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## Canada's forests: Adapting to change

# The State of Canada's Forests

## ANNUAL REPORT 2020

30<sup>TH</sup> ANNIVERSARY ISSUE

### FEATURES

How the forest sector provides  
support during a crisis

Monitoring forest fires in Canada  
from space

Collaborative research centred on  
knowledge co-creation

Canada 

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does Canada have?**

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**How does the forest  
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# Message from the Minister of Natural Resources

As Canadians, our forests permeate our lives, and Canada's forest sector is an essential economic engine and major employer of Canadians, including in Indigenous and rural communities.

The theme of this year's Report, *Adapting to Change*, reflects the sector's ability to respond to new challenges and create new opportunities. This adaptability has been evident during the COVID-19 pandemic as the forest sector, in partnership with the Government of Canada, quickly shifted gears to implement new procedures that ensured the health and safety of workers and communities while completing the tree-planting season. Throughout this period, we continued to work with Indigenous leaders and communities to ensure they could benefit from what the forest sector has to offer.



Adapting to change means finding innovative ways to use traditional waste products from sawmills and pulp mills. In Quebec, for example, the Toundra greenhouse is using waste heat and carbon dioxide from a nearby pulp mill to grow tens of millions of cucumbers each year.

To meet the increasing severity of forest fires, Natural Resources Canada scientists have teamed up with the Canadian Space Agency to create WildFireSat, the world's first satellite purpose-built to monitor wildfires.

And with the rate of climate change expected to be 10 to 100 times faster than the ability of forests to adapt, researchers are turning to genomics and selective breeding to give our trees a better chance to thrive in changing environments. Meanwhile, our forests will continue to be an essential tool as we combat climate change through natural solutions like the planting of two billion trees over ten years.

Adapting to change also means recognizing the intrinsic value of Indigenous knowledge and incorporating it into current and future practices. Scientists at Natural Resources Canada, together with Laval University, have worked with members of the Pessamit First Nation to create tools and practices for collaborative research.

As this Report makes clear, Canada's foresters are continuing to adapt — through innovation, imagination and excellence in sustainably managing this precious resource.

Thanks to their efforts, we can look forward to healthy, thriving forests for many generations to come.

The Honourable Seamus O'Regan  
Minister of Natural Resources

# The 2020 State of Canada's Forests Annual Report: An overview

**Forests and forest resources are an integral part of life in Canada. They are the source of many of the products we use every day, and they sustain many local economies across the country. They also provide numerous recreational opportunities and have strong cultural importance for many Canadians.**

Canadians, policy makers and decision makers need information to ensure that forests in Canada are sustainable for generations to come. *The State of Canada's Forests: Annual Report* is a science-based report that conveys trends, statistics and stories about Canada's forests and the forest sector from a national perspective.

With 9% of the world's forests found in Canada, and strong ties between Canadians and our forests, Canada has a strong commitment to sustainable forest management.

This report, the 30th edition of *The State of Canada's Forests*, aims to enhance decisions, inform public debate, and help demonstrate to consumers that Canadian products come from sustainably managed forests. It shows how the forest sector is critical to the low carbon transition and the efforts made across the value chain to grow the circular bioeconomy in Canada. The theme of this year's report is *Canada's forests: Adapting to change*, with stories and infographics centred around the challenges and opportunities for Canada's forests and forest sector in the face of change.



**Canada's forests and the forest sector are facing rapid and widespread change**

Natural disturbances such as forest fires, insects, and disease are essential to the health and renewal of Canada's forests. However, extreme weather events and changing environmental conditions associated with climate change, as well as the introduction of exotic insects and diseases, are increasing stand mortality, affecting wood fibre quality and supply, and leading to more frequent and severe wildfires.

Meanwhile, uncertainty in global trade, changes in consumer demands, and increasing international competition

are challenging Canada's forest sector. In addition, the coronavirus disease (COVID-19) pandemic has added even greater uncertainty for Canada's forest sector going forward, as the sector grapples with rapid and unexpected changes in global supply and demand as well as concerns with health and safety.

**Canada's forests are an essential part of global solutions**

In the face of global change, forests have emerged as an essential part of the solution to many critical challenges. They mitigate the effects of climate change; provide renewable products and energy; support high-paying jobs; and contribute

to a greener economy. Canada's forest sector has experienced the continued growth of mass timber as a low carbon, renewable building material and the importance of wood pellets as both a source of renewable heat and power and a driver of resource efficiency. The Canadian forest sector is adapting, too, by investing in emerging technologies, diversifying through bioproducts, and meeting the increasing demand for renewable energy.

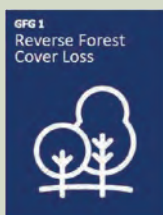


## The sustainability indicators in *The State of Canada's Forests: Annual Report* support:

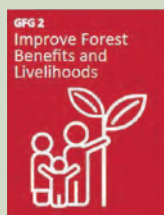


The United Nations' Sustainable Development Goal 15 – Life on Land, and

### The United Nations' Global Forest Goals:



(1) Reverse forest cover loss



(2) Improve forest benefits and livelihoods



(3) Protect forests and use sustainable forest products



(4) Mobilize resources

### Monitoring and reporting supports a sustainable future for forests

To ensure the long-term sustainability of Canada's forests and forest sector, comprehensive data and transparent reporting is critical. The sustainability indicators in *The State of Canada's Forests: Annual Report* provide data and analysis about the past, current, and future trends in Canada's forests and forest sector.

When measured over time, sustainability indicators:

- provide essential information about the state of, and trends in, Canada's forests
- highlight areas for improvement in forest management policies and practices
- supply reliable information for discussions and initiatives related to environmental performance and trade

The sustainability indicators in *The State of Canada's Forests: Annual Report* are comparable to those published by other countries participating in the Montréal

Process. This international working group of 12 nations measures progress toward the conservation and sustainable management of 90% of the world's boreal and temperate forests. Canada also uses some of these indicators to report on the United Nations Sustainable Development Goals as well as the United Nations' Global Forest Goals.

### Innovation and adaptation drive Canada's forest sector

The *State of Canada's Forests: Annual Report* also provides context about Canada's forest sector through feature stories that highlight how the forest sector is adapting and transforming. This year's report includes stories on:

- how a revolutionary greenhouse in Quebec is benefitting from an adjacent pulp mill
- how Canada will use a space satellite and artificial intelligence to fight forest fires
- how scientists and Indigenous communities are working toward co-creation of research

- how researchers are using genomics to help Canada's forests thrive in the face of climate change

These stories provide a snapshot of some of the current challenges and opportunities facing Canada's forests and forest sector and provide insight into where the future may lead.

### An authoritative report with trusted information

Canada has been sustainably managing its forests for many years and is proud to present this report. As it has for the last 30 years, *The State of Canada's Forests: Annual Report* is, and will continue to be, an accurate, comprehensive and authoritative source for information on the social, economic and environmental state of Canada's forests and forest sector.

The *State of Canada's Forests: Annual Report* is designed to be as informative and user-friendly as possible, and we welcome your feedback. Visit us at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests) and let us know what you think.







# From staple goods to essentials: How the forest sector provides support during a crisis

**2020 started with a crisis: a global pandemic surrounded by unprecedented uncertainty and economic recessions. While COVID-19 dominated headlines, so did stories about shortages of personal protective equipment like medical gowns and masks. During the COVID-19 pandemic, the forest sector was deemed essential to the well-being of Canadians because it directly supplies key sanitary household products and inputs for the production of numerous essential products and services, including medical gowns and non-medical masks.**

## **An unprecedented start to 2020**

A novel form of coronavirus and its associated disease, known as COVID-19, caused the pandemic in early 2020. COVID-19 causes pneumonia-like symptoms, including fever and difficulty breathing, and disproportionately affects elderly people and those with underlying health problems or compromised immune systems.

As in most countries around the world, confinement measures were put in place in Canada to slow the spread of the disease and ease the potential strain of an outbreak on the medical system until

a treatment or vaccine can help protect Canadians. The side effect has been an extraordinary economic slowdown.

While Canada's lockdown measures aimed to avert a health crisis, not all economic activities could be halted. Canada still needed to support critical infrastructure and the production of essential goods and services to ensure the health, safety and security of Canadians. In the days and weeks following lockdown announcements, governments in Canada identified the forest sector as playing an essential role in the lives of Canadians.

## **The integrated forest sector plays an essential role during a crisis**

The Canadian forest sector provides day-to-day essentials to Canadians, such as toilet paper, sanitary products, and packaging and food-packing materials. It also supplies materials needed to make personal protective equipment – a crucial supply during a pandemic – such as protective medical gowns and hygiene products.

### **How forest sector workers helped “flatten the curve”**

“Flattening the curve” refers to the public health strategy to slow the spread of COVID-19. Confinement and physical distancing measures reduce the spread of the virus so that the number of people needing medical attention at the same time does not exceed the medical system's ability to care for them.

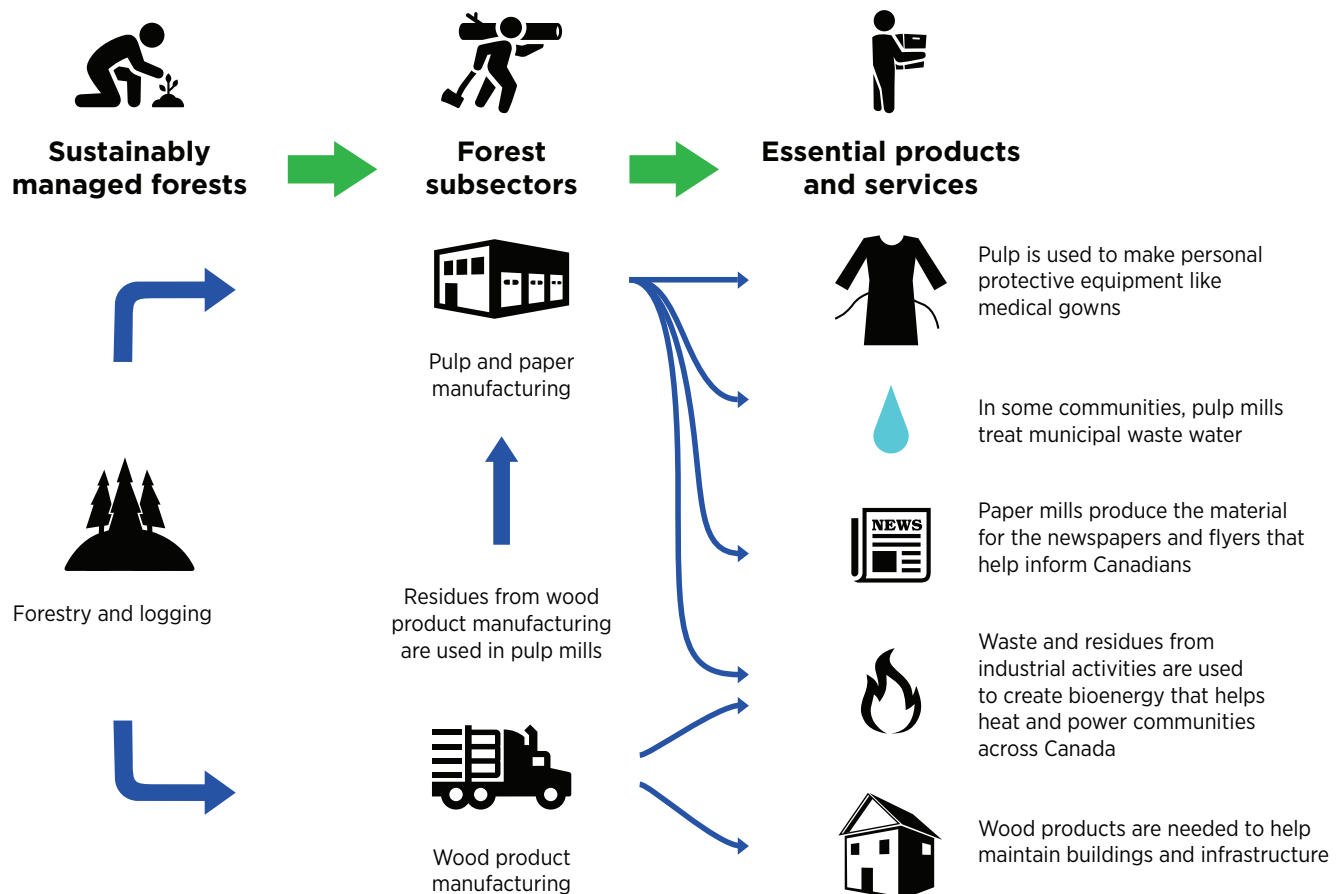
Forest sector workers continued to provide essential goods and services during the peak of the pandemic. Workplaces, including the forest sector, took steps to keep workers safe by reducing the workforce to maintain physical distancing, providing health screening to employees, wearing personal protective equipment, sequestering work teams and using technology to work remotely. Field workers, such as tree planters, also played their part in flattening the curve by working in self-contained camps with enhanced health and safety measures in place and reducing their interactions with local rural and Indigenous communities.



In addition, the forest sector provides essential services such as community wastewater treatment and power and heat in rural and remote communities. And though the construction industry

was put on pause at the peak of the pandemic, timber and wood building supplies continued to be essential to the repair and maintenance of essential infrastructure.

There is still considerable uncertainty about how the global pandemic will affect Canadians and economies around the world over the long-term. But one thing is certain: the forest sector will continue to provide the goods and services we need.



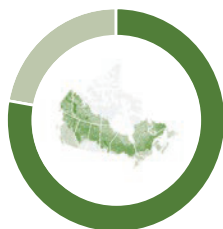
The forest sector is integrated and relies on sustainably managed forests to deliver essential products and services to Canadians. The forestry and logging subsector provides the pulp and paper manufacturing subsector and the wood product manufacturing subsector with the wood fibre needed to produce a variety of innovative and traditional products.

# SUSTAINABLE FORESTRY: ADAPTING TO CHANGE

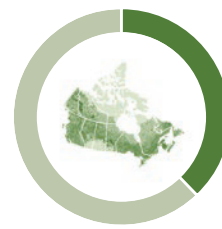
Key facts and figures about Canada's forests and forest sector



Canada has **9%**  
of the world's forests.



About **270 million ha**,  
or 78%, of Canada's forests are  
located in the boreal zone.



Forests cover **38%**  
of Canada's land area.

With **347 million hectares of forest**, Canada is the third-most forested country in the world.

## Canada's forests are important to Canadians, the economy and the environment



In 2018, the forest sector  
directly employed  
**204,555 people**.



In 2019, Canada's forest  
sector contributed  
**\$23.7 billion**  
to Canada's nominal GDP.



According to the last  
census (2016), over  
**70%** of Indigenous people in  
Canada live in or near forests.



Canada's boreal wetlands  
represent nearly  
**20%** of the  
world's wetlands.



## Canada's forests are managed sustainably for future generations

**200 million ha**  
of forest in Canada  
have a long-term forest  
management plan (2016).

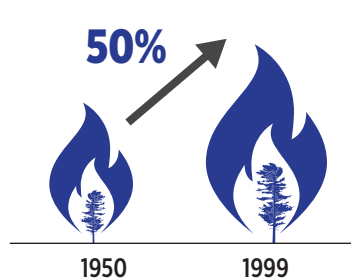
Canada has  
**168 million ha**  
of forest certified to third-party  
standards of sustainable forest  
management (2019).

**77%**  
of Canada's managed  
Crown forest land is certified  
to third-party standards of  
sustainable forest management.

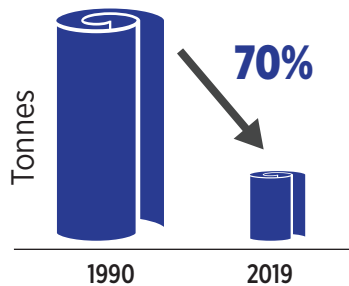
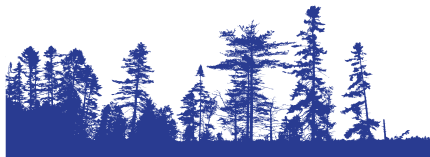
**By law**, all forests harvested on public lands must be regenerated.



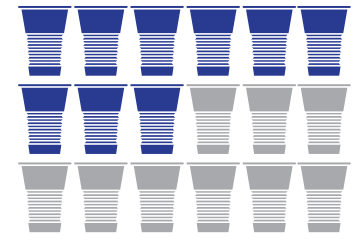
## Canada's forests and the forest sector are changing



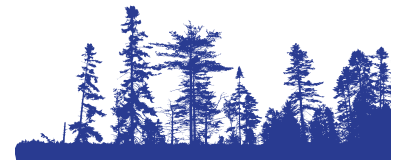
Between 1950 and 1999, the area burned annually in the North American boreal zone more than **doubled**.



In Canada, newsprint production **declined 70%** from 9 million tonnes in 1990 to 2.7 million tonnes in 2019 because of increased global competition from other low-cost producers and the increase of digital media.



Advanced bio-based products are expected to make up **50%** of consumer products by 2050.



## Canada's forest sector is adapting to change

	Area (ha)	Percent of forest area (%)
Area affected by insects (2018)	16,391,000	4.7%
Area burned (2019)	1,843,000	0.5%
Area harvested (2018)	748,000	0.2%
Area deforested (2018)	34,000	0.01%



**New technology:**  
In 2025, Canada will launch WildFireSat, the world's first satellite built specifically to monitor wildfires.



**New management strategies:** Foresters are starting to replant harvested sites with trees better adapted to future climate conditions.

## Canada's forest sector supports the transition toward net-zero emissions



**New techniques:**  
Mass timber is an innovative low-carbon, sustainable building material that allows the construction of taller and larger buildings.



**New products:**  
Forest biomass is refined into advanced biomaterials and biochemicals for use in health care, pharmaceutical, food and packaging applications. It could be the rayon shirt you are wearing, the compostable container for your take-out food, or one of your ice cream ingredients.



**New energy:**  
Forest biomass is the second-largest source of renewable energy after hydroelectricity, providing both heat and electricity to industry and communities (2017).

# When western and Indigenous science and knowledge come together: Collaborative research centred on knowledge co-creation

**Blending western and Indigenous science and knowledge isn't always an easy thing! Nevertheless, the Canadian Forest Service (CFS) has chosen to meet the challenge by daring to do forest science research differently. For the past year, CFS has been working on integrating a collaborative approach based on scientific and Indigenous knowledge co-creation into its practices.**

The Laurentian Forestry Centre (LFC) is one of six research centres in CFS whose work focusses mainly on research related to forested land. LFC intends to integrate collaboration with Indigenous communities into its practices as more than 70% of Indigenous people in Canada live in or near forests and have knowledge spanning generations about their traditional lands.

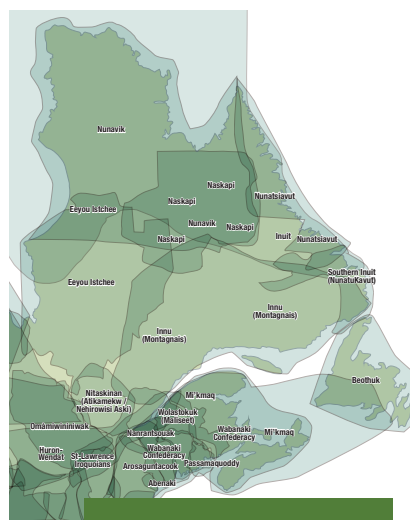
## A collaborative research approach

In partnership with the Chair of Educational Leadership in Indigenous Forestry at Laval University, LFC has undertaken a process that identifies best practices in conducting collaborative research with Indigenous peoples in Canada.

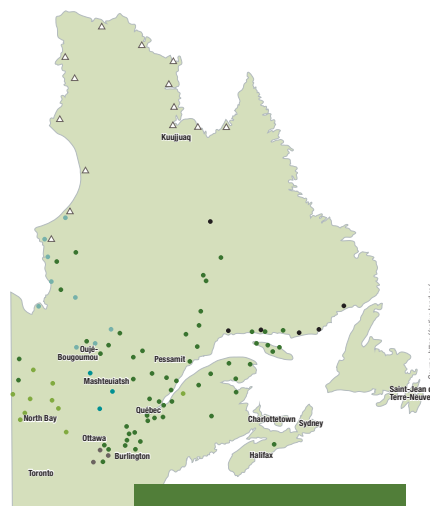
As a result of workshops with researchers and members of the Pessamit First Nation, the participants expressed a preference to collaborate through knowledge co-creation. This method involves active participation by collaborators at all stages of the research process, from project conception to publication of the results.

Workshop participants then compared the maps locating the traditional and claimed territories of the Indigenous peoples in Quebec with the study sites

operated by LFC researchers. This workshop showed that the activities of the research teams took place in traditional and claimed territories.



Traditional and Claimed Indigenous Territories. These boundaries do not totally correspond to those officially recognized by the Government of Canada.



Experimental sites of LFC and Quebec's Indigenous communities.



## A practical guide

Following the workshops, LFC proposed tools and practices that its scientific teams can use for collaborative research with Indigenous communities, based on ethical principles. This information was published in a report to guide the researchers in the process of co-creating knowledge with the participation of Indigenous communities, titled: *Initiative for Knowledge Co-creation in Collaboration With Indigenous Communities. Basic approach: Ethics of research.*

This report examines various aspects of research processes, including first contact with the communities; formulating the research questions; identifying research objectives; collecting and analyzing data; and publishing results. Guidance on these aspects is in accordance with the principles of ownership, control, access, and possession (OCAP) and in accordance with the research protocols produced by various Indigenous organizations. The guide presents

both the importance of knowledge co-creation for the Indigenous communities and the shared benefits for both groups.

This practical guide on knowledge co-creation will facilitate the implementation of more exhaustive and more inclusive new projects. Be curious, read these guides and learn – Canadian forests can only benefit!



The guide and summary sheet presents the different aspects to consider when establishing a collaborative research project based on the principles of knowledge co-creation between researchers and Indigenous communities.

### A successful method

Several projects have already benefited from this innovative approach of knowledge co-creation. One such project involves woodland caribou habitat. Following an initial visit to the forest on their **Nitassinan** (traditional land), the Pessamit First Nation welcomed an LFC research team for a discussion to establish first contact and identify areas of common interests. During this first visit, issues of common interest were discussed.

This exchange of knowledge made it possible to jointly conceive of a project analyzing woodland caribou habitat. The project was adapted to take into account the Pessamit community's empirical knowledge of how the woodland caribou use the land in different seasons. In this way, the community's participation and their knowledge made it possible to meet the research objectives and facilitate the project's implementation.

For the Pessamit community, this is a new approach. They can see that the researchers want to learn more

and are taking the time to understand the community's interests and needs in terms of research on the land. The Pessamit stakeholders say that the work is being done collaboratively and that they are truly participating in the research. As a result of working together to build the relationship, the community sees that their expertise and their knowledge are being taken seriously and are valued!





# BudCam: A network of collaboration

In this project, a national monitoring network that follows climate change effects on the timing of black spruce budburst – when the first leaves appear at the beginning of the season – thanks to collaboration with Indigenous communities. As part of this project, artificial intelligence is used to automate the detection of open black spruce buds in thousands of photos taken at regular intervals, allowing researchers to study the influence of the climate change on budburst phenology of this tree species. The BudCam project researchers plan to develop additional national indicators of climate change with Indigenous communities using knowledge co-creation.

## What does the Pessamit community think about the BudCam Project?

“There is impact for both the Pessamit and the LFC research teams. We’re exchanging knowledge about the land, and we’re creating new knowledge. Other exchanges are also taking place! For example, we’re sharing equipment and materials that we’re using for our own projects. It’s important to remember that this can also lead to other joint projects.” – Pessamit Innu Council, Land and Resources Sector

To learn more, visit the BudCam project website  
<https://apps-scf-cfs.nrcan.gc.ca/budcam/en/index>.



This camera takes photos at regular intervals to monitor black spruce budburst phenology, detected by artificial intelligence.



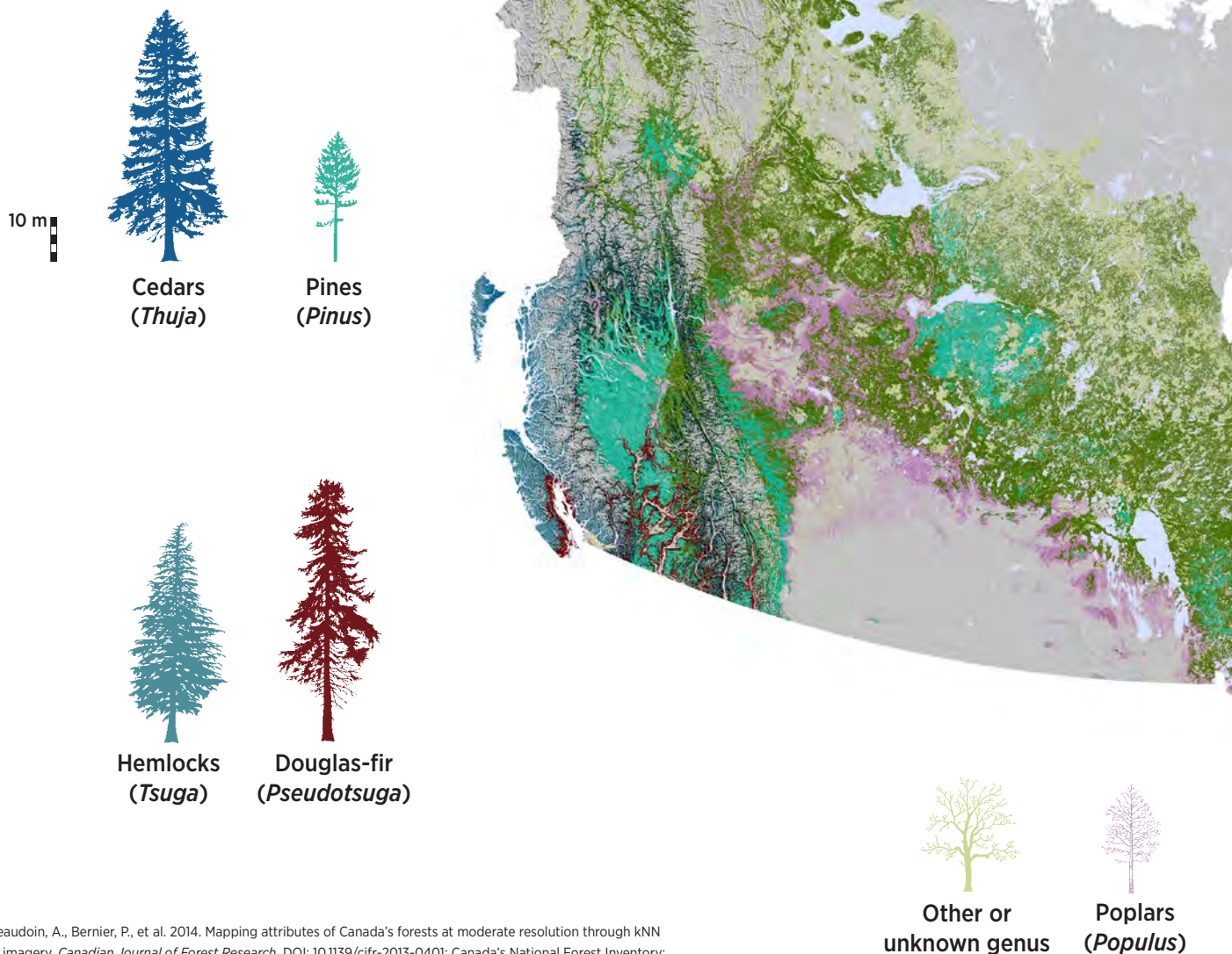
Open black spruce buds detected by the artificial intelligence model.



# Forest composition across Canada

Canada's forests contain many tree species. Grouping species according to genus makes it easier to see where trees of different types are dominant.

For example, moving northward from Canada's most densely populated areas in Ontario and Quebec, one passes first through maple-dominated forests, then through birch, and on into the spruces (including black spruce, white spruce and others) that dominate the boreal zone, a broad sweep of land from Yukon to Newfoundland and Labrador.



**Sources:** Beaudoin, A., Bernier, P., et al. 2014. Mapping attributes of Canada's forests at moderate resolution through kNN and MODIS imagery. *Canadian Journal of Forest Research*. DOI: 10.1139/cjfr-2013-0401; Canada's National Forest Inventory; Silhouettes reproduced from *Trees in Canada* by J.L. Farrar, 1995.

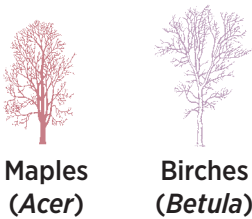
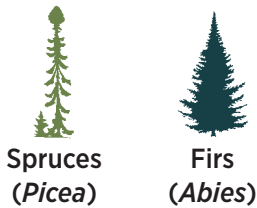




The forests around Canada's prairies are dominated by poplars (including trembling aspen and balsam poplar), but these species can also be found almost anywhere in Canada. Pines, too, are common throughout Canada, but are especially dominant in areas where forest fires have occurred frequently.

The West Coast is dominated by forests of hemlocks, cedars and Douglas-firs, whereas the forests of the East Coast are heavily mixed and species rich.

Faded colours on the map represent less densely forested areas. A silhouette is shown for one species of each genus, to represent that genus and provide an indication of the shape and size of trees found in different parts of Canada.







# HOW MUCH FOREST DOES CANADA HAVE?





**With over 347 million hectares (ha) of forest, Canada has 9% of the world's forests. Forests dominate many Canadian landscapes, but cover only 38% of Canada's land area. The forest area of Canada is stable, with less than half of 1% deforested since 1990. Although 77% of Canada's forests are found in the boreal zone, 37% of Canada's wood volume is found in our temperate forests.**

### What is a forest, exactly?

Forests are defined by the Food and Agriculture Organization of the United Nations as *land spanning more than 0.5 ha with trees higher than 5 metres and a canopy cover of more than 10% or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.*

Canada's 347 million ha of forest includes treed lands, but also temporarily non-treed areas, such as recently harvested areas and recently burned areas that will regrow.

Forest management areas include forest lands, but also non-forest and inland water areas within the management unit's boundaries. Some statistical reporting, such as the area of certified forest, refers to forest management area, rather than the forest area.

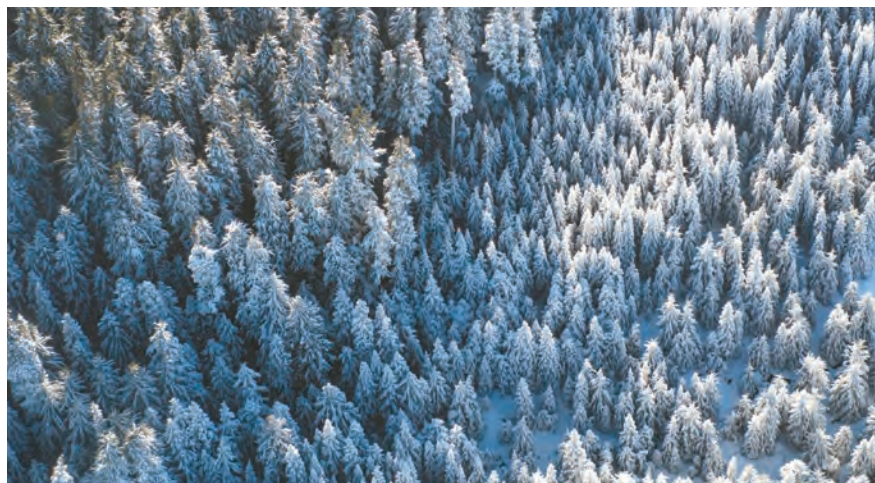
### What is deforestation?

Deforestation is when forest land is permanently cleared to make way for a new, non-forest land use.

### Trees outside of forests

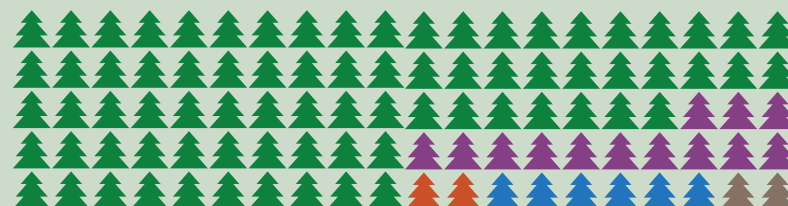
Forests dominate many Canadian landscapes, but trees are also an important feature of non-forest


landscapes. Wind rows and riparian woodlands (wooded areas around the edges of water bodies) are valued agricultural landscape features and provide habitat for a diversity of plant and animal species. Urban forests provide many environmental services to Canadians. It is estimated that Canada has more than 50 million ha of trees found outside of forests.




