Forest Industry Employment: A Jurisdictional Comparison

GREGG DELCOURT AND BILL WILSON
Industry, Trade and Economics
Canadian Forest Service
Pacific Forestry Centre
Victoria, British Columbia

Il y a un regain d’intérêt dans les options interventionnistes pour réduire l’ampleur et la persistance du chômage structurel dans les pays développés. L’histoire de la foresterie est truffée de telles politiques d’intervention. Pour essayer d’identifier les interventions qui ont réussi, cette étude analyse les niveaux relatifs d’emplois, dans le secteur forestier, d’une sélection de juridictions. Un indice d’emplois directs par millier de mètres cubes de bois d’œuvre coupé est estimé pour chaque juridiction. Les données sur l’emploi et les coupes sont standardisées et les niveaux d’emplois sont ajustés de façon à prendre en considération les différences dans les taux de changes et d’emplois. Les résultats indiquent une uniformité approximative des niveaux d’emplois parmi les juridictions, une tendance à substituer la main d’œuvre par le capital de même que des gains d’emplois directs provenant de l’intégration avec les produits du papier et du carton.

There is a renewed interest in interventionist options to reduce the magnitude and persistence of the structural unemployment in developed economies. Forestry has a broad history of such policy intervention. This study examines the relative levels of forest sector employment across a selection of jurisdictions in an effort to identify successful interventions. An index of direct jobs per thousand cubic metres of timber harvested is estimated for each jurisdiction, employment and harvest numbers are standardized, and employment levels are adjusted for both exchange and wage rate differences. The results indicate a rough uniformity in employment levels across jurisdictions, a trend to capital substitution in place of labour, and direct employment gains from forward integration into paper and paperboard products.

INTRODUCTION

In recent years many developed economies have increasingly experienced pronounced and persistent levels of unemployment (Organisation for Economic Cooperation and Development 1997). It can be reasonably argued that these levels are the product of technology and factor substitution, standard components of structural unemployment. In order to address unemployment, many jurisdictions have used public intervention to stimulate job creation, with the specific character of the interventions a product of the political, institutional, economic, and physical parameters of the jurisdiction.

Forest sector interventions to increase employment include enhanced resource access; trade restrictions on both exports, for example, logs; and imports such as manufactured wood products; capital and factor subsidies; market development aid; funding for research and development; and labour training support. In many Canadian jurisdictions, forestland
is largely provincial Crown land and access to timber is bound to a variety of tenure arrangements that require direct investment in processing capacity, sometimes termed appurtenancy clauses. This is the case in British Columbia, Alberta, and Ontario (Ross 1995; Haley and Luckert 1990).

British Columbia has pursued the objective of more jobs with a package of forest policy reforms and programming intended to position the forest sector for environmental, social, and economic sustainability. The package includes funding for labour training and transition support, via Forest Renewal BC; promotion of value-added manufacturing activity; and a de facto redefinition of appurtenance clauses affecting various forest companies. In 1997, forest companies agreed to increase employment in exchange for continued access to a specified volume of Crown timber — the Jobs and Timber Accord. These initiatives will impact on the access to and the cost of timber, which, in turn, affects employment, trade, and economic activity (see Wilson 1997).

This study examines the relative levels of direct forest sector employment in British Columbia, Alberta, Ontario, New Zealand, Sweden, Finland, Washington, and Oregon. These jurisdictions were selected because their forest industries all generate significant economic activity, employment, and export earnings, but yet present fundamentally different institutional and policy environments. The initial objective is to determine the levels of success of various employment interventions in other jurisdictions, so that any successful options could be subsequently evaluated for their potential benefit to the Canadian situation.

**METHODOLOGY**

Despite an abundance of inter-jurisdictional comparisons of social and economic performance, closer examination often reveals major discrepancies in what the data in the various jurisdictions are actually measuring, challenging the quality of these comparisons. A valid comparison of forest sector employment requires development of a standardized measure for direct employment. Standardization includes adjustments for differences in the definitions of forest sector employment and timber harvest volumes.

To develop an employment comparison across the selected jurisdictions that is not skewed by the magnitude of the timber harvest, direct employment numbers in each jurisdiction are related to an equivalent measure of forest output. The measurement unit adopted is the ratio of employment per thousand cubic meters (Mm³) of timber harvest. This measure necessitates careful calibration of a variety of parameters affecting estimates of timber harvest volume. These parameters include adjusting for roundwood imports; recycled fibre, which translates into timber harvest equivalents; and how the timber harvest is measured. The employment ratio takes the following form:

\[
\text{Employment Ratio} = \frac{\sum \text{All Forestry Employment}}{\text{Total Roundwood Harvest} + \text{Imported Fibre} + \text{Recycled Fibre}}
\]

