

# Hardwood Inventory 2005

## Nass and Cranberry TSA

Maps: 104A005, 103P046, 103P047, 103P057  
103P058, 103P059, 103P068, 103P095

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**Table of Contents**

**INTRODUCTION..... 4**

**OBJECTIVES ..... 5**

**SCOPE..... 6**

**METHODOLOGY..... 6**

**RESULTS..... 7**

Field Work ..... 7

Nass TSA ..... 9

    Area ..... 9

    Volume ..... 11

    Volume Calibrations..... 13

Nass TSA Combined Data 2004-2005 ..... 14

    Area ..... 14

    Volume ..... 15

Cranberry TSA ..... 16

    Area ..... 16

    Volume ..... 18

    Volume Calibrations..... 19

**RECOMMENDATIONS..... 20**

**CONCLUSIONS..... 20**

**APPENDICES..... 23**

    Appendix 1: Volume Uncorrected vs. Corrected by Site Index and Species ..... 23

    Appendix 2: Volume Uncorrected vs. Corrected by Age Class and Species ..... 23

    Appendix 3: Photographs of destructive sampling ..... 23

    Appendix 4: Polygon shape and size compared with 1975 FC1 ..... 23

    Appendix 5: CD-ROM containing all data collected in this project ..... 23

    Appendix 6: Project photographs..... 23

    Appendix 7: Explanation of Field Calibration Factor ..... 23

    Appendix 8: Tables from field notes..... 23

    Appendix 9: Table of polygons and attributes ..... 23

    Appendix 10: Scan showing completed mapsheets 2004-2005 ..... 23

**Figures and Tables**

Figure A Project Location ..... 4  
Figure B Total vs. Available Area by Leading Species – Nass TSA 2005..... 9  
Figure C Area by Site Index Range – Nass TSA 2005 ..... 10  
Figure D Leading Species by Age Class – Nass TSA 2005 ..... 11  
Figure E Volume Distribution – Nass TSA 2005 ..... 11  
Figure F Available Volume by Site Index Range – Nass TSA 2005..... 12  
Figure G Development of Calibration Factor - Nass TSA 2005..... 13  
Figure H Total vs. Available Area by Leading Species – Nass TSA 2004-2005 ..... 14  
Figure I Combined Total and Available Volumes – Nass TSA 2004-2005..... 15  
Figure J Total vs. Available Area by Leading Species - Cranberry TSA ..... 16  
Figure K Available Area by Site Index - Cranberry TSA..... 17  
Figure L Area by Leading Species by Age Class - Cranberry TSA ..... 17  
Figure M Volume Comparisons - Cranberry TSA ..... 18  
Figure N Available Volume by Site Index - Cranberry TSA..... 19  
Figure O Development of Calibration Factor - Cranberry TSA ..... 19  
Figure P Combined Nass/Cranberry TSA Volumes ..... 21

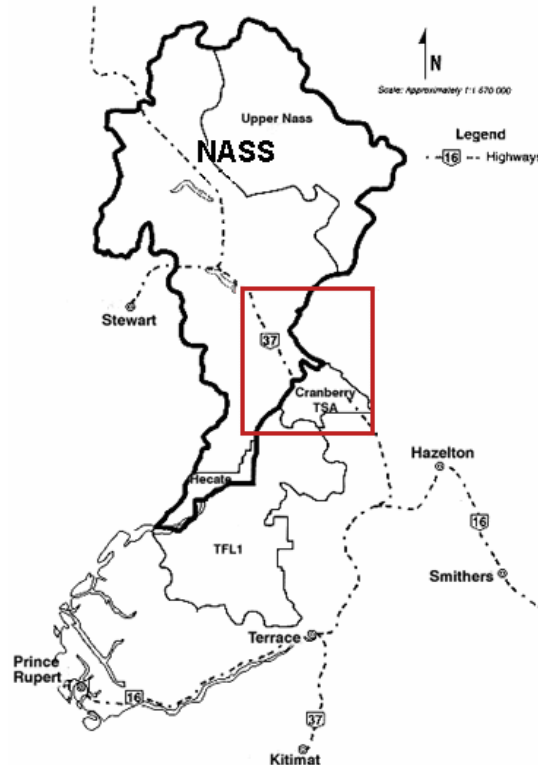
Table 1 Total and Available Area – Nass TSA 2005..... 10  
Table 2 Volume Comparisons – Nass TSA 2005 ..... 12  
Table 3 Total and Available Area – Nass TSA 2004-2005 ..... 14  
Table 4 Combined Volume Comparisons – Nass TSA 2004-2005 ..... 15  
Table 5 Total and Available Area - Cranberry TSA..... 16  
Table 6 Total and Available Volumes with Sawlog Content - Cranberry TSA..... 18  
Table 7 Combined Nass/Cranberry TSA Volumes..... 21

## Introduction

Local hardwood stands within the Kalum and Kispiox Forest Districts were not properly represented in both recent Timber Supply Review I and II simply because existing forest inventory data coming from forest cover maps inadequately shows deciduous stands. The reason for this situation is that when the 1974 inventory was undertaken priority was given to the delineation of conifer stands. Consequently, deciduous stands were poorly identified and often labeled as non-commercial or non-productive.

In March 2004 a hardwood inventory was completed for 3 mapsheets in the Nass Timber Supply Area. The project focused on the delineation of deciduous stands and compared this information with existing forest cover maps. The process gathered information about stand attributes, wood quality and the distribution of deciduous polygons on 1: 20 000 forest cover maps. This newly created deciduous inventory clearly showed the extent of discrepancies with existing FC1 and supplied information about deciduous locations and estimated available volumes. The project was well received by both industry and government and will be used in future management decisions governing deciduous resource utilization in the region.

The figure below illustrates the general location where the inventory was performed.



**Figure A Project Location**

Hardwood Inventory 2004 identified an available volume of 0.7 million cubic meters of deciduous timber along with 0.4 million cubic meters of available coniferous volume. This confirms that a large number of conifer leading polygons have a significant deciduous tree component.

This project is a continuation of the 2004 initiative. Eight 1:20 000 forest cover maps were selected to complete the hardwood inventory of the Nass and Cranberry Timber Supply Areas. The 2004 inventory concluded that there is a sense of urgency involved, because most of the stands found are already mature and over-mature; that the resource must be taken advantage of soon or lost.

There are plans underway to continue this inventory for the Kispiox TSA where the bulk of hardwood stands are located. There is a minimum of 23 mapsheets with heavy deciduous content within the Kispiox TSA.

## Objectives

The objective of this 2005 hardwood inventory is to obtain current information about hardwood stand occurrence across eight mapsheets. Two mapsheets are located within the Nass Timber Supply Area and the other six are located within the Cranberry Timber



Supply Area. This will complete the inventory across the most populous deciduous mapsheets and conclude the hardwood inventory for both timber supply areas. This report and the attached maps will show where deciduous stands are present, the stand attributes, average estimated volumes, wood quality and the number of hectares classified as available for harvest.

