Natural Resources
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THE STATE OF
CANADA'S FORESTS

Annual Report 2023

Canada

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The State of Canada's Forests

ANNUAL REPORT 2023

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Message from the Minister of Energy and Natural Resources

In the wake of the most destructive wildfire season in Canadian history, Canadians are feeling the effects of climate change. No region of the country is immune. From coast to coast to coast, extreme weather events are escalating in frequency and severity. There is an urgent need for action to prepare our communities for the impacts of climate change while also ensuring our workers and industries are advancing to seize the economic opportunities associated with taking action to fight climate change. And that's exactly what the Government of Canada is working toward.

In 2022–2023, Natural Resources Canada continued to deliver on its mandate to improve the lives of Canadians while ensuring that our country's natural resources are managed sustainably, competitively and inclusively. This report summarizes many of these initiatives, and it highlights the department's efforts to ensure economic growth, create good jobs in every region of the country and improve the lives and livelihoods of all Canadians.

NRCan is combating the climate crisis by supporting the development of our net-zero economy by 2050 under Canada's Emissions Reduction Plan. To accelerate Canada's low-carbon future, we are providing billions of dollars of investment through programs including the Smart Renewable and Electrification Pathways Program, which is deploying renewable energy and electrical grid modernization projects across Canada. These projects will reduce emissions by unlocking the generation of electricity with affordable, reliable and clean forms of energy while creating sustainable jobs for generations to come.

Around the world, governments are building efficient energy systems that require critical minerals. These minerals are the building blocks of clean energy technologies. With global demand growing, we have a generational opportunity for economic growth and job creation in communities across Canada. NRCan has set the stage to seize this generational opportunity by allocating nearly $4 billion in Budget 2022 through Canada's Critical Minerals Strategy, a strategy that

will create jobs, economic growth and opportunities to advance reconciliation with Indigenous people.

We are working with global partners to ensure that Canada becomes the global supplier of choice for clean technologies, energy and the minerals needed to support the worldwide shift to net zero. We are working with international and domestic partners to advance opportunities for collaboration in clean technology and innovation. This collaboration is critical to seizing the generational opportunities afforded by the rapid pace of global investment in cleaner technologies and industries.

To prepare our communities for the significant impacts of climate change, NRCan supported Canada's first National Adaptation Strategy. This was a vital step in order to adapt to unprecedented environmental conditions, improve human health and well-being and ensure resilience in supporting workers and the economy. To further protect Canadians and Canada's forests from climate change, the Fighting and Managing Wildfires in a Changing Climate Program and the Emergency Management Strategy provided valuable tools to enhance preparedness and mitigate risks.

NRCan continued to advance meaningful reconciliation with Indigenous Peoples through ongoing engagement to implement the *United Nations Declaration on the Rights of Indigenous Peoples*. We collaborated with Indigenous communities and partners to foster constructive dialogue to further develop initiatives like the National Benefits-Sharing Framework. We also continued to advance progress within the department by engaging with staff via the *Pathways to Reconciliation Initiative*, contributing to mutually beneficial relationships — ones founded on shared understanding and mutual respect — with Indigenous communities.

To achieve all of these intersecting goals, NRCan continued to work in collaboration with scientists, labour partners, industry and Indigenous Peoples and governments, alongside federal counterparts, and with provincial, territorial and local governments.

Science and data are essential to every NRCan initiative. The department has invested in modernizing the ways we work, notably through responsibly leveraging the potential of artificial intelligence to increase the value of new innovations through initiatives like the Digital Accelerator. Through world-class research, we informed the policy development process to support decision-making and help mitigate the impacts of natural and human hazards through regulations and policy, together with the support of innovative technologies.

NRCan continued to build on the progress made on all these fronts by advancing regulatory certainty for Canadians and businesses to achieve and maintain a reliable, affordable and clean energy supply that will grow our economy. We have continued to support Canadian workers through the Sustainable Jobs Plan to guide and organize efforts to ensure that workers have the right tools to contribute to the economy of the future. And through the Regional Energy and Resource Tables, we are engaging with provincial and territorial governments, workers, businesses and Indigenous partners to advance progress on vital economic opportunities that will enable Canada to take a coordinated and collaborative approach to creating generational wealth and a sustainable future for generations to come.

As the world accelerates climate action, Canada faces a choice: we can either lead in seizing the historic economic opportunities associated with building a global net-zero economy, or we can let them pass us by, with all the consequences attendant on inaction. As this report shows, we are choosing to plan for the future.

The global race to net zero is a critical economic mission for every region of Canada. By working together with provincial, territorial and Indigenous partners, we are advancing our efforts to support Canadians in seizing the enormous opportunities associated with building a sustainable and prosperous net-zero future.

The Honourable Jonathan Wilkinson
Minister of Energy and Natural Resources

The 2023 State of Canada's Forests Report: An overview

Canadians are deeply committed to sustainably managing their forests for the multiple important values they provide. Canada's rich forest ecosystems offer significant environmental, social and cultural benefits, as well as opportunities for responsible economic development. Sustainable forest management (SFM) ensures that these benefits are maintained for both present and future generations. SFM also aims to recognize the importance of Indigenous leadership and participation in forest management.

Canada has been managing its forests according to the principles of sustainable forest management for many years. The State of Canada's Forests: Annual Report has been a trusted and authoritative source of comprehensive information on the social, economic and environmental state of Canada's forests and forest sector for 33 years. Each year, The State of Canada's Forests: Annual Report delivers thematic content about Canada's forest sector through feature stories. To explore this year's theme of **Relationships for resiliency: Interconnections between people, nature, and the long-term sustainability of Canada's diverse forest-based values**, this report includes stories on:

- how Canada manages its forests for diverse values through the principles of sustainable forest management
- community forests helping to manage for multiple values at multiple scales in increasingly uncertain landscapes
- the impacts of climate change on sugar maple stands and maple syrup production, and how we can help maple stands preserve their health and adaptive capacity
- how sustainable forest management sequesters carbon and helps to mitigate climate change
- how forests help to protect healthy aquatic ecosystems and Canada's drinking water, and how forest disturbances and climate change affect our drinking water supply and quality
- the diverse people working across the forest sector supply chain, from forest regeneration, to the production of various forest products, to the development of new knowledge to help sustainably manage our forests

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.

Sustainability indicators are important tools

Science-based measures called **sustainability indicators** are helpful tools for understanding the overall condition or state of Canada's forests. Indicators provide a way to consistently define, assess, monitor and report progress toward sustainable forest management. Reporting on sustainability indicators over time helps to ensure and promote the long-term sustainable management of our forests. They do so by:

- providing reliable data and essential information on the state of and trends in Canada's forests
- highlighting any need for improvement in forest management policies and practices
- supplying reliable information for discussions and initiatives related to environmental performance and trade

The indicators included in The State of Canada's Forests annual reports are based on the most accurate and currently available data from Canada's most trusted sources, including Statistics Canada, the National Forestry Database and the National Forest Inventory, among others. These data and information are then analyzed by a collection of Canada's leading experts who produce the written text for each indicator in the report. As a whole, the indicators and the Statistical profiles section at the end of the report provide the government, industry, researchers and general public with relevant context on the current-day status, historical trends and future forecasts for these varied indicator topics. Above all, the indicators in this report demonstrate Canada's ongoing commitment to sustainable management of its forests and the forest sector.

Canada uses internationally agreed-upon indicators of sustainable forest management

Along with 11 other countries, Canada is a member of the Montréal Process, an international working group of northern- and southern-hemisphere nations committed to sustainable forest management. Since 1995, Montréal Process member countries have used a common set of science-based criteria and indicators to measure progress toward the conservation and sustainable management of 90% of the world's boreal and temperate forests. The set of indicators reported here is inspired by, and seeks to align with, this evolving and internationally relevant framework of criteria and indicators.

Sustainably managed forests contribute to global sustainable development goals

The United Nations identified 17 Sustainable Development Goals in the 2030 Agenda for Sustainable Development, which was adopted by United Nations member states, including Canada, in September 2015. In addition to the 17 Sustainable Development Goals, the Agenda includes 169 associated targets aimed at improving global sustainable development across social, economic and environmental dimensions as well as peace, governance and justice. The sustainability indicators in The State of Canada's Forests reports support:
- United Nations Sustainable Development Goal 15: Life on Land

- United Nations Global Forest Goals
    1. Reverse forest cover loss
    2. Improve the benefits and livelihoods derived from forests
    3. Protect forests and use sustainable forest products
    4. Mobilize resources

Reporting on the global Sustainable Development Goals is a step toward a shared understanding of the value of forests.

The State of Canada's Forests report is designed to be as informative and user-friendly as possible, and we welcome your feedback. Contact us at cfs-stateoftheforestsetatdesforets-scf@nrcan-rncan.gc.ca, and let us know what you think.

Canada's many forest values are enhanced by a rich diversity of relationships

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

Canada's forests are sustainably managed for a diversity of benefits

Canada has **367 million hectares (ha) of forest**, or **9% of the world's forest** and **25% of the world's boreal forest**.

72% of Crown forest land managed in Canada is **certified to third-party standards for sustainable forest management** (2022).

Nearly **10%** of Canada's forests are **protected** (2022).

Canada's maple syrup industry is thriving!

70%
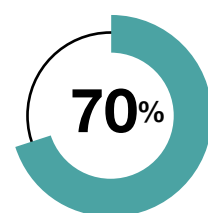
Canada produces approximately 70% of the world's maple syrup.

Production increased from 33 to 79 million litres between 2010 and 2022.

2010 **2022**
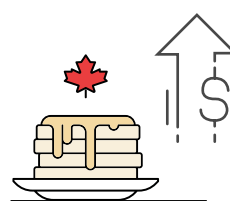
Maple product exports in 2022 totalled $616 million.

Canada's forests are dynamic and ever-changing systems

Natural disturbances are a part of healthy forest ecosystems.

In the boreal forest, the **specially adapted cones** of lodgepole pine and jack pine need the heat of fire to open and release their seeds.

Dead or dying trees (as a result of age, disease, insects, wildfire, or drought) are important habitats for **cavity-nesting birds**; these birds in turn help to control forest insect populations.

Percentage of total forest area affected by disturbances

Area affected by insects (2021)
15,953,011 ha (4.34%)

Area burned (2022)
1,654,255 ha (0.45%)

Area harvested (2021)
698,026 ha (0.19%)

Area deforested (2021)
50,518 ha (0.01%)
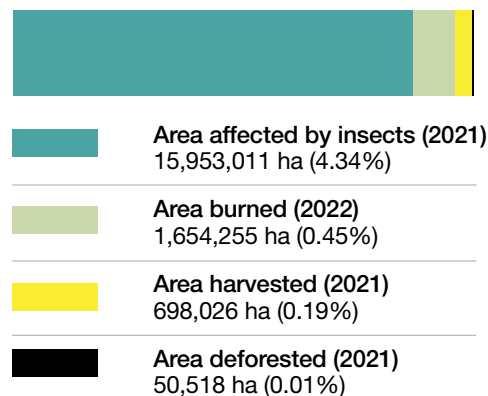
By modifying their environment, some wildlife species create a diversity of habitats for other species. They are ecosystem engineers.

For nesting, **woodpeckers** dig cavities in snags (standing dead trees) or living trees. These cavities are reused by several other species, such as ducks, owls, bluebirds and flying squirrels.

By building dams, **beavers** create habitats for several species of fish, birds, frogs and mammals. Dams also help create wetlands that improve water quality and reduce the risk of flooding.

Canada's forests are a source of health and well-being

Over **1/3 of Canada's population** lives in or near forests, including **55% of Indigenous people** (2021).

Spending time in nature **stimulates creativity, memory function and lowers stress** hormone (cortisol) levels.

90% of people say they **feel happier** when they are outside.

Connection to the land can be considered a **determinant of health for Indigenous Peoples**, as it is intimately linked to their culture.

Canada's forests provide a diversity of employment and revenue

Canada's forest sector contributed **$33.4 billion (1.2%)** to Canada's **nominal GDP** in 2022.

In 2022, Canada's forest sector **employed 212,660 people**.

Average earnings were approximately **$51,900 annually** (2022).

Change in percentage of total people employed in the forest sector between 2016 and 2021

+1.8%
+0.6%
+0.1%

— Indigenous   — Immigrants   — Women
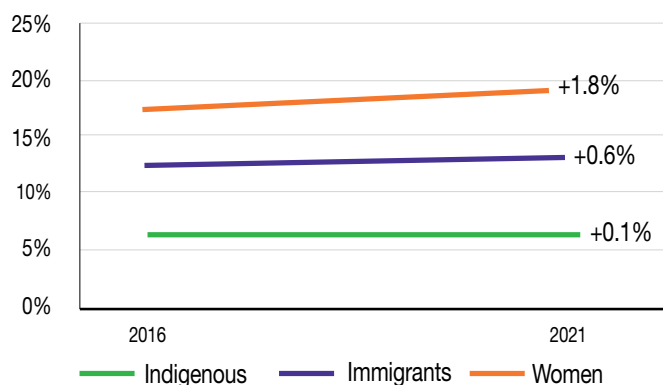
Canada's forests contribute to a low-carbon economy

Sustainable forest management **sequesters and stores significant amounts of atmospheric carbon** through forest regeneration, growth and harvesting to produce **long-lived wood products**.

Residues left over from traditional forest activities can be used to make **biofuels, which can replace fossil fuels** to **reduce net carbon emissions**.

The use of bioenergy has **reduced forest product facilities' GHG emissions from fossil fuels by 53%** between 2005 and 2020.

Forest contributions to Canada's drinking water

Forests are an important source of drinking water

Most of Canada's drinking water is sourced from forest ecosystems. This includes most rural and Indigenous communities. Healthy aquatic ecosystems and an adequate supply of clean water are some of the most important ecosystem services that forests provide. Here's why…

Forests play a key role in the water cycle. Forest canopies intercept some of the precipitation that falls on a landscape and this water is evaporated back to the atmosphere. Tree roots pull water from the soil and transpire this water to the atmosphere through their leaves and needles. These processes help reduce the size of flood events.

Precipitation

Evaporation and transpiration

Groundwater level

Runoff
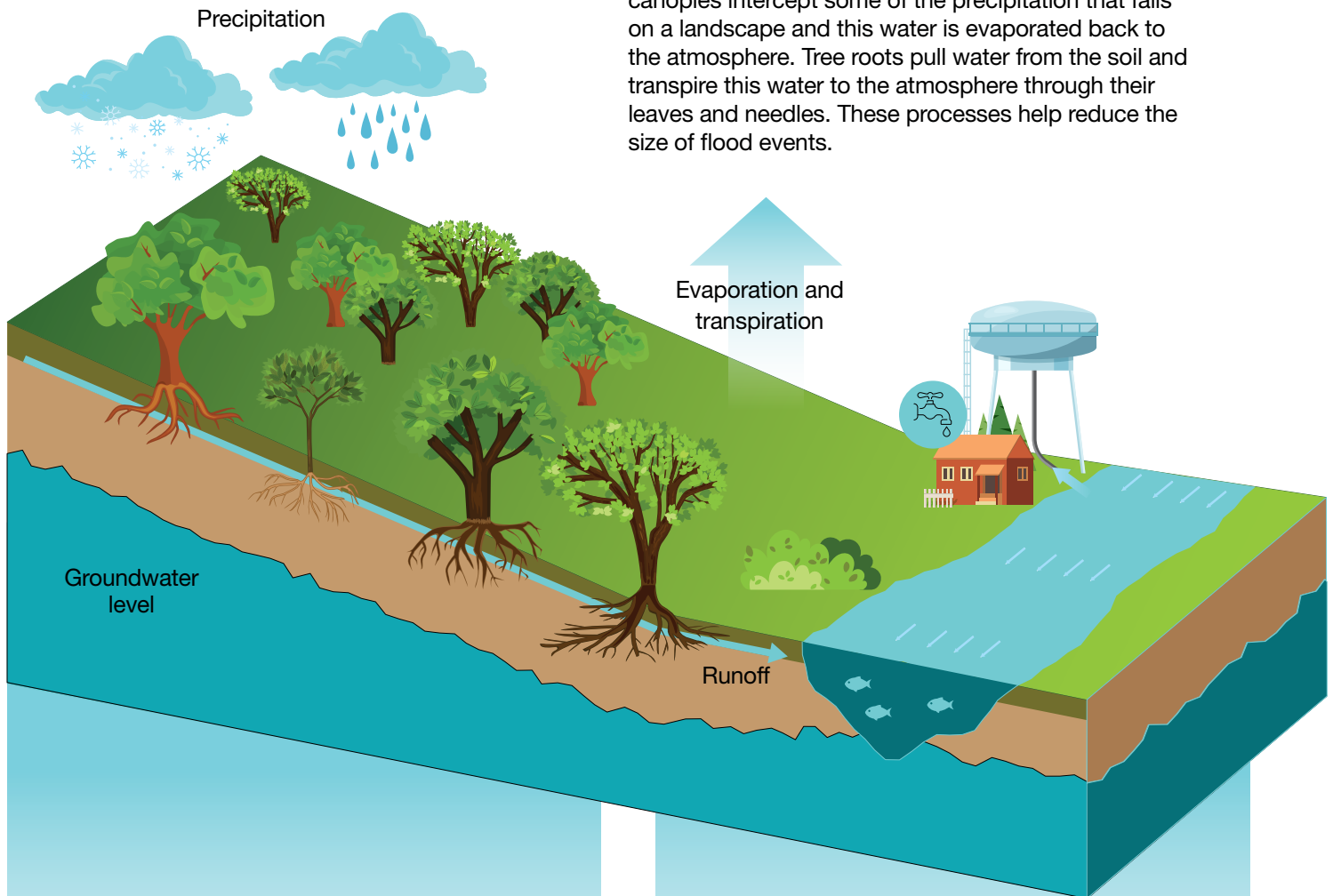
Forest soils naturally regulate downstream water supply by acting like sponges.

Forest soils store water during rainfall and snowmelt, and slowly release this water to streams and lakes during dry periods, thus ensuring a steady and predictable supply of water downstream.

The quality of water changes as it travels through the different layers of a forest, such as the forest canopy, forest floor and soil. Forest soils help filter water before it enters streams and lakes, providing clean water to communities and reducing water treatment costs.

Forest disturbance and climate change affect our drinking water supply and quality

Fire, insect outbreaks, harvesting and climate change impact water primarily through the death or removal of trees, disturbances to the forest floor, and the addition of dead biomass (and ash with fires) onto the soil surface. These disturbances can affect both the quantity and quality of the water that downstream communities use for drinking.

Forest disturbances can result in the removal of forest canopies and trees, which reduces both precipitation interception and tree transpiration. Disturbances can also compact or erode soils, making them less effective at storing water. Together, these changes to the water cycle can result in large floods and a less predictable water supply downstream.

Precipitation

Evaporation and transpiration

Groundwater level

Runoff
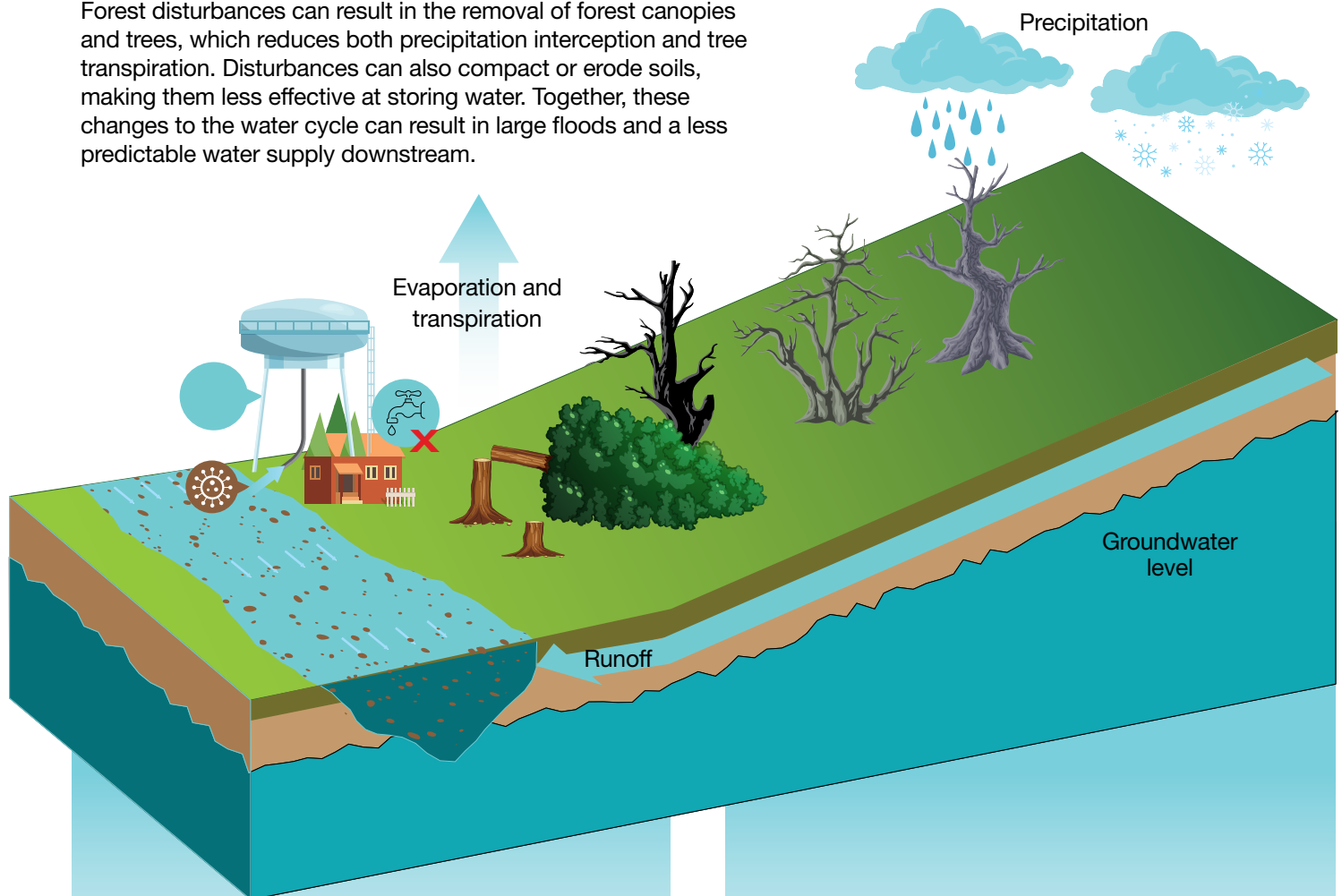
Changes to the water cycle caused by forest disturbance also impact water quality by altering the amount and pathway of water as it moves through forest ecosystems. In addition, decomposing dead trees and branches, ash from wildfires, as well as soil erosion, compaction and rutting from logging machinery can change the water chemistry. These changes in water quality can make water treatment more difficult and costly.

