

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015



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## I. EXECUTIVE SUMMARY

The inventory of timber and biomass resources on state lands classified for forestry use in the Middle Yukon River area has been initiated in part by the need to support potential development of biomass energy systems in this rural area of Alaska. Through funding provided by State Legislature through a capital improvement project grant, a timber and biomass inventory has been conducted using satellite imagery, aerial photography, ground plots and other information sources. The inventory provides digital stand type maps and interactive querying capability. It is the first widespread stand based inventory to be performed on state lands in the area and can be used by the Division of Forestry (DOF) for general forest and fire management planning. State lands that are included have been interim conveyed or patented. The volume data has been generated from timber stand data collected in July, 2014.

Inventory Area Land Classification	Acres	
Timberland	140,622	
Dwarf Forests	62,895	
Non-Forest	<u>68,621</u>	
Total Inventory Area:	272,138	
Timberland Area by Timber Type Size Class		
Sawtimber	6,386	
Mixed Sawtimber/Poletimber	36,300	
Poletimber	10,310	
Reproduction	<u>87,626</u>	
Total Timberland Area:	140,622	
Timberland Area by Timber Type Species Class		
White Spruce	6,386	
Hardwood	7,894	
Black Spruce/White Spruce	3,241	
Black Spruce/White Spruce/Birch	94,694	
White Spruce/Birch	19,794	
White Spruce/Balsam Poplar	<u>8,613</u>	
Total Timberland Area:	140,622	
Total Net Volume		
Cubic Feet (≥ 5"dbh)	Tons (≥ 5"dbh)	Board Feet (≥ 9"dbh)
127,801,382	2,505,434	349,698,360

TABLE I. INVENTORY VOLUME AND ACREAGE SUMMARY.

## II. OBJECTIVES

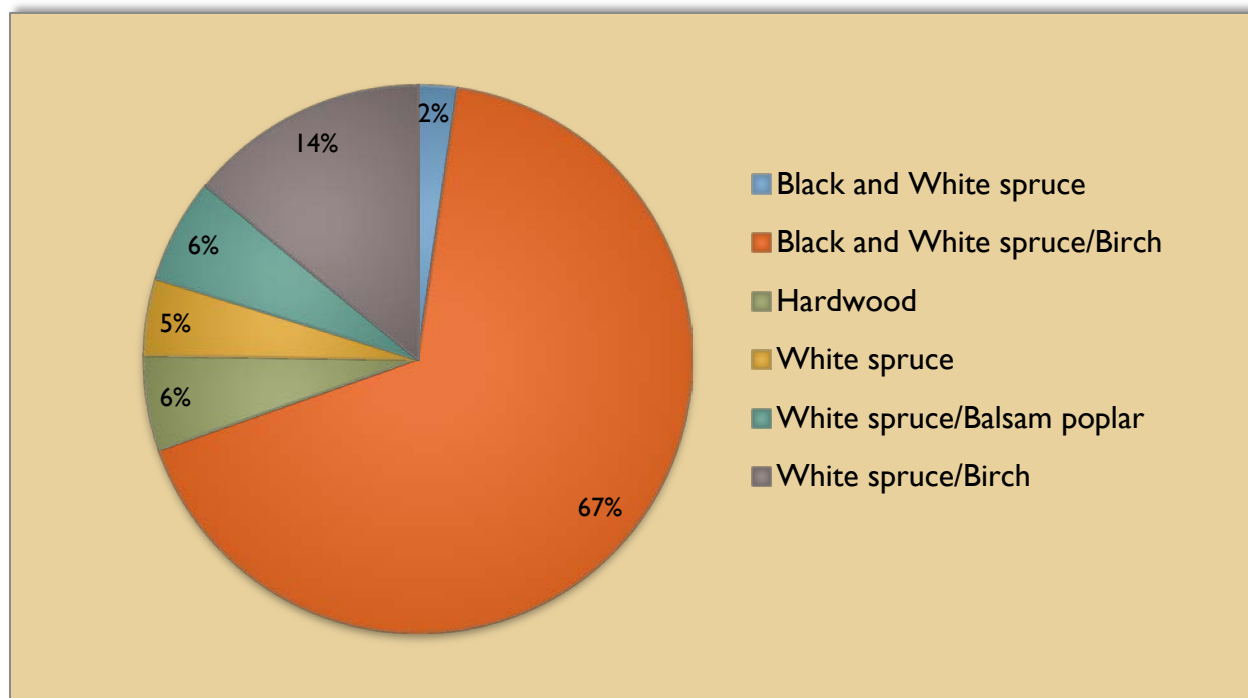
The objective of this report is to provide reliable inventory data to assist in the management of forest resources in the Middle Yukon River area. Determination of an operable land base, sustainable harvest rate and harvest scheduling all require accurate volume data and geographically referenced spatial locations of individual stands. This data, both in spatial and tabular form can be used to assess the availability of timber and biomass resources 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.
- Geographic Information System (GIS) mapping access of spatial data with volume and acreage querying capabilities.
- Timber harvest sustainability data to evaluate potential project development.
- Biomass resource information to supplement statewide energy atlas 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. Timber types sampled included sawtimber, poletimber and reproduction types, dwarf timber stands (mostly black spruce less than 25 feet tall at maturity) were not sampled.

Timber types to be sampled were selected randomly through the GIS. Access to stands was by foot and river boat. A total of 48 stands were field sampled. The timber cruise measurements from the sample stands provide estimates of volume, stocking, defect and growth by individual tree species.



**FIGURE 1. PERCENT OF TIMBERLAND AREA BY VEGETATION TYPE CLASS.**

#### **A. IMAGERY SOURCES**

Scanned high altitude aerial photography at a scale of 1:60,000 and Spot 2.5 meter resolution satellite imagery were used for the project. The date of the aerial photography was 1978 and the date of the Spot scenes was 2010. The scanned 1:63,360 color infrared photos were orthorectified and geo-referenced to the Spot 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.

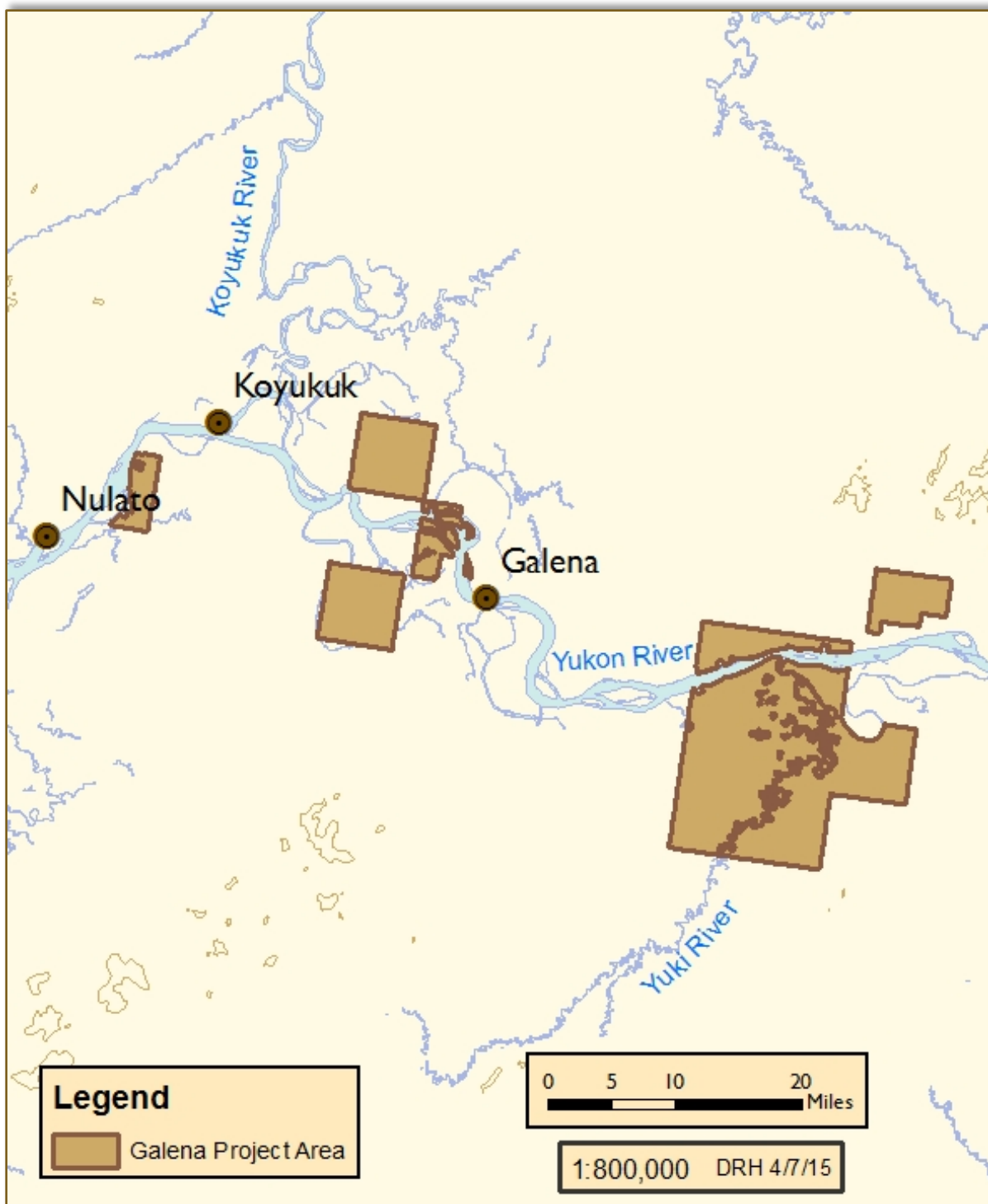


FIGURE 2. PROJECT AREA MAP.

## 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 2010 imagery in areas of landscape change such as along major rivers within the project area. Adjustments were also made for wildfire occurrence. 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.

## 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 300 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 1/250<sup>th</sup> acre plot (7.45 foot radius).

#### D. GEOGRAPHIC INFORMATION SYSTEM COVERAGE

Together with the tabular data, a GIS coverage was prepared for the inventory. Through the GIS, acreage and volume estimates as reported in this forest inventory can be recalculated to reflect any future changes in the forest land base. The acreage of individual polygons was calculated using ESRI ArcMap GIS software (*table 2*). A standardized vegetation key/mapping scheme was used for describing vegetation polygons (*table 3*). Storage in the GIS allows for queries of individual portions of the project area to be accomplished for planning purposes.