## Scope

The 2004 hardwood inventory selected 5 mapsheets from the Nass Timber Supply Area as containing the most deciduous stands. However, because of funding constraints only three mapsheets were completed in that project. The remaining two Nass TSA mapsheets, and six mapsheets within the Cranberry TSA form the basis for Hardwood Inventory 2005 and will conclude the hardwood inventory for both Timber Supply Areas. The mapsheets chosen in the Cranberry TSA likewise represent the most promising for hardwood management activities.

This inventory includes cruise plots and destructive field sampling of selected trees along with newly created maps and a database describing the polygons. Findings are presented separately and summarized for each TSA.

## Methodology

Identification of deciduous stands on existing FC1 maps. These maps are based on information originally collected in 1975. Using this information, we decided to color code deciduous polygons and the total area was calculated per mapsheet. All polygons containing a deciduous component greater than 20% were selected.

Initial delineation of deciduous polygons was done to form a new layer. The current project used the most recent colour hardcopy photography at a scale of 1:17 000 (1994) for the six mapsheets within the Cranberry TSA. In addition, scanned black and white 1:35 000 images from TRIM II (2000) were used for the two mapsheets in the Nass TSA. All applicable images were analyzed using 3D computer technology to produce the new layer as Microstation (dgn) files.

On maps where scanned images were not available we performed the delineation of deciduous polygons directly on the hard copy photographs. Further, all photographs were referenced and all delineated polygons were digitized using the latest mono-restitution technology.

The design of the field sampling plan was made during the initial delineation of the polygons. Some of the locations were changed during field sampling stage, mostly due to lack of access resulting from road deactivations, missing bridges etc. As noted above, the latest available aerial photography for the study area is already ten years out of date.

Fieldwork included the establishment of cruise plots and destructive sampling of selected trees was performed in order to examine wood quality and establish calibration ratios for the estimation of average sawlog content.

Final delineation of polygons and estimation of attributes was performed by a certified Vegetation Resource Inventory classifier.

In addition to the 1:20 000 scale map showing the 2005 inventory a second map was produced at 1:40 000 which shows both the findings from Hardwood Inventory 2004 and Hardwood Inventory 2005 in order to better represent the extent of the deciduous occurrence within both timber supply areas.

A comprehensive spreadsheet of the data was developed for calculations and future reference. In addition a PowerPoint presentation was created which presents the conclusions and explains the digital technology used in the project.

## Results

### *Field Work*

It was decided to establish 36 cruise sample plots. Numerous informal observations were obtained with the intent of gaining more information for the classification stage. The informal observations regarding stand attributes were recorded on maps and photos. All the original collected notes were kept for further reference.

<b>Number of plots</b>	<b>Mapsheet</b>
8	104A005
7	103P095
5	103P057
2	103P046
1	103P058
1	103P047
7	103P059
5	103P068
<b>36</b>	<b>8</b>

More cruise plots were originally planned for mapsheets 103P058, 103P046, 103P047, but the lack of passable roads made these areas generally inaccessible by vehicle.

All sample plot locations were selected in order to sample the greatest variety of deciduous stands spread throughout the eight mapsheets. All ground sample plots were established in treed polygons, which were chosen to provide data for the widest variety of site indexes possible. Overall, in this project 1 “XG” was established for every 24 polygons. This is approximately five times more intensive than what is normally used in the production of forest cover inventories, which uses on average 1 “XG” per 125 polygons.

Measurements were later incorporated into tables for calculating volumes and sawlog content factors. The information collected by cruisers included a tally of stem by species, diameter, age, height, density (stems/ha), basal area and average estimation of sawlog content for the species present. Special attention was given to estimate the opportunities for harvesting. Later these comments from the field, along with estimations from analyzing images on many different scales, would be used to determine the total harvestable area for each polygon.

The sample plots were established during the fall of 2004. Destructive sampling was carried out at the same time in order to calibrate average estimated sawlog content. A total of 57 trees representing most leading species were cut, scaled and graded for sawlog content on 36 established plots. Selected trees were felled, sectioned, measured and



graded. On each sample plot the most representative trees within the plot were chosen except those that could not be felled for reasons of safety. Trees were scaled to close utilization standards from the stump (30 cm height) and top (10 cm diameter). A reduction was made to the diameter of stump height for butt flare where warranted. The photos were taken during the field sampling and show representative cross sections (see Appendix 3).



Field data original tally cards from both cruise sample plots and destructive sampling of selected trees were kept for further reference along with all field calculations, working papers and representative cross sections of destructive samples.

Findings from the plots and all informal ground observations regarding stand attributes collected during each phase of fieldwork were used for final delineation of polygons and estimation of attributes and applied to the entire project.

## Nass TSA

The two mapsheets included in this 2005 inventory are those that were dropped from the 2004 inventory, because of budget constraints. These are 104A005 and 103P095, which are the most northern of the 5 mapsheets covering the area East of Meziadin Lake and South of Orenda Camp along Highway 37.

### Area

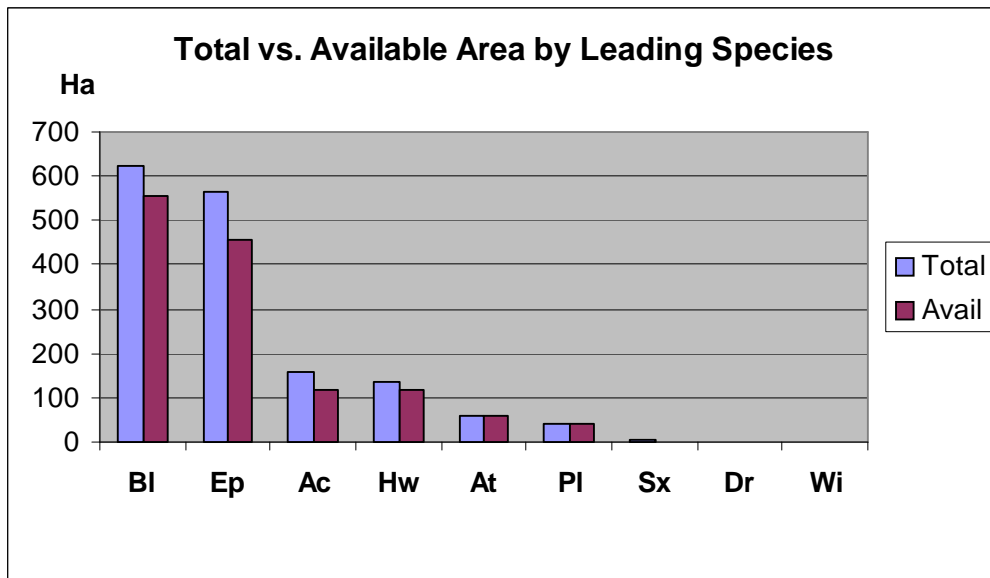


Figure B Total vs. Available Area by Leading Species – Nass TSA 2005

It was found that leading species occupy a total of 1,581 ha. This number was divided among seven leading species. Figure A illustrates that the most common hardwood leading species is Paper Birch (Ep) with 563 hectares, followed by Black Cottonwood (Ac) 159 ha and Trembling Aspen (At) 57 ha. The most popular coniferous species were Subalpine Fir (BI) 621 ha followed by Western Hemlock (Hw) 135, Lodgepole Pine (PI) 43 ha and Spruce (Sx) 3 ha. Some polygons leading by coniferous species (BI, Hw, PI, Sx) are shown in this figure, because they contain a significant percentage of deciduous species (minimum 20%).

