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Forest Resources on State Lands in the Susitna Valley



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I. EXECUTIVE SUMMARY

The inventory of forest resources within the Susitna Valley is the first comprehensive stand based inventory to be conducted by the Division of Forestry (DOF) in this area of the state. Funding for the project was made available through a 2010 forest inventory capital improvement project budget approval. Additional funding was from the State and Private Forestry organization of the United States Forest Service. State and Private Forestry's interest in the project was to obtain biomass resource information in part to determine the feasibility of supplying woody biomass to heat the newly constructed Susitna Valley High School. Information contained within this report will aid DOF in forest and fire management planning activities as well as identifying suitable biomass resources. State lands that are included have been classified for forestry use through the Susitna-Matanuska Area Plan. Lands west of the Susitna River are being considered for state forest designation.

			Acres
Inventory Area Land Classification			
Timberland			488,735
Dwarf Forests			39,015
Non-Forest			228,232
Water			16,434
Total Inventory Area:			772,416
Timberland Area by Timber Type Size Class			
Sawtimber			260,994
Poletimber			161,346
Reproduction			66,395
Total Timberland Area:			488,735
Timberland Area by Timber Type Species Class			
Hardwood			117,967
White Spruce/Hardwood			370,768
Total Timberland Area:			488,735
Total Net Volume			
Cubic Feet ($\geq 5''$dbh)	Tons ($\geq 5''$dbh)	Board Feet ($\geq 9''$dbh)	
620,223,584	14,236,019	2,090,242,465	

TABLE I. INVENTORY VOLUME AND ACREAGE SUMMARY.

FIGURE 1. FOREST INVENTORY VICINITY MAP.



II. OBJECTIVES

The objective of this report is to provide reliable inventory data to assist in the management of forest resources in the Susitna Valley. Determination of an operable land base, sustainable harvest rate and harvest scheduling all require accurate volume data and geographically referenced spatial locations of individual stands. This data, both in spatial and tabular form can be used to assess the availability of timber and biomass resources (Ashton et al. 2008. *Woody Biomass Desk Guide and Toolkit*) and determine economic viability of proposed harvest development activities. The inventory provides the following items useful for development and planning:

- Spatially accurate stand polygons overlaid on geographically rectified photo base.
- Accurate acreage determination of forest cover.
- Statistically valid sampling design that produces a variety of tree and stand attributes.
- Field sampling of tree and stand productivity variables useful for determining sustainable harvest rates.
- Internet Geographic Information System (GIS) mapping access of spatial data with volume and acreage querying capabilities.
- Field sampling of tree and stand productivity variables useful for future growth model development.
- Compatibility with Matanuska-Susitna (Mat-Su) borough forest inventory data.

III. METHODS

Forest inventory information was collected through a stratified random sampling design. The project area was divided into subpopulations (timber types) in order to account for variation in species composition, density and size class. Each timber type was then treated as a random sample population. The number of stands sampled within each timber type was based on the variability encountered in previous forest inventory and timber sale projects. Between 100 and 200 plots are required in a particular sample to achieve a sample error of 5% at one standard deviation. To sample a reasonable number of stands across the expansive project area the inventory was designed to sample roughly 200 plots (20 stands) per stratum. The reproduction stratum was the only sub sample that received less than this amount. Because of its low volume and value it was decided not to invest the field time to sample the full 200 plots. Instead 60 plots (6 stands) were sampled in the stratum. Also this stratum is highly variable especially in terms of trees greater than 5 inches in diameter and is difficult to achieve a highly accurate volume summary. Timber types sampled included sawtimber, poletimber and reproduction types, dwarf timber types were not sampled.

Timber types to be sampled were selected randomly and access to the stands was by foot, four-wheeler, or boat. A total of 127 stands were sampled. Field measurements were made in the selected stands to provide estimates of volume, stocking, defect and growth by individual tree species.

A. IMAGERY SOURCES

Scanned color infrared aerial photographs at the scale of 1:63,360 (1 inch = 1 mile), natural color digital ortho photographs at 1:40,000 (1 inch = .63 miles) and Quickbird satellite images were used for the project. The dates of 1:63,360 Alaska High Altitude Aerial Photography (AHAP) ranged from 1979-1984. The date of the digital ortho photographs and Quickbird scenes was 2005. The scanned 1:63,360 color infrared photos were orthorectified and geo-referenced to the digital ortho photos and Quickbird scenes. The photos were then mosaiced into a series of east-west flight lines. This was accomplished utilizing PCI image processing software. Digital stereo epipolar pairs were then created from the AHAP photos for the stereo interpretation process.

B. VEGETATION TYPING

The project area was vegetation typed directly on a computer screen using Dat/Em Summit Evolution software which allows the operator to view the images in stereo. In the vegetation typing process, boundaries of individual features (polygons) were determined from the stereo image of the photos and drawn with the computer mouse on the computer screen. The software was linked to ESRI ArcMap GIS software where attributed vegetation polygons were stored. In the process of delineating polygons, individual GIS shape files were created. These files store the geographic location of the polygons as well as specific attributes such as the timber type designation. The smallest size of the polygons drawn was approximately one acre. After completion of the timber typing, the polygons were adjusted to the 2005 imagery in areas of landscape change such as along major rivers within the project area. Sawtimber, poletimber and reproduction stands were classified as timberland and represent the areas of greater productivity. They are a component of a larger class of ground cover called forestland. Forestland is defined as land that is at least 10% covered by trees. Delineation of timberland types was based on tree species, size class and stand density. The most prevalent species determined the timber type. In mixed timber types, the secondary species represented at least 30% density of the type in question. Aids used in the interpretation of timber types on the imagery included color, texture, hue and physical location of the stand in question. The other component of forestland; dwarf forests, generally comprise black spruce stands that are less than 25 feet tall at maturity. These stands were not field sampled in the inventory and are of low productivity. Through observations made during the field work, it was determined that

these stands are not economically operable although there may be limited potential for biomass use as a by-product of hazard fuel reduction operations or other land clearing projects.

Vegetation Type	Acreage
Black Spruce	69,081
Black Spruce-White Spruce	5,048
White Spruce	23,798
Aspen	81
Balsam Poplar	12,814
Birch-Aspen	106
Paper Birch	168,201
Black Spruce-Birch	10,893
Timber Sales Harvested	93
White Spruce-Aspen	117
White Spruce-Balsam Poplar	10,259
White Spruce-Birch	222,811
White Spruce-Birch-Aspen	2,294
White Spruce-Black Spruce-Birch	2,154
Bare Ground	724
Dry Midgrass-Herb-Sedge	5,183
Lakes-Ponds	3,954
Mixed Low Shrub	18,223
Mixed Tall Shrub	90,084
Rivers-Flowing Water	12,479
Roads	643
Urban-Suburban	2
Wet Sedge-Grass	113,374
Total	772,416

TABLE 2. ACREAGE BY VEGETATION TYPE.

C. FIELD INVENTORY DESIGN

The variable plot radius sampling method was used for field data collection of poletimber and sawtimber size trees. The basal area factor utilized was 20 square feet. In each timber stand sampled, ten plots were spaced uniformly on a traverse located systematically through the stand. The traverse was located in such a manner as to attempt to sample the variation within a stand. To minimize travel time, plots were generally located with a maximum interval of 330 feet. Tally trees were selected or rejected with a relascope prism. On five of the ten plots,

species, tree vigor, crown ratio, defect type and estimated defect percentage, were recorded and tree diameter, total tree height, bark thickness, and ten-year growth were measured (measure plots). Tree diameters were measured 4.5 feet above ground, commonly known as “diameter breast height” or dbh. Co-dominate and dominant trees were cored at dbh to determine average age and site index of the sample stand. On the other alternating five plots, only the number of trees by species and size class selected by the relascope were recorded (count plots). Count plots generally serve to lower the sample error by increasing the overall plot numbers, but economize time spent in the field collecting data. Only trees five inches dbh and greater were measured utilizing the variable plot sampling method.

The fixed plot sampling method was used for field data collection of trees less than five inches dbh. At every other plot in the ten plot traverse (measure plots) seedling and sapling size trees were measured. Species and quality were recorded and tree diameter and total tree height were measured. The fixed plot was a circular 1/250th acre plot (7.45 foot radius).

D. GEOGRAPHIC INFORMATION SYSTEM COVERAGE

Together with the tabular data, a GIS coverage was prepared for the inventory. A standardized vegetation key/mapping scheme was used for describing vegetation polygons (*table 3*). The acreage of individual polygons was calculated using the ArcMap GIS software. Storage in the GIS will allow for queries of individual portions of the project area to be accomplished for planning purposes.

E. DATA SUMMARY

Upon completion of the field work, sampled stand data were entered into TCruise, a timber inventory software program. The inventory software calculated volume attributes for the individual sampled stands. These stands were then grouped into strata and re-processed in TCruise. The inventory contains seven separate sample strata for which estimates of gross and net volume per acre have been calculated. The strata contain field data from 127 individual timber stands containing 1,270 plots (*table 4*). Field data from some sampled stands were similar enough to each other to allow combining of different stand timber types into like strata. Acreage of un-sampled timber types deemed similar enough was also included in the strata. Characteristics of these timber types were observed during the field work phase of the inventory. Acreage of sampled and un-sampled timber types and the corresponding strata are shown in the appendix. Total inventory volume was calculated by multiplying the average per acre volume figures for each stratum by the number of acres each sample stratum represents. These calculations were performed in a Microsoft Access database and utilize the GIS acreage

figures. Output reports written in Access display numerous stand attributes from the associated database tables and queries.

LAND COVER KEY	
FOREST SPECIES	
1 Black Spruce	31 White Spruce-Birch
2 White Spruce	32 White Spruce-Black Spruce-Birch
3 Black Spruce-White Spruce	33 Black Spruce-Aspen
16 Balsam Poplar	34 White Spruce-Aspen
17 Birch	35 White Spruce-Black Spruce-Aspen
18 Aspen	37 White Spruce-Birch-Aspen
19 Birch-Aspen	38 White Spruce-Balsam Poplar
30 Black Spruce-Birch	39 White Spruce-Black Spruce-Birch-Aspen
DESCRIPTORS (Forests - Tree Size Class)	
S Sawtimber	≥ 9.0 inches DBH
P Poletimber	5.0 inches to 8.9 inches DBH
R Reproduction	< 5.0 inches DBH
D Dwarf	< 25 feet at maturity
BR Recently Burned	
W Wetland	
FOREST DENSITY	
X 60-100%	Calls are based
Y 25-59%	on crown closure
Z 10-24%	percent.
NON-FOREST	
68 Mixed Tall Shrub	95 Urban-Suburban
71 Mixed Low Shrub	96 Agriculture
76 Dry Midgrass-Herb-Sedge	97 Gravel pits, mines, quarries
79 Wet Sedge-Grass	98 Roads
80 Lakes-Ponds	99 Pipelines/Power lines
88 Rivers-Flowing Water	100 Clouds
94 Bare Ground	101 Timber Sales Harvested

TABLE 3. LAND COVER KEY.

F. DESCRIPTION OF STRATA

The seven strata are described below. Pictures are shown for selected strata where available. Generally the inventory project area is comprised of birch dominated stands with lesser amounts of white spruce mixed in. Pure stands of white spruce are nearly non-existent in the

inventory. Pure stands of black spruce are present but are generally classified as low productivity black spruce dwarf timber. Along the major river floodplains pure stands of balsam poplar sawtimber are present. Overall, the timber stands are very consistent in terms of age and average about 120 years old. There is little advanced regeneration. The age and regeneration characteristics points to a period of development that began with a single large disturbance, perhaps a large fire that occurred around 1890. Much of the birch sawtimber contains significant defect, but the white spruce sawtimber and birch poletimber are relatively defect free.