Vegetation Cover Type	Acres
Black and White spruce	3,241
Black and White spruce/Birch	94,695
Black and White spruce/Hardwood	62,895
Hardwood	7,894
Non-Forest Other	18
River	5,587
Shrubland	29,695
Water	5,034
Wetland	28,286
White spruce	6,386
White spruce/Balsam poplar	8,613
White spruce/Birch	19,794
	272,138

**TABLE 2. VEGETATION COVER TYPE ACREAGE SUMMARY.**

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 on crown closure percent.
	Y	25-59%	
	Z	10-24%	
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.

## 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. 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. Combinations of sampled and un-sampled timber types and the corresponding strata are shown in Appendix A. The inventory contains seven separate sample strata for which estimates of gross and net volume per acre have been calculated (Appendix B). The strata contain field data from 48 individual timber stands containing 480 plots (table 4). 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.

Stratum	Strata Description	Acres	Per- cent	Number of Stands
1	White Spruce Sawtimber	6,386	5%	6
2	Black-White Spruce Poletimber	3,241	2%	6
3	Hardwood Sawtimber/Poletimber	7,894	6%	7
4	White Spruce-Birch Sawtimber/Poletimber	19,794	14%	10
5	White Spruce-Balsam Poplar Sawtimber/Poletimber	8,613	6%	5
6	Black-White Spruce-Birch Poletimber	7,070	5%	5
7	Black-White Spruce-Birch Reproduction	87,626	62%	9
		140,622	100%	48

TABLE 4. NUMBER OF SAMPLE STANDS BY STRATA.

## F. DESCRIPTION OF STRATA

The seven strata are described below. Pictures are shown for selected strata where available.

### I. STRATUM I WHITE SPRUCE SAWTIMBER

This stratum is found in limited amounts across the project area. It occurs on the most productive sites (Viereck et al. 1992) and had the highest volume per acre within the project. The sites generally were well drained to moderately well drained with silt and silt loam soil types. Stands with the highest volumes per acre were found along riparian areas with active river flood events. Stands found on upland sites generally were on high ground with southerly aspect upriver of the mouth of the Yuki River. Average age of the stratum is 200 years. The stratum contains about 8,400 board feet per acre with a stem count five inches dbh and greater

of 153 trees per acre. The stratum averages 2,100 cubic feet per acre and has a net annual yield of 38 cubic feet per acre per year.



**FIGURE 3. STRATUM 1, WHITE SPRUCE SAWTIMBER, YUKI RIVER.**

## **2. STRATUM 2 BLACK AND WHITE SPRUCE POLETIMBER**

This stratum is found across the project area on sites that are of poor to medium productivity. Permafrost is probably present on numerous sites. In some stands white spruce is mixed in, but with generally minor amounts compared to black spruce. Average age of the stratum is 194 years, which is similar to the white spruce sawtimber stratum. This advanced age for such small trees further indicates low productivity. In much of the area an understory of black spruce saplings occur and average over 1,200 stems per acre. The stem count five inches dbh and greater averages 130 trees per acre. The stratum contains about 400 cubic feet per acre, the



lowest within the inventory. The stratum has a net annual yield of 9 cubic feet per acre per year.



**FIGURE 4. STRATUM 2, BLACK AND WHITE SPRUCE POLETIMBER, HILLS NORTH OF YUKON RIVER.**

### 3. STRATUM 3 HARDWOOD SAWTIMBER/POLETIMBER

This stratum is found mostly in the upland areas north of the Yukon River in the northeast portion of the project area. Stands contain mixtures of birch and aspen though aspen is less frequent and only present on southerly aspects. The stem count five inches dbh and greater is 208 trees per acre. Average age of the stratum is 122 years, the youngest of all seven strata. These stands contain an average of about 1,000 cubic feet per acre. The stratum has a net annual yield of 37 cubic feet per acre per year.





**FIGURE 5. STRATUM 3, HARDWOOD SAWTIMBER/POLETIMBER, HILLS NORTH OF YUKON RIVER.**

**4. STRATUM 4 WHITE SPRUCE AND BIRCH SAWTIMBER/POLETIMBER**

This stratum is found across the project area on sites that are of moderate to high productivity. Sites with the highest productivity are found adjacent to the active floodplain. Average age is 199 years and although somewhat old stands are still accumulating added growth. The stem count five inches dbh and greater averages 191 trees per acre. The stratum contains about 1,500 cubic feet per acre, and has a net annual yield of 23 cubic feet per acre per year. Board foot volume averages 4,300 board feet per acre.

**5. STRATUM 5 WHITE SPRUCE AND BALSAM POPLAR SAWTIMBER/POLETIMBER**

This stratum is found across the project area on active flood plain sites. Generally along with the white spruce sawtimber types these are the most productive. Tree stem count totals 145 trees per acre. The stratum contains about 1,600 cubic feet per acre, and about 5,800 board feet per acre. It has a net annual yield of 42 cubic feet per acre per year.





**FIGURE 6. STRATUM 5, WHITE SPRUCE AND BALSAM POPLAR SAWTIMBER/POLETIMBER, YUKI RIVER.**

**6. STRATUM 6 BLACK AND WHITE SPRUCE AND BIRCH POLETIMBER**

This stratum occurs across the project area on variable sites. Average age of the stratum is 133 and stand structure is quite variable. There is evidence of wildfires in some of the stands. The components of individual species are about equal. The stem count five inches dbh and greater averages 177 trees per acre. The stratum contains about 900 cubic feet per acre and has a net annual yield of 41 cubic feet per acre per year.

**7. STRATUM 7 BLACK AND WHITE SPRUCE AND BIRCH REPRODUCTION**

This is the largest stratum by acreage comprising over 62% of the total timberland acreage. This stratum is found across the project area on sites that are of poor to moderate productivity. Stands are quite variable and in some areas vigorous reproduction is present where past wildfires are evident. In other areas especially on the poorer sites the trees are

mostly sapling size and small poletimber and growth is slow. The age of the stratum of trees greater than 5 inches dbh is 123 years. Tree stem count five inches dbh and greater totals 163 trees per acre. The stem count of trees less than five inches dbh totals slightly greater than 2,000 trees per acre. Within this size class, about 90 trees per acre are between three and five inches dbh. The stratum contains 645 cubic feet per acre, and has a net annual yield of 23 cubic feet per acre per year.

## G. FOREST VOLUME DEFINITIONS

Estimates of timber volume are calculated with four different measurements; cubic foot volume, board foot volume, green tons and above ground biomass tons. The first two measurements are derived from published equations and are considered more statistically valid measurements. For example sample accuracy shown later in the report is based on the live cubic foot estimate. The cubic, board and green ton measurements are related to traditional log based timber harvesting where volume only includes the merchantable bole of the tree, for example, a minimum 5 inch diameter at breast height (dbh) and a minimum top diameter of 4 inches.

### I. CUBIC AND BOARD FOOT MEASUREMENTS

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 and PNW-59. Cubic volume is reported in Smalian's rule and for spruce and hardwoods includes volume to a 4-inch top (NOR-6) (Gregory and Haack 1964). Cubic volume is applied to trees greater than or equal to 5-inches dbh. 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) (Farr 1967a) and for hardwoods to an 8-inch top (NOR-5) (Haack 1963). Board foot volume is applied to trees greater than or equal to 9-inches dbh.



Volume Formula Name	Volume Unit	Species	Formula
<b>NOR-6</b>	Cubic Foot 4-inch Top	White and Black Spruce	$(-2.055)+0.2982*(dbh)+0.00181*(dbh)^2*ht$
<b>NOR-6</b>	Cubic 4-inch Top	Birch	$(-2.5767)+0.9524*(dbh)-0.10446*(dbh)^2-0.03303*(ht)+0.00282*(dbh)^2*(ht)$
<b>NOR-6</b>	Cubic 4-inch Top	Aspen	$(-0.5553)-0.02216*dbh^2+0.00246*dbh^2*ht$
<b>NOR-6</b>	Cubic 4-inch Top	Balsam Poplar	$(-3.2187)+0.8281*(dbh)-0.05908*(dbh)^2-0.01985*(ht)+0.00199*(dbh)^2*(ht)$
<b>PNW-59</b>	Board Foot Scribner 6-inch Top	White and Black Spruce	$39.71+4.2659*dbh-0.55865*dbh^2-1.1184*ht+0.016113*dbh^2*ht-437.92/dbh^2$
<b>NOR-5</b>	Board Foot Scribner 8-inch Top	Birch and Aspen	$(-27.263)+0.00995*dbh^2*ht$
<b>NOR-5</b>	Board Foot Scribner 8-inch Top	Balsam Poplar	$(-46.7415)+0.00956*dbh^2*ht$

**TABLE 5. VOLUME FORMULAS BY SPECIES FOR POLETIMBER AND SAWTIMBER SIZE CLASSES.**

## 2. TON MEASUREMENTS

Computation of green tons is somewhat less straight forward because published local volume tables by ton are not available. In the absence of local tables various publications have been produced that list the weight of green cordwood by species. These values can then be converted into pounds per cubic feet (Sturgeon 1979). The ton measurement represents the same diameter ranges as included in the cubic feet measurements ( $\geq 5$ "dbh to a 4 inch minimum top).

Species	Pounds per Cubic Foot
<b>White Spruce</b>	34
<b>Black Spruce</b>	34
<b>Birch</b>	50
<b>Aspen</b>	43
<b>Balsam Poplar</b>	43

**TABLE 6. INVENTORY SPECIES AND WEIGHT FOR POLETIMBER AND SAWTIMBER.**

### 3. ABOVE GROUND BIOMASS TON MEASUREMENTS

Computation of above ground 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 1/100<sup>th</sup> acre plots for white 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. For the purpose of a naming convention, the measurement is referred to as biomass tons or bio tons.

Species	
White Spruce	$-51.272*[\text{dbh}] + 11.28 *([\text{dbh}])^2 + 3.752*[\text{ht}]$
Black Spruce	
Birch	$-77.475*[\text{dbh}] + 16.826 *([\text{dbh}])^2 + 4.216*[\text{ht}]$
Aspen	$-65.425*[\text{dbh}] + 12.687 *([\text{dbh}])^2 + 4.272*[\text{ht}]$
Balsam Poplar	$-99.509*[\text{dbh}] + 12.19 *([\text{dbh}])^2 + 8.759*[\text{ht}]$

TABLE 7. REGRESSION EQUATION FOR GREEN WEIGHT OF ABOVE GROUND BIOMASS.

