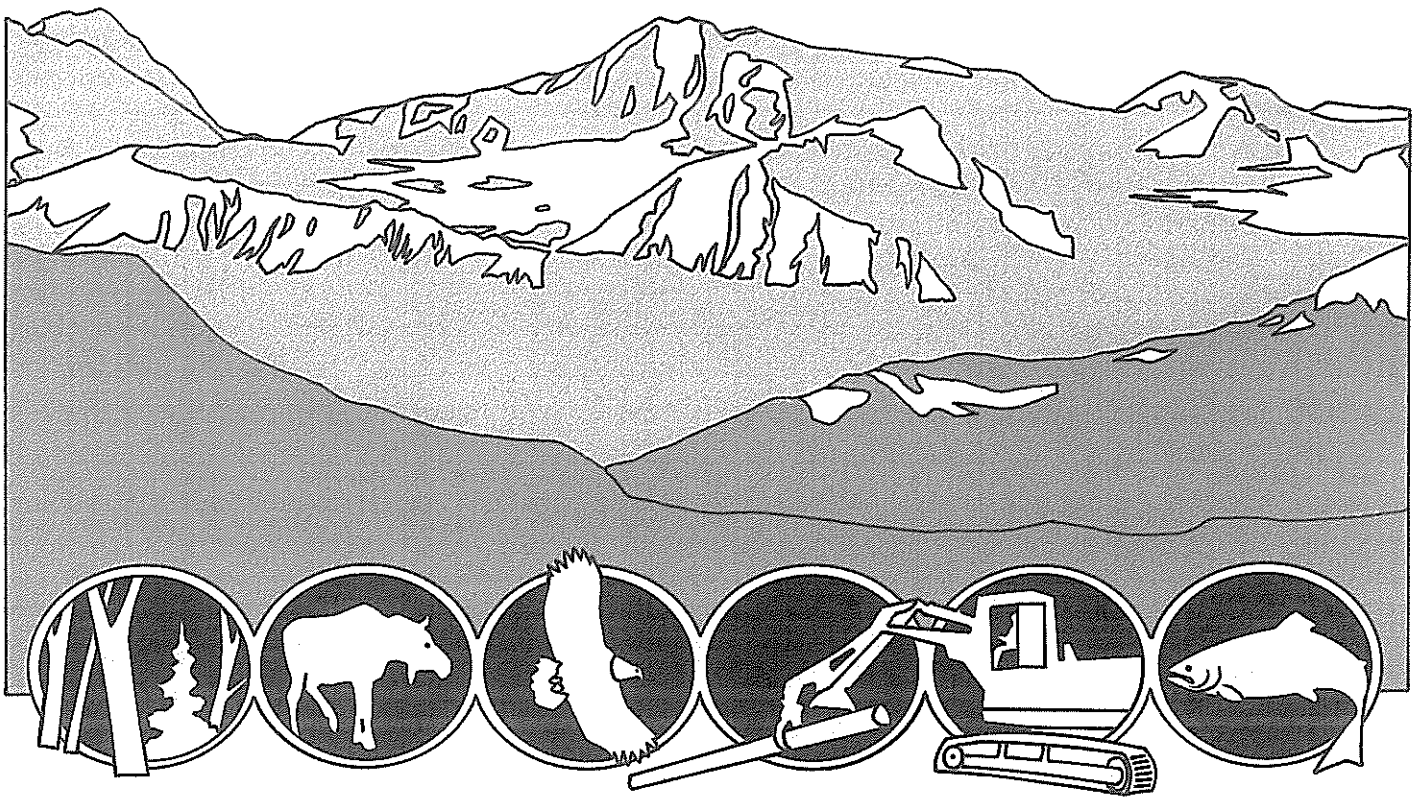
HAINES STATE FOREST
RESOURCE MANAGEMENT AREA



FOREST INVENTORY

Steven Phillips
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State of Alaska
Department of Natural Resources
Division of Forestry

Alaska Department of
NATURAL
RESOURCES

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STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
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PREFACE

This report provides a summary of the second major forest inventory completed for the Haines Area. The first formal inventory was undertaken as a cooperative project between the United States Forest Survey, a branch of the USDA Forest Service, and the Alaska Department of Natural Resources, Division of Lands. Field work for the original inventory was completed in 1965, with the results published in 1976 (LaBau and Hutchison 1976). The second inventory, which recorded field data during the summer of 1985, took advantage of the original permanent plots which fell within the boundaries of the State Forest.

The Alaska Department of Natural Resources completed the Haines State Forest Management Plan in the early part of 1986. This plan established broad land use allocations that provide direction and constraint to land managers, particularly with respect to the use of timber resources. Together with the plan, the Division of Forestry was requested to conduct an inventory of the forest to provide comprehensive information on resources and trends. This information would then be available to compliment current management activities, provide the basis for a new allowable annual harvest determination, and facilitate updates to the plan. The general process for the 1985 inventory included five distinct phases:

1. Establish 89 five-point cluster plots distributed throughout the forest to supply the bulk of the information used in this report;

2. Perform fall, buck, and scale analysis of 150 trees to create new volume tables and defect estimates for Sitka spruce and western hemlock;

3. Remeasure 30 fixed area cluster plots established in 1965 to determine growth, mortality, and change in defect over the 20-year period;

4. Create provisional site index curves for second growth spruce and hemlock; and

5. Compile past regeneration reports to determine general status of stocking on harvested lands.

Richard C. Sanders, Consulting Forester, operated under contract to collect the field data from the randomly selected sample sites and to conduct the fall, buck, and scale analysis. Division of Forestry staff completed the remeasure work on the 1965 inventory plots. The site index study was conducted by Dr. Wilbur Farr of the USDA Forest Service, Pacific Northwest Forest and Range Experimental Station, with the Division of Forestry assisting in data collection.

INVENTORY HIGHLIGHTS

Land Base

The Haines State Forest Resource Management Area incorporates 270,410 acres of state owned land. University of Alaska land is included in the timber base by cooperative agreement. The timber base is defined as operable forest lands available for harvest.

Land Status	All Lands	Forested	Timber Base	Past Harvest
General Selection	149,225	23,276	4,943	116
Mental Health	106,724	42,706	39,377	8,476
Univ. of Alaska	12,984	6,355	4,620	2,524
School Lands	1,477	403	291	330
Total Acres	270,410	72,740	49,231	11,446

Forest Volume

Operable and available forest lands contain an estimated net volume of 203 million cubic feet, or 879 million board feet Scribner.

52 percent is Sitka spruce - 105 million cubic feet

45 percent is hemlock - 91 million cubic feet

3 percent is cottonwood - 7 million cubic feet

The average net volume per acre for unharvested areas is 5,255 cubic feet or 22,699 board feet Scribner. Western and mountain hemlock are treated the same commercially, so are referred to jointly as "hemlock".

Allowable Cut

The sustained yield estimates are:

20.9 million cubic feet per decade

93.1 million board-feet (Scribner 16' log) per decade

69.6 million board feet (Scribner long log) per decade

Defect Analysis

Species	Cubic Defect	Scribner Defect
Sitka spruce	10%	22%
Hemlock	37%	58%

Growth and Mortality

Net annual growth and mortality in cubic feet based on remeasure plots:

Species	Growth	Mortality
Sitka spruce	370,700	853,300
Hemlock	16,400	185,700

Productivity

The average site index is estimated at 93 feet in 100 years or 59 feet in 50 years.

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GLOSSARY

Allowable cut: The average volume that may be harvested annually from a given forest unit, that will result in the eventual attainment and perpetuation of an approximately normal distribution of age classes, normal stocking, and a sustained yield.

Hanzlik formula:

Allowable Cut = **V/R + I**

where: V= volume of mature timber
R = rotation length
I = mean annual increment.

Area control:

Allowable Cut = **A/R * Vm_a**

where: A = number of acres in the timber base
R = rotation in years
Vm_a = average volume per acre of sawtimber stands

Kemp formula:

Allowable Cut =
($[A_1+3*A_2+5*A_3+7*A_4]$ / [4 * R]) * Vm_a

where: A_1 = area of unstocked and reproducing stands
A_2 = area of seedling and sapling stands
A_3 = area of poletimber stands
A_4 = area of sawtimber stands
Vm_a = average volume per acre of saw timber stands
R = rotation in years

Acquisition Authority: State lands are acquired from the federal government through several grant programs and the Statehood Act.

Available for timber harvest: State owned land where timber harvest is not a prohibited surface use according to the Haines State Forest Resource Management Area Plan.

Basal Area: The cross sectional area of a tree or trees based on diameter breast-height (D.B.H.).

Board-foot Volume: A volume measure represented by a board one foot long, one foot wide, and one inch thick. Volume is often expressed in 1000 board feet or MBF. Saw kerf and slab waste are not included in the volume.

Cord: 128 cubic feet of stacked wood including wood, bark, and air space. A cord is typically 80 to 90 cubic feet of solid wood.

Cubic-foot Volume: A volume measure represented by a cube of solid wood 12 inches on each side. The cubic foot volume of a log or tree is commonly computed by Smalian's formula.

Culmination of mean annual increment: (CMAI) The age at which stand growth averaged for the life of the stand is greatest. CMAI defines the rotation for maximum volume-growth productivity.

Cunit: 100 cubic feet of solid wood.

Diameter Breast-height (D.B.H.): Diameter of a tree measured at 4.5 feet above the ground on the uphill side. For trees with excess butt swell, D.B.H. is measured 4.5 feet above the root collar.

Defect tables: Tables estimating the unusable (cull) percentage of a tree based on species and type and/or location of defect indicator.

Diameter Class: Classification of trees based on diameters. 2-inch diameter classes are used in this publication. An 8 inch diameter class includes trees with D.B.H.'s between 7.0" and 8.9" inclusive.

Fall, buck, and scale: Procedure where trees are measured, cut to commercial specifications, and remeasured for gross and net volume calculations.

5-point cluster plot: Sampling method using plots composed of 5 variable radius sub-plots in a pentagonal arrangement.

Forest Land: Land at least 16% stocked by forest trees of any size, or formerly having such tree cover and not currently developed for non-forest use.

Gross growth: The increase in gross volume in a unit area over a specific time period.

Gross mortality: The gross volume of trees in a unit area that have died over a specific time period.

Gross volume: The volume contained within the bole of a tree, including wood, rot, and hollow

portions. Utilization standards of stumps and tops vary between measurements and should be specified.

Inoperable Forest Lands: Areas of forest land that are presently inoperable because of physical, financial, or administrative constraints. Factors include slope, access, soil stability, volume per acre, and proximity of a stand to other stands.

Land Cover Class: A grouping of vegetation stand types based on species and net volume per acre.

A. High volume conifer: Stands identified by type maps as containing spruce and/or hemlock of sawtimber size and high density.

B. Medium volume conifer: Stands identified by type maps as containing spruce and/or hemlock of sawtimber size and medium density.

C. Low volume conifer: Stands identified on type maps as containing spruce and/or hemlock of low density.

D. Cottonwood: Stands identified on type maps as being comprised primarily of cottonwood.

E. Regeneration: Areas that have had more than 50% of the basal area of the stand removed by timber harvests since 1960.

F. Woodland non-forest: Land not covered with trees. Includes brush fields interspersed between standing timber that potentially can support tree growth, and areas above timberline that cannot support tree growth.

Local volume tables: Tables for a prescribed area estimating tree volume as a function of diameter and height for a species or species group.

Log grade: A classification of logs based on external characteristics as indicators of quality or value. Grade determination follows the 1982 edition of the Puget Sound Log Scaling and Grading Rules.

Net growth: The difference in net volume for a unit area over a specific time period.

Net mortality: The net volume of trees in a unit area that have died over a specific time period.

Net volume: The usable portion of a tree, equal to gross volume less deductions for rot, sweep, or other defects affecting the use for wood products.

Non-commercial forest: Land classified as woodland non-forest or water.

Operable lands: Stands or portions of stands determined to be economically and environmentally feasible to harvest under present standards. Factors include slope, access, soil stability, volume per acre, bridge building and maintenance requirements, and proximity of a stand to other stands.

Scarification: Mechanical process of disturbing the forest floor to enhance the establishment and development of a new forest crop. The forest floor is the layer of unincorporated organic matter that lies on top of the mineral soil, composed of fallen leaves, twigs, and other plant remains.

Scribner Board-foot Volume: Volume computed using the Scribner log rule. Scribner is an empirical log rule that estimates the number of board feet contained in a log based on the length of the log and diameter at the small end. Allowance is made for saw kerf and slab waste.

Size Class: Classification of individual trees based on diameter at breast height:

Seedling-sapling: Trees 0.0 to 4.9 inches D.B.H.

Poletimber: Trees 5.0 - 10.9 inches D.B.H.

Small sawtimber: Trees 11.0 - 20.9 inches D.B.H.

Large sawtimber: Trees exceeding 21.0 inches D.B.H.

3-point fixed plot: Sampling method using three plots of fixed area close to each other.

Timber base: Operable land available for timber harvest.

Tree class: Category of basic tree description.

1. **Desirable crop tree:** Live overstory tree of a commercial species less than 150 years old (estimated) that is free of defect indicators, and exhibits good form and a healthy crown.

2. **Acceptable crop tree:** Live non-cull tree of a commercial species less than 150 years old

(estimated) with a normal, conical shaped crown.

3. **Mature high risk tree:** Live non-cull tree of a commercial species greater than 150 years old (estimated) of fair or poor vigor.

4. **Mature low risk tree:** Live non-cull tree of a commercial species greater than 150 years old (estimated) of good vigor.

5. **Rotten cull tree:** Live tree containing more than 75% defect in softwoods or more than 50% defect in hardwoods.

6. **Sound cull tree:** Live tree, not rotten, but unable to produce one merchantable log now or in the future due to poor form, deformed or sparse crown, or of a noncommercial species.

7. **Salvable dead tree:** Tree of a commercial species that has died within the last 5 years and contains at least one merchantable log.

8. **Non-salvable dead tree:** Tree dead less than five years of a commercial species that contains no salvable sawlogs.

