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An Economic Assessment of the Western Redcedar Industry in British Columbia

Christopher Gregory, Alec McBeath, and Cosmin Filipescu

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Canada

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An Economic Assessment of the Western Redcedar Industry in British Columbia

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Canadian Forest Service

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Abstract

Western redcedar is one of the most valuable commercial tree species in British Columbia. The western redcedar industry generates over $1 billion in economic activity annually and provides nearly 1900 jobs. Recent trends indicate a relative decline in the demand for redcedar products. British Columbia has the world's largest supply of standing redcedar, hence the renewed interest in better understanding the redcedar economy. In addition, published information on the economics of western redcedar is sparse. This report presents a compilation of currently available data and an analysis of trends to inform stakeholders, government, and industry. In addition, information gaps are identified to guide future research and data collection. We have not conducted a formal economic impact assessment; rather, we have surveyed the major sources of revenue and employment and report on how these contribute to the economy. Overall, lumber production has the largest impact, generating over $750 million in 2014, followed by shake and shingle production, which generated an estimated $175 million. With the uncertainty surrounding world economies, diversification of trade partners is required to ensure a thriving redcedar industry.

Résumé

Évaluation économique de l'industrie du thuya géant en Colombie Britannique

Le thuya géant est l'une des essences commerciales les plus précieuses en Colombie-Britannique. L'industrie du thuya géant génère une activité économique de plus d'un milliard de dollars par année et est source de près de 1 900 emplois. Les récentes tendances indiquent un recul relatif de la demande de produits faits de thuya. La Colombie-Britannique possède la plus grande réserve de thuyas géants sur pied au monde, d'où le regain d'intérêt à mieux comprendre l'économie du thuya géant. De plus, il y a très peu de renseignements publiés sur l'économie du thuya géant. Le présent rapport contient une compilation des données actuellement disponibles et une analyse des tendances pour éclairer les intervenants, le gouvernement et l'industrie. Les lacunes dans les connaissances sont également précisées en vue d'orienter les prochaines études et collectes de données. Nous n'avons pas mené d'évaluation officielle des retombées économiques, mais nous avons enquêté sur les principales sources de recettes et d'emploi et avons rendu compte de la façon dont elles contribuent à l'économie. De façon générale, la production de bois a la plus grande incidence, en générant plus de 750 millions de dollars en 2014, suivie de la production de bardeaux et de bardeaux de fente, qui a généré selon les estimations 175 millions de dollars. Compte tenu de l'incertitude entourant les économies mondiales, la diversification des partenaires commerciaux est nécessaire pour garantir une industrie prospère.

Key Points

- British Columbia has the world's largest stock of standing western redcedar and is the largest producer of redcedar products in the world.
- Western redcedar represented 7% of British Columbia's 2014 timber harvest volume and 18% of the coastal harvest.
- Annual harvest levels of western redcedar have fallen since 1995 across all log grades.
- Western redcedar generates over $1 billion annually; lumber exports dominate revenues, generating over $750 million.
- Over 80% of redcedar lumber, shake and shingle, and siding exports go to the United States.
- The western redcedar industry accounts for an estimated 1900 jobs in British Columbia.
- Nearly 30% of secondary manufacturing firms are heavily reliant on western redcedar.
- Secondary manufacturing use of redcedar has declined since 1997 and, as of 2012, has not seen a significant recovery.
- Information about western redcedar is sparse and several aspects of the industry could not be investigated, leaving gaps in the analysis of lumber, shakes, and employment.

1. Introduction

British Columbia is one of the world's major producers of wood products, with over 120 mills operating at an annual primary log use capacity of approximately 64 million m^3 (B.C. Ministry of Forests, Lands and Natural Resource Operations 2015). From logs to engineered wood products, British Columbia is at the forefront of wood production and forest products.

As the global economy changes and worldwide commodity prices fluctuate, economic stability is a primary concern for provincial and federal governments. British Columbia is the largest third-party certified sustainable forestry jurisdiction in the world (Council of Forest Industries 2015). Through forest management initiatives, British Columbia is working to ensure the supply of trees to the forest industry, one of the province's biggest employment sectors and an important economic driver.

British Columbia has the world's largest standing stock of western redcedar (*Thuja plicata*). Effective management is key to ensuring a sustainable redcedar industry, which has importance to forest-dependent communities in the province. Many coastal logging communities are reliant on redcedar because of the species' geographical distribution. It is also more valuable per cubic metre than other species such as western hemlock.

Redcedar is primarily manufactured into lumber, which can then be further processed in the remanufacturing sector. In addition to lumber, the other main product is shakes and shingles used for both roofing and siding. The secondary manufacturing sector also uses a substantial amount of redcedar.

In this report, we assess the economic importance of redcedar in British Columbia, providing a survey of the revenues and expenditures generated directly from the production of redcedar. Our research highlights four main areas: (1) economic output (monetary figures and shipment levels), starting with harvest and finishing with secondary products; (2) redcedar trade and the sustainability of global markets; (3) employment figures; and (4) data gaps and recommendations for future economic work. As such, this research does not constitute an economic impact assessment for the industry, which would evaluate the direct, indirect, and induced impacts of revenue generated as those revenues affect other sectors of the economy.

2. Background

Of the cedar trees found in Canada, the western redcedar is the largest, growing up to 60 m tall (Parish and Thomson 1995). Also found in Canada are the northern white-cedar (*Thuja occidentalis*) and the yellow-cedar, sometimes referred to as yellow cypress or Alaska-cedar (*Chamaecyparis nootkatensis*). Not true cedars, the white and redcedar are members of the *Thuja* genus, and the yellow is a member of the Cypress family. Because of its lightweight and decay-resistant wood, First Nations traditionally used redcedar for everything from textiles to transport items such as canoes and the tree is extremely important to many Indigenous peoples of the Pacific Northwest (First Nations and Indigenous Studies 2009).

The British Columbia government imposes certain restrictions and regulations on the use of all timber and thus the export of western redcedar logs harvested from provincial Crown land is restricted.[1] Cedar logs available for direct export come from private and federal forest lands and exports can be tracked because permits are required. Provincial Crown lands represent most of British Columbia's forests; therefore, most of the cedar harvested in the province is processed by primary manufacturers and further processed by secondary manufacturers before it is exported to foreign markets.

For simplicity, land in British Columbia is classified into the following three categories (see Figure 1).

- Federal Crown land, which makes up 1.1% of the provincial land mass, is exempt from the export restrictions on cedar logs and thus is one of the main suppliers of export logs (Dumont and Wright 2006).

1 For the restrictions on exports, see the *Forest Act*, RSBC 1996, Chapter 157, Part 10, "Manufacture in British Columbia": http://www.bclaws.ca/civix/document/LOC/complete/statreg/--%20F%20--/Forest%20Act%20[RSBC%201996]%20c.%20157/00_Act/96157_10.xml#part10 (Accessed November 2016).

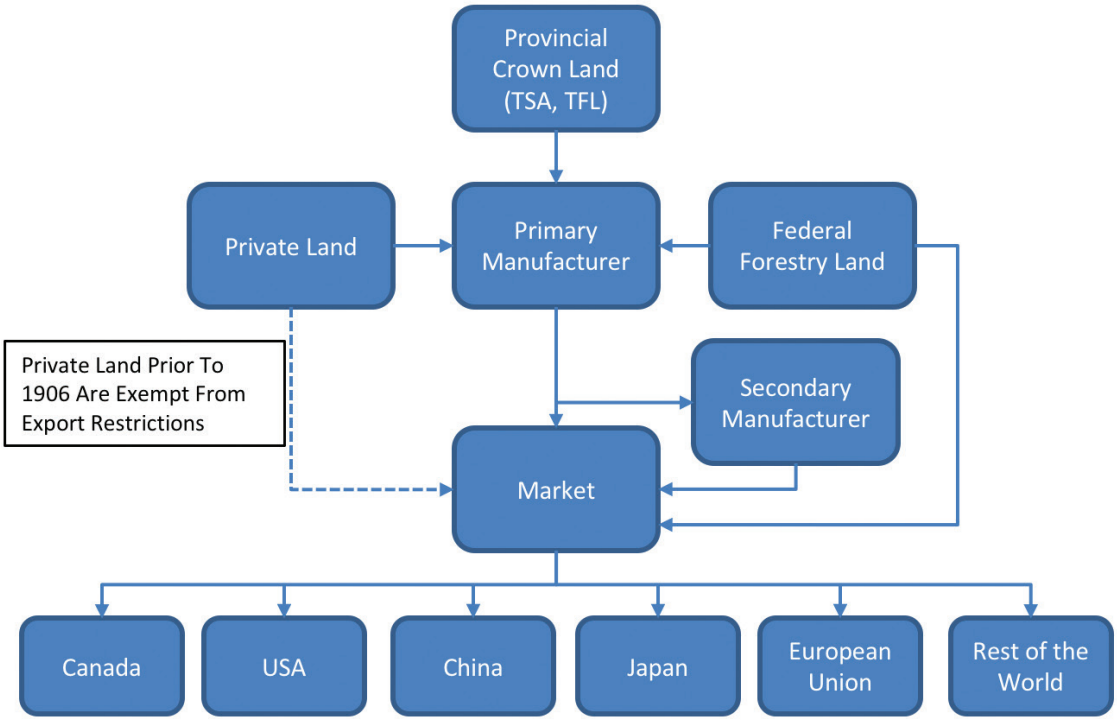


Figure 1. Cedar flowchart showing linkages between supply, manufacturing, and markets.

- Private land, which makes up 4.4% of the provincial land mass, has a grandfather clause that exempts any lands made private before 1906 from the export restrictions.
- Provincial Crown land, which represents 94.3% of the land mass, is regulated with export restrictions, stumpage fees, and fees in lieu of manufacturing clauses. Logs from Crown land can be exported; however, the onus is on the supplier to prove that the log is surplus to domestic needs and an export fee is paid before the export is conducted.

2.1 Cedar Standing Volumes and Range

Cedar's unique characteristics and desirability has led to concerns about the sustainability of the resource. For example, Bolsinger (1979) discussed concerns about the replacement rate of standing redcedar in the 1970s in the United States. For 2011, the British Columbia Vegetation Resource Inventory listed cedar as 6.6% of the total volume of provincial forests, or 14.9% of the coastal regions; however, owing to redcedar growth patterns and the methods used for measurement, these volumes may be underestimated (B.C. Ministry of Forests, Lands and Natural Resource Operations 2011).

Found along the Pacific Northwest coastline from southeast Alaska to California and in the wet belt of the British Columbia Interior (see Figure 2), redcedar grows alongside two of the province's other main commercial species, Douglas-fir and western hemlock (Klinka et al. 2000). Cedar has also been introduced in other countries such as Britain; however, the properties of the wood vary considerably, including the wood's natural durability (Gonzalez 1997). Climate change models forecast redcedar will expand into the areas between British Columbia's Interior wet belt and the Coast by 2085 (Hamann and Wang 2006), and the distribution of other timber species will also change.

