

**TANANA CHIEFS CONFERENCE INC.**  
**FOREST RESOURCES**  
**NIKOLAI VILLAGE/KUSKOKWIM RIVER WATERSHED**  
**ALASKA, 1987**

**By**

**Bill Zufelt, Forester**

**and**

**John C. Maisch, Inventory Forester**

**April, 1987**

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**TANANA CHIEFS CONFERENCE INC.**

**FAIRBANKS, ALASKA**

**Mitch Demientieff**

**President**

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Overall project supervision was by William J. Zufelt, Forestry Director, Tanana Chiefs Conference, Inc. Project design and office direction was by John C. Maisch.

Field participants were:

### Tanana Chiefs Conference, Inc.:

William Putman, Forester

John C. Maisch, Forester

William Zufelt, Forester

### U.S. Bureau of Indian Affairs

John M. Minor, Inventory Forester, Juneau Area Office

Mike Lebrun, Forester, Fairbanks Agency

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# HIGHLIGHTS

## Nikolai Village Forest Inventory

	<u>Acres</u>
Total Nikolai Village Inventory Area.....	73,200
Forested Lands.....	22,002
Non-forested Lands.....	43,120
Water, Kuskokwim River.....	4,260
Water, Lakes/Ponds.....	3,795
Cultural (Village/Airport).....	23

Forest Land, Stand Size Class by Timber Type:	
Sawtimber Type.....	9,554
Poletimber Type.....	12,448
Seedling/Sapling Type.....	None
TOTAL FOREST LAND	22,002

Forest Land, Species Composition by Timber Type:	
White Spruce Type.....	4,137
Black Spruce Type.....	3,257
Hardwood Type.....	6,742
Cottonwood Type.....	934
Mixed White Spruce/Hardwood Type.....	6,900
Mixed Black Spruce/Hardwood Type.....	32
TOTAL FOREST LAND	22,002

Forested Land Volume:<sup>1</sup>

Thousand<sup>2</sup>  
Cubic Feet  
46,254

Thousand<sup>3</sup>  
Board Feet  
125,985

<sup>1</sup> Primarily because of small acreage or limited timber values, some timber types were not sampled. Non-sampled timber types account for 1,663 acres of the 22,002 acres of forest land. Therefore, the above volume estimates are based on the 20,339 acres of forest land timber types actually sampled (Table 4).

<sup>2</sup> Includes all size classes 1.0" dbh and larger for sawtimber and poletimber classes.

<sup>3</sup> Includes only sawtimber trees 10.5" dbh and greater; Scribner Decimal C log rule.

## INTRODUCTION

At the request of the Nikolai Native Village Council and MTNT, Limited, the Tanana Chiefs Conference, Inc., with assistance from the U.S. Bureau of Indian Affairs, completed a forest inventory of forest lands for the Nikolai Village. Nikolai, one of four member villages incorporated into MTNT, Limited, is entitled to and has selected 69,120 acres of land under the terms of the Alaska Native Claims Settlement Act, 1971.

Funding for the project was secured from the Bureau of Indian Affairs through that agency's technical assistance program for Native village councils. Field measurements were completed during the summer of 1985. This report summarizes the field work and provides information on the location, extent, species composition, size class, and volume of timber on Nikolai village lands.

The project area encompasses approximately 73,000 acres, which includes the Nikolai village selection, lakes, and the Kuskokwim River and its tributaries. Located along the north, east, and south forks of the Kuskokwim River, the area is accessible only by regularly scheduled and charter air service and by river travel on the Kuskokwim River. The project area is located approximately 200 air miles northwest of Anchorage-Alaska's largest metropolitan area. (See Figure 1.)

Other major landholders in the area are other MTNT, Limited landholdings for the villages of McGrath, Telida, and Takotna; Doyon, Limited, and the State of Alaska.



## PHYSICAL DESCRIPTION

### Topography and Drainage

The project area is located in a wide, flat, alluvial plain enclosed in the Upper Kuskokwim River Basin. The plain serves as a collection basin for alluvial deposits from surrounding mountains and hills. The Kuskokwim Mountains lie to the north and the Alaska Range lies to the south. Mountain elevations are in excess of 4,000 feet directly to the north and in excess of 20,000 feet (Mt. Denali) to the south in the Alaska Range.

Elevations in the project area average approximately 400 feet and that elevation varies by only about 50 feet throughout the project area. In this regard, the area is flat, containing numerous lakes, marshy wetlands, and winding waterways scattered throughout the area.

The larger water courses draining into the area are the main branch of the Kuskokwim River as well as its south, east, and north forks, all of which are navigable. The village of Nikolai is located on the south fork of the Kuskokwim River. (See Figure 2.)

### Climate

The climate is best described as Continental, where summer and winter temperatures are generally extreme and precipitation is relatively light.

The Nikolai project area is located at a low elevation and surrounded by mountain ranges where the air loses much of its moisture before reaching the project area. The average annual precipitation varies between 10" and 20" (includes water equivalent of snow). Average annual snowfall is 60" to 70". Approximately 25% of the annual precipitation falls as rain in August.

Average maximum temperature is in the upper 60's, with average winter temperatures between -20°F and 0°F. Extreme temperatures range from -67°F and 90°F. Frost free days occur in the area from mid-May to mid-August. Surface winds are generally light.

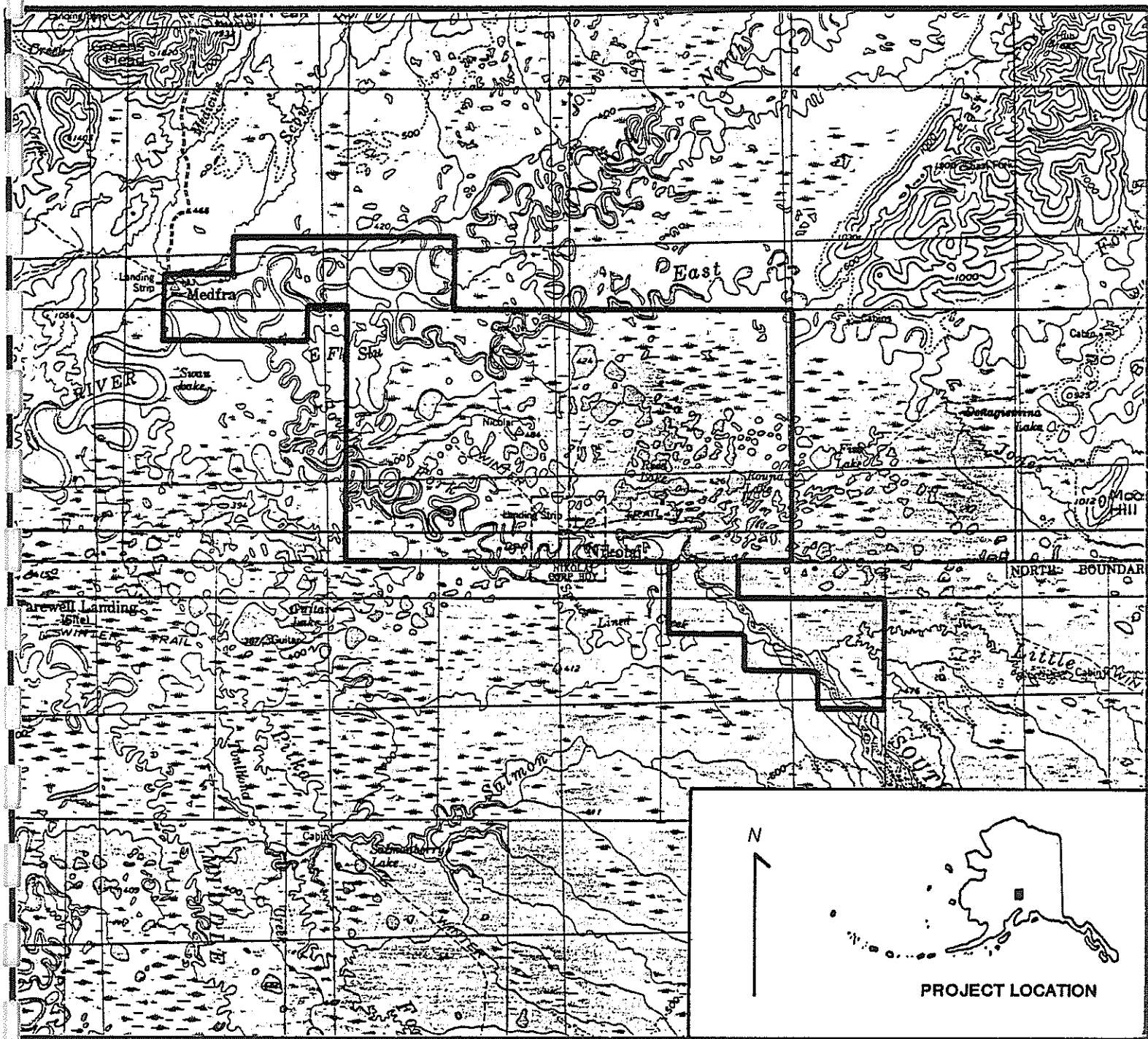
Breakup for the Kuskokwim River generally occurs between May 5-10, with freezeup occurring between November 3-20.

### Geology

Nikolai is located in a geologic area described as unconsolidated deposits, alluvial in origin - flood plain, alluvial fan, and terrace deposits bordering major streams and rivers.

In the northern area near Medfra, bedrock deposits of Paleozoic and older rock exist in the form of sedimentary and metamorphic rocks, chiefly schist and slate.

## NIKOLAI VILLAGE LAND SELECTIONS



**SCALE 1:250,000**

Figure 2.- Location of Nikolai forest inventory project, 1985.

## Soils

Parent materials for soils in the area are generally well-sorted flood plain, terrace, and alluvial fan deposits commonly associated with rivers and streams.

