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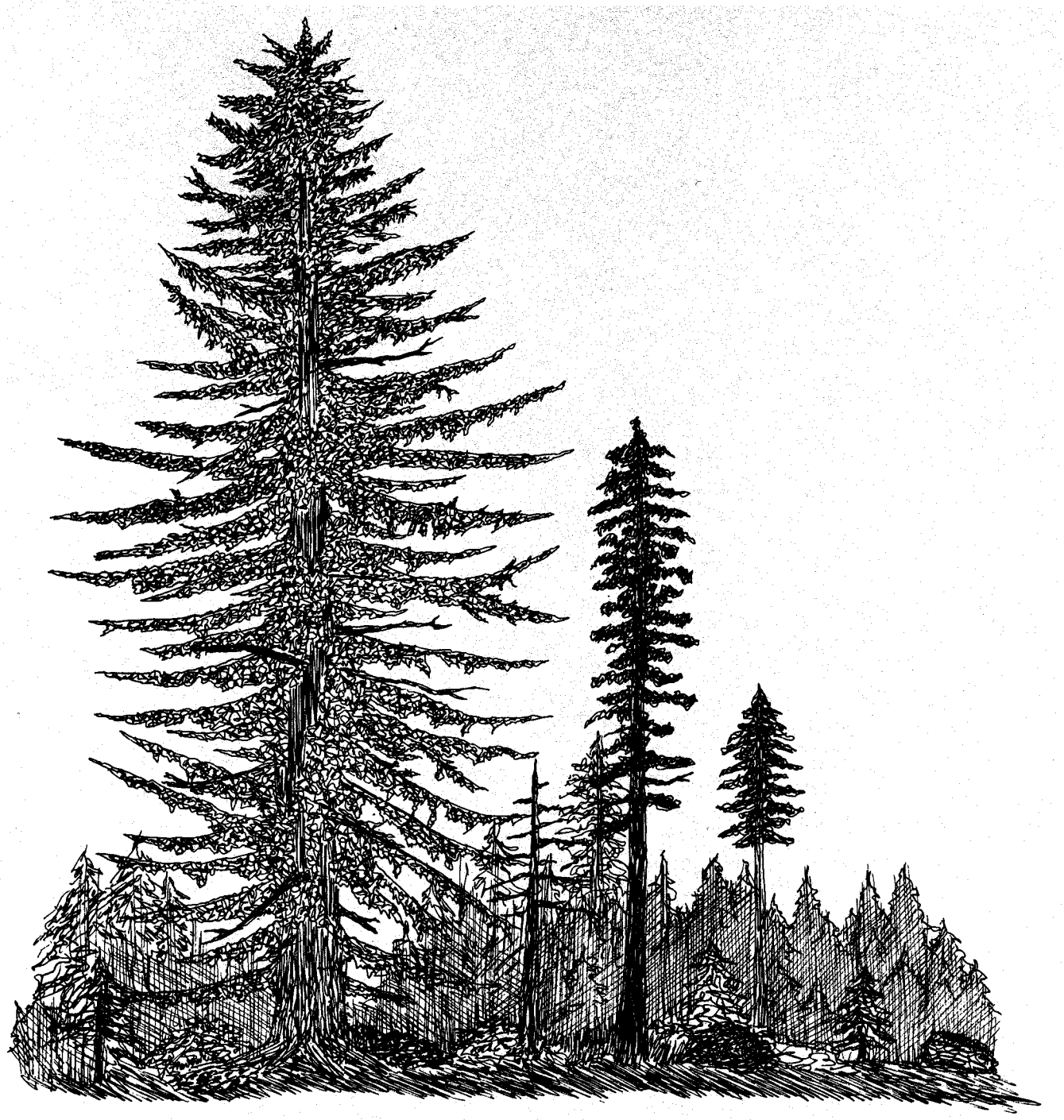
Timberland Resource of the Kenai Peninsula, Alaska, 1987

Willem W.S. van Hees and Frederic R. Larson



Authors

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Abstract

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The 1987 inventory of the forest resources of the Kenai Peninsula was designed to assess the impact of the spruce beetle *(Dendroctonus rufipennis* (Kirby)) on the timberland component of the forest resource. Estimates of timberland area, volumes of timber, and growth and mortality of timber were developed. These estimates of timber resource quantities were also categorized by owner. Total timberland area was estimated at 482 thousand acres. Cubic volume on this timberland was estimated at 1,211,577 thousand cubic feet. Timber growth and mortality were estimated at 9,245 and 7,958 thousand cubic feet, respectively. Detailed tables provide additional breakdowns of inventory results.

Keywords: Forest surveys, timber resources (insect damage), statistics (forest), Alaska (Kenai Peninsula).

Summary

A double sampling (two-phase) procedure was used to make estimates of area and volume. The first phase interpreted 5,597 aerial-photo sample plots. The plots on these photos were stratified by land class (timberland, other forest land, nonforest, and water). From the 5,597 photo points, a random sample of 1,216 plots was selected for further examination. From these, 130 were selected for visits on the ground. Tree measurements were made on these 130 plots in the second phase of the sampling to provide data for derived volume estimates. Area estimates were derived from proportional distribution of photo points adjusted to ground information.

The total area of the Kenai Peninsula inventory unit is estimated at 5,215 thousand acres. Forest land makes up about 1,909 thousand acres, nonforest 3,094 thousand acres, and water the remaining 212 thousand acres. Of the forested acres, 482 thousand are timberland. The most prevalent forest type on all forest land is white spruce (364 thousand acres), and then birch (154 thousand acres). Cubic volume on all timberland is estimated at 1,212 million cubic feet and growth and mortality volumes on this timberland are, estimated at 9,245 and 7,958 thousand cubic feet, respectively.

Preface

Forest Inventory and Analysis (FIA) is a nationwide project of the USDA Forest Service authorized by the Forest and Rangeland Renewable Resources Research Act of 1978. Work units of the project, located at Forest Service Experiment Stations, conduct forest resource inventories throughout the 50 States. The Pacific Northwest Research Station at Portland, Oregon, has responsibility for forest inventories in Alaska, California, Hawaii, Oregon, Washington, and the American Pacific Trust Islands.

Contents

Tables[1]

[1]Tables 1-22 are standard-format tables produced by FIA units throughout the Western United States. Tables 23-35 provide supplemental detailed information.

Highlights

	Thousand acres	*Thousand hectares*
Total Kenai Peninsula areas:	5,215	2,110
Forest land	1,909	772
Nonforest land	3,094	1,252
Non-Census water	24	10
Census water	187	76
Forested area:		
Timberland	482	195
Available timberland	287	116
Marginal timberland	1,351	547
Other forest land	76	31
Forest land type composition:		
Black spruce	44	18
Mountain hemlock	68	28
Sitka spruce	82	33
White spruce	364	147
Black cottonwood	3	1
Paper birch	154	62
Quaking aspen	6	2
Nonstocked and unclassified	1,187	481

	Growing stock		**Sawtimber**	
	Thousand cubic feet[a]	*Thousand cubic meters*[a]	*Thousand board feet*[b]	*Thousand cubic meters*[c]
Volumes on available timberland:				
Net volume	823,480	23,304	2,764,668	20,032
Net annual growth	5,696	161	25,865	103
Annual mortality	5,289	150	17,786	133

[a] Net volume of roundwood for growing stock trees 5.0 inches in d.b.h. (diameter at breast height) and larger.
[b] Net volume, Scribner rule, for softwood trees 9.0 inches and larger and for hardwood trees 11.0 inches in d.b.h. and larger.
[c] Net volume of roundwood for softwood trees 9.0 inches and larger and for hardwood trees 11.0 inches in d.b.h. and larger.

Introduction

The Kenai Peninsula of south-central Alaska, between 148°30' and 152°00' west longitude and between 59°05' and 61°05' north latitude (fig. 1) is rich in historic, cultural, and physical resources. In 1778, Captain James Cook sailed up the inlet on the western side of the peninsula. Shortly after Cook's expedition, Spaniards mounted three expeditions in this region. Russians, already established on Kodiak Island, also made many forays up Cook Inlet to the Kenai Peninsula.

Much of the cultural background of the Kenai Peninsula stems from the presence of the Kenaitze people and their interaction with Chugach tribes in Prince William Sound, the Koniag of Kodiak, and Russian fur traders. The Kenaitze are Athabascans, of the Tanaina tribe (Pedersen and Pedersen 1983).

More recently, homesteading helped increase the non-Native population on the Kenai Peninsula. Before World War II, homesteading was negligible. Although there was a surge in this activity after the war due to favorable agreements for veterans, actual habitation and use of the homesteads was less than expected. Of all patented or entered homestead land, 59 percent was found unoccupied or abandoned by mid-1955 (Johnson and Coffman 1956). Although the State of Alaska continues to make lands available to the public through different land-disposal programs, homesteading on the Kenai Peninsula has dwindled. Physically, the resources of the Kenai Peninsula are rich and diverse. Deposits of precious metals, large salmon fisheries, extensive stands of timber, and many large game mammals are a few of the resources available. Also, the presence of ice-free saltwater ports at Homer and Seward enhances the economic character of the region.

The Kenai Peninsula is characterized by a maritime climate. In contrast to areas entirely within interior Alaska, winters are warmer, summers cooler, and precipitation heavier. Precipitation, including the water equivalent of snow, is between 60 and 200 inches per year. Surface winds can be strong and persistent in this region, and average temperatures range from 5 to 60 °F (Selkregg 1974). The broad range of precipitation and temperature values reflects the diverse physiographic nature of the peninsula. The western half of the Kenai Peninsula is characterized by interior Alaska conditions and the eastern half is, for the most part, coastal.

During summer 1987, crews working with Forest Inventory and Analysis (FIA) Alaska collected data from ground plots for the field portion of the forest resources inventory of the Kenai Peninsula. These data provided the bulk of the raw material needed to develop estimates of different forest resource characteristics. These estimates, in turn, are necessary for State and national resource planners to more effectively direct resource conservation and usage activities.

