Forest sustainability in East Canada Quebec

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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 CO_2 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 the eastern part of Canada and particularly in Québec, including general condition, management and sustainability assessment.

2. Quebec forests overview

2.1. Location and distribution

Canada is a country located in the northern part of North America. Its ten provinces and three territories extend from the Atlantic to the Pacific and northward into the Arctic Ocean. The administrative map of the country is presented on Figure 1

Figure 1 : General map of Canada

Source: geology.com

This report will focus on one province: Québec. It is located in the eastern part of the country. It is bordered by the provinces Ontario, and the Hudson's Bay to the west, the Hudson's Straight to the north, Newfoundland and Labrador to the northeast, New Brunswick in the southeast. It also shares a border with several northern states of the United States of America. A map of Quebec is provided on Figure 2

General information on Québec can be found in the table below.

Table 1 : General information on tHe Canadian provinces

Province	Capital	Area in km²	Population in 2016	Density in Pop/km²
Ontario	Toronto	1,076,395	13,448,494	12.0
Quebec	***Quebec city***	***1,542,056***	***8,164,361***	***5.3***

Province	Capital	Area in km²	Population in 2016	Density in Pop/km²
Nova Scotia	Halifax	55,284	923,598	16.7
New Brunswick	Fredericton	72,908	747,101	10.2
Manitoba	Winnipeg	647,797	1,278,365	2.0
British Columbia	Victoria	944,735	4,648,055	4.9
Prince Edward Island	Charlottetown	5,660	142,907	25.2
Saskatchewan	Regina	651,036	1,098,352	1.7
Alberta	Edmonton	661,848	4,067,175	6.1
Newfoundland and Labrador	St. John's	405,212	519,716	1.3
Canada	**Ottawa**	**9,984,670**	**36,048,521**	**3.6**

Source: Wikipedia

Figure 2 : General map of Quebec

Source: geology.com

According to the National Statistics, with year 2017 as reference, forest land in Canada covers 347,069,000 ha[1]. It is the third largest country in terms of forest area behind Brazil and the Russian Federation. Other land with tree cover accounts for an additional 8,498,940 ha and other wooded land accounts for an additional 40,865,660 ha, for a total of 396,433,600 ha or 39,7% of the total land surface area.

[1] The state of Canada's forests – Annual report 2017

In Québec, forests cover more than 76,11 million hectares of the province's territory. It accounts for 59% of the total land area of the province and 24,5% of the forest area in Canada. About 2% of the world's forests are in Quebec.

The land use statistics of Quebec are presented in the table and the figure below:

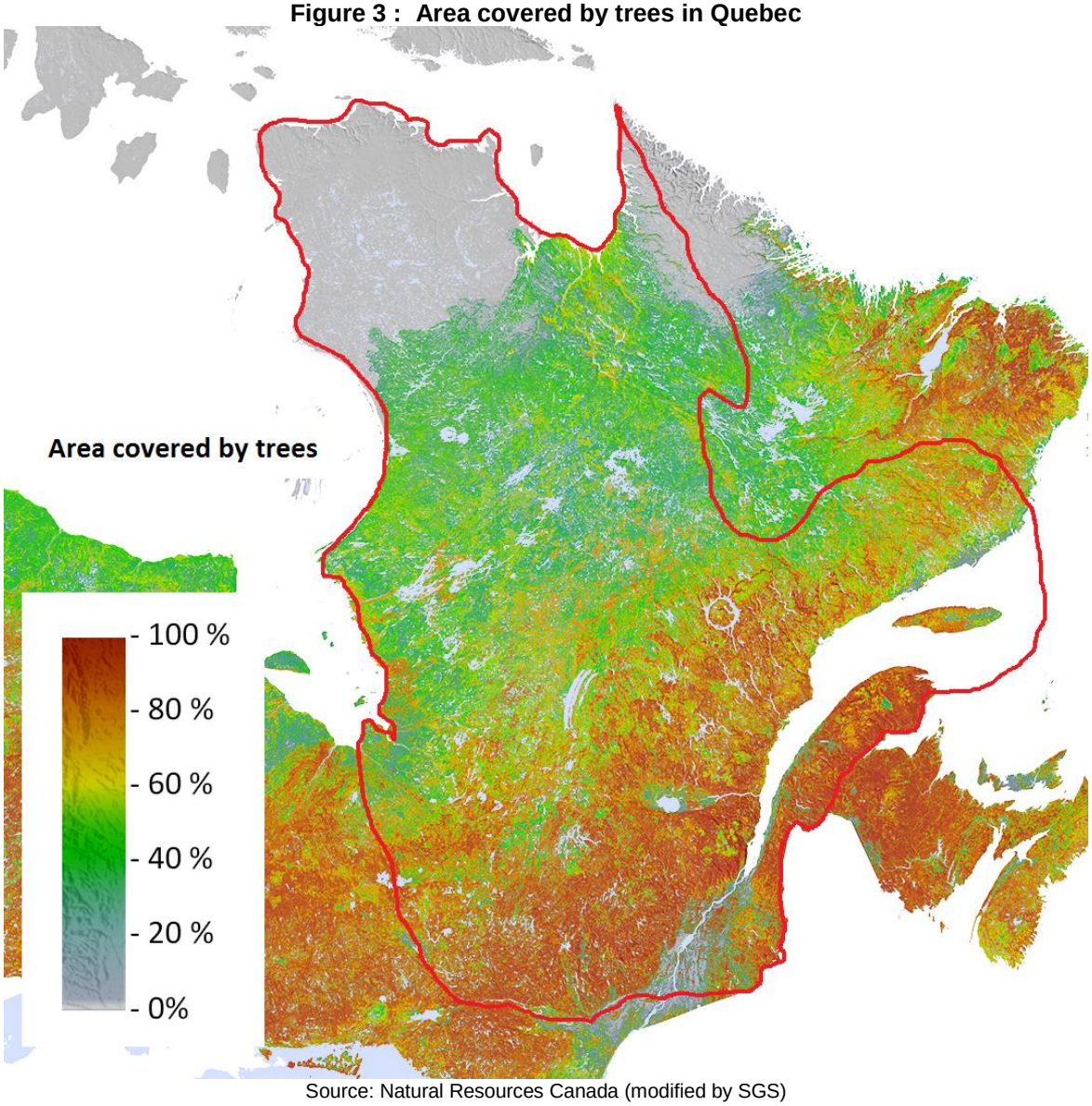
Table 2 : Land use in in Quebec

Land use	area (km²)	percentage Province	percentage land area
agriculture	63060	3.8%	4.9%
forest	761100	45.6%	59.0%

Data source : Ministère du Développement durable de l'environnement et de la lutte contre les changements climatiques (2017, Gouvernement du Québec) ; Quebec Handy Numbers, 2018 Edition (Institut de la statistique du Québec)

Figure 3 shows the distribution of forest cover in Quebec. As can be seen on the map, forests cover a large part of the territory and are evenly distributed in terms of surface. Areas in the south are more covered by trees, as the climate in the North West is too cold for substancial forest growth : it is covered by arctic habitats such as peatlands, taiga and toundra.

Figure 3 : Area covered by trees in Quebec



Source: Natural Resources Canada (modified by SGS)

2.2. Ecological zones

Climate in Canada is very diverse. It can go from temperate to boreal and polar. It depends on the region of the country. The same applies to Quebec which is a big province. Quebec presents four Köppen climate types: Tundra climate or polar climate (arctic region), cold continental without dry season and cold summer (subarctic climate – subarctic region), cold continental with dry and cold summer (northwest region alongside the Hudson's Bay) and cold summer without dry season and war summer (southern part of Quebec with the Great Lakes region and plain of Saint Lawrence). It is affected by the solar insolation, the temperature and precipitation of snow and rain.

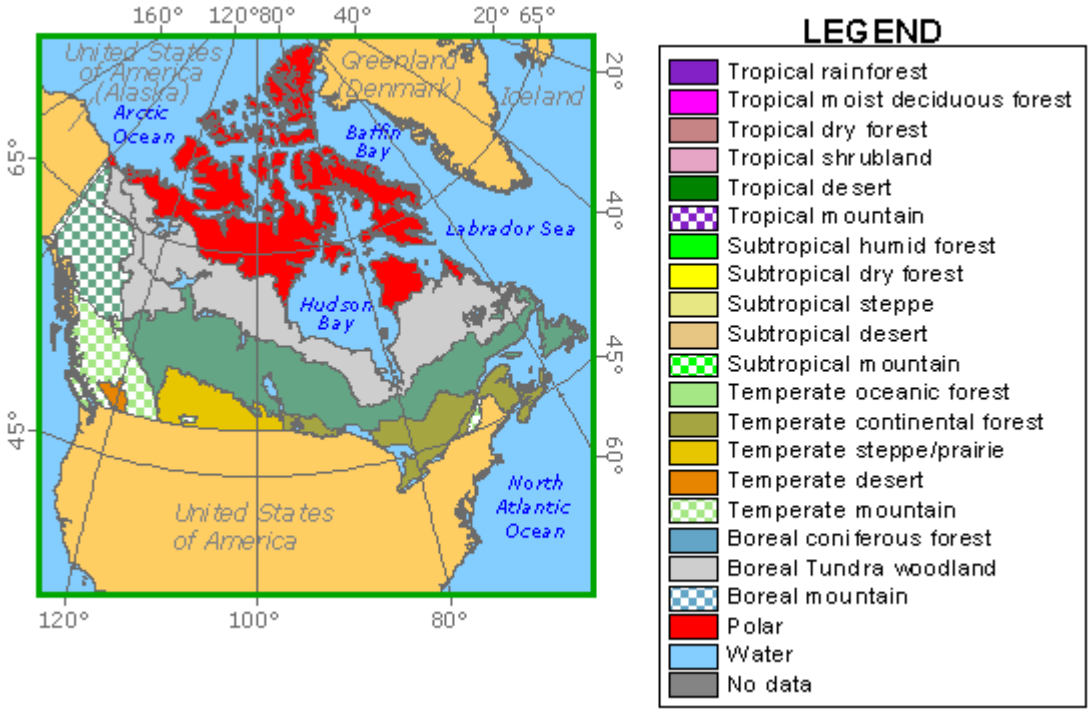
Precipitation is abundant throughout the year with oceanic and continental contributions. The average of precipitation is 1100 mm of rain per year. Temperature and insolation decrease gradually with the increase of latitude. At Quebec City, the length of the daily sunshine varies from about 8 hrs in December to 16 hrs in June and from 5hrs to 19 hrs for the annual variation at the northern tip of the province. Average of temperature, in Quebec City, are from minimum -18°C to maximum -8°C in January and from minimum 13,5°C to maximum 25°C.[2]

According to FAO, the country presents a great variety of ecological regions. Quebec features 3 ecological regions (Figure 4).:

- Temperate continental forest,
- Boreal coniferous forest,
- Boreal tundra woodland.

[2] Source: Environnement Canada, Ville de Québec, Climat Quebec

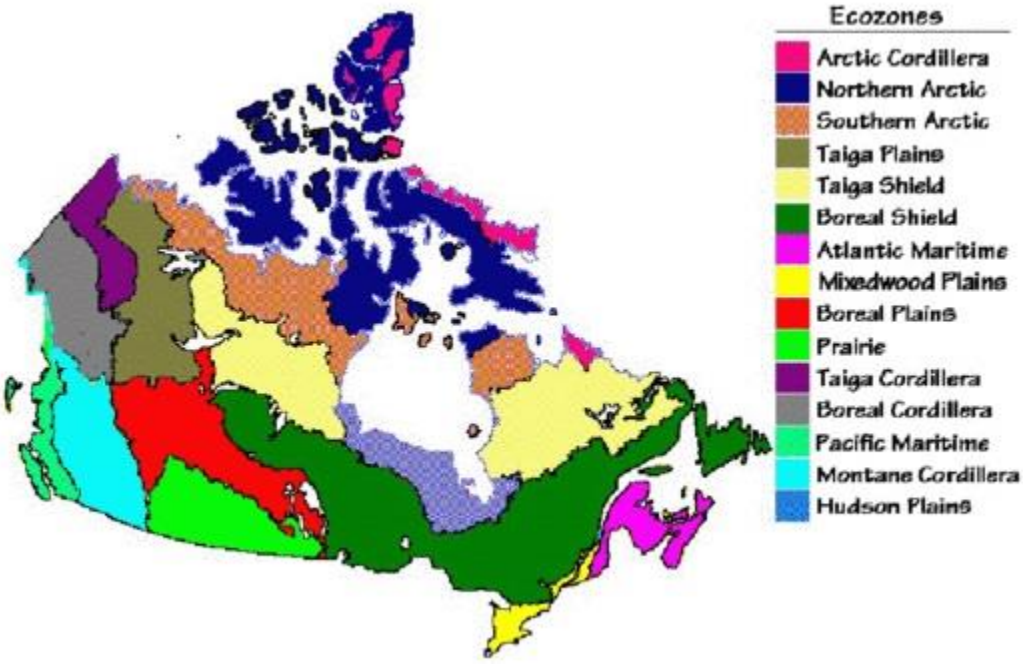
Figure 4 : Ecological zones in Canada



Source : http://www.fao.org/forestry/country/19971/en/can/

Canada has its own Ecozone classification. It is presented on Figure 5. In East Canada, there are: Northern Arctic, Arctic Cordillera, Southern Arctic, Taiga Shield, Boreal Shield, Atlantic Maritime, Mixedwood Plains and Hudson Plains.

Figure 5 : Terrestrial ecozones of Canada



Source : https://mrnagribianko-ecozones.wikispaces.com/1+Atlantic+Maritime

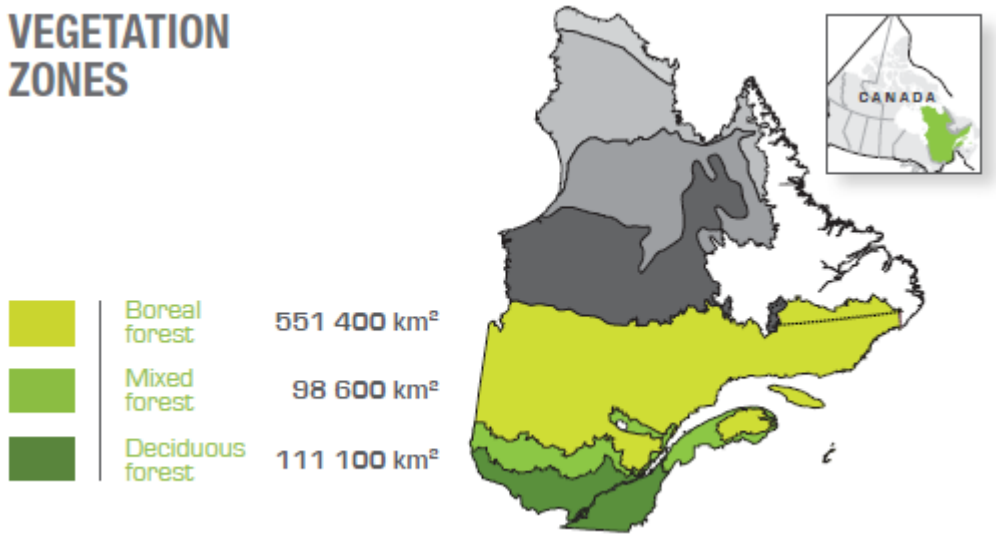
The distribution of vegetation in Quebec is determined mainly by climatic factors, which are generally less favorable the further north one goes. Quebec is divided into three vegetation zone:

- The northern temperate zone, dominated by hardwood and mixed stands
- The boreal zone, characterized by softwood stands
- The Arctic zone, where the vegetation is mostly made of shrubs and herbaceous plants

In particular for the province of Quebec, we can see that vegetation zones are a succession from south to north from broadleaves forest, mixed forest, boreal forest (softwood), and forther North non-forest ecosystems (Figure 6).