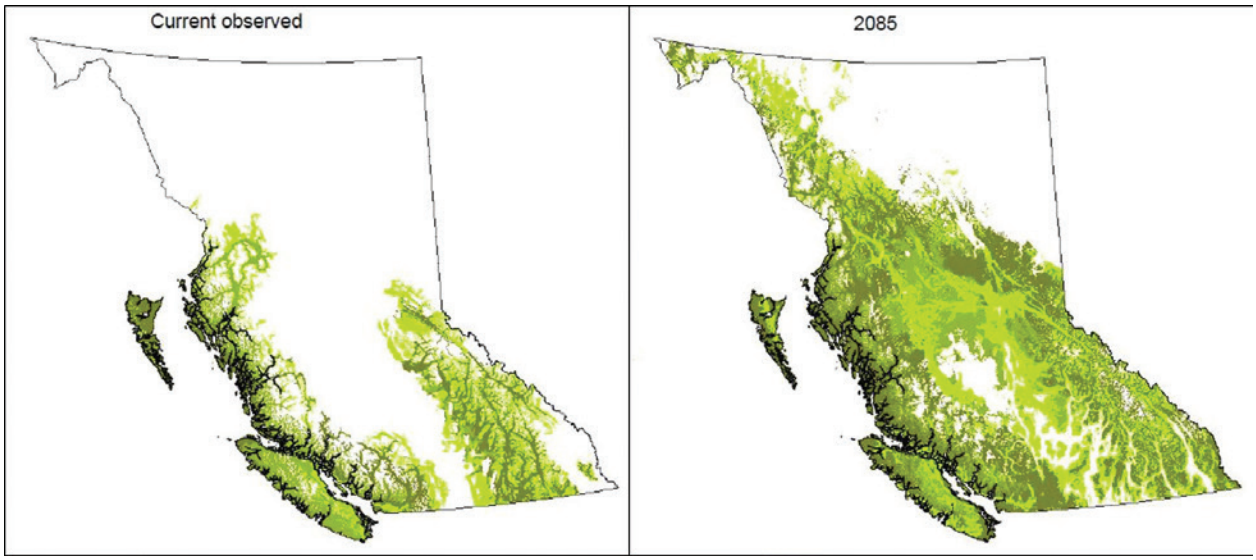


Figure 2. Current (2006) range of western redcedar and projected 2085 range (source: Hamann and Wang 2006).

2.2 Managing Redcedar Stands

Western redcedar has rotation ranges of 80–150 years (Minore 1983), which is a slower growth rate compared to other species. These trees also frequently have extensive stem decay, especially in old-growth forests (B.C. Department of Lands and Forests 1957; van der Kamp 1975, 1986). The activities of wood decay fungi can result in loss of wood strength and reduced yield, increased susceptibility to pests, stem breakage of live trees and, in some cases, tree mortality. In the context of timber supply, decay is a primary cause of cull in western redcedar, resulting in increased harvesting costs and often significantly reducing net volumes (Buckland 1946; Kimmey 1956; Renzie and Han 2001). Many studies detail the role of silviculture in growing redcedar. Unlike other species, cedar is particularly difficult to establish because of browsing by ungulates. The use of plastic tubes and research into browsing-resistant seedlings have helped to increase regeneration success, but costs remain comparatively high (Stein 1997).

2.3 Cedar Products

Contemporary uses of western redcedar include shake and shingle production for both roofing and siding, lumber, and many other manufactured products. Cedar is used in many applications because of its superior decay resistance, attractive red colouring, and aromatic features. Products competing with cedar include cement boards and poles, redwood (sequoia), treated pulp for hospital gowns, other tree species used in the shake and shingle industry, and non-wood products such as asphalt shingles and metal roofs.

The western redcedar is very important to many First Nations in British Columbia and has been called the "cornerstone of Northwest Coast aboriginal culture" (Parish and Thomson 1995). Numerous old-growth cedar trees bear the distinctive marks from cultural uses and are classified as "culturally modified trees" (First Nations and Indigenous Studies 2009). Table 1 presents common names and abbreviations for western redcedar; Table 2 lists primary and secondary wood products made from this species.

Table 1. Common names and abbreviations for western redcedar

Common names and abbreviations for western redcedar	
western red cedar	tree of life
arbor-vitae	*Thuja plicata*
Pacific redcedar	giant arborvitae
western arborvitae	giant cedar
shinglewood	canoe cedar
WRC	Cw

Table 2. Western redcedar products

Category	Products		
Primary products	• cants • dimensional lumber	• logs • mulch	• pulp • timbers
Secondary products	• architectural woodwork • aromatics • art • baskets • bee hives • bentwood boxes • canoes • caskets • cedar leaf oil • chests • clothing	• culinary cookware • decking • doors • fencing • fiberboard • finishing products • fish trap floats • furniture • gutters • horticultural boxes • hospital gowns • instruments	• log homes • paneling • plywood • poles • rope • saunas • shakes • shingles • ships • siding • veneer • window frames

3. Economic Activity

3.1 Harvest

Redcedar for both domestic use and export markets is an important part of British Columbia's forest economy, with most of the harvest coming from coastal areas (see Figure 2). In October 2015, the allowable annual cut totalled over 75 million m^3 for all species.[2] Cedar production as a percentage of the entire harvest has been falling for the period of available data (i.e., 1995–2014). For example, according to the province's Harvest Billing System (B.C. Ministry of Forests, Lands and Natural Resource Operations 2014b), the western redcedar harvest was over 7 million m^3 (10% of the total harvest) in 1995, but the harvest had fallen to 4.3 million m^3 (7% of the harvest) by 2014.

Because this species has a high value-to-volume ratio, it may experience a relative increase in harvesting during economic downturns. Log prices have recovered since 2008, with the average price for cedar logs rising above \$145/m^3 in 2014 (B.C. Ministry of Forests, Lands and Natural Resource Operations 2014a).[3] Cedar is seeing a recovery in demand as evidenced by rising production and prices, and current levels are promising; however, cedar's competitive advantage is being challenged by new products, markets, and an uncertain global economy.

2 Information retrieved from: https://www.for.gov.bc.ca/hts/analysis.htm

3 In 2014, the average log price in the province's coastal log market was \$147.75, using the grades H, I, J, and U.

Of the 4.3 million m^3 of western redcedar harvested in 2014 (Figure 3), nearly 80% of the province's entire harvest comes from coastal areas. Using domestic coastal timber pricing estimates, cedar had a 2014 annual value of over $600 million.[4]

Log prices are highly dependent on the grade[5] (Table 3), with high grades primarily used for lumber, mid-grades for shingles, and low grades for pulping. Excluding the top two grades, and with the exception of a surge in 2004, harvest volumes have declined for all major grades since 1995 (Figure 4); however, most grades have stabilized since 2009, with some even beginning to recover. Nevertheless, volumes of most grades have generally been on the decline, except for grades J and U. Table 3 provides details regarding western redcedar grades, prices, and associated uses.

Figure 5 shows western redcedar log prices in British Columbia from 1992 to 2014. The 2009 fall in price (and harvest) corresponds with the global economic downturn. As of 2014, most coastal grade prices have recovered to 2007 levels and current projections indicate prices across all grades will continue to rise (B.C. Ministry of Forests, Lands and Natural Resource Operations 2014a).

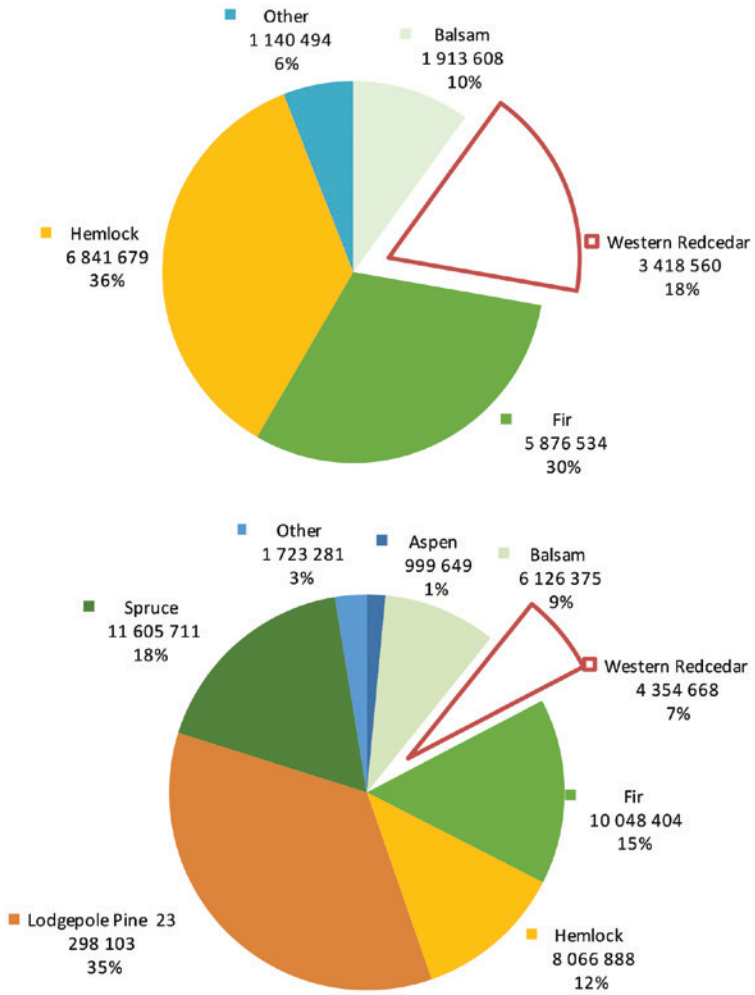


Figure 3. Total 2014 harvest volume by species (m^3) and species percentage of the harvest for coastal British Columbia (top) and the province as a whole (bottom) (source: B.C. Ministry of Forests, Lands and Natural Resource Operations' Harvest Billing System 2014b).

4 Information retrieved using B.C. Ministry of Forests, Lands, and Natural Resource Operations' coastal log market reports (2014a): $147.75/$m^3$ * 4 354 668 m^3 = $643 402 197.

5 Cedar is graded in numerous ways, from using physical descriptors (i.e., clear to knotty) to a more formal alphanumeric system. The grades are 1 through 8, and D through M, U, X, and Y. For more information, see B.C. Ministry of Sustainable Resource Management (2005) and the provincial Harvest Billing System (B.C. Ministry of Forests, Lands and Natural Resource Operations 2014b).

