

Southeast Alaska Forests: Inventory Highlights

Sally Campbell, Willem W.S. van Hees,
and Bert Mead

General Technical Report
PNW-GTR-609
August 2004



United States
Department of
Agriculture



Forest
Service



Pacific Northwest
Research Station





Twelve-Mile Arm, Prince of Wales Island. *Photo by Tom Iraci.*

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Cover: Harris River Bay, Prince of Wales Island, Alaska. *Photo by Tom Iraci.*



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U.S. Department of Agriculture, Forest Service
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Abstract

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This publication presents highlights of a recent southeast Alaska inventory and analysis conducted by the Pacific Northwest Research Station Forest Inventory and Analysis Program (USDA Forest Service). Southeast Alaska has about 22.9 million acres, of which two-thirds are vegetated. Almost 11 million acres are forest land and about 4 million acres have nonforest vegetation (herbs and shrubs). Species diversity is greatest in western hemlock–Alaska cedar closed-canopy forests, in mixed-conifer open and woodland forests, and in open tall alder-willow shrub type. Of the forest land, 4.1 million acres are classified as timberland (unreserved productive forest land). About 4.4 million acres of forest land are reserved from harvest; the majority of this reserved land (85 percent) is on the Tongass National Forest (USDA Forest Service). The volume of timber on timberland was estimated at 21,040 million cubic feet; the majority of volume—88 percent—is on the Tongass National Forest. Seventy-four percent of timberland acres and 84 percent of the growing-stock volume is in sawtimber stands older than 150 years, with western hemlock or western hemlock–Sitka spruce mix predominating. Most timberland in southeast Alaska is of relatively low productivity, producing less than 85 cubic feet per acre per year. For most timberland acres, average annual growth exceeds average annual mortality and harvest.



Auke village, near Juneau. Photo by Tom Iraci.

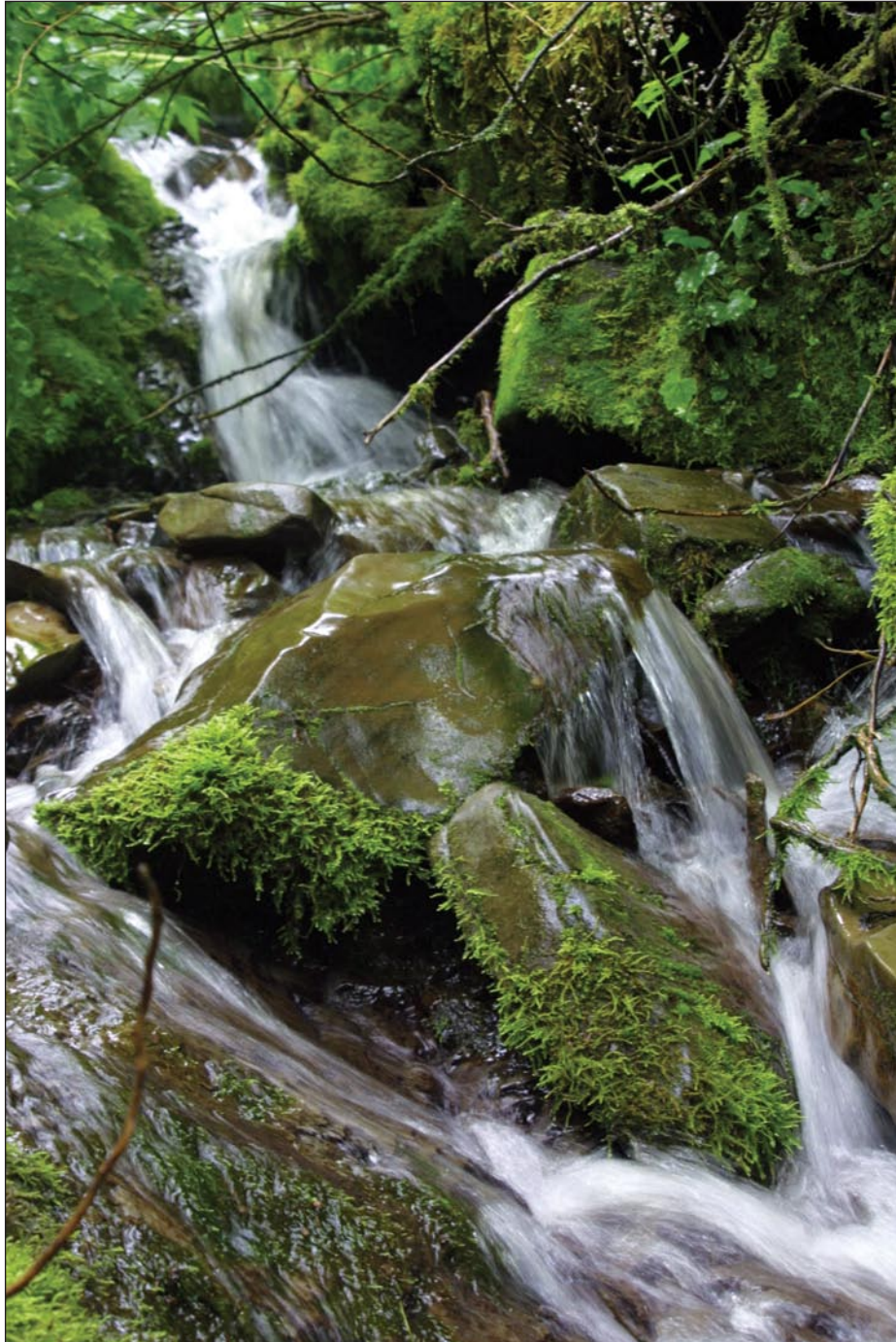


Photo by Andy Tasler.

Introduction

AN INVENTORY OF THE FOREST RESOURCES in southeast Alaska was conducted by the Pacific Northwest Research Station Forest Inventory and Analysis Program (USDA Forest Service) from 1995 to 2000 (fig. 1). An indepth analysis of the data has been published (van Hees 2003). Here we summarize a portion of the information from the 2003 report, focusing on some of the forestry issues in southeast Alaska:

- What types of vegetation are in southeast Alaska?
- How much is forest and who owns it?
- What forest land is protected from harvest?
- How much timber is available for harvest?
- How much of the forest is sawtimber and where is it?
- What is the productivity of southeast Alaska timberland?
- What is the rate of growth, mortality, and harvest?