Figure 6 : Vegetation zones in Quebec

(Source : Chiffres-Clés du Québec Forestier, Edition 2017 - Gouvernement du Québec)



Overall, Quebec is mostly covered with softwood as shown in the forest distribution data in the Table 3

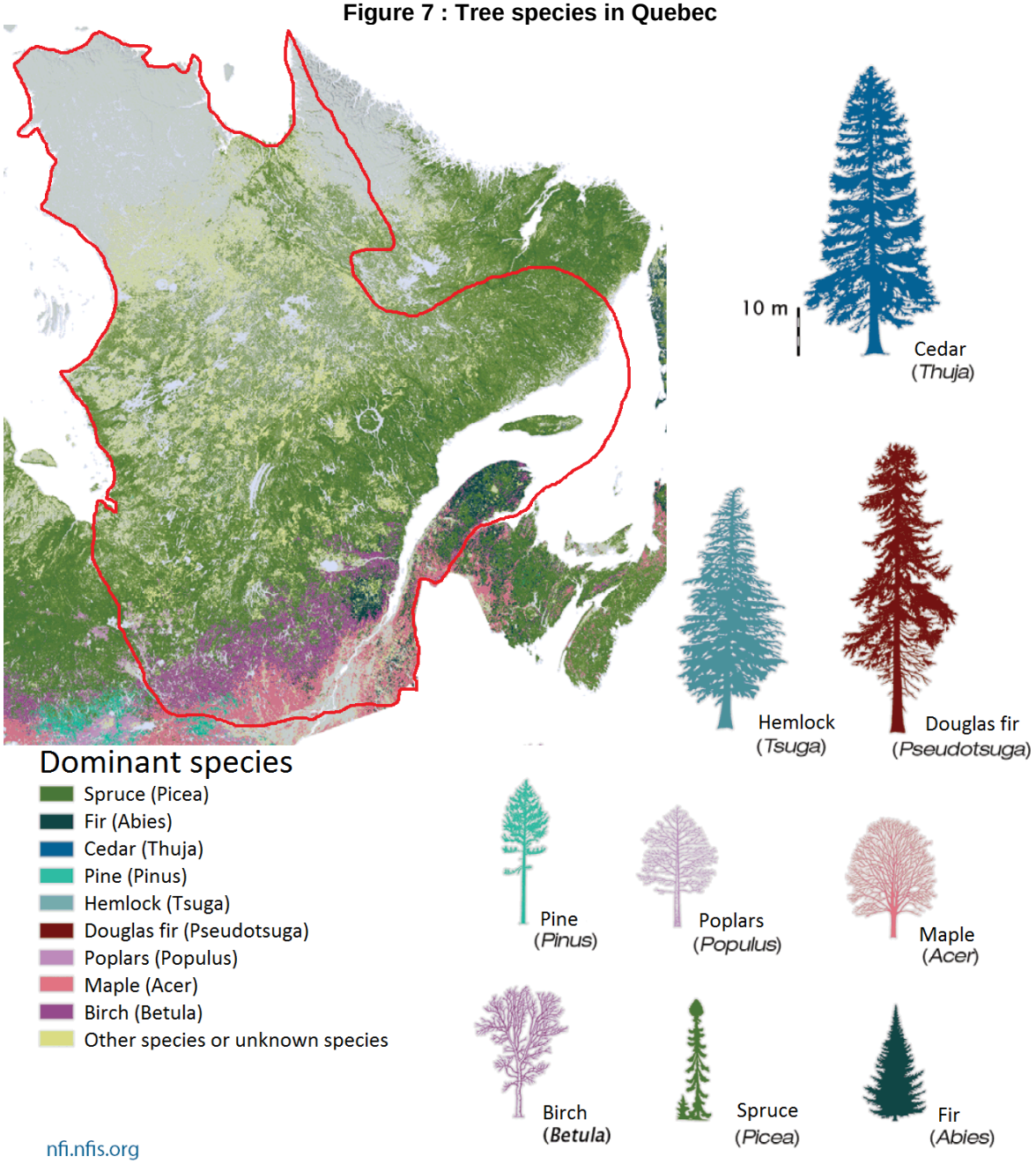
Table 3 : forest area (ha) by type

Category of stratum	Type of covered	Forest type	1970-1979	1980-1989	1990-2002	1996-2011	Variations	
7 meters and more	Sofwood	Spruce	12 291 900	11 905 300	10 961 400	10 346 900	-1 945 000	-16%
		Fir	3 351 000	2 161 700	1 895 500	1 907 300	-1 448 700	-43%
		Gray pinewoods	1 375 200	1 428 000	1 225 700	1 101 600	-273 600	-20%
		Other softwoods	174 700	208 300	215 300	250 000	75 300	-43%
	Total softwoods		17 192 800	15 703 300	14 297 900	13 605 800	-3 587 000	-21%
	Mixed	Mixed hardwood intolerant	4 793 300	4 677 600	4 975 500	5 432 100	638 800	13%
		Mixed hardwood tolerant	1 012 100	987 400	1 139 900	1 176 400	164 300	16%
	Total mixed		5 805 400	5 665 000	6 115 400	6 608 500	803 100	14%
	Hardwood	Intolerant hardwoods	1 685 900	2 316 400	1 994 000	1 625 600	-60 300	-4%
		Sugar bushes	1 056 800	1 169 900	1 237 200	979 300	-77 500	-7%
		Tolerant hardwoods	202 700	295 900	294 900	423 300	220 600	109%
	Total hardwoods		2 945 400	3 782 200	3 526 100	3 028 200	82 800	3%
2 to 7 meters	Softwood	Softwoods in regeneration	2 8541 300	1 868 900	1 980 500	2 917 000	65 700	2%
	Mixed	Mixed in regeneration	1 088 100	957 000	1 926 200	2 336 200	1 248 100	115%
	Hardwood	Hardwood in regeneration	290 600	338 500	486 500	349 900	59 300	20%
In process of regeneration			1 903 400	3 009 400	3 070 900	2 630 500	727 100	38%
Non-forest and unproductive			5 544 500	6 297 200	6 218 000	6 145 400	600 900	11%
Total			37 621 500	37 621 500	37 621 500	37 621 500	0	0%

Source: data from État de la forêt publique du Québec et de son aménagement durable–Bilan 2008-2013

Figure 7 presents the main tree species found in Quebec forests.

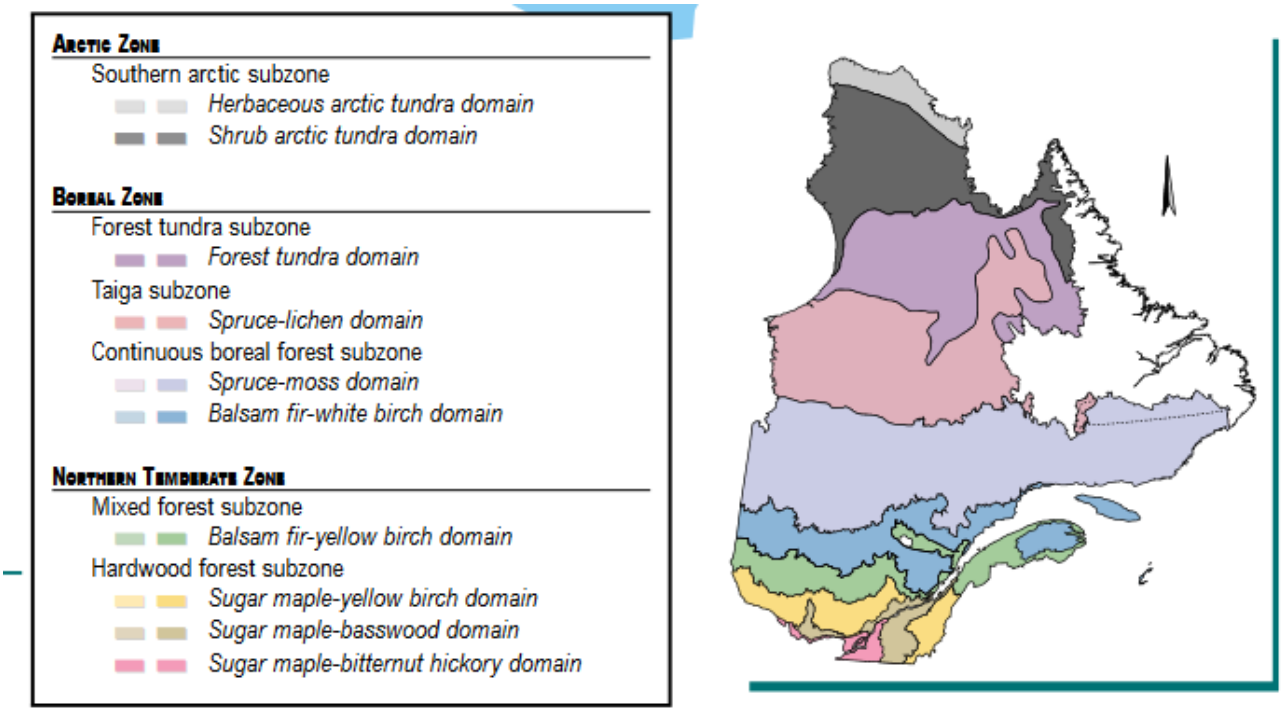
Figure 7 : Tree species in Quebec



Source : Natural Resources Canada (modified by SGS)

Quebec has ten bioclimatic domains (revised in 1998). Six of these, namely the sugar maple-bitternut hickory, sugar maple-basswood, sugar maple-yellow birch, balsam fir-yellow birch are broadleaves and mixed forests systems located in the southern Quebec. In central Quebec, we ave the boreal forests with balsam fir-white birch and spruce-moss domains, as well as sparse forest and non-forest vegetation systems including spruce-lichen (taiga) and forest tundra. Further north, we have shrub arctic tundra and herbaceous arctic tundra domains.

Figure 8 : Vegetation zones and bioclimatic domains in Quebec
(Source: Gouvernement du Québec)



Subzone groups some bioclimatic domain and are described below [3]:

Southern arctic subzone (Arctic zone)

- absence of trees, continuous permafrost and tundra-specific vegetation, which mainly consists of shrubs, herbaceous plants (mostly gramineous like species), mosses and lichens
- Northern part of Quebec
- Contain the following domain:
  - ***Shrub arctic tundra domain (197 800 km²)***

    The shrub arctic tundra bioclimatic domain extends approximately from the 58th parallel to the 61st parallel. Here, willows and dwarf birch grow alongside herbaceous species, mostly grasslike plants, as well as mosses and lichens. The domain is characterized by continuous permafrost and a topography resulting from ice activity. The vegetation canopy rarely grows beyond two metres high, and even then, only some species of arctic willow are

[3] Vegetation zones and bioclimatic domaines in Québec, Ministère des Ressources naturelles, Gouvernement du Québec, 2003

capable of reaching this height. Pockets of vegetation resembling the shrub arctic tundra can be found on some of southern Québec's highest summits, including the Chic-Chocs and Groulx mountains.

Forest tundra subzone (Boreal zone)

- Dominate by shrubs and lichens
- North land of Quebec
- Contain the following domain:
    - ***Forest tundra domain (217 000 km²)***

      The forest tundra bioclimatic domain is the ecotone, or transitional area, between the boreal zone to which it belongs, and the Arctic zone. It extends approximately from the 55th parallel to the 58th parallel. The landscape resembles a mosaic dominated by shrubby heathland punctuated by forests on sheltered sites. The mosaic is the result of fire and the harsh northern climate with its discontinuous permafrost. The northern boundary of the domain coincides with the tree line. It contains mainly stands of stunted black spruce measuring less than three metres in height.

The tree line (black spruce, white spruce and tamarack) separates the boreal zone from the Arctic zone.

Taiga subzone (Boreal zone)

- Dominate by open softwood forests on a lichen mat
- Center land of Quebec
- Contain the following domain:
    - ***Spruce-lichen domain (299 900 km²)***

      The spruce-lichen domain extends over the entire taiga subzone, which stretches from the 52nd parallel to the 55th parallel. Its main difference with the spruce-moss forest is its low-density forest cover. The lichen mat is dotted with black spruce trees, whose propagation is favoured by the harsh climate and low precipitation level. The balsam fir and jack pine are at the northernmost limit of their range here. Fire has destroyed vast areas of the spruce-lichen forest.

Continous boreal forest subzone (Boreal zone)

- Dominate by boreal softwood species
- Center land of Quebec
- Contain following domains:
    - ***Balsam fir-white birch domain (139 000 km²)***

      The balsam fir-white birch domain occupies the southern portion of the boreal zone. The forest landscape is dominated by balsam fir and white spruce stands mixed with white birch on mesic sites. On less favourable sites, black spruce, jack pine and larch often grow alongside white birch or trembling aspen. The yellow birch and red maple grow only in the southern portion of the domain. Forest dynamics are controlled primarily by the spruce budworm, since the balsam fir is abundant here. However, fire is also an important factor. There are two subdomains. The western one has a relatively even topography, with minimal changes in altitude. The fire cycle is also shorter, which explains the abundance of hardwood or mixed stands with intolerant hardwoods (trembling aspen, white birch and jack pine). Precipitation is generally more copious in the eastern subdomain due to the influence of the maritime climate; consequently, the fire cycle is longer here.

    - ***Spruce-moss domain (412 400 km²)***

Moving northward, the spruce-moss domain replaces the balsam fir-white birch domain. It stretches approximately to the 52nd parallel, and its northern boundary coincides with the boundary of the continuous boreal forest subzone. Forest landscapes are fairly uniform here, since the forest canopy is dominated extensively by the black spruce, often growing in pure stands but also accompanied on occasion by other species, such as the balsam fir. Balsam fir stands are found only on some of the slopes of the domain's hills. Some hardwoods, such as the white birch, trembling aspen and, to a lesser extent, the balsam poplar, also grow here. The undergrowth is composed of hypnaceous mosses and ericaceous shrubs. Herbaceous species are rare. The sprucemoss domain is divided into two precipitationbased subdomains. The fire cycle, which is the main factor in forest dynamics, is much longer in the east, where balsam fir stands are more abundant and the percentage of firs in spruce stands is higher.