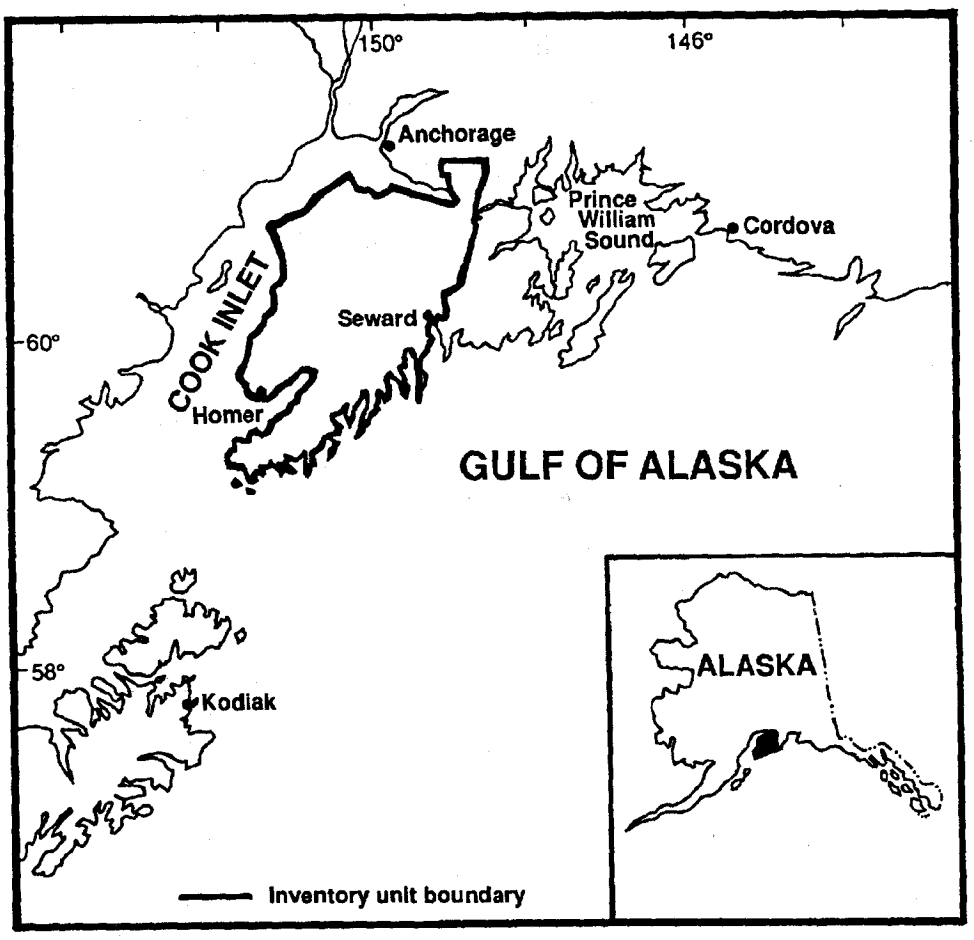

Figure 1—Kenai Peninsula timber inventory unit, 1987.

Inventory Procedures

The estimates of area and timber volumes from the 1987 timber inventory were based on a double sampling (two-phase) technique (Bickford 1952). In the first phase of the sampling study, 5,597 photo points were systematically distributed over 1:60,000-scale aerial photographs and then interpreted. Each photo point was stratified by land class (timberland, other forest land, nonforest, and water). From the 5,597 photo points, a random sample of 1,216 plots was selected for further examination. From these, 130 were selected for visits on the ground. Tree measurements were made on these 130 plots, in the second phase of the sampling, to provide data for derived volume estimates. Area estimates were derived from proportional distribution of photo points adjusted to ground information. Corrected area classifications and measurements of volume on these ground plots were the basis for the area and volume estimates presented in this paper.

So that area and volume estimates could be separable into different ownership categories, each aerial photo point was placed in an owner class reflective of the majo owner of the section (640 acres) of land on which the photo point fell. Relevant ownership information was obtained from the U.S. Department of the Interior, Bureau c Land Management (BLM) land title records available in Anchorage, Alaska. Proportion of photo points by owner were applied to area and volume estimates to provide breakdowns of these estimates by owner class.

Results

In the south-central region of Alaska, which includes the Kenai Peninsula, white spruce[2] and Sitka spruce cross-pollinate to form the hybrid Lutz spruce. Identification of Lutz spruce from physical characteristics apparent to the unaided eye is not consistent. Although FIA field crews attempted this identification, it became apparent during data analysis that there were difficulties. Lutz spruce is more similar to white spruce than to Sitka spruce in its habitat; it is more commonly found growing with tree species such as birch that are common associates of the white spruce forest type. Fo this reason, estimates of resource attributes relevant to Lutz spruce were grouped wit those of white spruce for final analysis and presentation in this report.

Area

Nearly 37 percent (1.9 million acres) of the total area of the Kenai Peninsula, 5.2 million acres, is forested. Timberland, in turn, comprises 25 percent, or 481.7 thousand acres, of the forest land total. Timberland makes up about 9 percent of the total Kenai Peninsula area. Not all this timberland is potentially available for forest products. About 195.1 thousand acres, or 40 percent of the timberland total, is in national parks and preserves and is reserved from timber usage (fig. 2).

Current ownership distribution of the forest resources on the Kenai Peninsula has been influenced by two major pieces of national legislation-the Alaska Native Claims Settlement Act 1971 (Public Law 92-203) and the Alaska National Interest Lands Conservation Act of 1980 (Public Law 96-487)-and by homesteading activities mentioned above.

Available timberland is relatively evenly divided among three ownership categories (timberlanc shown as "other Federal" are reserved). The U.S. Department of Agriculture (USDA) Forest Service administers 27 percent (78,773 acres) of the available timberland (or 16 percent of all timberland), the State of Alaska administers 33 percent (94,316 acres or 20 percent of all timberland), and the remaining 113,423 acres (40 percent of available timberland or 24 percen of all timberland) is held by various private owners (fig. 2).

White spruce is the, most common forest type in the available timberland base. It is the dominant forest cover on 136,711 acres, or 49 percent, of the available timberland. Reserved timberland, however, is predominantly birch. On these lands, birch covers 45 percent (88,122 acres) of the timberland whereas white spruce covers 40 percent (78,813 acres).

[2] See the section "Names of Trees" for scientific nomenclature.

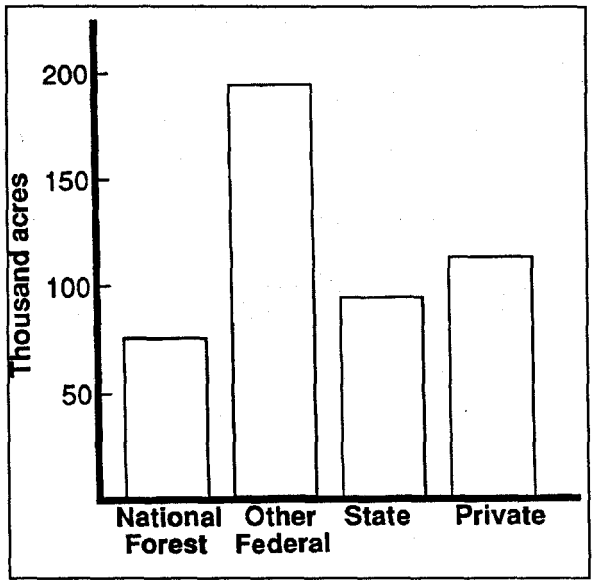

Figure 2—Area of timberland by owner, Kenai Peninsula, 1987.

The forests of the Kenai Peninsula have been, and currently are, influenced by an infestation of spruce beetles *(Dendroctonus rufipennis* (Kirby)). White spruce is the species of choice for the beetle, but Sitka spruce has also been attacked.

With the spruce beetle infestation concentrated in white spruce stands, distribution of the ownership of these stands may affect the course of the infestation. Timely removal of trees killed by beetle attack is important in reducing the rate of population spread. Thus, goals owners have for the use of timber on their land may be deciding factors in stemming the infestation.

Currently, white spruce stands on reserved land (78,814 acres), are not available for commercial-scale timber harvesting and will likely play no significant role in reducing infestation levels, except through natural processes. The USDA Forest Service has about 31,749 acres of white spruce stands (22 percent of all available white spruce timberland). Alaska controls 51,434 acres of white spruce (36 percent of available white spruce timberland), and private owners control the remaining 58,451 acres (41 percent of available white spruce timberland). Because no one owner controls management of all the susceptable spruce stands on the Kenai Peninsula, efforts at infestation control must come from all owners.

Volume

The forest lands of the Kenai Peninsula support about 1,545 million cubic feet of growing stock volume. Nearly 67 percent (1,035 million cubic feet) of this volume is on available forest lands; the remainder is on reserved lands. Most (78 percent) of the forest-land volume is concentrated on timberlands. Also, slightly more than half (53 percent or 823 million cubic feet) of the forest-land total is on available timberland. About 25 percent of the total volume is on reserved timberland, and the remaining 22 percent is on available and reserved other forest land.

Although estimates presented in this report focus on forest resource values relevant to the timberland base, spruce beetle activity is not limited to white spruce growing only on timberland.

In concert with area statistics presented above, most of the growing stock volume on available timberland is in the white spruce forest type; however, on reserved timberland, both white spruce and paper birch types have almost equal volumes. The white spruce type on available timberland has about 393 million cubic feet (48 percent of the volume on available timberland), and paper birch and white spruce on reserved timberland have 159 and 157 million cubic feet (41 percent of the volume on reserved timberland), respectively.

Within a given forest type such as white spruce, not all volume is in trees of the species for which the type is named. On reserved timberlands, 69 percent of the volume in the white spruce forest type is actually in white spruce trees. On available timberlands, the comparable percentage is 84 percent. On both reserved and available timberland, the bulk of the remaining volume in the white spruce forest type is in hardwood trees.

Ownership of the volume on timberland follows that of timberland area (fig. 3). The largest segment of volume on timberland is that on reserved (other Federal) lands. These lands currently support about 388 million cubic feet (32 percent of all volume on timberland) of growing stock volume. Cubic volume per acre on reserved lands is, however, the lowest of all owner categories at 1,988 cubic feet per acre across all forest types. Private owners control about 29 percent (350 million cubic feet) of the volume on all timberland. Also, cubic volume per acre is higher on privately owned timberland than on lands otherwise owned. The average privately owned acre of timberland has 3,083 cubic feet on it. The third most prevalent owner of cubic volume on timberland is the State of Alaska with about 23 percent (277 million cubic feet) of the available total, followed by the USDA Forest Service which has the remaining 16 percent (203 million cubic feet) of the volume on available timberland. The average cubic volume per acre for Alaska is 2,940; for the USDA Forest Service the average is 2,494 cubic feet per acre.