**Imports**

Both Sweden and Finland are established importers of hardwood logs for pulp production, Washington and Oregon have imported volumes to offset the harvest reductions resulting from the imposition of severe harvest restrictions on federal lands, and British Columbia imports fibre in response to supply shortages and reduced access to Crown timber. Estimates of the total imported fibre are developed for each jurisdiction and added to the reported timber harvest. This study assumes that all imported roundwood, pulp, and chips are processed in the import region. Thus, any jobs created or sustained by imported fibre are accounted for via a derived increase in roundwood use. Pulp and chip volumes are converted into roundwood using a conversion...
ratio for the particular product. Conversion ratios for woodpulp can vary from 2.29-5.24 m$^3$ per tonne depending on whether the pulping process is mechanical or kraft. The conversion factor used in developing the roundwood equivalent is based on jurisdiction pulping capacity by type.

**Recycled Paper**
Recycling legislation quickly produced a market for recycled fibre, with firms having made major capital investments in processing capacity. Recycled fibre is blended with virgin fibre to satisfy recycled content requirements. Many of the jurisdictions, including Canadian mills, import recycled fibre to blend in order to meet the recycle content requirements in destination markets. Employment from the production of paper and paperboard products with recycled content is included in forest industry employment estimates. In order to account for these jobs, the roundwood equivalent of recycled content is estimated.

**Harvest Measures**
The United States reports harvest volumes using a unique system. Instead of reporting volumes in cubic metres, the US uses the Scribner scale and reports timber harvest volumes in board feet or foot board measure (fbm). There is no singular conversion factor for Scribner fbm to m$^3$. The timber conversion factor ranges from 3.3 to 9.3 m$^3$ per thousand fbm (Mfbm Scribner) depending on species and log size — larger logs have a lower conversion ratio since more lumber can be recovered with less waste than from a smaller log. The most common conversion factor is 4.53 m$^3$ per Mfbm, but the US International Trade Commission has recommended a conversion factor of 5.66 for US/Canada cross-border stumpage comparisons. Washington and Oregon roundwood harvest volumes are converted using 4.53 m$^3$/Mfbm and 5.66 m$^3$/Mfbm for the coastal and interior production proportions respectively to capture the variation in the characteristics of the timber harvested.

An alternative timber conversion factor was estimated based on Washington and Oregon data on total timber harvest volume (measured in board foot Scribner units) used in the production of lumber and the volume of lumber production (measured in board foot units). A Scribner to cubic meters conversion factor for the timber harvest was developed with this data. The State lumber production was multiplied by a standard volumetric conversion factor specific to fbm to m$^3$ conversion. The lumber production, in m$^3$, was then converted into roundwood equivalents but again in m$^3$. Finally, the m$^3$ of roundwood equivalent was divided by the Scribner fbm timber used in lumber production to produce a conversion factor. The estimated conversion factor was 6.3 m$^3$ per 1,000 fbm Scribner.

The 6.3 estimated conversion factor was applied to the development of a standardized timber harvest and the results of this are illustrated as WA1 (Washington) and OR1 (Oregon) in Figures 2 and 3.

Sweden’s timber harvest is reported in six different categories, ranging from “total drain” to “wood consumption” (Skogsstyrelsen 1997). This study uses wood consumption as the base measure of timber harvest. Wood consumption is defined as “gross fellings” less whole trees left in the forest, transport losses, and bark volume. This measure is equivalent to the BC measure that would also include transport losses.

**Labour Measures**
The primary sources of data for Canadian forest sector employment by province are three different Statistics Canada surveys: the Annual Survey of Manufacturers; the Labour Force Survey; and the Survey of Employment, Payrolls and Hours (SEPH). BC employment is also estimated in an annual Price Waterhouse forest industry survey (Price Waterhouse 1996). This study uses the SEPH estimates for provincial forest sector employment because it provides a more comprehensive time series of sector employment.
Statistics Canada separates the forest industry into three major activities: logging and forestry services (SIC 041 and 051), wood and wood products (SIC 251-259), and paper and allied products (SIC 271-279). Jobs included under these classifications are referred to as direct employment because the activity is a direct result of the primary forest resource. (Indirect employment is not included in the current study.) The Forestry classification is comprised of the Logging industry and the Forestry Services industry. Forestry Services include reforestation, timber cruising, and fire fighting services. The Wood Industries sector includes the Sawmill, Planing Mill and Mill Products industries, Veneer and Plywood industries, and all other wood manufacturing industries. The Paper and Allied Products industry includes pulp and paper industries, the asphalt roofing industry, paper box and bag industries, and other converted paper products industries.

The national agencies gathering employment in the other selected jurisdictions use similar classifications with some minor modifications in the exact industries that are included. Employment data for Washington and Oregon are from the United States Bureau of Labor Statistics (BLS) publication Current Employment Statistics: State & Area Employment, Hours, & Earnings (1996). All firms with more than 250 employees and a sample of smaller firms are included in the survey. Approximately 360,000 establishments across the US are surveyed. This survey is comparable in scope and size to Statistics Canada’s SEPH. The employment data are calculated by taking the average annual number of jobs, part-time and full-time, which has the effect of overestimating employment.