Species	Total ha.	Available ha.	% Available
Bl	621	556	90
Ep	563	456	81
Ac	159	116	73
Hw	135	117	86
At	57	57	100
Pl	43	43	100
Sx	3	1.46	50
Dr	0	0	0
Wi	0	0	0
	<b>1581</b>	<b>1346</b>	

Table 1 Total and Available Area – Nass TSA 2005

Estimation of the available area for harvest was based on an analysis of the polygon’s geographic location, stand attributes and whether or not they fell into environmentally sensitive designations or into riparian management areas.

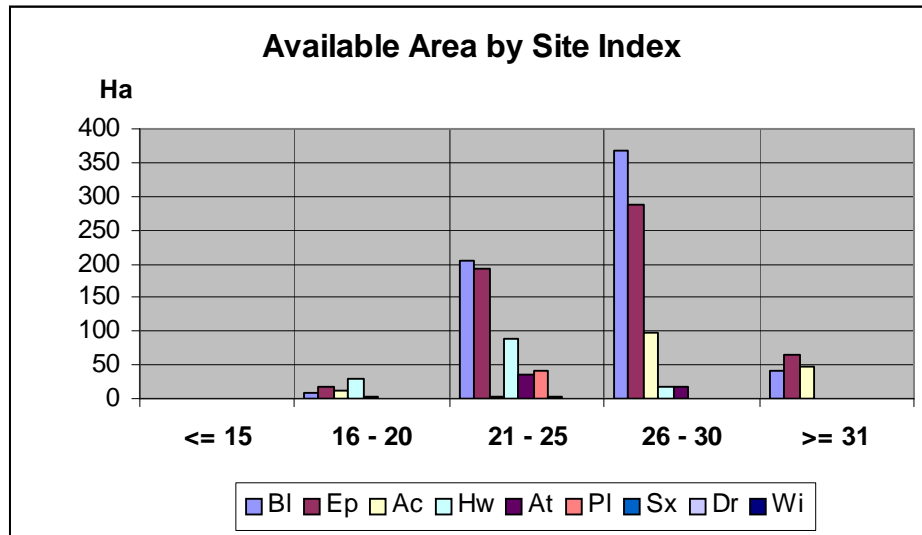


Figure C Area by Site Index Range – Nass TSA 2005

Figure C illustrates the distribution site indexes by hectare, which are occupied by leading species. It becomes evident that the majority of the delineated polygons fall into four site index classes 16 – 20, 21 – 25, 26-30 and >31. Most poor sites are located on West aspect slopes along Highway 37. Good and medium sites are predominantly located along the Nass River. These sites are primarily represented by Black Cottonwood.

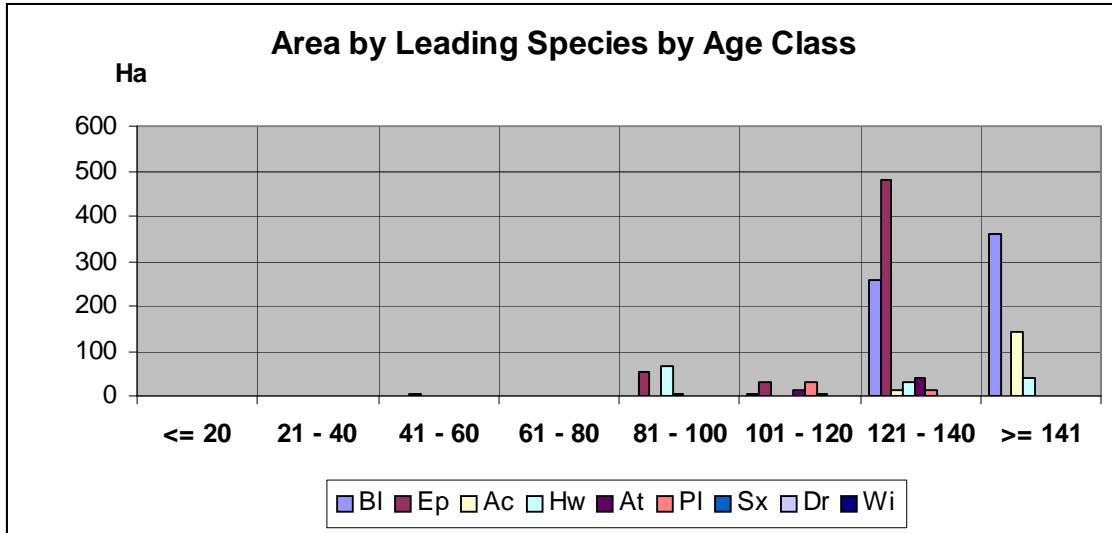


Figure D Leading Species by Age Class – Nass TSA 2005

Figure D illustrates the distribution of area by leading species according to their age class. It was found that the majority of the stands in the project area were within age classes 121-140 and >141. This distribution is consistent with the findings published in Hardwood Inventory 2004.