Examination of ownership of timber volume available for active management and susceptible to spruce beetles can help focus energies to slow spread of the infestation. Slightly more than 20 percent of the available timberland volume is in white spruce stands privately owned. On these lands, the cubic volume per acre is 2,877. If all forest types are included, cubic volume in privately owned white spruce trees makes up 21 percent of the available timberland volume. Cubic volume in white spruce stands on State lands amounts to 18 percent of the available total with a per acre average of 2,812 cubic feet. Species volume for State-owned white spruce trees amounts to 18 percent of the available volume. For the USDA Forest Service, the respective figures are 10 percent of the total available volume in white spruce stands, with a per-acre value of 2,534 and species volume of 13 percent of available volume.

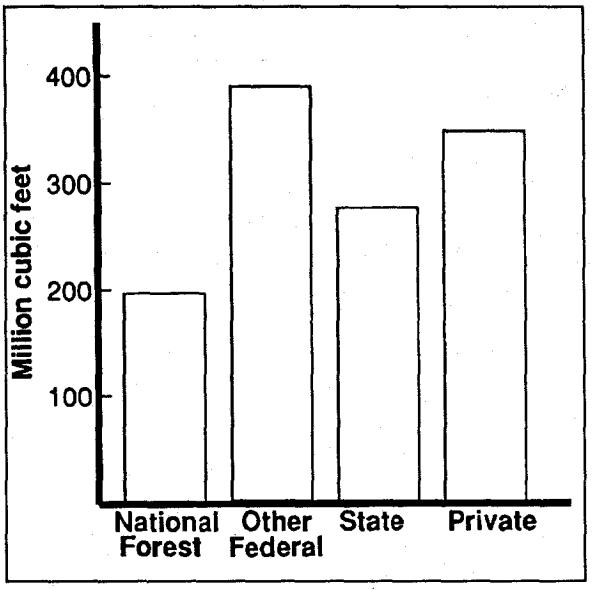

Figure 3—Net volume of growing stock on timberland, by owner, Kenai Peninsula, 1987.

Growth

Estimates of annual growth presented in this report are averages over the 10 years before the date of inventory. Increment cores taken from trees selected for detailed growth measurements were examined to establish the extent of decadal radial growth. The average annual growth from these measurements was used in growth computation algorithms. In the remainder of this report, gross and net growth estimates are averages, though the word "average" is not always used.

Gross growth (net annual growth plus mortality) on all timberland was estimated at 17,203 thousand cubic feet. This translates into a growth rate (gross growth divided by net volume) of about 1.42 percent. Comparable figures for available and reserved timberland are 1.33 and 1.60 percent. By ownership class the values are USDA Forest Service, 1.29; State of Alaska, 1.36; and for privately owned timberland, 1.34 percent.

Over the entire Kenai Peninsula, net annual growth of growing stock timber, on timberland, is positive, as estimated by this inventory. The estimate of net growth on all timberland is 9,245 thousand cubic feet. This amount of growth is nearly 1 percent of total growing stock volume on all timberland. About 62 percent of this growth volume (5,696 thousand cubic feet) is on available timberland. Growth on reserved timber was estimated at 3,549 thousand cubic feet.

About 49 percent (4,555 thousand cubic feet) of the net growth on all timberland was in the white spruce forest type. The Sitka spruce forest type accounted for 3,033 thousand cubic feet (33 percent), and the paper birch type accrued 1,555 thousand cubic feet (17 percent) of the total growth on all timberland. By species, the results rank similarly, except that growth on Sitka spruce trees (3,081 thousand cubic feet) was more than on other species. White spruce trees amassed 2,414 thousand cubic feet of growth, and paper birch about 2,053 thousand cubic feet. The reader may

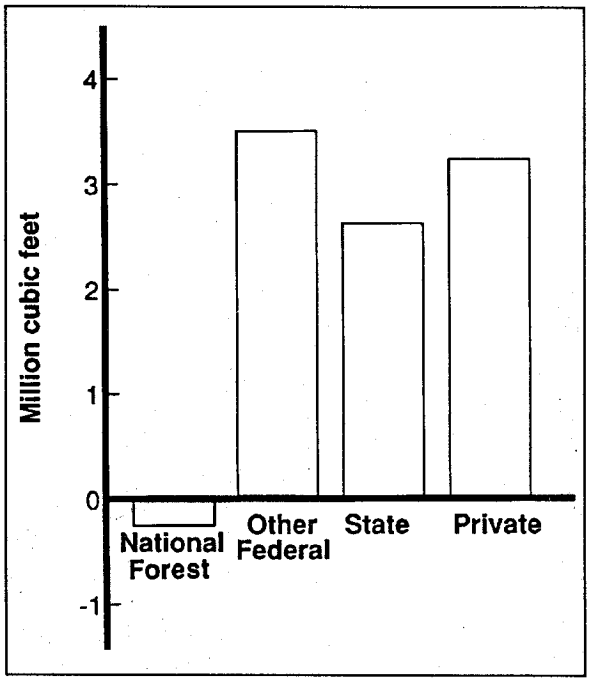

Figure 4—Net annual growth of growing stock on timberland, by owner, Kenai Peninsula, 1987.

note that black spruce growth, although low (245 thousand cubic feet), is significantly higher than that of white spruce when expressed as growth rate. This is a result of the sampling method, not because of actual growth rates.

Although net annual growth on timberland was positive overall, growth within specific regions of the Kenai Peninsula, as indicated by ownership patterns, differed significantly. Reflective of current spruce beetle infestation patterns, net annual growth of growing stock on timberland stands of white spruce managed by the USDA Forest Service was negative, thereby indicating that mortality exceeded gross growth. Net growth on these stands was -1,252 thousand cubic feet. Growth on other forest types under USDA Forest Service management was positive, but the large amount of mortality from beetles (see below) caused overall net growing stock growth on USDA Forest Service lands to be negative, amounting to -245 thousand cubic feet. Net growing stock growth on privately controlled timberlands was about 3,310 thousand cubic feet, on State lands it was 2,630 thousand cubic feet, and on reserved timberlands it was 3,549 thousand cubic feet (fig. 4).

Mortality

Estimates of mortality presented here are averages over the 5 years before the date of inventory. Like growth estimates, annual mortality estimates are averages, though the word "average" is not always used.

Average annual mortality on timberland, for the 5 years before this inventory was estimated at 7,958 thousand cubic feet per year. Sixty-six percent (5,289 thousand cubic feet) of this was on available timberlands.

Apparently the spruce beetle has had a significant impact on overall mortality. On all timberlands, insect damage is responsible for 52 percent (4,157 thousand

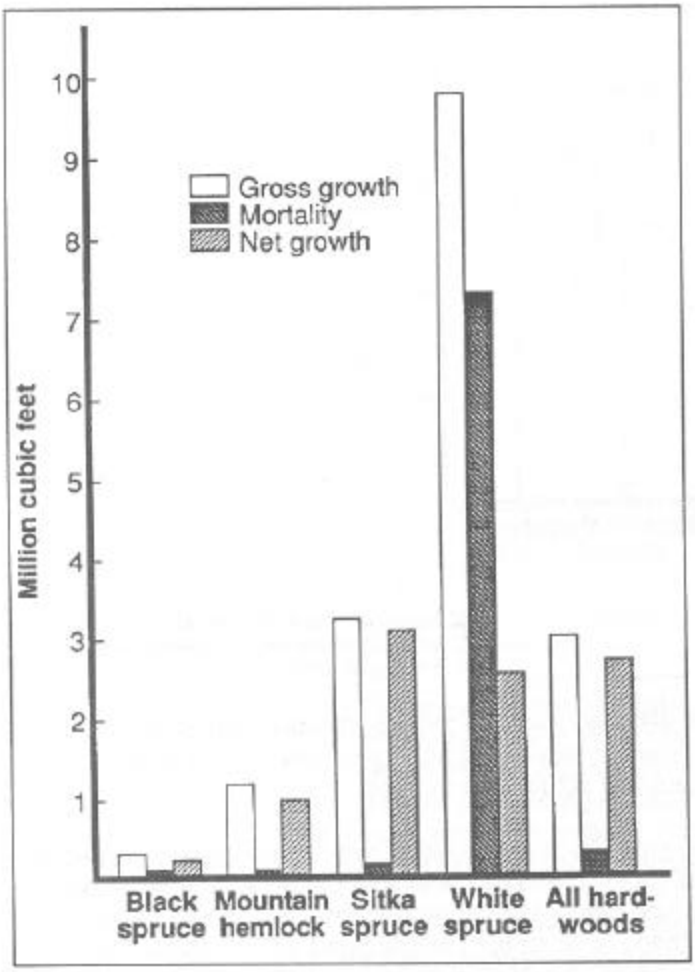

Figure 5—Gross annual growth, annual mortality, and net annual growth, in cubic feet, on all timberland, by species, Kenai Peninsula, 1987.

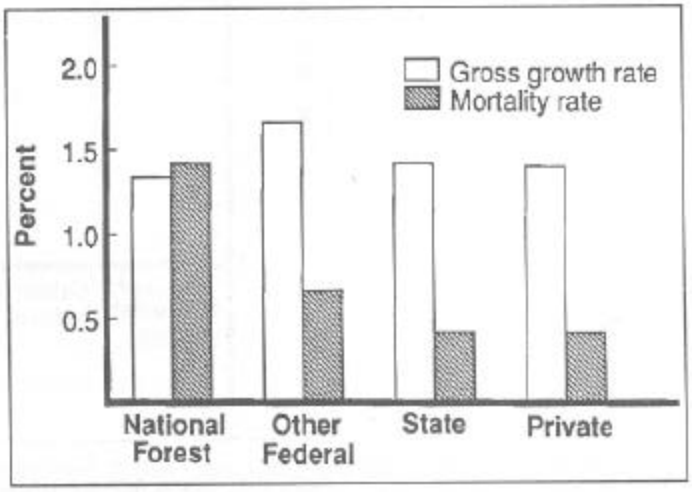

Figure 6—Gross annual growth and annual mortality rates, in percent, on timberland, by owner, Kenai Peninsula, 1987.

cubic feet) of the total mortality (7,956 thousand cubic feet). All insect-caused mortality was in white spruce trees where it accounted for 57 percent of the total mortality (7,314 thousand cubic feet) of white spruce trees (fig. 5). Of the insect-caused mortality, 67 percent (2,770 thousand cubic feet) was on available timberlands.

On all timberlands over the entire Kenai Peninsula inventory unit, the mortality rate (mortality volume divided by growing stock volume), 0.66 percent, was less than half that of the gross growth rate for the whole unit. In general, except for USDA Forest Service lands, this difference was similar for other lands (fig. 6). On available timberlands, the mortality rate was estimated at 0.64 percent and on reserved lands 0.69 percent. By ownership class, the corresponding values are 1.41 percent for USDA Forest Service timberlands, 0.42 percent for State of Alaska lands, and 0.39 for private lands. The impact of spruce beetle-caused mortality is apparent on USDA Forest Service lands; fully 65 percent of the mortality there is caused by the beetle.

