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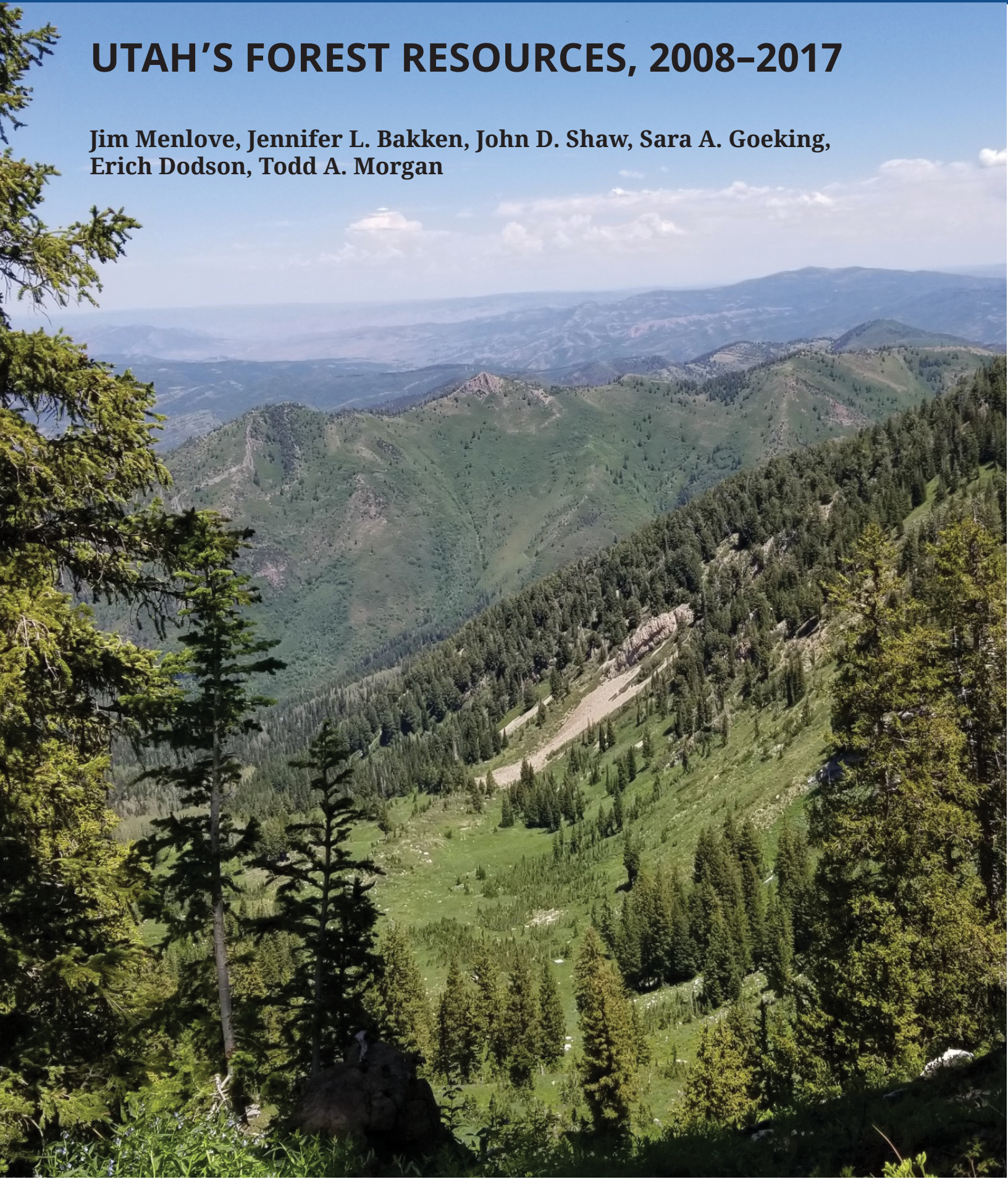
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UTAH'S FOREST RESOURCES, 2008–2017

**Jim Menlove, Jennifer L. Bakken, John D. Shaw, Sara A. Goeking,
Erich Dodson, Todd A. Morgan**



Abstract

This report presents a summary of the most recent Forest Inventory and Analysis (FIA) data of Utah's forests based on field data collected between 2008 and 2017. Many of the results were compared to earlier reports using data from 2000–2005 (DeBlander et al. 2010), and from 2003–2012 (Werstak et al. 2016). Utah's forest land covers 18 million acres, of which 39 percent (7 million acres) are administered by the Bureau of Land Management, U.S. Department of Interior, 35 percent (6.4 million acres) by the Forest Service, U.S. Department of Agriculture, and 15 percent (2.7 million acres) are privately owned. The State's most abundant forest-type group is Pinyon/juniper woodland, which covers 10.5 million acres (58 percent). At 1.1 billion live trees, the Woodland softwoods species group (predominately pinyon and juniper species) is the most common by number of live trees (5.0 inches or greater in diameter), followed by the Cottonwood and aspen species group (231 million live trees). Woodland softwoods make up about 45 percent (6.7 billion cubic feet) of the State's total live tree volume and 46 percent (121 million tons) of the biomass. Utah's forests contain 15 billion cubic feet of net volume in trees 5.0 inches in diameter and larger with an average annual mortality of trees 5.0 inches in diameter or larger totaling 250 million trees per year, and a negative average annual net growth of 41 million trees per year. This report includes descriptive highlights and tables of area, number of trees, biomass, volume, growth, mortality, and removals, as well as trends based on past inventories on forest land. Most sections and tables are organized by forest type or forest-type group, tree species group, diameter class, or owner group.

Keywords: Utah, forest inventory, field data, trees, biomass, growth, mortality

Cover: Gobbler's Knob, Alexander Basin, Mount Olympus Wilderness Area, Uinta-Wasatch-Cache National Forest, Utah (USDA Forest Service photo by Jennifer L. Bakken)

Authors

Jim Menlove (retired) was an Ecologist and a member of the Analysis Team with the Forest Inventory and Analysis Program at the U.S. Department of Agriculture (USDA) Forest Service, Rocky Mountain Research Station, with headquarters in Riverdale, Utah. He holds a B.S. degree in biology from the University of Utah and an M.S. degree in zoology and physiology from the University of Wyoming, both with an emphasis in ecology.

Jennifer L. Bakken (corresponding author) is a Forester and a member of the Analysis Team with the Forest Inventory and Analysis Program at the USDA Forest Service, Rocky Mountain Research Station, with headquarters in Riverdale, Utah. She holds a B.S. and an M.S. degree in forestry from Utah State University. (Contact: jennifer.l.bakken@usda.gov)

John D. Shaw is a Research Forester and a member of the Analysis Team with the Forest Inventory and Analysis Program at the USDA Forest Service, Rocky Mountain Research Station, with headquarters in Riverdale, Utah. He holds a B.S. and an M.S. degree in natural resources management from the University of Alaska Fairbanks, and a Ph.D. in forest ecology from Utah State University.

Sara A. Goeking is a Supervisory Biological Scientist and Deputy Program Manager with the Forest Inventory and Analysis Program at the USDA Forest Service, Rocky Mountain Research Station, with headquarters in Riverdale, Utah. She holds a B.S. degree in environmental science, an M.S. degree in forest ecology, and a Ph.D. in watershed sciences, all from Utah State University.

Erich Dodson is a Forester and a member of the Analysis Team with the Forest Inventory and Analysis Program at the USDA Forest Service, Rocky Mountain Research Station with headquarters in Riverdale, Utah. He holds a B.S. in biology from Trevecca Nazarene University and an M.S. degree in forestry from the University of Montana.

Todd A. Morgan is the Director of the Forest Industry Research Program at The University of Montana's Bureau of Business and Economic Research in Missoula, Montana. He received a B.A. degree in philosophy and a B.S. degree in forest science from Pennsylvania State and an M.S. degree in forestry from the University of Montana.

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INTRODUCTION, METHODS, AND DATA

Introduction

The State of Utah encompasses a wide variety of environments and forest types that are valued for their scenic beauty, wood products, traditional forms of food and shelter, wildlife habitat, and ecological functions. This report contains highlights of the status of Utah's forest resources, with discussions of pertinent issues based on data collected during the 2008 to 2017 evaluation period. This includes 10 years of inventory under the annual Forest Inventory and Analysis (FIA) system (Gillespie 1999).

This chapter briefly describes the implementation of the National FIA sample design in Utah, some basic differences between this inventory and previous FIA inventories of Utah's forests, and specific annual inventory methods. The following chapters will describe an overview of traditional forest attributes measured by the FIA program such as forest land area and wood volume, with specific references comparing previous annual reports of Utah's forest resources; in-depth descriptions of some of the categories of forest land; and descriptions of recent and current impacts on several of Utah's forest tree species. The appendices include supplemental information, including a glossary of terms used in this report, standard forest resource tables, and lists of forest types and tree species found in Utah.

Accessing Utah's Forest Inventory Data

FIA data are publicly available from the FIA website at <https://www.fs.usda.gov/research/programs/fia>. This site includes data downloads; online tools that allow users to perform custom queries; documentation of FIA's field inventory protocols and database structure; and interactive tools for exploring both standard and unique analysis of FIA data. Plot data may be downloaded in table form or summarized using a variety of tools from the FIA data and tools website (<https://www.fs.usda.gov/research/programs/fia#data-and-tools>), and for assistance with FIA data, contact persons listed under Data Consultations and Requests section, near the bottom of the same website. FIA database documentation user guides, including those used for this report (O'Connell et al. 2017), are available from the FIA library at the national FIA website (available at web address: <https://www.fs.usda.gov/research/understory?text=FIADB+Documentation>).

The national FIA database contains data from Utah's 1993 periodic inventory as well as annual forest inventory data, which are updated each year as additional plot measurements are collected. Data collected from each annual inventory plot are assigned an inventory year that corresponds to the year in which the plot was scheduled for measurement on a 10-year remeasurement cycle.

History of Forest Inventory and Analysis in Utah

Prior to implementation of the annual forest inventory in 2000, Utah's forest attributes were estimated from inventories that were conducted over a period of 2 to 5 years and repeated roughly every 10 to 15 years. Because these inventories were conducted periodically, they are referred to as periodic inventories. The most recent periodic inventories of Utah's forest resources were completed in 1978 (Van Hooser 1983) and 1993 (O'Brien 1999). Since the beginning of the annual inventory in Utah in 2000, two previous reports using annual data

have been produced, one using data from 2000–2005 (DeBlander et al. 2010) and one using data from 2003–2012 (Werstak et al. 2016).

Data from new inventories are often compared with data from earlier inventories to quantify forest trends. However, for the comparisons to be valid, the procedures used in the inventories must be compatible. Utah's procedures for past periodic inventories are different enough from present procedures that direct comparisons between them are not recommended. However, DeBlander et al. (2010) compared estimates to those from O'Brien (1999) with explanation of whether changes were actual, or if they were apparent due to inventory differences. Data from annual inventory reports have been collected under the same methodologies and therefore can be used reliably to identify trends between reports. Sections of this report will specifically do so. It should be noted that several definitional changes have been implemented since the 2005 report. Because those changes were made retroactively, some 2005 estimates reported here may be slightly different from those in DeBlander et al. (2010).

Overview of Inventory Methods

The data used to support information on the status and condition of forests in Utah were collected under the Rocky Mountain Research Station's Forest Inventory and Analysis (RMRS-FIA) program. In 1998, the Agricultural Research Extension and Education Reform Act, also known as the Farm Bill, mandated that inventories be conducted throughout the forests of the United States under an annualized system. The annual inventory system includes a systematic national sampling design consisting of one plot per approximately 6,000 acres, a nationally consistent plot configuration with four fixed-radius subplots, and annual measurement of a constant proportion of permanent plots. The inventory strategy for the western United States involves measurement of 10 systematic samples, or subpanels, where one subpanel is completed each year, and all subpanels are measured over a 10-year period. Each subpanel is spatially balanced across the State and is preassigned to be surveyed during a specific calendar year, which is referred to as an inventory year (see Appendix A for standard FIA terminology). The year in which each plot is surveyed is recorded as its measurement year. FIA's statistical sampling and estimation procedures are described in more detail in Bechtold and Patterson (2005). Where error bars are included in this report, they indicate one standard error from the estimated mean, or a 68 percent confidence interval (Bechtold and Patterson 2005).

Initial implementation of the annual inventory system in Utah began in 2000, and this report is based on the aggregated data collected in inventory years 2008 through 2017. Utah's full inventory consists of 9,171 plots of which during the current cycle, 3,103 sampled forest land, 5,720 sampled nonforest or water, and 348 were not sampled for various reasons.

Plot measurement begins when office staff assess plot locations using aerial imagery. Any plot locations that are clearly nonforest (for example: in a lake, parking lot, or agricultural field) are recorded and entered in the database as nonforest, along with their nonforest land use, land cover type, and percent live tree canopy cover. Plot locations that are forested (or potentially forested) are designated for field visit and potential full measurement by field

crews. (When field visit plots are found to be nonforest, the nonforest data information are recorded by field crews.) All plot locations occurring on USDA Forest Service National Forest System land in Region 4 (a large portion of which is in Utah) are field visited regardless of whether they are clearly nonforest or forested. Tree, understory vegetation, down woody material, and other data are collected on both forest and nonforest conditions. This is called the “all condition inventory,” and the nonforest condition data collected in Region 4 are not analyzed in this report.

The FIA field plot layout consists of four subplots (Bechtold and Scott 2005; USDA FS 2016a). The centers of subplots 2, 3, and 4 are located 120 feet from the center of subplot 1 at azimuths of 360, 120, and 240 degrees, respectively (fig. 1). Trees with a diameter (diameter at breast height [d.b.h.] or at root collar [d.r.c.]) of 5.0 inches and larger are measured on a 24-foot radius (1/24 acre) circular subplot. All trees less than 5.0 inches diameter are measured on a 6.8-foot radius (1/300 acre) microplot located 12 feet east of the center of each of the four subplots. Changes in land conditions (forest, nonforest, or water) that occur on the subplots and microplots are recorded and mapped. Those land conditions recorded as forest can be further differentiated by changes in reserved status, ownership group, forest type, stand size class, tree regeneration status, and tree density.

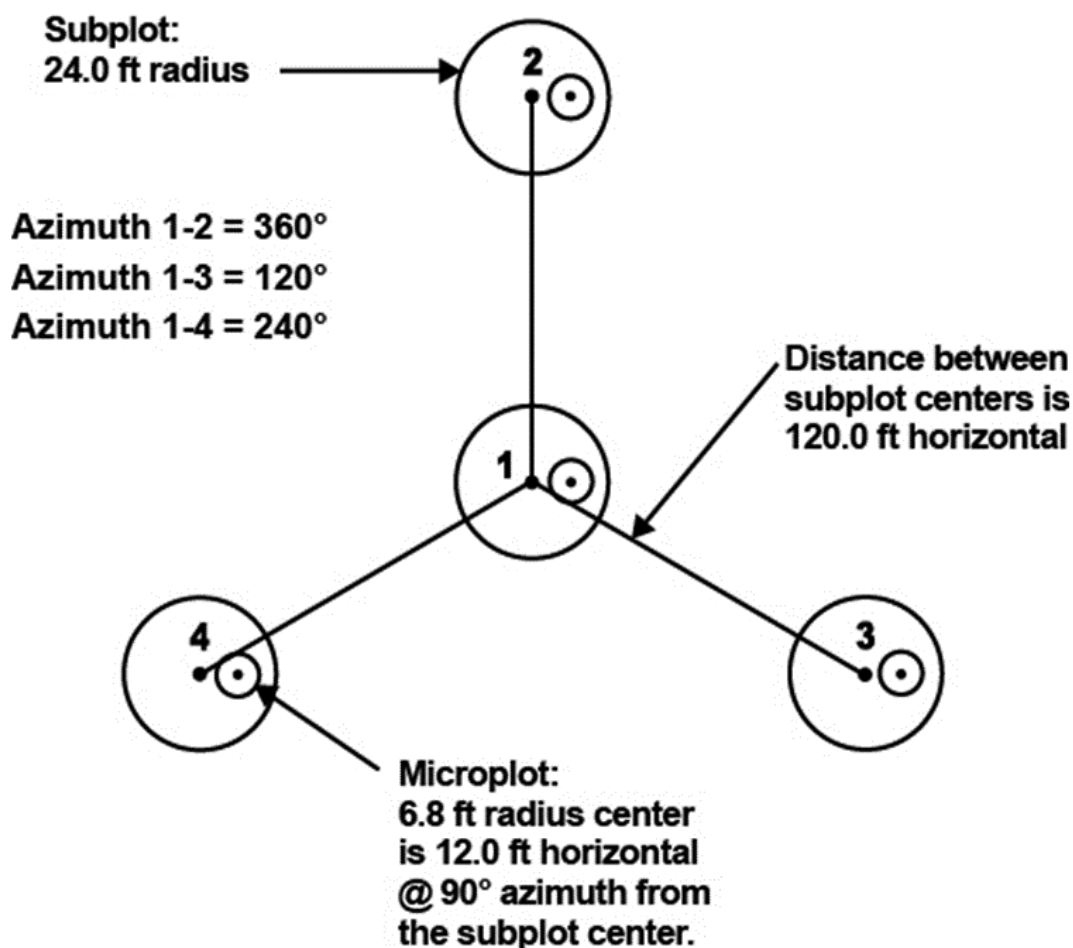


Figure 1—Plot configuration used by the Rocky Mountain Research Station Forest Inventory and Analysis Program.

Details regarding the FIA sampling scheme, plot design, and estimation procedures can be found in Bechtold and Patterson (2005). Specific data collection procedures are described in RMRS-FIA field manuals (USDA FS 2008, 2010, 2011, 2013, 2016a), which are available online at <https://www.fs.usda.gov/rm/ogden/data-collection/field-manuals.shtml>.

Overview of Tables

Estimated values for core FIA attributes are reported for Utah's forests, 2008–2017, in Appendix B, tables B1-B45. These tables show statistics for forest land area, number of trees, wood volume, tree biomass (oven-dry weight), growth, and mortality. Reported estimates in tables and figures are calculated using methods described in Bechtold and Patterson (2005). Sampling errors are at a 68 percent confidence level, or one standard deviation of the estimate. The tables in this report have been updated from those in previous annual reports for Utah and differ in two respects. First, all tables include estimate and sampling error at a 68 percent confidence level for each cell in the table rather than in a separate table. Second, there are tables for many tree-based estimates showing results for standing dead trees. Table B1 is the only table that reports estimates for all land cover types, and it summarizes the proportion of sample plots that were recorded as forest, nonforest, and nonsampled (e.g., due to inaccessibility). All other tables present estimates for only forest land.

This report also contains supplemental tables within the body of the report. To avoid confusion between supplemental tables found in individual report chapters and the standard FIA tables found in Appendix B, supplemental tables in the body of this report are labeled consecutively as they appear, beginning with table 1. Standard tables will be referred to beginning with the Appendix letter followed by the table number (e.g., table B2).

STATUS AND TRENDS OF UTAH'S FORESTS

This chapter summarizes the status of Utah's forests in terms of traditional forest attributes such as forest ownership, forest type, stand age, number of trees, volume, biomass, growth, mortality, and understory vegetation. These attributes will be compared to those from previous FIA reports using annual data (DeBlander et al. 2010; Werstak et al. 2016) to determine significant changes and trends. Nearly all attributes are based directly on FIA plot measurements, except where noted in individual sections. FIA uses a nationally consistent standard for defining different categories of forest land based on reserved status and productivity. These categories were developed for the purpose of separating forest land deemed suitable for timber production from forest land that was either unavailable or not suitable for timber harvesting activity, which includes woodland forest types.

The first division of forest land is unreserved forest land and reserved forest land. Unreserved forest land is considered available for harvesting activity where wood volume can be removed for timber products. Reserved forest land is considered unavailable for any type of wood utilization management practice due to legal designation. It should be noted that a combination of physical and regulatory factors may preclude removal of timber products from unreserved forest land, and timber removal may occasionally be allowed on reserved forest land to meet nontimber management objectives. Both unreserved and reserved forest lands are further divided based on productivity. Unreserved forest land is subdivided into timber land and unproductive forests. Timber land is defined as unreserved forest land capable of producing at least 20 cubic feet per acre per year of wood (at culmination of mean annual increment) from timber species. Unproductive forests, because of some combination of woodland (nontimber) tree species and site conditions, are those not capable of producing 20 cubic feet per acre of commercial-quality wood (see Appendix A for definition details).

Forest Land Area

The State of Utah covers 54.3 million acres of land and water of which 18 million acres (33 percent) are estimated to be forest land, by FIA definitions (table B2). Sixty-four percent of the State is nonforest land and 3 percent is water. Forest land proportions in our previous Utah reports are within 1 percent of the current estimates.

Twenty percent of Utah's forest land, or 3.7 million acres, is classified as timber land (unreserved and productive); 11 percent, 2.1 million acres, is reserved; and 68 percent is other forest land (unreserved and unproductive) (table B2). These proportions have been relatively stable through time (fig. 2). Table B2 also classifies reserved forest land as productive or unproductive. Woodland forest types (Appendix C), a major portion of Utah's forests, are defined as "unproductive" regardless of growth. This is a major contributor to Utah's unproductive forest land. Timber forest types are classed as unproductive forest land if trees do not produce 20 cubic feet per acre per year of wood.

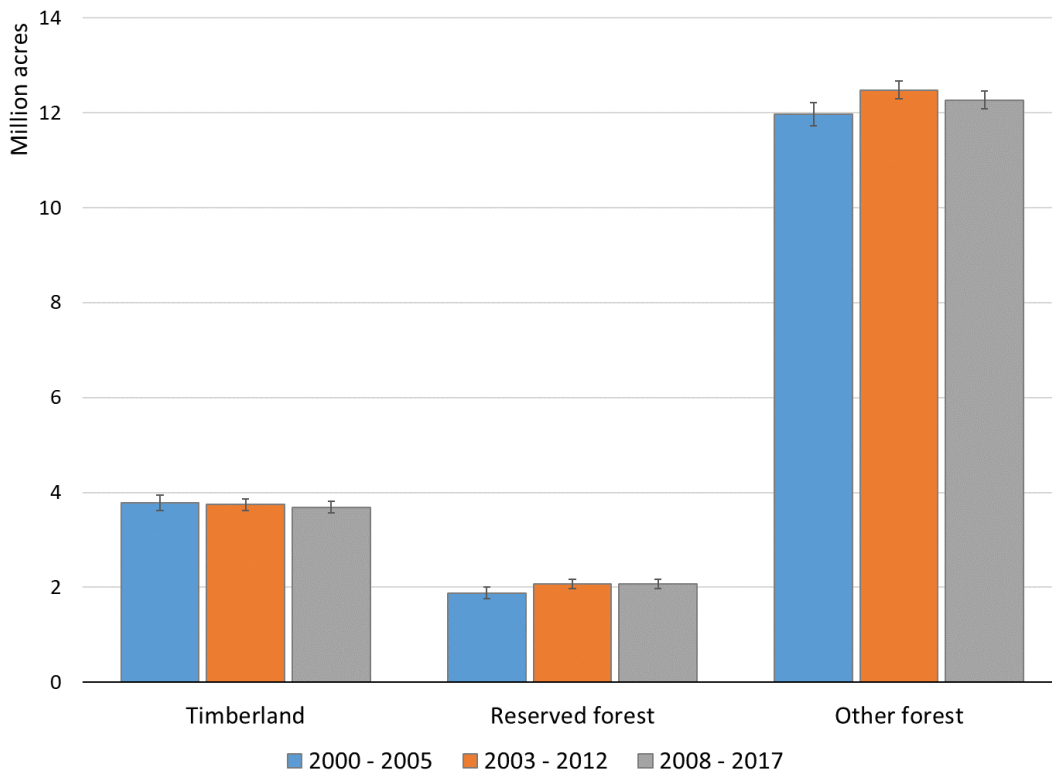


Figure 2—Estimates of forest land area by forest land status in Utah from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

Number of Trees

Estimates of the number of trees are beneficial to a variety of silvicultural, forest health, and habitat management applications. These estimates are typically combined with information about the size and species of the trees to provide meaningful summaries of forest dynamics and stand structure. Younger forest stands usually consist of large numbers of small-diameter trees, whereas older forest stands contain smaller numbers of large-diameter trees. FIA classifies individual tree species into species groups and categorizes each species and species group as either softwood or hardwood, as well as either woodland species or timber species (see Appendix D for tree species group definitions). Note that, like forest-type groups, species groups are aggregated and named at a national level and may have names inconsistent with a State’s forests. For example, the Ponderosa and Jeffrey pines species group in Utah only includes Ponderosa pine, and no Jeffrey pine.

Utah forests contain an estimated 7.0 billion live trees at least 1.0 inch in diameter (table B10), which represents a 7 percent decrease from the 2012 estimate (Werstak et al. 2016), or a loss of nearly 528 million trees. This decrease is a continuation of a trend from the 2005 estimate (DeBlander et al. 2010) (fig. 3). Eighty-one percent of the decrease from 2012 occurred in small-diameter trees less than 5.0 inches in diameter. Further examination shows that this decrease in small-diameter trees was entirely composed of woodland species, primarily Gambel oak, but also two-needle pinyon and Utah juniper. Conversely, the 19 percent decrease in live trees

5.0 inches in diameter and larger was focused on timber species, chiefly quaking aspen and lodgepole pine (figs. 4a and 4b).

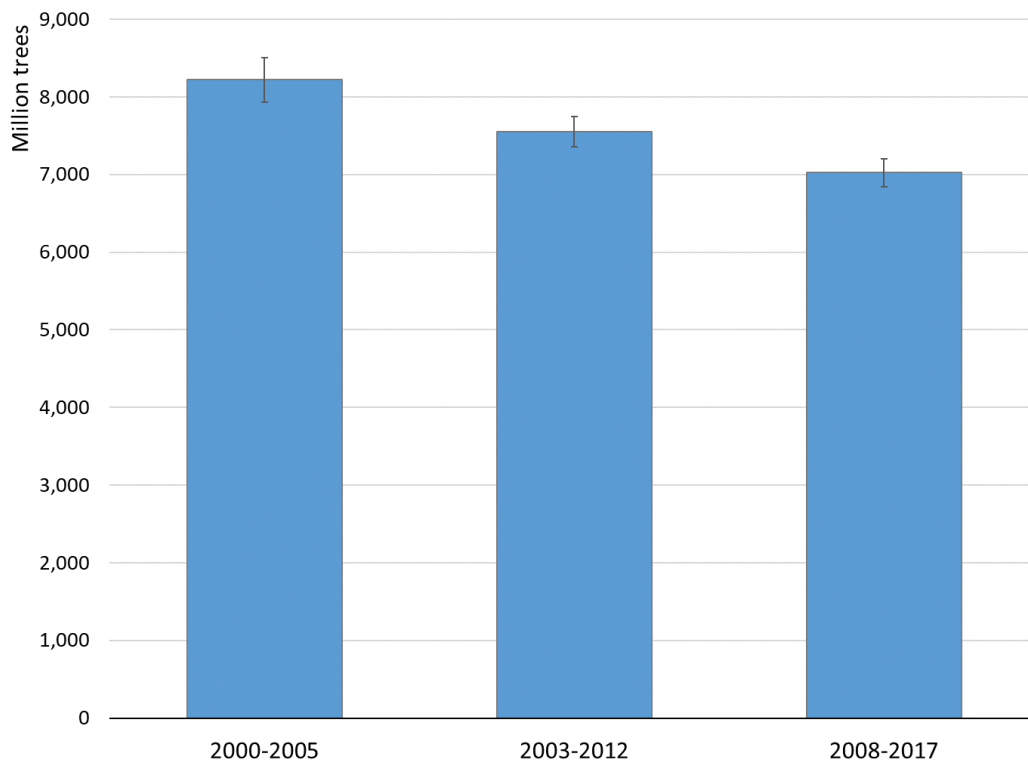


Figure 3—Estimates of number of live trees (≥ 1.0 inch diameter) in Utah from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

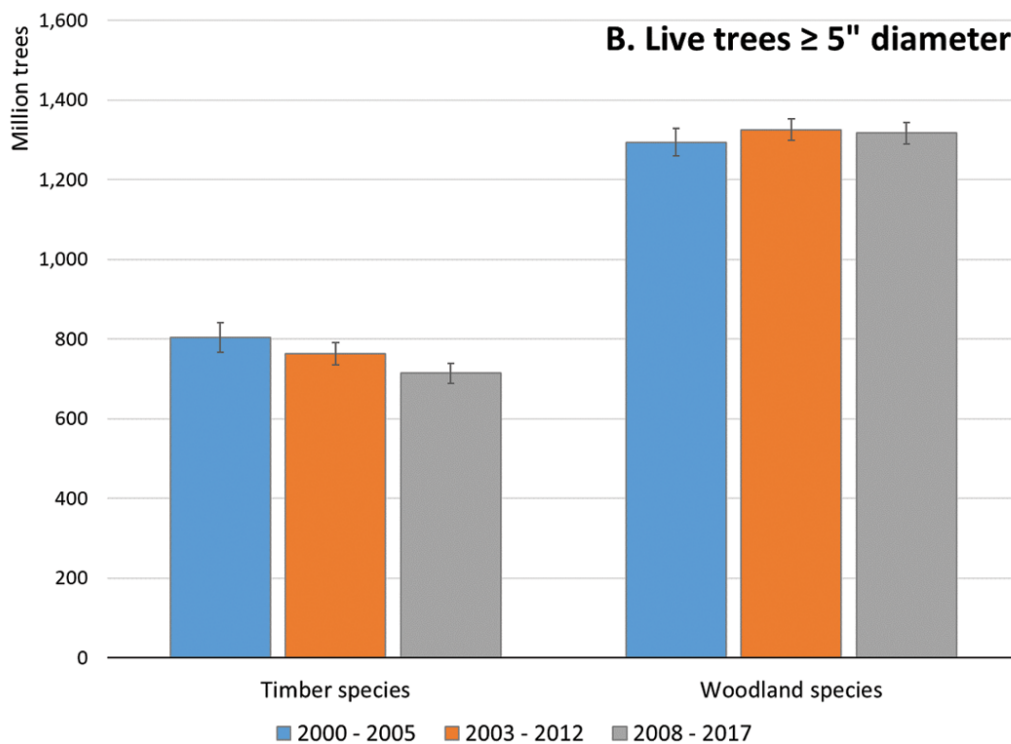
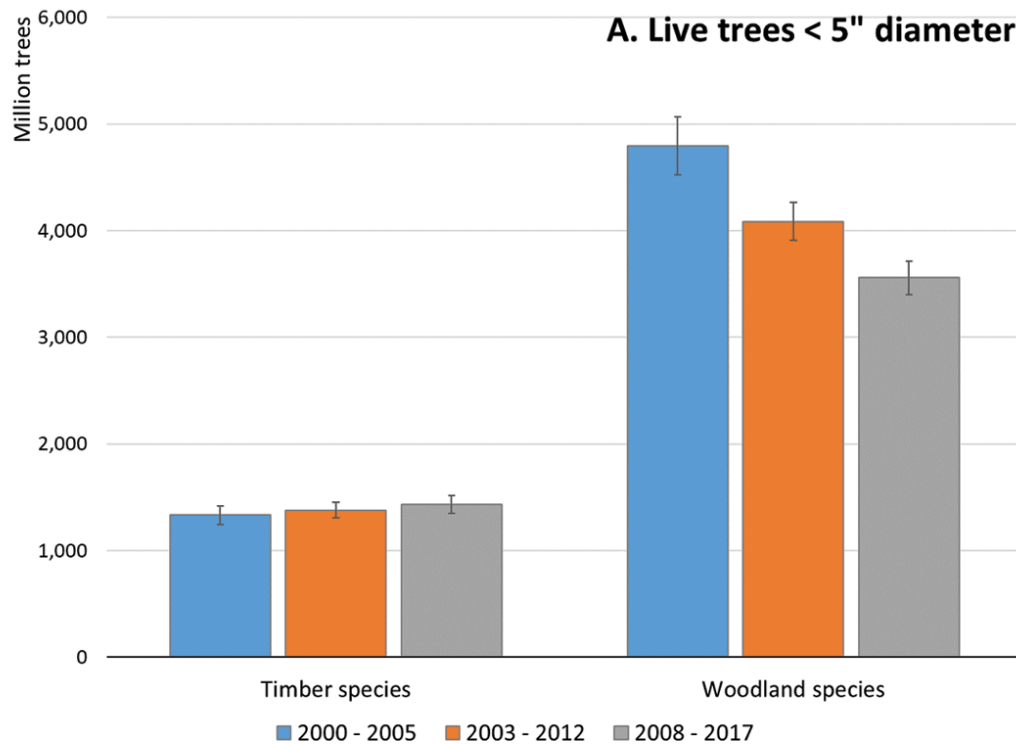


Figure 4—Comparisons changes in number of live trees estimates by timber and woodland species for (A) live saplings less than 5.0 inches diameter, and (B) live trees 5.0 inches diameter and greater. Data from 2000 through 2005 (DeBlender et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

Utah's forests also have 441 million standing dead trees (snags) 5.0 inches in diameter or larger (table B11), an increase since the 2005 estimate (fig. 5). Increases in the number of standing dead trees since 2012 occurred primarily in lodgepole pine (19.6 million more snags by 2017), Engelmann spruce (9.6 million more), and quaking aspen (5.9 million more). Douglas-fir and all three of the Woodland hardwood group species (Gambel oak, curleaf mountain-mahogany, and bigtooth maple) also contributed standing dead trees.

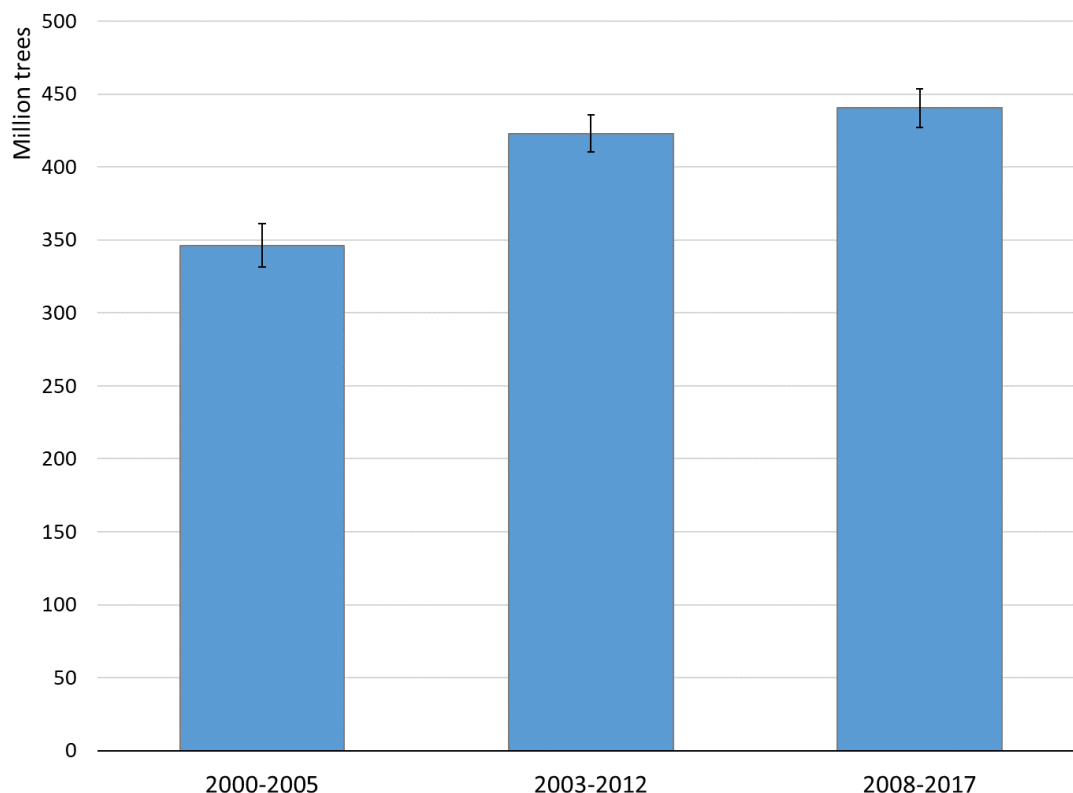


Figure 5—Estimates of number of standing-dead trees (≥ 5.0 inches diameter) in Utah from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

The Woodland hardwoods species group contains 43 percent of Utah's live trees (3.0 billion trees). All live tree estimates reported in this paragraph are 1.0 inch or greater in diameter. The Woodland hardwoods species group has 10 percent of Utah's standing dead trees (45 million snags). All standing dead tree estimates reported in this paragraph are for trees 5.0 inches or greater in diameter. Ninety-three percent of live, woodland hardwood trees are less than 5.0 inches diameter. The species group consists of Gambel oak (78 percent of live trees in the group), bigtooth maple (16 percent), and curleaf mountain-mahogany (6 percent). The Woodland softwood group (fig. 6) has 27 percent of the live trees in the State (1.9 billion trees) and 31 percent of the standing dead trees (135 million snags). Forty-one percent of live woodland softwood group trees are less than 5.0 inches in diameter. Trees in the woodland softwood species group are divided between Utah juniper (48 percent), two-needle pinyon (35 percent), singleleaf pinyon (12 percent), Rocky Mountain juniper (5 percent), and a handful of oneseed juniper (less than 0.1 percent). The Cottonwood and aspen species group has 11 percent of the live trees (748 million trees) and 20 percent of the standing dead trees (86 million snags).

Overall, the species/species groups that have the highest percentage of saplings compared to larger trees are as follows: Gambel oak, aspen, and the True fir species group. In contrast, the Woodland softwoods and Ponderosa and Jeffery pine species groups have the lowest percentage of saplings (fig. 6, table 1).

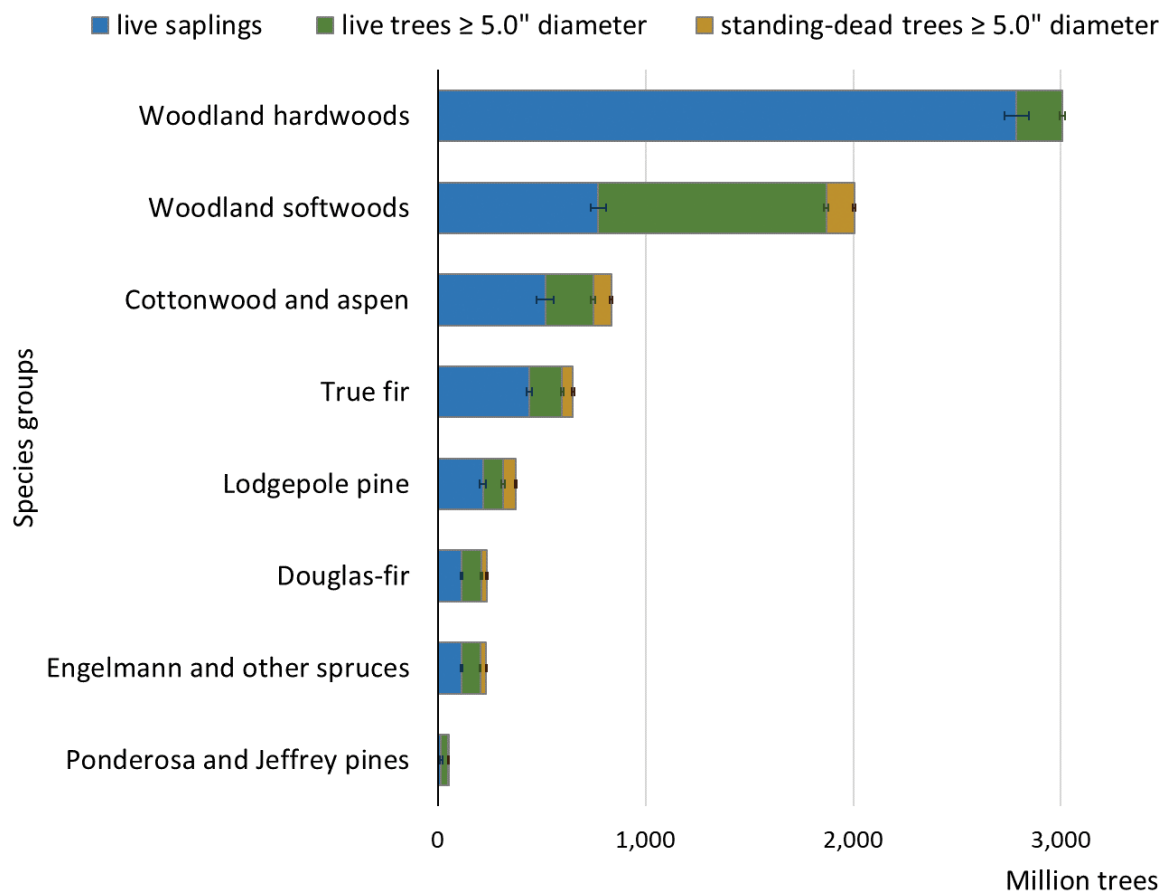


Figure 6—Number of live saplings (< 5.0 inches diameter), live trees ≥ 5.0 inches diameter, and standing-dead trees ≥ 5.0 inches diameter and major species group, Utah 2008–2017. Other western softwoods and other western hardwoods species groups are not shown due to small estimates.

Table 1—Number of live trees (at least 1 in. diameter), in million trees, on forest land (percent sampling error) by species group and reporting forest-type groups, Utah 2008-2017.

Species group	Forest-type group					All species groups
	Pinyon / juniper group	Forest conifer groups ^a	Woodland hardwoods group	Aspen / birch group	Other groups ^b	
Douglas-fir	34.8 (16.87)	152.6 (11.11)	8.5 (28.26)	13.7 (22.64)	0.7 (43.92)	210.2 (8.65)
Ponderosa and Jeffrey pines	8.9 (23.28)	34.1 (14.80)	3.8 (42.76)	0.6 (54.72)	0.6 (52.50)	47.8 (11.77)
True fir	13.9 (37.83)	460.6 (8.60)	10.7 (30.89)	112.2 (16.51)	0.3 (50.94)	597.7 (7.28)
Engelmann and other spruces	1.2 (69.28)	177.2 (10.61)	0.2 (100.00)	26.0 (24.75)	0.1 (72.58)	204.6 (9.64)
Lodgepole pine	0.0 (99.15)	305.2 (15.62)	— ^c (—)	9.2 (32.33)	— (—)	314.4 (15.15)
Woodland softwoods	1,813.5 (2.60)	15.6 (16.75)	37.6 (12.70)	0.8 (27.93)	2.4 (26.49)	1,869.9 (2.51)
Other western softwoods	1.7 (42.29)	12.8 (26.82)	0.1 (62.20)	1.9 (66.34)	0.2 (53.76)	16.7 (22.28)
Cottonwood and aspen	8.8 (37.54)	90.4 (14.00)	15.1 (27.43)	625.6 (10.10)	8.5 (31.82)	748.4 (8.58)
Other western hardwoods	1.5 (71.79)	— (—)	1.5 (99.40)	— (—)	5.7 (89.83)	8.7 (62.75)
Woodland hardwoods	451.3 (10.43)	89.7 (19.61)	2,401.4 (6.41)	62.6 (28.89)	1.5 (67.60)	3,006.5 (5.32)
All species groups	2,335.5 (3.06)	1,338.2 (5.72)	2,478.8 (6.30)	852.4 (8.69)	20.0 (30.86)	7,024.9 (2.58)

^a Forest conifer groups include the Fir/spruce/hemlock group, the Douglas-fir group, the Lodgepole pine group, the Ponderosa pine group, and the Other western softwoods group.

^b Other groups include the Elm/ash/cottonwood group and Nonstocked.

^c A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Numbers in rows and columns may not sum to totals due to rounding.

Tree Volume and Biomass

FIA reports the estimates of volume and biomass using several metrics, including the following: only the merchantable portions of trees of the appropriate size and status; all trees (live or standing dead at least 5.0 inches diameter [d.b.h. or d.r.c.]); growing-stock trees (live timber species trees at least 5.0 inches d.b.h. meeting minimum quality standards); or sawtimber trees (live timber softwood species at least 9.0 inches d.b.h. and live timber

hardwoods at least 11.0 inches d.b.h). Net volumes are computed by deducting rotten, missing, and/or form defect portions of trees from the gross volume.

Biomass of merchantable portions of trees are converted from sound volume (only rotten and missing portions deducted) based on the specific gravity of each tree species' wood and bark. Other portions of a tree's biomass (stump, limbs, and top) are calculated based on ratios in relation to the merchantable biomass. FIA volume equations, their coefficients, and biomass methods are described in Woodall et al. (2011).

The net volume of all live trees at least 5.0 inches in diameter on forest land in Utah totals 15.0 billion cubic feet. The net volume of standing dead trees is currently 3.4 billion cubic feet. Figure 7 shows the current estimates of live and standing-dead net volume for the 10 tree species with the most standing net volume (live or dead). Utah juniper has by far the most live net volume in Utah (4.1 billion cubic feet), followed by two-needle pinyon (1.9 billion cubic feet) and quaking aspen (1.6 billion cubic feet). The tree species with the highest net volume of standing dead trees is Engelmann spruce (762 million cubic feet), which is 58 percent of the net volume of live Engelmann spruce (1.3 billion cubic feet). The net volume of standing dead lodgepole pine (701 million cubic feet) is 90 percent of the net volume of live lodgepole pine (783 million cubic feet).

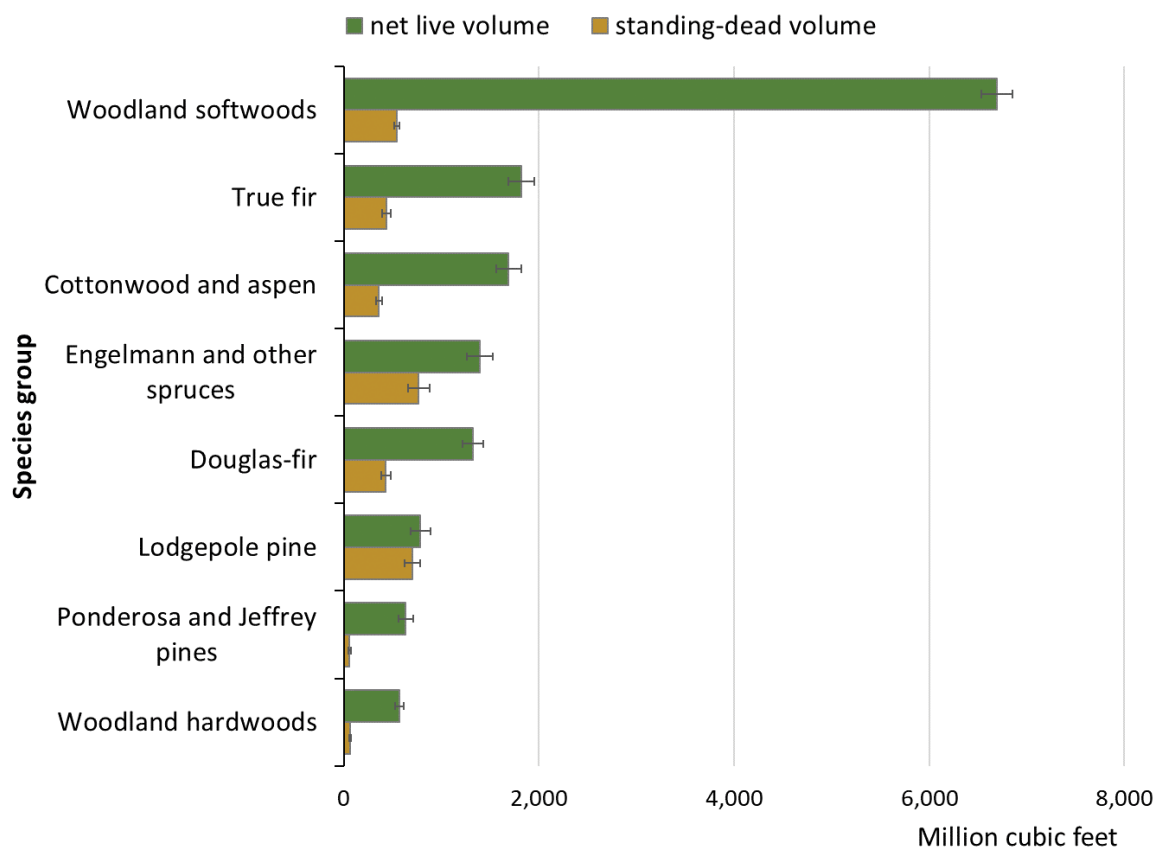


Figure 7—Net volume of live trees and standing-dead trees (both ≥ 5.0 inches diameter) by species group, Utah 2008–2017. Other western softwoods and other western hardwoods species groups are not shown due to small estimates.

The availability of timber volume for harvest is affected by three primary factors: reserved status, productivity, and merchantability. Timber land is defined as unreserved forest land capable of producing at least 20 cubic feet per acre per year of merchantable wood at culmination of mean annual increment. Growing-stock trees are live trees at least 5.0 inches in diameter that contain, or have the potential to produce, at least one 8-foot log that is reasonably free of defects. The net volume of growing-stock trees on timber land in Utah is 6 billion cubic feet (tables B23 and B24), or 40 percent of the total live net volume on forest land (table B19). Similar to all live net volume on forest land, the estimate for growing-stock trees on timber land is less than the 6.8 billion cubic feet 2005 estimate and the 6.3 billion cubic feet 2012 estimate.

Figure 8 shows the distribution of growing-stock net volume on timber land for the major growing-stock species in Utah. Over 70 percent of growing-stock net volume is found in four species: quaking aspen (1.4 billion cubic feet or 23 percent), Douglas-fir (1.0 billion cubic feet or 17 percent), Engelmann spruce (0.98 billion cubic feet or 16 percent), and subalpine fir (0.96 billion cubic feet, also 16 percent). Estimates by species group (table B23) show the True fir species group as having the most growing-stock net volume on timber land because both of Utah's true fir species, subalpine fir and white fir, are major growing-stock species (fig. 9).

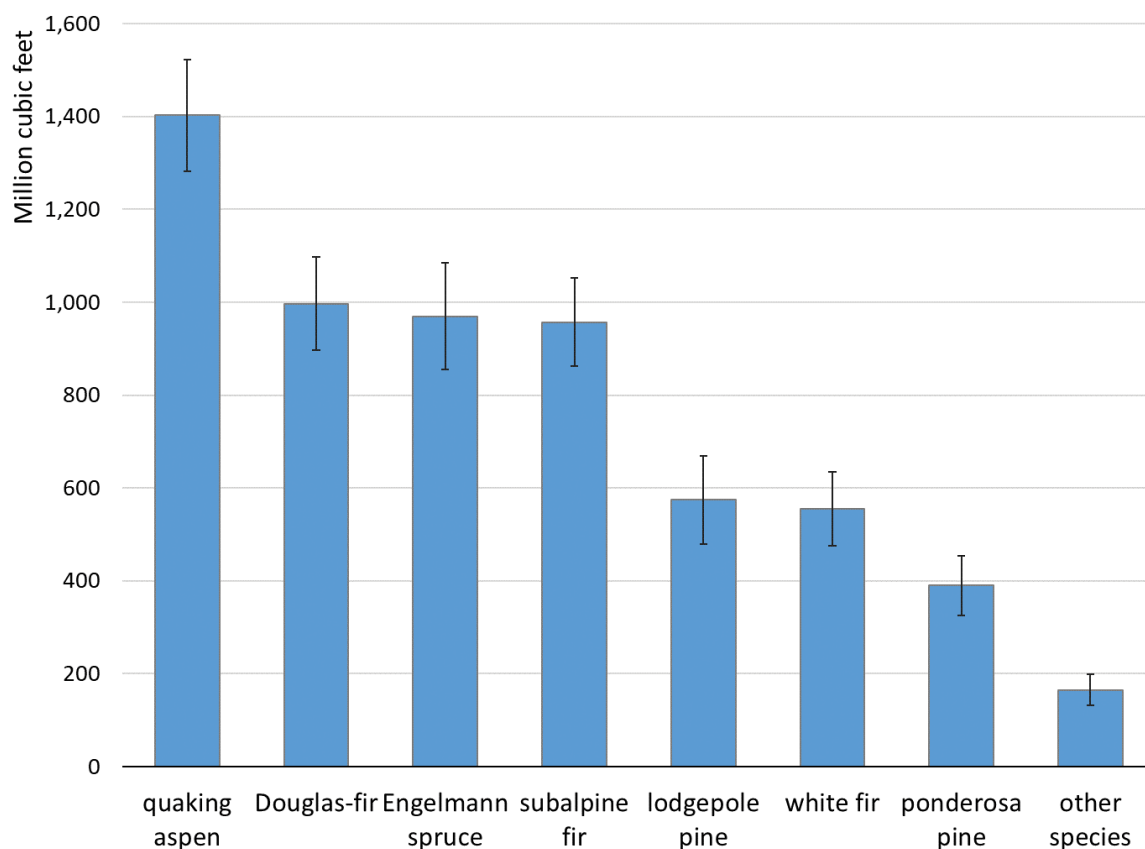


Figure 8—Net volume of growing-stock trees ≥ 5.0 inches diameter on timberland by species, Utah 2008–2017. Other species category includes limber pine, blue spruce, narrowleaf cottonwood, Great Basin bristlecone pine, Fremont cottonwood, and boxelder.

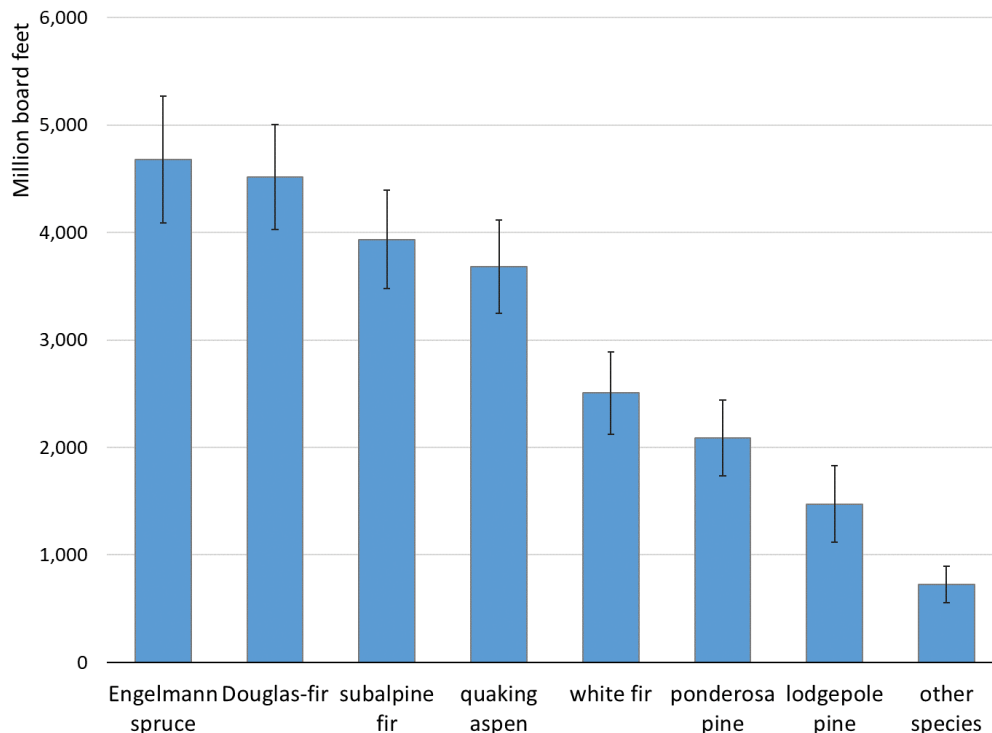


Figure 9—Net sawlog volume of sawtimber trees, in board feet (International ¼-inch rule) on timberland by species, Utah 2008–2017. Other species category includes blue spruce, limber pine, narrowleaf cottonwood, Great Basin bristlecone pine, Fremont cottonwood, and boxelder.

Sawtimber volume or live net volume of sawtimber trees, defined as softwood species 9.0 inches in diameter or larger, or hardwood species 11.0 inches in diameter, is expressed in board feet (International ¼ inch Rule). Utah’s sawtimber volume on timber land is 24 billion board feet. Engelmann spruce is the species with the highest sawtimber volume with nearly 20 percent of the sawtimber volume or almost 4.7 billion board feet, though sampling error overlapped with Douglas-fir, subalpine fir, and quaking aspen.

The total weight of oven-dry aboveground biomass of live trees (at least 1 inch in diameter) on Utah’s forest land is nearly 292 million tons (table B29). Forty-three percent (125 million tons) of this total is in the Woodland softwoods species group. The species group with the next highest estimates for biomass of live trees is the Cottonwood and aspen group, with 34 million tons. The True fir and the Douglas-fir species groups contribute 30 and 27 million tons, respectively. Aboveground biomass of standing dead trees in Utah is 50.4 million tons. The estimated dry biomass of live trees has shown a downward trend since previous reports and the estimated dry biomass of standing dead trees has increased, though these trends may not be statistically significant. Figure 10 compares current estimates of standing dead tree biomass for several species groups to those using data from previous State reports (DeBlander et al. 2010; Werstak et al. 2016). The partitioning of aboveground biomass between live trees less than 5.0 inches in diameter, live trees 5.0 inches in diameter and greater, and standing dead trees at least 5.0 inches in diameter is shown in figure 11 for the 10 species with the greatest aggregate aboveground biomass. Of note are the high proportions of standing dead tree biomass in lodgepole pine and Engelmann spruce.