Stratum	Stratum Description	Acres	Number of Sampled Plots	Number of Sampled Stands
1	Mixed Poletimber Closed	43,463	200	20
2	Mixed Poletimber Open	117,882	210	21
3	Hardwood Closed	47,503	200	20
4	Hardwood Open	70,464	200	20
5	Mixed Spruce/Hardwood Closed	81,521	200	20
6	Mixed Spruce/Hardwood Open	61,506	200	20
7	Mixed Reproduction	66,395	60	6
		488,735	1,270	127

TABLE 4. ACREAGE AND NUMBER OF SAMPLE PLOTS AND STANDS BY STRATA.

1. STRATUM 1 MIXED POLETIMBER CLOSED

This stratum is found throughout the project area but with heavier concentrations in the Willer-Kash area northeast of Willow. Most of the trees within the stratum are birch with a two to one ratio of poletimber to sawtimber. Defect averages around 10% and the average age is 109 years. This is the second youngest stratum in the inventory. The stem count (trees greater than 5" dbh) is the highest of all strata and averages 220 trees per acre. The stratum contains 1,644 cubic feet per acre. The stratum contains 41 tons per acre and has a net annual yield of 1.04 tons per acre per year (43 cubic feet per acre per year).

2. STRATUM 2 MIXED POLETIMBER OPEN

This stratum is found throughout the project area. The trees in this stratum are evenly split between white spruce and birch with minor amounts of black spruce poletimber. Defect averages around 12% and the average age is 102 years. This is the youngest stratum in the inventory. The stem count is 138 trees per acre. The stratum contains 1,049 cubic feet per acre. The stratum contains 23 tons per acre and has a net annual yield of 0.76 tons per acre per year (34 cubic feet per acre per year).

FIGURE 2. STRATUM I MIXED POLETIMBER CLOSED.



FIGURE 3. STRATUM 2 MIXED POLETIMBER OPEN.



3. STRATUM 3 HARDWOOD SAWTIMBER CLOSED

This stratum is found across the project area but with heavier concentrations in the Zero Lake Road area, Petersville Road area, and in the western reaches of the project area. Balsam poplar stands timber typed along the major river systems are included in this stratum. Birch comprises about 45% of the stocking with white spruce comprising 23% and balsam poplar comprising 11%. Defect averages around 15% and the average age is 130 years. The stem count is 149 trees per acre. The stratum contains 2,280 cubic feet per acre, the highest of the 7 strata. It contains 56 tons per acre and has a net annual yield of 1.05 tons per acre per year (43 cubic feet per acre per year).

FIGURE 4. STRATUM 3 HARDWOOD SAWTIMBER CLOSED.



4. STRATUM 4 HARDWOOD SAWTIMBER OPEN

This stratum is found throughout the project area. The trees in this stratum are comprised of birch and white spruce at a roughly 2 to 1 ratio. Defect averages around 16% and the average age is 131 years. The stem count is 91 trees per acre. The stratum contains 1,093 cubic feet per acre. The stratum contains 26 tons per acre and has a net annual yield of 0.67 tons per acre per year (29 cubic feet per acre per year).

5. STRATUM 5 MIXED SAWTIMBER CLOSED

This stratum is found across the project area but with heavier concentrations in central parts north of the Yentna River. Birch and white spruce comprise near equal portions of the stocking with small amounts of black spruce. Defect averages around 16% and the average age is 133 years. The stem count is 130 trees per acre. The stratum contains 1,434 cubic feet per acre. It contains 32 tons per acre and has a net annual yield of 0.75 tons per acre per year (33 cubic feet per acre per year).

FIGURE 5. STRATUM 5 MIXED SAWTIMBER CLOSED.



6. STRATUM 6 MIXED SAWTIMBER OPEN

This stratum is found across the project area but with heavier concentrations east of the Parks Highway and in the far northwest portions of the project area. Birch and white spruce comprise near equal portions of the stocking with small amounts of black spruce. The stocking however is less than in stratum 5. Defect averages around 11% and the average age is 126 years. The stem count is 114 trees per acre. The stratum contains 1,240 cubic feet per acre. It contains 26 tons per acre and has a net annual yield of 0.67 tons per acre per year (33 cubic feet per acre per year). This stratum contains the highest white spruce sawtimber volume and averages 3,086 net board feet per acre.

7. STRATUM 7 MIXED REPRODUCTION

This stratum is found throughout the project area and is quite variable in its species composition and stand structure. Black spruce is found in this stratum and comprises 43% of the stocking of trees greater than 5 inches. The remaining stocking is split between balsam poplar, birch and white spruce. In general the stands contain a majority of trees less than five inches dbh but some are not true reproduction stands, but stands of very slow growing trees.

They are however more productive than the common black spruce dwarf stands that occur widespread across the project area. These stands have measurable cubic foot volume and contain useable biomass. Average age was 120 years, but this age represents the poletimber component and not necessarily the true age of the smaller trees. The stem count averaged 166 trees per acre, but a substantial number of acceptable or better crop trees less than five inches dbh were present that totaled 408 trees per acre. The stratum contains 703 cubic feet per acre, and 16 tons per acre. The average net annual yield is 0.8 tons per acre per year (34 cubic feet per acre per year).

FIGURE 6. STRATUM 6 MIXED SAWTIMBER OPEN



IV. RESULTS

A. FOREST VOLUME DEFINITIONS

Estimates of timber volume on forested lands have been calculated with three different measurements; cubic foot volume, board foot volume and green tons. The cubic foot measurement includes all timber greater than or equal to five inches dbh and is divided among the live and dead poletimber and sawtimber components of the forest. The board foot

measurement is commonly used to determine the amount of lumber that can be sawn from a log. Because the measurement is based on actual boards that can be sawn from a log, it disregards all material wasted in the process such as slabs and sawdust. The board foot measurement only includes timber equal to or greater than 9 inches dbh.

Volume calculations for both cubic and board foot measurements are based on volume equations produced for Interior Alaska; U.S. Forest Service research notes NOR-5, NOR-6, PNW-59 and University of Alaska Forest Growth and Yield Program Statewide white spruce. Board foot volume is reported in Scribner Decimal C scale and is based on 16-foot log segments (short log scale). For spruce it is reported to a 6-inch top (PNW-59) and for hardwoods to an 8-inch top (NOR-5). Cubic volume is reported in Smalian's rule and for spruce and hardwoods includes volume to a 4-inch top (NOR-6, U of A). Both live and dead volume is reported. Dead volume includes recently dead trees estimated to have died within the last 5 years.

Computation of green tons was derived from researched local values found in the Matanuska-Susitna area and utilized in the Mat-Su borough forest inventory report (Sanders 2006. *Matanuska-Susitna Borough: Forest Inventory Report*).

Species	Pounds per Cubic Foot
White Spruce	33
Black Spruce	45
Birch	55
Aspen	50
Balsam Poplar	50

TABLE 5. WEIGHT BY SPECIES FOR POLETIMBER AND SAWTIMBER SIZE CLASSES.

Volume Formula Name	Volume Unit	Species	Formula
U of A	Cubic Foot 4-inch Top	White and Black Spruce	$(-0.8937)+0.9963*(0.00217*dbh^{1.85171}*ht^{1.06907})+0.0488*dbh-0.00316*ht$
NOR-6	Cubic 4-inch Top	Birch	$(-2.5767)+0.9524*(dbh)-0.10446*(dbh)^2-0.03303*(ht)+0.00282*(dbh)^2*(ht)$
NOR-6	Cubic 4-inch Top	Aspen	$(-0.5553)-0.02216*dbh^2+0.00246*dbh^2*ht$
NOR-6	Cubic 4-inch Top	Balsam Poplar	$(-3.2187)+0.8281*(dbh)-0.05908*(dbh)^2-0.01985*(ht)+0.00199*(dbh)^2*(ht)$
PNW-59	Board Foot Scribner 6-inch Top	White and Black Spruce	$39.71+4.2659*dbh-0.55865*dbh^2-1.1184*ht+0.016113*dbh^2*ht-437.92/dbh^2$
NOR-5	Board Foot Scribner 8-inch Top	Birch and Aspen	$(-27.263)+0.00995*dbh^2*ht$
NOR-5	Board Foot Scribner 8-inch Top	Balsam Poplar	$(-46.7415)+0.00956*dbh^2*ht$

TABLE 6. VOLUME FORMULAS BY SPECIES FOR POLETIMBER AND SAWTIMBER SIZE CLASSES.

B. INVENTORY VOLUME BY SPECIES

Inventory volume is reported below in *table 7* by tree species across all strata. When the entire volume by species is summed and divided by the timberland area of 488,735 acres there is an average volume of 1,269 net cubic feet per acre. Similarly, overall there is an average of 29 net tons per acre and 4,277 net board feet per acre. The values for cubic feet and tons are reported for trees equal to or greater than five inches dbh. Board foot values are reported for trees equal to or greater than nine inches dbh. *Table 8* reports inventory volume by species and size class across all strata. The sawtimber size class comprises 78% of the total net cubic volume or about 4,840,000 CCF. The poletimber size class comprises 22% of the total net cubic volume or about 1,360,000 CCF. Dead trees of both size classes comprise 0.8% of the total net cubic volume.

Species	Net CUFT Per Acre	Total Net CUNITS	Net Tons Per Acre	Total Net Tons	Net BDFT Per Acre	Total Net MBF
Aspen	1	4,290	<1	10,726	3	1,578
Balsam Poplar	141	686,951	4	1,717,377	531	259,550
Birch	613	2,994,053	17	8,233,646	1,986	970,492
Black Spruce	41	202,194	1	454,935	19	9,325
White Spruce	474	2,314,748	8	3,819,334	1,738	849,296
Total	1,269	6,202,236	29	14,236,018	4,277	2,090,242

TABLE 7. VOLUME PER ACRE AND TOTAL NET VOLUME ACROSS ALL STRATA.

	Gross Cunits	Net Cunits	Gross Tons	Net Tons	Gross MBF	Net MBF
Saw Live						
Aspen	4,602	4,290	11,505	10,726	1,655	1,578
Balsam Poplar	658,289	573,856	1,645,722	1,434,639	305,102	259,550
Birch	3,018,579	2,384,878	8,301,092	6,558,413	1,246,333	968,003
Black Spruce	21,988	21,034	49,474	47,327	9,758	9,325
White Spruce	1,893,562	1,825,089	3,124,378	3,011,397	869,515	837,682
Total	5,597,020	4,809,147	13,132,171	11,062,502	2,432,362	2,076,139
Saw Dead						
Birch	12,610	6,634	34,678	18,243	4,702	2,490
White Spruce	28,758	24,387	47,450	40,238	13,877	11,614
Total	41,368	31,021	82,128	58,481	18,579	14,104
Pole Live						
Balsam Poplar	102,773	102,555	256,933	256,388		
Birch	697,576	601,559	1,918,333	1,654,287		
Black Spruce	185,701	180,689	417,827	406,550		
White Spruce	474,991	459,780	783,735	758,636		
Total	1,461,040	1,344,583	3,376,828	3,075,861		
Pole Dead						
Balsam Poplar	10,568	10,540	26,421	26,350		
Birch	3,539	983	9,733	2,703		
Black Spruce	523	470	1,176	1,058		
White Spruce	6,298	5,492	10,392	9,062		
Total	20,929	17,485	47,722	39,173		
Grand Total	7,120,357	6,202,236	16,638,849	14,236,017	2,450,942	2,090,242

TABLE 8. TOTAL VOLUME BY SIZE CLASS AND SPECIES ACROSS ALL STRATA.

C. DEFECT ESTIMATES BY SPECIES

Defect renders portions of individual trees unusable or of very limited use as forest products due to physical damage such as forked stems, sweep and crook. *Table 9* ranks the most common defect types by species. The net volumes shown however do not take into account all defects because hidden defect has not been estimated. Visible defect is the difference between gross and net volume. Visible defect percentage by species is shown in *Table 10*.