Following a forest disturbance, such as a wildfire, an insect outbreak or harvesting, new trees may start to grow. As these trees mature, they restore water ecosystem services. CFS researchers are actively working to better understand the impacts of forest disturbance and recovery on water quality and quantity. This science helps to improve sustainable forest management practices to ensure healthy forested watersheds for the communities that depend on them, now and in the future.

Managing for diversity:

How sustainable forest management conserves and protects Canada's diverse forest values

Canada's forests are much more than just trees. Forests are complex ecosystems that also include soil, air, water and all the living organisms that depend on them for survival. Canada manages its forests for diverse values through the principles of sustainable forest management (SFM), taking not only today's needs, but future needs into consideration.

- The many forest types across the country hold an array of environmental, economic, social and cultural values that are important to diverse groups and individuals.
- SFM aims to protect and conserve the integrity of forest ecosystems and their inherent values.
- SFM is based on sound forest science, resource monitoring and reporting, as well as consultations with stakeholders, the public and Indigenous communities.

The sustainable forest management planning process

Most public land in Canada is regulated by provincial and territorial governments who have the primary authority to create and enforce laws related to natural resource management. Forest harvesting on public lands is enabled through forest management agreements with forest companies, often referred to as tenures or licences. Under these agreements, companies are permitted to operate on public lands for a substantial period (usually 20–25 years) and must adhere to SFM principles. Forest management plans are required for these public lands and must be approved by the province or territory before any harvesting occurs. Forest management plans are very complex and require input from a variety of subject area experts. The planning team for such is led by a registered professional forester who is licenced under provincial legislation (an "ingénieur forestier" in Québec) and subject to high ethical standards and continuing education.

Typically, forest management plans are 5–10 years in length. They outline forest management objectives for diverse values that support a long term forest management strategy. A key component of the forest management planning process is public and stakeholder engagement to ensure locally and regionally important values and objectives are identified and captured. Public and stakeholder engagement occurs multiple times throughout the development of the management plan. In addition to formal meetings, local citizen committees are encouraged to have frequent communication with the forest planning team throughout the process. Public consultation is also extremely important in the forest management planning process to consider the diverse societal values and perspectives.

Indigenous participation is another extremely important part in the management planning process and is increasing in many jurisdictions, especially where traditional uses and treaty rights may be impacted. Formal agreements featuring Indigenous-led forest management zones are in place in certain regions of Canada, as are agreements pertaining to the management and conservation of old-growth forests. Forest management planning, in most provinces and territories, has begun to formally incorporate local and Traditional Knowledge. Indigenous communities are progressively acquiring more forest management rights within their traditional territories.

Values and objectives can go above and beyond what is required by legislation. To minimize conflicting values, forest managers can use an Integrated Resource Management (IRM) approach, whereby many values and interests are considered in the management process. Those values could include:

- **ensuring sufficient habitat is available for locally important wildlife**

- **working to reduce the wildfire risk around communities**

- **addressing the impacts of climate change**

- **ensuring enough timber is harvested to provide local forestry jobs**

Overview of the adaptive forest management cycle used to sustainably manage Canada's public forests

Public, stakeholder and Indigenous engagement help establish forest management objectives for diverse values that support a long-term forest management strategy. Objectives vary throughout Canada to meet local values.

Experts from various fields of expertise provide important input to:
- forest management
- fish and wildlife
- forest ecology and biology
- forest modeling and analysis
- land use
- parks and natural heritage
- forest pest management
- wildfire
- enforcement

SFM practices and policies are continuously improved as new science and data become available or as societal values change.

Long-term sustainable forest management

Plan • Implement • Monitor • Evaluate • Adapt

Science-based decision support tools, or computer models, help forecast the impacts of forestry on forests and the values they provide through potential scenarios. They also help to understand the cumulative effects that natural and human disturbances can have on forests.

There are three forest management certification systems in Canada. They complement our laws and regulations and ensure that a forest company is operating legally, sustainably and in compliance with world-recognized standards.
- Canadian Standards Association (CSA)
- Forest Stewardship Council (FSC)
- Sustainable Forestry Initiative (SFI)

Monitoring, knowledge improvement and advances in technology will continue to increase efficiencies and capabilities in forest management planning, as lands are managed for diverse forest values.

Harvesting strategies Approaches vary according to composition, structure and function of Canada's many forest types.

Sustainable forest management: A careful balancing of diverse values

One SFM pillar is **economic values**. Forest harvesting and wood product manufacturing are critical sources of jobs for many communities in Canada, particularly rural and Indigenous communities. These jobs depend on a long-term, stable supply of wood. Sustainable harvesting of trees is determined through an annual allowable cut (AAC), which the province or territory establishes to maintain a wood supply in perpetuity.

The **environmental values** pillar of SFM can be represented by numerous values, but usually includes the protection of biodiversity, soils and water, and the reduction of carbon in the atmosphere. Forest managers strive to emulate natural disturbances in the management plan. Forest management practices supporting environmental values can involve:
- maintaining various stages of forest development, including old-growth forests, for providing diverse habitats
- managing the presence of a range of tree species of various ages over time
- leaving forest corridors to improve landscape connectivity
- varying the size and shape of harvested areas to represent natural disturbance patterns
- keeping a variable number of live and old trees, often called "veteran trees," and cavity trees for birds and other wildlife within harvest areas
- providing buffers around nesting trees and streams to preserve wildlife habitats and water quality

The third SFM pillar is **social or cultural values**. Cultural heritage and spiritual values are significant to many individuals and groups, including Indigenous Peoples. These values, along with the locations of particularly important sites, are identified during the planning process and should be included in scenario modeling activities. Indigenous rights are considered throughout the management planning process and any historically significant locations are identified for preservation.

Sustainable forest management: A driver of change

It is important to recognize that the balance of economic, environmental and cultural values changes over time. For instance, sustainable timber harvest used to be the primary focus of SFM. More recently, environmental values have been growing as the top priority for SFM. Forest management and conservation laws, policies, regulations and management guides are also shifting toward more emphasis on the ecological well-being of the forest.

- There is an **increased commitment to preserving biodiversity**, which includes the adoption and implementation of the Kunming-Montreal Global Biodiversity Framework (GBF) to halt and reverse biodiversity loss by 2030.
    - To support the global goals and targets set out in the framework, Natural Resources Canada (NRCan) is supporting Environment and Climate Change Canada (ECCC) to develop Canada's 2030 National Biodiversity Strategy.
    - At the provincial level, Nova Scotia has introduced a stand-alone Biodiversity Act, which provides for conservation and sustainable use of biodiversity in the province.
- **Alternative silviculture options are used to reduce clearcutting.** For example, Nova Scotia is adopting ecological forestry where public land is divided into three zones that work together to balance a range of interests (conservation, high production forest and mixed forest or matrix).
- **Old-growth forests are increasingly being protected and conserved.**
    - For example, the Province of British Columbia has introduced a plan to establish new Forest Landscape Planning tables to improve old-growth management, including the incorporation of Traditional Knowledge.
    - The Government of Canada, through ECCC and supported by NRCan, has also committed to the establishment of the Old Growth Nature Fund in collaboration with the Province of British Columbia, non-governmental organizations, and Indigenous and local communities.
- **Conservation areas are increasing**. As a Party to the United Nations Convention on Biological Diversity and the new GBF, Canada has committed to conserving 30% of Canada's lands and water by 2030.
    - To achieve this goal, the Government of Canada has committed to establishing ten new national parks in the next five years, including the proposed national park reserve in the South Okanagan-Similkameen in British Columbia.
    - The Government of Canada also continues to designate many of its federally managed lands as other effective area-based conservation measures (OECMs), which are specific areas that have conservation and biodiversity objectives in addition to other primary objectives. OECMs, such as Boishébert and Beaubears Island Shipbuilding National Historic Sites in Miramichi, New Brunswick and the Acadia Research Forest (ARF) near Fredericton, New Brunswick contribute to achieving Canada's conservation target by protecting old-growth forest ecosystems and representative natural forest conditions common to the Acadian Forest Region.

- **Forests play a key role in our nature-based climate solutions.**
  - The Government of Canada's 2 Billion Trees Program (2BT) provides funding over 10 years to support provinces and territories, municipalities, Indigenous organizations and governments, and for-profit and not-for-profit organizations in planting an incremental two billion trees across Canada that will support climate change mitigation and adaptation, while increasing biodiversity and human well-being.
  - Canada's National Adaptation Strategy (NAS) sets out a blueprint to reduce the risk of climate-related disasters, improve health outcomes, protect nature and biodiversity, build and maintain resilient infrastructure while supporting a strong economy and workforce.
  - NRCan's Climate Change Adaptation Program (2022–2027) provides funding for projects to help position Canada's regions and sectors to adapt to climate change.

Sustainable forest management is the driver of practices and policies to balance a complex diversity of values in forest ecosystems, communities, and economies. Managing forests for societal values that are increasing in number and often changing is an immense challenge. However, it is a challenge that Canada's forest managers are addressing through ongoing engagement with the public and stakeholders and through adaptive sustainable forest management.

Canada's forests are protected through strong laws and regulations at the federal, provincial/territorial and even municipal levels. SFM is a concerted effort among all levels of government, industry, and the public. There are several overarching federal acts that support SFM objectives, including the:
- *Forestry Act*
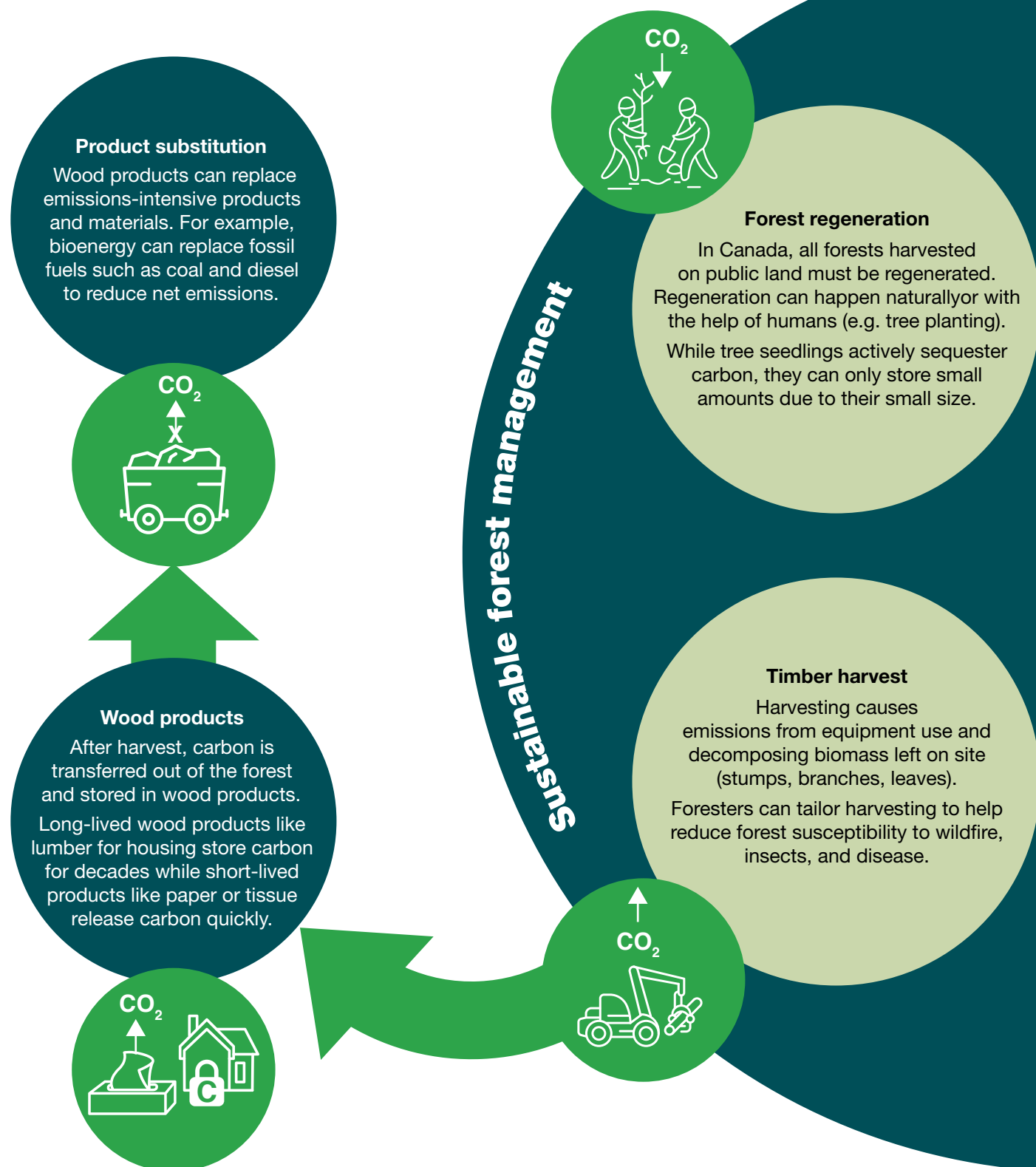- *Species at Risk Act*
- *Migratory Birds Convention Act*
- *Fisheries Act*
- *Impact Assessment Act*
- *Canadian Environmental Protection Act*
- *Pest Control Products Act*
- *Fertilizers Act*

The *Species at Risk Act* is a fundamental part of Canada's strategy to preserve biodiversity. It was created to meet Canada's commitment under the United Nations Convention on the Conservation of Biodiversity.

Growing trees and capturing carbon:

How sustainable forest management helps to mitigate climate change

Sustainable forest management

Product substitution

Wood products can replace emissions-intensive products and materials. For example, bioenergy can replace fossil fuels such as coal and diesel to reduce net emissions.

CO_2

Forest regeneration

In Canada, all forests harvested on public land must be regenerated. Regeneration can happen naturallyor with the help of humans (e.g. tree planting).

While tree seedlings actively sequester carbon, they can only store small amounts due to their small size.

CO_2

Wood products

After harvest, carbon is transferred out of the forest and stored in wood products.

Long-lived wood products like lumber for housing store carbon for decades while short-lived products like paper or tissue release carbon quickly.

CO_2

Timber harvest

Harvesting causes emissions from equipment use and decomposing biomass left on site (stumps, branches, leaves).

Foresters can tailor harvesting to help reduce forest susceptibility to wildfire, insects, and disease.

CO_2

CO₂

Young forest

Young forests grow quickly. They are very efficient at **sequestering carbon**—removing carbon from the atmosphere.

Carbon sequestered is stored in tree biomass (wood, roots, leaves) as well as in dead wood and soil organic matter.

Sustainable forest management

Mature forest

As trees age, their growth slows. Some trees die from various stressors like competition or disease. As trees die, they decay and decompose. This process transfers carbon and nutrients into forest soils and slowly emits carbon back into the atmosphere.

Mature forests **store** a lot of carbon but **sequester** it much more slowly than younger forests.

CO₂

Natural disturbance

Forests are susceptible to wildfires, insect outbreaks and disease.

Wildfires cause immediate emission of stored carbon as trees burn. Fires can create favourable conditions for forest regeneration.

CO₂

Sustainable forest management aims to maintain and enhance the environmental, social and economic values of forests for the benefit of present and future generations. It involves ensuring a long-term sustainable supply of wood-based products and ecosystem services while conserving biodiversity and protecting forest health. Canadian forests are managed under the guiding principles of sustainable forest management.

From regeneration to harvesting, Canada's managed forests sequester and store significant amounts of atmospheric carbon as they grow. Generally, mature forests that were previously harvested store less carbon than primary forests—or forests that have never been harvested. However, harvesting in the right way and at the right time can store carbon in wood products. Wood products provide an added benefit when they replace other less environmentally- and climate-friendly products and materials such as diesel, plastics and concrete. **Sustainable forest management can contribute to Canada's low-carbon future.**

Legend:

↓ Sequestration	↑ Emissions
↕ Avoided emissions	🔒 Carbon storage
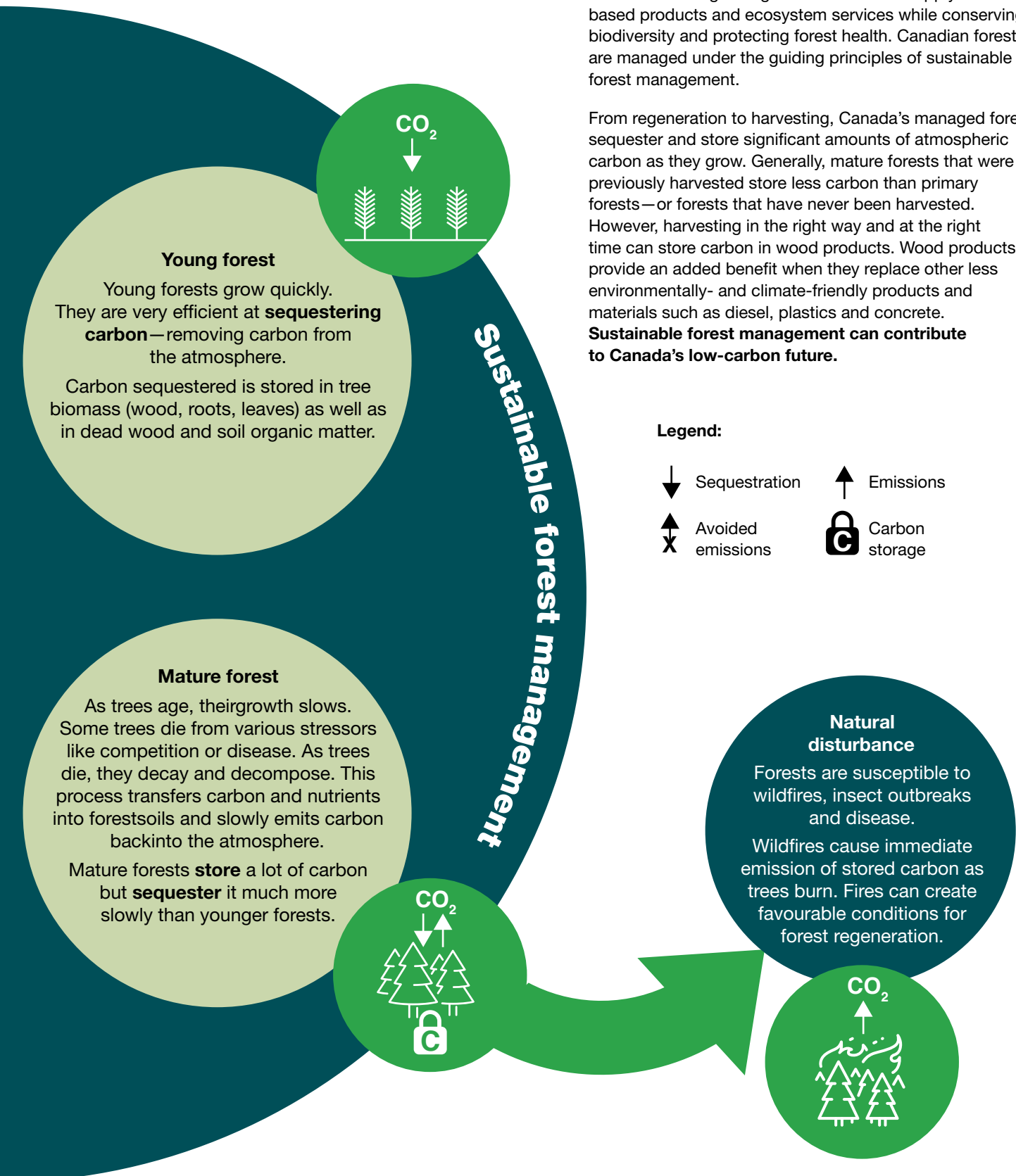
Maple syrup production and climate change:

Does the future taste as sweet?

Still seen as a secondary economic sector, maple syrup production is in fact a dynamic industry that imbues new energy into the regions where the next generation is present in numbers. However, climate change is having an impact on sugar maple stands and it is a significant concern to maple syrup producers.

- Canadian maple syrup production is an innovative, growing, and lucrative industry, making Canada the biggest producer of maple syrup in the world.
- Climate change, exotic insects and diseases are becoming more of a threat to maple stands and maple syrup production in North America.
- The maple syrup industry can promote the resilience of current maple stands by using silvicultural practices that increase the vigour of maples and functional diversity of maple stands.
- As climate shifts, it is possible to promote the establishment of maple stands farther north by encouraging the growth of maples where they are already present, and by planting them in a mix with other deciduous species where they are absent.

Maple syrup production, a growing industry in Canada

The use of maple sap, a non-timber forest product, is well rooted in North American history. European colonists learned from First Nations to use maple sap. Maple sugar then became a key staple for early settlers and was later replaced by maple syrup. For many Canadians, maple syrup production has been a source of income, hobby opportunities and family traditions. But over the last 50 years, Canadian maple syrup production has increased sevenfold, from 11 to 79 million litres (M L). This dramatic increase is the result of technological advancements (e.g., maple tubing systems, reverse osmosis, filter presses, high-performance evaporators), and maple syrup producer groups who had a far-reaching and expansive vision.