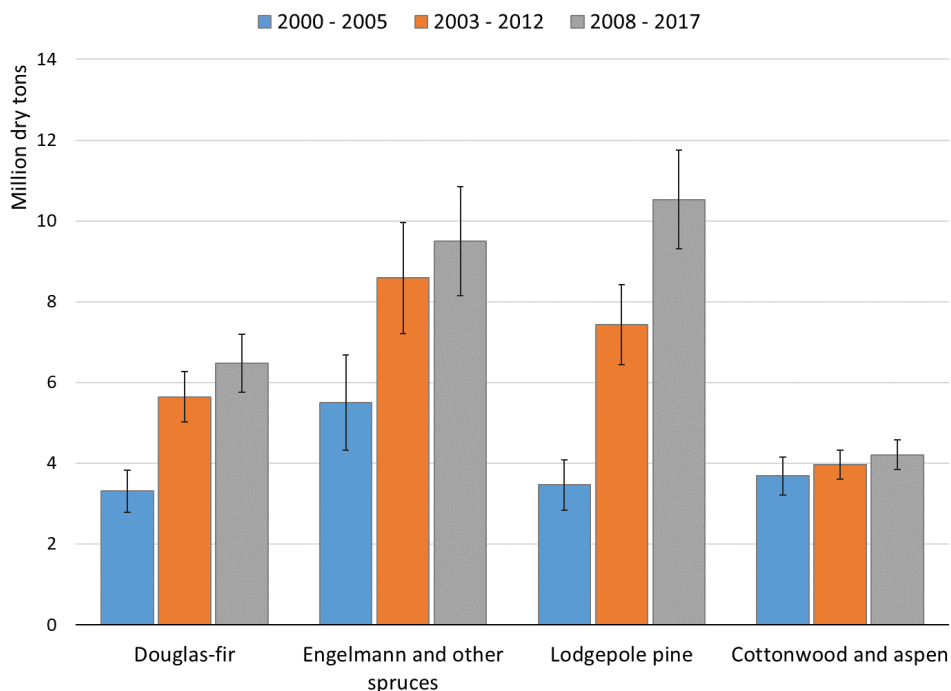


Figure 10—Estimates of aboveground biomass in standing-dead tree (≥ 5.0 inches diameter) for key species groups in Utah from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

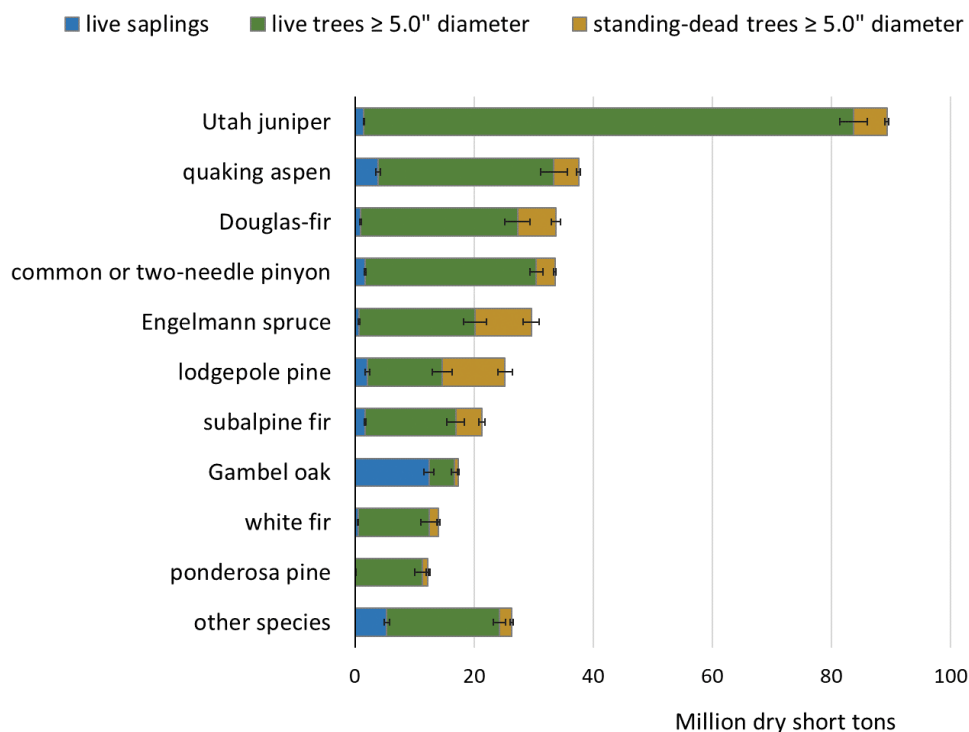


Figure 11—Aboveground biomass of live saplings (< 5.0 inches diameter), live trees ≥ 5.0 inches diameter, and standing-dead trees ≥ 5.0 inches diameter by major species group, Utah 2008–2017. Other species category includes singleleaf pinyon, Rocky Mountain juniper, bigtooth maple, curlleaf mountain-mahogany, limber pine, blue spruce, narrowleaf cottonwood, Great Basin bristlecone pine, Fremont cottonwood, boxelder, water birch, velvet ash, and oneseed juniper.

Tables 2 and 3 show live tree biomass and net volume, respectively, by species and forest-type groups. The estimates for each forest-type group include all of the different species that occur within that forest-type group. Because estimates of forest-type groups with small samples may not be representative, only forest-type groups sampled on at least 50 plots are included in this discussion. The Engelmann spruce forest type has the highest per acre net volume of live trees 5.0 inches in diameter and larger, with 2,328 cubic feet per acre, and has the highest biomass of live trees 1.0 inch in diameter and larger with 36.2 dry tons per acre. Net volume per acre splits notably between timber forest types, all of which have more than 1,000 cubic feet per acre, and woodland forest types, all of which have less than 1,000 cubic feet per acre. Patterns in biomass per acre do not precisely follow patterns in net volume per acre for two reasons. First, some forest types may have a larger proportion of trees less than 5.0 inches in diameter, and second, some forest types may contain a large proportion of trees with higher wood density.

Table 2—Aboveground dry weight of live trees (at least 1 in. diameter), in thousand tons, on forest land (percent sampling error) by species group and reporting forest-type groups, Utah 2008-2017.

Species group	Forest-type group					All species groups
	Pinyon / juniper group	Forest conifer groups ^a	Woodland hardwoods group	Aspen / birch group	Other groups ^b	
Douglas-fir	2,988.3 (13.96)	21,396.4 (9.88)	1,156.6 (26.81)	1,572.0 (19.95)	183.7 (53.22)	27,297.0 (7.99)
Ponderosa and Jeffrey pines	1,793.7 (20.57)	8,569.6 (14.50)	763.7 (30.31)	156.2 (55.47)	46.2 (62.59)	11,329.4 (11.56)
True fir	674.2 (33.47)	22,955.5 (8.74)	789.8 (35.97)	4,980.1 (13.49)	51.2 (75.67)	29,450.8 (7.17)
Engelmann and other spruces	50.1 (59.00)	19,510.9 (10.14)	58.8 (100.00)	1,634.2 (23.35)	7.0 (76.16)	21,260.9 (9.44)
Lodgepole pine	1.2 (99.15)	14,121.6 (12.63)	— ^c (—)	537.2 (31.99)	— (—)	14,660.0 (12.17)
Woodland softwoods	122,764.3 (2.43)	561.8 (17.96)	1,583.3 (11.62)	28.6 (36.17)	71.0 (24.17)	125,009.0 (2.37)
Other western softwoods	177.4 (40.14)	1,569.0 (26.62)	21.9 (70.01)	105.8 (66.56)	18.6 (63.34)	1,892.7 (22.71)
Cottonwood and aspen	204.9 (44.62)	4,576.0 (13.53)	831.4 (34.43)	28,042.4 (8.13)	595.3 (31.49)	34,250.0 (6.86)
Other western hardwoods	6.8 (71.54)	— (—)	28.8 (99.40)	— (—)	37.2 (68.48)	72.8 (53.04)
Woodland hardwoods	3,116.7 (9.49)	769.9 (17.62)	21,885.9 (6.35)	583.0 (29.46)	30.8 (65.20)	26,386.3 (5.37)
All species groups	131,777.5 (2.40)	94,030.7 (5.18)	27,120.2 (6.37)	37,639.5 (7.93)	1,041.0 (25.39)	291,608.9 (1.92)

^a Forest conifer groups include the Fir/spruce/hemlock group, the Douglas-fir group, the Lodgepole pine group, the Ponderosa pine group, and the Other western softwoods group.

^b Other groups include the Elm/ash/cottonwood group and Nonstocked.

^c A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table 3—Net volume of live trees (at least 5 in. diameter), in million cubic feet, on forest land (percent sampling error) by species group and reporting forest-type groups, Utah 2008-2017.^a

Species group	Forest-type group					All species groups
	Pinyon / juniper group	Forest conifer groups ^b	Woodland hardwoods group	Aspen / birch group	Other groups ^c	
Douglas-fir	142.2 (14.37)	1,036.6 (10.03)	57.4 (27.20)	74.3 (20.41)	9.2 (53.42)	1,319.6 (8.13)
Ponderosa and Jeffrey pines	100.1 (20.85)	479.7 (14.55)	42.6 (30.69)	8.8 (55.59)	2.6 (62.82)	633.7 (11.62)
True fir	37.0 (34.32)	1,412.7 (9.18)	44.9 (37.97)	321.5 (13.82)	3.2 (73.99)	1,819.2 (7.51)
Engelmann and other spruces	3.2 (58.77)	1,281.9 (10.31)	3.7 (100.00)	102.7 (23.62)	0.4 (75.50)	1,392.0 (9.63)
Lodgepole pine	0.1 (99.15)	752.6 (13.57)	— ^d (—)	30.4 (32.49)	— (—)	783.1 (13.06)
Woodland softwoods	6,558.2 (2.45)	35.8 (19.04)	96.9 (12.23)	2.1 (36.17)	4.0 (24.58)	6,696.9 (2.39)
Other western softwoods	10.1 (40.21)	90.8 (27.45)	1.3 (71.22)	5.7 (70.52)	1.1 (63.70)	109.0 (23.48)
Cottonwood and aspen	9.0 (51.56)	232.7 (14.95)	41.8 (37.89)	1,374.6 (8.90)	30.9 (33.84)	1,689.0 (7.50)
Other western hardwoods	0.2 (100.14)	— (—)	0.2 (99.40)	— (—)	1.1 (96.54)	1.5 (72.85)
Woodland hardwoods	58.4 (12.91)	17.8 (23.45)	479.8 (9.50)	9.6 (48.43)	1.4 (86.16)	567.0 (8.15)
All species groups	6,918.5 (2.44)	5,340.5 (5.37)	768.5 (8.94)	1,929.6 (8.56)	53.8 (26.89)	15,010.9 (2.16)

^a Numbers in rows and columns may not sum to totals due to rounding.

^b Forest conifer groups include the Fir/spruce/hemlock group, the Douglas-fir group, the Lodgepole pine group, the Ponderosa pine group, and the Other western softwoods group.

^c Other groups include the Elm/ash/cottonwood group and Nonstocked.

^d A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Numbers in rows and columns may not sum to totals due to rounding.

Forest Types and Forest-Type Groups

Forest type is a classification of forest land based on the species forming the plurality of living trees growing in a particular forest. Forest type names may be based on a single tree species or group of species. Forest types are an important indicator of diversity, structure, and successional stage. The distribution of forest types across the landscape is determined by factors such as climate, soil, elevation, aspect, and disturbance history. Changes in abundance of a particular forest type over time can help assess the impact of major disturbances related

to fire, weather, climate, insects, disease, and human-caused changes resulting from timber harvesting or ecosystem restoration.

Forest types are aggregated into forest-type groups to simplify trends and reporting over large scales. Because forest-type groups are aggregated and named at a national level, some may have names not representative of a particular State's forests. For example, the Fir/spruce/mountain hemlock group in Utah does not include mountain hemlock. Utah's forests are represented by 10 forest-type groups that are further classified into 20 distinct forest types, all of which are described in Appendix C. Some forest-type groups contain only one forest type, and other forest-type groups may contain several individual forest types.

Utah's most abundant forest-type group is the Pinyon/juniper group, which covers almost 11 million acres and accounts for 58 percent of the forest land in the State (fig. 12, table B3). The second most abundant forest-type group in Utah is the Woodland hardwood group, which covers 2.4 million acres, or 13 percent of the State's forest land. The Fir/spruce/mountain hemlock group and the Aspen/birch group each cover 9 percent of Utah's forest land (1.5 million acres each).

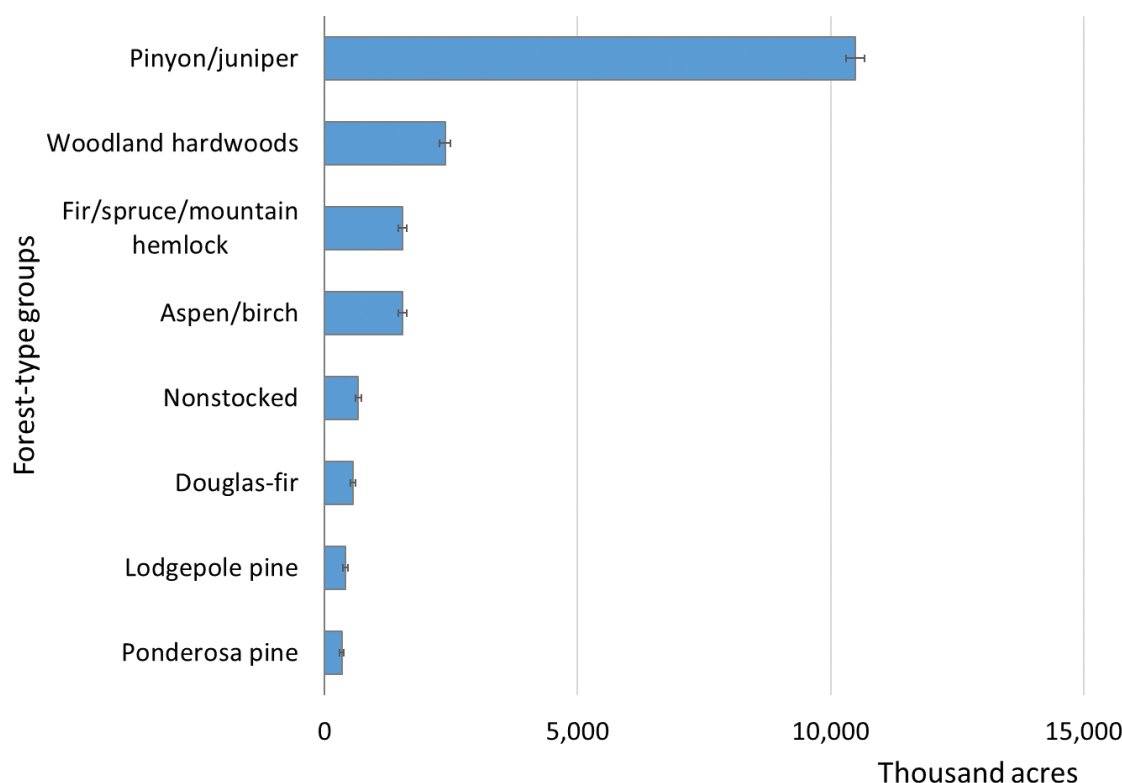


Figure 12—Area of forest land by major forest-type groups, Utah 2008–2017. Not shown due to small areas are the Elm/ash/cottonwood group and the Other western softwoods group.

The following sections detail the composition and characteristics of major forest-type groups. The Douglas-fir, Fir/spruce/mountain hemlock, Lodgepole pine, Ponderosa pine, and Other western softwoods groups are shown combined in figure 13 as Forest conifer groups.

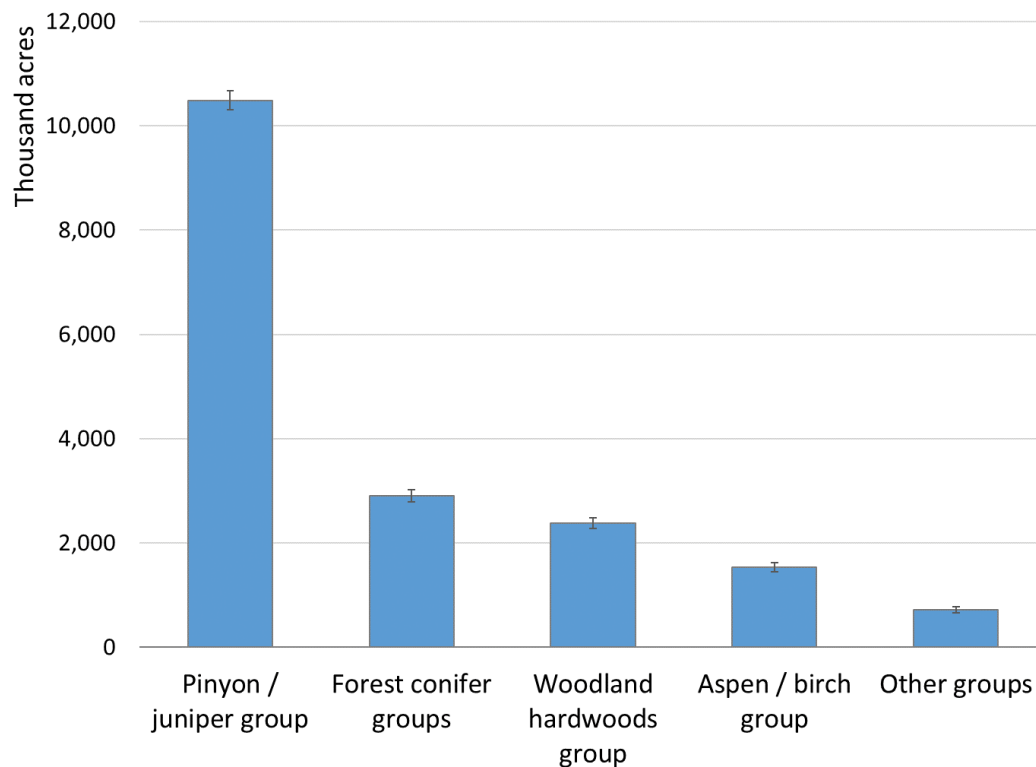


Figure 13—Area of forest land by forest-type groups for detail reporting, Utah 2008–2017. Forest conifer group includes the Fir/spruce/mountain hemlock, Douglas-fir, Lodgepole pine, Ponderosa pine, and Other western softwoods groups. Other groups include the Elm/ash/cottonwood group and Nonstocked forest land.

One of the drivers of forest type determination in Utah is elevation. Figure 14 shows the distribution of major forest-type groups across elevation classes. The Pinyon/juniper group dominates the lower elevations, with a peak between 6,000 and 6,999 feet. The Woodland hardwoods group occupies a generally higher elevation, with the most acres in the 7,000 to 7,999 feet elevation class. The Aspen/birch group and the Forest conifer groups (as defined previously) have most of their acres at elevations above 8,000 feet.

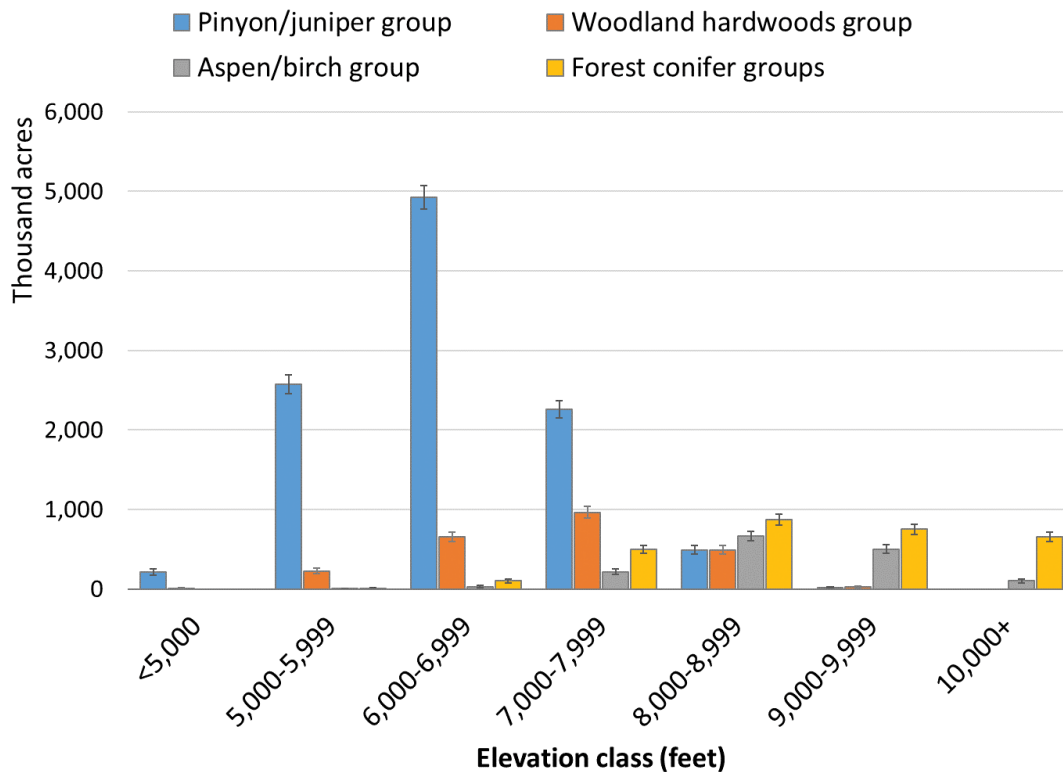


Figure 14—Area of forest land by reporting forest-type groups and elevation class, Utah 2008–2017.

Pinyon/juniper forest-type group

All forest types in the Pinyon/juniper group are defined as unproductive and therefore cannot be classified as timber land. Eighty-six percent of the group area is other forest land, and the remaining 14 percent is reserved forest. There are three forest types in the Pinyon/juniper group that all occur in Utah. Seventy-five percent of the group is Pinyon/juniper woodland, 20 percent is Juniper woodland, and 5 percent is Rocky Mountain juniper forest type. These percentages have changed little from past annual Utah reports.

The Pinyon/juniper forest-type group contains 2.3 billion live trees (≥ 1.0 inch in diameter) or 33 percent of those in the State. Combined, with the 10.5 million acres the group occupies, this is 223 live trees per acre, the lowest trees per acre of any of the four forest-type groups analyzed. Aboveground live biomass in the Pinyon/juniper group is 132 million tons (45 percent of Utah’s total), or 12.6 tons per acre. The net volume of live trees with diameters of 5 inches or greater is 6.9 billion cubic feet (46 percent of the State total), or 660 cubic feet per acre.

Seventy-eight percent of the live trees in the group are in the Woodland softwood species group (fig. 15). The Woodland softwoods species group also makes up 93 percent of the Pinyon/juniper forest-type group’s live aboveground biomass and 95 percent of its live net volume. The Woodland hardwoods species group contains 19 percent of the live trees in the Pinyon/juniper forest-type group. Ninety-eight percent of the net live volume of the Woodland softwoods species group in the State is contained within the Pinyon/juniper forest-type group.

In terms of the live net volume of individual tree species (fig. 16), the four species with the highest live net volume in the Pinyon/juniper forest-type group are all in the Woodlands softwoods species group: Utah juniper, common or two-needle pinyon, singleleaf pinyon, and Rocky Mountain juniper.

Forest conifer forest-type groups

The Forest conifer forest-type groups are a combination of the Douglas-fir, Fir/spruce/mountain hemlock, Lodgepole pine, Ponderosa pine, and Other western softwood forest-type groups and totals 2.9 million acres or 16 percent of Utah's forest land. All of the forest types within the Forest conifer forest-type groups qualify as potential timber land, and 81 percent of the area is timber land. Fifteen percent is reserved forest, and 4 percent is classified as other forest (unreserved and unproductive). The total acreage of the Forest conifer groups is composed of 53 percent Fir/spruce/mountain hemlock group, 19 percent Douglas-fir group, 14 percent Lodgepole pine group, 12 percent Ponderosa pine group, and 2 percent Other western softwoods group. The Fir/spruce/mountain hemlock forest-type group in Utah has five individual forest types: Engelmann spruce/subalpine fir, Engelmann spruce, White fir, Subalpine fir, and Blue spruce (fig. 17). Utah's Douglas-fir, Lodgepole pine, and Ponderosa pine forest-type groups all contain a single forest type with the same name as the forest-type group. In Utah, the Other western softwoods forest-type group includes the Limber pine and Foxtail/bristlecone pine forest types. When forest types are considered individually, the Douglas-fir forest type has the largest area (559 thousand acres) of the forest type in the Forest conifer group.

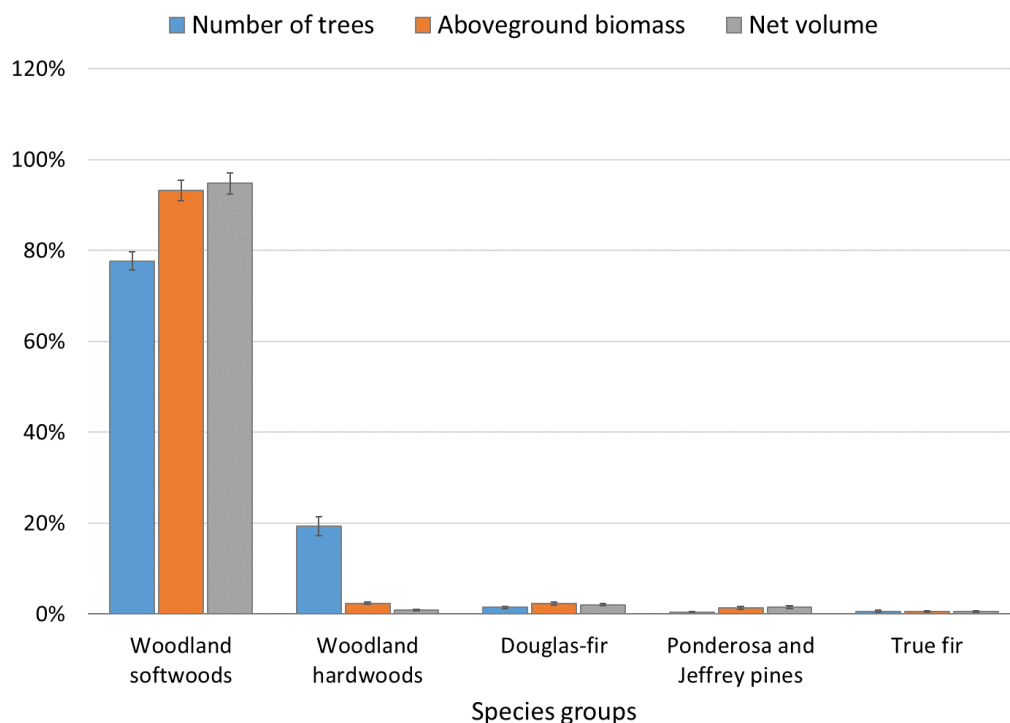


Figure 15—Percentages of number of live trees (≥ 1.0 inch diameter), aboveground biomass of live trees (≥ 1.0 inch diameter), and net volume of live trees (≥ 5.0 inches diameter) on the Pinyon/juniper forest-type group by major species group, Utah 2008–2017. Not shown due to small estimates are the Other western softwoods, Cottonwood and aspen, Engelmann and other spruces, Other western hardwoods, and Lodgepole pine species groups.

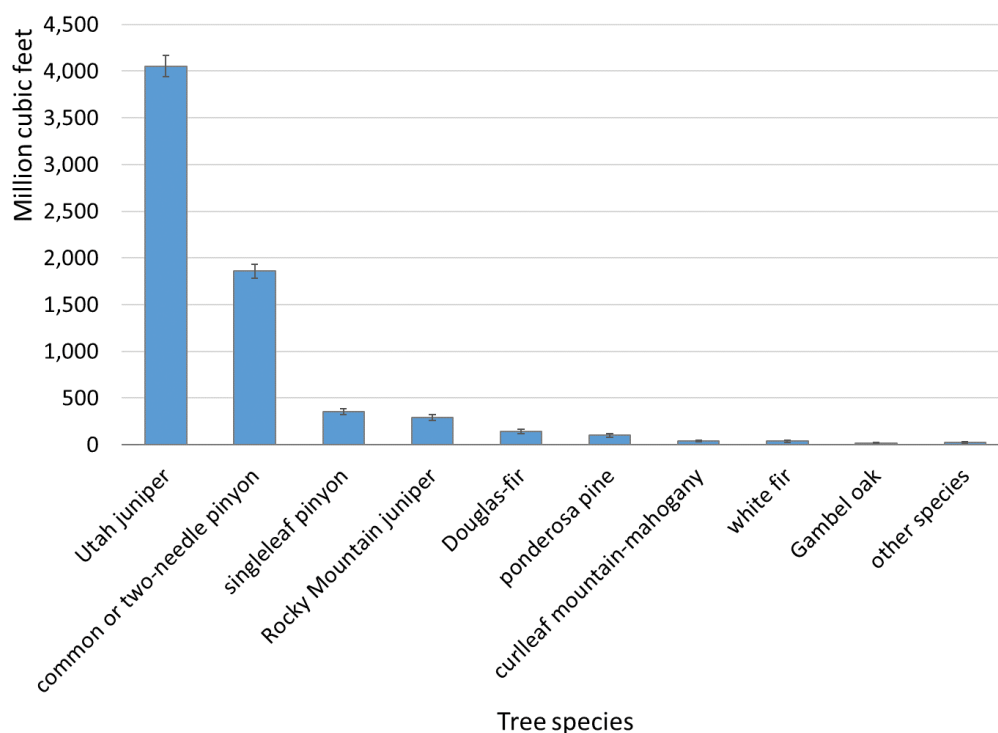


Figure 16—Net volume of live trees (≥ 5.0 inches diameter) on the Pinyon/juniper forest-type group by major species, Utah 2008–2017. Other species include limber pine, narrowleaf cottonwood, bigtooth maple, Great Basin bristlecone pine, quaking aspen, Fremont cottonwood, Engelmann spruce, blue spruce, velvet ash, lodgepole pine, and oneseed juniper.

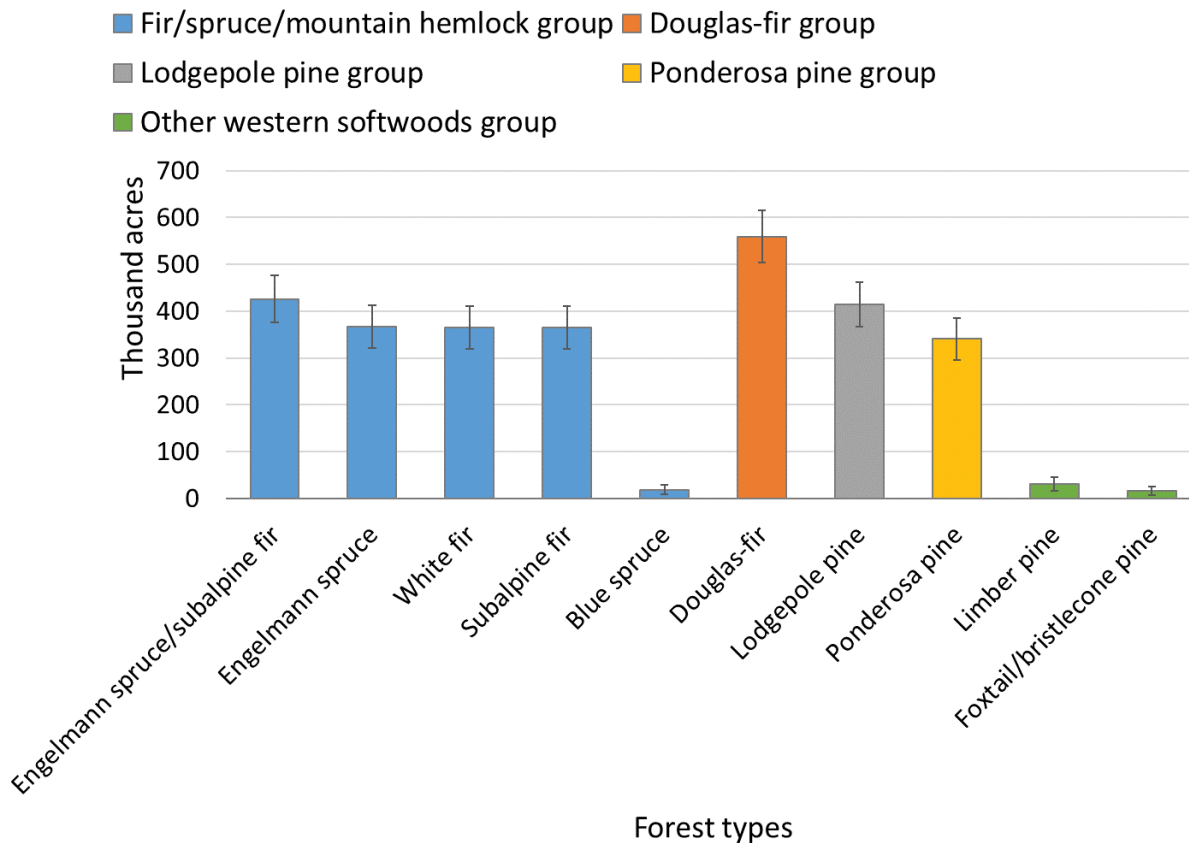


Figure 17—Area of combined Forest conifer forest-type groups by constituent forest-type groups and individual forest types, Utah 2008–2017.

The Forest conifer groups contain 1.3 billion live trees (19 percent; ≥ 1.0 inch in diameter) in the State. Spread across these groups' 2.9 million acres, this is 461 trees per acre. Thirty-two percent of the aboveground biomass of live trees in the State (94.0 million dry tons) is found in these forest-type groups, at 32.4 dry tons per acre. They also contain 36 percent of the State's live net volume (5.3 billion cubic feet; ≥ 5.0 inches in diameter) for 1,840 cubic feet per acre. The per acre values of live aboveground biomass and net volume are the most for any of Utah's forest-type groups.

An important tree species group in the Forest conifer forest-type group is the True fir group (subalpine fir and white fir), which encompasses 34 percent of the live trees, 24 percent of the live aboveground biomass, and 26 percent of the Forest conifer forest-type group's live net volume (fig. 18). Another common species group is the Engelmann and other spruces group (Engelmann spruce and blue spruce) with 13 percent of the live trees, 21 percent of the live aboveground biomass, and 26 percent of the live net volume. When the live net volume of individual species were compared within the Forest conifer groups, timber-type softwood species were dominate (fig. 19). Engelmann spruce has the highest live net volume with 1.2 billion cubic feet, followed by Douglas-fir with 1.0 billion cubic feet, then subalpine fir with 0.8 billion cubic feet.

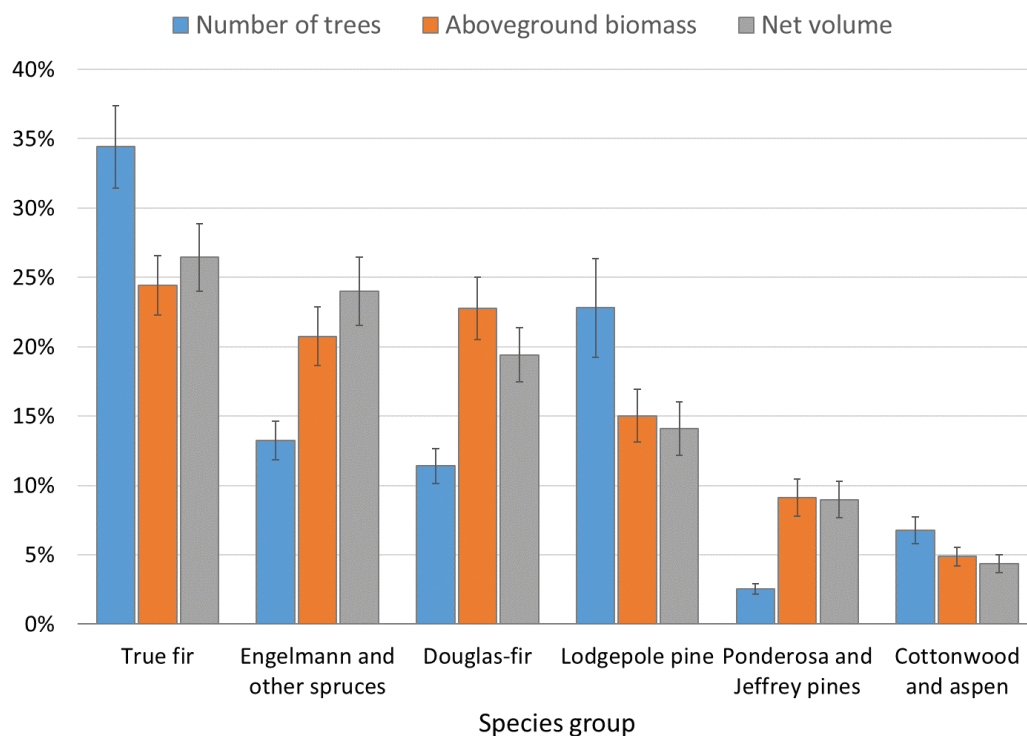


Figure 18—Percentages of number of live trees (≥ 1.0 inch diameter), aboveground biomass of live trees (≥ 1.0 inch diameter), and net volume of live trees (≥ 5.0 inches diameter) on the combined Forest conifer forest-type groups by major species group, Utah 2008–2017. Not shown due to small estimates are the Woodland hardwoods, Other western softwoods, and Woodland softwood species groups.

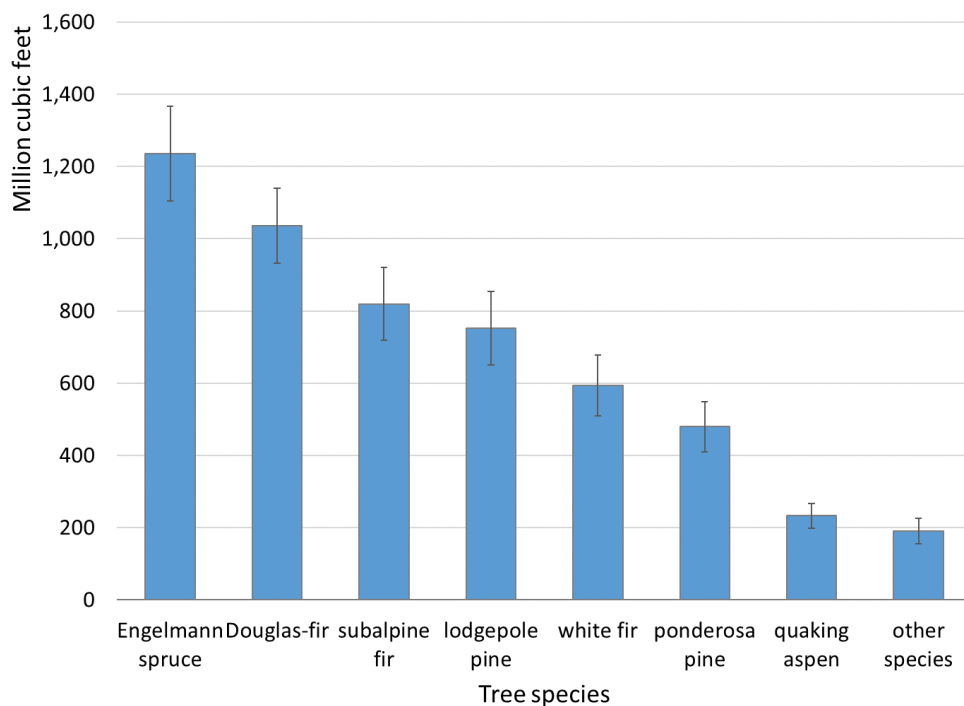


Figure 19—Net volume of live trees (≥ 5.0 inches diameter) on the combined Forest conifer forest-type groups by major species, Utah 2008–2017. Other species include limber pine, blue spruce, Rocky Mountain juniper, Great Basin bristlecone pine, common or two-needle pinyon, curlleaf mountain-mahogany, Gambel oak, bigtooth maple, Utah juniper, and singleleaf pinyon.

Woodland hardwoods forest-type group

Utah's Woodland hardwoods forest-type group includes three forest types: Deciduous oak woodland with 71 percent of the group, Cercocarpus woodland with 17 percent, and Intermountain maple woodland with 12 percent. Ninety-six percent of the area is classified as other forest (unreserved and unproductive) and the remaining 4 percent is reserved forest. Because all the forest types in this forest-type group are woodlands, no portion of the area can be classified as timber land.

As might be expected, the dominant species group is Woodland hardwoods (fig. 20). Trees in the Woodland hardwoods species group tend to have smaller diameters and occur in dense stands. As such, this tree species group—including Gambel oak, curleaf mountain-mahogany, and bigtooth maple trees—contains 97 percent of the live trees in the Woodland hardwoods forest-type group, but only 81 percent of the aboveground live biomass and 62 percent of the net live volume; other tree species that occur in the forest type tend to have a greater proportion of larger trees (fig. 21).

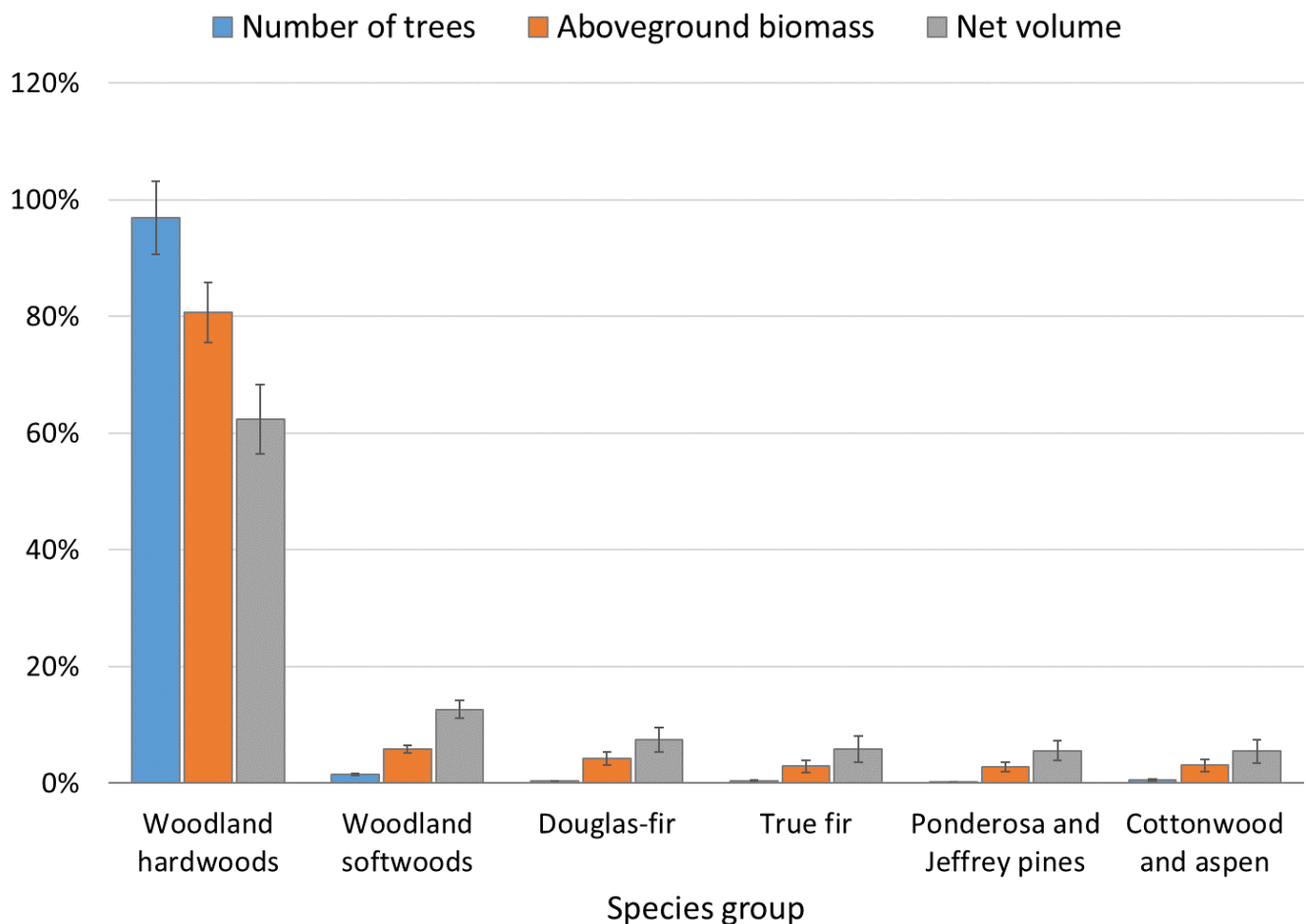


Figure 20—Percentages of number of live trees (≥ 1.0 inch diameter), aboveground biomass of live trees (≥ 1.0 inch diameter), and net volume of live trees (≥ 5.0 inches diameter) on the Woodland softwoods forest-type group by major species group, Utah 2008–2017. Not shown due to small estimates are the Engelmann and other spruces, Other western softwoods, and Other western hardwoods species groups.

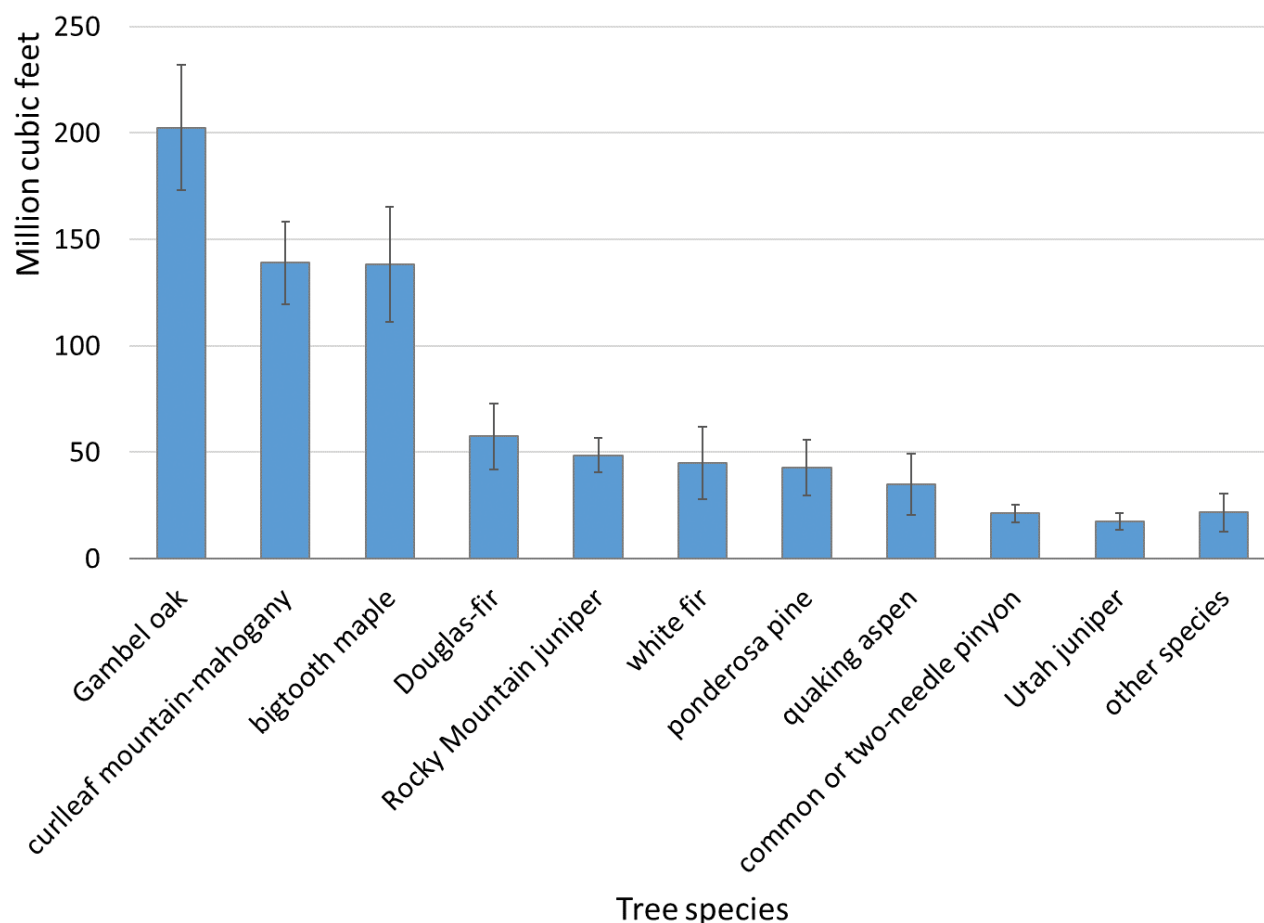


Figure 21—Net volume of live trees (≥ 5.0 inches diameter) on the Woodland softwoods forest-type group by major species, Utah 2008–2017. Other species include singleleaf pinyon, narrowleaf cottonwood, blue spruce, limber pine, Great Basin bristlecone pine, and boxelder.

Aspen/birch forest-type group

The Aspen/birch forest-type group in Utah contains a single forest type, the Aspen forest type, which is 78 percent timber land, 19 percent unreserved and unproductive other forest, and 3 percent reserved forest. This forest-type group contains 71 percent of the Cottonwood and aspen net volume in the State (fig. 22). Most of the other tree species groups that appear in the group are forest conifer types (fig. 23).

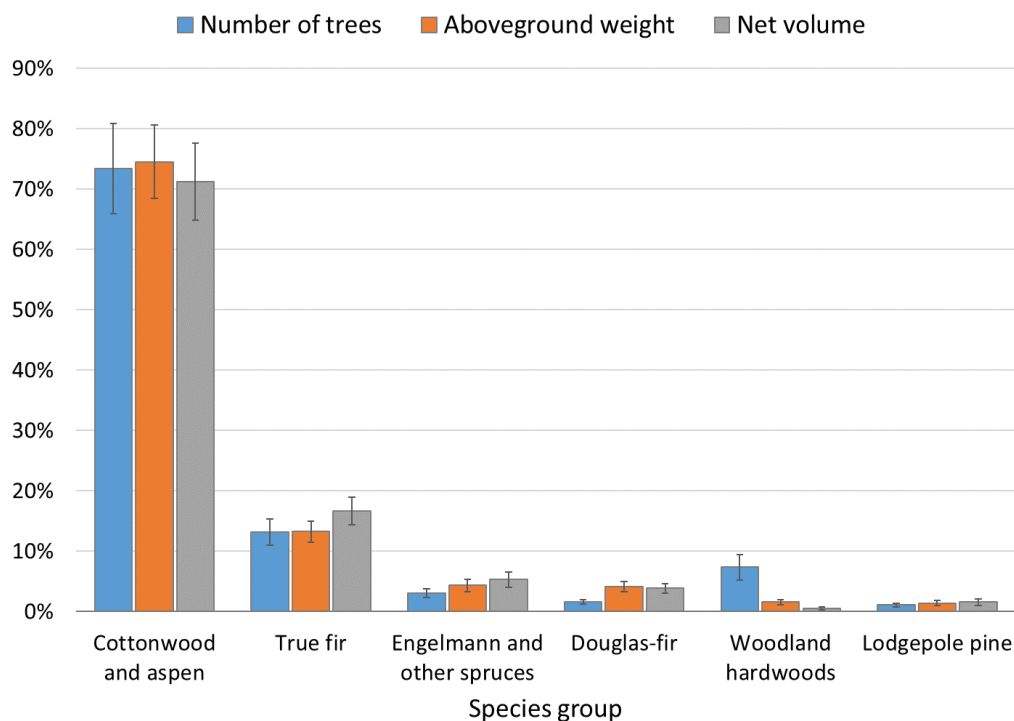


Figure 22—Percentages of number of live trees (≥ 1.0 inch diameter), aboveground biomass of live trees (≥ 1.0 inch diameter), and net volume of live trees (≥ 5.0 inches diameter) on the Aspen/birch forest-type group by major species group, Utah 2008–2017. Not shown due to small estimates are the Ponderosa and Jeffrey pines, Other western softwoods, and Woodland softwoods species groups.

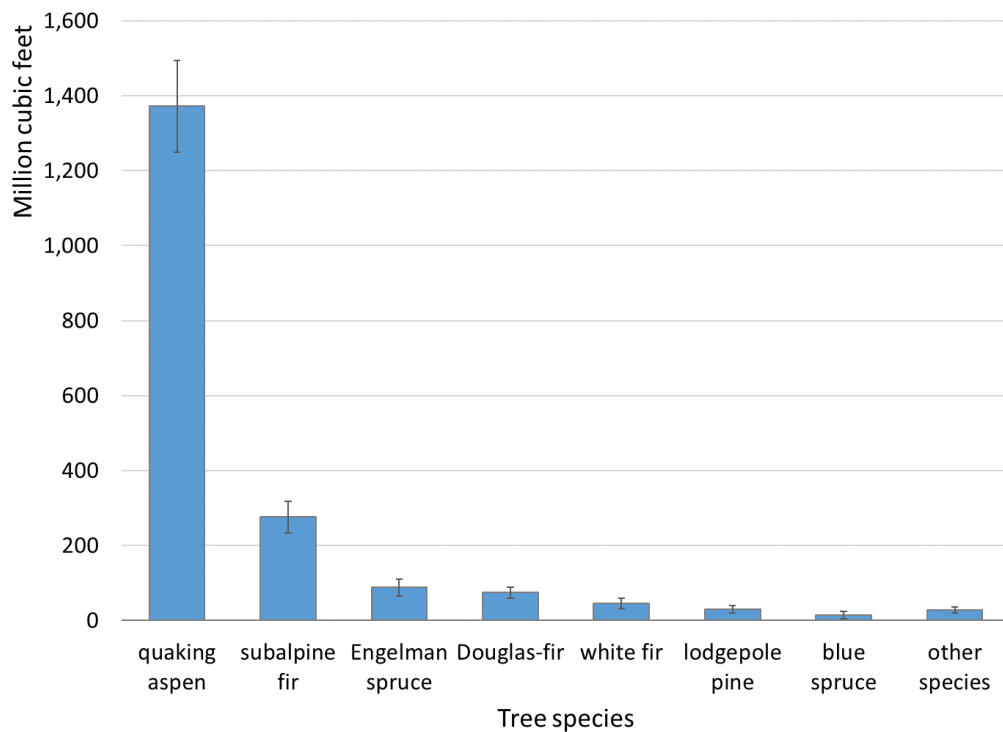


Figure 23—Net volume of live trees (≥ 5.0 inches diameter) on the Aspen/birch forest-type group by major species, Utah 2008–2017. Other species include ponderosa pine, bigtooth maple, limber pine, Rocky Mountain juniper, Gambel oak, Fremont cottonwood, narrowleaf cottonwood, and curleaf mountain-mahogany.

Forest land ownership

Utah's forest land is held or managed by a variety of different owners and public agencies, but almost 97 percent is controlled by four general management or ownership categories recognized by FIA. Thirty-nine percent of the forest land (7.1 million acres) is on public land managed by the Bureau of Land Management (BLM), 35 percent (6.4 million acres) is on National Forests under the National Forest System (NFS), 15 percent (2.7 million acres) is held by various private landowners, and 8 percent (1.4 million acres) is held by several agencies of the State of Utah (fig. 24). The remaining 447 thousand acres are split between the National Park Service, county or municipal lands, the Departments of Defense or Energy, other non-Federal lands, the U.S. Fish and Wildlife Service, and National Forest lands that are not a part of NFS (table B2). The following are some important forest characteristics of Utah's major forest landowners.

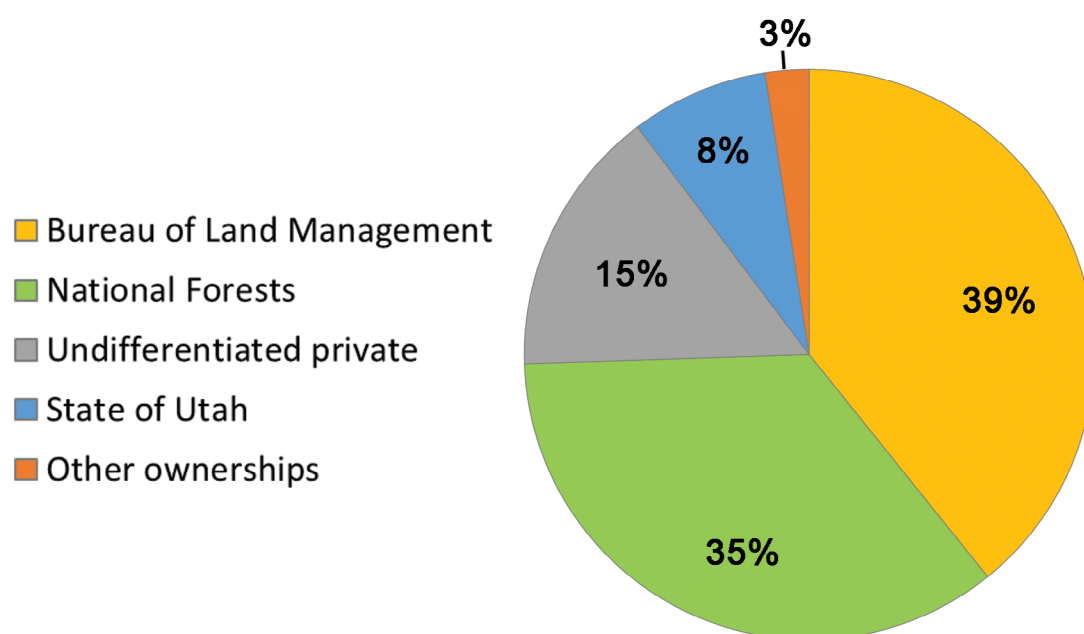


Figure 24—Percentage of all forest land by ownership classes, Utah 2008–2017. Other ownerships include the National Park Service, county or municipal lands, the Departments of Defense or Energy, other non-federal lands, the U.S. Fish and Wildlife Service, and other non-NFS National Forest lands.

Bureau of Land Management

The Bureau of Land Management manages forest land throughout Utah (fig. 25), primarily at the lower elevations of forest land occurrence (fig. 26). Forests classified as unreserved and unproductive make up 83 percent of forests on BLM land. The Pinyon/juniper forest-type group occupies 88 percent, or 6.2 million acres, of Utah's BLM forest land (fig. 27). By area, the second most dominant forest-type group is Woodland hardwoods, followed by the Nonstocked forest type and other forest types.