Species	Defect Type				
	Crook	Sweep	Scars	Frost Cracks	Forked Top
Aspen	-	-	1	-	1
Balsam Poplar	1	3	4	5	2
Birch	1	4	3	5	2
Black Spruce	3	1	4	5	2
White Spruce	3	1	2	5	4
Total					

TABLE 9. DEFECT TYPE RANKING BY SPECIES.

Species	Gross Cubic Feet/Ac	Net Cubic Feet/Acre	Percent Defect
Aspen	1	1	6.8
Balsam Poplar	158	141	11.0
Birch	764	613	19.8
Black Spruce	43	41	2.9
White Spruce	492	474	3.7
Total	1,457	1,269	12.9

TABLE 10. CUBIC FOOT DEFECT ESTIMATES BY SPECIES ACROSS ALL STRATA.

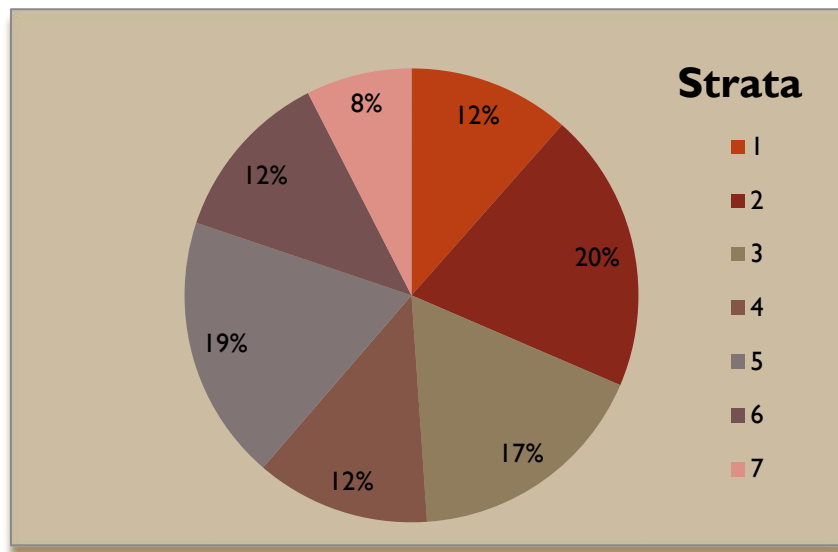
D. INVENTORY VOLUME BY STRATA

Timber inventory results by stratum and species are shown in below. Detailed results are contained in the appendix.

Stratum	Description	Total Net Cunits	Percent
1	Mixed Poletimber Closed	714,621	12%
2	Mixed Poletimber Open	1,236,517	20%
3	Hardwood Closed	1,082,981	17%
4	Hardwood Open	769,872	12%
5	Mixed Spruce/Hardwood Closed	1,168,660	19%
6	Mixed Spruce/Hardwood Open	762,907	12%
7	Mixed Reproduction	466,678	8%
Total Timberland Volume		6,202,236	100%

TABLE 11. TOTAL VOLUME BY STRATUM.

FIGURE 7. PERCENTAGE OF TOTAL NET CUBIC VOLUME BY STRATA.



Forest Resources on State Lands in the Susitna Valley

Stratum	Acres	Species	Net CF/Ac.	Net CCF	Net Tons/Ac.	Net Tons	Net BF/Ac.	Net MBF
1	43,463	Aspen	4	1,792	<1	4,480	12	527
		Balsam Poplar	5	2,214	<1	5,536	30	1,322
		Birch	1,164	505,709	32	1,390,700	2,457	106,788
		Black Spruce	124	53,683	3	120,787	117	5,067
		White Spruce	348	151,223	6	249,518	1,191	51,785
		Sum	1,645	714,621	41	1,771,021	3,807	165,489
2	117,882	Balsam Poplar	4	4,190	<1	10,474	20	2,326
		Birch	496	585,187	14	1,609,266	1,381	162,834
		Black Spruce	29	33,751	1	75,940	28	3,258
		White Spruce	520	613,389	9	1,012,092	1,636	192,907
		Sum	1,049	1,236,517	24	2,707,772	3,065	361,325
		3	47,503	Balsam Poplar	911	432,649	23	1,081,622
Birch	948			450,228	26	1,238,127	2,768	131,466
Black Spruce	1			641	<1	1,442		
White Spruce	420			199,463	7	329,114	1,594	75,734
Sum	2,280			1,082,981	56	2,650,305	9,178	435,968
4	70,464			Balsam Poplar	11	7,604	<1	19,011
		Birch	698	492,024	19	1,353,066	2,880	202,966
		White Spruce	384	270,244	6	445,903	1,577	111,131
		Sum	1,093	769,872	25	1,817,980	4,530	319,242
		5	81,521	Aspen	3	2,498	<1	6,246
Birch	755			615,656	21	1,693,053	2,892	235,780
Black Spruce	13			10,317	<1	23,212	6	497
White Spruce	663			540,189	11	891,311	2,534	206,603
Sum	1,434			1,168,660	32	2,613,822	5,445	443,932
6	61,506	Birch	476	292,772	13	805,122	2,050	126,099
		Black Spruce	4	2,648	<1	5,958	8	504
		White Spruce	760	467,487	13	771,354	3,086	189,822
		Sum	1,240	762,907	26	1,582,434	5,144	316,425
7	66,395	Balsam Poplar	362	240,294	9	600,734	331	21,988
		Birch	79	52,477	2	144,312	69	4,560
		Black Spruce	152	101,154	3	227,597		
		White Spruce	110	72,753	2	120,043	321	21,315
		Sum	703	466,678	16	1,092,686	721	47,863
		Total		6,202,236		14,236,020		2,090,244

TABLE 12. VOLUME SUMMARY BY STRATA AND SPECIES.

E. INVENTORY VOLUME OF SAPLING SIZE TREES

Inventory volume results have been calculated for the sapling component to determine the tonnage of this material that may be available as a biomass resource. These values represent the total above ground portion of the tree including branches and needles. Computation of above ground green weight biomass tons was derived from biomass regression equations that relate the weight of the total above ground portion of the tree including branches and needles to total height and dbh measurements. The DOF Tok Area Forestry Office conducted green weight measurements on 1/100th acre plots for spruce and aspen between 2008 and 2013. From these datasets regression equations were computed in Microsoft Excel. Due to inaccuracies in projecting weight of very small trees (negative regression values) the equations were only applied to trees greater than or equal to 1.5-inches dbh. The diameter limit also reflects what may constitute actual biomass harvest utilization. Although birch was not sampled in the weight study, the aspen formula was applied to the hardwood component, and gives an estimate of volume within this size class. Future weight studies are anticipated for the Susitna Valley area which will provide updated figures for both birch and balsam poplar. Below are the volume formulas.

Species	Green Weight in Pounds
White Spruce	$-51.272*[\text{dbh}] + 11.28*([\text{dbh}]^2 + 3.752*[\text{ht}])$
Black Spruce	
Birch	
Aspen	$-65.425*[\text{dbh}] + 12.687*([\text{dbh}]^2 + 4.272*[\text{ht}])$
Balsam Poplar	

TABLE 13. VOLUME FORMULAS FOR ABOVE GROUND GREEN BIOMASS.

Stratum	Species	Trees Per Acre	Biomass Tons
1			
	Birch	10	0.28
	Black Spruce	33	0.93
	White Spruce	18	0.11
	Sum	61	1.32
2			
	Birch	21	0.37
	Black Spruce	12	0.37
	White Spruce	26	0.33
	Sum	59	1.07
3			
	Birch	8	0.15
	Black Spruce	3	
	White Spruce	28	0.69
	Sum	39	0.84
4			
	Birch	5	
	White Spruce	13	0.20
	Sum	18	0.20
5			
	Birch	48	0.09
	White Spruce	20	0.29
	Sum	68	0.38
6			
	Birch	15	0.15
	Black Spruce	3	0.04
	White Spruce	53	1.29
	Sum	71	1.48
7			
	Balsam Poplar	25	1.13
	Birch	17	0.02
	Black Spruce	200	2.00
	White Spruce	8	
	Sum	250	3.15

TABLE 14. ABOVE GROUND GREEN TONS PER ACRE OF SAPLINGS BY STRATA.

F. SAMPLING ERROR BY VOLUME

Sample error was calculated for the live gross cubic foot estimate by strata and size class (*table 15*). The sample error percent is given within one standard deviation of the mean. This means that there is a 68% chance (one standard deviation) that the volume of the individual live size class components are within plus or minus the error percentage indicated.

Stratum	Number of Plots	Live Poletimber		Live Sawtimber		Combined	
		Gross CF/Ac	% Sampling Error	Gross CF/Ac	% Sampling Error	Gross CF/Ac	% Sampling Error
1	200	687	6.5	1,143	4.6	1,830	3.8
2	210	330	9.8	850	5.7	1,180	4.9
3	200	311	8.4	2,371	3.5	2,682	3.2
4	200	113	14.5	1,189	4.6	1,302	4.4
5	200	211	9.9	1,465	4.4	1,676	4.0
6	200	152	10.4	1,225	3.8	1,377	3.6
7	60	421	10.2	281	14.8	702	8.5
Total	1,270		3.6		1.8		1.6

TABLE 15. GROSS LIVE CUBIC FOOT PERCENT SAMPLING ERROR.

G. LOG GRADE

Log grade estimates were made during field sampling. Log grade was only tallied for the live sawtimber sized trees (≥ 9 inches dbh). A grade was given for each of the first two 16-foot log segments. Log grades use Puget Sound grading rules, which contain specifications for various species. White spruce and black spruce were applied to the Puget Sound western white pine rules. Aspen and birch were applied to red alder rules and balsam poplar to the cottonwood rules. The summary for white spruce trees in stratum 6 is shown in *table 16*. This stratum contained the highest white spruce net board foot per acre values. An overall species summary across all strata and the Puget Sound grading rules are shown in the appendix. Log grade results were not computed by volume but provide grade estimates in straight percentage terms of trees measured in the field. This gives a reference point for the grade distribution. In stratum 6 the first white spruce 16-foot log was coded a number 2 (12-inch top) in 15% of the measurements. Over one half of the measurements however, coded the first log segment as a number 4 log grade.

First 16-Foot Log Grade	Second 16-Foot Log Grade	Percent of Measurements
2	2	6 %
2	3	7 %
2	4	2 %
3	3	2 %
3	4	28 %
4	Cull	2 %
4	4	37 %
4	Utility	14 %
Utility	Cull	<1 %
Utility	4	<1 %
Utility	Utility	2 %

TABLE 16. WHITE SPRUCE LOG GRADE FOR STRATUM 6.

V. FOREST PRODUCTIVITY

A. SITE INDEX

Tree height has been found as the most reliable indicator of site productivity. In essence, the taller the tree the more productive is the growing site. When height is combined with tree age, the measurements can be reported as a site index number. This number gives the height in feet of a particular stand at a reference base age. Site index of white spruce uses a base age of 100 years whereas site index of hardwoods uses a base age of 50 years. Site index reflects the combined effect of all environmental factors and is therefore a good index of stand productivity. Site index calculations for white spruce are based on site index equations produced for Interior Alaska: U.S. Forest Service research paper PNW-53. Site index calculations for birch are based on site index equations produced for Interior Alaska; U.S. Forest Service research paper NOR-2. The aspen NOR-2 values were applied to the Balsam poplar measurements although this species was cored infrequently and has a limited sample size. In *tables 18 and 19* the white spruce and birch sample stand average site indices were prorated by the strata acreage to give an estimated distribution of sites across the project area.

Stratum	Strata Description	Site Index		
		White Spruce	Birch	Balsam Poplar
1	Mixed Poletimber Closed	68	54	
2	Mixed Poletimber Open	65	52	
3	Hardwood Sawtimber Closed	68	54	65
4	Hardwood Sawtimber Open	66	50	
5	Mixed Sawtimber Closed	69	52	
6	Mixed Sawtimber Open	63	51	
7	Mixed Reproduction	53		87
	Average	66	52	75

TABLE 17. SITE INDEX BY STRATA AND SPECIES.