Maple syrup production in 2022	Québec	New Brunswick	Ontario	Nova Scotia	Canada
Number of taps	48,672,648	3,523,948	2,013,549	420,383	**54,647,591**
Number of businesses	8,653	188	2,469	120	**11,541**
Maple syrup produced (M L)	72.5	3.7	2.7	0.2	**79.1**
Revenues (M $)	621.6	33.0	31.2	3.0	**688.7**

Canadian maple syrup production and exports, 2010–2022
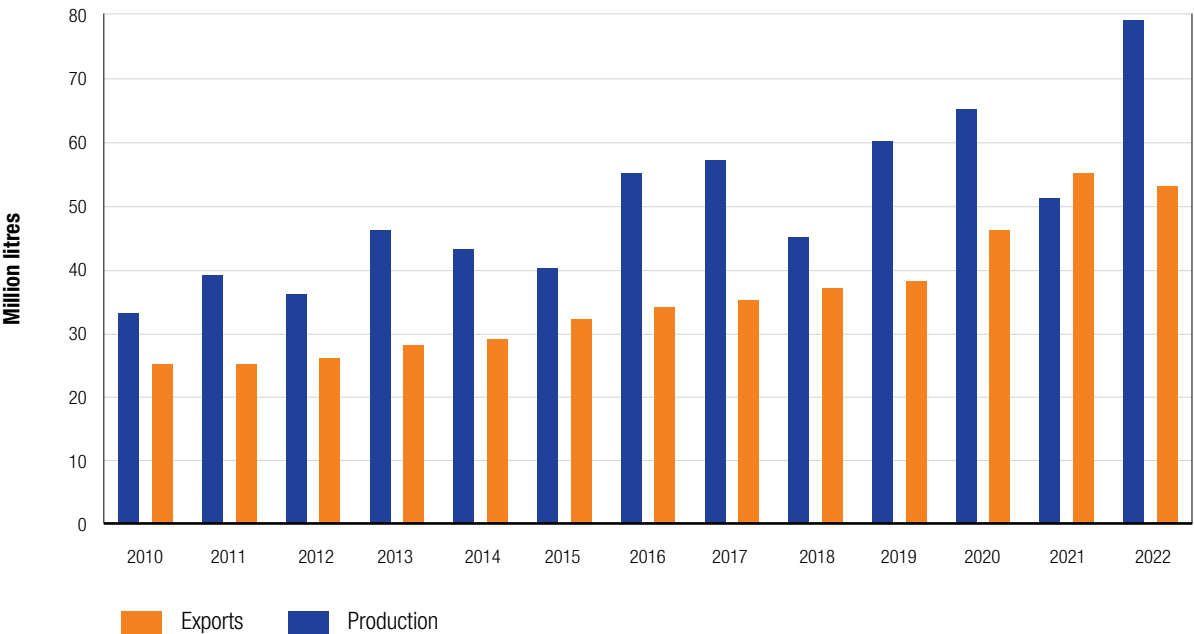
Canada produces approximately 70% of the world's maple syrup. The rest comes from the US.

Québec alone is responsible for 90% of Canada's production.

Canadian maple products are exported to nearly 75 countries. The US imports more than 60% of Canadian maple products.

Canadian maple product exports reached $616 million in 2022.

What does the future hold for maple trees and maple syrup production in terms of climate change and other biotic threats?

The impact that climate has on maple syrup production in Canada is increasing. Early bud break (bud development) in spring increases leaf exposure to late frost and the risk of damage to new developing tissues. This late-frost damage is possibly more significant than exposure to early frost in the fall. If such events become chronic, frost could reduce annual wood growth and the accumulation of reserves.

The maple sap season is also starting earlier than in the past. By the end of the century, the season is expected to start another two to three weeks earlier because of the earlier spring. Despite this, the effects of climate change on maple syrup yields are less obvious. Some authors predict that maple syrup production in Québec will increase due to higher temperatures, whereas others foresee little change. However, these predictions do not consider upsurges in extreme weather events (e.g., prolonged droughts, false springs and/or late frosts, periods of extreme heat) and epidemics of alien insects that could have a negative impact on the vigour and survival of our maples, and consequently, maple syrup production.

What can we do to help maple stands?

The maple syrup industry is aware of the impact of climate change and other biotic threats on its activities and is committed to both preserving maple stand health and increasing their adaptive capacity. To that end, silvicultural strategies may be implemented to mitigate climate risks and other threats to maple syrup production, such as:

- liming for select trees or stands, which increases the vigour of maples, enabling them to recover better in response to climate or biotic stress
- thinning, which aims to reduce the water demand of maples during periods of extreme drought
- diversifying, by maintaining a certain number of companion species with complementary functions (functional diversity) in maple stands to promote stand resistance and resilience

Extreme weather events will become more and more frequent in the future. In 2022, a derecho-type storm devastated hundreds of square kilometres of forest in Eastern Ontario and Western Québec. Several maple syrup producers were affected. In October, Hurricane Fiona destroyed forests in Nova Scotia. Some maple syrup producers lost 30% of their taps, others even more. These trees are not replaceable; it takes about 40 years for a maple to reach average sap production levels.

Maple syrup production is dependent on the non-structural carbon reserves in maples. These reserves are also essential for survival in the event of drought, to grow new leaves after defoliation events and to repair root damage.

A slow march north for maple stands

Maples will take hundreds of years, if not more, to migrate north naturally and follow their climate niche. In fact, the strong presence of conifers affects the germination capacity and growth of maples, slowing down their migration. However, there are forest management tools that can help to counter these limiting factors and facilitate their progression to new territories.

When maples start naturally colonizing more northern forests, it may be possible to increase the growth of young maples through thinning. The purpose of thinning is to reduce the number of conifers that slow down the establishment and growth of maples, while increasing the amount of available light. This type of management could facilitate the transition of mixed forests to maple stands. Where maples are absent but weather conditions permit, it may be possible to plant them with other deciduous species that improve the soil to facilitate their establishment and sustain their growth. Such movements, which constitute a form of assisted migration, are best limited to modest northward distances (e.g. < 200 km) to reduce survival risks of the migrated planting stock and to the recipient ecosystem.

Factors slowing the northward progression of sugar maples
- **Very slow growth of maples:** a tree achieves its full maturity between 50 and 100 years
- **Short seed dispersal distance:** most seeds drop to the ground within a radius of thirty metres from the parent tree
- **Adverse soil conditions in boreal forests:** reduced germination and initial survival of seedlings
- **Competition with different species:** lower performance of young trees
- **Seed predation by small mammals**
- **Herbivory (browsing) by deer and moose**

Community forests manage for multiple values at multiple scales in increasingly uncertain landscapes

What is a community forest?

A community forest advances sustainable forest management based on:
- local values
- local benefits
- local decision-making

> - Indigenous Peoples and local communities were legally recognized as having owned at least 447 million hectares (Mha) of forest land in the world with legally designated rights over an additional 80 Mha, for a total of 14% of the global forest area.
> - An estimated 36% of the world's remaining intact forest landscapes are on Indigenous lands.

Community forests are a unique form of tenure that differ from most provincial forest tenures that grant licences to forest companies to harvest specified forest areas or timber volume on Crown land over the long term. Most provinces and territories in Canada have some type of community forests with the majority concentrated in British Columbia (BC), Ontario and Québec. The definitions of community forestry and the legal frameworks that enable it vary from province to province. They range from special licences issued by a province to co-management with a province, industry joint ventures and Indigenous-led initiatives. Each community forest is unique, since the local community manages it and sets goals according to their values. Community forests also offer an avenue for governments and the private sector to engage in forest-sector partnerships with Indigenous Nations.

Examples of community forests across Canada

In BC…

BC is unique in Canada with its area-based forest licence called the Community Forest Agreement (CFA). The tenure was introduced in 1998 in response to a decade of conflict over forest management and calls for greater community control.
- BC currently has 60 CFA holders, ranging from 361 to 184,682 hectares.
- Half of CFAs are held by Indigenous Nations or in partnership with non-Indigenous communities.

- Licences are long-term, granting communities the exclusive right to harvest timber and manage botanical forest products within a fixed area.
- Governance is by community-based entities, including community corporations, limited partnerships, societies and co-ops.

> - Since 2002, BC has signed forestry agreements, including CFAs, with 177 First Nations, providing more than $382 million in revenue-sharing and access to more than 181 million m^3 of timber.
> - First Nations in BC hold tenures representing 13% of the provincial allowable annual cut—up from less than 3% in 2001.
> - In addition to CFAs, in 2019, BC added another area-based, long-term licence that has contributed to the forest area managed by First Nations—the First Nations Woodland Licence.

Twenty-five years later, CFA licence holders are demonstrating the success of this model and are creating multiple benefits for rural and Indigenous communities, including:
- local jobs
- community dividends
- investments in education, infrastructure and recreation
- re-investments in forests for enhanced stewardship, climate change adaptation and wildfire risk reduction

> - The BC Community Forestry Association (BCCFA, 2022) reported that CFAs created 0.48 full-time local jobs/1,000 m^3 in forestry, logging, and support services, which is approximately 76% greater than the industry average.
> - Almost 80% of BCCFA survey respondents made cash and/or in-kind contributions averaging $423,327 with an additional $38,516 in in-kind contributions. The total in-kind contribution was over $1 million.
> - The BCCFA reported an average of just over $100,000 from each CFA for investments in enhanced or modified management for ecological or social reasons.

While the rights conferred by a CFA are limited to harvesting timber, the benefits are more than just economic. Many CFAs go above and beyond legal requirements and are creating social, cultural and ecological benefits for their communities. This is in part due to provincial policies that

support the unique nature of these tenures by providing a degree of autonomy and flexibility, while keeping more of the economic benefit from resource revenues local.

To date, the success of BC's CFAs, as a particular legal framework to enable community forests, comes from supportive provincial forest policies, local ingenuity, as well as persistent local advocacy and collaboration.

A case study of the Haida Nation

The Haida Nation on Haida Gwaii (Xaayda Gwaay.yaay) in BC pursued its own path to bring forest management under local control after concerns were raised about the rate and methods of timber harvesting on the island. Several initiatives focused on building alliances between the Haida and local non-Indigenous communities. The Islands Community Stability Initiative (ICSI) began in 1995, long before BC's Community Forest Agreements began to be signed in 2000. ISCI submitted a proposal for a community forest pilot project.

While unsuccessful in securing a Community Forest Agreement, negotiations emerged from this application process that produced a land use plan guided by an ecosystem-based management (EBM) framework, a process initiated in 2003 and eventually signed as the Strategic Land Use Agreement (SLUA) in 2007. The SLUA was as much a product of long-standing Haida opposition, campaigns, and non-violent civil resistance as it was of provincial-Haida negotiations. The 2010 Haida Gwaii Land Use Order (the Order), signed by the BC and Haida governments, succeeded the SLUA. The Order incorporated EBM, an integrated management strategy for natural resources that promotes equitable sustainable use and conservation.

The Order is based on co-operation and a foundation of Western law incorporating spatial delineations of Haida values. It is unique and directly derived from the Haida community forest development process. The Order brings together Haida cultural values and overlays them on a Western model of resource management. It is an effort to reconcile the Western and Haida worldviews of stewardship. Moreover, it is an ongoing experiment to incorporate the traditional with the modern, admittedly within a framework that is based largely on Western management principles. Communities on Haida Gwaii trust and prefer a working relationship and co-management with the Council of the Haida Nation (CHN) over current requirements by the Ministry of Forests to partner with BC Timber Sales. While this does not preclude future relationships between the CHN and the Province of BC, it does illustrate that Haida Nation members feel the CHN holds and demonstrates a greater responsiveness to local concerns.

About the same time as the Order was signed, in 2010, the Haida Enterprise Corporation (HaiCo), the economic arm of the Haida Nation, formed Taan Forest Products. Taan adopted the Haida value of "yahguudang," meaning "respect for all living things and the interdependence that binds us." Taan received Forest Stewardship Council certification for its high forest management standards.

Decision makers are informed by setting and monitoring spatially measurable attributes by licencees and the province. However, the Haida approach is not perfect. The Haida Nation's ability to gather information about community lands and cultural features is limited. Western management overrides Haida traditional management in areas where resource use is permitted by BC. This is offset by providing buffer zones for Haida cultural features to protect them from resource exploitation and timber harvest damage. These restrictions allow the Haida to develop a different and adaptive approach to resource management. The lack of enabling legal frameworks that include the sharing of benefits and having a strategic influence on decision-making is a challenge for the successful negotiation of collaborative arrangements.

Haida Gwaii serves as an example of the primacy of relationship building and trust for the implementation of EBM and shared decision-making. While governance is complicated by the local context, it is constantly evolving and is not "one-size-fits-all." The recognition of Haida cultural features and the shared mandate to monitor and evaluate current logging practices are essential to disrupting the history of colonialism, distrust, and discrimination experienced by the Haida people. The Haida continue to pursue their own path with the Province of BC through a range of strategic and operational agreements, demonstrating that there are many ways to define "community forestry."

Across Canada…

- In 2021, Community Forests International announced a climate change action collaboration—the Common Ground Project—on the unceded territory of the Mi'kmaq and Wolastoqiyik with the Ulnooweg Development Group, which supports Indigenous initiatives and the Nova Scotia Family Forest Centre.
- Nova Scotia implemented a pilot project with the Medway Community Forest Cooperative in 2013. On Cape Breton, the Unama'ki Institute of Natural Resources, representing five Mi'kmaq communities, is working with the Province of Nova Scotia on shared governance of the Kluscap Wilderness Area. This is part of a growing trend across Canada to promote Indigenous Protected and Conserved Areas (IPCAs).
- In New Brunswick, community organizations like the Conservation Council of NB and Falls Brook Centre have promoted community forests for decades. The Upper Miramichi Community Forest Partnership has also made efforts to establish a community forest.
- The Model Forest of Newfoundland and Labrador promotes partnerships among government, industry, academia, environmental and community organizations to collectively find solutions to promote sustainable forest management. The Innu of Labrador have worked with the province to develop a mutually acceptable ecosystem-based forest management plan, which includes establishing protected areas based on a 2003 interim agreement.

- An interesting example of innovative forest management and tenure is the Algonquin First Nation of Kitigan Zibi. On their own reserve "common lands," they focus on the ecology and environment, promoting biodiversity to mitigate climate change. Off reserve, on Québec public lands that are still part of their traditional territory, the Natural Resource and Wildlife Office carries out silvicultural contracts that provide well-paid employment to community members and ensure the Office is financially viable.
- Ontario's community forest pilot project lasted five years in the 1990s. In the mid-2000s, following an economic collapse in the forest sector, Ontario brought in two new forms of tenure: Enhanced Sustainable Forest Licences and Local Forest Management Corporations. Both required a broader range of stakeholders on licence holder boards, particularly Indigenous and local community representation. While a few of these may be considered community forests, Ontario has not gone as far as other jurisdictions to introduce a specific community forest licence.
- In the Prairie provinces, Indigenous-industry partnerships are emerging. In Manitoba in 2018, Canadian Kraft Paper and Nekoté, a corporation representing seven First Nations, formed a 50-50 partnership—the Nisokapawino Forestry Management Corporation—to co-manage almost nine million hectares of northern Manitoba boreal forest. This is the largest forest tenure in North America overlapping with the traditional territories of nine First Nations.

- In Saskatchewan, Sakâw Askiy Management Inc. is a partnership of eight industry and First Nation groups holding the Prince Albert Forest Management Agreement for just over three million hectares of boreal forest. The business model is designed to give operating decision-making rights to local knowledge holders.
- In Alberta, municipalities and local organizations are following a North American trend to establish urban Community Food Forests to provide food and ecosystem services such as carbon sequestration and water management.
- The *Yukon First Nations Land Claims Settlement Act* and the *Forest Resources Act* provide for Renewable Resource Councils (RRCs). Both the territorial government and First Nations are responsible for determining membership in the RRCs, which act as an avenue for First Nations to provide input into the management of renewable resources. Similarly, in the Northwest Territories under land claim agreements, First Nations have established RRCs and Renewable Resource Boards for settlement lands. Some First Nations are developing their own forest management plans.
- While most community forests are established on Crown land, many are also located on private lands. One good example is the Eastern Ontario Model Forest, made up primarily of private landowners.

A path forward for community forestry in Canada

More communities, both Indigenous and non-Indigenous, want local forests to be managed in a way that meets community values and expectations. Many are learning from the successes and challenges of existing community forests and seeking to secure forest management rights for their communities. Nearly 30 years on, continued advocacy, policy learning, and forest policy reforms are needed if governments want to support additional and thriving community forests. Reforms include redistributing harvesting rights to Indigenous and rural communities, promoting changes to forest management regulations that reduce the emphasis on timber management, promote management of non-timber forest products and ecosystem services, and broaden the scope of management rights to allow more autonomy and flexibility for local solutions.

There remains a need to expand the diversity of tenure arrangements and increase the quality of interaction between non-Indigenous stakeholders and Indigenous Nations. Reconciliation based on a recognition of Indigenous rights, social licence and trust is achieved one conversation at a time.

Both provinces and the federal government have a role to play in supporting community forests. Community forests provide a collective approach to sustainable forest management based on a recognition of Indigenous rights, shared benefits and local decision making.
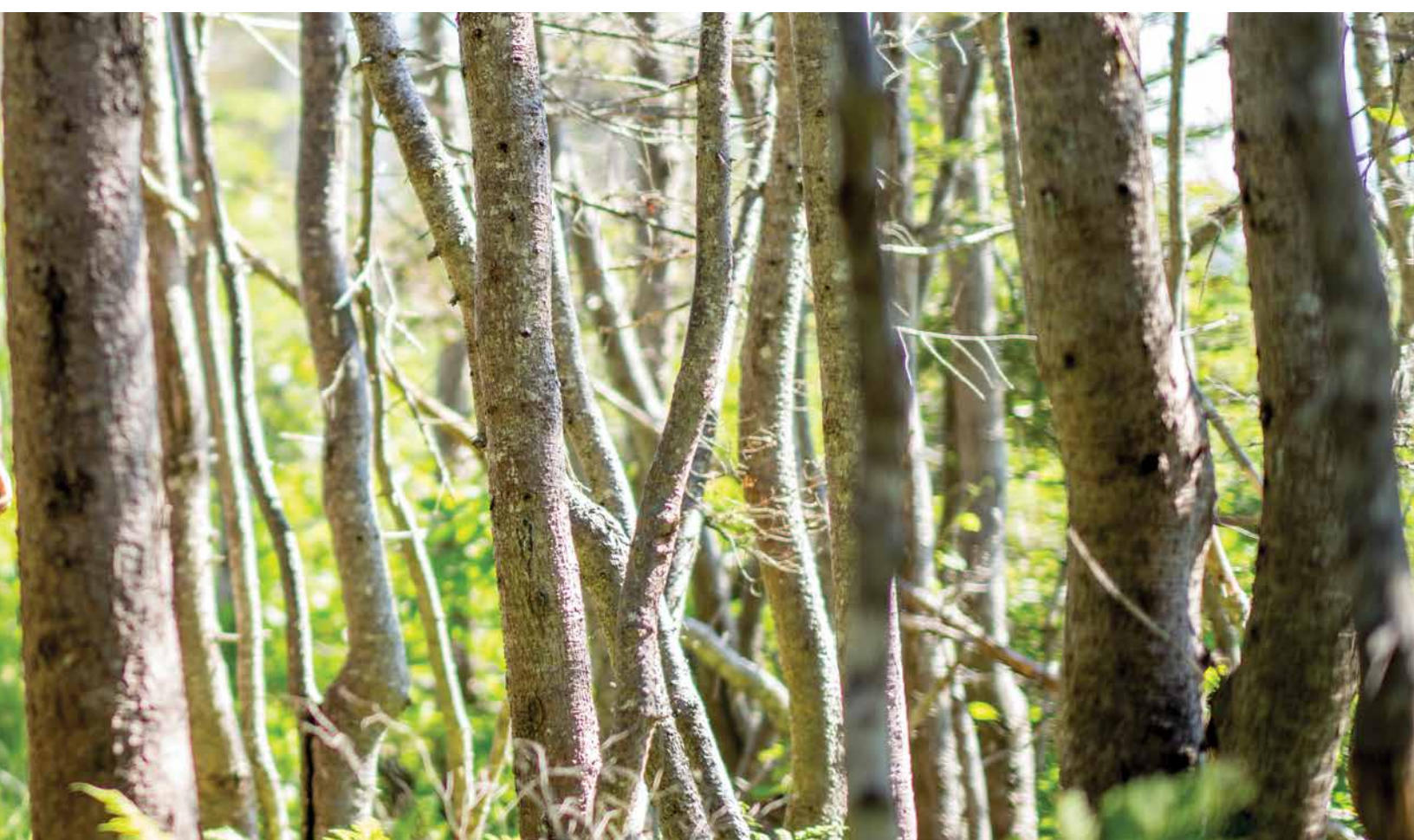
Human linkages throughout the forest sector supply chain

More than 1/3 of Canada's total population lives in or near forests and enjoys the environmental, physical and cultural benefits that they offer.

Many Indigenous forest stewardship and management practices have protected and preserved forests for generations.

Indigenous knowledge tells us a lot about forests, how to manage them, and how important they are to the environment.

Canada's forest supply chain begins with seeds. These seeds grow into trees that are sometimes cut down and harvested for their wood. Scientists can help us by selecting the most promising seeds that will provide growing trees with higher resistance to pests and disease.

Canada's forests are sustainably managed for timber. They also provide non-timber forest products such as maple syrup, wild blueberries, wild mushrooms, medicines, natural dyes, animal products and plant fibres.

Indigenous partners, companies, and local communities all influence the forest sector and create various jobs in the forest sector (e.g., loggers, truckers, woodlot owners and woodlot workers who are key to moving harvested wood and non-timber forest products out of the forest).

Scientists and researchers help to improve the sustainability of forest management by studying and developing innovative techniques that can be used to optimize forest resources while minimizing negative impacts on the environment and biodiversity.

Over 11,000 workers in Canada's forest sector are Indigenous. Many more Indigenous people and communities are owners and important stakeholders in the forest sector.

Wood pellets are used to heat homes, heat cooking grills, and as animal litter and bedding.

Forest product companies use wood to make traditional products: pulp and paper, packaging, low-carbon construction materials like lumber, wood building systems and other products that help Canada reach its net-zero goals.

Some forest product companies (refineries) make use of the residues left over from traditional forest activities to make advanced bioproducts and biofuels. Biorefined materials exist in products that people use every day (e.g., medications, cosmetics, bandages, containers, food packaging, glue and perfumes).

Most products get distributed using truck, rail or marine transportation, but for some facilities and some rural, remote and Indigenous communities, bioenergy from biofuels is distributed through district heating systems.

Scientists, researchers, and academics look for innovative ways to use refined forest products to replace plastics and packaging with more efficient products.

How much forest does Canada have?

There are 367 million hectares (ha) of forest across Canada. This is 15 times the size of all the Great Lakes put together. Across the country, Canadians have deep connections with forests—valuing, managing and using them in different ways. Therefore, retaining Canada's forest is vital. Since 1990, less than half of 1% has been deforested.

What is a forest?