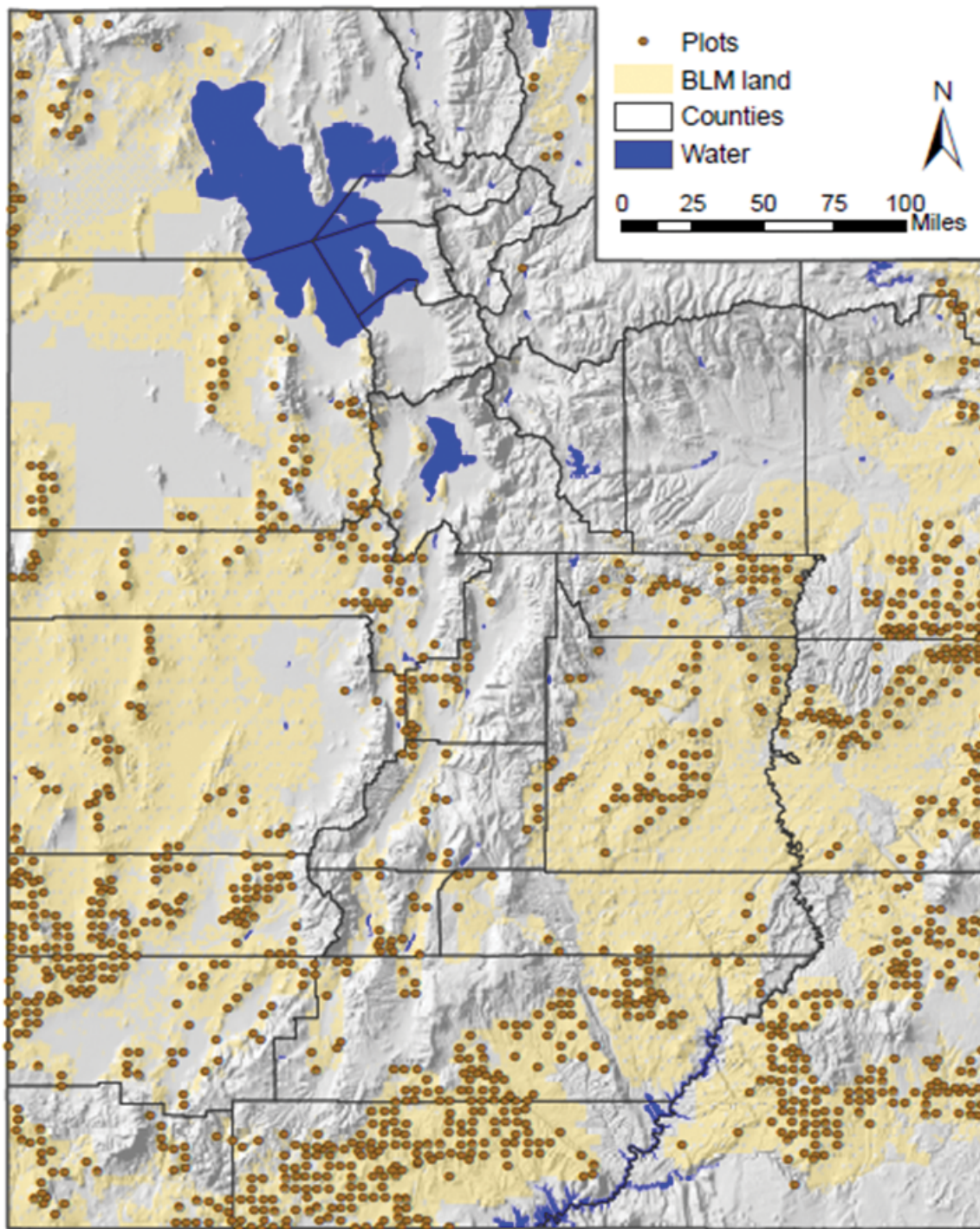


Figure 25—Distribution of forested inventory plots on lands administered by the Bureau of Land Management, Utah 2008–2017. Note: plot locations are approximate.

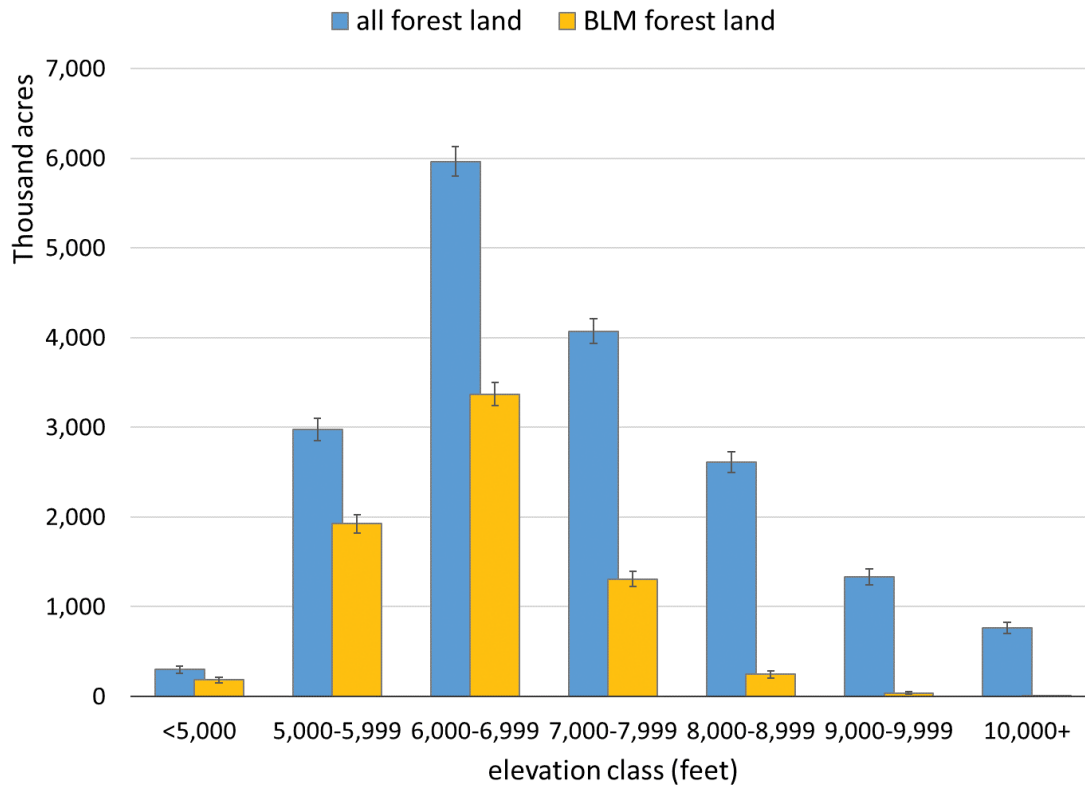


Figure 26—Area of BLM forest land compared to all forest land by elevation class, Utah 2008-2017.

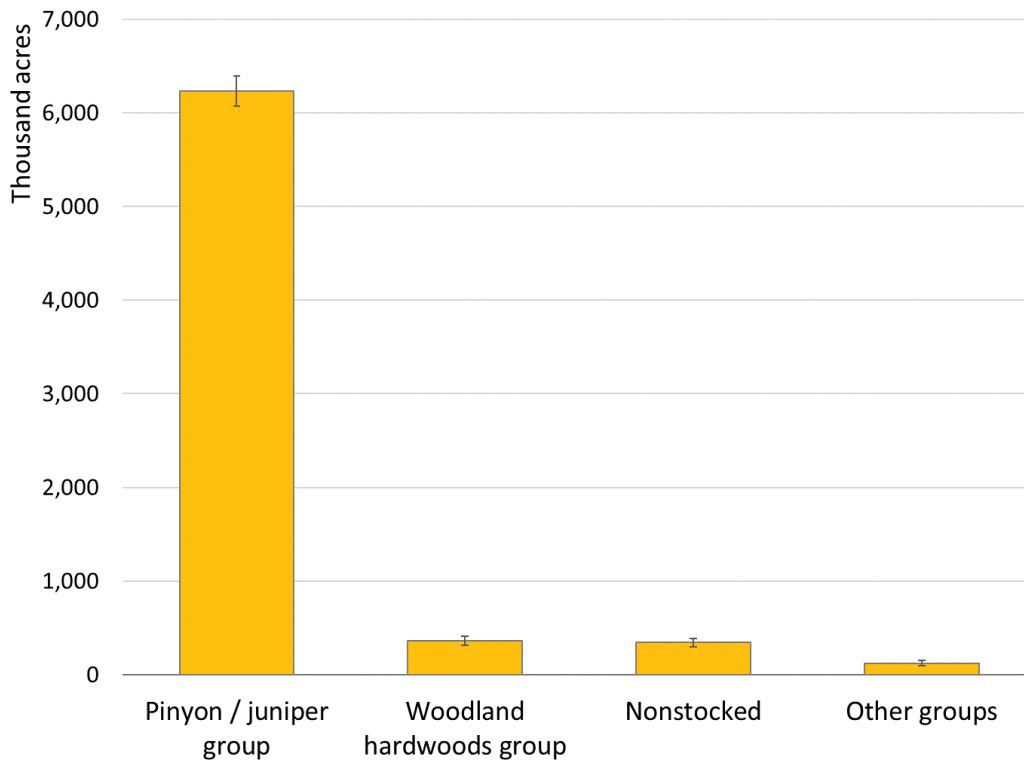


Figure 27—Area of BLM forest land by major forest-type groups, Utah 2008-2017. Other groups include the Douglas-fir, Fir/spruce/mountain hemlock, Ponderosa pine, Elm/ash/cottonwood, and Aspen/birch groups.

Although BLM manages 39 percent of the forest land in Utah, these forest lands contain only 27 percent of the aboveground biomass of live trees (diameter ≥ 1.0 inch). This averages 11 tons per acre, the lowest biomass per acre of any major forest ownership in Utah. Utah juniper, two-needle pinyon, singleleaf pinyon, and Rocky Mountain juniper are all in the woodland softwood species group; Gambel oak and curleaf mountain-mahogany are in the woodland hardwood species group (fig. 28). Douglas-fir is the only non-woodland species that constitutes more than one percent of the aboveground biomass on BLM forests in Utah.

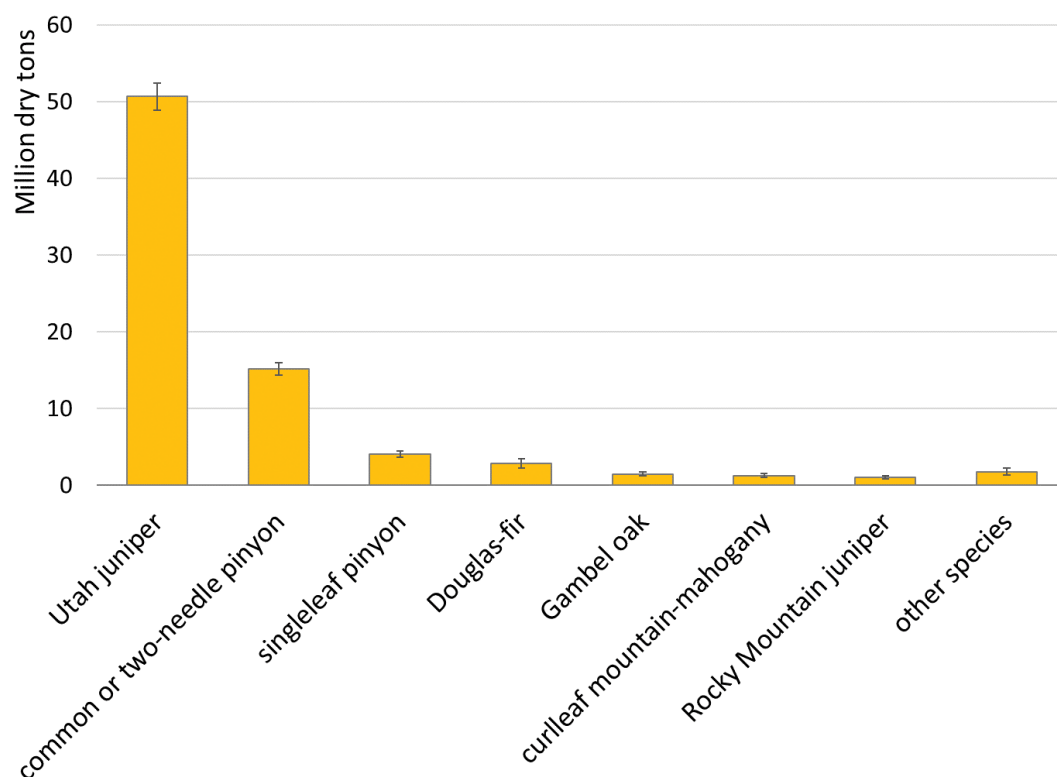


Figure 28—Aboveground weight of live trees ≥ 1.0 inch diameter on BLM forest land by individual tree species, Utah 2008–2017. Other species include ponderosa pine, subalpine fir, white fir, quaking aspen, bigtooth maple, Fremont cottonwood, limber pine, narrowleaf cottonwood, lodgepole pine, Engelmann spruce, Great Basin bristlecone pine, and velvet ash.

National Forest System (NFS)

The NFS consists of seven administrative national forests that are entirely or partially in Utah (fig. 29) and are found primarily at higher elevations in Utah (fig. 30). The Fishlake and Dixie National Forests are totally within the State; the Ashley, Manti-La Sal, and Uinta-Wasatch-Cache National Forests all have small portions in neighboring States; and the Caribou-Targhee and Sawtooth National Forests are primarily in neighboring States with small portions in Utah. Seventy-five percent of the State’s timber land is managed under the NFS, making it by far the major manager of timber land. Timber land occupies only 44 percent of NFS forest land (fig. 31), with 48 percent classified as other forest land (unreserved and unproductive), Utah’s dominant forest land class.

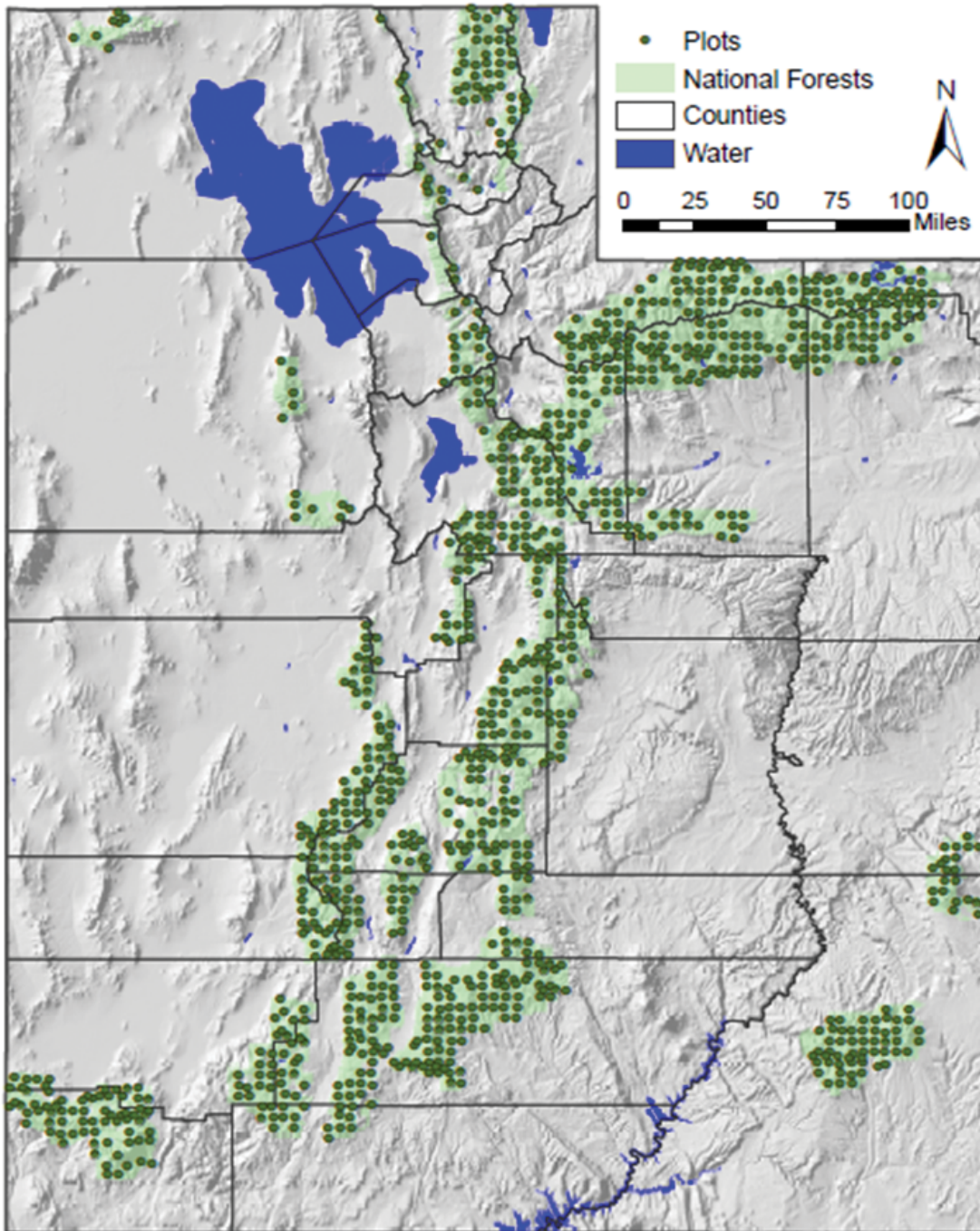


Figure 29—Distribution of forested inventory plots on lands administered by National Forests, Utah 2008-2017. Note: plot locations are approximate.

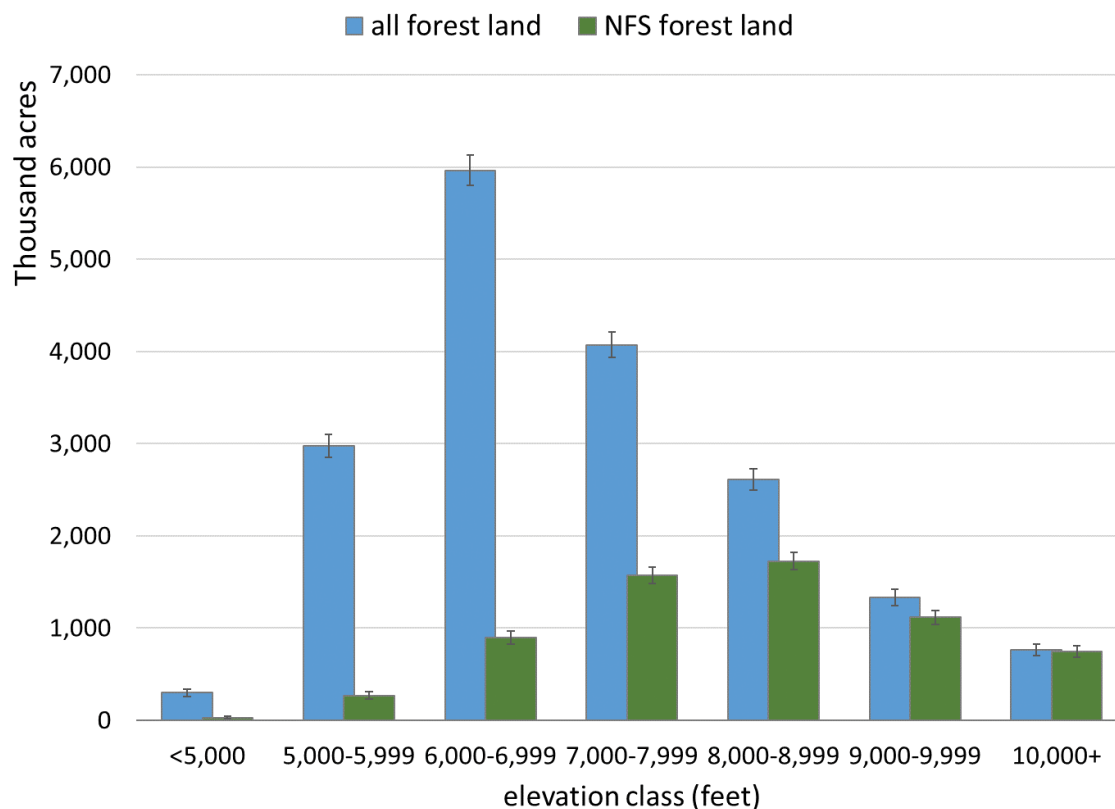


Figure 30—Area of NFS forest land compared to all forest land by elevation class, Utah 2008–2017.

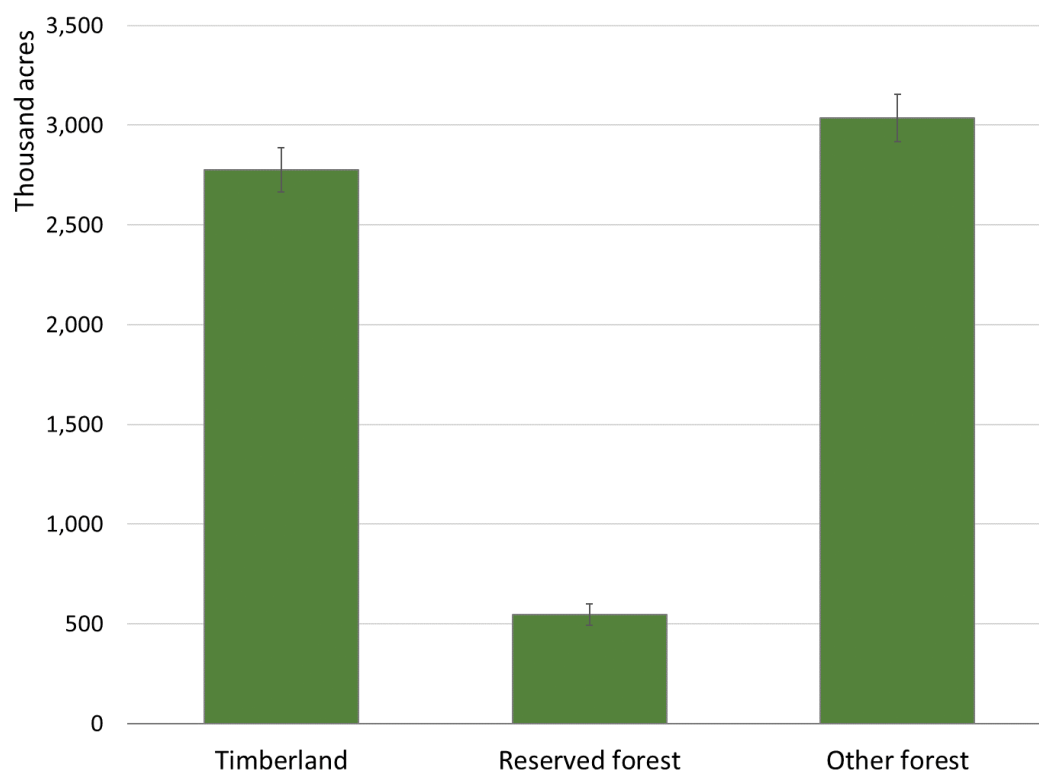


Figure 31—Area of NFS forest land by land status, Utah 2008–2017.

Although there is more timber land on NFS lands than on other ownerships, the most common forest-type group is still the Pinyon/juniper group, making up 27 percent of NFS forest land (1.7 million acres; fig. 32). The next most common is the Fir/spruce/mountain hemlock group, with 22 percent (1.4 million acres), followed by the Woodland hardwoods group (17 percent) and the Aspen/birch group (16 percent). National Forest System lands contain 35 percent of Utah’s forest land, and 51 percent of the net volume on forest land, or 1,217 live cubic feet per acre, by far the highest volume per acre of Utah’s major forest landowners. The top five tree species on NFS forest land by live net volume consist of timber species: Engelmann spruce, quaking aspen, subalpine fir, Douglas-fir, and lodgepole pine (fig. 33).

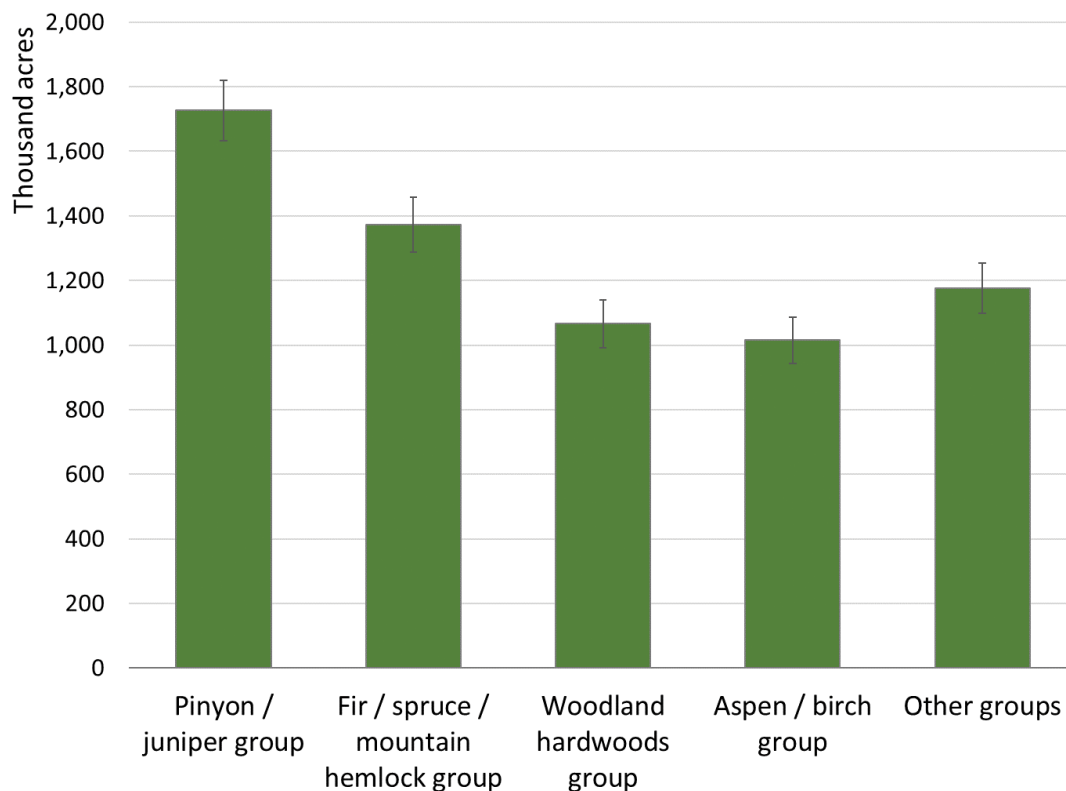


Figure 32—Area of NFS forest land by major forest-type groups, Utah 2008–2017. Other groups include the Lodgepole pine, Douglas-fir, Ponderosa pine, Nonstocked, Other western softwoods, and Elm/ash/cottonwood groups.

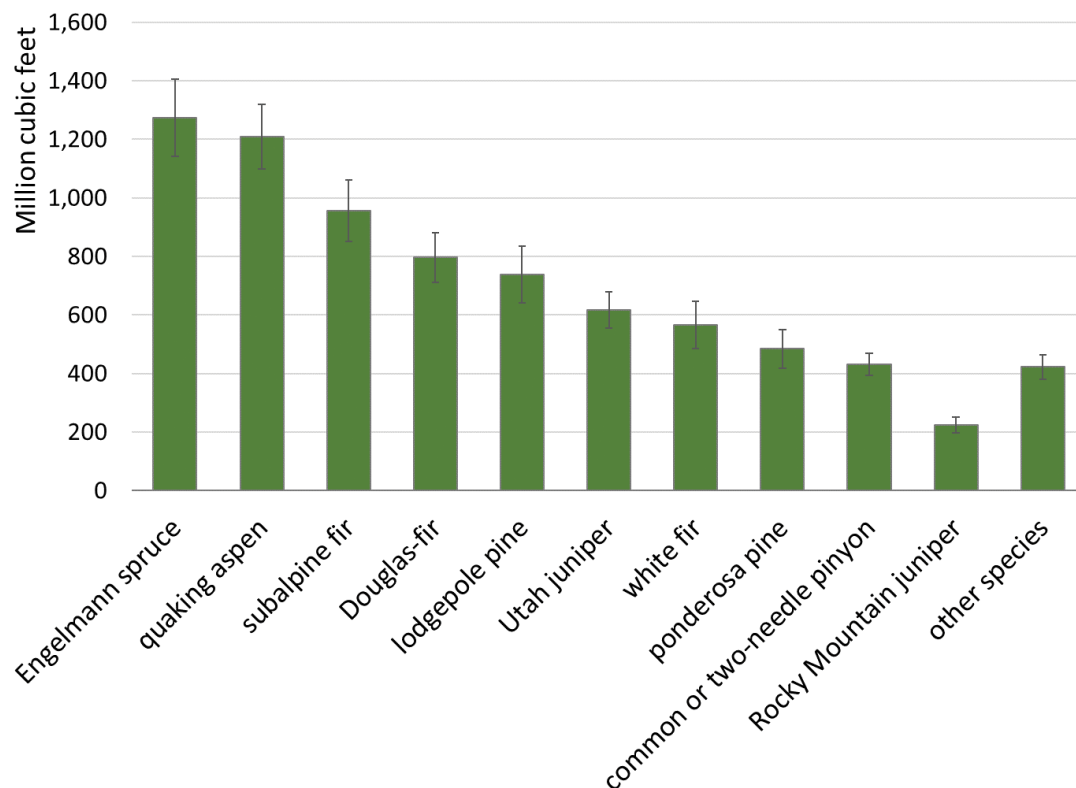


Figure 33—Net volume of live trees (≥ 5.0 inches diameter) on NFS forest land by individual tree species, Utah 2008–2017. Other species include Gambel oak, curlleaf mountain-mahogany, blue spruce, limber pine, bigtooth maple, singleleaf pinyon, Great Basin bristlecone pine, narrowleaf cottonwood, Fremont cottonwood, and boxelder.

Private ownerships

Privately owned forest land in Utah occurs in all counties (fig. 34), distributed relatively evenly across elevations, with slight underrepresentation at elevations above 9,000 feet. FIA recognizes several types of private forest land, but due to privacy concerns, does not publish details about these types. In Utah, private forest land ownership types include individuals and families, corporations, American Indian sovereign lands, unincorporated groups (such as hunting clubs or grazing cooperatives), and nongovernmental conservation organizations. FIA does not designate any private forest land as reserved, so Utah's private forest land can only be classed as timber land (21 percent) or other forests (unreserved and unproductive) (79 percent). Private owners control the second largest timber land portion in Utah after National Forests (586,000 acres; table B2). Figure 35 shows the major forest-type groups on private forest land, with the Pinyon/juniper group the most prevalent by acreage, followed by the Woodland hardwoods and Aspen/birch groups. The relative abundance of individual tree species by net live volume on private forest land is shown in figure 36. Compared to other ownerships, the live net volume of quaking aspen on private forest land is relatively high.

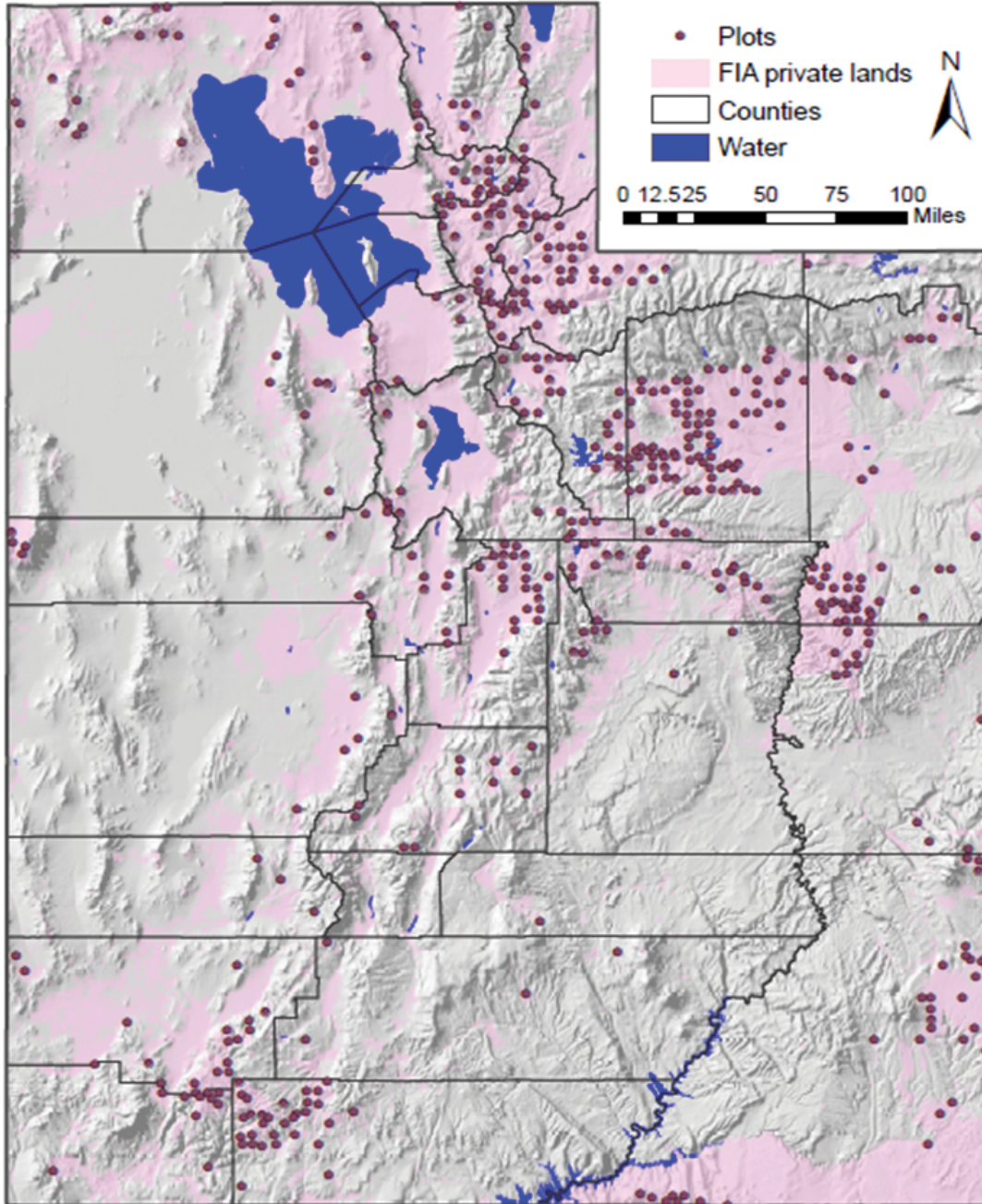


Figure 34—Distribution of forested inventory plots on various private ownerships, Utah 2008–2017. Note: plot locations are approximate and some on private lands may be swapped within counties.

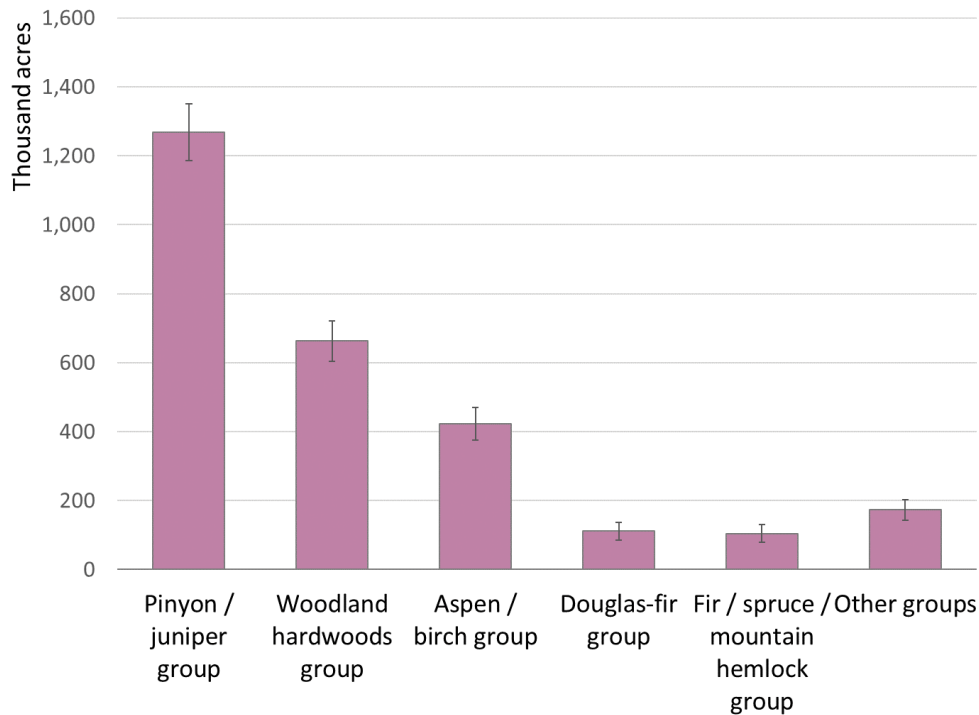


Figure 35—Area of privately owned forest land by major forest-type groups, Utah 2008–2017. Other groups include the Nonstocked, Ponderosa pine, Elm/ash/cottonwood, Lodgepole pine, and Other western softwoods groups.

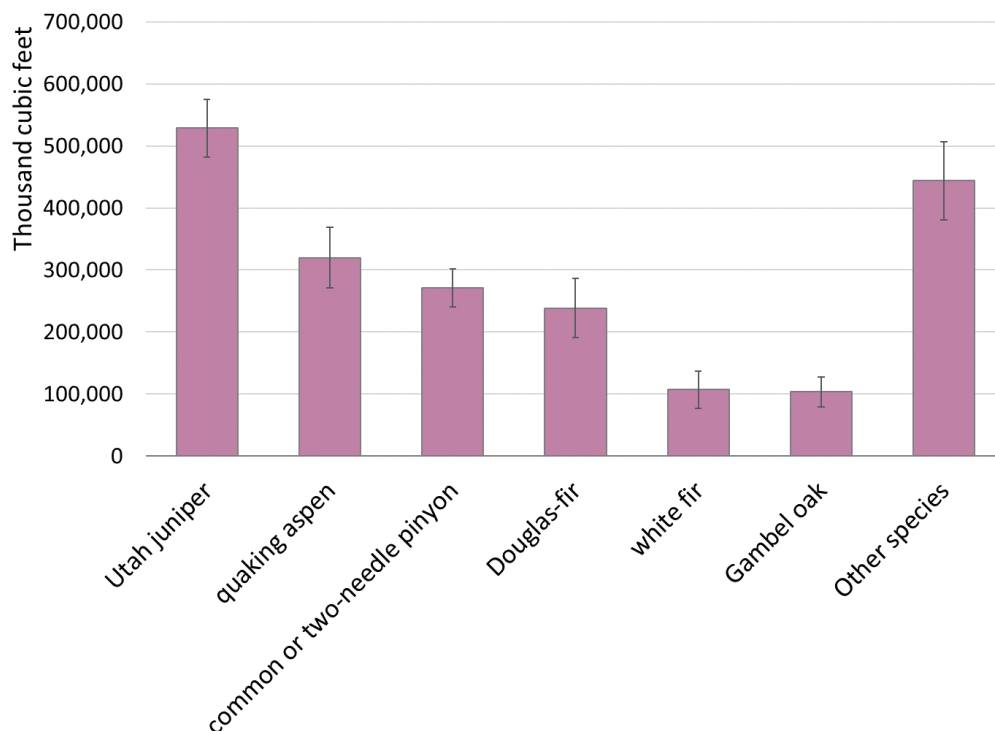


Figure 36—Net volume of live trees (≥ 5.0 inches diameter) on privately owned forest land by individual tree species, Utah 2008–2017. Other species include bigtooth maple, subalpine fir, Rocky Mountain juniper, ponderosa pine, lodgepole pine, Engelmann spruce, limber pine, curlleaf mountain-mahogany, narrowleaf cottonwood, singleleaf pinyon, Fremont cottonwood, blue spruce, and oneseed juniper.

State of Utah

State forest land is found throughout the State (fig. 37) but rarely at the highest elevations (above 9,000 feet). Eighty-two percent of this forest land is classified as other forest land (unreserved and unproductive), 14 percent is timber land, and the remaining portion is reserved forest. The most common forest-type group is the Pinyon/juniper group, with 67 percent of the forest land, followed by the Woodland hardwoods group with 16 percent. The most common nonwoodland forest-type groups are the Aspen/birch and Douglas-fir groups (fig. 38). As expected, the tree species with the highest live net volume are Utah juniper and two-needle pinyon (fig. 39). Douglas-fir and quaking aspen are also well represented by live net volume on Utah's State forest lands.

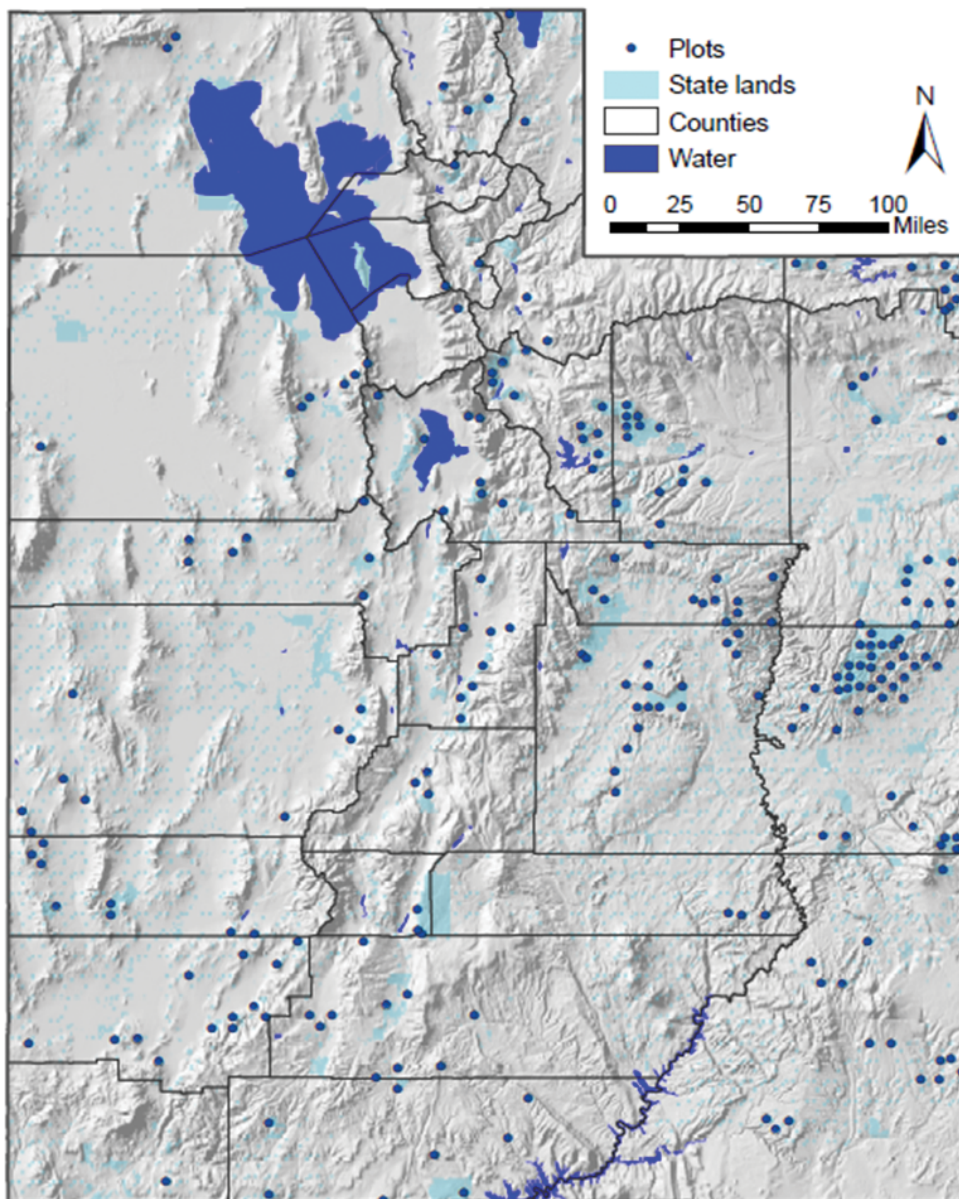


Figure 37—Distribution of forested inventory plots on lands administered by the State of Utah, 2008–2017. Note: plot locations are approximate.

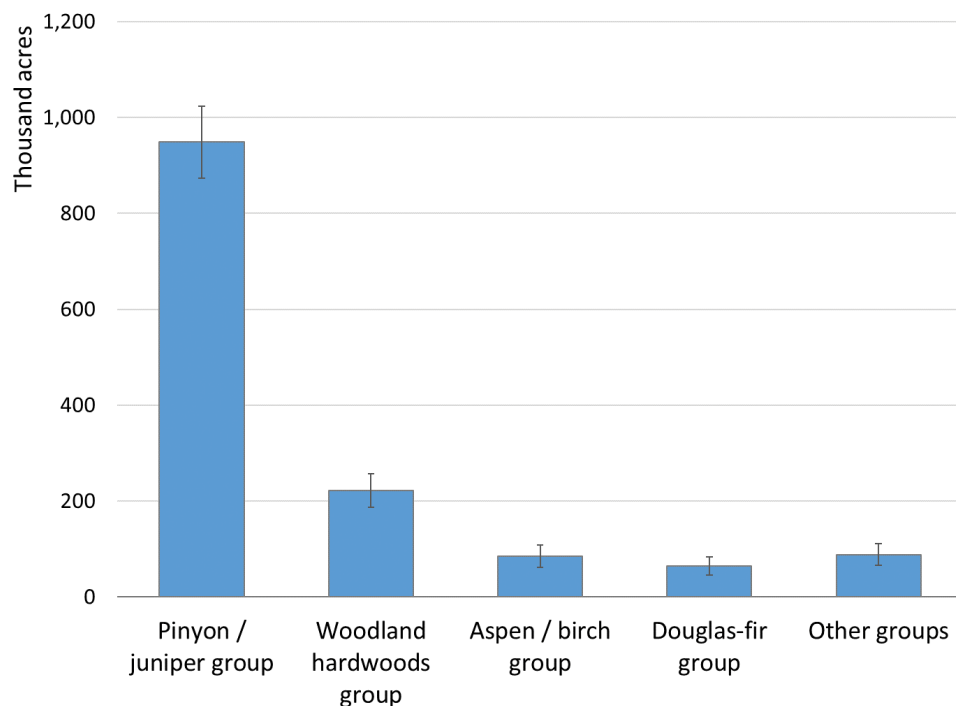


Figure 38—Area of State forest land by major forest-type groups, Utah 2008–2017. Other groups include the Nonstocked, Ponderosa pine, Fir/spruce/mountain hemlock, Other western softwoods, and Elm/ash/cottonwood groups.

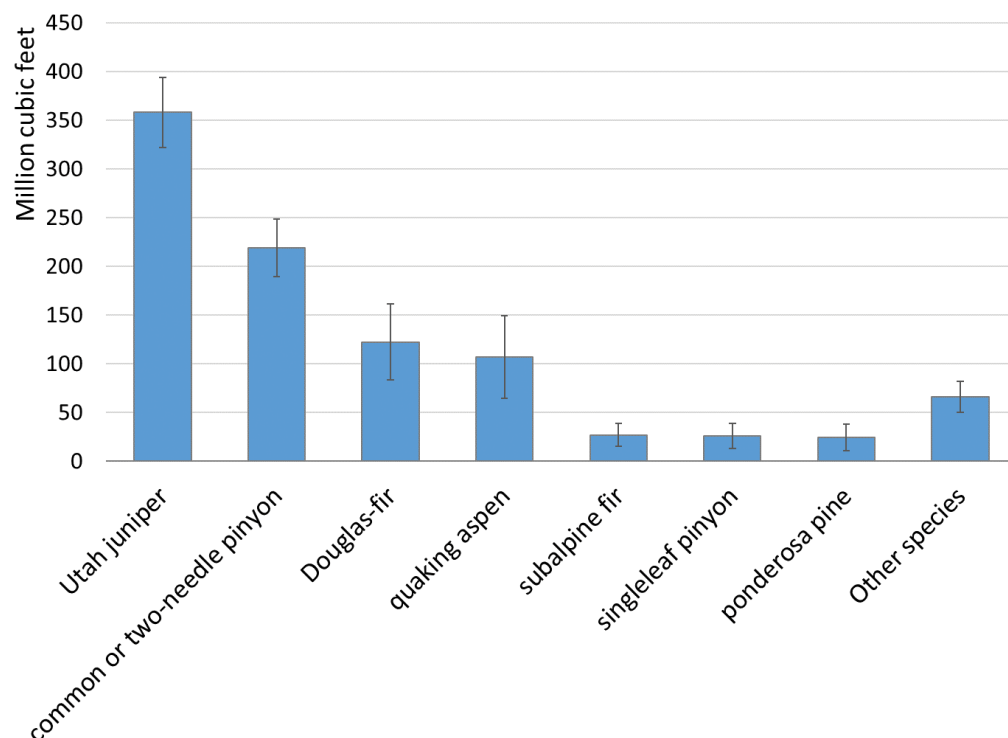


Figure 39—Net volume of live trees (≥ 5.0 inches diameter) on State forest land by individual tree species, Utah 2008–2017. Other species include curlleaf mountain-mahogany, white fir, Rocky Mountain juniper, Gambel oak, Engelmann spruce, bigtooth maple, and limber pine.

Stand Age Class

The age structure of tree species on forest land provides insight into shifts in stand structure and composition over time. For the first visit of each FIA plot, stand age is estimated (based on the average age of only those trees that fall within the calculated stand size class) for every plot that samples forest land and includes trees suitable for increment core extraction. This also applies to revisited plots after major change has occurred since the first visit. For example, suppose an FIA plot sampled a softwood forest type where about 30 percent of the live tree stocking was in the large-diameter stand size class (softwoods at least 9.0 inches in diameter and hardwoods at least 11.0 inches in diameter) and 70 percent were in the medium diameter stand size class (trees between 5.0 inches diameter and the large stand size class diameter threshold). The stand would fall into the medium stand size class, and therefore only the medium-size trees would be used to determine stand age. For previously sampled plots, the time between visits is simply added to the previous stand age unless there is evidence of a serious disturbance since the last measurement.

There are limitations on collecting data for stand age computations. Repeatable measurements of increment cores are difficult to collect from some tree species, particularly woodland species or those that may be very long-lived. Stand age may not accurately depict the age structure of uneven-aged stands, which encompass multiple age classes. Stand ages are difficult to accurately determine for stands that are dominated by small-diameter tree species such as Gambel oak. A stand age of zero is assigned to nonstocked conditions, which are stands that contain less than 10 percent stocking, usually due to disturbance. Because nonstocked plots are the only plots with a stand age of zero, estimates using them may be labeled as age class “0” or “Nonstocked” interchangeably in different reporting contexts.

Table B6 shows the area of Utah’s forest land by stand age class and forest-type group with stand age classes of 20 years. The largest stand age class is the 201+, or greater than 200 years class, which contains 17 percent of the forest land area, or 3.1 million acres. The next two largest classes comprise stand ages of 81 to 120 years, which together contain 23 percent, or 4.1 million acres, of forest land. Forty-eight percent of Utah’s forest is older than 120 years.

Figure 40 shows how 20-year age classes have changed over the last two Utah reports (DeBlander et al. 2010; Werstak et al. 2016) and this report. There are three general ways in which a forest stand can move from one age class to another; the first of which is to simply increase age and move into the next older class. Second, if a stand loses a cohort of tree species and/or diameters, stand age would be recalculated, usually to a younger age, but it is conceivable that stand age could increase. The third, possibly an extreme example of the second, is a stand-replacing disturbance that would move the stand back to nonstocked, or a stand age of zero. Some stand ages have increased, others have decreased, and still, others show no discernable trend. For most classes, it is difficult to determine which mechanisms are operating, but the increase in the 0-year stand age class (Nonstocked) can only be the result of continuing or increased disturbance. Increases in the 200+ years age class will be primarily the result of mature forest stands growing even older.

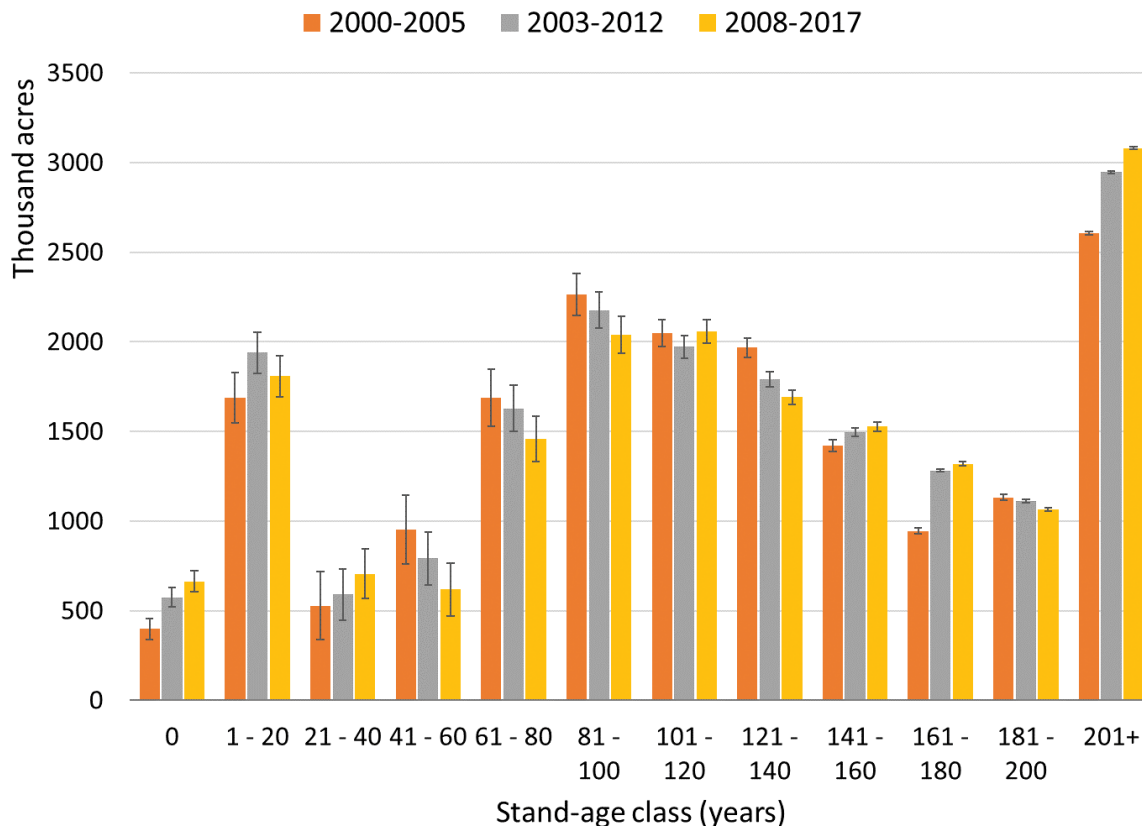


Figure 40—Estimates of forest land area by stand-age class in Utah from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

Considerable differences are apparent in stand age distribution among the major forest-type groups in Utah (fig. 41). The Pinyon/juniper group has the largest proportion of its area in stands over 200 years old (27 percent), with very little in the three age classes from 1 to 60 years old (4 percent). The Woodland hardwoods forest-type group has 53 percent of its area in the 1 to 20 years age class. A substantial portion of the Fir/spruce/mountain hemlock forest-type group's area has stand ages over 200 years but is most dominant in the age classes between 81 and 160 years. The Aspen/birch group is more dominant in younger age classes than the Fir/spruce/mountain hemlock group, those between 61 and 120 years. Aspen has 17 percent of its area in the 1 to 20 years age class and none in age classes over 181 years.

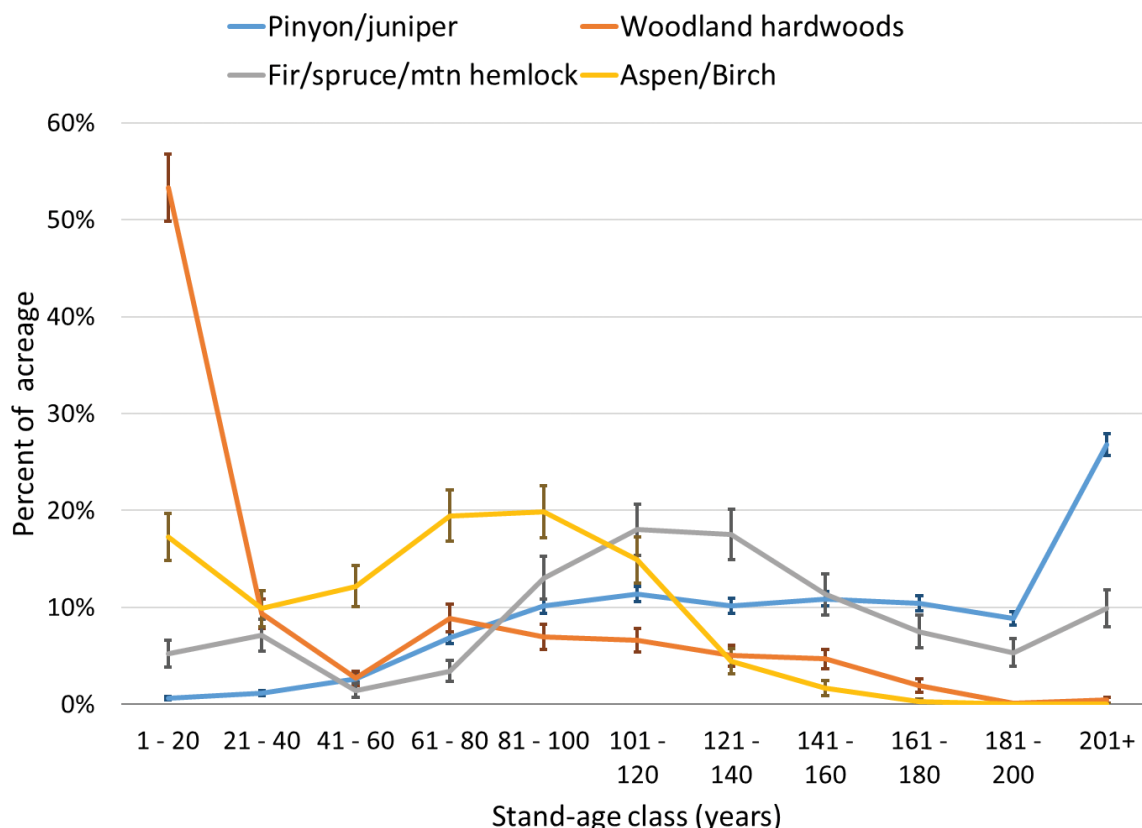


Figure 41—Distribution of forest land acreage by stand-age class for major forest-type groups, Utah 2008–2017.