Figure 1—Southeast Alaska inventory area, 2000.

Inventory Methods

The inventory of forest resources in southeast coastal Alaska used a systematic grid sample with grid spacing of 3 miles. In all, 3,946 plots were located within the inventory area; 862 of these plots had some productive forest on them. About half (1,984) of the locations had some forested land cover (productive, nonproductive, or inaccessible forest). Plots that were barren or covered with ice and snow were not visited on the ground. All vegetated plots (forested and nonforested) were visited and sampled with a cluster of four, 24-foot fixed-radius subplots. Each subplot was mapped for land cover. Field plot design is detailed in Scott and Bechtold (1995.)

Trees were sampled at each of the four subplots, with many attributes measured such as diameter, height, species, age, and number of seedlings. Down wood and vegetation structure and diversity were characterized at the first subplot in each vegetation type, on three linear transects for the down wood, and on an 18.5-foot-radius plot for the vegetation. Data collection procedures are documented annually (USDA Forest Service 1995–2000). Because this was an initial inventory, no remeasurement data were taken. Therefore, growth was modeled from radial growth and height measurements, and mortality year was estimated for dead trees.



PNW Forest Inventory and Analysis field crew members Misha Yaskov (left) and Shawn Osborn (right). *Photo by Andy Tasler.*

What Types of Vegetation Are in Southeast Alaska?

THE TOTAL LAND AND water area of the southeast Alaska inventory area is 22.9 million acres. Two-thirds of it has some kind of vegetation on it (fig. 2). Of this vegetated portion, 72 percent has forest as the major cover, 22 percent has shrubs and dwarf trees, and 6 percent has herbs, grass, moss, or lichens (fig. 3).

Location and Abundance of Nonforest Vegetation Types

Many nonforest areas in southeast Alaska are greatly influenced by recent glaciation history. Soils are typically thin and rocky. As glaciers recede, many of the earliest pioneer plants are nitrogen-fixing plants and shrubs, such as alder, which prepare the soil for colonization and further succession into forest community types. Nonforest communities may dominate these areas for decades to hundreds of years. Other areas are nonforest because of strong winds, cold, poorly drained soils present in low-lying areas, or extremely steep terrain subject to avalanches or rock fall.

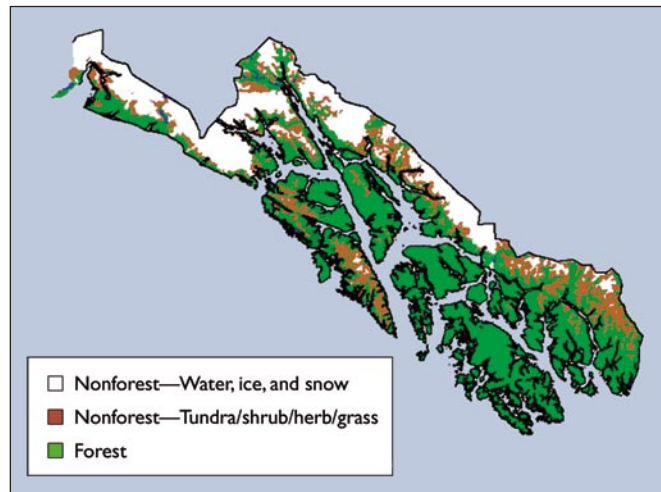


Figure 2—Land cover categories, southeast Alaska. Source: Statewide vegetation/land cover map of Alaska (Fleming 1998).

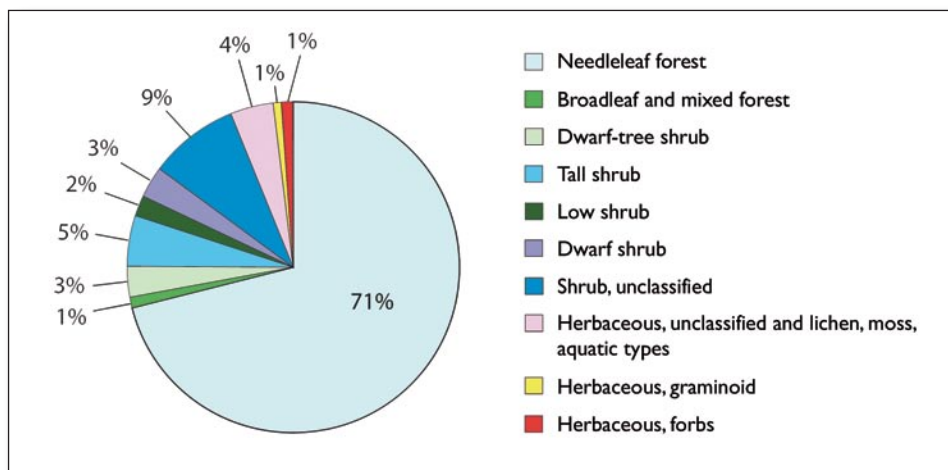


Figure 3—Area of vegetated land by vegetation type, southeast Alaska, 2000.



Mountain heather tundra. Photo by PNW-FIA.

- Dwarf-tree shrub types cover an estimated 415,000 acres, occurring either on alpine sites near treeline as krummholz or as stunted trees on wet or bog soil conditions at lower elevations.
- Tall shrub types are the most common nonforest condition sampled found on 791,000 acres, representing 5.2 percent of the vegetated area of southeast Alaska.
- Low shrub types predominate on 336,000 acres with copperbush (see “Common and Scientific Names”) type on 78,000 acres and sweetgale, a nitrogen-fixing shrub, type on 38,000 acres where it can compete in peatland areas where nitrogen is limiting.
- Dwarf shrub types including Alaska moss heather and mountain heather are found on 245,000 and 115,000 acres, respectively. Crowberry ericaceous dwarf shrub tundra occurs on 37,000 acres. Crowberry has small black berries that are favored by bears and that are eaten in small quantities by the Haida native people and more recent immigrants.
- Herbaceous types cover 905,000 acres, with mixed-herb and marsh types predominating, followed by wet sedge-tundra and alpine herb.
- Numerous other community types were documented on only a small number of plots, so detailed community descriptions and complete species lists cannot be written from the inventory data.



Open mountain hemlock. Photo by PNW-FIA.