### Volume

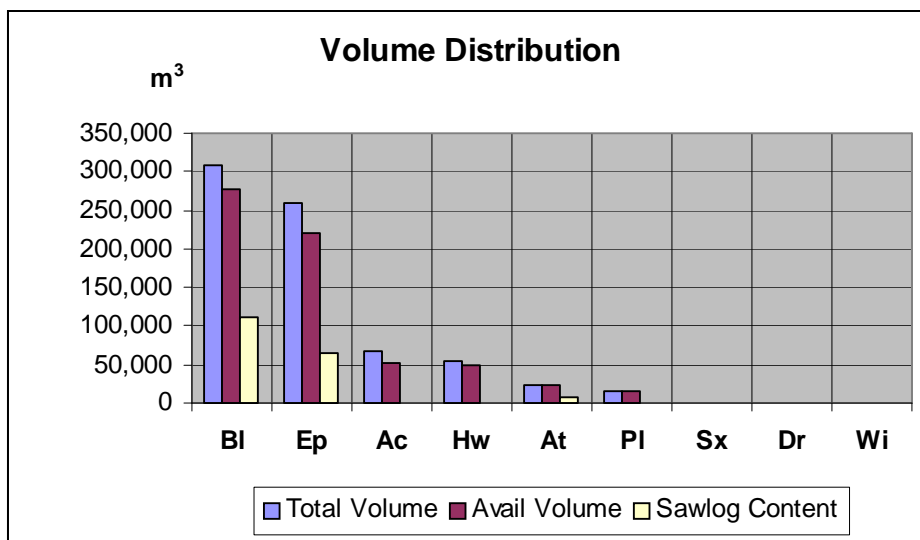


Figure E Volume Distribution – Nass TSA 2005

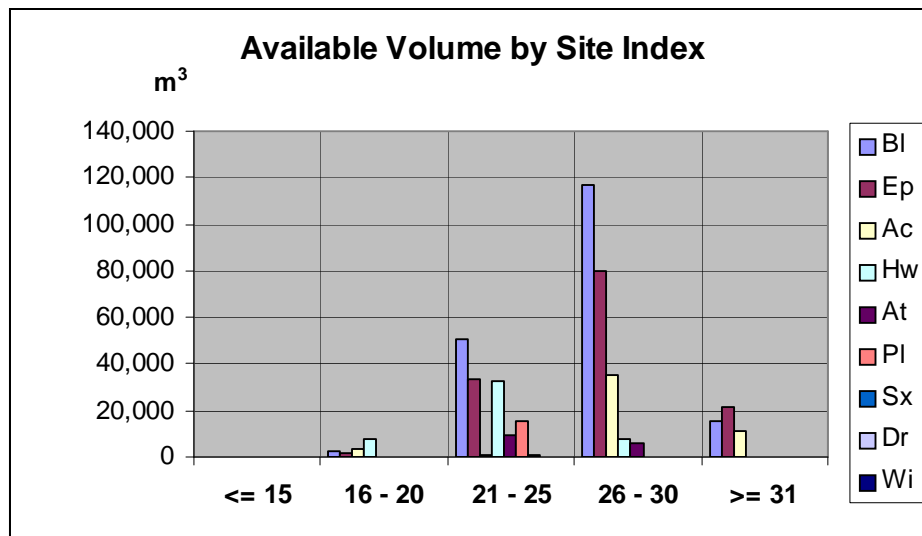
Figure E illustrates calculated total volumes. These volumes were calculated according to the available area derived as per Table 1 using the area of the polygon x m<sup>3</sup>/ha. Table 2

below shows the total vs. available volume comparisons for each species and their sawlog content.

	Total Volume	Avail Volume	Sawlog Content
<b>Bl</b>	307,369	276,198	110,479
<b>Ep</b>	260,428	219,936	64,419
<b>Ac</b>	67,008	50,632	0
<b>Hw</b>	55,601	48,345	0
<b>At</b>	22,750	22,750	7,963
<b>Pl</b>	15,259	15,259	0
<b>Sx</b>	908	454	363
<b>Total:</b>	<b>729,323</b>	<b>633,575</b>	<b>183,224</b>

**Table 2 Volume Comparisons – Nass TSA 2005**

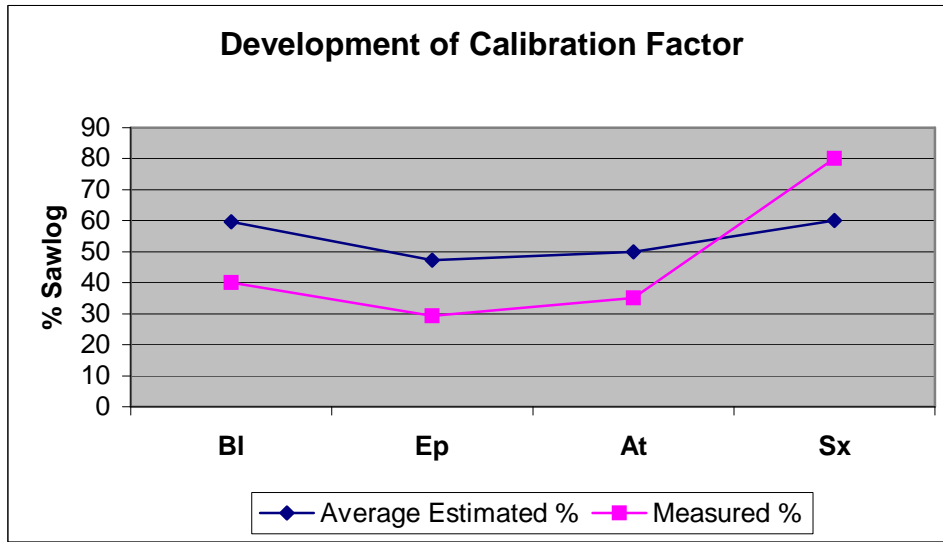
Table 2 shows 633,575 m<sup>3</sup> available for harvest of which we may expect 183,224 m<sup>3</sup> of sawlog content. It is worthwhile noting that the majority of the stands in the project area are mature and over-mature, so the available volume and quality of the wood will be deteriorating rapidly over the next decades.



**Figure F Available Volume by Site Index Range – Nass TSA 2005**

Figure F illustrates the volume distribution by site index for each species. The most volume is located in site index 26-30. This trend is consistent with the area distribution found in Figure C. Aspen represents the bulk of the available volume. A photo displaying a characteristic stand from this site index (26-30) is included in Appendix 6.

## Volume Calibrations



	Factor
At	0.70
Ep	0.62
BI	0.67
Sx	1.33

Figure G Development of Calibration Factor - Nass TSA 2005

Figure G illustrates development of the calibration factor for percent of sawlog for each measured species. Estimations were made during the cruising phase for each leading species. These estimates were compared with the findings from destructive sampling and obtained numerical differences were used to develop the factor. This method allowed us to more accurately calibrate average estimates of sawlog content for each species. See Appendix 7 for a detailed explanation of estimations and field calibration.



## Nass TSA Combined Data 2004-2005

This section shows the combined data from both inventories. Five mapsheets were completed in the Nass Timber Supply Area 104A005, 103P095, 103P086, 103P076, 103P067.