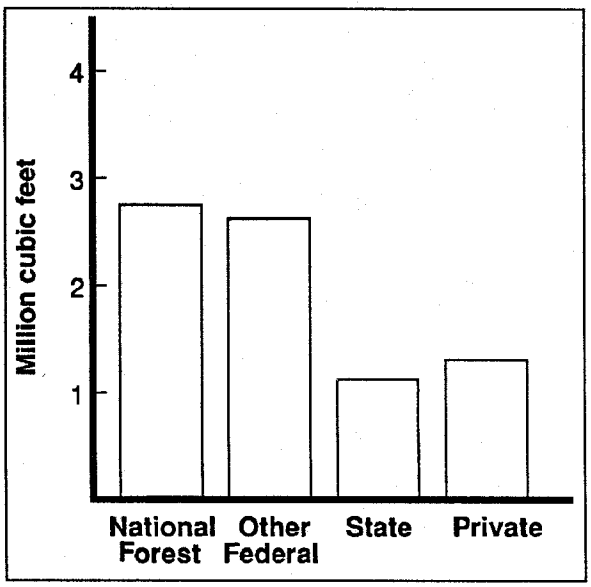

Figure 7—Annual mortality of growing stock on timberland, by owner, Kenai Peninsula, 1987.

On reserved lands, 52 percent of the mortality resulted from spruce beetle infestation. State of Alaska and privately owned timberlands currently suffer less from beetle infestation, so percentages of mortality caused by the beetle are lower on these lands; 39 percent and 36 percent, respectively.

In cubic-foot volume, insect-caused mortality was 1,826 thousand cubic feet on USDA Forest Service lands, 453 thousand cubic feet on State of Alaska lands, 491 thousand cubic feet on privately held lands, and 1,387 thousand cubic feet on reserved (other Federal) lands. Estimates of total mortality on these lands are, respectively, 2,775 thousand cubic feet, 1,154 cubic feet, 1,360 thousand cubic feet, and 2,669 thousand cubic feet (fig. 7).

Forest Resource Management Considerations

That the spruce beetle infestation on the Kenai Peninsula is epidemic is evident from data presented above. Halting the infestation in the near term is unlikely, but concerted efforts by all land owners and resource users can significantly slow natural cycling of insect populations.

Risk and Hazard Rating System

For land owners controlling softwood timber stands on the Kenai Peninsula that are not yet infested, or in which an infestation has passed on and not yet returned, it is of paramount importance that they be able to assess the relative danger of infestation or reinfestation faced by the stands. To this end, researchers with the Pacific Northwest Research Station and the USDA Forest Service's State and Private Forestry unit continue to examine risk and hazard of spruce beetle attack (Holsten 1984; Reynolds and Hard, in press). Their findings can help land resource managers evaluate the danger of infestation by spruce beetles.

Reynolds and Hard (in press) assessed risk as the percentage of stands with spruce beetle activity and hazard as the percentage of spruce stems, or spruce basal area,

attacked by beetles. They found that low-elevation (500 feet) mixed spruce-birch communities exhibited the greatest overall risk and hazard levels. In stands of intermediate elevation (500 to 1,000 feet), they found that a fibrous, organic soil layer greater than 2 inches deep was associated with increased risk.

Holster (1984) postulated that moisture stress caused by low soil temperatures increased susceptibility of white spruce to beetle attack. Holsten (1984) also developed a rough guide to rate uninfested spruce stands for probable high or low volume loss if attacked by spruce beetles.

Findings such as these can be employed by land resource managers to aid in formulating coordinated land use plans.

Materials Removal

For the timberland owner or land manager currently involved in forest management and timber harvesting, an important consideration is treatment of dead and down woody material, such as logging slash.

In their discussion of spruce beetle biology and life cycles, Holsten and others (1985) indicate that the beetles prefer to attack on the sides and bottoms of downed spruce, and that windthrown trees can be attractive to beetles through two attacks. Although many outbreaks in standing timber have originated in windthrown materials, logging residuals such as cull logs may serve as host material, also.

Timely removal or disposal of any spruce material that can serve as a base for an infestation to gain a foothold should be a major consideration in the planning, development, and execution of any timber harvesting or forest management plan.

Stand Conversion and Improvement

Silvicultural considerations can play an important role in reducing the impact and rate of spread of the spruce beetle infestation.

Hard and others (1983) note that high stand densities can reduce individual tree vigor, thereby increasing the risk of infestation. Stand improvement to remove susceptible trees and reduce stand density may increase tree resistance to attack. For low-elevation, mixed spruce-birch stands mentioned above, a combination of techniques may be appropriate: stand vigor could be increased by removal of susceptible trees, and the species composition could be altered to decrease the likelihood of infestation.

Several tools are available that can help reduce the long-term impact of the spruce beetle on the timber resource of the Kenai peninsula: (1) use of a risk and hazard rating system, (2) appropriate treatment of down and dead host material, and (3) silvicultural treatments including stand conversion or improvement.

Reliability of Inventory Data

All area and volume statistics reported here are estimates based on sampling and are subject to sampling error. Sampling errors for all estimates presented in the tables are available from the authors. The reliability of the inventory is expressed in terms of relative sampling error at the 68-percent confidence level.

	Design sampling error	Sampling error achieved	Sampling error of the total estimate
		Percent	
Available timberland area:			
Per million acres	3.0	4.0	
For the total 286,512 acres			7.5
Available other forest land area:			
Per million acres	10.0	3.4	
For the total 617,901 acres			4.4
Net growing stock volume on available timberland:			
Per billion cubic feet	10.0	9.2	
For the total 823,479,901 cubic feet			10.1
Net growth of growing stock on available timberland:			
Per billion cubic feet	10.0	1.7	
For the total 5,696,168 cubic feet			22.7

For the Kenai Peninsula inventory unit, growing stock volume was estimated at 823,479,901 cubic feet, ± 10.1 percent, with 68-percent confidence limits of 740,308,431 and 906,651,371 cubic feet. A 68-percent confidence level means that if repeated samples were taken of this population, the estimate of total volume would be between 740 and 907 million cubic feet 68 percent of the time.

Design sampling error goals were met for estimates of other forest land area, net growing stock volume on available timberland, and net growth of growing stock on available timberland; error goals for estimates of timberland area were slightly exceeded.

Terminology [3]

Available timberland—Timberland not withdrawn from use in production of timber products as a result of administrative statute or regulation.

Census water—Streams, sloughs, estuaries, and canals more than one-eighth of a mile wide; and lakes, reservoirs and ponds more than 40 acres in area. (Also see "noncensus water.")

Commercial species—Trees currently or prospectively suitable for industrial products.

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3 Terminology is from USDA Forest Service, Forest Service Handbook, Title 4813.1, 1967; and the manual of field instructions for the forest survey of the Kenai Peninsula, 1987.

Cull material—Portions of a tree unusable for industrial products because of rot, form, or other defect.

Cull trees—Live trees of sawtimber or poletimber size unmerchantable for saw logs now or prospectively because of defect, rot, or species.

Forest land—Land at least 16.7percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use.

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

> ***Black cottonwood —*** Forests in which a plurality of the stand is black cottonwood. Black cottonwood is found south of the Alaska Range in pure stands along the major rivers.
>
> ***Black spruce***—Forests in which a plurality of the stand is black spruce. Black spruce most often occurs in nearly pure stands but can be found mixed with white spruce, paper birch, and quaking aspen. Black spruce is fairly characteristic of poorer forest land.
>
> ***Hemlock-spruce***-—Forests in which 50 percent or more of the stand is western or mountain hemlock and where Sitka spruce comprises 30-49 percent of the stocking.
>
> ***Mountain hemlock***-—Forests in which a plurality of the stand is mountain hemlock. An associated species is western hemlock.
>
> ***Paper birch***—Forests in which a plurality of the stand is paper birch. Paper birch can occur in pure stands but is more often mixed with white spruce, quaking aspen, or black spruce.
>
> ***Sitka spruce***—Forests in which a plurality of the stand is Sitka spruce. An associated species is western hemlock.
>
> ***White spruce***-—Forests in which a plurality of the stand is white spruce. Common associates include paper birch and, occasionally, black spruce or quaking aspen.

Growing-stock trees-—Sawtimber trees, poletimber trees, saplings, and seedlings; that is, all live trees except cull trees.

Growing-stock volume—The net volume of sound wood in the bole of growing-stock trees 5.0 inches and larger in d.b.h. (diameter at breast height) from stump to a minimum 4.0-inch top outside bark, or to the point where the central stem breaks into limbs.

Hardwoods—Broad-leaved trees that are usually deciduous. "Commercial" interior Alaska hardwood species are balsam poplar, black cottonwood, paper birch, and quaking aspen.

Land area—The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than 120 feet wide; and lakes, reservoirs, and ponds less than 1 acre in area.

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

Marginal timberland—Forest land producing between 15 and 19 cubic feet per acre per year of wood at culmination of mean annual increment.

Mean annual increment (MAI)—A measure of the volume of wood, in cubic feet, produced on 1 acre during 1 year. Forest Inventory and Analysis minimum standard for timberland is the ability to produce 20 cubic feet per acre per year.

Merchantable tree—A merchantable tree must be producing or be capable of producing at least one merchantable saw log that is at least 50-percent sound for hardwoods or 33-percent sound for softwoods, board-foot measure. All poletimber less than 50-percent sound, cubic-foot measure, and all saplings with any sign of rot are not considered merchantable trees but rotten culls. Trees of such poor form that they will never produce a merchantable saw log are not classified as merchantable trees but as sound culls or rough trees.

Mortality—Number or sound wood volume of live trees dying from natural causes during a specified period.

Net annual growth of growing stock—The annual change in volume of sound wood in live sawtimber and poletimber trees.

Net annual growth of sawtimber—The annual change in net board-foot volume of live sawtimber trees.

Net volume—The gross volume of a-tree less deductions for rot, sweep, or other defect affecting product use.

Noncensus water—Streams, sloughs, estuaries, and canals between 120 feet and one-eighth of a mile wide; and lakes, reservoirs, and ponds between 1 and 40 acres in area. (Also see "census water.")