Diversity of Vegetation

Among closed forest plots, mixed-conifer forest had the highest diversity across all locations, followed by western hemlock–Alaska cedar and western hemlock–western redcedar forest. In open and woodland forests, the highest diversity was found in mixed-conifer forests, which have lower timber productivity. Lowest diversity values were found in Sitka spruce and black cottonwood forests. This may be because the black cottonwood type, and to a lesser extent, the pure Sitka spruce type, are often found in riparian areas, which are frequently flooded causing sparser understories with primarily pioneer vegetation species.

Among tall shrub types, highest diversity was found in open tall alder-willow types. Among low shrub types, the copperbush types had the highest diversity, and among dwarf shrub types, crowberry tundra type was highest in diversity. On herbaceous plots, mixed-herb types had highest diversity and fresh sedge marshes had the lowest diversity.



Red alder stand, southeast Alaska. Photo by Tom Iraci.



Fireweed, Blueberry Hill, near Juneau. Photo by Tom Iraci.

How Much of Southeast Alaska Is Forest and Who Owns It?

LESS THAN HALF OF southeast Alaska—10.9 million acres or 48 percent—is defined as forest land (figs. 2 and 4).

The Tongass National Forest¹ manages over 85 percent of the forest land in southeast Alaska; other federal agencies manage 5 percent, state and local agencies manage 4 percent, and the remaining 5 percent is privately owned (table 1).

¹ Estimates for the Tongass National Forest presented in this publication are derived from a sample and so do not precisely match similar estimates in the Tongass Land Management Plan.

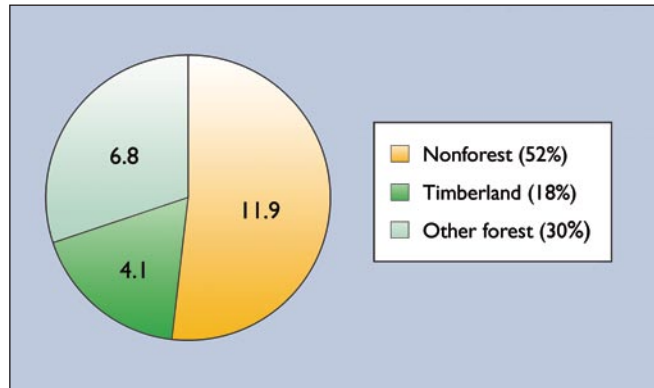


Figure 4—Area (million acres) of forest and nonforest, southeast Alaska, 2000.

Table 1—Estimated area by forest land class and owner group, southeast Alaska, 2000

Owner group	Timberland	Other forest land	Total forest land
----- Million acres -----			
National forest	3.4	5.9	9.4
Other federal	<.05	.6	.6
State and local	.3	.1	.4
Private	.4	.2	.6



Maybeso Creek and adjacent bogs, Prince of Wales Island. Photo by Tom Iraci.

What Forest Land Is Protected From Harvest?



Meadow with Bering Glacier in distance, Wrangell-St. Elias National Park. *Photo by Walter Foss.*

FORTY PERCENT OF the forest land in southeast Alaska (4.4 million acres) is reserved and includes national parks, national forest wilderness areas, and federal game refuges (fig. 5). State, local, and private lands do not currently have any forest land that is designated as reserved. In addition to forested lands officially designated as reserved (3.8 million acres), most of the timberland on the

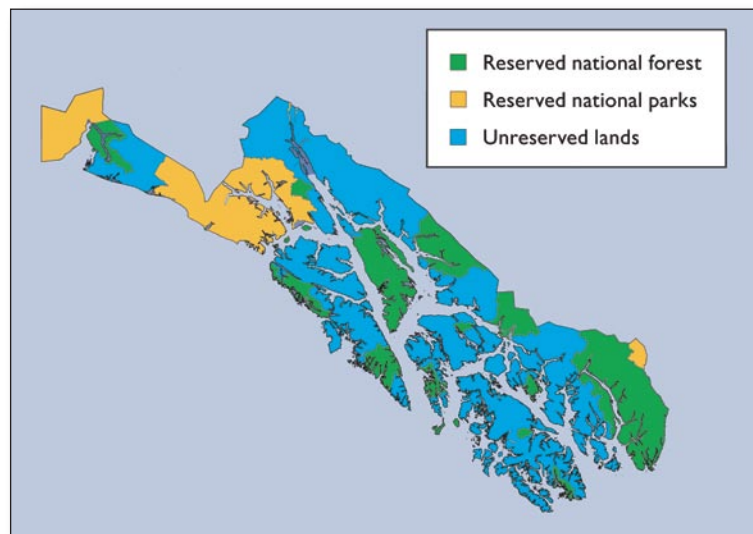


Figure 5—Protected areas in southeast Alaska. Source: Alaska Department of Natural Resources 2001.

Tongass National Forest (2.7 million acres or 80 percent) is not considered suitable for timber harvest under the Tongass Land Management Plan (USDA Forest Service 1997) because it is currently managed for other uses such as research natural areas, recreation areas, beach fringe, riparian areas, scenic viewsheds, and wild and scenic rivers. Revisions of the plan in the future could result in changes in timber production locations and acres.

How Much Timber Is Available for Harvest?

Timberland Area and Owners

A total of 4.1 million acres is classified as timberland, the productive component of forest land not withdrawn from timber harvest by law or statute.

Most of this timberland (3.4 million acres) is managed by the Tongass National Forest (fig. 6); of this, only 676,000

acres are considered suitable for timber harvest under the Tongass Land Management Plan (see “What Forest Land Is Protected From Harvest?” on page 7). The state of Alaska manages 258,000 acres of timberland, and 396,000 acres are in private ownership. Other federal agencies and municipalities, combined, manage less than 1 percent of all timberland.