Soils are generally silty and sandy loams, varying significantly depending on stage of development, how well-drained the soils are, depth of permafrost, and existence and depth of overlying peat layers. Permafrost is generally discontinuous, occurring mostly as isolated masses. Areas immediately adjacent to the Kuskokwim River, its forks, and associated sloughs are generally free of permafrost and support the better forest stands in the area. Soil patterns are somewhat complex, owing to the randomness of parent material deposition, stream/river course scars, and associated periodic flooding.

Table (1) gives a general description of the soils and associated vegetation found in the Kuskokwim flood plain. The better drained, more permafrost-free soils support the bottom land spruce/balsam poplar forests characterized by tall stands of white spruce, balsam poplar, paper birch, and quaking aspen. Understory vegetation includes high and low shrubs and a carpet of ferns, mosses and lichen.

The less developed and poorer drained permafrost soils support thickets of black spruce, willow, alder, and a variety of smaller shrubs, forbs, grasses, ferns and mosses.

Estimated %	Soil Occurrence/Description	Associated Vegetation
45%	Silt & sandy loams, occupying nearly level portions of flood plains and most meander scars. Poorly drained, shallow permafrost, peaty surface layer	Black Spruce Willows Sedges Mosses
35%	Stratified silt loam and sandy loams occupying natural levees and low terraces. Discontinuous permafrost	White Spruce Balsam poplar Paper birch Willows
20%	Deep, fibrous peat, occurs in slight depressions and meander scars	Low shrubs Sedges Mosses

**TABLE 1. Soil Description, Occurrence, and Associated Vegetation in Nikolai Village Inventory**

## METHODS

The inventory method used can best be described as a two-stage stratified double sample. In the first stage, stratification of the forest was accomplished by delineating the boundaries of timber and other vegetation classes on 1:60,000 and 1:31,680 scale color infrared aerial photographs (timber typing). The timber and vegetation classes used were those that were readily visible on the aerial photographs; i.e., tree species, size class, and tree density (see Table 2, Vegetation Typing Scheme, Nikolai Forest Inventory). Due to difficulty in distinguishing between aspen and birch species during the timber typing process, both species were typed together as a hardwood type. Balsam poplar (cottonwood), on the other hand, could be distinguished from the other hardwood species and was typed as a separate type: cottonwood.

The 1:31,680 scale aerial photographs were used where available, primarily the immediate Kuskokwim River corridor. The 1:60,000 scale aerial photographs were used to cover the remaining project area (see map, figure 2). A field reconnaissance was conducted in conjunction with timber typing work to provide ground verification of timber type work. Several sample plots of various stands were taken during the reconnaissance stage to obtain tree diameter and heights as well as stand volumes to further help in coordinating timber typing by size class and density.

In the second stage, field measurements were taken to provide timber volume estimates by timber type, as well as estimates of forest growth and defect.

### Timber Typing

The smallest timber stand delineated as a separate entity or type was approximately 15 acres in size. In delineating mixed types, at least 30% of each species (by tree density) had to be present.

Stand delineation proceeded by examining timber types that were verified by the reconnaissance and comparing them to like timber types found on the imagery. Aids used in comparison of types on the aerial photographs included color, texture, hue, and physical location of the stands in question. This comparison process was also used to distinguish between forest and non-forest lands.

A distinction is made between forest and non-forest lands for the purpose of this inventory. In the absence of any clear parameters to distinguish between operable and non-operable and/or commercial/non-commercial forest land of the area, photo interpreters relied on judgment to differentiate between non-forest bog, forested bog, and other "non-productive" forest lands and the potentially "productive" forest lands in general.

Forest lands are the white spruce, black spruce, cottonwood, birch, and aspen forested lands located on the better drained, more productive sites where tree growth is characterized by medium to tall tree heights, more vigorous crowns, and other identifiable characteristics associated with bottom land spruce and hardwood forests.

NIKOLAI VEGETATION  
TYPING SCHEME

SPECIES CALLS

Forestland		Shrubland	
S	White Spruce	TS	Tall Shrub/Alder/Other
BS	Black Spruce	TS	Tall Shrub/Willow
CW	Cottonwood	DS	Low Shrub/Bog Birch/
H	Hardwood/Birch or Aspen		Other
Wetlands		Special Cover Types	
W	Lakes/Ponds	Br	Recently Burned Area
B	Bog/Herbaceous Species	Ba	Bare Ground/Gravel Bar
TSw	Tall Shrub Wet/Alder/Other	Cu(95)	Cultural/Village
	in seasonably wet area.	(98)	Cultural/Roads/
R	River/Flowing Water		Airstrips

STAND DESCRIPTOR CALLS

D	Dwarf Forest/Scrub Forest	≤ 25 ft. Tall
R	Reproduction	≤ 4.4 in. DBH
P	Poletimber	4.5 in. to 10.4 in. DBH
S	Sawtimber	≥ 10.5 in. DBH

STAND DENSITY CALLS

1	10-24%	Calls are based
2	25-59%	on crown closure
3	60-100%	percent.

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Table 2. - Vegetation Cover Types Classification Standards.

Non-forest lands contain willow, alder, dwarf black spruce and hardwoods, and bog and grass areas. Special cover types such as roads, runways, or settlements are also non-forest land.

Timber types on non-forest land are considered unproductive at this time. The objective was to identify forest stands that now have commercial potential based on tree size, while eliminating obvious unproductive forest sites. Water areas were also delineated on the aerial photographs and were further divided into rivers and lakes.

### Field Inventory Design

The proportion of each forest land timber type to total forest area was calculated. The typed individual timber stands to be field sampled were selected randomly, based on their proportion to forest land as a whole. For example, a timber type occupying 10% of the forest area would receive approximately 10% of the field sample. Only poletimber and sawtimber stands were sampled. Table 3 gives a summary of the number of plots sampled by timber type.

The variable radius plot sampling method was used for data collection in the field. In each timber stand sampled, 10 plots were spaced along a traverse located randomly within the stand. At 5 alternating plots, tree diameters & total tree heights were measured. Diameters were measured at 4-1/2 feet above ground, commonly called "diameter breast height" or dbh. Live trees one-inch dbh and greater along with dead trees estimated to have died within the last five years were measured. Defect estimates were made for the measured live trees. On the other 5 alternating plots, only the number of trees and the species were recorded. Information from plot measurements was then computer processed to determine average net volume per acre for each stand visited. A total of 610 field plots were measured.

### Vegetative Cover Type Map

The vegetative cover type map shows the location of each timber stand and land classification as identified on the aerial photographs. The maps were produced by transferring the information from the photo acetate overlays to a 1:31,680 scale (2 inches = 1 mile) topographic base map. A Measuronics video graphics computer was used for this transferring process. Acreage figures were then calculated from

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NIKOLAI TIMBER TYPES

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		Number of Plots
Type 1	Cottonwood Sawtimber, Medium Stocked	10
Type 2	Cottonwood Poletimber, Well Stocked	10
Type 3	Hardwood Poletimber, Well Stocked	170
Type 4	Hardwood Poletimber, Medium Stocked	50
Type 5	White Spruce Sawtimber, Well Stocked	40
Type 6	White Spruce Sawtimber, Medium Stocked	30
Type 7	White Spruce Poletimber, Medium Stocked	20
Type 8	Black Spruce Poletimber, Medium Stocked	80
Type 9	White Spruce Sawtimber, Medium Stocked, with Tall Shrub	20
Type 10	Hardwood Poletimber, Well Stocked, with White Spruce Sawtimber, Well Stocked	30
Type 11	Hardwood Poletimber, Medium Stocked, with White Spruce Poletimber, Medium Stocked	20
Type 12	White Spruce Sawtimber, Well Stocked, with Hardwood Poletimber, Well Stocked	50
Type 13	White Spruce Sawtimber, Medium Stocked, with Hardwood Poletimber, Medium Stocked	80
Total		610

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**TABLE 3 - Number of Field Plot Sample by Forest Type**

Vegetative Cover Type Map

the vegetative cover type map for each labeled forestland timber type, as well as the water and river classifications, using the Measurronics computer (see Table 4). The total forest volume was then calculated by expanding the average per acre volume figures for each sampled timber type by the acreages in that type.

Timber Type	Area	%
Cottonwood Sawtimber, Medium Stocked (CWS2)	227	1
Cottonwood Poletimber, Well Stocked (CWP3)	523	2
Hardwood Poletimber, Well Stocked (HP3)	4,742	22
Hardwood Poletimber, Medium Stocked (HP2)	1,958	9
White Spruce Sawtimber, Well Stocked (SS3)	1,433	7
White Spruce Sawtimber, Medium Stocked (SS2)	1,028	5
White Spruce Poletimber, Medium Stocked (SP2)	563	3
Black Spruce Poletimber, Medium Stocked (BSP2)	2,562	12
White Spruce Sawtimber, Medium Stocked (SS2/TS) w/Tall Shrub	785	3
Hardwood Poletimber, Well Stocked Mixed w/White Spruce Sawtimber, Well Stocked (HP3/SS3)	956	4
Hardwood Poletimber, Medium Stocked Mixed w/White Spruce Poletimber, Medium Stocked (HP2/SP2)	705	3
White Spruce Sawtimber, Well Stocked Mixed w/Hardwood Pole- timber, Well Stocked (SS3/HP3)	1,358	6
White Spruce Sawtimber, Medium Stocked Mixed with Hardwood Poletimber, Medium Stocked (SS2/HP2)	3,499	16
* White Spruce Poletimber, Medium Stocked w/Tall Shrub (SP2/TS)	41	1
* White Spruce Poletimber, Well Stocked Mixed w/Hardwood Poletimber, Well Stocked (SP3/HP3)	91	1
* White Spruce Sawtimber, Poorly Stocked (SS1)	9	1
* White Spruce Sawtimber, Poorly Stocked w/Tall Shrub (SS1/TS)	278	1
* Black Spruce Poletimber, Poorly Stocked (BSP1)	36	1
* Black Spruce Poletimber, Well Stocked (BSP3)	659	3
* Cottonwood Poletimber, Medium Stocked (CWP2)	184	1
* Hardwood Poletimber, Medium Stocked Mixed w/Black Spruce Poletimber, Medium Stocked (HP2/BSP2)	32	1
* Hardwood Poletimber, Medium Stocked Mixed with White Spruce Sawtimber, Medium Stocked (HP2/SS2)	127	1
* Hardwood Poletimber, Medium Stocked w/Tall Shrub (HP2/TS)	10	1
* Hardwood Poletimber, Well Stocked Mixed w/White Spruce Poletimber, Well Stocked (HP3/SP3)	164	1
* Hardwood Sawtimber, Medium Stocked (HS2)	15	1
* Hardwood Sawtimber, Medium Stocked w/Tall Shrub (HS2/TS)	17	1
<b>TOTALS</b>	<b>22,002</b>	<b>100%</b>

**TABLE 4 - Forest Area by Timber Type**

\* Incidental timber types that have no recorded plot data and do not contribute to the total volume estimate.