## Who owns Canada's forests?

**Over 90%** of Canada's forests are found on publicly owned land, including:





 **77%** on provincial Crown land

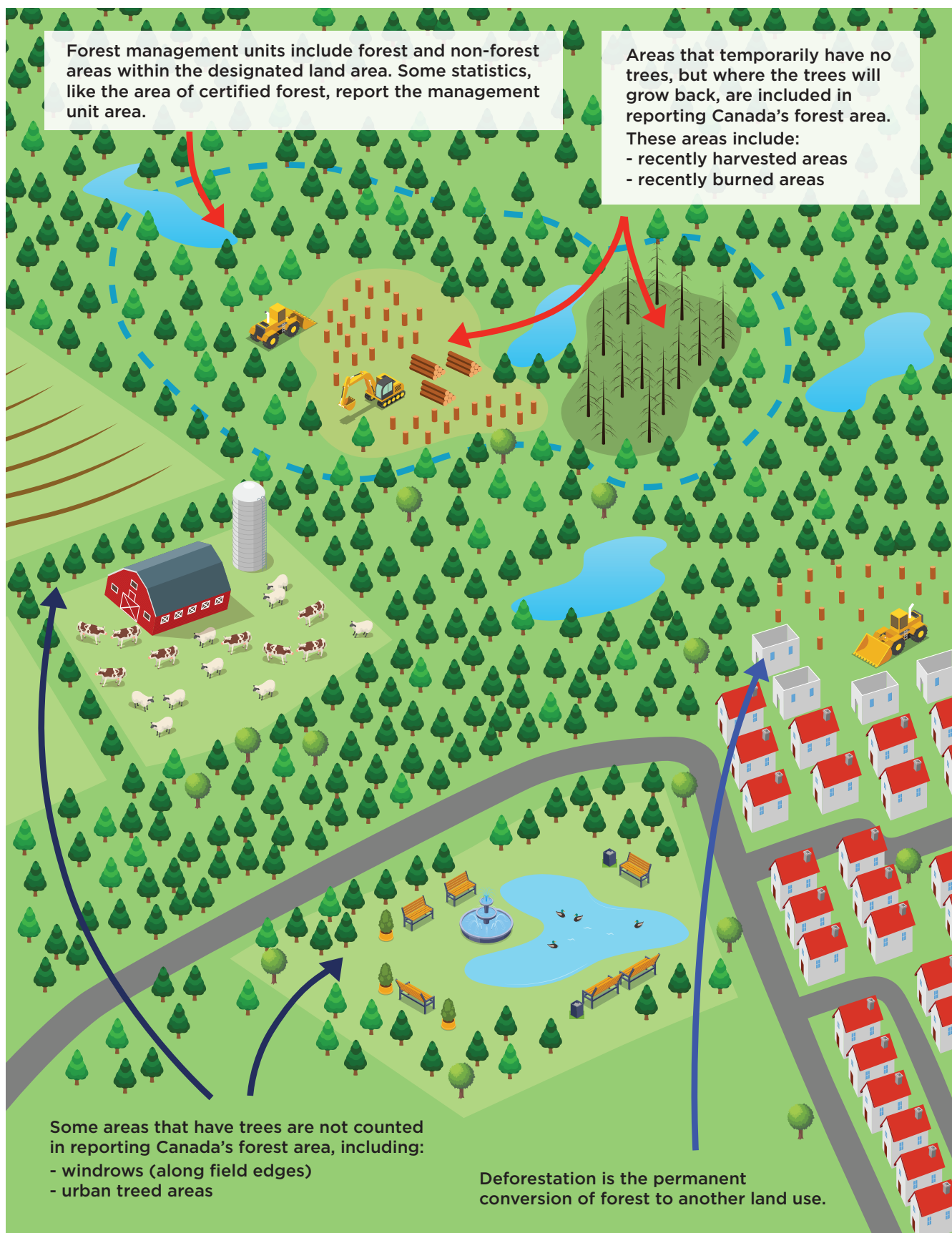
 **13%** on territorial Crown land

 almost **2%** on federal Crown land

The remaining forest area is:

 privately owned (just over 6%)

 Indigenous-owned (about 2%)



## 18 THE STATE OF CANADA'S FORESTS

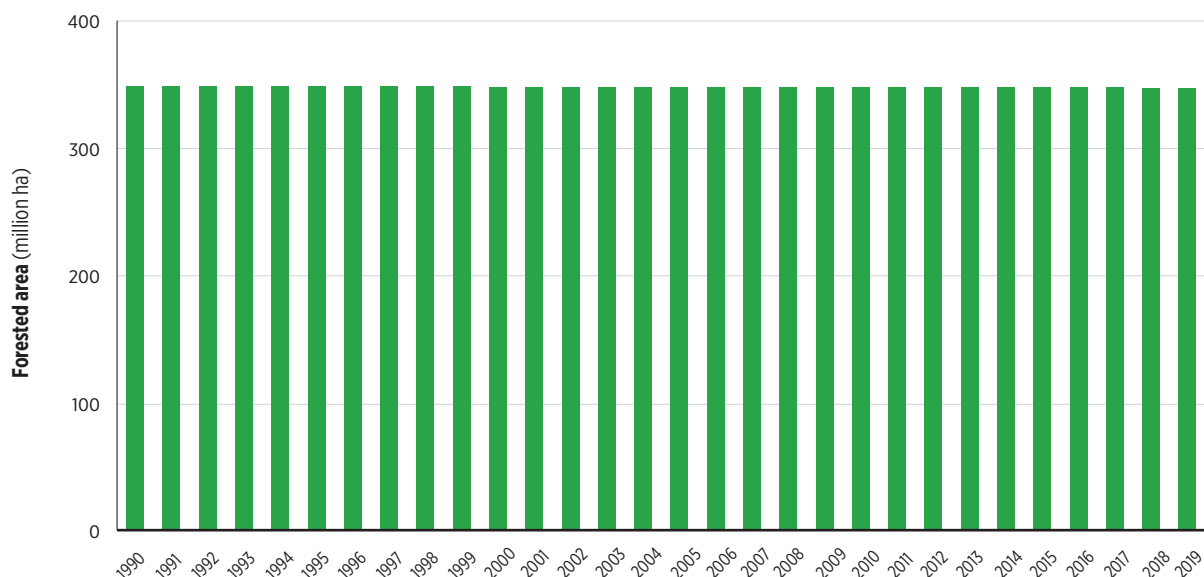




## Forest area

Canada has 347 million hectares (ha) of forest. Forest area in Canada is stable, with very few areas deforested or afforested. Since 1990, less than half of 1% of Canada's forest lands have been converted to a non-forest land use.

### Canada's estimated forest area, 1990–2019



### Why is this indicator important?

- Forest area is a basic sustainability indicator and is important to monitor closely, particularly in regions where forest area is being lost.
- Changes in forest area can affect resource availability, biodiversity and environmental services.
- Data presented here are based on Canada's National Forest Inventory (2005 base year), and adjusted annually for estimated forest area lost (deforestation) and gained (afforestation). See the indicator **Deforestation and afforestation** for more information.

Forests dominate the Canadian landscape in some ecozones but are a rare sight in others. For example, the Atlantic maritime ecozone is 81% forested, whereas the mixedwood plains ecozone is only 19% forested, and the prairie ecozone is less than 1% forested. Overall, forests cover 38% of Canada's land area.

### What is the outlook?

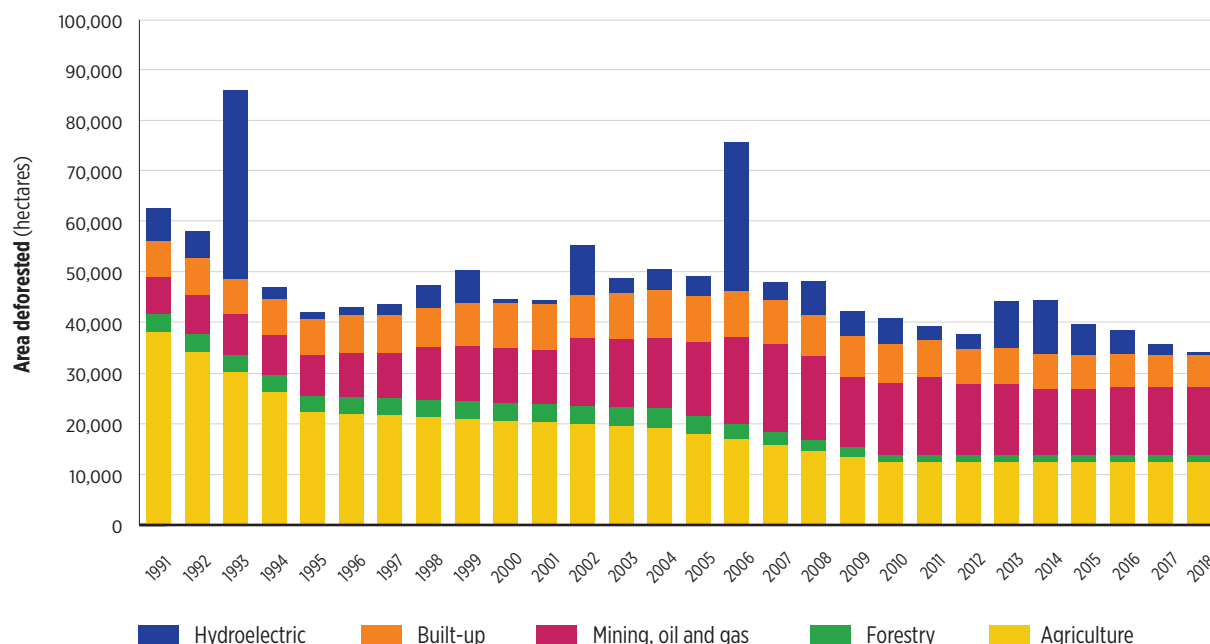
- Deforestation and afforestation rates are both likely to remain low.
- Natural changes in forest area are thought to occur gradually, but climate change may cause accelerated forest change, including expansions in some areas and losses in others.



## Deforestation and afforestation

Since 1990, Canada's low annual deforestation rate has declined even further, dropping from 64,000 hectares (ha) per year to about 34,300 ha per year in 2018.

### Estimated area (hectares) of annual deforestation in Canada, by industrial sector, 1991–2018



- Between 1990 and 2018, less than half of 1% of Canada's total forest area was converted to other land uses.
- Forests flooded during hydroelectric reservoir development produces large annual spikes in deforestation, as seen in 1993 and 2006.
- Conversion of forest to agricultural and hydroelectric land uses has declined in recent years.
- While the annual area of afforestation is very small relative to the total forest area of Canada, efforts are underway to increase capacity to track the amount of afforestation occurring under urban and rural planting initiatives.

#### Why is this indicator important?

- Forest loss affects biodiversity, soil, air and water quality, and wildlife habitat. Forests also store more carbon than other terrestrial ecosystem types and can be managed to mitigate climate change.

The National Deforestation Monitoring System (NDMS) tracks land use changes from forest to other land uses, such as agriculture or urban development, in Canada. Deforestation does not include areas of forest harvest.

#### What is the outlook?

- Canada's overall deforestation rate is expected to decline further over time.
- The dominant industrial sectors contributing to deforestation are agriculture; and mining, oil and gas. These conversions from forest are small relative to the size of Canada's forests.
- Ongoing and planned urban and rural planting initiatives are expected to increase the area afforested in coming years, as the contribution of this activity to restoring ecosystem services, including climate mitigation, is increasingly recognized.

**Source:** Canada's National Deforestation Monitoring System (NDMS); Dyk, A., Leckie, D., et al. 2015. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).





## Wood volume

Canada's forests contain an estimated 45 billion cubic metres of wood. Highly precise inventories of wood volume exist for forests that contribute to timber supply, where it is important to determine sustainable harvest levels. It is also important to monitor general trends in wood volume in all forests for scientific activities such as predicting fire behaviour and carbon accounting. Foresters who undertake forest inventories use a combination of on-the-ground monitoring; monitoring from aircraft with high-precision digital imagery and laser technologies; and monitoring from earth orbiting satellites to collect their data.

### Estimated wood volume (million cubic metres) in Canada

Year	1990	1995	2000	2005	2010	2015	2016	2017	2018
Wood volume	47,709	47,652	47,320	45,982	45,507	45,148	45,069	44,897	44,648

- The change in Canadian forest wood volume is the difference between gains from tree growth and losses from tree harvesting and natural mortality.
- Volume losses exceeded volume gains between 1990 and the present because of many factors, especially forest fires and insect outbreaks. 2017 and 2018 were the two worst fire years on record in British Columbia.

### Why is this indicator important?

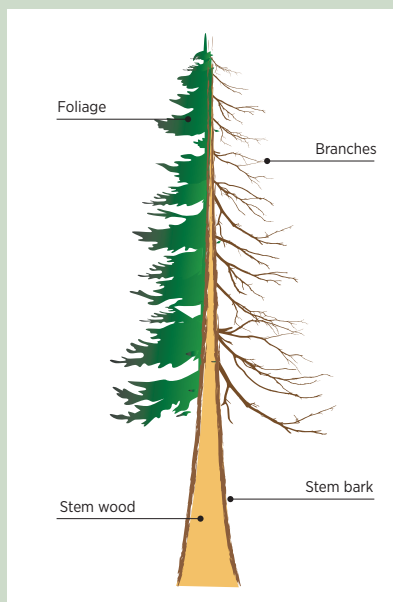
- Forest wood volume trends are a basic sustainability indicator.
- Wood volume is used along with other information to calculate forest biomass and determine how much carbon is stored in the living trees of Canada's forests.

### What is the outlook?

- Climate change is affecting wood volume trends by influencing tree growth rates, forest fire behaviour and a myriad of other factors. The overall outcome is difficult to predict, but continued wood volume decline is possible.

### What is wood volume?

Foresters may be interested in **total wood volume** or **merchantable wood volume**. **Merchantable wood volume** includes the stem wood of trees of merchantable size, from the top of the stump up to the minimum top diameter. Merchantable size limits, stump heights and top diameters vary depending on the jurisdiction and planned wood use. This indicator reports on **total wood volume**, which includes the stem wood of trees of all sizes, including the stump and top.





# IS TIMBER BEING HARVESTED SUSTAINABLY?





**Forest management in Canada is based on the principles of sustainable forest management, which support the production of ecosystem services while maintaining the health and diversity of forests. In 2018, the harvested area represented 0.2% of the total area of forest land.**

#### **The majority of Canadian forests are owned by regional governments**

Approximately 90% of Canadian forests are located on provincial or territorial public lands. Those governments are responsible for forest management. Although rules, regulations and policies that guide forest management vary from one province and territory to another, they are all based on the principle of sustainable forest management. For example, sustainable management is at the heart of the *Sustainable Forest Development Act* of Quebec.

#### **Harvesting rates take into account the growth of the forest**

The forest management process involves conducting resource inventories. Data

produced through these inventories provide information about the composition of tree species in forests, their age, and their structure, and allow planners to calculate the volume of wood that can be harvested sustainably. High-tech tools, such as satellite remote sensing or airborne laser (LIDAR), now contribute to forest inventories in Canada.

#### **Forest management plans outline management objectives and strategies**

Forest management plans describe planned forest activities for specific time periods and areas. For each region, they are prepared by governments, forest companies and other forestry stakeholders, in accordance with the laws, rules and policies of that place.

The process of creating management plans takes into account the interests and concerns of First Nations and of organizations and individuals affected by forest management on public lands. Public consultations are part of the planning process.

#### **Regeneration after harvesting is a key element of sustainable forest management**

The forestry regimes across Canada require regeneration of forests, either through natural or artificial means. The success of regeneration is assessed by using criteria that describe species composition, density, and stocking of free-to-grow stems after a specified number of years following harvesting.

Natural regeneration is often the most economical method of re-establishing forest tree species after harvesting. However, its success depends on the availability of seeds and propagules on sites and on past disturbances.

Artificial regeneration requires investments in seed collection, seedling production and planting. Nevertheless, it results in productivity gains thanks to tree breeding programs. Planting trees makes it possible to control the composition of regeneration and, therefore, offers an opportunity to adapt Canadian forests in response to global change.



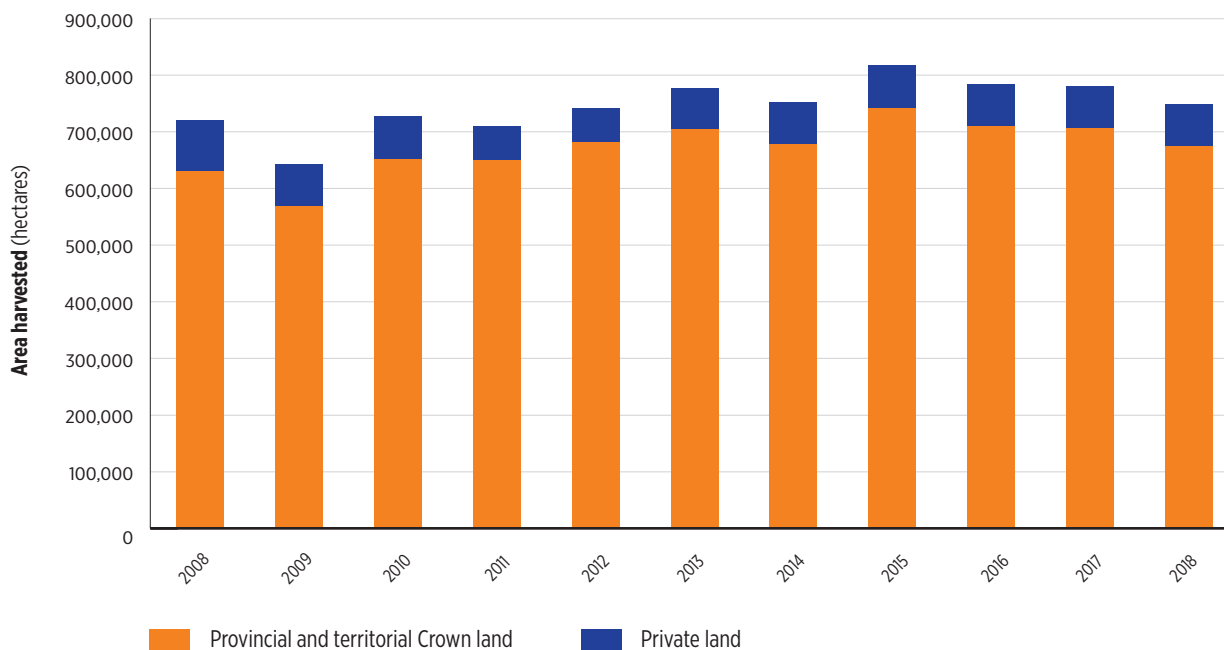
Across Canada, over 440 million seedlings were planted in 2018.



## Forest area harvested

Monitoring the area of forest harvested each year ensures that the level of industrial activity in Canada's forests is sustainable over the long term. In 2018, an estimated 748,000 hectares (ha) of forest were harvested. This is a 3.9% decrease from 2017 levels, when 778,000 ha were harvested, and well below the average area harvested each year during the peak period of 1995 to 2005 (1 million ha).

### Forest area harvested on private and Crown lands in Canada, 2008–2018



- The decline is largely due to a decrease in the area of provincial Crown forests harvested in British Columbia as forestry operations throughout the province were curtailed because of severe wildfires.

#### Why is this indicator important?

- Commercial timber harvesting is one of several indicators of the level of industrial activity in the forest sector.
- Harvesting of provincial Crown forests, the source of most commercial timber, is regulated to provide a sustainable level of timber for industrial use.

The area of forests harvested each year is less than half of 1% of Canada's 347 million ha of forest land, significantly smaller than the areas affected by insects and burned by fires each year.

#### What is the outlook?

- The area harvested each year will vary as forest managers adjust their management objectives in response to natural disturbances such as pests and forest fires and as the demand for Canadian forest products changes.

- Overall, demand for Canadian forest products was expected to remain strong in 2020, however, the COVID-19 pandemic has created some market uncertainty. Demand for Canadian forest products will depend on how quickly North American and global economies recover following the COVID-19 pandemic.

Source: National Forestry Database. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).

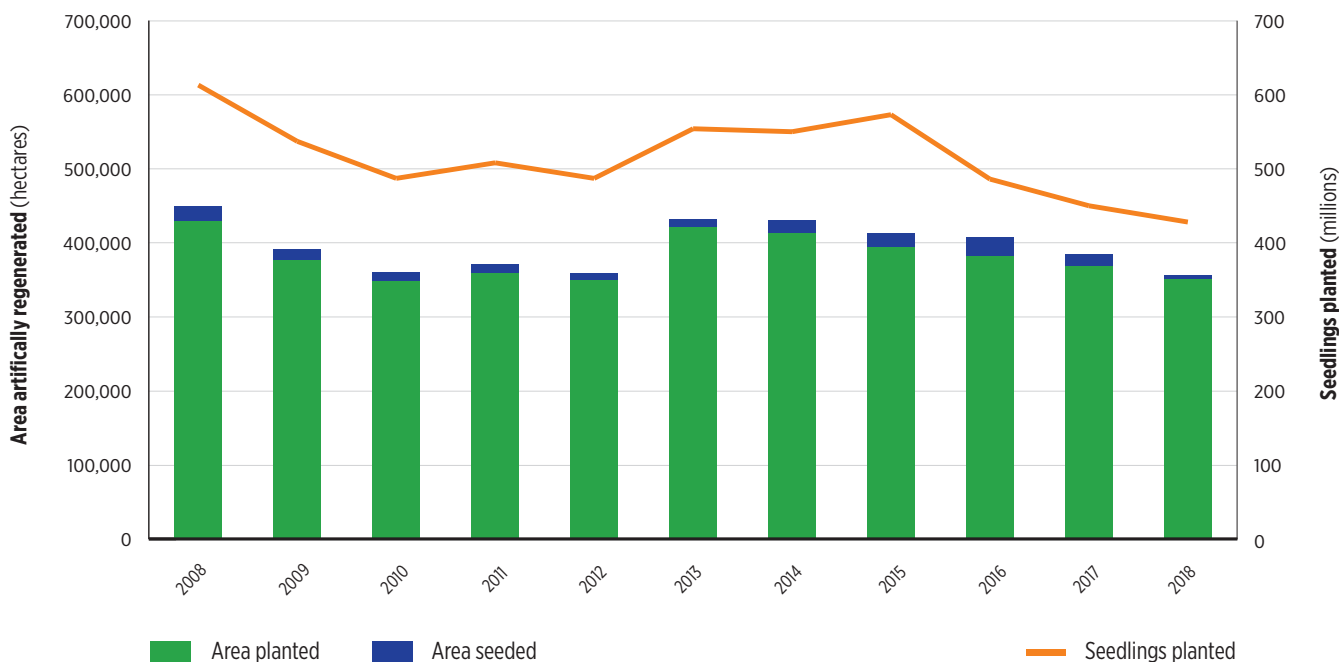




## Forest regeneration

In 2018, at least 427 million seedlings were planted on 350,000 hectares (ha) of provincial forest lands in Canada. An additional 6,000 ha of forest were established by seeding.

### Area artificially regenerated and number of seedlings planted on provincial and territorial Crown lands in Canada, 2008–2018



- In 2018, the area artificially regenerated declined by 8%, and the number of seedlings planted declined by 5%.
- Declines are likely related to the gradual decline in area harvested starting in 2015; mostly in British Columbia.

#### Why is this indicator important?

- Regeneration activities ensure that harvested areas regrow as forests and continue to produce timber and maintain ecosystem services, such as storing carbon, regulating water quality and providing habitat.
- The method used for regenerating forests can influence forest composition over time.

Successful regeneration is required following forest harvesting on public lands.

Forest type, silviculture system and the required composition of the new forest determine the regeneration method (natural or artificial).

Artificial regeneration – planting or seeding – has been applied to about 55% of the area harvested in the past 20 years.

#### What is the outlook?

- Regeneration is required on all Crown lands in Canada, so virtually all harvested lands will continue to be regenerated.

- The area regenerated annually is most strongly related to recent harvest levels. These levels are influenced by markets for wood products but are always within the bounds of sustainable forest management.
- The allowable harvest in British Columbia is projected to continually decline until stabilizing in 2025, mostly because of mortality from the mountain pine beetle epidemic. As a result, renewal rates are likely to follow a similar trend. As the largest Canadian forestry jurisdiction, a decline in British Columbia renewal rates will have a corresponding impact on the national totals.

Source: National Forestry Database. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).



## Genomics helps Canada's forests adapt to the future

### Scientists predict rapid and widespread climate change across Canada

Canada's forests provide important ecological services, economic resources and social benefits. They also play a key role in the global carbon cycle. However, scientists predict that increasing temperatures and changes in weather patterns associated with climate change will drastically affect Canada's forests in the near future. With the rate of projected climate change expected to be 10 to 100 times faster than the ability of forests adapt naturally, Canada's trees are benefitting from a helping hand.

#### Using natural variation to strengthen future forests

Across Canada, researchers are using cutting-edge science – genomics – to help prepare Canada's forests for the upcoming challenges. Genomics uses the fact that individual trees within the same species can have key differences in their genomes. Some tree populations of the same species from warm places can grow longer and faster than tree populations from colder places, but might be less cold hardy. The same species of tree in other areas may have adapted to different soil moisture conditions.

Populations of a tree species that grow at different altitudes can be as genetically different as populations growing hundreds of kilometres apart.

#### What is genomics?

Genomics is the science that aims to decipher and understand the entire genetic information of an organism (i.e. plants, animals, humans, viruses and microorganisms) encoded in DNA.

#### Reducing the time between generations

The limiting factor in conventional tree breeding programs is time. Historically, scientists have had to wait until offspring trees started to exhibit desired traits outwardly before scientists could know which performed the best. For some beneficial traits (such as wood attributes) in Canadian conifer species, this can take up to 30 years.

Recent breakthroughs in the science of genomics, notably with the FastTRAC project, could lead to dramatically faster and better decision making. Scientists across Canada are now using computers to compare the DNA of millions of trees, then identifying genetic markers associated with insect and drought resistance, nutrient use efficiency, productivity, and wood quality. Identifying these genetic markers means that scientists already know which parent trees will produce the best offspring without needing to wait for the offspring to express a particular trait. Finding the best offspring previously took many decades, but with genomic selection, the time needed to complete the same work is significantly reduced.

### Duration of breeding cycle

#### Genomic selection



#### Conventional breeding



Genomic selection is already starting to be used in operational tree breeding programs, such as those developed through the [FastTRAC](#) project. In these programs, researchers first identify the best parent trees based on characteristics such as growth rate and disease resistance. Offspring from these trees are then subjected to genetic trials in test plantations and exposed to natural conditions including extreme events such as drought or late frost during the spring. The parent trees that produced the most resistant offspring are the ones with the best genetic type for that particular set of conditions – the ones that will be selected to create the next generation of trees.





## Adapting to changing tree ranges

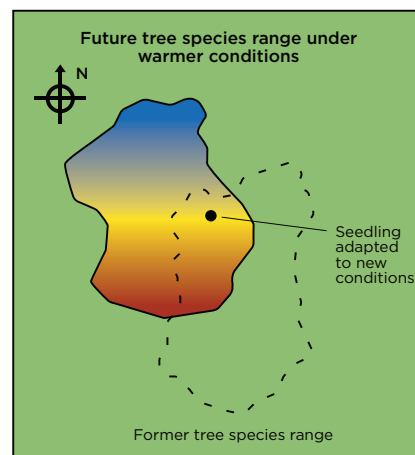
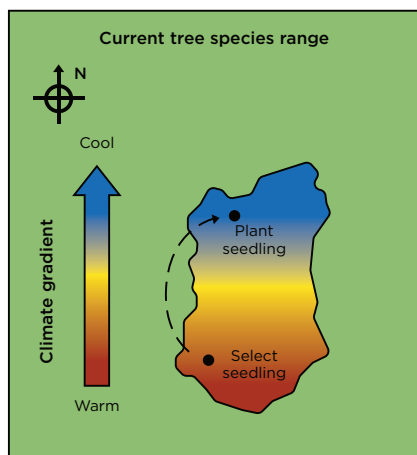
Genomics also gives trees a better chance to thrive in changing environments. For example, conditions in the northern portion of a tree species' range might be colder or drier than in the southern portion of the range. However, as temperatures in the north increase, the local trees may struggle to adapt to the new conditions.

Traditionally, foresters have used local tree seed for planting seedlings, as local populations were generally thought to be best adapted to the climate conditions of the site. However, with a rapidly changing climate, these local populations may not be able to adapt quickly enough, and while well-established adult trees can often withstand increased stress, seedlings are highly vulnerable. If forest managers know which seeds and seedlings from the southern portion of the range would thrive in the changing northern conditions, they can strategically select the hardiest and best-adapted for planting.

## Building a library of resources to manage for the future

Enter the researchers at the [CoAdapTree](#) project, who are providing insight to the forest managers by growing, testing,

## Selecting and planting seedlings for changing conditions



With a rapidly changing climate, local populations of trees may not be able to adapt quickly enough to remain healthy. Forest managers can help by strategically selecting the seedlings from one part of a tree species' range and planting them where they will be better adapted to new environmental conditions.

and sampling over 10,000 seedlings and trees and reading their genomes. The researchers can then look at the genomes and recommend which seeds and seedlings forest managers should plant to match both the current and projected local climate conditions of a species' range.

CoAdapTree is just one of several Canadian projects focusing on using micro-scale solutions to macro-scale challenges. For example, the Spruce-Up project is focused on decoding the genomes and identifying natural genetic variations within existing spruce tree populations for drought, insect resistance

and fibre quality. The research team will then create algorithms and other tools for forest managers to use when selecting the best growing stock. Similarly, the [RES-FOR](#) research team also uses genomics to help inform forest management, by creating mathematical models and an interactive website for forest managers.

These three projects are the result of joint efforts by university and government research teams, supported by Genome Canada.

With about 260 million spruce seedlings planted per year, spruces are the most reforested trees in Canada.



## Forests of the 21st century

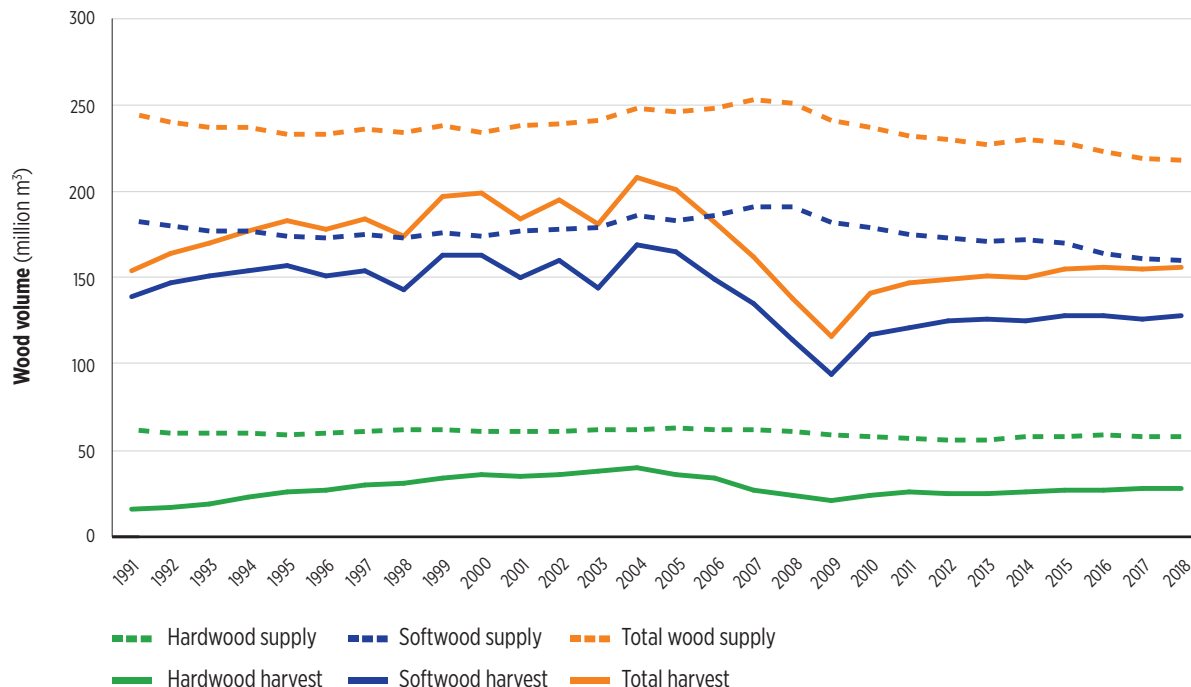
Advances in tree genomics are now making it possible to not only strengthen existing tree populations but also prepare Canada's trees for new environments. As forest health is of fundamental importance in the fight against climate change, these innovative researchers are ensuring that Canada's forests are resilient in the face of change.



## Volume harvested relative to the sustainable wood supply

In 2018, Canada harvested 156.2 million cubic metres (m<sup>3</sup>) of industrial roundwood, well below the estimated sustainable wood supply level of 217.9 million m<sup>3</sup>.

### Annual harvest versus supply deemed sustainable for harvest, 1991–2018



- This is an increase of 2.0 million m<sup>3</sup> from 2017 levels, when 154.2 million m<sup>3</sup> of industrial roundwood was harvested. At the same time, the estimated wood supply deemed to be sustainable declined by 1.4 million m<sup>3</sup>.
- Because the sustainable wood supply declined as harvest increased, the gap between them narrowed compared to 2017.
- The increase in harvest is attributable to a large increase in the volume of softwood timber harvested in British Columbia offset by smaller declines in Ontario and Alberta.

**Sustainable wood supply** refers to the volume of timber that can be harvested annually from federal, provincial, territorial and private lands while meeting environmental, economic and social objectives.

