Dynamic efficiency analysis of primary wood producers in British Columbia

Neda Salehirad\textsuperscript{a,1}, Taraneh Sowlati\textsuperscript{b,*}

\textsuperscript{a} Department of Wood Science, Faculty of Forestry, University of British Columbia, 2900 - 2424 Main Mall, Vancouver, BC, V6T-1Z4, Canada
\textsuperscript{b} Department of Wood Science, Faculty of Forestry, University of British Columbia, 2931 - 2424 Main Mall, Vancouver, BC, V6T-1Z4, Canada

Received 27 July 2006; received in revised form 19 September 2006; accepted 4 October 2006

Abstract

Primary wood manufacturing is one of the key sectors in Canada’s wood industry. The sector has gone through significant changes during the last decade. These changes were caused by a variety of factors, such as technological advancement, market restructuring, and policy and regulation shifts. One of the most affected provincial sectors due to these circumstances was the primary wood products in British Columbia (BC). In order to capture these effects, we studied the efficiency and productivity of BC primary wood producers using Data Envelopment Analysis and Malmquist total factor productivity from 1990 to 2002. The results showed that BC sawmills were highly scale efficient and the major cause for their inefficiency was technical capability rather than scale of operations. The productivity of BC sawmills improved in 2002 compared to that of 1990. This was the result of slight improvement in efficiency of sawmills, but more due to the frontier shift.

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Keywords: Data envelopment analysis; Malmquist index; Productivity and efficiency; Wood industry

1. Introduction

Primary wood manufacturing is a key sector in the Canadian wood industry. It has contributed between 8 and 19 billion CDN$ per year (about 60%) to the total manufacturing value of the wood industry since 1990. Among provinces in Canada, British Columbia (BC) has the largest share in the primary wood manufacturing with an annual production value of 5.5–9.5 billion CDN$ which accounts for more than 50% of the production value of the whole sector in Canada (Fig. 1).

Primary wood manufacturing mainly refers to sawmilling, which produces lumber, its variants and chips. The sawmilling sector in western Canada, including BC, started strategic planning to increase revenue since the 1980’s.
Their initial strategy was to increase production capacity which then shifted to minimizing labour costs. Consequently, they directed their strategies towards automation and speeding up the manufacturing processes. However, more recently they have been focusing on improving productivity and lumber recovery factor using optimization in their manufacturing systems [1]. In doing so, the sawmilling sector has experienced significant technological advancements particularly over the last decade. At the same time, the sector has been influenced by other factors such as supporting policies for the expansion of value-added wood products, the lumber trade dispute with the US, and general changes in the Canada’s economy [2].

This rapidly changing environment has affected the efficiency and productivity of primary wood manufacturing in BC. However, there has been no study, to the best of our knowledge, to evaluate such effects despite the importance of this sector and its key role in Canada and BC’s economy. This research was therefore designed to address that need.

We sought to analyze the efficiency of sawmills in BC in the period of 1990–2002. We utilized the Data Envelopment Analysis (DEA) technique in intertemporal and contemporaneous analyses to provide a picture of sawmills’ efficiencies over the study period and in each year individually. DEA models were used in this stage to measure technical, aggregate and scale efficiencies. To study the productivity of the BC sawmills over this period, Malmquist productivity index was calculated. This index was then decomposed into two indices: efficiency change (or catching-up) and frontier shift (or technical change). This helped to quantify the effects of technological advancement and efficiency changes on the productivity of sawmills.

This study is the first efficiency and productivity evaluation of the primary wood producers in BC over the recent period of 1990–2002. The sawmilling sector in BC has been studied by a number of researchers [3–7] using parametric methods. The latest study of the BC sawmills was conducted by [7] for the period of 1948–1984. They used a Translog cost function and concluded that while labour productivity increased, productivity of material and energy had decreased. Methods with a parametric approach require the specification of a functional form relating inputs and outputs which is difficult in many studies. Besides, they are quite demanding in terms of data requirement. The required cost and price data are usually difficult to obtain which can be problematic in practical analysis. However, once data are gathered, a parametric study can provide useful information. We utilized the DEA technique to study the temporal efficiency of this sector. The DEA technique enables incorporating multiple inputs and outputs simultaneously, even with different measurement units, to measure efficiency. It does not require a priori knowledge on the frontier function or the relative importance of inputs and outputs. DEA provides a single efficiency score for each unit which makes the comparison easy. It identifies a frontier comprising of best performers and indicates targets for inefficient ones. When using DEA to measure the relative efficiency of comparable units over a period of time, Malmquist Productivity index can be used to decompose the productivity change into efficiency change and the frontier shift.