## RESULTS

### Forest Lands

Forest lands in the project area occupy 30% of the land area or about 22,000 acres. Non-forest land occupies 59% or 43,120 acres. The Kuskokwim River accounts for 4,260 acres or 6% of the project area. The remaining area amounts to 3,795 acres or 5% of the project area and includes lakes larger than 10 acres, sloughs, and portions of the smaller Little Tonzona River (Table 5).

### Forest Volume By Timber Type

Estimates of timber volume on forested lands have been calculated by two different units of measure. The first is board feet, which is defined as a unit of wood 12" wide, 1" thick, and 12" long. The board foot measure is commonly used when referring to the quantity of lumber that can be sawn from a log. Because the board foot measure is based on the actual boards that can be sawn from a log, it disregards all material wasted in the manufacturing process; i.e., sawdust, slabs, and edgings.

For the purpose of this inventory, the board foot measure pertains only to sawlog sized trees; i.e., those trees 10.5" dbh and larger.

The second method used for indicating wood volume is the cubic foot measure. The cubic foot measure is more accurate than the board foot measure in estimating total log volume; i.e., it is based on the total cubic content of the log rather than the number of boards that can be sawn from the log.

The cubic foot measure can readily be converted to the cord measure of stacked wood. The average standard cord contains about 80 cubic feet of wood (Wenger, 1984; Stoddard, 1968; Dilworth and Bell, 1973). A standard cord of wood is 4'x4'x8' in dimension, or 128 cubic feet. The stacked cord of wood contains only about 80 cubic feet of solid wood because it also contains air space, as well as solid wood volume (Figure 3). For the purposes of this report, the cubic foot volume is given for all trees 1" at dbh and larger.

Timber volume calculations in both cubic feet and board feet are based on a net figure for sawlog size trees only. That is, deductions have been made for observed defect in sawlog size trees. However, the timber volumes shown are not truly net due to the fact that not all defects can be observed. Defect is wood that is made unusable due to rot or physical damage, such as breakage, sweep, crook, etc.

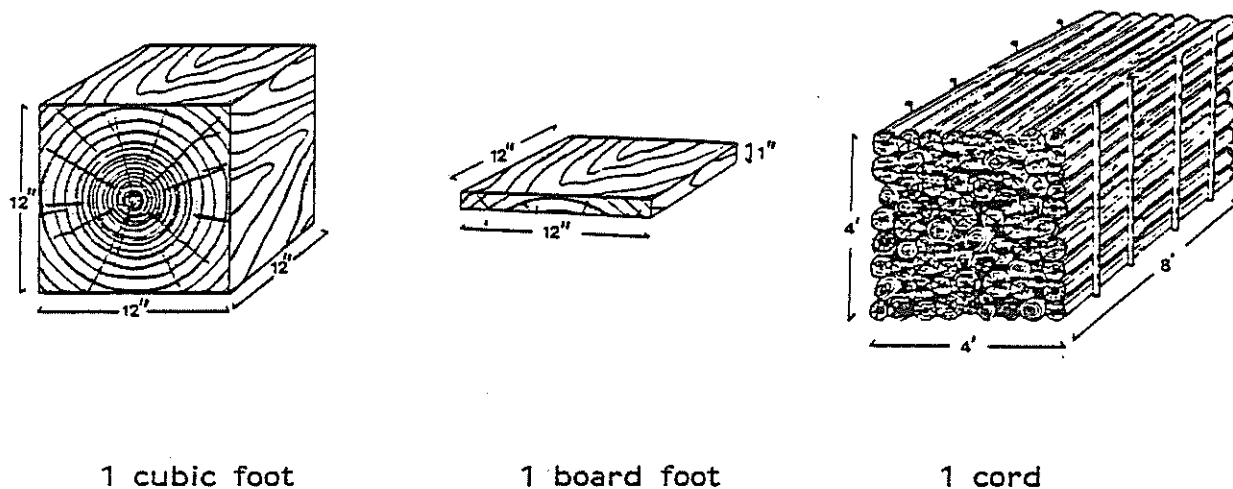
The average estimated percent of observed cubic foot defect for sawtimber trees by species for the Nikolai project was: White spruce sawtimber, 6%; cottonwood sawtimber, 31%; and hardwood sawtimber (birch/aspen), 25%.

The hardwood poletimber types occupy 6,700 acres, or 33% of the forest lands. The volume of these hardwood types in net cubic feet amounts to 25% of the cubic volume present on forest lands, or about 11,700,000 cubic feet (Table 6).

Hardwood tree species include paper birch (Betula papyrifera) and quaking aspen (Populus tremuloides). Of the two, birch is by far the predominate hardwood species, accounting for 96% of the hardwood cubic volume.

Land Class	Acres	Percent of Area
Forest	22,002	30
Non-Forest	43,120	59
Water, Kuskokwim River	4,260	6
Water, Other	3,795	5
Cultural (Village/Airport)	23	<1
TOTAL	73,200	100%

TABLE 5 - Nikolai Forest Inventory Area by Forest and Non-Forest Acres



**Figure 3 - Volume Definitions**

These hardwoods reach their best development on well-drained, sandy loam and silt loam soils. Within the project area, hardwoods are generally found on upland sites or sites not subjected to periodic flooding.

The white spruce sawtimber and poletimber types occupy about 3,800 acres, or 19% of the forest land. The white spruce sawtimber type predominates, occupying 85% of the combined acreage and accounting for 82% of the combined cubic volume (Table 6). The total volume of white spruce sawtimber/poletimber types account for 29% of the cubic volume present on forest lands or 13,390,000 cubic feet.

White spruce (Picea glauca) occurs in nearly pure stands and in mixed stands with cottonwood, birch, aspen, and black spruce. White spruce attains its best development on well drained silt and sand loams.

Species/Size Class	Acres	% of Area	Thousand Cubic Feet	%	Thousand Board Ft.	%
<u>Sawtimber Types</u>						
White Spruce	3,246	16	10,903	24	35,745	28
Cottonwood	227	1	688	1	1,996	2
Mixed Spruce, Sawtimber/ Hardwood Poletimber	<u>5,813</u>	<u>29</u>	<u>15,047</u>	<u>33</u>	<u>47,149</u>	<u>37</u>
	9,286	46	26,638	58	84,890	67
<u>Poletimber Type</u>						
White Spruce	563	3	2,487	5	7,732	6
Hardwood	6,700	33	11,659	25	22,796	18
Cottonwood	523	2	2,216	5	3,256	3
Mixed Hardwood/Spruce	705	3	1,499	3	4,470	4
Black Spruce	<u>2,562</u>	<u>13</u>	<u>1,755</u>	<u>4</u>	<u>2,841</u>	<u>2</u>
	<u>11,053</u>	<u>54</u>	<u>19,616</u>	<u>42</u>	<u>41,095</u>	<u>33</u>
TOTAL	20,339	100	46,254	100	125,985	100

**TABLE 6 - Forest Land Area and Volume by Timber Type (Species and Size Class),  
Nikolai Forest Inventory**

The mixed white spruce sawtimber/hardwood poletimber types occupy 5,813 acres, or 29% of the forest acreage. These types account for 33% of the cubic forest volume, or 15,047,000 cubic feet. Additionally, the type contains 37% of the sawlog board foot volume; and together with the white spruce sawlog volume, accounts for 65% of the sawlog board foot volume, or about 82,894,000 board feet. Board foot volumes are based on the Scribner Decimal C volume table.

The mixed white spruce/hardwood poletimber types account for 705 acres, or 3% of the forest area. In terms of cubic volume, these types contain 3% of the total forest volume, or about 1,499,000 cubic feet.

The black spruce poletimber types occupy a significant 13% of the total forest land area, or nearly 2,600 acres. However, in terms of timber volume, these types contain only 4% of the cubic foot volume present on forest lands. This relatively low volume to area ratio, when compared to other timber types, is due primarily to understocking and the relatively small tree size found in the black spruce poletimber stands.

Black spruce (Picea mariana) usually occurs as pure stands, but may have a mixture of white spruce, and hardwoods, primarily paper birch. Black spruce occurs commonly on organic soils with poor drainage closely underlain by permafrost (Eyre, 1980).

The cottonwood poletimber and sawtimber stands comprise the remaining forest land acreage, accounting for 3% of the forested area, or about 750 acres. By cubic volume, these types account for 6% of the forest volume, or about 2,900,000 cubic feet; over 75% of which is located within the cottonwood poletimber type.

Cottonwood or balsam poplar (Populus balsamifera), another hardwood species, is represented in its own separate type because it can readily be distinguished on aerial photographs from other tree species, and because it is found in nearly pure stands on flood plains where erosion and flooding are active.

A comparison of the timber type acreage and volume is illustrated in Figure 4. There are an additional 1,663 acres of timber types that were not sampled and do not contribute to the overall total forest volume (Table 4).