Site Index (100 Year)							
	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Stratum				Acres			
1			4,346	21,732	13,039	4,346	
2	8,420	8,420	8,420	58,941	33,681		
3			16,965	13,572	6,786	10,179	
4		3,915	23,488	19,573	19,573	3,915	
5			17,162	21,453	34,325	4,291	4,291
6			16,186	42,083	3,237		
7		33,198		33,198			
Percent	1%	3%	23%	42%	24%	6%	1%

TABLE 18. WHITE SPRUCE SITE INDEX (ACRES) BY STRATA.

Site Index (50 Year)							
	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Stratum				Acres			
1		16,717	20,060	6,687			
2		65,490	26,196	26,196			
3		7,917	23,752	15,834			
4		41,104	23,488	5,872			
5		48,913	32,608				
6		30,753	30,753				
7							
Percent	0%	47%	39%	14%	0%	0%	0%

TABLE 19. BIRCH SITE INDEX (ACRES) BY STRATA.

B. TIMBERLAND AREA AGE CLASS

Forest productivity can also be examined in terms of overall age class distribution. Typically as trees become older productivity declines. Hardwoods generally begin to decline after year 80 or 90 when rot becomes more frequent. White spruce is longer lived, but generally starts to decline after year 180. At this age white spruce becomes more susceptible to rot and insect damage. *Figure 8* indicates consistent ages across strata. Strata ages are computed from tree coring of trees greater than or equal to 5-inches dbh. The advance age of the reproduction stratum 7 is indicative of stands growing on poor sites.

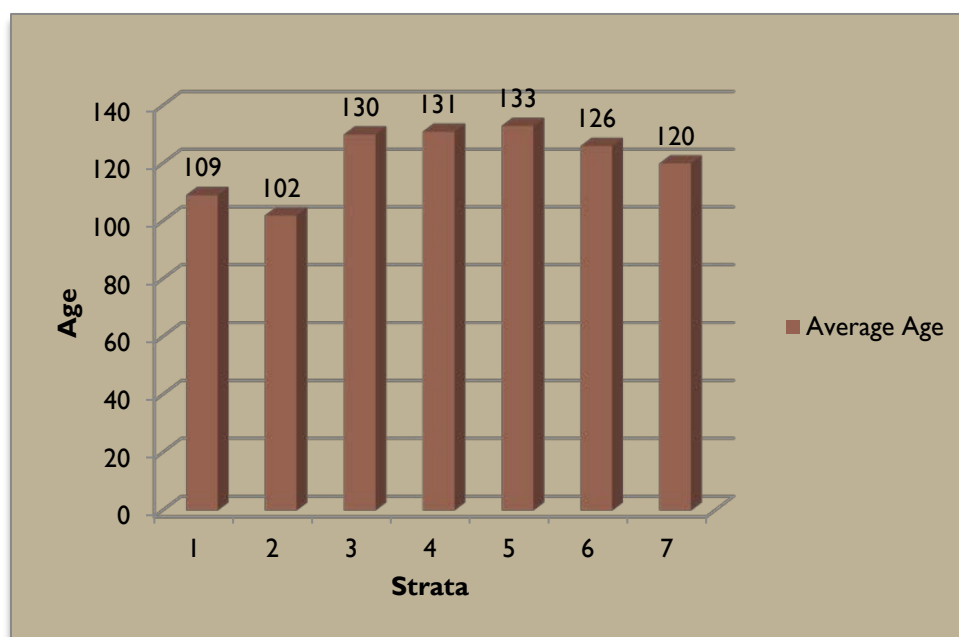


FIGURE 8. AVERAGE AGE BY STRATA.

Table 20 shows age class distribution in acres and percent of the total acreage. Roughly one-half of the timberland acreage is between 110 and 150 years of age and only one quarter of the acreage is less than 100 years of age. The decline of birch quality is evident in many of the stands and is reflected in the age class distribution where 75% of the stand acreage is in age classes that are over mature for birch.

Stand Age Class	Average Age	Acres	Percent of Total
40 - 50	41	3,848	1%
50 - 60	56	3,848	1%
60 - 70	66	19,242	4%
70 - 80	75	50,028	10%
80 - 90	81	11,545	2%
90 - 100	95	34,635	7%
100 - 110	108	34,635	7%
110 - 120	114	50,028	10%
120 - 130	125	69,270	14%
130 - 140	136	73,118	15%
140 - 150	145	53,876	11%
150 - 160	154	38,483	8%
160 - 170	163	23,090	5%
170 - 180	171	11,545	2%
180 - 190	188	3,848	1%
190 - 200	191	3,848	1%
210 - 220	215	3,848	1%
Weighted Average	118	488,735	100%

TABLE 20. PERCENT OF AREA BY AGE CLASS.

C. REGENERATION

Another measure of productivity is whether individual timber stands are being replaced by regeneration. Interior Alaska tree species are mostly even-aged and are replaced through natural regeneration following fire, flooding or insect outbreaks. In the absence of disturbance, stands are slowly replaced by understory regeneration. In many cases such as open decadent birch stands, regeneration is poor because the openings are filled with grass, forbs or brush. These stands are slow to regenerate unless a stand replacing disturbance such as wildfire occurs. Regeneration of desirable and acceptable crop trees was generally poor across the strata with the exception of stratum 7. Table 21 gives numbers of trees per acre less than 5 inches by species and stratum. Trees are of desirable and acceptable quality as determined in field. Undesirable trees not expected to become future crop trees are not included in the table.

Strata #	Strata Description	Number of Trees Per Acre < 5" dbh				
		White Spruce	Black Spruce	Birch	Aspen	Balsam Poplar
1	Mixed Poletimber Closed	83	128	75		
2	Mixed Poletimber Open	57	52	26		
3	Hardwood Sawtimber Closed	50	3	13		3
4	Hardwood Sawtimber Open	20		3		
5	Mixed Sawtimber Closed	53	20	80		
6	Mixed Sawtimber Open	90		18		
7	Mixed Reproduction	150	233			25

TABLE 21. NUMBER OF TREES PER ACRE LESS THAN 5 INCHES DBH BY SPECIES AND STRATA.

D. GROWTH AND MORTALITY ESTIMATES

Growth estimates have been determined through projections made with the timber cruise software TCruise. The software projects growth by utilizing 10 year diameter growth increment and bark thickness measurements collected in the field. By collecting both of these variables, the software is able to discount changes in bark thickness that would affect the accurate determination of diameter growth. The software calculates a diameter-height regression (displayed in the appendix) and then applies the projected heights to the new grown diameters. These diameter and height pairs are then processed through the volume tables to calculate gross growth. Diameter-height relationships, diameter growth and calculated bark thickness ratios (Husch et al. 2002. *Forest Mensuration, Fourth Edition.*) are shown in the appendix. Mortality estimates have been determined by dividing the recently dead volume estimates by 5 to get annual mortality. Recently dead trees were relatively uncommon in the inventory. Growth rates are consistent with Forest Service estimates of between 2 and 3% for unmanaged interior forests (Smith et al. 2007. *Forest Resources of the United States, 2007*). The percent annual growth figures in table 22 however, come with some caveats. These caveats are in regard to the high amount of rot indicators visible in the birch. Although these trees are still increasing in diameter (height growth is mostly flat) the internal rot is also increasing and continues to make these trees less useable over time. The software doesn't take this into account and is only projecting the external dimensional changes of the tree. If the increase in rot is taken into account across the forest and with the current age class distribution, there is probably an overall decrease in percent annual net growth.

Strata #	Strata Description	% Annual Growth	% Annual Mortality	% Annual Net Growth	CF Per Acre Per Year Growth	Tons Per Acre Per Year Growth
1	Mixed Poletimber Closed	2.63%	0.04%	2.59%	43	1.04
2	Mixed Poletimber Open	3.41%	0.12%	3.29%	34	1.00
3	Hardwood Sawtimber Closed	1.96%	0.06%	1.90%	43	1.05
4	Hardwood Sawtimber Open	2.76%	0.07%	2.69%	29	0.67
5	Mixed Sawtimber Closed	2.65%	0.31%	2.34%	33	0.75
6	Mixed Sawtimber Open	2.84%	0.15%	2.69%	33	0.67
7	Mixed Reproduction	5.48%	0.47%	5.01%	34	0.80
	Total Live Volume	2.78%	0.16%	2.62%	33	0.76

TABLE 22. GROWTH AND MORTALITY ESTIMATES.

E. SUSTAINED YIELD ESTIMATES

Estimates of sustained yield have been made to guide future management decisions. The estimates in this analysis only include the timberland acreage and volume. Dwarf forests are not included. The sustained yield has been calculated using area control, which divides the acreage of each stratum by the rotation age. To convert from area to volume, stratum volume per acre values were used. White spruce and mixed white spruce types use a rotation age of 120 years, which includes 10 years for establishment. The aspen timber type uses a rotation of 80 years, which includes 10 years for establishment. There have been no acreage reductions made for operability concerns.

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#	Strata Description	Acres	Rotation	Acres/ Yr.	Net CF/ Ac.	Net CF/Yr.	Net Tons /Ac.	Net Tons/ Yr.	Net BF/ Ac.	Net BF/Yr.
1	Mixed Pole Closed	43,463	120	362	1,645	595,805	41	14,886	3,807	1,378,864
2	Mixed Pole Open	117,882	120	982	1,049	1,030,485	24	23,576	3,065	3,010,903
3	HW Saw Closed	47,503	80	594	2,280	1,353,836	56	33,252	9,178	5,449,782
4	HW Saw Open	70,464	80	881	1,093	962,714	25	22,020	4,530	3,990,024
5	Mixed Saw Closed	81,521	120	679	1,434	974,176	32	21,807	5,445	3,699,015
6	Mixed Saw Open	61,506	120	513	1,240	635,562	26	13,326	5,144	2,636,557
7	Mixed Repro	66,395	120	553	703	388,964	16	8,853	721	398,923
Totals		488,734		4,564		5,941,542		137,720		20,564,068
Species Totals										
Aspen						3,487		104		13,178
Balsam Poplar						756,661		18,637		3,137,631
Birch						2,887,132		79,553		9,480,399
Black Spruce						168,976		3,729		78,059
White Spruce						2,125,286		35,698		7,854,801
Totals						5,941,542		137,720		20,564,068

TABLE 23. SUSTAINED YIELD ESTIMATE.