In addition to these employment classifications, there are other jobs that are a direct result of forestry. For instance, there are over 4,500 public sector forestry jobs in BC dealing with silviculture, inventory, timber sales, forest policy, and research. These are directly related to the forest industry, yet they are usually classified as government services rather than forestry employment. In New Zealand and Finland such public sector workers are included in forest sector employment. Estimates of government employees working in forestry are developed for each jurisdiction in this study and included in forest sector employment totals.

A standard problem among the various data sources is the quality of the data related to the service sector. Most government statistical agencies are better positioned to gather data on widgets than on services. This limitation contributes to an under-statement of forest employment in transportation services; for example, marine-hauling, heli-logging, and trucking firms are classified in the transportation industry; forest consulting, and forest product wholesaling and retailing.

A common deficiency in employment data series is the measurement of self-employment labour. In Sweden and Finland over 70 percent of the forestland is privately held, much of it in small parcels managed by individuals; in comparison, only 4 percent of BC forestland is privately owned. Sweden reports hours of employment and this was converted into full-time equivalents (FTEs) assuming a 35-hour work week and 52 weeks per year. Finland does not collect data on employment from harvesting private non-industrial forests. The volume from such forests constitutes almost 25 percent of total harvest and Finnish woodlands employment was adjusted on an equivalent basis.

Labour Wage Rates
There are fundamental differences in how wage rates are determined across jurisdictions, ranging from near right-to-work conditions to highly structured value for work-wage-determination conditions. One result is that the cost per unit of labour is very different across regions (Table 1). Employment per thousand m³ of harvest are calculated for nominal employment levels and also for employment levels adjusted for differences in wage rates.

Labour costs across the selected jurisdictions are compared by looking at the hourly cost of workers
weighted by the proportion of labour and their respective costs in lumber and wood products, and paper and allied product industries. (Due to incomplete data, the woodland division’s labour costs are assumed to equal the weighted average of the lumber and wood products and paper and allied product industries.) Data for the United States, Canada, Sweden, and Finland are taken from the United States Bureau of Labor Statistics (1996). These data are calculated as the hourly compensation for all production workers in the industry. BC, Alberta and Ontario data are calculated by using Statistics Canada wage data for the provinces and Canada and then creating an index. This method was also used for Washington and Oregon using wage data from United States Bureau of Labor Statistics (1996) and then creating an index with the United States wage data from the Bureau of Labor Statistics (1997). BC labour costs have consistently been approximately 20 percent higher than the Canadian average. This index was then applied to the US Bureau of Labor Statistics’ (1996) Canadian data. The results showed that, from 1986 to 1993, BC had the highest labour costs for six out of eight years in paper and allied and five out of eight years for lumber and wood products; the other years BC had the second highest hourly cost of production. Other regions with high labour costs included Finland and Sweden. In the lumber and wood products industries, Sweden’s labour cost exceeded all regions for three years in the early 1990s, until the devaluation of the Swedish krona in 1993.

Labour costs are subsequently converted to Canadian dollars using relevant exchange rates. This conversion does not address differences in real returns to labour, however. This could be done using a purchasing power parity (ppp) coefficient, but