Nonforest land—Land not qualifying as forest land. Includes land that has never supported forests and lands formerly forested where forest use is precluded by development for nonforest uses such as crops, improved pasture, residential areas, and city parks. Also includes improved roads and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forest areas must be more than 1 acre in size to qualify as nonforest land.

Nonstocked areas—Timberland less than 16.7 percent stocked with growing-stock trees.

Other forest land—Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions (producing less than 20 cubic feet per acre per year). This includes sterile or poorly drained forest land, subalpine forests, and steep rocky areas where topographic conditions are likely to prevent indefinitely management for timber production.

Poletimber-sized tree—Softwood tree 5.0 to 8.9 inches in d.b.h.; hardwood tree from 5.0 to 10.9 inches in d.b.h.

Poletimber stands—Stands at least 16.7-percent stocked with growing-stock trees of which half or more is in poletimber- and sawtimber-size trees, with poletimber stocking exceeding that of sawtimber.

Rough trees—Live trees 5.0 inches and larger in d.b.h. that do not contain a saw log, now or prospectively, primarily because of roughness or poor form, or because they are a noncommercial species.

Rotten trees—Live trees 5.0 inches and larger in d.b.h. that do not contain a saw log, now or prospectively, primarily because of rot.

Salvable dead trees—Standing dead trees considered currently or potentially merchantable by regional standards. A poletimber tree must be more than one-half sound; a sawtimber tree more than one-third sound (board measure).

Sapling-sized tree—A tree 1.0 to 4.9 inches in d.b.h.

Saw log—A log meeting minimum standards of diameter, length, and defect, including logs at least 12 feet long for softwoods (8 feet for hardwoods), sound and straight, and with a minimum small-end diameter inside bark of 6 inches for softwoods (8 inches for hardwoods).

Saw-log portion—That part of the bole of sawtimber trees between the stump and the saw-log top.

Saw-log top—The point on the bole of sawtimber trees above which a saw-log cannot be produced. The minimum saw-log top is 7.0 inches d.o.b. (diameter outside bark) for softwoods and 9.0 inches d.o.b. for hardwoods.

Sawtimber-sized tree—Softwood tree 9.0 inches d.b.h. and larger; hardwood tree 11.0 inches in d.b.h. and larger.

Sawtimber stands—Stands at least 16.7 percent stocked with growing stock trees, with half or more of total stocking in sawtimber- or poletimber-size trees, and with sawtimber stocking at least equal to poletimber stocking.

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 affecting use for lumber.

Scribner rule—The common board-foot timber scaling rule used locally in determining volume of sawtimber.

Seedling-sapling stands—Stands at least 16.7 percent stocked with growing stock trees of which more than half of the stocking is saplings and seedling-size trees.

Seedling-sized tree—An established tree less than 1.0 inch d.b.h.

Site productivity class—A classification of forest land based on capacity to grow crops of industrial wood.

Stand size class—A classification of forest land based on size of the growing stock present; that is, sawtimber, poletimber, or saplings and seedlings.

Stocking—The degree of occupancy of land by trees, measured either by basal area or by the number of trees in a stand by size or age and spacing, compared with the basal area or number of trees required to fully use the growth potential of the land; that is, the stocking standard.

Timberland—Forest land producing or capable of producing crops of industrial wood. Areas qualifying as timberland can produce more than 20 cubic feet per acre per year of industrial wood at culmination of mean annual increment.

Tree size class—A classification based on the diameter of the tree at breast height (4 -1/2 feet above the ground on the uphill side of the tree).

Unclassified land—Locations that could not be classified on aerial photography for a number of reasons including cloud cover or shadow.

Upper stem portion—That part of the main stem or fork of sawtimber trees above the saw-log top to a minimum top diameter of 4.0 inches outside bark or to the point where the main stem or fork breaks into limbs.

Names of Trees[4]

Common name	Scientific name
Softwoods:	
Black spruce	*Picea mariana* (Mill.) B.S.P.
Lutz spruce	*Picea* x *lutzii* Little
Mountain hemlock	*Tsuga mertensiana* (Bong.) Carr.
Sitka spruce	*Picea sitchensis* (Bong.) Carr.
White spruce	*Picea glauca* (Moench) Voss
Hardwoods:	
Black cottonwood	*Populus trichocarpa* Torr. & Gray
Paper birch	*Betula papyrifera* Marsh.
Quaking aspen	*Populus tremuloides* Michx.

[4] Scientific names are according to Viereck and Little (1972).

Tables

Estimates in this report were developed from statistically based samples and therefore are subject to sampling error. Sampling errors for estimates of various resource quantities are presented in the section, "Reliability of Inventory Data."

Table 1--Area by land class, Kenai Peninsula, Alaska, 1987

Forest land						
Available timberland	Reserved timberland	Available other forest	Reserved other forest	Total forestland	Nonforest[a]	All land
Thousand acres						
287	195	618	809	1,909	3,094	5,003

Totals may be off because of rounding.

Estimates are subject to sampling error.

[a] Does not include estimates of census water (187,271 acres) or noncensus water (24,224 acres).

Table 2--Area of reserved timberland and available and reserved other forest land by forest type, Kenai Peninsula, Alaska, 1987

Forest type	Reserved timberland	Available other forest	Reserved other forest	All land
	Thousand acres			
Black spruce	5	15	23	43
Mountain hemlock	5	18	7	30
Sitka spruce	11	17	4	32
White spruce	79	81	63	223
Total softwoods	101	131	97	329
Black cottonwood	0[a]	--	--	0
Paper birch	88	6	12	106
Quaking aspen	5	--	--	5
Total hardwoods	94	6	12	112
Nonstocked	1	--	--	1
Unclassified	--	481	701	1,182
All types	195	618	809	1,622

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

[a] Less than 500 acres.

Table 3--Area of all timberland by ownership class, Kenai Peninsula, Alaska, 1987

Public							Private				
	Other public						Other private				
National Forest	BLM	Indian	Other Federal	State	County and municipal	All public	Forest industry	Farmer	Miscellaneous private	All private	All classes
Thousand acres											
79	--	--	195	94	--	368	--	--	113	113	482

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 4--Area of available timberland by forest type and ownership group, Kenai Peninsula, Alaska, 1987

Forest type	Ownership group				
	National Forest	Other public	Forest industry	Other private	All owners
	Thousand acres				
Black spruce	--	0[a]	--	0	1
Mountain hemlock	31	4	--	3	38
Sitka spruce	0	20	--	29	49
White spruce	32	51	--	59	142
Total softwoods	63	75	--	91	229
Black cottonwood	3	0	--	0	3
Paper birch	13	16	--	19	48
Quaking aspen	--	0	--	0	1
Total hardwoods	16	16	--	19	52
Nonstocked	0	2	--	3	5
All types	79	93	--	113	287

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

[a] Less than 500 acres.

Table 5--Area of available timberland by ownership group and stand-size class, Kenai Peninsula, Alaska, 1987

Ownership group	Stand-size class				All classes
	Sawtimber	Poletimber	Seedling-sapling	Nonstocked	
	Thousand acres				
National Forest	58	18	3	0[a]	79
Other public	82	9	1	2	94
Forest industry	--	--	--	--	--
Other private	98	12	1	2	113
Total	238	39	5	5	287

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

[a] Less than 500 acres.

Table 6--Area of available timberland by ownership group and cubic-foot site class, Kenai Peninsula, Alaska, 1987

Ownership group	Site class						All classes
	225+	165-224	120-164	85-119	50-84	20-49	
	Thousand acres						
National Forest	--	--	--	--	5	73	79
Other public	--	--	--	--	8	87	94
Forest industry	--	--	--	--	--	--	--
Other private	--	--	--	--	8	106	113
Total	--	--	--	--	21	266	287

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 7--Area of available timberland by forest type and stand-size class, Kenai Peninsula, Alaska, 1987

Forest type	Stand-size class				All classes
	Sawtimber	Poletimber	Seedling-sapling	Nonstocked	
	Thousand acres				
Black spruce	--	--	1	--	1
Mountain hemlock	35	3	--	--	38
Sitka spruce	49	--	--	--	49
White spruce	128	10	4	--	142
Total softwoods	212	13	5	--	230
Black cottonwood	3	--	--	--	3
Paper birch	23	25	--	--	48
Quaking aspen	--	1	--	--	1
Total hardwoods	26	26	--	--	52
Nonstocked	--	--	--	5	5
All types	238	39	5	5	287

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 8--Number of live trees on available timberland by species and diameter class, Kenai Peninsula, Alaska, 1987

Species	Diameter class (inches at breast height)															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+	
	Thousand trees															
Softwoods:																
Black spruce	3,385	1,544	142	54	--	--	--	--	--	--	--	--	--	--	--	5,126
Mountain hemlock	10,670	4,744	2,177	1,885	1,048	949	692	411	304	96	51	20	30	5	3	23,086
Sitka spruce	--	349	511	1,541	1,151	961	820	588	521	334	271	119	92	100	312	7,673
White spruce	11,132	7,387	7,088	6,810	4,788	4,263	2,723	1,288	932	488	372	187	117	74	75	47,725
Total	25,188	14,025	9,918	10,290	6,988	6,174	4,236	2,287	1,757	919	695	327	239	179	389	83,610
Hardwoods:																
Black cottonwood	--	--	--	--	31	37	11	21	16	10	4	13	15	8	38	203
Paper birch	1,218	1,442	1,904	2,194	1,417	1,059	439	133	30	40	6	7	--	--	--	9,889
Quaking aspen	522	28	206	377	309	264	35	11	6	1	--	--	--	--	--	1,759
Total	1,740	1,470	2,110	2,571	1,758	1,360	484	165	52	51	11	20	15	8	38	11,852
All species	26,928	15,495	12,027	12,861	8,745	7,534	4,720	2,452	1,810	970	705	347	253	186	427	95,462

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 9--Number of growing stock trees on available timberland by species and diameter class, Kenai Peninsula, Alaska, 1987

Species	Diameter class (inches at breast height)															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+	
	Thousand trees															
Softwoods:																
Black spruce	1,608	1,544	142	54	--	--	--	--	--	--	--	--	--	--	--	3,350
Mountain hemlock	10,321	4,210	1,971	1,804	925	833	594	372	295	81	47	20	24	2	3	21,504
Sitka spruce	--	349	511	1,508	1,151	872	786	588	511	334	265	119	92	100	277	7,465
White spruce	9,997	7,233	6,845	6,612	4,758	4,263	2,695	1,246	932	468	364	184	117	74	73	45,862
Total	21,926	13,336	9,470	9,978	6,835	5,969	4,075	2,207	1,738	884	676	324	233	176	353	78,180
Hardwoods:																
Black cottonwood	--	--	--	--	20	13	11	21	16	10	4	13	15	8	34	166
Paper birch	1,218	1,442	1,780	2,103	1,304	874	354	87	28	28	6	1	--	--	--	9,226
Quaking aspen	349	28	206	307	281	261	32	4	--	1	--	--	--	--	--	1,470
Total	1,567	1,470	1,986	2,410	1,606	1,148	397	112	45	39	11	14	15	8	34	10,861
All species	23,494	14,806	11,455	12,389	8,441	7,117	4,472	2,319	1,783	923	687	338	247	184	387	89,042