### Area

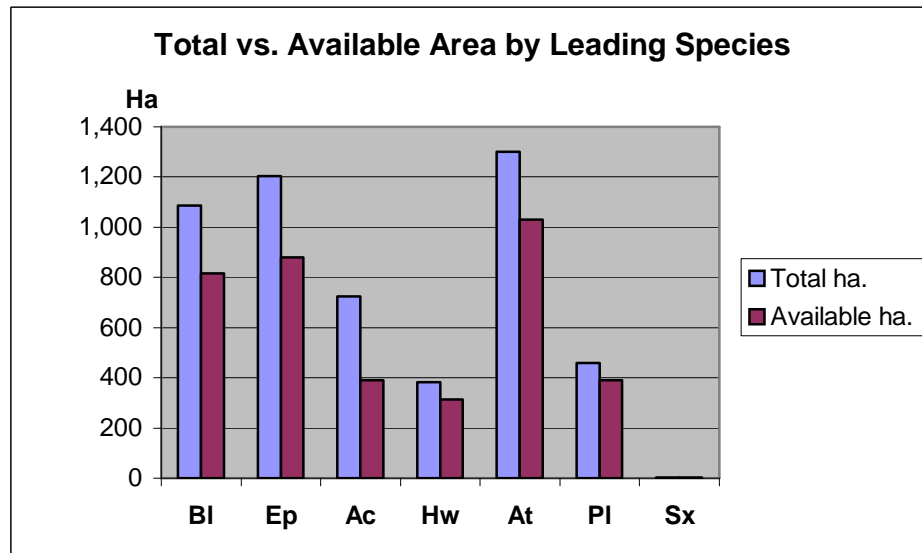


Figure H Total vs. Available Area by Leading Species – Nass TSA 2004-2005

It was found that leading species occupy a total of 5,159 ha. This number was divided among seven leading species. Figure H illustrates that the most common hardwood leading species is Trembling Aspen (At) 1,300 ha, followed by Paper Birch (Ep) with 1,204 ha, Subalpine Fir (BI) 1,087 ha, Black Cottonwood (Ac) 723 ha, Lodgepole Pine (PI) 460 ha, Western Hemlock (Hw) 383 ha and Spruce (Sx) 3 hectares. Again, some polygons leading by coniferous species (BI, Hw, PI, Sx) are shown in this figure, because they contain a significant percentage of deciduous species (minimum 20%).

	Total ha.	Available ha.
<b>At</b>	1,300	1,029
<b>Ep</b>	1,204	879
<b>BI</b>	1,087	817
<b>Ac</b>	723	390
<b>PI</b>	460	390
<b>Hw</b>	383	315
<b>Sx</b>	3	1
<b>Totals:</b>	<b>5,159</b>	<b>3,821</b>

Table 3 Total and Available Area – Nass TSA 2004-2005

Estimation of the available area for harvest was based on an analysis of the polygon's geographic location, stand attributes and whether or not they fell into environmentally sensitive designations or into riparian management areas.

More detailed analysis such as area distributions across site indexes and area by leading species by age class are available in each report.

## Volume

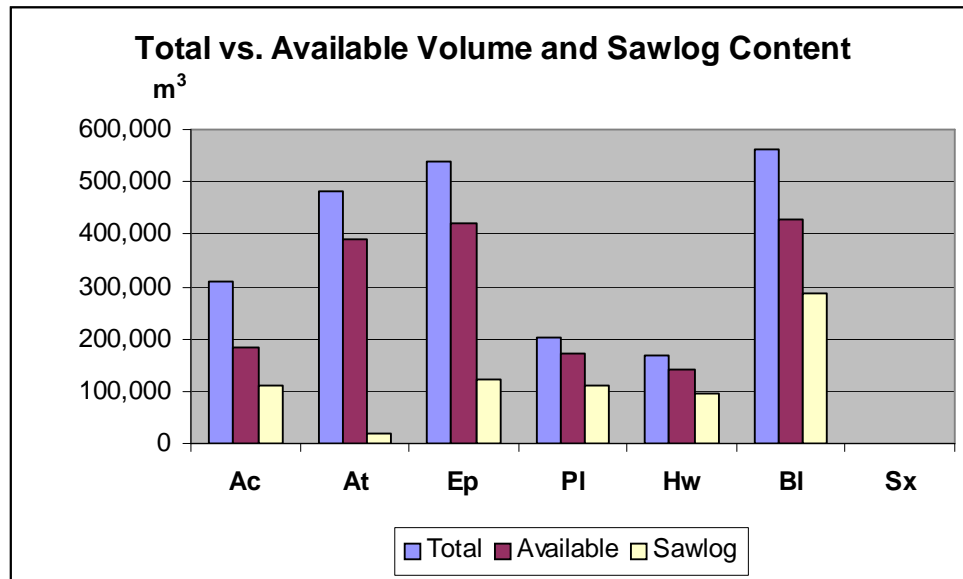


Figure I Combined Total and Available Volumes – Nass TSA 2004-2005

Figure I illustrates calculated total volumes. These volumes were calculated according to the available area derived as per Table 3 using the area of the polygon x m<sup>3</sup>/ha. Table 4 below shows the total vs. available volume comparisons for each species and their sawlog content.

	Total	Available	Sawlog Content
<b>Ac</b>	308,361	181,766	110,614
<b>At</b>	481,945	391,464	18,325
<b>Ep</b>	538,682	419,920	121,982
<b>PI</b>	204,264	172,575	111,463
<b>Hw</b>	168,247	140,452	93,682
<b>BI</b>	561,415	426,374	285,465
<b>Sx</b>	908	454	363
<b>Totals:</b>	<b>2,263,822</b>	<b>1,733,005</b>	<b>741,894</b>

Table 4 Combined Volume Comparisons – Nass TSA 2004-2005

Table 4 shows 1,733,005 m<sup>3</sup> available for harvest of which 741,894 m<sup>3</sup> is estimated average sawlog content. There is 993,150 m<sup>3</sup> of available deciduous volume with an average estimated sawlog content of 250,921 m<sup>3</sup>. Detailed breakdowns by leading species across site indexes and age class are available in the Volume section of each year's report.

## Cranberry TSA

Six mapsheets were chosen in the Cranberry TSA: 103P046, 103P047, 103P057, 103P058, 103P059 and 103P068. These mapsheets are the most promising for hardwood management activities.