Although DEA has many advantages, it has some shortcomings as well. To apply DEA, the number of units should be at least three times more than the total number of inputs and outputs. DEA may assign weights to inputs/outputs that are not meaningful in practice, however, different methods have been proposed to remove this limitation [8–10]. Another DEA limitation is that it does not identify any improvements for those units recognized as efficient. However, there are new developments in the theory of DEA to overcome this aspect [11]. Sowlati and Paradi proposed a linear programming model and a methodology for improving the efficiency of empirically efficient units by defining a...
practical frontier utilizing management input. Outliers may influence the DEA results and in addition, DEA typically employs deterministic data and performs deterministic efficiency analyses (does not accommodate measurement error and noise in data), except for stochastic DEA analyses.

Although DEA efficiency analysis based on a panel data has not yet been utilized to evaluate the Canadian wood industry, it was employed to evaluate the wood industry in other countries. Nyrud and Bergseng [12] studied the efficiency of the Norwegian sawmilling sector over the period of 1974–1991. They investigated the relationship between the efficiency scores and sawmills’ size, and found that smaller mills were less efficient than larger mills in most periods. Nyrud and Baardsen [13] investigated the productivity growth of sawmills in Norway using Malmquist index (during the same period as in [12], with the same DEA models and input and output factors). They found that the productivity on average increased. Technology has also improved during the entire study period while efficiency change was volatile.

The Canadian logging sector was studied using contemporaneous DEA efficiency analysis [14]. This study looked at the efficiency of logging industry in six boreal provinces during 1977–1995. A significant difference was observed in the efficiency of logging sector across the provinces. Besides, there was evidence of significant positive scale effects. In this study the DEA-based Malmquist index was applied and it was found that the productivity of the boreal logging industry in Canada increased in most years during the study period.

Salehirad and Sowlati [15] assessed the efficiency of BC sawmills in 2002. They examined the relationship between efficiency scores and two factors: forest regions and number of operating days. They concluded that BC sawmills were highly scale efficient and while the efficiency scores of different forest regions were statistically different, the number of operating days had no effect on the efficiency of a sawmill.

2. Methodology

2.1. Data envelopment analysis

DEA is a non-parametric approach that measures the relative efficiency of similar units, usually referred to as decision making units (DMU). DEA incorporates multiple inputs and outputs in a single efficiency measure, and assigns a relative efficiency score to each DMU. Best performers receive an efficiency score of 1 and form the efficient frontier. Inefficient units receive a score between 0 and 1 based on their distance from the efficient frontier. DEA provides an efficient target for inefficient units by projecting them on the frontier. The target units are either one of the actual DMUs on the frontier or a linear combination of them. The units that shape the target for an inefficient DMU are called its reference set.

DEA was originally introduced by Charnes et al. [16] in the form of an optimization mathematical programming, based on an earlier work of Farrell [17]. They formulated a DEA model, referred to as CCR, with a constant returns to scale (CRS) assumption as follows (1) [18]. A CRS assumption implies that all DMUs would be able to increase their outputs by a similar proportion, given an increase in the rate of their inputs, no matter what their scales are [17]. The efficiency score resulting from a CCR model is called aggregate efficiency.

$$\max \ z_o = \phi + \varepsilon. \sum_{j=1}^{s} s^+_j + \varepsilon. \sum_{i=1}^{r} s^-_i$$

s.t. $$\phi \cdot y_{jio} - \sum_{k=1}^{n} \lambda_k \cdot y_{jk} + s^+_j = 0 \quad j = 1, \ldots, s$$

$$\sum_{k=1}^{n} \lambda_k \cdot x_{ik} + s^-_i = x_{io} \quad i = 1, \ldots, r$$

$$\lambda_k, s^-_i, s^+_j \geq 0 \quad k = 1, \ldots, n; i = 1, \ldots, r; j = 1, \ldots, s.$$  \ (1)