9. **Older dead tree:** Trees dead longer than five years.

Variable radius plot: A plot on which a predetermined critical angle is projected from a central point, and swept in a full circle, to determine the basal area, tree count, and volume per unit of area. The radius of this plot is a function of tree diameter and is, therefore, variable.

OBJECTIVE

This project was designed to provide a reliable forest inventory of lands designated operable and available for harvest under the 1986 Haines State Forest Resource Management Area Management Plan.

INTRODUCTION

The Haines State Forest Resource Management Area was legislatively designated on July 1, 1982 by AS 41.15.500 - 41.15.541. The forest was established for utilization, perpetuation, conservation, and protection of the land and water, including the use of renewable and nonrenewable resources through multiple-use management.

The State Forest contains approximately 289,389 acres with 270,410 acres under State ownership. It is located between latitudes 59° and 60° north, and longitudes 135° and 137° west. The Haines area is in a transition zone between maritime and continental climates. Rainfall at the Haines terminal averages 51 inches per year, with most of that falling between September and March. Up the Klehini River near the Canada border, rainfall averages 34 inches annually. The average temperature for Haines terminal is 57°F in July and 22°F in January. Near the border, the July average is 58°F and January is 14°F.

The Haines State Forest is composed predominantly of two forest types, Western hemlock-Sitka spruce (SAF 225), and Black cottonwood - Willow (SAF 222). Black cottonwood (*Populus trichocarpa* Torr. & Gray) occurs primarily within the alluvial areas along major rivers and streams. In older cottonwood stands, Sitka spruce (*Picea sitchensis* (Bong.) Carr.) has become well established, creating a transitional forest between the two major types. Away from the rivers, western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) is typically the dominant species, changing to Sitka spruce and mountain hemlock (*Tsuga mertensiana* (Bong.) Carr.) at higher elevations. Stocking and height growth decrease as elevation nears treeline. Minor species components of lodgepole pine (*Pinus contorta* var. *latifolia* Engelm.), paper birch (*Betula papyrifera* var. *commutata* (Reg.) Fern.), and aspen (*Populus tremuloides* Mitchx.) occur throughout the forested areas.

PAST INVENTORIES

Several formal and informal forest inventories have been performed in the Haines area. The earliest report is a 1949 survey by George Gustafsen and Robert Mounteer for the Department of Interior, Bureau of Land Management. The survey indicated a sufficient volume of timber to sustain industrial development. Most lands were then in the public domain, managed by the USDI Bureau of Land Management.

The USDA Forest Service, in cooperation with the State of Alaska, Division of Lands, conducted an intensive timber inventory of the Haines-Skagway area. Field data was collected in 1965 on fixed area cluster plots which were systematically selected from a base of several thousand aerial photo plots. Each field plot was comprised of three one-fifth acre sub-plots. Trees were numbered to provide the means for an accurate remeasurement during the 1985 reinventory. The results of the original inventory are published in the USDA Forest Service Resource Bulletin PNW-67 (LaBau and Hutchison 1976). The 1965 inventory included a land base of 449,300 acres.

1985 INVENTORY

In 1985, the second intense inventory was undertaken to refine volume, growth, quality, and productivity estimates of the timber component on lands designated as the Haines State Forest Resource Management Area. Using direction and constraints culminating in the 1986 management plan, primary resource use and operability were determined. The 1986 management plan also directed the recalculation of allowable cut based on this inventory. The forest was stratified prior to allocating random sample plots and studies were devised to estimate defect and growth rates.

SAMPLE DESIGN

To accomplish the objectives of the inventory, six phases were identified:

1. Select and measure a stratified random sample of five point, variable radius, cluster plots, including the establishment of new permanent plots;

2. Sample all potential remeasure plots from the 1965 inventory which fell within the State Forest;

3. Select a sub-sample of trees from the stratified sample for defect analysis, volume table construction, and the determination of short log to long log ratio for Scribner board-foot scale;

4. Compile past individual stand stocking reports to summarize the status of regeneration on harvested lands;

5. Develop and automate key management "layers" in a Geographic Information System (GIS) to enhance analysis and management of resources within the State Forest.

6. Facilitate a cooperative effort with the USDA Forest Service, PNW Research Station in Juneau, to learn more about characteristics of second growth timber stands in the Haines area.

Based on estimates of variation from the 1965 inventory, an overall target of plus or minus ten percent accuracy at the 95% confidence level for gross volume estimates was set. A total of 89 five-point cluster plots were selected for volume and stocking determinations. Permanent plots were to be established at 31 of these locations.

The plots were assigned using rules of optimal allocation among four timbered strata that were identified in the forest management plan operability analysis (*see pages 133-134 of* **HSFRMAP**).

Stratum 1 - High Volume Stands

Stratum 2 - Medium Volume Stands

Stratum 3 - Low Volume Stands

Stratum 4 - Cottonwood

A fifth stratum, Young Growth Spruce, was identified to provide information on second growth stands using the cluster plot system. This stratum proved to be mislabeled as most areas were high elevation spruce and hemlock stands. Five of the seven plots measured were dropped from the analysis because of inoperability. Two plots were reallocated to their initial strata. Any acres that were originally considered for this stratum, based upon the mapped forest types, were assigned to their original strata of high, medium, or low volume potential. Two "Low" plots were dropped due to inoperability. The 82 resulting plots were analyzed to create the tables in this report.

Because of revisions to the forest plan after awarding the field measurement contract, the plan's timber base is a subset of the land base sampled. 13 of 82 plots are in locations now unavailable for timber harvest. All 82 plots are used to strengthen the statistical basis of volume and stocking. The 69 "in" plots predict overall gross volumes 2% higher than the 82 plots. Per acre volume figures using all 82 plots are noted by the term "Operable and Inventoried" or "Weighted for Operable and Available Forest Land". Any composite estimates are based on an assumption that stratification and operability are similar on available and unavailable lands. As the same type mapping and operability criteria were applied over the entire forest, this assumption seems safe. Statistical analysis has only been applied to the full 82 plots.

Phases 1 and 2 were accomplished in 1984 and 1985. The 82 plots included in the analysis were all measured in 1985.

Reports for phases 3 and 6 have been previously published. The "Haines State Forest Inventory Fall, Buck, and Scale Defect Study" was written by Richard Sanders and Calvin Kerr in September, 1985. Wilbur Farr published "Provisional Site Index and Height Growth Curves for Unmanaged Even-Aged Stands of Western Hemlock and Sitka Spruce at Haines, Alaska" in January, 1985. Richard McMahon computed "Volume Tables for Old-Growth Western Hemlock and Sitka Spruce on the Haines State Forest and Resource Management Area, Haines, Alaska" in February, 1986.

Phase 5 has been accomplished including layers for vegetation, operability, ownership or acquisition authority, roads, and State Forest boundaries. The Geographic Information System (GIS) database was constructed using ARC-INFO and is the basis for the acreage figures found in these tables.

A summary of phase 4 is included in the tables and described under the heading "Seedling and Sapling stands".

LAND BASE

The 1985 inventory is based on a total of 270,410 acres. This study did not address the forest resources of the Skagway area, which accounts for much of the difference in acreage between the 1965 and 1985 inventories. Within the Haines area itself, several major changes in the land and timber bases have taken place since 1965. Over-the-counter land sales and Native allotments have placed some former state and state selected lands into private ownership. In 1982, the Alaska Legislature created the Haines State Forest Resource Management Area and the Alaska Chilkat Bald Eagle Preserve (AS 41.15.500-41.15.541 and AS 41.20.506-41.20.525 respectively). This legislation provided for a long term commitment to public resource protection and management.

Classifications that allocated lands to primary and secondary uses in 1979 have further focused the land base available for timber harvest. In 1984, a careful stand-by-stand analysis to determine operability was completed by the Haines Area Forester. Determination of operability for a given stand may change over time with changes in harvesting technology and environmental constraints. The 1984 operability designations are appropriate for this analysis.

Appendix Tables 1 through 9 detail the land base by ownership, management designations, vegetation categories, and geographic subunits.

The following breakdown of Haines State Forest acreage illustrates the operable and available forest land:

Total State and University Land (Acres)	270,410
less non-forested	-186,223
Forested or Regeneration	84,187
less inoperable lands	-13,360
Operable Forested Land	70,827
less management constraints	-21,595
Total Forest Lands Operable and Available for Harvest (Acres)	49,231

11,504 acres have been harvested since 1960. 10,570 acres are operable and available for harvest, while 934 acres are on lands with future timber harvest constraints. 58 acres were partially cut and have mostly a hemlock residual cover, while 11,446 acres were clearcut. These are gross acres and include patches of shrub and pockets of remaining trees.

The distribution of operable forest land available for harvest by acquisition authority is as follows:

Owner	Area (acres)	Percent
Mental Health Grant	39,377	80
University of Alaska	4,620	9
General Selection	4,943	10
School	291	1
All Lands	49,231	100 %

FOREST STRATA

The Haines State Forest Management Area contains 2 forest types of significance: hemlock-spruce and cottonwood. The hemlock-spruce type was divided into three strata based on stand volume. An additional type, Paper birch, was reported in the 1965 inventory (LaBau and Hutchison 1976). This type is insignificant within the Haines State Forest. Regeneration and woodland-nonforest strata were not sampled. Acreage breakdowns of the strata may be found in the Appendix Tables 2 - 9.

The high volume conifer stratum is composed of western hemlock and Sitka spruce. Mountain hemlock and cottonwood are minor components. Western hemlock is the most frequent species and accounts for the majority of gross volume. Sitka spruce is less frequent but makes up most of the net volume because of its larger average size and lower defect. Overall stratum defect averages 44% using Scribner rule and 27% by cubic volume. Appendix Tables 15 through 19 provide comparisons based on species, stratum, and volume measure.

The medium volume conifer stratum is composed of the same species with different distributions. Western hemlock and Sitka spruce are near equal in gross volume despite a large difference in frequency. Mountain hemlock is more prevalent accounting for 7% of the gross cubic volume. Cottonwood is still a minor component. The medium volume stands average more trees per acre than the high volume stands but they are smaller in diameter and shorter. Defect averages 40% Scribner rule and 24% by cubic volume. The hemlock defect accounts for 78% of the cubic volume loss and 73% of the Scribner volume loss.

The low volume conifer stratum has a similar distribution of western hemlock, Sitka spruce, and mountain hemlock. More trees occur in the poletimber size class compared to the High and Medium strata. Spruce has a significantly larger average diameter than the hemlocks, accounting for the higher gross and net volumes. Mountain hemlocks are typically small diameter, making up 5% of the gross cubic volume. Cottonwood remains a minor component of the stand. Hemlocks account for 68% of the cubic volume defect and 61% of the Scribner defect.

In comparing the three conifer strata, the frequency and size of Sitka spruce changes very little, while the hemlocks vary considerably. Because of the high hemlock defect, the net volumes vary little among the high, medium, and low strata. Defect and species mix does vary from subunit to subunit, however, the sampling intensity was too small to make sound conclusions at the subunit level.

The cottonwood type makes up 3,590 acres of the State Forest. Most of the cottonwood type was included in the legislatively designated Alaska Bald Eagle Preserve. Black cottonwood and Sitka spruce occur at about the same frequency, with western hemlock a minor component. Pure stands of cottonwood commonly contain a dense understory of cranberry, grass, alder, and other vegetation that inhibit conifer regeneration. Sitka spruce is an emerging understory in the mixed stands. Cottonwood quality and defect is highly variable, and markets are erratic. The Haines studies did not intensively measure cottonwood defect nor create a local volume table.

Proportion of Species Occurring in each Stratum (stem count)

Stratum	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood
High Volume Conifer	28%	69%	3%	0%
Medium Volume Conifer	22%	57%	16%	5%
Low Volume Conifer	31%	42%	26%	1%
Black Cottonwood	41%	15%	0%	45%

FOREST VOLUME

Proportion of Total Volume by Species

Volume Measure	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood
Gross Cubic Feet	43%	49%	5%	3%
Net Cubic Feet	51%	41%	4%	5%
Gross Scribner	46%	47%	4%	3%
Net Scribner	60%	33%	3%	4%

The estimated total gross volume for the Haines State Forest is 493 million cubic feet or 2,672 million board feet (Scribner, 16 foot logs). Operable lands available for timber harvest contain a total net volume of 203 million cubic feet, or 879 million board feet. Net volume averages 5,255 cubic feet or 22,699 board feet per acre over the 38,719 acres of unharvested land. Gross volumes are 6,967 cubic feet or 37,890 board feet per acre. The defect percent for all species is 25% for cubic measure and 40% for board foot measure.

Appendix Table 15 and 16 detail the volumes per acre by strata, species,and volume measure. Tables 18 and 19 provide volume estimates weighted for the operable and availible forest land. Net volume distribution by species is significantly different from the gross volume figures, due to the greater level of defect in hemlock. As mentioned in the stratum descriptions, Sitka spruce volume does not change appreciably between the three conifer strata and thus forms a greater proportion of the stand volume in the lowest volume stands.

Gross and net volume for Sitka spruce, western hemlock, and mountain hemlock were derived from the Fall, Buck, and Scale study and defect analysis performed by Sanders and Kerr. The following are the equations used: (McMahon,86)

Cubic Foot Volume, Spruce & Hemlock, Haines, Alaska

1 foot stump to 6 inch top, diameter at 4.5 ft., total height.

$$V = 0.32370 + 0.00214 * DBH^{**1.80897} * TotHt^{**1.11278}$$

Scribner Board Foot Volume, Spruce & Hemlock, Haines, Alaska foot stump to 6 inch top, diameter at 4.5 ft., total height.

$$V = -13.32049 + 0.00371 * DBH^{**1.81821} * TotHt^{**1.37125}$$

Published equations were used for other tree species:

Cubic foot volume, Black cottonwood and willow. USDA-USFS Research Note NOR-6, Table 16. 1 foot stump to 6 inch top, 4.5 ft. diameter, total height.

Cubic foot volume, Paper birch. USDA-USFS Research Note NOR-6, Table 11. 1 foot stump to 4 inch top, diameter at 4.5 ft., total height.