#### Why is this indicator important?

- Forest managers track the volume of industrial roundwood harvested each year to ensure it falls within sustainable levels.

- Harvests from provincial Crown lands are regulated by allowable annual cuts (AAC). Although there is no AAC calculation for Canada as a whole, it is possible to compare the combined provincial AACs with the combined harvest totals from the same provincial Crown land base.

#### What is the outlook?

- Harvest levels are expected to remain below the sustainable wood supply, given the strong provincial and territorial regulatory regimes in place.
- Sustainable wood supply will continue to decline over the next several years as AACs in British Columbia are reduced in response to the impact of the mountain pine beetle and severe wildfires, further narrowing the gap between harvest and wood supply.

Source: National Forestry Database. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).



## Forest area with long-term management plans

Of Canada's 347 million hectares (ha) of forest land, more than 200 million ha are managed with a long-term management plan of 10 years or longer. This is an increase of 8% since 1990.

### Forest area with long-term management plans (thousands of hectares) in Canada

Year	1990	2000	2010	2015	2016
Forest area	185,013	188,103	187,844	188,656	200,086

- In Canada, a **managed forest** is often considered to include only areas managed for timber production. However, to align with the United Nations' Sustainable Development Goals, this indicator also includes forest lands managed in protected areas.
- Forest areas without a long-term management plan may include areas with short-term management plans, private land, or public land with no planned forest harvesting or operations.

- Management plans help ensure that public forests are managed sustainably. The development of the plan follows a strict process.
- Input from industry, government agencies, First Nations, the public and other stakeholders is most often required.

### Why is this indicator important?

- In Canada, forest management planning is one of the primary tools used to ensure that the country's publicly owned forests remain healthy and vibrant and are managed sustainably.
- Key to this approach is that public lands managed for forestry must, by law, have a forest management plan approved by the government before harvesting can take place. As well, parks and protected areas must have a government-approved management plan to guide conservation.
- Public participation fosters a planning process that is transparent and gives Canadians real influence in decision making.



Forest areas with long-term management plans include protected areas, like national parks.

### What is the outlook?

- The forest area covered by a long-term management plan is expected to remain stable or increase slightly in the near future.
- Some increases may occur as plans are developed for new areas, including areas managed by Indigenous peoples, or as plans are developed for new parks and protected areas.



# HOW DOES DISTURBANCE SHAPE CANADA'S FORESTS?





**Annually, insects, diseases, wildfires and drought affect more than 18 million hectares of forests in Canada. By killing trees, natural disturbances increase light penetration and disturb the soil to varying degrees, depending on the type of disturbance and its severity. These changes in turn allow new trees to sprout, grow and start a new forest succession – how whole forests grow back.**

Succession shapes landscapes by producing various types of forests, with trees of different ages and species that contribute to biodiversity. By killing trees, natural disturbances help cycle nutrients and also provide habitat for numerous insects, birds and animals that feed on, or live in, dead wood. Natural disturbances generate a patchwork of different kinds of forests across Canada.

#### **Natural disturbances from abiotic and biotic causes**

Natural disturbances can be caused by abiotic factors (i.e. the non-living components of the environment, such as temperature, water or wind) or biotic factors (i.e. the living parts of ecosystems, such as insects, fungi or bacteria). Abiotic disturbances are caused by natural forces such as wind, water or fire. Biotic disturbances are caused by high populations of an organism, such as spruce budworm or mountain pine beetle. Abiotic and biotic disturbances have different characteristics.

Abiotic disturbances	Biotic disturbances
<ul style="list-style-type: none"> <li>are caused by extreme weather conditions and are nearly impossible to predict</li> </ul>	<ul style="list-style-type: none"> <li>can be predicted through efficient monitoring</li> </ul>
<ul style="list-style-type: none"> <li>last only a few hours or days and kill most trees during this time</li> </ul>	<ul style="list-style-type: none"> <li>may last a decade, so trees take several years to die</li> </ul>
<ul style="list-style-type: none"> <li>kill healthy trees</li> </ul>	<ul style="list-style-type: none"> <li>kill weak trees because they are weakened over several years before death</li> </ul>
<ul style="list-style-type: none"> <li>affect all, or nearly all, tree species</li> </ul>	<ul style="list-style-type: none"> <li>usually affect a limited number of treespecies</li> </ul>
<ul style="list-style-type: none"> <li>physically disturb soils</li> </ul>	<ul style="list-style-type: none"> <li>do not physically disturb soils, but insect outbreaks may enhance soil nutrient cycling through caterpillar feces</li> </ul>

#### **Natural disturbances and biodiversity**

Contrary to popular belief, burned forests are not deserts for biodiversity. For example, during the weeks or months following a wildfire:

- Blueberries and morel mushrooms rapidly colonize burned forests, while other plants, such as jack pine, only regenerate in soils burned by wildfire.
- The number of insect species found in recently burned forests is double the number found in unburned forests.
- Smoke attracts many insects to burned forests, and several insect

species live in burned, but still-standing, trees called **snags**. These burn-associated insects are rarely found in green forests.

- Bark provides insulation against heat and, even in charred trees, the wood under the bark remains nutritious for many wood-eating insects following a fire. This feature is especially true in trees with thick bark or after fires of low-to-moderate intensity.
- In the boreal forest, after long-horned beetles colonize burned snags, there are sharp increases in the numbers of black-backed woodpeckers, which eat the beetles.



Whitespotted  
sawyer beetle



Black-backed  
woodpecker

In contrast, insect outbreaks do not cause such rapid changes at the stand level. Biodiversity remains similar to that found when insect populations were at an endemic level and in balance with their environment. For example, few long-horned beetles are found in trees killed by spruce budworm, compared to trees killed by fire. There are no specific “outbreak-associated” insects, whereas there are many “burn-associated” insects. However, biodiversity changes gradually as an outbreak progresses, such as for the mountain pine beetle or spruce budworm outbreaks, which have affected millions of hectares of forest over the past decade.

#### Natural disturbances and wood quality

Each kind of natural disturbance results in a unique group of insects colonizing the resulting dead trees. These are called **primary colonizing insects**, and they are the first insects that make the dead trees their home. And in turn, each kind of these primary colonizing insects affect the wood quality of the dead trees differently.

For example, following a wildfire, the white-spotted sawyer beetle digs deep holes into wood, which rapidly reduces the timber value of the tree for **salvage logging** – harvesting trees after a natural disturbance. In contrast, trees killed by spruce budworm are colonized by insects and fungi that cause a progressive decline in wood fiber quality.

Ecologically, snag colonization by insects and fungi enhances wood decomposition but economically, this decreases wood quality and value. Salvage logging plans need to be adapted to each type of disturbance to avoid stands severely affected by wood-colonizing insects. This adaptation helps to maximize benefits for the sector, but also ensures biodiversity conservation because these stands are considered of high conservation value for biodiversity.

Source: See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).

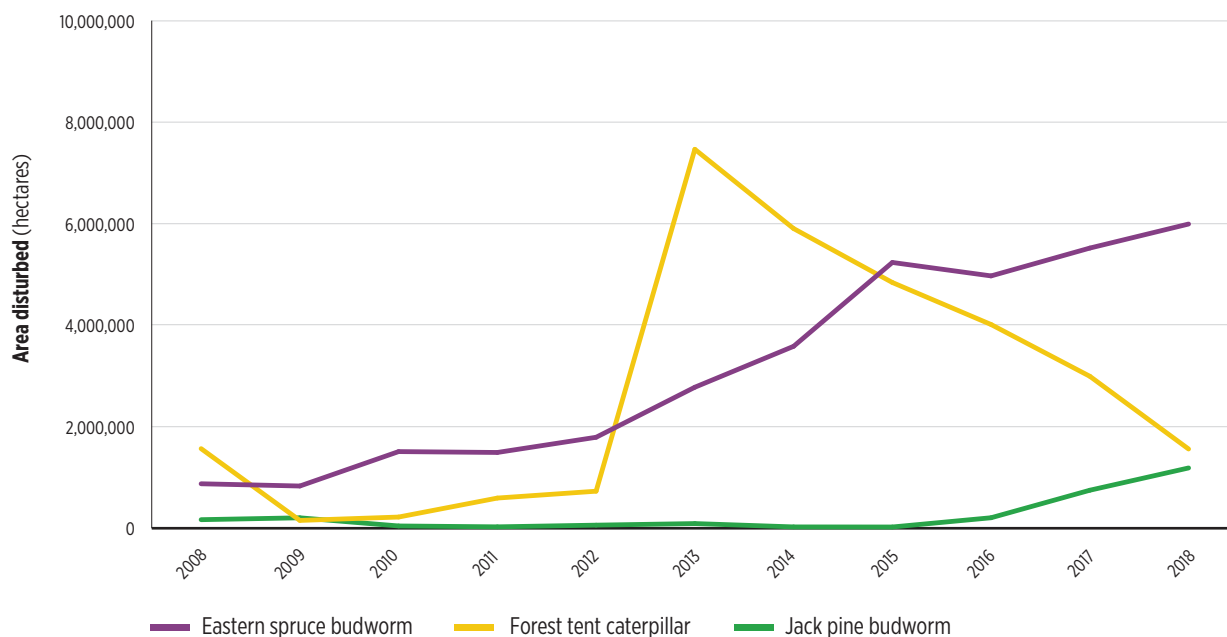




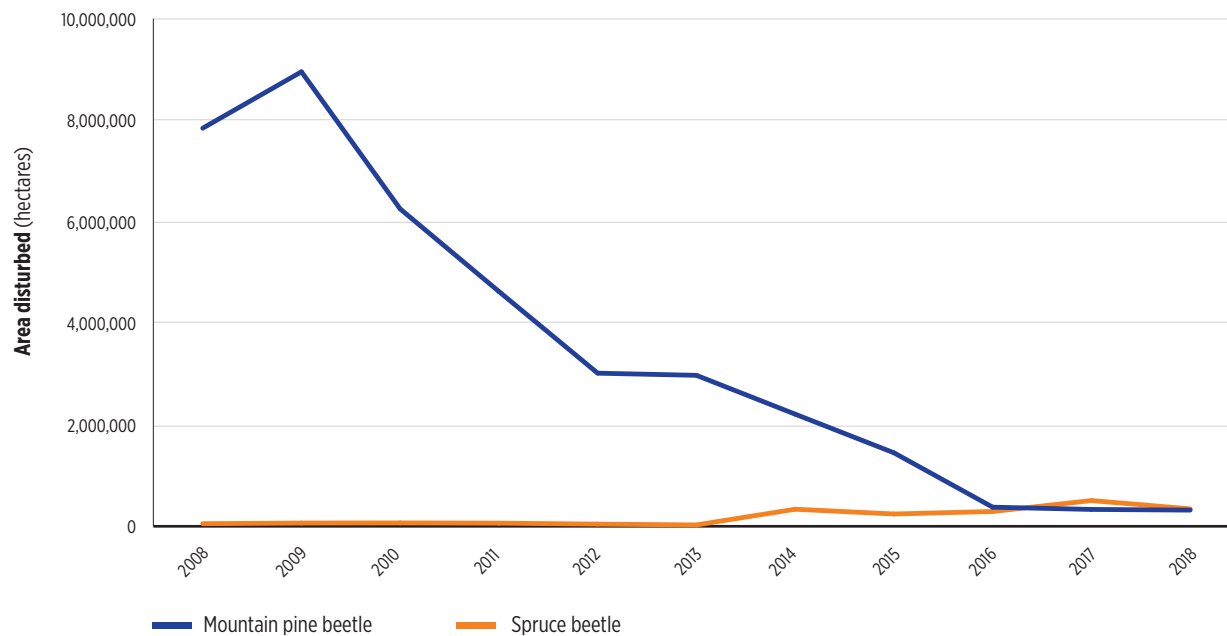
## Forest insects

In 2018, 16.9 million hectares (ha) of forests were affected by insects. This is a 3.5% increase over 2017.

### Forest area containing defoliated trees for three insects in Canada, 2008–2018



### Forest area containing beetle-killed trees for two insects in Canada, 2008–2018





- Forest pest insects kill trees by eating the tree's leaves or needles, or by feeding under the bark and so disrupting a tree's ability to transfer nutrients and water.
- Most trees can tolerate some insect damage, but years of repeated feeding can weaken or even kill trees. Tree mortality can also happen when many insects feed at the same time, during an "outbreak."
- Insect feeding and tree mortality can be detected from the air and used to measure changes in the population of insect pests.
- The area defoliated by spruce budworm continued to increase in Quebec, while Ontario and Manitoba experienced outbreaks of jack pine budworm. Budworms kill trees through years of repeated defoliation, but spruce budworm outbreaks are prolonged events, while jack pine budworm outbreaks are shorter, more frequent events.
- Forest tent caterpillar continued its decline across Canada. This species rarely kills trees but can impact the health of some hardwood species and is a nuisance when outbreaks occur near inhabited areas.

The indicator shows the area impacted by native forest insects. However, invasive alien insects also impacted forests in Canada in 2018. For example, the emerald ash borer expanded its range throughout the Maritimes and the hemlock woolly adelgid spread from the United States into Nova Scotia and Ontario.

- Spruce beetle is increasing in prevalence in western Canada, while mountain pine beetle continues to decline. Both species are bark beetles that can kill large numbers of trees very quickly.

#### Why is this indicator important?

- In Canada, forest insects can reduce timber supplies in all forests and affect carbon stocks in native forests. In urban forests, insects can impact ecosystem services and property values.

- Outbreaks of native insects are an expected and normal part of life in most Canadian forests. However, scientists predict that climate change could alter the location, frequency and intensity of outbreaks of native and invasive alien species, including species that have not been important defoliators in the past. Monitoring the changes in damage caused by all forest insects allows managers to predict impacts on overall forest health.

#### What is the outlook?

- Spruce beetle is killing significant volumes of spruce trees in regions that were previously impacted by mountain pine beetle, potentially exacerbating wood fibre supply issues in British Columbia.
- Outbreaks of jack pine budworm and spruce budworm are expected to increase across Canada, affecting significant areas of the boreal forest, including areas in northern Canada where outbreaks of budworms have rarely been seen.
- Invasive species will continue to threaten forests with the spread of emerald ash borer and hemlock woolly adelgid in the east.



Forest tent caterpillar

Source: National Forestry Database. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).





## Forest diseases

Diseases are caused by pathogens, primarily fungi in trees. All parts of a tree can become infected, leading to decreases in wood quality, productivity and occasionally death.

- Native pathogens co-exist with their hosts, achieving a balance over millennia, and are important for nutrient cycling, biodiversity and for other ecosystem processes.
- Disease effects from native pathogens typically occur over several growing seasons, causing gradual losses.
- Exotic introduced pathogens have caused extensive mortality to some tree species.
- Disease effects from exotic pathogens can occur quickly, resulting in rapid tree death.

### Why is this indicator important?

- Economic losses can accrue when wood quality and volume are reduced within managed forests.
- Tree diseases can be managed to reduce economic losses by planting less susceptible tree species, using silvicultural treatments such as brushing or thinning and selecting genetically improved stock for planting.

### What is the outlook?

- The effects of globalization, including increased trade, travel and tourism, can increase the risks of introducing exotic pathogens and their establishment, leading to increased damage to trees.
- We must remain vigilant to avoid the introduction of exotic pathogens, such as the oak wilt pathogen, *Bretziella fagacearum*, which is present in the northern United States.
- Technological improvements in DNA-based identification of forest pathogens are important tools in preventing the establishment of exotic pathogens.

### Climate change and tree disease:

- Weather regulates host / pathogen interactions.
- Suitable environmental conditions when the host is susceptible can facilitate pathogen infection.
- Under climate change, we expect differences in pathogen behaviour, as weather patterns and environmental conditions change.

It is difficult to predict exactly how forest disease will be impacted by climate change. Monitoring and being prepared to respond are important for reducing losses.



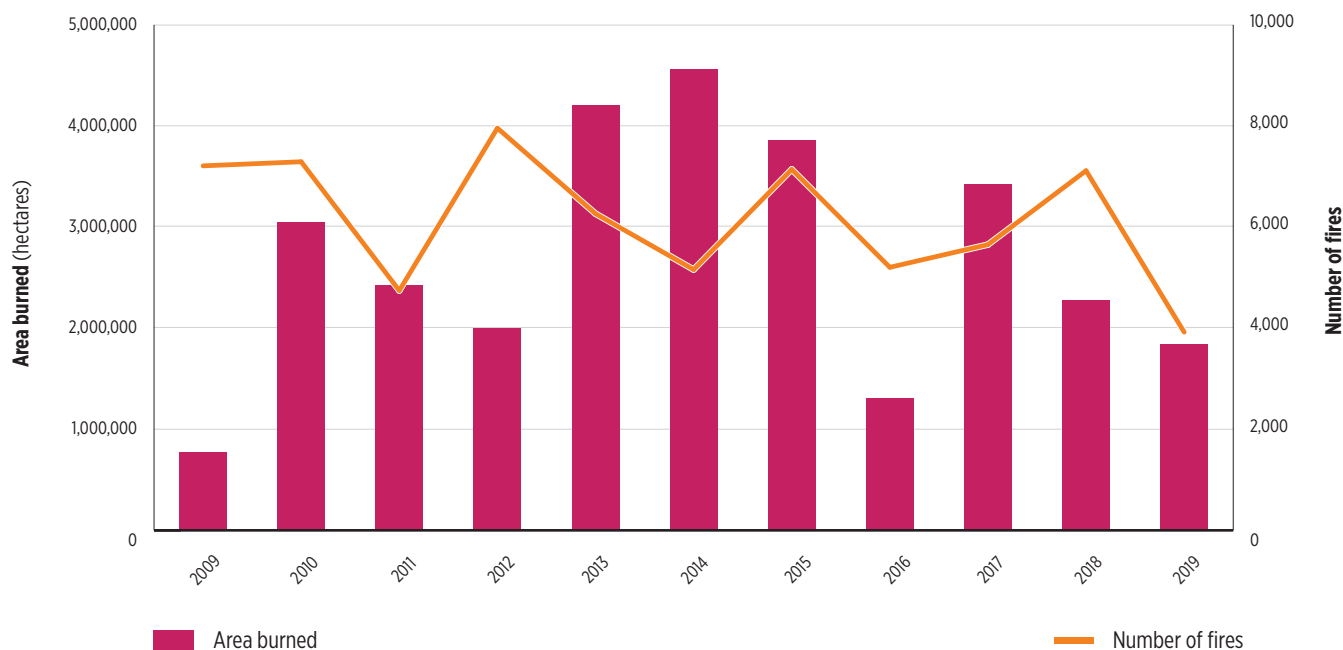
*Cronartium harknessii* is a native pathogen that is the causal agent of western gall rust, a common disease of hard pines, including lodgepole pine, jack pine and ponderosa pine in Canada.



## Forest fires

In 2019 there were 4,000 forest fires in Canada that burned almost 1.8 million hectares (ha) of forest, an amount 30% lower than the 25-year average. Nearly all the large forest fires in 2019 occurred in the boreal forest regions of Yukon, northern Alberta, and northwestern Ontario; regions that often see large fires.

### Forest area burned and number of forest fires in Canada, 2009–2019



- Northern Alberta saw 4 times the 10-year average burned area in May and June, which led to the evacuations of the communities of Wabasca and High Level.
- A very dry winter and spring, followed by record lightning strikes in July, resulted in double the 10-year average area burned in Yukon. Numerous evacuations, highway closures and widespread smoke lasted unusually late into mid-September.
- The Pikangikum First Nation in Ontario was partially evacuated in June and completely evacuated in July as two separate wildfires burned nearby. Overall, Ontario saw extensive wildfires in the northwest burning an area twice the 10-year average.

Following two consecutive record-setting forest fire seasons in British Columbia in 2017 and 2018, the area burned in British Columbia in 2019 was below the long-term average. Each spring and summer typically brings a unique combination of rain, lightning and wind. Record-breaking fire seasons followed by quieter ones are part of the inherent variability of fire weather in Canada.

Source: National Forestry Database. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).





## Monitoring forest fires in Canada from space

Forest fires, or wildfires, are becoming an increasing concern for Canadians across the country. To help prepare and respond to fires, Canada is looking upward to space.

Canada has almost 3.5 million km<sup>2</sup> of forest and is home to some of the largest and most intense wildfires in the world. These wildfires can jeopardize human safety, health, property, and ecosystems. As the climate changes globally, shifting patterns of hot, dry, and windy weather may greatly increase the incidence and impacts of wildfires. Scientists project that the current area of forest burned annually will double by 2050 and that overall, Canada will see more extreme and unmanageable fires.

The 2016 Fort McMurray wildfire was the most expensive natural disaster in Canadian history, with a total cost of approximately \$9 billion.

### Meeting change with innovation

Wildfire managers in Canada are working to address the challenges of increasing fire activity by modernizing tools and policies, but are faced with limitations in current technologies. Enter WildFireSat, a dishwasher-sized satellite launching in early 2025 that will significantly enhance our situational awareness and understanding of wildfire behaviour – and how that behaviour is changing alongside our climate.

### Firefighting fundamentals: The “initial attack”

A common technique used in fighting wildfires is the “initial attack.” Used by firefighters in Canada and around the world, the aim is to find fires just after they start, and quickly put them out before they grow large. However, not all fires can be caught at this early stage and the few that escape require far more effort and resources to manage.



### A bird's eye view

A critical step in managing large fires is collecting observations for tactical and strategic planning. To do so, an aircraft carrying a fire expert flies over the fire and makes a visual assessment. This information is then relayed to command centres to create a management strategy and deploy resources. It's an effective but resource-intensive method, and in a large country such as Canada, it's impossible to keep up with all the fires. This challenge will only increase with the projected future conditions.

### New eyes in the sky

In a country as vast as Canada, observation from space is the best way to get timely and consistent information on all active wildfires, with the precision that wildfire managers need. This is where WildFireSat comes in.

WildFireSat is the first satellite specifically built to monitor wildfires, as opposed to the current satellites constructed for other scientific purposes such as determining ocean and land surface temperatures. Unlike other satellites, WildFireSat's orbit will be optimized so that the satellite will be overhead during the late afternoon “peak burning period,” filling a crucial gap in satellite data.

Fires and other sources of intense heat can be detected, even through smoke, if a satellite sensor includes a channel near the 4- $\mu$ m (micrometres) wavelength range (a human hair is about 80  $\mu$ m). This wavelength is highly sensitive to energy emitted from objects hotter than about 200°C. Forest fire flame temperatures range from 800 to 1,200°C.



### Artificial intelligence means faster, more accurate information

Instead of human experts flying over a fire in an aircraft, WildFireSat will use artificial intelligence to analyze satellite images in near-real time, providing details such as the intensity of the fire, how fast it is moving and where it is going, as well as smoke and carbon emissions. Because the artificial intelligence on WildFireSat is so powerful, fire managers will get results in 30 minutes compared to the current two to five hours – and the WildFireSat team wants to provide that data for every fire in Canada.

In Canada, annual carbon emissions from wildfires can equal the annual carbon emissions from burning fossil fuels across the country.

As science surrounding WildFireSat continues to grow, fire managers will be able to use critical information from WildFireSat to guide them on the best way to fight a particular fire – whether by ground crews, bulldozers, or air attacks. Experts will also be able to use data from WildFireSat to better predict how long until the fire reaches a community, providing essential information to carry out safe and effective evacuations.

### The future is wide open

Canada is committed to open government, and WildFireSat is no exception. All processed and calibrated WildFireSat data will be rapidly available to the public. By providing real-time information during the peak burning period, WildFireSat will help to better protect Canadians, as well as their valuable resources, infrastructure, and the environment.



Source: See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).





## Forest carbon emissions and removals

In 2018, the total net emissions of carbon dioxide equivalent (CO<sub>2</sub>e) from Canada's managed forests (forest lands managed for timber production) and forest products were about 243 million tonnes (Mt).

The total net emissions are calculated by adding emissions/removals caused by human activities in Canada's managed forests to emissions/removals caused by large-scale natural disturbances in Canada's managed forests.

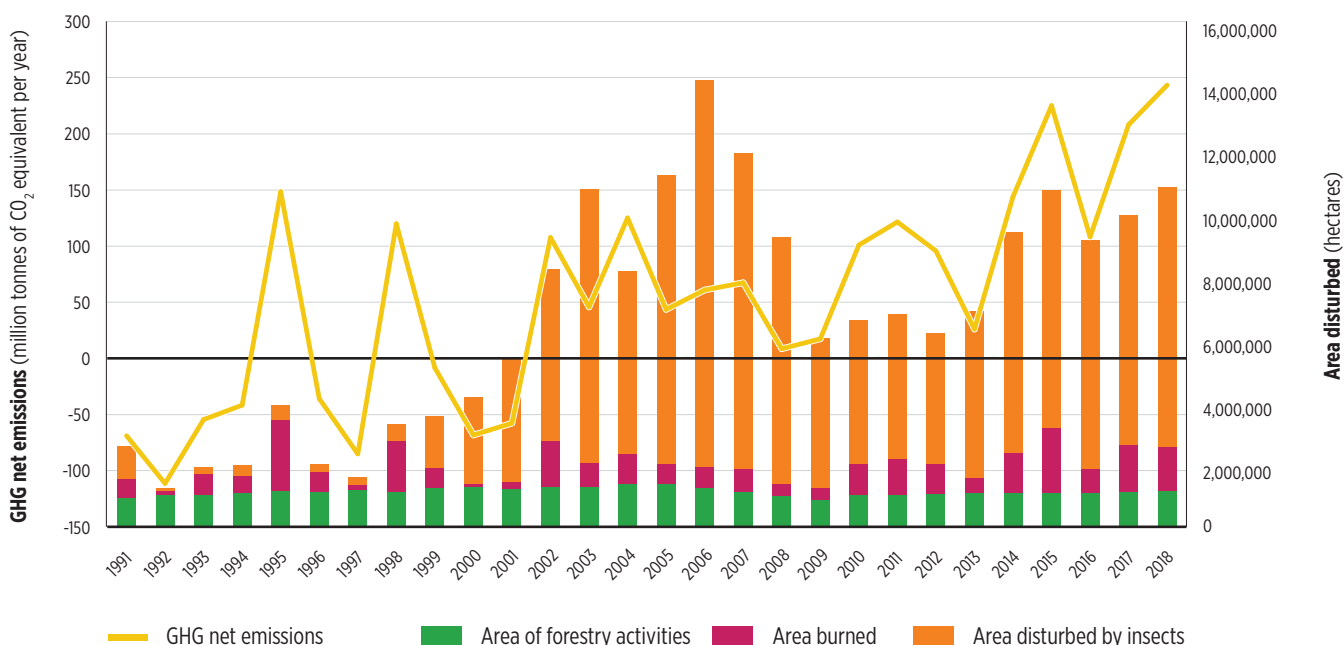
Human activities in Canada's managed forests accounted for removals of about 8 Mt CO<sub>2</sub>e in 2018, while large-scale natural disturbances accounted for emissions of about 251 Mt CO<sub>2</sub>e, resulting in net emissions of 243 Mt CO<sub>2</sub>e. (These figures include carbon monoxide emissions and emissions in 2018 from harvested wood products manufactured from wood harvested in Canada since

1900, which are reported as separate categories in the National Inventory Report; see section 6.9.4 of Canada's *2020 National Inventory Report, 1990–2018*.)

- Forest lands managed for timber production, and the emissions from harvested wood products harvested from these lands, continue to be an ongoing sink of carbon, removing 8 Mt CO<sub>2</sub>e from the atmosphere in 2018.
- In 2018, the area burned in Canada's managed forests was 1.4 million hectares (ha), similar to 2017.

Canada's forests both emit and absorb atmospheric carbon dioxide (CO<sub>2</sub>). In any given year, depending on the area of natural disturbances such as forest fires, insect outbreaks and windthrow, Canada's forests will either be a **source** or a **sink** of CO<sub>2</sub>. A **source** adds carbon to the atmosphere, while a **sink** absorbs it. Data from 2018 suggest that overall the forests were a source of CO<sub>2</sub> due to 1.4 million ha of area burned.

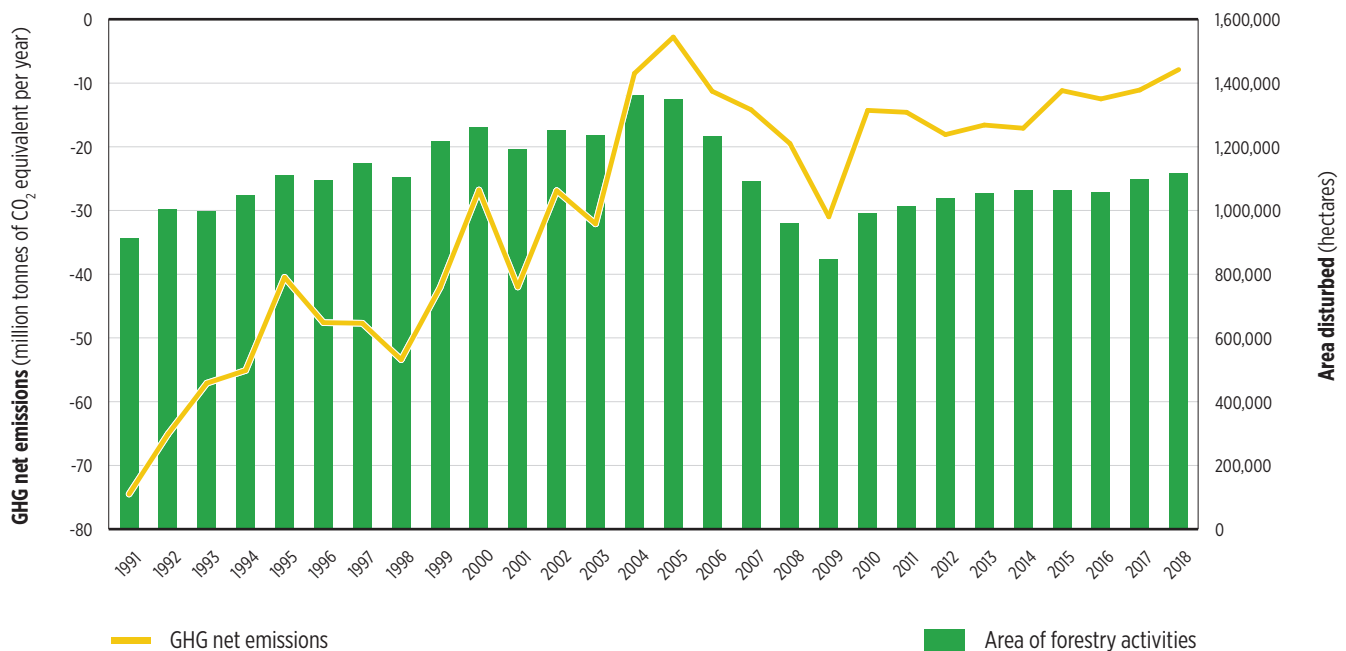
### Net carbon emissions in Canada's managed forests: All areas, 1991–2018



The total net emissions and removals from Canada's managed forests, taking into account both human activities and natural disturbances, was about 243 Mt CO<sub>2</sub>e (-8 + 251 = 243) in 2018. This includes the emissions in 2018 from wood harvested in Canada since 1900 and wood products used in Canada and abroad.

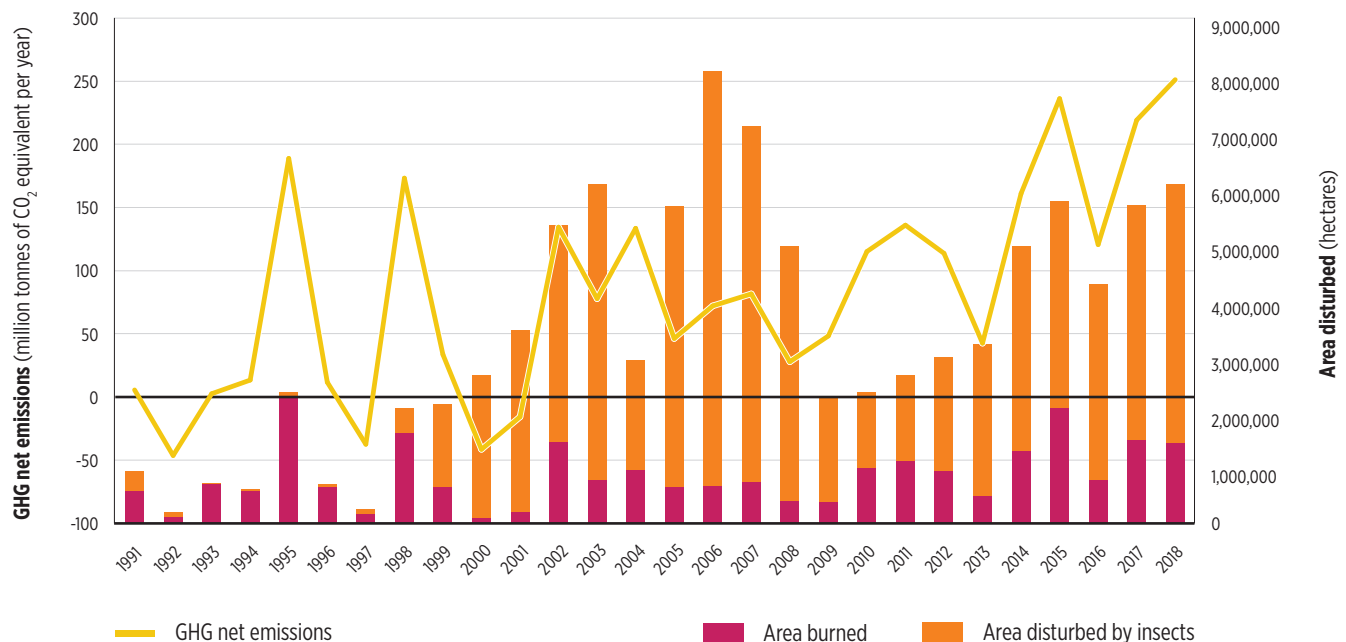


### Net carbon emissions in Canada's managed forest: Areas subject to human activities, 1991–2018



Forest management activities in Canada's managed forests, such as harvesting, slash pile burning, and regeneration, as well as the use and disposal of harvested wood products, were a net sink of about 8 Mt CO<sub>2</sub>e in 2018.