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 10--Net volume of growing stock on available timberland by species and diameter class, Kenai Peninsula, Alaska, 1987

Species	Diameter class (inches at breast height)													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+	
	Thousand cubic feet													
Softwoods:														
Black spruce	375	234	--	--	--	--	--	--	--	--	--	--	--	608
Mountain hemlock	2,124	7,263	7,253	11,089	12,054	10,718	11,274	4,439	2,535	1,394	2,457	129	450	73,178
Sitka spruce	1,510	9,224	11,668	14,624	21,529	22,512	23,958	22,262	21,787	11,133	10,573	14,075	55,065	239,920
White spruce	16,595	39,932	49,889	70,916	66,457	40,320	41,272	26,070	24,938	16,165	12,375	9,233	13,114	427,276
Total	20,603	56,653	68,810	96,628	100,039	73,549	76,504	52,772	49,260	28,691	25,405	23,437	68,629	740,981
Hardwoods:														
Black cottonwood	--	--	201	205	272	751	462	613	326	1,174	1,544	926	7,779	14,255
Paper birch	5,409	13,332	13,742	13,090	7,180	2,112	1,071	1,203	161	27	--	--	--	57,327
Quaking aspen	843	1,902	2,944	4,219	790	141	--	76	--	--	--	--	--	10,917
Total	6,252	15,235	16,887	17,514	8,241	3,005	1,533	1,892	487	1,201	1,544	926	7,779	82,499
All species	26,855	71,888	85,697	114,142	108,281	76,554	78,037	54,664	49,747	29,893	26,949	24,363	76,408	823,480

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 11--Net volume of sawtimber on available timberland by species and diameter class, Kenai Peninsula, Alaska, 1987

Species	Diameter class (inches at breast height)											
	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+	All classes
	Million board feet, Scribner rule											
Softwoods:												
Black spruce	--	--	--	--	--	--	--	--	--	--	--	--
Mountain hemlock	19	33	41	41	46	19	11	6	12	1	2	230
Sitka spruce	38	52	87	98	106	105	105	53	51	75	277	1,048
White spruce	114	194	210	137	163	112	114	84	69	50	93	1,340
Total	171	279	339	276	315	237	230	143	132	125	372	2,618
Hardwoods:												
Black cottonwood		1	1	3	2	3	1	5	6	4	32	58
Paper birch		34	23	8	4	5	1	0[a]	--	--	--	74
Quaking aspen		12	3	1	--	0	--	--	--	--	--	16
Total		47	26	11	5	8	2	5	6	4	32	147
All species	171	326	365	287	320	244	232	148	138	128	404	2,765

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

[a] Less than 500,000 board feet, Scribner rule.

Table 12--Net volume of growing stock on available timberland by species and ownership group, Kenai Peninsula, Alaska, 1987

Species	Ownership group				
	National Forest	Other public	Forest industry	Other private	All owners
	Thousand cubic feet				
Softwoods:					
Black spruce	57	233	--	318	608
Mountain hemlock	62,170	5,856	--	5,152	73,178
Sitka spruce	3,973	96,150	--	139,797	239,920
White spruce	104,875	148,915	--	173,486	427,276
Total	171,075	251,154	--	318,752	740,981
Hardwoods:					
Black cottonwood	11,660	1,347	--	1,248	14,255
Paper birch	10,802	21,301	--	25,224	57,327
Quaking aspen	2,925	3,497	--	4,495	10,917
Total	25,387	26,145	--	30,967	82,499
All species	196,462	277,299	--	349,719	823,480

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 13--Net volume of sawtimber on available timberland by species and ownership group, Kenai Peninsula, Alaska, 1987

Species	Ownership group				
	National Forest	Other public	Forest industry	Other private	All owners
	-------Million board feet, Scribner rule------				
Softwoods:					
Black spruce	--	--	--	--	--
Mountain hemlock	197	17	--	16	230
Sitka spruce	17	421	--	610	1,048
White spruce	371	445	--	524	1,340
Total	585	884	--	1,149	2,618
Hardwoods:					
Black cottonwood	47	5	--	5	58
Paper birch	5	31	--	38	74
Quaking aspen	3	6	--	7	16
Total	56	42	--	49	147
All species	641	926	--	1,198	2,765

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 14--Net volume of growing stock on available timberland by forest type and stand-size class, Kenai Peninsula, Alaska, 1987

Forest type	Stand-size class				All classes
	Sawtimber	Poletimber	Seedling-sapling	Nonstocked	
	Thousand cubic feet				
Black spruce	--	--	278	--	278
Mountain hemlock	93,362	3,689	--	--	97,051
Sitka spruce	236,143	--	--	--	236,143
White spruce	373,218	17,094	2,977	--	393,289
Total softwoods	702,273	20,783	3,254	--	726,761
Black cottonwood	11,683	--	--	--	11,683
Paper birch	38,649	43,409	--	--	82,058
Quaking aspen	--	1,393	--	--	1,393
Total hardwoods	50,332	44,802	--	--	95,134
Nonstocked	--	--	--	1,585	1,585
All types	753,054	65,586	3,254	1,585	823,480

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 15--Net volume of sawtimber on available timberland by forest type and stand-size class, Kenai Peninsula, Alaska, 1987

Forest type	Stand-size class				All classes
	Sawtimber	Poletimber	Seedling-sapling	Nonstocked	
	Million board feet, Scribner rule				
Black spruce	--	--	1	--	1
Mountain hemlock	323	6	--	--	329
Sitka spruce	1,032	--	--	--	1,032
White spruce	1,182	19	7	--	1,209
Total softwoods	2,537	25	8	--	2,571
Black cottonwood	50	--	--	--	50
Paper birch	95	42	--	--	137
Quaking aspen	--	2	--	--	2
Total hardwoods	145	44	--	--	189
Nonstocked	--	--	--	6	6
All types	2,682	70	8	6	2,765

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 16--Net volume of growing stock on available timberland by forest type and ownership group, Kenai Peninsula, Alaska, 1987

Forest type	Ownership group				
	National Forest	Other public	Forest industry	Other private	All owners
	Thousand cubic feet				
Black spruce	--	102	--	176	278
Mountain hemlock	82,925	7,527	--	6,599	97,051
Sitka spruce	596	95,927	--	139,620	236,143
White spruce	80,444	144,641	--	168,204	393,289
Total softwoods	163,965	248,197	--	314,599	726,761
Black cottonwood	10,084	861	--	738	11,683
Paper birch	22,398	26,961	--	32,699	82,058
Quaking aspen	--	511	--	883	1,394
Total hardwoods	32,482	28,333	--	34,320	95,135
Nonstocked	15	769	--	801	1,585
All types	196,462	277,299	--	349,719	823,480

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 17--Net volume of sawtimber on available timberland by forest type and ownership group, Kenai Peninsula, Alaska, 1987

Forest type	Ownership group				
	National Forest	Other public	Forest industry	Other private	All owners
	-------Million board feet, Scribner rule------				
Black spruce	--	0[a]	--	0	1
Mountain hemlock	283	25	--	21	329
Sitka spruce	3	420	--	609	1,032
White spruce	279	427	--	503	1,209
Total softwoods	565	872	--	1,134	2,571
Black cottonwood	43	4	--	3	50
Paper birch	33	47	--	57	137
Quaking aspen	--	1	--	2	2
Total hardwoods	76	52	--	61	189
Nonstocked	0	3	--	3	6
All types	641	926	--	1,198	2,765

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

[a] Less than 500,000 board feet, Scribner rule.

Table 18--Net volume of timber on available timberland by class of timber and species group, Kenai Peninsula, Alaska, 1987

Class of timber	Species group		
	Softwoods	Hardwoods	All species
	----------Thousand cubic feet----------		
Sawtimber trees:			
Sawlog portion	637,094	37,531	674,625
Upper-stem portion	26,631	6,594	33,225
Total sawtimber	663,725	44,125	707,850
Poletimber trees	77,257	38,374	115,630
All growing stock trees	740,981	82,499	823,480
Sound cull trees	6,311	2,131	8,442
Rotten cull trees	3,058	1,840	4,898
All live trees	750,351	86,470	836,820
Salvable dead trees	13,604	770	14,375
Total, all timber	763,955	87,240	851,195

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 19--Net annual growth of growing stock on available timberland by forest type and ownership group, Kenai Peninsula, Alaska, 1987

Forest type	Ownership group				
	National Forest	Other public	Forest industry	Other private	All owners
	Thousand cubic feet				
Black spruce	--	-6[a]	--	-11	-17
Mountain hemlock	-17	0[b]	--	3	-68
Sitka spruce	5	982	--	1,475	2,462
White spruce	-226	1,407	--	1,550	2,731
Total softwoods	-292	2,383	--	3,017	5,108
Black cottonwood	69	6	--	5	80
Paper birch	-22	220	--	261	459
Quaking aspen	--	7	--	12	19
Total hardwoods	47	223	--	278	558
Nonstocked	0	15	--	16	31
All types	-245	2,631	--	3,310	5,696

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

[a] Negative net annual growth indicates mortality exceeded gross growth.

[b] Less than 500 cubic feet.

Table 20--Net annual growth of sawtimber on available timberland by forest type and ownership group, Kenai Peninsula, Alaska, 1987

Forest type	Ownership group				
	National Forest	Other public	Forest industry	Other private	All owners
	------Thousand board feet, Scribner rule------				
Black spruce	--	-11	--	-18	-29
Mountain hemlock	-1,110[a]	-56	--	-39	-1,205
Sitka spruce	33	5,172	--	7,501	12,706
White spruce	678	5,790	--	6,444	12,912
Total softwoods	-399	10,895	--	13,888	24,384
Black cottonwood	314	27	--	23	364
Paper birch	-652	732	--	847	927
Quaking aspen	--	15	--	26	41
Total hardwoods	-338	774	--	896	1,332
Nonstocked	1	73	--	76	150
All types	-736	11,742	--	14,895	25,862

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

[a] Negative net annual growth indicates mortality exceeded gross growth.