### Table 1
Standardized Harvest, Employment and Wage Rates, 1993

<table>
<thead>
<tr>
<th></th>
<th>BC</th>
<th>Ontario</th>
<th>Alberta</th>
<th>Oregon</th>
<th>Washington</th>
<th>Sweden</th>
<th>Finland</th>
<th>New Zealand</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fibre Consumption (‘000 m³)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Harvest</td>
<td>78004</td>
<td>25432</td>
<td>14183</td>
<td>25252</td>
<td>20181</td>
<td>56500</td>
<td>42071</td>
<td>16028</td>
</tr>
<tr>
<td>Imports</td>
<td>710</td>
<td>1460</td>
<td>53</td>
<td>4151</td>
<td>3074</td>
<td>6019</td>
<td>6761</td>
<td>65</td>
</tr>
<tr>
<td>Recycled Fibre</td>
<td>494</td>
<td>2987</td>
<td>149</td>
<td>5449</td>
<td>3734</td>
<td>5352</td>
<td>3469</td>
<td>225</td>
</tr>
<tr>
<td><strong>Total Harvest Equivalent</strong></td>
<td>79208</td>
<td>29879</td>
<td>14385</td>
<td>34852</td>
<td>26989</td>
<td>67871</td>
<td>52301</td>
<td>16318</td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Employment</td>
<td>82916</td>
<td>63000</td>
<td>13500</td>
<td>62700</td>
<td>53000</td>
<td>90534</td>
<td>87004</td>
<td>29672</td>
</tr>
<tr>
<td>Other Forest Employa</td>
<td>4595</td>
<td>2800</td>
<td>267</td>
<td>200</td>
<td>200</td>
<td>1200</td>
<td>incl.</td>
<td>incl.</td>
</tr>
<tr>
<td><strong>Total Full Time Equivalent</strong></td>
<td>87511</td>
<td>65800</td>
<td>13767</td>
<td>62900</td>
<td>53200</td>
<td>91734</td>
<td>87004</td>
<td>29672</td>
</tr>
<tr>
<td><strong>Hourly Wage Rate (C$)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulp and Paper</td>
<td>32.66</td>
<td>25.84</td>
<td>28.37</td>
<td>21.61</td>
<td>21.61</td>
<td>26.37</td>
<td>27.15</td>
<td>15.64</td>
</tr>
<tr>
<td>Wood Products</td>
<td>23.99</td>
<td>17.68</td>
<td>19.68</td>
<td>15.60</td>
<td>16.03</td>
<td>21.79</td>
<td>19.53</td>
<td>8.41</td>
</tr>
<tr>
<td>Weighted Wage Rate</td>
<td>29.81</td>
<td>20.88</td>
<td>25.42</td>
<td>20.57</td>
<td>19.48</td>
<td>23.98</td>
<td>22.52</td>
<td>12.84</td>
</tr>
<tr>
<td>Exchange Rate (domestic currency/C$1993)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.78</td>
<td>0.78</td>
<td>6.04</td>
<td>4.44</td>
<td>1.43</td>
</tr>
</tbody>
</table>

*Government employees*
the quality of this option is a function of the basket of goods and services used to develop the ppp coefficient.

The base employment data include all forest industry jobs in logging, wood industries, and pulp and paper industries. The base harvest data include the volume of timber harvested. Both of these base numbers require considerable adjustment to allow for definition and measurement variation across the jurisdictions (for details on the calculations see Delcourt and Wilson 1997). The results of the adjustments are presented in Table 1.

FORESTRY IN BRITISH COLUMBIA

The British Columbia forest industry continues to be a major employer, a large contributor to GDP and the most important source of export earnings in the province. However, as the BC economy matures, the proportional contribution of forestry is theoretically expected to decline compared with the service sector. Results since the 1980s are largely consistent with this theory. Despite an increase in harvest levels over the 1983-1995 period, the proportion of total provincial direct employment in the forest sector declined from 8 percent to 6 percent (Statistics Canada, SEPH 1996). This is the product of relative growth in the service sector, increasing forest sector productivity (primarily through new technology), and rising production costs in forestry. There has also been a corresponding decline in sector GDP share — the forest sector’s share of GDP was 9 percent in 1983 and 7 percent in 1995. Forest exports, however, have increased considerably. As a percent of total BC exports, forest exports have grown from 53 percent in 1995 to 55 percent in 1983. Total forest product export earnings increased from about $5 billion to $17 billion from 1983 to 1995 (BC Stats 1997).

BC’s productive forests cover over 43 million hectares (45 percent) of the province and the commercially operable area is about one half of this area (23 million hectares). The annual area of harvest is less than one percent of the commercially operable area. The forest area is relatively enormous and biogeoclimatically very diverse. Generally, BC forestry is divided into two regions: the Coast Mountains and islands (the Coast) and the rest of BC (the Interior). Within these regions there is still a great deal of diversity, although management, harvesting, and processing strategies are similar.

The Coast region is wet, topographically rugged and often has highly productive timber sites. The primary commercial species are hemlock, western cedar, Douglas-fir, balsam fir, yellow cedar, and sitka spruce. Harvest levels have declined in absolute and relative terms in recent years. Currently, Coastal production constitutes about 30 percent of the total BC timber harvest.

The Interior region accounts for about 85 percent of BC’s productive forest area and about 70 percent of the provincial timber harvest. The major Interior commercial species are lodgepole pine, spruce, balsam fir, Douglas-fir, hemlock, larch, western red cedar, ponderosa pine, and poplar. The Interior industry is built on large volumes of lower-quality, small trees that are less accessible and transported by either rail or truck. Over the past 25 years the Interior harvest has increased by over 50 percent, whereas the Coast’s harvest has declined. Due to the characteristics of its standing timber, structural lumber, chips and pulp are the primary products derived from the Interior forests; the Interior produces over 70 percent of BC pulp chips.

Annual harvest volumes are set by the BC Forest Service. The annual allowable cut (AAC) is set for the province and individual forest licensees have a proportion of this volume. In order to sustain a stable employment base and provincial budgets, forest companies are allowed to harvest within 5 percent of their allowable cut (plus or minus) over their five-year forest plan. This allows forest companies to react to market conditions. The 1996 AAC was approximately 72 million m³.
Prior to the recent slight increase, employment in the BC forest industry as a percent of total BC employment had declined since 1980 (see Figure 1). Improved market conditions and new silviculture legislation are the primary reasons for this modest turnaround. During this period employment in woodlands/logging and wood processing industries declined; and employment in the pulp and paper industries was basically stable.