## IV. RESULTS

Selected results of the analysis are displayed in the following tables. “Timberland Area” refers to the portions of the land area that have been associated with forest inventory volume strata and have calculated volume estimates. It does not include shrubland vegetation types or dwarf forests. The results present inventory data by species and by various groupings of the individual 7 volume strata. Additional detailed inventory data reports appear in the appendix.

### A. INVENTORY VOLUME BY SPECIES

Inventory volume is reported below in Table 8 by tree species across all strata. When the entire volume by species is summed and divided by the timberland area of 140,622 acres there is an average volume of 909 net cubic feet per acre. Similarly, overall there is an average of 18 net tons per acre, 54 biomass tons per acre and 2,487 net board feet per acre. The values for cubic feet and tons are reported for trees equal to or greater than five inches dbh. Biomass ton value is reported for trees equal to or greater than 1.5 inches dbh and board foot values are reported for trees equal to or greater than nine inches dbh.

Species	Gross CF/Ac	Net CF/Ac	Gross Tons/Ac	Net Tons/Ac	Biomass Tons/Ac	Gross BF/Ac	Net BF/Ac
<b>Aspen</b>	3	3	0	0	0	0	0
<b>Balsam Poplar</b>	70	52	2	1	3	250	163
<b>Birch</b>	298	265	7	7	24	217	154
<b>Black Spruce</b>	24	22	0	0	3	41	41
<b>White Spruce</b>	612	566	10	10	24	2,305	2,129
	1,008	909	20	18	54	2,812	2,487

TABLE 8. TIMBERLAND VOLUME PER ACRE BY SPECIES ACROSS STRATA.

## B. INVENTORY VOLUME BY PRODUCT AND SPECIES

Inventory volume is reported in Table 9 by tree product and species across all strata. Sawtimber refers to trees greater than or equal to 9-inches dbh. Poletimber refers to trees greater than or equal to 5-inches dbh and less than 9-inches dbh. Sapling refers to trees less than 5-inches dbh but the biomass volume is only applied to trees between 1.5 and 4.9-inches dbh. In terms of net cubic volume within live trees, sawtimber size trees account for 64% of the volume and poletimber size trees account for 36% of the volume.

Product	Species	Gross CF (Thousands)	Net CF (Thousands)	Gross Tons (Thousands)	Net Tons (Thousands)	Biomass Tons (Thousands)	Gross BF (Thousands)	Net BF (Thousands)
<b>Saw Live</b>								
	Balsam Poplar	7,981	5,672	172	122	348	35,100	22,943
	Birch	10,441	7,554	261	189	599	30,548	21,614
	Black Spruce	808	785	14	13	59	5,734	5,734
	White Spruce	70,798	65,284	1,204	1,110	2,330	323,575	299,220
	Sum	90,028	79,294	1,650	1,434	3,336	394,957	349,511
<b>Saw Dead</b>								
	White Spruce	109	41	2	1	3	501	187
	Sum	109	41	2	1	3	501	187
<b>Pole Live</b>								
	Aspen	435	413	9	9	20	0	0
	Balsam Poplar	1,917	1,678	41	36	79	0	0
	Birch	31,534	29,681	788	742	1,932	0	0
	Black Spruce	2,080	2,031	35	35	186	0	0
	White Spruce	15,115	14,284	257	243	651	0	0
	Sum	51,081	48,087	1,131	1,064	2,868	0	0
<b>Pole Dead</b>								
	Black Spruce	426	343	7	6	50	0	0
	White Spruce	36	36	1	1	2	0	0
	Sum	462	379	8	6	52	0	0
<b>Sapling Live</b>								
	Aspen	0	0	0	0	14	0	0
	Balsam Poplar	0	0	0	0	17	0	0
	Birch	0	0	0	0	803	0	0
	Black Spruce	0	0	0	0	62	0	0
	Tamarack	0	0	0	0	22	0	0
	White Spruce	0	0	0	0	368	0	0
	Sum	0	0	0	0	1,285	0	0
	Grand Total	141,680	127,801	2,791	2,505	7,545	395,458	349,698

**TABLE 9. PRODUCT SUMMARY BY SPECIES.**

### C. DEFECT ESTIMATES BY SPECIES

Defect renders portions of individual trees unusable or of very limited use as forest products due to damage such as broken stems, sweep, crook and rot. Table 10 ranks the most common defect types by species. Sweep was the primary defect type in white spruce, whereas in birch and balsam poplar scars were the primary defect type. Net volume however does not take into account all defects because some hidden defect is difficult to determine. Rot indicators such as

conks however can be used as a proxy for hidden defect. Defect is the difference between gross and net volume. Defect percentage by species is shown in Table 11.

Species	Conks	Crook	Defect Type			
			Sweep	Scars	Broken Top	Forked Top
<b>Balsam Poplar</b>	5	2	3	1	4	6
<b>Birch</b>	4	3	5	1	6	2
<b>Black Spruce</b>	-	1	-	-	2	3
<b>White Spruce</b>	-	3	1	2	4	5

TABLE 10. DEFECT TYPE RANKING BY SPECIES.

Species	Gross Cubic Feet/Ac	Net Cubic Feet/Acre	Percent Defect
<b>Aspen</b>	3	3	5.1
<b>Balsam Poplar</b>	70	52	25.7
<b>Birch</b>	298	265	11.3
<b>Black Spruce</b>	24	22	4.7
<b>White Spruce</b>	612	566	7.5
Total	1,008	909	9.8

TABLE 11. CUBIC FOOT DEFECT BY SPECIES.

#### D. INVENTORY VOLUME BY SIZE AND TIMBER TYPE CLASS

Volume is reported below by grouping the 7 strata into sizes and timberland vegetation type class. In terms of net cubic volume, sawtimber types contain 10% of the total. Mixed sawtimber/poletimber and poletimber types contain 45% and reproduction types contain 44% of the total.

Size	Timber Type Class	Gross CF (000s)	Net CF (000s)	Gross Tons (000s)	Net Tons (000s)	Biomass Tons (000s)	Gross BF (000s)	Net BF (000s)
<b>Sawtimber</b>								
	White spruce	14,174	13,186	248	229	480	57,680	53,810
	Subtotal	14,174	13,186	248	229	480	57,680	53,810
<b>Saw/Pole</b>								
	Hardwood	9,195	8,171	222	197	345	16,294	13,859
	White spruce/Birch	31,401	28,804	597	542	1,299	94,324	85,625
	White spruce/Balsam poplar	16,079	13,604	317	265	596	62,511	50,234
	Subtotal	56,674	50,580	1,137	1,004	2,240	173,129	149,718
<b>Poletimber</b>								
	Black and White spruce	1,516	1,322	26	23	75	2,519	1,923
	Black and White spruce/Birch	6,396	6,201	122	118	279	14,069	13,630
	Subtotal	7,912	7,523	148	141	354	16,588	15,552
<b>Reproduction</b>								
	Black and White spruce/Birch	62,919	56,513	1,258	1,131	3,185	148,061	130,618
	Subtotal	62,919	56,513	1,258	1,131	3,185	148,061	130,618
	Grand total	141,680	127,801	2,791	2,505	6,259	395,458	349,698

TABLE 12. VOLUME BY SIZE AND TIMBER TYPE CLASS.

## E. TIMBER VOLUMES BY STRATA

Timber volume by strata is reported below in Table 13.

Trees ≥ 5"	Basal Area (Ft <sup>2</sup> )	Gross CF (≥5"dbh)	Net CF (≥5"dbh)	Gross Tons (≥5"dbh)	Net Tons (≥5"dbh)	Biomass Tons (≥1.5"dbh)	Gross BF (≥9"dbh)	Net BF (≥9"dbh)
Stratum 1 White Spruce Sawtimber 6,386 Acres								
153	92	2,220	2,065	39	36	76	9,033	8,427
Stratum 2 Black-White Spruce Poletimber 3,241 Acres								
130	34	468	408	8	7	31	777	593
Stratum 3 Hardwood Sawtimber/Poletimber 7,894 Acres								
208	67	1,165	1,035	28	25	55	2,064	1,756
Stratum 4 White Spruce-Birch Sawtimber/Poletimber 19,794 Acres								
191	81	1,586	1,455	30	27	71	4,765	4,326
Stratum 5 White Spruce-Balsam Poplar Sawtimber/Poletimber 8,613 Acres								
145	95	1,867	1,580	37	31	73	7,258	5,832
Stratum 6 Black-White Spruce-Birch Poletimber 7,070 Acres								
177	54	905	877	17	17	50	1,990	1,928
Stratum 7 Black-White Spruce-Birch Reproduction 87,626 Acres								
163	45	718	645	14	13	47	1,690	1,491

TABLE 13. VOLUME PER ACRE BY STRATA.

## F. SAMPLING ERROR BY VOLUME

Sample error was calculated for the live gross cubic foot estimate by strata and size class. 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. An overall sample error of 3.5% was calculated for all plots combined. It was difficult to achieve a design sample error of approximately 10% for each stratum due to the relatively small amount of plots. Stratum 7 had the highest error mostly due to the wide variation of the poletimber and sawtimber volume component in these sapling dominated stands.

Strata	Number of Plots	Live Poletimber		Live Sawtimber		Combined	
		Gross CF/Ac	% Sampling Error	Gross CF/Ac	% Sampling Error	Gross CF/Ac	% Sampling Error
1	60	219	17.3	2,001	8.3	2,220	7.7
2	60	279	16.6	131	16.7	410	12.5
3	70	527	11.7	638	10.8	1,165	7.9
4	100	452	9.2	1,134	6	1,134	5.0
5	50	275	26.3	1,592	13.2	1,867	11.9
6	50	424	14.7	480	14.3	904	10.3
7	90	346	8.1	368	25.3	714	13.6
<b>Total</b>	480	371	5.0	881	4.5	1,252	3.5

TABLE 14. GROSS LIVE CUBIC FOOT PERCENT SAMPLING ERROR.

## G. 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 (Farr 1967b). Site index calculations for birch are based on site index equations produced for Interior Alaska; U.S. Forest Service

research paper NOR-2 (Gregory and Haack 1965). Balsam poplar measurements were applied to the aspen NOR-2 values.