### Area

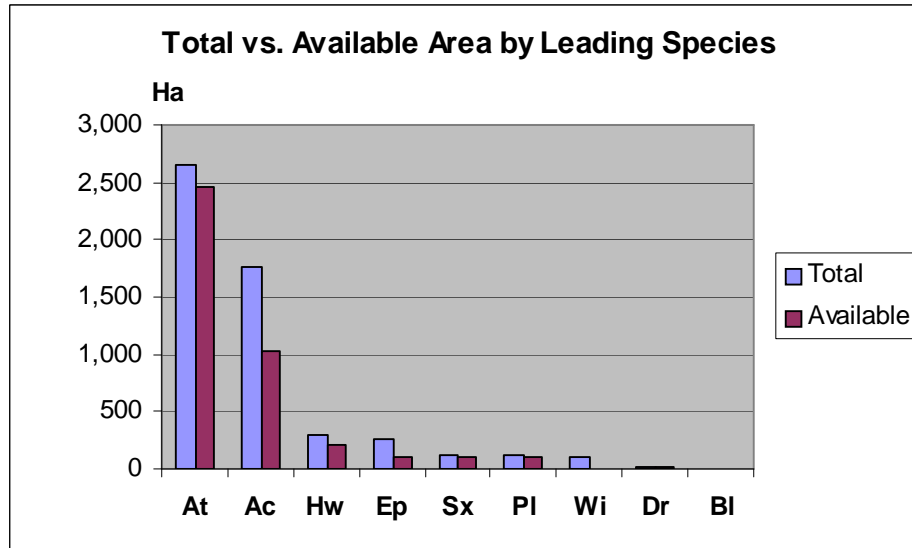


Figure J Total vs. Available Area by Leading Species - Cranberry TSA

It was found that leading species occupy a total of 5,308 ha. This number was divided among seven leading species. Figure J illustrates that the most common leading species are Trembling Aspen (At) 2,644 ha and Black Cottonwood (Ac) 1,756 ha followed by Western Hemlock (Hw) 289 ha, Paper Birch (Ep) 264 ha, Spruce (Sx) 120 ha and Lodgepole Pine (PI) 117 ha. Finally, Willow (Wi) leads in 101 ha, Dr in 13 ha and Subalpine Fir (BI) in 4 ha. These totals are shown as Table 5, below.

	Total	Available	% Available
<b>At</b>	2,644	2,454	93
<b>Ac</b>	1,756	1,035	59
<b>Hw</b>	289	201	69
<b>Ep</b>	264	112	42
<b>Sx</b>	120	106	88
<b>PI</b>	117	108	93
<b>Wi</b>	101	0	0
<b>Dr</b>	13	12	88
<b>BI</b>	4	4	100
	<b>5,308</b>	<b>4,031</b>	

Table 5 Total and Available Area - Cranberry TSA



Estimation of the available area for harvest was based on an analysis of the polygon's geographic location, stand attributes and whether or not they fell into environmentally sensitive designations or into riparian management areas.

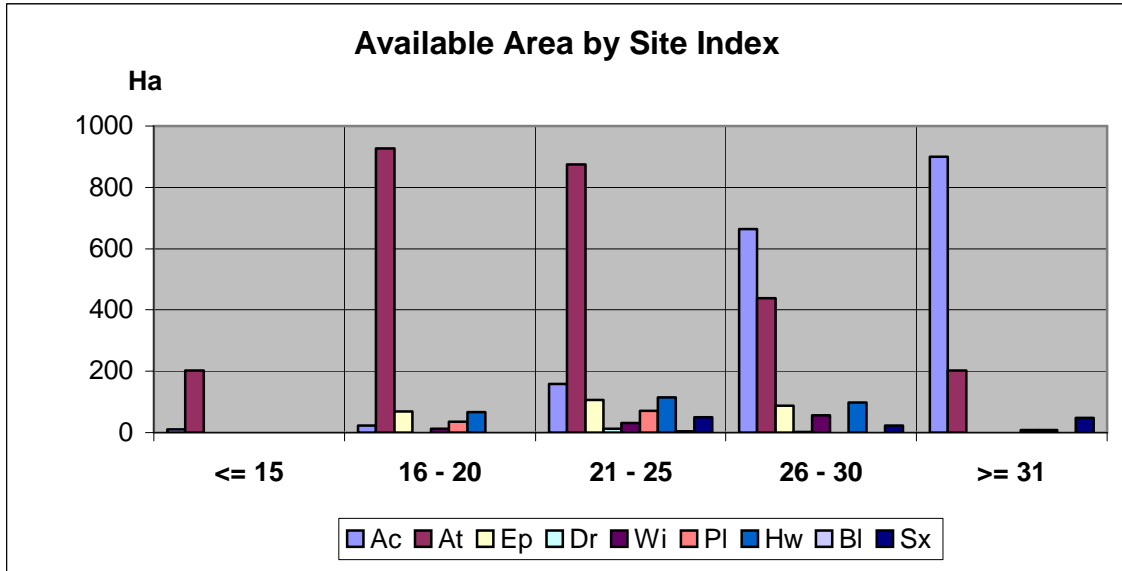


Figure K Available Area by Site Index - Cranberry TSA

Figure K illustrates the distribution site indexes by hectare, which are occupied by leading species. It is clear that the majority of the delineated polygons fall into four site index classes 16 – 20, 21 – 25, 26-30 and >31. Most good sites are located along the Cranberry River. These sites are predominately Cottonwood.

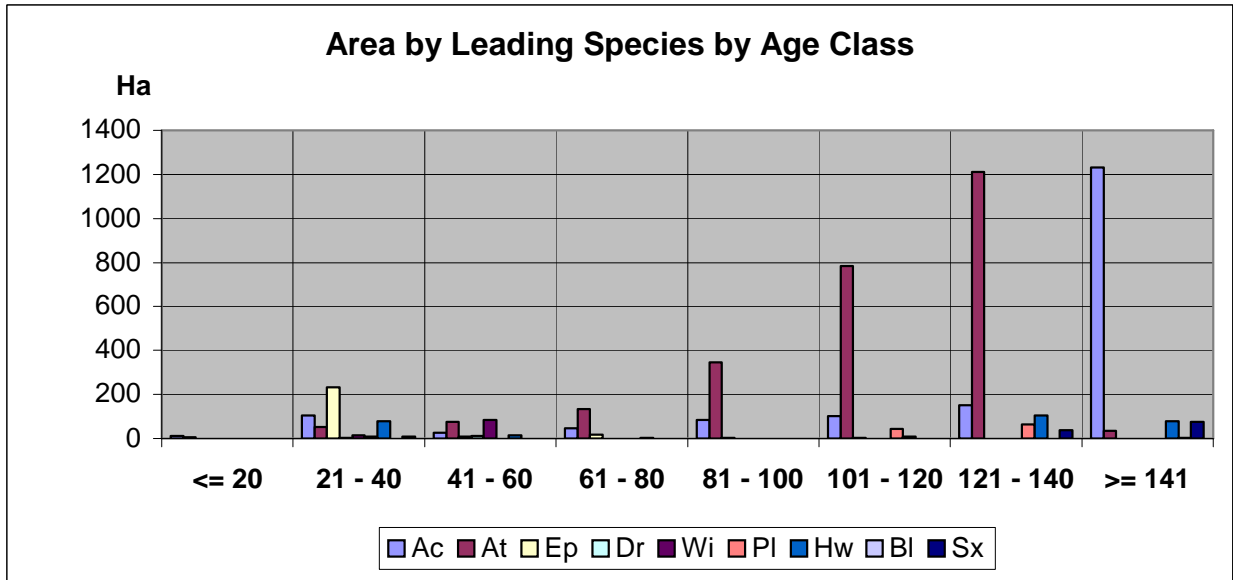


Figure L Area by Leading Species by Age Class - Cranberry TSA

Figure L charts the distribution of area by leading species according to their age class. It was found that the majority of the stands in the project area were within age classes 101-120 and older.