Wood-processing operations are increasingly capital intensive. In part, a consequence is that wood-processing employment has decreased from almost 36,000 jobs in 1980 to less than 29,000 jobs in 1995. Both harvesting and processing are more capital intensive in the Interior than in the Coastal region. Harvesting in the Interior, where the trees are smaller and the terrain flatter, is much more mechanized than in the Coast region. The Coast harvest is half that of the Interior but the Coastal industry employs more people in the woodlands operations (see Table 2).

**FORESTRY IN ALBERTA AND ONTARIO**

Both Alberta and Ontario forests are predominately Crown land with private land only accounting for 4 percent and 11 percent of total forestland, respectively. The majority of Alberta’s forests are located in the boreal forest region along the BC border. Approximately 60 percent of Alberta’s land area is covered by forests; softwood species account for about two-thirds of this forest area. The Alberta forest industry has experienced rapid growth over the past decade based on increased timber harvests. The Alberta harvest has produced the largest absolute and relative growth of any Canadian province. The hardwood and private land harvests have accounted for the bulk of the harvest growth. Industrial expansion in pulp, paper, and oriented strandboard production has led the demand for hardwood timber. The 1995-96 total harvest of 22.1 million m$^3$ consisted of 2.7 million m$^3$ from private lands, with the remainder from provincial lands.

**Figure 1**

Forest Sector Employment as a Percent of Total Employment, British Columbia

Note: Alberta (AL), British Columbia (BC), Finland (FI), New Zealand (NZ), Ontario (ON), Oregon (OR, OR1), Sweden (SW), and Washington (WA, WA1). OR1 and WA1 are described on page S13.

### Table 2
Harvest and Employment, Selected Industries, a British Columbia

<table>
<thead>
<tr>
<th>Year</th>
<th>Harvest ('000 m³)</th>
<th>Coast</th>
<th>% of Harvest</th>
<th>Interior</th>
<th>% of Harvest</th>
<th>Total</th>
<th>% of Harvest</th>
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<tbody>
<tr>
<td>1980</td>
<td>30,712</td>
<td>41</td>
<td>43,942</td>
<td>59</td>
<td>74,654</td>
<td>100</td>
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<tr>
<td>1985</td>
<td>27,712</td>
<td>36</td>
<td>49,156</td>
<td>64</td>
<td>76,866</td>
<td>100</td>
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<tr>
<td>1989</td>
<td>29,940</td>
<td>34</td>
<td>57,474</td>
<td>66</td>
<td>87,414</td>
<td>100</td>
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<tr>
<td>1992</td>
<td>24,719</td>
<td>31</td>
<td>53,860</td>
<td>69</td>
<td>78,579</td>
<td>100</td>
<td></td>
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<tr>
<td>1993</td>
<td>25,200</td>
<td>32</td>
<td>52,804</td>
<td>68</td>
<td>78,004</td>
<td>100</td>
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<tr>
<td>1994</td>
<td>24,050</td>
<td>32</td>
<td>51,043</td>
<td>68</td>
<td>75,093</td>
<td>100</td>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Employment Coast</th>
<th>% of Jobs</th>
<th>Interior % of Jobs</th>
<th>Total</th>
<th>% of All BC Forestry Jobs</th>
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<tbody>
<tr>
<td>1980</td>
<td>15,990</td>
<td>66</td>
<td>8,280</td>
<td>33</td>
<td>24,270</td>
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<tr>
<td>1985</td>
<td>11,029</td>
<td>57</td>
<td>8,439</td>
<td>43</td>
<td>19,468</td>
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<tr>
<td>1989</td>
<td>11,347</td>
<td>56</td>
<td>8,969</td>
<td>44</td>
<td>20,316</td>
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<tr>
<td>1992</td>
<td>9,761</td>
<td>55</td>
<td>8,137</td>
<td>45</td>
<td>17,898</td>
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<tr>
<td>1993</td>
<td>10,037</td>
<td>53</td>
<td>8,942</td>
<td>47</td>
<td>18,979</td>
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<tr>
<td>1994</td>
<td>8,854</td>
<td>54</td>
<td>7,526</td>
<td>46</td>
<td>16,380</td>
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#### Logging Employment (SIC 041)

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<tr>
<th>Year</th>
<th>1980</th>
<th>15,175</th>
<th>42</th>
<th>20,675</th>
<th>58</th>
<th>35,850</th>
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<tr>
<td>1985</td>
<td>10,716</td>
<td>37</td>
<td>18,285</td>
<td>63</td>
<td>29,001</td>
<td>38</td>
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<tr>
<td>1989</td>
<td>11,624</td>
<td>39</td>
<td>18,335</td>
<td>61</td>
<td>29,959</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>10,870</td>
<td>39</td>
<td>17,011</td>
<td>61</td>
<td>27,881</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>11,784</td>
<td>40</td>
<td>17,321</td>
<td>60</td>
<td>29,105</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>12,128</td>
<td>40</td>
<td>18,304</td>
<td>60</td>
<td>30,432</td>
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#### Sawmill and Planing Mill Employment (SIC 2512)