Understory Vegetation

FIA collects understory vegetation data using two distinct protocols that characterize overall vegetation structure and composition. Under the vegetation structure protocol, FIA field crews record the height class and percent cover that is occupied by each of four growth habits: forbs, graminoids, shrubs, and trees. Under the RMRS-FIA regional methods, only trees less than 5.0 inches in diameter were considered. There is no cover minimum for the vegetation structure protocol; growth habits that are present on a subplot at less than 1 percent are recorded as 1 percent. Under the species composition protocol, height class, growth habit, and percent cover are recorded for up to four species per growth habit that occupy at least 3 percent of the ground area on a subplot. RMRS-FIA regional methods used a minimum of 5 percent cover. In the species composition protocol, trees less than 5.0 inches in diameter are a separate growth habit from larger trees. On plots where many species are present but where each species occupies less area than the cover threshold for individual species, no species are recorded under the species composition protocol. However, the cover of these species in aggregate (and within the same growth habit) is recorded using the vegetation structure protocol.

Figure 42 depicts the average percent cover of each plant growth habit for each of Utah's forest-type groups and table 4 lists the four most commonly recorded species by growth habit. Average cover of each life form was calculated for each condition, then expanded to total cover for each forest-type group and divided by the total acres of each forest-type group.

As might be expected for forest land, trees have the highest cover of any growth form in all forest-type groups except for Nonstocked. The Woodland hardwood group has a higher percentage of its cover dominated by trees than other forest-type groups, followed by the Aspen/birch and Douglas-fir forest-type groups. After trees, shrubs are the plant growth habit with the highest average cover in all forest types except Nonstocked. The highest average shrub cover occurs in the Aspen/birch group, followed by the Elm/ash/cottonwood, Douglas-fir, and Woodland hardwoods groups. The Aspen/birch, Elm/ash/cottonwood and Fir/spruce/mountain hemlock groups have the highest relative-cover of forbs and are also those with substantially higher cover of forbs than graminoids. The Douglas-fir and Other western softwoods forest-type groups have marginally more forb cover than graminoid cover. Across all groups, relative-cover by graminoid plant growth habit is highest on average in the Nonstocked forest-type group.

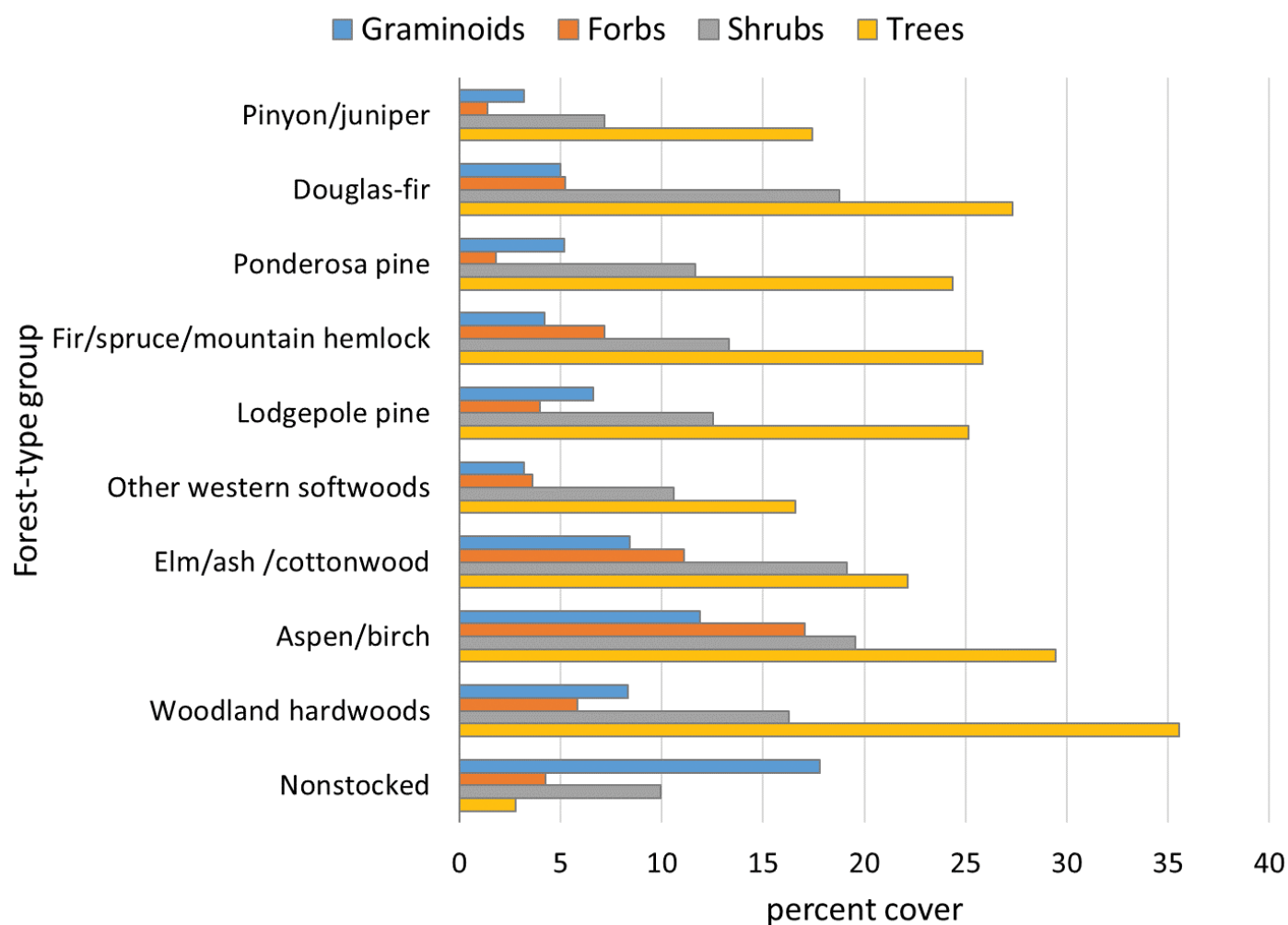


Figure 42—Average cover of vegetation growth habits by major forest-type group, Utah 2008–2017.

Table 4—The most frequently recorded understory plant species on forest land by growth habit, Utah 2008-2017.

Growth habit	Species	Common Name	Plot frequency (% of 3,103 plots)	Average cover
Forb	<i>Thalictrum fendleri</i>	Fendler's meadow-rue	3.13	9.0
	<i>Achillea millefolium</i>	common yarrow	2.19	5.0
	<i>Lathyrus lanszwertii</i>	Nevada pea	1.93	10.4
	<i>Agastache urticifolia</i>	nettleleaf giant hyssop	1.80	8.9
Graminoid	<i>Bromus tectorum</i>	cheatgrass	7.25	12.9
	<i>Pseudoroegneria spicata</i> ssp. <i>spicata</i>	bluebunch wheatgrass	6.35	8.5
	<i>Poa pratensis</i>	Kentucky bluegrass	5.25	12.4
	<i>Poa</i> spp.	bluegrass	5.25	8.6
Shrub	<i>Artemisia tridentata</i>	big sagebrush	21.40	9.0
	<i>Symphoricarpos oreophilus</i>	mountain snowberry	21.01	14.5
	<i>Cercocarpus montanus</i>	alderleaf mountain mahogany	10.70	9.4
	<i>Amelanchier utahensis</i>	Utah serviceberry	7.44	7.7
Understory tree	<i>Quercus gambelii</i>	Gambel oak	21.98	25.9
	<i>Pinus edulis</i>	two-needle pinyon	15.21	5.9
	<i>Populus tremuloides</i>	quaking aspen	11.83	16.5
	<i>Abies lasiocarpa</i>	subalpine fir	8.60	15.5

Down Woody Material

Down woody material (DWM) is an important component of forest that impacts fire behavior, wildlife habitat, soil stabilization, and carbon storage. The main components of DWM are fine woody debris (FWD), coarse woody debris (CWD), slash piles, litter, and duff. Fine woody debris comprises the small diameter (less than 3-inch diameter) fire-related fuel classes: 1-hour (0.01- to 0.24-inch diameter), 10-hour (0.25- to 0.9-inch diameter), and 100-hour (1.0- to 2.9-inch diameter). CWD is the larger diameter (3.0-inch diameter and larger), which is classified with the 1,000-hour fire-related fuel class.

Down woody material data collection was initially done on a small subset of plots. In 2006, and through 2012, RMRS-FIA began a DWM inventory in Utah on all forest plots (USDA FS 2006). During this time, RMRS-FIA worked with the national FIA program to develop a new, national DWM protocol to be used on all RMRS-FIA forest plots. Beginning in 2013, the new national DWM protocol was implemented in Utah (USDA FS 2013). Data from the two protocols can now be combined to make estimates of data collected from 2008 through 2017. If snow or other conditions make it impossible to sample all DWM components, plots or conditions are considered nonsampled for purposes of DWM estimates.

Table 5 shows the mean fuel loading by DWM component and forest-type group. Utah's high-elevation moist forests tend have the highest fuel loading (DWM biomass or short tons per acre), while the dryer low-elevation forests have relatively low fuel loading. The Lodgepole pine and Aspen/birch forest-type groups have the highest total fuel loading (the sum of all fuel loading components): 25.2 tons per acre and 24.6 tons per acre, respectively. The lowest fuel loading totals are found in Nonstocked (5.5 tons per acre) and the Pinyon/juniper forest-type group (5.7 tons per acre).

Table 5—Mean fuel loadings, in short tons per acre, on forest land by forest-type group and fuel class Utah, 2008-2017.^a

Forest-type group	Down and dead wood by time-lag fuel hour classes				Slash piles	Forest floor fuels	
	1 hr	10 hr	100 hr	1000+ hr		Duff	Litter
Pinyon / juniper	0.05	0.3	0.8	1.5	— ^b	1.3	1.7
Douglas-fir	0.0	0.8	2.3	4.2	0.1	4.7	3.3
Ponderosa pine	0.03	0.4	0.9	3.2	—	5.4	5.0
Fir / spruce / mountain hemlock	0.07	0.5	1.7	9.3	—	5.7	2.5
Lodgepole pine	0.06	0.5	1.9	8.7	—	9.4	4.7
Other western softwoods	0.04	0.3	1.3	5.0	—	4.0	2.2
Elm / ash / cottonwood	1.0	3.6	1.5	2.5	—	1.0	3.6
Aspen / birch	0.04	0.3	1.5	5.0	—	11.4	6.2
Woodland hardwoods	0.05	0.4	1.1	0.8	0.2	7.4	6.9
Nonstocked	0.02	0.2	0.7	1.5	—	1.0	2.0
Total all groups	0.05	0.4	1.1	2.7	0.0	3.7	3.1

^a Numbers in columns will not sum to totals due to averaging by acre.

^b A dash (—) indicates no sample for the cell; 0.0 indicates a value of > 0.0 but < 0.05 for the cell (<0.005 for 1 hr fuels).

Distribution of DWM fuel loading among components impacts fire behavior. Conifer forest types tend to have large portions of the DWM biomass in the down wood components (the three FWD components, CWD, and slash piles). The Fir/spruce/mountain hemlock and Lodgepole pine groups have the highest loading of the down wood components overall as well as the highest loadings in the 1,000-hour class (CWD). Down and dead wood components make up 59 percent of the Fir/spruce/mountain hemlock forest-type group's total fuel loading and 44 percent of that for the Lodgepole pine forest-type group. Deciduous hardwood types tend to have the majority of their fuel loading in the forest floor components, litter, and duff, due to the annual input of fallen leaves. The Aspen/birch forest-type group has the highest loading in forest floor fuels of any forest-type group, particularly in the duff component. The highest loading for the litter component occurs in the Woodland hardwoods forest-type group, and although the total forest floor fuel loading is only slightly more than that of the Lodgepole pine group, the proportion of total loading found in the forest floor fuels of Woodland hardwoods is higher than any other forest-type group (85 percent).

Diversity of CWD in terms of diameters and decay classes is important to wildlife habitat. Field crews assign a large-end diameter class for each CWD piece measured. Data in this report collected from 2008 through 2012 used five large-end diameter classes, data collected from 2013 through 2017 use six classes, with the same class breaks, but with an extra very large diameter class (40 inches or more). Because the very large class is rare and was only collected for a portion of the inventory, we will combine the two largest classes. Information about large-end diameter classes may be critical in determining habitat suitability for species that require large-diameter logs in their habitat. Decay classes range from class 1, which are newly fallen trees with no decay, to class 5, which no longer maintain the shape of a log, but are spread out on the ground. Although the pieces in decay class 5 contribute to biomass and carbon pools, their large-end diameter class is not recorded due to the degree of decomposition.

Table 6 shows the average volume of CWD by large-end diameter class or tables decay class for each forest-type group. Generally, most of the volume is in the 9.0- to 14.9-inch diameter class. The Fir/spruce/mountain hemlock, Douglas-fir, and Ponderosa pine forest-type groups, which produce large-diameter trees, contribute to the largest CWD class—and have substantially more volume per acre in the 21.0-inch and larger diameter class than other forest-type groups (fig. 43). Ponderosa pine has its highest volume in the 21.0-inch and larger diameter class. Note that some forest-type groups listed in table 6 that have lower values of volume per acre (such as the Pinyon/juniper group) have relatively high values of total volume in figure 43 because they cover large acreage. Conversely, the Lodgepole pine forest-type group, which covers fewer acres, has lower total volume even though its volume per acre is one of the highest. Forest types with low sample sizes and small estimates are not shown in figure 43. In terms of decay classes, the largest portion of the volume occurs in decay class 3 (fig. 44), which is described as having sound heartwood and supporting its own weight. This is true for all forest-type groups except for Other western softwoods, which may not have representative estimates due to small sample size.

Table 6—Mean volume of coarse woody debris, in cubic feet per acre, on forest land by forest-type group, large-end diameter, and decay class, Utah, 2008-2017.^a

Forest-type group	Large-end diameter (inches)					Decay-class					Total
	3.0-4.9	5.0-8.9	9.0-14.9	15.0-20.9	21.0+	1	2	3	4	5	
Pinyon / juniper	8.9	39.2	59.3	24.0	7.8	2.4	16.3	66.4	54.1	15.6	154.8
Douglas-fir	31.7	128.6	168.2	113.7	120.1	6.7	78.4	282.1	195.1	110.8	673.1
Ponderosa pine	20.5	104.7	62.4	53.5	115.6	22.2	57.3	178.4	98.9	36.3	393.2
Fir / spruce / mountain	39.9	243.4	412.0	272.0	156.1	37.3	277.3	422.7	386.0	256.4	1,379.7
Lodgepole pine	49.6	259.1	376.2	139.3	9.0	35.4	216.8	322.1	258.9	199.0	1,032.2
Other western softwoods	17.1	75.0	318.8	208.1	85.5	14.4	97.9	186.7	405.5	46.2	750.8
Elm / ash / cottonwood	9.2	109.6	86.1	96.0	— ^b	1.0	79.7	163.6	56.5	17.3	318.1
Aspen / birch	52.0	277.5	271.1	99.2	42.4	22.7	173.4	316.6	229.7	71.5	813.9
Woodland hardwoods	10.4	28.5	39.5	7.1	5.5	1.6	20.2	45.9	23.2	8.4	99.4
Nonstocked	14.3	43.3	40.8	38.2	3.0	2.0	46.2	66.9	24.5	14.5	154.2
Total all groups	17.5	85.2	115.7	56.6	27.6	8.3	61.4	130.9	103.1	47.6	351.3

^a Numbers in rows and columns may not sum to totals due to rounding.

^b A dash (—) indicates no sample for the cell; 0.0 indicates a value of > 0.0 but < 0.05 for the cell.

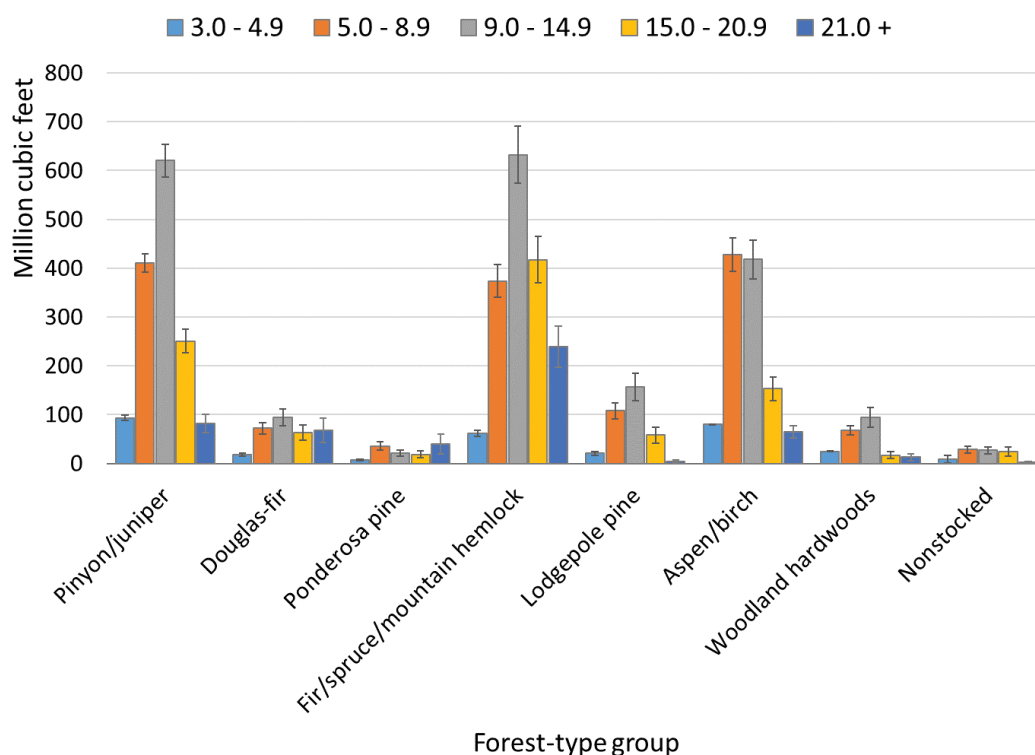


Figure 43—Total volume of coarse woody debris by forest-type group and large-end diameter class, Utah 2008–2017. Not shown due to small estimates are the Elm/ash/cottonwood group and the Other western softwoods group.

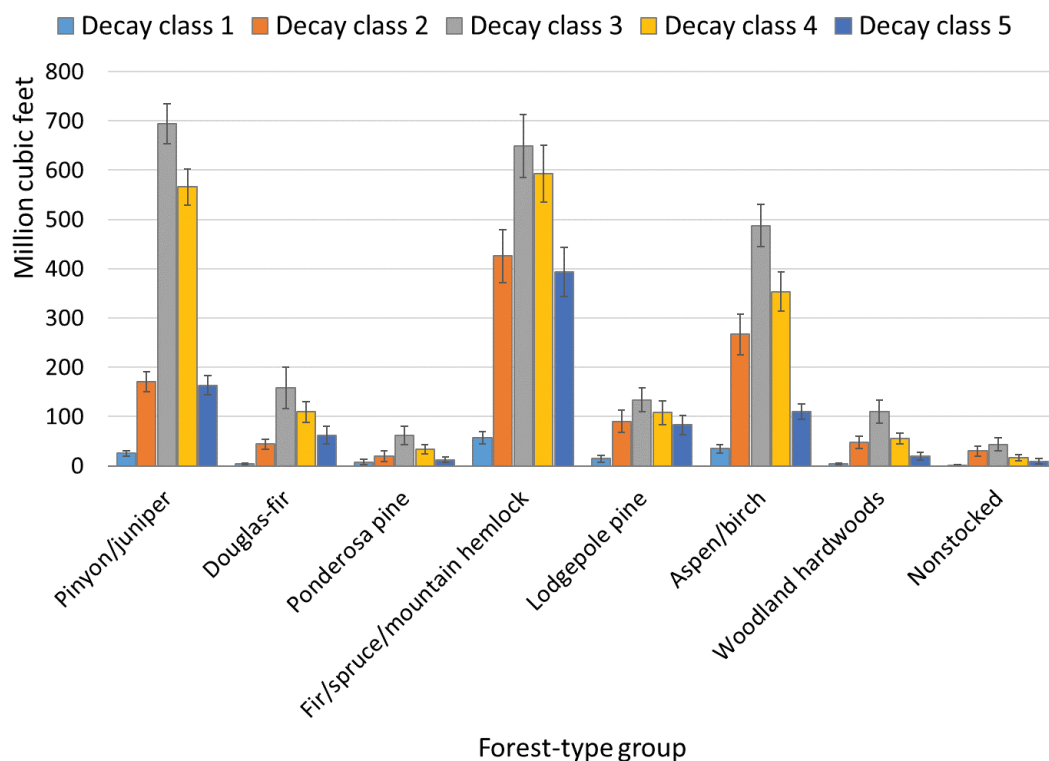


Figure 44—Total volume of coarse woody debris by forest-type group and decay class, Utah 2008–2017. Not shown due to small estimates are the Elm/ash/cottonwood group and the Other western softwoods group.

Most of the CWD biomass and carbon occurs on forest land managed by the Forest Service, consisting of both National Forest System and other Forest Service lands not within the National Forest System (table 7). As an exception, most of the CWD biomass and carbon present in the Pinyon/juniper, Elm/ash/cottonwood, and Nonstocked forest-type groups occurs within the Other Federal ownership group, with the highest amounts located on land managed by the Bureau of Land Management. The largest portion of CWD biomass and carbon are found in the Pinyon/juniper forest-type group (15.3 million tons of biomass and 7.9 million tons of carbon), with the next largest portion in the Fir/spruce/mountain hemlock forest-type group (14.3 million tons of biomass and 7.3 million tons of carbon).

Table 7—Biomass and carbon mass, in million short tons, of coarse woody debris on forest land by forest-type group and ownership group, Utah, 2008-2017.^a

Forest-type group	Ownership group									
	USDA Forest Service		Other Federal		State and local government		Undifferentiated Private		All owner groups	
	Biomass	Carbon	Biomass	Carbon	Biomass	Carbon	Biomass	Carbon	Biomass	Carbon
Pinyon / juniper	2.8	1.4	9.4	4.9	1.2	0.6	1.8	1.0	15.3	7.9
Douglas-fir	1.3	0.7	0.5	0.2	0.2	0.1	0.4	0.2	2.4	1.2
Ponderosa pine	0.9	0.4	0.0	0.0	0.2	0.1	0.0	0.0	1.1	0.6
Fir / spruce / mountain hemlock	13.1	6.7	0.4	0.2	0.1	0.1	0.7	0.4	14.3	7.3
Lodgepole pine	3.5	1.8	— ^b	—	—	—	0.1	0.0	3.6	1.9
Other western softwoods	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1
Elm / ash / cottonwood	—	—	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1
Aspen / birch	5.5	2.8	0.0	0.0	0.4	0.2	1.8	0.9	7.7	3.9
Woodland hardwoods	1.0	0.5	0.4	0.2	0.1	0.1	0.4	0.2	1.9	1.0
Nonstocked	0.4	0.2	0.5	0.3	0.0	0.0	0.1	0.0	1.0	0.5
Total all groups	28.6	14.6	11.4	5.9	2.3	1.2	5.5	2.8	47.8	24.5

^a Numbers in columns may not sum to totals due to rounding.

^b A dash (—) indicates no sample for the cell; 0.0 indicates a value of > 0.0 but < 0.05 for the cell.

FOREST HEALTH IN UTAH

Growth and Mortality

Growth and mortality are important factors in determining forest vigor, timber supply, and sustainability. Mortality is the average annual net volume of trees (diameter ≥ 5.0 inches) dying over a specified period of time due to natural causes, and it excludes the volume removed and utilized through harvesting. Growth is typically expressed by net annual growth, which is defined as gross growth, or the average annual change in volume of trees that are alive in the current inventory, minus annual tree mortality. Gross growth on all live trees for the current report is estimated at an average annual value of 209 million cubic feet per year. Gross growth is less than the average annual mortality of 250 million cubic feet per year (tables B37–39). Annual net growth, or growth volume on surviving trees minus mortality volume, of all trees at least 5.0 inches in diameter in Utah’s forests is negative 41 million cubic feet per year (tables B33–35). Negative annual net growth of 41 million cubic feet as a percent of the net volume of all live trees in Utah represents a loss of 0.27 percent per year of the standing live volume.

Net growth and mortality estimates have changed substantially since the 2005 Utah report, but less so since the 2012 report (fig. 45). Net growth was positive in the 2005 report, although gross growth was less than mortality. In contrast, the average net growth was negative in the 2012 report (Werstak et al. 2016) similar to the current report. Consistent net volume loss from high mortality without accounting for any harvest activity over the last 5 years underscores the need to better understand why specific trees may be dying.

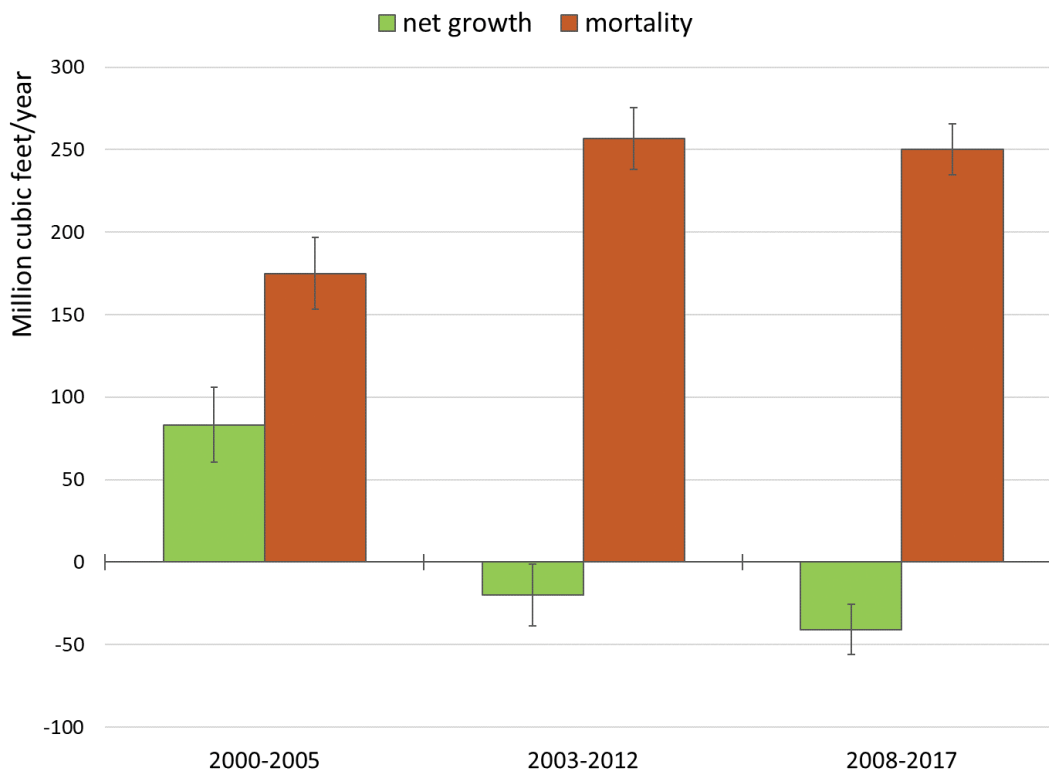


Figure 45—Estimates of annual net growth and annual mortality of trees (≥ 5.0 inches diameter) on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

All mortality trees are assigned a cause of death by field crews, though cause of death cannot always be determined with certainty. Interactions between insects, disease, and drought stress often occur (Anderegg et al. 2015; Shaw et al. 2005) which can result in difficulty determining a single cause of tree mortality. In Utah, the three major causes of tree death are insect attack, diseases, and fire and the portion assigned to each major cause is as follows: insects 46 percent, diseases 28 percent, and fire 14 percent. Mortality caused by insects and diseases has increased substantially since the 2005 report (fig. 46). Though disease mortality has increased since 2012 and insect mortality has declined, these changes are within sampling error. Other causes of tree mortality are animal damage, weather, other vegetation, unknown/other, and timber-related activities where the tree is not utilized.

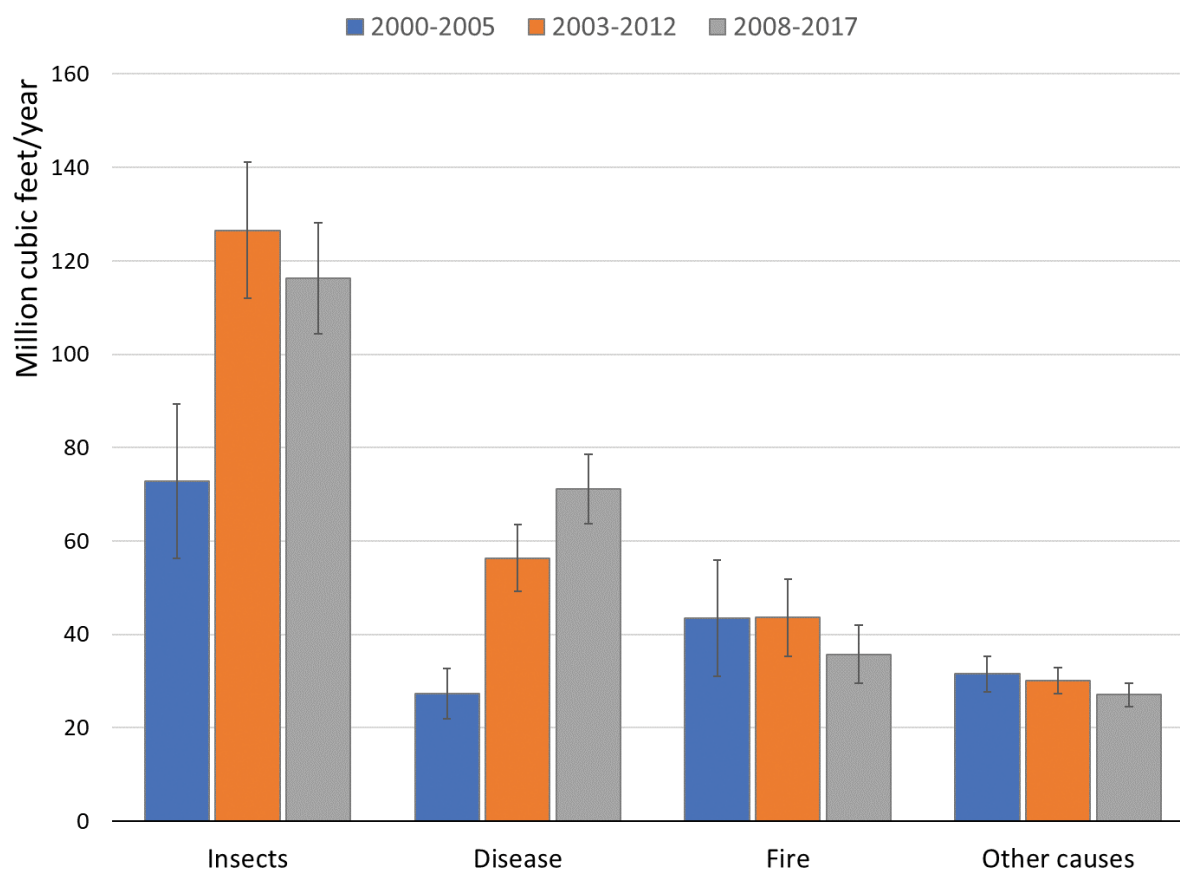


Figure 46—Estimates of annual mortality of trees (≥ 5.0 inches diameter) by cause of death on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

Recent studies have suggested declines in several common tree species in the western United States (Stanke et al. 2021). Tables B35 and B39 indicate that the tree species groups with a combination of negative net growth and high mortality are Lodgepole pine, Engelmann, and other spruces. Figure 47 shows net growth and mortality for the individual species with the top 10 mortality estimates in Utah.

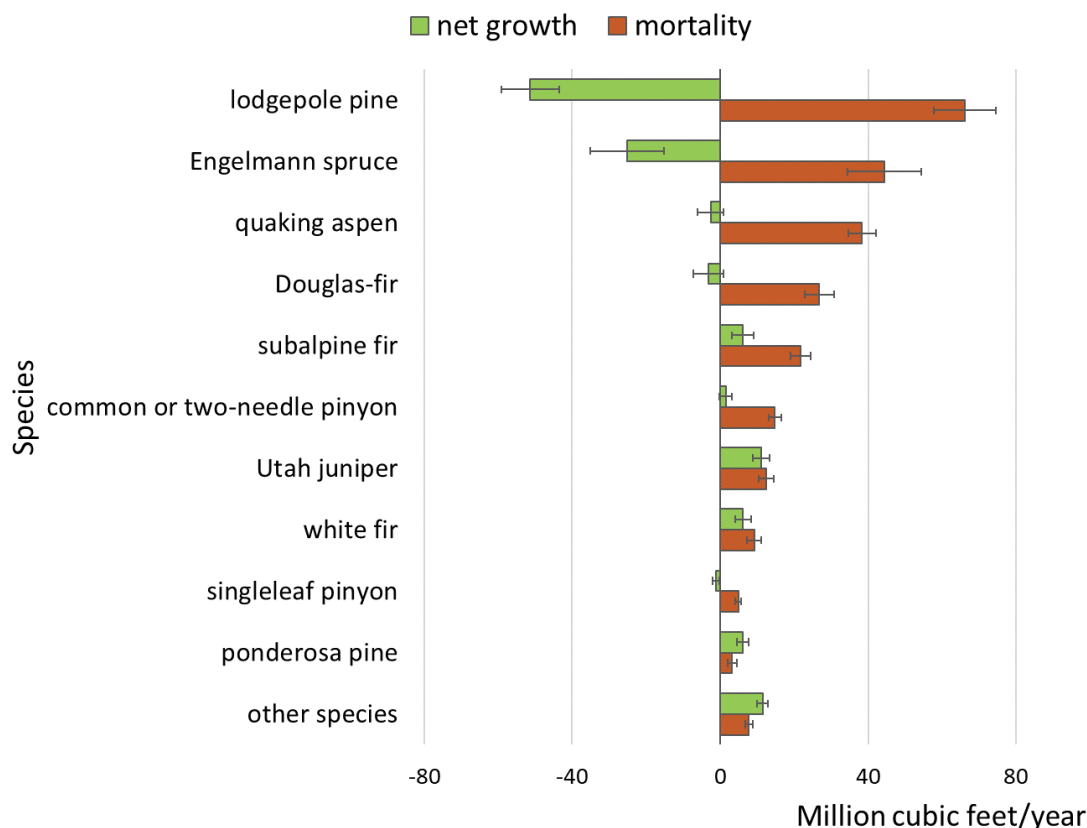


Figure 47—Estimates of annual net growth and annual mortality of trees (≥ 5.0 inches diameter) by species with high mortality, Utah 2008–2017. Other species category includes Gambel oak, curlleaf mountain-mahogany, Rocky Mountain juniper, limber pine, bigtooth maple, Fremont cottonwood, blue spruce, narrowleaf cottonwood, boxelder, and Great Basin bristlecone pine.

Lodgepole pine

Lodgepole pine had the least stability in forest structure of common species in a recent analysis of changes in forests of the western United States (Stanke et al. 2021). In the 2017 analysis of Utah, annual net growth of lodgepole pine in Utah is currently estimated at -51 million cubic feet per year, and mortality is 66 million cubic feet per year. The negative net growth of lodgepole pine represents an average volume loss of 6.6 percent per year of the current volume. Lodgepole pine has a relatively limited distribution in Utah, having been sampled in only seven Utah counties between 2008 and 2017, with the vast majority of trees in just four counties: Summit, Duchesne, Uintah, and Dagget. Estimates of annual net growth of lodgepole pine have consistently decreased from the 2005 report (DeBlander et al. 2010), when net growth was positive, to the 2012 report (Werstak et al. 2016), to the current report (fig. 48). Mortality estimates have increased with each Utah report as well. This increasing mortality trend has impacted estimates of live volume and standing dead volume for lodgepole pine (fig. 49), with live volume decreasing and standing dead volume increasing until they are almost equal (i.e., estimates within sampling error).

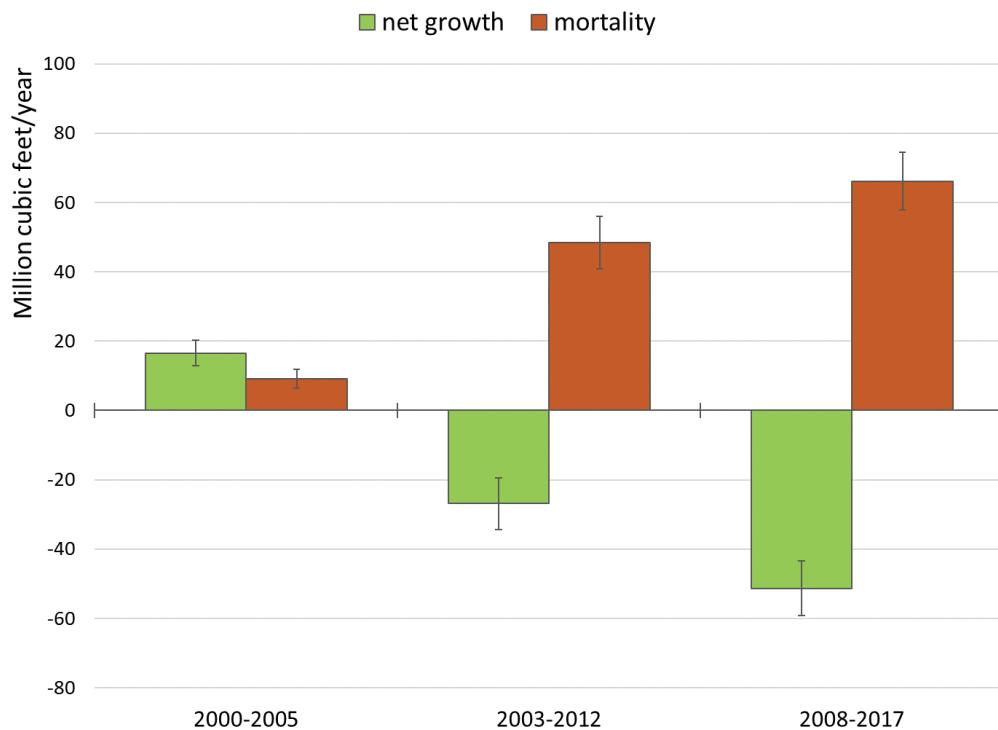


Figure 48—Estimates of annual net growth and annual mortality of lodgepole pine trees (≥ 5.0 inches diameter) on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

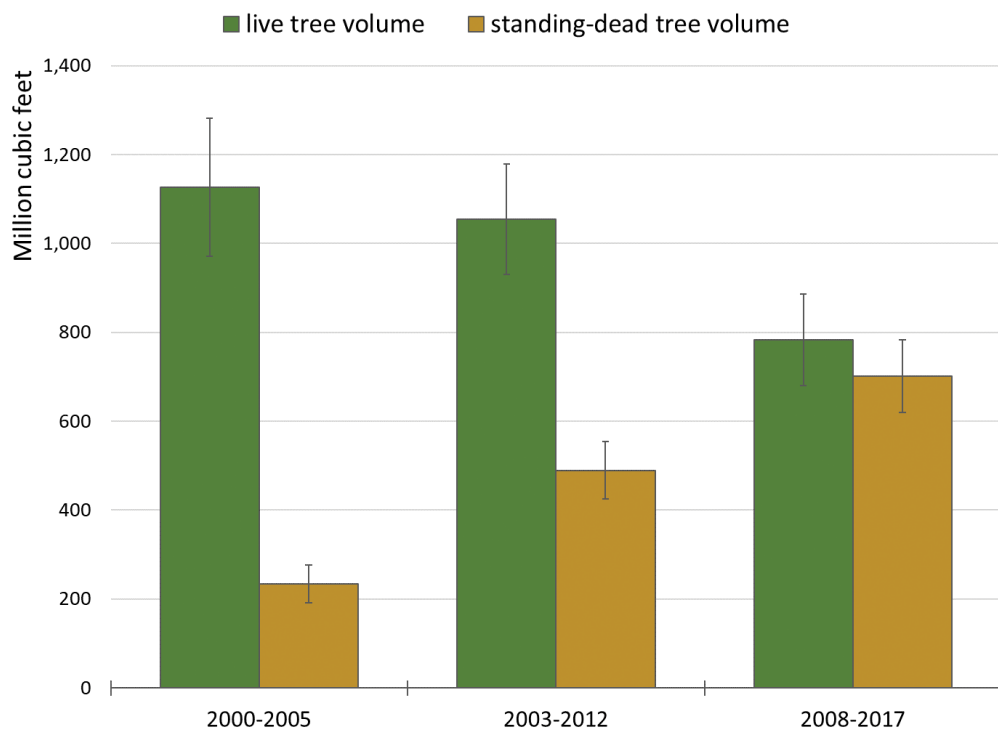


Figure 49—Net volume of live lodgepole pines and standing-dead lodgepole pines (both ≥ 5.0 inches diameter) on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

The primary cause of mortality in lodgepole pine is insect attack, which accounts for 77 percent of the annual mortality estimate (fig. 50). Lodgepole pine is a primary host of the mountain pine beetle (*Dendroctonus ponderosae* Hopkins), which has been causing epidemic outbreaks with high mortality in lodgepole pine across its range over the past two decades. Several RMRS-FIA 5-year reports for States with lodgepole pine have reported on high lodgepole mortality and mountain pine beetle (DeRose et al. 2018; Menlove et al. 2012; Thompson et al. 2010; Thompson et al. 2017; Witt et al. 2012).

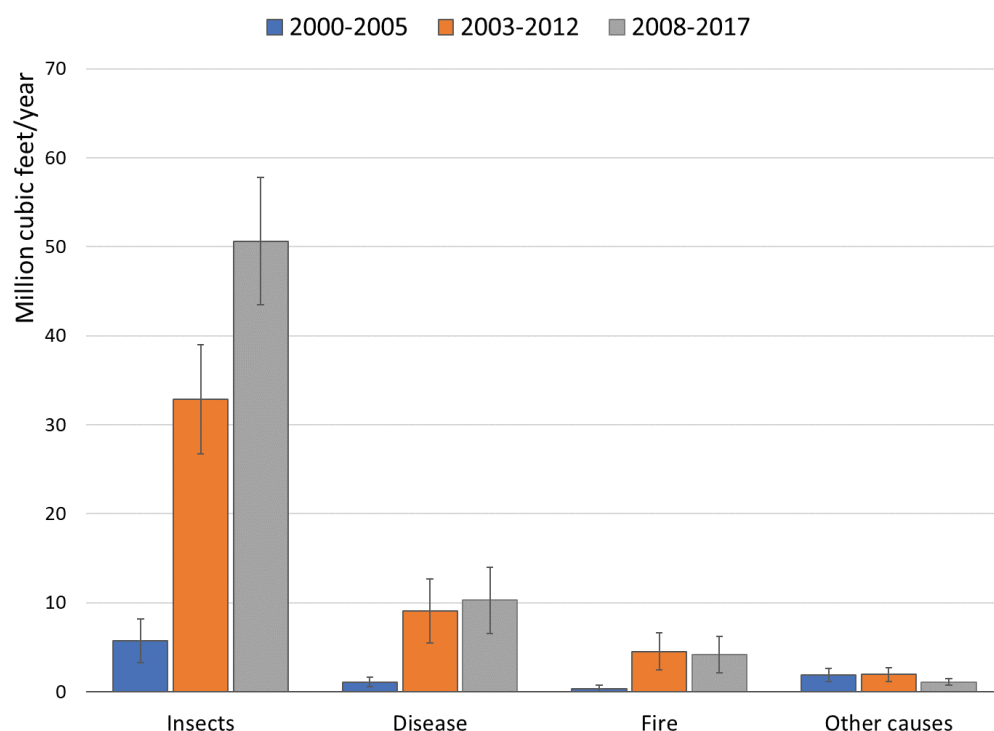


Figure 50—Estimates of annual mortality of lodgepole pines (≥ 5.0 inches diameter) by cause of death on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

When trees are recorded as mortality by RMRS-FIA field crews, they also estimate and record the year in which the trees died, which may differ substantially from the year trees were measured. Figure 51 shows the actual number of lodgepole pine trees with insect mortality, by the estimated mortality year, for all trees measured in Utah since 2000. The expected number of trees in figure 51 is what we would expect in FIA measurements if the total number of lodgepole pine mortality trees due to insects measured from 2000 through 2017 was the result of the same annual mortality between 1993 and 2016. Clearly, the greatest impact of insect mortality in lodgepole pine occurred between 2008 and 2010, with higher than expected mortality beginning in 2007 and continuing until 2013. This observance from FIA data is reasonably similar to aerial detection survey results from the western United States (USDA FS 2016b, 2019) where peak acres impacted occurred in 2009, and from continuous monitoring plots in the northwestern slopes of the Uinta Mountains (Audley et al. 2020) where the percentage of trees killed reached its peak in 2007, with a smaller peak in 2009.

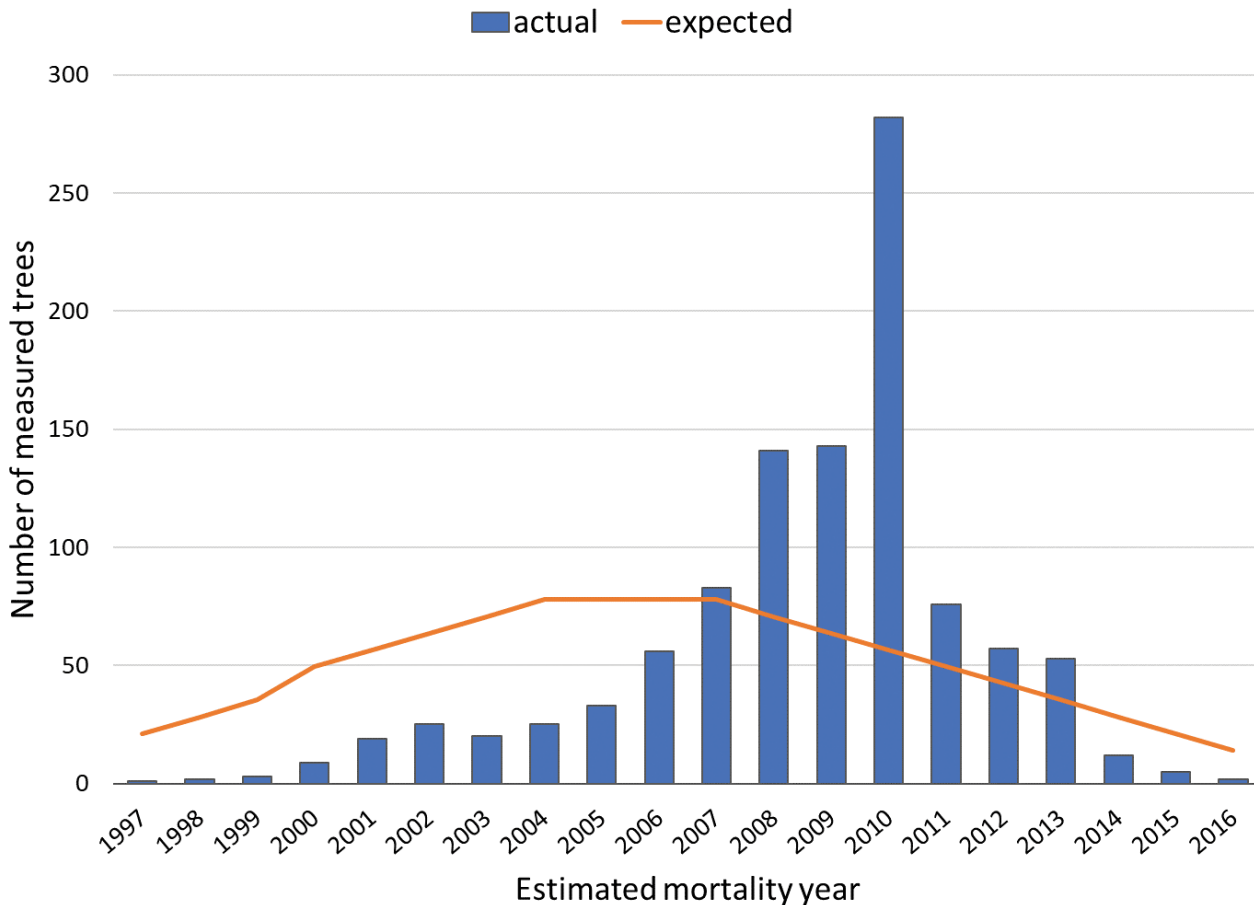


Figure 51—Actual number of lodgepole pine mortality trees measured with “Insects” as the cause of death by estimated mortality year, all annual measurements in Utah, 2000–2017. The “expected” number is what would be expected if the total number of mortality trees measured had died in equal numbers every year.

Engelmann spruce

Engelmann spruce forests have also shown considerable decline in the western United States in recent years (Stanke et al. 2021). Similarly, the net annual growth of Engelmann spruce in Utah is -25.2 million cubic feet per year, and mortality is 44.5 million cubic feet per year. The negative net growth represents an annual loss of 1.9 percent of the current live volume. Net growth of Engelmann spruce has been negative since the first Utah report (fig. 52) and neither net growth nor mortality has shown a significant trend (estimates are within sampling error), though net growth is lower, and mortality is higher in recent reports than in 2005 (DeBlander et al. 2010). The ongoing impact of negative net growth has influenced the balance of live and standing dead tree volume (fig. 53), with net live volume decreasing 16 percent since 2005 and standing dead volume increasing 76 percent.

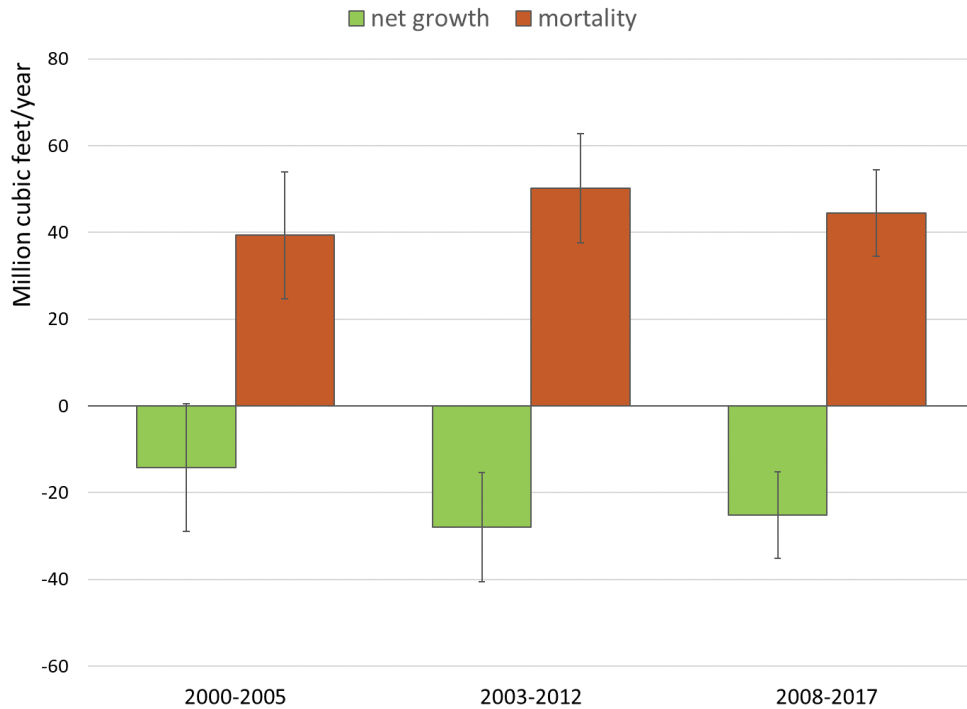


Figure 52—Estimates of annual net growth and annual mortality of Engelmann spruce trees (≥ 5.0 inches diameter) on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

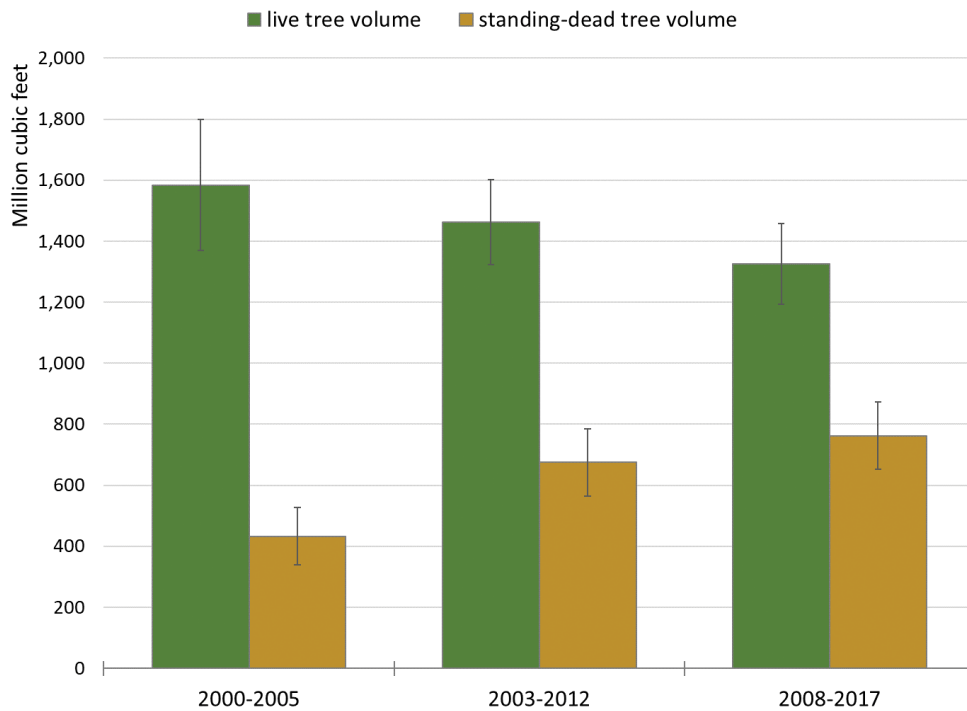


Figure 53—Net volume of live Engelmann spruce and standing-dead Engelmann spruce trees (both ≥ 5.0 inches diameter) on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

Figure 54 shows Engelmann spruce mortality by cause of death for previous and current report years. Insects have been the leading cause of death in every report's estimate, although other causes have increased a bit, resulting in the proportion of mortality caused by insects to decline from 91 percent in 2005 to 82 percent in 2012 to the current estimate of 74 percent, though all estimates are still within sampling error. The primary insect infecting Engelmann spruce is the spruce beetle (*Dendroctonus rufipennis* Kirby) (USDA FS 2016b, 2019). The 2005 Utah report (DeBlander et al. 2010) featured a section on spruce beetle mortality focusing on Engelmann spruce mortality on the Markagunt Plateau (Dixie National Forest), which at the time was the area of most severe spruce beetle activity in the State. Since that time spruce beetle outbreaks have moved generally northward through Utah as host tree species are depleted.

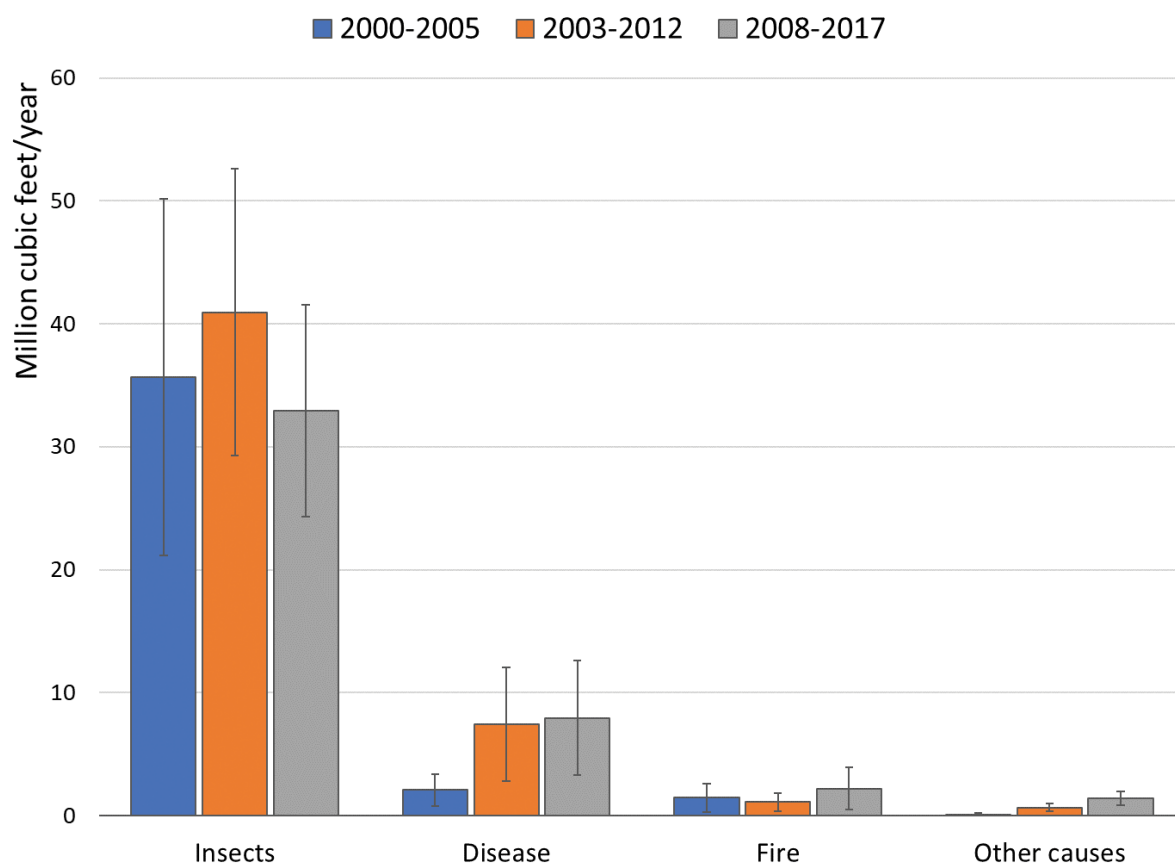


Figure 54—Estimates of annual mortality of Engelmann spruce trees (≥ 5.0 inches diameter) by cause of death on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

Quaking aspen

Aspen is the widest ranging tree species in North America and decline and dieback of aspen stands in western North America has been well documented (DeBlander et al. 2010; Frey et al. 2004; Rehfeldt et al. 2009; Stanke et al. 2021). While previous FIA reports have shown little change in aspen in Utah and Arizona (DeBlander et al. 2010; Shaw et al. 2018), there has been a trend in declining net growth and increasing mortality in Utah aspen (fig. 55) since the 2005 Utah report (DeBlander et al. 2010). As of 2017, average annual net growth is -2.6 million

cubic feet per year, which represents an annual loss of 0.2 percent of the current live volume. Despite earlier concerns about aspen, this is the first year when aspen net growth has been negative, although it should be noted sampling error for this estimate exceeds 100 percent. Unlike other tree species, where fire and insects are often the primary factors in mortality, disease is a primary mortality agent for aspen (Stanke et al. 2021). This is the case in Utah, where disease has been the primary aspen mortality agent, with a strongly increasing trend (fig. 56). While mortality has increased and net growth has declined, there has been a trend toward increasing aspen seedlings and at least a steady number of aspen saplings in Utah since 2009 (fig. 57), highlighting the importance of continued monitoring to better understand long-term aspen dynamics in Utah and western North America in general.