### Net carbon emissions in Canada's managed forest: Areas subject to natural disturbances, 1991–2018



Natural disturbances in Canada's managed forests resulted in net emissions of about 251 Mt CO<sub>2</sub>e in 2018. Forest greenhouse gas (GHG) emissions were similar to those in 2015 and 2017, in large part because of the 1.4 million ha of area burned in 2018.



### Why is this indicator important?

- Carbon as carbon dioxide (CO<sub>2</sub>) and as methane (CH<sub>4</sub>) in the atmosphere are important contributors to global warming.
- Canada's forest sector provides renewable resources to the Canadian economy, while also providing aesthetic values, clean water and wildlife habitat.

### What is the outlook?

- The impacts of climate change on Canada's future forest GHG balance are difficult to predict. Regionally, impacts can be both positive (enhanced forest growth and therefore greater carbon sinks) and negative (higher mortality, more forest fires or insect outbreaks). The area burned in British Columbia in 2019 was considerably lower than in 2017, 2018 and thus we expect overall GHG emissions in 2019 to be less than in the previous two years.
- Natural disturbances, mostly outside the control of humans, significantly impact the ability of Canada's managed forests to consistently absorb more CO<sub>2</sub> than they emit.
- Changes in forest management and the use of harvested wood products can contribute to mitigating the impacts of climate change.
- Increased use of long-lived wood products to store carbon in the built environment and the use of wood products instead of emissions-intensive materials such as concrete, steel and fossil fuels provide climate change mitigation opportunities.



Source: Environment and Climate Change Canada. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).





# HOW DO FORESTS BENEFIT CANADIANS?





**Forests provide Canadians a wealth of benefits that go beyond providing jobs and income. Forests provide habitat for living things, fight flooding, keep us cool, feed us, heal us and provide sanctuaries of spiritual meaning for many Canadians and Indigenous people.**

#### **Forest ecosystems are essential to life on earth**

A forest ecosystem is a dynamic place where living things like plants, animals and microbes interact with their environment and depend on each other for survival. Living organisms, including humans, depend on the services these forest ecosystems provide.

At a regional level, forests provide many services. They preserve soils that help prevent flooding, they provide habitat that support biodiversity, they provide shade that keep our cities cool and they help filter pollutants from the air that can affect human health.

At a global scale, forests are an essential component of the earth's carbon cycle where carbon transforms and moves between four major reservoirs – the atmosphere (air), the lithosphere (land), the biosphere (living organisms) and the hydrosphere (water). Forests contribute to this cycle by absorbing and storing carbon in the leaves, stems, trunks, branches and roots of growing trees. This capacity to store carbon, including carbon emitted from human activities, explains why trees have a key role in moderating climate change.

#### **Forests are a hub of social and cultural meaning**

Forests are essential to many Canadians' recreational activities and spiritual well-being. They serve as natural playgrounds for many activities like hiking, horseback riding, bird-watching and camping. For many Indigenous people, forests are essential to cultural traditions, such as hunting and trapping, and also serve as spiritual sanctuaries. The sustainable management of forest ecosystems allow us to benefit from all of the wonderful things we love about the great outdoors.

#### **Forests are the source of a renewable natural resource – wood!**

Forests are sustainably managed in Canada so that they can continue to provide social and cultural benefits and ecosystem services, while also providing goods such as wood and other forest products and services to Canadians. In 2019, the forest sector provided 205,000 jobs for Canadians, including about 12,000 jobs for Indigenous people, and was the primary source of economic wellbeing for 300 communities in Canada. As declared and experienced during the COVID pandemic, forest sector services and products are deemed to be essential to Canadians.



More than 70% of Indigenous people in Canada live in or near forests.

**Source:** Statistics Canada; Natural Resources Canada–Canadian Forest Service calculation. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).

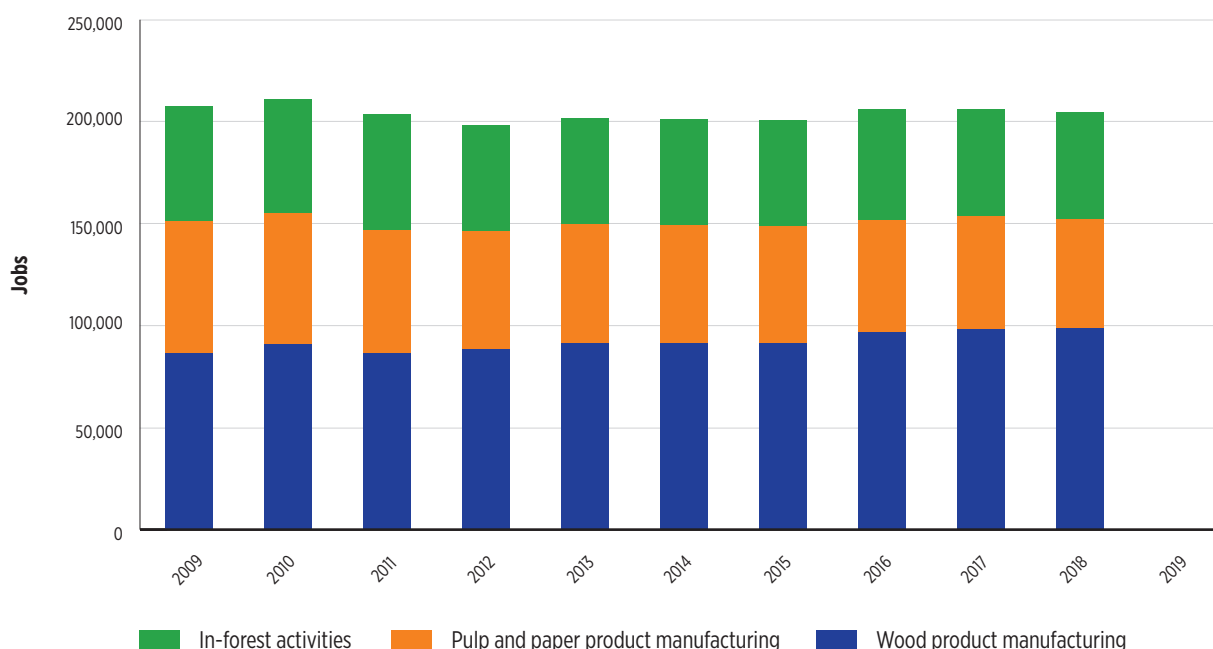


## Forest sector employment

Canada's forest sector provides thousands of jobs that support workers and communities across the country. In 2018, the forest sector employed 204,555 people and accounted for about 1.1% of total employment in Canada. According to the last census (2016), about 17% of forest sector workers are women and about 12% are immigrants. In addition, about 12,000 Indigenous people worked in the forest sector in 2016, representing about 7% of the sector's workforce.

The COVID-19 pandemic has affected data availability and 2019 employment data were not available at the time of publication. However, it is anticipated that 2019 employment data will show a decreasing trend. Despite the overall strength and competitiveness of the forest sector, the sector contended with multiple challenges that led to mill closures and curtailments in 2019, which are expected to affect sector employment.

### Forest sector direct employment, 2009–2019



- Employment in the wood product manufacturing subsector has been increasing in recent years; the subsector accounted for almost 50% of total forest sector employment in 2018.
- In 2018, the pulp and paper product manufacturing subsector accounted for about 26% of forest sector employment. However, over the past few years, the number of jobs in this subsector has declined. A declining demand for newsprint and printing and writing paper is driving the trend, as more people adopt digital media in place of paper products.
- In-forest activities, including nursery operations, tree planting, timber cruising, and logging, accounted for about 26% of forest sector employment in 2018. Employment in this subsector has been relatively stable.
- The forest sector is highly integrated, so jobs across all forest subsectors are interdependent. As a result, the closure of a mill or forest product manufacturing facility can have ripple effects throughout the supply chain – both upstream and downstream of the affected mill or facility.

#### COVID-19 and forest sector employment

The impacts of the COVID-19 pandemic have been felt across the economy, including in the forest sector. As of June 2020, there were over 100 facility closures or curtailments, affecting close to 20,000 workers. While most of these impacts are temporary, they could have a lasting effect on certain workers (see **What is the outlook?**)





### Distribution of forest sector jobs by subsector, 2018



- In-forest activities
- Pulp and paper product manufacturing
- Wood product manufacturing

### Why is this indicator important?

- The Canadian forest sector is an important employer nationwide, and contributes to the economic and social welfare of all Canadians.
- The forest sector's contribution to employment is particularly important in many rural and Indigenous communities, where forest-related work is often the main source of income.

### What is the outlook?

- The COVID-19 pandemic could affect demand for forest products over the next few years because slower economic growth is forecasted. Challenges such as forest fires, pests and trade disputes will also continue to affect forest sector employment.
- Despite these challenges, there are significant opportunities for the forest sector to remain a key employer in communities across the country and to support inclusive clean growth. Forest sector diversification through the growth of the circular bioeconomy (e.g. bioproducts and bioenergy) will create new job opportunities across the country.



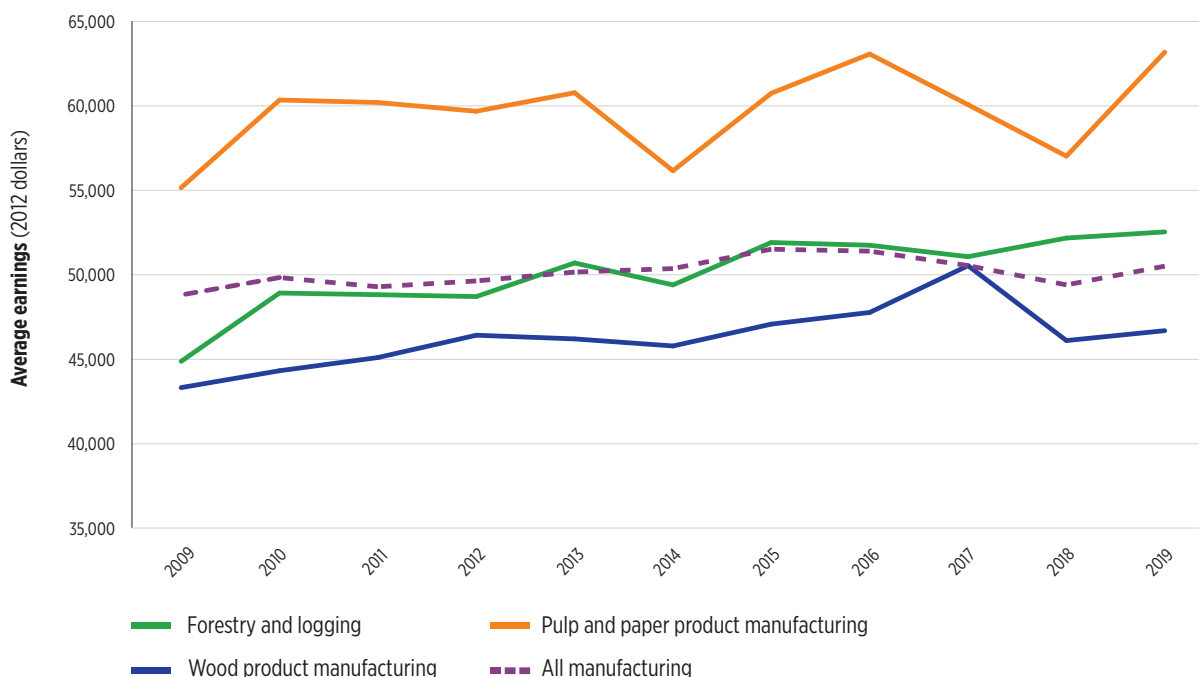
Source: Statistics Canada. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).



## Forest sector average earnings

In 2019, average earnings across the forest sector increased slightly from 2018 levels. They increased by 4.6% between 2018 and 2019, almost reaching 2016 levels – the highest in 10 years – with an average of about \$54,000 annually. However, average earnings tend to be volatile year-over-year, but with a fairly stable underlying trend since 2001.

### Average earnings in the forest sector compared with all manufacturing sectors, 2009–2019



**Average earnings** refers to the average net annual income per person directly employed in the forest sector, not including overtime pay.

- Between 2018 and 2019, only the pulp and paper manufacturing subsector saw a significant increase in average earnings, with a bump of 10.8%. This increase was the result of a combination of salaries slightly increasing combined with employment decreasing, as the least productive mills of that subsector ceased operations.

- The wood product manufacturing and in-forest activities subsectors both posted slight increases, of 1.3% and 0.7%, respectively, combined with stable employment.
- Overall, average earnings in the forest sector out-performed average earnings for all manufacturing, with the latter experiencing a modest 2.3% increase between 2018 and 2019. They have both been following a similar trend since 2001.

#### Why is this indicator important?

- Trends in forest sector average earnings indicate the importance of the sector to the economy and to the social well-being of Canadians, especially when compared with average earnings in other industries.

- Real wage growth (meaning wage growth that isn't the result of inflation) shows the change in actual purchasing power of forest sector employees.

#### What is the outlook?

- Moody's Analytics forecasts the coronavirus-related economic slowdown will adversely impact the forest sector over the short term, which could in turn drag down recent gains in average earnings.
- In the longer term, average earnings could recover as the forest sector continues its transformation towards the bioeconomy and remaining forest sector activities increase productivity.

Source: Statistics Canada. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).



## Forest communities

Forests provide a range of important economic, cultural and environmental benefits for many Canadian communities, including those in both urban and rural Canada.

- Over 23 million people live in or near forests in Canada (about two-thirds of the total population).
- About 300 communities across Canada rely on the forest sector for a significant share of jobs and income.
- About 2% of Canada's population (700,000 people) live in these forest-reliant communities.
- According to the last census (2016), over 1.1 million Indigenous people live in or near forests, and nearly 12,000 are employed in the forest sector.

**About 44% of people in Canada's forest sector labour force live in rural communities – a higher share than in most other sectors. For example:**



**44% Rural**  
Mackenzie, BC  
Kapuskasing, ON  
Maniwaki, QC  
Kedgewick, NB



**21% Urban**  
Kamloops, BC  
Pembroke, ON  
Alma, QC  
Fredericton, NB



**35% Large urban**  
Vancouver, BC  
Ottawa, ON  
Montréal, QC  
Halifax, NS

### Why is this indicator important?

- In communities where the forest sector provides a large share of jobs and income, issues that affect the forest sector can affect the entire community.
- In addition to their important role in local economies, forests are central to the health and well-being of all Canadians.

### What is the outlook?

- Rural and remote communities are often located near forest resources. For this reason, these communities will continue to play a role in Canada's forest sector, providing jobs and income for the people who live there.
- Despite 2020 challenges related to the COVID-19 pandemic, strong

demand for Canadian forest products, emerging opportunities in the bioeconomy, and increased use of high-value forest products are expected to continue to materialize, meaning that the forest sector will continue to provide opportunities for people across Canada, particularly those who live in rural, remote, and forest-reliant communities.





# HOW DOES THE FOREST SECTOR CONTRIBUTE TO CANADA'S ECONOMY?





**The forest sector is an important part of Canada's economy and is a key source of prosperity for people and communities from coast to coast.**

- About 205,000 people work in the forest sector (2018), including approximately 12,000 Indigenous people (2016).
- The forest sector generated about \$1.9 billion in revenue for provincial and territorial governments in 2018.
- The forest sector contributed about \$23.7 billion to Canada's nominal gross domestic product (GDP) in 2019.

- The value of Canadian forest product exports is about \$33 billion (2019).

#### **Canadian forest products**

Canada's traditional forest sector includes forestry and logging, pulp and paper manufacturing, and wood product manufacturing. Lumber, solid wood products, pulp, and paper account for most of the production and exports from Canada's forest sector.

The growing demand for non-traditional products, including an emerging market for bioproducts and value-added manufacturing has created new opportunities for the forest sector to create value and advance Canada's transition to a low-carbon economy in particular.

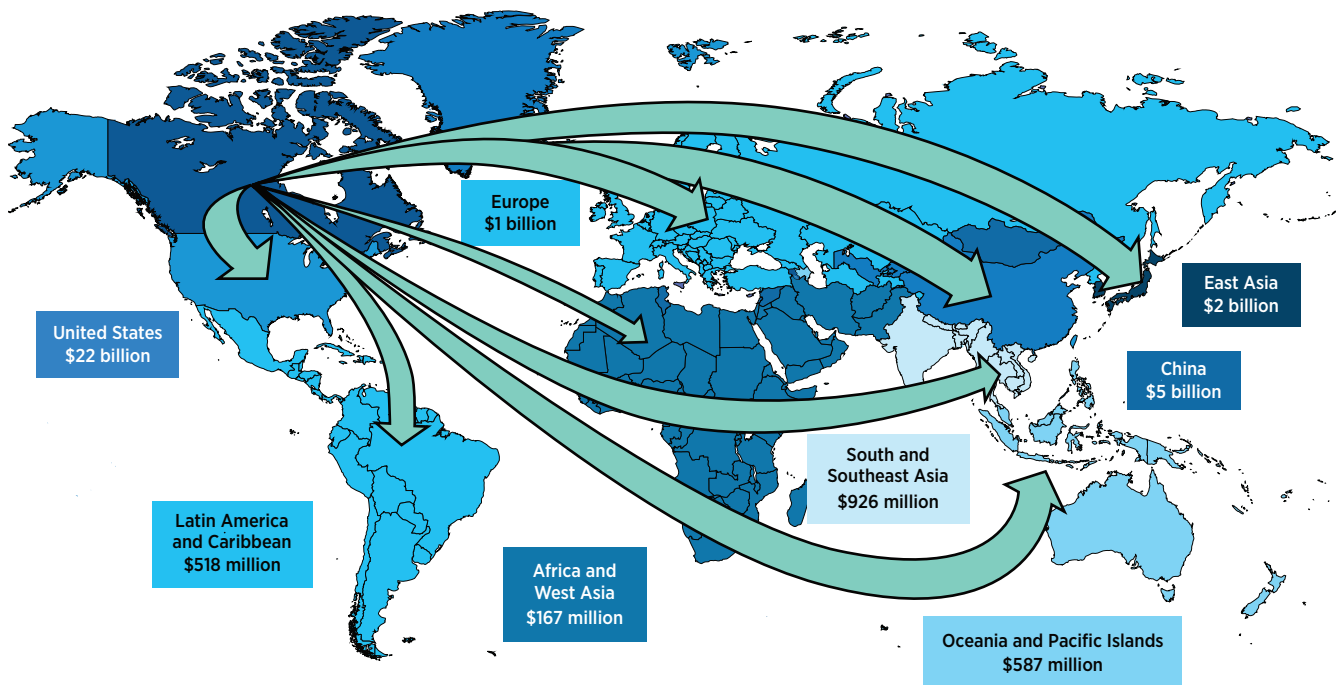




### Canadian forest products in an international context

Canada is a global leader in the production of many forest products, including softwood lumber, wood pulp, and wood pellets. Over two-thirds of Canadian forest products are exported, and the United States is our largest trade partner, accounting for about 68% of Canada's total forest product exports in 2019. However, export diversification efforts are opening opportunities in other markets, including Asia and Europe. Canada will continue to leverage new opportunities in global markets, and domestically, ensure that the forest sector remains a key economic engine for people and communities across the country.

## Canadian Forest Sector Exports by Major Region (2019)



While the forest sector accounted for a smaller overall share of Canada's economy than other major resource sectors in 2019, it remains an important source of economic opportunity for people and communities across Canada. With more jobs per unit of output than other major resource sectors, the forest sector is particularly important in rural and remote areas where few other industries operate.

Source: National Forestry Database. Statistics Canada. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).





## Forest sector gross domestic product

In 2019, the forest sector contributed \$23.7 billion (1.1%) to Canada's nominal GDP. The forest sector contracted by 7% in 2019 while the overall economy grew by 1%.

### Canadian forest sector GDP, 2009–2019



- The real GDP of both the wood product manufacturing subsector and the pulp and paper manufacturing subsector decreased by 6.0% and 7.9%, respectively. Weak global demand and domestic wood fibre supply challenges caused significant structural changes for both subsectors.
- The contribution of the forestry and logging subsector to Canada's real GDP decreased significantly (by 9.0%) between 2018 and 2019 because of constraints on the availability of wood fibre.

#### Why is this indicator important?

- Contribution to nominal GDP is one of the primary indicators used to gauge the size and health of Canada's forest sector compared with the size and health of other economic sectors in a year.
- Real GDP allows analysts to gauge the health of the Canadian forest sector's economy to that of the entire national economy. It measures the year-over-year change in the size of the forest sector's economy, taking into account inflation.

#### What is the outlook?

- Demand for traditional paper products is expected to continue falling in 2020, while household paper and packaging are expected to remain solid.
- Overall, the Canadian forest sector was expected to grow in 2020, however, the COVID-19 pandemic has created uncertainty. Stronger demand for Canadian lumber, stimulated by expected increases in United States housing starts, were expected to support that growth, but this may materialize later than expected depending on how North American and global economies perform following the COVID-19 pandemic.

**Gross domestic product (GDP)** is the total value of all final goods and services produced annually in a country. It can be thought of as the size of a country's economy. In 2018, the World Bank ranked Canada as the 10th largest economy in the world.

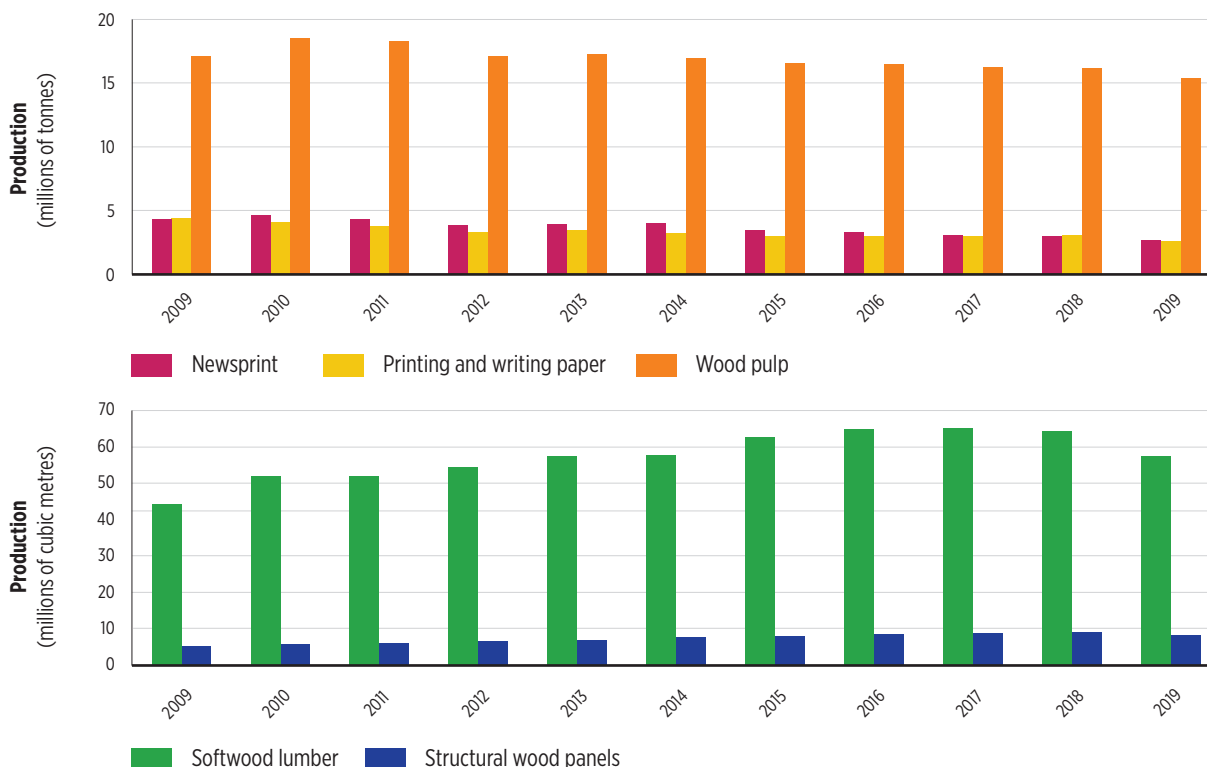
Source: Statistics Canada. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).



## Production of forest products

Production of both solid wood products and pulp and paper products decreased between 2018 and 2019. Within the solid wood products subsector, softwood lumber production decreased by 10.4%, and structural panel production fell by 7.8%. Within the pulp and paper subsector, wood pulp production decreased by 4.9%, while newsprint and printing and writing paper continued to decline, falling by 10.8% and 14.6%, respectively.

### Production of Canadian forest products, 2009–2019



- Significant challenges in 2019, such as fibre shortages in British Columbia; decreased demand for pulp, newsprint and printing and writing paper; and low commodity prices led to production declines.
- The significant number of sawmill closures or curtailments further affected feedstock availability for structural panels and wood pulp, compounding their challenges.

Canada is the world's largest producer of newsprint, the largest producer of northern bleached softwood kraft pulp and the second largest producer of softwood lumber.

#### Why is this indicator important?

- Canada is one of the top global manufacturers of forest products.
- Production is one of the first indicators influenced by economic and market challenges.

#### What is the outlook?

- While some improvements were expected in 2020, the COVID-19 pandemic and its economic aftershock will likely delay the recovery of lumber production, and possibly accelerate the decline of newsprint and printing and writing paper production. The breadth of the impact remains uncertain.

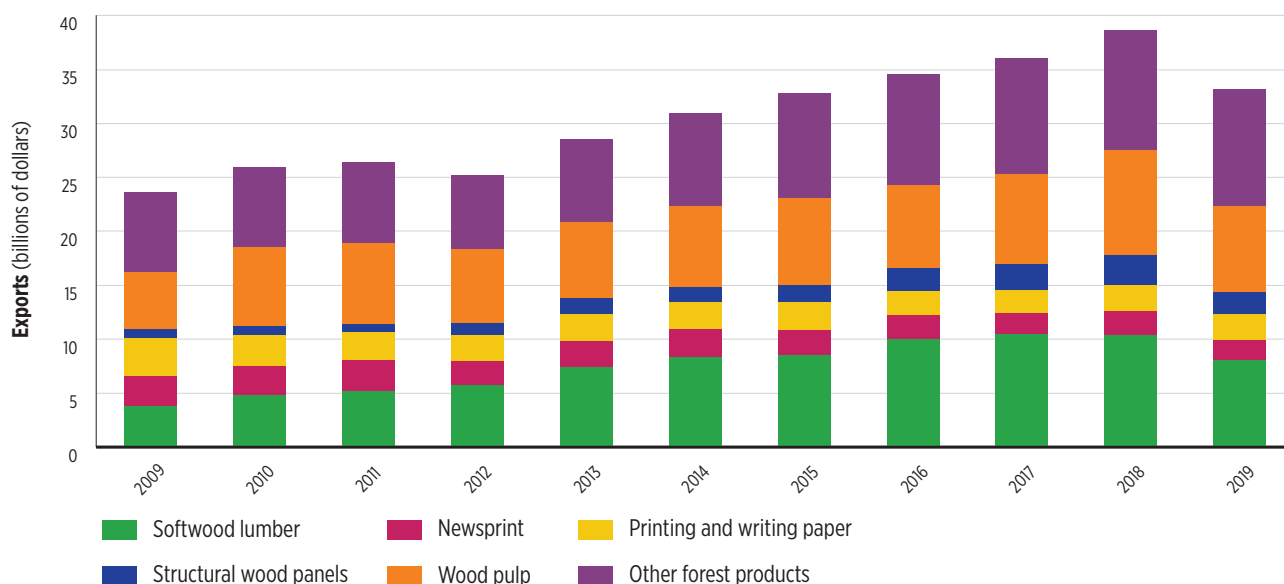
**Source:** APA – the Engineered Wood Association; Pulp and Paper Products Council; Statistics Canada. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).



## Exports of forest products

After six consecutive years of growth, Canada's total forest product exports declined 13.8% in 2019 to \$33.2 billion because of lower prices and reduced production for many forest products.

### Exports of Canadian forest products, 2009–2019



- Softwood lumber exports fell the most (\$2.2 billion) because of production curtailments in British Columbia and a lower average price of lumber.
- Wood pulp exports had the second-largest decline (\$1.7 billion) because of low pulp prices.

#### Why is this indicator important?

- As one of the largest forest product exporters, Canada is a key supplier to countries around the world.
- Canada has an abundant and renewable supply of wood that is sustainably managed. By exporting forest products, the Canadian forest industry meets the needs of global consumers while making a substantial contribution to Canada's economy and balance of trade.

#### What is the outlook?

- While some improvements were expected in 2020, the COVID-19 pandemic and its economic aftershock will likely have a negative impact on the trade of most forest products. The speed at which Canada's main markets recover, particularly the United States and China, will determine how fast exports recover.

By value, Canada is the fourth-largest forest product exporter in the world, behind China, the United States, and Germany. Canada is the leading exporter of softwood lumber, exporting US\$1.8 billion more than Russia, the second-largest exporting country, in 2019.





# HOW IS THE FOREST SECTOR CHANGING?



Closeup of young Oak seedling  
growing from acorn

**The forest sector is undergoing major changes because of shifting global markets for traditional forest products, as well as growing demand for non-traditional products that can be used in innovative, environmentally friendly and sustainable ways, advancing Canada's transition to a low-carbon economy.**

### **The forest sector is at a crossroad**

Demand for print media, such as newsprint and printing and writing paper, has continued to shrink as consumers increasingly turn to digital media. In 2019, global demand for newsprint fell 13%, and demand for printing and writing paper fell 6% from the previous year. In addition, declining fibre supply, growing protectionism, and the cyclical up-and-down markets of many commodities are pushing the forest sector to diversify product lines and pivot toward higher value products. The growing focus on climate change and sustainability offers such opportunities and demand for cost-effective, low-carbon solutions from the forest sector is expected to grow.

### **Adopting innovation**

The development of innovative new products and the discovery of new applications for existing products is helping the forest sector adjust to challenges, improve financial performance, and demonstrate a commitment to environmental performance and green growth.

For example, advances in engineered wood products and building systems are boosting demand for wood products. The advances are enabling the construction of taller, more sustainable, and more energy-efficient buildings

made primarily from wood, helping to reduce the carbon footprint of construction.

Additionally, wood-fibre residues and by-products of forest product manufacturing are being used to make bioproducts, a fast-growing category of products that includes biochemicals, biomaterials, and bioenergy. For example, compostable bioplastics are already a flagship of the forest sector's potential. Importantly, low-carbon biofuels from sustainable forest biomass, such as those produced from sawmilling and harvest residues, are currently the only alternatives for conventional aviation and marine fuel and will be central to the transition toward a low-carbon economy.

### **Restructuring to adapt to new trade patterns**

The expansion of trade has led to increased global integration across many industries. Many Canadian forest sector firms now operate facilities in the United States, and some have invested in European facilities as well. Considering that China and Japan have become key destinations for many Canadian forest products, the sector's structure has changed from Canadian companies competing in North American markets to North American companies competing in global markets.

### **Calling for a new generation of workers**

In 2016, women comprised only 17% of the workers in the forest sector, while immigrants, which represent 25% of the Canadian workforce, made up only 12% of the forest sector. Indigenous people made up 7% of forest sector employment compared to 4% for the Canadian workforce. The sector's transformation creates an opportunity to attract workers with science, technology, engineering and mathematics (STEM) education, higher technical skills and more diverse backgrounds.

An estimated 5 billion cups of coffee are brewed in single-serve machines in Canada each year. GCUP Technology Corp. is developing an alternative to the plastic pods used in these machines by creating pods made of bioplastics reinforced with wood fibre. The new pods are bio-based, 100 percent compostable and brew a great cup of coffee.