Table 21--Average annual mortality of growing stock on available timberland by forest type and ownership group, Kenai Peninsula, Alaska, 1987

Forest type	Ownership group				
	National Forest	Other public	Forest industry	Other private	All owners
	Thousand cubic feet				
Black spruce	--	8	--	13	21
Mountain hemlock	1,129	106	--	93	1,327
Sitka spruce	1	61	--	63	125
White spruce	1,266	796	--	959	3,021
Total softwoods	2,396	971	--	1,128	4,494
Black cottonwood	--	--	--	--	--
Paper birch	378	183	--	233	794
Quaking aspen	--	--	--	--	--
Total hardwoods	378	183	--	233	794
Nonstocked	--	--	--	--	--
All types	2,775	1,154	--	1,360	5,289

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 22--Average annual mortality of sawtimber on available timberland by forest type and ownership group, Kenai Peninsula, Alaska, 1987

Forest type	Ownership group				
	National Forest	Other public	Forest industry	Other private	All owners
	------Thousand board feet, Scribner rule------				
Black spruce	--	14	--	25	39
Mountain hemlock	5,279	445	--	383	6,107
Sitka spruce	7	332	--	345	684
White spruce	3,545	2,311	--	2,930	8,786
Total softwoods	8,831	3,102	--	3,682	15,615
Black cottonwood	--	--	--	--	--
Paper birch	1,235	421	--	513	2,170
Quaking aspen	--	--	--	--	--
Total hardwoods	1,235	421	--	513	2,170
Nonstocked	--	--	--	--	--
All types	10,067	3,524	--	4,195	17,786

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 23--Area of all forestland by forest type and cubic-foot site class, Kenai Peninsula, Alaska, 1987

Forest type	Cubic-foot site class					All classes
	50-84	20-49	15-19	10-14	1-9	
	Thousand acres					
Black spruce	--	6	25	6	6	44
Mountain hemlock	3	41	20	3	2	68
Sitka spruce	12	49	21	--	--	82
White spruce	--	220	90	46	7	364
Total	15	316	156	54	15	558
Black cottonwood	3	--	--	--	--	3
Paper birch	--	136	12	6	--	154
Quaking aspen	--	6	--	--	--	6
Total	3	142	12	6	--	163
Unclassified	--	--	1,182	--	--	1,182
Other nonstocked	6	--	--	--	--	6
All types	24	458	1,351	61	15	1,909

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 24--Area of all timberland by individual owner, stand-size class, and forest type, Kenai Peninsula, Alaska, 1987

Individual owner and stand-size class	Forest type								
	White spruce	Black spruce	Sitka spruce	Mountain hemlock	Quaking aspen	Black cottonwood	Birch	Other nonstocked	All forest types
	Acres								
National Forest:									
Nonstocked	--	--	--	--	--	--	--	48	48
Seedling and sapling	2,634	--	--	--	--	--	--	--	2,634
Poletimber	4,879	--	--	2,634	--	--	10,196	--	17,710
Sawtimber	24,235	--	143	28,590	--	2,634	2,777	--	58,381
Total	31,749	--	143	31,223	--	2,634	12,973	48	78,773
Other Federal:									
Nonstocked	--	--	--	--	--	--	--	908	908
Seedling and sapling	5,409	5,313	--	--	--	--	--	--	10,723
Poletimber	20,444	--	--	96	5,313	--	48,110	--	73,963
Sawtimber	52,960	--	11,109	5,372	--	96	40,012	--	109,549
Total	78,814	5,313	11,109	5,468	5,313	96	88,122	908	195,144

Table 24 (cont')

State:									
Nonstocked	--	--	--	--	--	--	--	2,389	2,389
Seedling and sapling	502	277	--	--	--	--	--	--	778
Poletimber	2,265	--	--	225	277	--	6,489	--	9,256
Sawtimber	48,667	--	20,211	3,459	--	225	9,331	--	81,892
Total	51,434	277	20,211	3,683	277	225	15,820	2,389	94,316
Private:									
Nonstocked	--	--	--	--	--	--	--	2,484	2,484
Seedling and sapling	671	479	--	--	--	--	--	--	1,150
Poletimber	2,855	--	--	193	479	--	8,116	--	11,642
Sawtimber	54,925	--	28,883	3,154	--	193	10,996	--	98,148
Total	58,451	479	28,883	3,346	479	193	19,112	2,484	113,423
All owners:									
Nonstocked	--	--	--	--	--	--	--	5,829	5,829
Seedling and sapling	9,217	6,068	--	--	--	--	--	--	15,286
Poletimber	30,443	--	--	3,149	6,068	--	72,912	--	112,571
Sawtimber	180,787	--	60,345	40,573	--	3,148	63,116	--	347,969
Total	220,446	6,068	60,345	43,722	6,068	3,148	136,027	5,829	481,655

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 25--Number of growing stock trees on all timberland by individual owner and species, Kenai Peninsula, Alaska, 1987

Individual owner	Species							All forest types
	White spruce	Black spruce	Sitka spruce	Mountain hemlock	Quaking aspen	Black cottonwood	Birch	
	Thousand trees							
National Forest	32,773	1,509	508	128,955	900	415	7998	173,058
Other Federal	121,005	43,890	5,435	9,990	9,558	657	45,149	235,684
State	26,880	3,758	8,808	10,552	1,840	84	9,476	61,397
Private	31,896	5,355	13,937	9,310	2,151	103	11,199	73,952
Total	212,554	54,512	28,689	158,807	14,449	1,258	73,822	544,091

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 26--Net volume of growing stock on all timberland by individual owner, stand-size class, and forest type, Kenai Peninsula, Alaska, 1987

Individual owner and stand-size class	Forest type								
	White spruce	Black spruce	Sitka spruce	Mountain hemlock	Quaking aspen	Black cottonwood	Birch	Other nonstocked	All forest types
	Thousand cubic feet								
National Forest:									
Nonstocked	--	--	--	--	--	--	--	15	15
Seedling and sapling	2,189	--	--	--	--	--	--	--	2,189
Poletimber	8,383	--	--	3,185	--	--	15,782	--	27,350
Sawtimber	69,873	--	596	79,740	--	10,084	6,615	--	166,908
Total	80,445	--	596	82,925	--	10,084	22,398	15	196,462
Other Federal:									
Nonstocked	--	--	--	--	--	--	--	292	292
Seedling and sapling	3,177	1,952	--	--	--	--	--	--	5,129
Poletimber	29,631	--	--	117	9,804	--	100,824	--	140,375
Sawtimber	124,063	--	53,829	6,151	--	369	57,888	--	242,301
Total	165,871	1,952	53,829	6,268	9,804	369	158,712	292	388,097
State:									
Nonstocked	--	--	--	--	--	--	--	769	769
Seedling and sapling	348	102	--	--	--	--	--	--	450
Poletimber	3,983	--	--	272	511	--	12,145	--	16,711
Sawtimber	140,310	--	95,928	7,255	--	861	14,816	--	259,169
Total	144,641	102	95,928	7,527	511	861	26,961	769	277,299

Table 26--(cont')

Private:									
Nonstocked	--	--	--	--	--	--	--	802	802
Seedling and sapling	439	176	--	--	--	--	--	--	615
Poletimber	4,728	--	--	232	883	--	15,482	--	21,325
Sawtimber	163,035	--	139,619	6,367	--	738	17,218	--	326,977
Total	168,202	176	139,619	6,599	883	738	32,699	802	349,719
All owners:									
Nonstocked	--	--	--	--	--	--	--	1,878	1,878
Seedling and sapling	6,153	2,229	--	--	--	--	--	--	8,383
Poletimber	46,725	--	--	3,806	11,198	--	144,233	--	205,961
Sawtimber	497,281	--	289,972	99,513	--	12,051	96,537	--	995,355
Total	550,159	2,229	289,972	103,319	11,198	12,051	240,770	1,878	1,211,577

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 27--Net volume of sawtimber on all timberland by individual owner, stand-size class, and forest type, Kenai Peninsula, Alaska, 1987

Individual owner and stand-size class	Forest type								
	White spruce	Black spruce	Sitka spruce	Mountain hemlock	Quaking aspen	Black cottonwood	Birch	Other nonstocked	All forest types
	Thousand board feet, Scribner rule								
National Forest:									
Nonstocked	--	--	--	--	--	--	--	54	54
Seedling and sapling	5,125	--	--	--	--	--	--	--	5,125
Poletimber	9,722	--	--	4,816	--	--	12,512	--	27,050
Sawtimber	264,388	--	2,695	277,775	--	42,930	20,654	--	608,443
Total	297,235	--	2,695	282,591	--	42,930	33,166	54	640,672
Other Federal:									
Nonstocked	--	--	--	--	--	--	--	1,034	1,034
Seedling and sapling	7,598	4,108	--	--	--	--	--	--	11,706
Poletimber	30,400	--	--	176	17,155	--	103,726	--	151,458
Sawtimber	351,821	--	234,741	16,768	--	1,571	137,543	--	742,443
Total	389,819	4,108	234,741	16,944	17,155	1,571	241,269	1,034	906,641
State:									
Nonstocked	--	--	--	--	--	--	--	2,721	2,271
Seedling and sapling	824	214	--	--	--	--	--	--	1,038
Poletimber	4,479	--	--	411	894	--	13,307	--	19,092
Sawtimber	421,289	--	420,253	24,158	--	3,665	34,157	--	903,522
Total	426,592	214	420,253	24,569	894	3,665	47,464	2,271	926,373

Table 27 (cont)

Private:									
Nonstocked	--	--	--	--	--	--	--	2,829	2,829
Seedling and sapling	1,041	370	--	--	--	--	--	--	1,412
Poletimber	5,183	--	--	352	1,544	--	16,678	--	23,757
Sawtimber	496,530	--	609,177	21,019	--	3,141	39,758	--	1,169,624
Total	502,754	370	609,177	21,371	1,544	3,141	56,436	2,829	1,197,622
All owners:									
Nonstocked	--	--	--	--	--	--	--	6,638	6,638
Seedling and sapling	14,588	4,692	--	--	--	--	--	--	19,281
Poletimber	49,784	--	--	5,755	19,594	--	146,223	--	221,357
Sawtimber	1,534,028	--	1,266,866	339,720	--	51,307	232,112	--	3,424,032
Total	1,598,400	4,692	1,266,866	345,475	19,594	51,307	378,335	6,638	3,671,308