Hardwood forest subzone (northern temperate zone)

- Southern part of Quebec
- Dominate by sugar maple
- Contain following domains:
    - ***Sugar maple-bitternut hickory domain (14 500 km²)***

Confined to southwestern Quebec, with its more clement climate, the sugar maple-bitternut hickory domain contains Quebec's most southerly species, some of which are thermophiles. Its forests are highly diversified. Some of the species found here are at the northernmost limit of their range. This is the case of the bitternut hickory, after which the forest is named, as well as the shagbark hickory, hackberry, black maple, swamp white oak, cork elm, pitch pine and several shrubs and herbaceous plants. The forest also contains other species that extend further north, such as the sugar maple, fir and spruce. It is not divided into subdomains.

    - ***Sugar maple-basswood domain (31 000 km²)***

The sugar maple-basswood domain stretches further to the north and east than the sugar maplebitternut hickory domain. Its plant life is also very diversified, although several species are at the northernmost limit of their range. In areas that are favourable, the basswood, American ash, hop-hornbeam and butternut grow alongside the sugar maple, but they are less common further north. There are two subdomains, distinguished by the aboundance of red oak stands and their distinct precipitation systems: one in the west, which is drier, and the other in the east, where precipitation is more abundant.

    - ***Sugar maple-yellow birch domain (65 600 km²)***

The sugar maple-yellow birch domain covers the hills bordering the southern Laurentian plateau and the Appalachians, in the northernmost portion of the hardwood forest subzone. Its plant life, less diversified on all but the best sites, includes many boreal species found throughout Québec. On its mesic sites, the yellow birch is one of the most predominant companion species to the sugar maple. The American beech, red oak and Eastern hemlock also grow here, but are rarely found past the forest's northern boundary. This domain also signals the end of the basswood and hop-hornbeam ranges. As for the entire hardwood forest subzone, forest dynamics are attributable mainly to windfall. The sugar maple-yellow birch forest has two subdomains, a drier one in the west and the other in the east, distinguished by their precipitation levels and the aboundance of white and red pine stands.

Mixed Forest subzone (northern temperate zone)

- Dominate by balsam fir, black spruce and yellow birch
- South of Quebec
- Contain the following domain:

- ***Balsam fir-yellow birch domain (98 600 km²)***

The balsam fir-yellow birch domain is an ecotone, i.e. a transition zone between the northern temperate zone to which it belongs, and the boreal zone. It stretches westward as far as central Québec, between latitudes 47o and 48o, and encompasses the Gaspé peninsula, the Appalachian hills east of Québec City, the Laurentian foothills north of the St. Lawrence River and the lowlands of Lake Saint-Jean. Its mesic sites feature mixed stands of yellow birch and softwoods, such as the balsam fir, white spruce and white cedar. The sugar maple is at the northernmost limit of its range here. Spruce budworm epidemics and forest fires are the two main elements of forest dynamics. The presence of yellow birch and pine stands, which diminish towards the east, is the main defining factor for two separate subzones, one in the west, characterized by the omnipresence of yellow birch-balsam fir forests on mesic sites, and one in the east, characterized by balsam fir-yellow birch forests.

- ***Herbaceous arctic tundra domain (38 200 km²)***

The herbaceous arctic tundra domain is Quebec's northernmost bioclimatic domain. The regional climate is so harsh that even shrubs are scarce and very small. Cyperaceous and gramineous species (sedges and grasses) mix with mosses and lichens to dominate landscapes where the bedrock and mineral soil are often bare. The entire area is covered with continuous permafrost.
This subzone is slightly less rich in terms of vegetation diversity than the hardwood forest.

2.3. Forest ownership[4]

Most forest land in Canada, about 94%, is publicly owned (Crown Land) and managed by provincial, territorial and federal governments. Only 6% of Canada's forest lands is privately owned.

This means that all those jurisdictions – provincial, territorial and federal – together have the ability to create and enforce the laws, regulations and policies required to meet Canada's commitment to sustainable forest management across the country.

Table 4 : Forest ownership in Canada

Ownership	percentage
Provincial	76.6%
Territorial	12.9%
Private	6.2%
Aboriginal	2.0%
Federal	1.6 %

The provinces and territories have many responsibilities and powers. They:

- develop and enforce forest laws
- set up a license or timber supply agreement with forest companies that want to harvest timber in publicly owned forests
- specify the responsibilities of the forest companies that are given access to public forests
- monitor the activities of those forest companies to ensure that laws, lease agreements and forest management plans are complied with
- collect royalties from forest companies for the timber they harvest from public forests
- manage designated protected areas, such as provincial parks and conservation areas

The 4% of Canada's forests owned by the federal government are located mainly in national parks, on lands owned by the Department of National Defense, and on lands held in reserve for, or otherwise controlled by, Aboriginal Peoples.
The federal government departments responsible for regulating and managing forestry operations on these lands include:

- Aboriginal Affairs and Northern Development Canada
- Department of National Defense
- Natural Resources Canada
- Parks Canada

Although only 6% of Canada's forests are privately owned, they contribute substantially to the country's wood products sector.

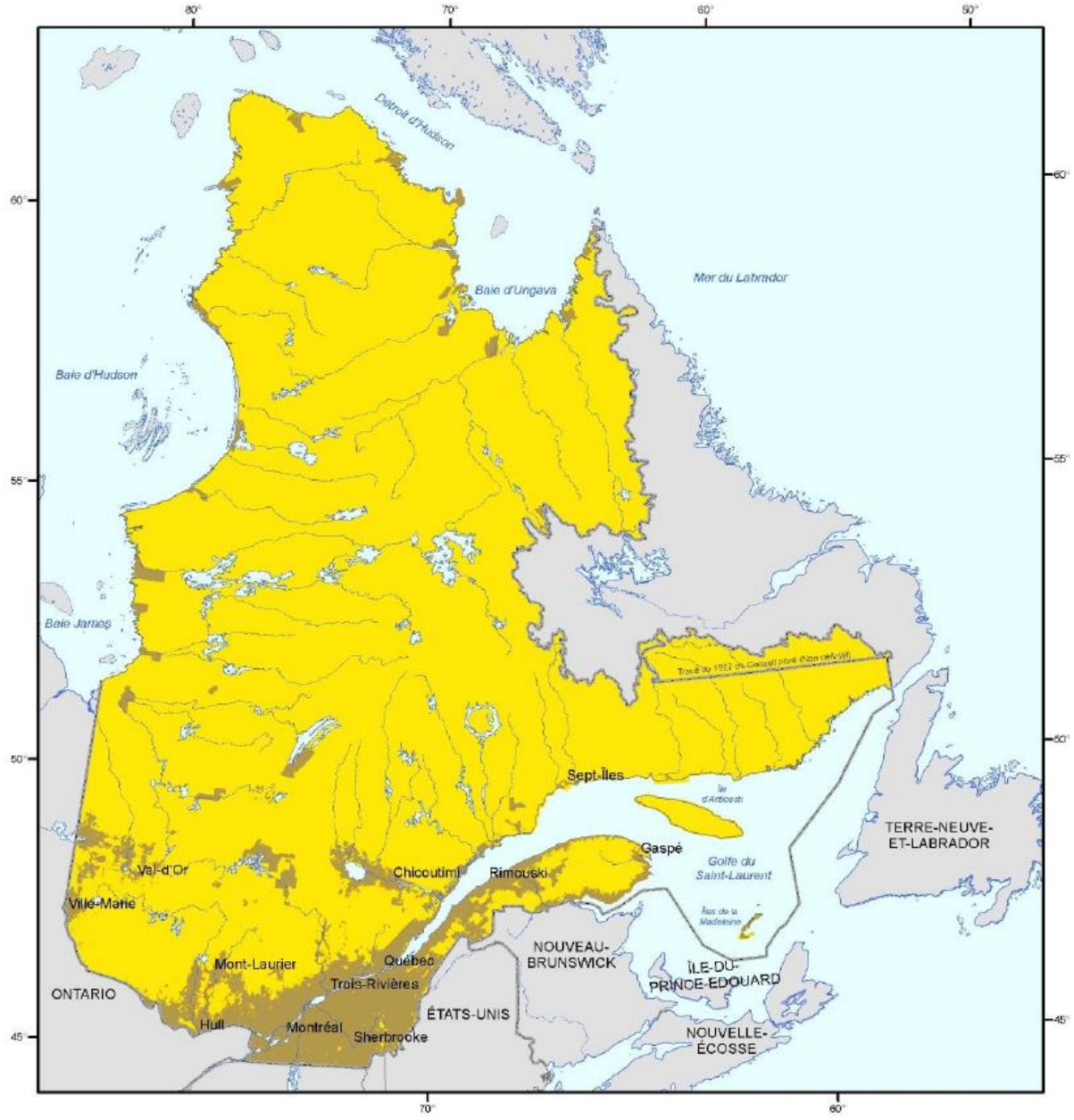
- This category is made up of large forests owned by forest companies, notably in the provinces of New Brunswick, Nova Scotia, Ontario, Quebec and British Columbia.
- The rest of the private ownership category includes small family-owned forests and woodlots.

[4] http://www.nrcan.gc.ca/forests/canada/ownership/17495

- One-tenth of the timber harvested in Canada comes from private lands.

In Quebec, the situation is similar with as much as 91,6 % of Crown land. Only 7,8 % of the province is privately owned
Figure 9.

Figure 9 : Crown land and private land in Quebec



Source: Ministry of Energy and Natural Resources, 2009 (modified by SGS)
(State's domain in yellow, private's domain in brown)

2.4. Competent authorities

In Canada

Canada's provinces and territories have jurisdiction over the vast majority of the country's forests, and develop and enforce laws, regulations and policies related to forests.

Those laws, regulations and policies differ from one jurisdiction to another but they are all:

- based on sustainable forest management principles
- developed in consultation with the public, industries and other interested parties
- grounded in scientific research and analysis

Provincial and territorial forest laws, regulations and policies govern a range of economic, social and environmental matters.

Provincial and territorial governments grant forest companies rights to harvest timber on public land and stipulate the responsibilities tied to those rights. These arrangements, also known as tenures, don't automatically give companies the authority to harvest timber. By law, governments must first approve forest management plans and authorize the proposed harvesting before any trees are felled.

The provinces and territories closely monitor forestry companies operating in publicly owned forests, through several means. Government agencies responsible for monitoring and enforcement.

Provincial and territorial laws and regulations also address the requirements of over-arching federal laws that apply to forests, and of international agreements Canada has signed.

Provincial and territorial laws generally also apply to timber harvested on land owned by the federal government. This means that forest management plans are required and must address inventory, harvesting, renewal and other activities. As well, before harvesting begins, contracts or permits must be in place. They must set out clearly what areas are to be cut, how wood will be marked and how revenues will be received.

Some provinces have laws that set standards for forest management practices on private lands. In most cases, however, forestry on private lands is governed by municipal regulations and supported by provincial guidelines or voluntary programs.

In Quebec

The Canadian constitution recognizes the provinces' exclusive jurisdiction over natural resources. As a result, the Quebec government is solely responsible for managing public forests, which cover most of the territory. Since 2014 a new administration named "Ministère des Forêts, de la Faune et des Parcs", MFFP (Ministry of Forest, Wildlife and Parks) has been created to manage forests, wildlife and national parks in Quebec. The mission statement of this administration is to *promote knowledge acquisition and to ensure the development and optimal use of forestry, wildlife and parks in Québec from a sustainable development perspective, for the benefit of the entire population.*

In addition to the MFFP the Quebec province appoints since 2005 a Chief Forester : an independent body appointed by the government to provide oversight and direction to the province's forestry industry. The Sustainable Forest Development Act specifies the main functions of the Chief Forester who, in keeping with the orientations and objectives the Sustainable Forest Management Strategy is responsible for:

- to establish the necessary methods, means and tools to calculate forest possibilities;
- prepare, publish and maintain a manual sustainable forest management to determine the forest possibilities;
- to determine the forest possibilities for the units planning and local forests taking into account the regional and local objectives for sustainable forest management;
- analyze the results obtained in terms of planning sustainable forest management in the State domain;
- advise the Minister on the direction and planning of the research and development in forestry, on the territorial limit and the delimitation of the management units and local forests, on the activities to be carried out to optimize forest management strategies as well as on any matter that he or she thinks needs attention or action government.

The Chief Forester is also in charge of producing and submitting to the National Assembly a five-year assessment of sustainable forest management. At the time of writing this report, the latest assessment that covers the period of 1er April 2013 to 31 March 2018 is not yet published. The latest assessment is the report of the Chief Forester covers the period 2008-2013.

2.5. Overview of wood-related industry

Harvest

In 2016, the Annual Allowable Cut in Quebec was 30.17 million m³ and the volume harvested was 22,256 millions m³ net merchantable volume. For private forests, on the same period, an estimation of the wood supply from private forests was 16.7 millions m³ and the volume harvested was 5 997 millions m³ net merchantable volume.

As we can see, the actual harvest remains much smaller than the estimated amount of wood that can be harvested sustainably, both on Crown land and private land.

Industry

The forest industry is one of Canada's most important manufacturing sectors. In 2016, it accounted for about 7% of Canada's total exports. It injected approximately $23 billion into Canada's economy. 211,075 jobs were supported by the industry, including 9,700 indigenous people. In 2015, it generated more than $1 billion in revenue for provincial and territorial governments.

The industry mainly consists in traditional forest products, these includes lumber and other solid wood products, and pulp and paper. It also includes upstream activities, such as forest management and logging. Non-traditional forest products are growing in prominence.

The forest industry plays a leading role in Quebec's economic development. Timber and non-timber forest products continue to fuel the economy. In 2013, the economic activity of the Quebec wood products industry generated an internal product gross domestic product (GDP) of $ 8.3 billion, a 2.7% contribution to the overall wealth produced in Quebec.

The economic contribution of different sectors related to the forest industry, it consists as follows:

Tableau 3-1 : Ratio of economic contributions of the forest, in 2013

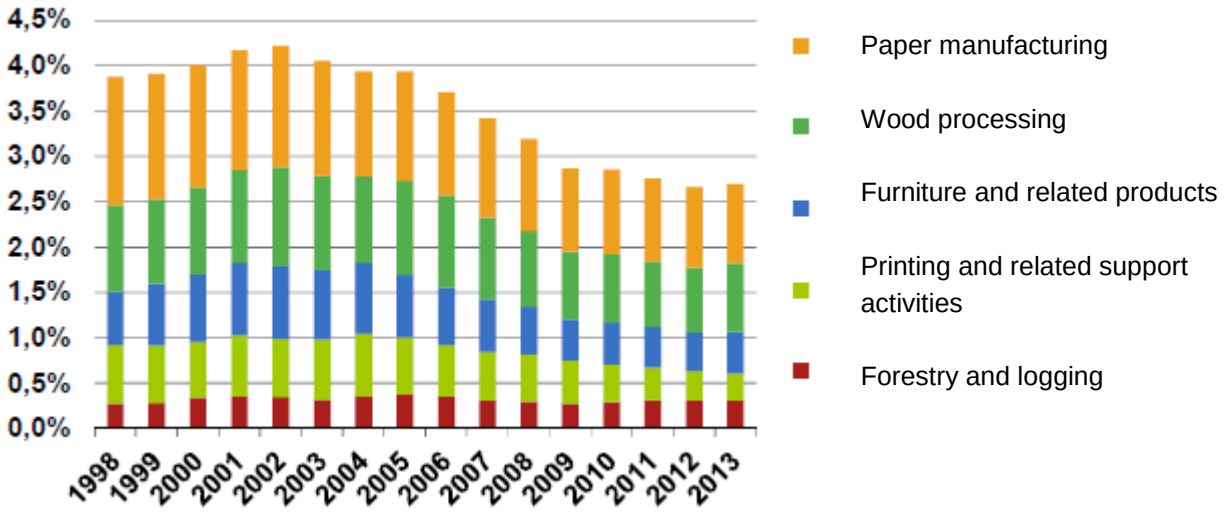
Sector	Ratio	Million $
Industry and forest products	72%	14 447
Wildlife and accommodation	15%	3 130
Forest management	11%	2 198
Non-timber forest products	2%	335

Source: Adapté de Beauregard (2015). Chantier sur la production de bois, *Le volet économique de la Stratégie d'aménagement durable des forêts*, Rapport final, février 2015, 65 p.