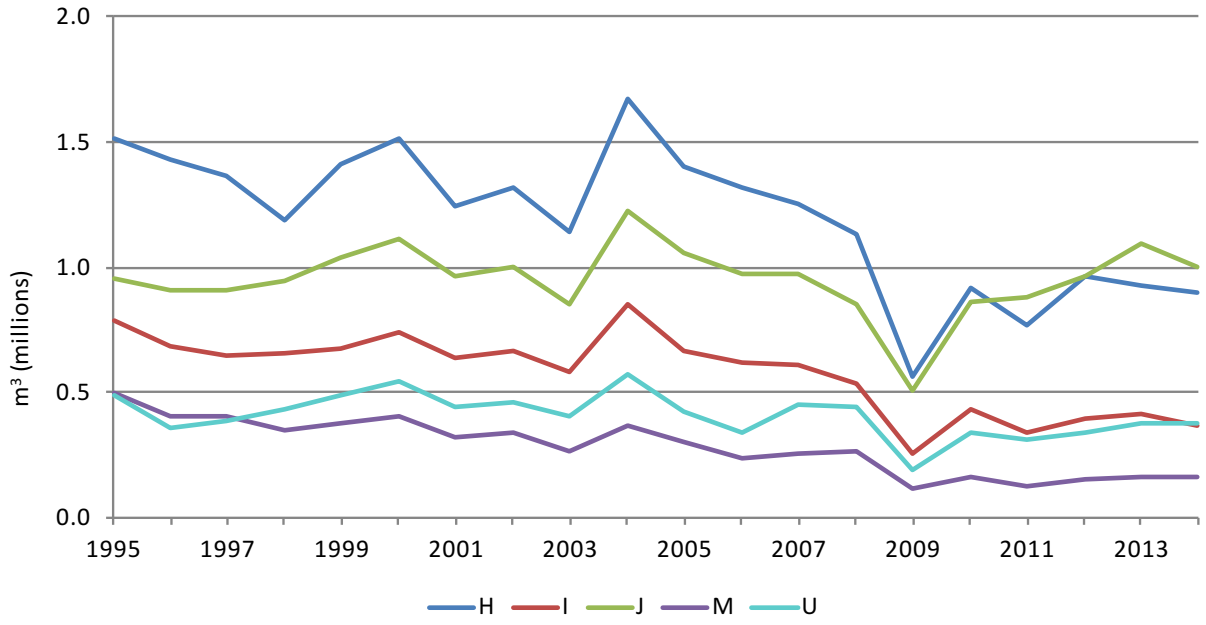


Figure 4. Western redcedar harvest volumes by grade (H, I, J, M, or, U) in British Columbia, 1995–2014 (source: B.C. Ministry of Forests, Lands and Natural Resource Operations' Harvest Billing System 2014b).

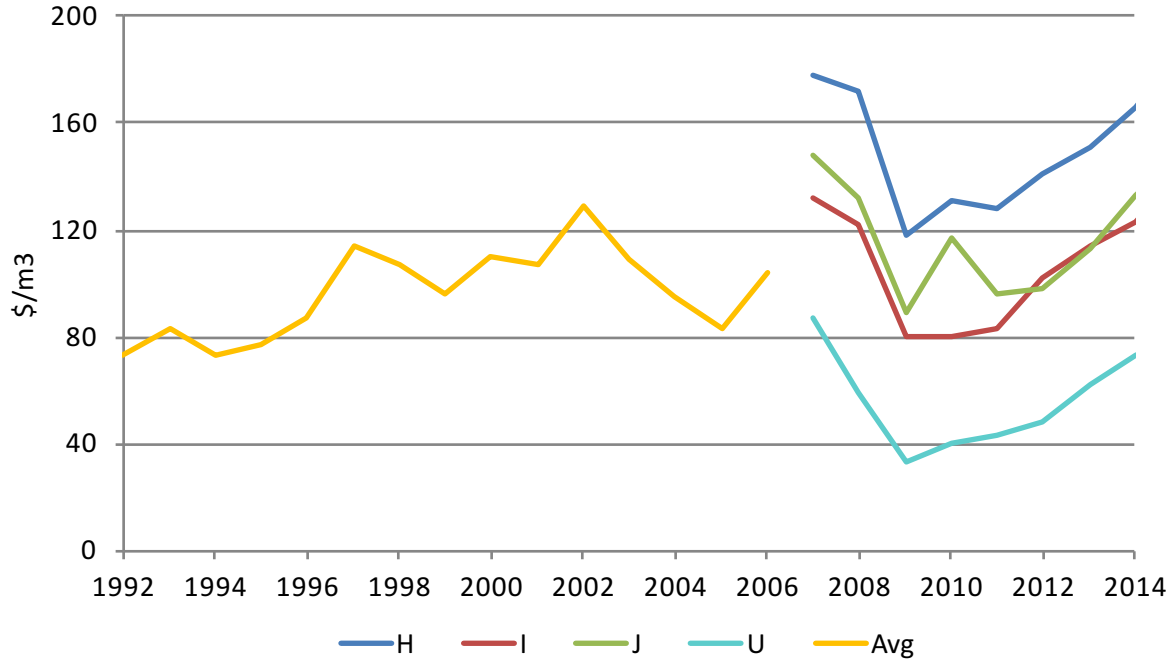


Figure 5. Western redcedar log grade (H, I, J, or, U) pricing ($ per m³) adjusted for inflation, 1995–2014 (source: B.C. Ministry of Forests, Lands and Natural Resource Operations' Coast Log Market Reports 2014a).[6]

6 Individual grade pricing has been recorded only after 2007.

Table 3. Western redcedar grades, prices and associated uses[ab]

Grade	2014 domestic $/m³ [cd]	Main uses[e]
D	313.35	lumber
F	268.93	lumber
H	198.28	lumber, large merch, small merch
I	146.89	small merch
J	158.93	gang, chip n' saw
K	189.13	large shingle
L	151.47	large shingle, utility shingle
M	103.16	large shingle, large pulp, small pulp
U	86.92	utility log, chip n' saw, large pulp, small pulp
X	61.22	utility log, large pulp, small pulp
Y	9.89	large pulp, small pulp

[a] Sources: B.C. Ministry of Forests, Lands and Natural Resource Operations 2012, 2014a.
[b] Note that this is a compilation from the Coast Log Prices report for 2012. Harvest Billing System data includes several other grades, including numerical grades given mostly to interior cedar.
[c] 2014 prices are the average reported prices from the Coast Log Market Reports.
[d] Pricing data is from coastal reports as interior reports do not use grade as a price basis.
[e] Main uses are compiled from the 2012 Coast Timber Prices Report.

3.2 Silviculture

Crown licensees are required to replant after harvesting. Figure 6 shows the number of western redcedar seedlings planted from 2001 to 2015. In 2014, over 9 million seedlings were planted.[7] Planted seedling quantities follow harvest trends with a 2-year delay, as planting is usually done in the year following the harvest.

The exact cost to successfully plant redcedar seedlings is difficult to estimate owing to variability in site accessibility, survival, and browsing protection, but it is likely to range from $4 to $10[8] per seedling (based on anecdotal industry information). The 2014 total direct impact generated by planting western redcedar, including nursery growth, transportation of seedlings to location, labour, and browsing protection, is estimated at $41 million.

7 Information obtained using B.C. Ministry of Forests, Lands and Natural Resource Operations' RESULTS web application (https://www.for.gov.bc.ca/his/results/).

8 This number is based on anecdotal industry information. To be conservative, a $4 proxy was chosen. This proxy was then applied to the total planted redcedar numbers obtained from a B.C. Ministry of Forests, Lands and Natural Resource Operations' RESULTS database query (https://www.for.gov.bc.ca/his/results/).

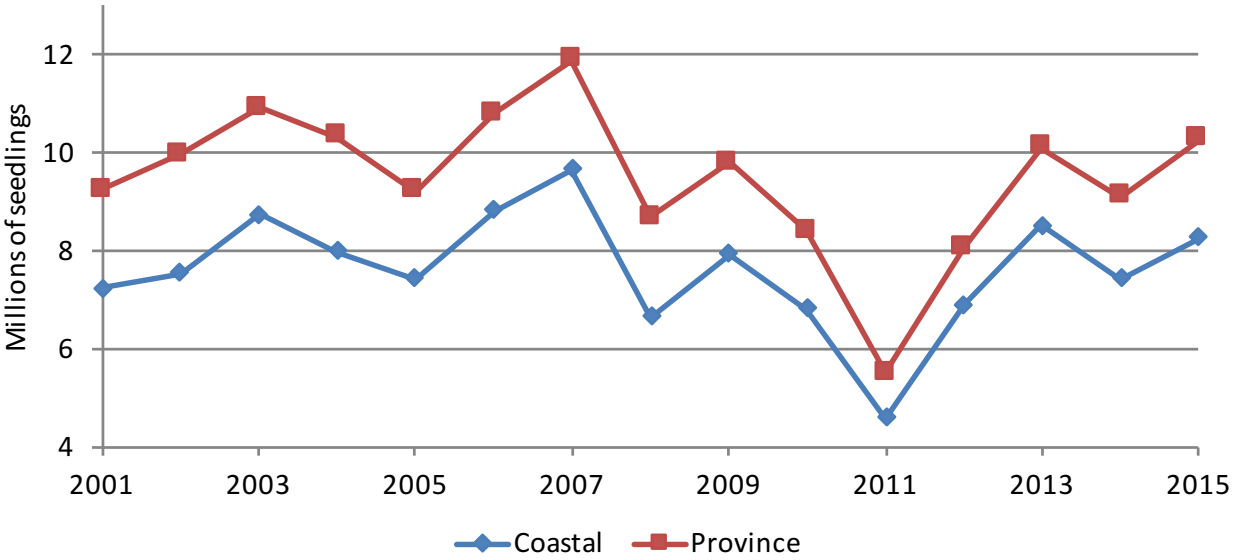


Figure 6. Western redcedar seedlings planted per year, 2001–2015 (source: B.C. Ministry of Forests, Lands and Natural Resource Operations' RESULTS database).

3.3 Log Exports

The British Columbia government imposes certain restrictions and regulations on the use of all timber. As such, the export of western redcedar logs harvested from provincial Crown land is restricted.[9] As shown in Figure 1, cedar logs available for direct export come from private and federal forest land, where data on exports can be tracked.

Cedar log exports (Figure 7) peaked in 2006 at over 300 000 m^3 (i.e., 12% of total log volume exported from the province).[10] Since this peak, volumes fell in 2014 to less than 80 000 m^3, representing only 1% of the total volume of all logs exported.[11]

Cedar log exports accounted for $13 million in 2014, which was 2% of the provincial total export value for logs (Figure 8). The primary markets were Japan (27%), South Korea (24%), Taiwan (19%), and the United States and Mainland China (15% each). The volume exported to Japan has seen a steady decline, from 86% of all cedar in 2008 to 21% of cedar in 2014.[12] The Japanese market is dominated by a preference for yellow cedar, a reflection of the country's building code standards.