This model assigns an efficiency score to each DMU, comparing them to each other. The formulation considers a given set of \( n \) DMUs with \( r \) inputs and \( s \) outputs. We denote, for each DMU\(_k\) \((k = 1, \ldots, n)\), the inputs with \( x_{ik} \) \((i = 1, \ldots, r)\) and the outputs with \( y_{jk} \) \((j = 1, \ldots, s)\). The decision variables of the model are \( \phi, \lambda_k \) \((k = 1, \ldots, n)\), \( s^-_i \) \((i = 1, \ldots, r)\) and \( s^+_j \) \((j = 1, \ldots, s)\). \( \phi \) represents the proportion by which DMU\(_o\), the unit under evaluation,
needs to increase its outputs in order to become as efficient as its best peers in the set. Therefore, \( 1/\phi \) represents the efficiency score of DMU\(_o\). \( \lambda_k \) (\( k = 1, \ldots, n \)) shows the share of DMU\(_k\) in defining an efficient target for DMU\(_o\). Slack variables, \( s^-_i \) (\( i = 1, \ldots, r \)) and \( s^+_j \) (\( j = 1, \ldots, s \)), indicate extra possible decreases in inputs and increases in outputs, respectively. Parameter \( \varepsilon \) is a non-Archimedean infinitesimal. Since the model measures the efficiency of a single DMU, DMU\(_o\), it needs to be solved \( n \) times. This is an output-oriented model since the objective is to produce maximum level of outputs with the same level of input consumption.

The CCR model (1) can be modified to accommodate variable returns to scale (VRS). Such a model evaluates each DMU against other DMUs in the same scale range. This model was introduced by Banker et al. [19], referred to as BCC, and requires an extra constraint (2) added to the CCR model (1). The efficiency score provided by a BCC model is called technical efficiency. A BCC model also indicates whether a unit is performing under decreasing, constant or increasing returns to scale. An increasing (decreasing) returns to scale is when an increase (decrease) in inputs results in a greater (less) than proportionate increase (decrease) in outputs.

\[
\sum_{k=1}^{n} \lambda_k = 1 \quad (k = 1, \ldots, n).
\]

The scale efficiency of a DMU can be calculated based on its aggregate and technical efficiencies resulting from CCR and BCC models, respectively (3). Scale efficiency represents the inefficiency of a DMU which is merely due to its scale of operations. The readers may refer to [20] for further discussion on the DEA method and its applications in forestry.

\[
\text{Scale Efficiency} = \frac{\text{Aggregate Efficiency}}{\text{Technical Efficiency}}.
\]

DEA can be used to study efficiency over time, which is commonly referred to as DEA dynamic studies. To do so, a contemporaneous or an intertemporal DEA analysis can be used. In a contemporaneous analysis, the efficiency of each unit is evaluated by comparing it to other units in the same period, independent from other periods. This measure does not reflect a relative efficiency from period to period. To analyze the efficiency trend, an intertemporal DEA analysis can be employed in which all units in the whole study period are compared together. However, this is only appropriate for a temporal analysis in which technological changes are negligible [21].

### 2.2. Malmquist total factor productivity (TFP) index

To measure the overall productivity change of a DMU between two periods in a DEA dynamic analysis, Malmquist TFP index can be used. Malmquist index, initially introduced by Malmquist [22], is calculated either directly between two adjacent periods [23], or by means of auxiliary measures using a base period [24]. Malmquist index for DMU\(_o\), here denoted by \( M_o \) (4), can be formulated using aggregate efficiency scores resulting from a CCR model (1), as follows [23]:

\[
M_o = \left( \frac{\phi_{ba}}{\phi_{ab}} \cdot \frac{\phi_{bb}}{\phi_{aa}} \right)^{1/2}.
\]

This index, \( M_o \), measures the total productivity change for DMU\(_o\) between periods \( a \) and \( b \). \( \phi_{ba} \) indicates the DEA efficiency of DMU\(_o\) in period \( b \) when it is evaluated against the frontier of period \( a \), i.e. compared to units in period \( a \), whereas \( \phi_{bb} \) is the efficiency estimation of DMU\(_o\) in period \( b \) when projected to the frontier of period \( b \). The other factors, \( \phi_{aa} \) and \( \phi_{ab} \), are defined in a similar way.