Forests within Canada and across the globe are very different. To make sure we are measuring forests the same way as other countries, Canada uses the definition of forest area established by the United Nations Food and Agriculture Organization (FAO):
- land not predominantly under agricultural or urban land use
- spanning an area greater than 0.5 ha
- with trees taller than 5 m
- and a tree canopy cover of more than 10%

     OR

- land that has the capability of reaching these criteria in the natural environment

Forest area is still considered to be forest after a temporary loss of tree cover, such as after a wildfire or clearcut harvesting. Changes in forest area result from:
- Afforestation: the deliberate establishment of forests on lands previously not forested
- Deforestation: the permanent clearing of forests to make way for new, non-forest land uses such as agriculture or urban expansion
- Natural forest expansion or dieback

Connections to the forest: Diverse and dynamic

Canadian perspectives on and relationships with the forest are diverse and evolve over time. From biodiversity, recreation, carbon storage and water filtration, to building materials, employment opportunities and cultural identity, Canadians expect a lot from the forest. And just like the dynamic forest itself, the values we expect from the forest are evolving all the time. Regionally tailored sustainable forest management policies and practices are developed and applied across Canada to balance these diverse values and integrate stakeholder input. They are designed to be adaptive with changing attitudes toward the forest.
- Over 90% of forests in Canada are on public land; 7% are under private ownership.
- Approximately 45% of forests on public land are managed for forestry.
- Almost 10% is legally protected with an additional 3% restricted for other reasons including ecological reserves and traditional land use.
- While not entirely free of human activity, 30% of forests in Canada have no formal management plan or designation.
- Forests in Canada have global significance because of their size, biodiversity and contributions to carbon and water cycling.

Indicator: Forest area

Canada's forests cover 367 million ha. Since 1990, less than half of 1% of Canada's forest has been deforested—converted to non-forest land use. Relative to the size of Canada's existing forests, very little afforestation has been recorded. Some gradual changes in forest area, including those attributed to climate change, are more challenging to quantify but include expansions in some areas and losses in others. The current estimate of forest area in Canada (367 million ha) is an improved estimate in relation to what was previously reported, and is based on better data and more advanced assessment tools.

- Like most countries, Canada uses an internationally standardized definition established by the United Nations (UN) Food and Agricultural Organization (FAO) to track forest area through time.
- While forest area in Canada is relatively stable, the tree cover within is more dynamic due to forest fires, insect infestations, harvest activities and regrowth of forest cover.
- Canada's National Forest Inventory continues to improve and refine estimates for critical sustainable forest management indicators, including forest area.

There are also other types of treed lands across Canada that do not fully meet the UN's definition of forest but can contribute to habitat for wildlife, the sequestration and storage of carbon, as well as many other values across the landscapes in which they are found. These include:

- "other wooded lands," which are areas with trees where the tree canopy cover is between 5 and 10%, usually accompanied by other vegetation types, like shrubs or bushes; there are 36 million ha of other wooded lands in Canada
- "other land with tree cover," which are distinguished from "forest areas" as being in predominantly urban and agricultural areas, such as orchards; there are 7 million ha of other land with tree cover in Canada

Why is this indicator important?

- Forest area losses are a concern and closely monitored because forests provide habitat for biodiversity and many important ecosystem goods and services.
- Forest area is a broadly used and regularly measured indicator. In conjunction with forest area, many other indicators are used to gauge the effectiveness of sustainable forest management.

Canada's estimated forest area, 1990–2022
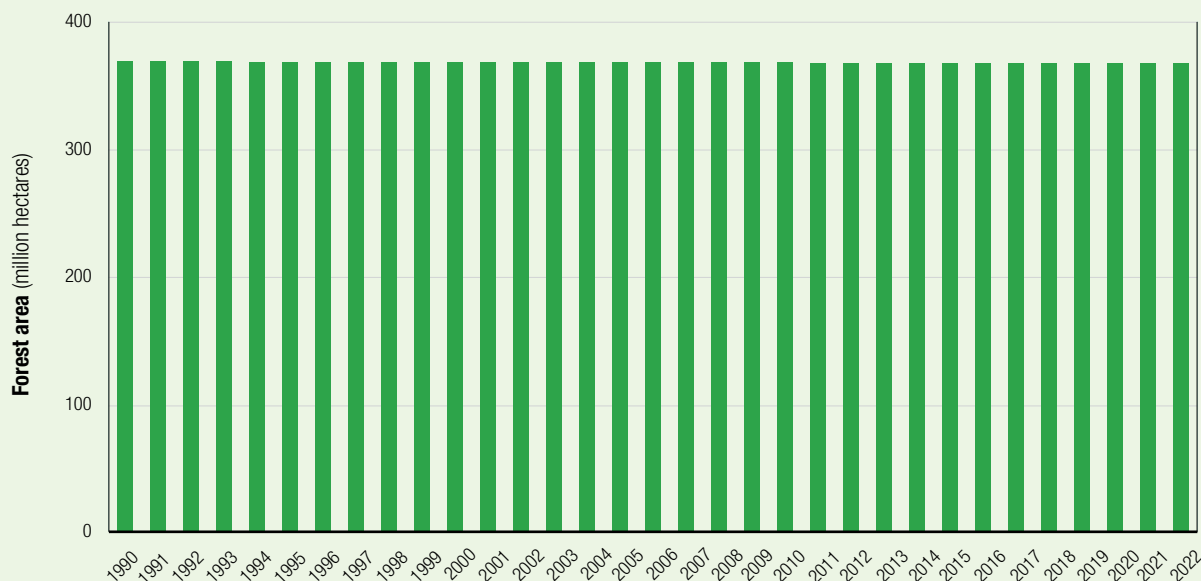
What is the outlook?

- Natural increases and decreases in forest area tend to occur gradually where and when growing conditions or disturbance patterns allow. Changes to natural ecosystem processes induced by climate change may accelerate this usually slow process.
- Forest area is expected to remain generally stable. Rates of human-induced change are likely to remain low. (See the **Deforestation and afforestation** indicator for more information.)

- The federal government's Forest Systems Information and Technology Enhancement (ForSITE) program will enhance the forest information available to support forest management decisions for sustainable and resilient forests and to publicly report on forest inventory and management practices.

Source: Dyk, A., Leckie, D., et al. 2015; Food and Agriculture Organization of the United Nations; National Forest Inventory. See *Sources and information* for more detail and visit us online at cfs.nrcan.gc.ca/stateoftheforests.

Indicator: Deforestation and afforestation

Canada's annual deforestation rate has slightly decreased over the last three decades. In 2021, 51,000 ha of forest were converted to non-forest land uses, as compared to 64,000 ha in 1990.

- Canada has 9% of the world's forest but is responsible for only 0.37% of global deforestation that has occurred since 1990.
- The main drivers of deforestation in Canada continue to be agricultural, mining, as well as oil and gas expansion.
- The development of hydroelectric reservoirs causes spikes in annual deforestation due to forest flooding, as seen in 1993 and 2006.

- Deforestation in the forestry category (see figure below) arises from new permanent forestry roads and other persistent clearings such as sizable landings.
- The low annual area of recorded afforestation is much smaller than the annual area of deforestation, which in turn is much smaller than the total area of Canada's forests.

Why is this indicator important?

- Forest loss affects biodiversity, soil, air and water quality, as well as the availability of wildlife habitat. Forests also store more carbon than other terrestrial ecosystems and can be managed to mitigate climate change by, for example, increasing forest area through afforestation or by avoiding deforestation.

Estimated area of annual deforestation in Canada, by industrial sector, 1990–2021
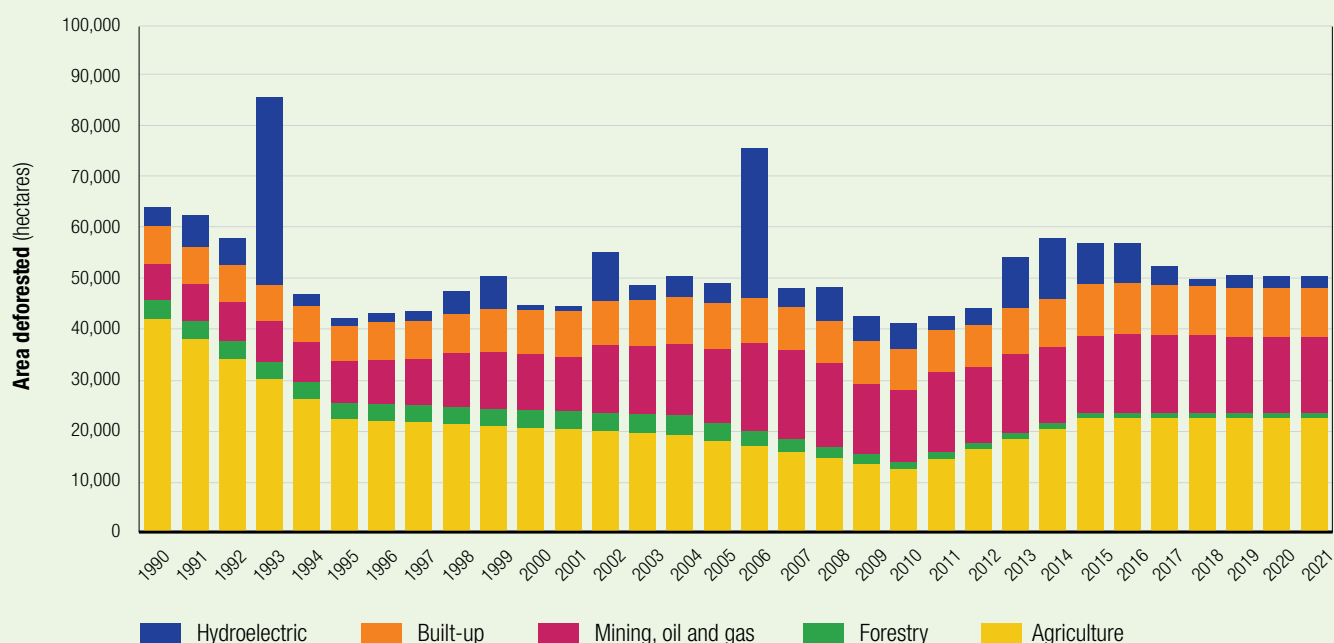
What is the outlook?

- The deforestation rate in Canada is expected to remain steady at its current levels.
- Ongoing and planned initiatives for planting trees in both urban and rural areas are expected to increase the afforested land area in coming years. The contribution of this activity to ecosystem services such as restoring habitat and carbon sequestration is increasingly recognized.
  - The federal government's 2 Billion Trees Program will enhance the rate of additional tree planting (through both afforestation and reforestation plantings) over the period between 2021 and 2030.

The National Deforestation Monitoring System (NDMS) tracks changes from forest land to other land uses across Canada. Deforestation does not include forest harvesting when forest is being regrown on the site.

The NDMS can show trends by time, region and industry sector type.

Indicator: Wood volume

There are an estimated 50.2 billion cubic metres of wood volume in Canada. Wood volume is one of the most frequently studied, measured and reported forest indicators because of its importance in assessing available wood supply for the forest sector, managing carbon stocks in forests and determining the productivity of Canada's forest resources.

Regular improvements to inventory methods and tools as well as updated data sources give us a better understanding of wood volume in Canada, and how it is changing through time.

- Just over half of the wood volume in Canada is in areas managed for forestry. A portion of this is available for wood supply, and other portions are set aside to achieve management objectives such as protection of water resources and wildlife habitat features.
- Around 11% of wood volume nationally is in legally protected areas with an additional 4% in areas restricted for other reasons including ecological reserves and traditional land uses.
- While not entirely free of human activity, over 20% of wood volume in Canada is in areas that have no formal forest management plan or designation.

Estimated wood volume (million cubic metres) in Canada

Year	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020	2021
Wood volume	54,555	54,524	54,050	52,292	51,648	51,167	51,095	50,885	50,591	50,494	50,558	50,199

Note: data are not consistent among different reporting years due to improvements in methodology. More information is included in the Sources and information section of this indicator.

Why is this indicator important?

- Wood volume is used along with other information to determine forest productivity, calculate biomass and estimate carbon storage in Canada's forests.
- It is important to monitor general trends in wood volume in all forests for predicting fire behaviour and monitoring carbon storage.

What is the outlook?

- After notable declines due to the historic mountain pine beetle outbreak in British Columbia and recent significant wildfire activity, the national wood volume trend continues to be driven primarily by natural disturbance dynamics.
- Other large-scale natural disturbances, such as insect or disease outbreaks and drought, may have negative impacts on wood volume and regrowth. While these disturbances occur regularly, normally at low-severity levels, occasional large or high-severity disturbances may have lasting impacts on national volume trends.

- Recent large forest disturbances, specifically wildfires, have led to local wood volume reductions. Wood volume recovery can take decades to reach pre-disturbance levels.
- The federal government's Forest Systems Information and Technology Enhancement (ForSITE) program will enhance the forest information available to support forest management decision for sustainable and resilient forests and to publicly report on forest inventory and management practices.

How are Canada's forests harvested sustainably?

Sustainable forest management aims to maintain and enhance the ecological, social and economic values of forests, ensuring their availability for present and future generations. Canada follows sustainable forest management principles for managing its forests; in 2021, approximately 698,000 hectares (ha) of forests were harvested in Canada, which represents roughly 0.2% of forested land.

Most forests in Canada are publicly owned

In Canada, provincial or territorial governments own nearly 90% of the forests. These forests are managed according to diverse regulations and policies, which adhere to the overarching principles of sustainable forest management, notably through ecosystem-based forest management planning.

Harvested volumes are based on forest growth

Forest management is a multidisciplinary process involving ground surveys, remote sensing and growth models to determine the composition, age, structure, and growth rates of forests. These factors are used to estimate the volume of wood that can be sustainably harvested while preserving ecosystem functions, such as carbon sequestration and wildlife habitats. Ongoing research aims to integrate climate factors into modeling tools to better understand the impact of climate on forest growth.

Managing forests: Desired states and strategies

Forest management plans outline the current and desired states and values of forest lands, including strategies to achieve sustainable forest management objectives, taking natural disturbances and climate change into consideration. These plans are developed by professional foresters in accordance with laws, regulations and policies. The process involves consultation and collaboration with Indigenous Peoples and other stakeholders, with increasing efforts to incorporate Indigenous knowledge and traditional practices into decision-making.

Climate change presents forest management with new challenges and opportunities

Like other regions around the world, Canadian forests and the forest sector face substantial challenges generated by global change. The shifting climate impacts the ability of some tree species to regenerate and alters forest ecosystems. At the same time, the changing climate can make Canadian forests suitable for growing new tree species that are currently not adapted to grow in northern latitudes.

As a complement to managing forests to favour natural regeneration, planting new trees usually results in higher productivity thanks to tree breeding programs and a better use of available growing space. This also allows for control over forest composition, so that ecosystems can be adapted to future climate conditions and other pressures from global environmental change. Researchers and practitioners are collaborating to develop adaptive silviculture to climate change. They are also working to create a sustainable forest-based bioeconomy sector to help reduce carbon emissions and maintain resilient forest ecosystems.

Forest management plans are created by involving and working together with Indigenous Peoples and other partners who are affected by forest management on public lands.

Indicator: Forest area harvested

The area harvested each year is an important indicator of the level of industrial activity in Canada's forests. This measure is used in assessing the long-term sustainability of harvesting activities. In 2021, an estimated 698,000 hectares (ha) of forest were harvested, which is a 2.4% decrease compared to 2020, when 715,200 ha were harvested.

- The area of forest harvested in Canada has decreased each year since 2017. This change is due to multiple factors, including reduced harvesting in areas affected by mountain pine beetle, severe wildfires and increased protection of old-growth forests.
- More recently, curtailments due to COVID-19 and weak market conditions have contributed to the decline in the area harvested.
- Compared to 2020, Alberta, Ontario and Yukon experienced the largest decrease in area harvested. In Alberta, the area harvested decreased by 13,400 ha (14%), while in Ontario and Yukon there was a decrease of 6,000 ha (5%) and 2,800 ha (94%), respectively. For the same period, the area harvested increased by 6,950 ha (3%) in Québec.
- Around 85% of the total area harvested in Canada is through clearcutting.

Each year, less than 0.5% of Canada's 367 million ha of forest land is harvested.

When averaged over the last 10 years, the area harvested each year is around 30% of the total area burned by wildfires, and only 5% of the area defoliated by insects.

Prior to harvesting, forestry professionals set a list of silvicultural objectives that are shaped by Sustainable Forest Management (SFM) principles. The method of harvest that is then chosen is the one that is most likely to achieve these objectives.

As an example, forested areas shaped by recurring wildfire events are often composed of even-aged stands. For these areas, clearcutting, or one of the variations on this system (e.g., clearcut with reserves that retains uniformly spaced or small groups of trees to provide wildlife habitat, among other benefits), is usually the most appropriate harvesting method as it creates conditions which lead to the rapid regrowth of the forest.

Forest area harvested on private and Crown land in Canada, 2011–2021
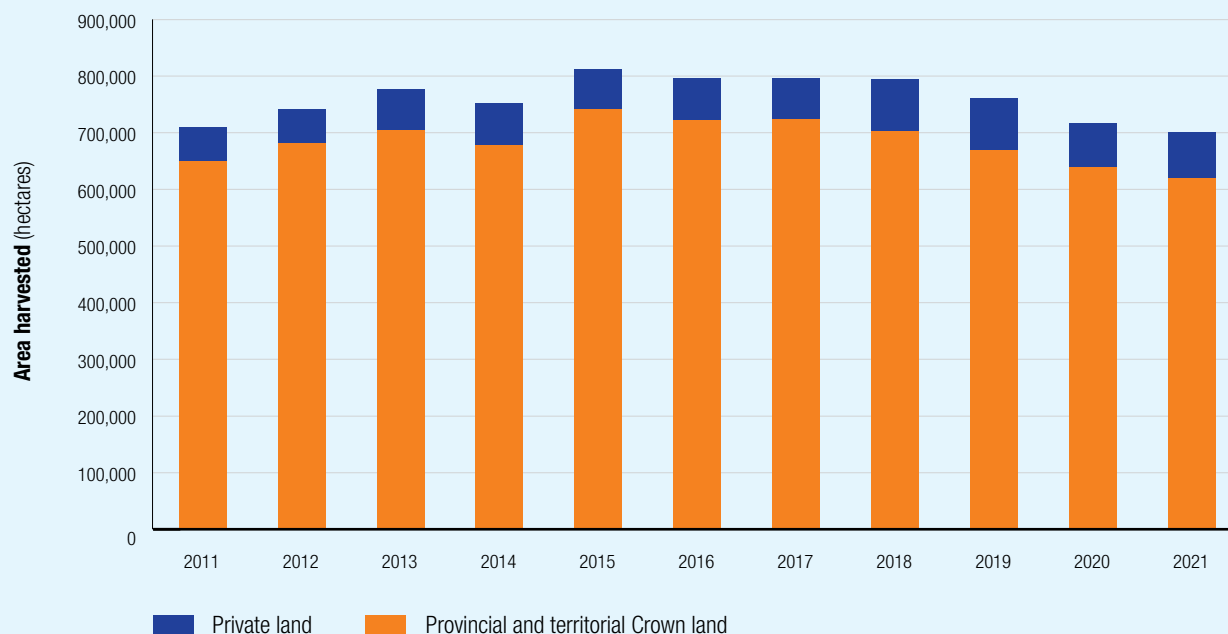
Why is this indicator important?

- Along with volume harvested, the area harvested is a key indicator used to determine if current commercial harvesting practices are sustainable over the long term.
- Regulations specify that commercial harvesting on Crown land can only occur in areas where it is considered publicly acceptable and economically feasible.
- Measuring change in the area harvested gives insight into the impact that commercial forestry operations have on Canada's forests.

What is the outlook?

- The expansion of old-growth forests protection and protected areas (for instance, through the federal program Canada Target 1), combined with a weakening economic outlook, means that the area harvested is likely to continue to decrease for the immediate future.
- Forestry companies in Canada are expanding their use of intensive forest management practices, such as in Nova Scotia. The province is shifting to ecological forestry and adopting a Triad approach where forest management

is intensified in some areas and other areas are further protected. These practices increase the amount of timber volume obtained per unit of area harvested, while leading to a decrease in the area harvested over the long-term.

- Each year, natural disturbances, such as pests and wildfires, impact the area available for harvest. These events are difficult to predict and forest managers must adjust their harvesting objectives in response to such events. However, there is support from multiple levels of government to assist in mitigating the impacts of wildfire and insect outbreaks while simultaneously creating economic opportunities for forestry and bioenergy production. One example is the Forests for Tomorrow (FFT) program, which is led by the Government of British Columbia. A second example is the federal government's 2 Billion Trees (2BT) program, which supports reforestation efforts within wildfire-impacted areas.

Indicator: Forest regeneration

In 2021, 452,000 ha of provincial forest lands in Canada were regenerated by planting and direct seeding. Of that total area, 443,000 ha were planted with 625 million seedlings.

- In 2021, both the area planted and the number of seedlings planted increased nearly 9% compared to the 10-year average.
- Both area planted and seedlings planted are at 10-year highs, which is at least partially due to large reforestation efforts in areas burned by wildfires.
- Direct seeding typically accounts for about 3% of the area artificially regenerated, but in 2021 that proportion declined to 2%. Seeding is only suitable on certain sites and requires large quantities of seeds; both may be factors in the reduced use of seeding.

- Successful regeneration is required following forest harvesting on public lands.
- Forest type and silviculture system determine the regeneration method (natural or artificial).
- Artificial regeneration—planting or seeding—has been applied to 59% of the area harvested in the past 20 years.