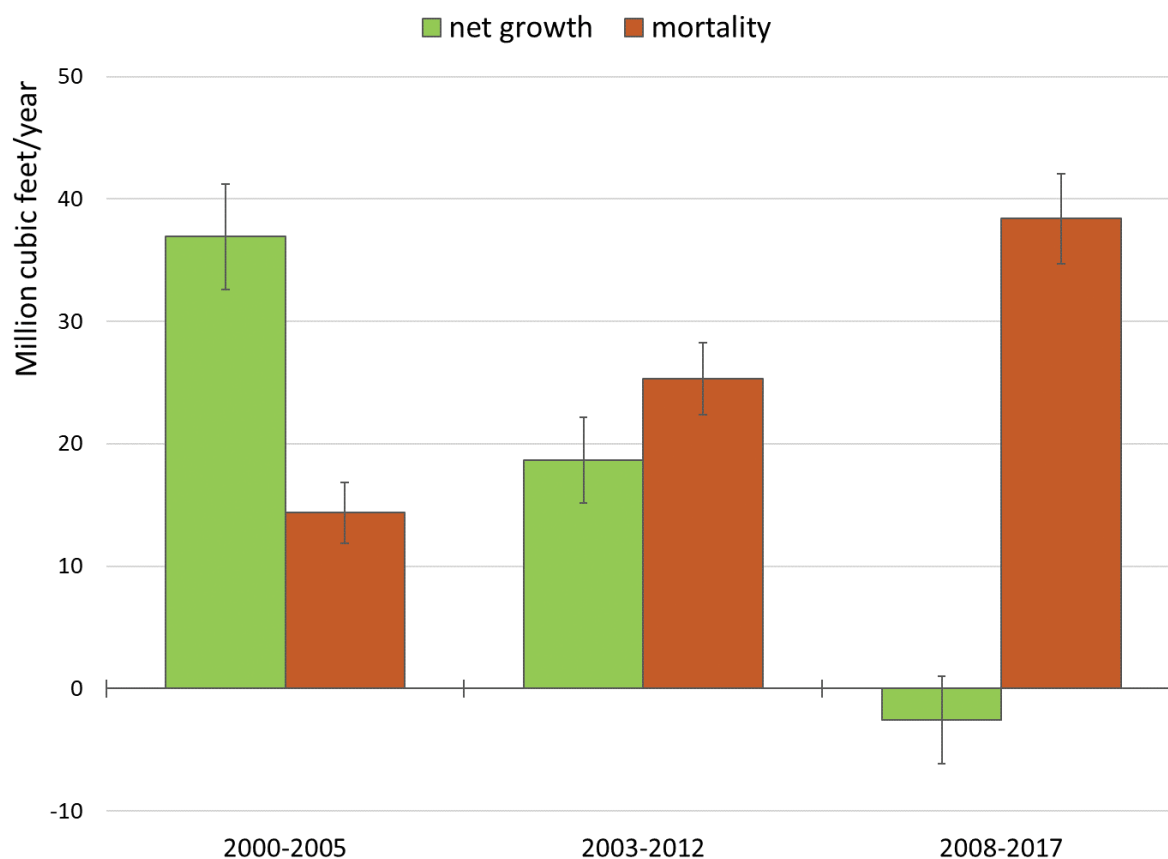


Figure 55—Estimates of annual net growth and annual mortality of quaking aspen trees (≥ 5.0 inches diameter) on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

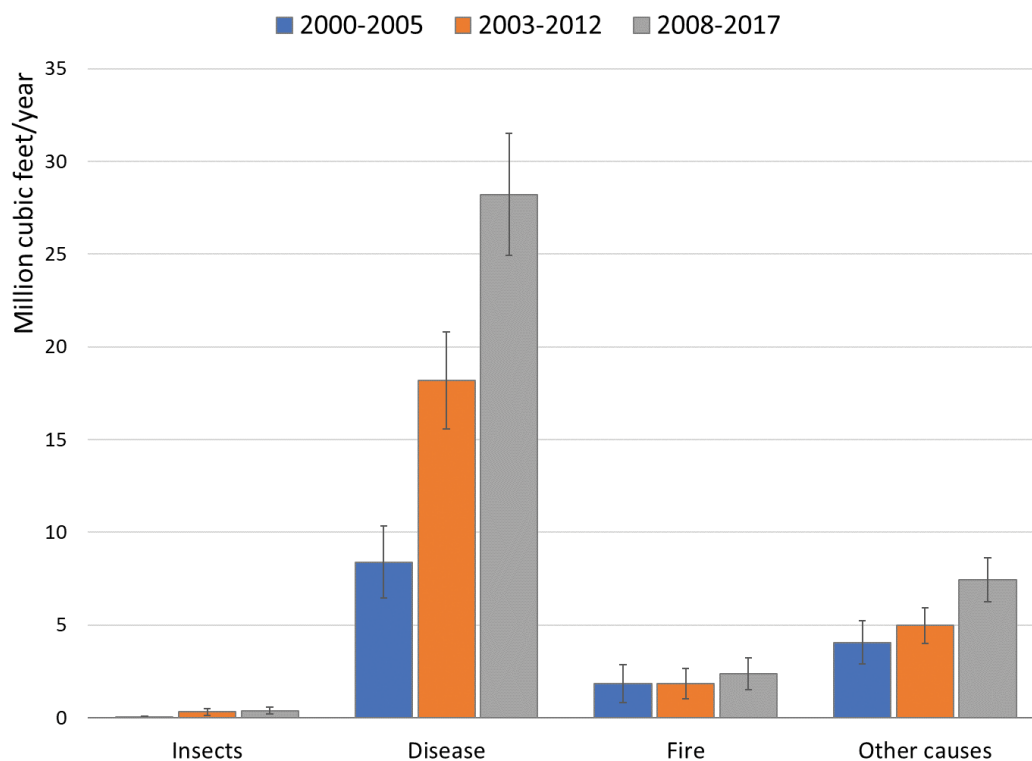


Figure 56—Estimates of annual mortality of quaking aspen trees (≥ 5.0 inches diameter) by cause of death on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

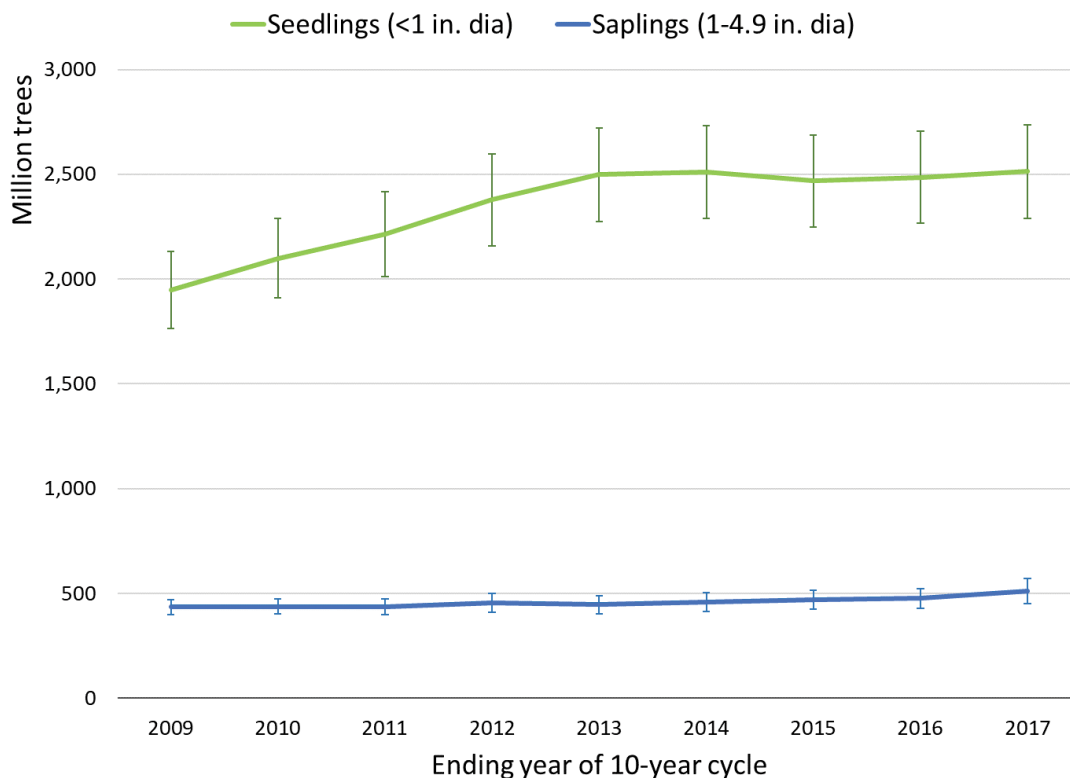


Figure 57—Trends in quaking aspen seedlings (< 1.0 inch diameter) and quaking aspen saplings (1.0 to 4.9 inches diameter) on forest land over full 10-year cycles, Utah, data collected 2000 through 2017.

Douglas-fir

Douglas-fir appears stable to increasing across various regions of the western United States (Stanke et al. 2021). In Utah, the average net growth in 2017 was -3.2 million cubic feet per year, although a net growth of 0 cubic feet per year is within sampling error for this estimate. This is an annual loss of 0.2 percent of the live standing volume in the State. Between the 2005 Utah report (DeBlander et al. 2010) to the 2012 report (Werstak et al. 2016), net growth declined and mortality increased; however, mortality and net growth have remained consistent (leveled off) since that time until now (fig. 58). With the increase in mortality since 2005, there has been, as expected, an increase in the amount of standing dead volume of Douglas-fir trees (fig. 59). Because Douglas-fir snags, especially larger snags, can remain standing for longer periods of time than many other species (Everett et al. 1999) this increase in standing dead may not be especially transient in nature. Like tree mortality overall, insects (41 percent) and disease (36 percent) are the top causes of mortality for Douglas-fir (fig. 60). While fire mortality has been decreasing over time, disease mortality has been increasing and was within sampling error of insect mortality for this 2017 report.

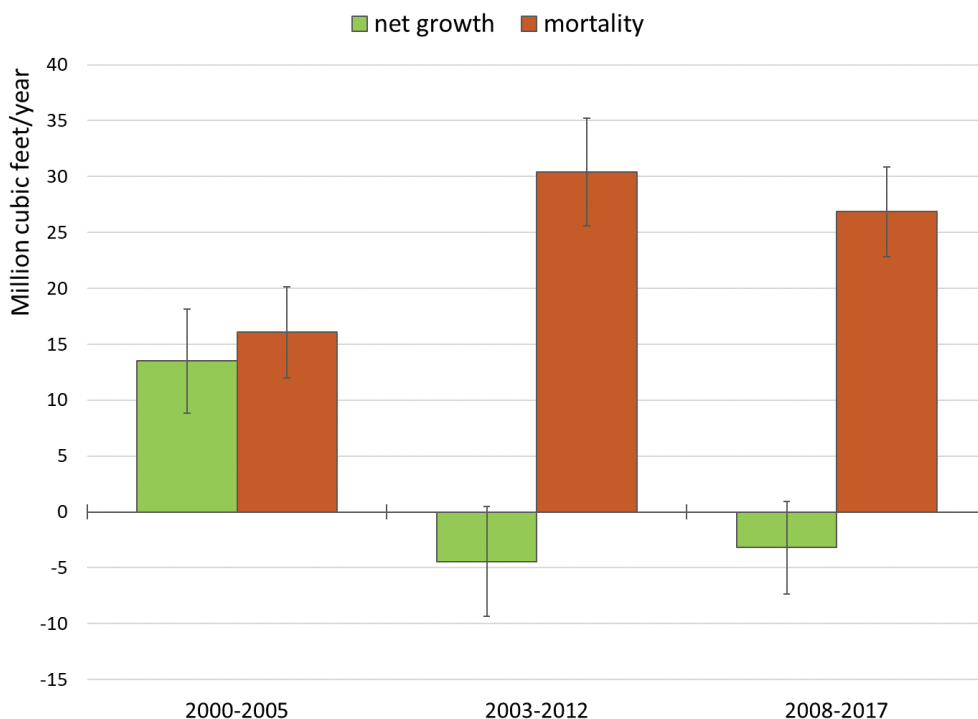


Figure 58—Estimates of annual net growth and annual mortality of Douglas-fir trees (≥ 5.0 inches diameter) on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

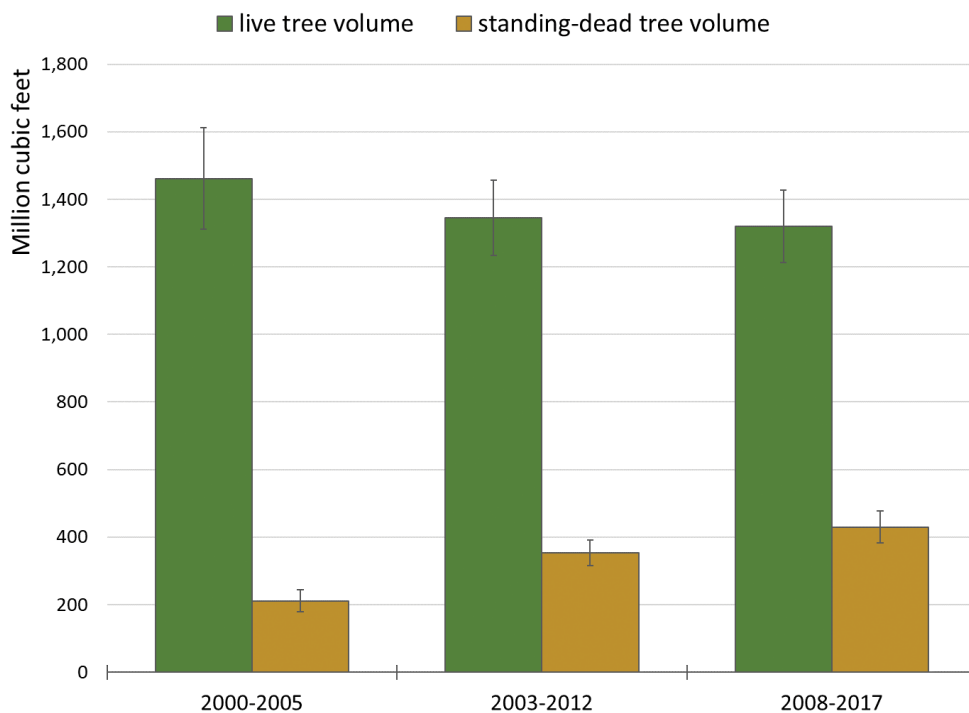


Figure 59—Net volume of live Douglas-fir and standing-dead Douglas-fir trees (both ≥ 5.0 inches diameter) on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

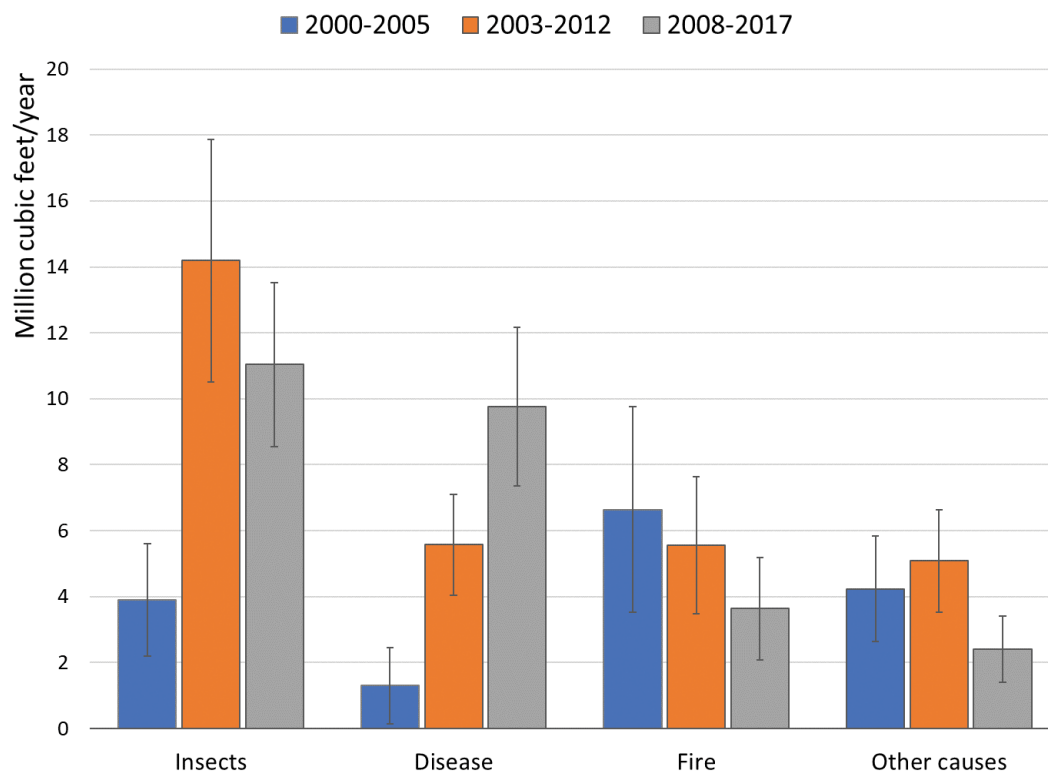


Figure 60—Estimates of annual mortality of Douglas-fir trees (≥ 5.0 inches diameter) by cause of death on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

Pinyons

Drought in the southwestern United States beginning in the late 1990s contributed to high pinyon (two-needle pinyon and singleleaf pinyon species are grouped together for this report) mortality in some areas (Mueller et al. 2005; Shaw et al. 2005), with the decrease in pinyon expected to have serious ramifications for the ecosystem (Mueller et al. 2005). An outbreak of pinyon Ips beetles (*Ips confusus*) from 2002 to 2004 also caused mortality on over 3 million acres of pinyon forests (Kleinman et al. 2012), raising concerns about the future of pinyon pines in the region. The 2005 Utah report also documented increasing pinyon mortality, but found mortality was lower across the entire population than found or hypothesized earlier from smaller scale observations (DeBlander et al. 2010). Net growth is near zero for the 10-year period ending in 2017 (fig. 61).

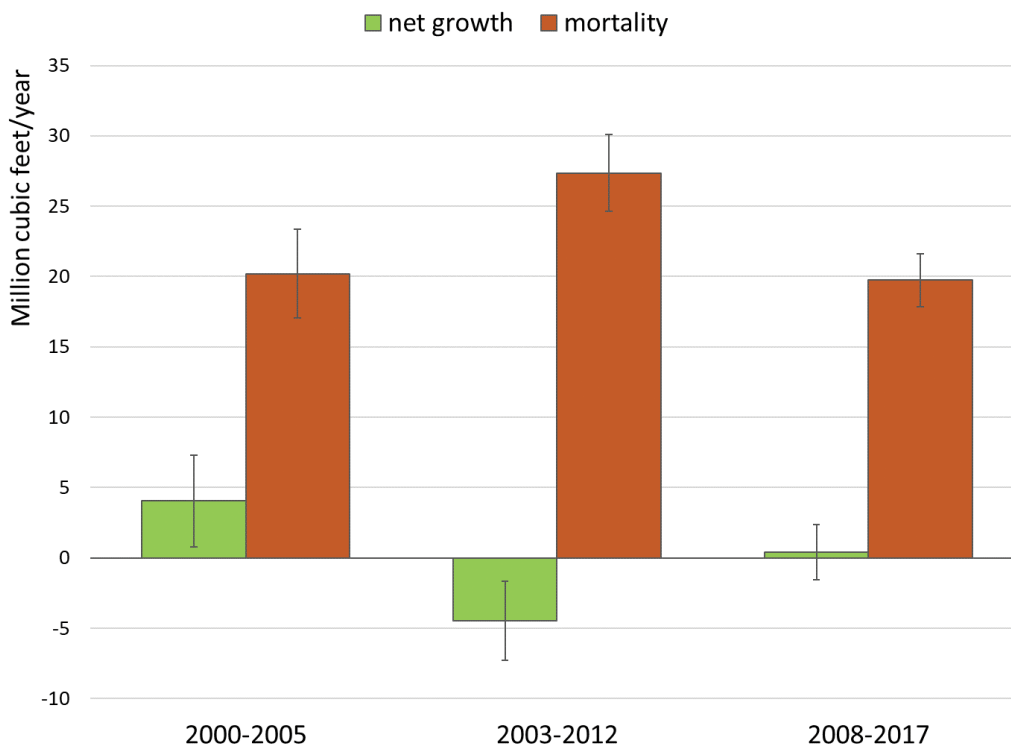


Figure 61—Estimates of annual net growth and annual mortality of pinyon species (≥ 5.0 inches diameter) on Utah forests from reports using data collected from 2000 through 2005 (DeBlander et al. 2010), data collected from 2003 through 2012 (Werstak et al. 2016), and the current report data collected from 2008 through 2017.

Future Estimates of Forest Change Components

Components of forest change—growth, mortality, and removals—are typically analyzed using measurements of the same plots at two points in time. It is possible, however, to estimate growth and mortality rates based on a single inventory, though removals require two plot measurements. Although the majority of plots in the current Utah inventory have been measured twice, RMRS-FIA is still in the process of developing procedures to follow the national standard for growth, removals, and mortality (Bechtold and Patterson 2005). Therefore, removals for Utah are estimated using data from mill surveys about the amount of wood cut

and estimated by the forest product industry with additional information in the *Timber Harvest* section of the “Timber Harvest and Forest Products Industry” chapter of this report.

The models used by RMRS-FIA to estimate tree growth and mortality are slightly different for single measurement plots (primarily plots measured in 2008 and 2009 for this report) and remeasured plots. On the first plot visit, annual growth is estimated from a sample of increment core measurements based on the previous 10 years of radial growth. Growth on plots with two measurements is based on a similar model using an individual tree’s change in diameter over the remeasurement period, usually 10 years. Mortality on first visit plots is calculated from trees that have died within the previous 5 years, based on field crews’ estimation. And for remeasured plots, mortality is defined as trees that were alive at the first measurement and dead at the second measurement. After the remeasurement population metadata are developed for Utah inventories, change components will use the national procedures where growth, removals, and mortality will be the change in calculated volume between measurement, averaged over the number of years between measurements. Plots with only a single measurement will be treated as nonsampled for change component estimates.

Live Tree Damage and Forest Disturbance

Live tree damage is damage that prevents the tree from surviving more than 1 to 2 years, reduces the growth of the tree in subsequent years, or negatively affects its marketable products. Damage is recorded on live trees 5.0 inches or larger in diameter (d.b.h. or d.r.c.). In this report, damage agents have been grouped into nine major categories: insect, disease, fire, animal, abiotic, competition, human, form defect, and unknown. A tree may have up to three damage agents recorded per tree; damage is typically assigned by inspecting the roots, then traveling along the bole, branches, and finally the foliage. If there are more than three agents occurring on a tree, the more collateral, detrimental damage agent is typically recorded as primary, then others are secondary (or tertiary) damage. Most damage agents affect a tree’s health, resulting in reduced growth, and may lead to death. However, form defect damage reflects a tree’s wood product value, but this generally has very little negative impact on tree health. Primary damage agents are reported here unless otherwise indicated.

A forest disturbance is an event that causes a noticeable change in the structure and composition of a forest area. The FIAs program records natural- and human-caused disturbances that reflect damage to live trees and causes of tree death or mortality (see the *Growth and Mortality* section of this report). The affected disturbance area must be an acre in size and have at least 25 percent damaged or recently dead trees (died within the last 5 to 10 years or mortality trees) or have affected 50 percent of an individual species’ tree count. Additionally, disturbances such as grazing, browsing, flooding, etc., must have at least 25 percent of ground surface or nontree vegetation affected. Disturbances are grouped into nine general categories including: insect, disease, fire, animal, weather, vegetation, human, geologic, and unknown. Human disturbance reported here includes silvicultural treatments (e.g., cutting, pruning, or chaining) as well as more general human-caused disturbance. Multiple disturbance agents may impact an area at one time (e.g., drought and insect infestation and/or disease disturbance), so up to three disturbances, ranging from the most

impact to the least, may be recorded during the inventory visit. Primary disturbances are reported here unless otherwise indicated.

Thirty-five percent (714.0 million) of live trees greater than 5 inches in diameter on forest land in Utah are timber tree species and the remaining 65 percent (1.3 billion live trees) are woodland tree species. Of these trees, 30 percent (214.1 million live trees) of timber trees and 18 percent (240.6 million live trees) of woodland trees exhibited at least one damage agent (table 8). Overall, for all live trees, 22 percent (454.8 million) had a primary damage recorded, 5 percent (96.4 million) had secondary damage, and 1 percent (19.2 million) had tertiary damage. The most common primary damage agents occurring in all live trees was form defect followed closely by disease, both at 9.7 percent (196.8 and 196.2 million live trees respectively). Form defect damages were found in 15 percent of live timber tree species (most frequently forked below merchantable top or crook/sweep) and 7 percent of live woodland tree species (mostly dead tops and open wounds). Damage by disease agents occurred in 12 percent of live timber tree species (typically cankers followed by stem decay) and 9 percent of live woodland tree species (mostly stem decay followed by dwarf mistletoe). Live trees with the primary damage agent coded as form defect decreased for both woodland and timber tree species groups from the 2000–2009 to the 2008–2017 inventories (figs. 62 and 63). Live woodland tree species with disease coded as the primary damage agent increased from 64.7 to 112.5 million live trees and damage from unknown causes decreased from 95.3 to 7.2 million live trees during the time period.

Table 8—Percent of all live trees, timber trees and woodland trees $\geq$ 5 inches d.b.h. or d.r.c. within each primary damage agent group for Utah 2008-2017. Parentheses indicate +/- one sampling error of the estimate.

Damage Agent	All Live Trees	Timber species	Woodland species
No damage	77.6 (1.3)	70.0 (2.8)	81.7 (1.7)
Insect	1.0 (0.1)	2.0 (0.3)	0.4 (0.1)
Disease	9.7 (0.3)	11.7 (0.8)	8.5 (0.3)
Fire	0.2 (0.1)	0.1 (0)	0.2 (0.1)
Animal	0.3 (0.0)	0.1 (0)	0.4 (0.1)
Abiotic	0.7 (0.1)	0.6 (0.1)	0.8 (0.1)
Competition	0.1 (0.0)	0.2 (0.0)	0.1 (0.0)
Human	0.3 (0.0)	0.0 (0.0)	0.5 (0.1)
Form defects	9.7 (0.3)	15.1 (0.7)	6.7 (0.4)
Unknown	0.4 (0.1)	0.2 (0.1)	0.5 (0.1)
Total	100.0 (1.6)	100.0 (3.6)	100.0 (2.0)

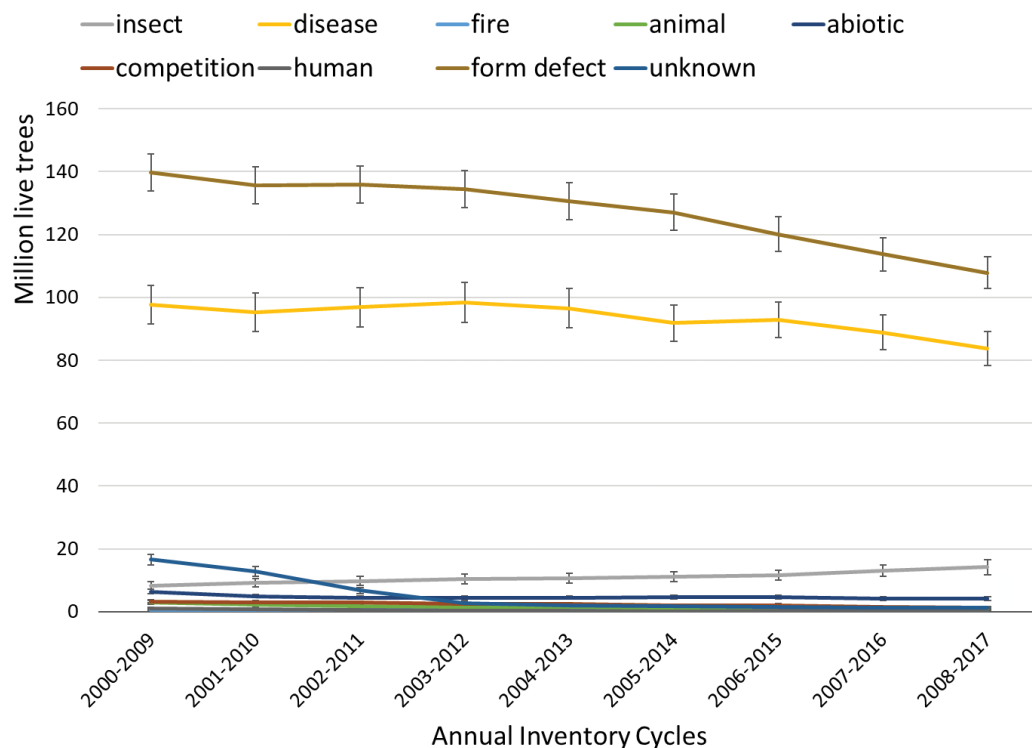


Figure 62—Trends in damage agents on live timber trees species (≥5 inches d.b.h.) on forest land over full 10-year cycles, Utah, data collected 2000 through 2017.

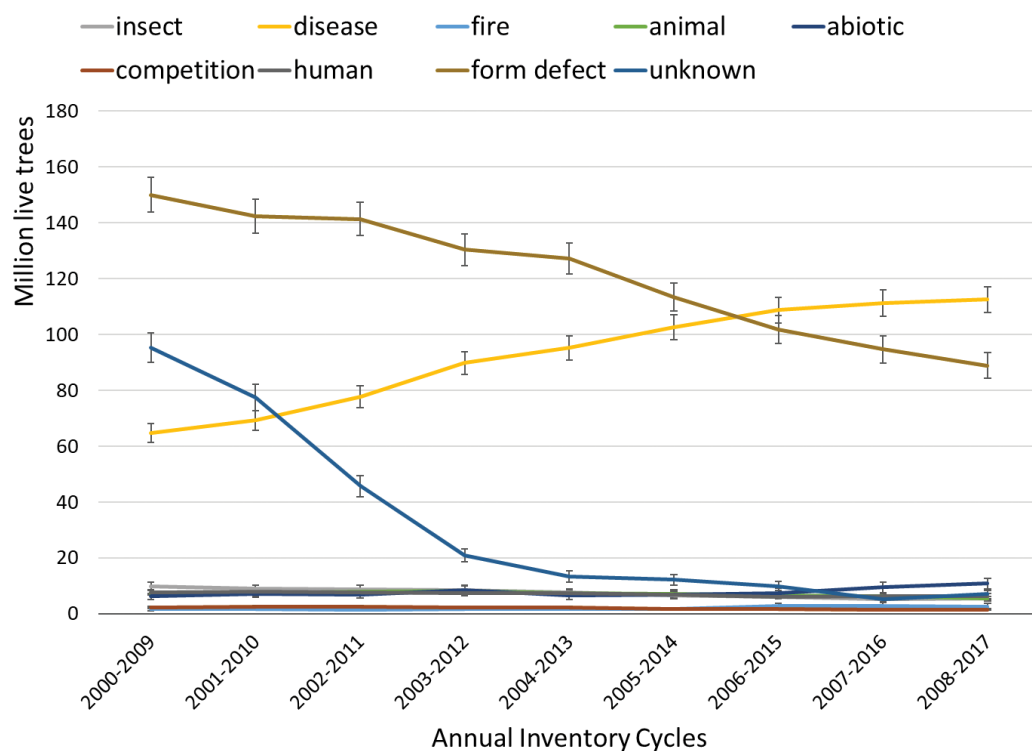


Figure 63— Trends in damage agents on live woodland trees species (≥5 inches d.r.c.) on forest land over full 10-year cycles, Utah, data collected 2000 through 2017.

Forest land in Utah exhibited at least one disturbance on 13 percent (2.3 million acres) of land, 0.8 percent (145.6 thousand acres) reported two disturbance agents, and 0.3 percent reported three agents. Forest disturbance varied within Utah's forest-type groups named for their dominant tree species (see Appendix D in this report for forest-type group definitions). For the purposes of reporting here, we aggregate these forest-type groups into the Timber-type groups (Douglas-fir, Ponderosa pine, Fir/spruce/mountain hemlock, Lodgepole pine, Other western softwoods, Elm/ash/cottonwood, and Aspen/birch forest-type groups), Woodland-type groups (Pinyon/juniper and Woodland hardwoods forest-type groups), and Nonstocked. There was a higher incidence of disturbance in the Timber group (26 percent or 1.2 million acres) and Nonstocked lands (36.2 percent or 233.5 thousand acres) than in the Woodland group lands (7 percent or 984.9 thousand acres) (table 9). Disturbance from insects was found to occur most often in the Timber group at 14 percent (over half of which occurred in the Lodgepole pine forest-type group) and less often in the Woodland group at 1.6 percent. Disease disturbance occurred in 8.0 percent of the Timber group lands (mostly in the Aspen/birch) and 2.4 percent of the Woodland group lands. Disturbance from fire occurred more often on Nonstocked lands at 31 percent compared to 2.4 and 2.0 percent in Timber and Woodland group lands, respectively.

Table 9—Percent occurrence of primary disturbance agents within all forest type groups compared to timber, woodland and nonstocked forest type groups for Utah 2008-2017. Parentheses indicate +/- one sampling error of the estimate.

Damage Agent	All Live Trees	Timber species	Woodland species	Nonstocked
No disturbance	87.0 (1.1)	74.0 (2.7)	92.3 (1.5)	65.0 (7.0)
Insect	4.7 (0.4)	14.4 (1.3)	1.6 (0.3)	0. (0.4)
Disease	3.7 (0.3)	7.7 (1.0)	2.4 (0.3)	1.9 (1.3)
Fire	3. (0.3)	2.4 (0.6)	2.0 (0.3)	31.2 (5.2)
Animal	0.38 (0.1)	0. (0.2)	0.4 (0.1)	1.0 (1.0)
Weather	0.6 (0.1)	0.7 (0.3)	0.6 (0.2)	— (—)
Competition	0. (0.0)	— (—)	0.1 (0.1)	— (—)
Human	0.2 (0.1)	0.2 (0.1)	0.5 (0.1)	0.7 (0.5)
Geologic	0.2 (0.1)	0.4 (0.1)	0. (0.1)	0.0 (0.0)
Unknown	0.0 (0.1)	— (—)	0.1 (0.0)	— (—)
Total	100.0 (1.0)	100.0 (2.9)	100.0 (1.5)	100.0 (8.9)

Within the the Timber group, disturbance caused by insects increased by 85 percent (352.4 to 650.7 thousand acres) between the 2000–2009 to the 2008–2017 inventories, during which there was an insignificant increase in disease and fire disturbances (fig. 64). Changes in disturbance for woodland-type groups depicted an increase in disease from 118 thousand acres (2002–2011 inventory) to 314 thousand acres (2005–2014 inventory). Insect disturbance in the Woodland group showed an insignificant gradual increase (2002–2011 to 2004–2013 inventories) that transitioned to a decrease by the 2008–2017 inventory to 200.9 thousand acres (fig. 65). These disturbance changes between 2000 and 2005 that impacted woodland

species, specifically pinyon/juniper woodlands, were likely influenced by drought in southwestern Utah (DeBlander et al. 2010). Between the 2000–2009 and 2008–2017 inventories, fire disturbance also increased in the Woodland group from 136 to 256 thousand acres and in the Nonstocked areas from 172 to 207 thousand acres (fig. 66), although the increase within Nonstocked areas is within the sampling error.

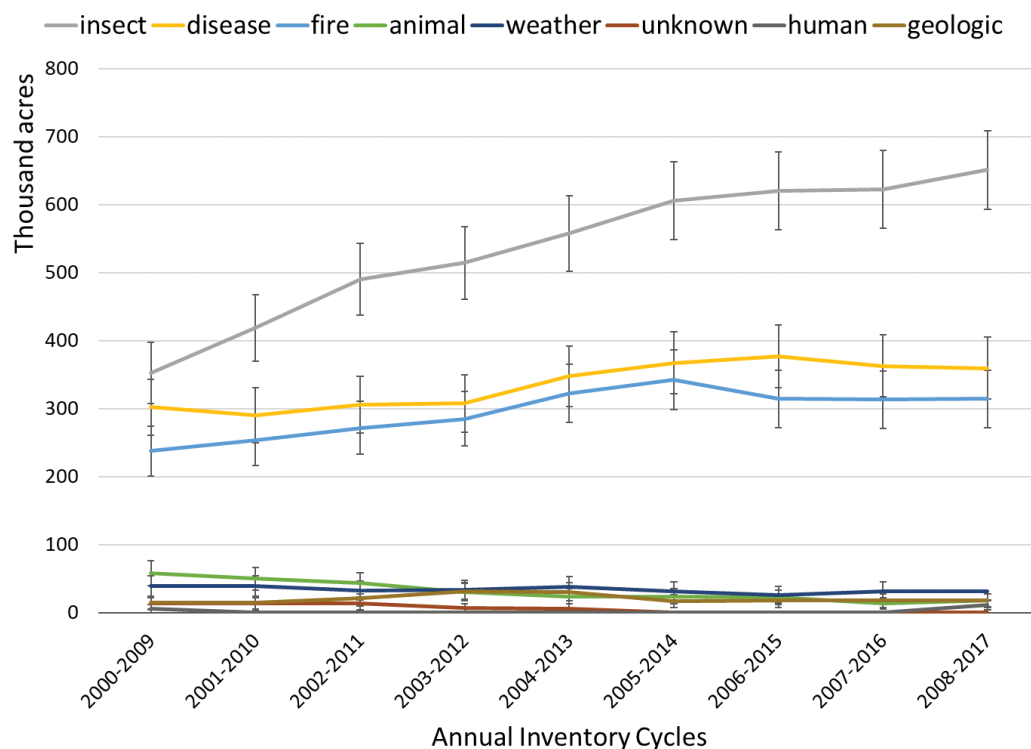


Figure 64—Trends of primary forest disturbance in acres occurring within timber forest-type groups from the 2000–2009 inventory through the 2008–2017 inventory.

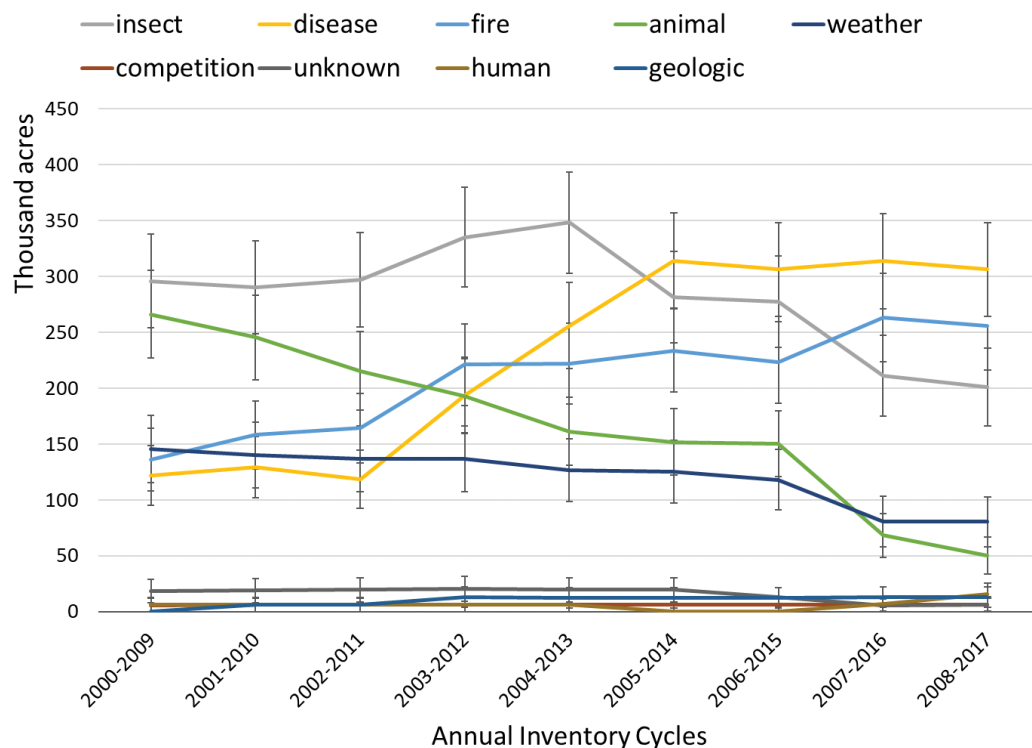


Figure 65—Trends of primary forest disturbance in acres occurring within woodland forest-type groups from the 2000–2009 inventory through the 2008–2017 inventory.

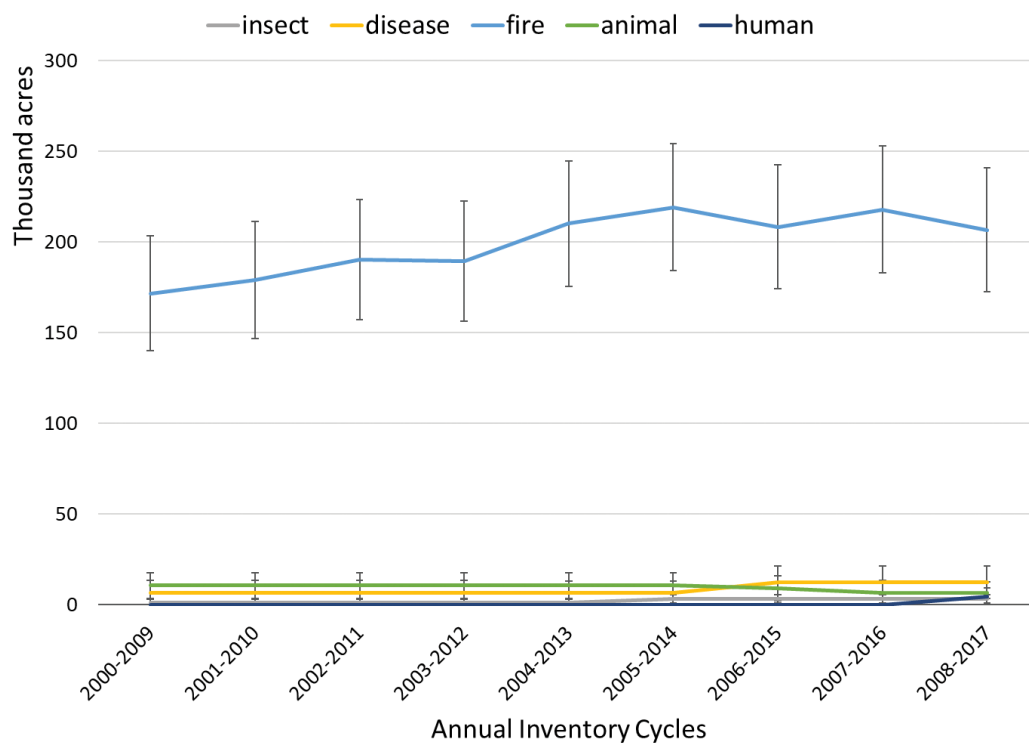


Figure 66 – Trends of primary forest disturbance in acres occurring within Nonstocked forest-type group from the 2000–2009 inventory through the 2008–2017 inventory.

TIMBER HARVEST AND FOREST PRODUCTS INDUSTRY

The following section primarily includes highlights of the forest products situation in Utah from *The Four Corners Timber Harvest and Forest Products Industry, 2016* (Hayes et al. 2021). This survey, conducted during the 2016 calendar year, is the latest in a series of similar reports dating back to the 1960s. The tables and figure in this section include information from previous reports to illustrate major trends. For additional details, such as information on wood utilization efficiency, refer to Hayes et al. (2021) and other reports. The information on timber harvest is determined primarily from mill surveys; it is not directly from remeasurement of FIA plots. In future reports, timber removals will be based on plot remeasurement.

Timber Harvest

Utah's commercial timber harvest in 2016 was 24.9 million board feet (MMBF) Scribner (table 10), 48 percent of which was live and 52 percent of which was salvage or standing dead when harvested. While Utah's harvest increased overall between the 2012 (Sorenson et al. 2016) and 2016 surveys, this increase occurred on National Forest land where harvest increased by 96 percent. Over this same survey period, harvest levels fell on private and tribal timber lands by 43 percent and on other public lands 50 percent. National Forests provided most of the State's harvest (79.8 percent) in 2016, with tribal and other private landowners accounting for 14.4 percent (3.6 MMBF) of Utah's timber harvest. The share of harvest from other public lands in Utah (not National Forest), including BLM and State lands, was 5.8 percent of the total in 2016.

Table 10—Utah timber harvest by ownership class, 1992, 2002, 2007, 2012, and 2016 (source: Keegan et al. 1995; Morgan et al. 2006; Hayes et al. 2012; Sorenson et al. 2016).

Ownership class	Survey Year									
	1992		2002		2007		2012		2016	
	MBF ^a Scribner	Percent of total	MBF Scribner	Percent of total	MBF Scribner	Percent of total	MBF Scribner	Percent of total	MBF Scribner	Percent of total
Private and tribal timberland	11,385	17.6	16,282	39.5	11,669	38.5	6,292	32.5	3,581	14.4
Public timberland	53,289	82.4	24,987	60.5	18,652	61.5	13,064	67.5	21,297	85.6
National Forest	49,989	77.3	23,776	57.6	15,490	51.1	10,117	52.3	19,848	79.8
Other Public ^b	3,300	5.1	1,211	2.9	3,162	10.4	2,947	15.2	1,449	5.8
All owners	64,674	100	41,269	100	30,321	100	19,356	100	24,878	100

^a MBF=thousand board feet

^b Other public ownership includes BLM and state

National Forests provided the majority of sawlogs (80 percent) and house logs (82 percent) harvested in Utah in 2016. Over 76 percent of all other products surveyed (e.g., furniture logs, post and poles, fiber logs) resulted from harvests on National Forests. Across all ownerships, sawlogs accounted for about 72 percent (17.9 MMBF) of the total volume harvested in 2016, while house logs and all other products accounted for 12 percent and 16 percent, respectively.

Engelmann and blue spruce accounted for the largest portion of harvest, at 31 percent (7.8 MMBF), followed by ponderosa pine (25 percent), lodgepole pine (22 percent), and Douglas-fir (15 percent; table 11). Although the distribution of wood volume among species is relatively constant over time, the share of harvest has varied widely. Given that the most recent harvest figures show that about half of the harvest is standing dead trees, this is likely due to changing opportunities for salvage as well as changing management emphasis. Aspen was identified as a species of management concern in the late 1990s and early 2000s (Bartos 2001; Bartos and Campbell 1998), and restoration activities likely accounted for aspen reaching 29 percent of harvest during the 2007 survey. Prior to the 2000s, and again recently, aspen has been a minor portion of the timber harvest.

Table 11—Proportion of Utah timber harvest by species, selected years (sources: Setzer and Wilson 1970; Setzer 1971; Setzer and Throssell 1977; Keegan and others 1995; Morgan and others 2006; Hayes and others 2012; Sorenson and others 2016).

Species	Survey Year							
	1966	1969	1974	1992	2002	2007	2012	2016
Percentage of harvest								
Spruces	19	13	22	35	44	42	31	31
Ponderosa pine	50	43	33	5	13	3	4	25
Lodgepole pine	18	18	27	46	23	13	41	22
Douglas-fir	3	11	8	4	8	11	11	15
Aspen and cottonwood	a	a	4	5	10	29	10	6
True firs ^b	4	7	3	5	2	2	2	1
Other species ^c	6	8	3	a	a	a	1	0
All species	100	100	100	100	100	100	100	100

^a Less than 0.5 percent

^b True firs include white, subalpine, and corkbark fir.

^c Other species include juniper and western white pine.

Timber Flow, Use, and Economic Value

More than half (51 percent) of Utah's 24.9 MMBF Scribner timber harvest was processed in-state. There is almost no inflow of timber from other States (0.017 MMBF from Idaho) to offset the outflow of almost 12.2 MMBF of timber to other States, making Utah a net wood exporter of almost half of the harvest volume. Of the outflow, about 4.6 MMBF was processed in Arizona, 4.5 MMBF in Wyoming, and 1.5 MMBF in both Idaho and Colorado.

The most recent survey of the forest products industry in Utah found 18 active manufacturers in 12 counties (fig. 67). In terms of the volume harvested, Utah ranks sixth among the eight RMRS-FIA States, which also include Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, and Wyoming. Facilities tend to be located near the forest resource—along the Wasatch Front, and near the Uinta Mountains and the high plateaus of southern Utah. This pattern also accounts for the out-of-state flow of wood, since where there are wood-processing facilities

in Utah, facilities are commonly also found just across State lines. As in most of the West, the structure of Utah's forest products industry has changed over the past 30 years, with the number of sawmills decreasing and the number and diversity of other manufacturers increasing (Hayes et al. 2012; Keegan et al. 1995, 2001a, b; Morgan et al. 2004a,b; Morgan et al. 2006; Sorenson et al. 2016). Despite the increase in manufacturer diversity, the number of facilities had decreased during the past two decades: Sorenson et al. (2016) identified 18 facilities in 2012, while Hayes et al. (2012) identified 27 facilities operating during 2007, and Morgan et al. (2006) identified 49 primary wood-processing plants in 2002.

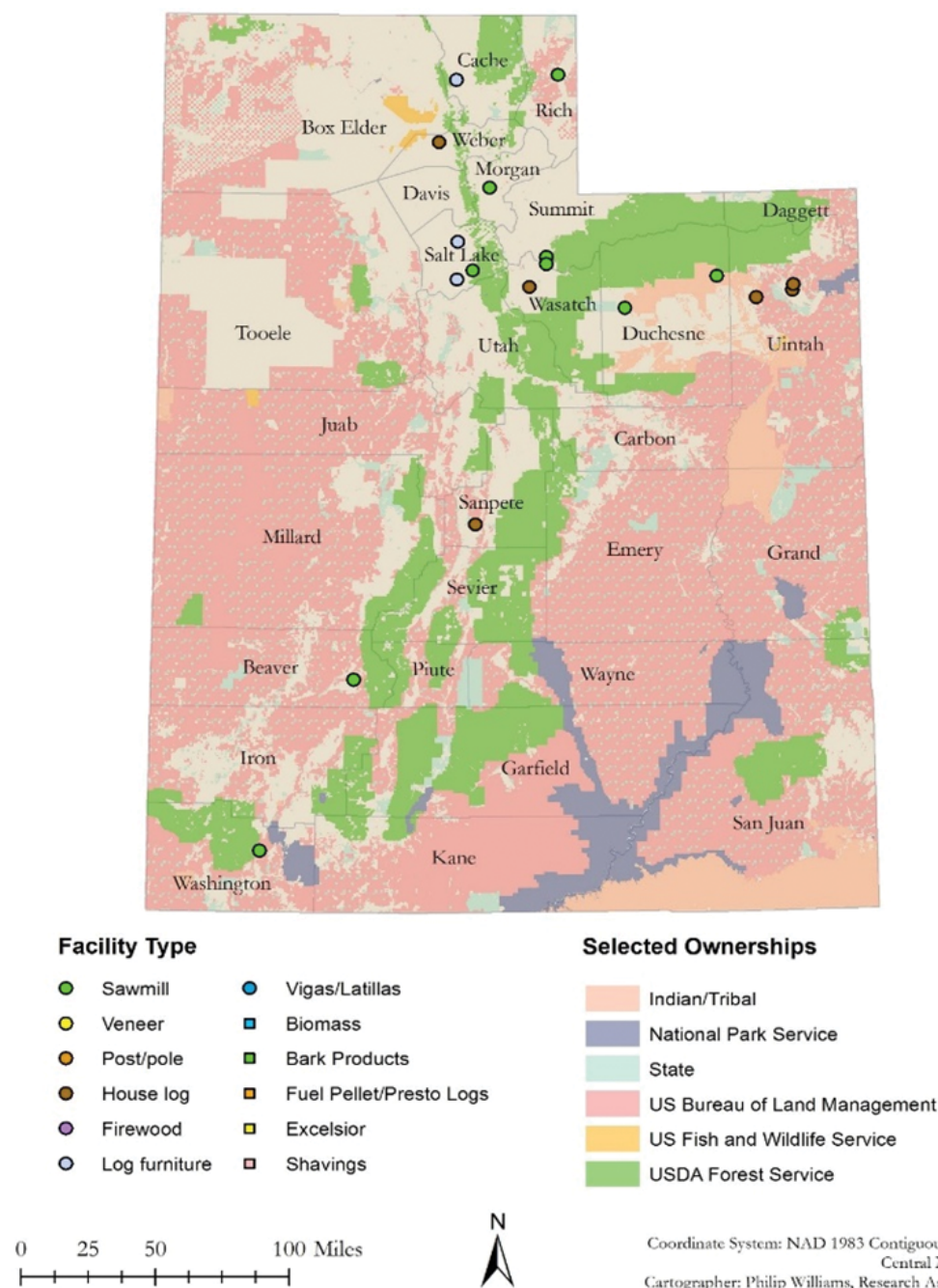


Figure 67 – Primary wood processing facilities in Utah, 2016.

Given that not all forest products are sawn lumber, comparison of different types of products is better described in terms of cubic feet of wood. Approximately 5.4 million cubic feet of wood was used by different manufacturing sectors both within and outside of Utah in 2016. Of this volume, 3.8 million cubic feet went as logs to sawmills, just under 1.0 million went to log home manufacturers, and just over 0.6 million went to other plants, including log furniture, post and pole, and fire/fuelwood facilities.

The most recent economic data showed finished product sales of \$19.7 million in 2016, about 25 percent higher than in 2012 when adjusted for inflation. However, this is still less than half of the value of the late 1990s and early 2000s, when inflation-adjusted sales were well over \$40 million. Lumber has decreased as a proportion of all finished product sales, a pattern that has been ongoing since the early 1990s. In the 1990s, sales from sawmills accounted for almost 73 percent of all sales, whereas they now account for just over 15 percent; the other 85 percent is from products such as house logs, poles, posts, and furniture. By sales value (\$7.6 million), Utah's log home sector is the largest in the Four Corners region, followed by Colorado and New Mexico.

This illustrates the high value of house logs and other forest products in comparison to sawn lumber: house logs and other products represent 85 percent of sales value from less than 30 percent of the volume. The relationship is complicated, however, because not all species and diameter classes are suitable for all products, and differences in finished product sales value represent differences in stumpage prices and costs of manufacturing.

There were over 6,100 jobs in Utah's primary and secondary forest industry during the 2016 survey, representing a 9 percent increase from 2012. Only 450 of those jobs were in the primary sector of forest industry, which includes forestry, logging, and forestry support work. The remainder of 5,650 workers in Utah's forest industry are considered secondary and include wood product and paper manufacturing. Altogether, Utah's forest industry worker earnings were just over \$300 million during 2016, up about 11 percent (adjusted for inflation) from 2012. Other kinds of jobs, which are not directly related to forestry products, are not reflected in the earnings total. For example, the 282 people employed in the forestry and logging sector are estimated to support an additional 160 jobs and nearly \$3 million in labor income in supporting sectors, such as equipment sales and repair.

Utah's forest products industry remains a small but relatively stable portion of the forest products industry of the greater Interior West, but the number of jobs it supports, the worker income, and product sales revenue is substantial for a State with a relatively small population. In addition, many forest products jobs are located well away from the dense population centers, providing sustainable jobs that would otherwise not be available in rural communities.

QUALITY ASSURANCE AND CONTROL

FIA employs a Quality Assurance (QA) program to ensure the quality of all collected data. The QA program provides a framework to assure the production of complete, accurate, and unbiased forest information of known quality. There are two primary facets of FIA's QA program: quality control and quality assessment. Quality control is intended to improve data quality by providing timely training and feedback to field crews, whereas the goal of quality assessment is to provide objective estimates of the repeatability of field measurements.

Quality control occurs throughout field data collection and compilation. The field aspect of quality control is conducted by data quality inspectors, who train all field crews, assess the quality of the data collected by individual crews, and then provide timely feedback to improve the crews' performance. Feedback is accomplished by means of hot checks and cold checks. During a hot check, an inspector accompanies a field crew to a plot and provides immediate feedback on the quality of their measurements. Cold checks occur when an inspector visits a recently completed plot, typically in possession of the original crew's data but without the crew present, and then verifies each measurement and provides the crew an overall score as well as feedback on measurements that did not meet FIA specifications. A key aspect of the quality control process is identifying why any errors may be occurring and then selecting a corrective action such as additional training. On average, hot checks are done on 2 percent of all field-sampled plots and cold checks are done on 5 percent of field-sampled plots. Quality control is also accomplished via the programming of portable data recorders that check for complete, valid, and reasonable values during data collection. Following data collection, information management specialists conduct further logic checks to address errors and missing values.

Quality assessment quantifies the overall precision of field measurements by comparing two independent measurements of the same plots. The independent measurements are collected by means of blind checks, where a regular field crew collects measurements and then a second crew collects a second set of measurements, without knowledge of or access to the first crew's measurements (Pollard et al. 2006). Thus, these paired observations provide a means of objectively assessing the repeatability of FIA's field measurements.