## Timber Type Acreage/Cubic Feet Volume Comparison

White Spruce, Cottonwood, Black Spruce, Hardwoods, and Mixed Types

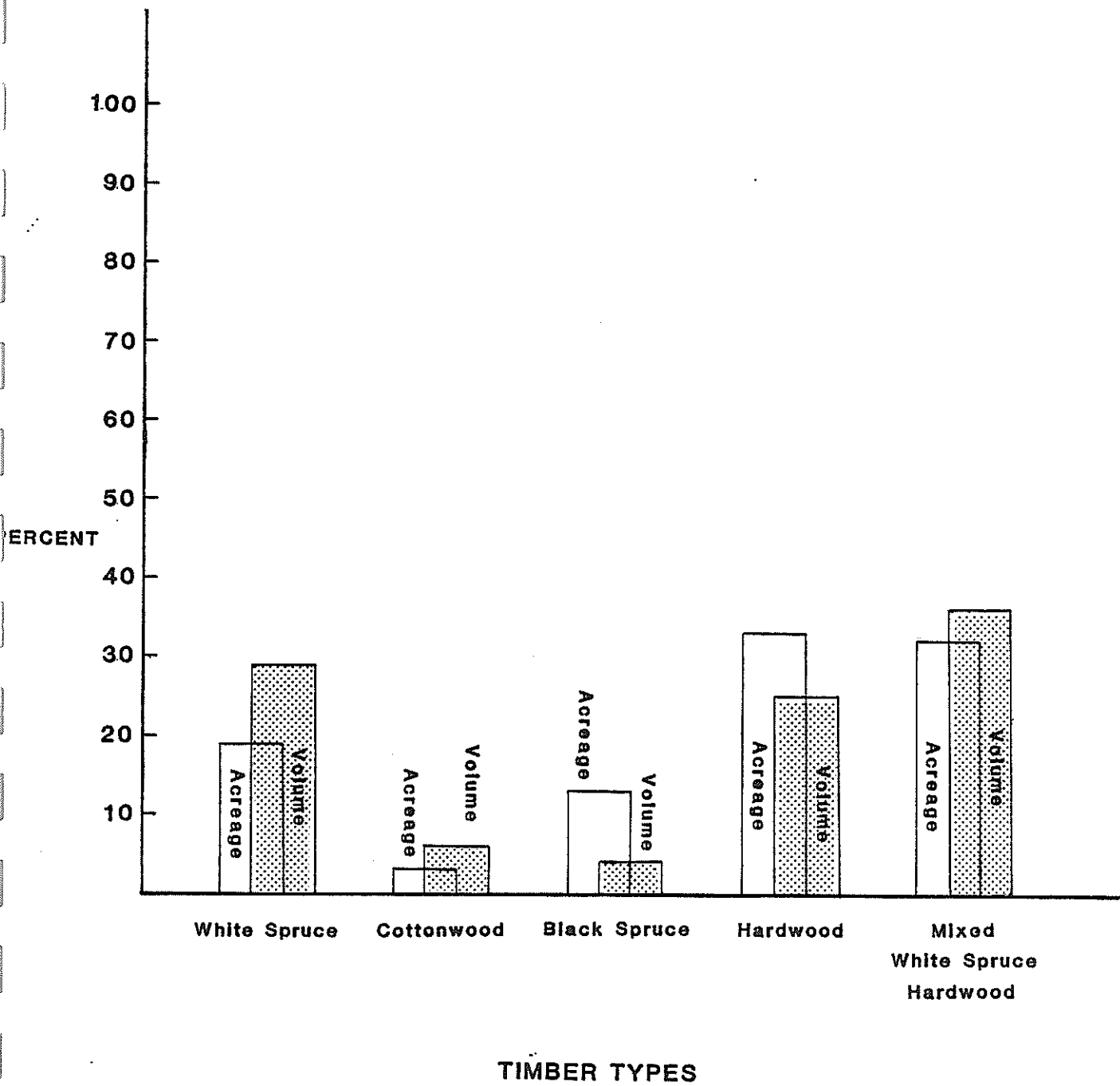


Figure 4. - Timber type acreage and volume comparison.

## Forest Volume by Size Class Without Regard to Timber Type

In this inventory project, individual timber stands have been mapped and sampled by timber types which are based on tree species, tree size, and overall stand density. In reality, however, the timber types identified may not and usually are not entirely homogeneous. This is a natural way of stand development in the forest. For example, in the white spruce sawtimber type, the stands are predominately made up of white spruce sawlog sized trees, but other spruce size classes, as well as the hardwood species and size classes of birch and aspen, as well as cottonwood may also be present.

An analysis of the total volume of each size class by species without regard to which timber type it occurs in is another way of quantifying the forest volume; i.e., what portion of the total volume is sawtimber, poletimber, or seedling/sapling? In other words, where we're talking about individual trees and not timber types.

A predominance of sawtimber trees may indicate immediate potential for high, short-term timber harvest levels and/or a declining old growth forest. On the other hand, a more balanced distribution of size classes may indicate a more diverse forest base with different management opportunities. In this regard, volume estimates have been further separated into size class components by sawtimber, poletimber, and seedling/sapling sized trees.

Live sawtimber size trees account for 26,048,000 cubic feet, or 56% of the total net volume. Live poletimber size trees account for 40% of the total net cubic volume, or about 18,300,000 cubic feet. Seedling/sapling trees and dead sawtimber account for the remaining 4%.

In terms of species, white spruce accounts for about 72% of the sawtimber tree cubic foot volume. In the poletimber size class, white spruce and hardwoods (mostly birch) are nearly equal, accounting for 48% and 39% of the poletimber volume, respectively. The total volume of all size classes is about 46,250,000 cubic feet. Table 7 gives a more complete summary of volume by size class and species.

NET VOLUME IN THOUSANDS				
	Cubic Feet	%	Board Feet	%
<u>Sawtimber</u>				
White Spruce	18,857	41	94,534	75
Black Spruce	338	1	1,635	1
Cottonwood	1,136	2	4,993	4
Hardwood*	5,717	12	22,910	18
	<u>26,048</u>	<u>56</u>	<u>124,072</u>	<u>98</u>
<u>Poletimber</u>				
White Spruce	8,809	19		
Black Spruce	689	1		
Cottonwood	1,633	4		
Hardwood*	7,194	16		
	<u>18,325</u>	<u>40</u>		
<u>Seedling/Sapling</u>				
White Spruce	295	<1		
Black Spruce	313	<1		
Cottonwood	-0-	-		
Hardwood*	894	2		
	<u>1,502</u>	<u>3</u>		
<u>Dead Sawtimber</u>				
White Spruce	103	<1	702	<1
Black Spruce	203	<1	810	<1
Cottonwood	-0-	-	-0-	-
Hardwood*	73	<1	401	<1
	<u>379</u>	<u>1</u>	<u>1,913</u>	<u>2</u>
TOTALS	46,254	100	125,985	100

TABLE 7 - Product Summary - Net Volume by Species/Size Class Without Regard to Timber Types, Nikolai Forest Inventory

\* Birch accounts for 96% of the hardwood cubic foot volume; aspen for 4%.

### Estimated Sampling Error

Sampling error was calculated for the cubic feet volume estimate for the Nikolai Village forest inventory and is given for both the sawtimber and poletimber components of all thirteen sampled timber types combined. The sawtimber and poletimber values are then combined to give a total inventory error (Table 8). The calculations for deriving this error can be found in Appendix A.

Sampling error percent is given within one standard deviation of the mean. This means there is a 68% chance (one standard deviation) that the inventory volume is within plus or minus the error percentage indicated. For example, the total volume of timber is 46,254,000 cubic feet and Table 7 shows a sampling error of 3.0%. This means for a total volume of 46,254,000, there is a 68% chance that the volume is within 1,387,620 cubic feet (3.0%) of the total volume estimate.

Size Class*	Percent Sampling Error	Total Inventory Sampling Error (%)
Sawtimber	3.3%	3.0%
Poletimber	5.6%	

**TABLE 8 - Net Cubic Feet Volume Sampling Error by Size Class,  
Nikolai Forest Inventory**

\* Represents the estimated sampling error by total net cubic feet volume for each size class without regard to timber type.

### Estimated Annual Harvest:

The Village of Nikolai has expressed an interest in establishing a forest products industry in their area, primarily as a source of local employment and as a means of benefiting from a major village asset, their timber resource. While it is beyond the scope of this report to suggest an allowable, sustained yield harvest level, it seems appropriate to make some estimate of an annual harvest level that could be sustained over time, as a general guide to future harvest activities. Estimates of potential harvest levels presented here are based on the following assumptions:

1. The project area is not now, nor likely to be in the near future, an area of intensive forestry. Harvest levels are likely to be well below the potential for the area.
2. With the exception of black spruce and cottonwood, all forest stands for which there is inventory data would be harvested. No allowance has been made for stands that might not be operable because of economic, social/cultural, or environmental considerations.
3. Estimates of annual harvest volume are based on the existing volume of seedling/sapling, poletimber, and sawtimber trees of all the timber stands for which there is inventory data. No allowance has been made for growth or mortality. By cubic foot volume, the existing forest consists of 56% sawtimber, 40% poletimber, 3% seedling sapling, and 1% dead sawtimber (Table 7). It is assumed that harvests will concentrate in the sawtimber component of the forest. Any mortality or wood loss to the seedling/sapling or poletimber components of harvested stands due to poor logging practices, exposure from opening the stand, or other factors would have the effect of eventually reducing harvest levels indicated here.
4. Growth and age information and field observations suggest that white spruce sawtimber products, houselogs and poles can be produced by age 100-120 years and that hardwood sawtimber and poles can be produced by age 60. Beyond that age, tree growth is beginning to decline on better sites.
5. There may be a regeneration gap after cutting. However, areas adjacent to rivers present fair to good seedbed conditions because of periodic flooding and the resulting silt deposition. Where excessive duff layers

present poor seedbed conditions, a scarification treatment to remove the duff may be required. It is anticipated that with normal seed production, adequate natural regeneration will be secured within 5-10 years following harvest. (Zasada, 1971). Clear-cut harvest blocks of 20 acres or less will be utilized.