In Quebec, between 2001 and 2013, the number of wood processing plants fell by 77%, from 1,144 to 260 plants. In the case of paper mills, the number of paper mills decreased by 24% from 63 to 48 during the same period while the volume harvested decreased from 30 to 20 Mm³.

This decrease, due in part to the financial crisis, was also felt in the country's GDP (Figure 10**Error! Reference source not found.**). In 2016, GDP attributable to the wood processing sector yielded 6 092 M$, which represented 1.9% of the country's GDP.

Figure 10 : Contribution of wood forest products to Quebec's GDP between 1998 and 2013



Source: État de la forêt publique du Québec et de son aménagement durable–Bilan 2008-2013 (modified by SGS)

Table 5 shows the origin of wood processed by the wood industry in Quebec. The majority of the wood consumed wood industries came from public forests or exchanges between factories (in particular residues provided by primary industry such s sawmills to secondary industry such as pulp and paper or particles boards). Only 12% of the material processed is from outside the province.

Table 5: Origin of wood processed by forest industry in Quebec (2016)

Origin	Volume (m³)
Public forests	20 673 944
Private forests	5 684 372
Outside Quebec	6 259 688
Exchanges between factories	18 527 487
Total	**51 145 491**

Source: Chiffres clés du Québec forestier – Edition 2017 (modified by SGS)

The number of wood processing plants and their consumption according to their sector of activity is summarized in the summary table below.

Table 6: Wood transformations facilities in Quebec

Categories	Number of factories in 2016	Consumption in 2016* (m^3)
Pulp and Paper Industry	22	16 050 252
Lumber industry	194	25 930 808
Veneer and plywood industry	9	234 682
Wood products industry	8	4 321 692
Turning and forming industry	4	18 772
Cogeneration and energy products industry	25	4 383 177
Other wood processing industry	9	206 108
Pulp and Paper Industry Without a License from the Department of Forests, Wildlife and Parks **	19	n/a

* Includes roundwood and joint products from primary processing.
** These mills consume only recycled fiber or pulp from primary processing
Source: Chiffres clés du Québec forestier – Edition 2017 (modified by SGS)

The most commonly used species are fir, spruce, jack pine and larch followed by hardwood species (Table 7).

Table 7: Roundwood consumption by species and origin, 2010 to 2015 (average 6 years)

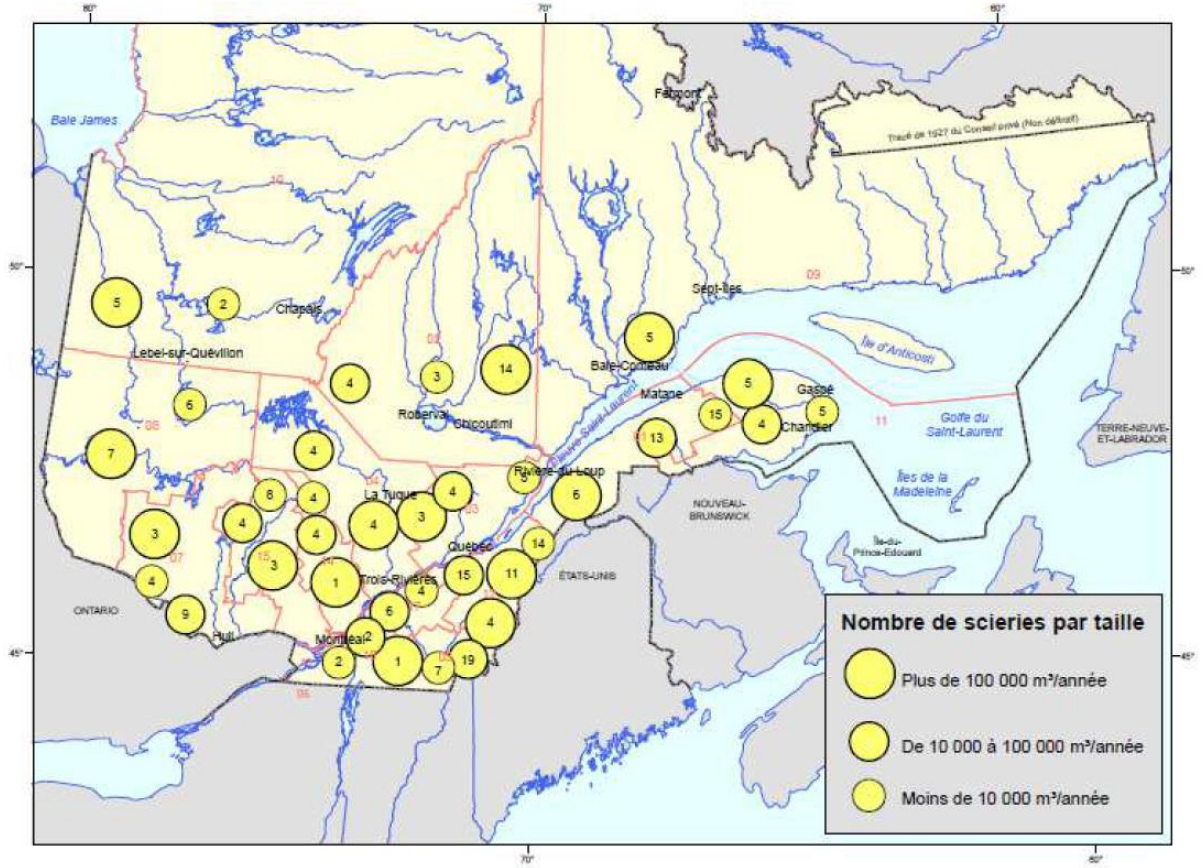
M^3 net	Hemlock	Thuja	White pine, Red pine	Poplars	Hard hardwoods	Fir, Spruce, gray pine, larches
Outside Quebec	119 545	165 879	428 872	174 334	1 263 772	1 897 791
Private forests	22 302	92 691	87 346	949 973	789 850	2 450 996
Public forests	8 384	55 106	53 171	1 396 410	1 743 674	16 018 015
Factories	677	7 699	979	52 916	109 378	115 619

Source : Ministère des Forêts, de la Faune et des Parcs, Direction du développement de l'industrie des produits du bois, Registre forestier. RESSOURCES ET INDUSTRIES FORESTIÈRES DU QUÉBEC PORTRAIT STATISTIQUE Édition 2016

Sawmills are mainly located in the southernmost part of the region (Figure 11).

The production of Christmas trees and maple syrup occupies a significant place in the Quebec's forest economy. Annual production is about 1.6 million Christmas trees. In 2011, Quebec had 8,675 ha and 282 companies dedicated to the production of Christmas trees.

Figure 11 : Distribution of sawmills in Quebec in 2014



Source: MFFP (2015). Portrait statistique, édition 2015. Ministère des Forêts, de la Faune et des Parcs ; État de la forêt publique du Québec et de son aménagement durable–Bilan 2008-2013

Employment

Over 50% of forest industry jobs are located in Ontario and Quebec. According to the latest available data (2006[5]), more than 200 Quebec municipalities would have a dependence on the forest products industry, including 140 for which this level would be considered high.

In 2015, 60,000 people were employed in Quebec in the sector of forest management and the transformation of the forest resource. These jobs in turn generate other indirect jobs estimated at 40,000 in the manufacturing industry, transport, chemicals, packaging products and energy (Table 8).

[5] MRNF (2006). L'industrie de la transformation des produits forestiers : une présence vitale dans plusieurs municipalités québécoises. Ministère des Ressources naturelles et de la Faune, 57 p.

Table 8: forest's employment evolution in Quebec

Variables (SCIAN)		2009	2010	2011	2012	2013	2014	2015
Ind. Prod. Properties	(11-33)	641 730	642 821	652 850	662 108	651 836	643 087	635 785
Manufacturing	(31-33)	424 516	419 855	419 194	417 350	408 406	402 415	404 714
Wood product manufacturing	(321)	28 441	28 327	27 108	27 006	26 587	27 159	28 053
Sawmills	(3211)	9 975	9 749	9 364	9 261	8 870	9 128	9 718
Panels	(3212)	4 976	5 086	4 613	4 654	4 816	4 857	5 015
Other wood products	(3219)	13 490	13 492	13 131	13 091	12 901	13 174	13 320
Furniture	(337)	23 830	23 592	23 058	22 778	22 292	20 966	20 919
Home Furniture	(3371)	16 902	16 585	16 177	15 771	15 066	14 215	14 411
Office Furniture	(3372)	5 745	5 616	5 638	5 744	5 946	5 582	5 318
Paper Manufacturing	(322)	27 354	24 634	25 075	23 733	23 969	22 701	21 813
Pulp and paper	(3221)	13 800	11 455	11 531	10 511	8 877	8 797	8 909
Converted paper	(3222)	13 553	13 179	13 544	13 223	15 091	13 904	12 905
Printing	(323)	18 668	16 103	15 837	14 523	12 703	12 513	12 103
Forestry, logging and support	[11N]	12 289	11 457	10 927	10 636	9 525	9 201	9 186
Forestry and logging	[113]	9 037	8 061	7 823	7 525	6 560	6 003	5 944
Support Activities for Forestry	[1153]	3 251	3 395	3 104	3 111	2 966	3 197	3 243

Source: Ressources et industries forestières du Québec, Portrait Statistique – Edition 2016 (modified by SGS)

Hunting, fishing and trapping activities also and generate significant economic benefits for Quebec and its regions. They provide 13,860 equivalent jobs and $ 453.7 million in wages paid to these workers.

3. Sustainability of Quebec forest

3.1. Evolution of forest area and risk of conversion

Over the past 25 years, the forest area in Canada has remained stable losing 1.2 million ha (0,34%). The main cause for this decrease is the clearing of forest land for new, non-forest land uses, for example: agriculture, road and hydroelectric developments. Over the next 10 to 20 years, the overall forest area is expected to remain stable.

Table 9: Estimated area (millions of hectares) of forest in Canada

Year	1990	1995	2000	2005	2010	2015
Forest area	348.3	348.0	347.8	347.6	347.3	347.1

Source: The state of Canada's Forests – Annual Report 2017

It is very difficult to find reliable figures about the net loss of forest surfaces in Quebec. This parameter is not subject to a specific monitoring, and the forest areas lost annually are so small compared to the vast forest areas that the comparison of estimated forest areas year to year is more likely to reflect changes in the methodology and the accuracy of the survey, rather than the land use change.

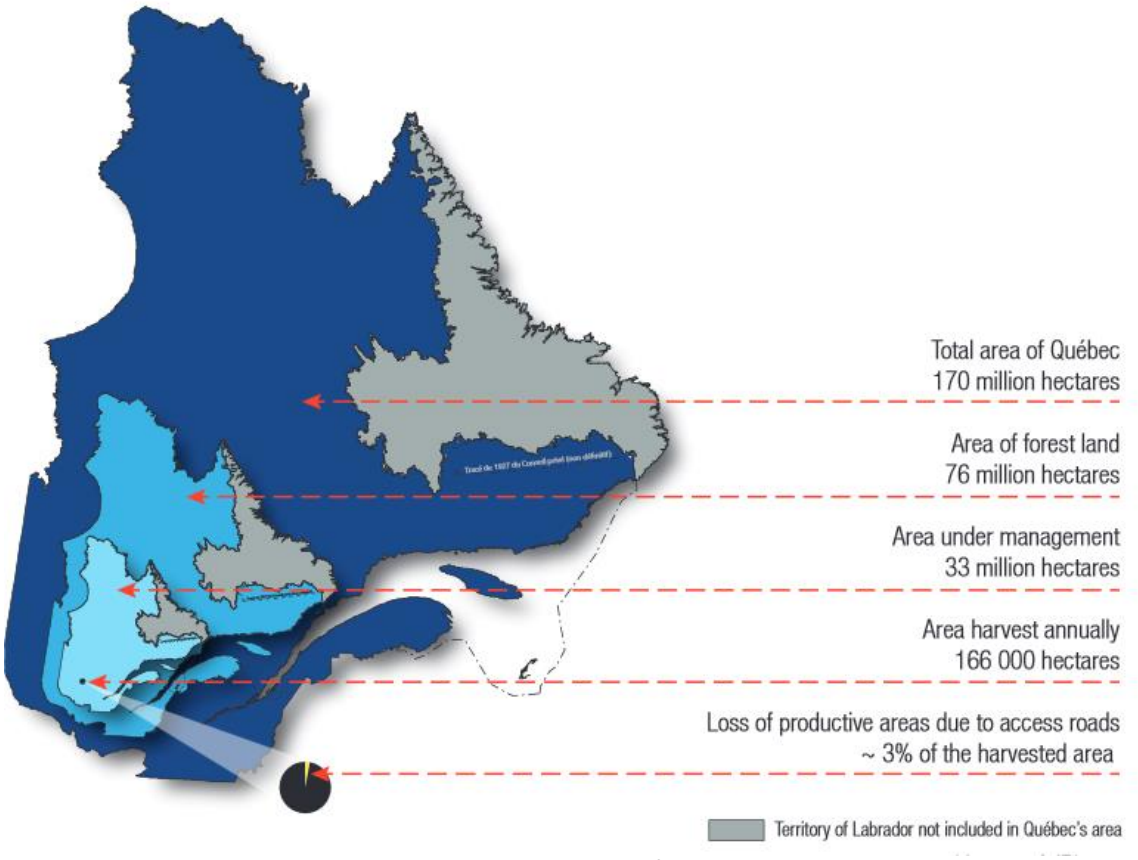
According to the MFFP[6], it can be estimated that about 3% of the area subject to clear cut and harvesting will result in a permanent land use change, mostly for the purpose of creating acces roads/tracks use for forest management (Figure 12)[7]. The remaining 97% will be allowed to develop into a forest again either through natural regeneration or through replantation. Since the annual harvested area in Quebec is estimated to 166 000 ha, the annual loss of forest is about 5000 ha. Compared to the total forest land of Quebec, which is estimated to 76 million ha, it is about 0.0066% per year, i.e. 0.16% in a 25 years timeframe.