Scribner board foot volume, Black cottonwood (Balsam poplar) and willow. USDA-USFS Research Note NOR-5, Table 9. 1 foot stump to top equal to 40% of DBH, diameter at 4.5 ft., total height.

Scribner board foot volume, Paper Birch (and aspen). USDA-USFS Research Note NOR-5, Table 6. 1 foot stump to top equal to 40% of DBH, diameter at 4.5 ft., total height.

Commercial forest lands in the Haines State Forest Resource Management Area are dominated by stands over 150 years old. The seedling-sapling age class originates primarily from harvested lands. Young sawtimber stands, less than 150 years old, and poletimber stands are infrequent, comprising only 9% of the forested area. Many of these young stands are of the cottonwood type. This age class imbalance is the result of few catastrophic events such as wildfire and the low incidence of timber harvest before 1960.

General Age Class Distribution

Mature and over mature Saw 150 Years or greater (acres)	66,695	79 %
Young Growth Pole and Saw less than 150 Years	7,252	9 %
Seedling and Sapling since 1960	10,137	10 %
Total Forest Land (acres)	84,084	

Old growth criteria were not defined for this inventory and are not reported.

QUALITY OF SAWTIMBER

Few logs in the Haines State Forest, about two percent, receive grades of number 1 sawlog, special mill or better, using the Puget Sound Log Scaling Rules. Scale data collected over the 1980-1990 period shows the following distribution of log grades.

Log Grades based on Scale Data
Percent of Net Scribner Volume 1980 - 1990

	Spruce %	Hemlock %
Number 1 Sawlog	1.1	0.3
Special Mill	2.6	1.1
Number 2 Sawlog	59.3	29.9
Number 3 Sawlog	25.1	16.0
Number 4 Sawlog	2.6	3.3
Utility	9.5	49.3

Over 90 percent of the net volume for hemlock and spruce was scaled number 2 sawlogs, number 3 sawlogs, or utility. Utility grades for hemlock included half the net volume (49%) due to the high levels of defect common in this species. By comparison, only 9% of the spruce volume received a similar grade.

GROWTH AND MORTALITY

Growth and mortality figures were computed from the remeasurement in 1985 of thirty fixed area (3-point, 1/5 acre) locations originally established in 1965. The net annual growth averaged only 22.8 board feet or 9.8 cubic feet per acre during the 20 year period. Confidence limits on these estimates, at the 95 percent level, are +/- 20.6 cubic feet or 113 board feet. Spruce mortality and expanding decay in live hemlock trees canceled volume increases from height and diameter for the surviving trees.

Several trends emerged from the analysis of remeasure plots: Spruce trees are dying at a much higher rate than hemlock or cottonwood. This mortality rate partially offsets the positive net volume growth of spruce trees. Overmature hemlocks tend to lose more volume through decay than they gain through gross growth (diameter and height growth), resulting in a negative growth rate, despite the low level of mortality.

The major implication from these results is that current yields are far less than their potential under managed stands. Existing stands typically contain high levels of decay and mortality, and low rates of height and diameter growth. Second growth stands will contain low levels of decay and rapid rates of height and diameter growth.

FOREST REGENERATION

Within the entire Haines State Forest, 11,446 acres of state land have been clear-cut harvested since 1960. Regeneration of these areas has been measured using stocking surveys. Sampling intensity and plot sizes varied between surveys, consequently survey statistics cannot be created for the group as a whole. Of the 2,353 small fixed plots taken throughout the harvested area, 1,146 or 49% were stocked with at least one conifer tree.

Species Composition of Regeneration Plots	
Sitka spruce	55%
Western and Mountain hemlock	44%
Black cottonwood	24%

Note: Many plots contain more than one species.

Based on these observations, the following conclusions are made:

1. Lower elevation, well stocked stands, have good to excellent regeneration from natural seeding as long as there was some scarification. Natural regeneration is more likely to be deficient in those units that were yarded in the winter, when snow cover and frozen ground inhibit soil and brush disturbance.

2. Natural regeneration will likely be inadequate in open stands that are brushy. Site preparation and planting has generally brought stocking to pre-harvest levels.

3. Areas of heavy scarification and compaction (roads and landings) have regenerated with alder. Moderate compaction (embankments) favors cottonwood.

4. There has been significant variability in regeneration success, even for seemingly similar sites. Since seed is readily available and biological hazards are low, the variability may be due to climatic or microsite differences. Notes on survey cards indicate that nurselogs are a benefit to seedling establishment and growth.

5. Without site preparation, survival of planted seedlings has been poor in older brush covered units. Where timber harvest or mechanical methods reduced brush, survival of natural and planted seedlings was enhanced.

300,000 seedlings have been planted on 1,113 acres within the Haines State Forest since 1977. All competitive timber sales now contain provisions for replanting of harvested areas.

HAINES FALL, BUCK, AND SCALE DEFECT STUDY

Defect by Species and Indicator Code

	Sitka spruce			
Position of External Indicator	Cubic-foot Decay	Sample Size	Board-Foot Scribner Decay	Sample Size
0 - None	7.1%	32	13.9%	32
1 - Above 32 feet	7.6	7	25.3	7
2 - Below 32 feet	10.7	14	27.8	14
3 - Both above and below 32 feet	26.0	7	45.0	7

	Hemlock			
Position of External Indicator	Cubic-foot Decay	Sample Size	Board-Foot Scribner Decay	Sample Size
0 - None	9.1%	36	19.3%	36
1 - Above 32 feet	18.6	6	35.5	6
2 - Below 32 feet	41.3	25	61.0	25
3 - Both above and below 32 feet	60.9	22	92.4	22

These results compare favorably with those published by the U.S. Forest Service (Farr, LaBau and Laurent 1976).

RELIABILITY OF THE INVENTORY

The target for the inventory was 10% standard error of the mean gross volume at the 95% confidence interval (two standard errors). The mean volumes reported for all trees in Appendix Tables 21 through 24 have a 95% chance of falling within two standard errors of the true but unknown volume per acre.

Results of statistical analysis of the 82 plots for percent sampling error for volume and stocking estimates are as follows (two standard errors):

The target level of accuracy for the inventory was attained for gross Scribner and gross cubic volume.

Gross cubic feet	8.9%	Gross Scribner board feet	9.7%
Net cubic feet	9.6%	Net Scribner board feet	11.7%
Basal area	7.5%	Number of trees	13.0%

SITE QUALITY

Site quality is an estimate of the productivity of the forest land for a certain species. A "Site Index" is a relative measure of the growth of a stand. Using the age and height of the dominant and codominant trees on a stand, future heights, stocking, and stand volume may be estimated.

Two site index systems are available for the Haines area, R.F. Taylor (1934) and W.A. Farr (1985). Taylor studied second growth even-aged western hemlock and Sitka spruce stands in Southeastern Alaska. Site index based on 100 years is calculated from total height and total age. Tables for site index, basal area, stocking, and cubic volume are included. Farr's study was based on even-age hemlock and spruce within the Haines State Forest. Site index is based on 50 years and calculated from total height and breast height age. Provisional tables (Farr 1985b) tie Farr's study to Taylor's.

The inventory included measurement of "Site Trees": codominant or dominant sound trees. Age was measured at 4.5 feet. Following Taylor's criteria, 6 of 82 plots qualify as even-age for which trees were measured. Average site index was 85 (base 100). 34 Sitka spruce and 15 western hemlock trees from 26 of the 82 plots met the criteria of basal age less than 155 years. All trees were sound though visual defects were evident on most trees. Sitka spruce averaged a site index of 91 (base 100), western hemlock averaged a site index of 81 (base 100). Taylor mentions that hemlock typically has a lower site index than spruce.

The inventory measured site trees in a variable plot rather than the fixed size plot for Farr's 1985 methodology. Applying Farr's criteria and equations to the inventory plots, only nine trees qualify as site trees. Results are Sitka spruce site index 69 (base 50; 4 trees), hemlock 54 (base 50; 5 trees). The forest growth survey to establish provisional site indexes show a Sitka spruce site index of 64 (base 50) and a western hemlock site index of 53 (base 50). The same plots averaged a site index of 91 (base 100). The forest growth survey measured a subset of the existing young stands and was not designed to provide forest wide statistics. The results of the inventory and the growth survey are, however, in agreement indicating a reliable site index of 91 (base 100) for use of Taylor's yield tables.

ROTATION LENGTH

When allowable cut was determined as part of the Haines State Forest Resource Management Plan in 1984, productivity was assumed to be related to the current stand stocking level. Thus different growth projections and optimal rotation lengths were determined for each of the three spruce-hemlock classes (high volume conifer, medium volume conifer, and low volume conifer). Site index data from this inventory showed no significant difference among the conifer classes so one rotation length will be used for all classes.

To maximize long term sustained yield, the rotation length will be set at the culmination of mean annual increment (CMAI). According to USDA Forest Service yield tables (Taylor, 1934; Table 15) CMAI in terms of merchantable cubic feet for Sitka spruce at site index 91 (base 100) is 110 to 120 years. Western hemlock averaged a site index of 81 (base 100) resulting in a CMAI of 120 to 140 years. 120 years will be used as the rotation length in the allowable cut models.

ALLOWABLE CUT

State owned land within the Haines State Forest Resource Management Area is divided into four ownerships: mental health, university, school, and general selection. By agreement, these lands contribute to the allowable cut base, and no attempt has been made to determine separate allowable cut levels by ownership.

An Alaska Department of Natural Resources (1973) analysis of the 1965 inventory for the Haines-Skagway area resulted in an allowable cut estimate of 19.5 million board-feet Scribner (16-foot log) on a land base of 111,000 acres. This figure was based on a rotation age of 100 years.

The allowable cut was recalculated in 1984, after creation of the Haines State Forest Resource Management Area. An allowable cut of 8.8 million board feet per year (Scribner, long log scale) was estimated using the USDA Forest Service FORPLAN program. This figure includes a three percent land base reduction for fish and wildlife conservation areas. For the present calculation, FORPLAN was not chosen because of a heavy reliance on second growth yield projections. These projections are considered unreliable due to the scarcity of young-growth stands within the forest.

Complex allowable cut models are of reduced applicability for Haines, where second growth yield data is lacking. Simple models, less dependent on long-term growth projections, will be used. The first step in this analysis is to calculate allowable cut, using several methods, to produce a range of potential harvest levels. Each model is discussed for its anticipated long-term sustainability. The model that dictates an allowable cut which best meets the standard of long-term, non-fluctuating flow is chosen as the most appropriate for the Haines State Forest Resource Management Area. Formulas for each model may be found in the Glossary under the term "Allowable Cut".

Volumes in this report are based on 16 foot (short) log standards. Allowable cut estimates, in terms of board feet long-log Scribner, require a reduction of 23% to reflect current scaling practices. This figure is based on the fall, buck, and scale analysis that was conducted as part of this inventory. The numbers in the following models should also be reduced by 3 percent to reflect land withdrawn for riparian corridors, including anadromous fish stream buffer zones.

HANZLIK FORMULA

The Hanzlik formula was developed for use in old-growth forests of the Pacific Northwest (Davis and Johnson, 1987). The remeasure study has provided figures for increment of 0.4 million cubic feet or 0.9 million board feet from old-growth stands. Harvested stands have not begun to show growth in cubic or Scribner measures during the 1985 inventory, thus the

increment from that portion of the equation can be listed as zero.

Using total volumes from Appendix Table 14 and a rotation age of 120 years, an allowable cut of 2.10 million cubic feet or 8.22 million board feet Scribner (16 foot log scale) per year is indicated. This number would increase within the next 20 years as the second growth stands begin to register rapid volume growth, raising the increment portion of the equation. Thus, the Hanzlik model appears conservative for the Haines State Forest.

KEMP FORMULA

The Kemp formula (Davis 1966) weights the stands based on their maturity. Results indicate an allowable cut of 13.22 million board feet or 3.06 million cubic feet per year. A cut of this level would not be sustainable for the long term as the managed portion of the forest is converted to younger growing stock. Future allowable cut levels would require reductions if the specified harvest maximums were actually cut during the preceding period.

AREA CONTROL

Using strict area control, 410 acres per year could be harvested yearly yielding 2.16 million cubic feet or 9.31 million board feet. If existing sawtimber and pole-timber stands maintain present stocking levels, then this harvest level would be sustainable for the next 97 years, at which time the current operable and available land base would support second growth stands. Then, the oldest of the current young growth stands (established in 1960) would have to be stocked with 5,250 cubic feet (22,500 board feet) per acre to result in a non-declining flow. According to Taylor's yield tables, this would require stands to average 50-55% of full stocking, a target that is realistic.

CONCLUSION

The three formula results on an annual basis are summarized below. The cubic and Scribner estimates have been reduced three percent for habitat maintenance within the harvest areas. The Scribner volume is further reduced 23% for conversion from short log scale to long log scale.

Allowable Cut Method	Cubic	Scribner
Hanzlik	2.03	6.14
Area Control	2.09	6.96
Kemp	2.97	9.87

Since a cut based on the Kemp formula would probably result in a downward revision over the following decades, and a cut based on the Hanzlik model would have the opposite effect, the area control model seems the most applicable for the Haines State Forest. Barring large fires or drastic changes in mortality trends, the cut level based on area control should produce an even flow over the next few decades. For future recalculations, yields from areas harvested in the 1960s can be estimated, once the stands are 40 years old or greater.

LITERATURE CITED

Alaska, State of. 1986. Haines State Forest Resource Management Area - Management Plan. Department of Natural Resources, Division of Forestry. 47 p., appendices, illus.

Alaska, State of; Department of Natural Resources, Division of Lands. 1973. Estimated Allowable Cut for Alaska's Timber Resource on State Lands. 5p., illus.

Davis, Kenneth P. 1966. Forest Management: Regulation and Valuation. 519 p., illus. McGraw-Hill Book Co.

Davis, Lawrence S., and Johnson, K. Norman. 1987. Forest Management, Third Edition. 790 p., illus. McGraw-Hill Book Co.