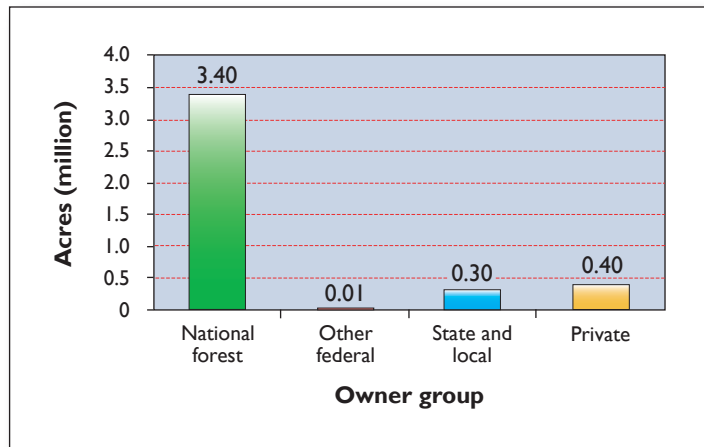
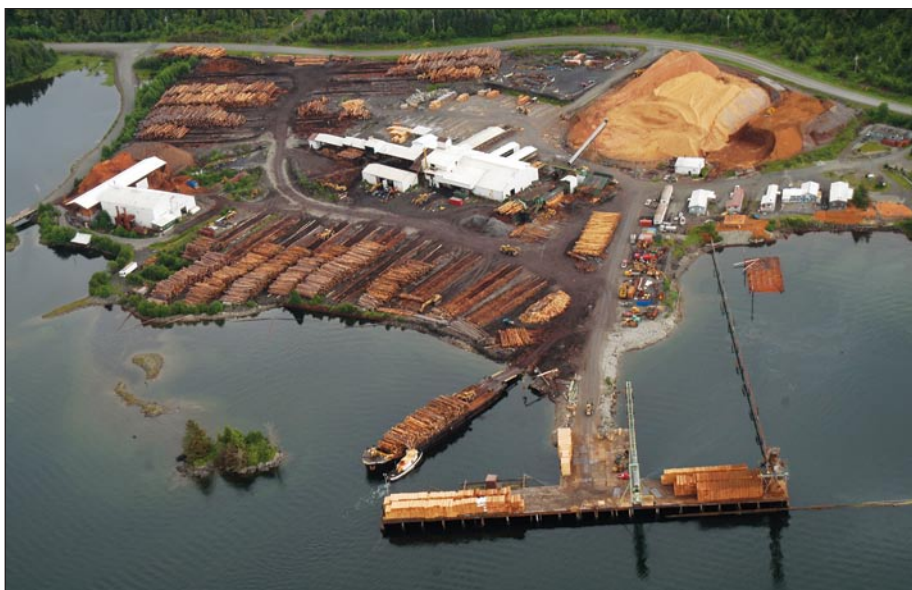


Figure 6—Area of timberland by owner group, southeast Alaska, 2000.



Mill near Craig, Alaska. Photo by Tom Iraci.



Clearcuts, southeast Alaska. Photo by Tom Iraci.

Timberland Volume and Owners

Timber availability also can be measured by the amount of wood volume available for harvest. Although the total volume of growing stock on timberland in southeast Alaska is 21.04 billion cubic feet, not all of this is available for harvest. The Tongass National Forest manages almost 88 percent (18.41 billion cubic feet) of all growing-stock volume on timberland (which is comparable to the 83 percent of timberland acres they manage) (fig. 7) but much of the timber volume on those acres is not suitable for harvest owing to restrictions under the Tongass Land Management Plan (see “What Forest Land Is Protected From Harvest?” on page 7).

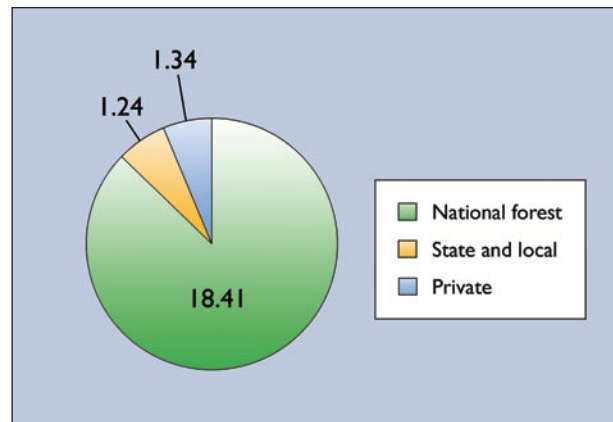


Figure 7—Growing-stock volume (billion cubic feet) on timberland by owner group, southeast Alaska, 2000.

How Much of the Forest Is Sawtimber and Where Is It ?

Area in Sawtimber

Timberland in southeast Alaska is dominated by sawtimber-sized stands (fig. 8). The majority of these stands are over 150 years old and make up about 74 percent of timberland acres (fig. 9). Eighty-eight percent of timberland on the Tongass National Forest has sawtimber stands, and 90 percent of them are more than 150 years old; in comparison, 65 percent of state, local, and private timberland has sawtimber stands of which 68 percent are more than 150 years old.

Western hemlock is either the primary species or a major component in a mix of species in most of the sawtimber-sized stands (fig. 10).

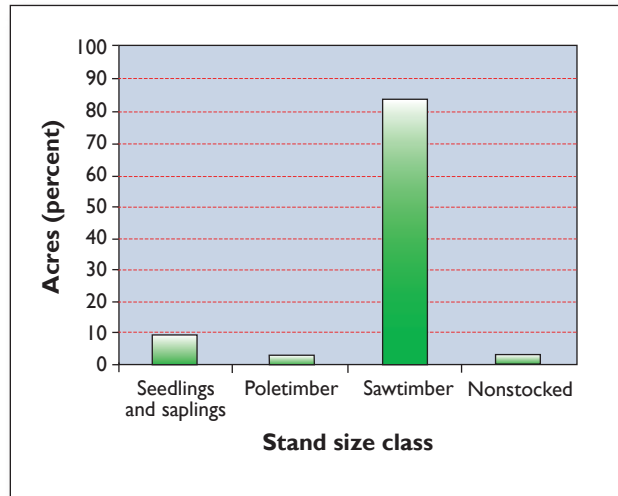


Figure 8—Percentage distribution of timberland acres by stand size classes, all owners, southeast Alaska, 2000.



Old sawtimber stand near Juneau, Alaska. Photo by PNW-FIA.

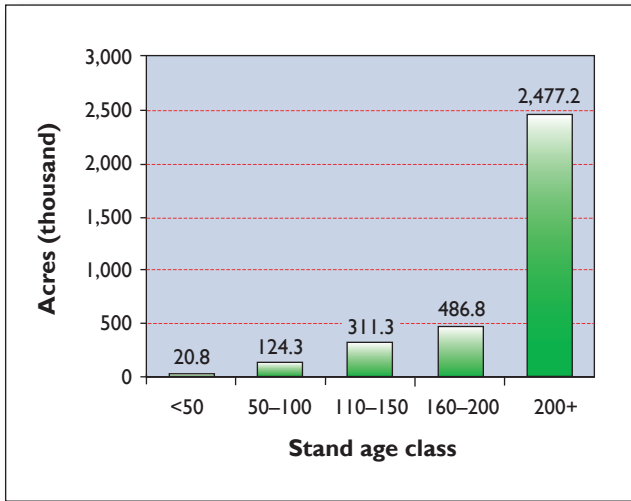


Figure 9—Distribution of sawtimber acres by stand age classes, southeast Alaska, 2000.

