



Forest sustainability in the province of British Columbia, Canada

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1. Introduction

The combustion of wood for energy purpose is not considered to contribute to the augmentation of greenhouse gases concentration in the atmosphere, as long as the CO₂ emissions released during the combustion of wood are balanced by the growth of new trees. It is therefore essential to investigate if the forests in the region where the wood used for energy purpose are managed in a sustainable way, avoiding resources associated with overexploitation of forests, land use change, depletion of carbon stocks, etc...

In this framework, literature research was carried out to produce a summary of forest management in British Columbia, including general condition, management and sustainability assessment.

2. British Columbia forests overview

2.1. Location and distribution

British Columbia is the westernmost province of Canada, and covers a total surface area of 944 735 km². British Columbia is divided into 29 regional districts. It also includes 8 counties which are divisions that are only relevant for the administration of justice.

The US states of Washington, Idaho and Montana border British Columbia to the south and Alaska to the northwest. The Canadian province of Alberta borders BC to the east, while the following Canadian Territories border BC to the north: Northwest Territories and Yukon Territories.

Figure 1: General maps of British Columbia



Source: www.maps.com

In total, forests surface in British Columbia is estimated to be just above 55 million ha (excluding estimated additional 3.7 million ha of sparsely forested land), which represents about 58% of the state surface¹. Other sources mention about 60 million ha and even up to 64.2 million hectares². Those differences are due to the inventory methods and on different ways to define a forest (in terms of minimum size, minimum height and minimum canopy cover).

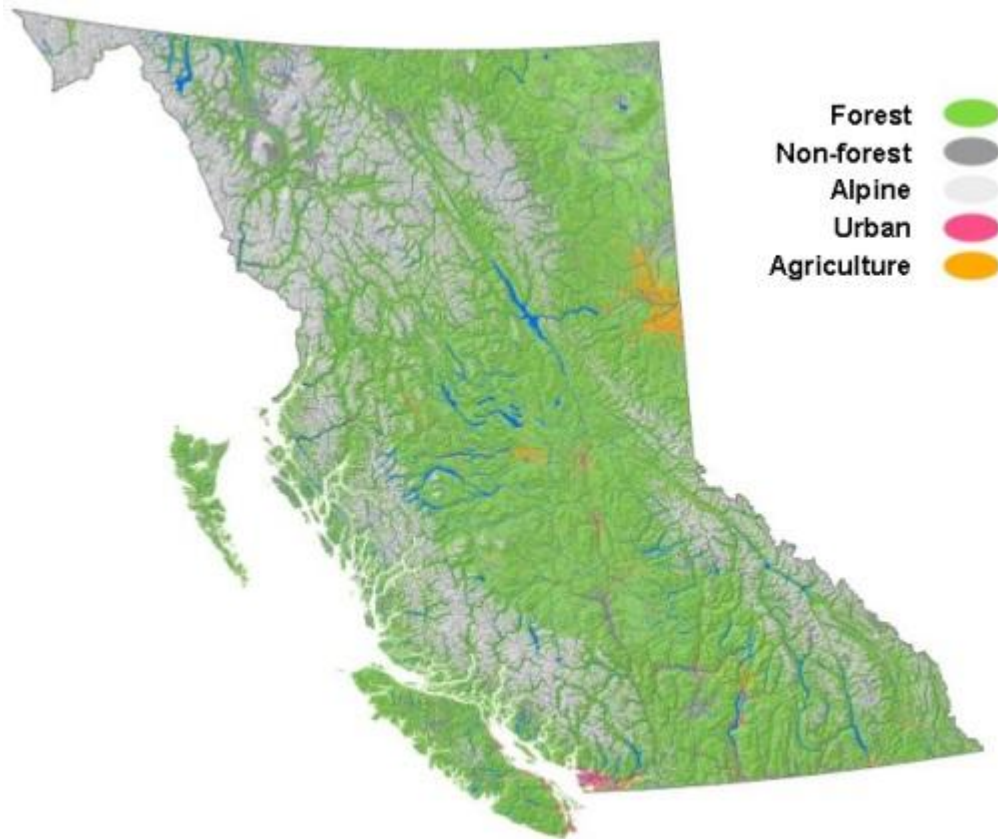
¹ B.C. Ministry of Forests, Mines and Lands. 2010. The State of British Columbia's Forests, 3rd ed. Forest Practices and Investment Branch, Victoria, B.C. www.for.gov.bc.ca/hfp/sof/index.htm#2010_report

² FP Innovations, 2010, Wood market statistics British Columbia <https://fpinnovations.ca/products-and-services/market-and-economics/Documents/2010-wood-market-statistics-in-bc.pdf>

It is estimated that about half of the British Columbia forest is unavailable to harvesting because of poor access³. Significant areas of British Columbia forest have no road access and cannot be harvested.

Figure 2 presents the forest distribution throughout the Province. The non forested areas include mainly some non forested alpine vegetation, as well as some urban areas and very limited agricultural lands.

Figure 2 : Forest distribution in British Columbia



source : B.C. Ministry of Forests, Mines and Lands. 2010. The State of British Columbia's Forests, 3rd ed. Forest Practices and Investment Branch, Victoria, B.C.

2.2. Ecological zones

British Columbia is almost entirely located within a vast mountain system, which includes divides and valleys oriented in a northwest-southeast direction. The Two major ranges are the Coast Mountains in the West and the Rocky Mountains in the East. There are gradual successions of different

³ Forestry Innovation Investment http://www.bcfii.ca/wp-content/uploads/bc-forest-sector/Wood-Fibre-Opps-WEB_Part2.pdf

elevations, climate, soil and vegetation conditions from north to south and from east to west, with as much as 9 different ecoregions (Figure 3).

The lowest point in British Columbia is at sea level. The highest point in the Province is St Elias Mountain on the Alaskan border, at 15300 feet above sea level (4663 m)⁴.

Areas in the South of the Interior Plateau have the hottest summer, with average maximal temperature regularly exceeding 30°C and sometimes reaching 40°C in July. The northern region is the coldest, with an average minimum temperature in January as low as -25°C in Fort Nelson and even colder in the high elevation areas.

On the west, the mountainous windward coast receives the greatest amount of annual rainfall, with rainfall in excess of 5000 mm per year. The driest region is the southern interior plateau, with an annual rainfall below 200 mm per year.⁵

British Columbia includes 9 terrestrial “ecoprovinces”, which mapped on Figure 3 and their description is given hereunder⁶:

COM - Coast and Mountains Ecoprovince

The Coast and Mountains Ecoprovince extends from the southeastern Alaska to the northern Cascade Mountains in Washington. In British Columbia it includes the windward side of the Coast Mountains and Vancouver Island, all of the Queen Charlotte Islands, and the Continental Shelf including Dixon Entrance, Hecate Strait, Queen Charlotte Strait and the Vancouver Island Shelf. The Coast and Mountains Ecoprovince consists of the large coastal mountains, a broad coastal trough and the associated lowlands, islands and continental shelf, as well as the insular mountains on Vancouver Island and the Haida Gwaii (formerly called the Queen Charlotte Islands) archipelago.

GED - Georgian Depression Ecoprovince

This ecoprovince lies between the Vancouver Island Mountains and Olympic Mountains on the west and the southern Coast Mountains and northern Cascade Ranges on the east. In British Columbia, this ecoprovince is a large basin that encompasses the southeastern Vancouver Island Ranges and the Nanaimo Lowlands in the west, the Strait of Georgia, Gulf Islands and Strait of Juan de Fuca in the middle, and the Georgia Lowlands and the Fraser Lowlands in the east. In Washington, this Ecoprovince is also a large basin that encompasses the lower, eastern slopes of the Olympic Mountains in the west, the Puget Trough and adjacent lowlands in the middle, and the western foothills of the Cascade Ranges on the east.

The majority of the human population in British Columbia and Washington occurs in this ecoprovince and the environment has been greatly modified. Large portions have been converted to exclusive urban and industrial use. Agriculture is intense and includes dairy production, food crops, berries and cereals. Logging remains important on the periphery of the settled area, but is coming into serious conflict with recreational use of the few remaining natural areas.

COM - Coast and Mountains Ecoprovince

⁴ <http://www.britannica.com/EBchecked/topic/79964/British-Columbia>

⁵ http://oldprism.nacse.org/pub/prism/maps/Precipitation/Total/States/BC/bcs_ppt.gif

⁶ Descriptions by the British Columbia Ministry of Environment <http://www.env.gov.bc.ca/ecology/ecoregions/>

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CEI - Central Interior Ecoprovince

The Central Interior Ecoprovince lies to the east of the Coast Mountains, between the Fraser Basin and the Thompson Plateau. This ecoprovince contains the flat to rolling Chilcotin and the Cariboo Plateaus and the southern two-thirds of the Nechako Plateau. It also contains the Chilcotin Ranges west to the centre of the Pacific Ranges and the Bulkley and Thatsa Ranges.

Agriculture is limited to grazing and small production of forage crops. Logging is the most extensive industry based on renewable resources and there are many mines.

SIM - Southern Interior Mountains Ecoprovince

The Southern Interior Mountains Ecoprovince consists of the Columbia Mountains and associated highlands, the Southern Rocky Mountain Trench, and the Continental Ranges of the Rocky Mountains and associated foothills. It lies east of the interior plateaus and west of the Interior Plains. In British Columbia it extends eastward to the British Columbia - Alberta boundary, however the Ecoprovince does extend as far east as the Interior Plains. The southern boundary in British Columbia is the 49th parallel or the Canada-USA border, however the Ecoprovince extends southward into northeastern Washington, northern Idaho and northwestern Montana as far south as the limit of Interior Cedar - Hemlock forests.

Forest-based industries are important and include a rapidly expanding tourism and recreation element. Coal mining occurs in the Elk River Valley and metal mining occurs in the lowlands and mountains. Extensive reservoir impoundments have occurred throughout this Ecoprovince on the Columbia and Kootenay rivers and their tributaries. Agriculture is restricted to the Rocky Mountain Trench, the Creston Valley, the southern Columbia Valley and the Robson Valley. It is largely based on grazing and forage crops, except in the extreme southwest where lowlands and floodplains have been developed for orchards and cereal crops.