Malmquist productivity index includes changes in efficiency and changes in technology. Therefore, the index can be decomposed into two effects: efficiency change (EC), and technical change (TC). EC index (or catching-up effect) (5) measures how the efficiency of the underlying unit has improved from one period to the other. This means how the unit’s utilization level of the same technology has changed. TC index (or frontier shift) (6), on the other hand, measures the shift in the technology from one period to another. The technology is identified as the best practice in each period represented by the (efficient) frontier. \( M_o \), EC and TC would indicate a progress if being greater than 1,
no change if equal to 1, and a regress if less than 1 [23].

\[ EC_o = \frac{\phi_{bh}}{\phi_{aa}} \]  \hspace{2cm} (5)

\[ TC_o = \left(\frac{\phi_{ba} \phi_{aa}}{\phi_{bb} \phi_{ab}}\right)^{1/2}. \]  \hspace{2cm} (6)

3. Data and analyses

3.1. Dataset

This study was based on a dataset acquired from the BC Ministry of Forests which included some performance factors of BC sawmills over the period of 1990–2002. The data elements for each mill include a mill identifier, lumber production volume (million board feet), chip production volume (thousand bone dry units), log consumption (thousand cubic meters), number of employees and number of operating days. The descriptive statistics of these data are given in Table 1. A total of 82 sawmills in each year were analyzed in this study, after dropping the records with missing or invalid values.

Generally, different types of logs are transformed to lumber, the main product, and chips, as the side product, in a sawmill. Other resources used in the production process of a sawmill are machinery, energy and labour. Accordingly, the sawmilling production can be well presented by the traditional production factors, namely raw materials, labour, capital, energy and products. All these factors were incorporated in this study except capital and energy, for which data were not available for individual sawmills. Based on the costs data available for the whole wood industry sector in BC from 1990 to 1997, capital and repair costs were 13% of the total cost (material, labour, capital, and energy) in 1990 and decreased to 9% in 1997; while, fuel and energy costs were just 3% of the total cost in 1990 and decreased to 2% in 1997 (see Appendix). These percentages indicate that although it was not possible for us to include capital and energy in our model, two important factors, material and labour, which accounted for more than 85% of the total cost were considered in the model.

Therefore, a DEA model was developed with two inputs and two outputs: log consumption and number of employees as inputs and lumber and chip production as outputs. The correlation test conducted on the inputs and the outputs reported no duplicative representation of performance factors. Consequently, all the four factors were used in the analyses.
Table 2
Summary results of intertemporal DEA efficiency analyses

<table>
<thead>
<tr>
<th></th>
<th>1990–2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate efficiency (CCR model)</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.68</td>
</tr>
<tr>
<td>SD</td>
<td>0.11</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.34</td>
</tr>
<tr>
<td># Efficient sawmills</td>
<td>3</td>
</tr>
<tr>
<td>Technical efficiency (BCC model)</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.71</td>
</tr>
<tr>
<td>SD</td>
<td>0.11</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.35</td>
</tr>
<tr>
<td># Efficient sawmills</td>
<td>14</td>
</tr>
<tr>
<td># Increasing returns to scale</td>
<td>647</td>
</tr>
<tr>
<td># Constant returns to scale</td>
<td>3</td>
</tr>
<tr>
<td># Decreasing returns to scale</td>
<td>416</td>
</tr>
<tr>
<td>Scale efficiency (CCR score/BCC score)</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.96</td>
</tr>
</tbody>
</table>

3.2. Analyses, results and discussion

To provide a preliminary picture of the BC sawmills’ efficiency over the study period, intertemporal analyses were performed using different DEA models. These models compared BC sawmills from 1990 to 2002. A CCR output-oriented model (1) was used to measure the aggregate efficiency of BC sawmills. A BCC output-oriented model (1) and (2) was then applied to estimate the technical efficiency of BC sawmills. Consequently, the scale efficiency was obtained based on (3). The results are summarized in Table 2.

As the results show, the average aggregate and technical efficiencies of BC sawmills during the study period were 0.68 and 0.71, respectively. This indicated that the scale efficiency of sawmills was quite high, which is evident from the average scale efficiency score. Actually, about 21% of sawmills were scale efficient on average. Inefficient sawmills located below the best practice frontier could improve their technical efficiency by better utilization of their resources for example by training their workforce, using the machinery and equipment efficiently, and improving their managerial ability and quality.

The results from the BCC model indicate that more than 61% (647 out of 1066) of sawmills performed under increasing returns to scale, while 39% (416 out of 1066) operated under decreasing returns to scale. The quest for economies of scale with the objective of creating larger and presumably more competitive organizations is often the rationale for mergers and acquisitions. With this intention, sawmills operating under increasing returns to scale would be attractive acquisition targets because they have the opportunity to become more efficient through growth. On the other hand, sawmills with decreasing returns to scale are unattractive merger/acquisition targets since they are already “too large”.