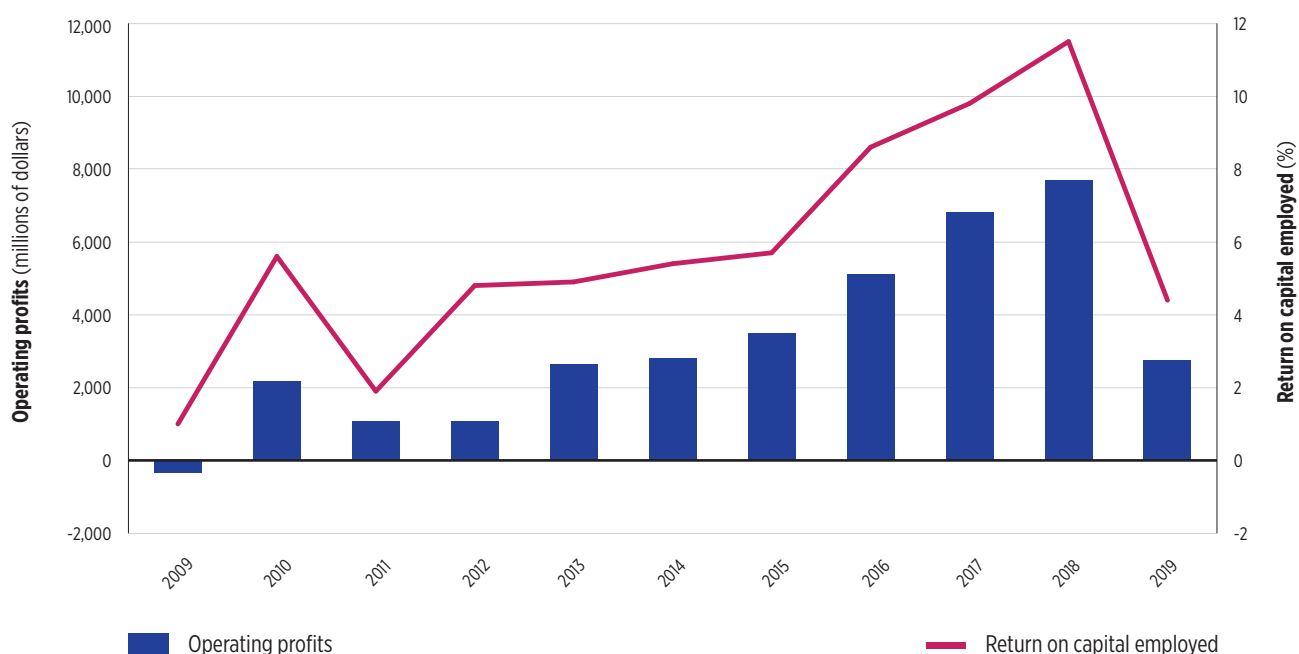




## Forest sector financial performance

The forest sector's financial performance worsened in 2019, marking the end of seven consecutive years of growth both in operating profits and in return on capital employed. In 2019, operating profits fell by 64.4% over 2018 levels, and return on capital employed fell to 4.4%, down from 11.5% in 2018.

### Financial performance by Canada's forest sector, 2009–2019



- After declining in late 2018, commodity prices remained relatively low throughout 2019, lowering the financial performance of the forest sector.
- Financial conditions improved slightly near the end of 2019 with higher lumber prices and renewed demand from the United States housing market.

#### Why is this indicator important?

- Strong financial performance is essential for the continued economic competitiveness of Canada's forest sector.
- Both operating profits and return on capital employed indicate whether Canada's forest sector can attract investment and continue to generate economic benefits to Canadians.

Together, **operating profits** and the **return on capital employed** can be used as measures of the forest sector's economic competitiveness.

**Operating profit** measures the difference between operating revenues and operating expenses.

**Return on capital employed** measures the efficiency of capital use in the sector.

#### What is the outlook?

- The COVID-19 pandemic will likely have a negative impact on world economies and Canada's forest sector, but the breadth of the impact remains uncertain.
- The federal government introduced a number of emergency response measures to assist workers and help businesses deal with COVID-19 and continues to work with provinces, territories, Indigenous communities, and industry to advance the transformation of the sector in the long-term.

Source: Statistics Canada. See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).

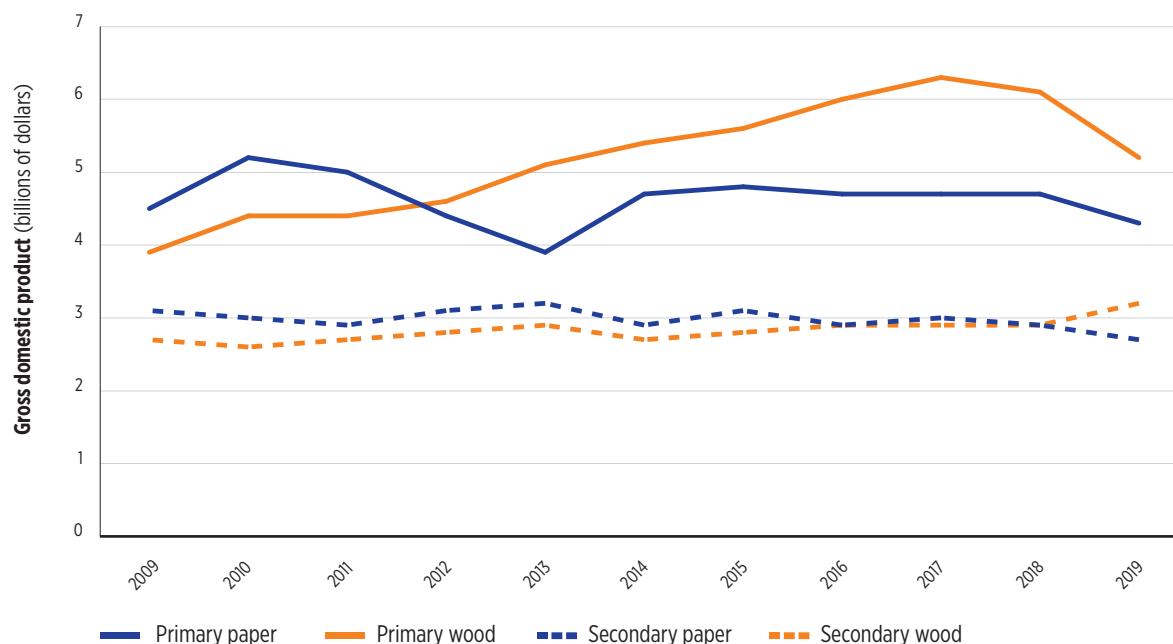




## Forest sector secondary manufacturing

Generally stable, the secondary wood and paper product industries in Canada generated over \$5.8 billion in real gross domestic product (GDP) in 2019. This represents a 1.3% increase from 2018 and follows a 2.3% decrease from 2017 to 2018.

### Gross domestic product from primary and secondary wood and paper product subsectors, 2009–2019



- Secondary wood manufacturing increased by 10.8% in 2019, while secondary paper manufacturing fell by 8.0%.
- Secondary manufacturing accounted for 38% of the total contribution of forest product manufacturing to GDP in 2019, up 3 percentage points from 2018.

Lumber and paper are used in secondary wood and paper product manufacturing to make intermediate and final products, such as doors and envelopes.

#### Why is this indicator important?

- Secondary manufacturing of forest products generates additional employment and revenue, which in turn increases the forest sector's overall contribution to the Canadian economy.
- Secondary manufacturing helps balance changes in world markets by being focused largely on domestic markets that tend to be more stable than the primary products geared to international demand.

#### What is the outlook?

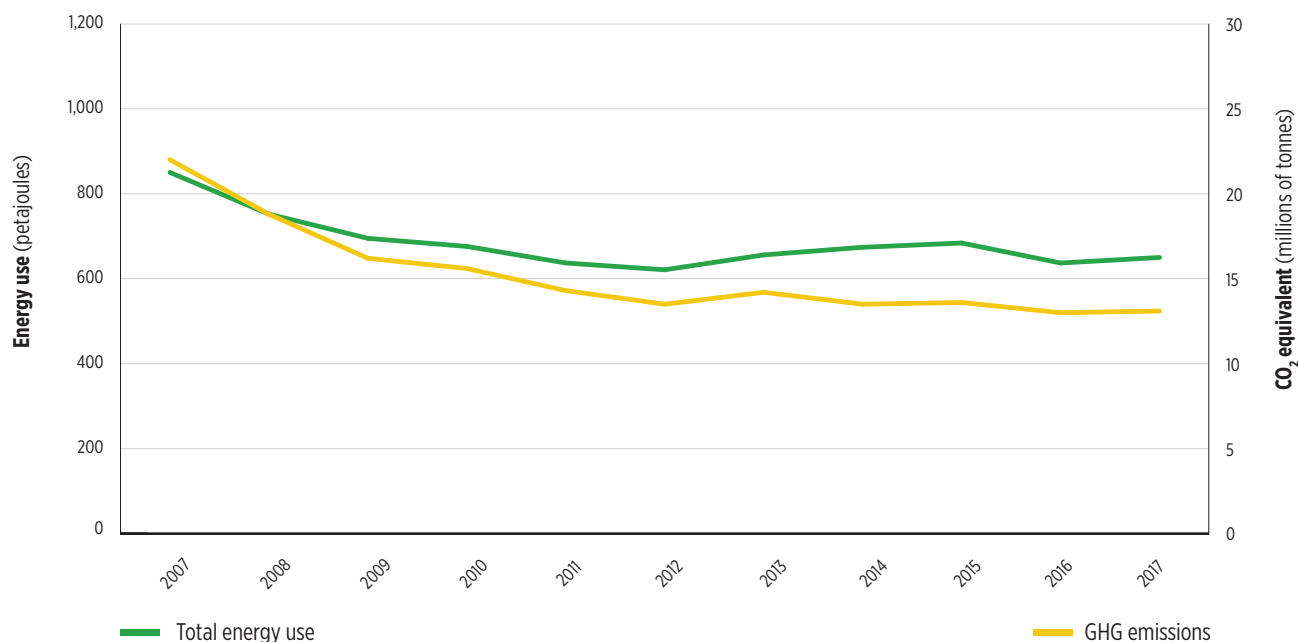
- There is a high degree of uncertainty in the demand for secondary paper and wood products for 2020. As the global economy deals with the consequences of the COVID-19 pandemic, demand for some secondary paper and wood products might increase (such as paper medical supplies and home office furniture) while many others decrease (such as industrial paper packaging and construction-related wood products).



## Forest sector carbon emissions

Total greenhouse gas (GHG) emissions from fossil fuel use in the Canadian forest sector have decreased over the last 10 years. Energy use has also decreased, but remained relatively flat in recent years. GHG emissions are expressed as carbon dioxide equivalents (CO<sub>2</sub>e).

### Fossil fuel greenhouse gas (GHG) emissions and total energy use in Canada's forest sector, 2007–2017



- Significant energy efficiency and emissions reduction technology have contributed to a 40% reduction in GHG emissions from fossil fuels in the sector between 2007 and 2017.
- Increased use of wood residues and by-products has resulted in bioenergy reaching 53% of the total energy use in the sector in 2017.

The forest sector's ability to generate its own electricity, largely from bioenergy, has reduced its reliance on fossil fuels. Between 2007 and 2017, the forest sector reduced energy use by 24% and total fossil GHG emissions (direct emissions plus indirect emissions from purchased electricity) by 40%.

- The Canadian forest bioenergy subsector has demonstrated strong growth over the last two decades. In 2017, the number of community bioheat installations reached 351, compared to 66 in 2011 and only 5 in 2000. Wood pellet production in Canada also grew from 0.4 million tonnes in 2005 to 3.0 million tonnes in 2017, providing a valuable outlet for large amounts of residues produced by sawmills across the country.
- The forest sector is transitioning to greater use of biomass for its own energy needs while continuing to advance as a supplier of forest biomass for energy generation in other sectors. As this happens, the need to track energy use and emissions for the sector grows more important.

#### Why is this indicator important?

- Unlike most other renewable energy sources, bioenergy results in direct GHG emissions. The difference when compared with fossil fuels, however, is that these emissions are part of the natural carbon cycle, where carbon removals occur in parallel with emissions.
- Bioenergy is part of a suite of solutions provided by the forest sector, which also include the increased use of wood in construction and improved forest management. Climate change mitigation benefits come from using local, sustainably sourced wood for bioenergy, with priority given to harvest residues and industrial residues, which have lower emissions on a life-cycle basis compared to the use of fossil fuels.



### What is the outlook?

- Meeting Canada's long-term GHG emission reduction targets will require a broad set of solutions, including nature-based climate solutions involving the natural carbon cycle, including using sustainably produced wood products. In turn, this requires forest sector value-chains that are predicated on climate-friendly, cascading wood-use policies, including increasing the appropriate use of bioenergy produced from sustainably managed forests.

- The Pan-Canadian Framework on Clean Growth and Climate Change in combination with the Forest Bioeconomy Framework for Canada set the stage for the forest sector to play a key role in climate change mitigation and regional economic development. Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy indicates that

substantial reductions in emissions and increases in removals by 2050 are possible. The improvements can occur through changes in how we manage forests, through greater domestic use of long-lived wood products and greater use of bioenergy from wood residues, and through afforestation.



Wood pellets, used for heating, provide a valuable outlet for large amounts of residues produced by sawmills across the country.





# Turning waste heat from a pulp mill into millions of cucumbers

## A history of environmental sustainability

In 1989, the small city of Saint-Félicien, Quebec, faced a problem of what to do with wood waste from the local sawmills, referred to as residuals – low-quality biomass with little apparent value. After some consideration, the town decided to turn the residuals into valuable electricity. By 1996, it had built a biomass-powered cogeneration power plant, providing electricity for 23,000 homes; steam for a sawmill's wood dryers; waste ash for agricultural soil improvements; and hot water for local agricultural energy needs.



Overall, the circular bioeconomy is an emerging growth sector for Quebec's and Canada's economies and is an important part of Canada's national and international commitments, such as the United Nations 2030 Agenda for Sustainable Development and the Montréal Process.



### A vision of the future

This northern Quebec city of 10,000 residents was not finished with forest-based sustainable development. In 2014 Saint-Félicien teamed up with Eric Dubé, the Fradet Family, and Resolute Forest Products. This partnership built one of the largest greenhouse complexes in Quebec: the cutting-edge Toundra Greenhouse. The goal of Toundra Greenhouse was to help Quebec become a more self-sufficient producer of vegetables, thereby reducing imports from outside the province and helping build a more resilient supply chain. The design of the greenhouse is centred around using residuals – in this case, water and CO<sub>2</sub> – from the adjacent Resolute Forest Products pulp mill in Saint-Félicien to offset the vast energy requirements of a large greenhouse. The concept of using greenhouses to grow vegetables might not be revolutionary, but the Toundra complex – with its focus on re-using waste as valuable inputs and innovative technology – is part of an accelerating larger transition to a circular economy.

The circular economy represents a combination of actions that are transforming our linear economy, which takes, makes and then tosses away. In a circular economy, waste is designed out of production processes; materials are kept in use for longer; and natural cycles are restored. In Saint-Félicien, circular economy activities were realized through new business relationships and investments that valued the residuals of one production process and used them as inputs into another.

Because the inputs – residuals – are renewable and sustainably managed, and the outputs – vegetables – are compostable, the circular economy supports natural cycles, including nutrient recycling and carbon management. When the circular economy uses organic materials, it becomes a circular bioeconomy.

### Turning heat and carbon dioxide into cucumbers

By December 2016, the Toundra Greenhouse complex had completed its first stage of construction, covering 8.5 hectares (ha), producing millions of cucumbers a year, and employing more than 100 workers. At the end of 2020, the greenhouse complex will complete its second stage of construction, covering 19 hectares and employing over 150 people. The adjacent pulp mill's heat residuals will provide 25% of the

greenhouse's heating requirements, reducing the greenhouse's energy costs. The mill will also be able to reduce its greenhouse gas emissions at rate equivalent to taking over 2,000 vehicles off the road per year.

Using carbon capture technology, Toundra Greenhouse will also collect up to 30 tonnes of CO<sub>2</sub> per day from the pulp mill to use for controlled injection into the greenhouse to enhance photosynthesis and optimize production. And in keeping with its commitment to environmental sustainability, 98% of the used water is recuperated for re-use; no pesticides are used; all the vehicles in the greenhouse are electric; and all the hydraulic systems use vegetable oil.







### Far-reaching implications

Toundra Greenhouse is the most technologically advanced greenhouse complex in Canada, using sensors and automation to supply light and nutrients to the plants. It is also one of the most productive greenhouses in Canada.

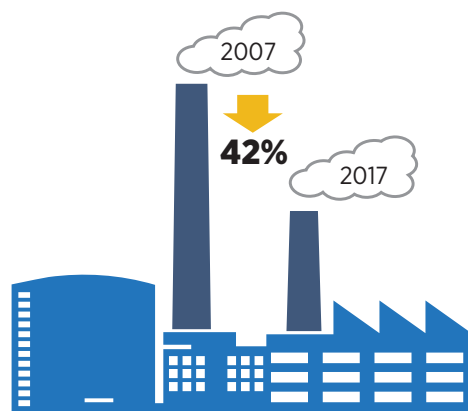
SUBWAY® has a contract to supply all 850 of its restaurants in Quebec and Eastern Canada with Toundra's cucumbers, and Sobeys Québec purchases enough cucumbers to supply 420 locations in Quebec. Producing food locally is an important aspect of the Canadian market, which relies heavily on food imports. More locally produced food contributes to a more sustainable and resilient food supply chain as well as local jobs and investment.

In recognition of this outstanding success, Toundra Greenhouse was awarded Quebec's prestigious Mercure business award for sustainable development. But the success of the project has much broader implications. It is an excellent example of how projects

can bring together circular bioeconomy activities with other strategies, such as digitization and carbon management, to create local, low-carbon and sustainable development opportunities for forest communities all across Canada.

Between 2007 and 2017, the forest industry reduced total fossil GHG emissions by


**42%**



Source: See **Sources and information** for more detail, or visit us online at [cfs.nrcan.gc.ca/stateoftheforests](https://cfs.nrcan.gc.ca/stateoftheforests).



# Statistical profiles


 <b>Canada</b> Population (January 2020) <b>37,894,799</b> Arboreal emblem <b>Maple</b>	
<b>Forest inventory</b>	
<b>Forest area by classification</b> (hectares)	
Forest land	346,964,664
Other wooded land	40,865,660
Other land with tree cover	8,498,940
<b>Forest area change</b> (hectares, 2018)	
Afforestation	Not available
Deforestation (total; by sectors below)	34,257
Mining, oil and gas	13,398
Agriculture	12,280
Built-up	6,512
Forestry	1,494
Hydroelectric	573
<b>Forest type</b> (forest land only)	
Coniferous	67.8%
Mixedwood	15.5%
Broadleaf	10.5%
Temporarily non-treed	5.9%
<b>Forest ownership</b>	
Provincial	76.6%
Territorial	12.9%
Private	6.2%
Indigenous	2.0%
Federal	1.6%
Municipal	0.3%
Other	0.4%
<b>Growing stock</b> (million cubic metres, 2018)	
Total volume	44,648
<b>Disturbance</b>	
<b>Insects</b> (hectares, 2018)	
Area defoliated by insects and containing beetle-killed trees	16,390,513
<b>Fire</b> (2019)	
Area burned (hectares)	1,842,612
Number of fires	3,921
<b>Forest management</b>	
<b>Harvesting</b> (2018)	
Area harvested (hectares)	747,690
Volume harvested (cubic metres)	158,063,563
<b>Regeneration</b> (hectares, 2018)	
Area planted	356,371
Area seeded	6,003
<b>Third-party certification</b> (hectares, 2019)	
Area certified	168,002,236
<b>Protected forest</b> (hectares, 2016)	
Area protected	29,507,000
<b>Greenhouse gas inventory</b>	
<b>For forest lands affected by land-use change</b> (2018)	
Removals from the atmosphere due to afforestation (CO <sub>2</sub> e/yr, megatonnes)	0.3
Total emissions due to deforestation (CO <sub>2</sub> e/yr, megatonnes)	9.4
<b>For managed forests</b> (2018)	
Area of managed forests (hectares)	226,000,000
Total net emissions or removals to the atmosphere, all causes (CO <sub>2</sub> e/yr, megatonnes)	243.2
Net emissions or removals due to natural disturbances (CO <sub>2</sub> e/yr, megatonnes)	251.1
Net emissions or removals due to human forest management activities and from harvested wood products (CO <sub>2</sub> e/yr, megatonnes)	-7.6
Transfers from the managed forest sector to the forest products sector due to harvesting (CO <sub>2</sub> e/yr, megatonnes)	-165.4


Domestic economic impact	
Canadian housing starts (2019)	208,685
Contribution to nominal GDP* (current dollars, 2019)	
Forestry and logging	4,076,976,361
Pulp and paper product manufacturing	9,133,494,899
Wood product manufacturing	10,481,523,166
Total contribution to nominal GDP	23,691,994,426
Contribution to real GDP* (constant 2012 dollars, 2019)	
Forestry and logging	3,627,000,000
Pulp and paper product manufacturing	7,001,000,000
Wood product manufacturing	8,436,000,000
Total contribution to real GDP	19,064,000,000
Revenue from goods manufactured (dollars, 2018)	
Logging	10,806,584,000
Pulp and paper product manufacturing	30,592,308,000
Wood product manufacturing	35,814,788,000
Total revenue from goods manufactured	77,213,680,000
Forest sector employment	
Employment (number)	
Survey of Employment, Payrolls and Hours (2019)	183,951
Canadian System of National Accounts (2018)	204,555
Natural Resources Satellite Account (2019)	226,988
Direct and indirect employment (2018)	302,489
Wages and salaries (dollars, 2018)	
Logging	1,783,545,000
Pulp and paper manufacturing	3,693,635,000
Wood product manufacturing	5,347,509,000
Total wages and salaries	10,824,689,000
Trade	
Balance of trade (total exports, dollars, 2019)	21,423,061,783
Value of exports (dollars, 2019)	
Primary wood products	1,423,398,212
Pulp and paper products	17,719,900,091
Wood-fabricated materials	14,108,048,255
Total value of exports	33,251,346,558
Value of imports (dollars, 2019)	
Primary wood products	577,214,869
Pulp and paper products	7,944,798,379
Wood-fabricated materials	3,306,271,527
Total value of imports	11,828,284,775

Domestic production and investment	
Production (2019)	
Hardwood lumber (cubic metres)	978,600
Softwood lumber (cubic metres)	57,653,200
Newsprint (tonnes)	2,678,000
Printing and writing paper (tonnes)	2,619,000
Wood pulp (tonnes)	15,392,000
Structural panels (plywood and oriented strandboard, cubic metres)	8,453,982
Capital expenditures (dollars, 2019)	
Forestry and logging	570,700,000
Pulp and paper product manufacturing	1,007,200,000
Wood product manufacturing	892,000,000
Total capital expenditures	2,469,900,000
Repair expenditures (dollars, 2018)	
Forestry and logging	515,500,000
Pulp and paper product manufacturing	1,251,800,000
Wood product manufacturing	1,069,100,000
Total repair expenditures	2,836,400,000
Domestic consumption	
Consumption (2019)	
Hardwood lumber (cubic metres)	1,021,909
Softwood lumber (cubic metres)	20,059,690
Newsprint (tonnes)	291,247
Printing and writing paper (tonnes)	1,024,583
Wood pulp (tonnes)	6,531,401
Structural panels (plywood and oriented strandboard, cubic metres)	2,689,838


\* See **Sources and information** section for information on GDP from Statistics Canada's Natural Resources Satellite Account.


See the **Sources and information** section for background information and sources for the statistics presented in these tables.


	<b>British Columbia</b>	
	Population (January 2020)	5,110,917
	Arboreal emblem	Western redcedar
<b>Disturbance</b>		
<b>Insects</b> (hectares, 2018)		
Area defoliated by insects and containing beetle-killed trees		6,228,569
<b>Fire</b> (2019)		
Area burned (hectares)		21,070
Number of fires		807
<b>Forest management</b>		
<b>Harvesting</b> (2018)		
Area harvested (hectares)		182,410
Volume harvested (cubic metres)		68,441,448
<b>Regeneration</b> (hectares, 2018)		
Area planted		179,996
Area seeded		401
<b>Third-party certification</b> (hectares, 2019)		
Area certified		51,811,125
<b>Domestic economic impact</b>		
Housing starts (2019)		44,932
<b>Revenue from goods manufactured</b> (dollars, 2018)		
Logging		5,573,890,000
Pulp and paper product manufacturing		5,621,120,000
Wood product manufacturing		12,636,362,000
Total revenue from goods manufactured		23,831,372,000
<b>Forest sector employment</b>		
<b>Employment</b> (number, 2019)		
Canadian System of National Accounts		Not available
Survey of Employment, Payrolls and Hours		50,599
<b>Wages and salaries</b> (dollars, 2018)		
Logging		883,494,000
Pulp and paper product manufacturing		622,811,000
Wood product manufacturing		1,656,152,000
Total wages and salaries		3,162,457,000
<b>Trade</b>		
Balance of trade (total exports, dollars, 2019)		9,786,190,713
<b>Value of domestic exports</b> (dollars, 2019)		
Primary wood products		1,153,276,391
Pulp and paper products		4,237,714,663
Wood-fabricated materials		6,336,702,568
Total value of domestic exports		11,727,693,622
<b>Value of imports</b> (dollars, 2019)		
Primary wood products		133,158,635
Pulp and paper products		898,399,230
Wood-fabricated materials		909,945,044
Total value of imports		1,941,502,909

	<b>Alberta</b>	
	Population (January 2020)	4,413,146
	Arboreal emblem	Lodgepole pine
<b>Disturbance</b>		
<b>Insects</b> (hectares, 2018)		
Area defoliated by insects and containing beetle-killed trees		1,229,398
<b>Fire</b> (2019)		
Area burned (hectares)		883,407
Number of fires		981
<b>Forest management</b>		
<b>Harvesting</b> (2018)		
Area harvested (hectares)		93,438
Volume harvested (cubic metres)		27,146,006
<b>Regeneration</b> (hectares, 2018)		
Area planted		74,205
Area seeded		597
<b>Third-party certification</b> (hectares, 2019)		
Area certified		21,149,524
<b>Domestic economic impact</b>		
Housing starts (2019)		27,325
<b>Revenue from goods manufactured</b> (dollars, 2018)		
Logging		990,024,000
Pulp and paper product manufacturing		2,530,062,000
Wood product manufacturing		4,531,504,000
Total revenue from goods manufactured		8,051,590,000
<b>Forest sector employment</b>		
<b>Employment</b> (number, 2019)		
Canadian System of National Accounts		Not available
Survey of Employment, Payrolls and Hours		15,279
<b>Wages and salaries</b> (dollars, 2018)		
Logging		177,375,000
Pulp and paper product manufacturing		Not available
Wood product manufacturing		685,597,000
Total wages and salaries		Not available
<b>Trade</b>		
Balance of trade (total exports, dollars, 2019)		3,114,596,456
<b>Value of domestic exports</b> (dollars, 2019)		
Primary wood products		27,390,229
Pulp and paper products		1,975,705,253
Wood-fabricated materials		1,462,513,536
Total value of domestic exports		3,465,609,018
<b>Value of imports</b> (dollars, 2019)		
Primary wood products		3,397,938
Pulp and paper products		199,842,592
Wood-fabricated materials		147,772,032
Total value of imports		351,012,562





	<b>Saskatchewan</b>	
	Population (January 2020)	1,181,666
	Arboreal emblem	White birch
<b>Disturbance</b>		
<b>Insects</b> (hectares, 2018)		
Area defoliated by insects and containing beetle-killed trees		149,198
<b>Fire</b> (2019)		
Area burned (hectares)		47,930
Number of fires		234
<b>Forest management</b>		
<b>Harvesting</b> (2018)		
Area harvested (hectares)		20,303
Volume harvested (cubic metres)		3,694,399
<b>Regeneration</b> (hectares, 2018)		
Area planted		7,324
Area seeded		Not available
<b>Third-party certification</b> (hectares, 2019)		
Area certified		5,996,839
<b>Domestic economic impact</b>		
Housing starts (2019)		2,427
<b>Revenue from goods manufactured</b> (dollars, 2018)		
Logging		131,291,000
Pulp and paper product manufacturing		Not available
Wood product manufacturing		730,076,000
Total revenue from goods manufactured		Not available
<b>Forest sector employment</b>		
<b>Employment</b> (number, 2019)		
Canadian System of National Accounts		Not available
Survey of Employment, Payrolls and Hours		1,594
<b>Wages and salaries</b> (dollars, 2018)		
Logging		19,221,000
Pulp and paper product manufacturing		Not available
Wood product manufacturing		96,612,000
Total wages and salaries		Not available
<b>Trade</b>		
Balance of trade (total exports, dollars, 2019)		456,522,661
<b>Value of domestic exports</b> (dollars, 2019)		
Primary wood products		2,407,541
Pulp and paper products		283,513,753
Wood-fabricated materials		257,028,824
Total value of domestic exports		542,950,118
<b>Value of imports</b> (dollars, 2019)		
Primary wood products		4,203,453
Pulp and paper products		53,306,232
Wood-fabricated materials		28,917,772
Total value of imports		86,427,457

	<b>Manitoba</b>	
	Population (January 2020)	1,377,517
	Arboreal emblem	White spruce
<b>Disturbance</b>		
<b>Insects</b> (hectares, 2018)		
Area defoliated by insects and containing beetle-killed trees		623,173
<b>Fire</b> (2019)		
Area burned (hectares)		101,140
Number of fires		277
<b>Forest management</b>		
<b>Harvesting</b> (2018)		
Area harvested (hectares)		9,439
Volume harvested (cubic metres)		1,321,436
<b>Regeneration</b> (hectares, 2018)		
Area planted		2,010
Area seeded		Not available
<b>Third-party certification</b> (hectares, 2019)		
Area certified		11,091,305
<b>Domestic economic impact</b>		
Housing starts (2019)		6,946
<b>Revenue from goods manufactured</b> (dollars, 2018)		
Logging		50,767,000
Pulp and paper product manufacturing		Not available
Wood product manufacturing		614,789,000
Total revenue from goods manufactured		Not available
<b>Forest sector employment</b>		
<b>Employment</b> (number, 2019)		
Canadian System of National Accounts		Not available
Survey of Employment, Payrolls and Hours		3,329
<b>Wages and salaries</b> (dollars, 2018)		
Logging		11,971,000
Pulp and paper product manufacturing		Not available
Wood product manufacturing		129,946,000
Total wages and salaries		Not available
<b>Trade</b>		
Balance of trade (total exports, dollars, 2019)		-87,223,477
<b>Value of domestic exports</b> (dollars, 2019)		
Primary wood products		1,015,167
Pulp and paper products		268,686,783
Wood-fabricated materials		217,117,461
Total value of domestic exports		486,819,411
<b>Value of imports</b> (dollars, 2019)		
Primary wood products		4,840,406
Pulp and paper products		402,496,956
Wood-fabricated materials		166,705,526
Total value of imports		574,042,888


	<b>Ontario</b>	
Population (January 2020)	14,711,827	
Arboreal emblem	Eastern white pine	
<b>Disturbance</b>		
<b>Insects</b> (hectares, 2018)		
Area defoliated by insects and containing beetle-killed trees	1,848,481	
<b>Fire</b> (2019)		
Area burned (hectares)	270,030	
Number of fires	535	
<b>Forest management</b>		
<b>Harvesting</b> (2018)		
Area harvested (hectares)	126,015	
Volume harvested (cubic metres)	13,980,018	
<b>Regeneration</b> (hectares, 2018)		
Area planted	72,636	
Area seeded	5,005	
<b>Third-party certification</b> (hectares, 2019)		
Area certified	27,539,123	
<b>Domestic economic impact</b>		
Housing starts (2019)	68,985	
<b>Revenue from goods manufactured</b> (dollars, 2018)		
Logging	1,181,942,000	
Pulp and paper product manufacturing	8,964,158,000	
Wood product manufacturing	5,514,648,000	
Total revenue from goods manufactured	15,660,748,000	
<b>Forest sector employment</b>		
<b>Employment</b> (number, 2019)		
Canadian System of National Accounts	Not available	
Survey of Employment, Payrolls and Hours	37,939	
<b>Wages and salaries</b> (dollars, 2018)		
Logging	200,496,000	
Pulp and paper product manufacturing	1,278,871,000	
Wood product manufacturing	1,002,210,000	
Total wages and salaries	2,481,577,000	
<b>Trade</b>		
Balance of trade (total exports, dollars, 2019)	-1,535,446,675	
<b>Value of domestic exports</b> (dollars, 2019)		
Primary wood products	60,538,337	
Pulp and paper products	2,940,424,597	
Wood-fabricated materials	1,784,962,367	
Total value of domestic exports	4,785,925,301	
<b>Value of imports</b> (dollars, 2019)		
Primary wood products	68,277,956	
Pulp and paper products	4,826,480,447	
Wood-fabricated materials	1,426,613,573	
Total value of imports	6,321,371,976	