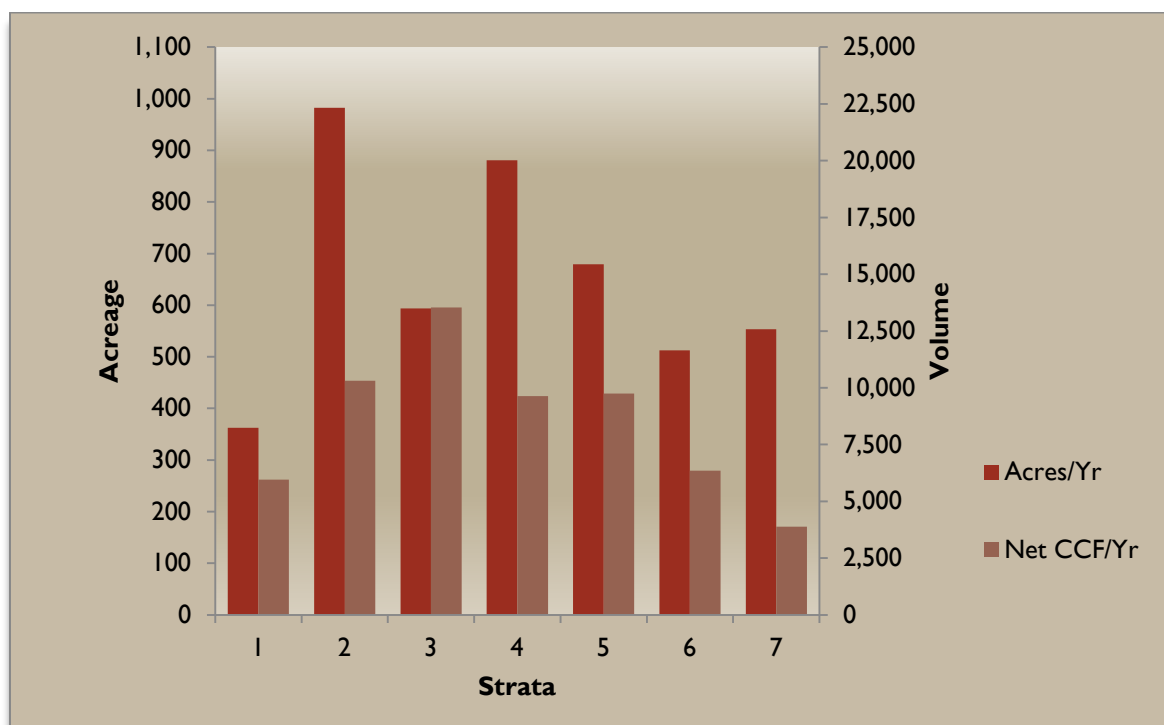


FIGURE 9. SUSTAINED YIELD COMPARISON BETWEEN STRATA.

VI. LITERATURE CITED

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Appendix A
ACRES BY VEGETATION TYPE AND STRATUM

Forest Resources on State Lands in the Susitna Valley

Vegetation Type		Acres Field Sampled?	
Stratum	1 Mixed Poletimber Closed		
	32PX	1,132	Yes
	18PX	4	Yes
	3PX	712	
	19PX	9	Yes
	1PX	68	
	38PX	824	Yes
	31PX	20,569	Yes
	2PX	1,724	
	37PX	347	Yes
	30PX	3,745	Yes
	16PX	403	
	17PX	13,926	Yes
Summary for 'stratum' = 1 (12 detail records)			
	Sum	43,463	
Stratum	2 Mixed Poletimber Open		
	32PY	350	
	18PY	9	Yes
	31PZ	13,140	
	38PY	4,737	
	38PZ	579	
	34PZ	13	
	17PY	23,242	Yes
	16PY	1,608	Yes
	16PZ	27	
	2PZ	3,543	
	2PY	11,002	Yes
	31PY	45,085	Yes
	1PY	131	
	34PY	6	Yes
	3PY	1,838	
	17PZ	11,064	
	30PY	1,509	
Summary for 'stratum' = 2 (17 detail records)			
	Sum	117,882	
Stratum	3 Hardwood Sawtimber Closed		
	19SX	31	
	17SX	43,395	Yes
	16SX	4,037	Yes
	18SX	39	
Summary for 'stratum' = 3 (4 detail records)			
	Sum	47,503	

Forest Resources on State Lands in the Susitna Valley

	Vegetation Type		Acres	Field Sampled?
Stratum	4	Hardwood Sawtimber Open		
	18SY		29	Yes
	17SZ		2,321	
	16SY		4,108	Yes
	16SZ		104	Yes
	17SY		63,903	Yes
Summary for 'stratum' = 4 (5 detail records)				
Sum			70,464	
Stratum	5	Mixed Sawtimber Closed		
	30SX		114	
	34SX		80	
	2SX		887	
	37SX		1,912	
	1SX		3	
	31SX		77,004	Yes
	32SX		6	Yes
	38SX		1,515	
Summary for 'stratum' = 5 (8 detail records)				
Sum			81,521	
Stratum	6	Mixed Sawtimber Open		
	2SY		1,492	Yes
	2SZ		67	
	19SY		7	
	30SY		20	
	31SZ		234	
	38SY		1,715	Yes
	37SY		19	
	31SY		57,855	Yes
	38SZ		97	
Summary for 'stratum' = 6 (9 detail records)				
Sum			61,506	
Stratum	7	Mixed Reproduction		
	16RX		1,501	Yes
	16RY		974	
	2RX		1,189	
	17SXBR		6	
	16RZ		52	
	18RY		0	
	1RZ		240	
	17PYBR		3	

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Vegetation Type	Acres	Field Sampled?
1RY	18,189	Yes
1RXBR	313	Yes
1RX	11,538	Yes
17PXBR	7	
17RZ	337	
17RY	6,081	
19RY	60	
17RX	3,867	
1RYBR	27	Yes
37RY	15	
31RX	2,523	
31RY	4,571	
31RZ	1,793	
2RXBR	395	
32RX	475	
32RY	184	
30RZ	86	
34RY	19	
31SXBR	15	
38RX	289	
38RY	486	Yes
38RZ	17	
3RX	1,359	
3RY	966	
3RYBR	11	
3RZ	100	
32RZ	6	
30RYBR	1	
101	93	
30PXBR	15	
30RX	2,429	
30RXBR	52	
30RY	2,824	Yes
2RZ	1,500	
2RY	1,786	
Summary for 'stratum' = 7 (43 detail records)		
Sum	66,395	
Stratum	20	Mixed Dwarf
2DZ	14	
2DY	198	
30DX	14	
1DXBR	62	
3DX	21	
17DY	47	

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Vegetation Type		Acres	Field Sampled?
	17DX	1	
	32DY	2	
	1DX	6,441	
	3DY	41	
	30DZ	20	
	1DZBR	43	
	1DZ	4,357	
	1DYBR	87	
	31DZ	22	
	1DY	27,584	
	30DY	64	
Summary for 'stratum' = 20 (17 detail records)			
	Sum	39,015	
Stratum	30 Tall Shrub		
	68	90,084	
Summary for 'stratum' = 30 (1 detail record)			
	Sum	90,084	
Stratum	31 Dry Meadow		
	76	5,183	
Summary for 'stratum' = 31 (1 detail record)			
	Sum	5,183	
Stratum	32 Low Shrub		
	71	18,223	
Summary for 'stratum' = 32 (1 detail record)			
	Sum	18,223	
Stratum	40 Wet Meadow		
	79	112,994	
	79BR	380	
Summary for 'stratum' = 40 (2 detail records)			
	Sum	113,374	
Stratum	50 Water		
	80	3,954	
Summary for 'stratum' = 50 (1 detail record)			
	Sum	3,954	
Stratum	60 Rivers		
	88	12,479	
Summary for 'stratum' = 60 (1 detail record)			
	Sum	12,479	
Stratum	70 Bare Ground		
	94	724	
Summary for 'stratum' = 70 (1 detail record)			
	Sum	724	

Forest Resources on State Lands in the Susitna Valley

Vegetation Type			Acres	Field Sampled?
Stratum	71	Urban-Suburban		
	95			2
Summary for 'stratum' = 71 (1 detail record)				
Sum				2
Stratum	74	Roads		
	98			643
Summary for 'stratum' = 74 (1 detail record)				
Sum				643
Grand Total				772,416

Appendix B
STAND TABLES PER ACRE BY STRATUM AND SPECIES

Forest Resources on State Lands in the Susitna Valley

DBH	# of Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Gross BF	Net BF
Stratum	1 Mixed Poletimber Closed					Acreage =	43,463	
Aspen								
10	0	0	2	2	0	0	1	0
13	0	0	3	2	0	0	13	12
Totals	0	0	5	4	0	0	14	12
Balsam Poplar								
33	0	0	5	4	0	0	29	23
36	0	0	3	0	0	0	20	0
40	0	0	3	1	0	0	18	7
Totals	0	1	11	5	0	0	68	30
Birch								
5	15	2	35	31	1	1		
6	18	4	67	62	2	2		
7	23	6	118	111	3	3		
8	27	10	190	177	5	5		
9	18	8	169	155	5	4	108	97
10	17	8	162	139	4	4	311	264
11	12	7	145	121	4	3	518	434
12	10	7	134	111	4	3	549	453
13	8	6	114	95	3	3	493	409
14	2	2	43	35	1	1	201	164
15	2	3	56	44	2	1	263	209
16	2	2	44	36	1	1	207	168
17	1	2	36	32	1	1	177	156
18	1	1	8	7	0	0	61	53
19	0	1	7	5	0	0	42	32
21	0	0	3	2	0	0	21	18
Totals	155	68	1,331	1,164	37	32	2,952	2,457
Black Spruce								
5	6	1	12	12	0	0		
6	14	3	33	29	1	1		
7	4	1	19	18	0	0		
8	6	2	32	31	1	1		
9	1	0	10	10	0	0	16	16
11	1	1	18	17	0	0	78	73
12	0	0	2	2	0	0	10	10
14	0	0	4	4	0	0	18	18
Totals	32	8	130	124	3	3	122	117

Forest Resources on State Lands in the Susitna Valley

DBH	# of Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Gross BF	Net BF
White Spruce								
5	4	1	7	7	0	0		
6	7	1	18	17	0	0		
7	5	2	25	24	0	0		
8	5	2	31	31	1	1		
9	3	2	34	33	1	1	79	77
10	2	1	30	30	0	0	121	120
11	1	1	26	25	0	0	115	110
12	1	1	21	20	0	0	92	87
13	1	1	33	33	1	1	154	151
14	1	2	48	47	1	1	230	228
15	0	0	15	14	0	0	78	77
16	1	1	32	30	1	0	161	151
17	1	1	21	21	0	0	107	105
18	0	0	3	3	0	0	17	17
19	0	0	0	0	0	0	5	6
20	0	0	6	6	0	0	32	31
25	0	0	6	6	0	0	33	32
Totals	33	16	357	348	6	6	1,224	1,191
Totals for stratum Mixed Poletimber Closed								
	220	93	1,834	1,644	46	41	4,380	3,808
Stratum	2 Mixed Poletimber Open					Acreage =		117,882
Balsam Poplar								
18	0	0	2	2	0	0	9	9
30	0	0	3	0	0	0	17	1
31	0	0	1	2	0	0	8	10
Totals	0	0	6	4	0	0	34	20
Birch								
5	3	0	6	6	0	0		
6	11	3	32	24	1	1		
7	8	2	35	32	1	1		
8	8	3	50	45	1	1		
9	9	4	82	74	2	2	77	69
10	5	3	60	52	2	1	134	114
11	4	3	51	46	1	1	186	167
12	3	3	50	42	1	1	206	171
13	5	4	80	60	2	2	330	243
14	2	2	41	28	1	1	192	131
15	3	2	32	25	1	1	155	121

Forest Resources on State Lands in the Susitna Valley

DBH	# of Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Gross BF	Net BF
16	2	2	43	35	1	1	215	170
17	1	1	10	8	0	0	83	60
18	1	2	16	9	0	0	101	65
19	1	1	13	7	0	0	68	38
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	5	4	0	0	40	32
23	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
Totals	66	36	606	496	17	14	1,788	1,381
Black Spruce								
5	1	0	0	0	0	0		
6	7	1	13	13	0	0		
7	2	1	6	5	0	0		
8	1	0	5	5	0	0		
10	1	0	6	6	0	0	28	28
Totals	12	3	30	29	1	1	28	28
White Spruce								
5	3	0	4	4	0	0		
6	11	2	30	29	0	0		
7	15	4	66	63	1	1		
8	7	2	50	49	1	1		
9	8	4	72	69	1	1	259	250
10	4	2	46	45	1	1	180	180
11	4	3	54	54	1	1	235	236
12	3	2	51	51	1	1	231	232
13	1	1	23	23	0	0	108	107
14	1	1	27	27	0	0	125	125
15	1	1	28	26	0	0	126	122
16	1	1	21	21	0	0	102	100
17	1	2	42	30	1	0	210	144
18	0	1	19	18	0	0	95	89
20	0	0	6	5	0	0	25	21
22	0	0	6	6	0	0	31	31
Totals	60	28	546	520	9	9	1,727	1,636
Totals for stratum Mixed Poletimber Open								
	138	67	1,188	1,049	26	23	3,577	3,065

