
New Brunswick Private Woodlot Stumpage Values

Stumpage Study
Methodology
July 2016

*New Brunswick Forest
Products Commission
in collaboration with
PricewaterhouseCoopers LLP*

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INTRODUCTION

What is the purpose of this report?

This report provides the methodology and assessment of various analyses for a study which was undertaken to determine the value of forest products in the form of standing trees on private woodlots in New Brunswick. The value of standing trees is commonly referred to as stumpage and, for the purpose of this report, is the value paid to the owner(s) of the trees by the person(s) harvesting those trees. In New Brunswick, the *Crown Lands and Forests Act* requires that all stumpage transactions on Crown lands be based upon private market prices (or fair market value). This requires that Government conduct periodic studies of stumpage values on private woodlots to ensure that Crown transactions are based on recent private market rates.

Who conducts this study?

The New Brunswick Forest Products Commission (Commission) is an independent body established under the *Natural Products Act* and the *Forest Products Act*. Among the various duties and functions of the Commission, there are two sub-sections of the *Forest Products Act* that specifically relate to this type of study:

- 11(a) *to examine and consider data relevant to the production and sales of purchased primary forest products; and*
- 11(e) *to conduct inquiries on the following matters with respect to primary forest products:*
 - (i) *The cost of production, distribution and transportation;*
 - (ii) *Prices, markets and systems of classification; and*
 - (iii) *Any other matter related to marketing.*

The Commission engaged PricewaterhouseCoopers LLP (PwC) to assist in the development of specified procedures for the validation of data and the methodology for the statistical analysis to be applied for this study. As a multinational professional services network, PwC is globally the largest firm of its kind with more than 100 years of experience in Canada, focusing on assurance, advisory and tax services for public, private, and government clients in the areas of corporate accountability, risk management, structuring and mergers, and performance and process improvement.

What is the purpose of the study?

The value of standing timber is typically referred to as stumpage. It is the value offered to a landowner by a party interested in harvesting the landowner's timber. Section 59(1) of the *Crown Lands and Forests Act* provides that royalty rates for stumpage on Crown lands shall be based on the fair market value of standing timber.

The purpose of this study is to compile a database of stumpage transactions from private woodlots in New Brunswick and, using average values of forest products in standing timber throughout the Province,

determine provincial average stumpage values. Those average values can be referred to as the fair market value of standing timber.

There are approximately 42,000 private woodlot owners in the Province, and hundreds of purchasers, including forest products processing facilities and over two hundred (200) private forestry contractors. Timber from private woodlots is also shipped to, and imported from, neighboring Canadian provinces such as Nova Scotia and the United States, but principally the state of Maine. The free inflow and outflow of wood products impact prices that private woodlot owners are paid for stumpage in New Brunswick.

Private woodlots represent almost thirty percent (30%) of the Province's forested land and were the source of over two (2) Million cubic meters of forest products between April 1, 2015 and March 31, 2016. When combined with the estimated 500,000 cubic meters of annual hardwood firewood production from private woodlots, this represents ninety-six percent (96%) of the sustainable annual allowable cut that was recommended in the 2012 *Private Forest Task Force Report* commissioned by the New Brunswick Government.

Roughly eighty-five percent (85%) of the forest products produced annually from private woodlots are sold to mills in New Brunswick, with the remaining volume shipped to other provinces or countries. Combined, privately owned industrial forest land and private woodlots represent approximately fifty percent (50%) of the forested land and production of primary forest products in the province.

The value of standing trees to the landowner is based on several factors. These factors can be categorized in four (4) general ways:

1. market/macro-economic factors (e.g. finished product value, import/exports, exchange rates),
2. land/forest conditions (e.g. tree size, terrain),
3. landowner policies/standards (e.g. harvest treatments, tree utilization expectations), and
4. operational efficiencies (e.g. road infrastructure, distance to mill, job size)

The value of stumpage on any one woodlot can be dependent upon these and other factors and can therefore vary throughout the Province. The objective of this study is to generate statistically accurate values for which stumpage from private woodlots was sold in the Province for the twelve-month period between October 2014 and September 2015.

What standards of quality are employed in the study?