SAL - Southern Alaska Mountains Ecoprovince

This Ecoprovince is located on the north side of the Gulf of Alaska. It extends from Lynn Canal in the east, across the Alsek, St. Elias, Wrangell, and Chugach Mountains to the Kenai Mountains in the west.

SOI - Southern Interior Ecoprovince

The Southern Interior Ecoprovince lies east of the crest of the Coast and Cascade Mountains and west of the Columbia Mountains. In the north it abuts the Central Interior Ecoprovince, and it extends southward across the Canada-USA border to the northern edge of the dry Columbia Basin. It is the southernmost part of the Interior Plateau system. The leeward portion of the coastal mountains and the drier portion of the Columbia Highlands are included because they share much of the same climate as the main plateau.

The largest human population in the interior of British Columbia occurs in this Ecoprovince. Agriculture is largely based on grazing and forage crops, but orchards and vineyards are integrated with a large and successful tourist industry in the Okanagan Valley.

BOP - Boreal Plains Ecoprovince

The Boreal Plains Ecoprovince lies east of the Rocky Mountains, south of the Fort Nelson Lowlands. It occurs on the Alberta Plateau, and consists of plateaus, plains, prairies, and lowlands, and away from the deeply incised large rivers is generally of low relief. It extends eastward, across northern Alberta, Saskatchewan and Manitoba and southern Northwest Territories.

Agriculture is limited to grazing with some cereal and forage crop production in the Peace Lowland Ecosection. Natural gas production and mining occurs throughout the hinterland and many seismic lines criss-cross the area. Logging of white spruce, lodgepole pine and trembling aspen has been occurs where good timber stands permit, but most forest removal is through clearing for agricultural fields.

TAP - Taiga Plains Ecoprovince

This ecoprovince lies to the east of the northern Rocky Mountains in the northeastern portion of British Columbia. It extends into the northwestern portion of Alberta above the Peace Lowland and into the Northwest Territories to Great Slave Lake where it follows the Mackenzie River to the mouth of the Liard River, then south along the eastern flank of the Mackenzie Mountains back into B.C. It is characterized as a large lowland that has been dissected below the Alberta Plateau surface by the Liard River and its tributaries, namely the Fort Nelson and Petitot Rivers.

NMB - Northern Boreal Mountains Ecoprovince

This ecoprovince lies east of the northern Boundary Ranges of the Coast Mountains, west of the Alberta Plateau, and south of the Taiga Cordillera of the Mackenzie Mountains. The general character of this ecoprovince is one of mountains and plateaus separated by wide valleys and lowlands that are strongly influenced by Arctic air. The Northern Boreal Mountains Ecoprovince extends from north-central British Columbia northward across the southern Yukon into east-central Alaska.

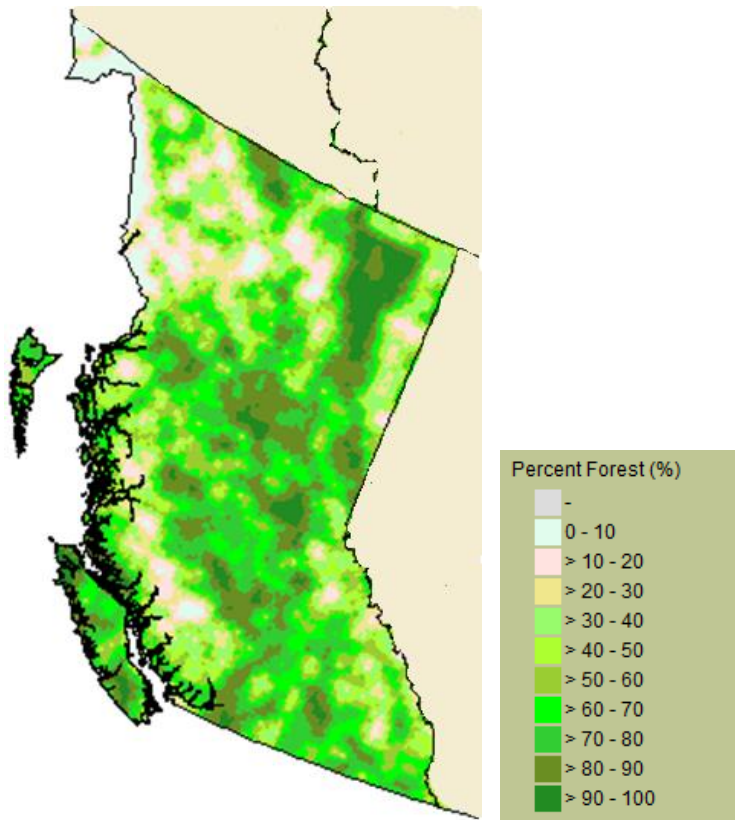
There has been little obvious effect of human activity in the area. Mineral exploration, open-pit mining and placer mining, have had the most serious habitat impacts, starting with the rush in the late 1890's to the Klondike gold fields, many prospectors staked claims within this ecoprovince, or supported developments along the lower Stikine River and Dease Lake, but continuing to present with placer mining, jade exploration and base metal exploration, one of the largest mines, now closed was the Asbestos mine at Cassiar, which necessitated building an industrial road to tidewater at Stewart. Logging is restricted to small, local operations. Guiding and trapping remain the most important industries based on renewable resources.

Figure 3: Ecoprovinces of British Columbia

Source: The British Columbia Ecoregion Classification, 2011 (D.A. Demarchi - Ecosystem Information Section - Ministry of Environment - Victoria, British Columbia)

Forests are present in all parts of British Columbia and cover about 60% of the territory (55 to 65 million ha, depending on the methodology) ⁷. The lands which are not forested include mostly high mountain ranges, as well as some urbanisation, and some limited agricultural land in the south. Figure 4 shows the distribution of forests throughout the territory.

⁷ B.C. Ministry of Forests, Mines and Lands. 2010. The State of British Columbia's Forests, 3rd ed. Forest Practices and Investment Branch, Victoria, B.C. www.for.gov.bc.ca/hfp/sof/index.htm#2010_report

Figure 4: Distribution of forests in British Columbia

source : modified from NFI (Canada's National Forest Inventory) <https://nfi.nfis.org>

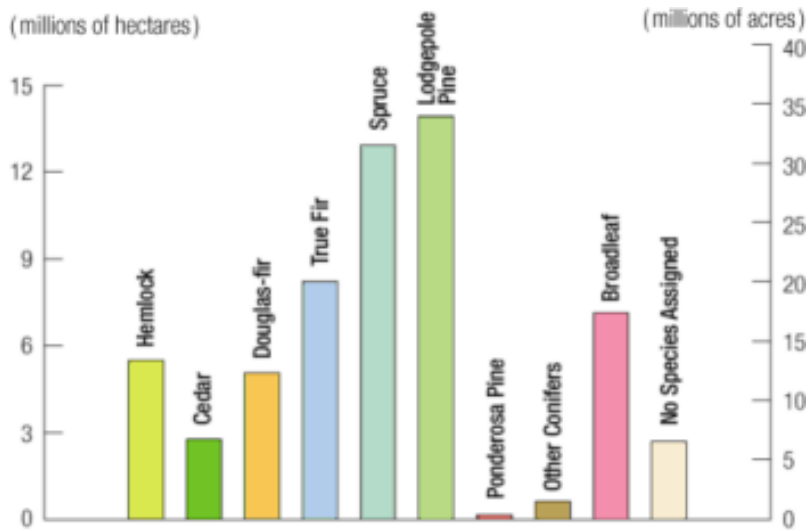
Figure 5 shows the abundance of the different tree species in British Columbia. Conifers predominate largely in British Columbia and account for the great majority of all forest species. Spruce, pine, fir and hemlock largely dominate the growing stock. Broadleaf trees are very marginal⁸. The Figure 6 maps the dominant forest tree species throughout the different parts of British Columbia.

Approximately one-half of the province's timber is located on land available for harvesting. The public forest land, on which timber harvesting is both feasible and permitted, is called the timber harvesting land base (THLB)⁹. The THLB totals 22 million hectares in B.C., relatively unchanged since 1996. An additional 2 million hectares of private forest land are also suitable for timber harvesting.

In the B.C. interior, a massive outbreak of the mountain pine beetle has killed much of the mature lodgepole pine.

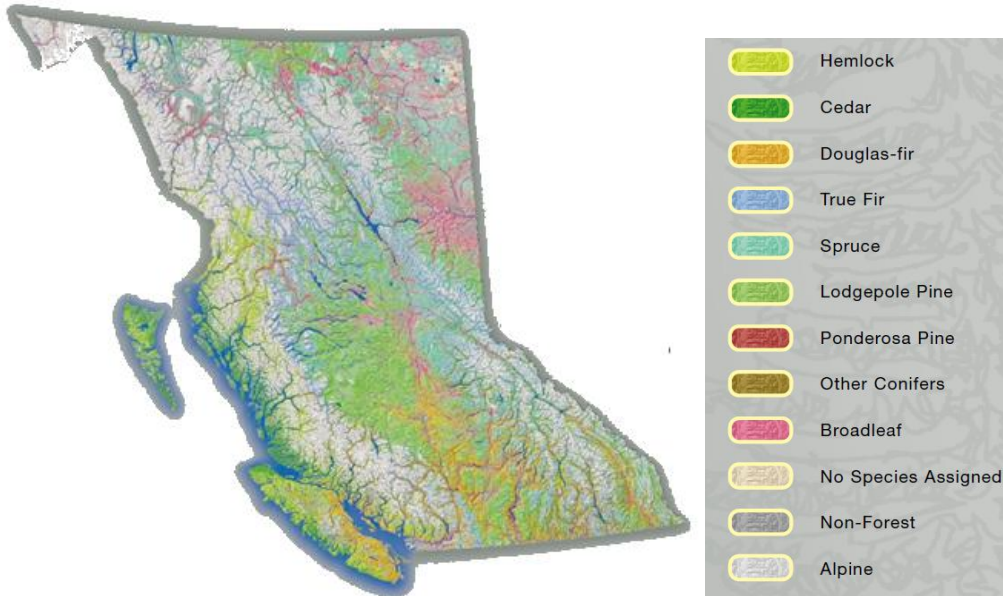
⁸ The State of British Columbia's Forests, 2010, op.cit.