Cedar log prices have always been above the average log price of all species combined (see Figure 9). Between 1988–2014, cedar prices ranged from 111% to 214%, compared to the average log price.[13]

9 For the restrictions on exports, see the *Forest Act*, RSBC 1996, Chapter 157, Part 10, "Manufacture in British Columbia": http://www.bclaws.ca/civix/document/LOC/complete/statreg/--%20F%20--/Forest%20Act%20[RSBC%201996]%20c.%20157/00_Act/96157_10.xml#part10 (Accessed December 2016).

10 Source: Statistics Canada, International Trade Statistics custom extract, September 2015. Reproduced and distributed on an "as is" basis, with the permission of Statistics Canada.

11 Source: BC Stats website: Exports and Imports Data, International Commodity Trade, Log Exports (http://www.bcstats.gov.bc.ca/Files/1292f88c-1142-4fa5-9c09-8cf8011aeef3/BCLogExports.xlsx).

12 *Ibid.*

13 *Op. cit.* BC Stats website.

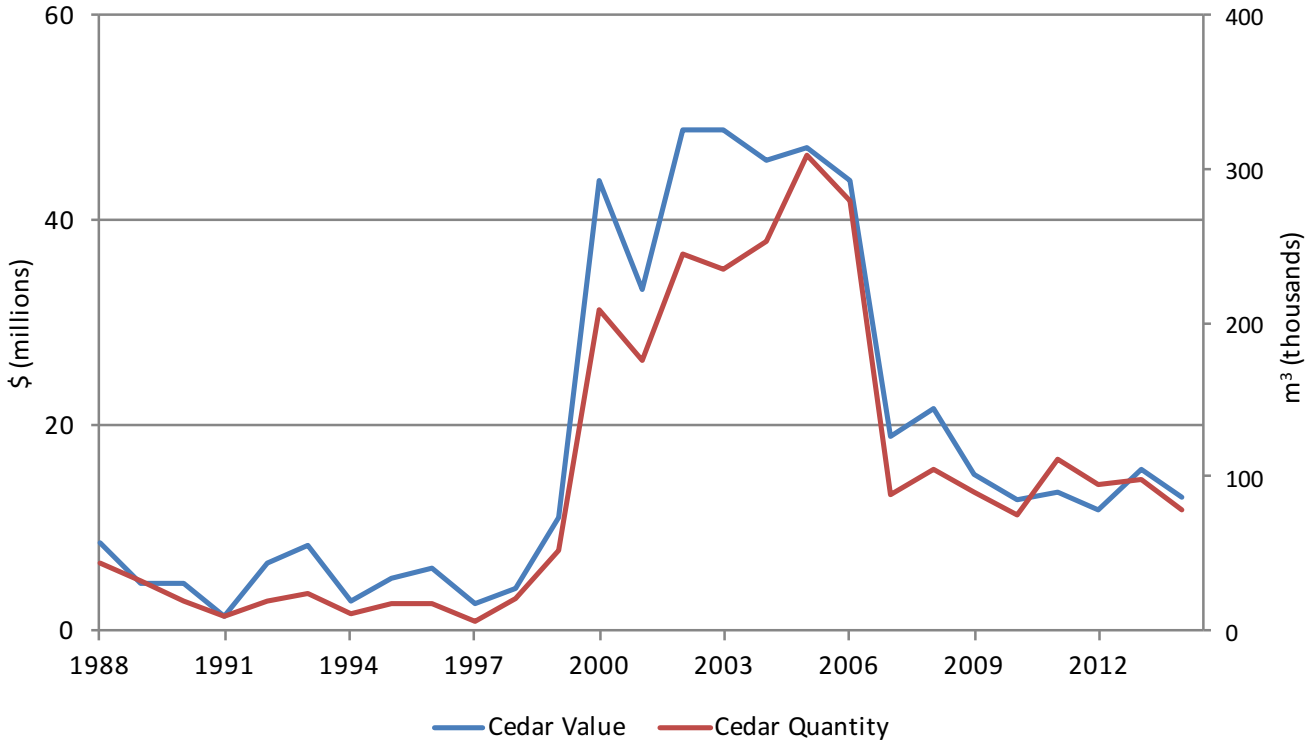
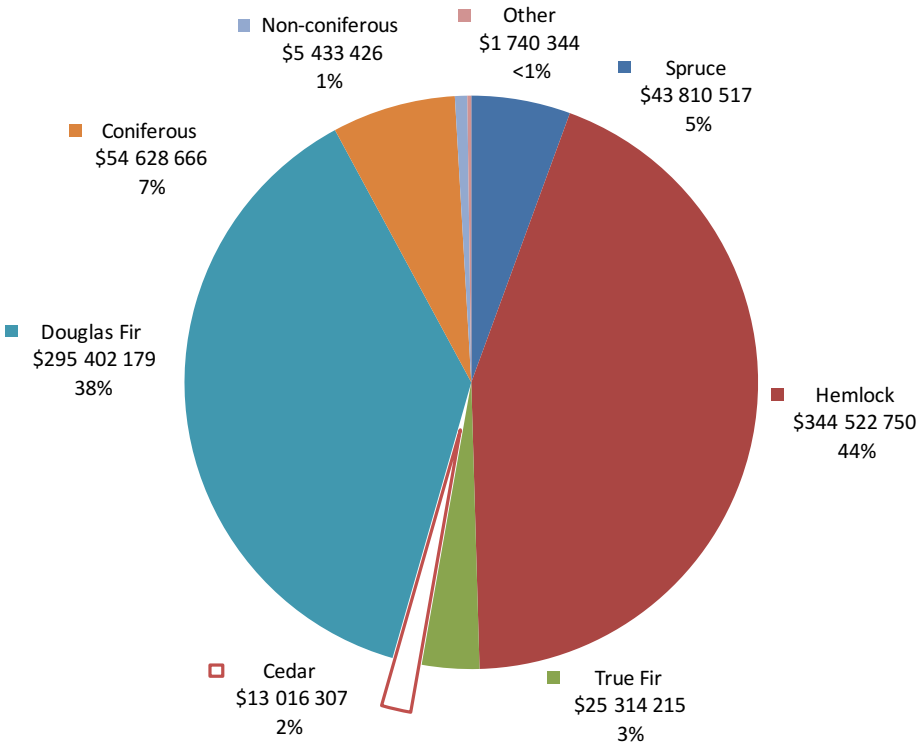


Figure 7. Cedar log export value ($) and quantities ($m^3$) by year, 1988–2014 (red and yellow cedar are not separated; source: BC Stats, see footnote 11).



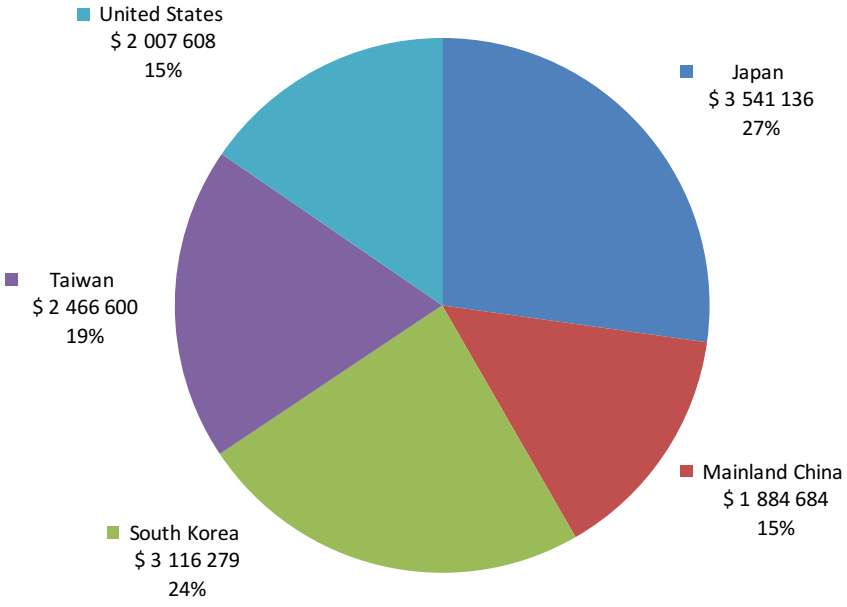


Figure 8. British Columbia log exports for 2014: values for all species (top); and red and yellow cedar values by country (bottom) (source: BC Stats; see footnote 11).

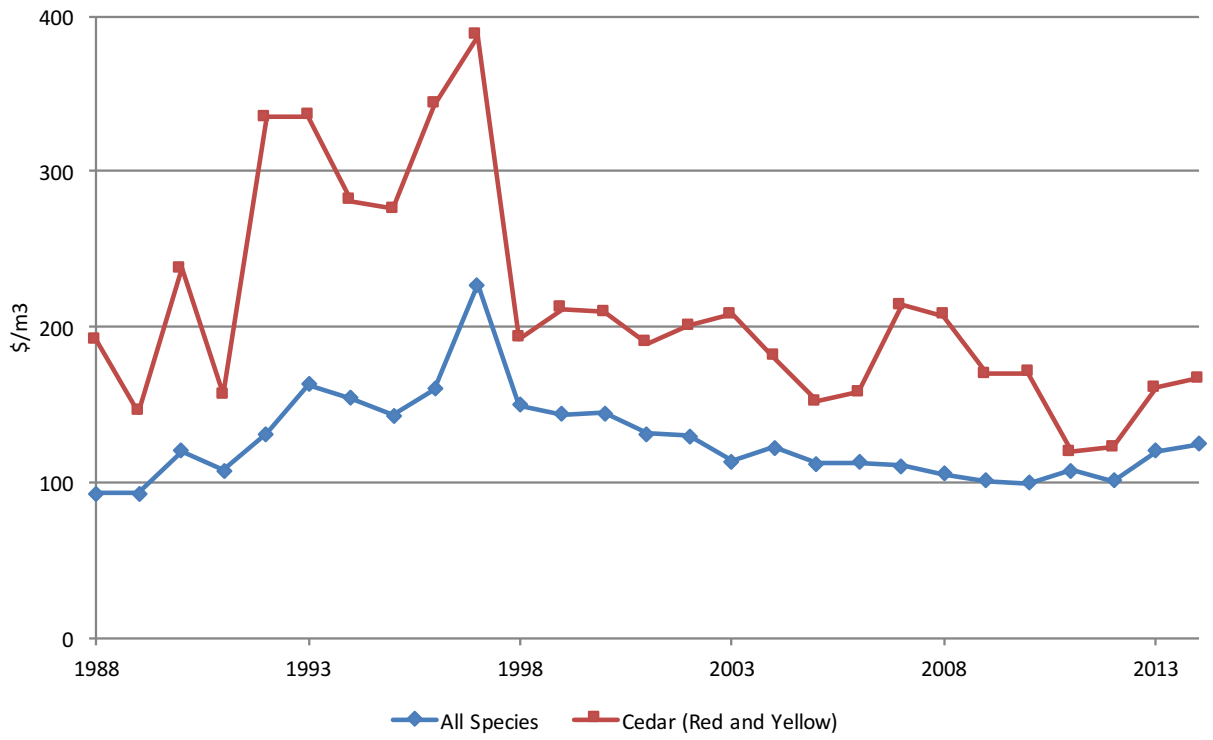


Figure 9. British Columbia red and yellow cedar log export values ($/m3) compared to average export values of all species, 1988–2013 (source: BC Stats, see footnote 11).