From the mid-1980s until the present study, the Department of Natural Resources determined fair market values based on surveys of private land stumpage agreements in New Brunswick and the greater Maritime region. Such surveys were conducted because of the legal requirement that all royalty rates for stumpage on Crown lands be based on the fair market value of standing timber. The surveys were conducted by independent consultants, such as AGFOR Inc. and Nortek Resource Solutions Inc., using the available means of collecting information and data at the time. Information from individual private woodlot owners was provided to independent consultants on a confidential basis and was subject to verification. The surveys were conducted every two to five years with Crown stumpage rates indexed to lumber prices in the interim years.

Utilizing advances in information technology and record keeping, the Commission's authority to obtain relevant information, and the improved services offered by the Forest Products Marketing Boards, the present study implements improvements to make the collection and analysis of private stumpage data even more robust. These include the following:

1. Employing the Commission to conduct the study, as an entity that possesses legal authority to collect the type of data required. Based upon the legal authority, the Commission will require all relevant parties to provide the necessary information.
2. Requiring parties involved in stumpage transactions to participate. By requiring parties to participate, the system will not be voluntary. It will be mandatory, ensuring comprehensive data collection.
3. Standardizing the data collection process. By standardizing the data collection process, the Commission will enhance the quality of the data and eliminate inconsistent record-keeping.
4. Having a third party auditor verify the transactions, assess the quality of reporting, and ensure valid methodologies. This ensures fair and impartial methodologies, information gathering and accuracy of data. This is an important element of the enhanced system.
5. Applying sound statistical analysis. This is important to ensure the data is organized and interpreted in a manner that promotes stakeholder confidence in the results.
6. Creating a goal of compiling a robust dataset of private woodlot, product-specific stumpage transaction prices in the Province. By creating a complete dataset of the product-specific transactions that can be updated monthly when fully implemented, the Commission will be able to evaluate stumpage markets on a more frequent basis.
7. Increasing the scope of information gathered from each transaction, including transaction specific identifiers such as transportation certificate number, load scale slip number, property identification number, volume, unit of measure and stumpage value. This provides the Commission with significantly more information, permitting increased analysis and verification.
8. Enabling the Commission to more frequently analyze stumpage values to ensure that the information reflects current private market conditions. This allows the Commission to calculate fair market values on a more frequent basis, eliminating the need for indexing created in prior system.

The submitted data will be treated with confidentiality and a version of each submission will remain on file in its original form. When the data is added to the database, the transactions will be assigned a number code in order to provide reference to the respondent for data validation purposes while ensuring anonymity.

STUDY METHODOLOGY

What are the potential information sources?

The information being requested includes details of transactions where wood originating from a private woodlot was harvested and sold as product specific and transaction based stumpage during a specific time period. Product specific and transaction based stumpage means that a monetary exchange was transacted between a woodlot owner and the person(s) conducting the harvesting of timber on the woodlot owner's land on the basis of an individual load or part thereof. This type of stumpage sale information is typically held by three parties in NB:

1. Forest Products Marketing Boards that offer services to deduct stumpage from sales transactions to pay to the woodlot owner,
2. forest product processing facilities who purchase stumpage directly from private woodlot owners, and
3. professional forestry contractors who purchase stumpage from private woodlot owners.

Leading up to this study, the Commission contacted the seven (7) Forest Products Marketing Boards and forest product processing facilities to determine the volume and quality of data that could be collected. It was learned that five (5) of the seven (7) Boards offered a service to the many forestry contractors and private woodlot owners whereby the Board would administer the terms of a stumpage agreement on behalf of the two parties and deduct the agreed upon stumpage value from each transaction and make payment to the woodlot owner on behalf of the forestry contractor. Although the proportion varied by region, it was learned that a large volume of data for Board-administered transactions could be collected from the Boards in the format and quality that was desired.

It was learned that, within the study period, certain domestic forest product processing facilities purchased stumpage from private woodlots to supplement their wood supply. Data from these companies could be collected for all of the products that were purchased by those companies from private woodlots in product specific and transaction based stumpage agreements.

To address the issue of stumpage payments directly from forestry contractors to private woodlot owners, the Commission held meetings in several Board regions with a number of the over two hundred (200) professional forestry contractors in the Province. It was learned through these meetings with contractors that their record keeping practices were generally much less sophisticated than those of the Boards and processing facilities, creating considerable difficulty for contractors to compile and submit verifiable data in the format required under the formal request to Boards and processing facilities.