Forest Resources on State Lands in the Susitna Valley

DBH	# of Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Gross BF	Net BF
Stratum	3 Hardwood Sawtimber Closed					Acreage =	47,503	
Balsam Poplar								
6	1	0	3	3	0	0		
9	1	0	10	8	0	0	14	12
10	0	0	6	5	0	0	15	14
12	0	0	7	5	0	0	17	13
13	0	0	11	11	0	0	46	44
14	0	0	11	11	0	0	48	48
15	1	1	17	15	0	0	76	68
16	1	2	54	45	1	1	264	224
17	1	2	59	55	1	1	291	272
18	1	1	37	35	1	1	189	177
19	1	2	71	65	2	2	371	337
20	1	3	78	70	2	2	410	370
21	1	3	76	71	2	2	408	378
22	1	2	51	45	1	1	273	242
23	1	2	74	67	2	2	406	367
24	1	2	74	60	2	2	405	331
25	0	1	36	28	1	1	201	153
26	1	2	57	49	1	1	322	277
27	0	2	60	52	1	1	333	288
28	0	1	40	34	1	1	225	188
29	0	0	17	16	0	0	90	89
30	0	1	48	34	1	1	271	195
31	0	1	16	12	0	0	92	69
32	0	1	45	36	1	1	253	204
36	0	1	27	20	1	0	156	113
37	0	1	20	15	0	0	113	84
38	0	0	9	4	0	0	53	26
39	0	1	16	13	0	0	91	74
40	0	1	14	8	0	0	83	49
42	0	0	8	6	0	0	46	36
47	0	0	5	3	0	0	31	20
50	0	1	17	10	0	0	94	55
Totals	16	36	1,073	911	27	23	5,687	4,816
Birch								
6	9	2	30	26	1	1		
7	15	4	86	69	2	2		
8	11	4	95	72	3	2		
9	14	6	130	115	4	3	131	116
10	11	6	129	110	4	3	282	239

Forest Resources on State Lands in the Susitna Valley

DBH	# of Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Gross BF	Net BF
11	9	5	100	80	3	2	339	270
12	8	6	142	116	4	3	560	456
13	6	4	93	77	3	2	362	306
14	4	4	104	77	3	2	440	322
15	4	4	89	66	2	2	408	303
16	2	3	47	34	1	1	255	179
17	3	3	52	43	1	1	252	211
18	1	2	35	28	1	1	187	152
19	0	1	16	12	0	0	83	62
20	1	1	11	7	0	0	65	43
21	0	0	7	4	0	0	49	29
22	0	1	9	8	0	0	61	50
23	0	0	3	1	0	0	23	11
24	0	0	5	2	0	0	32	6
26	0	0	3	1	0	0	32	13
Totals	99	57	1,187	948	33	26	3,563	2,768
Black Spruce								
6	1	0	1	1	0	0		
Totals	1	0	1	1	0	0		
White Spruce								
5	2	0	4	4	0	0		
6	4	1	7	6	0	0		
7	3	1	15	14	0	0		
8	5	2	30	30	1	0		
9	4	2	34	34	1	1	54	54
10	2	1	27	25	0	0	109	103
11	4	3	61	57	1	1	259	240
12	3	3	66	65	1	1	293	286
13	2	2	47	47	1	1	221	220
14	1	1	29	28	0	0	139	133
15	1	1	33	32	1	1	164	159
16	1	1	32	31	1	1	163	158
17	0	1	15	15	0	0	78	76
18	1	1	26	26	0	0	136	136
19	0	0	6	6	0	0	30	29
Totals	34	19	434	420	7	7	1,646	1,594
Totals for stratum Hardwood Sawtimber Closed								
	149	112	2,695	2,280	67	56	10,897	9,178

Forest Resources on State Lands in the Susitna Valley

DBH	# of Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Gross BF	Net BF
Stratum	4	Hardwood	Sawtimber	Open		Acreage =	70,464	
Balsam Poplar								
15	0	0	3	3	0	0	13	12
21	0	0	4	4	0	0	21	19
23	0	0	0	0	0	0	15	14
29	0	0	2	2	0	0	14	13
30	0	0	3	2	0	0	16	15
32	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0
Totals	0	1	12	11	0	0	79	73
Birch								
5	1	0	4	3	0	0		
6	5	1	16	12	0	0		
7	3	1	16	14	0	0		
8	3	1	15	12	0	0		
9	3	1	21	18	1	0	31	24
10	8	4	80	59	2	2	185	136
11	5	3	68	52	2	1	252	196
12	7	6	106	84	3	2	438	349
13	6	6	116	89	3	2	447	346
14	5	6	109	89	3	2	491	405
15	3	4	79	64	2	2	372	302
16	4	5	93	74	3	2	500	386
17	3	4	64	51	2	1	357	282
18	2	3	58	46	2	1	323	253
19	1	1	22	19	1	1	122	103
20	1	2	11	7	0	0	65	45
21	0	0	2	2	0	0	20	15
23	0	0	4	2	0	0	36	15
24	0	0	3	1	0	0	32	7
25	0	0	4	2	0	0	35	18
Totals	62	50	892	698	25	19	3,707	2,880
White Spruce								
5	2	0	4	4	0	0		
6	4	1	8	8	0	0		
7	5	1	18	18	0	0		
8	3	1	19	18	0	0		
9	1	1	10	10	0	0	18	18
10	2	1	21	20	0	0	93	89
11	2	1	26	26	0	0	109	112

Forest Resources on State Lands in the Susitna Valley

DBH	# of Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Gross BF	Net BF
12	3	2	48	47	1	1	214	212
13	2	2	50	48	1	1	230	223
14	1	1	26	26	0	0	122	122
15	1	1	21	20	0	0	104	97
16	1	1	36	33	1	1	180	162
17	2	2	60	56	1	1	309	288
18	1	1	21	21	0	0	102	105
19	0	0	10	9	0	0	52	47
20	0	0	3	0	0	0	17	3
21	0	0	5	1	0	0	20	7
24	0	1	17	17	0	0	94	94
Totals	29	18	403	384	7	6	1,662	1,577
Totals for stratum Hardwood Sawtimber Open								
	91	69	1,307	1,093	31	26	5,449	4,531
Stratum	5 Mixed Sawtimber Closed					Acreage = 81,521		
Aspen								
15	0	0	3	3	0	0	13	13
Totals	0	0	3	3	0	0	13	13
Birch								
6	6	1	13	11	0	0		
7	7	2	32	27	1	1		
8	5	2	34	29	1	1		
9	5	2	41	36	1	1	32	29
10	6	3	74	58	2	2	145	114
11	8	6	98	72	3	2	393	283
12	7	6	118	79	3	2	485	323
13	6	6	118	93	3	3	519	407
14	7	7	149	122	4	3	669	551
15	3	3	70	51	2	1	327	236
16	3	4	77	59	2	2	387	294
17	2	3	53	36	1	1	266	180
18	2	3	57	39	2	1	294	197
19	1	2	32	21	1	1	175	114
20	0	1	16	11	0	0	105	76
21	1	1	10	6	0	0	83	53
22	0	0	4	2	0	0	27	14
32	0	0	5	4	0	0	28	20
Totals	69	53	1,001	755	28	21	3,934	2,892

Forest Resources on State Lands in the Susitna Valley

DBH	# of Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Gross BF	Net BF	
Black Spruce									
5	3	1	6	6	0	0			
7	0	0	2	2	0	0			
8	1	0	3	3	0	0			
10	0	0	2	1	0	0	8	6	
Totals	4	1	13	13	0	0	8	6	
White Spruce									
5	2	0	5	5	0	0			
6	7	1	17	15	0	0			
7	6	2	22	22	0	0			
8	5	2	33	32	1	1			
9	9	4	78	74	1	1	194	185	
10	4	2	48	44	1	1	202	183	
11	9	6	128	122	2	2	554	526	
12	7	5	132	127	2	2	592	568	
13	2	2	47	45	1	1	215	209	
14	2	2	57	55	1	1	271	263	
15	2	2	54	53	1	1	263	258	
16	1	2	51	51	1	1	259	256	
17	0	0	12	12	0	0	59	58	
18	0	0	6	6	0	0	28	28	
Totals	57	31	690	663	11	11	2,638	2,534	
Totals for stratum Mixed Sawtimber Closed									
	130	85	1,708	1,434	39	32	6,592	5,446	
Stratum	6 Mixed Sawtimber Open					Acreage =		61,506	
Birch									
6	2	1	6	3	0	0			
7	3	1	16	6	0	0			
8	3	1	23	14	1	0			
9	4	2	24	18	1	0	22	16	
10	5	3	43	33	1	1	94	74	
11	6	3	57	42	2	1	211	156	
12	5	4	66	47	2	1	273	197	
13	6	5	90	75	2	2	374	313	
14	5	5	83	72	2	2	382	329	
15	5	6	89	78	2	2	432	378	
16	2	2	35	28	1	1	210	175	
17	2	3	30	23	1	1	243	176	

Forest Resources on State Lands in the Susitna Valley

DBH	# of Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Gross BF	Net BF	
18	1	2	20	17	1	0	115	98	
19	1	1	4	4	0	0	34	30	
20	1	1	6	4	0	0	41	26	
21	0	1	7	6	0	0	54	41	
22	0	1	3	3	0	0	25	21	
23	0	0	3	3	0	0	23	20	
24	0	0	0	0	0	0	0	0	
Totals Black Spruce	50	42	605	476	17	13	2,532	2,050	
8	0	0	2	2	0	0			
9	0	0	2	2	0	0	8	8	
Totals White Spruce	1	0	4	4	0	0	8	8	
5	3	1	8	8	0	0			
6	6	1	15	14	0	0			
7	3	1	12	11	0	0			
8	6	2	28	27	0	0			
9	11	5	100	99	2	2	287	283	
10	8	4	77	69	1	1	353	312	
11	7	4	96	95	2	2	420	415	
12	6	4	88	87	1	1	397	393	
13	6	5	122	120	2	2	563	556	
14	4	4	87	86	1	1	412	407	
15	2	2	52	52	1	1	255	252	
16	0	0	7	7	0	0	35	35	
17	1	1	26	26	0	0	133	131	
18	1	1	21	21	0	0	105	104	
19	1	1	18	18	0	0	91	91	
20	0	1	23	21	0	0	117	108	
Totals	63	38	778	760	13	13	3,169	3,086	
Totals for stratum Mixed Sawtimber Open									
	114	80	1,387	1,240	30	26	5,709	5,145	
Stratum	7 Mixed Reproduction					Acreage =		66,395	
Balsam Poplar									
5	7	1	15	15	0	0			
6	5	1	18	18	0	0			
7	8	2	45	45	1	1			
8	6	2	47	47	1	1			

Forest Resources on State Lands in the Susitna Valley

DBH	# of Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Gross BF	Net BF
9	8	3	74	74	2	2	31	31
10	9	5	109	109	3	3	171	171
11	3	2	32	30	1	1	69	63
14	3	1	23	23	1	1	66	65
Totals	49	18	364	362	9	9	337	331
Birch								
5	6	1	6	6	0	0		
6	11	2	22	14	1	0		
7	7	2	26	26	1	1		
8	4	1	17	17	0	0		
13	2	1	17	16	0	0	76	69
Totals	30	7	88	79	2	2	76	69
Black Spruce								
5	33	5	44	44	1	1		
6	29	6	64	63	1	1		
7	7	2	30	30	1	1		
8	3	1	15	16	0	0		
Totals	72	14	155	152	3	3		
White Spruce								
6	3	1	7	6	0	0		
7	5	1	16	16	0	0		
8	4	1	21	20	0	0		
10	2	1	26	26	0	0	109	109
18	1	2	41	41	1	1	212	212
Totals	15	6	111	110	2	2	321	321
Totals for stratum Mixed Reproduction								
	166	45	718	703	17	16	735	721