3.4 Primary Manufacturing

3.4.1 Lumber

Figure 10 shows the decrease in production of western redcedar lumber from 1999 to 2014. Production fell for the Coast/Interior from 125 000 m^3/34 500 m^3 in February 1999 to 55 000 m^3/14 800 m^3 in December 2011. This may be related to a change in consumer preference, increased competition, reduced standing stocks and harvest levels, or even because of the business cycle.

Before 2011, information was available on western redcedar production from mills in British Columbia; after 2011, most data were suppressed to meet the confidentiality requirements of the *Statistics Act*. Information on western redcedar lumber exports is reported separately (Figure 11); however, we cannot accurately measure the amounts or values of lumber consumed domestically, even in years for which we have data on total western redcedar production. In theory, we would take total production and net out the amount exported to find what remained for domestic use. For example, 473 million board-feet of western redcedar was produced in 2011 (Statistics Canada 2015), of which 457 million board-feet was exported (Figure 11). Nevertheless, we cannot conclude that the difference was consumed domestically, owing to a potential double counting of cedar lumber used by secondary manufacturers. We know that secondary manufactures have several sources of western redcedar and, to date, we have not been able to isolate the volumes from mills.

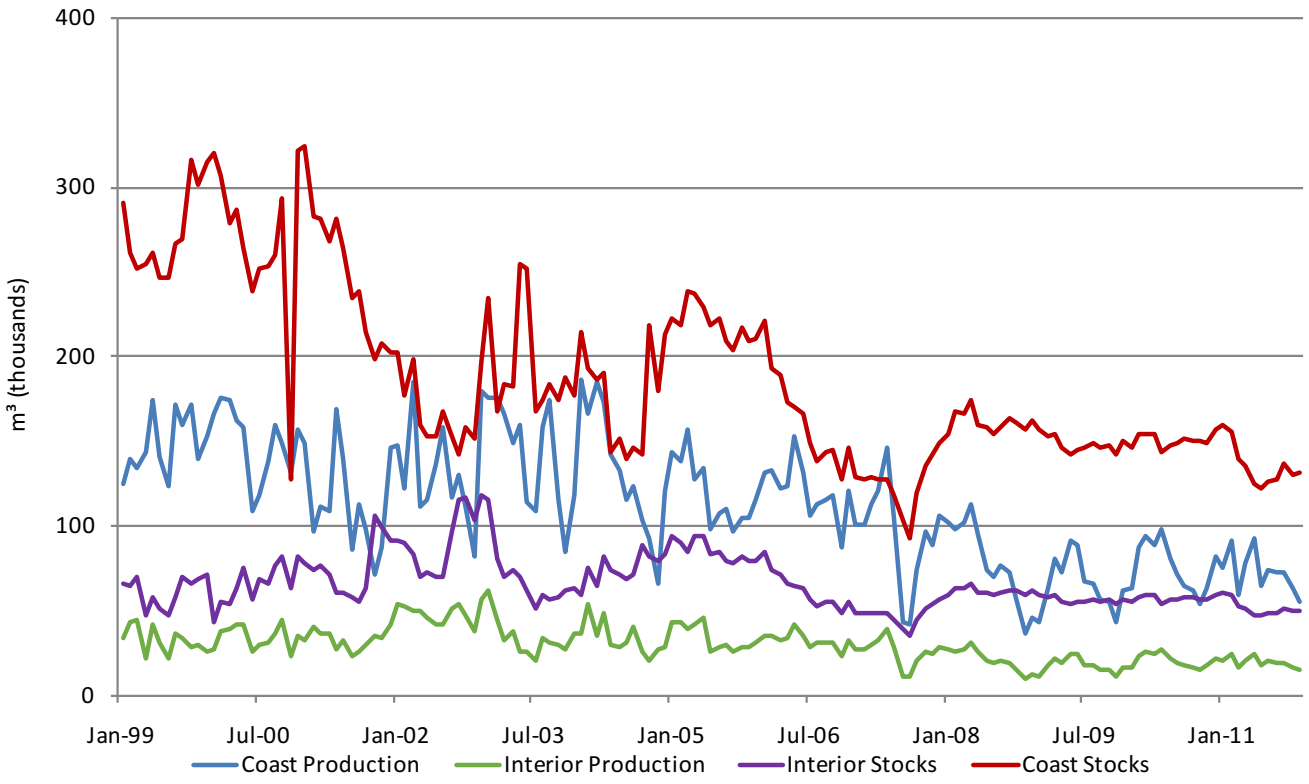


Figure 10. Estimated western redcedar lumber production and stock levels in British Columbia, 1999–2011 (source: Statistics Canada 2015). Note: Stocks are defined as the on-hand lumber stocks, not raw logs for production. Using available monthly Coast and Interior stock and production level data, we calculated averages that were then used to allocate the provincial amounts to the two regions for the periods with missing data (July 2005–December 2011). Owing to data suppression, we were unable to estimate beyond December 2011. Individual pieces of data beyond that date were omitted.

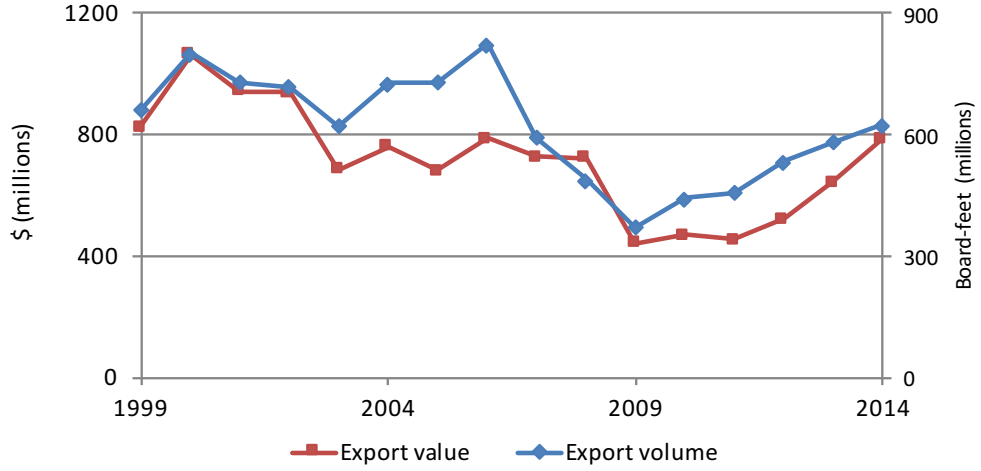


Figure 11. Western redcedar lumber export value and volume, 1999–2014 (source: Council of Forest Industries monthly export data, 1999–2014).

Western redcedar lumber exports have been steadily increasing since 2009 (Figure 11), up from $400 million to $787 million in 2014. Current indications suggest a recovery in the cedar lumber economy. Like many other forest products, the main market for Canadian redcedar lumber is the United States, which receives three quarters of the total exports (Figure 12). This trend in lumber exports is consistent with the downward pressure the American economy experienced in 2009.

Table 4 shows the average annual price per thousand board-feet. Prices bottomed in 2005, and peaked in 2008. Overall, lumber exports generated $787 million in revenue in 2014.

Table 4. Western redcedar lumber export prices per thousand board-feet (source: Council of Forest Industries monthly export data, 1999–2014)

Year	Nominal $	Real (2007) $
1999	1247	995
2000	1332	1109
2001	1288	1091
2002	1303	1117
2003	1099	973
2004	1046	956
2005	931	878
2006	953	922
2007	1221	1221
2008	1478	1537
2009	1190	1209
2010	1061	1109
2011	994	1073
2012	976	1066
2013	1105	1225
2014	1259	1421

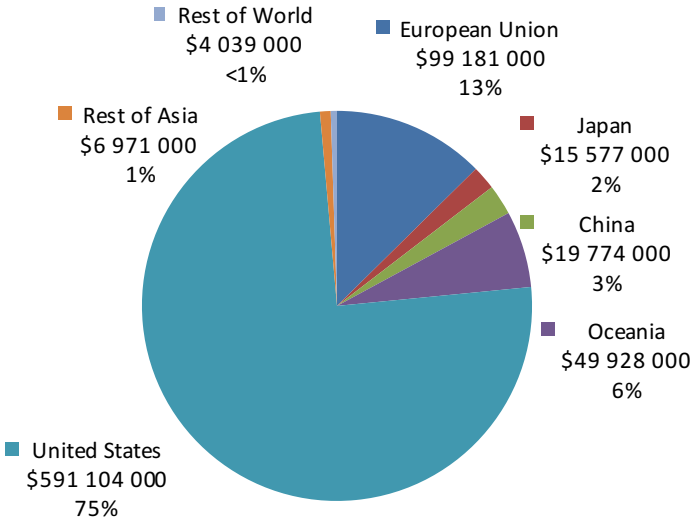


Figure 12. Value of western redcedar lumber exports by market for 2014 (source: Council of Forest Industries monthly export data, 1999–2014).

3.5 Secondary Manufacturing

The Canadian Forest Service conducts a secondary manufacturing survey for comparative analysis. Data on cedar was available for 2012 (Bogdanski and McBeath 2015). Figures 13–15 and Table 5 are derived from the 2012 survey and taken directly from the related report. This information amalgamates the different types of cedars, including both red and yellow.

Over 50% of firms in British Columbia relied on cedar in secondary manufacturing operations to some extent (Figure 13), and 30% of firms depended heavily on cedar (i.e., ≥ 50% of fibre used).