## Volume

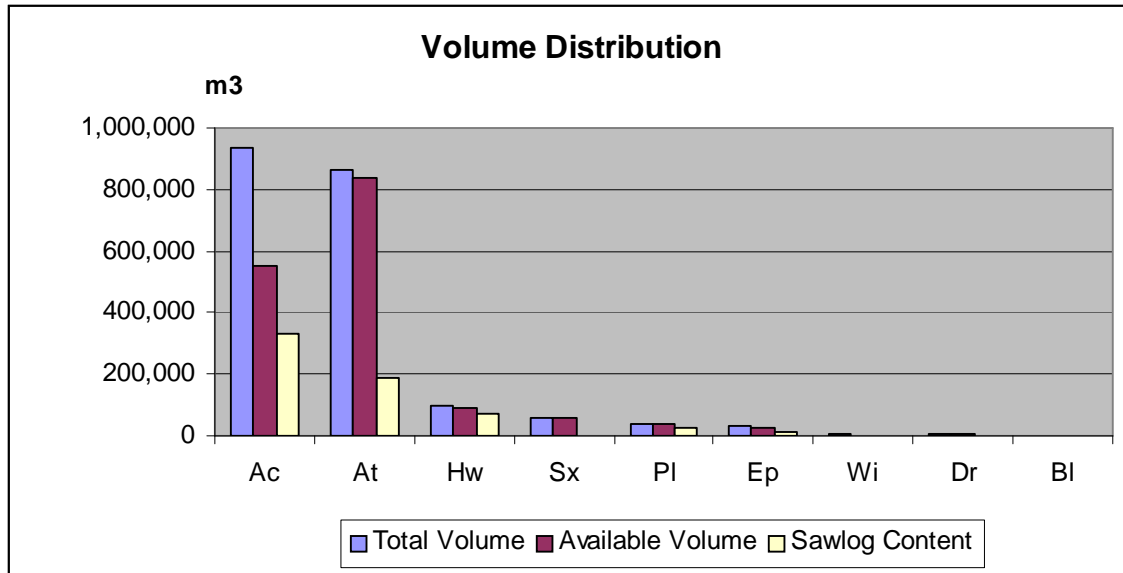


Figure M Volume Comparisons - Cranberry TSA

Calculated total volumes are shown in Figure M. These volumes were calculated according to the available area derived in Table 5 using the area of the polygon x m<sup>3</sup>/ha. Table 6 below shows the total vs. available volume comparisons for each species and their sawlog content.

	<b>Total</b>	<b>Available</b>	<b>Sawlog</b>
<b>Ac</b>	933,247	549,694	329,816
<b>At</b>	866,668	840,823	185,654
<b>Hw</b>	100,444	91,687	68,765
<b>Sx</b>	60,922	55,375	0
<b>PI</b>	36,786	36,353	25,447
<b>Ep</b>	33,222	24,032	10,706
<b>Wi</b>	5,169	0	0
<b>Dr</b>	3,411	3,328	0
<b>BI</b>	1,806	1,806	0
	<b>2,041,676</b>	<b>1,603,098</b>	<b>620,388</b>

Table 6 Total and Available Volumes with Sawlog Content - Cranberry TSA

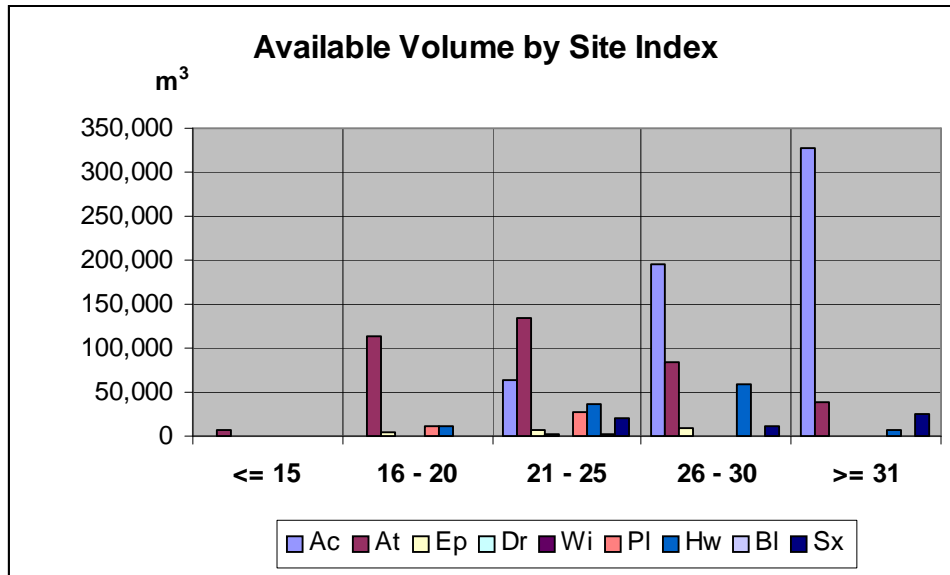
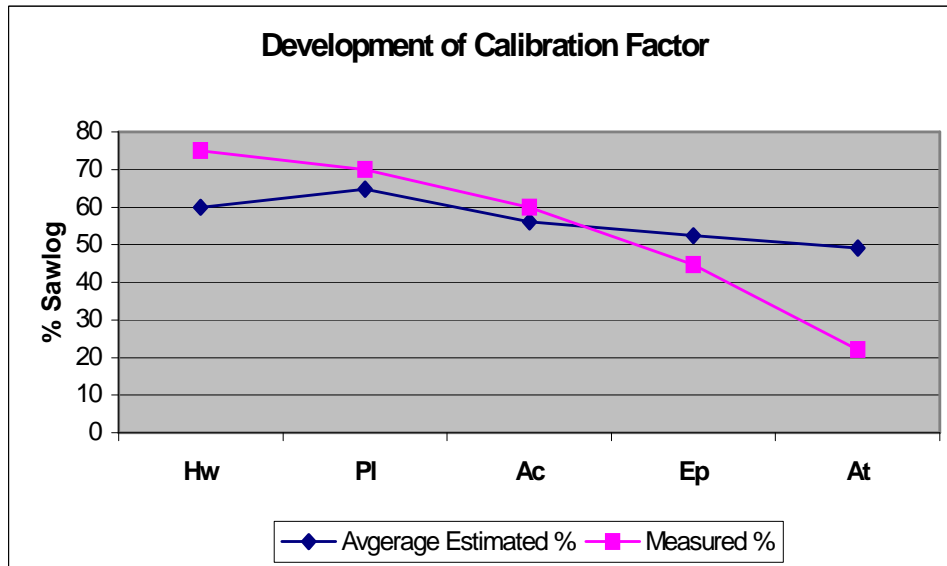


Figure N Available Volume by Site Index - Cranberry TSA

Figure N illustrates the volume distribution by site index for each species. The most volume is located in site index 26-30 and greater.