Farr, Wilbur A. 1985. Provisional Site Index And Height Growth Curves For Unmanaged Even-Aged Stands Of Western Hemlock And Sitka Spruce At Haines, Alaska. USDA Forest Service Forestry Sciences Laboratory, Juneau, 36 p.

Farr, Wilbur A. 1985b. Tables of Possible Interest To Silviculturists In Southeast Alaska. Silviculture Workshop; Sitka, Alaska; October 30 - November 1, 1985. 13 p.

Farr, Wilbur A. and Hard, John S. 1987. Multivariate Analysis of Climate Along the Southern Coast of Alaska - Some Forestry Implications. USDA Forest Service Research Paper PNW-RD-372, 38 p.

Gustafsen, George E. M., and Mounteer, Robert W. 1949. Haines Timber Survey Report. Unpublished paper. USDI Bureau of Land Management, 15 p.

Labau, Vernon J., and Hutchison, O. Keith. 1976. Timber Supply And Use in the Haines-Skagway Area, Alaska. USDA Forest Service Resource Bulletin PNW-67, 44 p.

McMahon, Richard E. 1986. Volume Tables For Old-Growth Western Hemlock And Sitka Spruce On The Haines State Forest Resource Management Area, Haines, Alaska. Unpublished report, 6 p.

Sanders, Richard C., and Kerr, Calvin. 1985. Haines State Forest Inventory Fall, Buck and Scale Defect Study. State of Alaska Department of Natural Resources, 10 p.

Taylor, R. F. 1934. Yield of Second-Growth Western Hemlock-Sitka Spruce Stands in Southeastern Alaska. USDA Forest Service Technical Bulletin No. 412, 29 p.

The Northwest Log Rules Advisory Group. 1982. Official Rules for the Puget Sound Log Scaling Bureau.

APPENDIX TABLES AND FIGURES

Table 1

Summary of All Lands Within Haines State Forest
By Management Unit and Owner

Unit	State Acquisition Authority				Non-State Inholdings	Total Acres
	General Selection	Mental Health	University	School		
Unit 1 Kelsall River		27,787	615		1,372	29,773
Unit 2 East Chilkat River		12,974	286		599	13,860
Unit 3 Klehini River		29,162	5,166	391	2,467	37,186
Unit 4 Chilkat Lake		17,993	201		468	18,662
Unit 5 Takhin/Kicking Horse	23,765	12,104	4,277	640	404	41,190
Unit 6 Chilkat Inlet	30,053	858	952	266	1,171	33,300
Unit 7 Chilkat Peninsula		550	720	55	192	1,517
Unit 8 Haines Highway	10,074	3,552	347	126	7,779	21,877
Unit 9 Chilkoot Lake	46,271	981	259		3,967	51,479
Unit 10 Ferebee River	39,062	763	160		560	40,546
Total Acres	149,225	106,724	12,984	1,477	18,979	289,389
Percentage of Total	52%	37%	4%	1%	7%	

Table 2

Summary of All Lands Within Haines State Forest
By Land Cover and Owner

Land Cover	State Acquisition Authority				Non-State Inholdings	Total Acres
	General Selection	Mental Health	University	School		
High Volume Conifer	4,744	12,382	900	202	1,527	19,755
Medium Volume Conifer	8,550	17,457	2,535	107	2,407	31,056
Low Volume Conifer	9,827	10,845	1,546	55	1,695	23,969
Cottonwood	155	2,021	1,375	40	478	4,068
Regeneration	116	8,476	2,524	330	945	12,392
Woodland, Non Forest	125,054	49,028	3,674	744	3,269	181,769
Water	779	6,514	431	1	8,656	16,380
Total Acres	149,225	106,724	12,984	1,477	18,979	289,389

Table 3

Summary of State Lands by Availability, Land Cover, and Owner					
	State Acquisition Authority				
Land Cover	General Selection	Mental Health	University	School	Total Acres
Available for Timber Harvest					
High Volume Conifer	533	9,461	550	0	10,544
Medium Volume Conifer	3,307	15,439	1,398	23	20,167
Low Volume Conifer	4,989	8,983	690	0	14,662
Cottonwood	0	1,041	134	0	1,175
Regeneration	0	8,332	1,912	268	10,512
Woodland, Non Forest	71,588	37,645	1,390	226	110,849
Water	523	5,303	52	0	5,878
Total Acres	80,941	86,203	6,127	517	173,788
Closed to Timber Harvest					
High Volume Conifer	4,211	2,922	349	202	7,683
Medium Volume Conifer	5,243	2,018	1,137	84	8,482
Low Volume Conifer	4,838	1,863	55	856	7,611
Cottonwood	155	980	1,241	40	2,415
Regeneration	116	144	612	62	934
Woodland, Non Forest	53,466	11,383	518	2,283	67,650
Water	256	1,211	1	379	1,846
Total Acres	68,284	20,521	3,911	3,906	96,622

Table 4

Summary of State Lands by Operability, Land Cover, and Owner					
	State Acquisition Authority				
Land Cover	General Selection	Mental Health	University	School	Total Acres
Operable by Ground Methods					
High Volume Conifer	3,753	10,962	900	194	15,808
Medium Volume Conifer	5,983	13,318	2,502	107	21,910
Low Volume Conifer	2,687	7,070	1,121	55	10,933
Cottonwood	108	1,680	1,043	40	2,871
Regeneration	116	8,476	2,524	330	11,446
Total Acres	12,647	41,507	8,090	725	62,969
Operable by Helicopter					
High Volume Conifer	927	1,132	0	0	2,060
Medium Volume Conifer	2,041	3,381	15	0	5,437
Low Volume Conifer	168	193	0	0	361
Cottonwood	0	0	0	0	0
Regeneration	0	0	0	0	0
Total Acres	3,136	4,707	15	0	7,858
Inoperable					
High Volume Conifer	64	288	0	8	360
Medium Volume Conifer	526	758	17	0	1,301
Low Volume Conifer	6,972	3,582	425	0	10,979
Cottonwood	47	341	332	0	719
Regeneration	0	0	0	0	0
Total Acres	7,609	4,968	774	8	13,360

Table 5

Summary of State Lands By Management Unit and Land Cover Class

Unit \ Land Cover	High Volume Conifer	Medium Volume Conifer	Low Volume Conifer	Cotton wood	Regen-eration	Woodland Nonforest	Water	Total Acres
All State Lands								
1) Kelsall River	1,953	3,104	2,853	83	7,216	12,925	269	28,403
2) East Chilkat River	1,251	3,295	2,184	200		6,324	7	13,261
3) Klehini River	4,213	6,197	3,634	907	3,734	12,458	3,575	34,718
4) Chilkat Lake	3,377	4,788	1,431	257		6,166	2,175	18,194
5) Takhin/Kicking Horse	2,744	3,122	1,808	1,829	35	30,443	805	40,785
6) Chilkat Inlet	2,008	873	508	248	416	27,815	260	32,129
7) Chilkat Peninsula	142	430	635		20	86	12	1,324
8) Haines Highway	220	235	215	66		13,337	26	14,099
9) Chilkoot Lake	2,026	4,905	4,225		25	36,164	167	47,511
10) Ferebee River	294	1,699	4,780			32,783	428	39,985
Total Acres	18,228	28,649	22,273	3,590	11,446	178,499	7,724	270,410
Percentage of Total	7%	11%	8%	1%	4%	66%	3%	
Available for Timber Harvest								
1) Kelsall River	1,953	3,075	2,714	83	6,898	12,911	269	27,903
2) East Chilkat River	1,251	3,228	2,164	28		6,282	7	12,960
3) Klehini River	3,901	5,783	3,132	849	3,614	12,005	2,916	32,200
4) Chilkat Lake	2,887	4,252	1,358	149		3,718	2,155	14,519
8) Haines Highway	220	235	215	66		13,337	26	14,099
9) Chilkoot Lake	107	2,148	1,717			31,802	92	35,867
10) Ferebee River	226	1,446	3,362			30,794	413	36,241
Total Acres	10,544	20,167	14,662	1,175	10,512	110,849	5,878	173,788
Percentage of Total	6%	12%	8%	1%	6%	64%	3%	
Closed to Timber Harvest								
1) Kelsall River		29	139		319	13		500
2) East Chilkat River		68	19	172		42	0	301
3) Klehini River	312	414	502	58	119	454	659	2,518
4) Chilkat Lake	490	536	73	108		2,448	20	3,675
5) Takhin/Kicking Horse	2,744	3,122	1,808	1,829	35	30,443	805	40,785
6) Chilkat Inlet	2,008	873	508	248	416	27,815	260	32,129
7) Chilkat Peninsula	142	430	635		20	86	12	1,324
8) Haines Highway								
9) Chilkoot Lake	1,918	2,757	2,508		25	4,362	74	11,645
10) Ferebee River	68	253	1,419			1,989	15	3,744
Total Acres	7,683	8,482	7,611	2,415	934	67,650	1,846	96,622
Percentage of Total	8%	9%	8%	2%	1%	70%	2%	

Table 6

Summary of State Lands by Management Unit, Operability, and Land Cover						
Unit / Land Cover	High Volume Conifer	Medium Volume Conifer	Low Volume Conifer	Cotton-wood	Regen-eration	Total Acres
Operable by Ground Methods						
1) Kelsall River	1,897	2,726	2,049	83	7,216	13,971
2) East Chilkat River	919	1,279	680	200		3,078
3) Klehini River	4,170	5,826	3,087	740	3,734	17,557
4) Chilkat Lake	2,778	3,760	1,116	257		7,911
5) Takhin/Kicking Horse	2,212	1,917	1,275	1,374	35	6,813
6) Chilkat Inlet	1,297	383	218	217	416	2,530
7) Chilkat Peninsula	142	430	217		20	809
8) Haines Highway	220	182	69			470
9) Chilkoot Lake	1,880	4,059	1,244		25	7,210
10) Ferebee River	294	1,348	977			2,620
Total Acres	15,808	21,910	10,933	2,871	11,446	62,969
Percentage of Total	25%	35%	17%	5%	18%	
Operable by Helicopter						
1) Kelsall River		292				292
2) East Chilkat River	301	1,602	159			2,063
3) Klehini River	22	280				303
4) Chilkat Lake	489	968				1,457
5) Takhin/Kicking Horse	462	1,081	55			1,598
6) Chilkat Inlet	692	433	33			1,157
7) Chilkat Peninsula						0
8) Haines Highway						0
9) Chilkoot Lake	93	609	114			816
10) Ferebee River		172				172
Total Acres	2,060	5,437	361	0	0	7,858
Percentage of Total	26%	69%	5%	0%	0%	
Currently Inoperable						
1) Kelsall River	56	86	805			946
2) East Chilkat River	30	414	1,344			1,789
3) Klehini River	21	91	547	167		826
4) Chilkat Lake	110	60	315			485
5) Takhin/Kicking Horse	70	124	477	454		1,126
6) Chilkat Inlet	20	58	257	32		366
7) Chilkat Peninsula			418			418
8) Haines Highway		53	147	66		266
9) Chilkoot Lake	52	236	2,867			3,155
10) Ferebee River		179	3,803			3,983
Total Acres	360	1,301	10,979	719	0	13,360
Percentage of Total	3%	10%	82%	5%	0%	

Table 7

Summary of State Lands Available for Timber Harvest by Operability, Unit, and Land Cover

Unit / Land Cover	High Volume Conifer	Medium Volume Conifer	Low Volume Conifer	Cotton-wood	Regen-eration	Total Acres
Operable by Ground Methods						
1) Kelsall River	1,897	2,697	1,910	83	6,898	13,484
2) East Chilkat River	919	1,212	660	28		2,819
3) Klehini River	3,897	5,498	2,600	727	3,614	16,337
4) Chilkat Lake	2,460	3,552	1,091	149		7,252
8) Haines Highway	220	182	69			470
9) Chilkoot Lake	103	2,141	425			2,669
10) Ferebee River	226	1,213	940			2,379
Total Acres	9,721	16,495	7,694	987	10,512	45,410
Percentage of Total	21%	36%	17%	2%	23%	
Operable by Helicopter						
1) Kelsall River		292				292
2) East Chilkat River	301	1,602	159			2,063
3) Klehini River		265				265
4) Chilkat Lake	416	698				1,113
8) Haines Highway						0
9) Chilkoot Lake	4					4
10) Ferebee River		84				84
Total Acres	721	2,941	159	0	0	3,821
Percentage of Total	19%	77%	4%	0%	0%	
Currently Inoperable						
1) Kelsall River	56	86	805			946
2) East Chilkat River	30	414	1,344			1,789
3) Klehini River	4	20	532	122		678
4) Chilkat Lake	11	2	268			281
8) Haines Highway		53	147	66		266
9) Chilkoot Lake		7	1,292			1,299
10) Ferebee River		149	2,421			2,571
Total Acres	101	731	6,809	188	0	7,829
Percentage of Total	1%	9%	87%	2%	0%	

Table 8

Summary of State Lands Operable and Available for Timber Harvest by Unit, Land Cover, and Owner

Unit	Land Cover	State Acquisition Authority: General Selection	Mental Health	University	School	Total Acres
Unit 1 Kelsall River	High Volume Conifer	0	1,874	23	0	1,897
	Medium Volume Conifer	0	2,976	13	0	2,989
	Low Volume Conifer	0	1,890	20	0	1,910
	Cottonwood	0	20	62	0	83
	Regeneration	0	6,853	45	0	6,898
	Total Acres	0	13,614	162	0	13,777
Unit 2 East Chilkat River	High Volume Conifer	0	1,221	0	0	1,221
	Medium Volume Conifer	0	2,814	0	0	2,814
	Low Volume Conifer	0	820	0	0	820
	Cottonwood	0	28	0	0	28
	Total Acres	0	4,882	0	0	4,882
Unit 3 Klehini River	High Volume Conifer	0	3,402	495	0	3,897
	Medium Volume Conifer	0	4,637	1,125	2	5,763
	Low Volume Conifer	0	2,062	538	0	2,600
	Cottonwood	0	657	70	0	727
	Regeneration	0	1,479	1,868	268	3,614
	Total Acres	0	12,236	4,095	270	16,601
Unit 4 Chilkat Lake	High Volume Conifer	0	2,862	13	0	2,876
	Medium Volume Conifer	0	4,137	113	0	4,250
	Low Volume Conifer	0	1,063	27	0	1,091
	Cottonwood	0	149	0	0	149
	Total Acres	0	8,212	154	0	8,366
Unit 8 Haines Highway	High Volume Conifer	200	0	19	0	220
	Medium Volume Conifer	115	16	30	21	182
	Low Volume Conifer	63	6	0	0	69
	Total Acres	378	22	50	21	470
Unit 9 Chilkoot Lake	High Volume Conifer	107	0	0	0	107
	Medium Volume Conifer	1,710	332	100	0	2,141
	Low Volume Conifer	286	80	59	0	425
	Total Acres	2,103	412	158	0	2,673