Even though the creation of access tracks can be considered as the main cause of lost of forest surfaces in Quebec, we don't have any data about the forest land lost to urbanisation in the areas of expansion of the cities, mining activities etc.…

[6] « Ministère des Forêts, de la Faune et des Parcs »

[7] https://mffp.gouv.qc.ca/english/international/pdf/Fiche-Deforestation-ang.pdf

Figure 12 : Estimated area (millions of hectares) of forest in Canada



Source : Ministère des forêts, de la faune et des Parcs [8]

The FSC risk assessment platform www.globalforestregistry.org considers that Canada is at low 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. Living wood volumes and removals

Canada's forests contain about 47 billion m³ of wood. The repartition by type of wood is presented in the table below:

[8] https://mffp.gouv.qc.ca/english/international/pdf/Fiche-Deforestation-ang.pdf

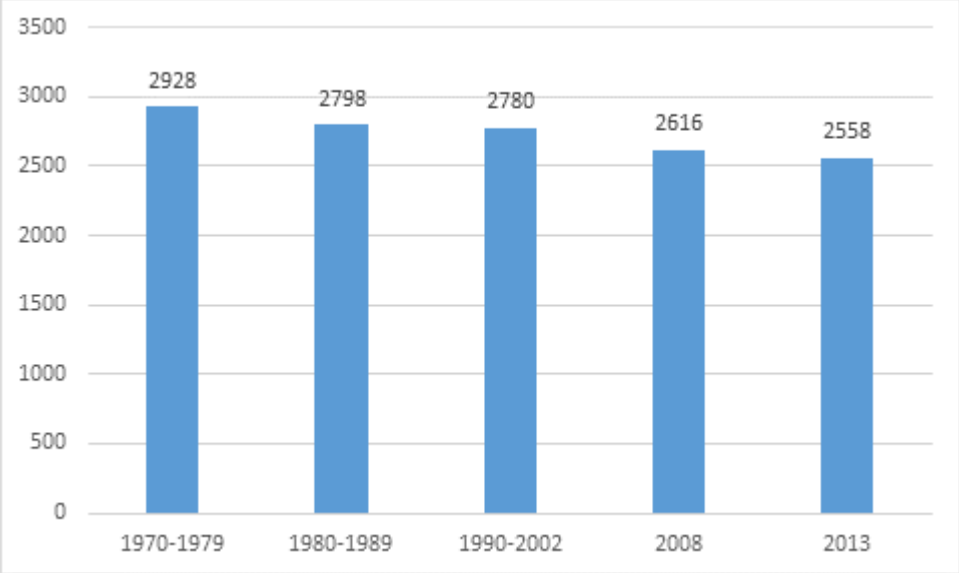
Table 10: Wood volume on forest land by wood type

Ecozone	Wood volume (million m³)
Coniferous	34,163.69
Mixedwood	7,383.55
Broadleaf	5,771.84
Non-treed	1.39
Total	**47,320.47**

Source: https://nfi.nfis.org/resources/general/summaries/en/html/CA3_T15_FORAGE20_VOL_en.html

The figure hereunder shows, for Quebec, the variation in standing timber volume of commercial species between 1970 and 2013.

Figure 13 : variation in standing timber volume (millions m3) in Quebec public forests between 1970-1979 and 2013



Source: État de la forêt publique du Québec et de son aménagement durable–Bilan 2008-2013[9]

As we can see in this figure, the volume of standing trees has been consistently decreasing between 1970-1979 and 2013. The loss of standing wood is about 13% in 40 years. This decrease is mainly due to volume fir, spruce, jack pine and larch. Broadleaves species, on the contrary have been rather stable in terms of volume during the same period, or have even increased.

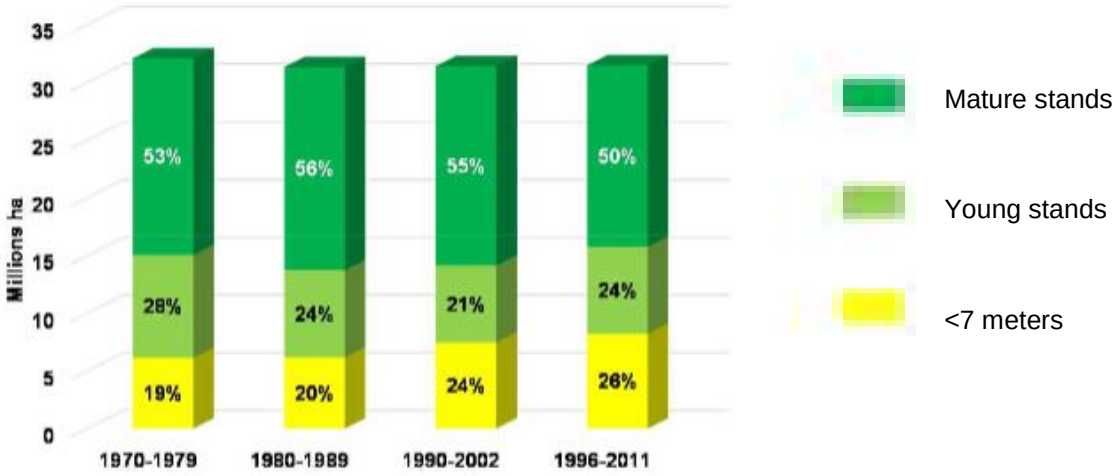
According to the Chief Forester, the main factor explaining the decrease of living volumes of wood would be the outbreak of spruce budworm caused 238 million cubic meters of mortality and probably as much loss of growth, so 476 million cubic meters. Other, more occasional, volume losses (fire, windthrow, etc.) might also have played a role in this decline. The distribution of class ages per

[9] http://forestierenchef.gouv.qc.ca/wp-content/uploads/2015/11/bilan_complet.pdf

surface shows that immature and young stands have increased in terms of surface, at the expanse of mature stands, which results in smaller wood volume in standing trees despite a stable forest surface in Quebec (Figure 14).

According to the Chief Forester[10], prediction models based on the current state of forest and the current management policies suggest that the volume of living wood is stabilizing. No significant further decrease is expected but no increase either : the volume of living wood is expected to stagnate during the next couple of decades.

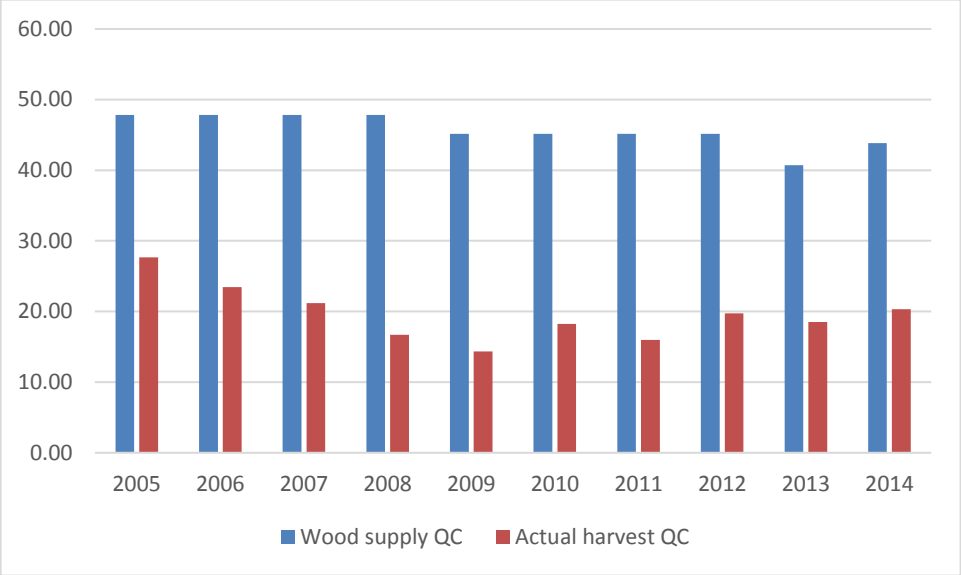
Figure 14 : proportion of age classes in Quebec public forests between 1970 and 2011



The yearly harvested volumes in all Quebec forests (public and private), as well as the estimated wood supply are presented on the next figure. We can see that the actually harvested remain far below the estimated value that might be harvested sustainably, mostly due to the economic context.

[10] http://forestierenchef.gouv.qc.ca/wp-content/uploads/2015/11/bilan_complet.pdf

Figure 15 : harvested volumes and estimated sustainable wood supply in Quebec forests (2005-2014)



(source : national forestry database http://nfdp.ccfm.org)

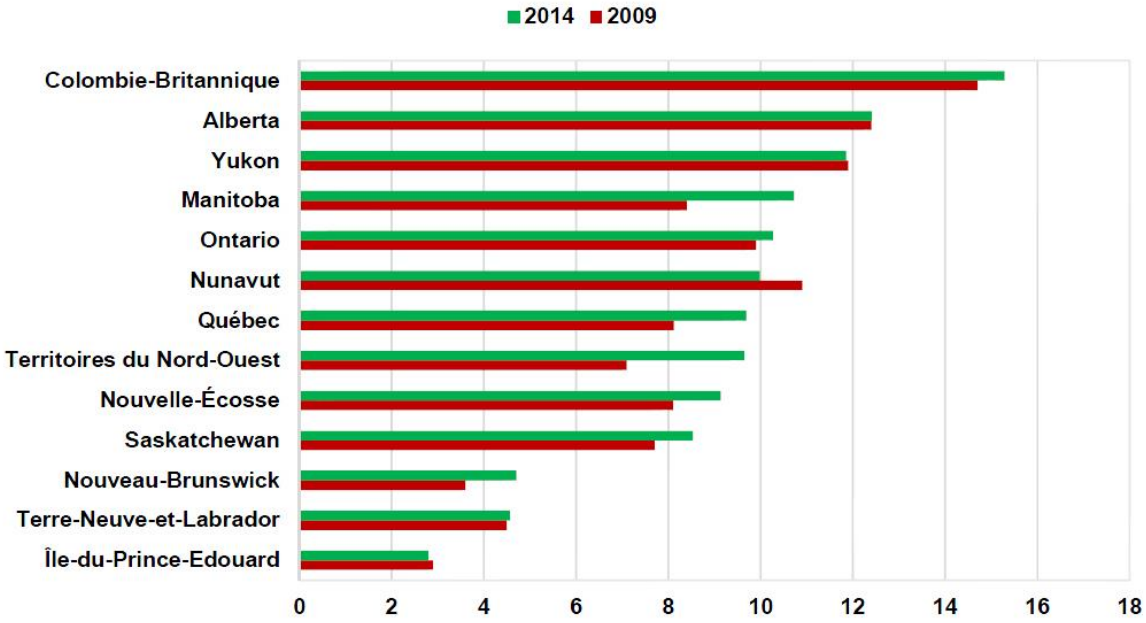
3.3. Protection of ecosystems and biodiversity

Protected areas

In order to protect and promote biological diversity, Quebec has defined protected areas in its territories that protect a series of forest areas from industrial exploitation and anthropogenic changes due to the development of natural resources. This network of protected areas has been chosen to be representative of the biological diversity of regional ecosystems.

The area and percentage of protected areas is increasing in Canada (Figure 16). In 2014, the proportion of protected areas varied from province to province, from 2.8% in Prince Edward Island to 15.3% in British Columbia.

Figure 16 : Percentage of protected areas in Canada



Source: Conseil canadien des aires écologiques. http://ccea.org/fr_main.htm (modified by SGS)

Specifically in Quebec, as per March 2015, the network of protected natural areas covers 9.16% of the territory. Approximately 82% of the surface area of the Quebec protected areas network belongs to the first three categories of IUCN (International Union for the Conservation of Nature) (I, II and III), those where protection measures are the most stringent (Table 11)

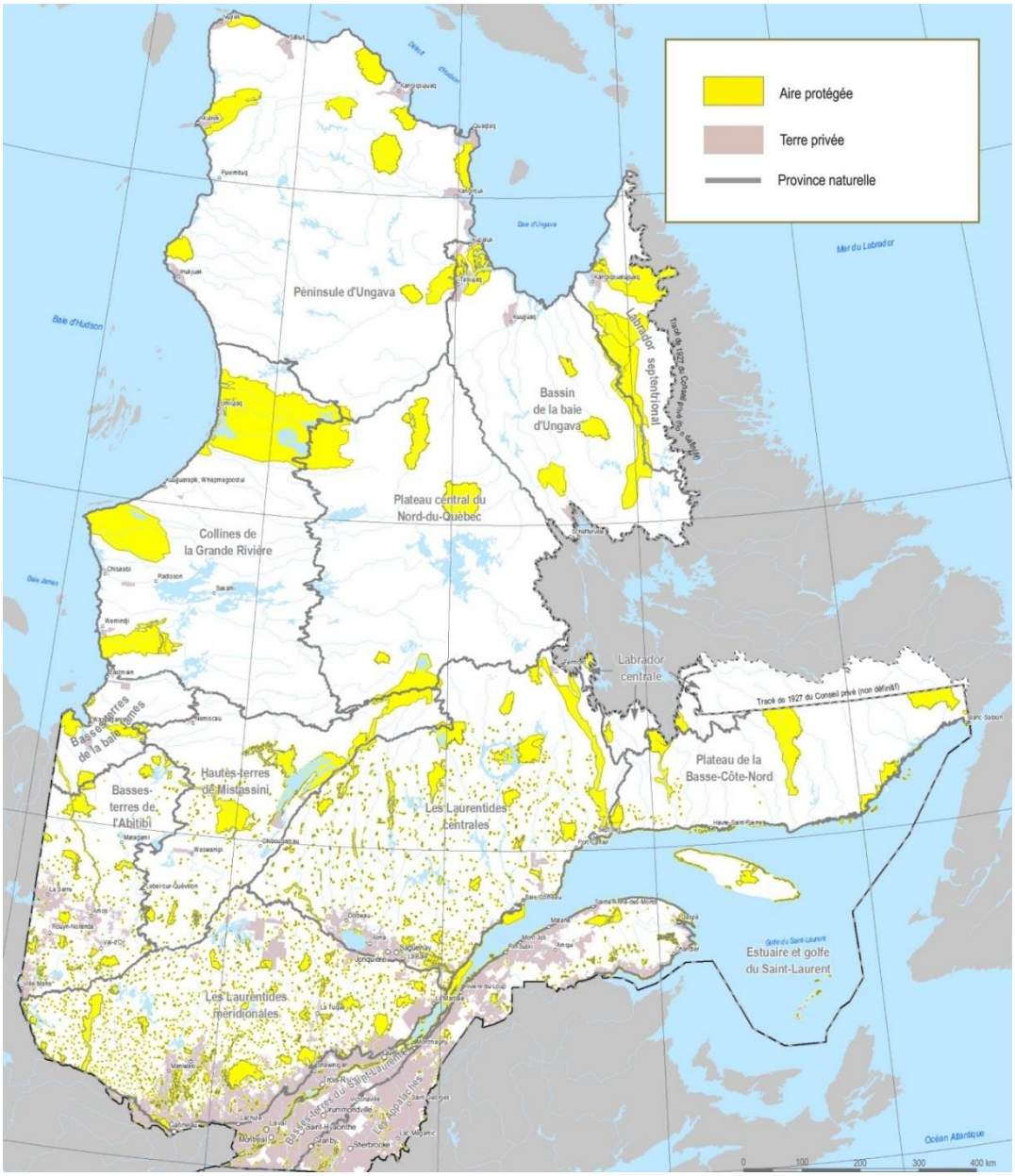
Table 11: distribution of protected areas in Quebec, by IUCN category, by surface area and percentage in March 2015

Category	Surface in km²	%
Ia	2 089	0,13
II	129 823	7,79
III	11 793	0,71
IV	8 903	0,53
VI	72	0,004
Without category	96	0,01

Source: data from http://www.mddelcc.gouv.qc.ca/biodiversite/aires_protegees/registre/Repartition.pdf

The Quebec network of protected areas consists of a network of units with different sizes (Figure 17). The largest protected areas are found mainly beyond the northern limit of forests (toundra and arctic ecosystems). Further south, in forest ecosystems, the protected units are smaller, but very numerous. To play their roles fully, protected areas need to have some connectivity and an area large enough to sustain natural processes (such as boreal forest fires) and viable populations (eg, woodland caribou).