Quality control and quality assessment both require a data quality standard that defines the target level of precision for field measurements. FIA has specific Measurement Quality Objectives (MQOs) that enumerate data quality standards for individual field-measured variables. MQOs were developed from knowledge of measurement processes in forestry and forest ecology as well as the requirements of the FIA program. Each variable's MQO consists of two parts: a measurement tolerance and a compliance standard. Measurement tolerances define the acceptable range of differences between independent observations, and compliance standards define the target percentage of independent observations that should be within the measurement tolerance. To assess whether measurements of a particular variable are meeting an MQO, we compare the compliance standard to the observed compliance rate, which is defined as the percentage of paired, independent measurements that are within that variable's tolerance. For example, the MQO for tree height defines the tolerance as plus or minus 10 percent and the compliance standard as 90 percent. This means that at least 90 percent of paired, independent measurements of tree height should be within 10 percent of each other. If the actual compliance rate is determined to be 91 percent, then

the measurements are meeting the MQO for tree height. For categorical variables (e.g., field-recorded forest type), the tolerance is often defined as “no errors,” where the compliance standard represents the minimum percentage of independent measurements that should assign the same category. The FIA field manual (USDA FS 2013) specifies the compliance standards and measurement tolerances for each variable; note that later versions of the field manual present tolerances as an appendix but do not list compliance standards.

The results of the most recent quality assessment for Utah are presented in tables 12a-b and 13a-b. Between 2008 and 2017, quality assessment data were collected from 99 plots comprising 106 conditions and 1,713 trees. Each variable and its associated MQO are followed by the percentage of total paired records that fall within one, two, three, and four times the tolerance. The last four columns show the number of observations that fell outside the tolerance. The percentage of observations that fall within the 1X tolerance level represents the observed compliance rate. Most of the compliance rates shown in tables 12 and 13 are similar to those reported by Werstak and others (2016), which indicates that FIA data quality has not changed appreciably in Utah in the past 5 years. Exceptions to this consistency over time include declines in the compliance rate for condition-level disturbance year and tree-level mortality year, as described below, as well as the tree-level variable “sound dead,” which declined from 65 percent (Werstak et al. 2016) to 42 percent (table 13).

Table 12A—National Core Variables. Results of quality assessment for condition-level variables in Utah, 2008-2017. Variables that did not have any non-null values recorded on any QA plots are not shown.

Variable	Measurement Quality Objective (MQO)		Percentage of data within tolerance (compliance rate)				Number of times data exceeded tolerance				Number of conditions
	Tolerance	Compliance standard	@1x	@2x	@3x	@4x	@1x	@2x	@3x	@4x	
Condition Status	No errors	At least 99% of the time	100.0%	—	—	—	0	—	—	—	106
Reserved Status	No errors	At least 99% of the time	100.0%	—	—	—	0	—	—	—	106
Owner Group	No errors	At least 99% of the time	100.0%	—	—	—	0	—	—	—	106
Forest Type	No errors	At least 95% of the time	91.8%	—	—	—	8	—	—	—	98
Stand Size	No errors	At least 99% of the time	80.6%	—	—	—	19	—	—	—	98
Regeneration Status	No errors	At least 99% of the time	99.0%	—	—	—	1	—	—	—	98
Tree Density	No errors	At least 99% of the time	100.0%	—	—	—	0	—	—	—	98
Stand Age	±10 %	At least 95% of the time	97.9%	97.9%	97.9%	97.9%	2	2	2	2	97
Disturbance 1	No errors	At least 99% of the time	90.9%	—	—	—	9	—	—	—	99
Disturbance Year 1	±2 yrs	At least 99% of the time	16.7%	50.0%	66.7%	66.7%	5	3	2	2	6
Disturbance 2	No errors	At least 99% of the time	100.0%	—	—	—	0	—	—	—	6
Treatment 1	No errors	At least 99% of the time	99.0%	—	—	—	1	—	—	—	98
Physiographic Class	No errors	At least 99% of the time	72.7%	—	—	—	27	—	—	—	99

Table 12B—Regional Core Variables. Results of quality assessment for condition-level variables in Utah, 2008-2017. Variables that did not have any non-null values recorded on any QA plots are not shown.

Variable	Measurement Quality Objective (MQO)		Percentage of data within tolerance (compliance rate)				Number of times data exceeded tolerance				Number of conditions
	Tolerance	Compliance standard	@1x	@2x	@3x	@4x	@1x	@2x	@3x	@4x	
Percent Crown Cover	±10 %	Not defined	80.0%	93.7%	98.9%	98.9%	19	6	1	1	95
Percent Bare Ground	±10 %	Not defined	82.7%	90.8%	94.9%	96.9%	17	9	5	3	98
Habitat Type 1	No errors	Not defined	72.7%	—	—	—	27	—	—	—	99
Habitat Type 2	No errors	Not defined	69.7%	—	—	—	30	—	—	—	99

Table 13A—National Core Variables. Results of quality assessment for tree-level variables in Utah, 2008-2017.

Variable	Measurement Quality Objective (MQO)		Percentage of data within tolerance (compliance rate)				Number of times data exceeded tolerance				Number of trees
	Tolerance	Compliance standard	@1x	@2x	@3x	@4x	@1x	@2x	@3x	@4x	
DBH	±0.1 /20 in.	At least 95% of the time	90.2%	95.7%	97.9%	98.5%	57	25	12	9	584
DRC using IW MQO	±0.2 in*#stems	At least 95% of the time	86.3%	93.5%	95.8%	96.8%	155	73	47	36	1,129
Azimuth	±10 °	At least 90% of the time	95.5%	98.8%	98.8%	98.8%	19	5	5	5	419
Horizontal Distance	±0.2 /1.0 ft	At least 90% of the time	77.1%	90.5%	96.7%	97.4%	96	40	14	11	419
Species	No errors	At least 95% of the time	99.6%	—	—	—	6	—	—	—	1,713
Tree Status	No errors	At least 95% of the time	99.7%	—	—	—	5	—	—	—	1,713
Rotten/Missing Cull	±10 %	At least 90% of the time	91.4%	97.0%	98.5%	99.4%	134	47	24	10	1,564
Total Length	±10 %	At least 90% of the time	79.5%	94.9%	98.3%	99.0%	351	88	29	17	1,713
Actual Length	±10 %	At least 90% of the time	77.7%	95.0%	98.7%	99.1%	207	46	12	8	929
Compacted Crown Ratio	±10 %	At least 80% of the time	69.0%	90.6%	98.4%	99.7%	459	139	24	5	1,482
Uncompacted Crown Ratio	±10 %	At least 90% of the time	82.8%	95.4%	98.4%	99.5%	229	62	22	7	1,334
Crown Class	No errors	At least 85% of the time	82.2%	—	—	—	264	—	—	—	1,482
Decay Class	±1 class	At least 90% of the time	100.0%	—	—	—	0	—	—	—	226
Cause of Death	No errors	At least 80% of the time	79.4%	—	—	—	20	—	—	—	97
Mortality Year	±2 yr	At least 70% of the time	55.7%	86.6%	96.9%	100.0%	43	13	3	0	97
Condition Class	No errors	At least 99% of the time	99.9%	—	—	—	1	—	—	—	1,713

Table 13B—Regional Core Variables. Results of quality assessment for tree-level variables in Utah, 2008-2017.

Variable	Measurement Quality Objective (MQO)		Percentage of data within tolerance (compliance rate)				Number of times data exceeded tolerance				Number of trees
	Tolerance	Compliance standard	@1x	@2x	@3x	@4x	@1x	@2x	@3x	@4x	
Mistletoe	±1 class	At least 90% of the time	98.4%	98.8%	99.2%	99.6%	24	18	12	6	1,482
Number of Stems	±1 stem	At least 90% of the time	96.0%	97.5%	98.6%	99.4%	45	28	16	7	1,129
Percent Missing Top	±10 %	At least 90% of the time	98.1%	98.1%	98.1%	98.1%	29	29	29	29	1,564
Sound Dead	±10 %	At least 90% of the time	42.0%	42.0%	42.0%	42.0%	907	907	907	907	1,564
Form Defect	±10 %	At least 90% of the time	61.5%	61.5%	61.5%	61.5%	40	40	40	40	104
Current Tree Class	No errors	At least 90% of the time	98.6%	—	—	—	24	—	—	—	1,713
Tree Age	±5 %	Not defined	15.4%	23.1%	30.8%	51.3%	33	30	27	19	39
Horiz Dist-timberland	±0.2 /1.0 ft	At least 90% of the time	97.9%	98.6%	99.1%	99.3%	12	8	5	4	584
Horiz Dist-woodland	±0.2 /1.0 ft	At least 90% of the time	89.3%	94.7%	97.3%	97.7%	121	60	30	26	1,129

The information in table 12 and table 13 shows that the compliance rates of most variables are meeting, or nearly meeting, the MQOs. For example, one tree-level regional variable that appears to be fairly repeatable is the variable “species” (table 13). At the 1X tolerance level, its observed compliance rate was more than 99 percent. This represents that more than 99 percent of the 1,713 paired observations assigned the same tree species. Overall, most condition-level variables are meeting their respective MQOs. Exceptions include forest type (92 percent), stand size (81 percent), and disturbance type (91 percent). Users of FIA’s stand size variable should note that most FIA tools and tables, including the tables presented in the appendices of this report, rely on forest type and stand size as calculated post-hoc from actual tree measurements, whereas the forest type and stand size variables shown here represent field-estimated values.

The field-measured variables that have the biggest influence on estimates of forest volume and biomass are tree species, tree status, tree diameter, and tree height. As shown in table 13, the compliance rates for the variables “species” and “tree status” were nearly 100 percent. The variables “DBH” and “DRC” represent the respective diameters of timber and woodland tree species. Whereas timber species are measured at breast height (4.5 feet above ground level), woodland species are measured near ground level at root collar. The 1X compliance rate was 90 percent for DBH, which has a 0.1-inch tolerance, and 86 percent for DRC. The tolerance for DRC is plus or minus 0.2 inches per stem, which allows for larger tolerances on multi-stemmed woodland trees where determining the precise measurement location is more difficult. Tree height is represented by the variables “total length” and “actual length.” Both variables have a tolerance level of plus or minus 10 percent of the observed length, and compliance rates at the 1X level were about 80 percent and 78 percent, respectively. Although the diameter and height variables both have fairly high repeatability, their compliance rates are slightly below

the compliance standards. Compliance rates that fall below compliance standards indicate variables for which more focus is needed. Compliance rates should improve with either more intensive crew training, clarification of protocols, or adjusting the variable's MQO to better reflect the realistic expectation of quality for that variable. Given the importance of these variables for estimating volume and biomass, they will be a high priority for future improvements via increased training and clarification of measurement protocols.

Other tree variables generally met the MQOs defined in table 13. Exceptions include uncompacted crown ratio (83 percent compliance rate), crown class (12 percent), mortality year (56 percent), sound dead (42 percent), form defect (62 percent), and tree age (15 percent). The repeatability of the variable "uncompacted crown ratio" has declined since the previous reporting period (Werstak et al. 2016), which suggests that increased attention during training and quality control can reverse the decline in repeatability. The compliance rates for sound dead and form defect do not exhibit any specific pattern over time, indicating that these variables may require not only increased training but perhaps also improved specifications for determining cull volume due to dead wood versus form defects.

Crown class was the least repeatable tree-level variable, with a 1X compliance rate of 12 percent. QA results from surrounding States suggest that the crown class variable is difficult to interpret in regions with an abundance of woodland forest types. Compliance rates for crown class were below 16 percent in Arizona, Colorado, Nevada, New Mexico, and Wyoming, while they were near 80 percent in Idaho and Montana, which contain more timber land forest types (DeRose et al. 2018). This discrepancy suggests that the following actions may improve the repeatability of these variables: (a) provide additional training and protocol clarification for crews working in woodland forest types, and/or (b) adjust the variables' definitions with respect to woodland trees.

Although the compliance rate for the variable "tree age" is quite low (15 percent; table 13), users are advised that the low compliance rate for tree age (15 percent) is based on field-measured ages, whereas the ages eventually recorded in the FIA database and used to assign stand ages is assigned in a tree-ring laboratory where technicians use sandpaper, microscopes, and sometimes modeling techniques to obtain more accurate age estimates. FIA has not yet compiled sufficient data to evaluate the compliance rate of laboratory-recorded tree ages. However, preliminary results show that it is much closer to the compliance standard for tree age. Such results provide evidence that data quality for tree and stand ages is substantially improved when tree cores are sent to a tree-ring laboratory for analysis. Finally, although the compliance rate for horizontal distance fell below the compliance standard (table 13), this variable does not affect any FIA estimates and is used only to help future field crews ensure they are correctly identifying each tree for remeasurement. It is likely that a wider tolerance or compliance standard could still meet the intent of this variable.

Two variables that appear to require improved training or protocol refinement are condition-level disturbance year and tree-level mortality year. The compliance rate for the condition-level variable "disturbance year" was only 17 percent, although this low compliance rate is based on only six observations (table 12). Similarly, the compliance rate for "mortality year," which has a tolerance of plus or minus 2 years, was only 56 percent based on 97 observations

(table 13). Both low compliance rates declined since the previous reporting period, wherein compliance rates for mortality year and disturbance year were 89 percent and 83 percent, respectively (Werstak et al. 2016). To improve these variables' compliance rates, increased training should focus on clues that indicate how long trees have been dead, such as evidence of decay as well as the abundance of fine branches and dead leaves, needles, or cones. Other possible methods of improving the compliance rate for condition-level disturbance year may include using disturbance maps that include annual delineations of specific disturbances such as wildfires and insect outbreaks.

CONCLUSIONS

Utah's 18 million acres of forest land are composed of mainly woodland forest-type groups (71 percent) of which Pinyon/juniper predominates. The remaining forest land consists of conifer forest-type groups (16 percent), hardwood forest-type groups (9 percent), and lastly nonstocked.

Eighty-five percent of Utah's forest land is in the public domain, of which the majority (39 percent) is managed by the Bureau of Land Management and closely followed by National Forest System (35 percent). Alternatively, private landowners account for 15 percent of Utah's forests.

Live trees (mostly woodland species) and to a lesser extent the overall net volume of live trees (5.0 inches diameter or greater) in Utah have declined somewhat since the 2012 (Werstak et al. 2016) and 2005 (DeBlander et al. 2010) estimates, resulting in an increase of standing dead by number and net volume of trees. However, the change in net volume, although consistently decreasing from year to year, is less than the sampling error.

Primarily insects, followed by disease and fire, continue to be major contributors to tree mortality within Utah during the current inventory and previous inventories. This inventory period indicated a decline in insect mortality and an increase in disease mortality from the 2012 inventory, though these changes are within sampling error. However, since 2005, there has been a considerable increase in both insect and disease mortality.

Timber harvesting in Utah was found to have increased since 2012 whereas decreases were found in prior years from 2007 to 2002 and 1992. The increase from 2012 mainly occurred in National Forests. Harvest levels on private timber land, tribal timber land, and other public lands continue to decline. This is likely due to changing opportunities for salvage as well as changing management emphasis because of forest disturbance and mortality.

The systematic interpenetrating panel design of the FIA annual inventory presents opportunities to assess trends in inventory estimates. Therefore, the information presented in this report serves as a baseline and might indicate opportunities for further analysis, investigation, or study. Quantitative inferences about temporal trends require updated estimates each year as additional panels are remeasured. These estimators can be used to track mortality events and lead to better monitoring of forest growth and tree harvest activity. As the annual inventory effort extends into the third measurement cycle in Utah, the power to detect trends and significant effects related to growth, mortality, removals, and other parameters of interest will be realized as estimates can be derived from remeasurement of previously measured plots that will be available. In this way, the FIA program fills the need for accurate and consistent, long-term monitoring procedures and data that analysts, managers, and researchers can rely on to monitor and study forest attributes and their dynamics over time.

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APPENDIX A: Standard Forest Inventory And Analysis Terminology

Note: For the FIA national glossary please go to the [FIA Glossary](#).

Average annual mortality—The average annual volume of trees 5.0-inches d.b.h./d.r.c. (diameter at breast height/diameter at root collar) and larger that died from natural causes.

Average annual net growth—The average annual net change in volume of trees 5.0-inches d.b.h./d.r.c. and larger in the absence of cutting (average annual gross growth minus average annual mortality).

Basal area (BA)—The cross-sectional area of a tree stem/bole (trunk) at the point where diameter is measured, inclusive of bark. BA is calculated for trees 1.0 inch and larger in diameter and is expressed in square feet. For timber species, the calculation is based on d.b.h. for woodland species, it is based on d.r.c.

Biomass—The quantity of wood fiber, for trees 1.0-inch d.b.h./d.r.c. and larger, expressed in terms of oven-dry weight. It includes aboveground portions of trees: bole/stem (trunk), bark, and branches. Biomass estimates can be computed for live and/or dead trees.

Board-foot volume—A unit of measure indicating the amount of wood contained in an unfinished board 1-foot wide, 1-foot long, and 1.0-inch thick. Board-foot volume is computed for the sawlog portion of a sawtimber-size tree; the sawlog portion includes the part of the bole on sawtimber-size tree from a 1-foot stump to a minimum sawlog top of 7.0 inches d.o.b. (diameter outside bark) for softwoods, or 9.0-inches d.o.b. for hardwoods.

- **Net board-foot volume** is calculated as the gross board-foot volume in the sawlog portion of a sawtimber-size tree, less deductions for cull (note: board-foot cull deductions are limited to rotten/missing material and form defect—referred to as the **merchantability factor—board-foot**). Board-foot volume estimates are computed in both Scribner and International ¼-inch Rule and can be calculated for live and/or dead (standing or down) trees.

Census water—Streams, sloughs, estuaries, canals, and other moving bodies of water 200 feet wide and greater, and lakes, reservoirs, ponds, and other permanent bodies of water 4.5 acres in area and greater.

Coarse woody debris—Down pieces of wood leaning more than 45 degrees from vertical with a diameter of at least 3.0 inches and a length of at least 3.0 feet.

Condition class—The combination of discrete landscape and forest attributers that identify, define, and stratify the area associated with a plot. Such attributes include reserved status, owner group, forest type, stand size class, stand origin, and tree density.

Crown class—A classification of trees based on dominance in relation to adjacent trees in the stand as indicated by crown development and amount of sunlight received from above and the sides.

Crown cover (Canopy cover)—The percentage of the ground surface area covered by a vertical projection of plant crowns. Tree crown cover for a sample site includes the combined cover of timber and woodland trees 1.0-inch d.b.h./d.r.c. and larger. Maximum crown cover for a site is 100 percent; overlapping cover is not double counted.

Cubic-foot volume (merchantable)—A unit of measure indicating the amount of wood contained in a cube 1 x 1 x 1 foot. Cubic-foot volume is computed for the merchantable portion of timber and woodland species; the merchantable portion for timber species includes that part of a bole from a 1-foot stump to a minimum 4.0-inch top d.o.b, or above the place(s) of diameter measurement for any woodland tree with a single 5.0-inch stem or larger or a cumulative (calculated) d.r.c. of at least 5.0 inches to the 1.5-inch ends of all branches. **Net cubic-foot volume** is calculated as the gross cubic-foot volume in the merchantable portion of a tree, less deductions for cull.

Diameter at breast height (d.b.h.)—The diameter of a tree bole/stem (trunk) measured at breast height (4.5 feet above ground), measured outside the bark. The point of diameter measurement may vary for abnormally formed trees.

Diameter at root collar (d.r.c.)—The diameter of a tree stem(s) measured at root collar or at the point nearest the ground line (whichever is higher) that represents the basal area of the tree, measured outside the bark. For multi-stemmed trees, d.r.c. is calculated from an equation that incorporates the individual stem diameter measurements. The point of diameter measurement may vary for woodland trees with stems that are abnormally formed. With the exception of seedlings, woodland stems qualifying for measurement must be at least 1.0 inch in diameter or larger and at least 1.0 foot in length.

Diameter class—A grouping of tree diameters (d.b.h. or d.r.c.) into classes of a specified range. For some diameter classes, the number referenced (e.g., 4-inch, 6-inch, 8-inch) is designated as the midpoint of an individual class range. For example, if 2.0-inch classes are specified (the range for an individual class) and even numbers are referenced, the 6.0-inch class would include trees 5.0- to 6.9-inches in diameter.

Diameter outside bark (d.o.b.)—Tree diameter measurement inclusive of the outside perimeter of the tree bark. The d.o.b. measurement may be taken at various points on a tree (e.g., breast height, tree top) or log, and is sometimes estimated.

Field plot/field location—A reference to the sample site or plot; an area containing the field location center and all sample points. A field location consists of four subplots and four microplots.

- **Subplot**—A 1/24-acre fixed-radius area (24-foot horizontal radius) used to sample trees 5.0-inches d.b.h./d.r.c. and larger and understory vegetation.
- **Microplot**—A 1/300-acre fixed-radius plot (6.8-foot radius), located 12 feet from the center of each subplot at an azimuth of 90 degrees, used to inventory seedlings and saplings.

Fixed-radius plot—A circular sample plot of a specified horizontal radius: 1/300 acre = 6.8-foot radius (microplot); 1/24 acre = 24.0-foot radius (subplot).

Forest land—Land that has at least 10 percent cover of live tally tree species of any size, or land formerly having such tree cover, and not currently developed for a nonforest use. The minimum area for classification as forest land is 1 acre. Roadside, stream side, and shelterbelt strips of trees must be at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams and other bodies of water, or natural clearings in forested areas are classified as forest if less than 120 feet in width or 1 acre in size. Grazed woodlands, reverting fields, and pastures that are not actively maintained are included if the above qualifications are satisfied.

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

Forest-Type group—A combination of forest types that share closely associated species or site requirements.

Gross growth—The annual increase in volume of trees 5.0-inches d.b.h. and larger in absence of cutting and mortality. Gross growth includes survivor growth, ingrowth, growth on ingrowth, growth on removals before removal, and growth on mortality prior to death.

Growing-stock trees—A live timber species, 5.0-inches d.b.h. or larger, with less than two-thirds (67 percent) of the merchantable volume cull, and containing at least one solid 8-foot section, now or prospectively, reasonably free of form defect, on the merchantable portion of the tree.

Growing-stock volume—The cubic-foot volume of sound wood in growing-stock trees at least 5.0-inches d.b.h. from a 1-foot stump to a minimum 4.0-inch top d.o.b. to the central stem.

Hardwood trees—Dicotyledonous trees, usually broadleaf and deciduous.

Inventory year—The year in which a plot was scheduled to be completed. Within each subpanel, all plots have the same inventory year. Inventory year may differ from measurement year.

Land use—The classification of a land condition by use or type.

Litter—The uppermost layer of organic debris on a forest floor; that is, essentially the freshly fallen, or only slightly decomposed material, mainly foliage, but also bark fragments, twigs, flowers, fruits, and so forth. Humus is the organic layer, unrecognizable as to origin, immediately beneath the litter layer from which it is derived. Litter and humus together are often termed duff.

Logging residue/products—Bolt—A short piece of pulpwood; a short log.

Industrial wood—All commercial roundwood products, excluding fuelwood.

Logging residue—The unused sections within the merchantable portions of sound (growing-stock) trees cut or killed during logging operations.

Mill or plant residue—Wood material from mills or other primary manufacturing plants that is not used for the mill's or plant's primary products. Mill or plant residue includes bark, slabs, edgings, trimmings, miscuts, sawdust, and shavings. Much of the mill and plant residue is used as fuel and as the raw material for such products as pulp, palletized fuel, fiberwood, mulch, and animal bedding. Mill or plant residue includes bark and the following components: Coarse residue (wood material suitable for chipping, such as slabs, edgings, and trim); Fine residue (wood material unsuitable for chipping, such as sawdust and shavings); Pulpwood (roundwood, whole-tree chips, or wood residues that are used for the production of wood pulp); Roundwood (logs, bolts, or other round sections cut from trees).

Mapped-plot design—A sampling technique that identifies (delineates or maps) and separately classifies distinct “conditions” on the field location sample area. At the most basic level, condition class delineations include forest land, nonforest land, and water. Forest land conditions can be further subdivided into separate condition classes if there are distinct variations in reserved status, owner group, forest type, stand size class, stand origin, and stand density, given that each distinct area meets minimum size requirements.

Measurement year—The year in which a plot was completed. Measurement year may differ from inventory year.

Merchantable portion—For trees measured at d.b.h. and 5.0-inches d.b.h. and larger, the merchantable portion (or “merchantable bole”) includes the part of the tree bole from a 1-foot stump to a 4.0-inch top (d.o.b.). For trees measured at d.r.c., the merchantable portion includes all qualifying segments above the place(s) of diameter measurement for any tree with a single 5.0-inch stem or larger or a cumulative (calculated) d.r.c. of at least 5.0 inches to the 1.5-inch ends of all branches; sections below the place(s) of diameter measurement are not included. Qualifying segments are stems or branches that are a minimum of 1 foot in length and at least 1.0 inch in diameter; portions of stems or branches smaller than 1.0 inch in diameter, such as branch tips, are not included in the merchantable portion of the tree.

Mortality tree—All standing or down dead trees 5.0-inches d.b.h./d.r.c. and larger that were alive at the previous inventory, or within the previous 5 years for the initial annual measurement.

National Forest System (NFS) lands—Public lands administered by the U.S. Department of Agriculture, Forest Service, such as national forests, national grasslands, and some national recreation areas.

National Park lands—Public lands administered by the U.S. Department of the Interior, Park Service such as national parks, national monuments, national historic sites (such as national memorials and national battlefields), and some national recreation areas.

Noncensus water—Portions of rivers, streams, sloughs, estuaries, and canals that are 30 to 200 feet wide and at least 1 acre in size; and lakes, reservoirs, and ponds 1 to 4.5 acres in size. Portions of rivers and streams not meeting the criteria for census water, but at least 30 feet wide and 1 acre in size, are considered noncensus water. Portions of braided streams not meeting the criteria for census water, but at least 30 feet in width and 1 acre in size, and more than 50 percent water at normal high-water level, are also considered noncensus water.

Nonforest land—Land that does not support, or has never supported, forests; and lands formerly forested where tree regeneration is precluded by development for other uses. Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining rights-of-way, power line clearings of any width, and noncensus water. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size, to qualify as nonforest land.

Nonstocked stand—A formerly stocked stand that currently has less than 10 percent stocking but has the potential to again become 10 percent stocked. For example, recently harvested, burned, or windthrow-damaged areas.

Other Federal lands—Public lands administered by Federal agencies other than the Forest Service.

Poletimber-size trees—For trees measured at d.b.h., softwoods 5.0- to 8.9-inches d.b.h. and hardwoods 5.0- to 10.9-inches d.b.h. For trees measured at d.r.c., all live trees 5.0- to 8.9-inches d.r.c.

Primary wood-processing plants—An industrial plant that processes roundwood products, such as sawlogs, pulpwood bolts, or veneer logs.

Private lands—All lands not owned or managed by a Federal, State, or other public entity, including lands owned by corporations, trusts, or individuals, as well as Tribal lands.

Productive forest land—Forest land capable of producing 20 cubic feet per acre per year of wood from trees, which are generally timber species (see Appendix D), on forest land classified as a timber forest type (see Appendix C).

Productivity—The potential yield capability of a stand calculated as a function of site index (expressed in terms of cubic-foot growth per acre per year at age of culmination of mean annual increment). Productivity values for forest land provide an indication of biological potential. Timber land stands are classified by the potential net annual growth attainable in fully stocked natural stands. For FIA reporting, Productivity Class is a variable that groups stand productivity values into categories of a specified range. Productivity is sometimes referred to as “yield” or “mean annual increment.”

Removals—The net volume of trees removed from the inventory by harvesting or other cultural operations (such as timber-stand improvement), by land clearing, or by changes in land use (such as a wilderness designation).

Reserved land—Land withdrawn from management for production of wood products through statute or administrative designation; examples include designated Federal wilderness areas, national parks and monuments, and most State parks.

Sampling error—A statistical term used to describe the accuracy of the inventory estimates. Expressed on a percentage basis to enable comparisons between the precision of different estimates, sampling errors are computed by dividing the estimate into the square root of its variance.

Sapling—A live tree 1.0- to 4.9-inches d.b.h./d.r.c.

Sawlog portion—The part of the bole of sawtimber-size trees between a 1-foot stump and the sawlog top.

Sawlog top—The point on the bole of sawtimber-size trees above which a sawlog cannot be produced. The minimum sawlog top is 7.0-inches d.o.b. for softwoods, and 9.0-inches d.o.b. for hardwoods.

Sawtimber-size trees—Softwoods 9.0-inches d.b.h. and larger and hardwoods 11.0 inches and larger.

Sawtimber volume—The growing-stock volume in the sawlog portion of sawtimber-size trees in board feet.

Seedlings—Live trees less than 1.0-inch d.b.h./d.r.c. and at least 6.0 inches in length for softwoods or 12.0 inches for hardwoods.

Site index—A measure of forest productivity for a timber land tree/stand. Expressed in terms of the expected height (in feet) of trees on the site at an index age of 50 (or 80 years for aspen and cottonwood). Calculated from height-to-age equations.

Site tree—A tree used to provide an index of site quality. Timber species selected for site index calculations must meet specified criteria with regards to age, diameter, crown class, and damage.

Snag—A standing dead tree.

Softwood trees—Coniferous trees, usually evergreen, having needle- or scale-like leaves.

Stand—A community of trees that can be distinguished from adjacent communities due to similarities and uniformity in tree and site characteristics, such as age-class distribution, species composition, spatial arrangement, structure, etc.

Stand density—A relative measure that quantifies the relationship between trees per acre, stand basal area, average stand diameter, and stocking of a forested stand.

Stand density index (SDI)—A widely used measure developed by Reineke (1933) and is an index that expresses relative stand density based on a comparison of measured stand values with some standard condition; **relative stand density** is the ratio, proportion, or percent of absolute stand density to a reference level defined by some standard level of competition. For FIA reporting, the SDI for a site is usually presented as a percentage of the maximum SDI for the forest type. Site SDI values are sometimes grouped into SDI classes of a specified percentage range. Maximum SDI values vary by species and region.

Standing dead tree—A dead tally tree at least 5.0 inches in diameter, has a bole that has an unbroken actual length of at least 4.5 feet, and leans less than 45 degrees from vertical as measured from the base of the tree to 4.5 feet. Portions of boles on dead trees that are separated greater than 50 percent (either above or below 4.5 feet) are considered severed and are included in down woody material (DWM) if they otherwise meet DWM tally criteria. For western woodland species with multiple stems, a tree is considered down if more than two-thirds of the volume is no longer attached or upright; without considering cut and removed volume. For western woodland species with single stems to qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, be at least 1.0 foot in unbroken actual length, and lean less than 45 degrees from vertical.

Stand size class—A classification of forest land based on the predominant diameter size of live trees presently forming the plurality of live-tree stocking. Classes are defined as follows:

- **Sawtimber stand (large-tree stand)**—A stand at least 10 percent stocked with live trees in which half or more of the total stocking is from live trees 5.0 inches or larger in diameter, and with sawtimber (large tree) stocking equal to or greater than poletimber (medium tree) stocking.
- **Poletimber stand (medium-tree stand)**—A stand at least 10 percent stocked with live trees in which half or more of the total stocking is from live trees 5.0 inches or larger in diameter, and with poletimber (medium tree) stocking exceeding sawtimber (large tree) stocking.
- **Sapling/seedling stand**—A stand at least 10 percent stocked with live trees in which half or more of the total stocking is from live trees less than 5.0 inches in diameter.
- **Nonstocked stand**—A formerly stocked stand that currently has less than 10 percent stocking but has the potential to again become 10 percent stocked. For example, recently harvested, burned, or windthrow-damaged areas.

Stocking—An expression of the extent to which growing space is effectively utilized by live trees.

Timber species—Tally tree species traditionally used for industrial wood products. These include all species of conifers, except pinyon and most junipers. Diameters for timber species are measured at breast height (d.b.h.).

Timber-stand improvement—A term comprising all intermediate cuttings or treatments, such as thinning, pruning, release cutting, girdling, weeding, or poisoning, made to improve the composition, health, and growth of the remaining trees in the stand.

Timber land—Unreserved forest land capable of producing 20 cubic feet per acre per year of wood from trees classified as a timber species (see Appendix D) on forest land designated as a timber forest type (see Appendix C).

Unproductive forest land—Forest land not capable of producing 20 cubic feet per acre per year of wood from trees classified as a timber species (see Appendix D) on forest land designated as a timber forest type and all forest lands designated as a woodland forest type (see Appendix C).

Unreserved forest land—Forest land not withdrawn from management for production of wood products through statute or administrative designation.

Wilderness area—An area of undeveloped land currently included in the Wilderness System, managed to preserve its natural conditions and retain its primeval character and influence.

Woodland species—Tally tree species that are not usually converted into industrial wood products. Common uses of woodland trees are fuelwood, fenceposts, and Christmas trees. These species include pinyon, juniper, mesquite, locust, mountain-mahogany (*Cercocarpus* spp.), Rocky Mountain maple, bigtooth maple, desert ironwood, and most western oaks (note: bur oak and chinkapin oak are classified as timber species). Because most woodland trees are extremely variable in form, diameter is measured at root collar.

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Table B1—Percentage of all area by land status; Utah, 2008-2017.

Land status		
Accessible forest land		Percent Sampling Error
Unreserved forest land	Timberland	6.3 (3.44)
	Unproductive	21.1 (1.61)
	Total	27.4 (1.21)
Reserved forest land	Productive	0.8 (10.7)
	Unproductive	2.9 (5.52)
	Total	3.7 (4.85)
Total accessible forest land		31.1 (1.05)
Nonforest and other land		Percent Sampling Error
Nonforest land		62.0 (0.58)
Water	Noncensus water	0.1 (38.08)
	Census water	2.9 (5.59)
	Total	3.0 (5.53)
Total nonforest and other land		64.9 (0.50)
Nonsampled land		Percent Sampling Error
Access denied		1.7 (7.78)
Hazardous conditions		2.0 (6.47)
Skipped visit		0.2 (23.74)
Other		0.1 (21.70)
Total nonsampled land		4.0 (4.72)

Table B2—Area, in thousand acres, of forest land (percent sampling error) by owner group, owner class, reserved status, and forest land status.^a

Owner group		Unreserved			Reserved			All forest land
		Timberland	Unproductive	Total	Productive	Unproductive	Total	
Forest Service	National forest	2,776.6 (4.04)	3,036.6 (3.87)	5,813.2 (2.53)	393.4 (11.75)	151.3 (19.46)	544.7 (9.88)	6,357.9 (2.35)
	Other Forest Service land	— (—)	4.5 (100.45)	4.5 (100.45)	— (—)	— (—)	— (—)	4.5 (100.45)
Other Federal	National Park Service	— (—)	— (—)	— (—)	47.3 (34.90)	319.9 (13.37)	367.2 (12.41)	367.2 (12.41)
	Bureau of Land Management	113.9 (21.30)	5,865.3 (2.65)	5,979.2 (2.61)	21.9 (48.36)	1,069.4 (6.79)	1,091.3 (6.71)	7,070.4 (2.35)
	Fish and Wildlife Service	— (—)	— (—)	— (—)	— (—)	6.3 (99.15)	6.3 (99.15)	6.3 (99.15)
	Departments of Defense/Energy	— (—)	16.1 (59.60)	16.1 (59.60)	— (—)	— (—)	— (—)	16.1 (59.60)
State and local government	State	190.8 (17.59)	1,154.5 (7.01)	1,345.3 (6.44)	6.5 (99.02)	57.1 (33.52)	63.7 (31.71)	1,409.0 (6.31)
	Local(County, Municipality, etc.)	20.8 (55.37)	24.9 (49.52)	45.7 (36.28)	— (—)	— (—)	— (—)	45.7 (36.28)
	Other non-Federal public	— (—)	7.2 (94.63)	7.2 (94.63)	— (—)	— (—)	— (—)	7.2 (94.63)
Private	Undifferentiated private and Native American	586.3 (9.61)	2,158.0 (4.87)	2,744.3 (4.20)	— (—)	— (—)	— (—)	2,744.3 (4.20)
Total		3,688.4 (3.38)	12,267.2 (1.54)	15,955.5 (1.12)	469.1 (10.78)	1,604.1 (5.60)	2,073.2 (4.90)	18,028.7 (0.97)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B3—Area, in thousand acres, of forest land (percent sampling error) by forest-type group and site productivity class (cuft/acre/year).^a

Forest-Type group	Site productivity class(cuft/acre/year)							Total all classes
	0-19	20-49	50-84	85-119	120-164	165-224	225+	
Pinyon/juniper group	10,488.2 (1.78)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	10,488.2 (1.78)
Douglas-fir group	4.7 (99.24)	451.6 (11.13)	91.2 (24.38)	11.8 (69.73)	— (—)	— (—)	— (—)	559.3 (9.90)
Ponderosa pine group	18.5 (58.08)	303.5 (13.81)	18.7 (57.86)	— (—)	— (—)	— (—)	— (—)	340.7 (13.00)
Fir/spruce/ mountain hemlock group	50.7 (34.37)	980.1 (7.38)	449.2 (11.30)	61.7 (31.12)	— (—)	— (—)	— (—)	1,541.7 (5.79)
Lodgepole pine group	52.6 (34.60)	355.9 (12.37)	6.2 (100.36)	— (—)	— (—)	— (—)	— (—)	414.6 (11.34)
Other western softwood group	13.9 (70.00)	33.1 (42.06)	— (—)	— (—)	— (—)	— (—)	— (—)	46.9 (36.14)
Elm/ash/ cottonwood group	3.1 (70.52)	45.0 (31.20)	11.4 (71.17)	— (—)	— (—)	— (—)	— (—)	59.5 (27.49)
Aspen/birch group	293.3 (13.42)	1,022.6 (7.13)	212.7 (16.41)	6.3 (99.40)	— (—)	— (—)	— (—)	1,534.9 (5.60)
Woodland hardwoods group	2,380.4 (4.49)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	2,380.4 (4.49)
Nonstocked	565.8 (9.61)	88.4 (23.98)	8.2 (58.56)	— (—)	— (—)	— (—)	— (—)	662.4 (8.85)
Total	13,871.2 (1.40)	3,280.2 (3.58)	797.5 (8.31)	79.8 (27.17)	— (—)	— (—)	— (—)	18,028.7 (0.97)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Tables continue on next page.

Table B5—Area, in thousand acres, of forest land(percent sampling error) by forest-type group and stand size class.^a

Forest-Type group	Stand size class				All size classes
	Large diameter	Medium diameter	Small diameter	Nonstocked	
Pinyon/juniper group	9,907.3 (1.87)	447.7 (11.17)	133.2 (20.63)	— (—)	10,488.2 (1.78)
Douglas-fir group	428.0 (11.39)	71.1 (28.03)	60.2 (30.96)	— (—)	559.3 (9.90)
Ponderosa pine group	315.8 (13.52)	— (—)	24.9 (50.61)	— (—)	340.7 (13.00)
Fir/spruce/mountain hemlock group	1,152.6 (6.87)	187.9 (17.17)	201.2 (16.89)	— (—)	1,541.7 (5.79)
Lodgepole pine group	128.9 (21.50)	150.8 (19.57)	134.9 (20.94)	— (—)	414.6 (11.34)
Other western softwood group	38.8 (38.96)	— (—)	8.1 (94.57)	— (—)	46.9 (36.14)
Elm/ash/cottonwood group	28.5 (42.62)	16.6 (49.34)	14.4 (51.29)	— (—)	59.5 (27.49)
Aspen/birch group	283.4 (14.13)	824.6 (8.02)	426.9 (11.10)	— (—)	1,534.9 (5.60)
Woodland hardwoods group	460.1 (10.80)	421.3 (11.25)	1,499.0 (5.90)	— (—)	2,380.4 (4.49)
Nonstocked	— (—)	— (—)	— (—)	662.4 (8.85)	662.4 (8.85)
Total	12,743.4 (1.49)	2,120.1 (4.84)	2,502.9 (4.43)	662.4 (8.85)	18,028.7 (0.97)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

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Table B6—Area, in thousand acres, of forest land (percent sampling error) by forest-type group and stand age class (years).^a

Forest-Type group	Stand age class(years)												All classes
	Nonstocked	1-20	21-40	41-60	61-80	81-100	101-120	121-140	141-160	161-180	181-200	201+	
Pinyon/juniper group	— (—)	68.0 (29.69)	121.8 (21.69)	277.9 (13.96)	720.2 (8.94)	1,064.5 (7.30)	1,194.2 (6.90)	1,067.4 (7.34)	1,142.7 (7.08)	1,095.2 (7.26)	926.7 (7.94)	2,809.6 (4.31)	10,488.2 (1.78)
Douglas-fir group	— (—)	31.7 (43.95)	28.5 (43.58)	33.5 (39.24)	67.5 (29.07)	129.1 (21.28)	84.2 (26.14)	69.0 (28.39)	34.0 (41.51)	25.6 (49.07)	28.2 (45.80)	28.0 (44.01)	559.3 (9.90)
Ponderosa pine group	— (—)	19.0 (57.74)	5.9 (105.09)	6.3 (97.69)	52.6 (33.21)	101.1 (24.43)	50.3 (35.46)	30.8 (44.39)	25.1 (50.43)	19.2 (57.24)	8.8 (69.95)	21.6 (51.05)	340.7 (13.00)
Fir/spruce/ mountain hemlock group	— (—)	80.8 (26.39)	110.2 (23.33)	22.0 (51.75)	53.1 (31.29)	201.3 (16.91)	278.1 (14.63)	270.4 (14.77)	174.8 (18.51)	115.8 (22.62)	82.1 (26.92)	153.1 (19.28)	1,541.7 (5.79)
Lodgepole pine group	— (—)	61.6 (31.43)	46.6 (36.63)	19.6 (56.85)	44.5 (37.21)	71.8 (29.47)	52.6 (33.13)	51.2 (34.95)	13.2 (70.23)	4.7 (99.24)	16.4 (59.54)	32.3 (44.01)	414.6 (11.34)
Other western softwood group	— (—)	— (—)	8.1 (94.57)	— (—)	— (—)	— (—)	— (—)	6.5 (99.02)	— (—)	6.9 (95.33)	— (—)	25.4 (47.20)	46.9 (36.14)
Elm/ash/ cottonwood group	— (—)	12.4 (57.64)	9.5 (68.35)	7.5 (67.32)	9.7 (61.66)	1.8 (94.63)	9.9 (79.70)	7.1 (96.54)	— (—)	1.6 (99.15)	— (—)	— (—)	59.5 (27.49)
Aspen/birch group	— (—)	265.2 (14.14)	152.0 (18.85)	187.1 (17.26)	298.8 (13.66)	304.8 (13.51)	228.6 (16.16)	68.3 (29.28)	26.1 (46.17)	4.1 (94.57)	— (—)	— (—)	1,534.9 (5.60)
Woodland hardwoods group	— (—)	1,268.9 (6.46)	222.5 (16.01)	63.9 (27.65)	211.3 (16.08)	166.1 (18.37)	157.9 (18.63)	119.4 (21.57)	111.1 (22.22)	46.4 (35.64)	2.7 (100.14)	10.3 (72.40)	2,380.4 (4.49)
Nonstocked	662.4 (8.85)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	662.4 (8.85)
Total	662.4 (8.85)	1,807.5 (5.34)	705.1 (8.84)	617.9 (9.25)	1,457.6 (6.12)	2,040.4 (5.13)	2,055.9 (5.17)	1,690.1 (5.74)	1,527.0 (6.06)	1,319.5 (6.57)	1,065.0 (7.37)	3,080.3 (4.08)	18,028.7 (0.97)

^a Numbers in rows and columns may not sum to totals due to rounding.
A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B7—Area, in thousand acres, of forest land (percent sampling error) by forest-type group and stand origin.^a

Forest-Type group	Stand origin		All forest land
	Natural stands	Artificial regeneration	
Pinyon/juniper group	10,482.1 (1.78)	6.1 (102.32)	10,488.2 (1.78)
Douglas-fir group	559.3 (9.90)	— (—)	559.3 (9.90)
Ponderosa pine group	340.7 (13.00)	— (—)	340.7 (13.00)
Fir/spruce/mountain hemlock group	1,541.7 (5.79)	— (—)	1,541.7 (5.79)
Lodgepole pine group	414.6 (11.34)	— (—)	414.6 (11.34)
Other western softwood group	46.9 (36.14)	— (—)	46.9 (36.14)
Elm/ash/cottonwood group	59.5 (27.49)	— (—)	59.5 (27.49)
Aspen/birch group	1,528.4 (5.62)	6.5 (99.02)	1,534.9 (5.60)
Woodland hardwoods group	2,380.4 (4.49)	— (—)	2,380.4 (4.49)
Nonstocked	662.4 (8.85)	— (—)	662.4 (8.85)
Total	18,016.1 (0.97)	12.6 (71.16)	18,028.7 (0.97)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Tables continue on next page.

Table B8—Area, in thousand acres, of forest land (percent sampling error) by forest-type group and disturbance class.^a

Forest-Type group	Disturbance class										
	Unavailable	Insect	Disease	Fire	Animal	Weather	Vegetation	Unknown	Human	Geologic	All forest land
Pinyon/juniper group	9,792.3 (1.90)	194.4 (17.67)	276.2 (14.53)	87.2 (25.67)	41.4 (36.13)	55.2 (33.56)	6.5 (100.00)	6.1 (94.57)	16.1 (58.26)	12.8 (71.56)	10,488.2 (1.78)
Douglas-fir group	437.8 (11.17)	72.7 (28.50)	45.7 (37.27)	3.2 (99.24)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	559.3 (9.90)
Ponderosa pine group	316.9 (13.57)	— (—)	7.7 (83.89)	16.1 (59.22)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	340.7 (13.00)
Fir/spruce/mountain hemlock group	1,169.2 (6.79)	262.4 (15.04)	60.8 (31.00)	8.0 (81.48)	— (—)	19.0 (56.65)	— (—)	— (—)	6.5 (100.00)	15.8 (60.31)	1,541.7 (5.79)
Lodgepole pine group	144.7 (20.18)	237.7 (15.09)	25.9 (49.32)	6.3 (99.24)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	414.6 (11.34)
Other western softwood group	46.9 (36.14)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	46.9 (36.14)
Elm/ash/cottonwood group	51.1 (29.88)	— (—)	— (—)	3.4 (95.33)	— (—)	4.9 (98.35)	— (—)	— (—)	— (—)	— (—)	59.5 (27.49)
Aspen/birch group	1,161.7 (6.56)	74.7 (28.17)	206.8 (16.65)	70.6 (29.17)	11.7 (62.36)	7.6 (84.61)	— (—)	— (—)	— (—)	1.8 (94.63)	1,534.9 (5.60)
Woodland hardwoods group	2,141.5 (4.77)	6.5 (99.02)	30.0 (43.44)	168.4 (19.03)	8.8 (78.14)	25.3 (49.84)	— (—)	— (—)	— (—)	— (—)	2,380.4 (4.49)
Nonstocked	428.9 (10.88)	3.2 (71.73)	12.6 (70.50)	206.6 (16.54)	6.5 (98.74)	— (—)	— (—)	— (—)	4.6 (76.02)	— (—)	662.4 (8.85)
Total	15,691.0 (1.22)	851.6 (7.93)	665.7 (9.28)	569.8 (10.03)	68.4 (27.94)	112.0 (23.29)	6.5 (100.00)	6.1 (94.57)	27.2 (43.87)	30.4 (43.70)	18,028.7 (0.97)

^a Numbers in rows and columns may not sum to totals due to rounding.
A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B9—Area, in thousand acres, of timberland (percent sampling error) by forest-type group and stand size class.^a

Forest-Type group	Stand size class				All size classes
	Large diameter	Medium diameter	Small diameter	Nonstocked	
Douglas-fir group	389.1 (11.96)	71.1 (28.03)	54.0 (32.54)	— (—)	514.2 (10.33)
Ponderosa pine group	264.5 (14.93)	— (—)	12.5 (72.44)	— (—)	277.0 (14.61)
Fir/spruce/ mountain hemlock group	933.3 (7.74)	166.1 (18.33)	147.4 (19.94)	— (—)	1,246.7 (6.58)
Lodgepole pine group	75.4 (28.50)	118.6 (22.31)	94.2 (25.20)	— (—)	288.2 (13.91)
Other western softwood group	30.0 (45.17)	— (—)	— (—)	— (—)	30.0 (45.17)
Elm/ash/ cottonwood group	20.3 (52.53)	15.0 (53.43)	12.9 (56.25)	— (—)	48.2 (31.41)
Aspen/birch group	265.3 (14.69)	648.5 (9.19)	282.7 (13.83)	— (—)	1,196.5 (6.53)
Nonstocked	— (—)	— (—)	— (—)	87.5 (23.75)	87.5 (23.75)
Total	1,978.0 (5.13)	1,019.2 (7.19)	603.6 (9.48)	87.5 (23.75)	3,688.4 (3.38)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Tables continue on next page.

Table B10—Number of live trees (at least 1 inches diameter), in thousand trees, on forest land (percent sampling error) by species group type and species group and diameter class (inches).^a

Species group type	Diameter class(inches)																			All classes	
	1.0-2.9	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	23.0-24.9	25.0-26.9	27.0-28.9	29.0-30.9	31.0-32.9	33.0-34.9	35.0-36.9	37+		
Softwood species groups																					
Douglas-fir	68,041.7 (12.99)	46,430.4 (14.21)	26,484.7 (9.38)	20,259.0 (8.76)	15,913.7 (9.07)	10,679.5 (9.80)	7,959.1 (10.18)	5,624.1 (10.38)	3,615.5 (12.95)		2,042.2 (17.82)	1,152.1 (20.71)	907.6 (22.66)	618.3 (27.59)	160.5 (49.26)	113.6 (57.48)	49.2 (91.53)	43.4 (94.63)	73.4 (71.38)	37.0 (100.36)	210,205.0 (8.65)
Ponderosa and Jeffrey pines	5,630.4 (33.29)	10,347.4 (23.11)	5,993.2 (14.11)	5,217.3 (14.87)	4,832.4 (15.38)	3,647.3 (14.79)	3,282.9 (17.99)	2,729.3 (17.72)	2,126.8 (15.72)		1,442.1 (19.51)	947.0 (23.47)	647.6 (24.10)	308.7 (35.11)	187.6 (45.16)	116.1 (57.10)	186.1 (45.10)	186.3 (45.08)	— (—)	— (—)	47,828.5 (11.77)
True fir	329,915.2 (9.21)	109,129.0 (9.71)	56,563.8 (7.09)	37,432.0 (7.37)	22,650.9 (7.95)	15,629.0 (8.26)	9,432.3 (9.04)	6,355.1 (10.60)	3,966.9 (12.05)		2,628.4 (15.15)	1,603.0 (19.22)	802.1 (24.16)	574.1 (29.45)	469.0 (28.54)	169.3 (47.86)	86.7 (66.54)	121.6 (56.24)	— (—)	178.6 (59.32)	597,707.0 (7.28)
Engelmann and other spruces	69,315.6 (13.28)	45,695.1 (14.78)	24,786.9 (9.78)	19,875.1 (9.06)	14,835.1 (10.03)	9,830.2 (11.01)	6,938.2 (10.84)	5,642.7 (12.89)	2,850.0 (15.08)		1,640.1 (18.37)	1,188.7 (20.64)	1,174.5 (21.38)	300.0 (35.60)	232.8 (46.77)	157.9 (49.99)	71.9 (72.32)	79.5 (70.15)	— (—)	— (—)	204,614.2 (9.64)
Lodgepole pine	132,594.7 (23.67)	84,077.6 (18.85)	50,929.9 (15.51)	25,434.4 (13.30)	11,001.7 (13.96)	5,281.6 (17.93)	2,869.1 (20.49)	1,475.3 (25.33)	414.1 (32.44)		262.6 (50.78)	38.0 (99.24)	— (—)	42.2 (98.13)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	314,421.3 (15.15)
Woodland softwoods	432,939.8 (4.76)	340,343.6 (4.78)	250,065.0 (2.80)	207,828.2 (2.64)	170,491.3 (2.70)	135,454.9 (2.75)	100,379.1 (2.94)	76,470.3 (3.12)	50,969.0 (3.56)		37,086.1 (3.96)	23,394.9 (4.75)	16,127.2 (5.48)	11,180.1 (6.46)	6,501.9 (8.11)	4,690.1 (9.86)	2,420.2 (12.74)	1,507.5 (15.87)	841.5 (21.12)	1,181.9 (19.78)	1,869,872.8 (2.51)
Other western softwoods	4,150.5 (44.48)	3,483.3 (40.05)	2,417.3 (18.95)	1,727.1 (21.25)	1,329.4 (23.66)	1,427.7 (24.07)	547.6 (28.03)	521.0 (31.69)	292.3 (39.82)		215.7 (41.41)	142.1 (51.71)	211.1 (41.96)	78.7 (99.02)	31.7 (104.41)	— (—)	— (—)	— (—)	— (—)	76.4 (70.50)	16,651.9 (22.28)
Subtotal	1,042,588.0 (4.76)	639,506.4 (4.16)	417,240.7 (2.72)	317,773.1 (2.24)	241,054.3 (2.20)	181,950.2 (2.28)	131,408.3 (2.47)	98,818.0 (2.65)	64,234.7 (3.05)		45,317.1 (3.53)	28,465.8 (4.24)	19,870.1 (4.90)	13,102.1 (5.92)	7,583.6 (7.45)	5,246.9 (9.23)	2,814.1 (11.75)	1,938.4 (13.97)	914.9 (20.25)	1,474.0 (17.95)	3,261,300.8 (2.47)
Hardwood species groups																					
Cottonwood and aspen	378,153.1 (14.76)	139,228.6 (9.91)	94,621.6 (7.75)	65,359.8 (7.68)	37,633.8 (8.32)	17,910.7 (9.95)	8,505.3 (12.03)	3,614.9 (15.21)	2,204.0 (20.26)		625.5 (28.81)	348.2 (36.85)	146.4 (50.94)	— (—)	37.7 (99.15)	— (—)	— (—)	— (—)	— (—)	— (—)	748,389.7 (8.58)
Other western hardwoods	7,776.8 (68.19)	472.1 (99.40)	208.2 (81.02)	123.0 (73.49)	37.3 (100.14)	42.6 (96.54)	— (—)	— (—)	— (—)		— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	8,660.0 (62.75)
Woodland hardwoods	2,335,637.8 (5.78)	450,410.6 (7.47)	125,650.0 (7.21)	52,282.7 (8.11)	21,399.5 (9.47)	11,518.8 (9.77)	4,919.7 (12.27)	2,254.9 (17.27)	1,275.8 (18.60)		464.5 (28.75)	452.3 (31.20)	113.7 (57.32)	76.9 (70.00)	— (—)	— (—)	31.7 (104.41)	— (—)	36.7 (99.43)	— (—)	3,006,525.7 (5.32)
Subtotal	2,721,567.7 (5.32)	590,111.2 (6.13)	220,479.9 (5.21)	117,765.5 (5.51)	59,070.6 (6.27)	29,472.2 (7.08)	13,425.0 (8.77)	5,869.8 (11.42)	3,479.8 (14.47)		1,090.0 (20.54)	800.5 (23.83)	260.1 (38.08)	76.9 (70.00)	37.7 (99.15)	— (—)	31.7 (104.41)	— (—)	36.7 (99.43)	— (—)	3,763,575.4 (4.52)
Total	3,764,155.7 (4.01)	1,229,617.6 (3.59)	637,720.6 (2.46)	435,538.6 (2.16)	300,125.0 (2.13)	211,422.4 (2.17)	144,833.3 (2.36)	104,687.8 (2.55)	67,714.5 (2.97)		46,407.1 (3.47)	29,266.3 (4.18)	20,130.2 (4.85)	13,179.1 (5.90)	7,621.3 (7.42)	5,246.9 (9.23)	2,845.9 (11.68)	1,938.4 (13.97)	951.6 (19.85)	1,474.0 (17.95)	7,024,876.2 (2.58)

^a Numbers in rows and columns may not sum to totals due to rounding.
A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B11—Number of standing dead trees (at least 5 inches diameter), in thousand trees, on forest land (percent sampling error) by species group type and species group and diameter class (inches).^a