(continued)

(continued) Table 8

Unit	Land Cover	State Acquisition Authority: General Selection	Mental Health	University	School	Total Acres
Unit 10 Ferebee River	High Volume Conifer	226	0	0	0	226
	Medium Volume Conifer	1,297	0	0	0	1,297
	Low Volume Conifer	940	0	0	0	940
	Total Acres	2,463	0	0	0	2,463
All Units	High Volume Conifer	533	9,359	550	0	10,443
	Medium Volume Conifer	3,121	14,911	1,381	23	19,436
	Low Volume Conifer	1,289	5,921	644	0	7,853
	Cottonwood	0	855	132	0	987
	Regeneration	0	8,332	1,912	268	10,512
	Total Acres	4,943	39,377	4,620	291	49,231

Table 9

Summary of State Lands by Operability, Land Cover and Management Option					
	Available for Harvest	Unavailable for Harvest			Total all Options
Land Cover		Public Recreation	University Reserved	Habitat or Watershed	
Operable					
High Volume Conifer	10,443	2,672	89	4,664	17,868
Medium Volume Conifer	19,436	2,884	233	4,795	27,348
Low Volume Conifer	7,853	1,363	166	1,912	11,294
Cottonwood	987	324	172	1,387	2,871
Regeneration	10,512	497	322	115	11,446
Total Acres	49,231	7,740	982	12,873	70,827
Inoperable					
High Volume Conifer	101	119	0	139	360
Medium Volume Conifer	731	132	0	438	1,301
Low Volume Conifer	6,809	2,569	202	1,399	10,979
Cottonwood	188	32	0	499	719
Total Acres	7,829	2,853	202	2,476	13,360
Total all Operabilities	57,061	10,593	1,184	15,348	84,186

Table 10

Summary of Harvested State Lands by Unit and Management Option					
	Available for Harvest	Unavailable for Harvest			Total all Options
Unit		Public Recreation	University Reserved	Habitat or Watershed	
Unit 1 Kelsall River	6,957	16	302		7,276
Unit 3 Klehini River	3,613	64		55	3,732
Unit 5 Takhin/Kicking Horse				35	35
Unit 6 Chilkat Inlet		416			416
Unit 7 Chilkat Peninsula			20		20
Unit 9 Chilkoot Lake				25	25
Total Acres	10,570	497	322	115	11,504

Note: Some harvested areas were partially cut. These lands are classified in other tables in the Medium or Low volume land covers. Acreages from this table are thus not directly comparable to the Regeneration land cover in other tables.

Table 11

Mean Volumes Per Acre and Standard Error by Land Cover Class
Operable and Inventoried Forest Lands

Unit of Measure	High Volume Conifer	Medium Volume Conifer	Low Volume Conifer	Black cottonwood
Gross Cubic Feet	8,449	6,766	5,890	3,821
Standard Error	482	515	576	597
Net Cubic Feet	6,186	5,110	4,650	3,065
Standard Error	426	389	545	457
Gross Scribner Board Feet	47,492	36,362	31,320	18,645
Standard Error	2,887	2,998	3,612	3,580
Net Scribner Board Feet	26,537	21,871	20,622	14,928
Standard Error	2,304	1,954	3,239	2,901

Table 12

Seedling and Sapling Understory on Existing Land Cover
Operable and Inventoried Forest Lands

Land Cover	Sitka Spruce	Western Hemlock	Mountain Hemlock	Total Count
Trees Per Acre				
High Volume Conifer	88	392	0	480
Medium Volume Conifer	76	303	154	533
Low Volume Conifer	194	412	88	694
Weighted Average	104	350	98	552
Average Height (feet)				All Species
High Volume Conifer	5	7	-	6.3
Medium Volume Conifer	3	4	5	4.1
Low Volume Conifer	6	3	6	4.2
Weighted Average	4.7	4.6	4.8	4.7

Table 13

Total Volumes by Land Cover Class
(volumes in millions of units)

	Cubic Feet MMCF		Scribner Board Feet MMBF	
All State Lands	Gross	Net	Gross	Net
High Volume Conifer	154	113	866	484
Medium Volume Conifer	194	146	1,042	627
Low Volume Conifer	131	104	698	459
Cottonwood	14	11	67	54
Total Volume	493	374	2,672	1,623
Operable				
High Volume Conifer	151	111	849	474
Medium Volume Conifer	185	140	994	598
Low Volume Conifer	67	53	354	233
Cottonwood	11	9	54	43
Total Volume	413	312	2,250	1,348
Operable and Available				
High Volume Conifer	88	65	496	277
Medium Volume Conifer	132	99	707	425
Low Volume Conifer	46	37	246	162
Cottonwood	4	3	18	15
Total Volume	270	203	1,467	879

Table 14

Total Volumes by Species
(volumes in millions of units)

	Cubic Feet MMCF		Scribner Board Feet MMBF	
All State Lands	Gross	Net	Gross	Net
Sitka spruce	222	199	1,288	1,007
Western hemlock	229	144	1,190	493
Mountain hemlock	21	15	92	49
Black cottonwood	20	15	99	73
Total Volume	492	373	2,669	1,622
Operable and Available				
Sitka spruce	117	105	684	533
Western hemlock	131	83	683	284
Mountain hemlock	12	8	54	28
Black cottonwood	9	7	46	33
Total Volume	269	203	1,466	878

Note: Birch and willow not included

Table 15

Scribner Board-foot Volume Per Acre By Species, Size Class, and Land Cover
Operable and Inventoried Forest Lands

Species	Size Class	High Volume Conifer	Medium Volume Conifer	Low Volume Conifer	Black cottonwood
Gross Scribner Board-foot Volume based on Haines Volume Equations					
098 Sitka spruce	large sawtimber	16,264	12,473	15,222	3,282
	small sawtimber	4,177	3,533	4,184	3,660
263 Western hemlock	large sawtimber	18,876	9,905	6,545	0
	small sawtimber	7,482	6,915	3,692	0
264 Mountain hemlock	large sawtimber	63	537	417	0
	small sawtimber	414	1,518	696	0
747 Black cottonwood	large sawtimber	175	992	345	8,638
	small sawtimber	0	453	220	2,884
Total Volume Per Acre		47,451	36,325	31,320	18,463
Net Scribner Board-foot Volume based on Haines Defect Study					
098 Sitka spruce	large sawtimber	12,300	9,672	11,998	2,657
	small sawtimber	3,350	2,872	3,350	3,077
263 Western hemlock	large sawtimber	6,556	3,428	2,246	0
	small sawtimber	3,898	3,879	1,947	0
264 Mountain hemlock	large sawtimber	11	195	185	0
	small sawtimber	232	868	456	0
747 Black cottonwood	large sawtimber	175	552	273	6,903
	small sawtimber	0	388	167	2,183
Total Volume Per Acre		26,523	21,853	20,622	14,819
Defect Percent					
098 Sitka spruce	large sawtimber	24%	22%	21%	19%
	small sawtimber	20%	19%	20%	16%
263 Western hemlock	large sawtimber	65%	65%	66%	
	small sawtimber	48%	44%	47%	
264 Mountain hemlock	large sawtimber	82%	64%	56%	
	small sawtimber	44%	43%	34%	
747 Black cottonwood	large sawtimber	0%	44%	21%	20%
	small sawtimber		14%	24%	24%
Average Defect Per Acre		44%	40%	34%	20%

Note: Paper birch and Willow are not included.

Table 16

Mean Cubic-foot Volume Per Acre By Species, Size Class, and Land Cover
Operable and Inventoried Forest Lands

Species	Size Class	High Volume Conifer	Medium Volume Conifer	Low Volume Conifer	Black cottonwood
Gross Cubic-foot Volume based on Haines Volume Equations					
098 Sitka spruce	large sawtimber	2,623	2,024	2,508	543
	small sawtimber	769	658	789	699
	poletimber	62	45	120	105
263 Western hemlock	large sawtimber	3,199	1,703	1,126	0
	small sawtimber	1,415	1,316	711	0
	poletimber	225	266	241	80
264 Mountain hemlock	large sawtimber	13	101	79	0
	small sawtimber	88	314	153	0
	poletimber	5	33	47	0
747 Black cottonwood	large sawtimber	32	176	65	1,608
	small sawtimber	0	101	50	653
	poletimber	0	19	0	62
Total Volume Per Acre		8,431	6,757	5,890	3,750
Net Cubic-foot Volume based on Haines Defect Study					
098 Sitka spruce	large sawtimber	2,335	1,819	2,237	498
	small sawtimber	698	601	703	647
	poletimber	56	42	111	27
263 Western hemlock	large sawtimber	1,835	967	616	0
	small sawtimber	976	951	496	0
	poletimber	177	213	185	0
264 Mountain hemlock	large sawtimber	6	59	47	0
	small sawtimber	63	228	121	0
	poletimber	2	27	43	0
747 Black cottonwood	large sawtimber	32	100	52	1,292
	small sawtimber	0	87	39	493
	poletimber	0	13	0	55
Total Volume Per Acre		6,178	5,107	4,650	3,011
Defect Percent					
098 Sitka spruce	large sawtimber	11%	10%	11%	8%
	small sawtimber	9%	9%	11%	7%
	poletimber	9%	7%	7%	74%
263 Western hemlock	large sawtimber	43%	43%	45%	
	small sawtimber	31%	28%	30%	
	poletimber	21%	20%	23%	100%
264 Mountain hemlock	large sawtimber	54%	42%	41%	
	small sawtimber	29%	27%	20%	
	poletimber	61%	20%	9%	
747 Black cottonwood	large sawtimber	0%	43%	21%	20%
	small sawtimber		14%	22%	24%
	poletimber		28%		12%
Average Defect Per Acre		27%	24%	21%	20%

Note: Birch and willow not included.

Table 17

Basal Area and Trees Per Acre by Species, Size Class, and Land Cover
Operable and Inventoried Forest Lands

Species	Size Class	High Volume Conifer	Medium Volume Conifer	Low Volume Conifer	Black cottonwood
Basal Area (square feet) at Breast Height (4.5 feet)					
098 Sitka spruce	large sawtimber	58.2	46.4	61.2	12.8
	small sawtimber	22.1	20.1	24.5	20.8
	poletimber	2.9	2.1	5.6	4.8
263 Western hemlock	large sawtimber	87.0	48.2	32.5	0.0
	small sawtimber	44.8	41.4	23.5	0.0
	poletimber	11.2	12.3	12.2	4.8
264 Mountain hemlock	large sawtimber	0.6	3.9	3.3	0.0
	small sawtimber	3.8	13.0	7.1	0.0
	poletimber	0.3	2.5	3.3	0.0
747 Black cottonwood	large sawtimber	1.0	5.3	1.9	46.4
	small sawtimber	0.0	3.4	1.9	22.4
	poletimber	0.0	0.9	0.0	3.2
Total Basal Area Per Acre		232.0	199.5	176.9	115.2
Trees Per Acre					
098 Sitka spruce	large sawtimber	13.2	10.6	14.5	3.5
	small sawtimber	16.3	13.7	18.2	19.4
	poletimber	7.8	4.6	16.7	11.4
263 Western hemlock	large sawtimber	19.6	11.8	7.5	0.0
	small sawtimber	32.0	32.0	18.2	0.0
	poletimber	33.4	32.9	30.4	12.4
264 Mountain hemlock	large sawtimber	0.2	1.3	0.9	0.0
	small sawtimber	3.0	9.5	5.5	0.0
	poletimber	0.7	8.9	9.7	0.0
747 Black cottonwood	large sawtimber	0.2	0.9	0.6	12.2
	small sawtimber	0.0	2.5	1.4	17.0
	poletimber	0.0	3.0	0.0	8.5
Total Trees Per Acre		126.4	131.6	123.7	84.5

Note: Paper birch and Willow are not included.