Area artificially regenerated and number of seedlings planted on provincial and territorial Crown lands in Canada, 2011–2021

Legend: Area seeded | Area planted | Number of seedlings planted
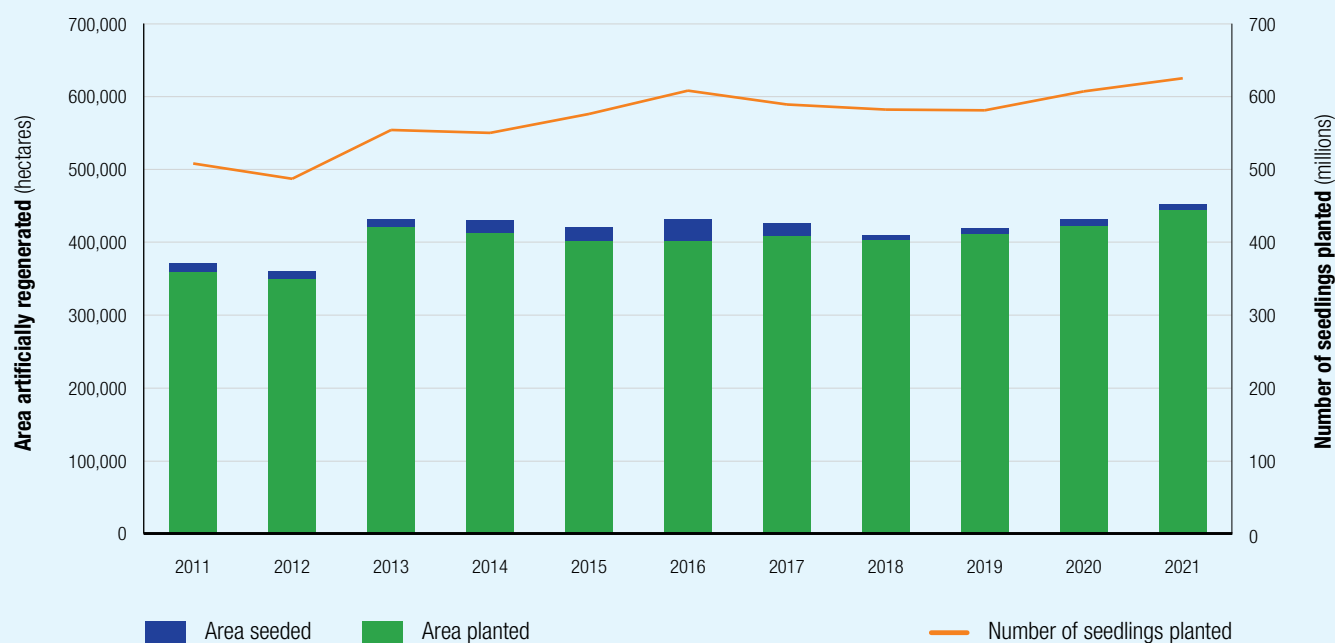
Why is this indicator important?

- Regeneration activities ensure that harvested areas, and sometimes those that experienced natural disturbances like fire and pests, 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. Most artificial regeneration is to establish coniferous trees.

What is the outlook?

- Regeneration rates are most strongly related to recent harvest levels. These levels are influenced by market conditions but are within the bounds of sustainable forest management.

- British Columbia accounts for nearly 50% of the national artificial regeneration activity in Canada. Tree planting increased in 2020 to help recover from record-breaking wildfire disturbances, but these elevated rates will likely decline in coming years. Furthermore, due to the mountain pine beetle (MPB) epidemic, harvest rates are expected to decline this decade, which will likely further reduce tree planting in the province.
- The 2 Billion Trees Program (2BT) will bolster the total area and number of seedlings planted across Canada, with efforts on public lands mostly related to reforestation following natural disturbances and forest restoration efforts.

Since 2021, 2BT-funded projects have planted over 220 species at more than 2,900 sites across Canada. 90% of these projects planted more than two tree species.

10% planted 1 tree species

90% planted 2 or more tree species

34% planted 2 to 5 tree species

34% planted 6 to 19 tree species

32% planted 20 or more tree species
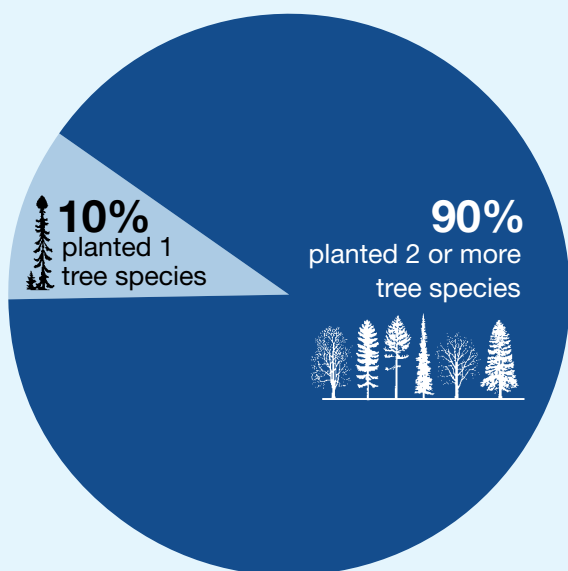
Tree diversity in the 2BT-funded plantation projects
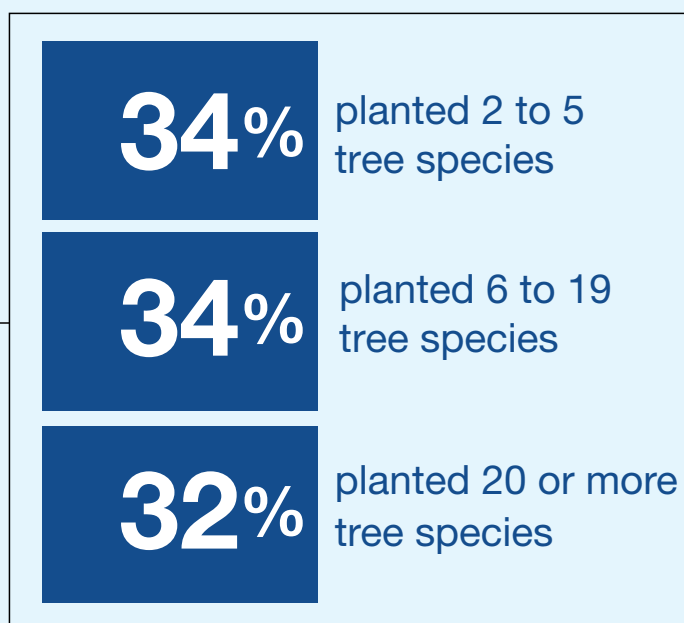
Indicator: Volume harvested relative to the sustainable wood supply

In 2021, Canada harvested 147.3 million cubic metres (m³) of industrial roundwood, which is well below the estimated sustainable wood supply level of 215.0 million m³.

- The harvested industrial roundwood volume increased by 6.2 million m³ from 2020 levels. At the same time, the estimated wood supply deemed to be sustainable declined by 272,697 m³.
- The gap between the volume of industrial roundwood harvested and the sustainable wood supply continues to narrow. Nonetheless, the harvested proportion of wood supply is only 1% more than the average over the last decade (2011–2020).
- Canada continues to harvest at levels that are below the level deemed to be sustainable.
- The increase in harvest is mostly attributable to net increases in timber volumes harvested in British Columbia and Québec.

Sustainable wood supply refers to the volume of timber that can be harvested annually from federal, provincial, territorial and private lands, while meeting long-term environmental, economic and social objectives as set out in legislations that regulate timber harvesting. In this indicator, wood supply refers to industrial roundwood supplies only.

Annual harvest versus supply deemed sustainable for harvest, 1990–2021
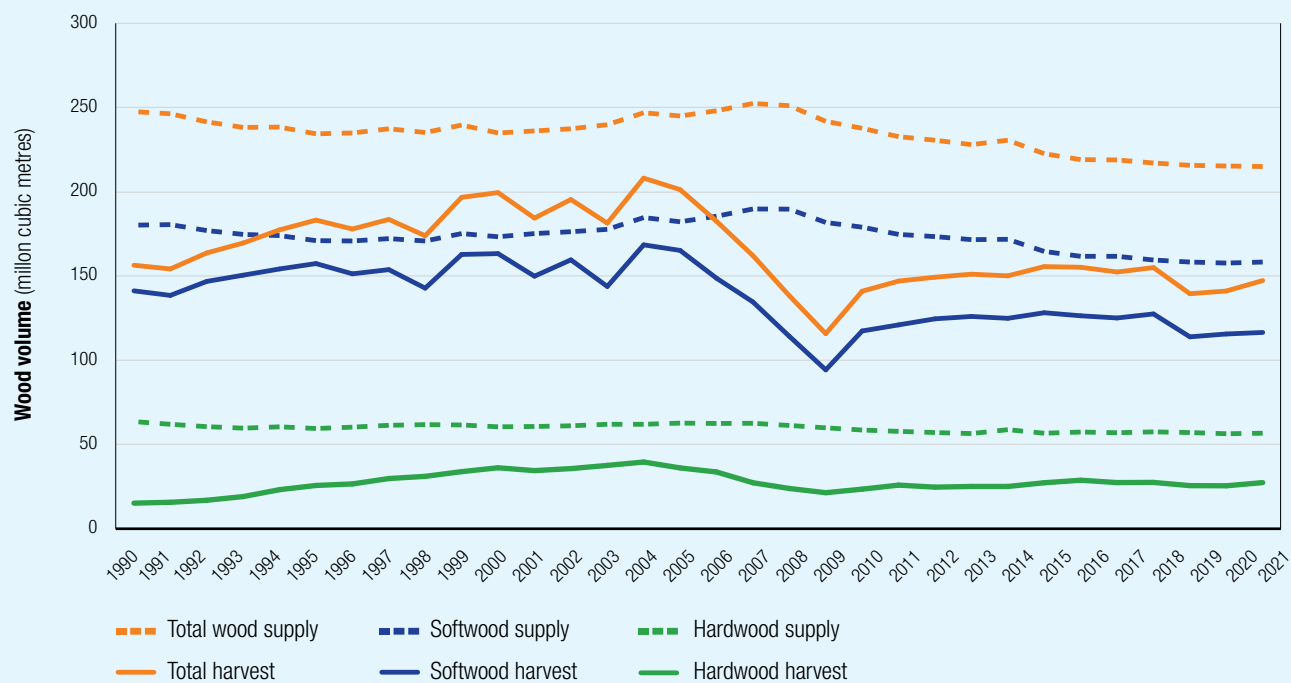
Why is this indicator important?

- Forest managers track the volume of industrial roundwood harvested each year to ensure it falls within long-term sustainable levels, as set out in provincial legislation and policies that regulate the harvest on provincial lands.
- Harvests from provincial Crown lands are regulated by the allowable annual cut (AAC) that each province sets. 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?

- Demand for Canadian wood products will remain strong, driven by the demand for new housing and the high quality of Canadian pulp.
- Harvest levels are expected to remain below the sustainable wood supply.

- The sustainable wood supply will continue to decline over the next several years, since AACs in many jurisdictions are reduced in response to the impact of insect outbreaks (e.g., mountain pine beetle, spruce budworm), hurricanes and severe wildfires, and to the measures that are being taken to protect woodland caribou habitat and old-growth forests. The Canadian Forest Service's Canadian Wood Fibre Centre (CWFC) develops knowledge, tools and approaches aimed at increasing forest resiliency, thereby reducing the risks to the forest fibre supply of Canada.
- The National Forest Inventory (NFI) and the National Forestry Database (NFD), which are collaborative efforts involving federal, provincial and territorial government agencies, help assess Canada's forests health and sustainable management. They provide reliable sources of national information on the extent, composition and characteristics of forests, and monitor changes to forest ecosystems over time through data on forest fires, insect outbreaks and forest harvesting.

Source: National Forestry Database. See *Sources and information* for more detail and visit us online at cfs.nrcan.gc.ca/stateoftheforests.

How does disturbance shape Canada's forests?

Disturbances such as windstorms, drought, wildfires, flooding and insect outbreaks are natural features of forest ecology, but they are increasing in frequency and strength due in part to climate change. Research to improve our ability to understand and predict changing climate regimes, species distributions and ecological dynamics will help us adapt to and mitigate the effects of forest disturbance.

Climate change is affecting forest disturbance in Canada

Climate change refers to long-term changes in global weather patterns such as average temperature or precipitation. Although these changes are gradual, they also feature extreme weather events such as a heat dome that produced record high temperatures in British Columbia in 2021, or an unusually severe ice storm that hit eastern Canada in 1998. Forest disturbances such as insect or disease outbreaks can be triggered by species range shifts or novel species interactions that occur in response to climate change. Drought, wildfire, or flooding often result from extreme weather events.

Individual forest disturbances build on one another due to their compounding negative effects on tree health or soil quality. Several prominent examples illustrate these complex interactions:
- Trembling aspen (*Populus tremuloides*) has declined along the southern edge of its boreal range in the Prairies since the 1980s as a result of both drought and defoliation by insects. Increased mortality generates higher levels of potential fuel for wildfires. It also alters local forest canopy structure, microcosms for other species and decomposition.
- A mountain pine beetle (*Dendroctonus ponderosae*) outbreak peaked across British Columbia in the early 2000s, facilitated by mild winter temperature. The beetle spread across the Rocky Mountains into the prairies, decimating pine forests in these regions. It has also

changed the likelihood of other disturbances through the production of increased wood fuel. Furthermore, it has altered the hydrology, affecting soil stability in mountainous terrain. Tree mortality has transformed lodgepole pine forests in this region from a net carbon sink to a source, further contributing to climate change.
- Forest fires have, on average, increased in size and frequency over the past 50 years, burning approximately 2.3 million ha per year since 1990. Projected temperature increases suggest that this trend will continue. However, predicting fire risk at specific locations is complicated by factors such as ground vegetation, precipitation patterns and fuel moisture content.

Forest management can mitigate the impacts of climate change

To address the impact of climate change on forests, responsive forest management is necessary. This involves several important practices, including:
- monitoring changes in forest distribution and composition
- projecting future climate and forest change via computational models that consider climatic inputs, timescales and ecological interactions
- promoting reforestation and afforestation using climate-informed seed selection and considering assisted migration of tree species to future favourable habitats
- sharing knowledge and resources with all parties involved in managing and responding to disturbances

(a)

(b)

(°C)
-1.5 -1.0 -0.5 -0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

(%)
-90 -70 -50 -30 -10 10 30 50 70 90
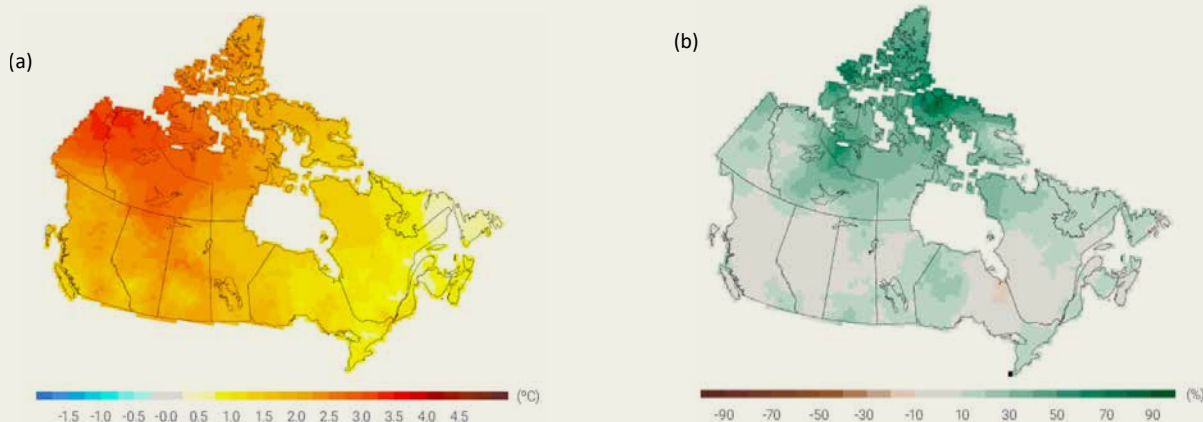
Canadian change in annual average (a) temperature from 1948 to 2016 [~1.7 °C nationwide] (b) precipitation from 1948 to 2012 [~20% nationwide]. Temperature is projected to increase from one to several degrees (depending on carbon emission levels), and precipitation from 5% to over 20%, before the year 2100. Images are from Canada's Changing Climate Report 2019.

The government supports progress toward a resilient future

- The WildFireSat satellite mission, a $169.9 million collaboration between Natural Resources Canada, the Canadian Space Agency and Environment and Climate Change Canada, will be the world's first purpose-built, public satellite system for monitoring fires that responds directly to the needs of fire managers in Canada. It will provide unprecedented, daily, near–real-time intelligence on all active wildfires, when the fire management agencies in the provinces and territories need to make critical decisions. Additionally, the mission will support smoke and air quality monitoring and forecasting, and downstream carbon emission monitoring. WildFireSat will also improve our ability to defend Canadian communities, especially the more vulnerable remote northern communities located in forested areas and enable more effective decisions about evacuations.

- The Forest Systems Information and Technology Enhancement (ForSITE) program, part of Budget 2023, "Investing in Canada's Forest Economy," will improve information related to forest carbon and forest integrity, to support decisions about strengthening and sustaining Canada's forest resources.

- The 2 Billion Trees program's research stream will inform reforestation and afforestation efforts through improved seed selection and innovative practices for maximizing carbon sequestration and optimizing the benefits for biodiversity and human well-being.

- Budget 2021 earmarked $28.7 million over five years, with $0.6 million in remaining amortization, to Natural Resources Canada to support increased mapping of areas in northern Canada at risk of wildfires.

- Canada regularly works with international partners to prevent the incursion of non indigenous (invasive) forest pests which may become problematic under climate change scenarios.

Source: Gauthier, S., Bernier, P., et al. 2014; Government of Canada; Kurz, W.A., Dymond, C.C., et al. 2008. See *Sources and information* for more detail and visit us online at cfs. nrcan.gc.ca/stateoftheforests.

Indicator: Forest insects

In 2021, 16.0 million ha of Canada's forests were affected by insects, a 10% decrease from 2020.

- The areas of moderate-to-severe defoliation by spruce budworm decreased over the entire country. This reduction was seen most strongly in Québec; however, in Ontario and the Northwest Territories, populations increased significantly. Jack pine budworm populations also fell, driven mostly by decreases in Ontario. Populations remained steady in Manitoba.
- The area affected by the spruce beetle decreased slightly, with almost all activity centred in British Columbia and Alberta.

- The unprecedented outbreak of spongy moth continued in Ontario in 2021, with defoliation increasing threefold to 1.8 million ha, primarily in southern Ontario. Additional defoliation occurred in parts of southern Québec.
- Almost 6 million ha of forest were affected by other insect species. The most significant impacts were seen in the west, with regional outbreaks of species such as large aspen tortrix and two-year cycle spruce budworm.

Insects are the most diverse group of organisms in Canada, with forests playing home to thousands of species. Many of these co-exist closely with trees. Only a small number kill trees or damage forests, but when they do, the impacts are often long-lasting and widespread.

Forest area (in hectares) containing defoliated or beetle-killed trees for key insects in Canada, 2011–2021

Legend:
- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland and Labrador
- Northwest Territories
- Nova Scotia
- Ontario
- Prince Edward Island
- Québec
- Saskatchewan
- Yukon
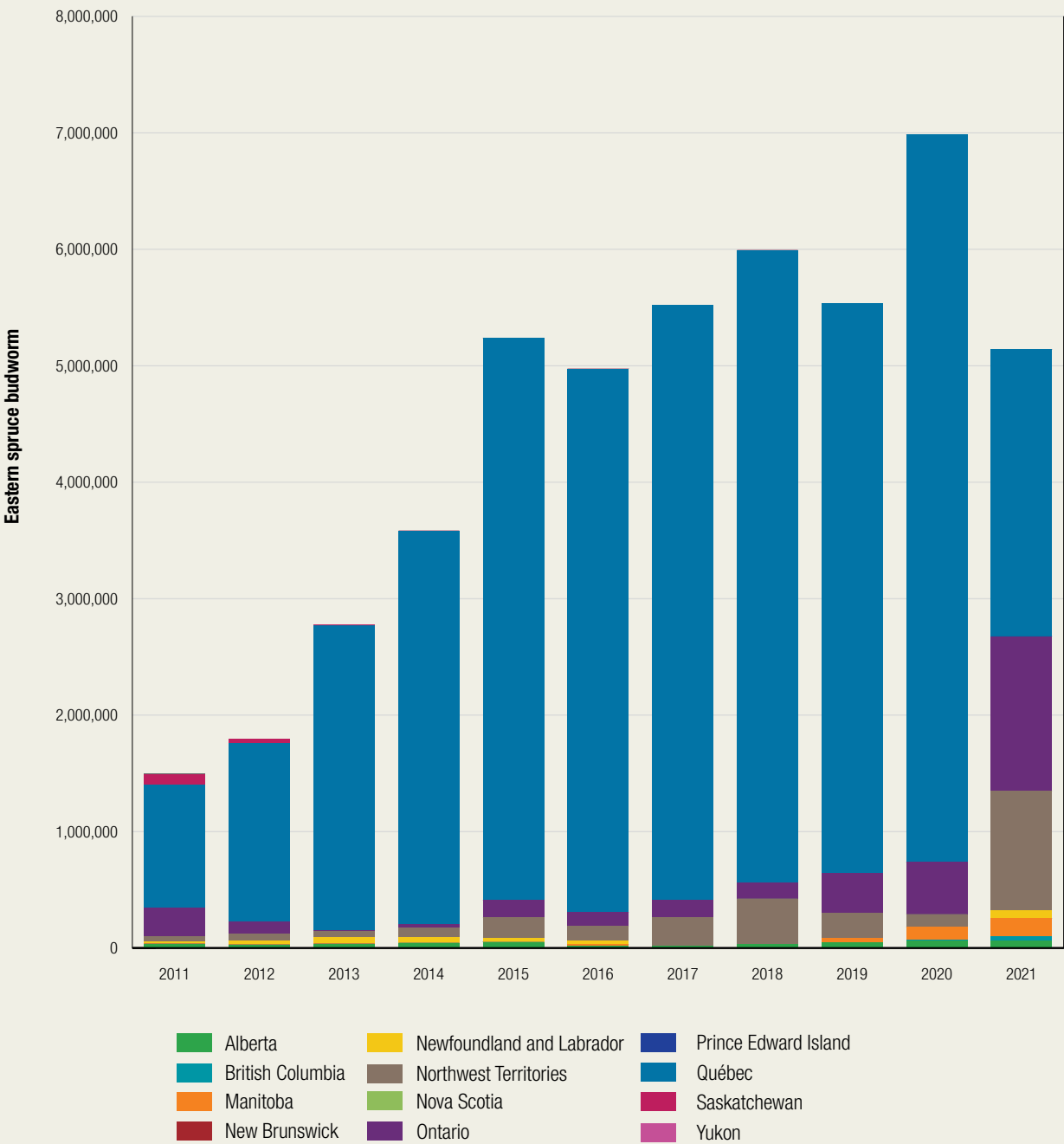
Forest area (in hectares) containing defoliated or beetle-killed trees for key insects in Canada, 2011–2021

Forest area (in hectares) containing defoliated or beetle-killed trees for key insects in Canada, 2011–2021

Alberta	Newfoundland and Labrador	Prince Edward Island
British Columbia	Northwest Territories	Québec
Manitoba	Nova Scotia	Saskatchewan
New Brunswick	Ontario	Yukon

Forest area (in hectares) containing defoliated or beetle-killed trees for key insects in Canada, 2011–2021

Legend:
- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland and Labrador
- Northwest Territories
- Nova Scotia
- Ontario
- Prince Edward Island
- Québec
- Saskatchewan
- Yukon

Forest area (in hectares) containing defoliated or beetle-killed trees for key insects in Canada, 2011–2021

Legend:
- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland and Labrador
- Northwest Territories
- Nova Scotia
- Ontario
- Prince Edward Island
- Québec
- Saskatchewan
- Yukon

Forest area (in hectares) containing defoliated or beetle-killed trees for key insects in Canada, 2011–2021

Legend:
- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland and Labrador
- Northwest Territories
- Nova Scotia
- Ontario
- Prince Edward Island
- Québec
- Saskatchewan
- Yukon

Why is this indicator important?