⁹ The State of British Columbia's Forests, 2010, op.cit.

Figure 5: Area of forest by predominant species

Source:

Ministry of Forests, Lands and Natural Resource Operations <http://www.for.gov.bc.ca/hfd/pubs/docs/mr/mr112/page08.htm>

Figure 6: Distribution of forest species in British Columbia

Source:

Ministry of Forests, Lands and Natural Resource Operations <http://www.for.gov.bc.ca/hfd/pubs/docs/mr/mr112/page07.pdf>

2.3. Forest ownership

About 95% of British Columbia's land and especially forest land is Crown Land managed by the Province¹⁰ (Table 1). Taking into account that there is also about 1 % of federal forest land, the forest land owned by private individuals or companies is less than 4%. This private ownership mainly results from the timber grant scheme, introduced in the 19th century and in use until the beginning of the 20th century. After this moment, all the numerous schemes used in British Columbia to have forest land exploited and/or harvested by private entities consisted exclusively in leasing and did not involve any transfer of property any longer.

British Columbia's forestland ownership distribution (as per 2010) is presented in the following table.

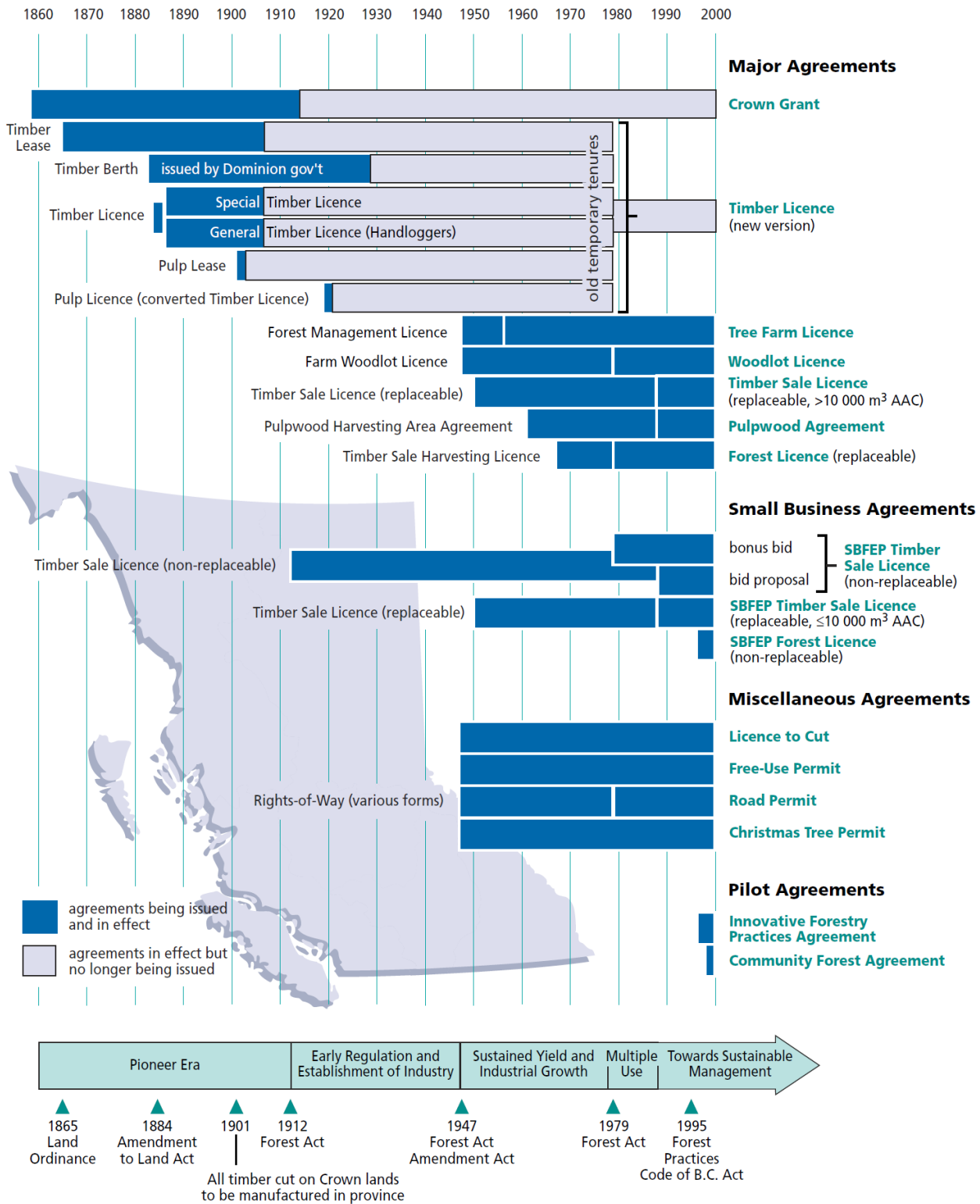
Table 1 : Area of forest lands by ownership groups

Ownership	millions ha	%
Crown Grants - Private administration	2.60	4.2%
Federal Lands - Federal administration	0.63	1.0%
Crown Lands - Provincial administration	52.12	84.6%
Crown Lands - Private and/or Provincial administration (land lease)	6.15	10.0%
Crown Lands - Provincial administration under active lease or permit	0.13	0.2%
TOTAL	61.63	100.0%

Source: calculated from www.hectaresbc.org

The different leasing schemes used for forest exploitation on Crown lands are presented on Figure 7.

¹⁰ The State of British Columbia's Forests, 2010, op.cit.

Figure 7: Overview of forest license schemes in British ColumbiaSource : Cortex (www.cortex.ca) British Columbia's Timber Tenure System

2.4. Competent authorities

Forest management in Canada is essentially at the level of the provinces. At the federal level, the authorities in charge in each province cooperate in the Canadian Council of Forest Ministers, which is more a discussion platform than a decision making entity. The decision power is at the level of the provinces.

In British Columbia, the public forests are managed by the Ministry of Forests, Lands and Natural Resource Operations. The Ministry is *responsible for establishing the conditions for access to and use of the province's forest, land and natural resources. Working with stakeholders, the Ministry develops policies, programs and legislation to promote industry competitiveness, and encourage investment in and development of natural resources. It also ensures that ministry activities support sustainable development and protect the public's interest in these resources*¹¹.

Specifically in terms of forest management, *the Ministry's role includes*¹²:

- *auctioning Crown timber to support the timber pricing system*
- *preparing forest stewardship plans and logging plans*
- *developing timber sale licences;*
- *constructing and maintaining logging roads and bridges;*
- *undertaking silviculture and forest protection treatments;*
- *ensuring the work is carried out in a safe manner.*

The local management divisions include the following regions (Figure 8) :

- Cariboo Region
- Kootenay/Boundary Region
- Northeast Region
- Omineca Region
- Thompson/Okanagan Region
- Skeena Region
- South Coast Region
- West Coast Region

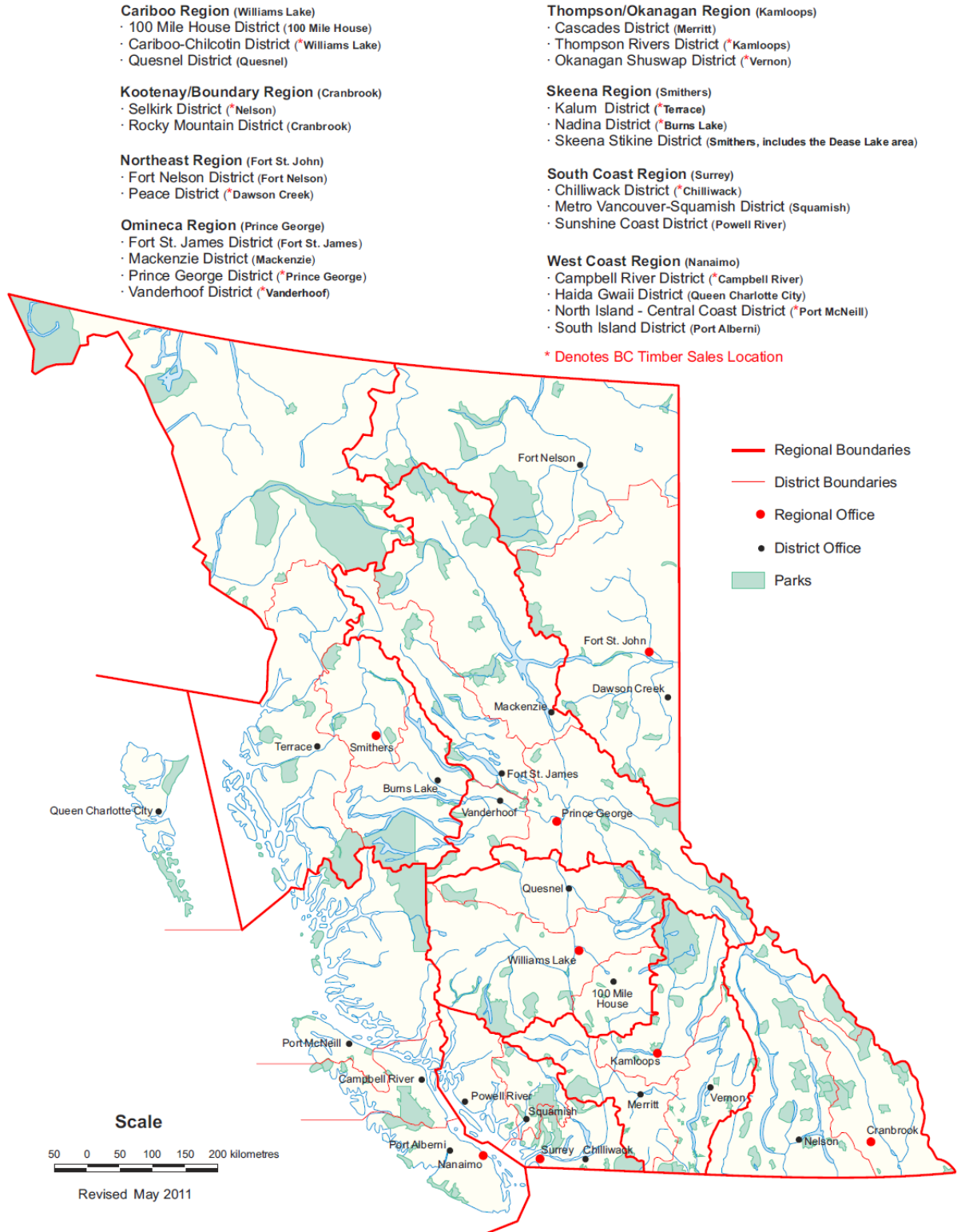
Each region has a regional office and includes several districts.