<table>
<thead>
<tr>
<th>Year</th>
<th>1980</th>
<th>n/a</th>
<th>-</th>
<th>n/a</th>
<th>-</th>
<th>21,540</th>
<th>23</th>
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<tbody>
<tr>
<td>1985</td>
<td>n/a</td>
<td>-</td>
<td>n/a</td>
<td>-</td>
<td>16,850</td>
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<tr>
<td>1989</td>
<td>n/a</td>
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<td>n/a</td>
<td>-</td>
<td>18,643</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>n/a</td>
<td>-</td>
<td>n/a</td>
<td>-</td>
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Pulp and Allied Employment (SIC 27)

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* The Annual Survey of Manufacturers is the only data source which supplies estimates of the woodland and sawmill industries for the BC Coast and Interior.

Source: Statistics Canada, various years.
Although the Ontario forest industry’s contribution to the provincial economy is relatively small compared to that of BC and Alberta, it still has the third largest forest products industry in Canada (behind BC and Quebec). Timber harvest in Ontario has been on the decline since its peak of 30 million m$^3$ in 1986. The majority of the harvest consists of softwood species (74 percent). The province calculates its AAC on an area basis and permits 400,000 hectares of its 58 million hectares of forestland to be harvested annually. In 1995, total harvest was 210,000 hectares compared to 190,000 hectares in BC, but total harvest volume was only one-third of that of BC.

Alberta’s expansion in harvest levels and its favourable investment climate have created opportunities for forest companies. In fact, Alberta is the only region in this study that has demonstrated a continual rise in forest industry employment over the past decade. From 1986 to 1995, roundwood harvest volumes and employment have increased by over 50 percent.

Employment in the Ontario forest industry has declined by over 22 percent since its peak in 1989, although total harvest has fallen by only 6 percent. This increased labour productivity shows up in the wood products and paper and allied industries arising from the characteristic substitution of capital in place of labour. Since 1989, employment in these industries has fallen by over 17 percent and 28 percent, respectively. The most prominent feature about the distribution of employment in the Ontario forest industry is the dominance of the pulp, paper, and paper products industries. In 1993, 56 percent of all Ontario forestry jobs were in the pulp, paper, and paper products industries compared to only 21 percent in BC and 26 percent in Alberta.

**Forestry in Washington and Oregon**

Washington and Oregon are major sources of softwood supply in the United States. Unlike most other US states, forestland in Washington and Oregon is predominantly owned by the public — almost 45 percent of Washington’s forests and over 60 percent of Oregon’s forests. Public lands account for approximately 60 percent and 75 percent of Washington and Oregon’s respective standing timber volumes (Western Wood Products Association 1994). The high percentage of public ownership has proven a critical element in timber harvests as the public sector responds to the demands of preservationists, particularly as a result of listing the northern spotted owl as a threatened species in 1990. A federal court injunction in May 1991 virtually closed the National Forests to timber harvesting until an Environmental Impact Statement outlining the forest industry’s participation in the recovery of the northern spotted owl was filed (Smyth 1996). The Congressional land-use plan resulted in major reductions in access to federal timber in Washington and Oregon. During the 1988-95 period, the harvest of federal timber in Washington and Oregon fell by almost 80 percent and total harvest volumes fell over 40 percent. The pulp and paper industry has worked to mitigate the supply reduction by increasing pulpwood imports and recycled fibre imports from the urban forest.

Forestry employment in these states was in decline as a result of labour-saving, capital investments, but this trend was sharply reinforced by the reduction in access to federal timber due to efforts to protect habitat for the northern spotted owl. Washington experienced employment reductions of 16 percent in woodlands/logging and 29 percent in wood processing. During the last eight years, Oregon’s woodlands/logging industry lost 35 percent of its jobs and the wood processing industry lost 21 percent of its jobs. By offsetting the timber supply reduction through imports and recycled fibre, the pulp and paper industries have been able to maintain employment levels over the study period.

**Forestry in Sweden and Finland**

Sweden is often cited as a global leader in sustainable forestry and it works hard to promote that
The Swedish forest is a highly managed, heavily regulated “crop” that covers about 55 percent of the total land area. The forests are even-aged stands in their second, third, and fourth rotation. Little old-growth forest remains. The forest industry employs an 80 to 120 year rotation, with little variation in types of species harvested — primarily Scots pine (38 percent) and Norway spruce (46 percent), along with some hardwoods (mainly white birch). Sweden’s harvest of approximately 65 million m$^3$ per year has increased in recent years and there is potential to increase future harvests significantly. The annual incremental growth is about 1.4 times the current harvest level.