How is the information requested?

The Commission will direct, pursuant to sub-section 11(1)(d) of the *Natural Products Act*, the seven (7) Boards and the forest products processing facilities that purchase stumpage from private woodlots to submit all available stumpage transaction information for the specific time period. The request is made formally under the *Act*, which grants the Commission the legislated authority required in requesting the submission of data, and to protect the privacy of the information.

The parties will be allowed one month to organize and submit data in a common format (as described below). The parties will also be provided sufficient notice in order to prepare and gather/compile supporting documentation for audit and verification purposes. The data submitted to the Commission will be treated with the quality standards described in the Introduction.

For the near term, information from professional forestry contractors will be collected in a different format and on a voluntary basis, similar to that of past studies. Information collected from this voluntary survey will not be included in final calculations but will be used to compare with the data collected from Boards and processing facilities as a result of the formal requests. For future studies,

efforts will be made to determine how the Commission may structure the mandatory collection of stumpage information from professional forestry contractors in a standardized format.

What information is to be collected?

The objective is to collect information in a manner conducive to third party review in order to validate the authenticity and accuracy of the reporting of each transaction. To accomplish this, it is necessary to be able to link wood sold to a processing facility to corresponding payment(s) made to the woodlot owner. This represents the fundamental transaction in a stumpage agreement.

Under the New Brunswick *Transportation of Primary Forest Products Act*, vehicles transporting wood products measuring greater than 1.22 meters (4 feet) in length require a Transportation Certificate (TC). The TC number provides a record of the origin woodlot and the load's final destination wood processing facility. When a load of wood is measured at a wood processing facility, a load scale slip is produced and links measured wood to a TC, and therefore back to the woodlot. TC and load scale slip information are critical to the authenticity of each stumpage transaction. The TC/load scale slip numbers, as well as nine (9) additional transaction descriptors, comprise the information to be requested from Boards and forest product processing facilities. A description and the purpose for collection of each data field are summarized in Table 1.

Table 1. Data collected by the Commission from Boards and Forest Product Processing Facilities.

Data Field	Description / Purpose
TC #	Transportation certificate number for the transaction – one of two possible methods of linking the transaction to stumpage paid to the woodlot owner for the transaction.
Load Slip #	Load or Scale slip number for the transaction - one of two possible methods of linking the transaction to stumpage paid to the woodlot owner for the transaction.
Date	Date that the transaction occurred (delivery or scale date).
PID #	Property Identification number for the private woodlot from which the transaction originated. This information is used for two purposes, first for Commission staff to verify that the property is a valid private woodlot; secondly to allow for Commission staff to assign the map grid number within which the private woodlot is located. The Department of Natural Resources (DNR) map grid location is used to assign a transportation distance for each transaction.
Species	Species of the forest products sold. This is to be used as the primary sorting field for the various timber classes. Species is also used to establish the appropriate conversion factor to convert the volume to solid cubic meters.
Product	Product of the forest products sold. This is used as the secondary sorting field for the various timber classes. Product is also used to establish the appropriate conversion factor to convert the volume to solid cubic meters.
Volume	Volume of the transaction as verifiable by the TC# or load slip #. It is used as the primary factor in converting the volume to solid cubic meters.
Unit of Measure	Unit of measure used to quantify the volume of the transaction at the destination. Unit of measure is used to establish the appropriate conversion factor to convert the volume to solid cubic meters.
Destination Mill	Delivery destination of the wood products in each transaction.
Stumpage Paid	Gross dollar (\$) value paid to the woodlot owner for the transaction.
MB Region	Forest Products Marketing Board region within which the harvesting occurred for each transaction.

Using the information included in Table 1, data fields will be added to the database for which information could be calculated or inferred to supplement the analyses described below. Table 2 below summarizes the fields that are subsequently added to the database by Commission staff.

Table 2. Data fields added by the Commission to allow for other analyses of the data.