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 28--Net volume of growing stock, per acre, on all timberland by individual owner, stand-size class, and forest type, Kenai Peninsula, Alaska, 1987

Individual owner and stand-size class	Forest type								All forest types
	White spruce	Black spruce	Sitka spruce	Mountain hemlock	Quaking aspen	Black cottonwood	Birch	Other nonstocked	
	Cubic feet								
National Forest:									
Nonstocked	--	--	--	--	--	--	--	321	321
Seedling and sapling	831	--	--	--	--	--	--	--	831
Poletimber	1,718	--	--	1,209	--	--	1,548	--	1,544
Sawtimber	2,883	--	4,167	2,789	--	3,828	2,382	--	2,859
Total	2,534	--	4,167	2,656	--	3,828	1,727	321	2,494
Other Federal:									
Nonstocked	--	--	--	--	--	--	--	321	321
Seedling and sapling	587	367	--	--	--	--	--	--	478
Poletimber	1,452	--	--	1,219	1,845	--	2,096	--	1,898
Sawtimber	2,343	--	4,846	1,145	--	3,844	1,446	--	2,211
Total	1,990	367	4,846	1,146	1,845	3,844	1,801	321	1,988
State:									
Nonstocked	--	--	--	--	--	--	--	321	321
Seedling and sapling	693	367	--	--	--	--	--	--	578
Poletimber	1,758	--	--	1,208	1,845	--	1,871	--	1,827
Sawtimber	2,883	--	4,746	2,097	--	3,826	1,587	--	3,164
Total	2,812	367	4,746	2,044	1,845	3,826	1,704	321	2,940

Table 28 (cont)

Private:									
Nonstocked	--	--	--	--	--	--	--	321	321
Seedling and sapling	654	367	--	--	--	--	--	--	548
Poletimber	1,656	--	--	1,202	1,845	--	1,907	--	1,832
Sawtimber	2,968	--	4,834	2,018	--	3,824	1,565	--	3,331
Total	2,877	367	4,834	1,972	1,845	3,824	1,710	321	3,083
All owners:									
Nonstocked	--	--	--	--	--	--	--	321	321
Seedling and sapling	667	367	--	--	--	--	--	--	548
Poletimber	1,535	--	--	1,208	1,845	--	1,978	--	1,829
Sawtimber	2,750	--	4,805	2,452	--	3,828	1,529	--	2,862
Total	2,495	367	4,805	2,363	1,845	3,828	1,770	321	2,515

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 29--Net volume of sawtimber, per acre, on all timberland by individual owner, stand-size class, and forest type, Kenai Peninsula, Alaska, 1987

Individual owner and stand-size class	Forest type								
	White spruce	Black spruce	Sitka spruce	Mountain hemlock	Quaking aspen	Black cottonwood	Birch	Other nonstocked	All forest types
	Board feet, Scribner rule								
National Forest:									
Nonstocked	--	--	--	--	--	--	--	1,125	1,125
Seedling and sapling	1,945	--	--	--	--	--	--	--	1,945
Poletimber	1,992	--	--	1,828	--	--	1,227	--	1,527
Sawtimber	10,909	--	18,846	9,715	--	16,298	7,437	--	10,422
Total	8,795	--	18,846	9,050	--	16,298	2,556	1,125	8,133
Other Federal:									
Nonstocked	--	--	--	--	--	--	--	1,125	1,125
Seedling and sapling	1,404	773	--	--	--	--	--	--	1,091
Poletimber	1,486	--	--	1,833	3,228	--	2,156	--	2,047
Sawtimber	6,643	--	21,133	3,121	--	16,365	3,437	--	6,777
Total	4,946	773	21,133	3,098	3,228	16,365	2,737	1,125	4,646
State:									
Nonstocked	--	--	--	--	--	--	--	1,125	1,125
Seedling and sapling	1,641	773	--	--	--	--	--	--	1,334
Poletimber	1,977	--	--	1,826	3,228	--	2,050	--	2,062
Sawtimber	8,656	--	20,793	6,984	--	16,333	3,660	--	11,033
Total	8,293	773	20,793	6,670	3,228	16,333	3,000	1,253	9,822

Table 29 (cont)

Private:									
Nonstocked	--	--	--	--	--	--	--	1,125	1,253
Seedling and sapling	1,551	773	--	--	--	--	--	--	1,227
Poletimber	1,815	--	--	1,823	3,228	--	2,055	--	2,040
Sawtimber	9,040	--	21,091	6,664	--	16,275	3,615	--	11,916
Total	8,601	773	21,091	6,387	3,228	16,275	3,952	1,125	10,558
All owners:									
Nonstocked	--	--	--	--	--	--	--	1,125	1,125
Seedling and sapling	1,582	773	--	--	--	--	--	--	1,261
Poletimber	1,635	--	--	1,827	3,228	--	2,005	--	1,966
Sawtimber	8,485	--	20,994	8,373	--	16,298	3,677	--	9,840
Total	7,250	773	20,994	7,901	3,228	16,298	2,781	1,125	7,622

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 30--Net annual growth of growing stock on all timberland, by forest type and individual owner, Kenai Peninsula, Alaska, 1987

Forest type	Owner				All owners
	National Forest	Other Federal	State	Private	
	Thousand cubic feet				
Black spruce	--	-120[a]	-6	-11	-137
Mountain hemlock	-71	35	0[b]	2	-34
Sitka spruce	5	571	982	1,475	3,033
White spruce	-226	1,824	1,407	1,550	4,555
Total	-292	2,310	2,383	3,016	7,417
Black cottonwood	69	3	6	5	83
Paper birch	-22	1,096	220	261	1,555
Quaking aspen	--	135	7	12	154
Total	47	1,234	233	278	1,792
Other nonstocked	0	6	15	16	37
All types	-245	3,549	2,631	3,310	9,245

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

[a] Negative net growth indicates mortality exceeded gross growth.

[b] 0 = less than 500 cubic feet.

Table 31--Net annual growth of growing stock on all timberland, by species and individual owner, Kenai Peninsula, Alaska, 1987

Species	Owner				All owners
	National Forest	Other Federal	State	Private	
	Thousand cubic feet				
Black spruce	-4[a]	228	5	16	245
Mountain hemlock	677	97	74	66	914
Sitka spruce	49	572	983	1,477	3,081
White spruce	-1,252	1,100	1,219	1,347	2,414
Total	-530	1,997	2,282	2,905	6,654
Black cottonwood	81	16	13	12	122
Paper birch	163	1,251	296	342	2,052
Quaking aspen	41	286	40	49	416
Total	285	1,553	349	405	2,592
All species	-245	3,549	2,631	3,310	9,245

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

[a] Negative net growth indicates mortality exceeded gross growth.

Table 32--Average annual mortality of growing stock on all timberland, by forest type and individual owner, Kenai Peninsula, Alaska, 1987

Forest type	National Forest	Other Federal	State	Private	All owners
	Thousand cubic feet				
Black spruce	--	148	8	13	169
Mountain hemlock	1,129	84	106	93	1,412
Sitka spruce	1	23	61	64	149
White spruce	1,266	1,035	796	958	4,055
Total	2,396	1,290	971	1,128	5,785
Black cottonwood	--	--	--	--	--
Paper birch	378	1,378	183	233	2,172
Quaking aspen	--	--	--	--	--
Total	378	1,378	183	233	2,172
All types	2,775	2,669	1,154	1,361	7,958

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 33--Average annual mortality of growing stock, on all timberland, by species and individual owner, Kenai Peninsula, Alaska, 1987

Species	Owner				
	National Forest	Other Federal	State	Private	All owners
	Thousand cubic feet				
Black spruce	5	38	11	11	65
Mountain hemlock	77	3	6	63	149
Sitka spruce	1	23	61	6	91
White spruce	2,665	2,331	1,062	1,256	7,314
Total	2,748	2,395	1,140	1,336	7,619
Black cottonwood	7	--	--	--	7
Paper birch	19	194	10	18	241
Quaking aspen	--	80	4	7	91
Total	26	274	14	25	339
All species	2,775	2,669	1,154	1,361	7,958

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 34--Average annual mortality of growing stock, on all timberland, by species and cause of death, Kenai Peninsula, Alaska, 1987

Species	Cause of death						All causes
	Insects	Disease	Animal	Weather	Suppression	Unknown	
	Thousand cubic feet						
Black spruce	--	65	--	--	--	--	65
Mountain hemlock	--	32	--	32	--	27	91
Sitka spruce	--	--	--	--	--	149	149
White spruce	4,157	262	339	535	24	1,996	7,314
Total	4,157	359	339	568	24	2,172	7,619
Black cottonwood	--	--	7	--	--	--	7
Paper birch	--	38	--	110	--	93	241
Quaking aspen	--	--	--	--	--	91	91
Total	--	38	7	110	--	184	339
All species	4,157	397	346	678	24	2,355	7,958

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

Table 35--Average annual mortality of growing stock, on all timberland, by individual owner and cause of death, Kenai Peninsula, Alaska, 1987

Owner	Cause of death						All causes
	Insects	Disease	Animal	Weather	Suppression	Unknown	
	Thousand cubic feet						
National Forest	1,826	123	51	107	0[a]	669	2,775
Other Federal	1,387	170	187	218	4	704	2,669
State	453	51	51	135	10	453	1,154
Private	491	53	57	218	10	529	1,360
Total	4,157	397	346	678	24	2,355	7,958

-- = no data were collected.

Estimates are subject to sampling error.

Totals may be off because of rounding.

[a] Less than 500 cubic feet.

Metric Equivalents

1 inch = 2.54 centimeters
1 foot = 0.3048 meter
1 acre = 0.4047 hectare
1 cubic foot = 0.0283 cubic meter
1 cubic foot per acre = 0.07 cubic meter per hectare
1 mile = 1.609 kilometers
°F=1.8°C+32

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The 1987 inventory of the forest resources of the Kenai Peninsula was designed to assess the impact of the spruce beetle (*Dendroctonus rufipennis* (Kirby)) on the timberland component of the forest resource. Estimates of timberland area, volumes of timber, and growth and mortality of timber were developed. These estimates of timber resource quantities were also categorized by owner. Total timberland area was estimated at 482 thousand acres. Cubic volume on this timberland was estimated at 1,211,577 thousand cubic feet. Timber growth and mortality were estimated at 9,245 and 7,958 thousand cubic feet, respectively. Detailed tables provide additional breakdowns of inventory results.

Keywords: Forest surveys, timber resources (insect damage), statistics (forest), Alaska (Kenai Peninsula).

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