Strata		Site Index in Feet		
		White Spruce	Birch	Balsam Poplar
<b>1</b>	White Spruce Sawtimber	61	---	---
<b>2</b>	Black-White Spruce Poletimber	37	---	---
<b>3</b>	Hardwood Sawtimber/Poletimber	44	45	---
<b>4</b>	White Spruce-Birch Sawtimber/Poletimber	56	45	51
<b>5</b>	White Spruce-Balsam Poplar Saw/Pole	65	47	54
<b>6</b>	Black-White Spruce-Birch Poletimber	43	43	---
<b>7</b>	Black-White Spruce-Birch Reproduction	63	40	---
	Weighted Averages by Area	59	42	52

TABLE 15. SITE INDEX BY STRATA AND SPECIES.

#### H. TIMBERLAND AREA AGE CLASS

Ages of the sampled timberland vegetation types reflect a mature unmanaged forest and ranged from a low of 53 years to a high of 373 years. Younger ages are present in the recently burned timberland vegetation types (38,576 acres) but were not sampled in the inventory. The youngest stand sampled was birch reproduction located on an upland site 24 river miles up the Yuki River. Although classified reproduction this stand had over 200 trees per acre greater than 5 inches dbh but had over 300 trees per acre between 3 and 4 inches dbh. Based on an average 10 year diameter increment of slightly over one inch, it is estimated that the stand began to grow into the pole class at about age 45. The oldest stand sampled was a white spruce sawtimber woodland stand located 6 miles downriver from Galena on the south bank of the Yukon River. This old stand had sparse stocking of only 17 trees per acre. 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. Table 15 shows the age class distribution in acres and percent of the total acreage. Over 50% of the timberland acreage is older than 120 years and 25% of the timberland acreage is older than 180 years. The stands greater than 180 were all spruce dominated. The age class distribution indicates lengthy fire return and flood intervals. These disturbance agents result in the clearing of vegetation, partial or entire removal of the organic mat, and thawing of permafrost. When a disturbance occurs, it can have profound effects on the characteristics of the



soil profile and subsequently on the trees growing on top. A wet-cold-frozen soil, with permafrost insulated by a thick organic mat can become a dry-warm soil type after a fire or flood. Though in some sites due to slope position and moisture soils may fail to thaw deeply (Swanson 1996). During field measurements, trees that had the greatest 10-year increment growth were almost always associated with warmer soils and thinner moss depth.

Stand Age Class	Average Age	Acres	Percent of Total
0 - 40	20	38,576	27%
40 - 60	53	2,126	2%
60 - 90	71	10,630	8%
90 - 120	107	12,756	9%
120 - 150	136	14,882	11%
150 - 180	164	29,763	21%
180 - 210	191	14,882	11%
210 - 240	216	6,378	5%
240 - 270	260	4,252	3%
270 - 300	283	2,126	2%
300 - 330	300	2,126	2%
360 - 390	371	2,126	2%

**TABLE 16. PERCENT OF AREA BY AGE CLASS.**

Table 17 reports the average age by individual stratum. From the age data it is evident that stratum 7 is not true reproduction, but does have significant numbers of trees less than 5 inches in diameter and a limited number of poletimber trees. It is this poletimber component however, that makes these stands have a potential for providing firewood and biomass resources.

Strata	Average Age
1 White Spruce Sawtimber	200
2 Black-White Spruce Poletimber	194
3 Hardwood Sawtimber/Poletimber	122
4 White Spruce-Birch Sawtimber/Poletimber	199
5 White Spruce-Balsam Poplar Saw/Pole	156
6 Black-White Spruce-Birch Poletimber	133
7 Black-White Spruce-Birch Reproduction	123

**TABLE 17. AVERAGE AGE BY STRATA AND VOLUME UNIT.**

## I. 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. These stands typically are closed hardwood stands and flood plain balsam poplar stands that contain a well stocked spruce understory. The regeneration tables give numbers of trees per acre less than 5 inches by species and stratum for each volume unit. Trees are of desirable and acceptable quality as determined in the field. Undesirable trees not expected to become future crop trees are not included in the table.

Trees <5" DBH							
Strata		White Spruce	Black Spruce	Aspen	Birch	Balsam Poplar	Tamarack
1	White Spruce Sawtimber	592			208	17	
2	Black-White Spruce Poletimber	633	1,117		250		42
3	Hardwood Sawtimber/Poletimber	186		114	286	36	
4	White Spruce-Birch Sawtimber/Poletimber	365	105	10	260		
5	White Spruce-Balsam Poplar Saw/Pole	770			140	90	
6	Black-White Spruce-Birch Poletimber	190	310		330		
7	Black-White Spruce-Birch Reproduction	761	100		544	11	44

TABLE 18. NUMBER OF SEEDLINGS/SAPLINGS BY STRATA AND SPECIES.

## J. GROWTH AND MORTALITY ESTIMATES

Growth estimates have been determined through projections made with the timber cruise software TCruise. Periodic annual gross growth has been projected utilizing the past 10-year diameter growth increment and bark thickness measurements collected in the field and software generated diameter/height coefficients. Growth increment and bark thickness measurements were collected from trees 5-inch dbh and greater across all diameter classes. The desired growth projection interval used was 10 years. The increased volume growth was then divided by 10 to calculate an annual growth rate. This volume figure was then divided by the growing stock base (live tree volume) to calculate a percentage growth rate. Diameter-height relationships, diameter growth and calculated bark thickness ratios (Husch et al. 2002) are shown in Appendix D.

Mortality estimates have been determined by dividing the recently dead volume estimates by 5 years to get annual mortality.

The mortality estimates were then subtracted from the gross growth figures to calculate net growth. The average net annual growth for the project area is 24 cubic feet per acre (*table 19*).

When the entire growing stock volume is combined across strata a total of 127,380,900 net cubic feet is present. Timberland is growing annually at 2.63% of net volume or 3,350,118 cubic feet. Growth rates are consistent with Forest Service estimates of between 2 and 3% (Smith et al. 2007) for unmanaged interior forests.

Strata		% Annual Growth	% Annual Mortality	% Annual Net Growth	CF Per Acre Per Year Net Growth
1	White Spruce Sawtimber	1.75%	0.00%	1.75%	36
2	Black-White Spruce Poletimber	1.91%	1.87%	0.04%	<1
3	Hardwood Sawtimber/Poletimber	4.00%	0.00%	4.00%	41
4	White Spruce-Birch Sawtimber/Poletimber	1.60%	0.00%	1.60%	23
5	White Spruce-Balsam Poplar Saw/Pole	2.42%	0.00%	2.42%	38
6	Black-White Spruce-Birch Poletimber	2.16%	0.00%	2.16%	19
7	Black-White Spruce-Birch Reproduction	3.47%	0.12%	3.35%	21
	<b>Total Live Volume</b>	<b>2.70%</b>	<b>0.07%</b>	<b>2.63%</b>	<b>24</b>

TABLE 19. GROWTH AND MORTALITY ESTIMATES.

## V. SUSTAINED YIELD ANALYSIS

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 hardwood timber type uses a rotation of 80 years, which includes 10 years for establishment. There have been no acreage reductions made for operability concerns.

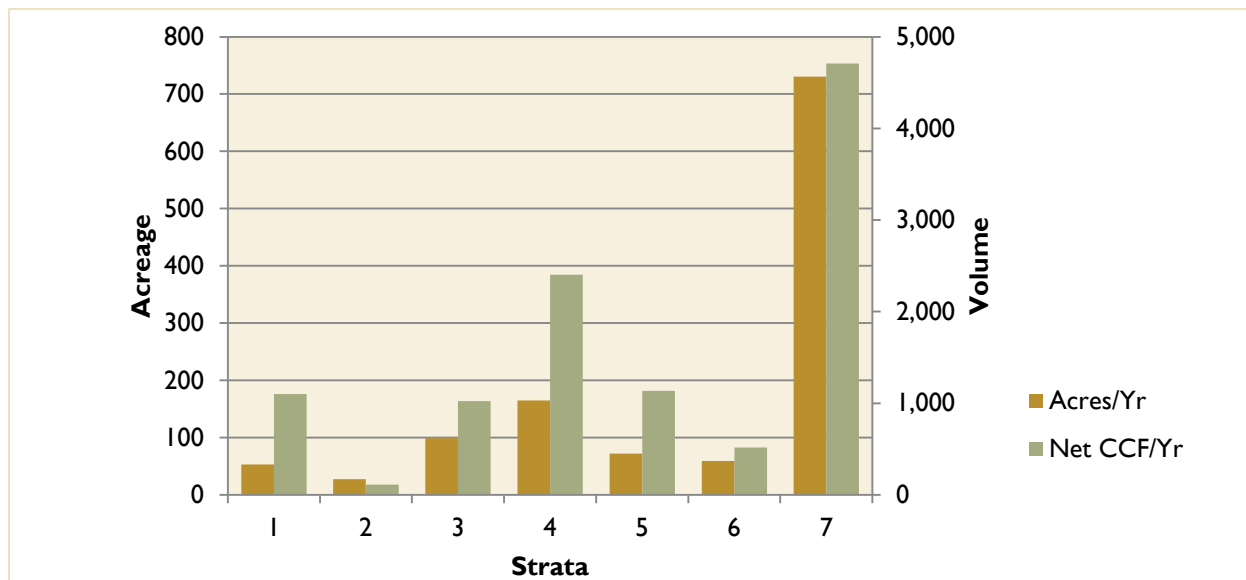
# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

Strata	Acres	Rotation	Acres/Yr	Net CF/Ac	Net CF/Yr	Net Tons/Ac	Net Tons/Yr	Bio Tons/Ac	Bio Tons/Yr	Net BF/Ac	Net BF/Yr
1	6,386	120	53	2,065	109,888	36	1,907	76	4,054	8,426	448,384
2	3,241	120	27	408	11,019	7	189	31	829	593	16,016
3	7,894	80	99	1,035	102,127	25	2,460	55	5,392	1,756	173,271
4	19,794	120	165	1,455	240,162	27	4,523	71	11,789	4,326	713,557
5	8,613	120	72	1,580	113,331	31	2,210	73	5,237	5,832	418,585
6	7,070	120	59	877	51,667	17	985	50	2,962	1,928	113,584
7	87,626	120	730	645	470,989	13	9,434	47	34,400	1,491	1,088,750
<b>Totals</b>	<b>140,622</b>		<b>1,205</b>		<b>1,099,182</b>		<b>21,708</b>		<b>64,663</b>		<b>2,972,147</b>

TABLE 20. SUSTAINED YIELD ESTIMATE, TOTAL TIMBERLAND AREA.