Beside the regional organisation, the central administration also includes several divisions, with specific scopes of activities:

- Corporate Initiatives Division
- Integrated Resource Operations Division
- Resource Stewardship Division
- Tenures, Competitiveness & Innovation Division
- Timber Operations, Pricing & First Nations Division

¹¹ Ministry of Forests, Lands and Natural Resource Operations - February 2014 - 2014/15 - 2016/17 Service Plan

¹² Ministry of Forests, Lands and Natural Resource Operations : Service Plan, op.cit.

Figure 8 : Management units of the National Forest in British Columbia

source : Ministry of Forests, Lands and Natural Resource Operations
<https://www.for.gov.bc.ca/mof/maps/regdis/regdismap.pdf>

2.5. Overview of wood-related industry

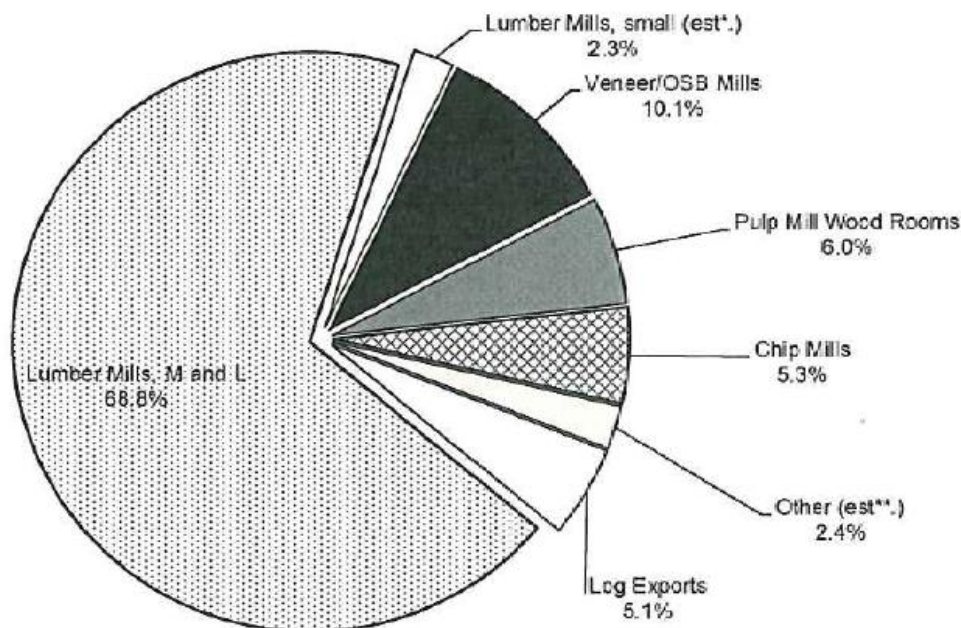
According to the British Columbia's Council of Forest Industries¹³, the contribution of the forestry sector to British Columbia's Gross Domestic Product in 2012 was 2.9%.

The total sales value of wood products in 2012 was 6.55 billion CAD (Canadian dollars), including 6.17 billion CAD for the export of wood products. It is 94.3% of the BC's wood sales and is 19.7% of BC's exports. The export destinations include mostly USA and increasingly Asia.

The direct employment in forest industry in 2012 was estimated to be 56 400 jobs and additional indirect employment is estimated to 112 800 jobs. The direct employment includes forestry (17 700 jobs), wood products (26 700 jobs) and pulp and paper (12 000 jobs).

As can be seen on Figure 9, the forest products are largely dominated by lumber (sawn wood), mostly for export. Exports of logs are very marginal.

Figure 9 : Distribution of forest products in British Columbia



Source : Ministry of Forests, Lands and Natural Resource Operations, 2009, Major timber processing facilities in British Columbia <http://www.for.gov.bc.ca/ftp/het/external/!publish/web/mill%20list/Public%20Report%202009.pdf>

An overview of the wood processing facilities in British Columbia, with the related processed volumes is provided on Table 2.

¹³ <http://www.cofi.org/bc-forest-industry/economics-statistics/>

Table 2 : Overview of main wood processing facilities and processed volumes

	Coast			Interior			Province		
	Number of Mills	Est. Volume Used (000 M ³)	Per Cent	Number of Mills	Est. Volume Used (000 M ³)	Per Cent	Number of Mills	Est. Volume Used (000 M ³)	Per Cent
Primary Log Use									
Lumber Mills, M and L	19	4,948	37.8%	53	28,189	80.3%	72	33,137	68.8%
Lumber Mills, small (est*.)	34	621	4.7%	28	468	1.3%	62	1,088	2.3%
Veneer/OSB Mills	3	1,430	10.9%	12	3,460	9.9%	15	4,890	10.1%
Pulp Mill Wood Rooms	8	1,989	15.2%	11	895	2.5%	19	2,884	6.0%
Chip Mills	6	1,339	10.2%	6	1,230	3.5%	12	2,569	5.3%
Other (est**.)	36	709	5.4%	51	446	1.3%	88	1,155	2.4%
Log Exports		2,043	15.6%		415	1.2%		2,458	5.1%
TOTAL	107	13,079	100%	161	35,102	100%	268	48,181	100%

Source : Ministry of Forests, Lands and Natural Resource Operations, 2009, Major timber processing facilities in British Columbia <http://www.for.gov.bc.ca/ftp/het/external/!publish/web/mill%20list/Public%20Report%202009.pdf>

3. Sustainability of British Columbia forest

3.1. Evolution of forest area and risk of conversion

Despite some literature research suggests, it does not seem to be any systematic assessment of the forest land area year by year in British Columbia. However, there are regular assessments and estimations of the surfaces concerned by deforestation and afforestation, which give an idea of the evolution and the risk of conversion.

Table 3 and related Figure 10 hereunder present the information available. Even though, the total surface area of forest land remains difficult to assess for methodological reasons (depending how a forest is defined and how the surface are estimated), the surface of forest land appears to have been extremely stable throughout recent years, with annual deforestation in the range of 0.01 % of the total forest land in British Columbia.

Some decades ago, particularly in the years 1970ies and 1980ies, deforestation in British Columbia used to be more important, particularly because of some large hydro projects and some significant land conversion to agriculture. Between 1970 and 2007, the annual loss of forest land surface was in the range of 12 000 ha, nearly twice more than nowadays¹⁴. Even so, it was only 0.02% of the forest area and the forest surfaces lost during the 20ies century remain a very small part of British Columbia's vast territories. Since the colonisation of British Columbia (starting in the 18th century), it is estimated that less than 3% of the original forest has been converted to other land uses¹⁵.

Table 3 : Deforestation and afforestation in British Columbia (1990-2010)

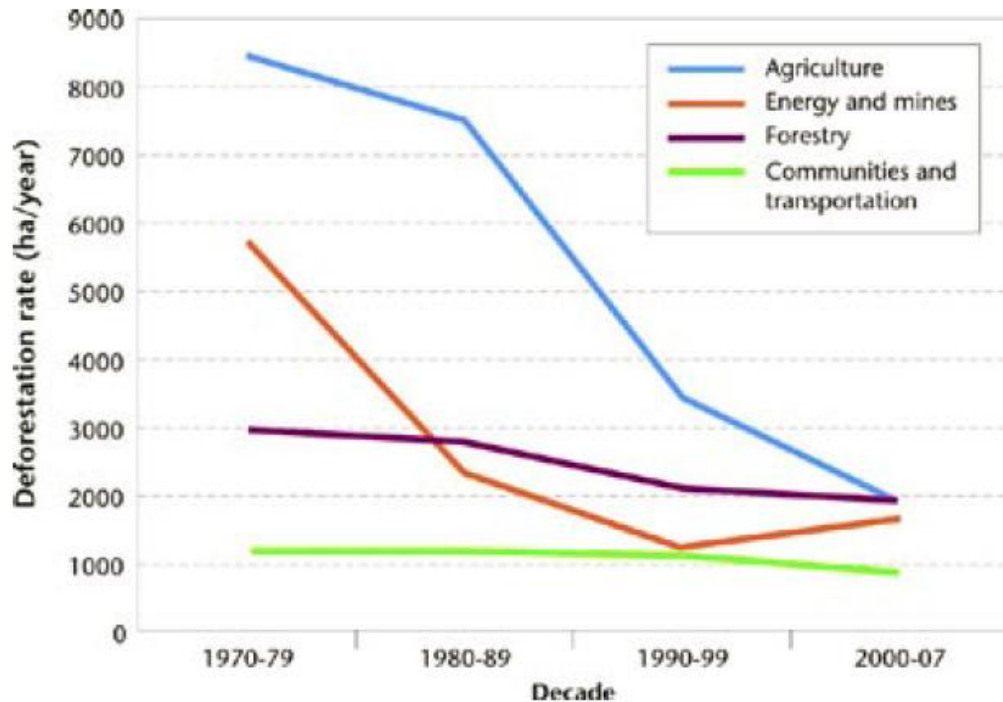
		1990	1995	1998	2000	2005	2007	2008	2009	2010
Afforestation	ha	-1370	-3032	-1902	-1902	-2428	unknown	unknown	unknown	unknown
	%	-0.002%	-0.005%	-0.003%	-0.003%	-0.004%	unknown	unknown	unknown	unknown
Deforestation	ha	10509	6998	6782	6656	6197	6223	6223	6223	6223
	%	0.017%	0.011%	0.011%	0.011%	0.010%	0.010%	0.010%	0.010%	0.010%

Source: BC Ministry of Environment, British Columbia GHG inventory report 2010

The percentages have been calculated in comparison with the total forested reported above in Table 1

¹⁴ The State of British Columbia's Forests, 2010, op.cit.