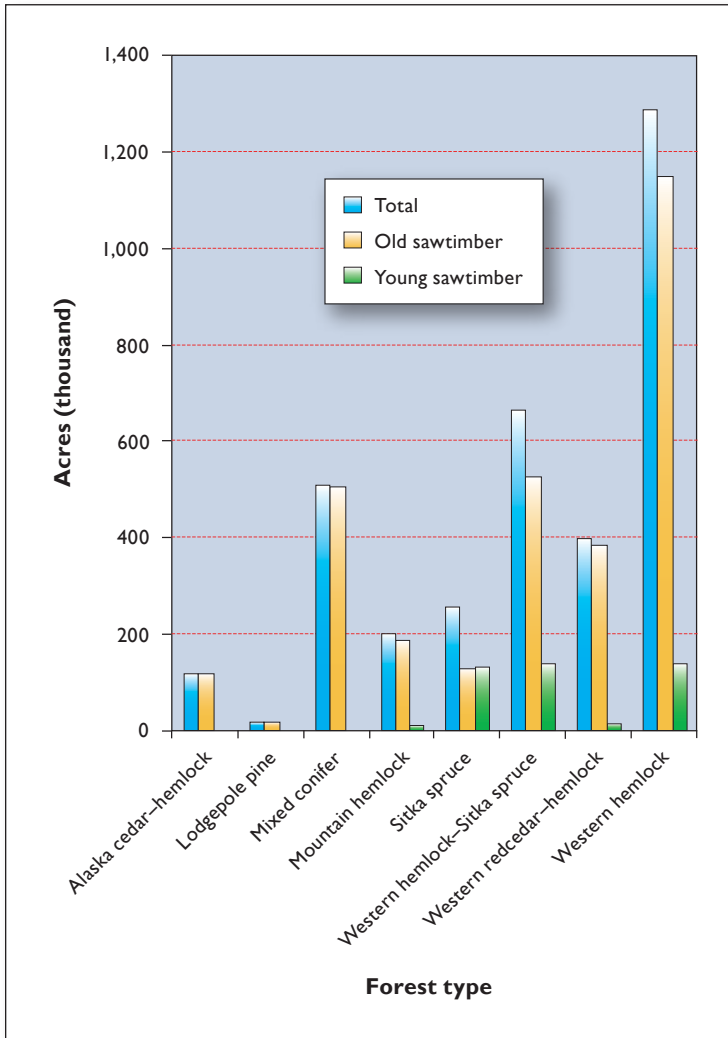


Figure 10—Area of timberland with sawtimber by softwood forest type, southeast Alaska, 2000.

Sawtimber Volume

The bulk, 84 percent (17.68 billion cubic feet), of all growing-stock volume on timberland is in old sawtimber-sized stands. An additional 15 percent (3.11 billion cubic feet) is in young sawtimber-sized stands. Over one-third of the timberland volume is in old sawtimber-sized stands of western hemlock (fig. 11). Along with stands of western hemlock–Sitka spruce, the old sawtimber-sized stands of these two forest types account for 52 percent (11.02 billion cubic feet) of the total volume.

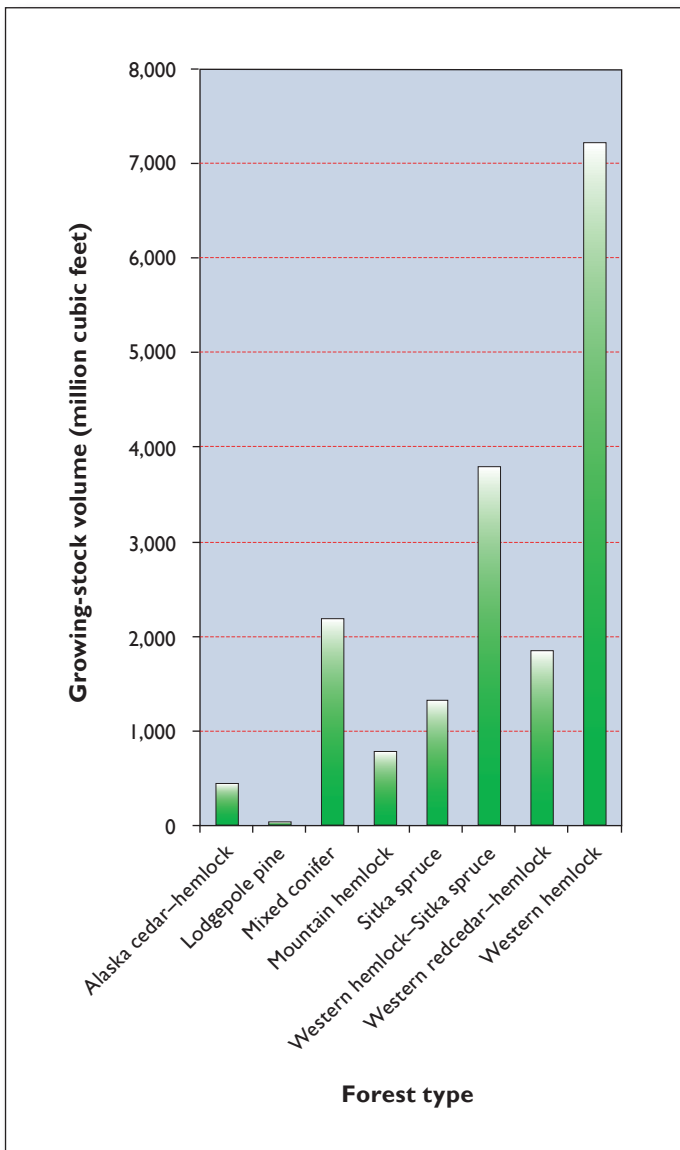


Figure 11—Volume of old sawtimber growing stock on timberland by softwood forest type, southeast Alaska, 2000.

What Is the Productivity of Southeast Alaska Timberland?