Figure 17 : Geographical distribution of the network of protected areas in the natural provinces in March 2015 – Protected areas (yellow), private land (grey), natural province (dark grey limits)



Source: http://www.mddelcc.gouv.qc.ca/biodiversite/aires_protegees/aires-carte.pdf

Boreal forest

The northernmost part of the Boreal Forest has been excluded from any commercial forestry activity. The excluded zone accounts for 43% of the Boreal Forest, which is about 30% of the total forest area of the province [11].

Territories free from forestry activities other than protected areas

Other forest areas are found to be free of forest harvest, in particular because they have harvesting constraints (access, slopes) or are unproductive. Some of these territories (for those large enough) contribute to conservation, including increasing connectivity in the area.
The percentages of the forests in such situations are presented in Table 12. In total, it is estimated to be 9.2% of the public forests in Quebec.

Table 12: Forest lands free of forestry activities, other than protected areas

Assignments	Proportion of (Crown land) forest area
Shoreline ecotones	0,5 %
Rarities of low density (C and D)	3,0 %
Black spruces with lichen	1,1 %
Stands on steep slopes and peaks	3,2 %
Landlocked stands and islands under 25 hectares	0,6 %
Protected ecological types (RE10, RE70, RS70, RE40, RS40 and RE11)	0,6 %
Other exclusions	0,2 %
Total	9,2 %

Source: Bureau du forestier en chef – Portrait de la couche CFET-BFEC – Synthèse provinciale (avril 2012) p. 51.
Note: The percentages are approximate. They refer to the area of public forest management units, with a gross area of 451,228 km².

Outside the reserves, the forest management rules have special provisions and restrictions of forestry activities around specific sensitive sites : heronry, mudflats, edges of ecological reserves, white-tailed deer containment areas, area of concentration of waterfowl, salmon spawning rivers, caribou calving grounds etc…, [12]

Woodland Caribou and protected species

The woodland caribou, which has been in decline for many years, has been protected as a threatened species across Canada since May 2003. In 2005, the woodland caribou became considered as a vulnerable species (but not yet endangered). Since April 5, 2016, the Government of Quebec has undertaken, through the "Plan d'action pour l'aménagement de l'habitat du Caribou

[11] http://forestierenchef.gouv.qc.ca/wp-content/uploads/2015/11/bilan_complet.pdf
[12] Source: MFFP – Règlement sur les normes d'intervention en milieu forestier (RNI) et Règlement sur l'aménagement durable des forêts du domaine de l'État (RADF).
https://www.mffp.gouv.qc.ca/forets/amenagement/amenagement-reglement.jsp

Forestier[13]", to protect the woodland caribou through the immediate deployment of protective measures for the essential components of woodland caribou. habitat and development of a long-term habitat management strategy for the species.

These measures have been designed to:

- maintain forest massifs residuals in disturbed territories
- provide ample spaces for caribou
- implementation of a long-term strategy to be developed for the development caribou habitat

Currently 65 protection areas, totaling 625 485 hectares (Units 023-71, 024-71, 025-71 and 027-51 in the Saguenay-Lac-Saint-Jean region for example as shown in Figure 18 : land protected for the woodland caribou, Saguenay-Lac-Saint-Jean region) are subject to strict schedules prohibiting the harvesting of timber for specific periods. Quebec has planned to protect more than 90% of the so-called intact forests on its territory.
Despite tose efferts, there are controversies in Quebec as several NGO blame the governement for failing to take sufficient measures for the conservation of caribou in boreal forest ecosystems.

In addition to the woodland caribou, other species (endemic, threatened or vulnerable wildlife and plant species) are also protected by Quebec's law and subject to specific conservations actions (Table 13).

Table 13: number of species associated with the forest environment listed as threatened or vulnerable or likely to be threatened or vulnerable

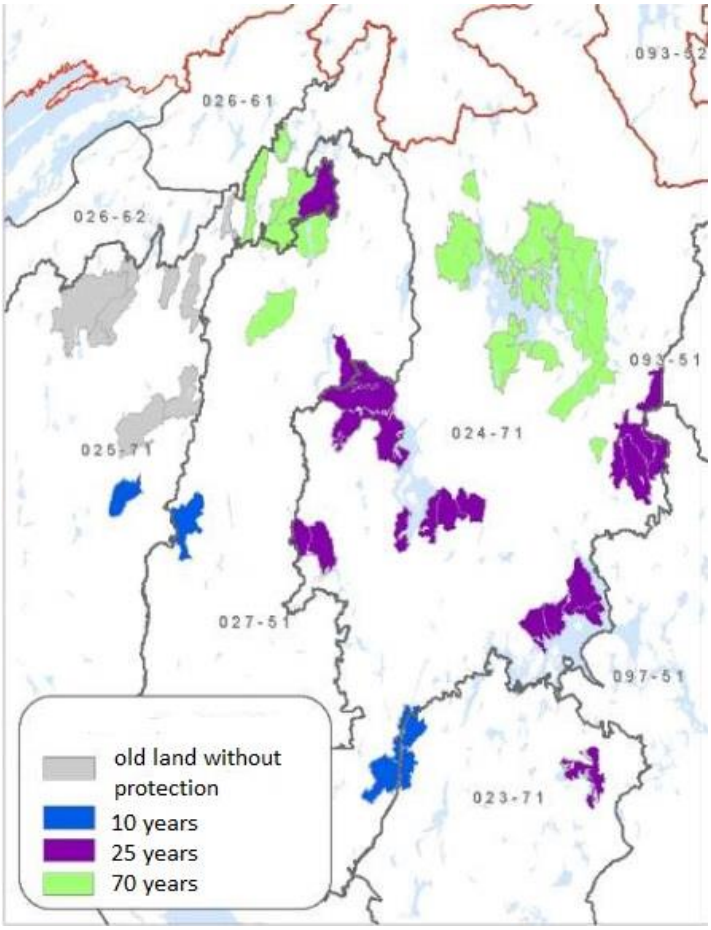
	Faune		Vascular Flora	
Statuts	**2008**	**2011**	**2008**	**2011**
Species designated as threatened	1	6	28	39
Species designated as vulnerable	7	9	6	12
Species likely to be designated as threatened or vulnerable	30	29	262	226
Vulnerable	NA	NA	9	9
Total	**38**	**44**	**305**	**286**

Source: État de la forêt publique du Québec et de son aménagement durable–Bilan 2008-2013

Those species include : American marten, wood turtle; northern dusky salamander; bald eagle; peregrine falcon; golden eagle, spring salamander; four-toed salamander; Barrow's Goldeneye; Oquassa Arctic char...

[13] http://mffp.gouv.qc.ca/publications/faune/napperon-caribou-forestier-2016.pdf

Figure 18 : land protected for the woodland caribou, Saguenay-Lac-Saint-Jean region



Source: Caribou Forestier, fiche thématique 2018-2023 (modified by SGS)

3.4. Protection of water

Aquatic organisms are sensitive to changes in habitat, including changes in water temperature, nutrient composition, and particulate matter levels. One of the greatest impacts on fish habitat is caused by increased sediment loading.

Water quality can be affected by forest harvesting, as forest cover is modified near waterways and through the construction of water crossings along forest access roads. This has the potential to increase water temperatures, nutrient loading, and amount of organic material in stream water.

Another possible impact can be the introduction of pollutants, such as hydrocarbons, into the aquatic environment as a result of accidental spills. Moreover, all the sections made on a watershed can cause leaching of nutrients and, as a result, lead to a change in the physico-chemistry of watercourses. Forestry activities may also have another type of impact when they result in changing

the flow of water in the ecosystem. Disturbance of the hydrological cycle of forests can cause a change in stream flow that can lead to bed and bank erosion.

In Quebec, the indicators adopted by the MFFP to assess the quantity and quality of water in the forest environment cover the following aspects[14]:

- Compliance with the standards of protection of the aquatic environment
- The importance of deforested areas per watershed
- The presence of erosion ditches

The results for the respective indicators are described hereunder for the latest monitoring period available to date (2008-2013)[15].

- Compliance with the standards of protection of the aquatic environment

An audit programme is in place and covers the following topics :

- Road network: works to cross watercourses, culverts, bridges and removable structures; forest roads including the road right-of-way, stacking areas and roads (on indurated beds or near lakes and streams) that require special authorization and construction standards.
- Other infrastructures: This element corresponds to sixteen provisions verified during the control of the application of the RNI. They concern sand pits, forest camps, forest drainage, drinking water intakes and fish farms.
- Banks and streams: the riparian strip and the forest edge of salmon rivers, lakes and other streams; the passage of machinery, the presence of waste and the washing of machinery in the beds of rivers and lakes; washing machinery within 60 m of streams and lakes.

The conformity with those requirement is assessed throughout time and the results during the most recent auditing period (2008-2013) leads to a conformity rate of 90%.

- The importance of deforested areas per watershed

The chosen indicator reflects the proportion of water shed involved in any major perturbation (i.e. harvesting, fire, disease or blown over). The objective for MFFP is to avoid that this proportion exceeds 50% in any watershed at any time. A set of 166 large watersheds is monitored against this indicator. In the period 2008-2013, this percentage remained under 50% in all monitored watersheds and even under 30% in most of them. Only 5 watersheds out of the 166 involved in the monitoring programme had a surface involved in major perturbation above 30% (but always under 50%).

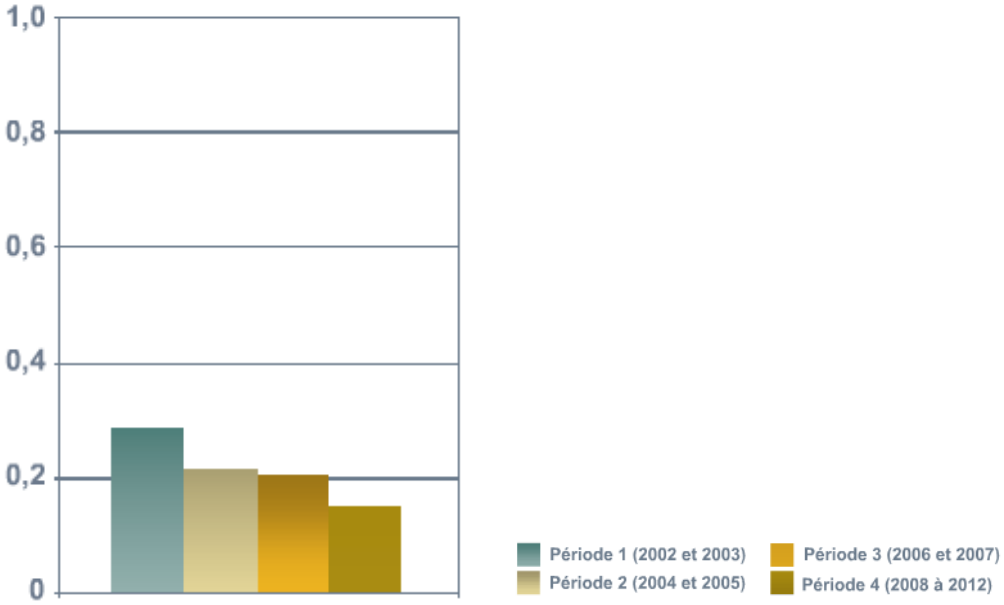
- The presence of erosion ditches

To determine the extent of erosion associated with the road network in public forests, the indicator is the average number of erosion cases observed per kilometer of road along the surveyed road network. The results for the last survey periods is presented hereunder.

[14] https://mffp.gouv.qc.ca/publications/enligne/forets/criteres-indicateurs/3/e32.asp
[15] ibidem

Significant progress has been achieved between 2002 and 2012, with a frequency of erosion damage reduced by about nearly 50%.

Figure 19 : number of erosion cases per km surveyed road in the monitoring programme



Source : MFFP, critères et indicateurs de l'aménagement durable des forêts[16]

3.5. Protection of soils

As for water quality in forested area, soil needs to be protected in order to maintain soil productivity which is a key indicator of forest ecosystem health. Forest management activities that reduce organic matter levels, compact the soil, cause rutting, or lead to erosion, reduce the ability of the soil to support productive forest growth.

To protect and conserve Quebec's forest soil, the MFFP[17] has established a set of performance standards, monitoring system and indicators. The assessment for two of them has been published for two of them in 2013[18]:

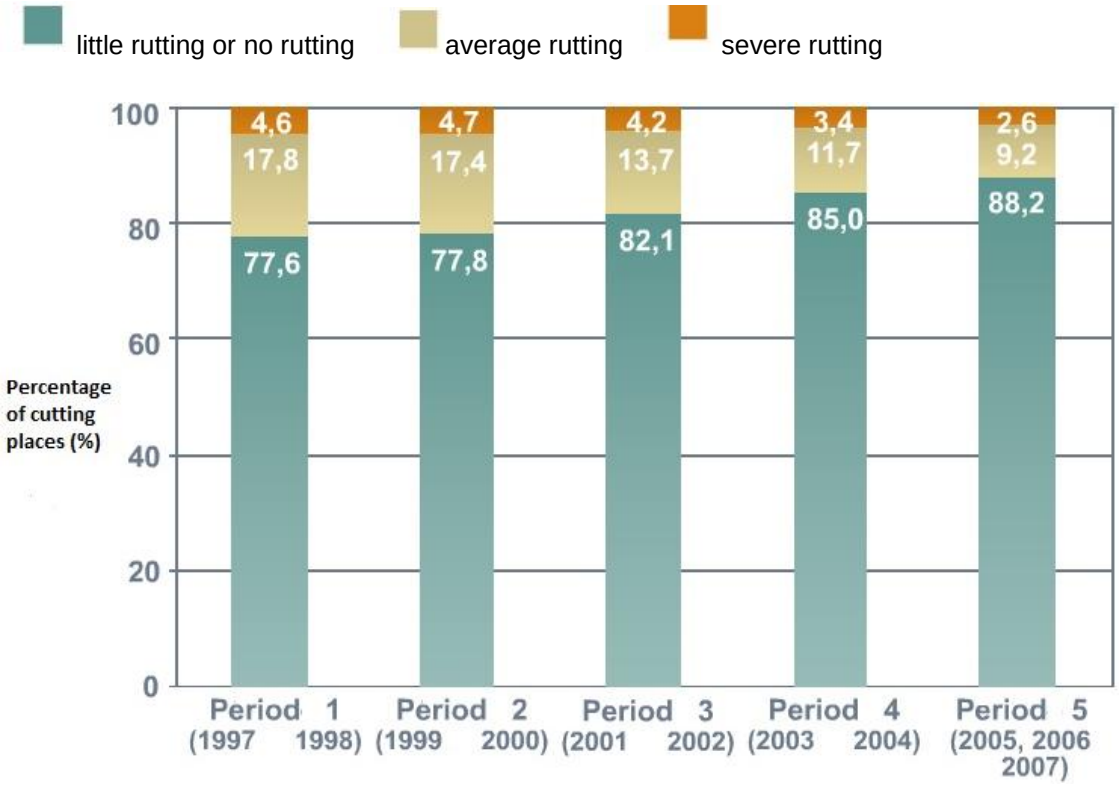
- occurrence of soil compaction through rutting in harvested areas (Figure 20),
- permanent loss of forest areas due to the creation of forest tracks (Figure 21).