¹⁵ The State of British Columbia's Forests, 2010, op.cit.

Figure 10 : Annual deforestation areas in British Columbia (1970-2007) by sector

Source: B.C. Ministry of Forests, Mines and Lands. 2010. The State of British Columbia's Forests, 3rd ed. Forest Practices and Investment Branch, Victoria, B.C. www.for.gov.bc.ca/hfp/sof/index.htm#2010_report

The FSC risk assessment platform (www.globalforestregistry.org) considers that Canada (as a whole) is at unspecified risk in terms of conversion of forest to other land uses, because the following criterion is verified at the country level:

- There is no net loss AND no significant rate of loss ($> 0.5\%$ per year) of natural forests and other naturally wooded ecosystems such as savannahs taking place in the eco-region in question.

3.2. *Standing trees volumes and removals*

The volumes of standing trees in British Columbia were estimated to 9.72 billions m^3 , based on the Canadian Forest Inventory 2001¹⁶. Another estimation available¹⁷ is roughly 11 billions m^3 . Those two figures are not necessarily comparable as they result from different estimations.

No systematic assessment of the volumes of standing trees is performed on a yearly basis.

¹⁶ FP Innovations, 2010, Wood market statistics British Columbia <https://fpinnovations.ca/products-and-services/market-and-economics/Documents/2010-wood-market-statistics-in-bc.pdf>

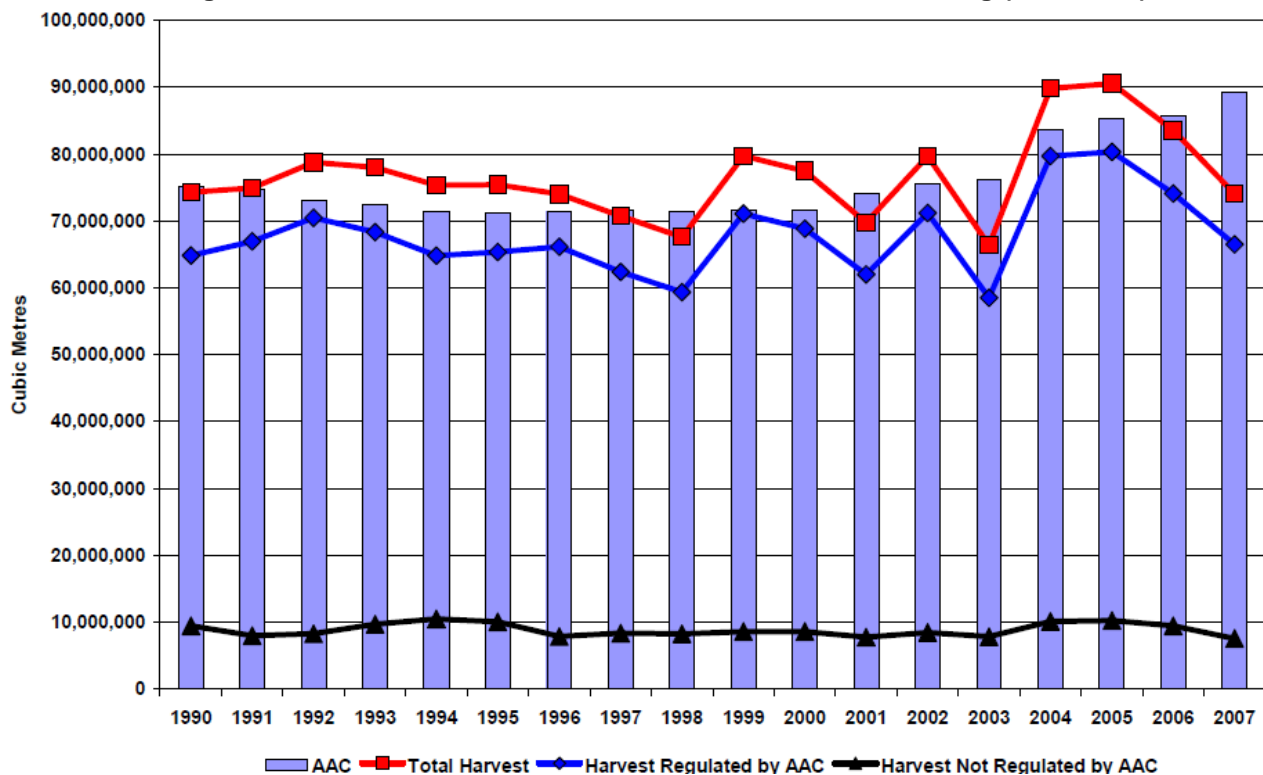
¹⁷ The State of British Columbia's Forests, 2010, op.cit.

It is however quite certain that the volumes of standing trees are currently depleting and that future estimations of the volumes will show the full extent of this diminution¹⁸. The reason for this is the recent outbreak of mountain pine beetle infestation (started in after 2001 and becoming more severe after 2005) and also the frequent and severe wildfires experienced after 2000. The mountain pine beetle infestation has killed a significant proportion of pine, resulting in diminution in the forest annual growth, which can not compensate any longer the losses (normal decay and harvesting as well as aggravated losses due to wildfires).

In terms of harvested volumes, there is a specific system in place to plan and monitor the activities. At provincial level, the government sets an Allowable Annual Cut (AAC) for most public land and some of the private land. This system has been in place since 1949 to prevent overexploitation of the resources. It is estimated that 89% of the harvested volumes in British Columbia are regulated by AAC. The remaining 11% are unregulated land, including mostly private land and a minority of public land.

After 2000, the AAC has been increased in some regions as a response to the mountain pine beetle outbreak (the affected pines need to be cleared for pest control and wood recovery purpose). However, in total, due to the prevailing economic circumstances, the timber demand has been low and we have seen the actual total levels of harvesting (both on regulated and unregulated land) actually dropping after 2005.

Figure 11 : Allowable annual cuts and actual levels of harvesting (1990-2007)



¹⁸ The State of British Columbia's Forests, 2010, op.cit.

3.3. Protection of ecosystems and biodiversity

As shown on Table 4, the conservation lands in British Columbia cover 13 986 209 ha, which represent about 14.8% of the land area in British Columbia¹⁹. The protected areas are managed by BC Parks, a service of the Ministry of the Environment at the provincial level.

Table 4 : Lands under protection status in British Columbia

Designation	Number	Area (hectares)
Ecological Reserves	148	160,452
Class A Parks	627	10,489,687
Class B Parks	2	3,778
Class C Parks	14	495
Conservancies	156	2,942,705
Protected Areas	80	383,439
Recreation Areas	3	5,933
Total	1,030	13,986,209

Source: BC Parks, annual report 2012-2013

The different types of conservation status are described hereunder²⁰:

- **Ecological reserves** are reserved for ecological purposes including areas: for research and education; that maintain representative examples of natural ecosystems; that serve as examples of ecosystems modified by human activities and offer an opportunity to study their recovery; that protect rare or endangered flora and fauna; and, unique examples of botanical, zoological or geological phenomena. While most ecological reserves are open to the public, they are not established for outdoor recreation and no extractive activities are allowed.
- **Class A parks** are lands dedicated to the preservation of their natural environment for the inspiration, use and enjoyment of the public. Development in a Class A park is limited to that which is necessary for the maintenance of its recreational values. Activities such as grazing, hay cutting and other uses (except commercial logging, mining or hydro electric development) that existed at the time the park was established may be allowed to continue in certain parks.
- **Class B parks** differ from Class A parks in that a Class B park may permit a broader range of activities and uses provided that such uses are not detrimental to the recreational values of the park.
- **Class C parks** differ from Class A parks in that a Class C park must be managed by a local board. They are generally small parks providing local recreational amenities.

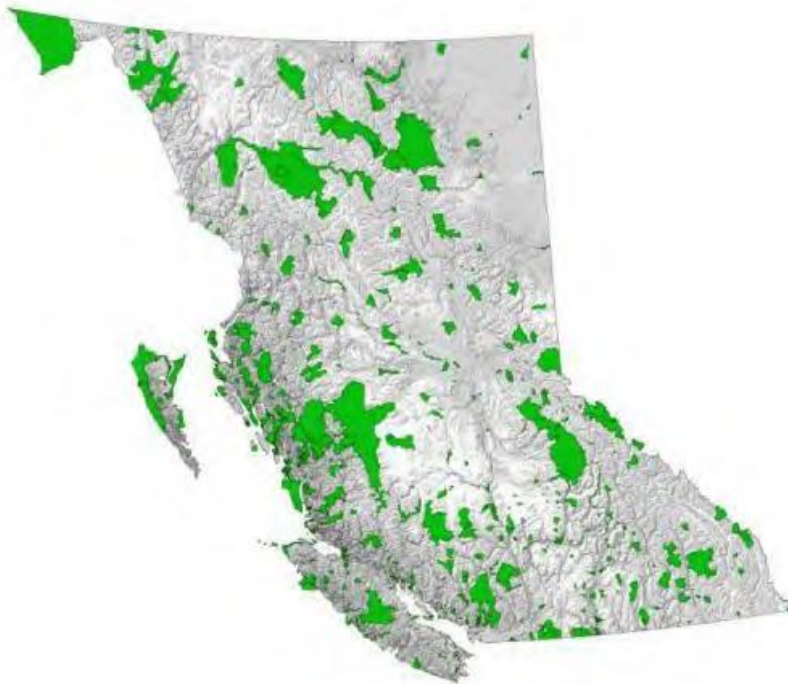
¹⁹ The State of British Columbia's Forests, 2010, op.cit.