Table 18

Scribner Board-foot Per Acre by Tree Class and Species
Weighted for Operable and Available Forest Land

Tree Class	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood	Paper Birch	Willow	Total Trees
Gross Scribner Board-foot Per Acre							
Desirable Crop Tree	1,618	463	29	131			2,242
Acceptable Crop Tree	2,163	1,230	51	298	11		3,752
Mature High Risk Tree	9,177	10,284	699	392	5		20,557
Mature Low Risk Tree	4,224	1,849	306	49			6,429
Rotten Cull Tree	228	3,659	280	303		4	4,475
Sound Cull Tree	27	49	20	9	15		119
Savable Dead Tree	223	65					288
Non-salvable Dead Tree		28					28
Total	17,661	17,628	1,386	1,181	31	4	37,890
Net Scribner Board-foot Per Acre							
Desirable Crop Tree	1,393	374	24	129			1,920
Acceptable Crop Tree	1,727	677	39	249	9		2,701
Mature High Risk Tree	6,732	4,237	349	308	3		11,629
Mature Low Risk Tree	3,625	1,408	247	49			5,329
Rotten Cull Tree	112	566	71	104		4	857
Sound Cull Tree							
Savable Dead Tree	187	52					240
Non-salvable Dead Tree		23					23
Total	13,777	7,338	729	840	11	4	22,699

Figure 18

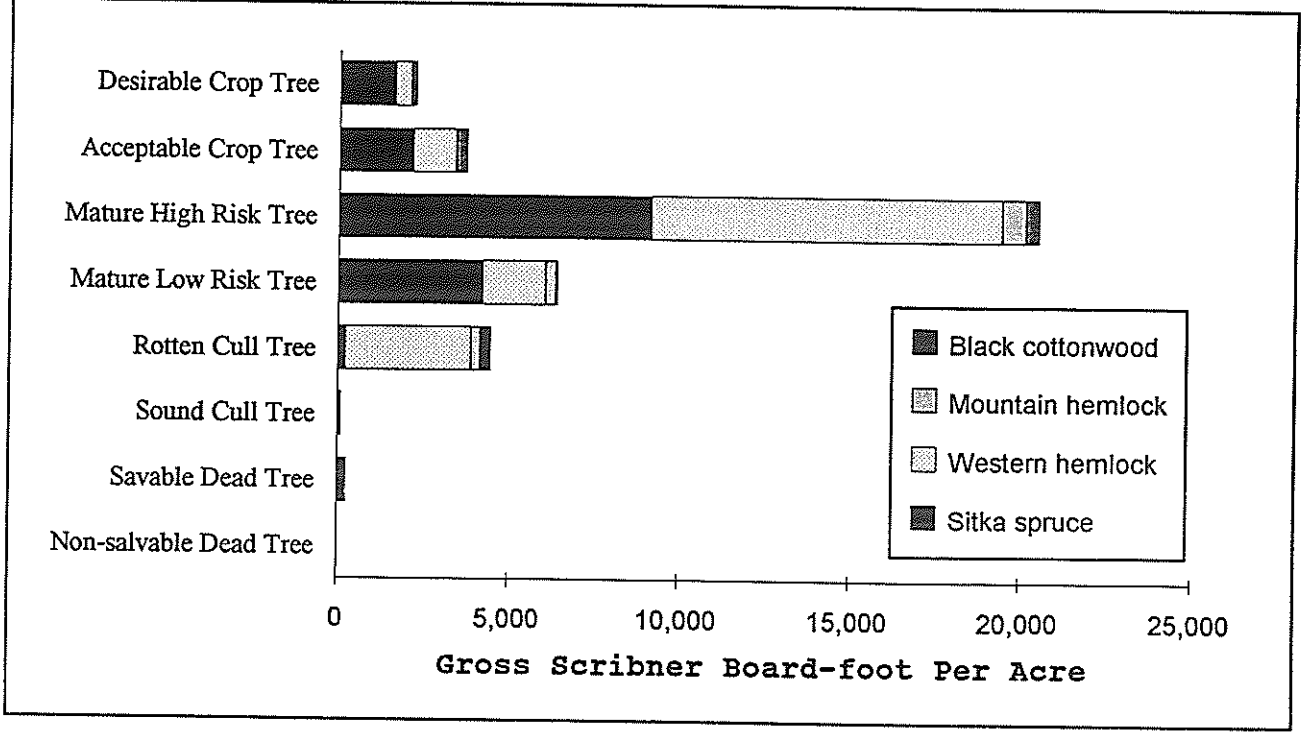


Table 19

Cubic foot Volume Per Acre by Tree Class and Species
Weighted for Operable and Available Forest Land

Tree Class	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood	Paper Birch	Willow	Total Trees
Gross Cubic foot Volume Per Acre							
Desirable Crop Tree	296	117	6	28			447
Acceptable Crop Tree	444	351	21	72	2		890
Mature High Risk Tree	1,509	1,818	148	74	2		3,551
Mature Low Risk Tree	686	342	64	9			1,101
Rotten Cull Tree	45	680	61	53		2	841
Sound Cull Tree	8	54	11	3	5	1	81
Savable Dead Tree	39	11					50
Non-salvable Dead Tree	1	6					7
Total	3,028	3,378	311	240	9	2	6,967
Net Cubic foot Volume Per Acre							
Desirable Crop Tree	275	106	5	28			414
Acceptable Crop Tree	406	267	18	60	2		752
Mature High Risk Tree	1,334	1,127	101	59	1		2,622
Mature Low Risk Tree	637	299	59	9			1,004
Rotten Cull Tree	30	294	31	19		2	375
Sound Cull Tree	1	30	5		1	0	37
Savable Dead Tree	36	10					46
Non-salvable Dead Tree		5					5
Total	2,718	2,138	219	175	4	2	5,255

Figure 19

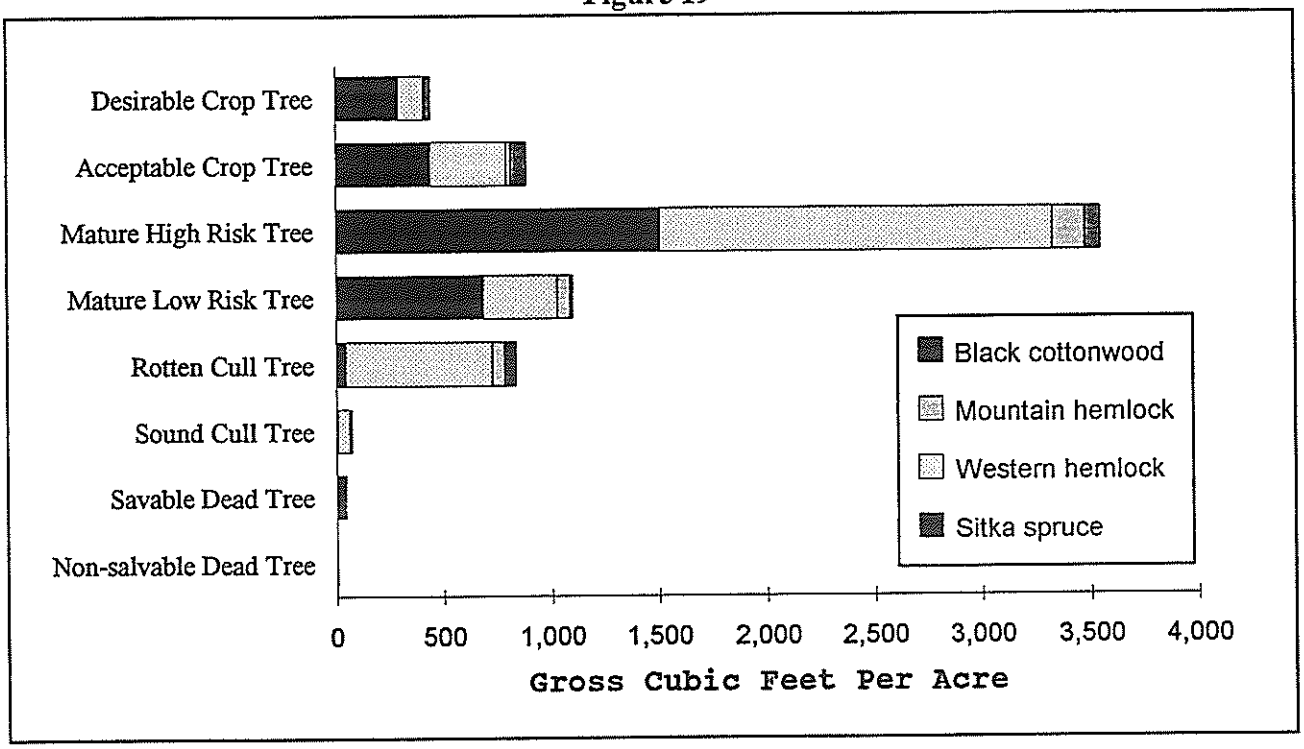


Table 20

Average Number of Trees Per Acre by Tree Class and Species Weighted for Operable and Available Forest Land

Tree Class	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood	Paper Birch	Willow	Total Trees
Desirable Crop Tree	5.41	5.00	0.09	0.58			11.08
Acceptable Crop Tree	13.83	22.56	3.29	2.13	0.06		41.87
Mature High Risk Tree	9.99	20.68	4.52	0.70	0.10		35.98
Mature Low Risk Tree	4.28	6.02	1.98	0.12			12.40
Rotten Cull Tree	0.96	11.35	2.31	0.24		0.12	14.97
Sound Cull Tree	0.47	7.26	1.99	0.84	0.46	0.26	11.28
Savable Dead Tree	0.42	0.10					0.52
Non-salvable Dead Tree	0.12	0.16					0.28
Older Dead Trees	7.43	8.20	1.38	0.90	0.33		18.24
Total	42.91	81.33	15.55	5.51	0.96	0.38	146.62

Figure 20

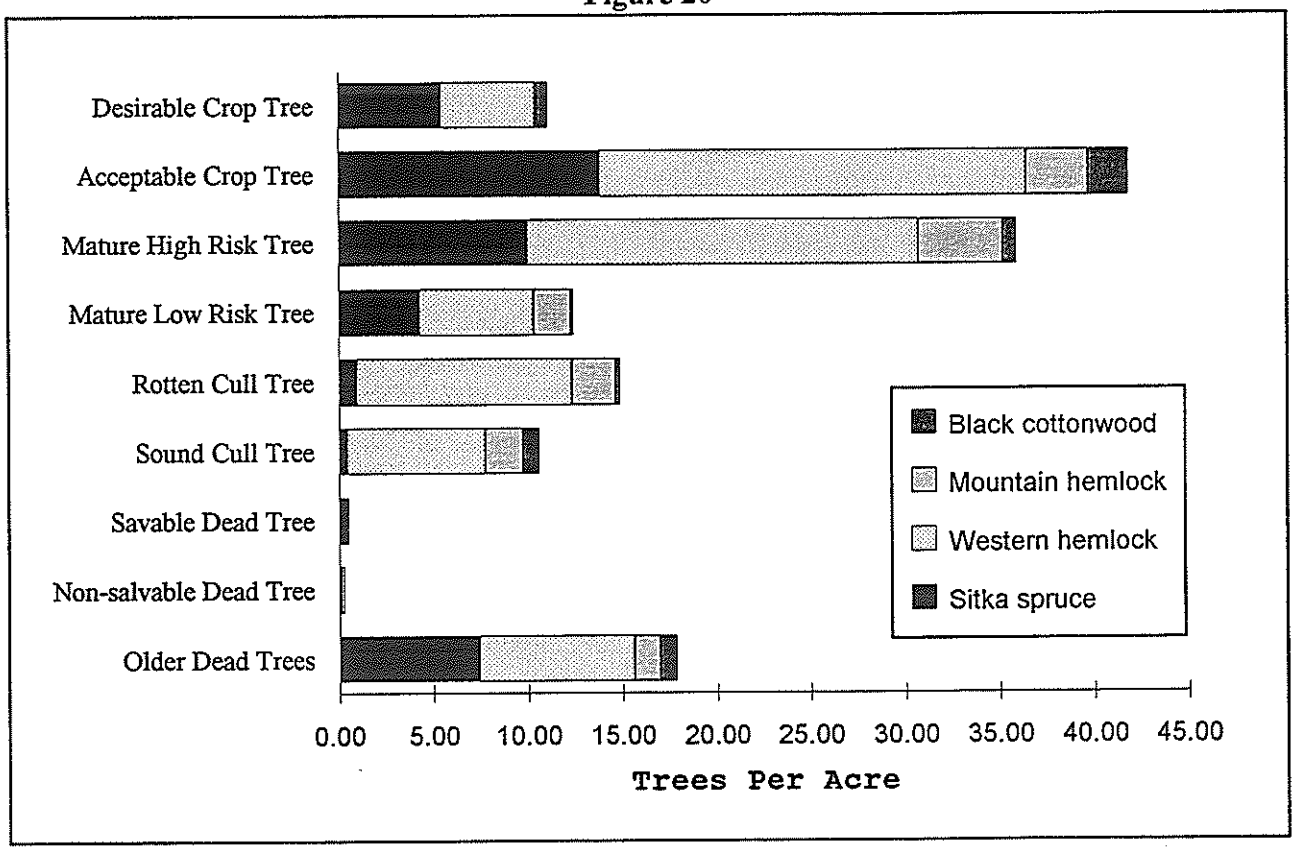


Table 21

Square Feet of Basal Area Per Acre by Tree Class and Species Weighted for Operable and Available Forest Land

Tree Class	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood	Paper Birch	Willow	Total Trees
Desirable Crop Tree	8.1	3.6	0.2	0.9			12.8
Acceptable Crop Tree	13.9	13.1	1.3	2.5	0.1		31.0
Mature High Risk Tree	36.0	52.0	6.1	2.1	0.1		96.3
Mature Low Risk Tree	15.3	9.1	2.6	0.3			27.3
Rotten Cull Tree	1.6	22.4	2.9	1.7		0.1	28.6
Sound Cull Tree	0.4	3.0	0.7	0.2	0.4	0.1	4.8
Savable Dead Tree	1.0	0.3					1.3
Non-salvable Dead Tree	0.0	0.2					0.2
Older Dead Trees	6.4	4.8	1.0	0.3	0.1		12.6
Total	82.7	108.5	14.8	8.0	0.7	0.2	214.9