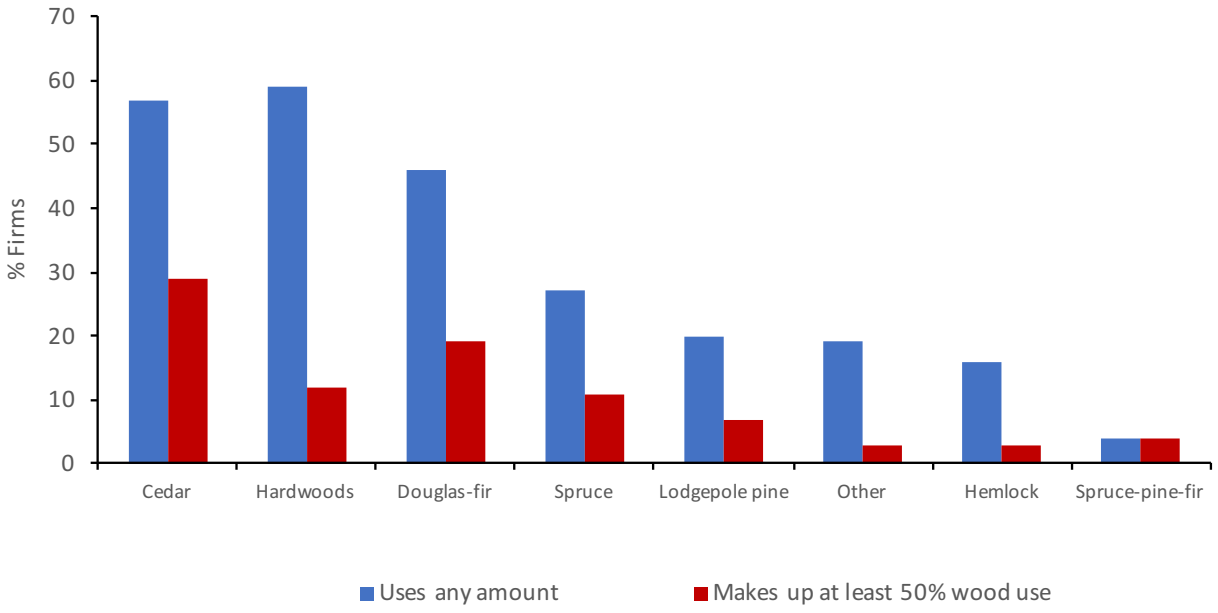


Figure 13. Secondary manufacturing species reliance, showing proportion of firms by species usage (from Bogdanski and McBeath 2015).

The species mix pertaining to secondary manufacturing (Figure 14) indicates cedar makes up a substantial (20%) amount of the entire volume of wood used in provincial mills.

Of the different species surveyed in British Columbia, cedar is the only species to consistently lose considerable manufacturing volumes over time. Other major species have seen downward trends, but these have all seen some relative recovery (Figure 15).

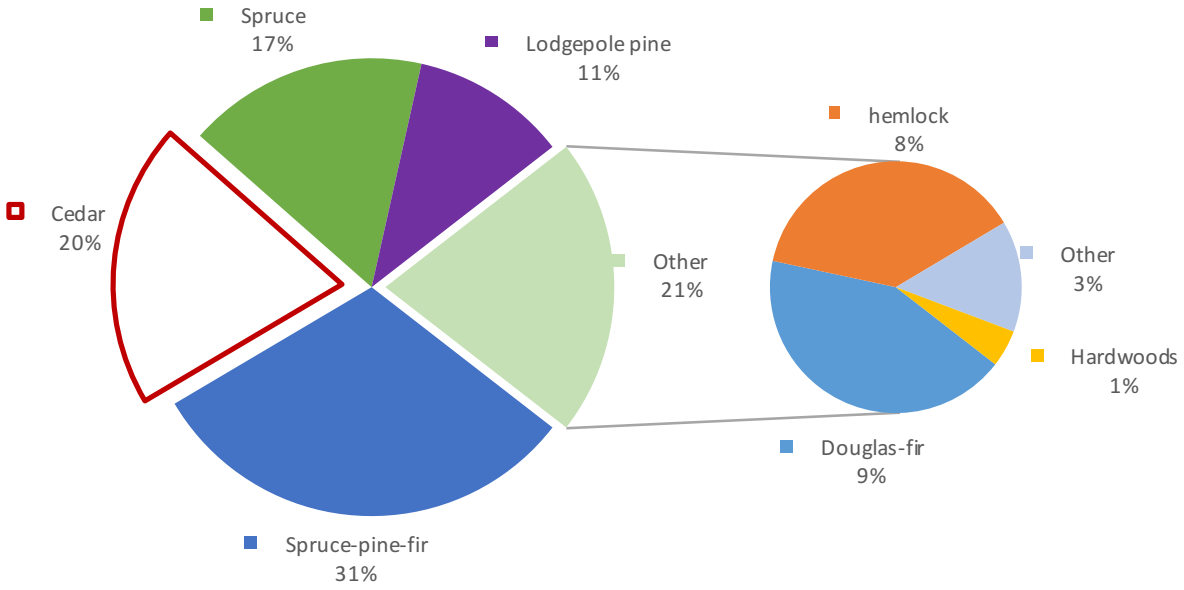


Figure 14. Secondary manufacturing species mix in British Columbia (Bogdanski and McBeath 2015).

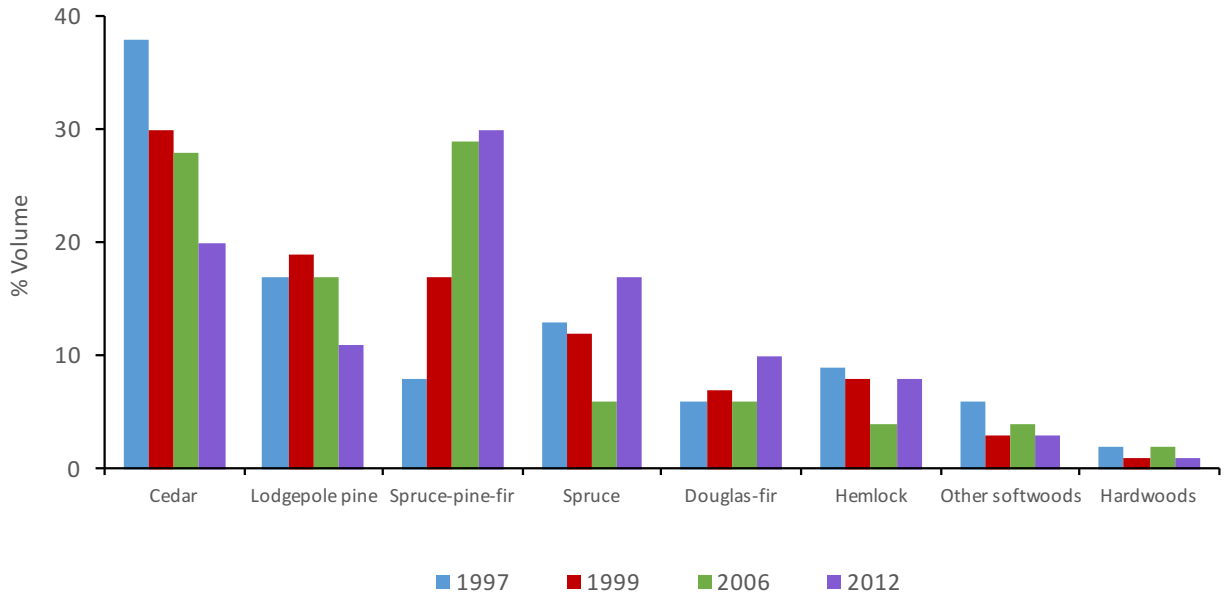


Figure 15. Secondary manufacturing species usage in British Columbia, 1997–2012 (Bogdanski and McBeath 2015).

Table 5 shows more detail on species used in secondary manufacturing. The two main users of cedar are shake and shingle and remanufacturing firms, with limited activity in cabinetry, engineered wood products, millwork, pallets, and other products. British Columbia's shake and shingle production is supplied solely by western redcedar.

Table 5. Percent secondary manufacturing species usage by business type (from Bogdanski and McBeath 2015)

Business type	Spruce–pine–fir	Cedar	Spruce	Lodgepole pine	Douglas-fir	Hemlock	Other	Hardwoods
Cabinets	0	3	0	0	2	0	22	73
Engineered wood products	3	5	21	21	29	11	11	0
Furniture	0	0	0	0	15	22	10	53
Millwork	0	7	3	3	50	3	2	32
Other wood products	83	5	4	1	4	0	3	0
Pallets and containers	6	3	39	12	21	20	0	0
Remanufacturing	15	30	23	14	7	10	1	0
Shake and shingles	0	100	0	0	0	0	0	0
Total	**31**	**20**	**17**	**11**	**10**	**8**	**3**	**1**

3.5.1 Siding

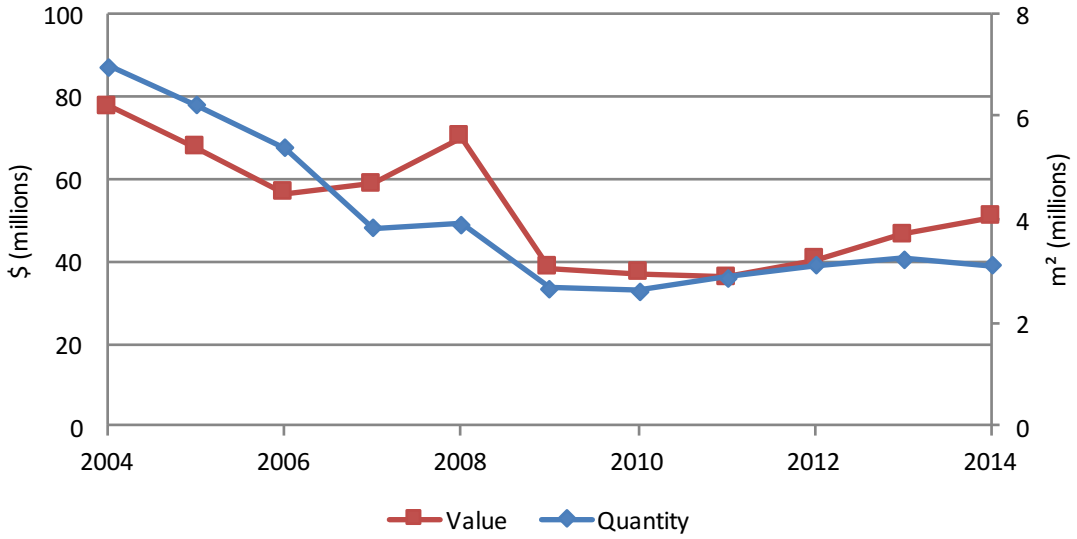


Figure 16. Western redcedar siding export value and quantities, 2004–2014 (source: Natural Resources Canada's Trade Retrieval and Aggregation System).

In 2014, western redcedar siding exports generated over $50 million (Figure 16). Unlike lumber, siding export quantities and value have yet to recover to pre-2009 levels. The United States is the largest consumer of Canadian western redcedar siding (95%; see Figure 17).

Siding prices (per m^2) peaked in 2008 and had the lowest price in 2006 (Table 6). Prices have risen, with 2014 having the highest prices since the housing crash in the United States.