#### Estimated White Spruce Harvest Level:

From the inventory data there are 10,327 acres within white spruce and mixed spruce/hardwood types (SS3, SS2, SP2, SS2/TS, HP3/SS3, SS3/HP3, SS2/HP2, HP2/SP2). If sawlog products can be produced in 120 years, and it takes 10 years for natural regeneration, then the number of acres that would be harvested annually is:

$$\frac{\text{Estimated}}{\text{Harvest}} = \frac{10,327 \text{ acres}}{130 \text{ years}} = 79 \text{ acres/year}$$

From the inventory data, these white spruce types have approximately 2,075 cubic feet of white spruce timber per acre. This is calculated by dividing the total volume of spruce component for the above types by the acreage of these types. The estimated annual harvest for spruce in cubic feet would be:

$$\text{Spruce: } 79 \text{ acres} \times 2,075 \text{ ft}^3/\text{acre} = 164,000 \text{ ft}^3/\text{year}$$

In terms of board feet, the sawtimber volume of existing stands averages about 7,600 board feet/acre. If this average volume is representative of the average spruce sawtimber volume per acre to be harvested throughout the rotation period, the spruce annual harvest estimate in terms of board feet would be:

$$\begin{array}{l} \text{Spruce annual} \\ \text{Harvest in} \quad = 79 \text{ acres} \times 7,600 \text{ bf/acre} = 600,000 \text{ bf} \\ \text{Board feet} \end{array}$$

#### Estimated Hardwood Harvest level:

From the inventory data there are 13,218 acres within hardwood and mixed hardwood/spruce types (HP3, HP2, HP2/SP2, SS2/HP2, SS3/HP3, HP3/SS3). If pole or sawlog products can be produced in 60 years, and it takes 10 years for natural regeneration, then the number of acres that can be harvested annually is:

$$\frac{\text{Estimated harvest}}{= \frac{13,218 \text{ acres}}{70 \text{ years}}} = 189 \text{ acres}$$

From the inventory data, these hardwood types have approximately 870 cubic feet of hardwood timber per acre. This is calculated by dividing the total volume of hardwood component for the above types by the acreage of these types. The estimated annual harvest for spruce in cubic feet would be:

$$\frac{\text{Estimated Harvest}}{= 189 \text{ acres} \times 870 \text{ ft}^3/\text{acre}} = 164,000 \text{ ft}^3$$

In terms of board feet, the sawtimber volume of existing stands average about 1,500 board feet/acre. If this average volume is representative of the average hardwood sawtimber volume per acre to be harvested throughout the rotation period, the hardwood annual harvest estimate in terms of board feet would be:

$$\begin{array}{l} \text{Hardwood annual} \\ \text{Harvest in} \\ \text{Board feet} \end{array} = 189 \text{ acres} \times 1,500 \text{ bf/acre} = 283,000 \text{ bf}$$

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**APPENDIX A**  
**Calculation of Percent Error**

# Nikolai Village Forest Inventory Error % by

## Sawtimber/Poletimber Combined

Type	$N_s$	$N_s^2$	% of Sample	$\bar{Sx}$	$\bar{Sx}^2$	$\bar{X}_s$	$(N_s^2 \bar{Sx}^2)$
Pole	610	372,100	50		1,698.41	1,234.9	631,978,300
Saw	610	372,100	50		2,364.73	868.6	879,916,020
	1220						1,511,894,320

### Calculation of Standard Error

$$SE = \sqrt{\frac{\sum (N_s^2 \bar{Sx}^2)}{(N_s)^2}} = 31.87 \text{ cubic feet/acre}$$

### Calculation of Weighted Population Mean

$$\bar{X} = 1234.9(.50) + 868.6(.50)$$

$$\bar{X} = 1051.8$$

### Calculation of Sampling Error

$$EZ = t \frac{(SE) (100)}{\bar{X}} = \frac{1 (31.87) (100)}{1051.8} = 3.0\%$$

Where:

- SE = standard error of mean (overall)
- $\bar{X}$  = overall population mean as estimated by sampling
- N = number of plots in the inventory
- $N_s$  = number of plots in a type or stratum
- $\bar{Sx}$  = standard error of the mean for a type or stratum
- $\sum$  = sum of
- EZ = sampling error in percent (overall)
- $\bar{X}_s$  = mean of stratum as estimated by sampling
- $t_s$  = number of standard deviations

# Nikolai Village Forest Inventory Error % by Size Class

## Sawlog Error % in Cubic Feet

Type	N <sub>s</sub>	N <sub>s</sub> <sup>2</sup>	% of Sample	S $\bar{x}$	S $\bar{x}$ <sup>2</sup>	$\bar{X}_s$	(N <sub>s</sub> <sup>2</sup> S $\bar{x}$ <sup>2</sup> )
CWS2	10	100	1.64	358.75	128,701.60	2,050	12,870,160
CWP3	10	100	1.64	298.78	89,267.10	1,416	8,926,710
HP3	170	28,900	27.87	59.09	3,491.04	585	100,891,000
HP2	50	2,500	8.20	114.48	13,105.67	1,080	32,764,180
SS3	40	1,600	6.56	265.61	70,547.61	3,162	112,876,200
SP2	20	400	3.28	413.91	171,321.50	2,835	68,528,600
BSP2	80	6,400	13.11	21.17	448.25	158	2,868,823
SS2/TS	20	400	3.28	231.76	53,713.62	1,083	21,485,450
HP3/SS3	30	900	4.92	149.94	22,482.01	1,428	20,233,800
HP2/SP2	20	400	3.28	171.08	29,268.37	1,316	11,707,350
SS3/HP3	50	2,500	8.20	169.28	28,654.37	1,676	71,635,910
SS2/HP2	80	6,400	13.11	144.42	20,855.69	1,699	133,476,400
	610		100.00				631,978,300

## Calculation of Standard Error

$$SE = \sqrt{\frac{\sum (N_s^2 S\bar{x}^2)}{N^2}} = 41.21 \text{ cubic feet/acre}$$

## Calculation of Weighted Population Mean

$$\bar{X} = 2050(.0164) + 1416(.0164) + 585(.2787) + 1080(.0820) + 1955(.0492) + 2835(.0328) + 158(.1311) + 1083(.0328) + 1428(.0492) + 1316(.0328) + 1676(.0820) + 1699(.1311)$$

$$\bar{X} = 1234.9 \text{ cubic feet/acre}$$

## Calculation of Sampling Error

$$E\% = t \frac{(SE) (100)}{\bar{X}} = \frac{1 (41.21) (100)}{1234.9} = 3.3\%$$

Where:

- SE = standard error of mean (overall)
- $\bar{X}$  = overall population mean as estimated by sampling
- N = number of plots in the inventory
- N<sub>s</sub> = number of plots in a type or stratum
- S $\bar{x}$  = standard error of the mean for a type or stratum
- $\sum$  = sum of
- E% = sampling error in percent (overall)
- $\bar{X}_s$  = mean of stratum as estimated by sampling
- t = number of standard deviations

# Nikolai Village Forest Inventory Error % by Size Class

## Poletimber Error % in Cubic Feet

Type	N <sub>s</sub>	N <sub>s</sub> <sup>2</sup>	% of Sample	S $\bar{x}$	S $\bar{x}$ <sup>2</sup>	$\bar{X}_s$	(N <sub>s</sub> <sup>2</sup> S $\bar{x}$ <sup>2</sup> )
CWS2	10	100	1.64	268.52	72,102.99	90	7,210,299
CWP3	10	100	1.64	631.80	399,171.20	2,808	39,917,120
HP3	170	28,900	27.87	80.03	6,404.48	741	185,089,500
HP2	50	2,500	8.20	211.65	44,795.72	1,245	111,989,300
SS3	40	1,600	6.56	340.05	115,630.60	1,447	185,009,000
SP2	20	400	3.28	328.30	107,782.20	1,403	43,112,880
BSP2	80	6,400	13.11	48.67	2,368.77	310	15,160,120
SS2/TS	20	400	3.28	135.49	18,356.45	702	7,342,581
HP3/SS3	30	900	4.92	120.15	14,436.02	450	12,992,420
HP2/SP2	20	400	3.28	131.70	17,344.36	818	6,937,746
SS3/HP3	50	2,500	8.20	121.27	14,705.93	994	36,764,820
SS2/HP2	80	6,400	13.11	164.08	26,922.90	943	172,306,600
	610		100.00				879,916,020

### Calculation of Standard Error

$$SE = \sqrt{\frac{\sum (N_s^2 S_{\bar{x}}^2)}{N^2}} = 48.63 \text{ cubic feet/acre}$$

### Calculation of Weighted Population Mean

$$\bar{X} = 980(.0164) + 2808(.0164) + 741(.2787) + 1447(.0636) + 795(.0492) + 1403(.0328) + 310(.1311) + 702(.0328) + 450(.0492) + 818(.0328) + 994(.0820) + 943(.1311)$$

$$\bar{X} = 868.6 \text{ cubic feet/acre}$$

### Calculation of Sampling Error

$$E\% = t \frac{(SE) (100)}{\bar{X}} = \frac{1 (48.63) (100)}{868.6} = 5.6\%$$

Where:

- SE = standard error of mean (overall)
- $\bar{X}$  = overall population mean as estimated by sampling
- N = number of plots in the inventory
- N<sub>s</sub> = number of plots in a type or stratum
- S $\bar{x}$  = standard error of the mean for a type or stratum
- $\sum$  = sum of
- E% = sampling error in percent (overall)
- $\bar{X}_s$  = mean of stratum as estimated by sampling
- t = number of standard deviations

**APPENDIX B**

**Net Volume Per Acre by Timber Type and Size Class**

TIMBER TYPE #1  
Net Volume Per Acre

Cottonwood Sawtimber Medium Stocked (CWS2)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	161	740
Hardwood	<u>1,889</u>	<u>8,051</u>
Subtotal:	2,050	8,791
<u>Live Poletimber Volume</u>		
Spruce	152	
Hardwood	<u>828</u>	
Subtotal:	980	
<u>Dead Poletimber Volume</u>		
Spruce	-	
Hardwood	-	
Subtotal:		
<u>Live Seedling/Sapling Volume</u>		
Spruce	-	
Hardwood	-	
Subtotal		
Total Net Volume Per Acre	<u>3,030</u>	<u>8,791</u>