²⁰ BC Parks, annual report 2012-2013

- **Conservancies** are set aside for: (a) the protection and maintenance of their biological diversity and natural environments; (b) the preservation and maintenance of social, ceremonial and cultural uses of First Nations; (c) the protection and maintenance of their recreational values; and (d) development or use of natural resources in a manner consistent with the purposes of (a), (b) and (c) above. Conservancies provide for a wider range of low impact, compatible economic opportunities than Class A parks, however, commercial logging, mining and hydro electric power generation, other than local run-of-the-river projects, are prohibited.
- **Protected areas** are established by order in council under the Environment and Land Use Act and generally have one or more existing or proposed activities that are not usually allowed in a park (e.g., proposed industrial road, pipeline, transmission line or communication site). Allowable activities are determined by specific provisions when the area is established as well as relevant sections of the Park Act and regulations.
- **Recreation areas** are set aside for public recreational use. The majority of these areas were established to allow a mineral resource evaluation under a time-limited tenure; no other industrial activities are permitted. All current recreation areas are being evaluated to determine if they should become fully protected or returned to integrated resource management lands.

The location of the protected areas is presented on Figure 12.

Figure 12 : Provincial reserves in British Columbia



Source: BC Parks, annual report 2012-2013

If we focus on forest lands, protected areas are 7.6 million hectares, which represent about 14% of the province forests. The old growth forests are more represented in the protected areas than the young stands. It is estimated that 23% of forests older than 250 years are protected ²¹.

²¹ The State of British Columbia's Forests, 2010, op.cit.

Significant efforts have been made in the last couple of years to increase British Columbia's protected forest areas (Table 5). Between 1991 and 2008, the surface of protected forest has increased by 200%.

Table 5 : Evolution of protected forest area (1991-2008)

year	1991	2002	2008
protected forest area (million ha)	2.5	5.7	7.6

Source: B.C. Ministry of Forests, Mines and Lands. 2010. The State of British Columbia's Forests, 3rd ed. Forest Practices and Investment Branch, Victoria, B.C.

3.4. Protection of water

In British Columbia, several legal provisions aim to ensure that the quality of surface water and groundwater is appropriately protected, the provincial *Water Act* and *Drinking Water Protection Act* and the federal *Fisheries Act*. In the forestry context, the former *Forest Practices Code of British Columbia Act* and the new *Forest and Range Practices Act* (FRPA) are the most important pieces of legislation²². They are applicable to the different types of forest licenses on public land (96% of the forests), but it is not applicable to private land. It includes:

- protection of community watersheds
- protection of fisheries-sensitive watersheds,
- specification of objectives by the governments, applicable to all forest and range operations. In addition,
- legal requirements for riparian reserves,
- various restrictions on road building, harvesting, and silviculture.

The FRPA has been only in place since 2004, and older legal requirements apply to operation plans submitted by licensees and approved before 2004 (based on the Forest Practices Code).

The government (and in particular the Ministry of Forests, Mines and Lands) is responsible to enforce the legal requirements on Crown land. There is a dedicated administration in charge of the assessing the compliance of the operations with the legal requirements (and in particular with the provisions of the FRPA) through systematic field audits: the Forest Practice Board²³.

Based on the latest Annual Report of the Forest Practice Board²⁴, the activities assessed during the year 2012-2013 are presented in Table 6. We can see that the vast majority of the heaviest works performed (construction of road, bridges, harvesting) with potentially the most serious impacts were checked on the field, while lighter operations (maintenance, regeneration...) were more scarcely sampled for field check.

²² The State of British Columbia's Forests, 2010, op.cit.

²³ B.C. Ministry of Forests, Mines and Lands <http://www.fpb.gov.bc.ca>

²⁴ B.C. Ministry of Forests, Mines and Lands
[http://www.fpb.gov.bc.ca/Forest Practices Board 2012-2013 Annual Report.pdf](http://www.fpb.gov.bc.ca/Forest_Practices_Board_2012-2013_Annual_Report.pdf)

Table 6 : Field checks operated by the Forest Practice Board in 2012-2013

Activity	Population	Field checked
Harvesting (# of blocks)	619	427
Road Construction (km)	772	554
Road Deactivation (km)	373	289
Road Maintenance (km)	7011	2612
Bridge Construction (# of bridges)	47	41
Bridge Maintenance (# of bridges)	774	342
Silviculture – Free Growing (# of blocks)	570	224
Silviculture – Regeneration Due (# of blocks)	641	195
Silviculture – Planting (# of blocks)	534	262
Silviculture – Site Preparation (# of blocks)	48	12
Fire Protection (# of active sites)	27	25

source : Forest Practices Board Annual Report 2012-2013

http://www.fpb.gov.bc.ca/Forest_Practices_Board_2012-2013_Annual_Report.pdf

The results of the assessment were as follows:

- 16 audit reports were issued
- 7 audits had no issue at all and 9 had some issues
- the issues included
 - o 30 significant non-compliances
 - o 5 areas of improvement
 - o 6 unsound practices.

Most issues found were related to roads and bridges. Corrective actions were taken where appropriate.

As most forest in British Columbia is certified under a forestry standard (see section 3.10 hereunder), additional requirements for the protection of water are also applicable to most forest land, in accordance with the relevant forest standards.

3.5. Protection of soils

In a similar way, as for the protection of water, the protection of soil in British Columbia relies on British Columbia's *Forest and Range Practices Act* (FRPA) and formerly on *Forest Practices Code of British Columbia Act*. The provisions of the FRPA in terms of soil conservation include:²⁵

²⁵ B.C. Ministry of Forests, Mines and Lands <https://www.for.gov.bc.ca/hfp/frep/values/soils.htm>

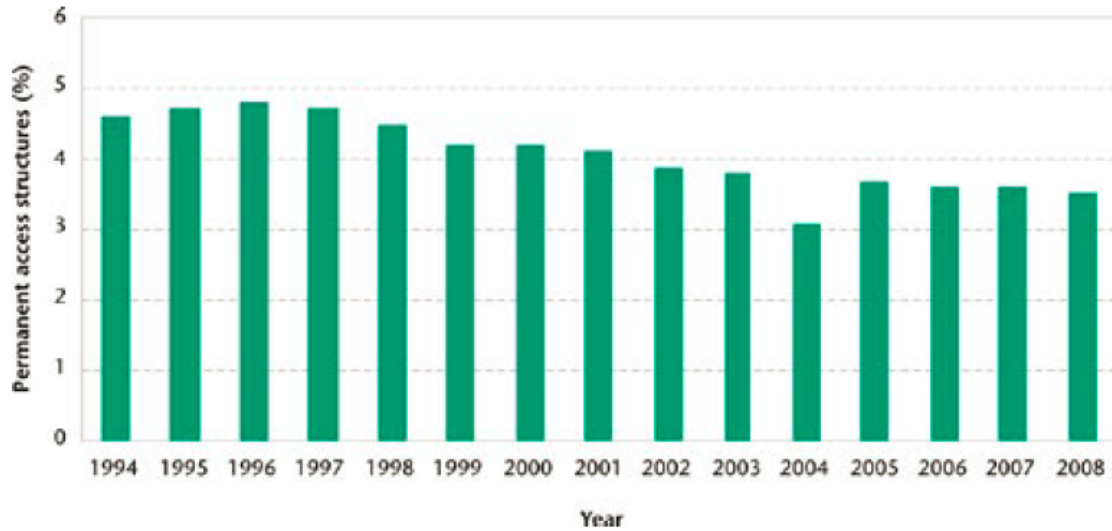
- *limiting the extent of soil disturbance caused by harvesting and silviculture activities that negatively affect the physical, chemical, and biological properties of the soil.*
- *addressing the inherent sensitivity of a site to soil-degrading processes to minimize detrimental soil disturbance, landslides, soil erosion, and sediment delivery to streams.*
- *limiting the area of productive forest land that is occupied by permanent roads, landings, pits, quarries, and trails to the minimum necessary to safely conduct forest practices.*

As described under section 3.4, it appears from the last annual report of the Forest Practice Board (2012-2013) that forestry operations (and in particular the heaviest works such as harvesting, road and bridges construction) are closely monitored for compliance with applicable legislation through field checks. Even though some significant non compliances were found during field checks (in 9 audits out of 17), they were followed up for corrective actions.

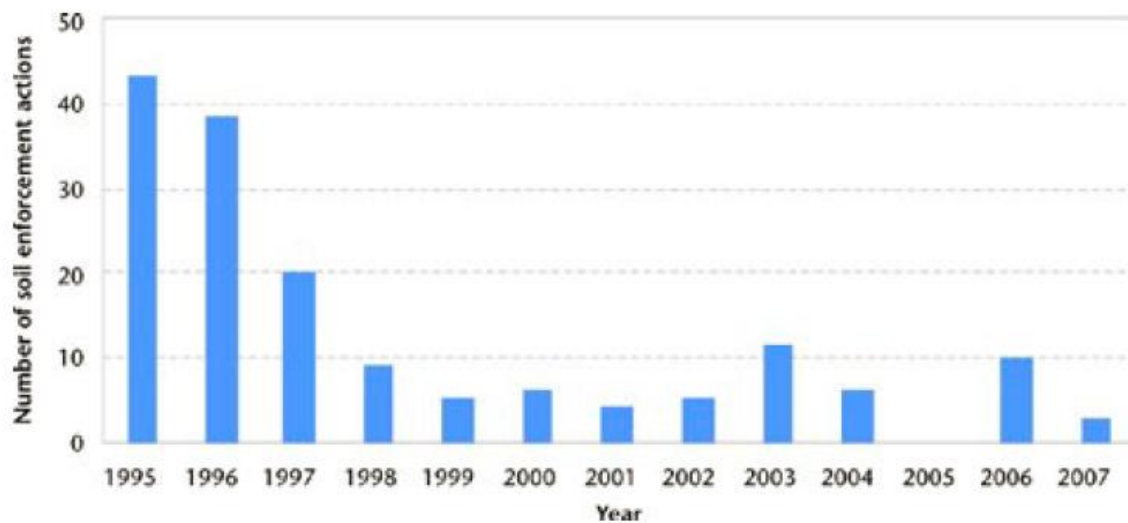
Under FRPA, soil disturbance is classified into two main types: areas occupied by permanent access structures and areas occupied by soil disturbance in the net area to be reforested. The latest report on the state of BC forests (by In the Ministry of Forests, Mines and Lands²⁶) includes indicators for those two aspects of soil protection:

- The area occupied by permanent access structures, as a percentage of harvested area, is regularly assessed and the trend shows a decrease in the area occupied by those structures since the years 1990ies (Figure 13).
- The damages to soil during harvesting activities are regularly monitored by the Ministry and enforcement actions are taken, when the legally authorized degree of disturbance is exceeded. The statistics show that much less enforcement actions were taken after the years 1990, reflecting an improvement in terms of soil impact during harvesting operations (Figure 14).