Figure 21

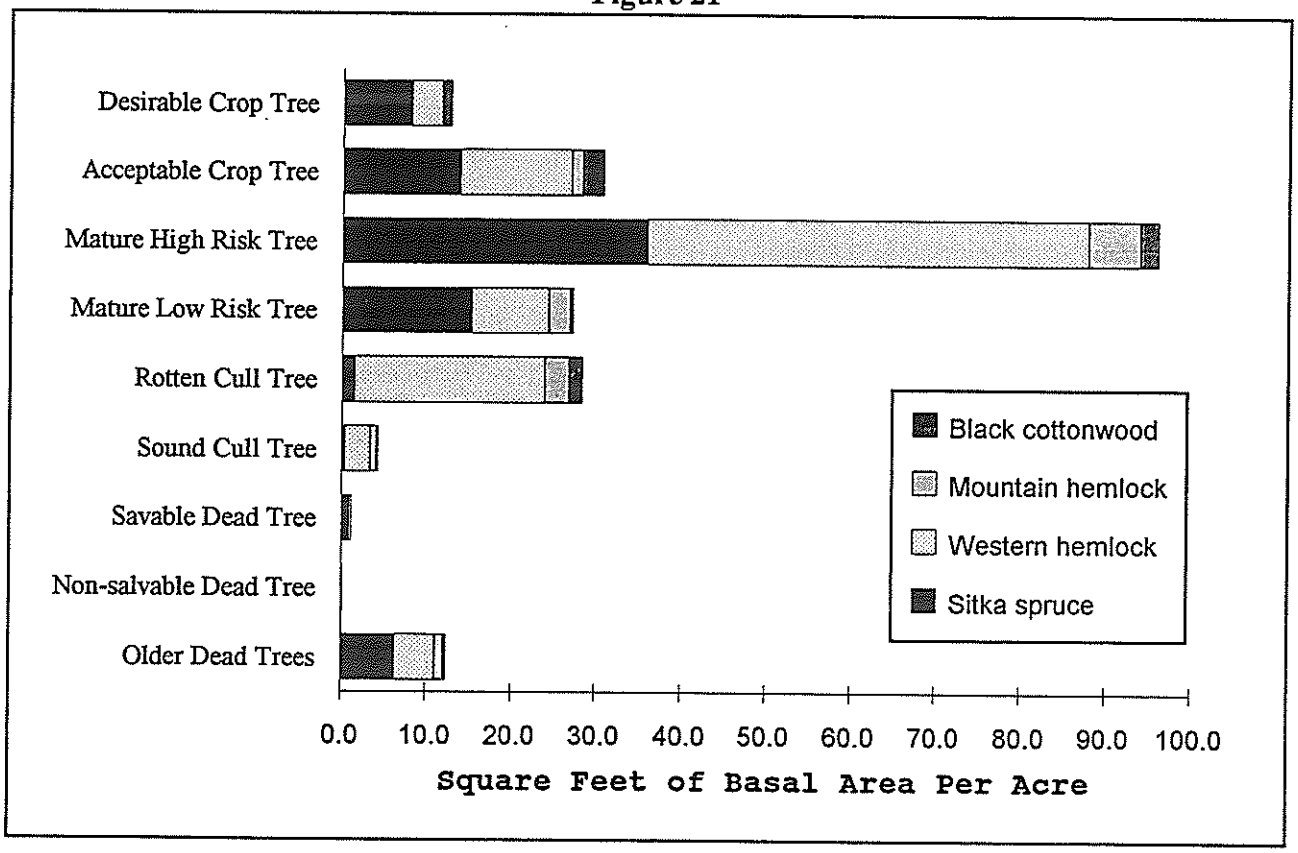


Table 22

Gross Scribner Board-foot Volume Per Acre by Diameter Class and Species
Weighted for Operable and Available Forest Land

Diameter Class	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood	Paper Birch	Willow	Total Trees
12	384	633	94	31	7	4	1153
14	379	1008	158	24	5		1574
16	854	1411	256	109			2630
18	888	1687	255	97	19		2946
20	1337	1498	253	84			3173
22	1533	1371	95	100			3099
24	1536	1643	113	116			3407
26	1997	1490	89	73			3650
28	2198	1423	27	29			3678
30	963	1019	18	58			2059
32	973	1083	29	26			2111
34	982	889		58			1929
36	923	620		68			1611
38	884	576		42			1502
40	772	507		44			1323
42	343	248		56			647
44	269	186					455
46	232	125					357
48	148	62		56			266
50	64	67		58			190
52		63					63
54		19					19
55.0 & Over				50			50
Total	17,661	17,628	1,386	1,181	31	4	37,890

Note: Diameter Classes cover 2.0 inch ranges, eg. "16" has a diameter range of 15.0" to 16.9"

Figure 22

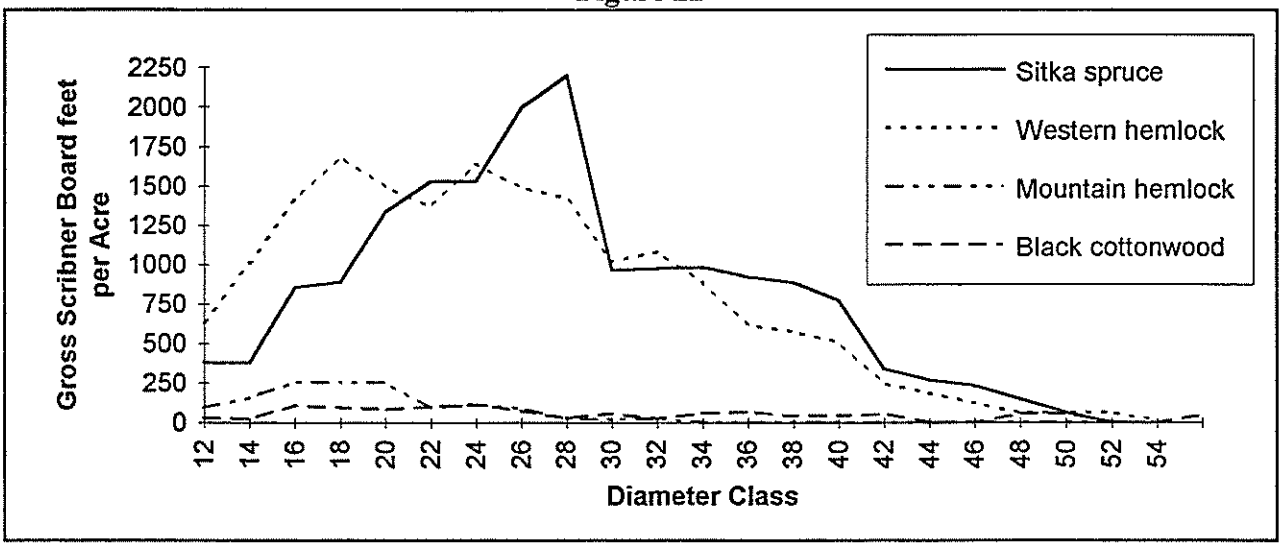


Table 23

Net Scribner Board-foot Volume Per Acre by Diameter Class and Species
Weighted for Operable and Available Forest Land

Diameter Class	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood	Paper Birch	Willow	Total Trees
12	316	406	68	28		4	823
14	302	600	91	20	3		1016
16	706	768	141	95			1711
18	703	837	139	68	9		1755
20	1075	783	152	72			2082
22	1216	609	26	82			1933
24	1218	630	33	103			1985
26	1570	595	43	62			2270
28	1748	575	16	25			2364
30	752	288	7	41			1088
32	743	333	14	14			1103
34	779	255		36			1070
36	710	163		22			895
38	657	153		37			847
40	575	137		23			734
42	236	70		33			339
44	191	51					242
46	131	39					170
48	106	29		45			181
50	41	5		32			79
52		11					11
54		1					1
55.0 & Over				0			0
Total	13,777	7,338	729	840	11	4	22,699

Note: Diameter Classes cover 2.0 inch ranges, eg. "16" has a diameter range of 15.0" to 16.9"

Figure 23

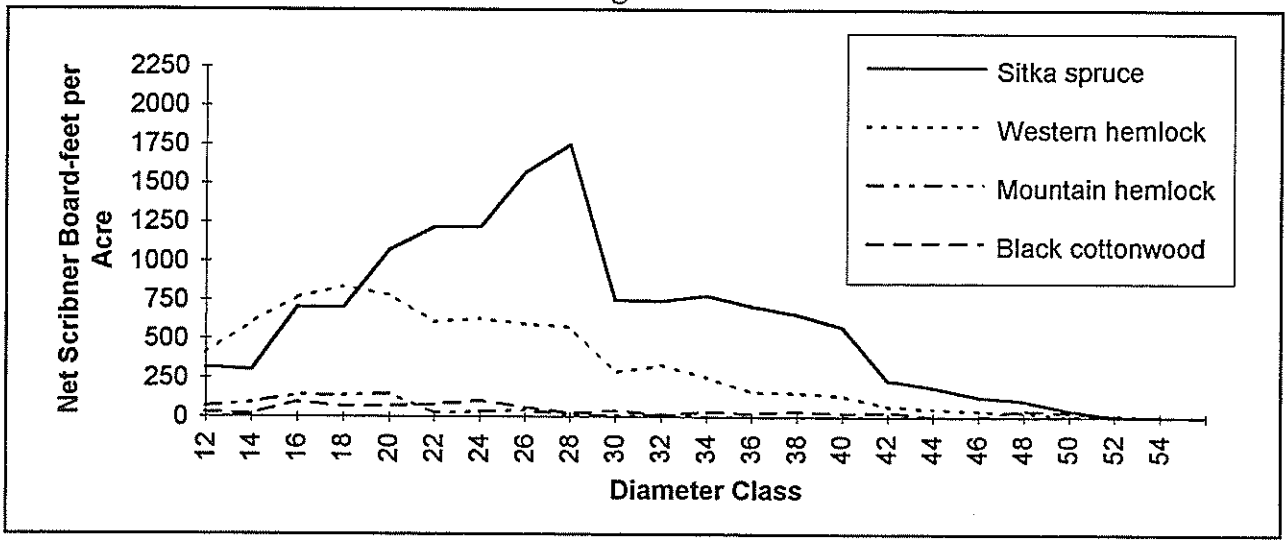


Table 24

Gross Cubic foot Volume Per Acre by Diameter Class and Species
Weighted for Operable and Available Forest Land

Diameter Class	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood	Paper Birch	Willow	Total Trees
6	14	32	11	1			57
8	11	61	5	4			81
10	41	152	12	7	2	1	214
12	82	140	23	10	2	2	259
14	76	201	36	6	1		320
16	161	270	54	24			509
18	162	308	51	20	4		544
20	235	268	49	17			568
22	261	241	19	20			541
24	257	287	22	22			588
26	326	258	16	14			615
28	359	244	5	5			614
30	155	174	3	11			343
32	158	182	5	4			349
34	156	149		10			316
36	146	104		12			262
38	140	96		7			244
40	121	84		8			212
42	54	41		10			104
44	42	31					73
46	37	21					58
48	23	10		10			43
50	10	11		10			31
52		10					10
54		3					3
55.0 & Over				8			8
Total	3028	3378	311	240	9	2	6967

Note: Diameter Classes cover 2.0 inch ranges, eg. "16" has a diameter range of 15.0" to 16.9"

Figure 24

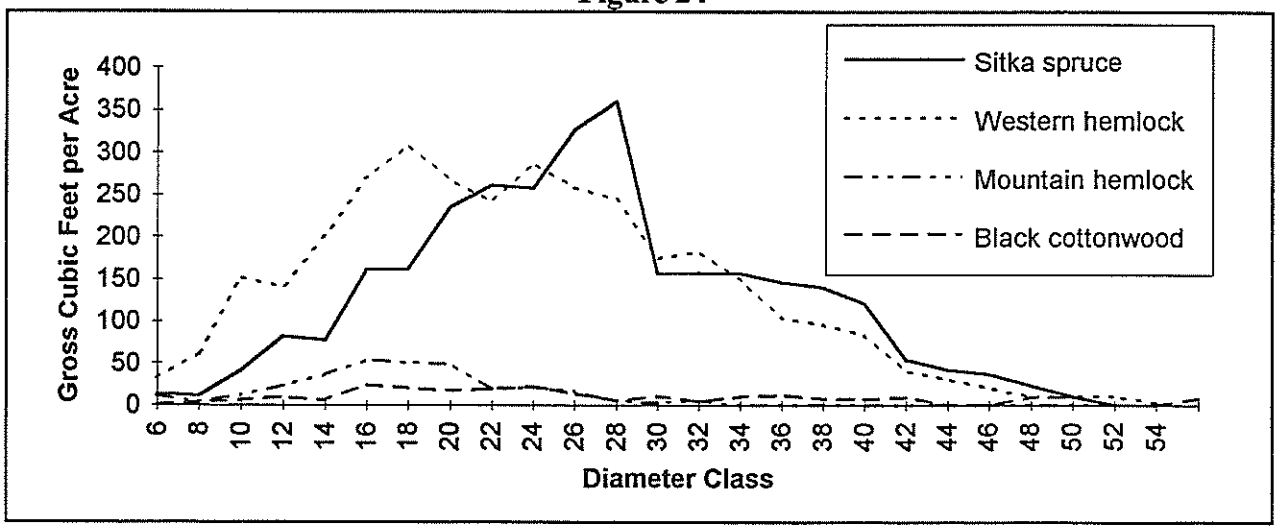


Table 25

Net Cubic foot Volume Per Acre by Diameter Class and Species
Weighted for Operable and Available Forest Land

Diameter Class	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood	Paper Birch	Willow	Total Trees
6	13	27	9				49
8	9	47	4	4			64
10	38	118	9	5	1	0	171
12	75	109	20	9		2	214
14	68	149	26	5	1		248
16	148	191	38	21			399
18	146	208	35	14	2		405
20	212	185	37	14			448
22	236	154	10	16			416
24	233	170	12	20			434
26	295	155	11	12			472
28	325	149	4	5			482
30	140	91	2	8			241
32	141	99	3	2			245
34	142	79		6			227
36	131	53		4			188
38	124	48		7			180
40	106	42		4			153
42	46	21		6			72
44	36	16					52
46	26	11					37
48	20	7		8			35
50	8	4		6			18
52		5					5
54		1					1
55.0 & Over				0			0
Total	2718	2138	219	175	4	2	5255

Note: Diameter Classes cover 2.0 inch ranges, eg. "16" has a diameter range of 15.0" to 16.9"