Total Acreage of Type = 227

\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #2  
Net Volume Per Acre

Cottonwood Poletimber Well Stocked (CWP3)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	64	173
Hardwood	<u>1,352</u>	<u>6,052</u>
Subtotal:	1,416	6,225
<u>Dead Sawlog Volume</u>		
Spruce		
Hardwood		
Subtotal:		
<u>Live Poletimber Volume</u>		
Spruce	46	
Hardwood	<u>2,762</u>	
Subtotal:	2,808	
<u>Live Seedling/Sapling Volume</u>		
Spruce	13	
Hardwood	<u>-</u>	
Subtotal:	13	
Total Net Volume Per Acre	<u>4,237</u>	<u>6,225</u>

Total Acreage of Type = 523

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\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #3  
Net Volume Per Acre

Hardwood Poletimber Well Stocked (HP3)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	404	1,897
Hardwood	<u>181</u>	<u>825</u>
Subtotal:	585	2,722
<u>Dead Sawlog Volume</u>		
Spruce		
Hardwood		
Subtotal:		
<u>Live Poletimber Volume</u>		
Spruce	272	
Hardwood	<u>469</u>	
Subtotal:	741	
<u>Live Seedling/Sapling Volume</u>		
Spruce	24	
Hardwood	<u>120</u>	
Subtotal:	144	
Total Net Volume Per Acre	<u>1,470</u>	<u>2,722</u>

Total Acreage of Type = 4,742

---

\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #4  
Net Volume Per Acre

Hardwood Poletimber Medium Stock (HP2)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	781	3,740
Hardwood	<u>299</u>	<u>1,310</u>
Subtotal:	1,080	5,050
<u>Dead Sawlog Volume</u>		
Spruce		
Hardwood		
Subtotal:		
<u>Live Poletimber Volume</u>		
Spruce	664	
Hardwood	<u>581</u>	
Subtotal:	1,245	
<u>Live Seedling/Sapling Volume</u>		
Spruce	18	
Hardwood	<u>95</u>	
Subtotal:	113	
Total Net Volume Per Acre	<u>2,438</u>	<u>5,050</u>

Total Acreage of Type = 1,958

---

\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #5  
Net Volume Per Acre

White Spruce Sawtimber Well Stocked (SS3)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	2,793	13,610
Hardwood	<u>369</u>	<u>1,636</u>
Subtotal:	3,162	15,246
<u>Dead Sawlog Volume</u>		
Spruce		
Hardwood		
Subtotal:		
<u>Live Poletimber Volume</u>		
Spruce	1,297	
Hardwood	<u>150</u>	
Subtotal:	1,447	
<u>Live Seedling/Sapling Volume</u>		
Spruce	3	
Hardwood	<u>-</u>	
Subtotal:	3	
Total Net Volume Per Acre	<u>4,612</u>	<u>15,246</u>

Total Acreage of Type = 1,433

---

\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #6  
Net Volume Per Acre

White Spruce Sawtimber Medium Stocked (SS2)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	1,763	8,703
Hardwood	<u>192</u>	<u>836</u>
Subtotal:	1,955	9,539
<u>Dead Sawlog Volume</u>		
Spruce	1	69
Hardwood	<u>-</u>	<u>-</u>
Subtotal:	1	69
<u>Live Poletimber Volume</u>		
Spruce	626	
Hardwood	<u>169</u>	
Subtotal:	795	
<u>Live Seedling/Sapling Volume</u>		
Spruce	5	
Hardwood	<u>-</u>	
Subtotal:	5	
Total Net Volume Per Acre	<u>2,756</u>	<u>9,608</u>

Total Acreage of Type = 1,028

---

\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #7  
Net Volume Per Acre

White Spruce Poletimber Medium Stocked (SP2)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	2,835	13,684
Hardwood	<u>-</u>	<u>-</u>
Subtotal:	2,835	13,684
<u>Dead Sawlog Volume</u>		
Spruce	1	51
Hardwood	<u>-</u>	<u>-</u>
Subtotal:	1	51
<u>Live Poletimber Volume</u>		
Spruce	1,133	
Hardwood	<u>270</u>	
Subtotal:	1,403	
<u>Live Seedling/Sapling Volume</u>		
Spruce		
Hardwood		
Subtotal:		
Total Net Volume Per Acre	<u>4,239</u>	<u>13,735</u>

Total Acreage of Type = 563

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\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #8  
Net Volume Per Acre

Black Spruce Poletimber Medium Stocked (BSP2)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	132	638
Hardwood	<u>26</u>	<u>103</u>
Subtotal:	158	741
<u>Dead Sawlog Volume</u>		
Spruce	31	282
Hardwood	<u>14</u>	<u>52</u>
Subtotal:	45	334
<u>Live Poletimber Volume</u>		
Spruce	269	
Hardwood	<u>41</u>	
Subtotal:	310	
<u>Live Seedling/Sapling Volume</u>		
Spruce	122	
Hardwood	<u>16</u>	
Subtotal:	138	
Total Net Volume Per Acre	<u>651</u>	<u>1,075</u>

Total Acreage of Type = 2,562

---

\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #9  
Net Volume Per Acre

White Spruce Sawtimber/Tall Shrub  
Medium Stocked (SS2/TS)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	144	4,490
Hardwood	<u>939</u>	<u>632</u>
Subtotal:	1,083	5,122
<u>Dead Sawlog Volume</u>		
Spruce		
Hardwood		
Subtotal:		
<u>Live Poletimber Volume</u>		
Spruce	526	
Hardwood	<u>176</u>	
Subtotal:	702	
<u>Live Seedling/Sapling Volume</u>		
Spruce	51	
Hardwood	<u>21</u>	
Subtotal:	72	
Total Net Volume Per Acre	<u>1,857</u>	<u>5,122</u>

Total Acreage of Type = 785

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\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #10  
Net Volume Per Acre

Hardwood Poletimber/White Spruce Sawtimber  
Well Stocked (HP3/SS3)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	1,051	5,423
Hardwood	<u>427</u>	<u>1,950</u>
Subtotal:	1,478	7,373
<u>Dead Sawlog Volume</u>		
Spruce		
Hardwood		
Subtotal:		
<u>Live Poletimber Volume</u>		
Spruce	89	
Hardwood	<u>361</u>	
Subtotal:	450	
<u>Live Seedling/Sapling Volume</u>		
Spruce	-	
Hardwood	<u>34</u>	
Subtotal:	34	
Total Net Volume Per Acre	<u>1,962</u>	<u>7,373</u>

Total Acreage of Type = 956

\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #11  
Net Volume Per Acre

Hardwood Poletimber/White Spruce Poletimber  
Medium Stocked (HP2/SP2)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	786	3,908
Hardwood	<u>530</u>	<u>2,433</u>
Subtotal:	1,316	6,341
<u>Dead Sawlog Volume</u>		
Spruce		
Hardwood		
Subtotal:		
<u>Live Poletimber Volume</u>		
Spruce	274	
Hardwood	<u>544</u>	
Subtotal:	818	
<u>Live Seedling/Sapling Volume</u>		
Spruce	66	
Hardwood	<u>68</u>	
Subtotal:	134	
Total Net Volume Per Acre	<u>2,268</u>	<u>6,341</u>

Total Acreage of Type = 705

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\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #12  
Net Volume Per Acre

White Spruce Sawtimber/Hardwood Poletimber  
Well Stocked (SS3/HP3)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	1,314	6,449
Hardwood	<u>362</u>	<u>1,633</u>
Subtotal:	1,676	8,082
<u>Dead Sawlog Volume</u>		
Spruce	-	-
Hardwood	<u>25</u>	<u>110</u>
Subtotal:	25	110
<u>Live Poletimber Volume</u>		
Spruce	476	
Hardwood	<u>518</u>	
Subtotal:	994	
<u>Live Seedling/Sapling Volume</u>		
Spruce	11	
Hardwood	<u>26</u>	
Subtotal:	37	
Total Net Volume Per Acre	<u>2,732</u>	<u>8,192</u>

Total Acreage of Type = 1,358

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\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

TIMBER TYPE #13  
Net Volume Per Acre

White Spruce Sawtimber/Hardwood Poletimber  
Medium Stocked (SS2/HP2)

<u>Live Sawlog Volume</u>	<u>Net Volume/Acre Cubic Feet</u>	<u>Net Volume/Acre Board Feet *</u>
Spruce	1,279	6,168
Hardwood	<u>420</u>	<u>1,907</u>
Subtotal:	1,699	8,075
<u>Dead Sawlog Volume</u>		
Spruce	29	172
Hardwood	<u>1</u>	<u>34</u>
Subtotal:	30	206
<u>Live Poletimber Volume</u>		
Spruce	481	
Hardwood	<u>462</u>	
Subtotal:	943	
<u>Live Seedling/Sapling Volume</u>		
Spruce	4	
Hardwood	<u>28</u>	
Subtotal:	32	
Total Net Volume Per Acre	<u>2,704</u>	<u>8,281</u>

Total Acreage of Type = 3,499

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\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

**APPENDIX C**

**Total Net Volume Per Acre by Timber Type and Size Class**

# TIMBER TYPE #1

Total Net Volume By Species and Size Class For CWS2

Cottonwood Sawtimber Medium Stocked

## TOTAL VOLUME

<u>Species/Size Class</u>	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	36.5	5	168.0	8
Dead Sawtimber				
Live Poletimber	34.5	5	-	-
Live Seedling/Sapling				
Subtotal:	<u>71.0</u>	<u>10</u>	<u>168.0</u>	<u>8</u>
 <u>Hardwood</u>				
Live Sawtimber	428.8	63	1,827.6	92
Dead Sawtimber				
Live Poletimber	188.0	27	-	-
Live Seedling/Sapling				
Subtotal:	<u>616.8</u>	<u>90</u>	<u>1,827.6</u>	<u>92</u>
Total:	<u>687.8</u>	<u>100</u>	<u>1,995.6</u>	<u>100</u>

Total Acreage of Type = 227

\* Includes only trees 10.5" d.b.h. and larger, and uses the Scribner Decimal C log rule.