As we can see, there has been an improvement in terms of rutting avoidance in Quebec between 1997 and 2007, with a reduction of the situations of severe and average rutting.

[16] https://www.mffp.gouv.qc.ca/publications/enligne/forets/criteres-indicateurs/3/323/323.asp
[17] « Ministère des Forêts, de la Faune et des Parcs »
[18] https://mffp.gouv.qc.ca/publications/enligne/forets/criteres-indicateurs/3/e31.asp

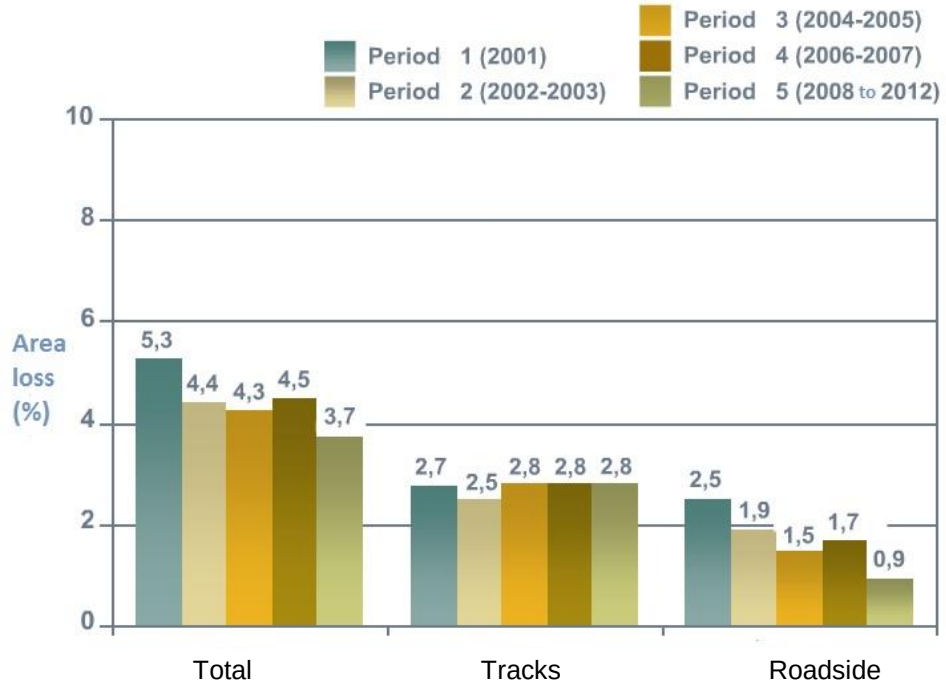
As previously mentioned (see section 3.1) about 3% of the harvested area result in a permanent loss of forest surface due to the creation of new forest tracks (2.8% is the estimated figure for 2008-2012). This figure is rather stale. Additional surfaces are lost to roadside management (less than 1% for 2008-2012).

Figure 20 : monitoring of rutting in Quebec public forests (1997 – 2007)



Source: MRN-DPF, December 2012 (modified by SGS)

Figure 21 : permanent loss of forest area due to creation of new forest tracks in Quebec between 2001 and 2012 (stated as the percentage of the harvested surface)



Source: MRNF-DPF, April 2013 (modified by SGS)

3.6. Protection of carbon stocks

In forest land the carbon stocks mainly includes:

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

In his latest available report (État de la forêt publique du Québec et de son aménagement durable– Bilan 2008-2013[19]), the Chief Forester does not provide any evolution of the forest carbon stock throughout recent years, nor does he provide an estimate of the total carbon stock throughout all Quebec forests. He does provide an assessment of the carbon stock per ha in living merchantable wood volumes in 18 forest management units in 3 specific regions of Quebec (Figure 22). There is also an evaluation of the total carbon stock in those 3 regions, including C in merchantable standing wood and C sequestrated in harvested products (Figure 23). In addition to the assessment of the current situation, the graphs also show the expected evolution of the carbon stocks between 2013 and 2038. Note that the model takes into account the typical life cycle of the different products (paper, panels, sawnwood…), associated with a certain duration of carbon sequestration.

The first graph (Figure 22) features rather stable carbon stocks over time in the respective regions, even though there are big differences between the regions : the Nordic forest ecosystem (Côte Nord) have obviously a smaller living biomass (sparser, smaller trees). The region of Bas St-Laurent reflects a younger forest, with some expected increase of living biomass in the future. The very stable

[19] http://forestierenchef.gouv.qc.ca/wp-content/uploads/2015/11/bilan_complet.pdf

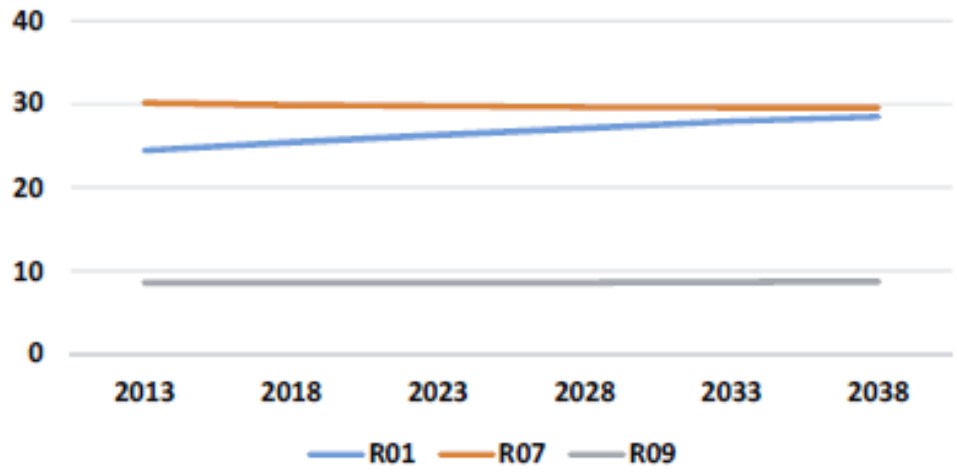
expected carbon stocks in Outaouais reflects a more mature forest, with little possibility to further increase the living stocks.

The second graph (Figure 23) shows a clearer increase of carbon stocks over time because in this model the carbon sequestrated as forest products are taken into account I this model.

It must be noted that none of those graphs includes all the carbon compartments of the forest ecosystem besides merchantable standing wood (soil carbon, dead wood etc…).

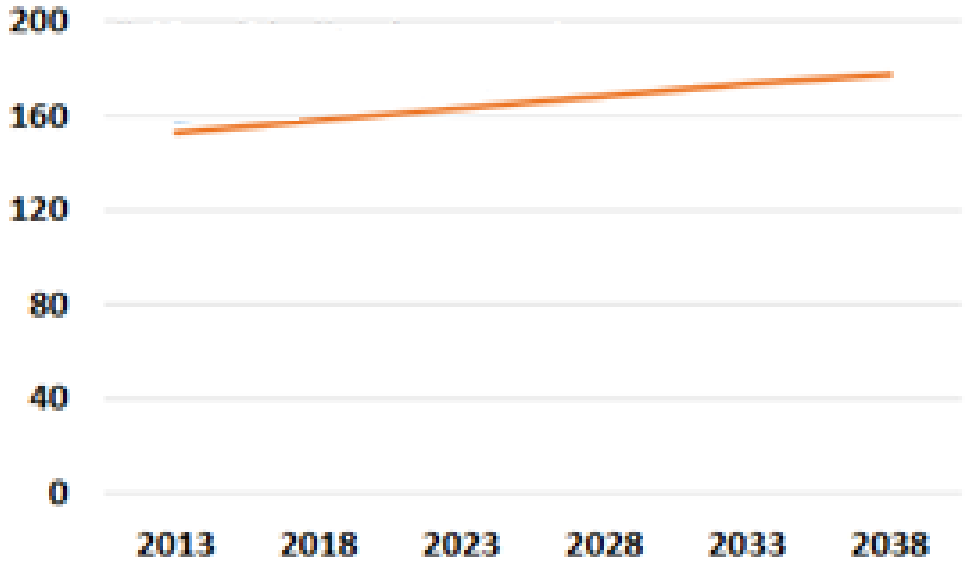
We have seen that the estimated volume of living wood has dropped by 13% during the last 13% years, so it can be expected that the carbon stocks have decreased as well during this period, even though it is quite possible that the other compartments of forest carbon have not followed the same evolution.

Figure 22 : expected evolution of carbon stocks associated to merchantable standing wood for 18 FMU in 3 regions between 2013 and 2038 (tonnes C / ha)



R01= Bas-St Laurent, R07 = Outaouais, R09 = Côte-Nord
Source: État de la forêt publique du Québec et de son aménagement durable–Bilan 2008-2013

Figure 23 : expected evolution of carbon stocks, including C in merchantable standing wood and C sequestrated in harvested products for 18 development units in 3 regions between 2013 and 2038 (million tonnes C)



Total for 18 FMU in 18 regions of Quebec : Bas-St Laurent + Outaouais + Côte-Nord
Source: État de la forêt publique du Québec et de son aménagement durable–Bilan 2008-2013

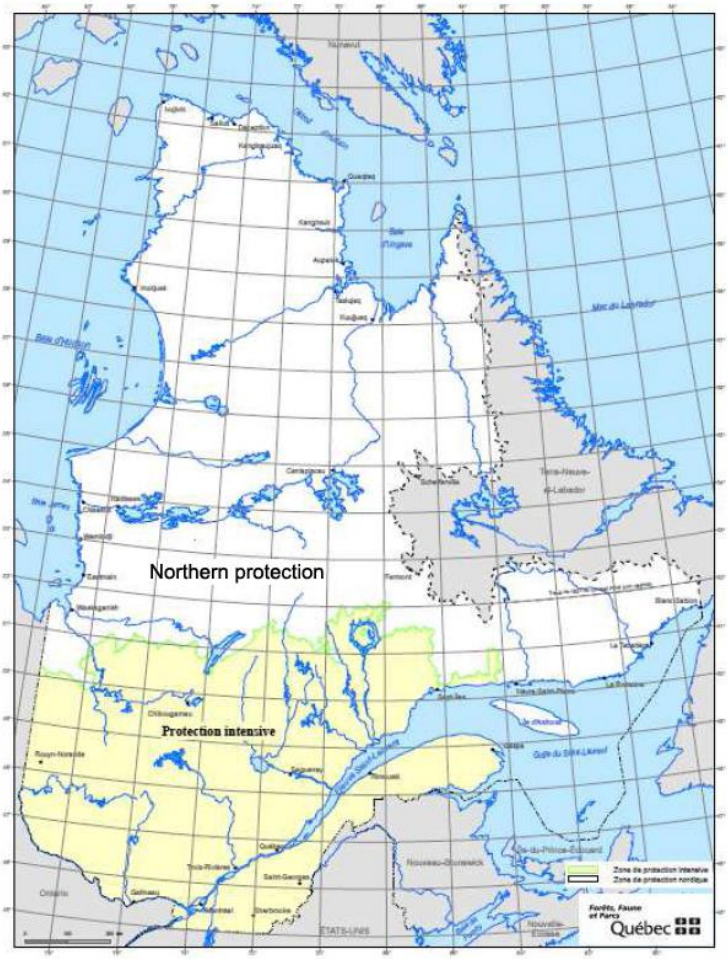
3.7. Protection of air quality

Forest fires affect the air quality because of the emissions of various pollutants in the atmosphere.

The province of Quebec is divided into two protection zones (Figure 24):

- *The intensive protection zone (area of approximately 51.9 Mha) where a fire exclusion policy, according to which all forest fire must be systematically fought, is applied. A prevention program fires of human origin are also in effect. The boundary of the intensive protection zone follows the northern limit of the attributable forest.*
- *The northern protection zone where forest fire control is only carried out as part of the agreements or in support of civil security.*

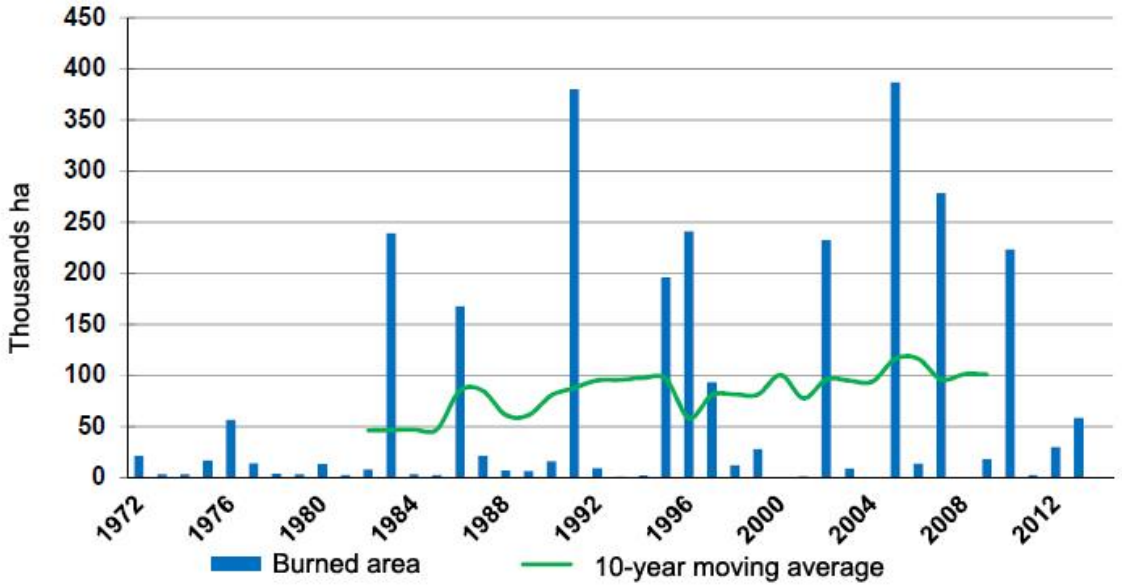
Figure 24 : management zones for forest fire protection



Source: http://www.mffp.gouv.qc.ca/forets/fimaq/feu/fimaq-feu.jsp (modified by SGS)

Area of forest affected by fires in Quebec is shown in the figure below. For the period 2008-2013, 2 410 fires burned 274 490 hectares, an average of about 55 000 ha per year. In 2017, 290 fires burned 6 630,1 hectares.