Species group type	Diameter class(inches)																	All classes
	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	23.0-24.9	25.0-26.9	27.0-28.9	29.0-30.9	31.0-32.9	33.0-34.9	35.0-36.9	37+	
Softwood species groups																		
Douglas-fir	4,303.4 (14.31)	3,698.5 (14.15)	3,931.0 (12.94)	3,940.9 (13.97)	2,629.7 (15.75)	2,633.6 (16.64)	1,422.7 (17.86)	1,262.8 (18.24)	652.7 (25.45)	354.2 (36.50)	300.9 (39.24)	207.3 (43.97)	146.1 (50.28)	38.9 (98.74)	81.4 (68.50)	37.0 (99.97)	34.1 (105.01)	25,675.2 (9.42)
Ponderosa and Jeffrey pines	380.9 (31.04)	152.6 (49.77)	205.5 (43.94)	279.2 (42.89)	455.2 (33.08)	185.3 (45.18)	227.1 (40.73)	186.6 (44.84)	75.0 (70.46)	111.5 (58.39)	69.0 (72.33)	74.6 (71.30)	73.4 (72.20)	113.4 (58.21)	— (—)	— (—)	83.2 (68.65)	2,672.7 (17.00)
True fir	18,156.5 (10.74)	13,088.3 (11.32)	9,026.2 (10.74)	5,364.0 (11.36)	2,651.4 (14.73)	1,813.3 (16.83)	1,327.2 (18.47)	526.3 (28.70)	411.7 (30.83)	112.8 (59.28)	157.6 (49.04)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	52,635.4 (8.94)
Engelmann and other spruces	4,038.3 (15.73)	4,002.2 (14.58)	4,404.6 (14.64)	4,418.7 (14.90)	3,003.6 (15.60)	2,844.9 (16.51)	2,268.6 (18.24)	1,383.0 (19.31)	1,131.2 (20.92)	774.7 (29.60)	262.9 (38.45)	117.1 (58.84)	190.2 (45.35)	39.2 (102.84)	152.3 (50.76)	42.2 (98.13)	85.4 (69.22)	29,159.0 (11.48)
Lodgepole pine	17,313.9 (16.31)	16,933.8 (13.19)	10,989.8 (15.00)	7,655.7 (15.38)	4,549.1 (16.14)	2,080.0 (20.17)	827.4 (28.94)	439.3 (31.79)	273.4 (37.16)	42.2 (98.13)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	61,104.6 (11.07)
Woodland softwoods	28,034.1 (7.84)	29,536.9 (5.90)	24,781.0 (5.30)	18,844.4 (5.76)	12,610.2 (5.97)	9,311.6 (6.81)	5,762.3 (8.51)	2,914.3 (11.39)	1,538.9 (15.74)	1,040.4 (18.94)	629.9 (24.51)	184.4 (44.92)	109.3 (58.31)	113.7 (57.51)	36.5 (100.43)	36.7 (99.43)	— (—)	135,484.7 (4.19)
Other western softwoods	608.9 (36.61)	555.0 (31.66)	429.0 (37.43)	363.5 (41.00)	177.0 (45.74)	177.6 (46.34)	136.1 (62.42)	228.4 (59.98)	72.9 (71.14)	74.9 (73.52)	72.2 (72.65)	— (—)	— (—)	43.4 (94.63)	— (—)	— (—)	— (—)	2,938.9 (24.05)
Subtotal	72,836.1 (5.81)	67,967.5 (4.88)	53,767.2 (4.61)	40,866.4 (4.82)	26,076.1 (4.96)	19,046.3 (5.41)	11,971.4 (6.48)	6,940.8 (7.92)	4,155.8 (10.12)	2,510.7 (13.98)	1,492.5 (16.23)	583.4 (25.85)	519.0 (27.02)	348.5 (33.20)	270.2 (37.77)	115.9 (57.33)	202.7 (44.23)	309,670.5 (3.55)
Hardwood species groups																		
Cottonwood and aspen	47,161.3 (8.17)	22,020.2 (9.83)	9,684.2 (10.37)	4,071.2 (13.46)	1,633.6 (19.33)	782.0 (24.91)	524.0 (30.02)	115.7 (73.95)	153.3 (49.88)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	86,145.5 (7.19)
Woodland hardwoods	29,786.9 (10.13)	8,455.4 (11.43)	3,564.3 (15.59)	1,482.3 (17.85)	930.8 (27.14)	324.7 (36.72)	114.8 (73.71)	35.9 (100.04)	37.1 (102.26)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	44,732.4 (8.93)
Subtotal	76,948.2 (6.31)	30,475.6 (7.71)	13,248.5 (8.59)	5,553.5 (10.91)	2,564.4 (15.72)	1,106.7 (20.62)	638.8 (27.93)	151.6 (61.21)	190.4 (44.83)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	130,877.9 (5.57)
Total	149,784.3 (4.44)	98,443.1 (4.12)	67,015.7 (4.07)	46,419.9 (4.44)	28,640.5 (4.71)	20,153.0 (5.23)	12,610.3 (6.30)	7,092.4 (7.86)	4,346.2 (9.86)	2,510.7 (13.98)	1,492.5 (16.23)	583.4 (25.85)	519.0 (27.02)	348.5 (33.20)	270.2 (37.77)	115.9 (57.33)	202.7 (44.23)	440,548.4 (3.03)

^a Numbers in rows and columns may not sum to totals due to rounding.
A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B13—Net volume of live trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by ownership group, owner class, reserved status, and forest land status.^a

Ownership group	Unreserved			Reserved			All forest land
	Timberland	Unproductive	Total	Productive	Unproductive	Total	
Forest Service							
National forest	4,926.1 (5.65)	1,879.3 (5.75)	6,805.5 (4.23)	813.5 (15.39)	99.1 (25.55)	912.6 (13.95)	7,718.1 (3.96)
Other Forest Service land	— (—)	1.5 (100.45)	1.5 (100.45)	— (—)	— (—)	— (—)	1.5 (100.45)
Other Federal							
National Park Service	— (—)	— (—)	— (—)	63.7 (41.61)	153.1 (17.80)	216.8 (17.45)	216.8 (17.45)
Bureau of Land Management	120.6 (31.08)	3,292.3 (3.64)	3,412.9 (3.64)	7.0 (56.25)	624.3 (8.53)	631.3 (8.44)	4,044.2 (3.27)
Fish and Wildlife Service	— (—)	— (—)	— (—)	— (—)	7.7 (99.15)	7.7 (99.15)	7.7 (99.15)
Departments of Defense/Energy	— (—)	4.5 (90.31)	4.5 (90.31)	— (—)	— (—)	— (—)	4.5 (90.31)
State and local government							
State	279.1 (25.41)	638.3 (9.52)	917.5 (10.12)	9.1 (99.02)	23.5 (42.97)	32.7 (41.51)	950.1 (9.88)
Local(County, Municipality, etc.)	46.9 (59.00)	5.1 (89.23)	52.1 (53.41)	— (—)	— (—)	— (—)	52.1 (53.41)
Other non-Federal public	— (—)	2.7 (94.63)	2.7 (94.63)	— (—)	— (—)	— (—)	2.7 (94.63)
Private							
Undifferentiated private and Native American	752.2 (13.06)	1,261.0 (7.69)	2,013.2 (6.74)	— (—)	— (—)	— (—)	2,013.2 (6.74)
Total	6,124.9 (4.87)	7,084.9 (2.49)	13,209.8 (2.36)	893.3 (14.36)	907.7 (7.20)	1,801.1 (7.94)	15,010.9 (2.16)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B14—Net volume of standing dead trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by ownership group, owner class, reserved status, and forest land status.^a

Ownership group	Unreserved			Reserved			All forest land
	Timberland	Unproductive	Total	Productive	Unproductive	Total	
Forest Service							
National forest	1,825.8 (7.95)	235.6 (10.03)	2,061.4 (7.08)	316.8 (19.44)	71.5 (48.44)	388.3 (17.96)	2,449.7 (6.42)
Other Forest Service land	— (—)	0.3 (100.45)	0.3 (100.45)	— (—)	— (—)	— (—)	0.3 (100.45)
Other Federal							
National Park Service	— (—)	— (—)	— (—)	19.4 (54.43)	29.8 (29.86)	49.2 (27.86)	49.2 (27.86)
Bureau of Land Management	41.6 (38.80)	332.5 (6.52)	374.1 (7.18)	1.9 (94.35)	58.9 (14.04)	60.7 (13.90)	434.8 (6.45)
Fish and Wildlife Service	— (—)	— (—)	— (—)	— (—)	1.0 (99.15)	1.0 (99.15)	1.0 (99.15)
Departments of Defense/Energy	— (—)	0.0 (104.95)	0.0 (104.95)	— (—)	— (—)	— (—)	0.0 (104.95)
State and local government							
State	82.8 (33.45)	66.0 (16.16)	148.8 (19.81)	0.6 (99.02)	4.1 (45.94)	4.7 (41.94)	153.6 (19.24)
Local(County, Municipality, etc.)	1.4 (68.83)	0.4 (96.54)	1.8 (57.02)	— (—)	— (—)	— (—)	1.8 (57.02)
Private							
Undifferentiated private and Native American	192.6 (17.26)	116.9 (12.04)	309.6 (11.58)	— (—)	— (—)	— (—)	309.6 (11.58)
Total	2,144.2 (7.02)	751.8 (4.69)	2,896.0 (5.25)	338.6 (18.45)	165.2 (22.23)	503.9 (14.20)	3,399.8 (4.78)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B15—Net volume of live trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by forest-type group and stand size class.^a

Forest-Type group	Stand size class				All size classes
	Large diameter	Medium diameter	Small diameter	Nonstocked	
Pinyon/juniper group	6,778.4 (2.50)	124.2 (15.50)	15.9 (34.63)	— (—)	6,918.5 (2.44)
Douglas-fir group	849.1 (13.91)	63.3 (33.51)	27.9 (35.39)	— (—)	940.3 (12.78)
Ponderosa pine group	491.7 (15.74)	— (—)	6.9 (58.37)	— (—)	498.7 (15.53)
Fir/spruce/ mountain hemlock group	2,873.2 (8.19)	217.4 (23.38)	86.1 (24.60)	— (—)	3,176.7 (7.53)
Lodgepole pine group	332.9 (27.02)	278.4 (22.13)	58.5 (26.19)	— (—)	669.7 (16.20)
Other western softwood group	54.4 (48.02)	— (—)	0.7 (94.57)	— (—)	55.2 (47.40)
Elm/ash/ cottonwood group	30.4 (42.85)	8.0 (49.07)	0.4 (73.22)	— (—)	38.8 (35.03)
Aspen/birch group	731.2 (16.65)	1,121.0 (10.31)	77.4 (18.10)	— (—)	1,929.6 (8.56)
Woodland hardwoods group	317.4 (15.95)	289.4 (15.02)	161.6 (13.13)	— (—)	768.5 (8.94)
Nonstocked	— (—)	— (—)	— (—)	15.0 (33.05)	15.0 (33.05)
Total	12,458.6 (2.59)	2,101.7 (6.94)	435.6 (8.62)	15.0 (33.05)	15,010.9 (2.16)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B16—Net volume of standing dead trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by forest-type group and stand size class.^a

Forest-Type group	Stand size class				
	Large diameter	Medium diameter	Small diameter	Nonstocked	All size classes
Pinyon/juniper group	506.2 (4.61)	14.4 (28.19)	4.6 (39.20)	— (—)	525.2 (4.50)
Douglas-fir group	161.0 (20.56)	57.2 (41.60)	13.4 (40.46)	— (—)	231.6 (17.68)
Ponderosa pine group	19.8 (36.72)	— (—)	7.9 (72.05)	— (—)	27.7 (33.22)
Fir/spruce/ mountain hemlock group	940.7 (10.62)	206.8 (24.72)	230.5 (35.34)	— (—)	1,378.0 (9.87)
Lodgepole pine group	160.2 (27.32)	144.3 (31.03)	117.9 (29.38)	— (—)	422.4 (16.36)
Other western softwood group	8.7 (61.04)	— (—)	4.1 (94.57)	— (—)	12.7 (51.36)
Elm/ash/ cottonwood group	4.7 (57.73)	1.4 (94.10)	— (—)	— (—)	6.1 (49.46)
Aspen/birch group	97.6 (22.41)	269.8 (13.14)	166.4 (26.84)	— (—)	533.9 (11.33)
Woodland hardwoods group	24.7 (21.92)	24.8 (23.37)	90.0 (18.27)	— (—)	139.5 (13.03)
Nonstocked	— (—)	— (—)	— (—)	122.6 (15.72)	122.6 (15.72)
Total	1,923.6 (6.00)	718.7 (11.01)	634.8 (15.83)	122.6 (15.72)	3,399.8 (4.78)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B17—Net volume of live trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by species group type and species group and ownership group.^a

Species group type	Ownership group				
	Forest Service	Other Federal	State and local government	Private and Native American	All owners
Softwood species groups					
Douglas-fir	796.4 (10.66)	155.3 (19.44)	129.3 (30.67)	238.7 (19.80)	1,319.6 (8.13)
Ponderosa and Jeffrey pines	484.2 (13.79)	73.5 (32.63)	24.6 (55.76)	51.5 (32.13)	633.7 (11.62)
True fir	1,522.0 (8.55)	48.6 (41.31)	59.9 (33.13)	188.7 (19.43)	1,819.2 (7.51)
Engelmann and other spruces	1,335.6 (9.93)	0.4 (103.29)	19.8 (71.74)	36.1 (44.06)	1,392.0 (9.63)
Lodgepole pine	738.1 (13.07)	2.7 (105.01)	— (—)	42.4 (82.02)	783.1 (13.06)
Woodland softwoods	1,321.8 (6.74)	3,885.9 (3.22)	617.5 (9.63)	871.8 (8.15)	6,696.9 (2.39)
Other western softwoods	70.5 (27.03)	6.7 (46.61)	0.5 (70.16)	31.2 (53.81)	109.0 (23.48)
Subtotal	6,268.5 (4.29)	4,173.0 (3.22)	851.6 (9.36)	1,460.3 (7.84)	12,753.4 (2.29)
Hardwood species groups					
Cottonwood and aspen	1,221.6 (9.08)	16.5 (34.27)	110.9 (38.46)	340.0 (14.71)	1,689.0 (7.50)
Other western hardwoods	0.2 (99.40)	0.2 (100.14)	1.1 (96.54)	— (—)	1.5 (72.85)
Woodland hardwoods	229.2 (10.84)	83.6 (19.15)	41.4 (23.34)	212.9 (16.69)	567.0 (8.15)
Subtotal	1,451.0 (7.79)	100.2 (17.88)	153.3 (28.74)	552.9 (11.55)	2,257.5 (5.95)
Total	7,719.5 (3.96)	4,273.3 (3.19)	1,004.9 (9.74)	2,013.2 (6.74)	15,010.9 (2.16)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B18—Net volume of standing dead trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by species group type and species group and ownership group.^a

Species group type	Ownership group				
	Forest Service	Other Federal	State and local government	Private and Native American	All owners
Softwood species groups					
Douglas-fir	230.9 (15.56)	87.2 (22.93)	58.0 (32.40)	53.8 (32.81)	429.9 (11.13)
Ponderosa and Jeffrey pines	41.2 (30.97)	12.6 (42.67)	2.9 (68.32)	3.3 (85.74)	59.9 (23.75)
True fir	358.6 (11.23)	13.9 (56.07)	11.7 (54.62)	51.1 (31.06)	435.3 (10.17)
Engelmann and other spruces	752.2 (14.61)	— (—)	0.3 (95.43)	14.9 (65.73)	767.5 (14.37)
Lodgepole pine	673.7 (12.04)	1.8 (105.01)	— (—)	25.5 (48.71)	701.0 (11.61)
Woodland softwoods	91.2 (12.48)	341.1 (5.41)	49.5 (14.67)	62.2 (13.69)	544.1 (4.31)
Other western softwoods	31.4 (41.02)	0.5 (73.35)	0.4 (99.24)	6.7 (51.86)	39.0 (34.21)
Subtotal	2,179.3 (7.05)	457.1 (6.49)	122.8 (19.55)	217.6 (14.64)	2,976.7 (5.32)
Hardwood species groups					
Cottonwood and aspen	247.9 (10.28)	7.6 (52.17)	29.0 (41.16)	75.4 (19.06)	359.9 (8.76)
Woodland hardwoods	22.8 (15.43)	20.2 (29.61)	3.6 (29.15)	16.6 (21.31)	63.2 (12.34)
Subtotal	270.7 (9.47)	27.9 (25.80)	32.6 (36.83)	92.0 (16.21)	423.1 (7.65)
Total	2,450.0 (6.42)	484.9 (6.40)	155.4 (19.03)	309.6 (11.58)	3,399.8 (4.78)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B19—Net volume of live trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by species group type and species group and diameter class(inches).^a

Species group type	Diameter class(inches)																	All classes
	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	23.0-24.9	25.0-26.9	27.0-28.9	29.0-30.9	31.0-32.9	33.0-34.9	35.0-36.9	37+	
Softwood species groups																		
Douglas-fir	43.0 (10.63)	87.4 (9.21)	131.1 (9.67)	155.3 (10.62)	173.0 (11.05)	181.5 (11.25)	151.3 (13.52)	113.2 (18.56)	74.1 (21.20)	73.1 (23.05)	63.1 (29.95)	16.3 (50.71)	13.2 (57.46)	11.8 (91.53)	9.0 (94.63)	10.2 (74.00)	13.0 (100.36)	1,319.6 (8.13)
Ponderosa and Jeffrey pines	7.1 (15.45)	18.9 (16.01)	34.2 (16.18)	43.2 (15.04)	61.9 (19.22)	75.7 (20.04)	74.0 (16.87)	68.0 (20.59)	61.5 (24.50)	51.3 (24.66)	34.1 (36.08)	21.3 (45.31)	16.2 (57.36)	31.0 (46.11)	35.3 (45.87)	— (—)	— (—)	633.7 (11.62)
True fir	94.6 (7.21)	172.1 (7.62)	204.6 (8.04)	240.3 (8.54)	216.8 (9.29)	208.5 (11.41)	171.7 (12.72)	148.2 (15.88)	106.4 (20.51)	62.8 (26.58)	44.4 (28.85)	56.2 (29.38)	27.5 (49.00)	13.0 (66.55)	16.6 (63.56)	— (—)	35.6 (58.29)	1,819.2 (7.51)
Engelmann and other spruces	42.4 (9.77)	98.0 (9.30)	144.1 (10.42)	162.9 (11.28)	174.7 (11.15)	203.3 (13.39)	139.6 (15.41)	102.0 (19.57)	93.9 (20.87)	112.8 (22.17)	35.3 (36.61)	33.6 (47.30)	23.5 (50.63)	14.3 (72.34)	11.5 (77.88)	— (—)	— (—)	1,392.0 (9.63)
Lodgepole pine	147.9 (17.25)	179.7 (14.75)	149.9 (16.49)	115.3 (19.49)	84.7 (21.90)	62.3 (26.39)	20.0 (33.38)	17.9 (54.12)	2.6 (99.24)	— (—)	2.8 (98.13)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	783.1 (13.06)
Woodland softwoods	246.3 (3.04)	438.0 (2.89)	624.2 (2.94)	774.4 (3.03)	774.9 (3.07)	793.1 (3.23)	652.6 (3.77)	590.4 (4.16)	437.9 (5.01)	361.6 (5.77)	306.3 (6.77)	204.9 (8.53)	171.8 (10.40)	104.7 (13.49)	72.9 (16.70)	42.3 (22.21)	100.6 (24.88)	6,696.9 (2.39)
Other western softwoods	3.5 (19.38)	6.4 (22.69)	8.2 (23.90)	14.8 (23.19)	8.7 (28.08)	10.9 (34.84)	8.1 (41.01)	7.3 (42.85)	5.5 (54.60)	11.9 (42.49)	5.4 (99.02)	2.2 (104.41)	— (—)	— (—)	— (—)	— (—)	16.2 (71.06)	109.0 (23.48)
Subtotal	584.8 (4.75)	1,000.4 (3.43)	1,296.3 (3.07)	1,506.2 (3.06)	1,494.6 (3.15)	1,535.3 (3.49)	1,217.1 (3.82)	1,047.0 (4.54)	781.9 (5.39)	673.6 (6.42)	491.4 (7.37)	334.4 (9.36)	252.3 (11.09)	174.7 (15.10)	145.4 (17.80)	52.5 (22.94)	165.4 (22.23)	12,753.4 (2.29)
Hardwood species groups																		
Cottonwood and aspen	180.3 (8.34)	335.8 (8.35)	375.3 (8.92)	297.7 (10.72)	215.0 (12.69)	118.5 (15.75)	96.5 (22.38)	32.7 (30.31)	21.7 (38.90)	12.9 (51.94)	— (—)	2.6 (99.15)	— (—)	— (—)	— (—)	— (—)	— (—)	1,689.0 (7.50)
Other western hardwoods	0.3 (74.70)	0.4 (72.57)	0.2 (100.14)	0.6 (96.54)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	1.5 (72.85)
Woodland hardwoods	171.4 (8.58)	145.3 (10.60)	94.0 (11.82)	61.4 (10.98)	35.0 (13.14)	23.0 (19.98)	15.1 (20.45)	6.9 (31.58)	7.5 (31.86)	2.6 (58.04)	1.3 (71.75)	— (—)	— (—)	1.4 (104.41)	— (—)	2.1 (99.43)	— (—)	567.0 (8.15)
Subtotal	352.1 (5.91)	481.5 (6.62)	469.4 (7.55)	359.6 (9.05)	250.0 (11.05)	141.6 (13.55)	111.5 (19.54)	39.6 (25.60)	29.2 (30.03)	15.5 (44.32)	1.3 (71.75)	2.6 (99.15)	— (—)	1.4 (104.41)	— (—)	2.1 (99.43)	— (—)	2,257.5 (5.95)
Total	936.8 (3.73)	1,482.0 (3.22)	1,765.7 (3.11)	1,865.8 (3.09)	1,744.7 (3.17)	1,676.9 (3.40)	1,328.7 (3.85)	1,086.6 (4.48)	811.2 (5.35)	689.1 (6.33)	492.7 (7.35)	337.0 (9.32)	252.3 (11.09)	176.1 (15.00)	145.4 (17.80)	54.5 (22.39)	165.4 (22.23)	15,010.9 (2.16)

^a Numbers in rows and columns may not sum to totals due to rounding.
A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B20—Net volume of standing dead trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by species group type and species group and diameter class(inches).^a

Species group type	Diameter class(inches)																	All classes
	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	23.0-24.9	25.0-26.9	27.0-28.9	29.0-30.9	31.0-32.9	33.0-34.9	35.0-36.9	37+	
Softwood species groups																		
Douglas-fir	5.9 (15.95)	12.7 (15.00)	24.9 (14.48)	44.6 (15.11)	45.7 (17.12)	67.9 (18.22)	47.0 (18.77)	51.2 (19.35)	36.3 (26.65)	20.9 (39.92)	21.0 (44.13)	18.2 (45.55)	14.2 (50.91)	1.7 (98.74)	11.4 (74.98)	6.3 (99.97)	— (—)	429.9 (11.13)
Ponderosa and Jeffrey pines	0.5 (35.02)	0.4 (54.62)	1.0 (49.69)	2.4 (45.83)	6.0 (35.20)	2.1 (55.68)	2.6 (60.24)	6.3 (52.74)	3.6 (81.63)	6.8 (59.75)	2.4 (94.84)	1.3 (79.76)	6.5 (73.22)	9.8 (64.59)	— (—)	— (—)	8.3 (92.91)	59.9 (23.75)
True fir	30.6 (11.86)	58.4 (12.41)	75.5 (11.67)	74.2 (12.34)	48.5 (16.14)	42.8 (19.56)	46.7 (20.38)	23.7 (33.08)	23.5 (33.54)	6.8 (67.13)	4.5 (51.82)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	435.3 (10.17)
Engelmann and other spruces	6.4 (18.88)	17.4 (16.91)	38.6 (16.31)	69.2 (15.29)	68.0 (17.39)	96.9 (18.04)	95.8 (19.33)	80.1 (20.57)	73.4 (21.38)	77.8 (30.83)	27.6 (41.53)	17.7 (61.10)	32.2 (46.26)	6.7 (102.84)	25.2 (52.63)	7.0 (98.13)	27.2 (69.23)	767.5 (14.37)
Lodgepole pine	45.7 (17.97)	111.4 (14.11)	135.2 (15.53)	142.6 (15.85)	116.6 (16.26)	69.1 (21.31)	33.4 (30.99)	24.6 (32.16)	18.1 (37.67)	4.1 (98.13)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	701.0 (11.61)
Woodland softwoods	22.5 (8.80)	46.4 (6.97)	67.9 (6.16)	81.7 (6.67)	77.1 (6.96)	77.8 (7.89)	58.8 (9.34)	40.9 (12.57)	24.2 (17.42)	19.6 (20.63)	13.2 (29.77)	3.6 (48.96)	4.4 (59.37)	3.6 (64.83)	1.1 (100.43)	1.3 (99.43)	— (—)	544.1 (4.31)
Other western softwoods	0.7 (33.47)	1.8 (31.49)	2.4 (37.80)	2.7 (43.38)	1.8 (48.79)	3.9 (48.65)	3.9 (65.94)	8.5 (72.48)	2.4 (73.13)	4.0 (74.46)	4.2 (72.70)	— (—)	— (—)	2.8 (94.63)	— (—)	— (—)	— (—)	39.0 (34.21)
Subtotal	112.3 (8.41)	248.5 (7.39)	345.6 (7.17)	417.4 (6.92)	363.7 (7.16)	360.6 (7.75)	288.2 (8.93)	235.2 (10.21)	181.6 (12.14)	140.1 (19.42)	72.8 (21.68)	40.8 (33.80)	57.3 (30.38)	24.6 (41.23)	37.8 (41.94)	14.6 (64.45)	35.5 (57.33)	2,976.7 (5.32)
Hardwood species groups																		
Cottonwood and aspen	70.4 (9.14)	91.0 (11.18)	74.9 (10.76)	50.5 (14.68)	27.9 (23.15)	19.2 (27.27)	15.6 (35.43)	5.5 (96.68)	5.1 (61.38)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	359.9 (8.76)
Woodland hardwoods	26.6 (16.13)	14.5 (16.39)	9.3 (20.68)	4.3 (19.20)	4.9 (28.71)	1.8 (43.50)	1.0 (78.39)	0.2 (100.04)	0.6 (102.26)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	63.2 (12.34)
Subtotal	96.9 (7.94)	105.5 (9.87)	84.2 (9.80)	54.8 (13.59)	32.8 (20.13)	21.0 (25.25)	16.6 (33.54)	5.7 (92.70)	5.6 (56.20)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	423.1 (7.65)
Total	209.3 (6.00)	353.9 (6.00)	429.8 (6.12)	472.2 (6.34)	396.5 (6.78)	381.6 (7.44)	304.9 (8.63)	241.0 (10.20)	187.2 (11.89)	140.1 (19.42)	72.8 (21.68)	40.8 (33.80)	57.3 (30.38)	24.6 (41.23)	37.8 (41.94)	14.6 (64.45)	35.5 (57.33)	3,399.8 (4.78)

^a Numbers in rows and columns may not sum to totals due to rounding.
A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B21—Net volume of live trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by forest-type group and stand origin.^a

Forest-Type group	Stand origin		All forest land
	Natural stands	Artificial regeneration	
Pinyon/juniper group	6,916.3 (2.44)	2.2 (102.32)	6,918.5 (2.44)
Douglas-fir group	940.3 (12.78)	— (—)	940.3 (12.78)
Ponderosa pine group	498.7 (15.53)	— (—)	498.7 (15.53)
Fir/spruce/mountain hemlock group	3,176.7 (7.53)	— (—)	3,176.7 (7.53)
Lodgepole pine group	669.7 (16.20)	— (—)	669.7 (16.20)
Other western softwood group	55.2 (47.40)	— (—)	55.2 (47.40)
Elm/ash/cottonwood group	38.8 (35.03)	— (—)	38.8 (35.03)
Aspen/birch group	1,927.5 (8.58)	2.2 (99.02)	1,929.6 (8.56)
Woodland hardwoods group	768.5 (8.94)	— (—)	768.5 (8.94)
Nonstocked	15.0 (33.05)	— (—)	15.0 (33.05)
Total	15,006.6 (2.17)	4.3 (71.19)	15,010.9 (2.16)

^a Numbers in rows and columns may not sum to totals due to rounding.
A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B22—Net volume of standing dead trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by forest-type group and stand origin.^a

Forest-Type group	Stand origin		All forest land
	Natural stands	Artificial regeneration	
Pinyon/juniper group	525.2 (4.50)	— (—)	525.2 (4.50)
Douglas-fir group	231.6 (17.68)	— (—)	231.6 (17.68)
Ponderosa pine group	27.7 (33.22)	— (—)	27.7 (33.22)
Fir/spruce/mountain hemlock group	1,378.0 (9.87)	— (—)	1,378.0 (9.87)
Lodgepole pine group	422.4 (16.36)	— (—)	422.4 (16.36)
Other western softwood group	12.7 (51.36)	— (—)	12.7 (51.36)
Elm/ash/cottonwood group	6.1 (49.46)	— (—)	6.1 (49.46)
Aspen/birch group	533.2 (11.34)	0.6 (99.02)	533.9 (11.33)
Woodland hardwoods group	139.5 (13.03)	— (—)	139.5 (13.03)
Nonstocked	122.6 (15.72)	— (—)	122.6 (15.72)
Total	3,399.2 (4.78)	0.6 (99.02)	3,399.8 (4.78)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B23—Net volume of growing-stock trees (at least 5 inches diameter), in million cubic feet, on timberland (percent sampling error) by species group type and species group and diameter class(inches).^a

	Diameter class(inches)																		
Species group type	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	23.0-24.9	25.0-26.9	27.0-28.9	29.0-30.9	31.0-32.9	33.0-34.9	35.0-36.9	37+	All classes
Softwood species groups																			
Douglas-fir	33.4 (13.21)	66.1 (11.50)	98.9 (11.72)	124.1 (12.39)	136.6 (13.27)	134.3 (14.10)	118.8 (15.74)	88.5 (22.40)		54.0 (24.51)	56.8 (26.17)	45.5 (36.49)	9.5 (70.20)	8.7 (71.05)	11.8 (91.53)	— (—)	10.2 (74.00)	— (—)	997.1 (10.02)
Ponderosa and Jeffrey pines	3.6 (22.69)	13.3 (20.80)	21.2 (21.78)	25.0 (20.50)	41.6 (25.74)	54.9 (26.06)	45.3 (24.13)	35.0 (31.25)		33.6 (28.10)	27.8 (33.41)	14.3 (58.40)	17.4 (50.57)	5.6 (95.33)	23.5 (51.91)	27.5 (51.31)	— (—)	— (—)	389.8 (16.40)
True fir	79.7 (8.22)	147.7 (8.55)	177.5 (8.93)	207.6 (9.29)	186.3 (10.06)	167.8 (12.36)	154.2 (13.70)	127.4 (17.71)		84.0 (24.18)	43.2 (31.07)	26.5 (36.49)	40.2 (34.76)	20.2 (57.79)	6.6 (94.63)	7.8 (94.63)	— (—)	35.6 (58.29)	1,512.3 (8.21)
Engelmann and other spruces	31.1 (11.13)	70.8 (10.66)	108.4 (12.46)	116.6 (13.82)	120.9 (13.56)	142.8 (16.46)	106.7 (18.59)	77.3 (23.45)		67.0 (24.57)	102.2 (23.75)	25.5 (42.55)	33.6 (47.30)	13.7 (69.90)	14.3 (72.34)	— (—)	— (—)	— (—)	1,030.9 (11.33)
Lodgepole pine	115.9 (21.18)	133.7 (18.89)	110.9 (21.11)	78.2 (26.29)	62.1 (27.85)	51.4 (30.82)	8.8 (45.80)	13.1 (69.19)		— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	574.1 (16.64)
Other western softwoods	2.0 (24.05)	3.0 (28.21)	5.4 (28.83)	9.6 (26.29)	6.1 (34.54)	4.9 (43.44)	3.1 (60.03)	5.4 (50.37)		2.6 (73.29)	9.9 (46.76)	5.4 (99.02)	— (—)	— (—)	— (—)	— (—)	— (—)	16.2 (71.06)	73.8 (28.98)
Subtotal	265.7 (9.90)	434.5 (7.29)	522.3 (6.74)	561.2 (6.91)	553.6 (7.19)	556.1 (8.01)	436.9 (8.74)	346.7 (11.21)		241.3 (12.80)	239.9 (14.27)	117.4 (20.54)	100.7 (23.65)	48.3 (35.62)	56.2 (36.09)	35.3 (45.11)	10.2 (74.00)	51.8 (45.81)	4,578.1 (5.54)
Hardwood species groups																			
Cottonwood and aspen	143.5 (9.58)	268.9 (9.38)	312.0 (9.86)	260.4 (11.81)	196.5 (13.74)	116.0 (15.96)	82.3 (25.12)	28.0 (33.53)		11.2 (46.03)	12.9 (51.94)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	1,431.8 (8.41)
Other western hardwoods	0.2 (96.54)	0.3 (96.54)	— (—)	0.6 (96.54)	— (—)	— (—)	— (—)	— (—)		— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	1.1 (96.54)
Subtotal	143.7 (9.56)	269.1 (9.37)	312.0 (9.86)	261.0 (11.78)	196.5 (13.74)	116.0 (15.96)	82.3 (25.12)	28.0 (33.53)		11.2 (46.03)	12.9 (51.94)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	1,432.9 (8.41)
Total	409.4 (7.55)	703.6 (6.10)	834.3 (5.98)	822.2 (6.34)	750.0 (6.62)	672.2 (7.32)	519.2 (8.39)	374.8 (10.71)		252.5 (12.39)	252.8 (13.75)	117.4 (20.54)	100.7 (23.65)	48.3 (35.62)	56.2 (36.09)	35.3 (45.11)	10.2 (74.00)	51.8 (45.81)	6,010.9 (4.92)

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B24—Net volume of growing-stock trees (at least 5 inches diameter), in million cubic feet, on timberland (percent sampling error) by species group type and species group and ownership group.^a

Species group type	Ownership group				
	Forest Service	Other Federal	State and local government	Private and Native American	All owners
Softwood species groups					
Douglas-fir	619.7 (12.50)	66.2 (38.45)	114.2 (33.74)	197.0 (23.27)	997.1 (10.02)
Ponderosa and Jeffrey pines	321.9 (18.68)	12.1 (84.84)	23.2 (58.98)	32.6 (42.36)	389.8 (16.40)
True fir	1,274.8 (9.30)	24.6 (66.06)	58.3 (33.75)	154.7 (20.81)	1,512.3 (8.21)
Engelmann and other spruces	980.3 (11.74)	0.4 (103.29)	19.8 (71.74)	30.4 (50.66)	1,030.9 (11.33)
Lodgepole pine	529.3 (16.88)	2.7 (105.01)	— (—)	42.1 (81.89)	574.1 (16.64)
Other western softwoods	53.4 (34.05)	3.2 (79.18)	— (—)	17.2 (63.98)	73.8 (28.98)
Subtotal	3,779.4 (6.26)	109.1 (32.30)	215.5 (24.22)	474.1 (17.47)	4,578.1 (5.54)
Hardwood species groups					
Cottonwood and aspen	1,077.0 (9.87)	6.4 (50.77)	98.9 (42.27)	249.5 (17.08)	1,431.8 (8.41)
Other western hardwoods	— (—)	— (—)	1.1 (96.54)	— (—)	1.1 (96.54)
Subtotal	1,077.0 (9.87)	6.4 (50.77)	100.0 (41.92)	249.5 (17.08)	1,432.9 (8.41)
Total	4,856.3 (5.68)	115.6 (31.42)	315.4 (23.90)	723.6 (13.27)	6,010.9 (4.92)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Tables continue on next page.

Table B25—Net volume of sawtimber trees, in million board feet(International 1/4-inch Rule), on timberland (percent sampling error) by species group type and species group and diameter class(inches).^a

Species group type	Diameter class(inches)															All classes
	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	23.0-24.9	25.0-26.9	27.0-28.9	29.0-30.9	31.0-32.9	33.0-34.9	35.0-36.9	37+	
Softwood species groups																
Douglas-fir	348.4 (12.36)	550.6 (12.81)	669.8 (13.25)	693.7 (14.39)	633.2 (15.73)	487.5 (22.38)	292.9 (24.89)	323.4 (26.29)	276.5 (37.03)	50.2 (69.54)	48.8 (71.23)	76.5 (91.53)	— (—)	63.5 (73.73)	— (—)	4,515.0 (10.83)
Ponderosa and Jeffrey pines	71.4 (22.34)	113.6 (20.78)	214.5 (25.85)	304.5 (26.52)	276.1 (24.26)	204.7 (30.97)	197.6 (28.17)	164.5 (33.63)	88.1 (59.00)	108.0 (51.08)	37.0 (95.33)	135.6 (53.79)	171.2 (51.50)	— (—)	— (—)	2,086.8 (16.94)
True fir	720.9 (9.09)	988.5 (9.44)	938.2 (10.14)	868.1 (12.56)	813.8 (13.84)	683.2 (17.98)	438.5 (24.52)	245.4 (31.94)	137.9 (36.79)	223.5 (35.71)	111.9 (58.47)	38.6 (94.63)	42.3 (94.63)	— (—)	190.0 (58.88)	6,440.8 (9.23)
Engelmann and other spruces	445.5 (12.67)	573.1 (13.97)	640.8 (13.68)	788.1 (16.52)	600.6 (18.67)	440.2 (23.76)	389.4 (24.47)	604.3 (23.97)	149.9 (42.89)	195.3 (47.43)	83.6 (70.38)	83.0 (72.38)	— (—)	— (—)	— (—)	4,993.8 (12.06)
Lodgepole pine	426.3 (23.17)	356.1 (27.65)	305.7 (28.69)	263.8 (31.31)	46.1 (46.22)	75.0 (69.07)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	1,472.9 (24.11)
Other western softwoods	16.5 (29.83)	34.9 (26.70)	26.2 (34.76)	21.9 (44.45)	14.5 (59.77)	25.4 (50.61)	10.7 (73.28)	46.9 (46.24)	27.1 (99.02)	— (—)	— (—)	— (—)	— (—)	— (—)	91.0 (71.96)	315.2 (33.53)
Subtotal	2,029.1 (7.15)	2,616.7 (7.10)	2,795.2 (7.26)	2,940.1 (8.17)	2,384.3 (8.79)	1,916.1 (11.35)	1,329.1 (12.82)	1,384.4 (14.48)	679.4 (21.02)	577.0 (23.97)	281.3 (35.90)	333.7 (36.91)	213.5 (45.36)	63.5 (73.73)	281.1 (46.13)	19,824.4 (6.10)
Hardwood species groups																
Cottonwood and aspen	— (—)	1,305.8 (11.99)	1,051.0 (13.69)	659.4 (16.34)	479.7 (25.88)	157.5 (35.18)	57.5 (47.19)	69.3 (54.86)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	3,780.3 (11.55)
Other western hardwoods	— (—)	1.4 (96.54)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	1.4 (96.54)
Subtotal	— (—)	1,307.2 (11.97)	1,051.0 (13.69)	659.4 (16.34)	479.7 (25.88)	157.5 (35.18)	57.5 (47.19)	69.3 (54.86)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	3,781.7 (11.55)
Total	2,029.1 (7.15)	3,923.9 (6.55)	3,846.3 (6.71)	3,599.5 (7.47)	2,863.9 (8.55)	2,073.5 (10.87)	1,386.6 (12.44)	1,453.7 (13.99)	679.4 (21.02)	577.0 (23.97)	281.3 (35.90)	333.7 (36.91)	213.5 (45.36)	63.5 (73.73)	281.1 (46.13)	23,606.0 (5.62)

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B26—Net volume of sawtimber trees, in million board feet(International 1/4-inch Rule), on forest land (percent sampling error) by species group type and species group and ownership group.^a

Species group type	Ownership group				
	Forest Service	Other Federal	State and local government	Private and Native American	All owners
Softwood species groups					
Douglas-fir	3,661.6 (11.47)	644.4 (20.31)	568.0 (33.62)	1,066.0 (22.15)	5,940.0 (8.87)
Ponderosa and Jeffrey pines	2,551.7 (14.32)	417.6 (34.56)	135.5 (56.52)	278.2 (33.17)	3,383.0 (12.06)
True fir	6,449.9 (9.75)	210.1 (43.54)	222.3 (38.30)	817.9 (21.50)	7,700.3 (8.55)
Engelmann and other spruces	6,393.9 (10.58)	— (—)	97.4 (76.09)	160.9 (44.58)	6,652.3 (10.27)
Lodgepole pine	1,825.0 (18.29)	9.3 (105.01)	— (—)	211.6 (86.67)	2,045.8 (18.55)
Other western softwoods	265.9 (33.20)	15.2 (59.89)	0.7 (94.57)	152.2 (56.29)	434.0 (28.41)
Subtotal	21,148.1 (5.85)	1,296.6 (17.69)	1,024.0 (24.66)	2,686.8 (16.33)	26,155.5 (5.07)
Hardwood species groups					
Cottonwood and aspen	3,215.1 (12.70)	41.4 (47.89)	262.7 (52.43)	671.6 (21.26)	4,190.9 (10.75)
Other western hardwoods	— (—)	— (—)	1.4 (96.54)	— (—)	1.4 (96.54)
Subtotal	3,215.1 (12.70)	41.4 (47.89)	264.1 (52.23)	671.6 (21.26)	4,192.2 (10.75)
Total	24,363.2 (5.58)	1,338.0 (17.45)	1,288.1 (23.30)	3,358.4 (14.02)	30,347.7 (4.77)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B27—Aboveground dry weight of live trees (at least 1 inches diameter), in million tons, on forest land (percent sampling error) by ownership group, owner class, reserved status, and forest land status.^a

Ownership group	Unreserved			Reserved			All forest land
	Timberland	Unproductive	Total	Productive	Unproductive	Total	
Forest Service							
National forest	87.3 (5.46)	41.6 (5.26)	128.9 (3.88)	13.5 (14.89)	2.1 (23.76)	15.6 (13.19)	144.5 (3.63)
Other Forest Service land	— (—)	0.0 (100.45)	0.0 (100.45)	— (—)	— (—)	— (—)	0.0 (100.45)
Other Federal							
National Park Service	— (—)	— (—)	— (—)	1.2 (41.39)	3.0 (17.67)	4.2 (17.24)	4.2 (17.24)
Bureau of Land Management	2.4 (29.90)	63.8 (3.54)	66.2 (3.54)	0.1 (55.03)	12.0 (8.46)	12.2 (8.37)	78.4 (3.18)
Fish and Wildlife Service	— (—)	— (—)	— (—)	— (—)	0.2 (99.15)	0.2 (99.15)	0.2 (99.15)
Departments of Defense/Energy	— (—)	0.2 (73.90)	0.2 (73.90)	— (—)	— (—)	— (—)	0.2 (73.90)
State and local government							
State	5.5 (24.07)	13.1 (8.92)	18.6 (9.49)	0.3 (99.02)	0.5 (40.22)	0.7 (43.04)	19.3 (9.27)
Local(County, Municipality, etc.)	0.8 (58.58)	0.5 (57.31)	1.3 (41.14)	— (—)	— (—)	— (—)	1.3 (41.14)
Other non-Federal public	— (—)	0.1 (94.63)	0.1 (94.63)	— (—)	— (—)	— (—)	0.1 (94.63)
Private							
Undifferentiated private and Native American	14.7 (12.35)	28.7 (6.70)	43.4 (5.93)	— (—)	— (—)	— (—)	43.4 (5.93)
Total	110.8 (4.67)	148.0 (2.31)	258.7 (2.11)	15.1 (13.81)	17.8 (7.10)	32.9 (7.34)	291.6 (1.92)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B28—Aboveground dry weight of standing dead trees (at least 5 inches diameter), in million tons, on forest land (percent sampling error) by ownership group, owner class, reserved status, and forest land status.^a

Ownership group	Unreserved			Reserved			All forest land
	Timberland	Unproductive	Total	Productive	Unproductive	Total	
Forest Service							
National forest	24.9 (7.73)	4.3 (9.18)	29.1 (6.66)	4.4 (19.93)	1.1 (48.34)	5.5 (18.35)	34.6 (6.12)
Other Forest Service land	— (—)	0.0 (100.45)	0.0 (100.45)	— (—)	— (—)	— (—)	0.0 (100.45)
Other Federal							
National Park Service	— (—)	— (—)	— (—)	0.3 (56.17)	0.5 (30.01)	0.8 (27.49)	0.8 (27.49)
Bureau of Land Management	0.5 (36.87)	5.9 (6.20)	6.5 (6.43)	0.0 (94.55)	1.0 (12.38)	1.1 (12.34)	7.5 (5.77)
Fish and Wildlife Service	— (—)	— (—)	— (—)	— (—)	0.0 (99.15)	0.0 (99.15)	0.0 (99.15)
Departments of Defense/Energy	— (—)	0.0 (93.69)	0.0 (93.69)	— (—)	— (—)	— (—)	0.0 (93.69)
State and local government							
State	1.3 (34.08)	1.2 (15.25)	2.4 (19.15)	0.0 (99.02)	0.1 (45.90)	0.1 (43.02)	2.5 (18.54)
Local(County, Municipality, etc.)	0.0 (65.19)	0.0 (75.10)	0.0 (48.93)	— (—)	— (—)	— (—)	0.0 (48.93)
Private							
Undifferentiated private and Native American	2.6 (17.31)	2.3 (11.48)	4.8 (10.62)	— (—)	— (—)	— (—)	4.8 (10.62)
Total	29.3 (6.85)	13.6 (4.37)	42.9 (4.76)	4.8 (18.89)	2.7 (20.34)	7.5 (13.94)	50.4 (4.39)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Tables continue on next page.

Table B29—Aboveground dry weight of live trees (at least 1 inches diameter), in million tons, on forest land (percent sampling error) by species group type and species group and diameter class(inches).^a

Species group type	Diameter class(inches)																			All classes
	1.0-2.9	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	23.0-24.9	25.0-26.9	27.0-28.9	29.0-30.9	31.0-32.9	33.0-34.9	35.0-36.9	37+	
Softwood species groups																				
Douglas-fir	0.2 (14.16)	0.8 (14.45)	0.9 (10.62)	1.8 (9.21)	2.7 (9.67)	3.1 (10.62)	3.5 (11.05)	3.6 (11.25)	3.0 (13.51)	2.2 (18.56)	1.5 (21.20)	1.4 (23.05)	1.2 (29.95)	0.3 (50.70)	0.3 (57.46)	0.2 (91.53)	0.2 (94.63)	0.2 (74.01)	0.3 (100.36)	27.3 (7.99)
Ponderosa and Jeffrey pines	0.0 (46.19)	0.1 (25.26)	0.1 (15.44)	0.3 (16.01)	0.6 (16.18)	0.8 (15.04)	1.1 (19.22)	1.3 (20.04)	1.3 (16.87)	1.2 (20.59)	1.1 (24.50)	0.9 (24.66)	0.6 (36.08)	0.4 (45.31)	0.3 (57.36)	0.5 (46.11)	0.6 (45.87)	— (—)	— (—)	11.3 (11.56)
True fir	0.7 (9.36)	1.5 (10.52)	1.4 (7.15)	2.6 (7.58)	3.0 (7.99)	3.6 (8.48)	3.2 (9.28)	3.1 (11.25)	2.6 (12.68)	2.2 (15.92)	1.6 (20.35)	0.9 (26.58)	0.7 (29.10)	0.8 (29.53)	0.4 (49.30)	0.2 (66.56)	0.2 (63.30)	— (—)	0.6 (58.29)	29.5 (7.17)
Engelmann and other spruces	0.2 (14.59)	0.6 (15.32)	0.7 (9.78)	1.5 (9.29)	2.2 (10.41)	2.4 (11.27)	2.6 (11.17)	3.0 (13.38)	2.0 (15.42)	1.5 (19.58)	1.4 (20.87)	1.6 (22.14)	0.5 (36.61)	0.5 (47.30)	0.3 (50.63)	0.2 (72.52)	0.2 (77.87)	— (—)	— (—)	21.3 (9.44)
Lodgepole pine	0.5 (20.71)	1.6 (19.11)	2.4 (17.25)	2.9 (14.74)	2.4 (16.48)	1.8 (19.49)	1.3 (21.90)	1.0 (26.39)	0.3 (33.38)	0.3 (54.12)	0.0 (99.24)	— (—)	0.0 (98.13)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	14.7 (12.17)
Woodland softwoods	1.2 (4.88)	3.0 (4.85)	4.1 (3.00)	7.3 (2.85)	10.6 (2.89)	13.4 (2.95)	13.7 (3.02)	14.3 (3.18)	12.0 (3.70)	10.9 (4.08)	8.2 (4.91)	6.9 (5.63)	5.8 (6.69)	3.9 (8.38)	3.3 (10.27)	2.0 (13.29)	1.4 (16.55)	0.9 (22.21)	1.9 (25.39)	125.0 (2.37)
Other western softwoods	0.0 (50.14)	0.0 (42.91)	0.1 (19.39)	0.1 (22.59)	0.1 (23.36)	0.3 (23.62)	0.1 (27.99)	0.2 (34.60)	0.1 (40.86)	0.1 (42.76)	0.1 (54.12)	0.2 (42.49)	0.1 (99.02)	0.0 (104.41)	— (—)	— (—)	— (—)	— (—)	0.3 (71.07)	1.9 (22.71)
Subtotal	2.8 (4.93)	7.5 (5.32)	9.7 (4.73)	16.6 (3.35)	21.7 (2.99)	25.3 (2.97)	25.6 (3.07)	26.5 (3.33)	21.3 (3.70)	18.5 (4.39)	13.9 (5.13)	12.0 (6.04)	9.0 (7.17)	5.9 (8.74)	4.6 (10.48)	3.2 (14.68)	2.7 (17.04)	1.1 (22.80)	3.0 (22.19)	230.9 (2.17)
Hardwood species groups																				
Cottonwood and aspen	1.1 (13.13)	2.8 (10.07)	3.6 (8.34)	6.3 (8.33)	6.7 (8.91)	5.2 (10.71)	3.7 (12.67)	2.0 (16.03)	1.6 (22.31)	0.5 (30.26)	0.4 (38.79)	0.2 (51.87)	— (—)	0.0 (99.15)	— (—)	— (—)	— (—)	— (—)	— (—)	34.3 (6.86)
Other western hardwoods	0.0 (66.01)	0.0 (99.40)	0.0 (74.96)	0.0 (72.69)	0.0 (100.14)	0.0 (96.54)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	0.1 (53.04)
Woodland hardwoods	9.5 (5.83)	7.2 (7.56)	3.0 (8.57)	2.5 (10.92)	1.6 (12.25)	1.0 (11.15)	0.6 (13.33)	0.4 (19.56)	0.2 (20.10)	0.1 (31.11)	0.1 (31.86)	0.0 (58.04)	0.0 (71.75)	— (—)	— (—)	0.0 (104.41)	— (—)	0.0 (99.43)	— (—)	26.4 (5.37)
Subtotal	10.6 (5.35)	10.1 (6.08)	6.7 (5.92)	8.8 (6.69)	8.3 (7.61)	6.2 (9.11)	4.2 (11.10)	2.4 (13.87)	1.8 (19.55)	0.6 (25.62)	0.5 (29.98)	0.3 (44.24)	0.0 (71.75)	0.0 (99.15)	— (—)	0.0 (104.41)	— (—)	0.0 (99.43)	— (—)	60.7 (4.44)
Total	13.5 (4.31)	17.6 (4.11)	16.4 (3.72)	25.4 (3.24)	30.0 (3.09)	31.6 (3.04)	29.8 (3.10)	28.9 (3.26)	23.2 (3.72)	19.1 (4.33)	14.4 (5.08)	12.3 (5.97)	9.0 (7.16)	6.0 (8.70)	4.6 (10.48)	3.2 (14.60)	2.7 (17.04)	1.1 (22.30)	3.0 (22.19)	291.6 (1.92)

^a Numbers in rows and columns may not sum to totals due to rounding.
A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B30—Aboveground dry weight of standing dead trees (at least 5 inches diameter), in million tons, on forest land (percent sampling error) by species group type and species group and diameter class(inches).^a

Species group type	Diameter class(inches)																			All classes
	1.0-2.9	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	23.0-24.9	25.0-26.9	27.0-28.9	29.0-30.9	31.0-32.9	33.0-34.9	35.0-36.9	37+	
Softwood species groups																				
Douglas-fir	0.0 (46.55)	0.0 (59.24)	0.1 (16.35)	0.2 (15.33)	0.4 (14.70)	0.7 (15.23)	0.7 (17.33)	1.1 (18.98)	0.7 (18.86)	0.8 (19.85)	0.6 (27.72)	0.3 (39.14)	0.3 (45.67)	0.3 (47.24)	0.2 (54.18)	0.0 (98.74)	0.1 (74.97)	0.1 (99.97)	0.1 (105.01)	6.5 (11.05)
Ponderosa and Jeffrey pines	— (—)	— (—)	0.0 (35.78)	0.0 (57.28)	0.0 (49.70)	0.0 (43.61)	0.1 (34.52)	0.0 (55.82)	0.0 (66.54)	0.1 (60.66)	0.1 (81.27)	0.1 (59.74)	0.0 (99.96)	0.0 (79.00)	0.1 (73.22)	0.1 (68.86)	— (—)	— (—)	0.1 (96.29)	0.9 (24.71)
True fir	0.0 (36.89)	0.1 (43.14)	0.4 (12.00)	0.8 (12.43)	1.0 (11.65)	1.0 (12.43)	0.6 (16.45)	0.6 (18.94)	0.6 (20.09)	0.3 (34.23)	0.3 (33.95)	0.1 (67.42)	0.1 (54.08)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	6.0 (10.09)
Engelmann and other spruces	0.0 (69.58)	— (—)	0.1 (18.68)	0.2 (17.15)	0.5 (16.56)	0.9 (15.41)	0.9 (17.13)	1.2 (18.06)	1.2 (19.11)	1.0 (20.65)	0.9 (21.66)	0.9 (30.32)	0.3 (41.62)	0.2 (61.04)	0.4 (46.41)	0.1 (102.84)	0.3 (55.20)	0.1 (98.13)	0.3 (69.33)	9.5 (14.27)
Lodgepole pine	0.0 (63.82)	0.0 (98.13)	0.7 (17.90)	1.7 (14.21)	2.0 (15.57)	2.1 (15.98)	1.7 (16.32)	1.0 (21.30)	0.5 (31.23)	0.4 (32.14)	0.3 (37.78)	0.1 (98.13)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	10.5 (11.59)
Woodland softwoods	0.0 (33.32)	0.1 (30.77)	0.4 (9.24)	0.8 (7.14)	1.2 (6.06)	1.4 (6.72)	1.3 (6.75)	1.4 (7.74)	1.1 (9.07)	0.7 (12.21)	0.4 (17.02)	0.4 (20.33)	0.2 (27.96)	0.1 (48.96)	0.1 (58.41)	0.1 (64.83)	0.0 (100.43)	0.0 (99.43)	— (—)	9.6 (4.33)
Other western softwoods	— (—)	— (—)	0.0 (33.52)	0.0 (32.24)	0.0 (38.60)	0.0 (43.16)	0.0 (49.22)	0.1 (47.71)	0.1 (65.08)	0.1 (76.31)	0.0 (71.66)	0.1 (75.19)	0.1 (72.70)	— (—)	— (—)	0.0 (94.63)	— (—)	— (—)	— (—)	0.5 (34.66)
Subtotal	0.1 (25.05)	0.2 (25.84)	1.7 (8.49)	3.7 (7.38)	5.1 (7.11)	6.1 (6.88)	5.4 (6.94)	5.3 (7.43)	4.2 (8.34)	3.4 (9.80)	2.6 (11.86)	1.9 (17.85)	1.0 (21.37)	0.6 (32.83)	0.8 (29.79)	0.3 (41.59)	0.4 (43.22)	0.2 (62.37)	0.5 (52.28)	43.6 (4.95)
Hardwood species groups																				
Cottonwood and aspen	0.1 (31.25)	0.3 (32.76)	0.9 (8.98)	1.0 (11.03)	0.9 (11.26)	0.6 (15.22)	0.3 (22.81)	0.2 (26.96)	0.2 (34.19)	0.0 (97.11)	0.0 (60.38)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	4.6 (8.41)
Woodland hardwoods	0.5 (15.58)	0.5 (22.26)	0.5 (16.64)	0.3 (17.34)	0.2 (20.31)	0.1 (19.28)	0.1 (28.52)	0.0 (43.50)	0.0 (78.39)	0.0 (100.04)	0.0 (102.26)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	2.2 (10.41)
Subtotal	0.6 (14.34)	0.9 (18.61)	1.4 (8.28)	1.3 (9.47)	1.0 (9.99)	0.7 (13.75)	0.4 (19.20)	0.2 (24.32)	0.2 (32.02)	0.1 (90.26)	0.1 (52.92)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	6.8 (6.55)
Total	0.7 (13.23)	1.1 (16.29)	3.1 (6.12)	5.0 (6.02)	6.2 (6.20)	6.8 (6.35)	5.8 (6.59)	5.6 (7.18)	4.4 (8.10)	3.4 (9.75)	2.6 (11.67)	1.9 (17.85)	1.0 (21.37)	0.6 (32.83)	0.8 (29.79)	0.3 (41.59)	0.4 (43.22)	0.2 (62.37)	0.5 (52.28)	50.4 (4.39)

^a Numbers in rows and columns may not sum to totals due to rounding.
A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B31—Aboveground carbon in live trees (at least 1 inches diameter), in million tons, on forest land (percent sampling error) by ownership group, owner class, reserved status, and forest land status.^a

Ownership group Forest Service	Unreserved			Reserved			All forest land
	Timberland	Unproductive	Total	Productive	Unproductive	Total	
National forest	43.7 (5.46)	20.8 (5.26)	64.5 (3.88)	6.7 (14.89)	1.1 (23.76)	7.8 (13.19)	72.3 (3.63)
Other Forest Service land	— (—)	0.0 (100.45)	0.0 (100.45)	— (—)	— (—)	— (—)	0.0 (100.45)
Other Federal							
National Park Service	— (—)	— (—)	— (—)	0.6 (41.39)	1.5 (17.67)	2.1 (17.24)	2.1 (17.24)
Bureau of Land Management	1.2 (29.90)	31.9 (3.54)	33.1 (3.54)	0.1 (55.03)	6.0 (8.46)	6.1 (8.37)	39.2 (3.18)
Fish and Wildlife Service	— (—)	— (—)	— (—)	— (—)	0.1 (99.15)	0.1 (99.15)	0.1 (99.15)
Departments of Defense/Energy	— (—)	0.1 (73.90)	0.1 (73.90)	— (—)	— (—)	— (—)	0.1 (73.90)
State and local government							
State	2.8 (24.07)	6.5 (8.92)	9.3 (9.49)	0.1 (99.02)	0.2 (40.22)	0.4 (43.04)	9.7 (9.27)
Local(County, Municipality, etc.)	0.4 (58.58)	0.3 (57.31)	0.7 (41.14)	— (—)	— (—)	— (—)	0.7 (41.14)
Other non-Federal public	— (—)	0.0 (94.63)	0.0 (94.63)	— (—)	— (—)	— (—)	0.0 (94.63)
Private							
Undifferentiated private and Native American	7.4 (12.35)	14.3 (6.70)	21.7 (5.93)	— (—)	— (—)	— (—)	21.7 (5.93)
Total	55.4 (4.67)	74.0 (2.31)	129.4 (2.11)	7.5 (13.81)	8.9 (7.10)	16.4 (7.34)	145.8 (1.92)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B32—Aboveground carbon in standing dead trees (at least 5 inches diameter), in million tons, on forest land (percent sampling error) by ownership group, owner class, reserved status, and forest land status.^a