- Insects are a normal and natural part of all forest ecosystems and all trees are fed upon by one or more species. Some species of insects, however, may increase their populations to enormous numbers and affect vast areas. These outbreaks are often a normal part of the functioning of forest ecosystems, triggering renewal and change in forest structure. Outbreaks may also reduce Canada's timber supply, affect carbon stocks, increase the risk of wildfires and reduce the recreational and non-timber uses of forests. Severe insect outbreaks can disrupt the forestry sector, leading to regional or national economic impacts. Therefore, it is important to monitor insect populations to ensure proper management of the effects of outbreaks.
- Invasive insects are an increasing threat to forests in Canada. These species and their negative impacts are most frequently experienced in the southern regions of the country with the highest population density. The effects of invasive insects may be significant but are often difficult to predict because they lack a co-evolved relationship with the trees and ecosystems they infest in Canada. This uncertainty sometimes results in unpredicted events, like the large outbreak of spongy moth seen in southern Ontario in 2020 and 2021. Regulatory controls to limit the establishment or spread of invasive species within Canada, or imposed on Canada by trading partners, can increase production costs, impact timber supply and restrict market access. Understanding the impact of these species and preventing their introduction to Canada will enable Canada to minimize the impacts on fragile ecosystems.

What is the outlook?

- Spongy moth populations are expected to decrease substantially across Ontario and Québec. Outbreaks of this insect are regulated by fungal and viral diseases that could reduce outbreak populations to low levels within one to three years. Virus activity increases as spongy moth populations rise. After several years of an increasing spongy moth population, widespread viral infections of caterpillars were expected to cause this insect's population collapse by 2022. The fungal disease may also wipe out spongy moth populations, but it depends more on cool, wet weather. A return to hot or dry conditions could cause these outbreaks to reemerge sooner than the typical 10-year cycle.

- The location and magnitude of spruce budworm outbreaks will change over time. In Québec, outbreaks appear to be diminishing, but populations are trending upward in Ontario and the Northwest Territories. The pattern in the east reflects the typical pattern of budworm outbreaks as they move through the eastern boreal and temperate forest region. Defoliation remains low to nil in New Brunswick and on the island of Newfoundland, where there are aggressive experimental programs to suppress emerging populations. Spruce budworm populations also increased in the Northwest Territories to levels not seen since the late 1990s and early 2000s.
- Mountain pine beetle populations have stabilized at low levels over much of western Canada but will continue to affect significant areas of forests in Alberta. The insect does not show signs of spreading into northern Saskatchewan from eastern Alberta, where the province has been conducting an aggressive control program. Spruce beetle will likely continue to impact large areas in British Columbia, significantly impacting both the timber supply and forest ecosystems.
- The Spruce Budworm Early Intervention Strategy initiative, led by Natural Resources Canada, works with partners to help keep spruce budworm populations below outbreak threshold and minimize tree damage and timber losses in Atlantic Canada's spruce and fir forests.
- Federal support for mountain beetle management in Alberta continued until March 2023. Investments in beetle control and research supported employment and general safety and security of communities in Alberta, and the general safety and security of communities in Alberta and other provinces to the east whose economic well-being and safety depend on healthy forest ecosystems.
- The provinces will continue to conduct insect pest management programs, such as foliage protection programs against spruce budworm in Québec and Ontario, and mountain pine beetle management in Alberta and Saskatchewan.

Indicator: Forest diseases

Endemic diseases are a normal component of healthy forest ecosystems, where they help shape forest structure, composition and succession. However, invasive diseases caused by introduced exotic pathogens can seriously threaten the biodiversity, health and productivity of Canadian forests.

- Whitebark pine is at high risk of extinction in the wild because of mortality caused by white pine blister rust and factors that affect regeneration such as climate change and fire exclusion.
- American beech is threatened by two invasive diseases: beech bark disease and the recently discovered beech leaf disease.
- Oak wilt disease is absent in Canada but found < 1 km from the US-Canada border near Windsor, ON.

Why is this indicator important?

- Introduced diseases can have serious ecosystem consequences through impacts on tree health and economic impacts caused by reduced wood supply.
- Managing forest diseases involves appropriate site selection, silvicultural methods, planting resistant or non-host tree species and planting-improved stock from tree breeding programs.

What is the outlook?

- The proximity of oak wilt in adjacent US states makes it very likely that this disease will be introduced into Canada. Beech leaf disease and beech bark disease are expected to continue to spread and affect the health of beech in younger and older age classes, respectively.
- Climate change, especially increases in temperature or precipitation, may make Canada's climate more suitable to exotic species that have not been able to establish or spread here.
- Canada invests in proactive surveillance and early detection measures, including introducing a network of aerial spore traps and developing DNA-based detection tools, to intercept and respond to forest pathogens of concern.
- The Canadian Forest Service conducts research across Canada to reduce the effects of forest pathogens in commercial forests and works with the Canadian Food Inspection Agency to reduce the risk of pathogens in wood imports and exports.
- A large collaborative project between the federal government and the provincial governments of British Columbia, Alberta, and Québec, supported by the 2 Billion Trees program, will enable the identification of pathogen-free seed, resulting in healthy seedlings for planting.
- Provinces manage forest pathogens through good forest management practices, matching tree species to the climate and soils, genetic improvement programs, and removal of diseased trees.

Since the beginning of the 20th century, Canadian forests have been forever changed by invasive diseases introduced via live plants and wood, including white pine blister rust, Dutch elm disease, chestnut blight, beech bark disease, butternut canker, European larch canker, dogwood anthracnose and more.

Sampling a Norway maple killed by sooty bark disease in Victoria, BC showing the typical soot-like black masses of spores on the bark.

Indicator: Forest fires

Though the total area burned by forest fires in 2022 was below average, two areas of the country experienced unusually active fire seasons: the Maritimes and the western territories.

- A spring fire in Yarmouth County grew to become Nova Scotia's largest fire on record.
- In Newfoundland, three lightning-caused fires collectively called the Central Fire Complex started in late July near the town of Grand Falls-Windsor. Firefighting crews from five provinces worked into September to bring the fires under control. These were the largest fires in Newfoundland since 1961.
- As was the case in much of the country, spring was cool and wet in the Yukon. But the end of June was hot and dry, and in the first week of July, more than 20,000 lightning strikes ignited 136 fires, keeping crews and fire managers busy with fire suppression, structure protection and highway closures.
- In contrast, the total area burned in Ontario in 2022 was less than 2% of the long-term average.
- The threat of fire to infrastructure was highlighted in July when a wildfire burned the power line to the community of Pukatawagan in northern Manitoba. The entire population of the community, over 2000 people, was evacuated because the fire was burning nearby. Though the threat

of the fire receded, they were unable to return home for more than a month because of the power outage. Power was restored with the installation of two 1500-kW diesel generators while Manitoba Hydro worked to replace 77 burned power poles. Repairs to the line were completed in early October.

- Despite extensive protection efforts including high-volume sprinklers and fire-resistant wrapping around power poles, a September fire near Jasper damaged transmission lines and cut off power to the town for two weeks. Everything from campgrounds to gas stations were closed. Tourism Jasper estimated that the town lost $10 million in revenue.
- The fire season continued well into the fall in much of the country. In the western provinces, warm, dry conditions caused significant fire activity to continue into late October. In Québec, there were 33 fires in November, which is normally outside the fire season.
- The total area burned in Canada in 2022 was 1.7 million ha, an area more than twice the size of greater Toronto, or more than five times the size of greater Vancouver.

Over the last decade, fire management agencies have increasingly recognized the value of prescribed burning to promote forest health and biodiversity. It can also be used to protect communities from wildfire. Catastrophic wildfire events like the 2016 Fort McMurray fire put forest communities on notice that fire poses a serious threat. In recent years many communities have taken action to protect their communities in a variety of ways, including prescribed burning. A notable example is the Whitehorse South Fire Risk Reduction project, which included thinning or burning 400 ha of forest that could provide a corridor for fire to enter the city of Whitehorse.

Forest area burned and number of forest fires in Canada, 2000–2022
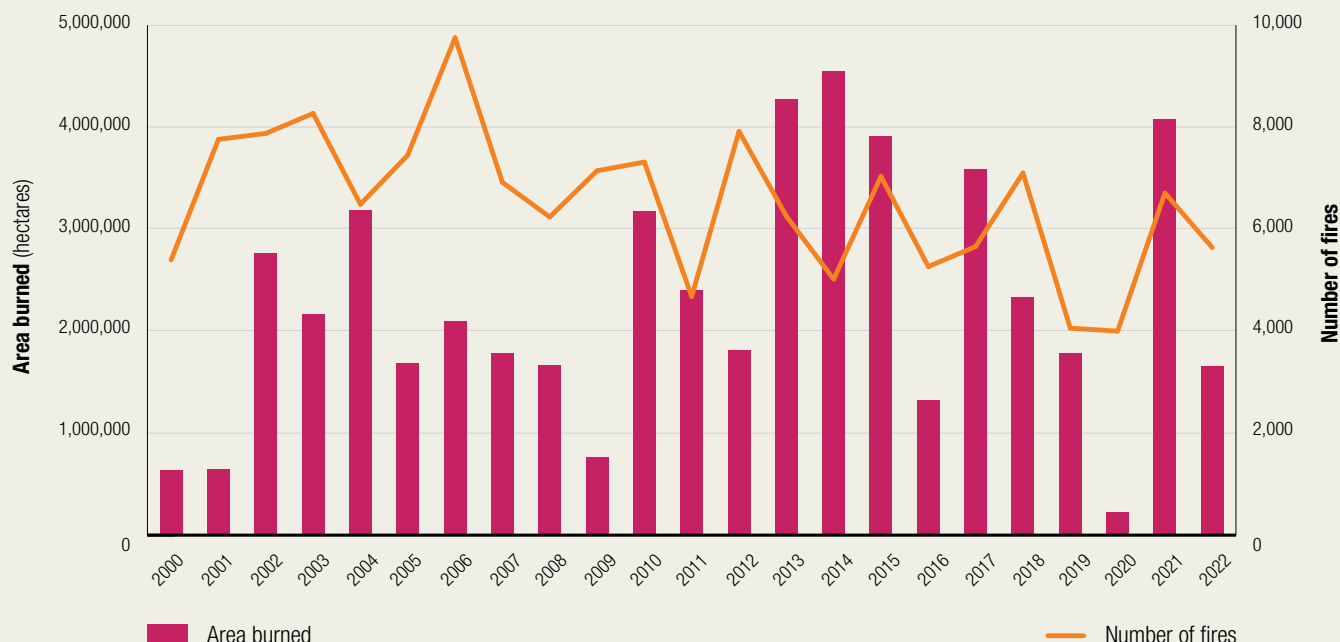
Why is this indicator important?

- Forest fires can damage or destroy homes and businesses in forested areas, trigger evacuations and disrupt people's lives and livelihoods.
- Fires produce large amounts of smoke, reducing air quality and visibility.
- An average of $1 billion is spent annually on fire management.
- However, fire plays an important and beneficial role in forest health, succession and nutrient cycling.

What is the outlook?

- Forest fire occurrence and spread vary significantly from year to year, but there are reasons why fires are becoming more damaging, not to mention more costly and difficult to control:
  ○ There are more homes, businesses and infrastructure in the wildland-urban interface.
  ○ There are more people living and working in forested areas and visiting forested areas for recreation.
  ○ There is a buildup of flammable forest fuel from insect-caused mortality and decades of successful fire suppression.

  ○ Increasing variability in the climate results in more incidents of drought and high winds, which are ideal conditions for fire spread.
- Recent investments will improve emergency management in Canada, including expanded funding in support of wildland fire prevention and mitigation, and result in modernized national wildfire information and decision-support systems in support of emergency management and wildfire management.
- Our ability to detect and monitor wildfires throughout Canada will be significantly enhanced, especially in Northern Canada, through the development of the first wildland fire-dedicated Satellite System, WildFireSat (targeted to be used operationally in 2029).
- Investments targeted toward wildfire preparation and response capacity include working with Canada's wildland fire management agencies to increase Canada's capacity to prepare for and respond to wildland fires. This includes investments to train community-based wildland firefighters, and support for provinces and territories to procure specialized firefighting equipment.

Indicator: Forest carbon emissions and removals

In 2021, total net greenhouse gas (GHG) emissions, reported as carbon dioxide equivalent (CO_2e), from Canada's managed forests (forest lands managed for timber production, conservation or fire suppression) and forest products were approximately 302.1 million tonnes (Mt).

Total net emissions are calculated by adding emissions/removals caused by human activities in Canada's managed forests to emissions/removals caused by natural disturbances in Canada's managed forests.

Human activities in Canada's managed forests accounted for removals of about 8.0 Mt CO_2e from the atmosphere in 2021, while natural disturbances accounted for emissions of about 310.1 Mt CO_2e, resulting in net emissions of about 302.1 Mt CO_2e.

• The area burned in Canada's managed forests in 2021 was approximately 2.3 million hectares. This was the largest area burned in any year since 1990, about eighteen times the area burned in 2020 and 9% higher than the previous

record in 2015. This contributed to the area of Canada's managed forest affected by natural disturbances emitting about 310 Mt CO_2e.

> Canada's forests both absorb carbon and emit atmospheric carbon dioxide, methane, carbon monoxide and nitrous oxide. In any given year, depending on the area of natural disturbances such as forest fires, insect outbreaks and windthrows, Canada's forests will either be a source of GHGs or a sink of atmospheric carbon. In 2021, the largest area burned since 1990, and managed forests were an overall source of approximately 302.1 Mt CO_2e of GHGs.

Net carbon emissions in Canada's managed forests: All areas, 1990–2021
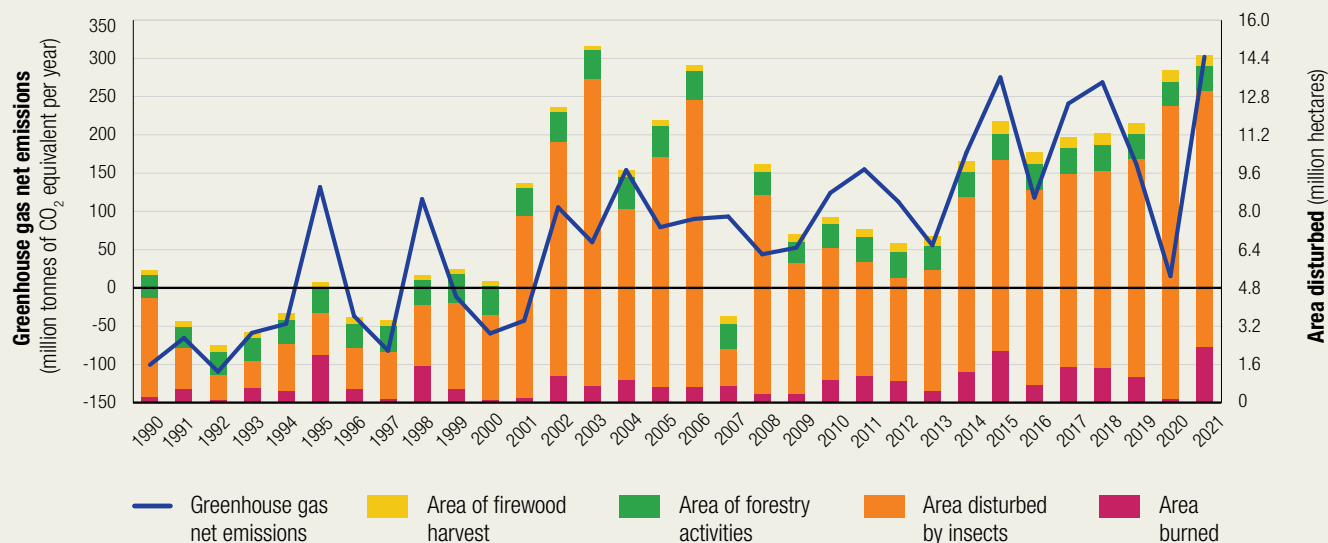
The total net emissions and removals from Canada's managed forests (line, left axis) and area affected by disturbance types (stacked bars, right axis), considering both human activities and natural disturbances, were approximately 302.1 Mt CO_2e in 2021, making the forests a net source in 2021.

Net carbon emissions in Canada's managed forests: Areas subject to human activities, 1990–2021
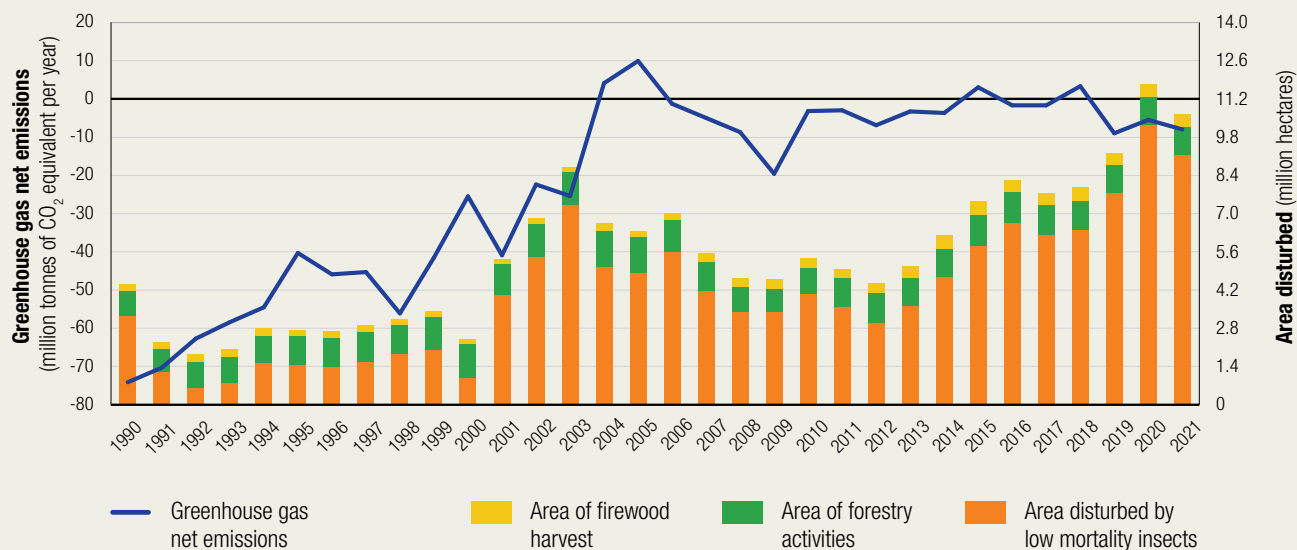
Human activities in Canada's managed forests, such as harvesting, slash pile burning, prescribed burning, regeneration, firewood collection and wildfire suppression, as well as the use and disposal of harvested wood products manufactured from wood harvested in Canada but occurring anywhere in the world, were a net sink of approximately 8.0 Mt CO_2e in 2021.

Net carbon emissions in Canada's managed forests: Areas subject to natural disturbances, 1990–2021
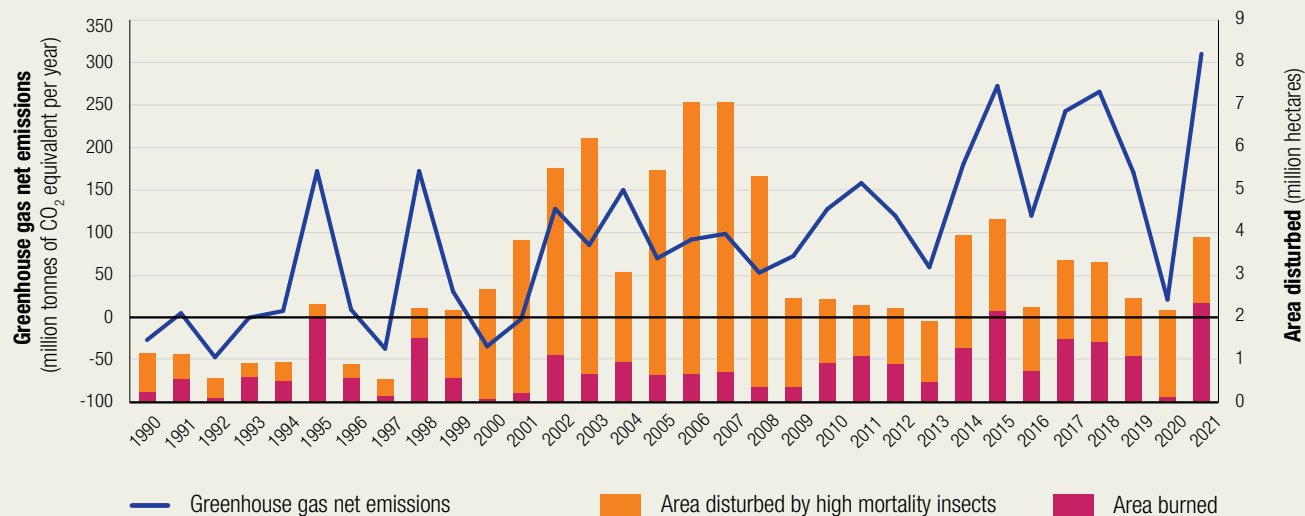
The highest area burned since 1990 contributed to net emissions of about 310.1 Mt CO_2e in 2021.

Why is this indicator important?

- Emissions of carbon dioxide (CO_2), methane (CH_4), carbon monoxide (CO) and nitrous oxide (N_2O) from forest land are important contributors to global warming.
- Canada's forest sector provides renewable resources to the Canadian economy, resulting in emissions and removals, while also providing employment, aesthetic values, clean water, wildlife habitat and many other ecosystem services.

What is the outlook?