Figure 25 : area burned annually in the intensive protection zone between 1972 and 2014



Source : SOPFEU http://www.sopfeu.qc.ca/

The regions most affected by forest fires are Saguenay-Lac-Saint-Jean, which represents 19% of the province with the largest areas burned. It is also the region where the fire cycle is the shortest. Then come Nord-du-Québec, Côte-Nord, Mauricie and Abitibi-Témiscamingue. In the others regions, the effects of fire are negligible. In conclusion, the most affected region is the boreal region of Quebec (in terms of burned area).

3.8. Illegal logging

According to the government of Canada[20], the country is recognized as a producer of legally and sustainably harvested forest products. Comprehensive laws and regulations have been put in place to govern harvesting and trade in timber. Forest operations are closely monitored and the law is enforced, Canada successfully keeps illegal logging and the trade in illegal timber down to negligible levels in all regions.

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

- Evidence of enforcement of logging related laws in the district [21]
- 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 permits [22]
- There is little or no evidence or reporting of illegal harvesting in the district of origin[23]

[20] http://www.nrcan.gc.ca/forests/canada/laws/17479
[21] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[22] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[23] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/

- 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[24]

3.9. Civil rights and traditional rights

The FSC risk assessment platform www.globalforestregistry.org considers Canada as 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[25]
- The country or district is not designated a source of conflict timber (e.g. USAID Type 1 conflict) [26]
- 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 [27]
- 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

The forest of Quebec are of particular significance for the so-called First Nations (indigenous peoples). In addition to the Inuit people, there are 10 First Nations in 41 communities in Quebec. Specific laws and treaties are in place to ensure that the traditional use of the forest is available to the First Nations.

The links that bind First Nations to the forest are part of integral to their identity, existence and development. Even today, the forest is important in the way of life of many members of Aboriginal communities in particular for the practice of certain hunting, fishing, trapping and gathering for food, ritual or social purposes.

3.10. Forest certification

Forest certification is a voluntary process whereby an accredited and independent registration body recognizes that forest management practices meet pre-established standards for sustainable forest management.

The main forest certification schemes used in Canada are (all three are recognized in Quebec):

- The Canadian Standards Association (CSA) Sustainable Forest Management Standard (SFM), approved by the Standards Council of Canada
- The two standards of the Forest Stewardship Council (FSC) Principles and Criteria for Forest Management that are applicable to Ontario - Great Lakes/St. Lawrence Draft Standard and the National Boreal Standard;
- The SFI Inc.'s Sustainable Forestry Initiative (SFI).

[24] chttp://www.transparency.org/cpi2015

[25] http://www.globalwitness.org/pages/en/forests.html

[26] Conflict Timber: Dimensions of the Problem in Asia and Africa Volume I Synthesis Report

[27] Global Child labor trends 2000 to 2004. ILO (International Labour Office).

To date, over 90% of publicly owned forest under management is certified under one of the forest certification systems in use, with almost one-quarter of this area having two certifications (SFI and FSC) (Figure 27). The certification rate of Quebec's public forests is among the highest in the world with, in 2017, more than 26 million hectares were certified SFI and 24 million hectares certified FSC (public and private forests). The first forest management certificate was issued in 2002 by the FSC. The area of certified forests has not stopped growing ever since (Figure 26).

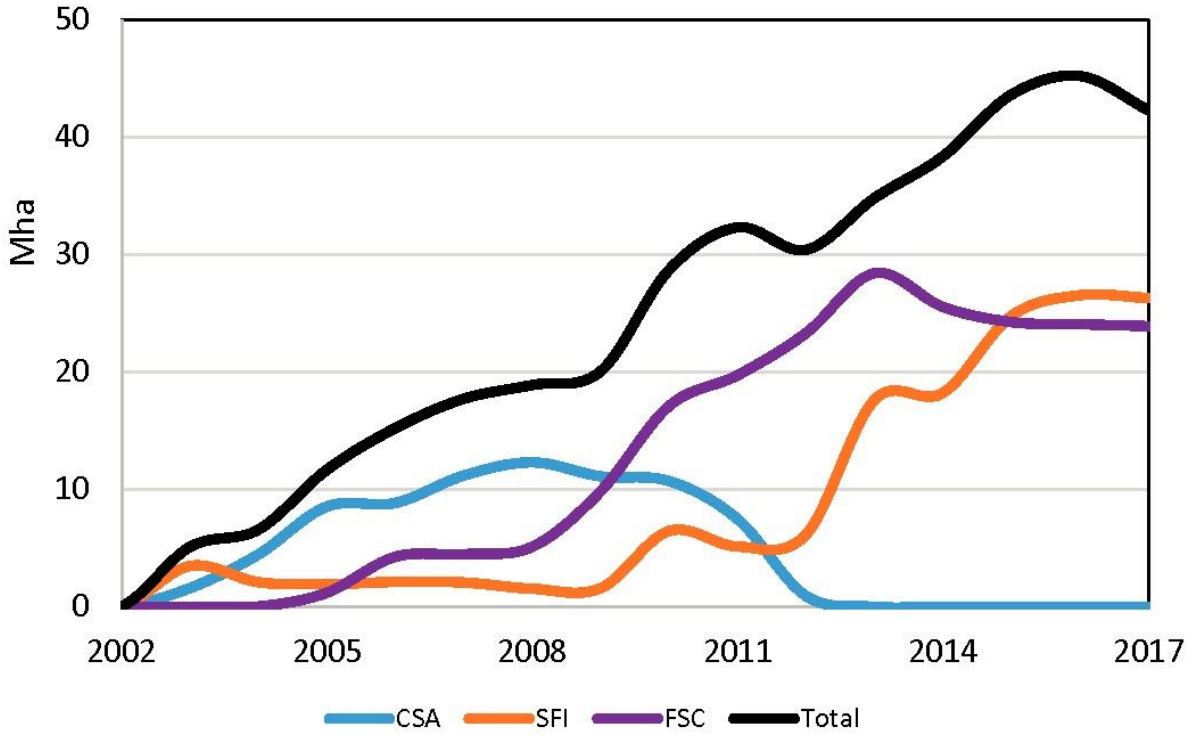
In Quebec, forest management on Crown Land is the responsibility of the companies in charge of a specific FMU (forest management unit) and the companies are in charge of applying for certification if they wish to do so. The authorities support companies in this direction by advocating for environmentally appropriate, socially beneficial and economically viable development.

The MFFP ministry (« Ministère des Forêts, de la Faune et des Parcs »)[28]:

- *follow the evolution of markets and standards as well as the state of forest certification;*
- *collaborates in the development and updating of the various forest certification systems (CSA, FSC and SFI) highlighting the particularities of Quebec's forest regime;*
- *provides support to forest companies to obtain or maintain forest certification by:*
    - *the establishment of mechanisms for efficient exchanges and collaboration with the beneficiaries of a guarantee of supply;*
    - *production of technical data and documentary evidence;*
    - *participation in audit audits.*
- *does not favor any forest certification system, it gives companies the choice of the system that suits them best.*

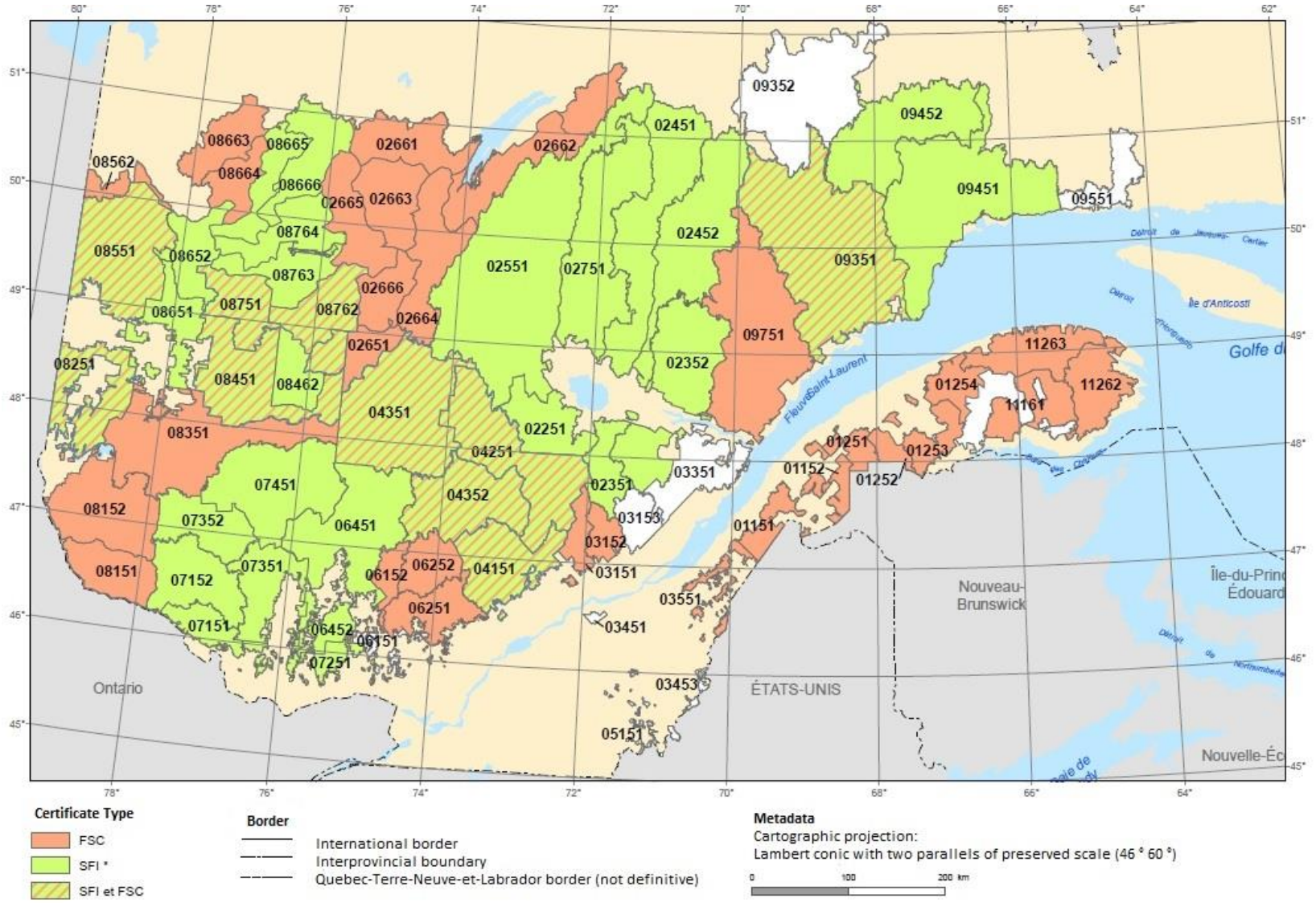
[28] Source : https://mffp.gouv.qc.ca/publications/enligne/forets/criteres-indicateurs/5/537/537.asp

Figure 26 : evolution of forest management certification in Quebec (in million ha)



Source : Ministère des Forêts, de la Faune et des Parcs, march 2018 (modified by SGS)

Figure 27 : map portrait of forest certification in the forests of the State domain of Quebec



Source: Direction de la Gestion des stocks ligneux, Ministère des Forêts, de la Faune et des Parcs - Direction de la protection des forêts - 2018/03/01 (modified by SGS)

4. Conclusions

Forest land in Quebec is estimated to cover 76,11 million hectares, about 45.6% of the province. Broadleaves and mixed forests are present in the South, while boreal forest, dominated by spruce and fir is located in the central part. Further North, taiga ecosystem features a low density of trees and no trees are present in the arctic ecosystems (toundra).

Most forests in Quebec is publicly owned (91,4% Crown Land). Those are managed by provincial and federal government. The rest (8,6%) is owned by first nations or privately owned.

The ministry in charge of forests on Crown land is the MFFP (Ministère des Forêts, de la Faune et des Parks) is responsible for the long-term health of forests. Private companies are allocated the management and the right to harvest on specific forest management units on Crown Land. In addition, the Chief Forester is charge of advising the ministry and monitoring the state of forests.

The forest industry is one of Canada's most important manufacturing sectors. In the period 2005-2010, forest industry in Quebec experienced a downturn and has been slowly recovering afterwards. It is reflected by a decrease in the incomes and the employment, as well as smaller harvested levels.

Canada's forest area is stable through time losing only 0.34% in 25 years. The risk of conversion to other land uses is low. No statistics on land use change are available in Quebec, except that it is estimated that 3% of the harvested land is lost to the creation of access tracks (0.0066% per year, i.e. 0.16% in a 25 years timeframe). This does not include forest land lost to urban/industrial developments, mining, etc…, which is not monitored in Quebec.

Quebec has put in place a series of measures and laws for the protection of biodiversity. The protected areas, mostly National Parks represented, in 2015, a network covering 9.16% of the province. An additional 9.2% of the forest on Crown Land is excluded from harvesting because it can't be accessed and 43% of the Boreal forests are excluded from production. Evenn though specific efforts are made for the protection of woodland caribou (vulnerable species in Quebec) a controversy remains about whether or not those efforts are sufficient for the future of the caribou populations.

Some monitoring programmes and performance indicators are in place for the quality of water, particularly in terms of impact of the harvesting operations and the creation of forest tracks. The results show that the intended standard is achieved and that the performance indicators show improvement during the last couple of decades.

Wildfires occur regularly in Quebec, even though the impacted areas can be quite different between one year and another. The average affected area was about 100,000 ha per year in recent years, with maximum in the range of 200,000 to 400,000 ha for the worst years. It remains a small proportion of the forest (max 0.5% for the worst year). The most affected part of Quebec is the Boreal region.

The volume of standing trees is estimated to have decreased by 13% over the last 25 years, mostly because of diseases causing mortality and reduced growth. It is expected to stabilize during the next couple of decades. The forest carbon stocks are not monitored but the carbon stock in living wood is expected to remain stable in the next couple of decades in the regions where a predictive model has been prepared. It is probable that the forest carbon stocks in Quebec have decreased together with the volumes of living wood during the last 25 years, even though no assessment at all is available for the other compartments of forest carbon stocks (soil, dead wood, etc..). Some models take into account the amount of carbon sequestrated in forest products.

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

There are more than 26 million hectares were certified SFI and 24 million hectares certified FSC in Quebec (90% of the public forests).

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