	<b>Quebec</b>	
Population (January 2020)	8,537,674	
Arboreal emblem	Yellow birch	
<b>Disturbance</b>		
<b>Insects</b> (hectares, 2018)		
Area defoliated by insects and containing beetle-killed trees	5,551,793	
<b>Fire</b> (2019)		
Area burned (hectares)	10,225	
Number of fires	339	
<b>Forest management</b>		
<b>Harvesting</b> (2018)		
Area harvested (hectares)	202,007	
Volume harvested (cubic metres)	29,018,384	
<b>Regeneration</b> (hectares, 2018)		
Area planted	Not available	
Area seeded	Not available	
<b>Third-party certification</b> (hectares, 2019)		
Area certified	43,493,594	
<b>Domestic economic impact</b>		
Housing starts (2019)	47,967	
<b>Revenue from goods manufactured</b> (dollars, 2018)		
Logging	2,104,640,000	
Pulp and paper product manufacturing	9,580,492,000	
Wood product manufacturing	9,508,590,000	
Total revenue from goods manufactured	21,193,722,000	
<b>Forest sector employment</b>		
<b>Employment</b> (number, 2019)		
Canadian System of National Accounts	Not available	
Survey of Employment, Payrolls and Hours	59,129	
<b>Wages and salaries</b> (dollars, 2018)		
Logging	343,457,000	
Pulp and paper product manufacturing	1,080,415,000	
Wood product manufacturing	1,456,367,000	
Total wages and salaries	2,880,239,000	
<b>Trade</b>		
Balance of trade (total exports, dollars, 2019)	7,359,334,690	
<b>Value of domestic exports</b> (dollars, 2019)		
Primary wood products	113,452,625	
Pulp and paper products	6,219,989,819	
Wood-fabricated materials	3,261,207,885	
Total value of domestic exports	9,594,650,329	
<b>Value of imports</b> (dollars, 2019)		
Primary wood products	288,634,459	
Pulp and paper products	1,384,703,970	
Wood-fabricated materials	561,977,210	
Total value of imports	2,235,315,639	

 <b>New Brunswick</b> Population (January 2020) <b>779,993</b> Arboreal emblem <b>Balsam fir</b>	
<b>Disturbance</b>	
<b>Insects</b> (hectares, 2018)	
Area defoliated by insects and containing beetle-killed trees	440
<b>Fire</b> (2019)	
Area burned (hectares)	224
Number of fires	178
<b>Forest management</b>	
<b>Harvesting</b> (2018)	
Area harvested (hectares)	74,469
Volume harvested (cubic metres)	9,362,714
<b>Regeneration</b> (hectares, 2018)	
Area planted	11,505
Area seeded	Not available
<b>Third-party certification</b> (hectares, 2019)	
Area certified	4,235,954
<b>Domestic economic impact</b>	
Housing starts (2019)	2,935
<b>Revenue from goods manufactured</b> (dollars, 2018)	
Logging	622,186,000
Pulp and paper product manufacturing	2,108,845,000
Wood product manufacturing	1,698,077,000
Total revenue from goods manufactured	4,429,108,000
<b>Forest sector employment</b>	
<b>Employment</b> (number, 2019)	
Canadian System of National Accounts	Not available
Survey of Employment, Payrolls and Hours	10,272
<b>Wages and salaries</b> (dollars, 2018)	
Logging	105,088,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total wages and salaries	Not available
<b>Trade</b>	
Balance of trade (total exports, dollars, 2019)	1,548,844,872
<b>Value of domestic exports</b> (dollars, 2019)	
Primary wood products	36,763,300
Pulp and paper products	1,163,110,207
Wood-fabricated materials	612,225,019
Total value of domestic exports	1,812,098,526
<b>Value of imports</b> (dollars, 2019)	
Primary wood products	74,668,624
Pulp and paper products	147,687,425
Wood-fabricated materials	40,897,605
Total value of imports	263,253,654


 <b>Nova Scotia</b> Population (January 2020) <b>977,457</b> Arboreal emblem <b>Red spruce</b>	
<b>Disturbance</b>	
<b>Insects</b> (hectares, 2018)	
Area defoliated by insects and containing beetle-killed trees	698
<b>Fire</b> (2019)	
Area burned (hectares)	154
Number of fires	135
<b>Forest management</b>	
<b>Harvesting</b> (2018)	
Area harvested (hectares)	31,151
Volume harvested (cubic metres)	3,359,178
<b>Regeneration</b> (hectares, 2018)	
Area planted	5,091
Area seeded	Not available
<b>Third-party certification</b> (hectares, 2019)	
Area certified	1,284,871
<b>Domestic economic impact</b>	
Housing starts (2019)	4,719
<b>Revenue from goods manufactured</b> (dollars, 2018)	
Logging	107,501,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total revenue from goods manufactured	Not available
<b>Forest sector employment</b>	
<b>Employment</b> (number, 2019)	
Canadian System of National Accounts	Not available
Survey of Employment, Payrolls and Hours	2,606
<b>Wages and salaries</b> (dollars, 2018)	
Logging	28,748,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total wages and salaries	Not available
<b>Trade</b>	
Balance of trade (total exports, dollars, 2019)	582,834,095
<b>Value of domestic exports</b> (dollars, 2019)	
Primary wood products	28,535,522
Pulp and paper products	447,165,908
Wood-fabricated materials	157,200,137
Total value of domestic exports	632,901,567
<b>Value of imports</b> (dollars, 2019)	
Primary wood products	15,671
Pulp and paper products	26,722,264
Wood-fabricated materials	23,329,537
Total value of imports	50,067,472



 <b>Prince Edward Island</b> Population (January 2020) <b>158,158</b> Arboreal emblem <b>Red oak</b>	
<b>Disturbance</b>	
<b>Insects</b> (hectares, 2018)	
Area defoliated by insects and containing beetle-killed trees	17
<b>Fire</b> (2019)	
Area burned (hectares)	9
Number of fires	2
<b>Forest management</b>	
<b>Harvesting</b> (2018)	
Area harvested (hectares)	107
Volume harvested (cubic metres)	342,449
<b>Regeneration</b> (hectares, 2018)	
Area planted	273
Area seeded	Not available
<b>Third-party certification</b> (hectares, 2019)	
Area certified	0
<b>Domestic economic impact</b>	
Housing starts (2019)	1,504
<b>Revenue from goods manufactured</b> (dollars, 2018)	
Logging	10,841,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total revenue from goods manufactured	Not available
<b>Forest sector employment</b>	
<b>Employment</b> (number, 2019)	
Canadian System of National Accounts	Not available
Survey of Employment, Payrolls and Hours	Not available
<b>Wages and salaries</b> (dollars, 2018)	
Logging	1,814,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total wages and salaries	Not available
<b>Trade</b>	
Balance of trade (total exports, dollars, 2019)	26,888,565
<b>Value of domestic exports</b> (dollars, 2019)	
Primary wood products	0
Pulp and paper products	26,731,312
Wood-fabricated materials	179,218
Total value of domestic exports	26,910,530
<b>Value of imports</b> (dollars, 2019)	
Primary wood products	0
Pulp and paper products	15,432
Wood-fabricated materials	6,533
Total value of imports	21,965

 <b>Newfoundland and Labrador</b> Population (January 2020) <b>521,365</b> Arboreal emblem <b>Black spruce</b>	
<b>Disturbance</b>	
<b>Insects</b> (hectares, 2018)	
Area defoliated by insects and containing beetle-killed trees	650
<b>Fire</b> (2019)	
Area burned (hectares)	320
Number of fires	93
<b>Forest management</b>	
<b>Harvesting</b> (2018)	
Area harvested (hectares)	7,925
Volume harvested (cubic metres)	1,358,570
<b>Regeneration</b> (hectares, 2018)	
Area planted	3,331
Area seeded	0
<b>Third-party certification</b> (hectares, 2019)	
Area certified	1,399,901
<b>Domestic economic impact</b>	
Housing starts (2019)	945
<b>Revenue from goods manufactured</b> (dollars, 2018)	
Logging	32,717,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total revenue from goods manufactured	Not available
<b>Forest sector employment</b>	
<b>Employment</b> (number, 2019)	
Canadian System of National Accounts	Not available
Survey of Employment, Payrolls and Hours	45
<b>Wages and salaries</b> (dollars, 2018)	
Logging	11,751,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total wages and salaries	Not available
<b>Trade</b>	
Balance of trade (total exports, dollars, 2019)	169,971,729
<b>Value of domestic exports</b> (dollars, 2019)	
Primary wood products	19,100
Pulp and paper products	156,820,654
Wood-fabricated materials	18,391,207
Total value of domestic exports	175,230,961
<b>Value of imports</b> (dollars, 2019)	
Primary wood products	17,727
Pulp and paper products	5,142,630
Wood-fabricated materials	98,875
Total value of imports	5,259,232

 <b>Yukon</b> Population (January 2020) <b>41,078</b> Arboreal emblem <b>Subalpine fir</b>		
<b>Disturbance</b>		
<b>Insects</b> (hectares, 2018)		
Area defoliated by insects and containing beetle-killed trees		8,947
<b>Fire</b> (2019)		
Area burned (hectares)		279,169
Number of fires		116
<b>Forest management</b>		
<b>Harvesting</b> (2018)		
Area harvested (hectares)		100
Volume harvested (cubic metres)		5,810
<b>Regeneration</b> (hectares, 2018)		
Area planted		0
Area seeded		Not available
<b>Third-party certification</b> (hectares, 2019)		
Area certified		0
<b>Trade</b>		
Balance of trade (total exports, dollars, 2019)		511,107
<b>Value of domestic exports</b> (dollars, 2019)		
Primary wood products		0
Pulp and paper products		0
Wood-fabricated materials		520,033
Total value of domestic exports		520,033
<b>Value of imports</b> (dollars, 2019)		
Primary wood products		0
Pulp and paper products		1,106
Wood-fabricated materials		7,820
Total value of imports		8,926

 <b>Northwest Territories</b> Population (January 2020) <b>44,904</b> Arboreal emblem <b>Tamarack</b>		
<b>Disturbance</b>		
<b>Insects</b> (hectares, 2018)		
Area defoliated by insects and containing beetle-killed trees		749,149
<b>Fire</b> (2019)		
Area burned (hectares)		111,099
Number of fires		149
<b>Forest management</b>		
<b>Harvesting</b> (2018)		
Area harvested (hectares)		326
Volume harvested (cubic metres)		33,151
<b>Regeneration</b> (hectares, 2018)		
Area planted		Not available
Area seeded		Not available
<b>Third-party certification</b> (hectares, 2019)		
Area certified		0
<b>Trade</b>		
Balance of trade (total exports, dollars, 2019)		37,047
<b>Value of domestic exports</b> (dollars, 2019)		
Primary wood products		0
Pulp and paper products		37,142
Wood-fabricated materials		0
Total value of domestic exports		37,142
<b>Value of imports</b> (dollars, 2019)		
Primary wood products		0
Pulp and paper products		95
Wood-fabricated materials		0
Total value of imports		95

<b>Nunavut</b> Population (January 2020) <b>39,097</b>		
<b>Trade</b>		
Balance of trade (total exports, dollars, 2019)		0
<b>Value of domestic exports</b> (dollars, 2019)		
Primary wood products		0
Pulp and paper products		0
Wood-fabricated materials		0
Total value of domestic exports		0
<b>Value of imports</b> (dollars, 2019)		
Primary wood products		0
Pulp and paper products		0
Wood-fabricated materials		0
Total value of imports		0

# Sources and information

The data in this report are derived from a number of sources, which are identified here by their relevant section. Where necessary, data have been edited for accuracy and consistency. All data are subject to revision.

In most cases, the data represent the year before the reporting period. However, when they are gathered from several sources, it takes longer to analyze and produce them. In these cases, the numbers reflect results from two or three years before the reporting period.

While most figures are calculated for the calendar year, some are based on the federal government's fiscal year (April 1 to March 31). Numbers are rounded off. In the case of employment data, they are rounded to the nearest hundred. All dollar figures, unless specified otherwise, are in Canadian dollars.

It may not be possible to directly compare the data from the various sections, as they come from several sources that may compile their statistics differently from each other.

Dates on which data were accessed online are now included for the Food and Agriculture Organization of the United Nations, the National Forest Inventory, the National Forestry Database, the Canadian Interagency Forest Fire Centre, and Statistics Canada.

## The 2020 State of Canada's Forests Report: An overview

Food and Agriculture Organization of the United Nations. 2015. *Global Forest Resources Assessment 2015 Desk Reference*. Rome, Italy. <http://www.fao.org/3/a-i4808e.pdf>

Additional information can be found at:

- Montréal Process Working Group. <https://www.montrealprocess.org/>
- United Nations. 2019. Global Forest Goals and Targets. <https://www.un.org/esa/forests/wp-content/uploads/2019/04/Global-Forest-Goals-booklet-Apr-2019.pdf>

### Photo credits:

- Global forest goal icons provided courtesy of the International Model Forest Network.
- Sustainable development goal 15 icon provided courtesy of the United Nations.

## From staple goods to essentials: How the forest sector provides support during a crisis

### Photo credit:

- Coronavirus by akr11\_ss/Shutterstock.

## Canada's forests: Resilient to change

Brandt, J., Flannigan, M., et al. 2013. An introduction to Canada's boreal zone: ecosystem processes, health, sustainability, and environmental issues. *Environmental Reviews* 21(4): 207–226. <https://cfs.nrcan.gc.ca/publications?id=35234>

Bioindustrial Innovation Canada. 2018. *Canada's Bioeconomy Strategy: Leveraging our Strengths for a Sustainable Future*. [http://www.biotech.ca/wp-content/uploads/2016/03/National\\_Bioeconomy\\_Strategy\\_EN-compressed.pdf](http://www.biotech.ca/wp-content/uploads/2016/03/National_Bioeconomy_Strategy_EN-compressed.pdf)

Canadian Space Agency. WildFireSat: Enhancing Canada's ability to manage wildfires. <https://www.asc-csa.gc.ca/eng/satellites/wildfiresat/default.asp>

Certification Canada. Canadian statistics. (accessed March 11, 2020). <http://certificationcanada.org/en/statistics/canadian-statistics/>

- Double counting of area certified to both FSC and PEFC in 2019 has been removed from the total area of forest certified of Canada.
- Natural Resources Canada–Canadian Forest Service prepared calculations for net forest area certified in other countries based on data from:
  - Forest Stewardship Council. 2019. *Facts & Figures December 2019*. <https://fsc.org/en/page/facts-figures> (accessed March 12, 2020).
  - Forest Stewardship Council. 2019. *Double certifications FSC and PEFC – estimations for mid 2018*. <https://ic.fsc.org/file-download.doublecertification-fsc-and-pefc-estimations-for-mid-2018.a-8204.pdf> (accessed March 12, 2020).
  - Programme for the Endorsement of Forest Certification. 2019. *Facts and Figures 2019*. <https://www.pefc.org/discover-pefc/facts-and-figures> (accessed March 12, 2020).

Certification Canada. Provincial statistics. <http://certificationcanada.org/en/statistics/provincial-statistics/> (accessed May 4, 2020).

- The percentage of managed public forest land area that is certified was calculated for each province and territory in two steps. First, statistics were collected from Certification Canada, except for Quebec and Nova Scotia, to calculate area of public forest that is certified. Next, this area was divided by the area of managed public forest land. The area of managed public forest land was calculated using the map of forest management in Canada, 2017 version, including all public lands that have long- or short-term forest tenure, except for British Columbia, Alberta, Quebec, New Brunswick and Prince Edward Island.
- Map of forest management in Canada, 2017 version. <https://open.canada.ca/data/en/dataset/d8fa9a38-c4df-442a-8319-9bbcbdc29060>
- Provincial government statistics for the certified area were used for Quebec and Nova Scotia.
- Statistics from provincial governments for the managed public forest land area were used instead of GIS calculations based on the Map of forest management in Canada, 2017 version, for British Columbia, Alberta, Quebec, New Brunswick and Prince Edward Island.
- Note that, for consistency with certification statistics, managed public forest land area includes forest and non-forest land areas within forest tenure areas.



Dyk, A., Leckie, D., et al. 2015. *Canada's National Deforestation Monitoring System: System Description*. Victoria, British Columbia: Natural Resources Canada–Canadian Forest Service, Pacific Forestry Centre. <http://cfs.nrcan.gc.ca/publications?id=36042>

- Describes Canada's deforestation monitoring system. Note that the system was initially set up for greenhouse gas inventory and forest carbon accounting purposes, so it uses the greenhouse gas inventory and carbon accounting definition of **forest**.
- National deforestation estimates are calculated on a periodic basis using the method described in *Canada's National Deforestation Monitoring System: System Description*.
- Data provided by the National Deforestation Monitoring System, special tabulation, March 12, 2020.

Environment and Climate Change Canada. 2020. *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada*. <https://unfccc.int/documents/224829>

- Environment and Climate Change Canada's *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada* is based on data and analysis from Natural Resources Canada–Canadian Forest Service's National Forest Carbon Monitoring, Accounting and Reporting System.

Food and Agriculture Organization of the United Nations. 2014. *Global Forest Resources Assessment 2015 Country Report: Canada*. Rome, Italy. <http://www.fao.org/3/a-az181e.pdf>

- Describes the methodology used to adjust the National Forest Inventory baseline estimate of forest area.

Food and Agriculture Organization of the United Nations. 2016. *Global Forest Resources Assessment 2015*. <http://www.fao.org/forest-resources-assessment/past-assessments/fra-2015/en/>

- This dataset was used to calculate Canada's forest area as a proportion of the world's forest area. It also provided the national forest area of all countries except Canada.

Food and Agriculture Organization of the United Nations. 2018. *Global Forest Resources Assessment 2020: Terms and Definitions*. <http://www.fao.org/3/i8661en/i8661en.pdf>

- **Forest, afforestation** and other terms are defined in this document. Note that Canada uses this definition of **forest** for most, but not all, purposes. A slightly different definition is used for the national greenhouse gas inventory and forest carbon accounting.

Kasischke, E., Turetsky, M. 2006. Recent changes in the fire regime across the North American boreal region–Spatial and temporal patterns of burning across Canada and Alaska. *Geophysical Research Letters* 33(9). <https://doi.org/10.1029/2006GL025677>

National Forest Inventory. Standard reports, Table 4.0. Area (1000 ha) of forest and non-forest land in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/CA3\\_T4\\_FOR\\_AREA\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/CA3_T4_FOR_AREA_en.html) (accessed March 29, 2020).

- Baseline estimate of Canada's forest area.
- NFI baseline photo plot data collected during 2000–2006 were used to estimate the forest area within protected areas, assuming no change in forest area between 1990 and 2016. The forest area is generally stable in Canada and protected areas are typically less subject to land-use change than non-protected areas.
- The forest area is not the same as the area of tree cover. Some treed areas, such as treed urban and agricultural land areas, are not classified as forest. Some non-treed areas, such as recently harvested areas that will be replanted, are classified as forest.

The area of tree cover is routinely mapped using satellite data, but land use is also taken into account when assessing the area of forest.

National Forest Inventory. Standard reports, Table 4.2. Area (1000 ha) of forest and non-forest land by boreal zone in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/BOR3\\_T4\\_FOR\\_AREA\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/BOR3_T4_FOR_AREA_en.html) (accessed March 29, 2020).

- Baseline estimate of Canada's boreal zone and boreal forest land.

National Forestry Database. Forest fires, Table 3.1.2, Area burned by jurisdiction, cause class, response category and protection zone. <http://nfdp.ccfm.org/en/data/fires.php> (accessed April 14, 2020).

- National Forestry Database sources 2019 fire data from the Canadian Interagency Forest Fire Centre (CIFFC).

National Forestry Database. Forest insects, Table 4.1, Area of moderate to severe defoliation (including beetle-killed trees) by insects. <http://nfdp.ccfm.org/en/data/insects.php> (accessed April 14, 2020).

National Forestry Database. Harvest, Table 5.2, Area harvested by jurisdiction, tenure, management and harvesting method. <http://nfdp.ccfm.org/en/data/harvest.php> (accessed April 14, 2020).

- Data include provincial Crown and private forest land subject to even-aged management (clearcutting), uneven-aged management (selection cutting), and commercial thinning harvest methods.
- The National Forestry Database reports the area harvested in Quebec in 2018 as “not available.” However, Natural Resources Canada–Canadian Forest Service has included an estimate of this value in reporting Canada's total harvested area.

Natural Resources Canada. *Energy Fact Book, 2019–2020*. Ottawa, ON. [https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/energy-factbook\\_EN-feb14-2020.pdf](https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/energy-factbook_EN-feb14-2020.pdf)

Pedlar, J., McKenney, D., et al. 2012. Placing forestry in the assisted migration debate. *BioScience* 62: 835–842. <https://cfs.nrcan.gc.ca/publications?id=34149>

Pulp and Paper Products Council.

- Production figures for newsprint are based on data from the Pulp and Paper Products Council.

Statistics Canada. Table 36-10-0401-01 (formerly CANSIM 379-0029) Gross domestic product (GDP) at basic prices by industry (x 1,000,000). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610040101> (accessed March 26, 2020).

- Natural Resources Canada–Canadian Forest Service's calculations for 2019 nominal GDP are based on Statistics Canada's tables 36-10-0434-01, 18-10-0032-01 and 18-10-0029-01 (formerly CANSIM 379-0031, 329-0077 and 329-0074, respectively): GDP in 2012 constant prices, and estimated industry price deflators indexed to 2010.

Statistics Canada. Table 36-10-0489-01 (formerly CANSIM 383-0031): Labour statistics consistent with the System of National Accounts (SNA), by job category and industry. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610048901> (accessed June 2, 2020).

- Data include NAICS 113, 1153, 321, and 322.
- Employment includes jobs held by people employed directly in the following industries: forestry and logging, support activities for forestry, pulp and paper product manufacturing, and wood product manufacturing.

- Natural Resources Canada–Canadian Forest Service prefers to use employment data from Statistics Canada’s System of National Accounts (SNA) because these data are linked to the underlying framework used to compile the Canadian System of National Accounts.
- Statistics Canada updated the Labour statistics consistent with the System of National Accounts (SNA) in February 2020, which included several changes to the 2018 employment data for NAICS 113, 1153, 321, and 322 that were initially released on May 22nd, 2019. This means that the 2018 SNA data reported here are adjusted from values reported in previous editions of the *State of Canada’s Forests: Annual Report*.

Ste-Marie, C. (Compiler). 2014. *Adapting Sustainable Forest Management to Climate Change: A Review of Assisted Tree Migration and its Potential Role in Adapting Sustainable Forest Management to Climate Change*. Ottawa, Ontario: Canadian Council of Forest Ministers. <https://www.ccfm.org/pdf/CCFM%20Assisted%20Tree%20Migration%20November%202014%20English%20FINAL.pdf>

Webster, K., Beall, F., et al. 2015. Impacts and prognosis of natural resource development on water and wetlands in Canada’s boreal zone. *Environmental Reviews* 23(1): 78–131. <https://cfs.nrcan.gc.ca/publications?id=35970>

Williamson, T., Johnston, M., et al. 2019. Adapting to climate change in Canadian forest management: Past, present and future. *The Forestry Chronicle* 95(2): 76–90. <https://cfs.nrcan.gc.ca/publications?id=40117>

### **Forest area with a long-term forest management plan**

Natural Resources Canada–Canadian Forest Service. 2018.

- Provinces and territories supplied the data for the total forest area with a long-term management plan, which were compiled by Natural Resources Canada–Canadian Forest Service. The data were adjusted to align with the total forest area as reported in Canada’s National Forest Inventory and in the sustainability indicator *Forest area* in *The State of Canada’s Forests: Annual Report 2020*.

### **Number of Indigenous people that live in or near forests**

Natural Resources Canada–Canadian Forest Service. Calculations based on Statistics Canada’s 2016 Census of Population and Natural Resources Canada–Canadian Forest Service’s National Forest Inventory’s forested land cover.

National Forest Inventory. <https://nfi.nfis.org/en/>

Statistics Canada. 2016 Census of Population. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/index-eng.cfm>

- Spatial (geographic information system) analysis used the two previous sources to calculate the percentage of forest cover by census subdivision (CSD). To be considered forested, a CSD needed to contain  $\geq 25\%$  of forested land cover. Populations residing within those forested CSDs are considered living in or near forests.
- This analysis is based on Statistics Canada’s census subdivisions. A **subdivision** is “the general term for municipalities (as determined by provincial/territorial legislation) or areas treated as municipal equivalents for statistical purposes (e.g. Indian reserves, Indian settlements and unorganized territories).” Since there is no standardized definition of **community** across provinces and territories, using census subdivisions allows for a consistent approach in reporting over time. In 2016, Canada was divided into 5,161 census subdivisions.

## **When western and Indigenous science and knowledge come together: Collaborative research centred on knowledge co-creation**

Natural Resources Canada–Canadian Forest Service. *BudCam*. <https://apps-scf-cfs.nrcan.gc.ca/budcam/en/index>

Théberge, D., Picard, M.-A., et al. 2019. *Initiative for Knowledge Co-creation in Collaboration With Indigenous Communities. Basic Approach: Ethics of Research*. <https://cfs.nrcan.gc.ca/publications?id=40002>

Théberge, D., Picard, M.-A., et al. 2019. Meeting between Researchers and Indigenous Communities. <https://cfs.nrcan.gc.ca/publications?id=40004>

### **Number of Indigenous people that live in or near forests**

Natural Resources Canada–Canadian Forest Service. Calculations based on Statistics Canada’s 2016 Census of Population and Natural Resources Canada–Canadian Forest Service’s National Forest Inventory’s forested land cover.

National Forest Inventory. <https://nfi.nfis.org/en/>

Statistics Canada. 2016 Census of Population. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/index-eng.cfm>

- Spatial (geographic information system) analysis used the two previous sources to calculate the percentage of forest cover by census subdivision (CSD). To be considered forested, a CSD needed to contain  $\geq 25\%$  of forested land cover. Populations residing within those forested CSDs are considered living in or near forests.
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### **Photo credits:**

- Photo of tree bark sampling courtesy of Roger Brett.
- Photo of Budcam camera and photo of budburst from Natural Resources Canada–Canadian Forest Service.

## **Forest composition across Canada**

Beaudoin, A., Bernier, P., et al. 2014. Mapping attributes of Canada’s forests at moderate resolution through kNN and MODIS imagery. *Canadian Journal of Forest Research*, 44: 521–532. <https://cfs.nrcan.gc.ca/publications?id=35489>

Farrar, J.L. 1995. *Trees in Canada*. Ottawa: Fitzhenry & Whiteside. <https://cfs.nrcan.gc.ca/publications?id=38371>

National Forest Inventory. Maps – Forest composition across Canada. <https://nfi.nfis.org/en/maps>

Additional information can be found at:

- Beaudoin, A., Bernier, P., et al. 2018. Tracking forest attributes across Canada between 2001 and 2011 using a *k* nearest neighbors mapping approach applied to MODIS imagery. *Canadian Journal of Forest Research* 48: 85–93. <https://cfs.nrcan.gc.ca/publications?id=38979>

## How much forest does Canada have?

Dyk, A., Leckie, D., et al. 2015. *Canada's National Deforestation Monitoring System: System Description*. Victoria, British Columbia: Natural Resources Canada–Canadian Forest Service, Pacific Forestry Centre. <http://cfs.nrcan.gc.ca/publications?id=36042>

- Describes Canada's deforestation monitoring system. Note that the system was initially set up for greenhouse gas inventory and forest carbon accounting purposes, so it uses the greenhouse gas inventory and carbon accounting definition of **forest**.

Food and Agriculture Organization of the United Nations. 2014. *Global Forest Resources Assessment 2015 Country Report: Canada*. Rome, Italy. <http://www.fao.org/3/a-az181e.pdf>

- Describes the methodology used to adjust the National Forest Inventory baseline estimate of forest area.

Food and Agriculture Organization of the United Nations. 2015. *Global Forest Resources Assessment 2015 Desk Reference*. Rome, Italy. <http://www.fao.org/3/a-i4808e.pdf>

- This dataset was used to calculate Canada's forest area as a proportion of the world's forest area.

Food and Agriculture Organization of the United Nations. 2018. *Global Forest Resources Assessment 2020: Terms and Definitions*. Rome, Italy. <http://www.fao.org/3/i8661en/i8661en.pdf>

- This document describes the definitions of **forest**, **afforestation** and other terms. Note that Canada uses this definition of **forest** for most but not all purposes. For example, the national greenhouse gas inventory and forest carbon accounting use a slightly different definition.

National Forest Inventory. Standard reports, Table 4.0. Area (1000 ha) of forest and non-forest land in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/CA3\\_T4\\_FOR\\_AREA\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/CA3_T4_FOR_AREA_en.html) (accessed March 11, 2020).

- Baseline estimate of Canada's forest area.

National Forest Inventory. Standard reports, Table 4.2. Area (1000 ha) of forest and non-forest land by boreal zone in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/BOR3\\_T4\\_FOR\\_AREA\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/BOR3_T4_FOR_AREA_en.html) (accessed March 11, 2020).

- Baseline estimate of Canada's forest area in the boreal zone.

National Forest Inventory. Standard reports, Table 15.2. Total tree volume (million m<sup>3</sup>) on forest land by forest type, age class, and boreal zone in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/BOR3\\_T15\\_FORAGE20\\_VOL\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/BOR3_T15_FORAGE20_VOL_en.html) (accessed March 11, 2020).

- Baseline estimate of Canada's total tree volume on forest land in the non-boreal (temperate) zone.

### Photo credit:

- Snow covered forest stock photo by stockstudioX/iStock by Getty Images.

## Forest area

Dyk, A., Leckie, D., et al. 2015. *Canada's National Deforestation Monitoring System: System Description*. Victoria, B.C.: Natural Resources Canada–Canadian Forest Service, Pacific Forestry Centre. <http://cfs.nrcan.gc.ca/publications?id=36042>

- This document describes Canada's deforestation monitoring system. Note that the system was initially set up for greenhouse gas inventory and forest carbon accounting purposes, so it uses the greenhouse gas inventory and carbon accounting definition of **forest**.

Food and Agriculture Organization of the United Nations. 2014. *Global Forest Resources Assessment 2015 Country Report: Canada*. Rome, Italy. <http://www.fao.org/3/a-az181e.pdf>

- Describes the methodology used to adjust the National Forest Inventory baseline estimate of forest area.

Food and Agriculture Organization of the United Nations. 2018. *Global Forest Resources Assessment 2020: Terms and Definitions*. Rome, Italy. <http://www.fao.org/3/i8661en/i8661en.pdf>

- This document provides definitions of **forest**, **afforestation**, and other key terms. Note that Canada uses this definition of **forest** for most, but not all, purposes. National greenhouse gas inventory and forest carbon accounting uses a slightly different definition of **forest** and **deforestation**.

National Forest Inventory. Standard reports, Table 1.1. Area (1000 ha) of land cover by terrestrial ecozone in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/NFI3\\_T1\\_CL\\_AREA\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/NFI3_T1_CL_AREA_en.html) (accessed March 26, 2020).

- Baseline estimate of Canada's forest area by ecozone.

National Forest Inventory. Standard reports, Table 4.0. Area (1000 ha) of forest and non-forest land in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/CA3\\_T4\\_FOR\\_AREA\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/CA3_T4_FOR_AREA_en.html) (accessed March 26, 2020).

- Baseline estimate of Canada's forest area.

National Forest Inventory. Standard reports, Table 4.1. Area (1000 ha) of forest and non-forest land by terrestrial ecozone in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/NFI3\\_T4\\_FOR\\_AREA\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/NFI3_T4_FOR_AREA_en.html) (accessed March 26, 2020).

- Baseline estimate of Canada's forest area by ecozone.

Publications referenced when considering the potential effects of climate change on forest area:

- Johnston, M., Campagna, M., et al. 2009. *Vulnerability of Canada's Tree Species to Climate Change and Management Options for Adaptation: An Overview for Policy Makers and Practitioners*. Ottawa, Ont.: Canadian Council of Forest Ministers. <http://cfs.nrcan.gc.ca/publications?id=30276>
- Natural Resources Canada–Canadian Forest Service. *Changing climate, changing forest zones*. <https://www.nrcan.gc.ca/climate-change/impacts-adaptations/climate-change-impacts-forests/impacts/changing-climate-changing-forest-zones/13093> (accessed March 26, 2020)
- Price, D.T., Alfaro, R.I., et al. 2013. Anticipating the consequences of climate change for Canada's boreal forest ecosystems. *Environmental Reviews* 21, 322–365. <http://cfs.nrcan.gc.ca/publications?id=35306>

## Deforestation and afforestation

Dyk, A., Leckie, D., et al. 2015. *Canada's National Deforestation Monitoring System: System Description*. Victoria, B.C.: Natural Resources Canada–Canadian Forest Service, Pacific Forestry Centre. <http://cfs.nrcan.gc.ca/publications?id=36042>



- National deforestation estimates are calculated on a periodic basis using the method described in *National Deforestation Monitoring System: System Description*. Figure data provided by the National Deforestation Monitoring System, special tabulation, March 13, 2020.

Environment and Climate Change Canada. 2020. *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada*. <https://unfccc.int/documents/224829>

- Environment and Climate Change Canada's *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada* is based on data and analysis from Natural Resources Canada–Canadian Forest Service's National Forest Carbon Monitoring, Accounting and Reporting System.