With over 66 percent of its land area covered with forests, Finland is the most densely forested Nordic country. The topography of Finland, like Sweden, consists of plateaus of worn bedrock and boreal forests; almost all of Finland’s forests are located in lowland areas near waterways. The forests consist of second- and third-growth with little remaining old growth. The predominant species are pine (46 percent), spruce (37 percent), and hardwoods (17 percent), as in Sweden. Finland’s harvest in 1995 was approximately 51.4 million m$^3$ (more than 50 percent of which is consumed by pulp mills) far less than its annual increment (growth) of about 80 million m$^3$. Harvest levels in both Sweden and Finland fluctuate widely due to the high percentage of private, small-holder ownership.

Timber harvesting in Sweden and Finland is capital intensive and highly mechanized. Fallers are a rare site in the forests. The gentle terrain and intensively managed stands allow felling, pruning, and thinning machinery easy access. The forests have a neat, well-groomed appearance because of intensive management. Timber use is very high and little fibre is left behind. Thinnings are used for pulp furnish and the slash from clear-cuts is made into chips and used for fuel.

Total employment in the forest industry has declined significantly over the past decade despite the increased timber harvest. Over the 1986-93 period, Swedish woodlands/logging employment declined by 28 percent and employment in the wood-processing industries declined by 27 percent. The pulp and paper industry has reduced employment levels by 23 percent. The major Swedish companies have adopted a forward-integration strategy and have invested heavily in manufacturing capacity within the European market. Major companies with half of their employees located outside Sweden are the norm.

Although the harvest level has increased in Finland, employment levels in the forest sector have declined as companies become increasingly capital intensive. Finland’s flat topography, homogeneous timber stock and intensive management regime lends itself to highly mechanized harvesting (Food and Agriculture Organization 1988). Over the 1986-94 period woodlands-logging employment was reduced by almost 50 percent and wood-processing employment declined by 13 percent. The pulp and paper industry has also reduced employment (Finnish Forest Research Institute 1995).

The liberalization of financial markets and the crash of the Soviet export market in the 1980s combined to produce a major recession in Finland. National production declined by 12 percent over the period 1991-93. This recession, the European Union entry process, a declining terms of trade and an increasing tax burden caused the national unemployment rate to increase from 3.5 percent in 1990 to 18.3 percent in 1994 (Holm and Somervouri 1997). These shocks served to reinforce an established trend to increased mechanization in forestry.

**FORESTRY IN NEW ZEALAND**

Timber harvest in New Zealand has increased sharply in recent years as the volume of mature plantation timber increases and log market prices improve (van Kooten, Wilson, and Vertinsky 1998). New Zealand has no restrictions on log exports and
domestic log prices have risen along with international log market prices in response to supply restrictions in traditional exporting jurisdictions like Washington, Oregon, and Malaysia. The current area in plantation is about 1.6 million hectares and timber production is 15 million m$^3$. Timber production will double in the next two decades with the existing plantation inventory.

The plantations have been almost totally privatized in response to New Zealand’s fiscal crunch in the 1980s and the consequent market liberalization. The privatization is increasingly attracting international investors and about 20 percent of the holdings are by non-corporate investors — a pure timber supply investment. The trend in new planting is about 100,000 hectares per year, with plantings driven by market signals rather than public sector inducements. Rotation length for the radiata pine plantations is about 28 years.

Employment in forestry declined as an immediate result of privatization of the plantations in the 1980s, but has since started to increase. The increase is the result of investment in new plantings and in expanded processing capacity. The industry is continually seeking efficiency improvements in an effort to strengthen investment performance.

**INTER-JURIDISCTIONAL COMPARISON OF EMPLOYMENT LEVELS**

Employment standardized for harvest and labour estimates produces significant differences among the jurisdictions. Ontario, New Zealand, Washington, and Oregon are at the high end in jobs/Mm$^3$ at over 1.8 jobs per 1,000 m$^3$ of harvest. These jurisdictions have relatively low wages. Sweden, Alberta, and British Columbia are at the low end of the range in jobs/Mm$^3$ (see Figure 2).

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**Figure 2**

Standardized Estimates of Jobs per Mm$^3$ Harvest, 1993

Note: See Figure 1.
Because there is wide range in the wage rates for forest sector employment across the selected jurisdictions (Table 1), a comparison of standardized jobs/Mm³ measures adjusted for differences in the wage rates was also estimated (Figure 3). This adjustment provides employment per unit of harvest in dollar terms rather than person years. When wage rate differentials are taken into account, the variation in jobs/Mm³ is reduced. This suggests that, when differences in wage rates are taken into account, the highly competitive forest products sectors in the various jurisdictions have proceeded down a somewhat similar path by substituting capital for labour to reduce labour-factor shares. The rough uniformity across the selected jurisdictions in standardized and adjusted employment levels occurs despite the considerable variation among the operating fundamentals for the forest sectors.