Species	Net CF/Yr	Net Tons/Yr	Bio Tons/Yr	Net BF/Yr
<b>Aspen</b>	4,772	103	401	0
<b>Balsam Poplar</b>	61,473	1,321	3,699	192,020
<b>Birch</b>	339,302	8,494	29,273	230,969
<b>Black Spruce</b>	26,421	450	2,980	47,464
<b>White Spruce</b>	667,215	11,340	28,127	2,501,693
<b>Totals</b>	<b>1,099,182</b>	<b>21,708</b>	<b>64,480</b>	<b>2,972,147</b>

TABLE 21. SUSTAINED YIELD ESTIMATE BY SPECIES, TOTAL TIMBERLAND AREA.



**FIGURE 7. SUSTAINED YIELD COMPARISON BETWEEN STRATA, TOTAL TIMBERLAND AREA.**

## I. LITERATURE CITED

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Appendix A  
ACREAGE SUMMARY BY STRATUM AND VEGETATION TYPE

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

Vegetation Type	Acres	Field Sampled?	Vegetation Type	Acres	Field Sampled?
Stratum 1 White Spruce Sawtimber			38SY	435	Yes
2SY	348	Yes	38SX	1,499	Yes
2SX	5,994	Yes	38PY	213	No
3SX	40	No	38PX	2,403	Yes
3SY	4	No	16PX	1,154	Yes
Sum	6,386		16SY	547	No
Stratum 2 Black-White Spruce Poletimber			16SX	2,053	Yes
1PY	27	No	Sum	8,613	
3PX	1,465	Yes	Stratum 6 Black-White Spruce-Birch Poletimber		
3PY	297	No	32PY	359	Yes
1PX	50	No	32PX	6,221	Yes
2PX	1,060	Yes	30PX	71	No
2PY	342	Yes	32SX	91	No
Sum	3,241		30PY	106	No
Stratum 3 Hardwood Sawtimber/Poletimber			39PY	44	No
17SX	2,173	No	39PX	178	Yes
18PX	152	No	Sum	7,070	
17SZ	14	No	Stratum 7 Black-White Spruce-Birch Repro		
19SX	1,128	Yes	1RY	2,285	No
17SY	358	Yes	16RY	276	No
17PY	294	Yes	30R	1	No
19PX	622	Yes	2RX	814	No
19PY	15	No	17PXBR	30	No
17PX	3,137	Yes	17PYBR	118	No
Sum	7,894		30RX	3,900	Yes
Stratum 4 White Spruce-Birch Sawtimber/Poletimber			1RZ	81	No
31SX	9,007	Yes	1RYBR	21	No
34PX	14	No	16RX	2,860	Yes
31SY	115	Yes	19RY	170	No
37PX	671	Yes	18SYBR	14	No
37PY	27	No	18RY	60	No
37SX	114	No	30RXBR	3,012	No
31PX	9,711	Yes	19PYBR	12	No
31PY	136	Yes	19PZBR	53	No
Sum	19,794		18RX	624	No
Stratum 5 White Spruce-Balsam Poplar Sawtimber/Poletimber			17SYBR	43	No
16PY	309	Yes	1RX	7,957	Yes

Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

Vegetation Type	Acres	Field Sampled?	Vegetation Type	Acres	Field Sampled?
19RXBR	718	No	32PYBR	33	No
1RXBR	457	No	32RXBR	155	No
17RYBR	117	No	32RYBR	16,974	No
17RY	456	No	31PXBR	10	No
19SYBR	298	No	30RZ	7	No
17RXBR	4,452	No	30RYBR	11,292	No
18RZ	15	No	32RX	6,545	Yes
17RX	6,350	Yes	Sum	87,626	
19PXBR	4	No	Stratum20 Black-White Spruce-Hardwood Dwarf		
19RX	1,782	Yes	30DX	417	No
39PXBR	27	No	30DY	796	No
33RY	5	No	3DX	6	No
34RX	12	No	3DY	4	No
30RY	1,547	No	30DZ	207	No
35RX	16	No	17DY	37	No
37RX	438	No	17DX	61	No
37RXBR	186	No	1DZ	11,621	No
37RY	38	No	39DX	200	No
33RX	62	No	19DX	10	No
38RY	21	No	32DX	7	No
34RY	2	No	31DY	3	No
39RX	2,524	No	1DX	27,313	No
39RXBR	48	No	1DXBR	27	No
39RY	769	No	33DZ	60	No
39RYBR	7	No	1DY	15,435	No
3RX	6,773	Yes	1DYBR	1,720	No
3RXBR	45	No	33DX	22	No
3RY	707	No	1DZBR	4,917	No
3RYBR	15	No	30DYBR	33	No
38RX	985	Yes	Sum	62,895	
32RY	463	No	Stratum30 Tall Shrub		
31RXBR	6	No	68	8,802	No
37PYBR	121	No	68BR	1,026	No
31RY	8	No	Sum	9,827	
31SXBR	12	No	Stratum35 Low Shrub		
32PXBR	294	No	71	14,900	No
31RX	498	No	71BR	4,747	No



# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

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Vegetation Type	Acres	Field Sampled?	Vegetation Type	Acres	Field Sampled?
76	220	No			
Sum	19,867				
Stratum40 Wet Meadow					
79	23,918	No			
79BR	4,367	No			
Sum	28,286				
Stratum50 Water					
80	5,034	No			
Sum	5,034				
Stratum60 Rivers					
88	5,587	No			
Sum	5,587				
Stratum70 Bare Ground					
94	18	No			
Sum	18				
Grand Total	272,138				

Appendix B  
STAND TABLES PER ACRE BY STRATUM AND SPECIES

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

Stand Table For Trees Greater Than or Equal to 5" dbh										
DBH	Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Biomass Tons	Gross BF	Net BF	
Stratum 1	White Spruce Sawtimber									
Balsam Poplar										
11	1	0	6	1	0	0	0	11	3	
16	1	1	23	15	0	0	1	107	69	
Sum	1	1	28	16	1	0	1	117	72	
Birch										
5	11	1	14	14	0	0	2			
6	2	0	4	5	0	0	0			
7	5	2	33	31	1	1	1			
8	1	0	5	5	0	0	0			
9	5	3	36	27	1	1	2	50	37	
11	3	2	32	0	1	0	2	121	1	
Sum	28	9	124	81	3	2	8	171	38	
White Spruce										
5	18	3	26	26	0	0	2			
6	3	1	13	12	0	0	0			
7	13	3	54	54	1	1	3			
8	6	2	42	40	1	1	2			
9	10	4	97	88	2	2	3	265	254	
10	15	9	211	204	4	3	7	832	807	
11	14	9	238	227	4	4	7	996	949	
12	9	7	178	175	3	3	6	785	770	
13	10	9	252	247	4	4	8	1,155	1,133	
14	10	11	298	281	5	5	9	1,422	1,341	
15	6	7	211	205	4	3	6	1,033	1,003	
16	8	10	288	271	5	5	9	1,436	1,350	
17	2	3	94	85	2	1	3	481	437	
18	1	3	55	50	1	1	2	281	265	
19	0	0	11	1	0	0	0	57	6	
Sum	124	82	2,068	1,968	35	33	66	8,744	8,316	
Totals for stratum 1 White Spruce Sawtimber										
	153	92	2,220	2,065	39	36	75	9,033	8,427	
Stratum 2	Black-White Spruce Poletimber									
Birch										
5	11	2	9	6	0	0	1			
6	3	1	4	4	0	0	0			
7	2	1	5	0	0	0	0			
8	1	1	2	0	0	0	0			
Sum	17	3	20	10	1	0	2			
Black Spruce										
5	21	3	17	16	0	0	2			
6	23	4	44	44	1	1	3			
7	20	5	73	69	1	1	3	0	0	
8	10	3	47	44	1	1	2			
9	4	1	10	8	0	0	1			
Sum	77	17	191	181	3	3	12	0	0	
White Spruce										

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

DBH	Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Biomass Tons	Gross BF	Net BF
5	10	1	6	6	0	0	1		
6	2	1	6	6	0	0	0		
7	9	2	34	34	1	1	2		
8	7	2	38	37	1	1	2	0	0
9	3	1	19	18	0	0	1	51	51
10	1	1	15	14	0	0	0	63	59
11	1	1	18	17	0	0	1	72	68
13	1	1	34	13	1	0	1	155	58
14	1	1	27	21	0	0	1	121	94
16	0	1	19	17	0	0	1	97	87
19	0	1	20	16	0	0	1	107	86
24	0	1	21	16	0	0	1	113	90
Sum	36	14	256	217	4	4	10	777	593
Totals for stratum Black-White Spruce Poletimber									
	130	34	468	408	8	7	23	777	593
Stratum	3	Hardwood Sawtimber/Poletimber							
Aspen									
5	18	3	35	34	1	1	2		
7	1	1	6	6	0	0	0		
Sum	18	3	41	40	1	1	2		
Balsam Poplar									
13	0	0	6	6	0	0	0	23	23
Sum	0	0	6	6	0	0	0	23	23
Birch									
5	55	9	93	93	2	2	1		
6	29	6	73	63	2	2	2		
7	13	5	56	56	1	1	2		
8	25	9	159	156	4	4	6		
9	23	10	201	167	5	4	8	256	228
10	6	4	105	77	3	2	3	285	223
11	12	6	138	118	3	3	7	513	437
12	8	7	165	144	4	4	6	661	572
14	1	2	11	9	0	0	1	53	45
16	1	1	16	9	0	0	2	72	35
Sum	173	57	1,017	891	25	22	37	1,841	1,538
White Spruce									
6	3	1	11	11	0	0	0		
7	7	2	25	25	0	0	1		
8	3	1	10	8	0	0	1		
9	1	1	9	9	0	0	0		
12	1	1	13	13	0	0	0	56	56
13	1	1	12	12	0	0	0	53	53
16	0	0	7	7	0	0	0	35	35
18	0	1	14	13	0	0	1	56	51
Sum	16	6	101	98	2	2	4	200	195
Totals for stratum Hardwood Sawtimber/Poletimber									
	208	67	1,165	1,035	28	25	44	2,064	1,756
Stratum	4	White Spruce-Birch Sawtimber/Poletimber							