²⁶ The State of British Columbia's Forests, 2010, op.cit.

Figure 13 : Percentage of harvested land occupied by permanent access structures

Source: B.C. Ministry of Forests, Mines and Lands. 2010. The State of British Columbia's Forests, 3rd ed. Forest Practices and Investment Branch, Victoria, B.C. www.for.gov.bc.ca/hfp/sof/index.htm#2010_report

Figure 14 : Number of enforcement actions taken in relation with unacceptable degree of soil disturbance on harvesting site

Source: B.C. Ministry of Forests, Mines and Lands. 2010. The State of British Columbia's Forests, 3rd ed. Forest Practices and Investment Branch, Victoria, B.C. www.for.gov.bc.ca/hfp/sof/index.htm#2010_report

3.6. Protection of carbon stocks

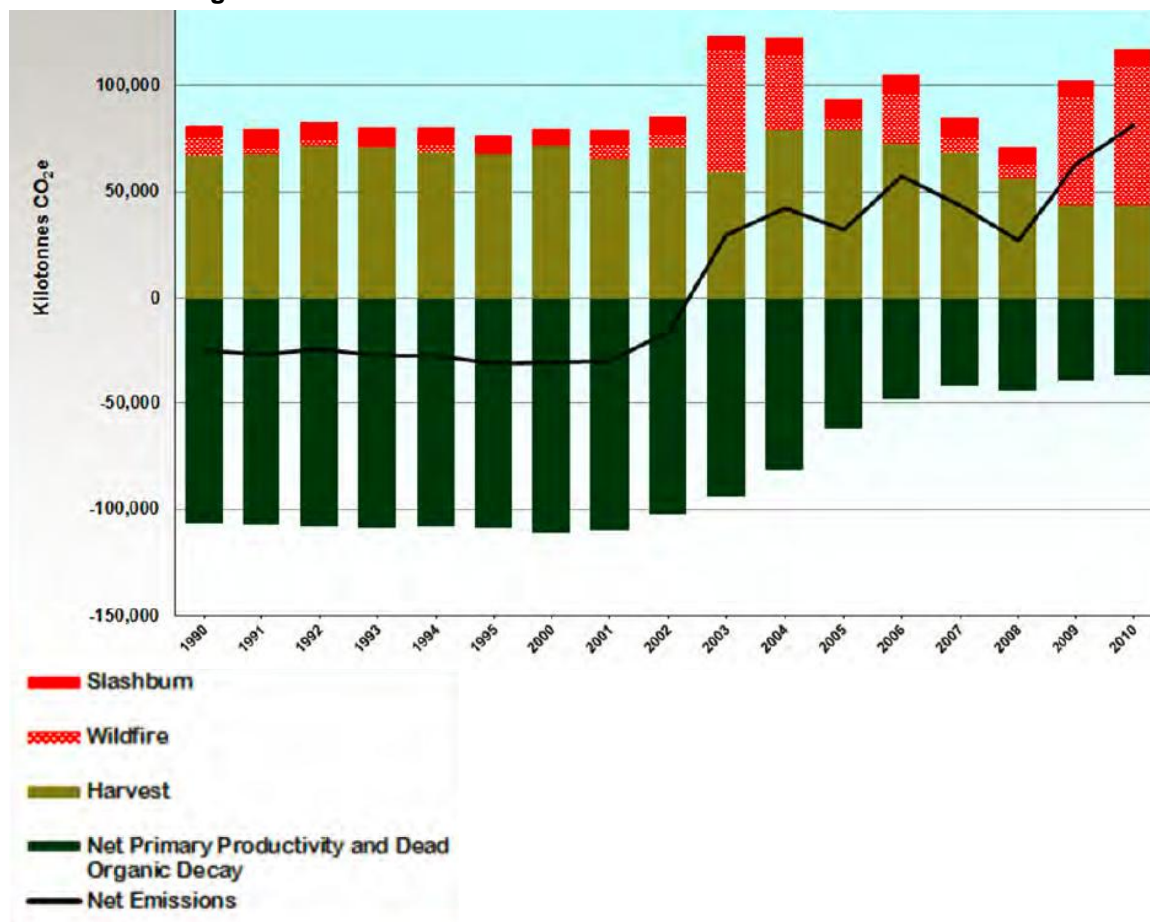
In forest land, the carbon stocks mainly include:

- living above ground and below ground woody biomass,
- soil organic carbon,
- carbon in litter.

We have seen in section 3.2 that the volume of standing trees is expected to be decreasing because of the impact of the recent mountain pine beetle outbreaks (resulting in reduced growth and increased decay) and the augmentation of frequency and severity of wildfires.

For the same reason as shown on Figure 15, we can see that the carbon stock of the BC forests is currently estimated to deplete, despite the reduced level of harvesting. It results in increasing net carbon emissions. The BC forests used to be a carbon sink until 2002. From 2003 onwards, it has become a carbon emission source. The estimated emissions were in excess of 75 million tons CO₂ in 2010.

Figure 15 : Carbon emissions from forest land in British Columbia



Source: British Columbia Greenhouse Gas Inventory Report 2010

3.7. Protection of air quality

The main impact of forestry on air quality relates to fire. It includes wild fire (which are unintended) and prescribed fire (which is used as part of forest management under controlled conditions).

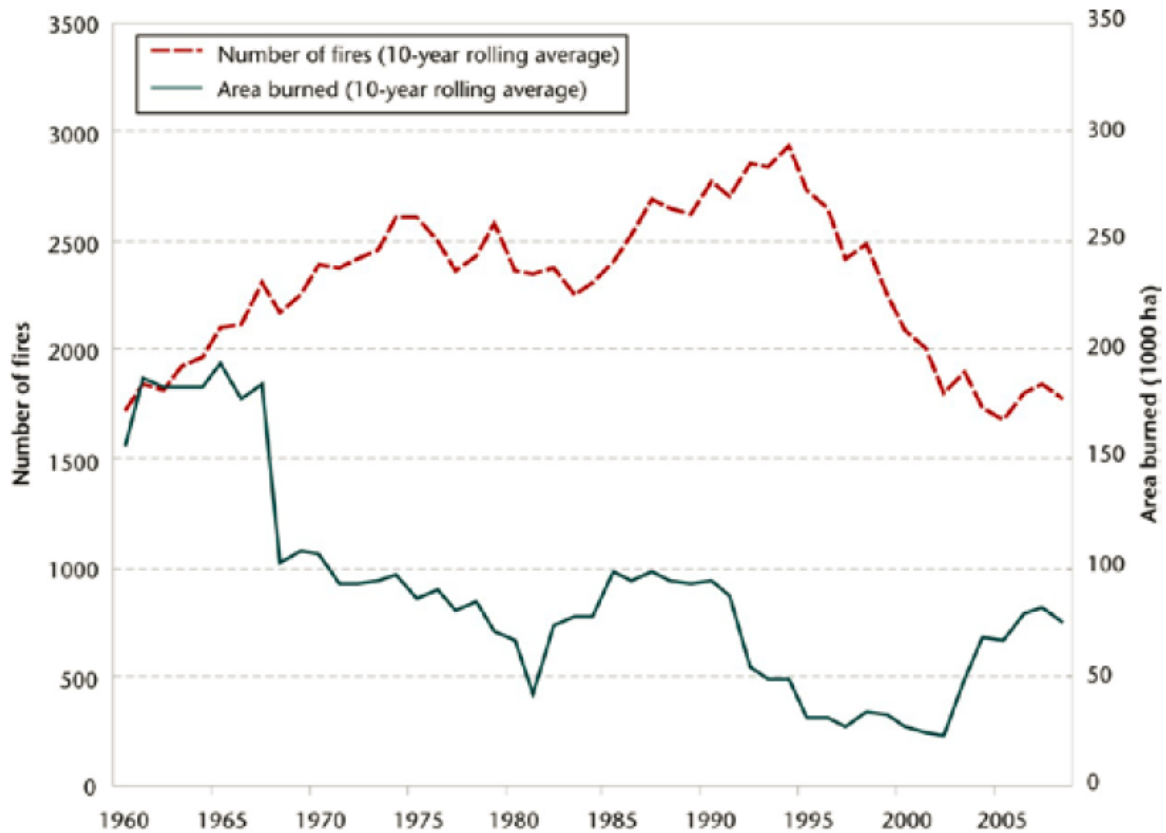
The objectives of prescribed fire can include pest management, site preparation before replanting or regeneration, preventing wild fire... The use of prescribed fire declined at the end of the 20th century, but interest has grown again after 2000, especially as a tool for ecological management.

In 2008, the multi-agency Prescribed Fire Council was created in British Columbia²⁷. The objectives include:

- recommendation to improve legal framework
- improving collaboration between agencies in charge
- strategic planning to avoid wildfire
- developing best management practices
- training
- public communication and sensibilisation
- modelling of fuel stocks.

The surfaces affected by wildfire decreased most of the time during the 20th century. After 2000, some severe wildfire took place (particularly in 2008), facilitated by the build up of fuel stock, climatic conditions and presumably some impact of the mountain pine beetle outbreak. Increased awareness of the importance of fuel stock management is intended to reduce the frequency and the severity of wildfire in the future.