Data Field	Description / Purpose
Volume (m3)	The volume of the transacted wood products in solid cubic meters. Conversions from the original volume and unit of measure are calculated using DNR / Commission accepted conversion factors.
Stumpage (\$/m3)	The rate per cubic meter that the woodlot owner received for the transacted wood products. This is calculated by dividing the gross stumpage amount by the calculated cubic meter volume.
Season	This field is assigned a value of 'S' (summer) or 'W' (winter). Summer transactions occur between May 1 st and October 31 st and winter transactions between November 1 st and April 30 th . The values in the field are assigned based on the month in which the transaction occurred and are used to establish the volume conversion to be applied.

How will the information be standardized?

It is anticipated that the study participants' submissions will consist primarily of data extracted from internal accounting systems. In most cases, the participants employ different data coding practices in describing the same data. For example, the submissions received may contain, within the species field, description variations for Spruce, Fir, Jack Pine such as spruce-fir, SF, SPF, or others. For data fields requiring standardizing, the Commission will establish standardized descriptions to use for the multiple variations that will be received in the raw data submissions. Standardized descriptions will be created for the Species, Product, Unit of Measure and Destination Mill fields. This standardization is the only modification to be made to the submitted data, promoting simplicity and efficiency in sorting, grouping and analysis.

How will the accuracy of information be verified?

One of the improvements sought for this study was to develop procedures to verify that the submitted data was accurate and could be substantiated with appropriate supporting documentation. In order to accomplish this, the Commission employed a firm with expertise in audit procedures to assist in the development of verification procedures that could be used on an ongoing basis.

The Commission engaged PricewaterhouseCoopers LLP (PwC) to create a Specified Procedures Plan that would serve as the basis of an audit to test the accuracy of the submitted information. The decision on the number of samples selected for verification is based on the intention of achieving a reliability of at least ninety-five percent (95%) with a margin of error of five percent (5%). This means that if an equivalent sized random sample of transactions were selected, the accuracy of the data would fall within five (5) percentage points ninety-five (95) times out of one hundred (100).

How will the information be analyzed and summarized?

The purpose of this study is to determine average stumpage values paid for various primary forest products from private woodlots in New Brunswick. The collected data will be grouped and analyzed by species and products most commonly used in stumpage agreements between a woodlot owner and a person wishing to harvest an owner's trees. When necessary, the Commission will also consider species/product groups that are likely to be used for Crown timber harvests. The species and product groupings to be used for the study are summarized in Table 3 below.

Table 3. Species and Products groups used in the study.

SPECIES	PRODUCT	GROUP
CEDAR	SAWLOG	CEDSAW
CEDAR	STUDWOOD	
CEDAR	TREELENGTH	
POPLAR	CHIPS	HWDPW
HARDWOOD	CHIPS	
HARDWOOD	PULPWOOD	
POPLAR	PULPWOOD	
HARDWOOD	SAWLOG	HWDSL
RED PINE	PULPWOOD	OSRWB**
HEMLOCK	PULPWOOD	
WHITE PINE	PULPWOOD	
TAMARACK	PULPWOOD	
TAMARACK	SAWLOG	OSSL
HEMLOCK	SAWLOG	
WHITE PINE	SAWLOG	PISL
SPF*	ROUNDWOOD BIOMASS	SPFRWB**
SPF*	CHIPS	
SPF*	PULPWOOD	
SPF*	SAWLOG	SPFSL
SPF*	STUDWOOD	SPFST

* SPF = Spruce, Fir, Jack Pine

** RWB = Round wood biomass, including pulpwood and chips produced at the harvest site.

The dependent variable of interest is the calculated value of stumpage in dollars per cubic meter (\$/m³) within each of the species/product groups. A separate phase of the engagement with PwC was to provide advice with respect to the following analysis methodology being proposed by the Commission. (PwC advice is attached in Appendix A – Stumpage System Process Analysis.)

Often, in larger collections of data, values that are significantly higher or lower than the average are commonly referred to as outliers. Outliers can sometimes indicate faulty data, flawed procedures or cases where data is influenced by unknown or abnormal factors.

Options for identifying and dealing with outliers were explored. Ultimately, the Commission will apply an approach used in an adjacent jurisdiction in averaging stumpage values (*2014 Stumpage Prices – Department of Agriculture, Conservation and Forestry, Maine Forest Service – November 6, 2015*). This approach consists of sorting the stumpage values (\$/m³) from lowest to highest for each species/product group. Once values are sorted, transactions located below the fifth (5th) percentile and above the ninety-fifth (95th) percentile are excluded from the statistical calculations for each species/product group.