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

DBH	Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Biomass Tons	Gross BF	Net BF
Aspen									
6	3	1	6	5	0	0	0		
Sum	3	1	6	5	0	0	0		
Balsam Poplar									
6	2	0	3	2	0	0	0		
7	1	0	4	4	0	0	0		
8	1	0	5	5	0	0	0		
13	0	0	4	1	0	0	0	13	3
14	1	1	11	3	0	0	0	43	11
15	0	0	7	3	0	0	0	33	14
Sum	5	2	35	18	1	0	1	90	28
Birch									
5	12	2	15	14	0	0	1		
6	28	6	72	69	2	2	4		
7	20	6	74	72	2	2	5		
8	9	3	54	52	1	1	3	0	0
9	7	3	55	41	1	1	3	74	39
10	7	3	66	45	2	1	4	125	88
11	4	2	43	28	1	1	3	212	94
Sum	86	26	378	321	9	8	23	410	221
Black Spruce									
5	4	1	4	4	0	0	0		
9	2	1	9	8	0	0	1		
Sum	6	1	13	12	0	0	1		
White Spruce									
5	3	0	4	4	0	0	0		
6	10	2	22	21	0	0	1		
7	9	2	42	41	1	1	2		
8	10	4	70	70	1	1	3		
9	17	8	157	149	3	3	6	405	379
10	14	8	160	153	3	3	6	644	618
11	8	6	131	128	2	2	4	554	542
12	6	5	113	103	2	2	4	498	455
13	4	4	107	99	2	2	3	444	454
14	4	4	108	103	2	2	4	515	492
15	3	4	102	98	2	2	3	490	470
16	2	2	53	52	1	1	2	262	254
17	0	0	13	10	0	0	0	67	51
18	0	1	25	25	0	0	1	130	130
22	0	1	14	13	0	0	1	72	66
23	1	1	34	31	1	1	2	184	166
Sum	91	51	1,154	1,100	20	19	40	4,266	4,077
Totals for stratum White Spruce-Birch Sawtimber/Poletimber									
	191	81	1,586	1,455	30	27	66	4,765	4,326
Stratum 5 White Spruce-Balsam Poplar Sawtimber/Poletimber									
Balsam Poplar									
5	12	2	17	16	0	0	1		
6	17	3	30	30	1	1	2		

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

DBH	Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Biomass Tons	Gross BF	Net BF
7	3	1	8		0				
8	16	6	100	93	2	2	3		
9	8	3	50	39	1	1	2	1	1
10	13	7	132	130	3	3	5	186	182
11	6	4	56	47	1	1	3	114	98
12	3	2	51	46	1	1	2	182	163
13	1	1	15	13	0	0	1	53	45
14	2	2	57	45	1	1	2	243	194
15	2	3	50	40	1	1	2	238	195
16	3	5	68	46	1	1	3	371	226
17	3	6	114	85	2	2	4	552	411
18	3	6	113	52	2	1	4	564	262
19	2	4	61	38	1	1	3	438	267
20	1	2	49	33	1	1	2	267	180
21	1	2	30	16	1	0	1	181	96
22	1	2	41	27	1	1	2	293	193
23	2	1	0	0	0	0	4	79	15
Sum	99	63	1,042	795	22	17	46	3,761	2,526
Birch									
5	3	0	0		0				
6	3	0	5	5	0	0	0		
7	1	0	6	6	0	0	0		
12	3	2	36	33	1	1	2	148	133
Sum	9	3	48	44	1	1	3	148	133
White Spruce									
6	3	0							
7	5	1	14	14	0	0	1		
8	3	1	19	19	0	0	1		
9	6	3	66	66	1	1	2	85	86
10	1	0	12	13	0	0	0	43	43
11	4	3	83	80	1	1	2	347	332
12	3	3	86	86	1	1	2	378	381
13	1	1	35	35	1	1	1	164	164
14	3	4	110	107	2	2	3	529	514
15	3	5	128	116	2	2	3	624	569
16	2	3	95	86	2	1	2	483	438
17	1	1	37	34	1	1	1	188	173
18	0	1	43	36	1	1	1	243	204
19	0	1	25	25	0	0	0	136	139
25	0	1	24	24	0	0	1	130	130
Sum	37	29	777	740	13	13	21	3,350	3,173
Totals for stratum White Spruce-Balsam Poplar Sawtimber/Poletimber									
	145	95	1,867	1,580	37	31	69	7,258	5,832
Stratum 6 Black-White Spruce-Birch Poletimber									
Birch									
5	5	1	12	11	0	0	1		
6	31	6	80	81	2	2	5		
7	8	2	30	30	1	1	2		
8	16	6	73	66	2	2	5		

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

DBH	Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Biomass Tons	Gross BF	Net BF
9	5	3	40	36	1	1	2	47	46
Sum	65	17	236	225	6	6	15	47	46
Black Spruce									
5	15	2	16	16	0	0	1		
6	23	4	38	38	1	1	2		
7	10	3	30	30	1	1	2		
Sum	48	9	84	84	1	1	5		
White Spruce									
5	14	2	17	17	0	0	1		
6	9	2	21	19	0	0	1		
7	10	4	29	29	0	0	2		
8	9	4	69	68	1	1	2		
9	1	1	17	17	0	0	0	61	62
10	10	6	157	148	3	3	4	642	603
11	2	2	39	39	1	1	1	161	161
12	1	1	14	11	0	0	0	62	49
13	3	3	78	77	1	1	2	352	343
14	2	2	63	63	1	1	2	286	286
16	2	3	80	81	1	1	3	378	379
Sum	64	27	585	568	10	10	19	1,943	1,882
Totals for stratum Black-White Spruce-Birch Poletimber									
	177	54	905	877	17	17	39	1,990	1,928
Stratum 7 Black-White Spruce-Birch Reproduction									
Birch									
5	44	6	58	56	1	1	5		
6	30	6	82	81	2	2	5		
7	19	5	72	69	2	2	5		
8	6	2	35	27	1	1	2		
9	0	0							
10	3	1	11	2	0	0	2	20	3
12	1	1	10	9	0	0	0	39	36
Sum	103	21	269	243	7	6	18	59	39
Black Spruce									
5	6	1	2	2	0	0	0		
6	4	1	6	5	0	0	0	0	0
7	2	0	3	3	0	0	0	0	0
8	3	1	1	1	0	0	1		
9	1	0	6	5	0	0	0	35	35
10	1	0	4	3	0	0	0	31	31
Sum	16	3	21	20	0	0	2	65	65
White Spruce									
5	7	1	9	8	0	0	0		
6	2	0	5	5	0	0	0		
7	8	2	32	31	1	1	1		
8	8	3	46	39	1	1	2		
9	6	3	42	33	1	1	2	190	150
10	2	1	17	5	0	0	1	75	22
11	3	2	47	45	1	1	2	196	189
12	2	2	45	39	1	1	1	198	171

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

DBH	Trees	Basal Area	Gross CF	Net CF	Gross Tons	Net Tons	Biomass Tons	Gross BF	Net BF
13	1	1	20	20	0	0	1	91	91
14	4	4	95	91	2	2	3	443	427
15	1	1	19	19	0	0	1	94	91
16	0	0	12	7	0	0	0	61	34
17	0	0	12	11	0	0	0	59	56
18	0	0	10	10	0	0	0	55	55
19	0	0	8	8	0	0	0	45	42
26	0	0	10	10	0	0	0	59	59
Sum	45	22	429	382	7	6	16	1,565	1,387
Totals for stratum Black-White Spruce-Birch Reproduction									
	163	45	718	645	14	13	36	1,690	1,491

Stand Table For Trees Greater Than or Equal to 1.5" dbh and Less Than 5" dbh

DBH	Trees	Biomass Tons
Stratum 1	White Spruce Sawtimber	
Birch		
2	17	0
3	8	0
5	8	1
Sum	33	1
White Spruce		
2	33	
3	17	0
Sum	50	0
Totals for stratum White Spruce Sawtimber		
	83	1
Stratum 2	Black-White Spruce Poletimber	
Birch		
2	75	1
3	25	0
4	8	0
Sum	108	1
Black Spruce		
2	58	0
3	100	1
4	33	2
5	8	1
Sum	200	4
Tamarack		
4	8	0
Sum	8	0
White Spruce		
2	8	
4	17	1
5	17	1
Sum	42	2



# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

DBH	Trees		Biomass Tons
Totals for stratum Black-White Spruce Poletimber			
		358	7
Stratum	3	Hardwood Sawtimber/Poletimber	
Aspen			
	4	36	2
Sum		36	2
Birch			
	2	79	0
	3	93	2
	4	29	2
	5	36	4
Sum		236	8
White Spruce			
	2	50	
	3	7	0
	4	14	0
	5	7	1
Sum		79	1
Totals for stratum Hardwood Sawtimber/Poletimber			
		350	11
Stratum	4	White Spruce-Birch Sawtimber/Poletimber	
Birch			
	2	40	0
	3	45	0
	4	35	2
	5	20	2
Sum		140	4
Black Spruce			
	2	5	
	3	5	0
Sum		10	0
White Spruce			
	2	40	0
	3	10	0
	4	10	1
Sum		60	1
Totals for stratum White Spruce-Birch Sawtimber/Poletimber			
		210	6
Stratum	5	White Spruce-Balsam Poplar Sawtimber/Poletimber	
Balsam Poplar			
	2	40	1
	3	20	0
	4	20	1
Sum		80	2
Birch			

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

DBH	Trees	Biomass Tons
3	50	0
Sum	50	0
White Spruce		
2	50	
3	30	0
4	10	0
5	20	1
Sum	110	2
Totals for stratum White Spruce-Balsam Poplar Sawtimber/Poletimber		
	240	4
Stratum 6	Black-White Spruce-Birch Poletimber	
Birch		
2	50	1
3	10	0
4	70	4
Sum	130	5
Black Spruce		
2	50	
3	40	1
4	60	2
5	20	2
Sum	170	4
White Spruce		
2	50	1
3	10	0
5	10	1
Sum	70	2
Totals for stratum Black-White Spruce-Birch Poletimber		
	370	11
Stratum 7	Black-White Spruce-Birch Reproduction	
Birch		
2	161	0
3	156	1
4	94	4
5	11	1
Sum	422	7
Black Spruce		
2	6	
4	6	0
Sum	11	0
Tamarack		
2	17	
3	17	0
Sum	33	0

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

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DBH	Trees	Biomass Tons
White Spruce		
2	56	
3	39	1
4	22	1
5	28	2
Sum	144	3
Totals for stratum Black-White Spruce-Birch Reproduction		
	611	11