### Volume Calibrations



	Factor
Hw	1.25
PI	1.08
Ac	1.07
Ep	0.85
At	0.45

Figure O Development of Calibration Factor - Cranberry TSA

Figure O illustrates development of the calibration factor for percent of sawlog for each measured species. This factor was developed in the same manner as for the Nass TSA. Please see Appendix 7 for a detailed explanation of estimations and field calibration.

## Recommendations

These recommendations apply to both the Nass and Cranberry TSA areas. Any differences in applicability are noted within the text.

As recommended in Hardwood Inventory 2004, existing FC1 maps should be considered for updating in order to adequately incorporate deciduous stands. Many polygons have different shapes and boundaries when compared with this project's delineation. Additionally, the significant coniferous presence as a part of deciduous polygons has not been adequately accounted for in inventories prior to 2004.

A systematic destructive sampling program within deciduous stands would improve the accuracy of available data by enabling better calibration of sawlog content and site index designation for deciduous species.

It is recommended that utilization of deciduous resources begin in the near future, because volumes will continue to decline in the majority of the stands. In addition, logging will provide the best hard data about volumes and wood quality which can be interpolated and applied to stands with similar attributes.

We continue to recommend urgency in this program, because the majority of the deciduous volumes are in the upper age classes (Figures D and L above). The next logical area in which to conduct a hardwood inventory is the Kispiox TSA. This TSA contains at least 26 mapsheets with high deciduous populations.

## Conclusions

Hardwood Inventory 2005, when combined with Hardwood Inventory 2004, completes the deciduous inventory on two timber supply areas on eleven selected mapsheets. The most promising mapsheets were chosen based on their high deciduous population and accessibility for future management activities.

The five mapsheets from the Nass TSA are 103P067, 103P076, 103P086, 103P095 and 104A005. The six selected mapsheets from the Cranberry TSA are: 103P046, 103P047, 103P057, 103P058, 103P059 and 103P068.

The total available estimated coniferous volume combined for both the Nass and Cranberry TSA is 0.9 million m<sup>3</sup>. The corresponding deciduous available volume is 2.4 million m<sup>3</sup>.

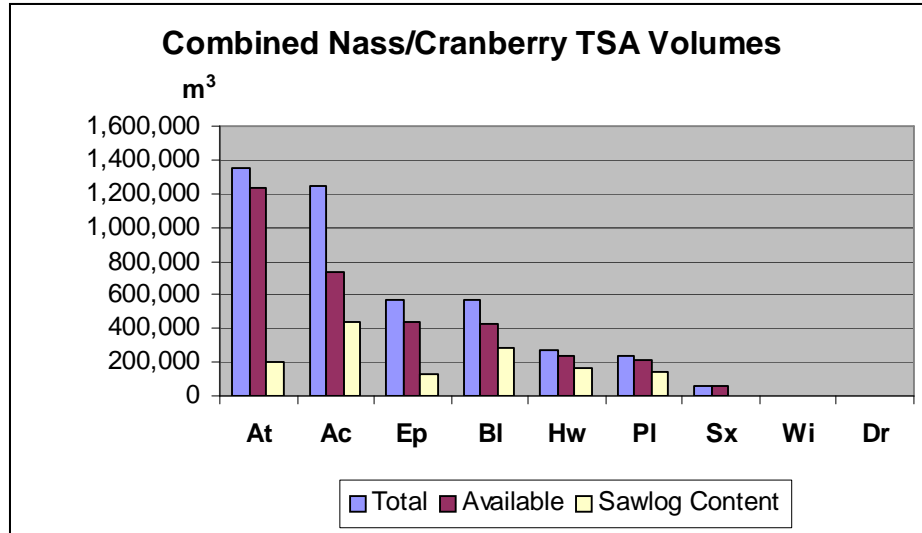


Figure P Combined Nass/Cranberry TSA Volumes

	Total Volume	Available Volume	Sawlog Content
<b>At</b>	1,348,613	1,232,287	203,978
<b>Ac</b>	1,241,608	731,460	440,430
<b>Ep</b>	571,903	443,952	132,688
<b>BI</b>	563,222	428,180	285,465
<b>Hw</b>	268,692	232,139	162,447
<b>PI</b>	241,050	208,928	136,910
<b>Sx</b>	61,830	55,829	363
<b>Wi</b>	5,169	0	0
<b>Dr</b>	3,411	3,328	0
<b>Totals:</b>	<b>4,305,498</b>	<b>3,336,102</b>	<b>1,362,282</b>

Table 7 Combined Nass/Cranberry TSA Volumes

Destructive sampling indicates that wood quality is generally poor. This is reflected in Table 7, which shows that sawlog content is estimated at only approximately 30% of available volume. This percentage varies from species to species. For example, Cottonwood has an available sawlog content of about 60% whereas Birch has an available sawlog content of around 30% and Aspen 20%.

This finding regarding volumes and estimated sawlog content for deciduous species corresponds with findings in the Deciduous Inventory Review 2003. However, Review 2003 did not account for the mixed in coniferous component revealed by Hardwood Inventory 2004 and 2005 which found 925, 000 cubic meters of available conifer volume amongst stands previously classified as deciduous.

Destructive sampling and scaling was performed using an experienced logging contractor and small mill owner. His input in estimating volumes and sawlog content of every

sampled tree was invaluable from the perspective of a small, local owner/operator where the commercial viability of a given log may be very different than that for a large mill.

The vast majority of the stands designated as harvestable are located near existing road access and therefore well suited to the independent, small contractor. Confidence in the wood quality assessments and volume estimates reported here will increase greatly as the studies continue through the Kispiox TSA, which holds the most deciduous volume in the area.

Published provincial Timber Supply Review employment coefficients indicate that one person-year of employment results from each 1,000 cubic meters harvested. Additionally, a spin-off of two more person-years would be created in indirect jobs. Clearly, with over 4 million cubic meters of total volume, hundreds of jobs would result from utilizing this resource.

Hardwood Inventory 2005 marks the successful completion of 11 mapsheets. These inventories are important to our region, because they are the first inventories ever undertaken specifically focused on deciduous species. These findings are the first step in beginning to manage these valuable resources for both domestic and export purposes.

## **Appendices**

- Appendix 1: Volume Uncorrected vs. Corrected by Site Index and Species**
- Appendix 2: Volume Uncorrected vs. Corrected by Age Class and Species**
- Appendix 3: Photographs of destructive sampling**
- Appendix 4: Polygon shape and size compared with 1975 FC1**
- Appendix 5: CD-ROM containing all data collected in this project**
- Appendix 6: Project photographs**
- Appendix 7: Explanation of Field Calibration Factor**
- Appendix 8: Tables from field notes**
- Appendix 9: Table of polygons and attributes**
- Appendix 10: Scan showing completed mapsheets 2004-2005**