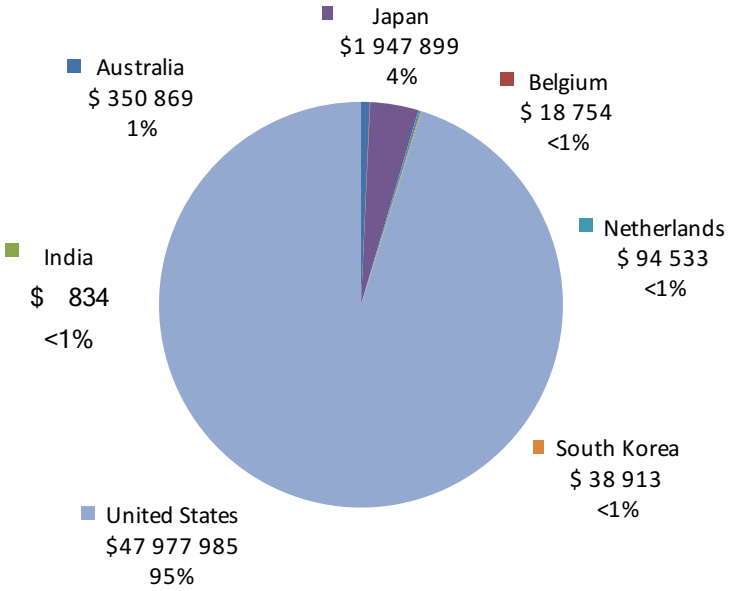


Figure 17. Western redcedar siding exports by market in 2014 (source: Innovation, Science and Economic Development Canada 2016).

Table 6. Western redcedar siding export prices per square metre (with real $ 2007; source: Natural Resources Canada's Trade Retrieval and Aggregation System)

Year	Nominal $	Real (2007) $
2004	11.12	12.17
2005	10.84	11.50
2006	10.47	10.82
2007	15.25	15.25
2008	17.84	17.16
2009	14.38	14.15
2010	14.10	13.49
2011	12.48	11.57
2012	12.90	11.82
2013	14.29	12.88
2014	16.14	14.30

3.5.2 Shakes and Shingles

In 2014, shake and shingle export value was $173 million (Figure 18) with 90% of exports going to the United States (Figure 19). Like siding, shakes and shingles have not recovered to pre-2009 levels.

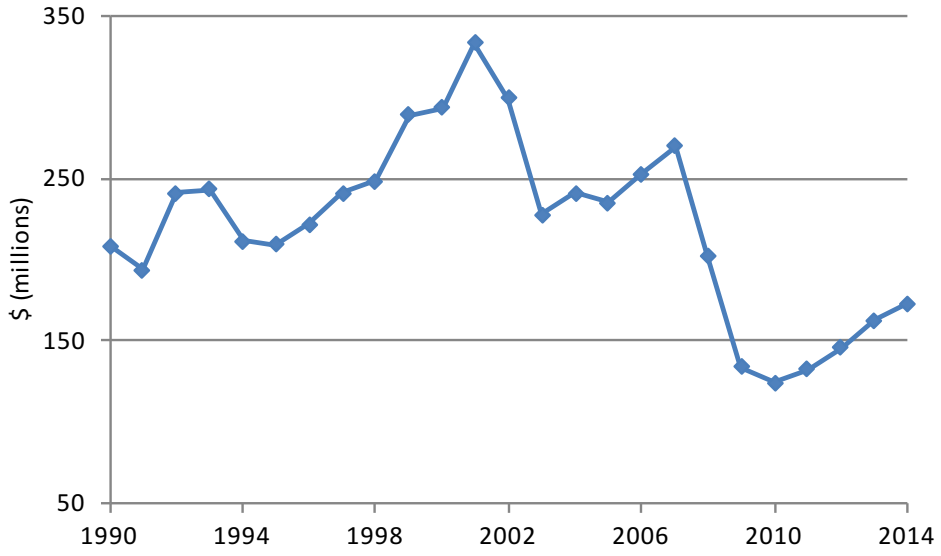


Figure 18. Shakes and shingles total export value, 1990–2014 (source: Innovation, Science and Economic Development Canada 2016).

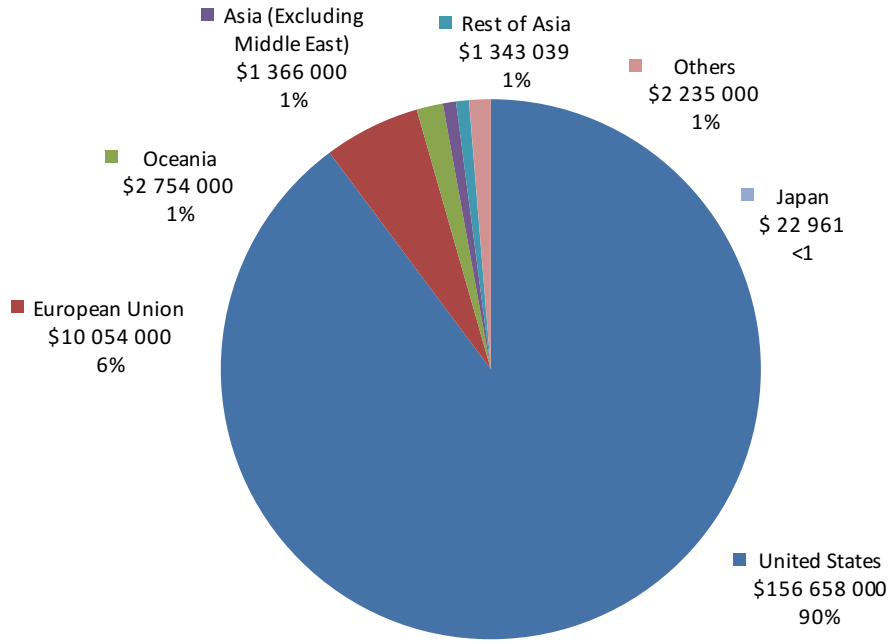


Figure 19. Shake and shingle export value by market in 2014 (source: Innovation, Science and Economic Development Canada 2016).

3.5.3 Other Secondary Products

Using the data collected through the 2012 secondary manufacturing survey for British Columbia (Bogdanski and McBeath 2015), we derived estimates for sales of other redcedar products. Calculating average sales per firm by business type, we estimated that an additional $129 million in sales was attributable to redcedar (Table 7). This excludes sales for siding and shakes and shingles, which were included separately above. Aside from remanufacturing, the largest business type within this "other" category is engineered wood products with $10 million in revenue.

Table 7. Other secondary manufacturing revenues, 2012

Business type	Scaled estimate ($)
Cabinets	503 344
Engineered wood products	10 343 100
Millwork	4 119 500
Other wood products	1 983 750
Pallets and containers	175 714
Remanufacturing	112 182 281
Total	**129 307 689**

3.6 Economic Output Summary

Overall, redcedar lumber supplies 60% of cedar's total direct impact at $750 million (Table 8). In 2014, redcedar represented 13% of all provincial lumber exports in value (Council of Forest Industries n.d.). The sum of all secondary manufacturing, including siding and shakes and shingles together with other secondary products, totals $352 804 476; cedar represents over 25% of the total impact of secondary manufacturing output in British Columbia (Bogdanski and McBeath 2015).

Table 8. Total gross economic output for western redcedar in British Columbia

Production type	Year	Total value ($)
Silviculture	2014	41 069 708
Exported Logs	2014	13 016 307
Lumber	2014	786 574 000
Siding	2014	50 429 787
Shakes and shingles	2014	173 067 000
Other secondary products	2012	129 307 689
Total		**1 193 464 491**

4. Employment

Very little data is currently available on forest industry employment, specifically in relation to species; therefore, we provide estimates for employment attributed to cedar production. To calculate a rough estimate of employment from primary manufacturing involving western redcedar, we used data from BC Stats (2013, 2014), *Major Primary Timber Processing Facilities in British Columbia – 2013* (B.C. Ministry of Forests, Lands and Natural Resource Operations 2015), the Harvest Billing System (B.C. Ministry of Forests, Lands and Natural Resource Operations 2014b), and data collected during the secondary manufacturing survey (Bogdanski and McBeath 2015).

4.1 Primary Manufacturing Employment Methodology and Discussion

Log use percentages were first calculated by taking the total log volumes and usage for each region and then applying the provincial total for that usage as the divisor. The 2013 provincial employee total for wood manufacturing, adjusted for veneer/oriented strand board, shakes and shingles, and other mills (which is considered secondary manufacturing), is 23 695 persons. This number was multiplied by the provincial percentage for the lumber mill/pulp mill usage type to isolate the employees by their log use (BC Stats 2013; B.C. Ministry of Forests, Lands and Natural Resource Operations 2015). This value was multiplied by the region (Coast or Interior) percentage to isolate the employee numbers by usage and region (B.C. Ministry of Forests, Lands and Natural Resource Operations 2015). Finally, the employees were restricted to just those involved in western redcedar production by using the 2013 harvest volume for this species as a proxy for the volume through the different primary manufacturing uses (B.C. Ministry of Forests, Lands and Natural Resource Operations 2014b).

We allocate employment according to volumes of fibre used across primary uses or mill types. We apply a mill's portion of the provincial fibre use to calculate the portion of the province's forest employment attributable to that mill. We disintegrate these numbers further by taking the portion of provincial fibre known to be western redcedar and the region in which the mill operates. For example, a value for *Western Redcedar Employees in the Coastal Region in Lumber Mills* is calculated as follows:

Wood Manufacturing Employment × % of Fibre Used in Lumber Mills × % of Fibre Used on the Coast × % of All Western Redcedar = Western Redcedar Employees by Region and Log Use

23 695 × 0.8025 × 0.1477 × 0.1784 = 501

Overall, the western redcedar primary manufacturing sector supports approximately 1350 employees in primary production facilities, or 6% of British Columbia's wood manufacturing employees (Table 9).

4.2 Primary Manufacturing Production Employment

Table 9 breaks down provincial primary manufacturing production employment in 2013 by regions and primary log uses.

Table 9. British Columbia primary manufacturing production employment in 2013: all wood species versus western redcedar (source: BC Stats 2013; B.C. Ministry of Forests, Lands and Natural Resource Operations 2015)

Primary log use	Estimated all species employment	Estimated cedar employees
Coast		
Lumber mills	2809	501
Pulp mill wood rooms	589	11
Chip mills	592	106
Log exports	2269	405
Total	6259	1022
Interior		
Lumber mills	16 206	307
Pulp mill wood rooms	296	6
Chip mills	473	9
Log exports	462	9
Total	17 437	330
Province		
Lumber mills	19 015	808
Pulp mill wood rooms	885	16
Chip mills	1066	115
Log exports	2730	414
Total	23 695	1352

[a] Total adjusted by removing veneer/oriented strand board, shakes and shingles, and other mills.