United Nations Framework Convention on Climate Change. 2002. *Report on the Conference of the Parties on its Seventh Session, Held at Marrakesh from 29 October to 10 November 2001; Addendum, Part Two: Action Taken by the Conference of the Parties*. FCCC/CP/2001/13/Add.1. Bonn, Germany. <https://unfccc.int/resource/docs/cop7/13a01.pdf>

- Natural Resources Canada–Canadian Forest Service's National Deforestation Monitoring System and National Forest Carbon Monitoring, Accounting and Reporting System both define **forest** as a minimum land area of 1 hectare, with tree crown cover of more than 25%, and with trees having the potential to reach a minimum height of 5 metres at maturity in situ. This definition harmonizes with the definitions found in the Marrakesh Accords of the United Nations Framework Convention on Climate Change, but is different from the Food and Agriculture Organization of the United Nations' definition used elsewhere in this report.
- Values have been updated with new mapping, affecting estimates from 2004 onward, and totals include hydroelectric reservoirs.
- Deforestation by the forestry sector signifies the creation of new permanent forestry access roads.
- Deforestation by the hydroelectric sector includes new hydro lines and reservoir flooding.
- Deforestation by the built-up sector includes industrial, institutional or commercial developments as well as municipal urban development, recreation (ski hills and golf courses) and transportation.
- Deforestation by the mining, oil and gas sector includes mine development for minerals and peat as well as oil and gas developments.

## Wood volume

Environment and Climate Change Canada. 2020. *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada*. <https://unfccc.int/documents/224829>

- Environment and Climate Change Canada's *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada* is based on data and analysis from Natural Resources Canada–Canadian Forest Service's National Forest Carbon Monitoring, Accounting and Reporting System.

Kurz, W., Dymond, C., et al. 2009. CBM-CFS3: A model of carbon dynamics in forestry and land-use change implementing IPCC standards. *Ecological Modelling* 220, 480–504. <https://cfs.nrcan.gc.ca/publications?id=29137>

National Forest Inventory. Standard reports, Table 15.0. Total tree volume (million m<sup>3</sup>) on forest land by forest type and age class in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/CA3\\_T15\\_FORAGE20\\_VOL\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/CA3_T15_FORAGE20_VOL_en.html) (accessed March 27, 2020).

- Baseline estimate of Canada's wood volume.

## Methodology used to adjust baseline estimates of wood volume:

- Canada's National Forest Inventory (NFI) is completing the data processing, quality control, compilation and estimation for its first re-measurement cycle (2008 to 2017). Canada is therefore in a position to report national wood volume estimates for only one period using NFI data. NFI baseline data were collected from 2000 to 2006, and the wood volume estimate based on these data is reported here in the 2000 reporting year.
- Forecasting and backcasting from 2000 was done using above-ground biomass carbon stock estimates from Canada's National Forest Carbon Monitoring Accounting and Reporting System (NFCMARS), NIR 2020 version. Changes in wood volume should be closely related to changes in above-ground forest biomass and above-ground forest biomass carbon. Wood volume in 2000 was used to calculate wood volume in all other reporting years using the change in above-ground biomass carbon stock relative to 2000, as follows:
  - Wood volume in [year] = (wood volume in 2000) x (above-ground biomass in [year] / above-ground biomass in 2000)
  - Wood volume data are typically used to derive above-ground biomass and carbon data, but the opposite was done here because the NFI has only one complete measurement cycle whereas NFCMARS has a complete time series from 1990 to 2017.
  - In NFCMARS, the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) uses merchantable wood volume growth increment data and converts these to biomass and then carbon. However, this all happens internally in the model, and CBM-CFS3 outputs are all in units of carbon (CBM-CFS3: a model of carbon-dynamics in forestry and land-use change implementing IPCC standards. 2009. Kurz, W., et al.).
  - Note that NFCMARS does not provide data for all of Canada's forests. It is assumed here that the above-ground biomass carbon stock trend in Canada's managed forests is a good predictor of wood volume trend for Canada's entire forest (managed and unmanaged).

## Is timber being harvested sustainably?

National Forestry Database. Harvest, Table 5.2. Area harvested by jurisdiction, tenure, management and harvesting method. <http://nfdp.ccfm.org/en/data/harvest.php> (accessed June 3, 2020).

- The National Forestry Database reports the area harvested in Quebec in 2018 as "not available." However, Natural Resources Canada–Canadian Forest Service has included an estimate of this value in reporting Canada's total harvested area.

National Forestry Database. Regeneration, Table 6.2.1. Number of seedlings planted by jurisdiction, tenure and species group. <http://nfdp.ccfm.org/en/data/regeneration.php> (accessed June 3, 2020).

National Forestry Inventory. Standard reports, Table 12.0. Area (1000 ha) of forest land by ownership in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/CA3\\_T12\\_FOROWN\\_AREA\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/CA3_T12_FOROWN_AREA_en.html) (accessed June 3, 2020).

Quebec. *Sustainable Forest Development Act*: RLRQ, chapter A-18.1, updated on December 31, 2019, [Quebec], Éditeur officiel du Québec, 2019. <http://legisquebec.gouv.qc.ca/en/ShowDoc/cs/A-18.1> (accessed March 17, 2020).

## Photo credit:

- Black spruce seedling photo by Nelson Thiffault.

## Forest area harvested

National Forestry Database. Harvest, Table 5.2 Area harvested by jurisdiction, tenure, management and harvesting method. <http://nfdp.ccfm.org/en/data/harvest.php> (accessed June 3, 2020).

- Data include provincial and territorial Crown and private forest land subject to even-aged management (clearcutting), uneven-aged management (selection cutting), and commercial thinning harvest methods.
- The graph does not display federal lands because their small area cannot be represented at the given scale.
- Natural Resources Canada–Canadian Forest Service has estimated the area harvested in Quebec, and included this value in reporting the national area harvested.

## Forest regeneration

Government of British Columbia. Trends in timber harvest in B.C. <http://www.env.gov.bc.ca/soe/indicators/land/timber-harvest.html> (accessed April 5, 2020).

National Forestry Database. Regeneration, Table 6.2. Area of direct seeding by jurisdiction, tenure and application method. <http://nfdp.ccfm.org/en/data/regeneration.php> (accessed May 28, 2020).

National Forestry Database. Regeneration, Table 6.2.1. Number of seedlings planted by jurisdiction, tenure and species group. <http://nfdp.ccfm.org/en/data/regeneration.php> (accessed May 28, 2020).

National Forestry Database. Regeneration, Table 6.2.2. Area planted by jurisdiction, tenure and species group. <http://nfdp.ccfm.org/en/data/regeneration.php> (accessed May 28, 2020).

### Notes:

- Data are for forests on provincial and territorial Crown lands across Canada. Federally and privately owned lands are excluded.
- Area seeded data for the years 2015, 2016, 2017 and 2018 are reported as “not available” in the National Forestry Database for the province of Quebec. Therefore, the national total reported here does not include the area seeded in the province of Quebec for those years. Years prior to 2015 include data for Quebec.
- Area planted data for the years 2017 and 2018 are reported as “not available” in the National Forestry Database for the province of Quebec. Therefore, the national total reported here does not include the area planted in the province of Quebec for those years. Years prior to 2017 include data for Quebec.
- Data concerning the number of seedlings planted for the years 2016, 2017 and 2018 are reported as “not available” in the National Forestry Database for the province of Quebec. Therefore, the national total reported here does not include seedlings planted in the province of Quebec for those years. Years prior to 2016 include data for Quebec.
- Natural regeneration is often the most efficient approach for regenerating harvested areas. One scenario is when there is abundant existing understorey regeneration and a plentiful seed supply (e.g. lowland black spruce and tolerant hardwoods, respectively). Another scenario is when tree species that can resprout from established root systems are present and desired (e.g. trembling aspen). The area of forest naturally regenerated is not reported by jurisdiction, so it is estimated as the difference between total area harvested and the area artificially regenerated.
- Artificial regeneration is suitable for sites where there is insufficient desired natural regeneration and where the objective is to achieve species composition targets required for sustainable forest management objectives.

## Genomics helps Canada’s forests adapt to the future

Alberta Government. Review of insect and disease challenges to Alberta coniferous forests in relation to resistance breeding and climate change. <https://open.alberta.ca/publications/9781460112793#summary>

CoAdaptTree. <https://coadapttree.forestry.ubc.ca/>

Genome British Columbia. Forest technology building better renewable resources. <https://www.genomebc.ca/forest-technology-building-better-renewable-resources/>

Isabel N., Holliday J., et al. 2019. Forest genomics: Advancing climate adaptation, forest health, productivity, and conservation. *Evolutionary Applications* 13(1): 3-10. <https://doi.org/10.1111/eva.12902>

Lenz, P., Nadeau, S., et al. 2019. Multi-trait genomic selection for weevil resistance, growth, and wood quality in Norway spruce. *Evolutionary Applications* 13(1):76-94. <https://doi.org/10.1111/eva.12823>

National Forestry Database. Regeneration, Table 6.2.1. Number of seedlings planted by jurisdiction, tenure and species group. <http://nfdp.ccfm.org/en/data/regeneration.php> (accessed May 28, 2020).

Natural Resources Canada–Canadian Forest Service. Distribution of tree species. <https://www.nrcan.gc.ca/climate-change/impacts-adaptations/climate-change-impacts-forests/forest-change-indicators/distribution-tree-species/17778>

RES-FOR. <https://resfor.ualberta.ca/>

Science. January 27, 2020. Massive effort to document the genetics of European forests bears fruit. <https://www.sciencemag.org/news/2020/01/massive-effort-document-genetics-european-forests-bears-fruit>

Spruce-Up. <https://spruce-up.ca/en/>

### Photo credit:

- Seedlings at Natures Affinity Inc. from “The Forests of Canada” collection, Natural Resources Canada–Canadian Forest Service.

## Volume harvested relative to the sustainable wood supply

National Forestry Database. Wood supply, Table 2.1 Wood supply estimates by tenure and species group. <http://nfdp.ccfm.org/en/data/woodsupply.php> (accessed April 20, 2020).

- Wood supply includes allowable annual cuts for provincial and territorial Crown lands and potential harvests for federal and private lands.
- The discrepancy between the “total industrial roundwood” supply volumes and the sum of the “total industrial softwoods” and “total industrial hardwoods” supply volumes is due to a very small amount of harvest categorized as “unspecified.” This supply represents some of the federal wood supply that has not been differentiated between “softwood” and “hardwood.”

National Forestry Database. Harvest, Table 5.1 Net merchantable volume of roundwood harvested by jurisdiction, tenure, category and species group. <http://nfdp.ccfm.org/en/data/harvest.php> (accessed April 20, 2020).

- Harvests include total industrial roundwood and exclude fuelwood and firewood.

- The discrepancy between the harvested volumes of “total industrial roundwood” and the sum of the “total industrial softwoods” and “total industrial hardwoods” is due to a very small amount of harvest categorized as “unspecified.” Typically, this harvest occurs in mixedwood forests where neither softwood or hardwood categories strictly apply, and it accounts for less than 1% of the harvested volume of total industrial roundwood. More information on these data can be found at the National Forestry Database.

## Forest area with long-term management plans

Natural Resources Canada–Canadian Forest Service. 2018.

### Notes:

- Provinces and territories supplied the data for the total forest area with a long-term management plan, which were compiled by Natural Resources Canada–Canadian Forest Service. The data were adjusted to align with the total forest area as reported in Canada’s National Forest Inventory and in the sustainability indicator Forest area in *The State of Canada’s Forests: Annual Report 2020*.

### Photo credit:

- Great-horned owl, Victoria, Canada stock photo by BirdImages/ iStock by Getty Images.

## How does disturbance shape Canada’s forests?

Béland, J, Baucé, É., et al. 2019. Early responses of bark and wood boring beetles during an outbreak of the hemlock looper *Lambdina fiscellaria* (Guenée) (Lepidoptera: Geometridae) in a boreal balsam fir forest of North America. *Agriculture and Forest Entomology* 21: 407-416. <https://onlinelibrary.wiley.com/doi/abs/10.1111/afe.12347>

Boucher, D., Boulanger, Y., et al. 2018. Current and projected cumulative impacts of fire, drought, and insects on timber volumes across Canada. *Ecological Applications* 28, 1245-1259. <https://cfs.nrcan.gc.ca/publications?id=39205>

Boucher, J., Azera, E., et al. 2012. Saproxylic beetles in disturbed boreal forest: Temporal dynamics, habitat associations and community structure. *Ecoscience* 19: 328-343. [https://cfs.nrcan.gc.ca/publications?id=34417&lang=en\\_CA](https://cfs.nrcan.gc.ca/publications?id=34417&lang=en_CA)

Boucher, J., Hébert, C., et al. In press. A flexible approach for predicting and mapping post-fire woodborer attacks in black spruce and jack pine forests using the delta Normalized Burn Ratio (dNBR). *Canadian Journal of Forest Research*.

Boucher, J., Hébert, C., et al. 2016. High conservation value forests for burn-associated saproxylic beetles: an approach for developing sustainable post-fire salvage logging in boreal forest. *Insect Conservation and Diversity* 9: 402-415. <https://onlinelibrary.wiley.com/doi/full/10.1111/icad.12175>

Boulanger, Y., Gauthier, S., et al. 2014. A refinement of models projecting future Canadian fire regimes using homogeneous fire regime zones. *Canadian Journal of Forest Research* 44, 365-376. <http://cfs.nrcan.gc.ca/publications?id=35420>

Boulanger, Y., Sirois, L., et al. 2013. Distribution patterns of three long-horned beetles (Coleoptera: Cerambycidae) shortly after fire in boreal forest: adults colonizing stands versus progeny emerging from trees. *Environmental Entomology* 42:17-28. <https://doi.org/10.1603/EN12003>

Cadorete-Breton, Y., Hébert, C., et al. 2016. Vertical distribution of three longhorned beetle species (Coleoptera: Cerambycidae) in burned trees of the boreal forest. *Canadian Journal of Forest Research* 46: 564-571. <http://www.nrcresearchpress.com/doi/pdf/10.1139/cjfr-2015-0402>

De Grandpré, L., Waldron, K., et al. 2018. Incorporating insect and wind disturbances in a natural disturbance-based management framework for the boreal forest. *Forests* 9(8), 471. <http://www.mdpi.com/1999-4907/9/8/471>

Gauthier, S., Bernier, P., et al. 2015. Boreal forest health and global change. *Science* 349, 819-822. <http://cfs.nrcan.gc.ca/publications?id=36186>

Gillett, N., and Weaver, A. 2004. Detecting the effect of climate change on Canadian forest fires. *Geophysical Research Letters* 31, L18211. <https://cfs.nrcan.gc.ca/publications?id=24957>

Hanes, C., Wang, X., et al. 2019. Fire-regime changes in Canada over the last century. *Canadian Journal of Forest Research* 49, 256-269. <https://cfs.nrcan.gc.ca/publications?id=39501>

Kurz, W., Stinson, G., et al. 2008. Risk of natural disturbances makes future contribution of Canada’s forests to the global carbon cycle highly uncertain. *Proceeding of the National Academy of Sciences* 105, 1551-1555. <https://cfs.nrcan.gc.ca/publications?id=28079>

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### Photo credits:

- White-spotted sawyer beetle photo by Jocelyn Lebel, Ministère des Forêts, de la Faune et des Parcs du Québec.
- Black backed woodpecker feeding his young stock photo by Frank Fichtmüller for iStockphoto/Getty images.

## Forest insects

Bleiker, K., Boisvenue, C., et al. 2019. *Risk Assessment of the Threat of Mountain Pine Beetle to Canada’s Boreal and Eastern Pine Forests*. Natural Resources Canada and Canadian Council of Forest Ministers Forest Pest Working Group. Pacific Forestry Centre, Victoria, British Columbia. <https://cfs.nrcan.gc.ca/publications?id=35406>

Canadian Food Inspection Agency. Emerald ash borer – *Agrilus planipennis*. <https://www.inspection.gc.ca/plant-health/plant-pests-invasive-species/insects/emerald-ash-borer/eng/1337273882117/1337273975030>

Canadian Food Inspection Agency. Hemlock woolly adelgid – *Adelges tsugae* (Annand). <https://www.inspection.gc.ca/plant-health/plant-pests-invasive-species/insects/hemlock-woolly-adelgid/eng/1325610383502/1325610993895>

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National Forestry Database. Forest insects, Table 4.1, Area of moderate to severe defoliation (including beetle-killed trees) by insects. <http://nfdp.ccfm.org/en/data/insects.php> (accessed April 14, 2020).

#### Notes:

- Forest area disturbed by defoliators includes only areas with tree mortality and moderate to severe defoliation. Defoliation does not always imply mortality. For example, stands with moderate defoliation often recover and may not lose much growth.
- Defoliation is mapped on an insect species basis, and a given area may be affected by more than one species at a time. This may result in double or triple counting in areas affected by more than one species, exaggerating the extent of the total area defoliated.
- Defoliation caused by exotic species is not mapped.

#### Photo credit:

- Forest tent caterpillar stock photo by pokergecko/iStock by Getty Images.

### Forest diseases

Canadian Food Inspection Agency. *Bretziella fagacearum* (previously known as *Ceratocystis fagacearum* Oak Wilt) - Fact Sheet. <http://www.inspection.gc.ca/plants/plant-pests-invasive-species/diseases/oak-wilt/fact-sheet/eng/1325629194844/1325632464641>

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Ostry, M. and Laflamme, G. 2009. Fungi and diseases – natural components of healthy forests. *Botany* 98: 22–25. <https://cfs.nrcan.gc.ca/publications?id=31073>

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Sturrock, R., Frankel, S., et al. 2011. Climate change and forest diseases. *Plant Pathology* 60: 133–149. <https://www.fs.usda.gov/treesearch/pubs/38993>

#### Photo credit:

- *Cronartium harknessii* photo by Tod Ramsfield.

### Forest fires

Canadian Broadcasting Corporation. October 6, 2019. Yukon's fire season was one of most 'complex and challenging' in years. <https://www.cbc.ca/news/canada/north/yukon-wildfire-season-2019-complex-1.5310233>

Global News. June 1, 2019. Evacuations continue Saturday in Pikangikum First Nation as forest fire rages. <https://globalnews.ca/news/5342377/evacuations-continue-pikangikum-first-nation/>

Global News. July 9, 2019. Full evacuation from Pikangikum First Nation begins due to forest fire. <https://globalnews.ca/news/5470829/full-evacuation-pikangikum-forest-fire/>

National Forestry Database. Table 3.1.1. Number of fires by jurisdiction, cause class, response category and protection zone. <http://nfdp.ccfm.org/en/data/fires.php> (accessed April 6, 2020).

National Forestry Database. Table 3.1.2. Area burned by jurisdiction, cause class, response category and protection zone. <http://nfdp.ccfm.org/en/data/fires.php> (accessed April 6, 2020).

- The National Forestry Database sources 2019 fire data from the Canadian Interagency Forest Fire Centre.

### Monitoring forest fires in Canada from space

Alam, R., Islam, S., et al. 2017. *Rapid Impact Assessment of Fort McMurray Wildfire*. Edmonton, Alberta: Institute for Catastrophic Loss Reduction and MacEwan University. [http://0361572.netsolhost.com/images/AlamIslam\\_QuickResponseSummary-ICLR.pdf](http://0361572.netsolhost.com/images/AlamIslam_QuickResponseSummary-ICLR.pdf)

Canadian Forest Service–Natural Resources Canada. Forest fires. <https://www.nrcan.gc.ca/our-natural-resources/forests-forestry/wildland-fires-insects-disturban/forest-fires/13143>

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Hanes, C., Wang, X., et al. 2019. Fire-regime changes in Canada over the last half century. *Canadian Journal of Forest Research*, 49(3): 256–269. <https://doi.org/10.1139/cjfr-2018-0293>

KPMG LLP. 2017. *May 2016 Wood Buffalo Wildfire Post-Incident Assessment Report*. <https://www.alberta.ca/assets/documents/Wildfire-KPMG-Report.pdf>

Natural Resources Canada. Changing How We Fight Wildfires. <https://www.nrcan.gc.ca/simply-science/changing-how-we-fight-wildfires/22599>

Wooster, M., Roberts, G., et al. 2005. Retrieval of biomass combustion rates and totals from fire radiative power observations: FRP derivation and calibration relationships between biomass consumption and fire radiative energy release. *Journal of Geophysical Research*, no. 110:D24311. <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2005JD006318>

Wotton, B., Flannigan, M., et al. 2017. Potential climate change impacts on fire intensity and key wildfire suppression thresholds in Canada. *Environmental Research Letters*, 12(9). <http://dx.doi.org/10.1088/1748-9326/aa7e6e>

#### Photo credit:

- Firefighting a forest fire stock photo by Mooneydriver/iStock by Getty Images.

### Forest carbon emissions and removals

Environment and Climate Change Canada. 2020. *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada*. <https://unfccc.int/documents/224829>

## Notes:

- This indicator is estimated annually using Natural Resources Canada–Canadian Forest Service’s National Forest Carbon Monitoring, Accounting and Reporting System. The system integrates information about forest inventories, forest growth, natural disturbances, forest management activities and land-use change to evaluate carbon stocks, stock changes and emissions of non-CO<sub>2</sub> greenhouse gases in Canada’s managed forests. The system estimates changes in biomass, woody debris, litter and soil carbon pools. The system also estimates transfers to the forest product sector and the fate of harvested wood products manufactured from wood harvested in Canada since 1900. The estimates include carbon storage and emissions resulting from these products regardless of where in the world these emissions occur.
- **Managed land** includes all lands managed for production of any wood products or wood-based bioenergy, for protection from natural disturbances, or for the conservation of ecological values. Within those managed lands, **forest** includes all areas of 1 hectare or more having the potential to develop forest cover, with a minimum crown closure of 25% and a minimum tree height of 5 metres at maturity in situ.
- Insect-affected areas in the second figure include only those areas assigned to the natural partition where tree mortality caused by insects exceeded 20% of biomass. However, in the third figure, all areas affected by insects are shown (anthropogenic and natural partitions).
- When stands are affected by stand-replacing wildfires, the emissions and subsequent removals during post-fire regrowth are reported in the category of **natural disturbances**. When regrowing stands reach commercial maturity, the emissions and removals are reported in the **management activity** category. Stands affected by partial disturbances that cause more than 20% mortality are reported in the **natural disturbance** category until the biomass reaches pre-disturbance levels.
- Harvested wood product emissions are estimated using the **production approach** of the Intergovernmental Panel on Climate Change (IPCC) and include annual emissions from all wood harvested in Canada since 1900, regardless of its current location. Transfers of wood and paper products to landfills are assumed to instantly oxidize as CO<sub>2</sub>.
- For forest lands affected by land-use change, the deforestation and afforestation figures reflect annual rates. Figures for CO<sub>2</sub>e equivalent (CO<sub>2</sub>e) emissions and removals reflect the current year plus the emissions in the reporting year from lands that were converted from forest in the previous 20 years. Thus, the figures for CO<sub>2</sub>e emissions include residual emissions from areas deforested over the past 20 years. As well, the figures for CO<sub>2</sub>e removals in the reporting year include removals by all areas afforested over the past 20 years.
- Emissions bear a positive sign. Removals bear a negative sign.
- Starting in 2015, international greenhouse gas (GHG) reporting guidelines changed with respect to harvested wood products. Accordingly, Canada reports the net GHG balance of forested ecosystems and the net GHG balance from harvested wood products. In previous years, all wood removed from the forest was assumed to instantly release all carbon to the atmosphere, despite the long-term storage of carbon in houses and other long-lived wood products. Reporting the fate of carbon in harvested wood products encourages both the sustainable management of forests and the management of harvested wood products aimed at extending carbon storage.

Additional information can be found at:

- Kurz, W., Shaw, C., et al. 2013. Carbon in Canada’s boreal forest: A synthesis. *Environmental Reviews* 21, 260–292. <http://cfs.nrcan.gc.ca/publications?id=35301>
- Kurz, W., Hayne, S., et al. 2018. Quantifying the impacts of human activities on reported greenhouse gas emissions and removals in Canada’s managed forest: Conceptual framework and implementation. *Canadian Journal of Forest Research* 48(10): 1227–1240. <https://cfs.nrcan.gc.ca/publications?id=39352>
- Lemprière, T., Kurz, W., et al. 2013. Canadian boreal forests and climate change mitigation. *Environmental Reviews* 21, 293–321. <http://cfs.nrcan.gc.ca/publications?id=35627>
- Metsaranta, J., Shaw, C., et al. 2017. Uncertainty of inventory-based estimates of the carbon dynamics of Canada’s managed forest (1990–2014). *Canadian Journal of Forest Research* 47, 1082–1094. <http://cfs.nrcan.gc.ca/publications?id=38890>
- Natural Resources Canada–Canadian Forest Service. Carbon budget model. <http://www.nrcan.gc.ca/forests/climate-change/carbonaccounting/13107>
- Natural Resources Canada–Canadian Forest Service. Inventory and land-use change. <https://www.nrcan.gc.ca/forests/climate-change/carbonaccounting/13111>
- Ogle, S., Domke, G., et al. 2018. Delineating managed land for reporting national greenhouse gas emissions and removals to the United Nations Framework Convention on Climate Change. *Carbon Balance Management* 13:9. <https://doi.org/10.1186/s13021-018-0095-3>.
- Stinson, G., Kurz, W., et al. 2011. An inventory-based analysis of Canada’s managed forest carbon dynamics, 1990 to 2008. *Global Change Biology* 17, 2227–2244. <http://cfs.nrcan.gc.ca/publications?id=32135>

## Photo credit:

- House under construction stock photo by laughingmango/iStock by Getty Images.

## How do forests benefit Canadians?

### Forest-reliant communities

Natural Resources Canada–Canadian Forest Service. Calculations based on Statistics Canada’s 2016 Census of Population.

Statistics Canada. 2016 Census of Population. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/index-eng.cfm>

- This analysis is based on Statistics Canada’s census subdivisions. A **subdivision** is “the general term for municipalities (as determined by provincial/territorial legislation) or areas treated as municipal equivalents for statistical purposes (e.g. Indian reserves, Indian settlements and unorganized territories).” Since there is no standardized definition of **community** across provinces and territories, using census subdivisions allows for a consistent approach in reporting over time. In 2016, Canada was divided into 5,161 census subdivisions.
- In 2019, the Canadian Forest Service (CFS) adopted a new method for identifying communities that rely on economic activity from natural resource sectors. The method is based on the sector dependence index (SDI), a well-established approach to assess the relative importance of a given sector to local economies. In addition to considering the share of total income generated from the forest sector, CFS used the SDI to establish if the forest sector provides a high number of jobs relative to the average Canadian community. The calculations also established if there are many other sectors that are also a source of jobs for local residents.

- In 2018, *The State of Canada's Forests Annual Report* noted that the forest sector was a major source of income for 105 census subdivisions in Canada. In 2019, following the new method, it reported that 300 Canadian communities rely on the forest sector for a significant share of economic activity.
- Employment data from Statistics Canada's 2016 Census of Population refers to the number of people **employed**, not in the **labour force** (which includes those people **unemployed**).

#### Number of Indigenous people and Canadians that live in or near forests

Natural Resources Canada–Canadian Forest Service. Calculations based on Statistics Canada's 2016 Census of Population and Natural Resources Canada–Canadian Forest Service's National Forest Inventory's forested land cover.

National Forest Inventory. <https://nfi.nfis.org/en/>

Statistics Canada. 2016 Census of Population. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/index-eng.cfm>

- Spatial (geographic information system) analysis used the two previous sources to calculate the percentage of forest cover by census subdivision (CSD). To be considered forested, a CSD needed to contain  $\geq 25\%$  of forested land cover. Populations residing within those forested CSDs are considered living in or near forests.
- This analysis is based on Statistics Canada's census subdivisions. A **subdivision** is "the general term for municipalities (as determined by provincial/territorial legislation) or areas treated as municipal equivalents for statistical purposes (e.g. Indian reserves, Indian settlements and unorganized territories)." Since there is no standardized definition of **community** across provinces and territories, using census subdivisions allows for a consistent approach in reporting over time. In 2016, Canada was divided into 5,161 census subdivisions.

#### Indigenous employment in the forest sector

Statistics Canada. 2016 Census of Population (special extraction, April 20, 2018).

- Natural Resources Canada–Canadian Forest Service calculations for Indigenous employment are based on Statistics Canada's 2016 Census of Population.
- These values refer to the number of people **employed**, not in the **labour force**, which includes those **unemployed**.
- **Indigenous** refers to people who are First Nations (North American Indian), Métis or Inuk (Inuit). **Indigenous** also refers to people who are Registered or Treaty Indians (that is, registered under the *Indian Act*) and/or those who have membership in a First Nation or Indian band.

#### Total employment

Statistics Canada. Table 36-10-0489-01 (formerly CANSIM 383-0031): Labour statistics consistent with the System of National Accounts (SNA), by job category and industry. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610048901> (accessed June 2, 2020).

- Data include NAICS 113, 1153, 321, and 322.
- Employment includes jobs held by people employed directly in the following industries: forestry and logging, support activities for forestry, pulp and paper product manufacturing, and wood product manufacturing.

- Natural Resources Canada–Canadian Forest Service prefers to use employment data from Statistics Canada's System of National Accounts (SNA) because these data are linked to the underlying framework used to compile the Canadian System of National Accounts.
- Statistics Canada updated the Labour statistics consistent with the System of National Accounts (SNA) in February 2020, which included several changes to the 2018 employment data for NAICS 113, 1153, 321, and 322 that were initially released on May 22nd, 2019. This means that the 2018 SNA data reported here are adjusted from values reported in previous editions of the *State of Canada's Forests: Annual Report*.

#### Photo credit:

- Beautiful Kayaker stock photo by philsajonesen/iStock by Getty Images.

#### Forest sector employment

Statistics Canada. 2016 Census of Population, customized tables. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/index-eng.cfm> (accessed March 17, 2020).

Statistics Canada. Table 36-10-0489-01 (formerly CANSIM 383-0031): Labour statistics consistent with the System of National Accounts (SNA), by job category and industry. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610048901> (accessed June 2, 2020).

- Data include NAICS 113, 1153, 321, and 322.
- Employment includes jobs held by people employed directly in the following industries: forestry and logging, support activities for forestry, pulp and paper product manufacturing, and wood product manufacturing.
- Natural Resources Canada–Canadian Forest Service prefers to use employment data from Statistics Canada's System of National Accounts (SNA) because these data are linked to the underlying framework used to compile the Canadian System of National Accounts.
- Statistics Canada updated the Labour statistics consistent with the System of National Accounts (SNA) in February 2020, which included several changes to the 2018 employment data for NAICS 113, 1153, 321, and 322 that were initially released on May 22nd, 2019. This means that the 2018 SNA data reported here are adjusted from values reported in previous editions of the *State of Canada's Forests: Annual Report*.

#### Indigenous employment in the forest sector

Statistics Canada. 2016 Census of Population (special extraction, April 20, 2018).

- Natural Resources Canada–Canadian Forest Service calculations for Indigenous employment are based on Statistics Canada's 2016 Census of Population.
- These values refer to the number of people **employed**, not in the **labour force**, which includes those **unemployed**.
- **Indigenous** refers to people who are First Nations (North American Indian), Métis or Inuk (Inuit). **Indigenous** also refers to people who are Registered or Treaty Indians (that is, registered under the *Indian Act*) and/or those who have membership in a First Nation or Indian band.

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- Industry meets nature stock photo by fremme/iStock by Getty Images.



## Forest sector average earnings

Statistics Canada. Table 14-10-0204-01 (formerly CANSIM 281-0027) Average weekly earnings by industry, annual. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410020401> (accessed March 30, 2020).

Statistics Canada. Table 18-10-0005-01 (formerly CANSIM 326-0021) Consumer Price Index, annual average, not seasonally adjusted. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000501> (accessed March 30, 2020).

### Notes:

- The data excludes overtime.
- The 2019 average earnings were calculated using the Consumer Price Index re-based to 2012 values. This method matches the one used for the previous report in which all data prior to 2018 were updated as well according to current method.
- Issues of *The State of Canada's Forests: Annual Report* prior to 2018 calculated real average earnings using GDP at market prices as the measure of inflation. More recent issues of *The State of Canada's Forests: Annual Report* use the Consumer Price Index (including volatile commodities) because it is a better indicator of the spending power of Canadians.

Additional information can be found at:

- Canadian Forest Industries. Coronavirus will drive paper, forest products price lower: Moody's. <https://www.woodbusiness.ca/coronavirus-will-drive-paper-forest-products-prices-lower-moodys/>
- Canadian Forest Industries. FEA: forest products will 'bounce back' after sharp decline in mid-2020. <https://www.woodbusiness.ca/fea-forest-products-markets-will-bounce-back-after-sharp-decline-in-mid-2020/>
- Pulp & Paper Canada. Let's talk tissue: Market outlook for 2020. An update on tissue industry trends in North America and beyond going into 2020. <https://www.pulpandpapercanada.com/lets-talk-tissue-market-outlook-for-2020/>
- Natural Resources Canada–Canadian Forest Service. Industry – Overview. <https://www.nrcan.gc.ca/our-natural-resources/forests-forestry/forest-industry-trade/overview-canadas-forest-industry/13311>

## Forest communities

### Forest-reliant communities

Natural Resources Canada–Canadian Forest Service. Calculations based on Statistics Canada's 2016 Census of Population.