PRODUCTIVITY IN THIS SECTION refers to timber productivity rather than other measures of forest productivity. Most timberland in southeast Alaska is only slightly more productive than the minimum needed to qualify as timberland. Only about 23 percent of all southeast Alaska timberland produces more than 85 cubic feet per acre per year. In comparison, 86 percent of timberland in western Washington produces more than 85 cubic feet per acre per year (MacLean et al. 1992). Timber productivity in Alaska tends to be lower than elsewhere because a higher percentage of the forest is marginally productive—a characteristic of more northern latitudes. Stands with the greatest tree volume are generally near tidewater, with stand heights and wood quality diminishing with increasing elevation (Harris and Farr 1974).

Timber Productivity by Owner

The majority of forest stands on the Tongass National Forest are in the lower productivity classes (fig. 12). Highly productive timberland (>165 cubic feet per acre per year) is a minor component of southeast Alaska’s forests; only 32,000 acres of timberland are in this category and all are on the Tongass. Nearly 40 percent of state and local timberland, however, is of relatively high productivity, producing between 85 and 165 cubic feet per acre per year. On private timberland, only 18 percent produces over 85 cubic feet per acre per year.

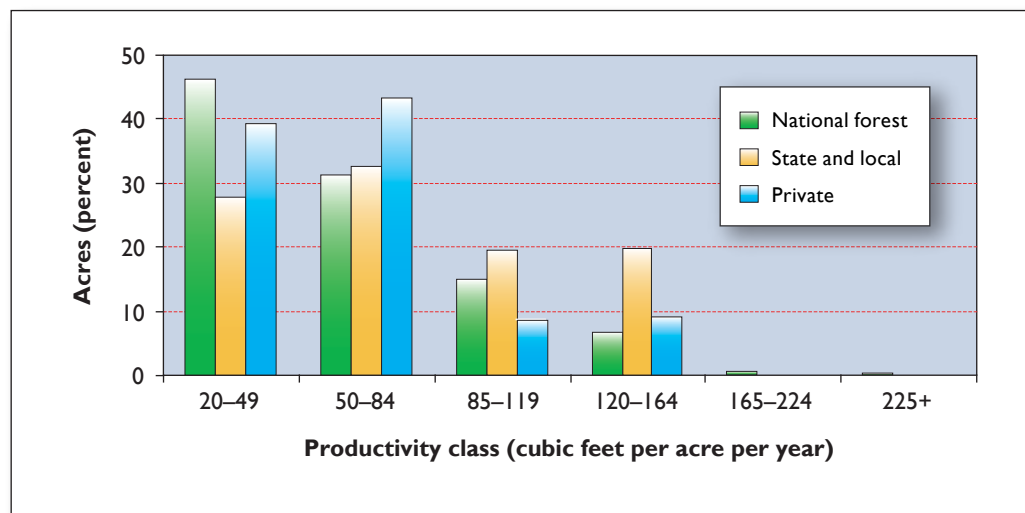
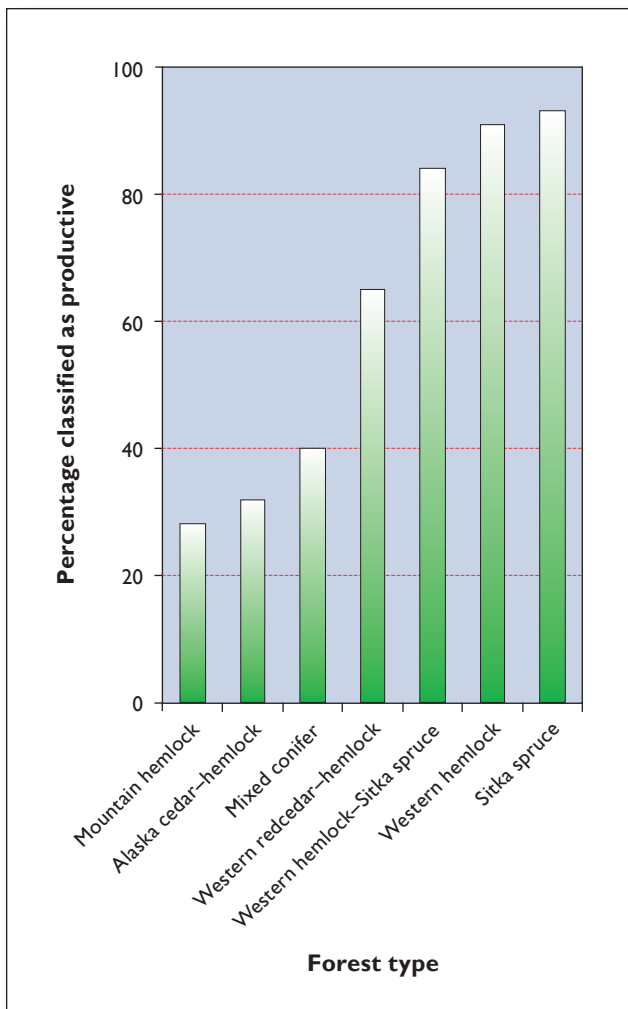


Figure 12—Percentage distribution of timberland acres by owner groups and cubic-foot site productivity classes, southeast Alaska, 2000.



Uneven-aged stands on the Maybeso Experimental Forest, Prince of Wales Island. Photo by Tom Iraci.



Timber Productivity by Forest Type

Productivity is highest in stands of Sitka spruce, western hemlock, and mixed hemlock and spruce (fig. 13). Mixed conifer, mountain hemlock, and Alaska cedar-hemlock stands have the lowest productivity.