The average technical efficiency of sawmills in 1990 was 0.68, while it was 0.77 for sawmills in 2002. This shows 13% increase in average technical efficiency of sawmills over the study period. Moreover, based on the frontier analysis of the BCC model, 14 sawmills were technically efficient while 64% of them were so in years 2000, 2001 and 2002. The increase in efficiency of sawmills over the study period which is observed here might not purely be due to improvements in technical efficiency, since in our intertemporal analysis, sawmills in the whole study period were compared to a single frontier. It is not possible to distinguish between efficiency changes and technical changes (frontier shift) in an intertemporal analysis. The case of BC sawmills suggests that there has been technological advancement in the sector. To explore this issue better, we used Malmquist productivity index within the DEA framework to decompose the changes into efficiency and technical changes. Therefore, contemporaneous DEA analyses were performed using CCR and BCC models for each year separately. It means in these models, each sawmill was compared to other sawmills in the same year.
As was expected, the average efficiency scores in the contemporaneous analysis increased compared to those of the intertemporal analysis, since each sawmill was compared to a smaller sample size. The range for average aggregate efficiency was between 0.79 and 0.87, while it was between 0.83 and 0.88 for average technical efficiency. It was observed that the scale efficiency of BC sawmills was high, which was also concluded from the intertemporal analysis (Table 3).

It is not possible to compare sawmills’ efficiency from one year to another in a contemporaneous analysis, since the efficiency measures are calculated based on a frontier for each year. However, these measures can be used in a Malmquist index to further investigate the changes.

In order to analyze productivity changes, Malmquist index was calculated for the period of 1990–2002. The comprising elements of Malmquist index were also measured to identify the efficiency and technical changes. These indices incorporated the contemporaneous aggregate efficiency scores. To report productivity change, efficiency change and frontier shift, we considered three periods: the whole study period (1990–2002) and two sub-periods (1990–1995 and 1996–2002), since estimation of Malmquist indices for each year can be vulnerable to data errors or noise. Table 4 shows the average changes for each period.

The results indicated that the productivity of BC sawmills improved in 2002 compared to that of 1990 ($M = 1.112$). This was the result of slight improvement in efficiency of sawmills ($TC = 1.003$), but more due to frontier shift ($TC = 1.111$). Estimated Malmquist indices for the two sub-periods revealed that efficiency decrease and productivity growth were mainly due to frontier shift.

Many BC sawmills invested in new technology and optimization systems over the past decade as explained earlier. The poor industry performance (efficiency decrease) during each sub-period may have happened since sawmills were adjusting to the new technology. Please note that the base year in the first sub-period is 1990, while it is 1996 for the second sub-period. Improved production efficiency for the whole study period might be the outcome of sawmills adjusting to new technology successfully over this period.

The Malmquist results again show that inefficient sawmills should focus on technical efficiency and catching-up towards the best performers by efficiently utilizing their resources to transform inputs to outputs.

Comparing the results of our study on the productivity and efficiency of BC sawmilling sector to those of [13] on the Norwegian sawmilling sector indicates that the sectors in both regions experienced productivity and technology
improvements over the study periods. Two previous studies on BC sawmills [3,7], although using parametric methods, also showed technology improvement in this sector.

Economic conditions in Canada and abroad and business cycles over the past decade may also have affected sawmills’ technical efficiency. Economic recession in Canada in 1991 [25] and slowdown in construction sector in North America in 1995 are among the important events during the first sub-period (1990–1995). In 1995, housing starts were down 27% (from the previous year) in Canada and 6.3% in US [26]. The decline in construction sector in North America resulted in a slowdown in the softwood lumber market. The weak demand for lumber affected exports and shipments of sawmills. Export of sawmill and planing mill products declined 3.8% in 1995, however, the employment in this sector increased slightly by 0.7% in the same year [26]. All these indicate that sawmills’ production declined due to the weak demand for lumber while employment in this sector was the same (or slightly more). The economic recession in Japan, economic slowdown in other South-East Asian countries and Lumber Agreement are among the major events affecting the performance of BC sawmills during the second sub-period (1996–2002). The value of exports to Japan, which was mainly dominated by BC, decreased in 1996 after the phenomenal growth since the beginning of the 90’s [27]. Export of wood from four provinces in Canada, including British Columbia, to the United States got constrained under the Lumber Agreement [27]. Quotas imposed under the Canada–USA agreement, as well as the growing increase in prices for raw materials had negative effects on how the sector could perform [27].