# TIMBER TYPE #2

Total Net Volume By Species and Size Class For CWP3

Cottonwood Poletimber Well Stocked

TOTAL VOLUME				
<u>Species/Size Class</u>	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	33.5	2	90.5	3
Dead Sawtimber				
Live Poletimber	24.1	1	-	-
Live Seedling/Sapling	6.8	<1	-	-
Subtotal:	<u>64.4</u>	<u>3</u>	<u>90.5</u>	<u>3</u>
 <u>Hardwood</u>				
Live Sawtimber	707.1	32	3,165.2	97
Dead Sawtimber				
Live Poletimber	1,444.5	65	-	-
Live Seedling/Sapling				
Subtotal:	<u>2,151.6</u>	<u>97</u>	<u>3,165.2</u>	<u>97</u>
<hr/>				
Total:	2,216.0	100	3,255.7	100

Total Acreage of Type = 523

\* Includes only trees 10.5" d.b.h. and larger, and uses the Scribner Decimal C log rule.

# TIMBER TYPE #3

## Total Net Volume By Species and Size Class For HP3

### Hardwood Poletimber Well Stocked

<u>Species/Size Class</u>	<u>TOTAL VOLUME</u>			
	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	1,915.8	27	8,995.6	70
Dead Sawtimber				
Live Poletimber	1,289.8	19		
Live Seedling/Sapling	113.8	2		
Subtotal:	3,319.4	48	8,995.6	70
 <u>Hardwood**</u>				
Live Sawtimber	858.3	12	3,912.1	30
Dead Sawtimber				
Live Poletimber	2,224.0	32		
Live Seedling/Sapling	569.0	8		
Subtotal:	3,651.3	52	3,912.1	30
<hr/>				
Total:	6,970.7	100.0	12,907.7	100

Total Acreage of Type = 4,742

\* Includes only trees 10.5" d.b.h. and larger, and uses the Scribner Decimal C log rule.

\*\* Birch comprises 60%, Cottonwood comprises 26% and Aspen comprises 14% of the hardwood volume in cubic feet.

# TIMBER TYPE #4

Total Net Volume By Species and Size Class For HP2

Hardwood Poletimber Medium Stocked

<u>Species/Size Class</u>	TOTAL VOLUME			
	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	1,529.2	32	7,322.9	74
Dead Sawtimber				
Live Poletimber	1,300.1	27		
Live Seedling/Sapling	35.2	1		
Subtotal:	<u>2,864.5</u>	<u>60</u>	<u>7,322.9</u>	<u>74</u>
 <u>Hardwood**</u>				
Live Sawtimber	585.4	12	2,565.0	26
Dead Sawtimber				
Live Poletimber	1,137.6	24		
Live Seedling/Sapling	186.0	4		
Subtotal:	<u>1,909.0</u>	<u>40</u>	<u>2,565.0</u>	<u>26</u>
<hr/>				
Total	4,773.5	100	9,887.9	100

Total Acreage of Type = 1,958

\* Includes only trees 10.5" d.b.h. and larger, and uses the Scribner Decimal C log rule.

\*\* Birch comprises 98%, of the total hardwood volume in cubic feet.

# TIMBER TYPE #5

Total Net Volume By Species and Size Class For SS3

White Spruce Sawtimber Well Stocked

<u>Species/Size Class</u>	TOTAL VOLUME			
	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	4,002.4	61	19,503.1	89
Dead Sawtimber				
Live Poletimber	1,858.6	28		
Live Seedling/Sapling	4.3			
Subtotal:	5,865.3	89	19,503.1	89
<u>Hardwood</u>				
Live Sawtimber	528.8	8	2,344.4	11
Dead Sawtimber				
Live Poletimber	214.9	3		
Live Seedling/Sapling				
Subtotal:	743.7	11	2,344.4	11
Total	6,609.0	100	21,847.5	100

Total Acreage of Type = 1,433

\* Includes only trees 10.5" d.b.h. and larger, and uses the Scribner Decimal C log rule.

# TIMBER TYPE #6

## Total Net Volume By Species and Size Class For SS2

### White Spruce Sawtimber Medium Stocked

<u>Species/Size Class</u>	TOTAL VOLUME			
	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	1,812.3	64	8,946.7	90
Dead Sawtimber	1.0	<1	70.9	1
Live Poletimber	643.5	23		
Live Seedling/Sapling	5.1	<1		
Subtotal:	2,461.9	87	9,017.6	91
<u>Hardwood</u>				
Live Sawtimber	197.4	7	859.4	9
Dead Sawtimber				
Live Poletimber	173.7	6		
Live Seedling/Sapling				
Subtotal:	371.1	13	859.4	9
Total	2,833.0	100	9,877.0	100

Total Acreage of Type = 1,028

\* Includes only trees 10.5" d.b.h. and larger, and uses the Scribner Decimal C log rule.

# TIMBER TYPE #7

Total Net Volume By Species and Size Class For SP2

White Spruce Poletimber Medium Stocked

<u>Species/Size Class</u>	TOTAL VOLUME			
	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	1,595.6	67	7,703.7	100
Dead Sawtimber	.5	<1	28.6	<1
Live Poletimber	637.6	27		
Live Seedling/Sapling	-			
Subtotal:	<u>2,233.7</u>	<u>94</u>	<u>7,732.3</u>	<u>100</u>
 <u>Hardwood</u>				
Live Sawtimber				
Dead Sawtimber				
Live Poletimber	152	6		
Live Seedling/Sapling				
Subtotal:	<u>152</u>	<u>6</u>	<u>0</u>	<u>0</u>
Total	<u>2,385.7</u>	<u>100</u>	<u>7,732.3</u>	<u>100</u>

Total Acreage of Type = 563

\* Includes only trees 10.5" d.b.h. and larger, and uses the Scribner Decimal C log rule.

# TIMBER TYPE #8

## Total Net Volume By Species and Size Class For BSP2

### Black Spruce Poletimber Medium Stocked

<u>Species/Size Class</u>	TOTAL VOLUME			
	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	338.2	20	1,634.6	59
Dead Sawtimber	79.4	5	722.5	26
Live Poletimber	689.2	41		
Live Seedling/Sapling	312.6	19		
Subtotal:	<u>1,419.4</u>	<u>85</u>	<u>2,357.1</u>	<u>85</u>
 <u>Hardwood</u>				
Live Sawtimber	66.6	4	263.9	10
Dead Sawtimber	35.9	2	133.2	5
Live Poletimber	105.0	6		
Live Seedling/Sapling	41.0	3		
Subtotal:	<u>248.5</u>	<u>15</u>	<u>397.1</u>	<u>15</u>
Total	<u>1,667.9</u>	<u>100</u>	<u>2,754.2</u>	<u>100</u>

Total Acreage of Type = 2,562

\* Includes only trees 10.5" d.b.h. and larger, and uses the Scribner Decimal C log rule.

# TIMBER TYPE #9

Total Net Volume By Species and Size Class For SS2/TS

White Spruce Sawtimber Tall Shrub Medium Stocked

<u>Species/Size Class</u>	TOTAL VOLUME			
	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	113.0	8	3,524.6	88
Dead Sawtimber				
Live Poletimber	412.9	28	-	
Live Seedling/Sapling	40.0	3		
Subtotal:	<u>565.9</u>	<u>39</u>	<u>3,524.6</u>	<u>88</u>
 <u>Hardwood</u>				
Live Sawtimber	737.0	51	496.0	12
Dead Sawtimber				
Live Poletimber	138.2	9	-	
Live Seedling/Sapling	16.5	1		
Subtotal:	<u>891.7</u>	<u>61</u>	<u>496.0</u>	<u>12</u>
Total	<u>1,457.6</u>	<u>100</u>	<u>4,020.6</u>	<u>100</u>

Total Acreage of Type = 785

\* Includes only trees 10.5" d.b.h. and larger, and uses the Scribner Decimal C log rule.

# TIMBER TYPE #10

## Total Net Volume By Species and Size Class For HP3/SS3

Hardwood Poletimber/White Spruce Sawtimber  
Well Stocked

### TOTAL VOLUME

<u>Species/Size Class</u>	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	1,004.7	54	5,184.4	74
Dead Sawtimber				
Live Poletimber	85.0	4		
Live Seedling/Sapling				
Subtotal:	<u>1,089.7</u>	<u>58</u>	<u>5,184.4</u>	<u>74</u>
 <u>Hardwood**</u>				
Live Sawtimber	408.2	22	1,864.2	26
Dead Sawtimber				
Live Poletimber	345.1	18		
Live Seedling/Sapling	32.5	2		
Subtotal:	<u>785.8</u>	<u>42</u>	<u>1,864.2</u>	<u>26</u>
Total	1,875.5	100	7,048.6	100

Total Acreage of Type = 956

\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

\*\* Birch comprises 100%, of the total cubic foot volume.

# TIMBER TYPE #11

Total Net Volume By Species and Size Class For HP2/SP2

Hardwood Poletimber/White Spruce Poletimber  
Medium Stocked

## TOTAL VOLUME

<u>Species/Size Class</u>	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	554.1	35	2,755.1	62
Dead Sawtimber				
Live Poletimber	193.2	12		
Live Seedling/Sapling	46.5	3		
Subtotal:	<u>793.8</u>	<u>50</u>	<u>2,755.1</u>	<u>62</u>
 <u>Hardwood**</u>				
Live Sawtimber	373.6	23	1,715.3	38
Dead Sawtimber				
Live Poletimber	383.5	24		
Live Seedling/Sapling	47.9	3		
Subtotal:	<u>805.0</u>	<u>50</u>	<u>1,715.3</u>	<u>38</u>
Total	1,598.8	100	4,470.4	100

Total Acreage of Type = 705

\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

\*\* Birch comprises 100 % of the total cubic foot volume.