Appendix C  
TOTAL VOLUME BY STRATUM

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

	Total Gross CF	Total Net CF	Total Gross Tons	Total Net Tons	Total Biomass Tons	Total Gross BF	Total Net BF
Stratum 1	White Spruce Sawtimber					Acreage =	6,386
Balsam Poplar							
Saw Live	179,433	102,571	3,858	2,205	6,207	749,949	460,297
Sum	179,433	102,571	3,858	2,205	6,207	749,949	460,297
Birch							
Saw Live	432,642	172,045	10,816	4,301	28,853	1,093,429	245,664
Pole Live	357,877	346,383	8,947	8,660	23,233		
Sum	790,519	518,428	19,763	12,961	52,086	1,093,429	245,664
White Spruce							
Pole Live	1,038,619	987,919	17,657	16,795	46,876		
Saw Live	12,165,778	11,576,772	206,818	196,805	375,285	55,836,504	53,103,790
Sum	13,204,396	12,564,691	224,475	213,600	422,161	55,836,504	53,103,790
Stratum Total	14,174,349	13,185,690	248,096	228,766	480,454	57,679,883	53,809,752
Stratum 2	Black-White Spruce Poletimber					Acreage =	3,241
Birch							
Pole Live	65,522	32,764	1,638	819	6,264		
Sum	65,522	32,764	1,638	819	6,264		
Black Spruce							
Pole Dead	40,589	34,501	690	587	1,773	0	0
Pole Live	578,670	553,048	9,837	9,402	35,518		
Sum	619,259	587,549	10,527	9,988	37,291	0	0
White Spruce							
Pole Dead	35,880	35,880	610	610	1,634	0	0
Pole Live	259,805	256,493	4,417	4,360	13,254		
Saw Dead	108,959	41,285	1,852	702	3,326	501,237	187,304
Saw Live	426,081	368,305	7,243	6,261	13,420	2,018,189	1,735,452
Sum	830,726	701,963	14,122	11,933	31,634	2,519,426	1,922,757
Stratum Total	1,515,507	1,322,276	26,288	22,741	75,188	2,519,426	1,922,757
Stratum 3	Hardwood Sawtimber/Poletimber					Acreage =	7,894
Aspen							
Pole Live	320,918	315,929	6,900	6,792	13,700		
Sum	320,918	315,929	6,900	6,792	13,700		
Balsam Poplar							
Saw Live	48,293	48,293	1,038	1,038	1,684	178,845	178,845
Sum	48,293	48,293	1,038	1,038	1,684	178,845	178,845
Birch							
Saw Live	4,620,614	3,883,650	115,515	97,091	196,710	14,534,135	12,144,114
Pole Live	3,407,392	3,151,526	85,185	78,788	98,275		
Sum	8,028,006	7,035,176	200,700	175,879	294,985	14,534,135	12,144,114
White Spruce							
Pole Live	433,482	418,751	7,369	7,119	20,438		
Saw Live	364,248	352,876	6,192	5,999	14,487	1,580,880	1,536,465
Sum	797,730	771,627	13,561	13,118	34,925	1,580,880	1,536,465
Stratum Total	9,194,947	8,171,025	222,200	196,828	345,295	16,293,860	13,859,424
Stratum 4	White Spruce-Birch Sawtimber/Poletimber					Acreage =	19,794
Aspen							
Pole Live	114,349	97,196	2,458	2,090	6,553		

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

	Total Gross CF	Total Net CF	Total Gross Tons	Total Net Tons	Total Biomass Tons	Total Gross BF	Total Net BF
Sum	114,349	97,196	2,458	2,090	6,553		
Balsam Poplar							
Saw Live	449,614	134,700	9,667	2,896	13,693	1,781,341	547,060
Pole Live	246,100	215,397	5,291	4,631	13,032		
Sum	695,714	350,097	14,958	7,527	26,725	1,781,341	547,060
Birch							
Saw Live	2,974,554	2,059,450	74,364	51,486	170,557	8,112,003	4,374,790
Pole Live	4,502,792	4,289,080	112,570	107,227	278,516		
Sum	7,477,346	6,348,530	186,934	158,713	449,073	8,112,003	4,374,790
Black Spruce							
Pole Live	264,621	240,772	4,499	4,093	17,594		
Sum	264,621	240,772	4,499	4,093	17,594		
White Spruce							
Pole Live	3,820,812	3,775,642	64,954	64,186	151,976		
Saw Live	19,027,802	17,991,915	323,473	305,863	646,614	84,430,828	80,702,714
Sum	22,848,614	21,767,557	388,426	370,048	798,590	84,430,828	80,702,714
Stratum Total	31,400,643	28,804,152	597,275	542,472	1,298,535	94,324,173	85,624,565
Stratum 5	White Spruce-Balsam Poplar Sawtimber/Poletimber					Acreage =	8,613
Balsam Poplar							
Saw Live	7,303,449	5,386,316	157,024	115,806	326,009	32,389,981	21,756,977
Pole Live	1,670,641	1,462,520	35,919	31,444	65,916		
Sum	8,974,090	6,848,836	192,943	147,250	391,925	32,389,981	21,756,977
Birch							
Saw Live	313,635	282,271	7,841	7,057	18,997	1,272,084	1,144,876
Pole Live	102,055	97,180	2,551	2,429	5,445		
Sum	415,690	379,451	10,392	9,486	24,443	1,272,084	1,144,876
White Spruce							
Saw Live	6,091,146	5,778,279	103,549	98,231	153,124	28,849,030	27,332,584
Pole Live	597,887	597,887	10,164	10,164	26,555		
Sum	6,689,032	6,376,166	113,714	108,395	179,680	28,849,030	27,332,584
Stratum Total	16,078,812	13,604,453	317,049	265,131	596,047	62,511,095	50,234,437
Stratum 6	Black-White Spruce-Birch Poletimber					Acreage =	7,070
Birch							
Pole Live	1,446,551	1,372,841	36,164	34,321	97,182		
Saw Live	222,132	218,445	5,553	5,461	8,923	335,580	326,082
Sum	1,668,683	1,591,286	41,717	39,782	106,105	335,580	326,082
Black Spruce							
Pole Live	593,654	593,654	10,092	10,092	36,194		
Sum	593,654	593,654	10,092	10,092	36,194		
White Spruce							
Saw Live	3,174,113	3,073,606	53,960	52,251	90,862	13,733,256	13,303,596
Pole Live	959,634	942,531	16,314	16,023	45,458		
Sum	4,133,746	4,016,137	70,274	68,274	136,319	13,733,256	13,303,596
Stratum Total	6,396,083	6,201,076	122,083	118,149	278,619	14,068,836	13,629,677
Stratum 7	Black-White Spruce-Birch Reproduction					Acreage =	87,626
Birch							
Pole Live	21,651,788	20,391,033	541,295	509,776	1,423,330		

# Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

	Total Gross CF	Total Net CF	Total Gross Tons	Total Net Tons	Total Biomass Tons	Total Gross BF	Total Net BF
Saw Live	1,877,785	937,983	46,945	23,450	175,365	5,200,971	3,378,297
Sum	23,529,572	21,329,016	588,239	533,225	1,598,695	5,200,971	3,378,297
Black Spruce							
Saw Live	807,508	785,050	13,728	13,346	59,487	5,733,612	5,733,612
Pole Live	643,037	643,037	10,932	10,932	96,284		
Pole Dead	385,273	308,914	6,550	5,252	48,548	0	0
Sum	1,835,818	1,737,000	31,209	29,529	204,319	5,733,612	5,733,612
White Spruce							
Saw Live	29,549,091	26,141,762	502,335	444,410	1,036,149	137,126,137	121,505,840
Pole Live	8,004,869	7,304,932	136,083	124,184	346,081		
Sum	37,553,960	33,446,693	638,417	568,594	1,382,230	137,126,137	121,505,840
Stratum Total	62,919,350	56,512,709	1,257,866	1,131,348	3,185,244	148,060,721	130,617,750
Grand Totals	141,679,691	127,801,382	2,790,855	2,505,434	6,259,381	395,457,994	349,698,360

Acreage = 140,622

Total Volume For Trees Greater Than or Equal to 1.5" dbh and Less than 5" dbh

Total Biomass Tons

Stratum 1	White Spruce Sawtimber	Acreage =	6,386
Balsam Poplar			
Birch		5,939	
White Spruce		128	
Stratum Total		6,066	
Stratum 2	Black-White Spruce Poletimber	Acreage =	3,241
Birch		4,667	
Black Spruce		12,056	
Tamarack		940	
White Spruce		6,611	
Stratum Total		24,275	
Stratum 3	Hardwood Sawtimber/Poletimber	Acreage =	7,894
Aspen		13,972	
Balsam Poplar			
Birch		62,598	
White Spruce		9,473	
Stratum Total		86,043	
Stratum 4	White Spruce-Birch Sawtimber/Poletimber	Acreage =	19,794
Aspen			
Balsam Poplar			
Birch		88,477	
Black Spruce		1,979	
White Spruce		25,534	
Stratum Total		115,990	
Stratum 5	White Spruce-Balsam Poplar Sawtimber/Poletimber	Acreage =	8,613
Balsam Poplar		16,623	
Birch		2,067	
White Spruce		13,781	
Stratum Total		32,471	
Stratum 6	Black-White Spruce-Birch Poletimber	Acreage =	7,070
Birch		34,287	
Black Spruce		31,672	