²⁷ <http://bcwildfire.ca/prevention/PrescribedFire/docs/BC%20Prescribed%20Fire%20Council%20Brochure.pdf>

Figure 16 : Number of wildfire and areas affected (1960-2008)

Source: B.C. Ministry of Forests, Mines and Lands. 2010. The State of British Columbia's Forests, 3rd ed. Forest Practices and Investment Branch, Victoria, B.C. www.for.gov.bc.ca/hfp/sof/index.htm#2010_report

The forestry sector, and in particular wildfires and prescribed fires, are the main sources of emissions of fine particles in British Columbia²⁸.

3.8. *Illegal logging*

The FSC risk assessment platform (www.globalforestregistry.org) considers that Canada is at low risk in terms of illegal logging, because the following criteria are all verified:

- 1.1 Evidence of enforcement of logging related laws in the district²⁹
- 1.2 There is evidence in the district demonstrating the legality of harvests and wood purchases that includes robust and effective system for granting licenses and harvest permits³⁰
- 1.3 There is little or no evidence or reporting of illegal harvesting in the district of origin³¹

²⁸ The State of British Columbia's Forests, 2010, op.cit.

²⁹ www.illegal-logging.info ; www.eia-international.org ; <http://www.ahec-europe.org/>

³⁰ www.illegal-logging.info ; www.eia-international.org ; <http://www.ahec-europe.org/>

³¹ www.illegal-logging.info ; www.eia-international.org ; <http://www.ahec-europe.org/>

1.4 There is a low perception of corruption related to the granting or issuing of harvesting permits and other areas of law enforcement related to harvesting and wood trade.³²

3.9. Civil rights and traditional rights

The FSC risk assessment platform (www.globalforestregistry.org) considers that Canada is at low risk in terms of violation of civil and traditional rights, because the following criteria are all verified:

- There is no UN Security Council ban on timber exports from the country concerned
- The country or district is not designated a source of conflict timber (e.g. USAID Type 1 conflict)
- There is no evidence of child labor or violation of ILO Fundamental Principles and Rights at work taking place in forest areas in the district concerned
- There are recognized and equitable processes in place to resolve conflicts of substantial magnitude pertaining to traditional rights including use rights, cultural interests or traditional cultural identity in the district concerned
- There is no evidence of violation of the ILO Convention 169 on Indigenous and Tribal Peoples taking place in the forest areas in the district concerned

3.10. Forest certification

The main forest certification schemes used in British Columbia are:

- CSA (Canadian Standards Association - Group Sustainable Forest Management System³³) which is endorsed by PEFC (Programme for the Endorsement of Forest Certification)
- SFI (Sustainable Forestry Initiative³⁴), which is endorsed by PEFC (Programme for the Endorsement of Forest Certification)
- FSC (Forest Stewardship Council³⁵), which is specifically suitable for small private owners

The certified forest area under each of those schemes as for 2010 is presented in the table hereunder:

³² <http://www.transparency.org/cpi2012/results>

³³ <http://www.csasfmforests.ca/>

³⁴ <http://www.sfiprogram.org>

³⁵ www.fsc.org

Table 7 : Certified forest land in British Columbia (2010)

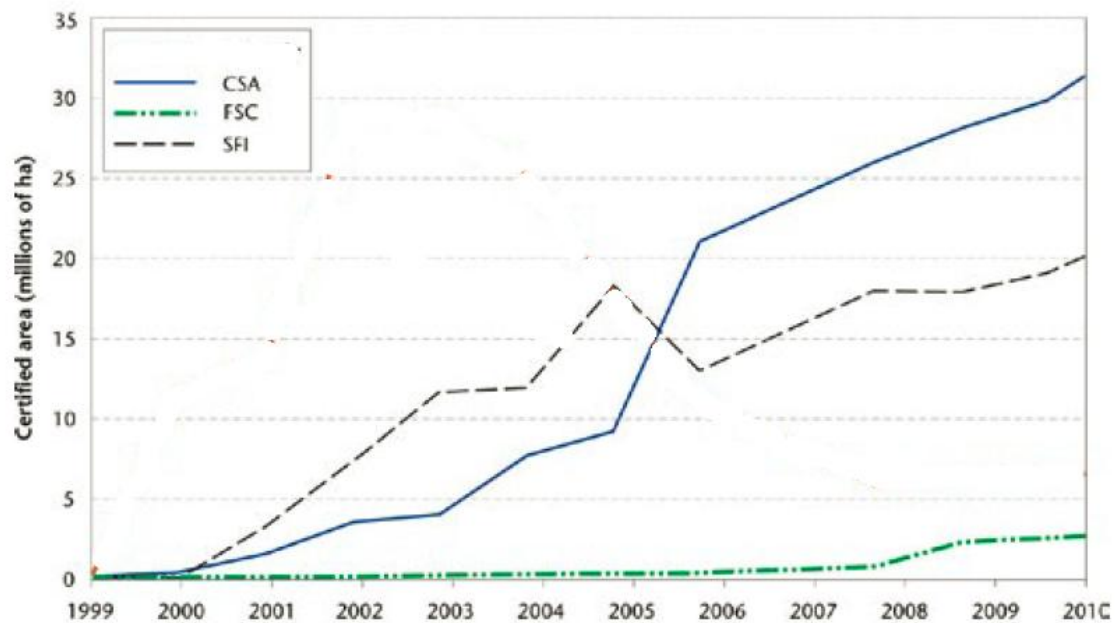
	CSA	SFI	FSC	Total certified
Area certified (millions ha)	31.4	20.1	2.6	54.1
Percentage forests	50%	32%	4%	86%

Source: calculated from B.C. Ministry of Forests, Mines and Lands. 2010. The State of British Columbia's Forests, 3rd ed.

Forest Practices and Investment Branch, Victoria, B.C. www.for.gov.bc.ca/hfp/sof/index.htm#2010_report

The percentages have been calculated in comparison with the total forested reported above in Table 1

The extent of certified forests has quickly increased since 2000, as can be seen on Figure 17.

Figure 17 : Evolution of certified forest surface under CSA, FSC and SFI in British Columbia

Source: B.C. Ministry of Forests, Mines and Lands. 2010. The State of British Columbia's Forests, 3rd ed. Forest Practices and Investment Branch, Victoria, B.C. www.for.gov.bc.ca/hfp/sof/index.htm#2010_report

4. Conclusions

British Columbia has very large forest land (55 to 65 million ha, depending on the methodology and the definition of forests), which represents about 60% of the province's land area. About half of the forest land is considered potentially available to timber harvesting (timber harvesting land base - THLB); the rest is considered out of reach. The province is very diverse in terms of ecological conditions, and the forest is present in most of them (coast, mountains, interior plains), except the highest alpine levels.

Approximately 96% of British Columbia's forest land area is publicly-owned (mostly Crown land administered by the provincial Ministry of Forests, Mines and Lands). Private ownerships accounts for the remaining 4%. Forest exploitation is organized through a system of licensed granted by the province to private management and logging companies. Some old concessions were allocated as transfer of property, but afterwards the concessions were always allocated as part of leasing schemes.

Conifers predominate largely in British Columbia and account for the great majority of all forest species. Spruce, pine, fir and hemlock largely dominate the growing stock. Broadleaf are very marginal. In the B.C. Interior, a massive outbreak of the mountain pine beetle started after year 2000 and impacted much of the mature lodgepole pine.

The forest area of British Columbia is not systematically monitored in terms of surface on a yearly basis. However, an accurate methodology is used to evaluate the forest surfaces lost on an annual basis. After 2000, the yearly average loss of forest land is estimated to be between 6000 and 6500 ha yearly, which is equivalent to a 0.01% loss of forest each year. Hence, the risk of conversion of a particular forest area to another land use is most of the time negligible. In the years 1970ies and 1980ies, the annual loss of forest land used to be twice as much because of major hydro and agricultural projects.

The volume of harvested wood used to fluctuate between 65 and 90 million cubic metre per year in the period 1990 to 2000. Then, after 2000, the mountain pine beetle outbreak led the authorities to raise the levels of Allowable Annual Cuts (AAC) as part of effort to salvage timber and control pest propagation. However, in total, due to the prevailing economic circumstances, the timber demand was low and the total levels of harvesting dropped after 2005.

The standing trees volume is not regularly assessed at the provincial level. Nevertheless, because of the mountain pine beetle outbreak, it is anticipated that this volume is currently depleting. One of the consequences is also a decrease of the carbon stock associated to living woody biomass. As a result, and despite a reduced level of harvesting, the forests of British Columbia have become a net source of greenhouse gases, even though they used to be a sink of greenhouse gases for several decades. The estimated emissions are in excess of 75 million tons CO₂ in 2010.

Protected forest areas, mostly provincial parks, cover 7.6 million hectares, which is about 14% of the province forest land. Significant efforts have been made in the last couple of years to increase British Columbia's protected forest areas, with an increase of protected land by 200% between 1991 and 2008.

The protection of soil and water in British Columbia relies on British Columbia's *Forest and Range Practices Act* (FRPA) and formerly on *Forest Practices Code of British Columbia Act*. It appears from the last annual report of the Forest Practice Board (2012-2013) that forestry operation (and in particular the heaviest works such as harvesting, road and bridges construction) are closely monitored for compliance with applicable legislation through field checks. Even though some significant non compliances were found during field checks (in 9 audits out of 17), they were followed up for corrective actions. The monitoring of infractions suggests that there have been significant improvements in recent years in terms of damages to soil during harvesting operations.

Even though controlled fires are regularly used in forest management practices in British Columbia, the use of fire is subject to permit and carefully monitored in order to preserve air quality. After several seasons of severe wildfire in the early years 2000, efforts have been made to avoid any excessive accumulation of fuel in the forests.

The FSC risk assessment platform considers that Canada is at low risk in terms of violation of illegal logging and in terms of violation of traditional and civil rights.

The forest certification systems have strongly developed in British Columbia since 2000, with 86 % of forest certified under one of the three systems (CSA, SFI and FSC). CSA is the most important system, with 50% of the certified forests.

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