Figure 25

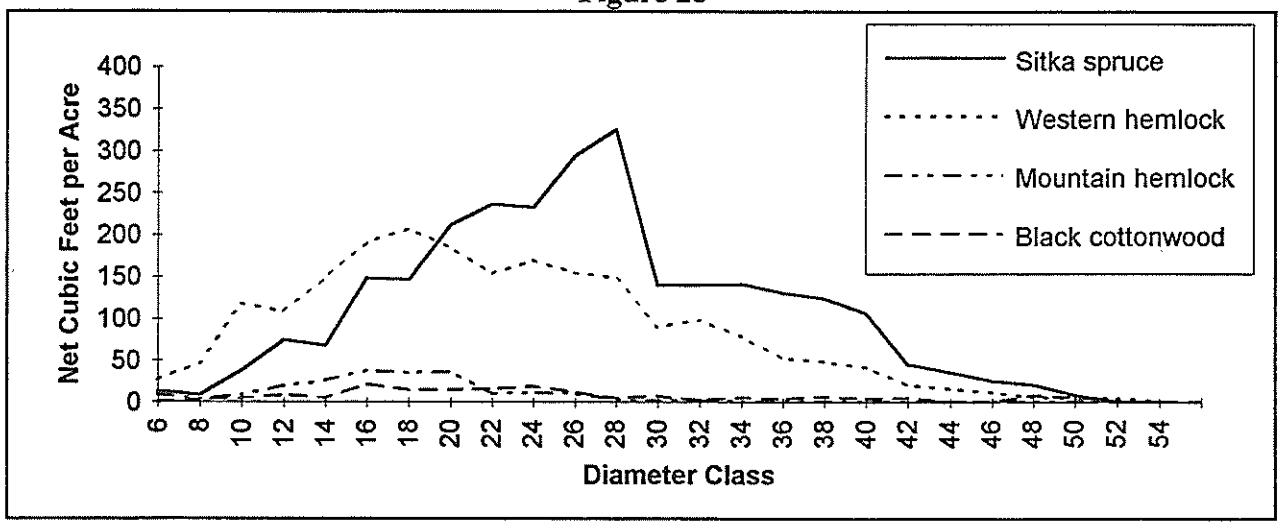


Table 26

Average Number of Trees Per Acre by Diameter Class and Species Weighted for Operable and Available Forest Land

Diameter Class	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood	Paper Birch	Willow	Total Trees
6	3.28	10.73	4.08	0.78			18.87
8	1.61	9.35	1.17	0.41			12.54
10	3.23	11.92	1.36	0.53	0.22	0.26	17.53
12	3.74	7.02	1.45	0.55	0.24	0.12	13.12
14	2.48	6.45	1.66	0.19	0.03		10.82
16	3.62	6.22	1.60	0.58			12.02
18	2.68	5.17	1.10	0.38	0.13		9.45
20	2.95	3.53	0.87	0.26			7.61
22	2.51	2.63	0.34	0.26			5.74
24	1.99	2.63	0.27	0.21			5.10
26	2.00	2.02	0.16	0.10			4.28
28	1.96	1.62	0.05	0.04			3.67
30	0.73	0.99	0.02	0.05			1.79
32	0.65	0.88	0.04	0.03			1.60
34	0.55	0.65		0.05			1.25
36	0.46	0.41		0.05			0.92
38	0.40	0.34		0.03			0.76
40	0.30	0.26		0.03			0.59
42	0.12	0.12		0.03			0.27
44	0.09	0.08					0.17
46	0.08	0.05					0.13
48	0.04	0.02		0.02			0.08
50	0.02	0.02		0.02			0.06
52		0.02					0.02
54		0.01					0.01
55.0 & Over				0.01			0.01
Total	35.48	73.13	14.16	4.61	0.62	0.38	128.39

Note: Diameter Class covers 2.0 inches, eg. "16" has a diameter range of 15.0" to 16.9"

Figure 26

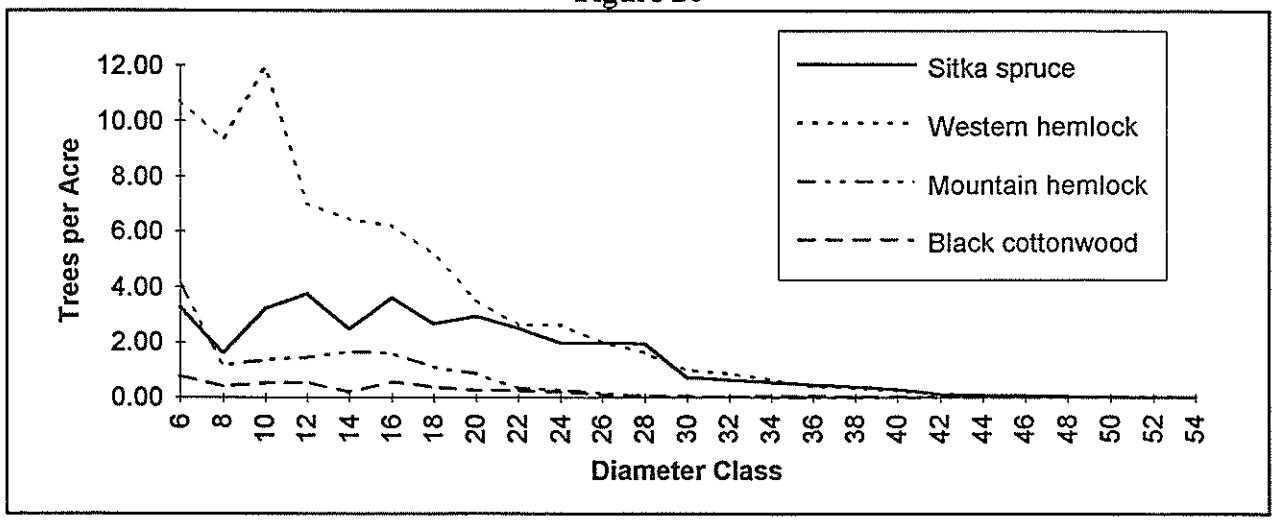


Table 27

Square Feet of Basal Area Per Acre by Diameter Class and Species
Weighted for Operable and Available Forest Land

Diameter Class	Sitka Spruce	Western Hemlock	Mountain Hemlock	Black Cottonwood	Paper Birch	Willow	Total Trees
6	0.7	2.1	0.9	0.1			3.7
8	0.6	3.3	0.4	0.2			4.4
10	1.8	6.5	0.7	0.3	0.1	0.1	9.6
12	2.9	5.4	1.2	0.4	0.2	0.1	10.2
14	2.6	6.7	1.7	0.2	0.0		11.3
16	5.0	8.7	2.3	0.8			16.7
18	4.7	9.1	2.0	0.7	0.2		16.7
20	6.3	7.7	1.9	0.6			16.5
22	6.6	6.8	0.9	0.7			15.0
24	6.2	8.2	0.9	0.7			15.9
26	7.3	7.3	0.6	0.4			15.6
28	8.3	6.9	0.2	0.2			15.5
30	3.5	4.9	0.1	0.3			8.8
32	3.7	4.9	0.2	0.2			8.9
34	3.4	4.1		0.3			7.8
36	3.2	2.9		0.3			6.4
38	3.1	2.6		0.2			6.0
40	2.6	2.2		0.2			5.1
42	1.2	1.1		0.3			2.6
44	0.9	0.9					1.8
46	0.9	0.6					1.5
48	0.5	0.3		0.3			1.0
50	0.2	0.3		0.3			0.8
52		0.3					0.3
54		0.1					0.1
55.0 & Over				0.3			0.3
Total	76.4	103.7	13.8	7.7	0.6	0.2	202.3

Note: Diameter Class covers 2.0 inches, eg. "16" has a diameter range of 15.0" to 16.9"

Figure 27

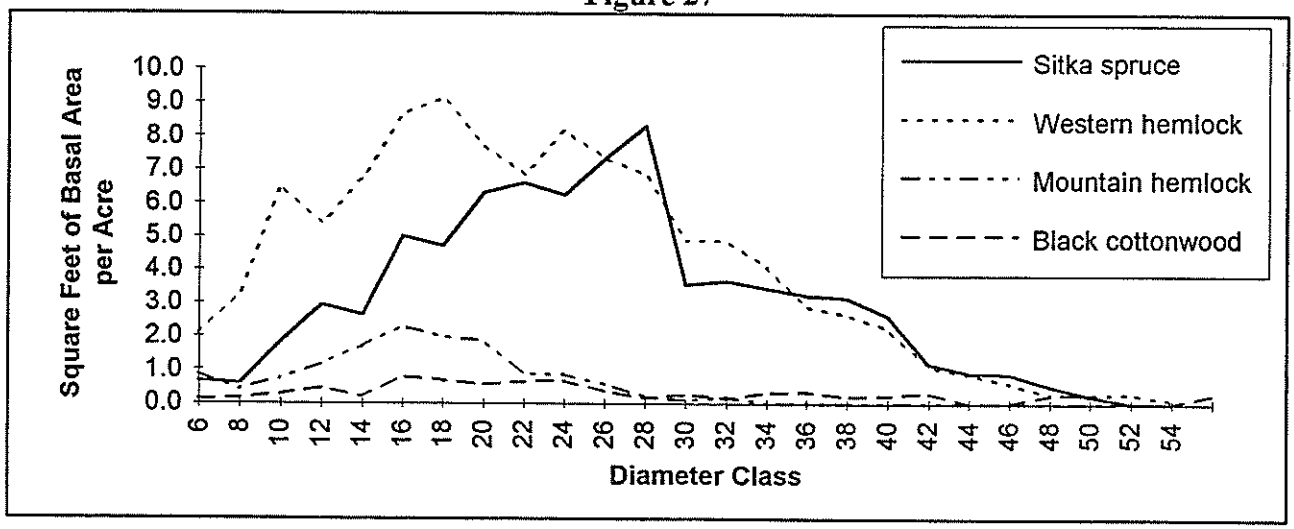


Table 28

Total Annual Volume Growth Operable and Available Forest Lands
Data From Remeasure Plots

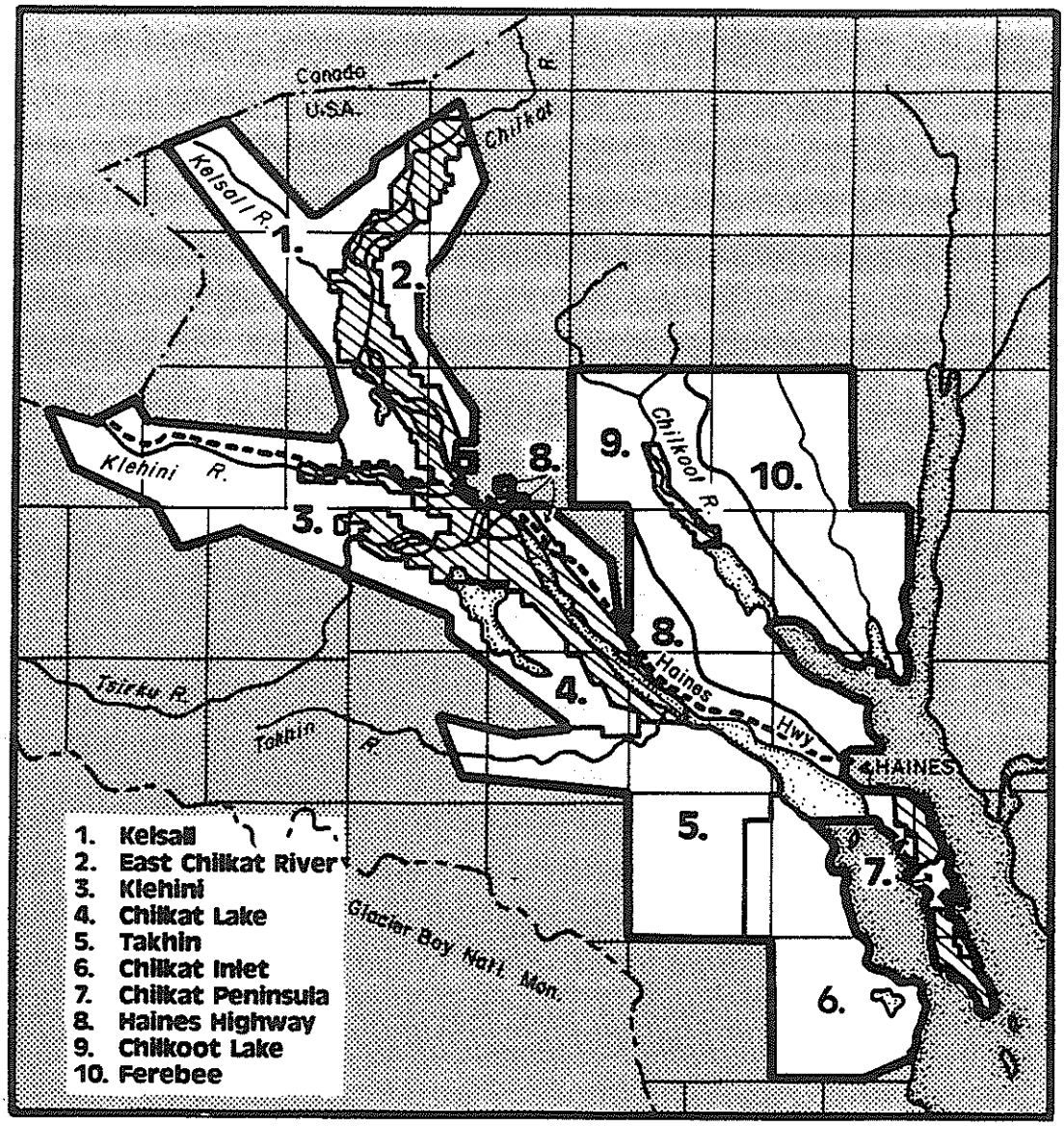
	Cubic Feet		Scribner Board Feet	
Species	Gross Cunits	Net Cunits	Gross M bd. ft.	Net M bd. ft.
Sitka spruce	4,203	3,707	4,213	2,668
Western/Mountain hemlock	11,327	-164	6,186	-2,079
Black cottonwood	248	332	241	311
All Species	15,778	3,874	10,641	899

Table 29

Total Annual Mortality Operable and Available Forest Lands
Data From Remeasure Plots

	Cubic Feet		Scribner Board Feet	
Species	Gross Cunits	Net Cunits	Gross M bd. ft.	Net M bd. ft.
Sitka spruce	10,242	8,533	5,543	4,082
Western/Mountain hemlock	4,084	1,857	2,249	619
Black cottonwood	1,050	666	432	237
All Species	15,375	11,056	8,223	4,938

Management Unit Index



Haines State Forest Management Plan