**CONCLUSIONS**

The global forest industry continues to experience structural change in the factors of production. Over the past decade, the number of jobs per 1,000 m³ harvested (abstracting from any standardization) has declined in every region except Washington and Oregon. In regions such as British Columbia, Sweden, and Finland the decline in the number of forestry jobs has been coupled with an increase in harvests. In Washington and Oregon the absolute decline in the number of jobs has been offset by a massive reduction in harvest levels due to preservation objectives. Employment has been maintained by increased fibre imports and targeted government transfers. The underemployment will inevitably be displaced.
The substitution of labour for capital is evident in all jurisdictions investigated in this study. The woodlands/logging industries have experienced the largest reduction in employment (despite increases in post-harvest management employment). The trend to increased mechanization in harvesting and handling, both for efficiency and safety reasons, is the major driver in the labour displacement. The wood-processing industry has also experienced considerable job loss across all jurisdictions examined here. This has led to a keen interest in promoting secondary manufacturing, often using direct intervention. Although the potential employment gains from secondary manufacturing have been demonstrated (Jacques 1996), there are some major challenges to expanding this industry (Wilson 1996). Sweden, for example, has invested heavily in secondary manufacturing with success in pulp and paper but not in solid wood. The cost of labour is proving a binding constraint in Swedish secondary manufacturing and the investment is being relocated to the former Eastern European and Baltic countries.

Among the forest industries, employment in the pulp and paper industry has been the least affected. This is likely due to the high capital-to-labour ratio in modern processing facilities and the high labour productivity factors. The absolute levels of employment have been largely constant but output per unit of labour has increased dramatically because of technological gains and recovered fibre utilization. The Ontario employment measure is heavily weighted to paper and paper-products manufacturing which supplies the eastern market. The Ontario producer enjoys a strong locational advantage in meeting the needs of this market.

With the exception of Alberta, each region included in this study has seen dramatic reductions in absolute forest sector employment. In comparison with the other jurisdictions considered here, BC forest sector employment has been more stable over the study period. However, there are pressures building in the BC industry. The BC Interior industry is commodity based and will continue to pursue the efficiency gains required to maintain a competitive position. Over the period 1979-92, employment in the Interior region fell about 17 percent despite harvest volumes increasing by 18 percent.

The Coastal industry has experienced greater job losses than the Interior and a reduction in harvest. During the 1979-92 period, there was a 30 percent decrease in the number of jobs and a 19 percent decrease in harvests. Coastal forestry is high cost and any erosion of market margins in Japan will aggravate the financial stability of the industry.

The inter-jurisdictional comparison of sector employment levels did not produce any singular examples of employment generating policy intervention. There are positive employment gains to be had from moving up the value-added chain in manufacturing forest products. However, any such gains must be considered against the fundamental challenges of a highly competitive supply side of the market, one in which there exists a variety of institutional barriers aimed at improving the position of domestic producers.

**Notes**

1. It was difficult to obtain accurate production and shipment data at the US state level. Two regional studies (Ward 1997; Larson 1994) provide estimates of the inter-state flow of timber into Washington and Oregon. These estimates were used as a proxy for inter-state import volumes. Timber flows into Ontario from other provinces were not available and no proxy was used to account for this volume.

2. Lumber imports for remanufacture could not be estimated. Washington imports a substantial volume of lumber from BC primary mills for secondary manufacturing.

3. The “urban forest” (recycled fibre) is a significant component of the forest products industry in most developed economies. In terms of fibre production-recovery, the City of New York is a leading producer of wood fibre rivalling the fast-growth timber plantations in the southern hemisphere.
This volumetric conversion factor was adjusted to reflect the difference in nominal versus real dimensions in the lumber produced. The nominal measure is 2 inches by 4 inches but the real measure is 1.5 inches by 3.5 inches and the real volume is only 65.6 percent of the nominal volume. Although lumber production will be in a range of dimensions the proxy dimension used in the calculation was 2 inches by 4 inches. This understates the real volume of lumber.

A lumber recovery factor of 40 percent was used which is consistent with efficient sawmill operation. This understates the timber requirement. The range in mill recovery is 27-44 percent.

Background and comments on the limitations of each survey are presented in Delcourt and Wilson (1997) and Dobie (1992).

Adjusting for the differences in wage rates makes the unit of measuring labour consistent across jurisdictions. Wage rates are determined by market and institutional factors.

Total compensation is determined by adjusting each country’s average earnings to include direct pay that is not included in earnings. Hourly compensation is defined as all payments made directly to the worker before payroll deductions. It also includes employer expenditures for legally required insurance programs and contractual and private benefit plans (United States Bureau of Labor Statistics 1996).

**REFERENCES**