Ownership group	Unreserved			Reserved			All forest land
	Timberland	Unproductive	Total	Productive	Unproductive	Total	
Forest Service							
National forest	12.4 (7.73)	2.1 (9.18)	14.6 (6.66)	2.2 (19.93)	0.5 (48.34)	2.8 (18.35)	17.3 (6.12)
Other Forest Service land	— (—)	0.0 (100.45)	0.0 (100.45)	— (—)	— (—)	— (—)	0.0 (100.45)
Other Federal							
National Park Service	— (—)	— (—)	— (—)	0.1 (56.17)	0.3 (30.01)	0.4 (27.49)	0.4 (27.49)
Bureau of Land Management	0.3 (36.87)	3.0 (6.20)	3.2 (6.43)	0.0 (94.55)	0.5 (12.38)	0.5 (12.34)	3.8 (5.77)
Fish and Wildlife Service	— (—)	— (—)	— (—)	— (—)	0.0 (99.15)	0.0 (99.15)	0.0 (99.15)
Departments of Defense/Energy	— (—)	0.0 (93.69)	0.0 (93.69)	— (—)	— (—)	— (—)	0.0 (93.69)
State and local government							
State	0.6 (34.08)	0.6 (15.25)	1.2 (19.15)	0.0 (99.02)	0.0 (45.90)	0.0 (43.02)	1.3 (18.54)
Local(County, Municipality, etc.)	0.0 (65.19)	0.0 (75.10)	0.0 (48.93)	— (—)	— (—)	— (—)	0.0 (48.93)
Private							
Undifferentiated private and Native American	1.3 (17.31)	1.1 (11.48)	2.4 (10.62)	— (—)	— (—)	— (—)	2.4 (10.62)
Total	14.6 (6.85)	6.8 (4.37)	21.5 (4.76)	2.4 (18.89)	1.4 (20.34)	3.7 (13.94)	25.2 (4.39)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B33—Average annual net growth of trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by ownership group, owner class, reserved status, and forest land status.^a

Ownership group	Unreserved			Reserved			All forest land
	Timberland	Unproductive	Total	Productive	Unproductive	Total	
Forest Service							
National forest	-46.4 (-28.17)	7.8 (32.81)	-38.6 (-34.46)	-9.6 (-51.79)	-4.5 (-65.69)	-14.2 (-40.65)	-52.8 (-27.11)
Other Forest Service land	— (—)	0.0 (-100.45)	0.0 (-100.45)	— (—)	— (—)	— (—)	0.0 (-100.45)
Other Federal							
National Park Service	— (—)	— (—)	— (—)	0.7 (60.04)	-0.8 (-123.30)	-0.1 (-1473.66)	-0.1 (-1473.66)
Bureau of Land Management	-0.4 (-252.56)	2.0 (130.17)	1.6 (177.51)	0.1 (89.76)	2.4 (22.90)	2.5 (22.23)	4.1 (70.52)
Fish and Wildlife Service	— (—)	— (—)	— (—)	— (—)	-0.1 (-99.15)	-0.1 (-99.15)	-0.1 (-99.15)
Departments of Defense/Energy	— (—)	0.1 (85.74)	0.1 (85.74)	— (—)	— (—)	— (—)	0.1 (85.74)
State and local government							
State	-3.1 (-87.86)	1.9 (52.77)	-1.2 (-247.25)	0.1 (99.02)	0.2 (65.59)	0.3 (54.92)	-0.8 (-351.93)
Local(County, Municipality, etc.)	0.6 (72.03)	0.2 (66.90)	0.8 (59.07)	— (—)	— (—)	— (—)	0.8 (59.07)
Other non-Federal public	— (—)	0.0 (94.63)	0.0 (94.63)	— (—)	— (—)	— (—)	0.0 (94.63)
Private							
Undifferentiated private and Native American	1.2 (265.20)	6.7 (21.14)	7.9 (43.60)	— (—)	— (—)	— (—)	7.9 (43.60)
Total	-48.1 (-28.51)	18.7 (21.63)	-29.4 (-48.67)	-8.7 (-57.60)	-2.8 (-114.45)	-11.5 (-51.30)	-40.9 (-37.38)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B34—Average annual net growth of trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by forest-type group and stand size class.^a

Forest-Type group	Stand size class				
	Large diameter	Medium diameter	Small diameter	Nonstocked	All size classes
Pinyon/juniper group	26.6 (8.20)	1.3 (32.18)	0.0 (511.94)	— (—)	27.9 (7.97)
Douglas-fir group	5.1 (53.11)	-2.3 (-69.79)	-0.2 (-218.42)	— (—)	2.6 (121.14)
Ponderosa pine group	5.7 (19.92)	— (—)	-0.2 (-161.82)	— (—)	5.5 (21.79)
Fir/spruce/mountain hemlock group	-15.2 (-56.47)	-7.0 (-50.84)	-15.2 (-45.24)	— (—)	-37.4 (-30.70)
Lodgepole pine group	-8.7 (-43.58)	-7.4 (-55.41)	-10.0 (-33.75)	— (—)	-26.1 (-24.35)
Other western softwood group	0.3 (94.91)	— (—)	0.0 (94.57)	— (—)	0.3 (82.63)
Elm/ash/cottonwood group	0.0 (-2022.88)	0.5 (53.84)	0.0 (72.72)	— (—)	0.5 (66.11)
Aspen/birch group	2.2 (93.82)	4.4 (69.35)	-13.2 (-39.07)	— (—)	-6.6 (-95.54)
Woodland hardwoods group	2.9 (25.10)	4.8 (16.67)	-2.4 (-82.33)	— (—)	5.3 (42.15)
Nonstocked	— (—)	— (—)	— (—)	-12.8 (-20.59)	-12.8 (-20.59)
Total	18.9 (54.42)	-5.7 (-110.65)	-41.2 (-22.97)	-12.8 (-20.59)	-40.9 (-37.38)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B35—Average annual net growth of trees (at least 5 inches diameter), in million cubic feet, on forest land (percent sampling error) by species group type and species group and ownership group.^a

Species group type	Ownership group				
	Forest Service	Other Federal	State and local government	Private and Native American	All owners
Softwood species groups					
Douglas-fir	-2.7 (-111.98)	-0.5 (-240.49)	-1.9 (-103.28)	1.9 (84.80)	-3.2 (-128.67)
Ponderosa and Jeffrey pines	5.5 (23.40)	-0.7 (-112.46)	0.3 (57.84)	0.9 (35.88)	6.1 (24.99)
True fir	9.2 (35.48)	0.6 (88.22)	0.6 (121.98)	1.9 (67.59)	12.3 (29.25)
Engelmann and other spruces	-23.6 (-42.22)	0.0 (103.29)	0.4 (70.09)	-0.6 (-128.22)	-23.8 (-41.97)
Lodgepole pine	-48.8 (-16.00)	-0.1 (-105.01)	— (—)	-2.4 (-56.59)	-51.3 (-15.31)
Woodland softwoods	5.3 (31.58)	4.7 (53.09)	1.5 (65.22)	3.0 (29.61)	14.6 (22.57)
Other western softwoods	0.1 (291.01)	0.0 (47.15)	-0.1 (-117.39)	0.1 (179.30)	0.1 (398.73)
Subtotal	-55.1 (-25.32)	4.1 (72.73)	0.8 (326.11)	4.8 (62.24)	-45.3 (-32.55)
Hardwood species groups					
Cottonwood and aspen	-1.1 (-261.00)	0.0 (-740.19)	-1.5 (-62.41)	0.9 (225.45)	-1.8 (-202.54)
Other western hardwoods	0.0 (-99.40)	0.0 (100.14)	0.0 (96.54)	— (—)	0.0 (788.18)
Woodland hardwoods	3.3 (18.86)	0.0 (-6683.91)	0.7 (25.32)	2.2 (34.28)	6.2 (16.84)
Subtotal	2.2 (129.15)	-0.1 (-948.64)	-0.8 (-116.59)	3.1 (68.35)	4.4 (83.96)
Total	-52.8 (-27.10)	4.1 (75.81)	0.0 (-10301.88)	7.9 (43.60)	-40.9 (-37.38)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B36—Average annual net growth of growing-stock trees (at least 5 inches diameter), in million cubic feet, on timberland (percent sampling error) by species group type and species group and ownership group.^a

Species group type	Ownership group				
	Forest Service	Other Federal	State and local government	Private and Native American	All owners
Softwood species groups					
Douglas-fir	-5.1 (-58.86)	-0.8 (-127.74)	-2.0 (-95.63)	1.6 (96.36)	-6.3 (-63.59)
Ponderosa and Jeffrey pines	3.9 (21.42)	0.0 (113.13)	0.3 (58.99)	0.6 (47.20)	5.0 (18.48)
True fir	6.6 (46.07)	0.3 (149.42)	0.6 (127.63)	1.4 (88.95)	8.9 (38.09)
Engelmann and other spruces	-24.9 (-39.54)	0.0 (103.29)	0.4 (70.09)	-0.7 (-102.35)	-25.3 (-39.13)
Lodgepole pine	-26.7 (-22.37)	-0.1 (-105.01)	— (—)	-2.4 (-56.64)	-29.2 (-20.79)
Other western softwoods	0.1 (205.16)	0.0 (69.55)	-0.1 (-99.24)	0.0 (465.61)	0.0 (905.81)
Subtotal	-46.0 (-27.55)	-0.6 (-182.42)	-0.9 (-251.46)	0.6 (477.79)	-46.9 (-28.06)
Hardwood species groups					
Cottonwood and aspen	0.4 (614.37)	0.2 (151.18)	-1.3 (-67.60)	0.6 (307.31)	-0.1 (-3564.33)
Other western hardwoods	— (—)	— (—)	0.0 (96.54)	— (—)	0.0 (96.54)
Subtotal	0.4 (614.37)	0.2 (151.18)	-1.3 (-68.10)	0.6 (307.31)	-0.1 (-4005.11)
Total	-45.6 (-28.59)	-0.4 (-264.47)	-2.2 (-123.21)	1.2 (263.68)	-47.0 (-29.06)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B37—Average annual mortality of trees (at least 5 inches diameter), in million trees, on forest land (percent sampling error) by ownership group, owner class, reserved status, and forest land status.^a

Ownership group	Unreserved			Reserved			All forest land
	Timberland	Unproductive	Total	Productive	Unproductive	Total	
Forest Service							
National forest	140.2 (9.72)	16.8 (14.81)	157.0 (8.78)	21.6 (23.92)	6.2 (50.09)	27.9 (21.44)	184.8 (7.95)
Other Forest Service land	— (—)	0.0 (100.45)	0.0 (100.45)	— (—)	— (—)	— (—)	0.0 (100.45)
Other Federal							
National Park Service	— (—)	— (—)	— (—)	0.3 (66.49)	1.8 (53.90)	2.1 (46.95)	2.1 (46.95)
Bureau of Land Management	2.9 (42.31)	21.7 (11.72)	24.6 (11.45)	0.1 (87.09)	1.3 (34.90)	1.5 (32.88)	26.1 (10.95)
Fish and Wildlife Service	— (—)	— (—)	— (—)	— (—)	0.1 (99.15)	0.1 (99.15)	0.1 (99.15)
State and local government							
State	8.5 (34.01)	3.1 (31.98)	11.5 (26.36)	0.1 (99.02)	0.0 (100.85)	0.1 (91.01)	11.7 (26.07)
Local(County, Municipality, etc.)	0.1 (81.22)	0.0 (96.54)	0.2 (71.65)	— (—)	— (—)	— (—)	0.2 (71.65)
Private							
Undifferentiated private and Native American	17.2 (20.01)	8.0 (16.58)	25.2 (14.59)	— (—)	— (—)	— (—)	25.2 (14.59)
Total	168.9 (8.42)	49.6 (7.78)	218.5 (6.67)	22.2 (23.36)	9.5 (34.78)	31.7 (19.18)	250.2 (6.17)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B38—Average annual mortality of trees (at least 5 inches diameter), in million trees, on forest land (percent sampling error) by forest-type group and stand size class.^a

Forest-Type group	Stand size class				
	Large diameter	Medium diameter	Small diameter	Nonstocked	All size classes
Pinyon/juniper group	22.4 (8.45)	0.9 (42.23)	0.2 (72.44)	— (—)	23.5 (8.21)
Douglas-fir group	9.2 (25.73)	3.9 (46.70)	0.9 (58.60)	— (—)	13.9 (21.64)
Ponderosa pine group	1.7 (34.61)	— (—)	0.4 (97.69)	— (—)	2.1 (33.31)
Fir/spruce/ mountain hemlock group	62.3 (14.52)	12.6 (30.25)	17.4 (40.62)	— (—)	92.3 (12.94)
Lodgepole pine group	13.1 (32.99)	13.8 (33.17)	12.4 (29.36)	— (—)	39.3 (17.91)
Other western softwood group	0.2 (95.03)	— (—)	— (—)	— (—)	0.2 (95.03)
Elm/ash/cottonwood group	0.5 (61.26)	0.0 (71.05)	— (—)	— (—)	0.5 (58.81)
Aspen/birch group	12.1 (21.06)	25.5 (13.43)	16.3 (32.10)	— (—)	53.9 (12.40)
Woodland hardwoods group	2.2 (25.56)	2.0 (23.25)	7.1 (27.41)	— (—)	11.3 (18.31)
Nonstocked	— (—)	— (—)	— (—)	13.2 (20.10)	13.2 (20.10)
Total	123.6 (8.61)	58.8 (11.92)	54.6 (17.75)	13.2 (20.10)	250.2 (6.17)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B39—Average annual mortality of trees (at least 5 inches diameter), in million trees, on forest land (percent sampling error) by species group type and species group and ownership group.^a

Species group type	Ownership group				
	Forest Service	Other Federal	State and local government	Private and Native American	All owners
Softwood species groups					
Douglas-fir	16.2 (18.72)	3.1 (38.24)	4.5 (44.00)	3.1 (45.72)	26.9 (14.93)
Ponderosa and Jeffrey pines	1.8 (52.43)	1.5 (49.22)	0.0 (95.43)	0.0 (100.00)	3.3 (36.09)
True fir	25.8 (11.92)	0.8 (54.87)	1.1 (58.73)	3.3 (39.75)	31.0 (11.03)
Engelmann and other spruces	43.1 (23.14)	— (—)	0.0 (95.43)	1.4 (57.09)	44.6 (22.46)
Lodgepole pine	63.0 (13.04)	0.2 (105.01)	— (—)	3.0 (53.98)	66.2 (12.55)
Woodland softwoods	6.5 (23.52)	21.0 (11.45)	2.7 (35.48)	3.4 (24.47)	33.7 (9.16)
Other western softwoods	0.8 (35.44)	0.0 (102.32)	0.1 (99.24)	0.1 (98.13)	1.1 (30.78)
Subtotal	157.3 (9.06)	26.6 (11.01)	8.4 (29.49)	14.3 (20.95)	206.6 (7.20)
Hardwood species groups					
Cottonwood and aspen	25.9 (11.06)	0.6 (47.16)	3.2 (41.18)	9.1 (21.50)	38.8 (9.49)
Other western hardwoods	0.0 (99.40)	— (—)	— (—)	— (—)	0.0 (99.40)
Woodland hardwoods	1.7 (20.17)	1.1 (28.09)	0.2 (33.58)	1.8 (31.97)	4.7 (15.36)
Subtotal	27.6 (10.44)	1.7 (24.76)	3.4 (39.24)	10.9 (18.81)	43.6 (8.60)
Total	184.9 (7.95)	28.3 (10.64)	11.8 (25.74)	25.2 (14.59)	250.2 (6.17)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B40—Average annual mortality of growing-stock trees (at least 5 inches diameter), in million trees, on timberland (percent sampling error) by species group type and species group and ownership group.^a

Species group type	Ownership group				
	Forest Service	Other Federal	State and local government	Private and Native American	All owners
Softwood species groups					
Douglas-fir	15.3 (19.62)	1.8 (59.53)	4.3 (44.90)	2.5 (53.63)	24.0 (16.41)
Ponderosa and Jeffrey pines	0.7 (62.53)	0.0 (94.57)	0.0 (95.43)	0.0 (100.00)	0.7 (57.93)
True fir	22.6 (13.11)	0.6 (69.17)	1.0 (59.87)	2.8 (46.07)	27.0 (12.22)
Engelmann and other spruces	40.3 (24.62)	— (—)	0.0 (95.43)	1.4 (57.14)	41.7 (23.85)
Lodgepole pine	37.3 (17.12)	0.2 (105.01)	— (—)	2.9 (54.09)	40.4 (16.14)
Other western softwoods	0.6 (46.22)	0.0 (102.32)	0.1 (99.24)	0.1 (98.13)	0.8 (37.35)
Subtotal	116.7 (11.24)	2.7 (45.00)	5.5 (40.79)	9.7 (28.88)	134.6 (10.06)
Hardwood species groups					
Cottonwood and aspen	21.4 (12.59)	0.1 (81.73)	2.7 (46.27)	7.0 (26.24)	31.2 (11.10)
Subtotal	21.4 (12.59)	0.1 (81.73)	2.7 (46.27)	7.0 (26.24)	31.2 (11.10)
Total	138.1 (9.82)	2.8 (43.06)	8.3 (34.23)	16.7 (20.29)	165.8 (8.52)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash(—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B41—Area, in million acres, of forest land (percent sampling error) by inventory unit, county, reserved status, and forest land status.^a

	Inventory unit			Inventory unit			All forest land
Inventory unit	Timberland	Unproductive	Total	Productive	Unproductive	Total	
Northern							
Box Elder	0.0 (68.36)	0.3 (10.59)	0.3 (10.47)	0.0 (102.26)	— (—)	0.0 (102.26)	0.3 (10.17)
Cache	0.1 (15.85)	0.1 (17.69)	0.3 (8.67)	0.0 (50.45)	0.0 (70.41)	0.0 (40.02)	0.3 (6.89)
Davis	0.0 (70.85)	0.0 (100.00)	0.0 (57.26)	— (—)	— (—)	— (—)	0.0 (57.26)
Morgan	0.1 (22.89)	0.1 (18.37)	0.2 (9.56)	— (—)	— (—)	— (—)	0.2 (9.56)
Rich	0.1 (19.01)	0.0 (39.84)	0.1 (12.71)	— (—)	— (—)	— (—)	0.1 (12.71)
Salt Lake	0.0 (33.83)	0.1 (22.36)	0.1 (14.82)	0.0 (55.15)	0.0 (67.19)	0.0 (39.75)	0.2 (9.63)
Summit	0.4 (8.70)	0.2 (16.43)	0.6 (5.88)	0.1 (26.29)	0.0 (56.18)	0.1 (23.34)	0.7 (4.37)
Tooele	0.0 (65.31)	0.4 (8.28)	0.4 (8.21)	0.0 (70.69)	0.0 (37.07)	0.1 (32.81)	0.5 (7.39)
Utah	0.2 (16.67)	0.5 (7.24)	0.6 (4.28)	0.0 (54.02)	— (—)	0.0 (54.02)	0.7 (3.84)
Wasatch	0.3 (9.38)	0.2 (16.23)	0.5 (5.33)	0.0 (99.02)	0.0 (71.80)	0.0 (57.90)	0.5 (5.02)
Weber	0.0 (40.54)	0.1 (17.65)	0.1 (12.75)	— (—)	— (—)	— (—)	0.1 (12.75)
Subtotal	1.3 (5.17)	2.0 (4.13)	3.3 (2.49)	0.2 (18.59)	0.1 (24.58)	0.3 (14.55)	3.6 (2.19)
Uinta							
Daggett	0.1 (14.46)	0.1 (18.23)	0.3 (8.15)	0.0 (47.87)	0.0 (40.67)	0.1 (30.46)	0.3 (5.94)
Duchesne	0.4 (10.75)	0.6 (8.40)	0.9 (5.07)	0.2 (16.74)	0.0 (53.28)	0.2 (15.69)	1.1 (3.53)
Uintah	0.2 (15.89)	0.8 (5.96)	1.0 (4.38)	— (—)	0.0 (42.74)	0.0 (42.74)	1.0 (4.29)
Subtotal	0.7 (7.69)	1.5 (4.77)	2.2 (3.09)	0.2 (15.80)	0.1 (25.87)	0.3 (13.28)	2.5 (2.51)
Central							
Juab	0.0 (45.08)	0.4 (7.78)	0.5 (7.02)	— (—)	0.0 (103.29)	0.0 (103.29)	0.5 (6.86)
Millard	0.0 (34.97)	0.6 (6.33)	0.7 (5.70)	— (—)	— (—)	— (—)	0.7 (5.70)
Piute	0.1 (22.51)	0.2 (13.08)	0.2 (7.08)	— (—)	— (—)	— (—)	0.2 (7.08)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B41 continued.

Inventory unit	Inventory unit			Productive	Inventory unit		All forest land
	Timberland	Unproductive	Total		Unproductive	Total	
Sanpete	0.2 (16.51)	0.4 (9.46)	0.5 (5.14)	— (—)	— (—)	— (—)	0.5 (5.14)
Sevier	0.2 (15.19)	0.5 (7.53)	0.6 (4.56)	— (—)	— (—)	— (—)	0.6 (4.56)
Wayne	0.1 (28.96)	0.1 (16.23)	0.2 (10.82)	— (—)	0.1 (26.73)	0.1 (26.73)	0.3 (9.03)
Subtotal	0.5 (9.00)	2.2 (3.57)	2.7 (2.54)	— (—)	0.1 (25.88)	0.1 (25.88)	2.8 (2.50)
Eastern							
Carbon	0.1 (19.16)	0.4 (8.61)	0.5 (4.73)	— (—)	— (—)	— (—)	0.5 (4.73)
Emery	0.1 (22.28)	0.5 (8.06)	0.6 (6.22)	— (—)	— (—)	— (—)	0.6 (6.22)
Grand	0.1 (22.07)	0.8 (5.41)	0.9 (4.29)	— (—)	0.0 (51.39)	0.0 (51.39)	1.0 (4.21)
San Juan	0.1 (21.99)	1.5 (3.91)	1.6 (3.47)	0.0 (99.40)	0.1 (32.84)	0.1 (31.16)	1.6 (3.33)
Subtotal	0.5 (10.64)	3.2 (2.83)	3.7 (2.25)	0.0 (99.40)	0.1 (27.67)	0.1 (26.65)	3.8 (2.20)
Southwestern							
Beaver	0.0 (34.91)	0.7 (4.50)	0.8 (3.86)	— (—)	— (—)	— (—)	0.8 (3.86)
Garfield	0.4 (11.09)	0.8 (7.15)	1.1 (4.71)	0.0 (46.87)	0.4 (10.77)	0.5 (10.42)	1.6 (3.28)
Iron	0.1 (20.23)	0.7 (5.26)	0.9 (3.98)	0.0 (98.74)	0.0 (98.74)	0.0 (69.58)	0.9 (3.83)
Kane	0.1 (21.35)	0.5 (9.05)	0.7 (7.55)	0.0 (53.72)	0.7 (8.15)	0.7 (7.95)	1.4 (3.74)
Washington	0.0 (54.55)	0.6 (6.73)	0.6 (6.50)	0.0 (36.58)	0.1 (20.05)	0.2 (16.96)	0.8 (4.46)
Subtotal	0.7 (8.49)	3.3 (2.90)	4.0 (2.34)	0.1 (24.64)	1.3 (6.19)	1.4 (5.92)	5.4 (1.72)
Total	3.7 (3.38)	12.3 (1.54)	16.0 (1.12)	0.5 (10.78)	1.6 (5.60)	2.1 (4.90)	18.0 (0.97)

Table B42—Area, in million acres, of forest land (percent sampling error) by inventory unit, county, ownership group, and forest land status.

Inventory unit	Forest Service			Other federal			State and local government			Private and Native Amercian			All forest land
	Timberland	Other forest Land	Total	Timberland	Other forest Land	Total	Timberland	Other forest Land	Total	Timberland	Other forest Land	Total	
Northern													
Box Elder	0.0 (92.84)	0.0 (34.49)	0.1 (32.33)	— (—)	0.1 (18.32)	0.1 (18.32)	— (—)	0.0 (71.05)	0.0 (71.05)	0.0 (99.97)	0.1 (20.78)	0.1 (20.33)	0.3 (10.17)
Cache	0.1 (17.61)	0.1 (18.89)	0.2 (9.82)	— (—)	— (—)	— (—)	— (—)	0.0 (60.89)	0.0 (60.89)	0.0 (56.86)	0.0 (38.89)	0.1 (31.28)	0.3 (6.89)
Davis	— (—)	0.0 (100.00)	0.0 (100.00)	— (—)	— (—)	— (—)	0.0 (70.85)	— (—)	0.0 (70.85)	— (—)	— (—)	— (—)	0.0 (57.26)
Morgan	0.0 (63.30)	— (—)	0.0 (63.30)	— (—)	— (—)	— (—)	— (—)	0.0 (91.53)	0.0 (91.53)	0.1 (26.82)	0.1 (19.65)	0.2 (12.32)	0.2 (9.56)
Rich	0.0 (34.37)	— (—)	0.0 (34.37)	0.0 (72.36)	0.0 (51.66)	0.0 (40.97)	0.0 (99.78)	0.0 (105.01)	0.0 (82.03)	0.0 (39.34)	0.0 (105.01)	0.0 (37.85)	0.1 (12.71)
Salt Lake	0.0 (44.30)	0.1 (25.61)	0.1 (18.62)	— (—)	— (—)	— (—)	0.0 (66.45)	0.0 (53.95)	0.0 (40.88)	— (—)	0.0 (40.68)	0.0 (40.68)	0.2 (9.63)
Summit	0.3 (11.11)	0.1 (20.02)	0.5 (8.07)	— (—)	0.0 (98.13)	0.0 (98.13)	0.0 (98.13)	0.0 (98.13)	0.0 (69.10)	0.1 (23.63)	0.1 (19.01)	0.2 (14.22)	0.7 (4.37)
Tooele	0.0 (100.32)	0.1 (27.99)	0.1 (27.90)	— (—)	0.3 (9.72)	0.3 (9.72)	0.0 (100.32)	0.0 (38.47)	0.0 (37.84)	0.0 (100.04)	0.0 (40.76)	0.0 (37.71)	0.5 (7.39)
Utah	0.1 (18.07)	0.3 (10.12)	0.5 (6.72)	0.0 (94.63)	0.1 (33.88)	0.1 (31.63)	0.0 (94.63)	0.1 (30.55)	0.1 (28.87)	0.0 (94.63)	0.1 (28.93)	0.1 (28.65)	0.7 (3.84)
Wasatch	0.3 (11.79)	0.1 (29.62)	0.3 (9.88)	— (—)	— (—)	— (—)	0.0 (48.98)	0.0 (37.88)	0.1 (29.33)	0.0 (37.19)	0.1 (24.57)	0.1 (19.49)	0.5 (5.02)
Weber	0.0 (55.94)	0.0 (44.39)	0.0 (33.33)	— (—)	— (—)	— (—)	— (—)	0.0 (101.87)	0.0 (101.87)	0.0 (64.14)	0.1 (23.00)	0.1 (20.34)	0.1 (12.75)
Subtotal	0.9 (6.55)	0.9 (7.16)	1.8 (4.07)	0.0 (58.35)	0.5 (8.54)	0.6 (8.44)	0.1 (29.19)	0.2 (16.55)	0.3 (14.33)	0.3 (13.71)	0.7 (8.46)	0.9 (6.83)	3.6 (2.19)
Uinta													
Daggett	0.1 (15.11)	0.1 (19.88)	0.2 (8.98)	— (—)	0.0 (40.04)	0.0 (40.04)	0.0 (97.69)	0.0 (38.87)	0.0 (35.87)	— (—)	0.0 (104.80)	0.0 (104.80)	0.3 (5.94)
Duchesne	0.3 (13.76)	0.3 (12.54)	0.5 (7.87)	— (—)	0.1 (28.95)	0.1 (28.95)	0.0 (46.76)	0.0 (35.65)	0.1 (28.10)	0.1 (24.77)	0.4 (11.39)	0.4 (9.84)	1.1 (3.53)
Uintah	0.2 (18.11)	0.0 (37.05)	0.2 (15.80)	0.0 (51.74)	0.4 (9.60)	0.5 (9.44)	0.0 (99.15)	0.1 (24.18)	0.1 (23.38)	0.0 (53.43)	0.2 (14.55)	0. (13.96)	1.0 (4.29)
Subtotal	0.5 (9.05)	0.4 (10.22)	1.0 (5.80)	0.0 (51.74)	0.5 (8.95)	0.6 (8.83)	0.0 (38.82)	0.2 (17.80)	0.2 (16.07)	0.1 (22.48)	0.6 (8.96)	0.7 (8.05)	2.5 (2.51)
Central													
Juab	0.0 (72.50)	0.1 (27.22)	0.1 (24.94)	0.0 (73.26)	0.3 (13.04)	0.3 (12.58)	— (—)	0.0 (39.60)	0.0 (39.60)	0.0 (103.29)	0.1 (23.62)	0.1 (22.75)	0.5 (6.86)
Millard	0.0 (34.97)	0.3 (12.20)	0.3 (10.89)	— (—)	0.3 (13.11)	0.3 (13.11)	— (—)	0.0 (34.49)	0.0 (34.49)	— (—)	0.0 (40.17)	0.0 (40.17)	0.7 (5.70)

Table B42 continued.

Inventory unit	Forest Service			Other federal			State and local government			Private and Native Amercian			
	Other forest			Other forest			Other forest			Other forest			All forest land
	Timberland	Land	Total	Timberland	Land	Total	Timberland	Land	Total	Timberland	Land	Total	
Piute	0.1 (23.01)	0.1 (23.26)	0.1 (13.27)	— (—)	0.1 (25.73)	0.1 (25.73)	0.0 (107.21)	0.0 (61.20)	0.0 (60.67)	— (—)	— (—)	— (—)	0.2 (7.08)
Sanpete	0.2 (17.88)	0.1 (24.70)	0.2 (12.99)	— (—)	0.1 (23.65)	0.1 (23.65)	— (—)	0.1 (34.76)	0.1 (34.76)	0.0 (58.63)	0.1 (21.65)	0.1 (19.65)	0.5 (5.14)
Sevier	0.2 (15.90)	0.3 (10.37)	0.5 (6.85)	— (—)	0.1 (24.69)	0.1 (24.69)	— (—)	0.0 (59.85)	0.0 (59.85)	0.0 (66.20)	0.0 (36.12)	0.1 (31.36)	0.6 (4.56)
Wayne	0.1 (30.94)	0.1 (32.72)	0.1 (20.03)	0.0 (95.33)	0.2 (17.94)	0.2 (17.47)	— (—)	0.0 (55.34)	0.0 (55.34)	— (—)	0.0 (95.33)	0.0 (95.33)	0.3 (9.03)
Subtotal	0.5 (9.57)	0.9 (6.87)	1.4 (4.86)	0.0 (59.73)	0.9 (7.15)	0.9 (7.05)	0.0 (107.21)	0.2 (17.76)	0.2 (17.74)	0.0 (40.94)	0.3 (13.60)	0.3 (12.65)	2.8 (2.50)
Eastern													
Carbon	0.0 (47.57)	0.0 (77.71)	0.0 (42.24)	0.0 (54.25)	0.2 (14.37)	0.2 (13.28)	0.0 (46.73)	0.1 (30.74)	0.1 (25.14)	0.1 (32.33)	0.1 (27.91)	0.1 (19.66)	0.5 (4.73)
Emery	0.1 (25.09)	0.1 (30.30)	0.1 (18.56)	— (—)	0.4 (10.83)	0.4 (10.83)	— (—)	0.1 (23.91)	0.1 (23.91)	0.0 (59.84)	0.0 (56.20)	0.0 (40.78)	0.6 (6.22)
Grand	0.0 (45.11)	0.0 (35.91)	0.1 (28.31)	0.0 (67.25)	0.5 (8.56)	0.6 (8.35)	0.1 (31.26)	0.2 (15.88)	0.3 (13.46)	0.0 (80.97)	0.1 (31.36)	0.1 (29.13)	1.0 (4.21)
San Juan	0.1 (26.02)	0.3 (12.58)	0.4 (10.92)	0.0 (80.74)	1.0 (6.13)	1.0 (6.11)	0.0 (99.40)	0.1 (26.79)	0.1 (25.78)	0.0 (57.97)	0.2 (18.66)	0.2 (17.67)	1.6 (3.33)
Subtotal	0.2 (15.83)	0.4 (10.98)	0.6 (8.78)	0.0 (37.76)	2.1 (4.33)	2.2 (4.26)	0.1 (25.15)	0.5 (11.10)	0.5 (9.88)	0.1 (24.37)	0.3 (13.52)	0.4 (11.51)	3.8 (2.20)
Southwestern													
Beaver	0.0 (43.95)	0.1 (28.28)	0.1 (23.21)	0.0 (59.11)	0.6 (6.09)	0.6 (5.87)	— (—)	0.0 (35.99)	0.0 (35.99)	— (—)	0.0 (57.47)	0.0 (57.47)	0.8 (3.86)
Garfield	0.4 (11.44)	0.4 (10.15)	0.8 (6.40)	0.0 (55.33)	0.7 (7.97)	0.7 (7.83)	— (—)	0.0 (35.30)	0.0 (35.30)	— (—)	0.0 (50.49)	0.0 (50.49)	1.6 (3.28)
Iron	0.1 (25.62)	0.1 (21.41)	0.2 (15.62)	0.0 (98.74)	0.5 (8.39)	0.5 (8.36)	0.0 (98.74)	0.1 (27.46)	0.1 (26.28)	0.0 (41.21)	0.1 (30.85)	0.1 (24.26)	0.9 (3.83)
Kane	0.1 (25.25)	0.0 (49.87)	0.1 (22.34)	— (—)	1.0 (5.67)	1.0 (5.67)	— (—)	0.1 (35.12)	0.1 (35.12)	0.0 (43.33)	0.1 (20.45)	0.2 (18.12)	1.4 (3.74)
Washington	0.0 (79.60)	0.3 (10.34)	0.3 (10.21)	— (—)	0.4 (10.86)	0.4 (10.86)	— (—)	0.0 (100.14)	0.0 (100.14)	0.0 (74.37)	0.1 (32.56)	0.1 (30.05)	0.8 (4.46)
Subtotal	0.6 (9.40)	1.0 (6.68)	1.6 (4.98)	0.0 (37.59)	3.2 (3.31)	3.2 (3.28)	0.0 (98.74)	0.2 (16.22)	0.2 (15.97)	0.1 (27.73)	0.3 (14.04)	0.4 (12.37)	5.4 (1.72)
Total	2.8 (4.04)	3.6 (3.52)	6.4 (2.35)	0.1 (21.30)	7.3 (2.31)	7.5 (2.28)	0.2 (16.76)	1.3 (6.76)	1.5 (6.20)	0.6 (9.61)	2.2 (4.87)	2.7 (4.20)	18.0 (0.97)

Table B43—Area, in million acres, of timberland (percent sampling error) by inventory unit and county and stand size class.^a

Inventory unit	Large diameter	Medium diameter	Small diameter	Nonstocked	All size classes
Northern					
Box Elder	0.0 (71.36)	0.0 (99.97)	— (—)	— (—)	0.0 (68.36)
Cache	0.1 (22.01)	0.0 (36.27)	0.0 (82.40)	0.0 (82.64)	0.1 (15.85)
Davis	0.0 (70.85)	— (—)	— (—)	— (—)	0.0 (70.85)
Morgan	0.0 (33.27)	0.0 (47.67)	0.0 (74.37)	— (—)	0.1 (22.89)
Rich	0.0 (30.54)	0.0 (50.75)	0.0 (48.53)	— (—)	0.1 (19.01)
Salt Lake	0.0 (38.36)	0.0 (96.54)	— (—)	— (—)	0.0 (33.83)
Summit	0.1 (19.92)	0.2 (18.12)	0.1 (20.19)	0.0 (98.13)	0.4 (8.70)
Tooele	0.0 (74.50)	0.0 (100.32)	— (—)	— (—)	0.0 (65.31)
Utah	0.1 (22.03)	0.0 (38.48)	0.0 (54.66)	0.0 (104.95)	0.2 (16.67)
Wasatch	0.1 (21.71)	0.1 (19.13)	0.1 (26.79)	0.0 (99.02)	0.3 (9.38)
Weber	0.0 (71.43)	0.0 (70.30)	0.0 (101.87)	0.0 (101.87)	0.0 (40.54)
Subtotal	0.6 (9.13)	0.4 (10.92)	0.3 (14.17)	0.0 (48.03)	1.3 (5.17)
Uinta					
Daggett	0.1 (28.08)	0.1 (26.80)	0.0 (55.59)	0.0 (71.46)	0.1 (14.46)
Duchesne	0.2 (15.68)	0.1 (25.63)	0.1 (27.33)	0.0 (70.84)	0.4 (10.75)
Uintah	0.1 (23.66)	0.1 (29.43)	0.0 (46.51)	0.0 (74.34)	0.2 (15.89)
Subtotal	0.4 (11.86)	0.2 (15.74)	0.1 (21.70)	0.0 (48.46)	0.7 (7.69)
Central					
Juab	0.0 (58.75)	0.0 (73.26)	— (—)	— (—)	0.0 (45.08)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B43 continued.

Inventory unit	Large diameter	Medium diameter	Small diameter	Nonstocked	All size classes
Millard	0.0 (36.37)	0.0 (97.41)	— (—)	— (—)	0.0 (34.97)
Piute	0.0 (47.15)	0.0 (38.48)	0.0 (56.33)	0.0 (84.26)	0.1 (22.51)
Sanpete	0.1 (23.63)	0.0 (35.81)	0.0 (44.81)	— (—)	0.2 (16.51)
Sevier	0.1 (24.78)	0.1 (24.58)	0.0 (60.94)	0.0 (104.41)	0.2 (15.19)
Wayne	0.0 (42.58)	0.0 (70.03)	0.0 (66.19)	— (—)	0.1 (28.96)
Subtotal	0.3 (13.55)	0.2 (16.83)	0.1 (28.03)	0.0 (67.37)	0.5 (9.00)
Eastern					
Carbon	0.1 (27.64)	0.0 (55.99)	0.0 (39.36)	— (—)	0.1 (19.16)
Emery	0.1 (29.17)	0.0 (73.80)	0.0 (51.45)	0.0 (77.90)	0.1 (22.28)
Grand	0.1 (27.23)	0.0 (61.63)	0.0 (56.83)	— (—)	0.1 (22.07)
San Juan	0.1 (23.90)	0.0 (78.48)	0.0 (100.33)	0.0 (99.40)	0.1 (21.99)
Subtotal	0.3 (13.39)	0.1 (33.23)	0.1 (26.45)	0.0 (63.13)	0.5 (10.64)
Southwestern					
Beaver	0.0 (45.04)	0.0 (70.48)	0.0 (99.47)	— (—)	0.0 (34.91)
Garfield	0.2 (15.28)	0.1 (25.75)	0.0 (35.81)	0.0 (52.17)	0.4 (11.09)
Iron	0.1 (25.94)	0.0 (50.14)	0.0 (57.82)	0.0 (98.74)	0.1 (20.23)
Kane	0.1 (24.34)	0.0 (71.21)	0.0 (74.66)	0.0 (100.00)	0.1 (21.35)
Washington	0.0 (100.14)	0.0 (62.42)	— (—)	— (—)	0.0 (54.55)
Subtotal	0.4 (11.15)	0.1 (19.90)	0.1 (27.21)	0.0 (43.92)	0.7 (8.49)
Total	2.0 (5.13)	1.0 (7.19)	0.6 (9.48)	0.1 (23.75)	3.7 (3.38)

Table B44—Area, in million acres, of timberland (percent sampling error) by inventory unit and county and stocking class of growing-stock trees.^a

Inventory unit	Nonstocked	Poorly stocked	Medium stocked	Fully stocked	Overstocked	All size classes
Northern						
Box Elder	0.0 (99.97)	0.0 (99.97)	0.0 (99.97)	— (—)	— (—)	0.0 (68.36)
Cache	0.0 (82.64)	0.0 (35.33)	0.1 (24.23)	0.0 (57.36)	0.0 (100.36)	0.1 (15.85)
Davis	— (—)	0.0 (70.85)	— (—)	— (—)	— (—)	0.0 (70.85)
Morgan	— (—)	0.0 (38.36)	0.0 (44.31)	0.0 (63.30)	— (—)	0.1 (22.89)
Rich	— (—)	0.0 (72.36)	0.0 (47.22)	0.0 (32.53)	0.0 (59.40)	0.1 (19.01)
Salt Lake	— (—)	0.0 (66.45)	0.0 (66.45)	0.0 (96.54)	0.0 (96.54)	0.0 (33.83)
Summit	0.0 (98.13)	0.1 (21.06)	0.2 (15.80)	0.1 (23.77)	0.0 (62.25)	0.4 (8.70)
Tooele	— (—)	— (—)	0.0 (82.39)	0.0 (100.32)	— (—)	0.0 (65.31)
Utah	0.0 (104.95)	0.1 (28.46)	0.0 (38.49)	0.1 (31.15)	— (—)	0.2 (16.67)
Wasatch	0.0 (99.02)	0.0 (35.15)	0.2 (16.23)	0.1 (23.18)	0.0 (99.02)	0.3 (9.38)
Weber	0.0 (101.87)	— (—)	0.0 (48.87)	0.0 (101.87)	— (—)	0.0 (40.54)
Subtotal	0.0 (47.08)	0.3 (12.53)	0.6 (9.15)	0.3 (12.57)	0.0 (36.39)	1.3 (5.17)
Uinta						
Daggett	0.0 (71.46)	0.1 (25.89)	0.1 (30.06)	0.0 (68.29)	0.0 (97.69)	0.1 (14.46)
Duchesne	0.0 (54.01)	0.1 (21.70)	0.2 (18.22)	0.1 (28.76)	0.0 (59.85)	0.4 (10.75)
Uintah	0.0 (74.34)	0.0 (38.28)	0.1 (29.10)	0.1 (26.64)	0.0 (69.89)	0.2 (15.89)
Subtotal	0.0 (41.85)	0.2 (15.28)	0.3 (13.76)	0.2 (18.79)	0.0 (45.52)	0.7 (7.69)
Central						
Juab	— (—)	0.0 (103.29)	0.0 (103.29)	0.0 (59.26)	— (—)	0.0 (45.08)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B44 continued.

Inventory unit	Nonstocked	Poorly stocked	Medium stocked	Fully stocked	Overstocked	All size classes
Millard	0.0 (97.41)	0.0 (97.41)	0.0 (53.15)	0.0 (61.64)	— (—)	0.0 (34.97)
Piute	0.0 (84.26)	0.0 (107.21)	0.0 (61.20)	0.0 (46.31)	0.0 (40.78)	0.1 (22.51)
Sanpete	— (—)	0.1 (29.17)	0.0 (38.40)	0.1 (29.81)	0.0 (102.84)	0.2 (16.51)
Sevier	0.0 (104.41)	0.0 (41.71)	0.1 (24.78)	0.0 (34.20)	0.0 (46.52)	0.2 (15.19)
Wayne	— (—)	0.0 (49.22)	0.0 (55.35)	0.0 (66.19)	— (—)	0.1 (28.96)
Subtotal	0.0 (55.41)	0.1 (20.68)	0.2 (17.33)	0.2 (17.66)	0.1 (29.89)	0.5 (9.00)
Eastern						
Carbon	— (—)	0.0 (46.66)	0.0 (34.84)	0.1 (32.42)	0.0 (94.57)	0.1 (19.16)
Emery	0.0 (77.90)	0.0 (35.59)	0.0 (59.84)	0.0 (43.17)	0.0 (105.09)	0.1 (22.28)
Grand	— (—)	0.0 (37.12)	0.0 (39.07)	0.0 (68.92)	0.0 (54.63)	0.1 (22.07)
San Juan	0.0 (99.40)	0.0 (42.55)	0.0 (42.35)	0.0 (40.35)	0.0 (70.13)	0.1 (21.99)
Subtotal	0.0 (63.13)	0.1 (19.90)	0.1 (20.80)	0.1 (20.82)	0.0 (38.80)	0.5 (10.64)
Southwestern						
Beaver	— (—)	0.0 (99.47)	0.0 (57.47)	0.0 (57.27)	0.0 (99.47)	0.0 (34.91)
Garfield	0.0 (50.94)	0.1 (24.04)	0.1 (22.55)	0.1 (20.90)	0.0 (53.48)	0.4 (11.09)
Iron	0.0 (98.74)	0.0 (70.25)	0.1 (33.08)	0.1 (34.05)	0.0 (74.53)	0.1 (20.23)
Kane	0.0 (82.34)	0.1 (28.73)	0.0 (43.33)	0.0 (70.49)	— (—)	0.1 (21.35)
Washington	— (—)	0.0 (100.23)	0.0 (71.22)	0.0 (100.14)	— (—)	0.0 (54.55)
Subtotal	0.0 (39.75)	0.2 (17.50)	0.2 (15.99)	0.2 (16.37)	0.0 (40.61)	0.7 (8.49)
Total	0.1 (21.55)	1.0 (7.30)	1.4 (6.13)	1.0 (7.38)	0.2 (16.68)	3.7 (3.38)

Table B45—Net volume of growing-stock trees (at least 5 inches diameter), in million cubic feet, on timberland (percent sampling error) by inventory unit and county and spgrpgrpnm2.^a

Inventory unit	Other softwoods	Hard hardwoods	Pine	Soft hardwoods	All size classes
Northern					
Box Elder	10.0 (81.60)	— (—)	— (—)	0.0 (99.97)	10.0 (81.58)
Cache	196.6 (27.14)	— (—)	50.5 (97.34)	50.2 (31.63)	297.3 (25.01)
Davis	25.2 (72.00)	— (—)	— (—)	0.3 (100.00)	25.5 (71.76)
Morgan	147.8 (36.23)	— (—)	— (—)	15.6 (33.22)	163.4 (33.44)
Rich	91.9 (38.11)	— (—)	39.8 (84.97)	60.4 (33.00)	192.2 (25.93)
Salt Lake	82.4 (62.18)	— (—)	— (—)	36.4 (76.73)	118.8 (47.69)
Summit	246.9 (18.63)	— (—)	142.3 (20.51)	89.3 (23.98)	478.5 (12.46)
Tooele	26.3 (67.14)	— (—)	— (—)	— (—)	26.3 (67.14)
Utah	319.3 (26.89)	— (—)	— (—)	47.0 (38.96)	366.3 (24.23)
Wasatch	244.2 (21.91)	— (—)	5.2 (98.31)	209.6 (21.23)	459.0 (14.87)
Weber	53.9 (62.58)	— (—)	— (—)	8.7 (96.09)	62.6 (55.29)
Subtotal	1,444.6 (10.67)	— (—)	237.8 (28.01)	517.5 (12.67)	2,199.9 (8.16)
Uinta					
Daggett	58.4 (29.21)	— (—)	90.2 (28.54)	2.6 (49.79)	151.2 (18.68)
Duchesne	310.3 (17.62)	— (—)	121.9 (27.34)	49.2 (35.45)	481.4 (14.64)
Uintah	166.4 (28.59)	— (—)	177.8 (32.16)	54.0 (46.82)	398.3 (20.78)
Subtotal	535.1 (13.92)	— (—)	389.9 (18.21)	105.8 (29.06)	1,030.8 (10.89)
Central					
Juab	56.4 (64.65)	— (—)	— (—)	0.5 (74.14)	56.9 (64.34)

^a Numbers in rows and columns may not sum to totals due to rounding.

A dash (—) indicates no sample for the cell; 0 indicates a value of greater than 0 but less than 0.1.

Table B45 continued.

Inventory unit	Other softwoods	Hard hardwoods	Pine	Soft hardwoods	All size classes
Millard	62.0 (43.25)	— (—)	— (—)	24.0 (69.43)	85.9 (40.19)
Piute	89.4 (41.18)	— (—)	— (—)	64.6 (41.28)	154.0 (31.90)
Sanpete	165.4 (23.16)	— (—)	— (—)	90.6 (28.91)	256.0 (20.81)
Sevier	138.8 (22.97)	— (—)	— (—)	157.9 (26.68)	296.8 (21.24)
Wayne	34.5 (38.47)	— (—)	6.4 (95.33)	6.1 (54.92)	47.0 (33.70)
Subtotal	546.5 (14.25)	— (—)	6.4 (95.33)	343.6 (17.12)	896.5 (12.22)
Eastern					
Carbon	86.6 (29.02)	— (—)	0.5 (88.72)	52.4 (37.32)	139.4 (25.24)
Emery	114.6 (32.41)	— (—)	0.6 (105.09)	38.0 (45.30)	153.2 (30.11)
Grand	105.5 (30.02)	— (—)	21.9 (62.21)	68.3 (58.08)	195.7 (32.91)
San Juan	121.5 (49.34)	— (—)	111.8 (37.36)	70.2 (46.83)	303.6 (28.03)
Subtotal	428.2 (18.99)	— (—)	134.8 (32.61)	228.9 (25.22)	791.9 (15.34)
Southwestern					
Beaver	48.0 (52.30)	— (—)	11.7 (86.90)	23.6 (54.21)	83.4 (44.60)
Garfield	385.8 (18.42)	— (—)	125.5 (27.80)	85.0 (27.44)	596.4 (14.94)
Iron	140.6 (29.31)	— (—)	4.1 (64.93)	111.5 (37.14)	256.2 (27.52)
Kane	73.7 (34.49)	— (—)	45.7 (39.59)	10.8 (42.12)	130.3 (26.04)
Washington	11.6 (74.28)	— (—)	8.0 (100.14)	6.1 (92.64)	25.6 (66.41)
Subtotal	659.8 (13.64)	— (—)	195.0 (21.27)	237.1 (20.99)	1,091.8 (11.49)
Total	3,614.2 (6.19)	— (—)	963.9 (11.90)	1,432.9 (8.41)	6,010.9 (4.92)

APPENDIX C: Utah Forest-Type Groups And Forest Types, With Descriptions And Timber (T) Or Woodland (W) Designations

Forest types are usually named for the predominant species (or group of species) on the condition. To determine the forest type, the stocking (site occupancy) of trees is estimated by softwoods and hardwoods. If softwoods predominate, then the forest type will be one of the softwood types and if hardwoods predominate, then the forest type will be one of the hardwood types (Arner and others 2001). Some other special stocking rules apply to individual forest types and are described below.

Associate species are defined as those that regularly form the majority of the nonpredominant species stocking of mixed-species conditions. These descriptions are applicable to the current inventory; species importance, including predominance in some cases, will vary for other States or inventory years. When species are listed, they are in decreasing order of overall forest type stocking.

ASPEN/BIRCH GROUP (T)

Aspen

Predominant species: quaking aspen

Associate species: subalpine fir, limber pine, white fir

Other species: curlleaf mountain-mahogany, Rocky Mountain juniper, California red fir, singleleaf pinyon, whitebark pine, incense-cedar, western juniper, lodgepole pine

DOUGLAS-FIR GROUP (T)

Douglas-fir

Predominant species: Douglas-fir

Associate species: none identified

Other species: white fir, Engelmann spruce, limber pine, Great Basin bristlecone pine, quaking aspen

ELM/ASH/COTTONWOOD GROUP (T)

Cottonwood

Predominant species: black cottonwood

Associate species: none identified

Other species: curlleaf mountain-mahogany

Special rules: Stocking of cottonwoods must be at least 50 percent of total stocking.

FIR/SPRUCE/MOUNTAIN HEMLOCK GROUP (T)

Engelmann spruce

Predominant species: Engelmann spruce

Associate species: quaking aspen

Other species: limber pine

Special rules: To use Engelmann spruce stocking predominance, subalpine fir stocking must be less than 5 percent of the total. If subalpine fir stocking is 5 percent or more, Engelmann spruce stocking must be at least 75 percent of the total.

Red fir

Predominant species: California red fir

Associate species: none identified

Other species: western white pine, lodgepole pine, western juniper, Jeffrey pine, white fir

Subalpine fir

Predominant species: subalpine fir

Associate species: limber pine

Other species: quaking aspen, whitebark pine

Special rules: To use subalpine fir stocking predominance, Engelmann spruce stocking must be less than 5 percent of the total. If Engelmann spruce stocking is 5 percent or more, subalpine fir stocking must be at least 75 percent of the total.

White fir

Predominant species: white fir

Associate species: curlleaf mountain-mahogany, limber pine, Douglas-fir, Rocky Mountain juniper, Great Basin bristlecone pine, ponderosa pine, quaking aspen

Other species: singleleaf pinyon, Utah juniper, Jeffrey pine, Engelmann spruce

LODEPOLE PINE GROUP (T)

Lodgepole pine

Predominant species: lodgepole pine

Associate species: California red fir

Other species: Jeffery pine, whitebark pine, western white pine, limber pine, mountain hemlock, white fir

NONSTOCKED

Nonstocked

Predominant species: most nonstocked conditions have no live-tree stocking. Where live trees are present, they are most often Utah juniper and/or singleleaf pinyon

Associate species: seldom more than one species on a condition.

Other species (complete species list): Utah juniper, singleleaf pinyon, curlleaf mountain-mahogany, western juniper, Jeffrey pine, limber pine

Special rules: Used when all live stocking is less than 10 percent. Implies disturbance but may be used for sparse stands with no disturbance, especially with woodland species.

OTHER WESTERN SOFWOODS GROUP (T)

Foxtail pine/bristlecone pine

Predominant species: Great Basin bristlecone pine

Associate species: limber pine

Other species: Engelmann spruce, white fir, curlleaf mountain-mahogany, quaking aspen

Special rules: This is mostly an “either/or” forest type. Foxtail pine does not occur in Utah, so this will always be Great Basin bristlecone pine predominance.

Note: In the previous periodic inventory, Great Basin bristlecone pine was not distinguished from Rocky Mountain bristlecone pine. The species code used for all bristlecone pines in that inventory was retained for Rocky Mountain bristlecone pine. Therefore, species-based reports using Utah 1993 data may return results for “Rocky Mountain bristlecone pine.” These are almost certainly Great Basin bristlecone pines.

Limber pine

Predominant species: limber pine

Associate species: white fir

Other species: quaking aspen, Great Basin bristlecone pine, Engelmann spruce, Douglas-fir, curlleaf mountain-mahogany, subalpine fir

Western juniper

Predominant species: western juniper

Associate species: none identified

Other species: curlleaf mountain-mahogany, Utah juniper, western white pine, quaking aspen

Whitebark pine

Predominant species: whitebark pine

Associate species: none identified

Other species: quaking aspen, mountain hemlock

PINYON/JUNIPER GROUP (W)

Juniper woodland

Predominant species: Utah juniper

Associate species: none identified

Other species: white fir, western juniper, curlleaf mountain-mahogany

Special rules: Predominance of any combination of junipers other than Rocky Mountain juniper or western juniper, and where live pinyons are NOT present.

Pinyon/juniper woodland

Predominant species: singleleaf pinyon, Utah juniper, common or two-needle pinyon

Associate species: curlleaf mountain-mahogany

Other species: white fir, Gambel oak, Rocky Mountain juniper, quaking aspen, ponderosa pine

Special rules: Any combination of pinyons and junipers other than Rocky Mountain juniper or western juniper predominate. Pinyons must be present.

Rocky Mountain juniper

Predominant species: Rocky Mountain juniper

Associate species: none identified

Other species: quaking aspen, ponderosa pine, curlleaf mountain-mahogany, white fir, whitebark pine, subalpine fir

PONDEROSA PINE GROUP (T)

Jeffrey pine

Predominant species: Jeffrey pine

Associate species: white fir

Other species: curlleaf mountain-mahogany, western white pine, whitebark pine, incense-cedar

Ponderosa pine

Predominant species: ponderosa pine

Associate species: none identified

Other species: singleleaf pinyon, white fir, curleaf mountain-mahogany

WOODLAND HARDWOODS GROUP (W)

***Cercocarpus* (mountain brush) woodland**

Predominant species: curleaf mountain-mahogany

Associate species: singleleaf pinyon, Utah juniper, white fir, limber pine

Other species: Rocky Mountain juniper, quaking aspen, Great Basin bristlecone pine, Jeffrey pine, western juniper, Douglas-fir

Deciduous oak woodland

Predominant species: Gambel oak

Associate species: singleleaf pinyon

Other species: curleaf mountain-mahogany, Utah juniper

Mesquite woodland

Predominant species: screwbean mesquite, honey mesquite

Associate species: none identified

Other species: none identified

APPENDIX D: Tree Species Groups And Tree Species Measured In Utah's Annual Inventory, With Common Name, Scientific Name, And Timber (T) Or Woodland (W) Designation

HARDWOODS

Cottonwood and aspen group (T)

Black cottonwood (*Populus balsamifera*)

Quaking aspen (*Populus tremuloides*)

Woodland hardwoods group (W)

Curlleaf mountain-mahogany (*Cercocarpus ledifolius*)

Gambel oak (*Quercus gambelii*)

Honey mesquite (*Prosopis glandulosa*)

Screwbean mesquite (*Prosopis pubescens*)

SOFTWOODS

Douglas-fir group (T)

Douglas-fir (*Pseudotsuga menziesii*)

Engelmann and other spruces group (T)

Engelmann spruce (*Picea engelmannii*)

Incense-cedar group (T)

Incense-cedar (*Calocedrus decurrens*)

Lodgepole pine group (T)

Lodgepole pine (*Pinus contorta*)

Other western softwoods group (T)

Great Basin bristlecone pine (*Pinus longaeva*)

Limber pine (*Pinus flexilis*)

Mountain hemlock (*Tsuga mertensiana*)

Western juniper (*Juniperus occidentalis*)

Whitebark pine (*Pinus albicaulis*)

Ponderosa and Jeffrey pines group (T)

Jeffrey pine (*Pinus jeffreyi*)

Ponderosa pine (*Pinus ponderosa*)

True fir group (T)

California red fir (*Abies magnifica*)

Subalpine fir (*Abies lasiocarpa*)

White fir (*Abies concolor*)

Western white pine group (T)

Western white pine (*Pinus monticola*)

Woodland softwoods group (W)

Common or two-needle pinyon (*Pinus edulis*)

Rocky Mountain juniper (*Juniperus scopulorum*)

Singleleaf pinyon (*Pinus monophylla*)

Utah juniper (*Juniperus osteosperma*)

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