4.3 Secondary Manufacturing Employment Methodology and Discussion

Secondary employment was derived using data collected through the 2012 survey of secondary manufacturing in British Columbia (Bogdanski and McBeath 2015). Using the surveyed data, we narrowed down the number of secondary manufacturing employees by companies using cedar; then, using each company's estimate of cedar usage as a percentage of total wood volume, we narrowed down further to determine the number of employees and firms. The large employers in this sector are on the Coast, particularly in the Lower Mainland and Fraser Valley. This is consistent with secondary manufacturing in general (Bogdanski and McBeath 2015). The business types that rely on cedar and employ the greatest number of employees are remanufacturing, engineered wood products, and shakes and shingles.

4.4 Secondary Manufacturing Production Employment

Of the secondary manufacturing firms in the survey, 53 firms reported using cedar to some extent. Eighteen (34%) of the firms were heavily reliant (i.e., firms using ≥ 50% volume of fibre) on cedar and employ 410 (76%) of the 536 full-time equivalents (Table 10).

Given cedar's geographical distribution, the majority of firms involved in cedar secondary manufacturing are located along the Coast and in the Interior's wet belt (Figure 20). Companies within these areas rely most heavily on cedar.

Table 10. Secondary manufacturing cedar employees (source: Bogdanski and McBeath 2015)

Business type	Cariboo	Coast	Fraser Valley	Kamloops	Nelson	Northern	Total
Cabinets			4				**4**
Engineered wood products	2	2	17	9	17	0	**47**
Millwork		6	2	1			**8**
Other wood products		4	1	0	40		**45**
Pallets and containers			5				**5**
Remanufacturing		80	157	1	10		**248**
Shake and shingles		15	163				**178**
Total	**2**	**106**	**351**	**10**	**67**	**0**	**536**

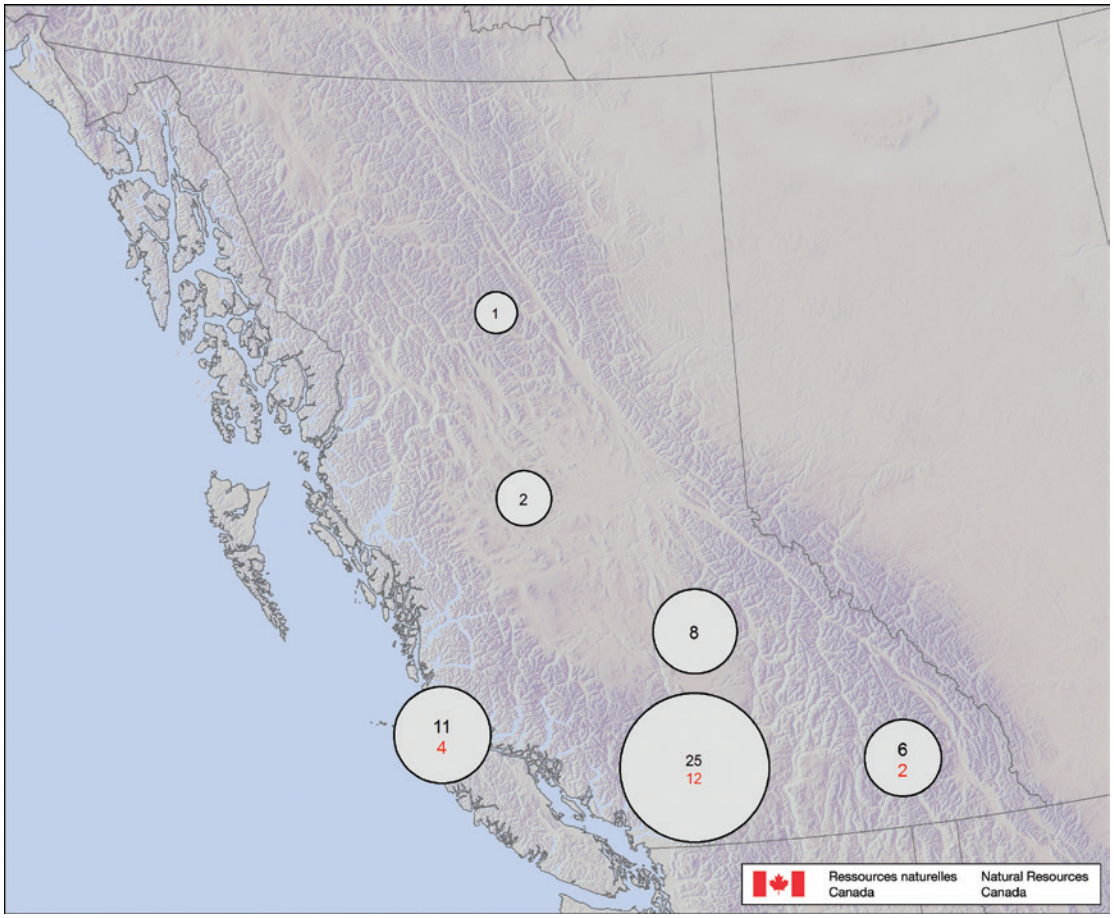


Figure 20. Secondary manufacturing cedar companies map (source: Bogdanski and McBeath 2015). Note: The black text indicates the location and the total number of firms using some cedar. The red text underneath indicates the number of firms heavily reliant on cedar (≥ 50% of volume used).

4.5 Employment Summary

Table 11 provides a summary of the number of employees involved in primary and secondary western redcedar manufacturing in British Columbia.

Table 11. Primary and secondary western redcedar manufacturing employment in British Columbia

	Total employees
Primary manufacturing	1352
Secondary manufacturing	536
Total	**1888**

5. Socioeconomic Factors and Future Demand

With increased reliance on renewable resources and green technologies, demand for wood is rising. Already we are seeing building codes change to incorporate and allow for taller wood structures. With other sectors such as energy struggling, the provincial timber supply may become more important to jobs in British Columbia and Canada than in the past. As trade policies are proposed and others expire, British Columbia and Canada's place in international markets is under challenge.

British Columbia's wood producers face difficulties in diversifying markets outside the United States. Although many countries are interested in importing raw logs (especially cedar), provincial policy has protected western redcedar logs from leaving British Columbia. Managing market volatility should be a primary concern when considering ways to effectively manage the cedar industry, particularly when provincial lumber, siding, and shakes and shingles dominate cedar exports to the United States market.

Entire companies can stand on innovation, and this is the main reason why the competitive advantage of western redcedar faces challenges. Newer products, such as wood plastics and concrete boards, last longer, require less maintenance, and are easily matched to house style and colour. The beauty of natural wood and the sustainable advantages are key factors in maintaining and growing cedar's market niche. Innovations related to prolonging cedar's natural in-service durability, as well as improving silviculture costs and benefits, could help improve the cedar industry's competitive advantage and encourage consumers to accept cedar as an alternative to competing products. Future research should evaluate the substitutability between cedar and other products.

6. Information Gaps and Recommendations for Further Research

6.1 Knowledge Gaps

During this study, we identified several knowledge gaps requiring further research, including data reliability, employment data, domestic demand, shake and shingle production data, lack of sales data for some cedar products, primary mill locations, and country access.

Data Reliability

Numerous issues arose related to data reliability, and some industry contacts even warned about the accuracy of certain databases at the single-species level. For example, the Vegetation Resource Inventory is generally considered less accurate for cedar because larger species tend to overtop redcedar, leading to an underestimation in cedar volumes. In addition, production and stock data from Statistics Canada contained numerous gaps, which caused some issues when analyzing data.

Employment Data

Employment information for western redcedar manufacturing is currently compiled at a very broad scale. To obtain accurate data about the employment effects of western redcedar, a more in-depth survey will be required. The data we present here should be considered as estimates only.

Domestic Demand

Abundant information is available about western redcedar exports; however, we found no databases related to interprovincial or domestic consumption of wood products.

Shake and Shingle Data

The determination of western redcedar production trends requires further information about the quantity of shakes and shingles produced. Because shake and shingle manufacturing is a relatively labour-intensive business type, we may have underestimated the employment figures related to this industry. A survey of producers may help to determine the number of employees involved, as well as the production quantities. In addition, export data related to shakes and shingles is not separated by species. For this reason, we used shake and shingle export value aggregates as a proxy because cedar is the most commonly used species for this product.

Lack of Data

Information was lacking in the following areas.

- Pole production and sales
- Pulp production and sales
- Shakes and shingles production and sales
- Fencing production and sales
- Cant production and sales
- Decking production and sales
- Chipping production and sales
- Tertiary production and value
- Other redcedar product production and sales
- Employment
  - Tertiary
  - Full-time equivalents primary
- Art
  - Used by many First Nations artists for carving and other forms of art, this industry has been estimated at around $2 billion (Allen 2016), of which a portion would relate to western redcedar. Further exploration is needed to determine whether estimates can be produced.

Primary Mill Locations

We were unable to develop a map detailing primary cedar production facilities. Further research and mapping could provide information on which communities are most reliant on cedar.

Market Access

Anecdotal evidence suggests redcedar can support market diversification for other wood products and trade negotiations with new markets; therefore, more research into the use of redcedar as the access route for other timber products is required.

6.2 Recommendations for Further Research

Our identification of knowledge gaps highlighted the need for additional research in the following areas:

1. Map cedar production facilities
2. Cross price elasticity of cedar
3. Mill survey detailing employment and production
4. Research into the economics of cedar silviculture
5. A qualitative report into the products competing with cedar
6. Investigate the role of redcedar in trade negotiations

7. Summary and Conclusions

In recent years, the western redcedar industry has contracted in a direct relationship to the global economic downturn. Cedar production levels have decreased and even usage of cedar in secondary manufacturing has fallen dramatically. Redcedar harvest levels have declined over the years but appear to have stabilized since the 2009 economic downturn. Log exports have declined and now make up 2% of British Columbia's log exports. Lumber is still the main redcedar product, supporting 800 manufacturing jobs across the province and generating $750 million in sales. The shake and shingle business type follows, generating $175 million in sales. However, since 1995, production of redcedar siding experienced a drastic decline.

The forest industry relies heavily on the United States as a trading partner and, therefore, its economic trends are directly reflected in the redcedar data. Global economic outlook is uncertain, owing to recent events in Asia and the increased competition in energy markets.

Economic research into the redcedar industry is challenging because of the lack of reliable data. Future primary research should focus on obtaining results from carefully designed surveys that address as many data gaps as possible. A better understanding of competing products and price elasticities would provide a good basis for policy aimed at preventing the loss of cedar's market share. In addition, investigating the geographic centres where economic impacts are most felt could help to identify small logging communities with a heavy reliance on redcedar. As a final place to focus research, the role of western redcedar in negotiating trade agreements should be examined. We hypothesize that cedar may be a preferred species that can be used to negotiate effectively and access new markets for other forest products.

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