepalese browntop	923	5	3	58	253	411	179	11
bull thistle	645	-	2	55	310	176	102	-
multiflora rose	558	-	4	151	232	137	30	2
autumn olive	232	2	-	9	101	71	40	5
European privet	175	2	-	9	123	35	5	-
black locust	127	1	-	16	31	70	-	6
common barberry	123	-	-	8	80	21	13	-
English ivy	83	-	-	3	11	10	56	2
Norway maple	68	3	-	-	26	35	4	-
honeysuckle	51	-	-	-	5	43	3	-
oriental bittersweet	47	-	-	19	12	11	2	-
Texas greeneyes	29	-	-	9	14	3	1	-
common reed	28	-	-	-	28	-	-	-
tree of heaven	24	-	-	1	7	5	11	-
Japanese barberry	18	-	-	9	6	1	1	-
silktree	14	1	-	1	11	-	1	-
garlic mustard	13	-	-	-	5	7	-	-
Amur honeysuckle	12	-	-	9	-	4	-	-
Russian olive	11	-	-	-	-	11	-	-
Amur corktree	8	-	-	4	4	-	-	-
reed canarygrass	7	-	-	-	3	3	1	-
Japanese knotweed	7	-	-	7	-	-	-	-
Bell's honeysuckle	4	-	-	1	-	2	-	-
burning bush	3	-	-	-	2	-	-	-
forest sandmat	3	-	-	-	2	1	-	-
Louis' swallow-wort	2	-	-	-	2	-	-	-
winter creeper	1	-	-	1	-	-	-	-
Callery pear	1	-	-	-	1	-	-	-