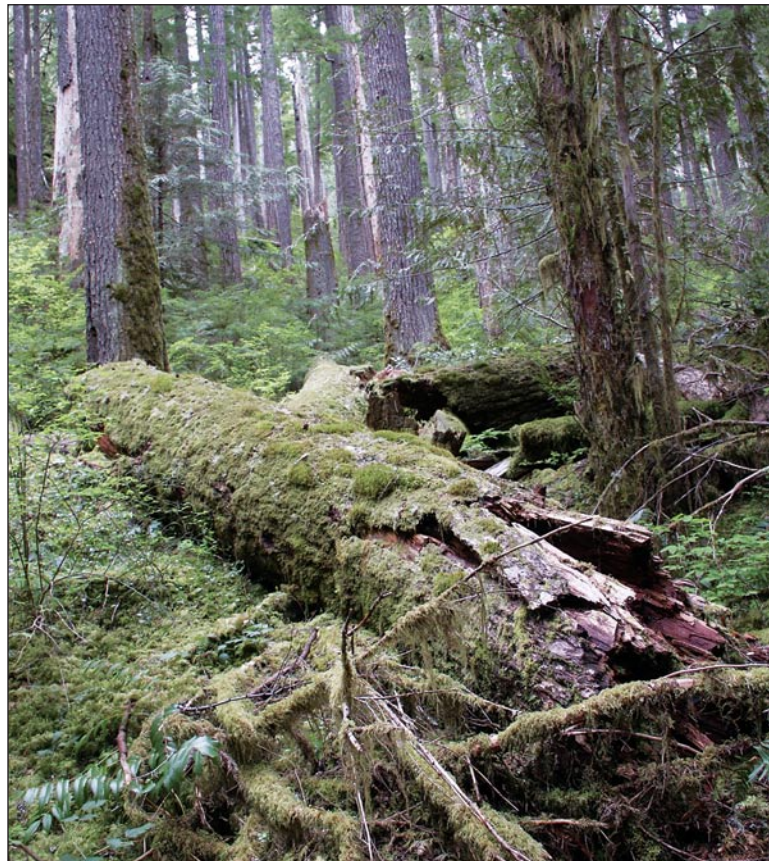
Figure 13—Percentage of unreserved forest land stands classified as productive (capable of producing >20 cubic feet per acre per year) by forest type, southeast Alaska, 2000.

What Is the Rate of Growth, Mortality, and Harvest?

Growth, Mortality, and Harvest

Average gross annual growth of growing stock on timberland is estimated at 174.1 million cubic feet. Growth exceeded mortality for growing stock on timberland for all owners (fig. 14), resulting in overall positive net growth.

About one-third of the gross growth, or 60.3 million cubic feet, occurred in the western hemlock forest type (fig. 15). All forest types except for mixed conifer showed positive net growth (gross growth minus mortality). In the mixed-conifer type, mortality (primarily in old sawtimber-sized stands) exceeded gross growth, resulting in a negative net growth of -3.2 million cubic feet.



Down dead trees in western hemlock stand. *Photo by Karen Waddell.*

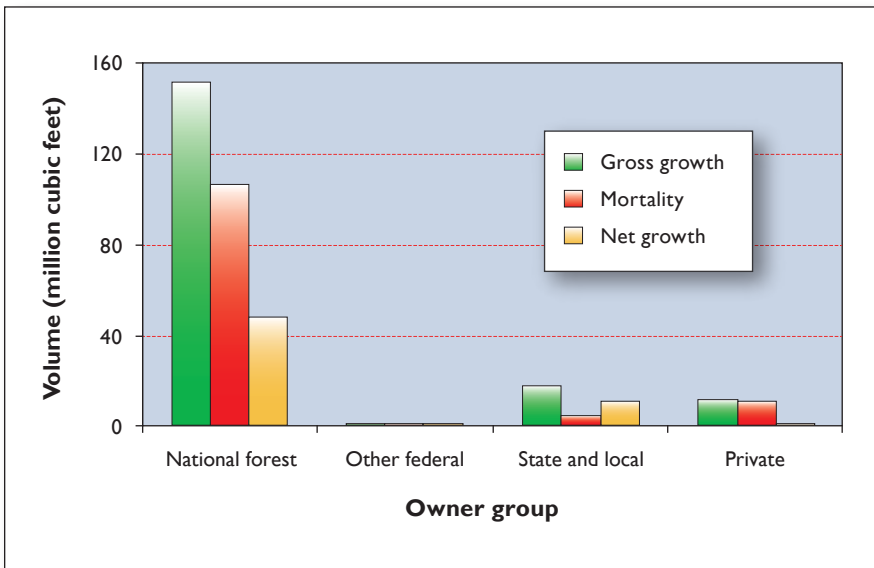


Figure 14—Average gross annual growth, average annual mortality, and average net annual growth (gross growth minus mortality) by owner group, southeast Alaska, 2000.

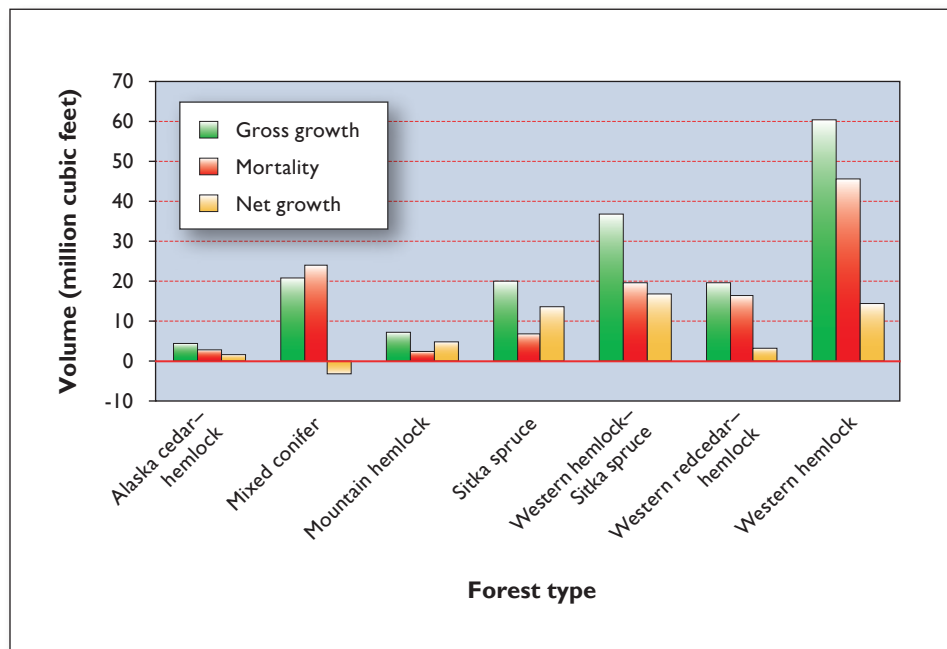


Figure 15—Average gross annual growth, average annual mortality, and average net annual growth of growing stock on timberland by softwood forest type, southeast Alaska, 2000.



Logging truck, with old dead and young live trees in foreground. Photo by Andy Tasler.