- The impacts of climate change on Canada's future forest GHG balance are difficult to predict but will be characterized by significant inter-annual variability.
- Preliminary estimates of the area burned in 2022, while not as large as the area burned in 2021, suggest that emissions from fires will remain high.
- Regionally, impacts of climate change can be both positive (enhanced forest growth and therefore greater carbon sinks) and negative (higher mortality, more forest fires or insect outbreaks).
- Natural disturbances, mostly outside of human control, significantly impact the ability of Canada's managed forests to consistently absorb more CO_2 than they emit.
- Changes in forest management and the use and disposal of harvested wood products can contribute to mitigating climate change.
- Increased use of long-lived wood products to store carbon in the built environment and use of wood products instead of emissions-intensive materials such as concrete, steel and fossil fuels can provide opportunities to mitigate climate change.
- The data and models that are used to generate estimates of forest carbon emissions and removals are improved on an ongoing basis as new science and measurements become available.
- The data and science that support continuous improvement of estimates is developed in partnership with academia, industry, non-governmental organizations, as well as federal, provincial, territorial and international governments.

- Federal and provincial governments are investing in programs aimed at reducing fuel loads in Canada's forests and to improve fire-fighting capabilities.
- The new Forest Systems Information and Technology Enhancement (ForSITE) program, part of Budget 2023, "Investing in Canada's Forest Economy," is an investment in core operations to improve the Canadian Forest Service (CFS) capacity on national forest monitoring data and reporting to improve information on forest carbon and forest health, support Canada's reputation and actions for sustainability, and facilitate market access for forest products.
- ForSITE leverages the federal government's existing role in developing and sharing nimble, responsive, accurate, verified and climate change-informed forest and carbon data for all of Canada's forests.
- The program will increase transparency and accessibility of forest monitoring, GHG estimation, accounting and reporting information, improving public confidence (both domestic and internationally) in Canada's forests management practices.
- The federal program Green Construction through Wood (GCWood) promotes the use of wood in innovative buildings, where increased use of long-lived wood products to store carbon in the built environment and use of wood products instead of emissions-intensive materials such as concrete, steel and fossil fuels can provide opportunities to mitigate climate change.
- The NRCan program, Enhancing Forest Climate Change Adaptation and Mitigation Strategies, will help to develop and disseminate knowledge and tools to improve the forest and forest sector adaptation to climate change, and to deliver analyses and projections for how forest carbon accounting and mitigation actions can make long-term contributions to meeting Canada's greenhouse gas emission reduction targets.

How do forests benefit Canadians?

Forests play a vital role in the health, stability and well-being of our planet. Forests provide essential environmental and ecosystem services, offer recreational, health, spiritual and cultural benefits, supply crucial goods and services, and are a key source of economic prosperity across Canada.

Forests are essential for life

Forests are home to a rich array of plants, animals and microbes. These organisms depend on both their interactions with each other and the environment for their survival.

Forests provide numerous essential ecosystem services, including water and air purification, cooling surface and air temperature, nutrient cycling, soil preservation and flood mitigation. These services directly and significantly benefit the lives of Canadians, ranging from improved health to reduced risks of natural disasters.

Forests are also key to the global carbon cycle. As forests grow, they sequester and store carbon in their leaves, branches, trunks and roots. The ability of a tree to store carbon, including carbon emitted from human activities, explains its vital role in mitigating climate change.

Forests provide spiritual, cultural, health and recreational benefits

Forests provide a wealth of benefits to Canadians. They serve as natural playgrounds, offering a wide variety of recreational and ecotourism activities such as hiking, camping, mountain bike riding and bird-watching. Forests can also act as spiritual sanctuaries and hold aesthetic importance; exposure to forests and nature may improve mental health by reducing stress and anxiety. To many Indigenous Peoples, forests are central to important cultural practices and support traditional and contemporary livelihoods.

Forests sustainably support Canadian communities

Forests are sustainably managed in Canada. When trees are harvested, each part of that tree can be used, maximizing yield and reducing waste. From harvesting trees to producing every day essential goods and services (such as lumber, furniture, toilet paper and sanitary products, packaging, and biofuels for power generation in remote communities), Canadians rely on forests to meet their needs. Across the country, forests also provide economic benefits, including to rural, remote and Indigenous communities. The forest sector supports over 300 forest-reliant communities and directly employs 212,660 Canadians, including over 11,000 Indigenous people.

Support for Indigenous rights and priorities

As the original stewards, and with a knowledge that goes back generations, Indigenous Peoples have a key role in the transformation of the forest sector and in addressing the economic, social and environmental challenges of managing forest lands and resources. The forest sector is also an important potential avenue for advancing the work of reconciliation with First Nations, Métis and Inuit communities, including through the alignment of NRCan's initiatives, policies and programs with the *United Nations Declaration on the Rights of Indigenous Peoples Act* (UNDA).

Source: Statistics Canada. See *Sources and information* for more detail and visit us online at cfs.nrcan.gc.ca/stateoftheforests.

Indicator: Forest sector employment

In 2022, Canada's forest sector employed 212,660 people, which is a marginal decrease (< 1%) from 2021. According to the last census (2021), approximately 19% of forest sector workers are women, 13% are immigrants, 12% are visible minorities and 6% are Indigenous. In 2021, over 11,000 Indigenous people worked in the forest sector.

- Employment in the forest sector was fairly stable between 2021 and 2022.
- Employment in in-forest activities, which includes nursery operations, tree planting and timber cruising and logging, decreased slightly in 2022 and remains slightly below pre-pandemic levels.
- The decrease in employment in in-forest activities was offset by minor increases in employment in the wood products manufacturing and pulp and paper manufacturing subsectors.

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 facility.

Forest sector direct employment, 2012–2022

Legend: In-forest activities | Pulp and paper product manufacturing | Wood product manufacturing
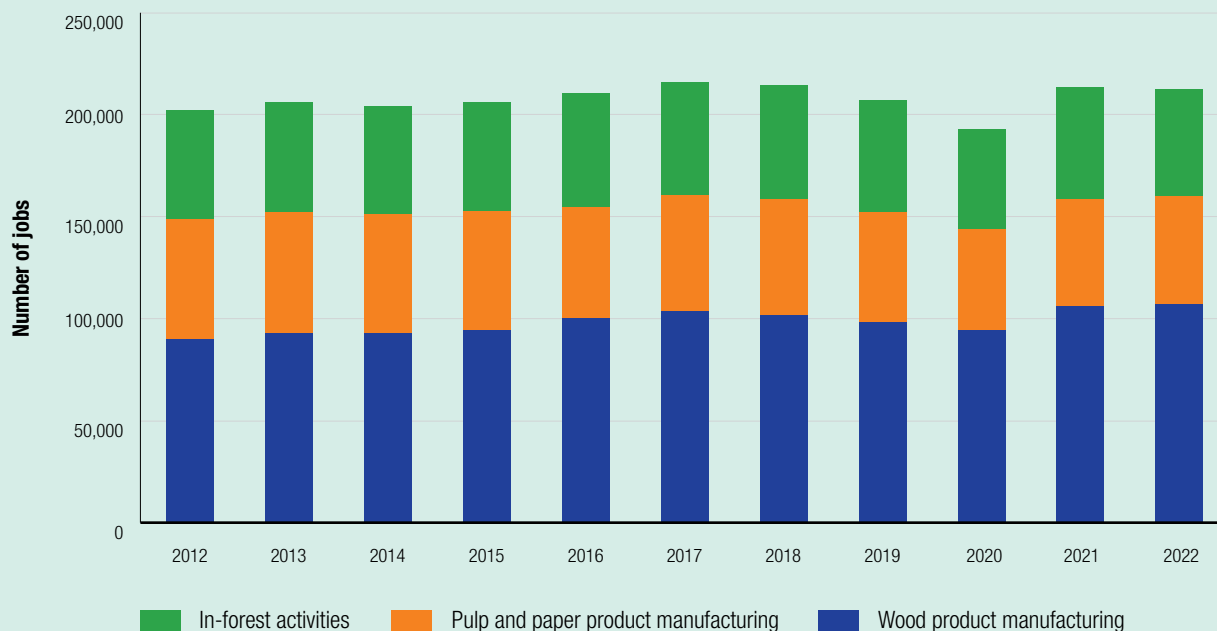
Why is this indicator important?

- The forest sector is an important employer nationwide and contributes to the economic and social welfare of Canadians. Forest sector employment is particularly important in many rural and Indigenous communities, where it is often a key source of income.

What is the outlook?

- After ramping up operations to meet surging demand in 2020 and 2021, continued strong demand through most of 2022 supported forest sector employment. Long-term challenges related to fibre supply, as well as emerging issues such as inflation and falling prices, may negatively affect employment in the forest sector.

- Despite these challenges, the sector's transformation to increase efficiencies in the use of timber and energy, reduce negative environmental impacts and shift production toward higher-value and specialty products will create new job opportunities across the country.

- There are various provincial and federal programs that support employment in the forest sector. The federal Indigenous Forestry Initiative (IFI) is one example of how the Government of Canada helps to increase the participation of Indigenous Peoples in the Canadian economy and improve economic outcomes for Indigenous Peoples throughout Canada.

Source: Statistics Canada. See *Sources and information* for more detail and visit us online at cfs.nrcan.gc.ca/stateoftheforests.

Indicator: Forest sector average earnings

Average 2022 earnings across the forest sector fell 4.8% from record-high levels reached in 2021. Earnings hit their lowest point since 2018, averaging approximately $51,900 annually. While they are volatile year-over-year, average earnings have generally followed a stable upward trend since 2011.

- In 2022, earnings from wood product manufacturing and from forestry and logging activity were down 6.2% and 2.6%, respectively, as compared to 2021. Over the same period, average earnings in the pulp and paper product manufacturing subsector fell 5.7% as compared to 2021.
- Increasing production costs due to inflation and supply chain disruptions, fibre shortages in Western Canada and British Columbia, as well as declining lumber and panel commodity prices for the wood product manufacturing sector have led numerous facilities to curtail operations, either temporarily or permanently, which impacted compensation of the workforce in the sector.

- Overall, average earnings in the forest sector remained slightly higher than average earnings across all manufacturing jobs, but earnings for the latter only declined 1% between 2021 and 2022, to $50,000.

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

Average earnings in the forest sector compared with all manufacturing sectors, 2012–2022

Legend:
- Pulp and paper product manufacturing
- All manufacturing
- Forestry and logging
- Wood product manufacturing
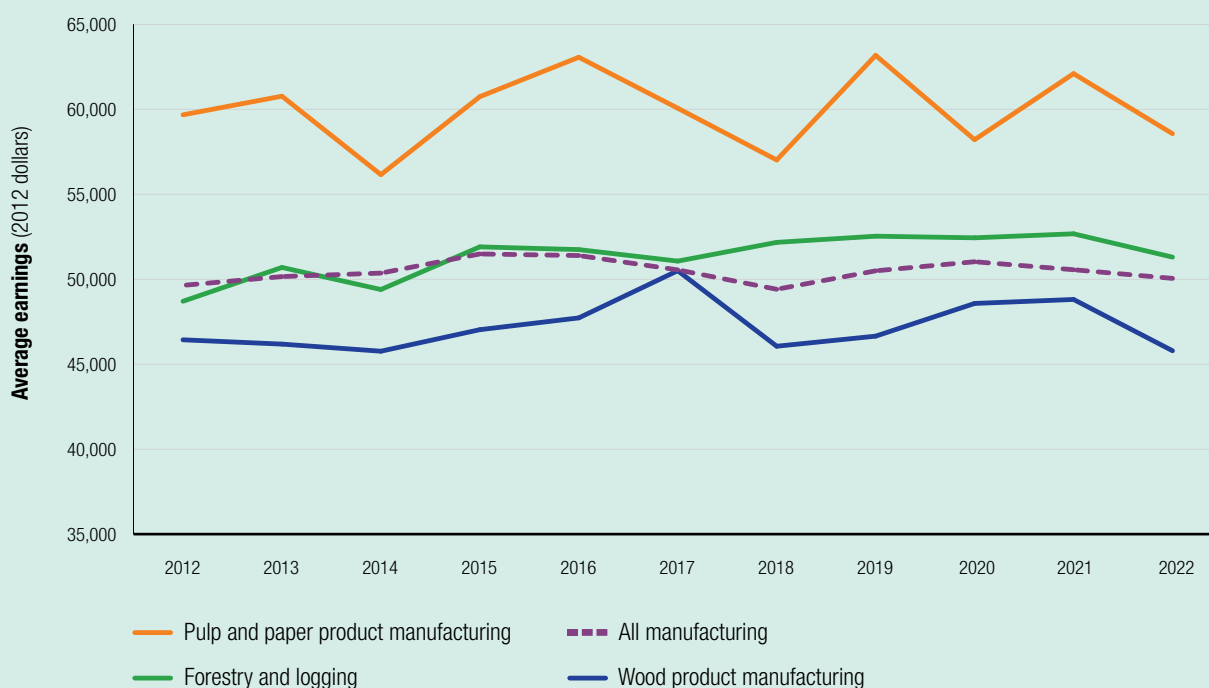
Why is this indicator important?

- Trends in forest sector average earnings indicate the importance of the sector to the economy and social well-being of Canadians when compared with other industries.
- Real wage growth (that is not the result of inflation) shows the change in actual purchasing power of forest sector employees.

What is the outlook?

- In the short term, compensation levels will be impacted by commodity price performance, as well as by rising production costs driven by higher energy prices, inflation and logistic issues.
- In the longer term, improving productivity and the transition toward specialized technical positions with enhanced skills and education will support higher compensation. The forest sector will also continue to compete with other resource sectors to attract workers, which should lead to an increase in wages.

- There are various provincial and federal programs that support employment in the forest sector. The federal Indigenous Forestry Initiative (IFI) is one example of how the Government of Canada helps to increase the participation of Indigenous Peoples in the Canadian economy and improve economic outcomes for Indigenous Peoples throughout Canada.
- The federal government's Forest Innovation program (FIP) aims to improve the sustainability and economic productivity of Canada's forest sector, by supporting the advancement of new products, and improved processes and technologies.

Indicator: Forest communities

Forests offer significant benefits to communities throughout Canada and across urban and rural areas, in terms of the environment, economy and culture.
- Over one-third of Canada's population live in or close to forests.
- In about 300 Canadian communities, the forest industry is a key source of employment and income.
- The communities that rely on the forest sector account for about 2% of Canada's population, or about 615,000 people.
- As of 2021, nearly one million Indigenous people live in or close to forested areas and the forest sector employs over 11,000 Indigenous people.

Why is this indicator important?

- Not only is forest sector employment in rural and Indigenous communities important for Canada's overall economic health, but supporting Indigenous-led forestry projects is one of many ways to promote reconciliation, self-determination and economic development in Indigenous communities. Additionally, forests have cultural significance for many Indigenous Peoples. Respecting the relationship between Indigenous communities and forests and recognizing the value of Indigenous knowledge is intrinsic to implementing the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and fostering innovation in the forest sector.
- Forest-reliant communities have shown resilience in the face of challenges like climate change and mill closures. Supporting these communities by providing education and capacity-building is important for maintaining sustainable partnerships to overcome obstacles.

Canada's forests are a significant factor in the lives of people in many Indigenous and rural communities, where the forest sector is one of the largest employers.

What is the outlook?

- Forest-dependent communities were presented with new opportunities during the COVID-19 pandemic due to higher demand for solid wood products, in response to the increased construction of single-family homes and the use of personal hygiene paper products at home.
- A skilled and resilient forest workforce is crucial for the sector to adapt to market changes and support Canada's transition to a low-carbon economy. Therefore, it is important for Canada to make continuous efforts in recruiting, training and retaining workers to sustain the sector.
- Communities in Canada that depend on forests continue to experience the effects of climate change and natural disturbances, such as frequent and severe wildfires and pest infections, which impact forest health.
- Since 2017, the Green Construction through Wood (GCWood) program has been successfully encouraging the use of innovative wood-based building technologies in construction projects, including generating awareness and implementation of innovative wood building systems with First Nations across Canada. For example, the Tsleil-Waututh First Nation's Administration and Health Centre in British Columbia is a primary structure that is all wood. It showcases the values of the community's cultural heritage that is embodied in the design solutions and were developed through an integrated collaborative design process with the entire Tsleil-Waututh community.

- Since 2017, the Indigenous Forestry Initiative (IFI) has been successfully accelerating Indigenous entry to the sector, supporting Indigenous businesses, skills training, and capacity building for Indigenous-led forest sector projects. For example, one project in Ontario resulted in 40 First Nation participants receiving training as truck drivers, millwrights or heavy equipment mechanics, developing skills to succeed in the forest products sector.
- The IFI continues to evolve to better align with Indigenous priorities, most recently broadening its mandate to include targeted support for forest stewardship. The program's new grants stream has the potential to directly increase Indigenous participation in forest management planning and SFM policy discussions.
- Ensuring diverse perspectives in forest sector dialogues is important, as communities in Canada that depend on forests continue to experience the effects of climate change and natural disturbances, such as frequent and severe wildfires and pest infections, impacting forest health.

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

The forest sector is an important contributor to Canada's economy, serving as a source of prosperity for communities and workers across the country. In 2022, the forest sector contributed $33.4 billion to Canada's nominal gross domestic product (GDP), directly employed 212,660 people and exported $45.6 billion of forest products.

Forest sector contributions to environmental and clean technology products in Canada

The forest sector is a key and growing contributor to the environmental and clean technology products sector in Canada. The share of forest sector jobs that fall within the environmental and clean technology products sector (6.9%) is higher than the share of jobs across the broader economy (1.6%). The value (and share) of environmental and clean technology products attributable to the forest sector increased from $1.4 billion (2.0%) in 2019 to $2.4 billion (3.3%) in 2021, with solid wood product manufacturing accounting for over two-thirds of forest sector contribution. Across all sectors, environmental and clean technology products are valued at $73.1 billion, or approximately 3.1% of Canada's GDP.

Forest sector contributions across Canada

Forest sector operations contribute to provincial and territorial economies across Canada and serve as an important source of jobs and income with the largest contributions in Québec (29% of national forest sector jobs), British Columbia (26%) and Ontario (23%). Alberta (9%), Atlantic Canada (8%), Manitoba (3%), Saskatchewan (2%) and the territories (0.1%) account for the remaining forest sector jobs. Forest sector contributions are particularly important in many rural, remote and Indigenous communities, where there are often few other industries, making forest-related work a main source of employment and income. In fact, over two-fifths of Canada's forest sector workforce lives in rural and remote communities. In addition, the forest sector also generates about $2.3 billion in revenue for provincial and territorial governments (2020). On average, over the last decade, forest sector GDP and employment have accounted for 1.2% and 1.1% of Canada's total nominal GDP and employment, respectively.

Composition of gross domestic product from environmental and clean technology products attributable to the forest sector, 2019 to 2021
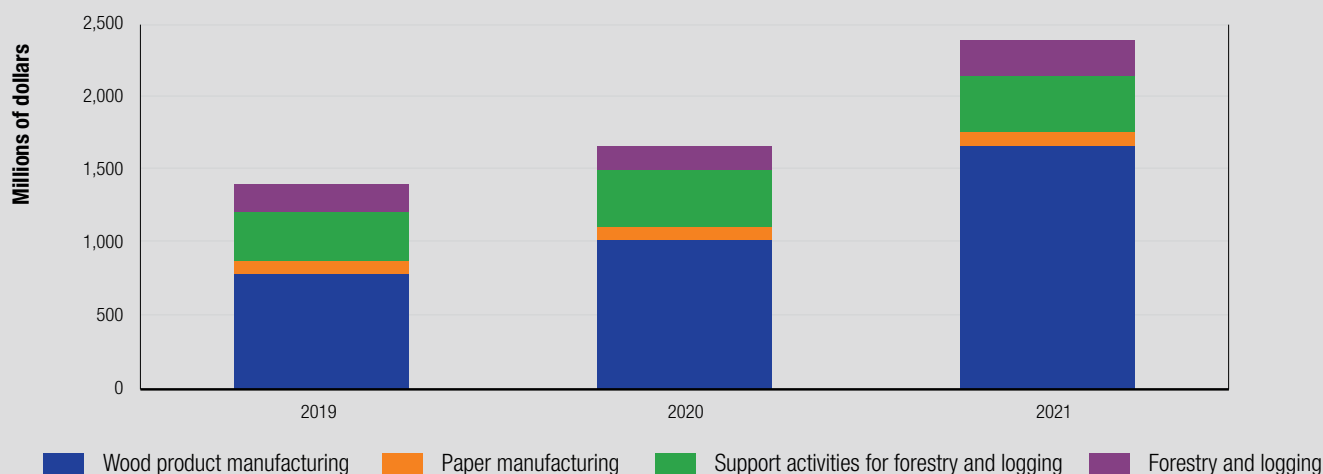
Canadian forest products in the global market

Our forest sector is an export-oriented industry and global leader in the export of softwood lumber, northern bleached softwood kraft (NBSK) pulp and newsprint. Canadian softwood lumber exports account for about 30% of Canada's total forest product exports, most of which are exported to the United States. China is Canada's second-largest export market for forest products and is a key destination for Canada's NBSK pulp. Since the disruption in global supply chains related to the COVID-19 pandemic, the share of Canada's forest products exported to the United States has been larger than previous years. Despite this larger share, Canada continues to focus on market diversification and new opportunities in emerging markets, particularly in Asia and Europe.

Innovation in Canada's forest sector

New and innovative forest products are an increasingly important part of Canada's economy. These include innovative building materials such as cross-laminated timber and other innovative wood products, biofuels that can substitute for fossil fuels, biodegradable replacements for single-use plastics, and various personal care products. Through programs such as Investments in Forest Industry Transformation, the Government of Canada supports the forest sector transition toward new markets, ensuring that Canada is able to meet increasing global demand for innovative forest products.

Indicator: Forest sector gross domestic product

In 2022, the forest sector contributed $33.4 billion (1.2%) to Canada's nominal GDP, which represents a growth of 7% compared to 2021. However, real GDP was flat year-over-year.

Canada's total economy grew by 17% in nominal terms during 2022 and by 3.6% in real terms.
- Prices for wood products were elevated for much of 2022, while pulp prices reached record highs, helping explain the difference between the forest sector's nominal and real GDP.

- In the wood product manufacturing subsector, real GDP rose 6% thanks to the continued high demand in the home building, repair and remodeling markets.
- Real GDP in the pulp and paper manufacturing subsector decreased 3% year-over-year. Reduced demand for packaging and the ongoing decline in newsprint was partially offset by a recovery in printing and writing papers.
- Real GDP in the forestry and logging subsector fell 10% in 2022, driven by ongoing wood supply constraints in British Columbia.