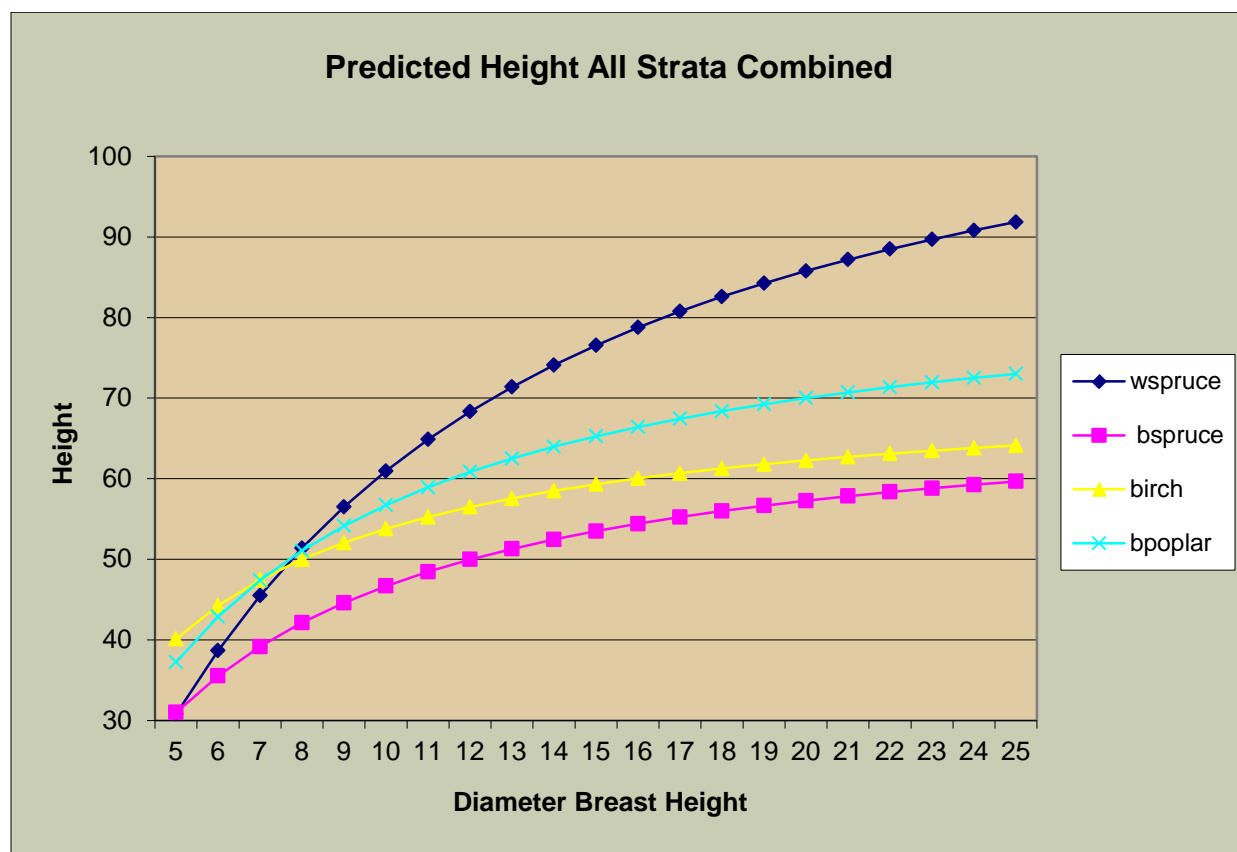


## Timber Inventory of State Forest Lands in the Middle Yukon River Area 2015

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White Spruce			10,887		
Stratum Total			76,846		
Stratum	7	Black-White Spruce-Birch Reproduction		Acreage =	87,626
Birch			604,618		
Black Spruce			16,649		
Tamarack			21,030		
White Spruce			301,433		
Stratum Total			943,730		
Grand Total			1,285,421		
				Acreage =	140,622

Appendix D  
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	120.72	-6.8336	1
Black Spruce	70.27	-4.094	1
Birch	72.1	-2.9317	1
Balsam Poplar	86.39	-4.2072	1

"e" is a numerical constant that is equal to 2.71828

The corresponding Microsoft 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

			Radial Growth (In.)	Single Bark Thickness (In.)
<b>Aspen</b>	(3 detail records)	Average=	0.20	0.37
<b>Balsam Poplar</b>	(20 detail records)	Average=	0.37	0.75
<b>Birch</b>	(92 detail records)	Average=	0.39	0.31
<b>Black Spruce</b>	(21 detail records)	Average=	0.19	0.37
<b>White Spruce</b>	(182 detail records)	Average=	0.32	0.44

Bark Thickness Ratio by Species

			DBH	DIB*	Bark Thickness Ratio
<b>Aspen</b>	(3 detail records)	Sum=	18	15	0.875
<b>Balsam Poplar</b>	(20 detail records)	Sum=	243	213	0.876
<b>Birch</b>	(92 detail records)	Sum=	743	686	0.923
<b>Black Spruce</b>	(21 detail records)	Sum=	152	136	0.898
<b>White Spruce</b>	(182 detail records)	Sum=	2,196	2,037	0.928
<b>Over All</b>		Sum=	3,352	3,088	0.921

\*DIB = Diameter Inside Bark

Appendix E  
SITE INDEX DISTRIBUTION

Site Index Distribution (Acres) by Stratum

White Spruce Site Index (100 Year)

	20-30	30-40	40-50	50-60	60-70	70-80	80-90
<b>Stratum</b>							
<b>1</b>				2,554	3,831		
<b>2</b>	648	1,945	648				
<b>3</b>	1,973	1,973		1,973	1,973		
<b>4</b>		2,474	2,474	9,897	4,948		
<b>5</b>				2,153	4,306		2,153
<b>6</b>		3,535		3,535			
<b>7</b>				43,813	43,813		
<b>Percent</b>	2%	7%	2%	45%	42%	0%	2%

Birch Site Index (50 Year)

	20-30	30-40	40-50	50-60
<b>Stratum</b>				
<b>3</b>		1,316	5,263	1,316
<b>4</b>		9,897	9,897	
<b>4</b>			8,613	
<b>6</b>			7,070	
<b>7</b>	21,906	21,906	43,813	
<b>Percent</b>	17%	25%	57%	1%

Balsam Poplar Site Index (50 Year)

	20-30	30-40	40-50	50-60
<b>Stratum</b>				
<b>4</b>				19,794
<b>5</b>				8,613
<b>Percent</b>				100%

Appendix F  
TREE QUALITY



Puget Sound Log Scaling and Grading Bureau Specifications

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			
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.		
All Species Cull Logs	0	Logs do not qualify as a Utility Log					

Percent of Measured Sawtimber Trees by Log Grade

	Grade 1 <sup>st</sup> 16' Log	Grade 2 <sup>nd</sup> 16' Log	# Of Trees Measured	% Of Trees Measured
Balsam Poplar				
	0	0	21	31%
	1	1	1	1%
	1	2	4	6%
	1	5	2	3%
	2	2	3	4%
	2	3	1	1%
	2	4	3	4%
	2	5	4	6%
	3	4	1	1%
	4	4	1	1%
	4	5	5	7%
	5	0	3	4%
	5	5	18	27%
Total for Balsam Poplar			67	
Birch				
	0	0	16	21%
	0	5	3	4%
	3	4	1	1%
	3	5	1	1%
	4	0	8	11%
	4	4	1	1%
	4	5	11	15%
	5	0	19	25%
	5	5	15	20%
Total for Birch			75	
Black Spruce				
	4	0	1	20%
	4	5	1	20%
	5	0	3	60%
Total for Black Spruce			5	
White Spruce				
	0	0	13	4%
	1	2	2	1%
	2	2	5	2%

Grade 1st Log	Grade 2nd Log	# Of Trees Measured	% Of Trees Measured
2	3	35	12%
2	4	3	1%
2	5	1	0%
3	0	1	0%
3	3	1	0%
3	4	72	24%
3	5	5	2%
4	0	6	2%
4	4	78	26%
4	5	40	13%
5	0	13	4%
5	4	3	1%
5	5	23	8%
Total for White Spruce		301	
Grand Total Trees Measured		448	

### Tree History Codes

Tree history codes are used to express differences between trees in terms relating to the desired management of the stand.

<u>Code</u>	<u>Description</u>
1	Desirable crop trees.
	a. Less than rotation age (assume 150 years spruce, 100 years hardwood)
	b. Alive
	c. Noncull
	d. A commercial species
	e. Capable of producing one merchantable sawlog
	f. Isolated, dominant, or codominate trees
	g. At least 40 percent covered with live crown
	h. Of good form
	i. Free of defect indicators
2	Acceptable crop trees.
	a. Less than rotation age (assume 150 years spruce, 100 years hardwood)
	b. Alive
	c. Noncull
	d. A commercial species
	e. Capable of producing one merchantable sawlog

- f. Normal conical shaped crown. No evidence of flattening crown. Pole sized crop trees with deformed crowns will be classed as sound cull.
- 3 Mature high risk trees.
  - a. Over rotation age (assume 150 years spruce, 100 years hardwood)
  - b. Alive
  - c. Noncull
  - d. A commercial species
  - e. Capable of producing one merchantable sawlog
  - f. Of fair or poor vigor, as indicated by low crown ratio, dead branches, disease, internal rot, and/or mechanical damage.
- 4 Mature low risk trees. Trees will be coded low-risk only if obviously healthy and vigorous and if no damage code applies to it.
  - a. Over rotation age (assume 150 years spruce, 100 years hardwood)
  - b. Alive
  - c. Noncull
  - d. A commercial species
  - e. Capable of producing one merchantable sawlog
  - f. Of good vigor, as indicated by high crown ratio, vigorous leader, no evidence of disease, rot or mechanical damage.
- 5 Rotten cull trees. Trees not able to produce one merchantable log, primarily due to defect.
  - a. Alive
  - b. More than 75 percent rotten cull in softwoods and more than 50 percent rotten cull in hardwoods
- 6 Sound cull trees. Trees not able to produce one merchantable sawlog, primarily due to defect.
  - a. Alive
  - b. Not rotten cull trees
  - c. Trees not able to produce one merchantable sawlog, now or in the future, primarily due to bole roughness and poor form, or deformed or sparsely needled crown, or is a noncommercial species.
- 7 Salvable dead trees.
  - a. Dead within the last five years
  - b. Sawtimber
  - c. A commercial species
  - d. Contain at least one merchantable log
- 8 Non-salvable dead trees.
  - a. Dead within the last five years
  - b. A commercial species
  - c. No salvable sawlogs

Percent of Measured Trees by Tree History

	Tree History	# Of Trees Measured	% Of Trees Measured
Aspen			
	6	8	100%
Total for Aspen		8	
Balsam Poplar			
	1	2	2%
	2	18	21%
	3	18	21%
	4	16	18%
	5	20	23%
	6	13	15%
Total for Balsam Poplar		87	
Birch			
	1	16	7%
	2	99	41%
	3	18	8%
	4	6	3%
	5	24	10%
	6	76	32%
Total for Birch		239	
Black Spruce			
	1	8	16%
	2	18	37%
	3	5	10%
	4	6	12%
	6	9	18%
	7	2	4%
	8	1	2%
Total for Black Spruce		49	
White Spruce			
	1	79	20%
	2	120	30%
	3	67	17%
	4	94	23%
	5	5	1%
	6	35	9%

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Tree History	# Of Trees Measured	% Of Trees Measured
7	1	0%
8	3	1%
Total for White Spruce	404	
Grand Total Trees Measured	787	