Harvest levels in southeast Alaska have decreased in recent years, from over 126 million cubic feet in 1995 to about 50 million in 2001. Levels have fluctuated by owner with removals on the Tongass National Forest generally decreasing, thus influencing the overall level. Harvest has increased significantly on state lands since 2000 and has decreased almost annually since 1997 on private lands. State lands and the Tongass National Forest showed net growth (gross growth minus mortality) exceeding annual harvest amounts for most years since 1995 (fig. 16). Harvest levels on private lands were much higher than net growth for all years despite decreasing harvest levels (fig. 16).

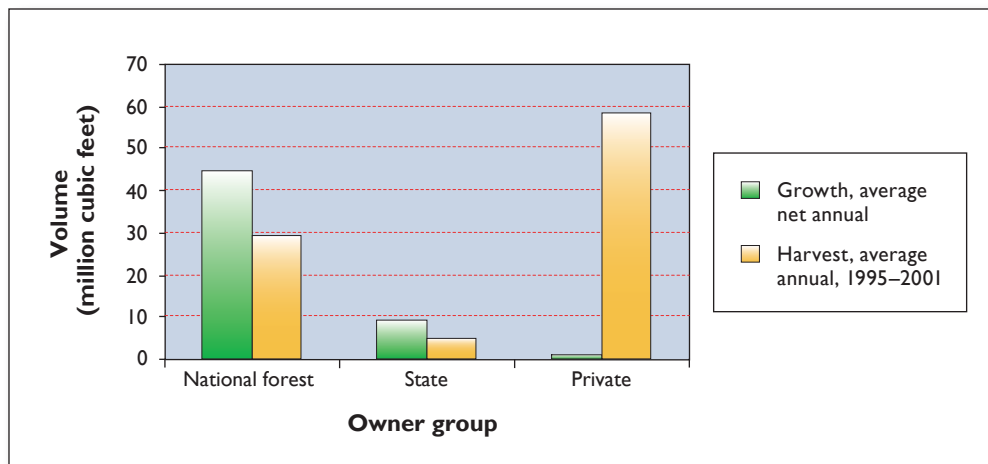


Figure 16—Annual average growth and harvest for sawtimber on timberland by owner group, southeast Alaska, 2000. Source: USDA Forest Service, Alaska Region.

Common and Scientific Names

Common name	Scientific name
Trees:	
Alaska cedar	<i>Chamaecyparis nootkatensis</i> (D. Don) Spach
Black cottonwood	<i>Populus balsamifera</i> L. ssp. <i>trichocarpa</i> (Torr. & Gray ex Hook.) Brayshaw
Lodgepole pine	<i>Pinus contorta</i> (Dougl.) ex Loud.
Mountain hemlock	<i>Tsuga mertensiana</i> (Bong.) Carr.
Red alder	<i>Alnus rubra</i> (Bong.)
Sitka spruce	<i>Picea sitchensis</i> (Bong.) Carr.
Western hemlock	<i>Tsuga heterophylla</i> (Raf.) Sarg.
Western redcedar	<i>Thuja plicata</i> (Donn) ex D. Don
Other vegetation:	
Alaska moss heather	<i>Cassiope mertensiana</i> (Bong.) D. Don.
Copperbush	<i>Elliottia pyroliflorus</i> (Bong.) S.W. Brim & P.F. Stevens
Crowberry	<i>Empetrum nigrum</i> L.
Fireweed	<i>Chamerion angustifolium</i> (L.) Holub
Mountain heather	<i>Phyllodoce</i> spp. Salisb.
Sweetgale	<i>Myrica gale</i> L.

Metric Equivalents

- 1 inch = 2.54 centimeters
- 1 foot = 0.3048 meters
- 1 mile = 1.609 kilometers
- 1 acre = 0.4047 hectares
- 1 cubic foot = 0.0283 cubic meters
- 20 cubic feet per acre = 1.3994 cubic meters per hectare

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Glossary

average gross annual growth—The increase in net volume of wood (the gross volume less deductions for defect) for growing-stock trees during the year.

average net annual growth—Average gross annual growth minus the volume of trees that died during the year (average annual mortality).

cull trees—Live trees of sawtimber or poletimber size that are not merchantable for saw logs and are unlikely to become merchantable because of defect, rot, or species.

d.b.h.—Diameter at breast height.

forest land—Land that is at least 16.7 percent stocked by live trees of any size or that formerly had such tree cover and is at least an acre in size and 120 feet wide.

forest type—A classification of forest land based on the species forming a plurality of stocking on the area currently occupied by tree cover. Identification of the appropriate forest type for this inventory required a decision process described in van Hees 2003.

growing-stock trees—All live trees except cull trees.

growing-stock volume—Net volume in cubic feet of live sawtimber and poletimber growing-stock trees from stump to a minimum 4.0-inch top (of central stem) outside the bark. Net volume equals gross volume less deductions for rot and missing stem sections.

land class—A classification of land by major use, such as timberland, other forest, or nonforest. The minimum size (area) for classification is 1 acre.

mortality—The volume of wood from trees that died from natural causes during a specified period.

nonforest land—Land that does not qualify as forest land. Includes land that has never supported forests and lands formerly forested where forest use is precluded by development for nonforest uses.

other forest land—Forest land not capable of producing 20 cubic feet per acre per year or more of wood and not withdrawn from timber use by statute or administrative regulation.

reserved forest land—Forest land withdrawn from timber use through statute or administrative regulation.

sawtimber stands—Stands at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber trees (growing-stock trees at least 11.0 inches in d.b.h. for hardwoods and 9.0 inches for softwoods) or poletimber trees (growing-stock trees greater than 5.0 inches and less than 11.0 in d.b.h.) and with sawtimber stocking at least equal to that of poletimber.

sawtimber volume—Net volume of sawtimber trees measured in board feet. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber. Board feet are often converted to cubic feet.

seedling and sapling stands—Stands at least 16.7 percent stocked with growing-stock trees and with saplings (1.0 to 4.9 in d.b.h.) or seedlings (<1.0 in d.b.h.) composing more than half this stocking.

stand size class—A classification of forest land based on the predominant size of trees present: sawtimber, poletimber, or seedlings and saplings.

stand age class—The 10-year age class that best characterizes the stand.

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

timberland—Forest land that is capable of producing 20 cubic feet of wood per acre per year and is not reserved from timber harvest.

vegetation diversity—The average number of distinct species across all locations, also called species richness or alpha diversity.

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