After removal of outliers, a number of statistical calculations will be performed. The primary statistic of interest in this study is the mean (average) stumpage rate for the various species/product groups. The descriptive statistics calculated for the species/product groups are detailed in Table 4 below.

Table 4. Summary of descriptive statistics calculated for the species/product groups.

Statistic	Description
Species/Product	Grouping of the species and products for a timber class to be described.
Mean	Simple arithmetic mean is the sum of the values in a numeric data field divided by the number of records found in that data field. In the case of this study, the field of interest was the stumpage value expressed in dollars per cubic meter (\$/m ³). For each species/product group, the stumpage values per cubic meter for each transaction were totaled and divided by the number of transactions in the group.
Standard Deviation	For each species/product group the standard deviation was calculated as an indicator of the variability of the data. Standard deviation is a number used to tell how measurements for a group are spread out from the average (mean), or expected value.
Minimum	Lowest stumpage value (\$/m ³) within the species/product groups.
Maximum	Highest stumpage value (\$/m ³) within the species/product groups.
Response Volume	Total volume (m ³) of the transactions in the collected data for each species/product group.
Harvest Volume	Total volume (m ³) of all products harvested from private woodlots in New Brunswick within the time period studied for each species/product group.
Confidence Interval	When calculating a mean using the response data, the confidence interval is the range of values within which there is a certain percentage of confidence that the true mean falls within.

In previous stumpage surveys, general practice was to use Board level average stumpage values in conjunction with Board region harvest levels to calculate a weighted provincial average. The reasons for this were twofold:

1. market conditions and opportunities with respect to the various forest products often differ from one Board region to another, creating situations where the average stumpage value of specific species/product groups vary among Board regions, and

2. the availability and consequently the volume of data collected within each Board region varied, creating the need to ensure that a higher volume of data collected within a specific Board region did not outweigh smaller amounts of data collected from other regions.

On the advice of PwC, the Commission does not recommend using this method of calculation because it hinges on the assumptions that the Board level results are an accurate representation of the stumpage values paid within each region and that the harvest levels comprise one hundred percent (100%) transaction based stumpage.

The Commission is of the belief that the risk in making the aforementioned assumptions are:

1. There may not be sufficient sample stumpage data collected within any given Board region for any specific species/product group to support making the assumption that the Board region average is accurate and representative of the Board region's stumpage values; and
2. No method currently exists to segregate the volume harvested specifically through transaction based stumpage agreements. The proportion of transaction based stumpage harvests may vary by region and, therefore, simply weighting on total harvest levels may inadvertently introduce bias to the weighting calculations.

In planning for future studies, the Commission will attempt to address issues where data shortfalls exist, as well as seeking quantifiable information with respect to the proportions of transaction based stumpage harvests within the seven Board regions. The Commission does not recommend relying on the Board-weighting method to determine the average provincial stumpage value until these issues are addressed. The weighted provincial average calculation would then be based on real data, as opposed to assumptions, and provide the level of accuracy that is desired.

APPENDIX A

MEMO – STUMPAGE SYSTEM PROCESS ANALYSIS

**PREPARED BY:
PRICEWATERHOUSE COOPERS, LLC**

Memo

To: / Location: New Brunswick Forest Products Commission

From: / Location: PricewaterhouseCoopers LLP

Date: April 26, 2016

Subject: **Stumpage System Process Analysis**

As a component of the engagement between PricewaterhouseCoopers LLP ("us" or "PwC") and the New Brunswick Forest Products Commission ("you" or "NBFPFC") dated December 18, 2015, you have provided us the following information:

- An Excel file with your collected fair market value data ("FMV_DB_FPC_PWC_Feb4_2016.xls");
- An Excel file with your calculations of confidence intervals relating to the fair market value data ("Confidence Interval Calculations.xlsx"); and,
- A Word document describing your preferred methodology for determining the fair market value rates ("FMV Methodology_V2.docx").