Statistics Canada. 2016 Census of Population. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/index-eng.cfm>

- The forest sector communities indicator is based on Statistics Canada's census subdivisions. A **subdivision** is "the general term for municipalities (as determined by provincial/territorial legislation) or areas treated as municipal equivalents for statistical purposes (e.g. Indian reserves, Indian settlements and unorganized territories)." Since there is no standardized definition of **community** across provinces and territories, using census subdivisions allows for a consistent approach in reporting over time. In 2016, Canada was divided into 5,161 census subdivisions.

- In 2019, the Canadian Forest Service (CFS) adopted a new method for identifying communities that rely on economic activity from natural resource sectors. The method is based on the sector dependence index (SDI), a well-established approach to assess the relative importance of a given sector to local economies. In addition to considering the share of total income generated from the forest sector, CFS used the SDI to establish if the forest sector provides a high number of jobs relative to the average Canadian community. The calculations also established if there are many other sectors that are also a source of jobs for local residents.
- In 2018, *The State of Canada's Forests Annual Report* noted that the forest sector was a major source of income for 105 census subdivisions in Canada. In 2019, following the new method, it reported that 300 Canadian communities rely on the forest sector for a significant share of economic activity.
- Employment data from Statistics Canada's 2016 Census of Population refers to the number of people **employed**, not in the **labour force** (which includes those people **unemployed**).

### Number of Indigenous people and Canadians that live in or near forests

Natural Resources Canada–Canadian Forest Service. Calculations based on Statistics Canada's 2016 Census of Population and Natural Resources Canada–Canadian Forest Service's National Forest Inventory's forested land cover.

National Forest Inventory. <https://nfi.nfis.org/en/>

Statistics Canada. 2016 Census of Population. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/index-eng.cfm>

- Spatial (geographic information system) analysis used the two previous sources to calculate the percentage of forest cover by census subdivision (CSD). To be considered forested, a CSD needed to contain >=25% of forested land cover. Populations residing within those forested CSDs are considered living in or near forests.
- The forest sector communities indicator is based on Statistics Canada's census subdivisions. A **subdivision** is "the general term for municipalities (as determined by provincial/territorial legislation) or areas treated as municipal equivalents for statistical purposes (e.g. Indian reserves, Indian settlements and unorganized territories)." Since there is no standardized definition of **community** across provinces and territories, using census subdivisions allows for a consistent approach in reporting over time. In 2016, Canada was divided into 5,161 census subdivisions.

### Indigenous employment in the forest sector

Statistics Canada. 2016 Census of Population (special extraction, April 20, 2018).

- Natural Resources Canada–Canadian Forest Service calculations for Indigenous employment are based on Statistics Canada's 2016 Census of Population.
- These values refer to the number of people **employed**, not in the **labour force**, which includes those **unemployed**.
- **Indigenous** refers to people who are First Nations (North American Indian), Métis or Inuk (Inuit). **Indigenous** also refers to people who are Registered or Treaty Indians (that is, registered under the *Indian Act*) and/or those who have membership in a First Nation or Indian band.

## How does the forest sector contribute to Canada's economy?

National Forestry Database. Revenues, Table 8.1 Statement of revenues from the sale of timber from provincial Crown land, by jurisdiction. <http://nfdp.ccfm.org/en/data/revenues.php> (accessed March 16, 2020).

Statistics Canada. 2016 Census of Population (special extraction, April 20, 2018).

- Natural Resources Canada–Canadian Forest Service calculations for Indigenous employment are based on Statistics Canada's 2016 Census of Population.
- These values refer to the number of people “employed,” not “in the labour force,” which includes those “unemployed.”
- **Indigenous** refers to people who are First Nations (North American Indian), Métis, Inuk (Inuit), and/or those who are Registered or Treaty Indians (that is, registered under the *Indian Act*), and/or those who have membership in a First Nation or Indian band.

Statistics Canada. Table 36-10-0450-01 (formerly CANSIM 384-0047) Revenue, expenditure and budgetary balance - General governments, provincial and territorial economic accounts (x 1,000,000). <https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3610045001> (accessed April 6, 2020).

Statistics Canada. Table 33-10-0006-01 (formerly CANSIM 180-0003) Financial and taxation statistics for enterprises, by industry type. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3310000601> (accessed April 29, 2020).

- Includes data for NAICS codes 1153, 113, 321 and 322.
- Includes data for Total Taxes and Total Indirect Taxes.

Statistics Canada. Table 36-10-0401-01 (formerly CANSIM 379-0029) Gross domestic product (GDP) at basic prices by industry (x 1,000,000). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610040101> (accessed April 29, 2020).

- Natural Resources Canada–Canadian Forest Service's calculations for 2015–2019 nominal GDP are based on Statistics Canada's tables 36-10-0434-01, 18-10-0032-01 and 18-10-0029-01 (formerly CANSIM 379-0031, 329-0077 and 329-0074, respectively): GDP in 2012 constant prices, and estimated industry price deflators indexed to 2010.

Statistics Canada. Table 36-10-0402-01 (formerly CANSIM 379-0030) Gross domestic product (GDP) at basic prices, by industry, provinces and territories (x 1,000,000). Chained (2012) dollars. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610040201> (accessed April 29, 2020).

- Includes data for NAICS codes 113, 1153, 321 and 322

Statistics Canada. Table 36-10-0489-01 (formerly CANSIM 383-0031): Labour statistics consistent with the System of National Accounts (SNA), by job category and industry. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610048901> (accessed June 2, 2020).

- Data include NAICS 113, 1153, 321, and 322.
- Employment includes jobs held by people employed directly in the following industries: forestry and logging, support activities for forestry, pulp and paper product manufacturing, and wood product manufacturing.

- Natural Resources Canada–Canadian Forest Service prefers to use employment data from Statistics Canada's System of National Accounts (SNA) because these data are linked to the underlying framework used to compile the Canadian System of National Accounts.
- Statistics Canada updated the Labour statistics consistent with the System of National Accounts (SNA) in February 2020, which included several changes to the 2018 employment data for NAICS 113, 1153, 321, and 322 that were initially released on May 22nd, 2019. This means that the 2018 SNA data reported here are adjusted from values reported in previous editions of the *State of Canada's Forests: Annual Report*.

Statistics Canada. Merchandise trade data (special extraction, March 16, 2020).

- “Total all forest products” includes only HS codes 44, 47 and 48.

### Photo credit:

- Timber manufacturing facility stock photo by natrass/iStock by Getty Images.

## Forest sector gross domestic product

Nominal GDP:

Statistics Canada. Table 36-10-0401-01 (formerly CANSIM 379-0029) Gross domestic product (GDP) at basic prices by industry (x 1,000,000). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610040101> (accessed March 26, 2020).

- For nominal GDP up to (and including) 2016. Statistics Canada. Tables 36-10-0434-01, 18-10-0032-01, and 18-10-0029-01
- (formerly CANSIM 379-0031, 329-0077 and 329-0074, respectively). <http://www5.statcan.gc.ca/cansim/a01?lang=eng> (accessed March 16, 2020).
- Natural Resources Canada–Canadian Forest Service's calculations for 2017–2019 nominal GDP are based on Statistics Canada's tables 36-10-0434-01, 18-10-0032-01 and 18-10-0029-01 (formerly CANSIM 379-0031, 329-0077 and 329-0074, respectively): GDP in 2012 constant prices, and estimated industry price deflators indexed to 2010.

Real GDP:

Statistics Canada. Table 36-10-0434-01 (formerly CANSIM 379-0031) Gross domestic product (GDP) at basic prices, by industry, monthly (x 1,000,000) <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610043401> (accessed March 16, 2020).

- Real GDP in 2012 constant prices.
- Nominal and real GDP vary in that real values are adjusted for inflation whereas nominal values are not. Therefore, real GDP is used to account for differences between time periods (e.g. comparing 2017 and 2018 GDP).
- Data from Statistics Canada's Natural Resources Satellite Account (NRSA) are a key source of information on the economic contribution of the forest sector in Canada. The NRSA, the result of collaboration between Natural Resources Canada and Statistics Canada, is able to capture economic activity in forest industry segments that have traditionally been difficult to measure, such as wood furniture manufacturing. According to data from the NRSA, the forest sector directly accounted for \$26.4 billion (or 1.2%) of Canada's nominal GDP in 2019.

## Production of forest products

APA – The Engineered Wood Association. Quarterly production reports.

- The production and consumption data of structural panels (plywood and oriented strand board) are from APA – The Engineered Wood Association.

Pulp and Paper Products Council.

- Production and consumption figures for newsprint, printing and writing paper, and wood pulp are based on data of the Pulp and Paper Products Council.

Statistics Canada. Table 16-10-0045-01 Lumber, production, shipments and stocks, monthly (x 1,000). <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=3030064> (accessed March 5, 2020).

Statistics Canada. Table 16-10-0017-01 Lumber production, shipments, and stocks by species, monthly (x 1,000). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610001701> (accessed March 5, 2020).

- Data used for lumber production include total softwood production for Canada.
- In January 2019, Statistics Canada noted that they made changes to the sampling and estimation methods for the monthly Sawmills survey, which is the source of the softwood lumber production data for this indicator. As a result of these changes, Statistics Canada replaced Table 16-10-0017-01 with Table 16-10-0045-01 as of January 2019. See <https://www150.statcan.gc.ca/n1/daily-quotidien/200302/dq200302a-eng.htm> for more information.
- Lumber production data for years 2009 to 2013 (inclusive) comes from the older Table 16-10-0045-01.
- Lumber production data for years 2014 to 2019 (inclusive) comes from the newer Table 16-10-0017-01.
- Because of changes in sampling and estimation methods in the Sawmills survey, readers should exercise caution in comparing data from different sources directly.

## Exports of forest products

Statistics Canada. Merchandise trade data (special extraction, March 3, 2020).

- **Total all forest products** includes only HS Codes 44, 47, and 48.

IHS Connect. Global Trade Atlas (extracted March 10, 2020).

- **Forest Products** includes only HS Codes 44, 47, and 48.
- **Softwood Lumber** includes only HS Codes 440710, 440711, 440712, and 440719.
- Global value comparisons are on a United States dollar basis.

## How is the forest sector changing?

Coffee Association of Canada. Coffee Facts. <https://www.coffeeassoc.com/coffee-facts/>

Li, J. 2018. Comparative life cycle assessment of single-serve coffee packaging in Ontario. Master's thesis, University of Waterloo. <http://hdl.handle.net/10012/12860>

Pulp and Paper Products Council. *World Printing & Writing Report – December 2019*.

Pulp and Paper Products Council. *World Newsprint Statistics – Global 100 Report for December 2019*.

Statistics Canada. 2016 Census of Population, customized tables. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/index-eng.cfm> (accessed March 17, 2020).

Statistics Canada. Table 17-10-0005-01 Population estimates on July 1st, by age and sex. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000501> (accessed June 11, 2020).

ThinkWood. Taller Wood. <https://www.thinkwood.com/building-better/taller-buildings>

UBC Sustainability. *Brock Commons Tallwood House Fact Sheet*. [https://sustain.ubc.ca/sites/default/files/brock\\_commons\\_tallwood\\_house\\_apr\\_2018\\_web\\_003.pdf](https://sustain.ubc.ca/sites/default/files/brock_commons_tallwood_house_apr_2018_web_003.pdf)

### Photo credit:

- G-Cup photo by GCUP Technology Corp.

## Forest sector financial performance

Statistics Canada. Quarterly balance sheet and income statement, by North American Industry Classification System (NAICS) (special extraction, February 26, 2020).

## Forest sector secondary manufacturing

Industry Canada. Trade data online. <https://www.ic.gc.ca/app/scr/tstd/ttd/crtr.html?productType=NAICS&lang=eng> (accessed March 10, 2020).

Statistics Canada. Table 16-10-0047-01 (formerly CANSIM 304-0014) Manufacturers' sales, inventories, orders and inventory to sales ratios, by industry (dollars unless otherwise noted) <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610004701> (accessed March 10, 2020).

Statistics Canada. Table 36-10-0434-06 (formerly CANSIM 379-0031) Gross domestic product (GDP) at basic prices, by industry, annual average, industry detail (x 1,000,000), Canada. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610043406> (accessed June 10, 2020).

### Notes:

- Real GDP in 2012 constant prices.
- Industry Canada defines **value added** as a measure of net output, meaning gross output minus the purchased inputs that have been embodied in the value of the product.
- Domestic consumption is calculated as domestic sales minus exports plus imports.

## Forest sector carbon emissions

Environment and Climate Change Canada. 2020. *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada*. <https://unfccc.int/documents/224829>

Natural Resources Canada. Comprehensive energy use database. [https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/trends/comprehensive\\_tables/list.cfm](https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/trends/comprehensive_tables/list.cfm) (accessed April 22, 2020).

- The data were calculated by using the NRCan Residential End-Use Model and Electricity Energy-Use Model.

Statistics Canada. 2019. *Report on Energy Supply and Demand in Canada (2016 revision)*. <https://www150.statcan.gc.ca/n1/pub/57-003-x/57-003-x2019001-eng.htm>

### Photo credit:

- Wood pellets stock photo by Urbazon/iStock by Getty Images.



## Turning waste heat from a pulp mill into millions of cucumbers

BioDesign. <https://canadabiodesign.com/>

Canadian Forest Industries. Turning wood residues into cucumbers. <https://www.woodbusiness.ca/wood-to-cucumbers-4630/>

Cision. December 6, 2016. Quebec cucumbers from Toundra Greenhouse are now available year-round at IGA! <https://www.newswire.ca/news-releases/quebec-cucumbers-from-toundra-greenhouse-are-now-available-year-round-at-iga-605004176.html>

Clean50. Resolute Forest Products – Vegetable Greenhouse using Waste Heat & Carbon. <https://clean50.com/projects/resolute-forest-products-vegetable-greenhouse-using-waste-heat-carbon/>

Ellen MacArthur Foundation. Completing the Picture - New paper tells how the circular economy tackles climate change. <https://www.ellenmacarthurfoundation.org/news/climate-change-paper-released>

Greanleaf Power. St-Félicien. <https://www.greenleaf-power.com/facilities/st-felicien.html>

The Resolute Blog. December 14, 2016. Mission Accomplished for Toundra Greenhouse. <https://blog.resolutefp.com/2016/12/mission-accomplished-toundra-greenhouse/>

The Resolute Blog. April 25, 2017. Resolute wins a prestigious Mercuriades Award. <https://blog.resolutefp.com/2017/04/resolute-wins-prestigious-mercuriades-award/>

Ville de Saint-Félicien. Serres Toundra. <https://www.ville.stfelicien.qc.ca/fr/citoyens/les-grands-projets/serres-toundra/>

World Business Council for Sustainable Development. CEO Guide to the circular bioeconomy. <https://www.wbcsd.org/Programs/Circular-Economy/Factor-10/Resources/CEO-Guide-to-the-Circular-Bioeconomy>

### Photo credit:

- Photos courtesy of Toundra Greenhouse.

# Statistical profiles

## Population

Statistics Canada. Table 17-10-0009-01 (formerly CANSIM 051-0005): Population estimates, quarterly. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000901> (accessed May 27, 2020).

## Forest inventory

### Forest area by classification

Food and Agricultural Organization of the United Nations. 2014. *Global Forest Resources Assessment 2015 – Country Report: Canada*. Rome, Italy. <http://www.fao.org/3/a-az181e.pdf>

National Forest Inventory. Standard reports, Table 4.0, Area (1000 ha) of forest and non-forest land in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/CA3\\_T4\\_FOR\\_AREA\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/CA3_T4_FOR_AREA_en.html) (accessed May 11, 2020).

- The base estimate of forest area for Canada comes from the National Forest Inventory (NFI) at the source listed above.
- The estimate of current forest area was calculated by taking the National Forest Inventory baseline estimate at the source above (Table 1.1) and adjusting it for known increases in forest area (afforestation) and known decreases in forest area (deforestation) that occurred during the time since baseline data were collected. These adjustments are described in Canada's 2015 country report to the Food and Agriculture Organization of the United Nations for Global Forest Resources Assessment 2015, available at <http://www.fao.org/3/a-az181e.pdf>.
- The National Forest Inventory uses the following definitions from the Food and Agriculture Organization of the United Nations (FAO):
  - **Forest land** – land spanning more than 0.5 hectares where the tree canopy covers more than 10% of the total land area and the trees can grow to a height of more than 5 metres. It does not include land that is predominantly urban or used for agricultural purposes.
  - **Other land with tree cover** – areas of land where tree canopies cover more than 10% of the total area and the trees, when mature, can grow to a height of at least 5 metres. Includes treed areas on farms, in parks and gardens, and around buildings. Also includes tree plantations established mainly for purposes other than wood production, such as fruit orchards.
  - **Other wooded land** – areas of land where: 1) tree canopies cover 5% –10% of the total area and the trees, when mature, can grow to a height above 5 metres; or 2) shrubs, bushes and trees together cover more than 10% of the area. These areas include treed wetlands (swamps) and land with slow-growing and scattered trees. They do not include land that is predominantly agricultural or urban.

### Forest area change

Environment and Climate Change Canada. 2020. *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada*. <https://unfccc.int/documents/224829>

- Environment and Climate Change Canada's *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada* uses Natural Resources Canada–Canadian Forest Service's National Forest Carbon Monitoring, Accounting and Report System.

## Forest type

National Forest Inventory. Standard reports, Table 5.0 Area (1000 ha) of forest land by forest type and age class in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/CA3\\_T5\\_FORAGE20\\_AREA\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/CA3_T5_FORAGE20_AREA_en.html) (accessed May 11, 2020).

## Forest ownership

National Forest Inventory. Standard reports, Table 12.0 Area (1000 ha) of forest land by ownership in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/CA3\\_T12\\_FOROWN\\_AREA\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/CA3_T12_FOROWN_AREA_en.html) (accessed May 11, 2020).

## Growing stock

Environment and Climate Change Canada. 2020. *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada*. <https://unfccc.int/documents/224829>

- Environment and Climate Change Canada's *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada* is based on data and analysis from Natural Resources Canada–Canadian Forest Service's National Forest Carbon Monitoring, Accounting and Reporting System.

National Forest Inventory. Standard reports, Table 15.0 Total tree volume (million m<sup>3</sup>) on forest land by forest type and age class in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/CA3\\_T15\\_FORAGE20\\_VOL\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/CA3_T15_FORAGE20_VOL_en.html) (accessed May 11, 2020).

- Baseline estimate of Canada's wood volume

National Forest Inventory. Standard reports, Table 16.0, Total tree volume (million m<sup>3</sup>) by species group and age class in Canada. [https://nfi.nfis.org/resources/general/summaries/en/html/CA3\\_T16\\_LSAGE20\\_VOL\\_en.html](https://nfi.nfis.org/resources/general/summaries/en/html/CA3_T16_LSAGE20_VOL_en.html) (accessed May 11, 2020).

Kurz, W., Dymond, C., et al. 2009. CBM-CFS3: A model of carbon dynamics in forestry and land-use change implementing IPCC standards. *Ecological Modelling* 220, 480–504. <https://cfs.nrcan.gc.ca/publications?id=29137>

The methodology used to adjust baseline estimates of wood volume is described in the Sources and information for the **Wood Volume** sustainability indicator.

## Disturbance

### Insects

National Forestry Database. Forest insects – Forest insects, Table 4.1 Area of moderate to severe defoliation (including beetle-killed trees) by insects. <http://nfdp.ccfm.org/en/data/insects.php> (accessed May 11, 2020).

- Forest area disturbed by defoliators includes only areas with tree mortality and moderate to severe defoliation. Defoliation does not always imply mortality. For example, stands with moderate defoliation often recover and may not lose much growth.
- Defoliation is mapped on an insect species basis, and a given area may be affected by more than one species at a time. This may result in double or triple counting in areas affected by more than one species, exaggerating the extent of the total area defoliation.

## Fire

National Forestry Database. Forest fires, Table 3.1.1 Number of fires by jurisdiction, cause class, response category, and protection zone. <http://nfdp.ccfm.org/en/data/fires.php> (accessed May 11, 2020).

National Forestry Database. Forest fires, Table 3.1.2 Area burned by jurisdiction, cause class, response category, and protection zone. <http://nfdp.ccfm.org/en/data/fires.php> (accessed May 11, 2020).

- National data include all burned areas within Canada's forests. Provincial and territorial data do not include fires within national parks. In 2019, 75 fires burned 117,826 hectares in national parks across Canada. Some of these fires include controlled or prescribed burning for ecological restoration purposes.
- The National Forestry Database sources 2019 fire data from the Canadian Interagency Forest Fire Centre (CIFFC).

## Forest management

### Harvesting

National Forestry Database. Harvest, Table 5.1 Net merchantable volume of roundwood harvested by jurisdiction, tenure, category and species group. <http://nfdp.ccfm.org/en/data/harvest.php> (accessed May 11, 2020).

National Forestry Database. Harvest, Table 5.2 Area harvested by jurisdiction, tenure, management and harvesting method. <http://nfdp.ccfm.org/en/data/harvest.php> (accessed May 11, 2020).

- The national and provincial/territorial profile figures for harvesting volumes include data for industrial roundwood, pulpwood, logs and bolts, fuel wood and firewood from federal, provincial and territorial Crown land and from private land.
- Area harvested data include federal, provincial, territorial and private forest lands.
- Natural Resources Canada–Canadian Forest Service has estimated the area harvested in Quebec. This value is included in reporting the national area harvested.

### Regeneration

National Forestry Database. Regeneration, Table 6.2 Area of direct seeding by jurisdiction, tenure and application method. <http://nfdp.ccfm.org/en/data/regeneration.php> (accessed May 11, 2020).

National Forestry Database. Regeneration, Table 6.2.2 Area planted by jurisdiction, tenure and species group. <http://nfdp.ccfm.org/en/data/regeneration.php> (accessed May 11, 2020).

### Third-party certification

Certification Canada. Canadian statistics. <http://certificationcanada.org/en/statistics/canadian-statistics/> (accessed May 06, 2020).

- If a forest area has been certified to more than one of the three sustainable forest management standards (Canadian Standards Association, Sustainable Forestry Initiative, and Forest Stewardship Council), the area is counted only once. Therefore, the total certification for sustainable forest management standards may be less than the sum of the individual totals for these standards. The independently certified forest area is calculated using Forest Management Units, which include streams, lakes, rivers and roads.

## Protected forest

Canadian Protected and Conserved Areas Database (CPCAD). <https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/protected-conserved-areas-database.html>

- Previous editions of the *State of Canada's Forests: Annual Report* cited the Canadian Council on Ecological Area's Conservation Areas Reporting and Tracking System (CARTS) as a data source for calculating the area of protected forests in Canada. In 2019, CARTS evolved into the Canadian Protected and Conserved Areas Database (CPCAD), managed by Environment and Climate Change Canada. As a result, the reference for the source of this data has been updated as well.
- Protected areas were identified in 2016 by using GIS data collected by the Canadian Council of Forest Ministers for a national project that mapped forest management. The information included data from the Conservation Areas Reporting and Tracking System (CARTS) and from provinces and territories on protected area boundaries and categorization.
  - Canadian Council of Forest Ministers. Forest Management in Canada, 2017 Story Map. <https://manitoba.maps.arcgis.com/apps/MapJournal/index.html?appid=86cdd21b2cd84388bf54787f90f2b5d> (accessed May 28, 2020).
  - National Forest Inventory. Map of Forest Management in Canada, 2017 version. <https://open.canada.ca/data/en/dataset/d8fa9a38-c4df-442a-8319-9bbcbdc29060> (accessed May 28, 2020).
  - Stinson, G., Thandi, G., et al. 2019. A new approach for mapping forest management areas in Canada. *Forestry Chronicle*, 95(2):101-112. <https://cfs.nrcan.gc.ca/publications?id=39934>

National Forest Inventory. <https://nfi.nfis.org>

## Greenhouse gas inventory

Environment and Climate Change Canada. 2020. *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada*. <https://unfccc.int/documents/224829>

- Environment and Climate Change Canada's *National Inventory Report 1990–2018: Greenhouse Gas Sources and Sinks in Canada* is based on data and analysis from Natural Resources Canada–Canadian Forest Service's National Forest Carbon Monitoring, Accounting and Reporting System.
- For forest lands affected by land-use change, the deforestation and afforestation figures reflect annual rates. Figures for CO<sub>2</sub> equivalent (CO<sub>2</sub>e) emissions and removals reflect the current year plus the previous 20 years. Thus, the figures for CO<sub>2</sub>e emissions include residual emissions from areas deforested over the past 20 years, and the figures for CO<sub>2</sub>e removals include ongoing removals by all areas afforested over the past 20 years.
- See the sources and information for the sustainability indicator **Carbon emissions and removals** for more detail.

## Domestic economic impact

### Canadian housing starts

Statistics Canada. Table 34-10-0126-01 (formerly CANSIM 027-0009): Canada Mortgage and Housing Corporation, housing starts, under construction and completions, all areas, annual. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3410012601> (accessed May 26, 2020).

- A rate adjustment is used for economic or business data that attempts to remove seasonal variations in the data. The time of year will affect most data. Adjusting for the seasonality in data enables more accurate month-to-month comparisons. The seasonally adjusted annual rate (SAAR) is calculated by dividing the unadjusted annual rate for the month by its seasonality factor and creating an adjusted annual rate for the month. These adjustments are more often used when economic data are released to the public.

### Contribution to nominal GDP

Statistics Canada. Table 36-10-0401-01 (formerly CANSIM 379-0029) Gross domestic product (GDP) at basic prices by industry (x 1,000,000). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610040101> (accessed April 29, 2020).

- Natural Resources Canada–Canadian Forest Service's calculations for 2019 nominal GDP are based on Statistics Canada's Tables 36-10-0434-01, 18-10-0032-01 and 18-10-0029-01 (formerly CANSIM 379-0031, 329-0077 and 329-0074, respectively): GDP in 2012 constant prices and estimated industry price deflators indexed to 2010.
- Data from Statistics Canada's Natural Resources Satellite Account (NRSA) are a key source of information on the economic contribution of the forest sector in Canada. The NRSA, the result of collaboration between Natural Resources Canada and Statistics Canada, is able to capture economic activity in forest industry segments that have traditionally been difficult to measure, such as wood furniture manufacturing. According to data from the NRSA, the forest sector directly accounted for \$26.4 billion (or 1.2%) of Canada's nominal GDP in 2019.

### Contribution to real GDP

Statistics Canada. Table 36-10-0434-01 (formerly CANSIM 379-0031) Gross domestic product (GDP) at basic prices, by industry, monthly (x 1,000,000) <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610043401> (accessed March 16, 2020).

- Real GDP in 2012 constant prices.
- Real and nominal GDP vary such that real values are adjusted for inflation and nominal values are not. Therefore, real GDP is used to account for differences between time periods (e.g. comparing 2018 and 2019 GDP).
- Data from Statistics Canada's Natural Resources Satellite Account (NRSA) are a key source of information on the economic contribution of the forest sector in Canada. The NRSA, the result of collaboration between Natural Resources Canada and Statistics Canada, is able to capture economic activity in forest industry segments that have traditionally been difficult to measure, such as wood furniture manufacturing. According to data from the NRSA, the forest sector directly accounted for \$26.4 billion (or 1.2%) of Canada's nominal GDP in 2019.



## Revenue from goods manufactured

Statistics Canada. Table 16-10-0117-01 (formerly CANSIM 301-0008): Principal statistics for manufacturing industries, by North American Industry Classification System (NAICS) (x 1,000). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610011701> (accessed March 6, 2020).

Statistics Canada. Table 16-10-0114-01 (formerly CANSIM 301-0009): Logging industries, principal statistics by North American Industry Classification System (NAICS) (x 1,000). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610011401> (accessed March 6, 2020).

- Revenue from goods manufactured includes revenue from the sale of goods manufactured using materials owned by the establishment, as well as from repair work, manufacturing service charges and work contracted to others.

## Forest sector employment

### Employment

Statistics Canada. Table 14-10-0202-01 (formerly CANSIM 281-0024): Employment by industry, annual. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410020201> (accessed May 25, 2020).

Statistics Canada. Table 36-10-0489-01 (formerly CANSIM 383-0031): Labour statistics consistent with the System of National Accounts (SNA), by job category and industry. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610048901> (accessed June 2, 2020).

- Data include NAICS 113, 1153, 321, and 322.
- Employment includes jobs held by people employed directly in the following industries: forestry and logging, support activities for forestry, pulp and paper product manufacturing, and wood product manufacturing.
- Natural Resources Canada–Canadian Forest Service prefers to use employment data from Statistics Canada's System of National Accounts (SNA) because these data are linked to the underlying framework used to compile the Canadian System of National Accounts.
- Statistics Canada updated the Labour statistics consistent with the System of National Accounts (SNA) in February 2020, which included several changes to the 2018 employment data for NAICS 113, 1153, 321, and 322 that were initially released on May 22nd, 2019. This means that the 2018 SNA data reported here are adjusted from values reported in previous editions of the *State of Canada's Forests: Annual Report*.

Statistics Canada. Table 38-10-0285-01 (formerly CANSIM 388-0010): Natural resources satellite account, indicators (x 1,000,000). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810028501> (accessed May 29, 2020).

- Natural Resources Canada prefers to use employment data from Statistics Canada's System of National Accounts (SNA) because these data are linked to the underlying framework used to compile the Canadian System of National Economic Accounts (e.g., GDP, national wealth).
- Employment data can also be sourced from Statistics Canada's Survey of Employment, Payrolls and Hours, and the Natural Resources Satellite Account (NRSA).

- SEPH data focuses on industry and can be used for comparing direct company employment in forestry with that in other sectors.
- Data from Statistics Canada's Natural Resources Satellite Account (NRSA) are a key source of information on the economic contribution of the forest sector in Canada. The NRSA is able to capture economic activity in forest industry segments that have traditionally been difficult to measure, such as wood furniture manufacturing.

Natural Resources Canada calculated indirect employment using Statistics Canada's National Symmetric Input-Output Tables (15-207-XCB) and National Multipliers (15F0046XDB).

- The calculations for indirect employment were changed in 2019 to better account for employment in the forest sector. This change affects data for 2018 and going forward. Retroactive changes to previous year's data have not been applied at this time.

### Wages and salaries

Statistics Canada. Table 16-10-0117-01 (formerly CANSIM 301-0008): Principal statistics for manufacturing industries, by North American Industry Classification System (NAICS) (x 1,000). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610011701> (accessed March 6, 2020).

Statistics Canada. Table 16-10-0114-01 (formerly CANSIM 301-0009): Logging industries, principal statistics by North American Industry Classification System (NAICS) (x 1,000). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610011401> (accessed March 6, 2020).

- Wages and salaries are the earnings, in cash or in kind, of Canadian residents for work performed before deduction of income taxes and contributions to pension funds, employment insurance and other social insurance schemes.

### Trade

Statistics Canada. Merchandise trade data (special extraction), monthly data.

- Balance of trade is the difference between the value of the goods and services that a country exports domestically and the value of the goods and services that it imports. If a country's exports exceed its imports, it has a trade surplus. If its imports exceed exports, the country has a trade deficit.

## Domestic production and investment

### Production

APA – The Engineered Wood Association. Quarterly production reports.

- The production and consumption data of structural panels (plywood and oriented strand board) are from APA – The Engineered Wood Association.

Pulp and Paper Products Council.

- Production and consumption figures for newsprint, printing and writing paper, and wood pulp are based on data of the Pulp and Paper Products Council.

Statistics Canada. Table 16-10-0017-01 Lumber production, shipments, and stocks by species, monthly (x 1,000). <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610001701> (accessed March 5, 2020).

- Data used for lumber production include total softwood production for Canada.
- In January 2019, Statistics Canada noted that they made changes to the sampling and estimation methods for the monthly Sawmills Survey, which is the source of the softwood lumber production data. As a result of these changes, Statistics Canada replaced Table 16-10-0017-01 (which was used in previous editions of the *State of Canada's Forests: Annual Report*) with Table 16-10-0045-01 as of January 2019. See <https://www150.statcan.gc.ca/n1/daily-quotidien/200302/dq200302a-eng.htm> for more information.

#### **Capital expenditures and repair expenditures**

Statistics Canada. Table 34-10-0035-01 (formerly CANSIM 029-0045): Capital and repair expenditures, non-residential tangible assets, by industry and geography (x 1,000,000) <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3410003501> (accessed May 6, 2020).

- Capital expenditures include the costs of procuring, constructing and installing or leasing new durable plants, machinery and equipment, whether for the replacement of or addition to existing assets. Also included are all capitalized costs, such as costs for feasibility studies and architectural, legal, installation and engineering fees; the value of capital assets put in place by firms, either by contract or with the firm's own labour force; and capitalized interest charges on loans for capital projects.
- Repair expenditures include costs to repair and maintain structures, machinery and equipment.

#### **Domestic consumption**

Consumption figures for a range of products, calculated by Natural Resources Canada–Canadian Forest Service.

- This information is available only at the national level.
- Domestic consumption of wood pulp (tonnes) contains Natural Resources Canada–Canadian Forest Service estimates of import volumes that may be subject to revision.





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