Appendix C
VOLUME PER ACRE AND TOTAL VOLUME BY STRATUM

Forest Resources on State Lands in the Susitna Valley

Stratum	1 Mixed Poletimber Closed									Acreage =		43,463			
	Trees/ Ac	BA/ Ac	Gross CF/ Ac	Net CF/ Ac	Gross Tons/ Ac	Net Tons/ Ac	Gross BF/ Ac	Net BF/ Ac	Total Gross CF	Total Net CF	Total Gross Tons	Total Net Tons	Total Gross BF	Total Net BF	
Aspen															
Saw Live	0	0	5	4	0	0	14	12	210,371	179,206	5,259	4,480	603,067	526,511	
Species Totals	0	0	5	4	0	0	14	12	210,371	179,206	5,259	4,480	603,067	526,511	
Balsam Poplar															
Saw Live	0	1	11	5	0	0	68	30	485,958	221,441	12,149	5,536	2,934,745	1,322,050	
Species Totals	0	1	11	5	0	0	68	30	485,958	221,441	12,149	5,536	2,934,745	1,322,050	
Birch															
Saw Live	63	42	836	703	23	19	2,952	2,457	36,315,629	30,548,929	998,680	840,096	128,309,812	106,788,032	
Pole Live	91	26	496	461	14	13			21,555,167	20,021,994	592,767	550,605			
Species Totals	155	68	1,331	1,164	37	32	2,952	2,457	57,870,796	50,570,923	1,591,447	1,390,700	128,309,812	106,788,032	
Black Spruce															
Saw Live	2	1	29	27	1	1	122	117	1,239,109	1,187,513	27,880	26,719	5,288,063	5,066,665	
Pole Live	29	7	100	95	2	2			4,342,748	4,133,750	97,712	93,009			
Pole Dead	1	0	1	1	0	0			52,256	47,030	1,176	1,058			
Species Totals	32	8	130	124	3	3	122	117	5,634,113	5,368,294	126,768	120,787	5,288,063	5,066,665	
White Spruce															
Pole Live	22	6	91	90	2	1			3,965,594	3,909,414	65,432	64,505			
Pole Dead	0	0	3	2	0	0			108,718	79,262	1,794	1,308			
Saw Live	10	10	263	256	4	4	1,224	1,191	11,427,897	11,133,623	188,560	183,705	53,217,542	51,785,162	
Species Totals	33	16	357	348	6	6	1,224	1,191	15,502,209	15,122,299	255,786	249,518	53,217,542	51,785,162	
Strata Totals	220	93	1,834	1,644	46	41	4,380	3,808	79,703,446	71,462,163	1,991,409	1,771,021	190,353,229	165,488,421	
Stratum	2 Mixed Poletimber Open									Acreage =		117,882			
Balsam Poplar															
Saw Live	0	0	6	4	0	0	34	20	703,301	418,959	17,583	10,474	4,010,915	2,326,387	
Species Totals	0	0	6	4	0	0	34	20	703,301	418,959	17,583	10,474	4,010,915	2,326,387	
Birch															
Saw Live	33	27	458	366	13	10	1,788	1,381	53,952,147	43,187,463	1,483,684	1,187,655	210,736,014	162,833,716	
Pole Live	33	9	148	130	4	4			17,472,374	15,331,284	480,490	421,610			
Species Totals	66	36	606	496	17	14	1,788	1,381	71,424,520	58,518,748	1,964,174	1,609,266	210,736,014	162,833,716	
Black Spruce															
Saw Live	1	0	6	6	0	0	28	28	689,324	671,397	15,510	15,106	3,344,781	3,257,797	
Pole Live	11	2	24	23	1	1			2,846,494	2,703,707	64,046	60,833			
Species Totals	12	3	30	29	1	1	28	28	3,535,818	3,375,105	79,556	75,940	3,344,781	3,257,797	
White Spruce															
Saw Live	23	18	381	362	6	6	1,716	1,628	44,910,524	42,701,615	741,024	704,577	202,340,540	191,924,407	
Pole Live	37	10	158	152	3	3			18,633,713	17,964,618	307,456	296,416			
Saw Dead	0	0	2	2	0	0	11	8	269,215	202,690	4,442	3,344	1,288,306	982,761	
Pole Dead	1	0	4	4	0	0			521,122	469,980	8,599	7,755			
Species Totals	60	28	546	520	9	9	1,727	1,636	64,334,575	61,338,903	1,061,520	1,012,092	203,628,847	192,907,168	
Strata Totals	138	67	1,188	1,049	26	23	3,577	3,065	139,998,214	123,651,714	3,122,833	2,707,771	421,720,557	361,325,068	

Forest Resources on State Lands in the Susitna Valley

Trees/	BA/ Ac	Gross Ac	Net CF/ Ac	Gross Net CF/ Tons/ Ac Ac	Gross Tons/ Ac	BF/ Ac	Net BF/ Ac	Total Gross CF	Total Net CF	Total Gross Tons	Total Net Tons	Total Gross BF	Total Net BF	
Stratum	3 Hardwood Sawtimber Closed								Acreage =		47,503			
Balsam Poplar														
Pole Live	1	0	3	3	0	0		145,290	123,497	3,632	3,087			
Saw Live	15	36	1,070	908	27	23	5,687	4,816	50,808,606	43,141,388	1,270,215	1,078,535	270,170,198	228,767,693
Species Totals	16	36	1,073	911	27	23	5,687	4,816	50,953,896	43,264,885	1,273,847	1,081,622	270,170,198	228,767,693
Birch														
Saw Live	59	45	944	756	26	21	3,551	2,760	44,825,692	35,894,929	1,232,707	987,111	168,700,359	131,091,385
Pole Dead	1	0	5	2	0	0		240,208	75,539	6,606	2,077			
Pole Live	38	11	230	186	6	5		10,943,625	8,830,138	300,950	242,829			
Saw Dead	1	0	8	5	0	0	12	8	377,651	222,206	10,385	6,111	568,353	374,678
Species Totals	99	57	1,187	948	33	26	3,563	2,768	56,387,176	45,022,813	1,550,647	1,238,127	169,268,712	131,466,063
Black Spruce														
Pole Live	1	0	1	1	0	0		64,074	64,074	1,442	1,442			
Species Totals	1	0	1	1	0	0		64,074	64,074	1,442	1,442			
White Spruce														
Pole Live	17	5	76	74	1	1		3,621,022	3,496,879	59,747	57,699			
Saw Live	17	14	358	346	6	6	1,646	1,594	16,987,413	16,449,402	280,292	271,415	78,178,850	75,733,563
Species Totals	34	19	434	420	7	7	1,646	1,594	20,608,435	19,946,282	340,039	329,114	78,178,850	75,733,563
Strata Totals	149	112	2,695	2,280	67	56	10,897	9,178	128,013,581	108,298,054	3,165,976	2,650,305	517,617,760	435,967,319
Stratum	4 Hardwood Sawtimber Open								Acreage =		70,464			
Balsam Poplar														
Saw Live	0	1	12	11	0	0	79	73	832,649	760,445	20,816	19,011	5,587,494	5,145,212
Species Totals	0	1	12	11	0	0	79	73	832,649	760,445	20,816	19,011	5,587,494	5,145,212
Birch														
Pole Live	14	4	58	47	2	1		4,082,683	3,335,231	112,274	91,719			
Saw Live	47	46	829	647	23	18	3,677	2,859	58,424,757	45,572,841	1,606,681	1,253,253	259,129,667	201,447,654
Pole Dead	0	0	0	0	0	0		0	0	0	0			
Saw Dead	1	0	5	4	0	0	30	22	360,122	294,342	9,903	8,094	2,098,535	1,518,688
Species Totals	62	50	892	698	25	19	3,707	2,880	62,867,563	49,202,414	1,728,858	1,353,066	261,228,202	202,966,342
White Spruce														
Saw Live	15	15	348	329	6	5	1,662	1,577	24,500,689	23,171,297	404,261	382,326	117,127,821	111,131,011
Pole Live	14	4	56	55	1	1		3,913,969	3,853,107	64,580	63,576			
Species Totals	29	18	403	384	7	6	1,662	1,577	28,414,658	27,024,404	468,842	445,903	117,127,821	111,131,011
Strata Totals	91	69	1,307	1,093	31	26	5,449	4,531	92,114,870	76,987,263	2,218,516	1,817,980	383,943,517	319,242,565
Stratum	5 Mixed Sawtimber Closed								Acreage =		81,521			
Aspen														
Saw Live	0	0	3	3	0	0	13	13	249,841	249,841	6,246	6,246	1,051,856	1,051,856
Species Totals	0	0	3	3	0	0	13	13	249,841	249,841	6,246	6,246	1,051,856	1,051,856
Birch														
Saw Live	48	47	901	674	25	19	3,909	2,885	73,430,819	54,950,388	2,019,348	1,511,136	318,632,768	235,183,875
Pole Dead	1	0	1	0	0	0		113,722	22,744	3,127	625			
Saw Dead	1	0	6	2	0	0	25	7	523,243	146,838	14,389	4,038	2,034,763	596,216

Forest Resources on State Lands in the Susitna Valley

Trees/	BA/ Ac	Gross Ac	Net CF/ Ac	Gross CF/ Ac	Net Tons/ Ac	Gross Tons/ Ac	BF/ Ac	Net BF/ Ac	Total Gross CF	Total Net CF	Total Gross Tons	Total Net Tons	Total Gross BF	Total Net BF
Pole Live	19	6	93	79	3	2			7,568,380	6,445,603	208,130	177,254		
Species Totals	69	53	1,001	755	28	21	3,934	2,892	81,636,164	61,565,574	2,244,995	1,693,053	320,667,531	235,780,091
Black Spruce														
Pole Live	4	1	11	11	0	0			928,103	928,103	20,882	20,882		
Saw Live	0	0	2	1	0	0	8	6	129,451	103,561	2,913	2,330	621,673	497,338
Species Totals	4	1	13	13	0	0	8	6	1,057,555	1,031,664	23,795	23,212	621,673	497,338
White Spruce														
Pole Live	24	7	107	102	2	2			8,728,753	8,343,921	144,024	137,675		
Saw Dead	1	1	24	21	0	0	115	100	1,927,619	1,685,755	31,806	27,815	9,353,540	8,189,175
Saw Live	31	23	559	540	9	9	2,523	2,434	45,609,214	43,989,179	752,552	725,821	205,676,100	198,413,708
Species Totals	57	31	690	663	11	11	2,638	2,534	56,265,586	54,018,855	928,382	891,311	215,029,640	206,602,883
Strata Totals	130	85	1,708	1,434	39	32	6,592	5,446	139,209,145	116,865,934	3,203,418	2,613,823	537,370,701	443,932,169
Stratum	6 Mixed Sawtimber Open									Acreage =		61,506		
Birch														
Pole Live	10	3	56	32	2	1			3,458,556	1,988,620	95,110	54,687		
Saw Live	40	39	549	444	15	12	2,532	2,050	33,748,096	27,288,536	928,073	750,435	155,758,108	126,098,591
Species Totals	50	42	605	476	17	13	2,532	2,050	37,206,652	29,277,156	1,023,183	805,122	155,758,108	126,098,591
Black Spruce														
Pole Live	0	0	2	2	0	0			130,390	123,870	2,934	2,787		
Saw Live	0	0	2	2	0	0	8	8	140,941	140,941	3,171	3,171	503,587	503,587
Species Totals	1	0	4	4	0	0	8	8	271,331	264,812	6,105	5,958	503,587	503,587
White Spruce														
Saw Live	41	31	674	660	11	11	3,116	3,047	41,444,913	40,588,212	683,841	669,705	191,659,068	187,379,793
Saw Dead	1	1	11	9	0	0	53	40	678,939	550,223	11,202	9,079	3,235,613	2,442,227
Pole Live	21	6	93	91	2	2			5,729,870	5,610,266	94,543	92,569		
Species Totals	63	38	778	760	13	13	3,169	3,086	47,853,722	46,748,700	789,586	771,354	194,894,681	189,822,020
Strata Totals	114	80	1,387	1,240	30	26	5,709	5,145	85,331,705	76,290,668	1,818,874	1,582,434	351,156,376	316,424,198
Stratum	7 Mixed Reproduction									Acreage =		66,395		
	Trees/ Ac	BA/ Ac	Gross CF/ Ac	Net CF/ Ac	Gross Tons/ Ac	Net Tons/ Ac	Gross BF/ Ac	Net BF/ Ac	Total Gross CF	Total Net CF	Total Gross Tons	Total Net Tons	Total Gross BF	Total Net BF
Balsam Poplar														
Pole Dead	3	1	16	16	0	0			1,056,845	1,053,983	26,421	26,350		
Saw Live	18	9	196	193	5	5	337	331	12,998,365	12,843,345	324,959	321,084	22,398,583	21,988,500
Pole Live	28	8	153	153	4	4			10,132,038	10,132,038	253,301	253,301		
Species Totals	49	18	364	362	9	9	337	331	24,187,248	24,029,366	604,681	600,734	22,398,583	21,988,500
Birch														
Saw Live	2	1	17	16	0	0	76	69	1,160,746	1,044,672	31,921	28,728	5,066,259	4,559,633
Pole Live	28	6	70	63	2	2			4,676,781	4,203,026	128,611	115,583		
Species Totals	30	7	88	79	2	2	76	69	5,837,528	5,247,697	160,532	144,312	5,066,259	4,559,633
Black Spruce														
Pole Live	72	14	155	152	3	3			10,258,264	10,115,402	230,811	227,597		