Your objective is to produce statistically defensible stumpage rates for wood from Private Lands in the Province of New Brunswick. You have communicated various challenges with your methodology (i.e. identifying the significant drivers for the calculation of stumpage, which could require the transactional data to be grouped by distance/region and/or species, etc.).

Workstream #1 in the engagement letter was to assist you with Stumpage System Process Analysis and we have completed the following process analysis activities related to your information described above:

- Project A: We developed an econometric model to examine the statistical relationships within data you collected regarding stumpage rates charged for wood sourced from Private Lands (the "Dataset"). The majority of our effort was spent in this project and our draft memo dated February 25, 2016 was provided to you on February 26, 2016.
- Project B: On page 2 of this memo we confirmed that your confidence interval calculations were performed using the correct statistical formulae.
- Project C: We reviewed your methodology for determining the fair market value rates and our suggestions to you are provided on pages 2-3 of this memo.

PricewaterhouseCoopers LLP
PwC Tower, 18 York Street, Suite 2600, Toronto, Ontario, Canada M5J 0B2
T: +1 416 863 1133, F: +1 416 365 8215, www.pwc.com/ca

"PwC" refers to PricewaterhouseCoopers LLP, an Ontario limited liability partnership, which is a member firm of PricewaterhouseCoopers International Limited, each member firm of which is a separate legal entity.

Project B: Review of Confidence Interval Calculations

You have provided us with an Excel file containing your average stumpage rates by species/product that were calculated using the fair market value dataset, including the related confidence intervals around the average stumpage rates ("Confidence Interval Calculations.xlsx"). We have not audited the stumpage rate formulas/calculations, but you have asked us to confirm that the related confidence intervals were calculated using the correct statistical formulae. We reviewed the confidence interval formulas in your document and confirm that you are using the correct statistical formulae for your stated purpose and dataset.

Project C: Review of Methodology for Determining the FMV Rates

You have provided us with a Word document describing your methodology for determining the fair market value rates ("FMV Methodology_V2.docx"). Your methodology document also refers to an attached Excel file where averages were calculated ("Final_Dataset_Weighted_Average_Calculations.xlsx"). We reviewed the document and the related Excel file, and although we have not audited the stumpage rate formulas/calculations, we do offer the following discussion of your methodology:

1. Outliers:

In your methodology for calculating the mean stumpage values you are excluding the data from the lowest and highest 5 percentiles. You mention that this methodology for excluding outliers is "used by the State of Maine in their annual stumpage report, so it is believed that for consistency with the adjacent jurisdiction, this would be an acceptable method for us to deal with outliers".

We reviewed the State of Maine annual stumpage reports for the last five years and only in the last year (2014 data released on November 6, 2015) did they include the following information on how their averages were calculated: "The average price (or mean) is calculated by multiplying the corresponding volume by the stumpage price for each species and product reported by woodland owners. These are added together and divided by the sum of all the volumes (reported with corresponding stumpage prices) for that product and species. This is a weighted average".

There is no discussion of removing outliers in the Maine report, but you have confirmed that New Brunswick Department of Natural Resources staff have had direct discussions with representatives from the State of Maine. The data at the 5 percentiles may be valid data and not outliers, therefore the data could be utilized in your calculations. It could also be argued that the low and high data will naturally have less associated volume and therefore this data will have less influence on the weighted average. We suggest that you consider conducting and reporting on the calculations without removing the lowest and highest 5 percentiles for comparative purposes, however, your chosen methodology would offer some consistency with the adjacent jurisdiction, Maine. During an interview, you also mentioned that you intend on adding an appendix to your calculations where the data is analysed using alternate approaches for comparative purposes and not removing outliers as we have suggested above may be a useful alternate approach for you to include in your appendix.

2. Mean Stumpage:

Your document discusses two options for calculating the mean stumpage: the arithmetic mean, or the interquartile mean of the data, which was used in the most recent Fair Market Value determination in 2012.

We would recommend that you use the more simple arithmetic mean approach, even though interquartile mean was used and accepted in the previous survey. Since your calculated average stumpage rates and your methodology may also come under scrutiny in discussions around trade issues, we would suggest that you include the results of the interquartile mean method in the appendix of your report where you will provide the results of alternate calculation approaches. This will provide the reader of your final report with a comparative analysis of the arithmetic mean versus the interquartile mean approaches.