# TIMBER TYPE #12

Total Net Volume By Species and Size Class For SS3/HP3

White Spruce Sawtimber/Hardwood Poletimber  
Well Stocked

## TOTAL VOLUME

<u>Species/Size Class</u>	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	1,784.4	48	8,757.7	79
Dead Sawtimber				
Live Poletimber	646.4	18		
Live Seedling/Sapling	14.9	<1		
Subtotal:	2,445.7	66	8,757.7	79
 <u>Hardwood**</u>				
Live Sawtimber	491.6	13	2,217.6	20
Dead Sawtimber	33.9	1	149.4	1
Live Poletimber	703.4	19		
Live Seedling/Sapling	35.3	1		
Subtotal:	1,264.2	34	2,367.0	21
<hr/>				
Total	3,709.9	100	11,124.7	100

Total Acreage of Type = 1,358

\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

\*\* Birch comprises 92% and Cottonwood comprises 8% of the total  
cubic foot volume.

# TIMBER TYPE #13

## Total Net Volume By Species and Size Class For SS2/HP2

White Spruce Sawtimber/Hardwood Poletimber  
Medium Stocked

### TOTAL VOLUME

<u>Species/Size Class</u>	<u>Thousand Cubic Feet</u>	<u>%</u>	<u>Thousand Board Feet*</u>	<u>%</u>
<u>Spruce</u>				
Live Sawtimber	4,475.2	47	21,581.9	75
Dead Sawtimber	101.5	1	602.2	2
Live Poletimber	1,683.0	18		
Live Seedling/Sapling	14.0	<1		
Subtotal:	6,273.7	66	22,184.1	77

### Hardwood\*\*

Live Sawtimber	1,469.6	16	6,672.1	23
Dead Sawtimber	3.5	<1	118.9	<1
Live Poletimber	1,616.5	17		
Live Seedling/Sapling	98.0	1		
Subtotal:	3,187.6	34	6,791.0	23

Total	9,461.3	100	28,975.1	100
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Total Acreage of Type = 3,499

\* Includes only trees 10.5" d.b.h. and larger, and uses the  
Scribner Decimal C log rule.

\*\* Birch comprises 100 % of the total cubic foot volume.

**APPENDIX D**  
**Stand Tables**

TIMBER TYPE 5  
 White Spruce Sawtimber, Well Stocked (SS3)  
 Number Of Live Trees Per Acre  
 By Diameter And Height Class  
 (White Spruce Sawlog Component Only)

Diameter Class (Inches)	Height Class (Feet)										Total	Percent
	40	50	60	70	80	90	100	110	120			
12			6	4	1						11	55
14		1	1	3							5	25
16				2	1						3	15
18				1							1	5
20												
22												
Total		1	7	10	2						20	100
Percent		5	35	50	10						100	

TIMBER TYPE 6  
 White Spruce Sawtimber, Medium Stocked (SS2)  
 Number Of Live Trees Per Acre  
 By Diameter And Height Class  
 (White Spruce Sawlog Component Only)

Diameter Class (Inches)	Height Class (Feet)										Total	Percent
	40	50	60	70	80	90	100	110	120			
12		2	6	7	2						17	49
14			1	9	3						13	37
16			1			1					2	6
18						3					3	8
20												
22												
Total		2	8	16	5	4					35	100
Percent		6	23	46	14	11					100	

TIMBER TYPE 7  
 White Spruce Poletimber, Medium Stocked (SP2)  
 Number Of Live Trees Per Acre  
 By Diameter And Height Class  
 (White Spruce Sawlog Component Only)

Diameter Class (Inches)	Height Class (Feet)										Total	Percent
	40	50	60	70	80	90	100	110	120			
12		5	10	6	11						32	60
14					4	4					8	15
16			3		8						11	21
18					2						2	4
20												
22												
Total		5	13	6	25	4					53	100
Percent		10	24	11	47	8					100	

TIMBER TYPE 9  
 Spruce Sawtimber/Tall Scrub, Medium Stocked  
 Number Of Live Trees Per Acre  
 By Diameter And Height Class  
 (White Spruce Sawlog Component Only)

Diameter Class (Inches)	Height Class (Feet)										Total	Percent
	40	50	60	70	80	90	100	110	120			
12			9	10							19	53
14				8	2						10	28
16				4							4	11
18												
				1	1	1					3	8
22												
Total			9	23	3	1					36	100
Percent			25	64	8	3					100	

TIMBER TYPE 10  
 Hardwood Poletimber/Spruce Sawtimber, Well Stocked (HP3/SS3)  
 Number Of Live Trees Per Acre  
 By Diameter And Height Class  
 (White Spruce Sawlog Component Only)

Diameter Class (Inches)	Height Class (Feet)										Total	Percent
	40	50	60	70	80	90	100	110	120			
12			3	2							5	25
14				1	1						2	10
16				4	1						5	25
18												
20					2	3					5	25
22						1					1	5
24						1					1	5
26						1					1	5
Total			3	7	4	6					20	100
Percent			15	35	20	30					100	

TIMBER TYPE 12  
 White Spruce Sawtimber/Hardwood Poletimber, Well Stocked (SS3/HP3)  
 Number Of Live Trees Per Acre  
 By Diameter And Height Class  
 (White Spruce Sawlog Component Only)

Diameter Class (Inches)	Height Class (Feet)										Total	Percent
	40	50	60	70	80	90	100	110	120			
12			2	7	4						13	45
14				3	6						9	31
16				1	2	1					4	14
18				1	1	1					3	10
20												
22												
Total			2	12	13	2					29	100
Percent			7	41	45	7					100	

TIMBER TYPE 13  
 White Spruce Sawtimber/Hardwood Poletimber,  
 Medium Stocked (SS2/HP2)  
 Number Of Live Trees Per Acre  
 By Diameter And Height Class  
 (White Spruce Sawlog Component Only)

Diameter Class (Inches)	Height Class (Feet)										Total	Percent
	40	50	60	70	80	90	100	110	120			
12	2	3	2	15	5						27	57
14			2	8	2	1					13	28
16				1	3						4	9
18					1	2					3	6
20												
22												
Total	2	3	4	24	11	3					47	100
Percent	4	6	9	51	24	6					100	

**APPENDIX E**

**White Spruce Growth Information**

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## White Spruce Growth Information

Stand Number	Diameter (inches)	Total Height (feet)	Age (years)	10-Year growth (1/20 inch)
1	19.2	90	145	--
	14.3	79	99	36
30	5.4	35	112	10
	8.3	50	178	6
	10.4	55	128	8
110	9.1	53	106	4
	9.6	58	85	10
	19.4	92	229	8
272	14.0	80	275	2
	9.0	45	150	4
290	12.5	76	138	10
	11.8	65	103	20
	13.2	86	99	6
325	7.8	54	120	6
	14.7	67	210	14
111	12.6	77	123	4
	14.7	77	149	2
	5.7	42	49	16
351	5.0	30	97	4
55	15.4	75	122	8
	11.8	65	96	18
37	7.6	57	66	6
38	7.1	48	159	8
64	11.8	76	136	4
	12.0	76	84	10
101	13.6	72	126	20
	12.5	75	125	18
	9.8	54	97	16
303	6.2	41	46	10
12	10.0	60	129	6
	9.0	55	111	6
	16.0	105	106	8
45	11.0	70	160	4
	10.5	65	120	8
	10.4	60	160	4
119	16.2	95	165	14
	14.6	90	132	12
	17.0	96	202	4
	10.8	62	76	22
	10.6	81	120	4

<u>Stand Number</u>	<u>Diameter (inches)</u>	<u>Total Height (feet)</u>	<u>Age (years)</u>	<u>10-year growth (1/20 inch)</u>
292	13.1	74	114	4
	13.6	83	133	6
	14.2	92	98	8
	7.5	55	124	4
16	12.9	67	220	6
	15.2	66	250	4
29	7.5	50	147	6
53	4.0	45	49	2
	5.7	45	32	12
124	11.2	45	150	8
	9.4	56	92	8
	9.2	64	109	18
	12.0	69	193	6
125	5.0	36	60	24
130	10.6	65	84	8
	9.5	65	113	4
	12.3	65	92	4
241	5.1	29	32	24
	9.1	46	92	12
	10.8	50	81	8
244	9.8	63	117	6
	10.4	70	159	4
246	13.3	79	204	8
	13.3	62	162	6
284	10.0	56	250	12
	10.0	56	250	2
376	12.5	95	227	4
107	11.8	66	115	8
234	10.5	53	195	6
87	14.3	74	107	4
	10.4	64	220	2
100	18.2	75	95	18
	12.5	70	175	4
67	12.0	74	250	8
	12.3	74	95	22
75	14.5	68	89	14
	12.2	79	115	8
88	13.0	69	87	10
	13.5	78	102	8
91	10.9	59	67	12
	9.9	61	135	6
97	15.4	97	218	16
	13.3	74	98	10
	14.5	79	94	16
	15.8	77	154	6
	15.5	82	307	6
	11.1	69	148	12

Stand Number	Diameter (inches)	Total Height (feet)	Age (years)	10-year growth (1/20 inch)
384	12.0	74	130	12
	9.7	57	112	12
76	17.6	86	78	20
	16.5	97	114	8
	13.6	85	190	6
96	10.4	66	130	6
98	14.5	78	116	14
	16.4	79	98	8
115	10.2	64	251	4
	9.3	69	197	12
	11.0	76	70	10
330	12.3	76	232	4
	10.9	68	210	6
	8.9	61	150	4

#### SUMMARY

	<u>Arithmetic Average</u>	<u>Range</u>
Diameter (inches)	11.6	4.0 - 19.4
Total Height (feet)	67.5	29 - 105
Age (years)	135.8	32 - 307
Radial Growth (1/20)	9.1	2 - 36