Forest Resources on State Lands in the Susitna Valley

Trees/	BA/ Ac	Gross Ac	Net CF/ Ac	Gross CF/ Ac	Net Tons/ Ac	Gross Tons/ Ac	BF/ Ac	Net BF/ Ac	Total Gross CF	Total Net CF	Total Gross Tons	Total Net Tons	Total Gross BF	Total Net BF
Species Totals	72	14	155	152	3	3			10,258,264	10,115,402	230,811	227,597		
White Spruce														
Saw Live	3	3	67	67	1	1	321	321	4,475,578	4,475,578	73,847	73,847	21,314,592	21,314,592
Pole Live	12	3	44	42	1	1			2,906,161	2,799,746	47,952	46,196		
Species Totals	15	6	111	110	2	2	321	321	7,381,739	7,275,324	121,799	120,043	21,314,592	21,314,592
Strata Totals	166	45	718	703	17	16	735	721	47,664,779	46,667,789	1,117,823	1,092,685	48,779,434	47,862,725
					712,035,740 Gross Cubic Feet				620,223,584 Net Cubic Feet					
Grand Totals =	488,735 Acres			2,450,941,572 Gross Board Feet				2,090,242,465 Net Board Feet						
				16,638,849 Gross Tons				14,236,019 Net Tons						

Appendix D
LOG GRADE BY SPECIES

Forest Resources on State Lands in the Susitna Valley

Species	Grade No.	Gross Diameter	Gross Length	Minimum Volume	Surface	Annual Ring Count	Slope of Grain
White/Black Spruce	1	20 Inches	16 Feet		75% Clear	8 per Inch	< 3 inches/foot
	2	12 Inches	12 Feet		50% Clear, Knots < 2.5 inches in diameter	8 per Inch	< 2 inches/foot
	3	6 Inches	12 Feet	50 BF Net			May include excessive slope with deduction
	4	5 Inches	12 Feet	10 BF Net			
Aspen/Birch	1	16 Inches	8 Feet		75% Clear		
	2	12 Inches	8 Feet		50% Clear		
	3	10 Inches	8 Feet	10 BF Net			
	4	5 Inches	8 Feet	10 BF Net			
Balsam Poplar	1	10 Inches	8 Feet		< 4 Knots per log		
	2	6 Inches	8 Feet				
	4	5 Inches	8 Feet	10 BF Net			
All Species Utility Logs	5	4 Inches	12 Feet	10 BF Net			
	Logs do not meet sawmill grades, but are suitable for the production of firm usable chips to an amount not less than 50% of gross scale. A log that is burned or charred or is not mechanically barkable, shall not qualify as a Utility Log.						

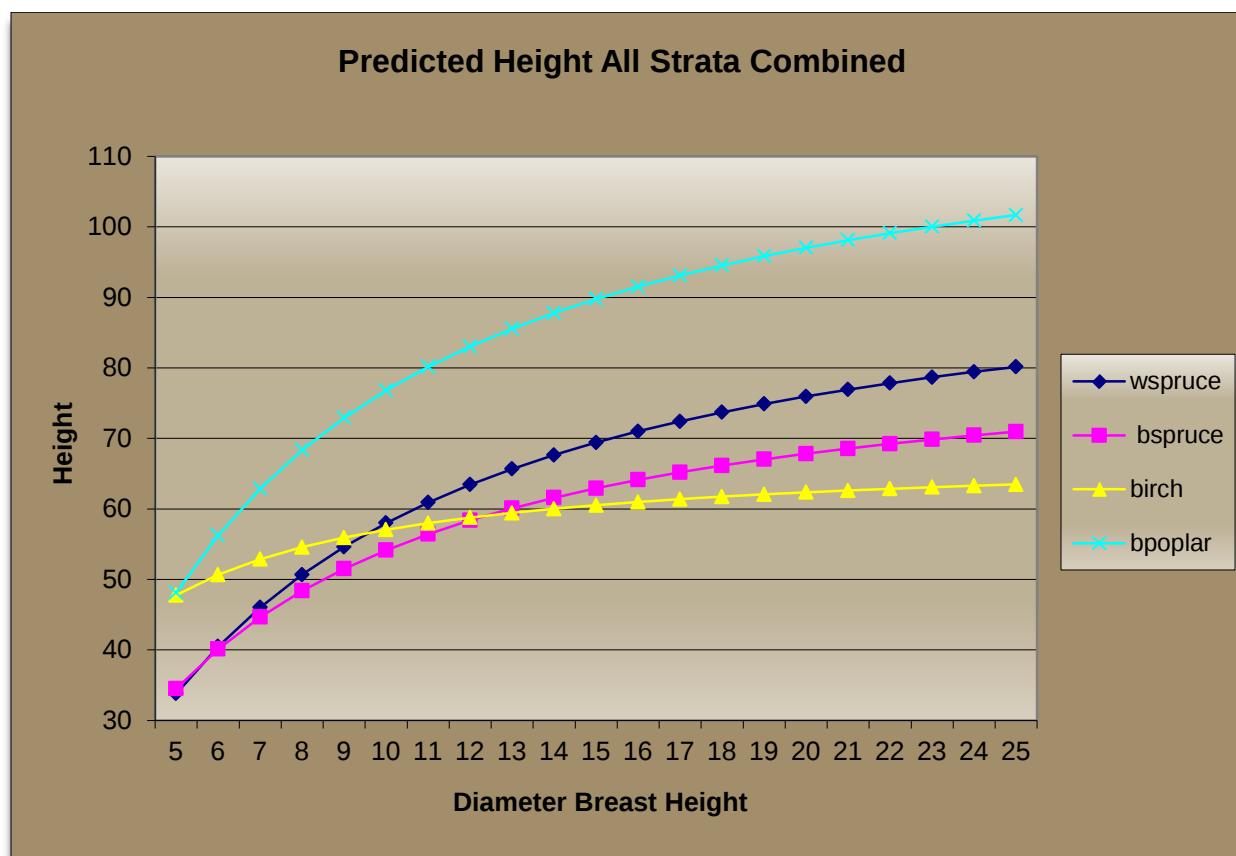
Forest Resources on State Lands in the Susitna Valley

	Grade 1st Log	Grade 2nd Log	# Of Trees	% Of Trees Measured
Aspen				
	3	3	1	33%
	4	4	1	33%
	5	5	1	33%
Total for Aspen			3	
Balsam Poplar			3	1%
	1	1	112	55%
	1	2	36	18%
	1	5	4	2%
	2	2	11	5%
	2	4	7	3%
	2	5	4	2%
	4	4	1	0%
	4	5	2	1%
	5	Cull	2	1%
	5	3	1	0%
	5	5	21	10%
Total for Balsam Poplar			204	
Birch			95	8%
		3	1	0%
	1		2	0%
	1	1	4	0%
	1	2	16	1%
	1	3	6	1%
	1	4	2	0%
	1	5	5	0%
	2	Cull	3	0%
	2	2	20	2%
	2	3	77	7%
	2	4	26	2%
	2	5	36	3%
	3	Cull	6	1%
	3	2	1	0%
	3	3	18	2%
	3	4	100	9%
	3	5	60	5%
	4	Cull	22	2%
	4	4	142	12%
	4	5	144	13%

Forest Resources on State Lands in the Susitna Valley

	Grade 1st Log	Grade 2nd Log	# Of Trees	% Of Trees Measured
	5	Cull	53	5%
	5	2	4	0%
	5	3	3	0%
	5	4	7	1%
	5	5	293	26%
Total for Birch			1146	
Black Spruce				
	2	4	1	9%
	4	4	6	55%
	4	5	3	27%
	5	Cull	1	9%
Total for Black Spruce			11	
White Spruce				
			7	1%
	1	2	1	0%
	2	2	22	4%
	2	3	67	13%
	2	4	18	3%
	3	3	13	2%
	3	4	112	21%
	3	5	4	1%
	4	Cull	11	2%
	4	4	195	37%
	4	5	60	11%
	5	Cull	6	1%
	5	3	1	0%
	5	4	2	0%
	5	5	8	2%
Total for White Spruce			527	
Grand Total Trees Measured			1891	

Appendix E
DIAMETER/HEIGHT RELATIONSHIPS, TEN YEAR GROWTH, AND BARK THICKNESS



Reciprocal dbh height prediction model:

$$ht_{top} = ae^{\frac{-b}{dbh^c}}$$

Species	A Coefficient	B Coefficient	C Coefficient
White Spruce	99.46	-5.3958	1
Black Spruce	84.96	-4.5047	1
Birch	68.14	-1.7778	1
Balsam Poplar	122.58	-4.6747	1

"e" is a numerical constant that is equal to 2.71828, the corresponding Excel equation appears as follows:

$$\text{Height} = \text{A Coefficient} * \text{POWER}(e, \text{B Coefficient} / \text{dbh})$$

Ten Year Radial Growth and Bark Thickness by Species

Species		Radial Growth (In.)	Single Bark Thickness (In.)
Aspen	(2 detail records)		
	Average	0.35	0.60
Balsam Poplar	(107 detail records)		
	Average	0.54	1.52
Birch	(763 detail records)		
	Average	0.31	0.47
Black Spruce	(44 detail records)		
	Average	0.25	0.38
White Spruce	(529 detail records)		
	Average	0.48	0.45

Bark Thickness Ratio by Species

		DBH	DIB*	Bark Thickness Ratio
Aspen	(2 detail records)			
	Sum=	27.90	25.50	0.914
Balsam Poplar	(107 detail records)			
	Sum=	2,517.70	2,191.50	0.870
Birch	(763 detail records)			
	Sum=	9,878.90	9,157.50	0.927
Black Spruce	(44 detail records)			
	Sum=	337.10	303.80	0.901
White Spruce	(529 detail records)			
	Sum=	6,266.20	5,788.60	0.924
Grand Total	Sum=	19,027.80	17,466.90	0.918
				Average All Species