We observed a continuing decline in the number of establishments while analyzing the data (number of sawmills, lumber production) we received from the BC Ministry of Forests. The number of sawmills in BC has decreased by 22% since 1990, however, the total volume of lumber production has expanded by about 2% in 2002 compared to that in 1990. Obviously, the mills that stayed in the business could increase their production by enhancing the technology and improving their efficiency. This is what we saw in our Malmquist results for the whole study period as well.

It should be noted that the efficiency results reported here are based on the factors and data elements included in the DEA models. It means that the results show how efficient the sawmills are in using labour and logs to produce lumber and chips. The effect of noise or error in data was not considered in DEA, since it is a deterministic method.

4. Conclusions

DEA has been used in many efficiency trend studies of manufacturing and service industries. In this paper, DEA-based dynamic efficiency measurement methods were used to study the efficiency and productivity of BC sawmills during 1990–2002.

The efficiency measurements revealed that although BC sawmills enjoyed high scale efficiency, their aggregate efficiency remained low due to deficiencies in technical efficiency. Implementing policies such as learning, knowledge sharing, structural reforms, or alternative business approaches to improve technical efficiency could reward the efficiency of the whole sector and the individual mills. This analysis also suggested a fairly stable trend in the efficiency of sawmills.

The productivity measure was a combined measure of efficiency change and frontier shift. Comparing the results of 2002 to that of the 1990, a slight improvement was observed in the sector’s efficiency while productivity and technology increased more. The productivity and technology changes showed that technological advancement was the major cause for productivity growth of the sector. The technological advancements can be tracked in such operational changes as automation, machinery productivity increase and applications of optimization in manufacturing systems which happened gradually in 1990–2002.

If data on other performance factors were available, this study could take them into account as well. Allocative, cost and profit efficiency analyses could be performed, if cost and price data were accessible.

Acknowledgment

We are grateful to the BC Ministry of Forests for providing the dataset of BC sawmills for our analyses.

Appendix

See Table A.1.
Table A.1
Costs of wood industry in British Columbia, 1990–1997

<table>
<thead>
<tr>
<th>Year</th>
<th>Capital and repair (Million $)</th>
<th>Total wages (Million $)</th>
<th>Fuel and electricity (Million $)</th>
<th>Materials and supplies (Million $)</th>
<th>Total cost (Million $)</th>
<th>% Capital and repair</th>
<th>% Fuel and electricity</th>
<th>% Capital, repair, fuel and energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>830.7</td>
<td>1290</td>
<td>169</td>
<td>4203</td>
<td>6,492.7</td>
<td>0.13</td>
<td>0.03</td>
<td>0.15</td>
</tr>
<tr>
<td>1991</td>
<td>558.1</td>
<td>1165</td>
<td>161</td>
<td>3734</td>
<td>5,618.1</td>
<td>0.10</td>
<td>0.03</td>
<td>0.13</td>
</tr>
<tr>
<td>1992</td>
<td>596.7</td>
<td>1348</td>
<td>197</td>
<td>4462</td>
<td>6,603.7</td>
<td>0.09</td>
<td>0.03</td>
<td>0.12</td>
</tr>
<tr>
<td>1993</td>
<td>752.8</td>
<td>1446</td>
<td>203</td>
<td>5548</td>
<td>7,949.8</td>
<td>0.09</td>
<td>0.03</td>
<td>0.12</td>
</tr>
<tr>
<td>1994</td>
<td>841.7</td>
<td>1556</td>
<td>217</td>
<td>6662</td>
<td>9,276.7</td>
<td>0.09</td>
<td>0.02</td>
<td>0.11</td>
</tr>
<tr>
<td>1995</td>
<td>943</td>
<td>1597</td>
<td>218</td>
<td>7357</td>
<td>10,115</td>
<td>0.09</td>
<td>0.02</td>
<td>0.11</td>
</tr>
<tr>
<td>1996</td>
<td>761.6</td>
<td>1560</td>
<td>224</td>
<td>7551</td>
<td>10,096.6</td>
<td>0.08</td>
<td>0.02</td>
<td>0.10</td>
</tr>
<tr>
<td>1997</td>
<td>665.5</td>
<td>1562</td>
<td>232</td>
<td>7622</td>
<td>10,081.5</td>
<td>0.07</td>
<td>0.02</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Source: Natural Resources Canada [28,29].

References