Gross domestic product (GDP) represents the total value of all final goods and services that are produced each year. It is a measure of the size of a country's economy.

In 2021, the World Bank ranked Canada as the ninth-largest economy in the world.

Canadian forest sector's gross domestic product, 2012–2022

Figure: Top — stacked bar chart titled "Nominal gross domestic product (billion dollars)" showing Forestry and logging (green), Wood product manufacturing (blue), and Pulp and paper manufacturing (orange) for years 2012–2022. Bottom — bar chart titled "Real gross domestic product growth (% annual)" comparing Total all sectors (yellow) and Total forest sector (purple) for years 2012–2022.

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 Canada's other economic sectors.
- The change in real GDP shows the growth of the forest sector after accounting for inflation. Analysts use this indicator to compare the Canadian forest sector's output to that of the national economy.

What is the outlook?

- Short-term slowdown is expected in the wood products subsector as housing starts and renovation spending have been negatively impacted by the high mortgage rates caused by the rising interest rates that central banks have implemented to combat inflation. However, longer-term prospects for this sector will be supported by strong underlying demand in the US housing market.

- In the pulp and paper subsector, demand for traditional paper products, such as newsprint, as well as printing and writing paper, will continue to be challenged by increased digitalization. In contrast, packaging products will benefit from stable demand for online shopping and deliveries, as well as Canada's recent ban of single-use plastics.
- There are various provincial and federal programs that support the use of wood in Canada. The federal Green Construction through Wood (GCWood) program encourages the use of innovative wood-based building technologies in construction projects to decarbonize the built environment. British Columbia's Wood First program focuses on advancing wood use and innovative wood construction technologies in the province. Both programs aim to globally showcase wood products in the field of construction.

Source: Statistics Canada. See *Sources and information* for more detail and visit us online at cfs.nrcan.gc.ca/stateoftheforests.

Indicator: Production of forest products

Between 2021 and 2022, Canadian production of most forest products decreased. Softwood lumber production decreased by 9.5% and production of structural panels decreased by 0.7%. In the pulp and paper sector, printing and writing paper production increased by 6.8% in 2022, while wood pulp and newsprint production decreased by 4.7% and 2.6%, respectively.

- Demand for solid wood products softened in 2022 due to higher mortgage rates and persistent inflation, which reduced affordability and slowed residential construction activity in both Canada and the United States. This prompted mills to curtail production, particularly in British Columbia where fibre availability is an ongoing challenge.

- Despite strong global pulp demand and record high pulp prices in 2022, wood pulp production in Canada was affected by global supply chain challenges, as well as transportation disruptions and fibre shortages in British Columbia.
- Printing and writing paper production continued to recover from a significant decline in 2020, partially due to an uptick in demand from commercial print advertising.

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.
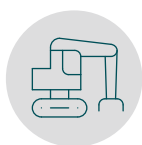
Production of Canadian forest products, 2012–2022

Chart 1: Production (million tonnes) of Newsprint, Printing and writing paper, and Wood pulp, 2012–2022

Chart 2: Production (million cubic metres) of Softwood lumber and Structural wood panels, 2012–2022
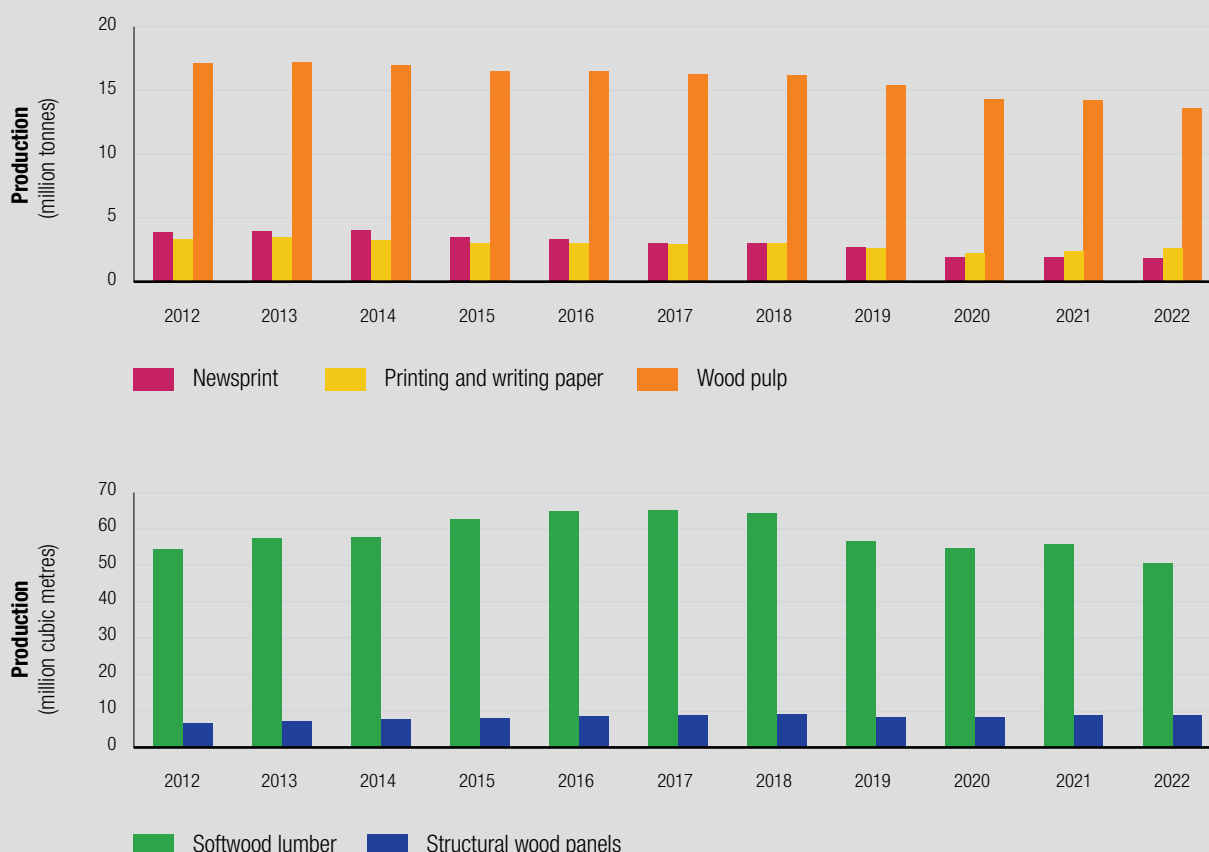
Why is this indicator important?

- Canada is one of the top manufacturers of forest products in the world.
- Production is one of the first indicators to be affected by economic and market challenges.

What is the outlook?

- Demand for solid wood products is expected to decline further in 2023 as residential construction activity continues to slow as a result of deteriorating affordability and worsening macroeconomic conditions. Production downtime is likely in British Columbia, where wildfires and the mountain pine beetle have affected the supply and cost of logs in the region.
- Solid wood product production downtime in British Columbia and other regions in Canada has a trickle-down effect on pulp production through a reduction in available woodchips.

- Printing and writing paper production reached near pre-pandemic levels in 2022 but is expected to continue its long-term downward trend (along with newsprint) due to decreased demand from the ongoing digitalization of media.
- The federal government's Forest Innovation program (FIP) enables the growth of the forest bioeconomy by delivering R&D and technology transfer funding for the forest sector and aims to improve the sustainability and economic productivity of Canada's forest sector.
- The government of British Columbia's Operational Tree Improvement program contributes to improving the public forest asset base by conserving forest gene resources, and supporting development and availability of genetically well-adapted, high-quality reforestation material originating from natural sources. This program has been in existence since at least 1997.

Indicator: Exports of forest products

In 2022, Canada's total forest products exports increased 1.4% to $45.6 billion, as compared to 2021, with most exports bound for the United States. However, year-over-year changes in exports varied widely across product types.

- In 2022, softwood lumber exports decreased the most ($2.8 billion; down 17% compared to 2021) and the value of structural wood panel exports also dropped 14% year-over-year. Softening demand due to rising interest rates and declining prices for lumber and panels over the second half of the year led to the decrease in export values.
- Export values in 2022 for newsprint, as well as printing and writing paper bounced back after years of long-term decline, up 35% and 33%, respectively, from 2021 levels. Wood pulp and other forest products also rose 16% and 15% from 2021 levels. Fibre shortages, high production costs and shifts toward higher-valued paper and packaging all supported higher export values in these product categories.

Why is this indicator important?

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

What is the outlook?

- Demand for softwood lumber and structural wood panels for home construction has been negatively impacted by inflation and related increased interest rates that central banks have implemented. The speed at which Canada's main markets recover, particularly the United States, will determine how fast exports recover.

Exports of Canadian forest products, 2012–2022

Legend:
- Other forest products
- Printing and writing paper
- Wood pulp
- Newsprint
- Structural wood panels
- Softwood lumber
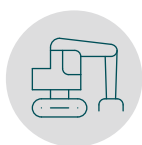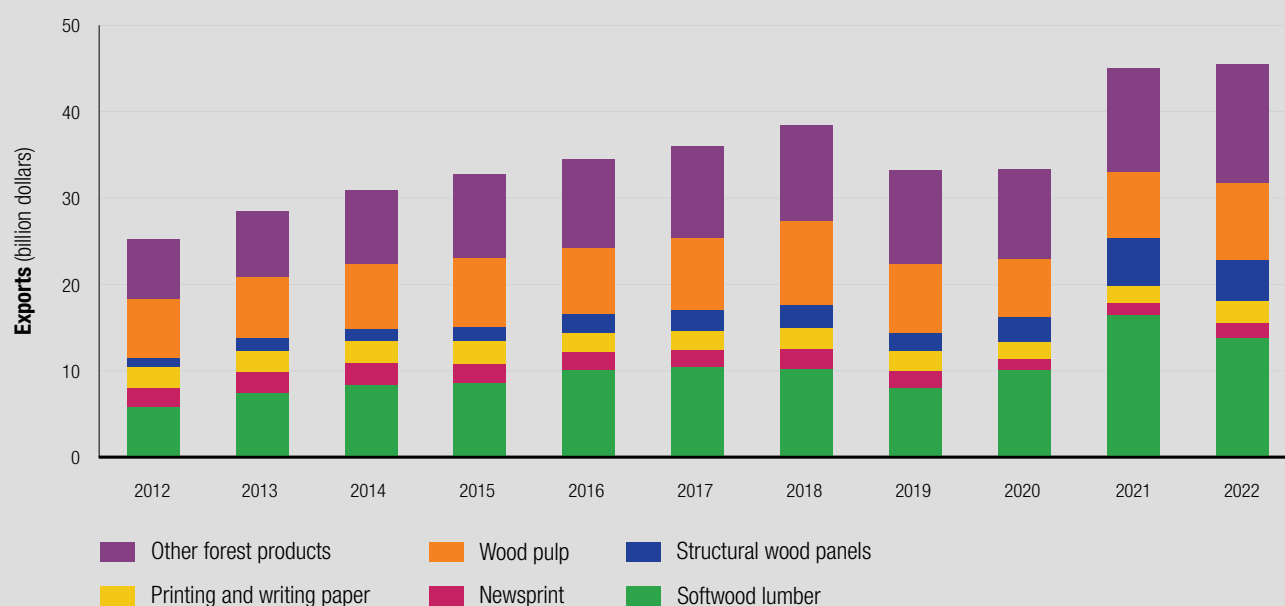
- In the longer term, forest product exports will continue to benefit from strong underlying demand in the US residential construction sector, which is the main market for Canadian panels and softwood lumber. However, other products, such as newsprint, as well as printing and writing paper, are expected to continue to trend downward over the long term as consumers shift away from these products.
- To counter the weaker longer-term prospects for some paper products, Canada is seeking to diversify its forest product offerings by adding value through more secondary wood manufacturing and investing in innovative, low-carbon projects. The goal is to create new or diversified revenue streams for Canadian producers that generates more value from the same amount of wood.

- When companies are ready to export, Canada's position as one of the most trade-connected countries in the world can benefit forest sector producers. Canada currently has 15 free trade agreements with 51 countries; together, these agreements cover 1.5 billion consumers worldwide.

Canada is the world's leading exporter of softwood lumber, exporting $13.7 billion in 2022.

By value, Canada is the fourth-largest forest products exporter in the world, behind China, Germany and the United States.

Source: Statistics Canada. See *Sources and information* for more detail and visit us online at cfs.nrcan.gc.ca/stateoftheforests.

How is the forest sector changing?
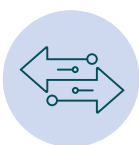
Canada's forest sector is changing in ways likely never conceived when economist Harold Innis described the Canadian economy as dependent on resource production when he said we were, "…hewers of wood and drawers of water." Resource production continues to this day, and yet so much has changed and continues to change into a circular bioeconomy.

What is the circular forest bioeconomy?

The circular forest bioeconomy designs out the notion of waste. Under this approach, trees are harvested based on sustainable forest management principles, and all parts of a tree are used. For example, logs may be used to produce lumber; by-products of lumber production and harvest residuals (e.g., tree tops, branches, etc.) are directed to making other products.

Also in a circular bioeconomy, products are reused or transformed as they are recycled: imagine a wooden bridge being disassembled for its lumber to be reused in other construction. When it can no longer be reused, or has reached its end of life, it can be used for chips or even sent to a biorefinery to make bioproducts, such as personal care products. Such practices increase the economic value of each log. Ultimately, materials and emissions in the bioeconomy are returned to nature, which supports natural nutrient and carbon cycles. Maximizing opportunities in the circular forest bioeconomy helps optimize the use of natural resources while helping Canada's forest sector and forest communities adapt to evolving market conditions.

CO_2
Trees sequester carbon
Reforestation
Sustainably managed forests
Sawmills
Sawmill residue (e.g., bark, sawdust, woodchips)
Pulp
Biofuels and bioenergy
Net-negative emissions with carbon capture and storage
Reuse and recycle
Paper, cardboard, textiles
Bioenergy processes
Advanced bioproducts
Lumber
Long-term carbon storage in wood products
Biodegradable

How are we advancing the circular forest bioeconomy?

In 2017, the Canadian Council of Forest Ministers (CCFM) endorsed A Forest Bioeconomy Framework for Canada. The Framework identified four pillars on which the forest bioeconomy rests, including community and Indigenous partnerships, biomass supply, the marketplace and innovation. In 2021, Ministers asked that the Framework be updated to focus on actions that help further forest bioeconomy development.

The Renewed Forest Bioeconomy Framework was endorsed by the CCFM in 2022. It highlights challenges to forest bioeconomy development and identifies corresponding actions to accelerate the circular forest bioeconomy. Some examples of action measures include bringing innovations to market, biomass supply mapping, developing standards and certifications for bioproducts, and communicating the benefits of the forest bioeconomy. The goal is to ensure that when we harvest wood, we receive the highest possible value from forest materials and are supporting science-based sustainable forest management as we take a leading role in the transition to a sustainable economy.

Canadians remain hewers of wood but are also now creators of innovative solutions and shapers of advanced products. Adaptation is key to ensure strong industry performance that contributes to a sustainable economy. The marketplace has shifted in recent years toward the use of advanced wood products and other circular bioproducts. The forest sector is meeting high demand for lumber and engineered wood building systems. It is also using wood waste, called residuals, to increase the development of biochemicals that can be used to produce biobased pharmaceuticals, compostable bioplastics and industrial chemicals. When higher value uses are not an option, residuals are converted into bioenergy (including for bioheat and biofuels), which are important for Canada's path to net zero emissions by 2050.
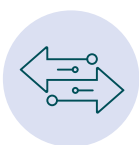
Indicator: Forest sector financial performance

Financial performance in the forest sector remained at a record high in 2022 despite emerging challenges. In 2022, operating profits increased 6% from 2021, more than double the 2018 pre-pandemic record high. The forest sector is a capital-intensive industry and generated a return on capital employed of 7.2% in 2022. This was slightly lower than last year (-1%), but high enough that capital resources continued to generate strong economic value.

- Commodity panel and lumber prices fell from their 2021 peaks but remained above pre-pandemic averages over most of the year, while pulp prices surged to record highs (albeit temporarily), helping companies generate strong profits in 2022.
- High prices compensated for rising operating and investment costs resulting from inflation, increasing interest rates and supply chain disruptions, as well as labour and fibre shortages, allowing firms to keep generating a good return on their investments.

Both operating profits and the return on capital employed indicate the economic competitiveness of the forest sector. Operating profit measures the difference between operating revenues and operating expenses. Return on capital employed measures the efficiency of capital in the sector.

Financial performance by Canada's forest sector, 2012–2022

Legend: Operating profits (blue bars) | Return on capital employed (red line)

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 are indicative of the ability of the forest sector to attract investment and generate economic benefits for Canadians.

What is the outlook?

- High inflation, geopolitical uncertainty and the risk of economic recession may impact financial performance and investments in the sector in the short term.
- In the longer term, robust underlying demand for wood products and certain pulp and paper products will support the financial performance of the sector.
- There are various provincial and federal programs that support the competitiveness and resiliency of Canada's forest sector. The federal Investments in Forest Industry Transformation (IFIT) program is one example of how the Government of Canada facilitates the adoption of transformative and innovative technologies and products to support new or diversified revenue streams, such as next generation building products, advanced biomaterials, biochemicals, and biofuels.
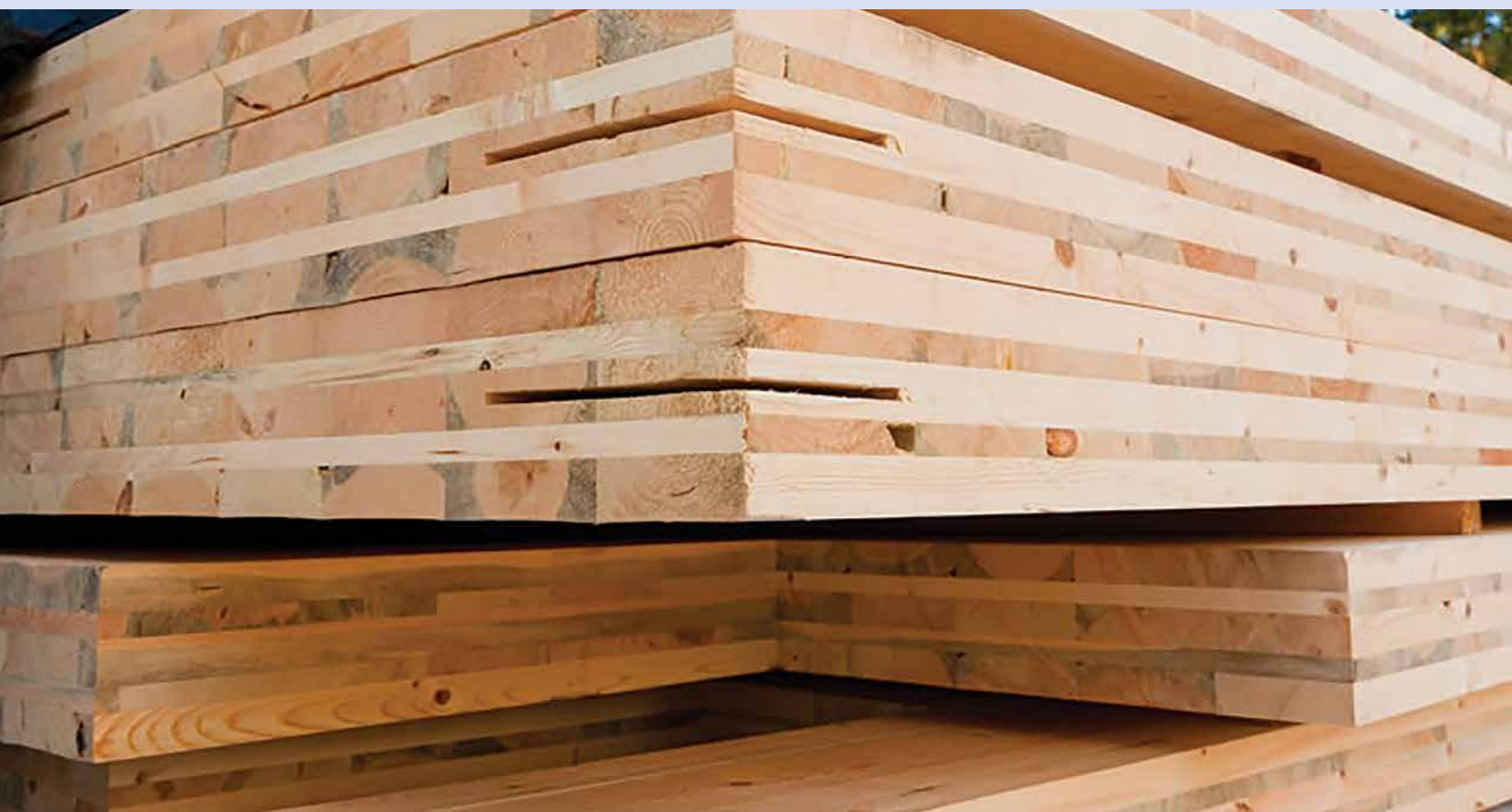
Source: Statistics Canada. See *Sources and information* for more detail and visit us online at cfs.nrcan.gc.ca/stateoftheforests.
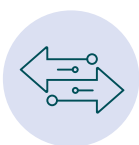
Indicator: Forest sector secondary manufacturing

The secondary wood and paper product manufacturing industries in Canada generated $6.55 billion in real gross domestic product (GDP) in 2022. Growth in real GDP decelerated, edging up 0.4% over 2021. However, real GDP from forest sector secondary manufacturing has grown 11.4% since 2012.

- Secondary wood manufacturing real GDP increased 5.2% over 2021 levels, while secondary paper manufacturing real GDP decreased 4.6% below 2021 levels.
- Secondary wood manufacturing was supported by strong domestic and export sales. The continuous decrease in secondary paper manufacturing real GDP was largely due to the growth of competing imports and diminishing pandemic-induced demand for hygiene products and packaging products.

Secondary wood and paper product manufacturing is the further processing of primary mill lumber and bulk pulp and paper products into hundreds of intermediate and final products, from furniture and sheds to cardboard boxes and tissue paper.

The industry GDP shows its contribution to the Canadian economy. It measures the value that the industry adds in terms of employee compensation, operating surplus, plus taxes, less subsidies.

Gross domestic product from primary and secondary wood and paper product subsectors, 2012–2022

Legend:
- Primary paper products
- Primary wood products
- Secondary paper products
- Secondary wood products
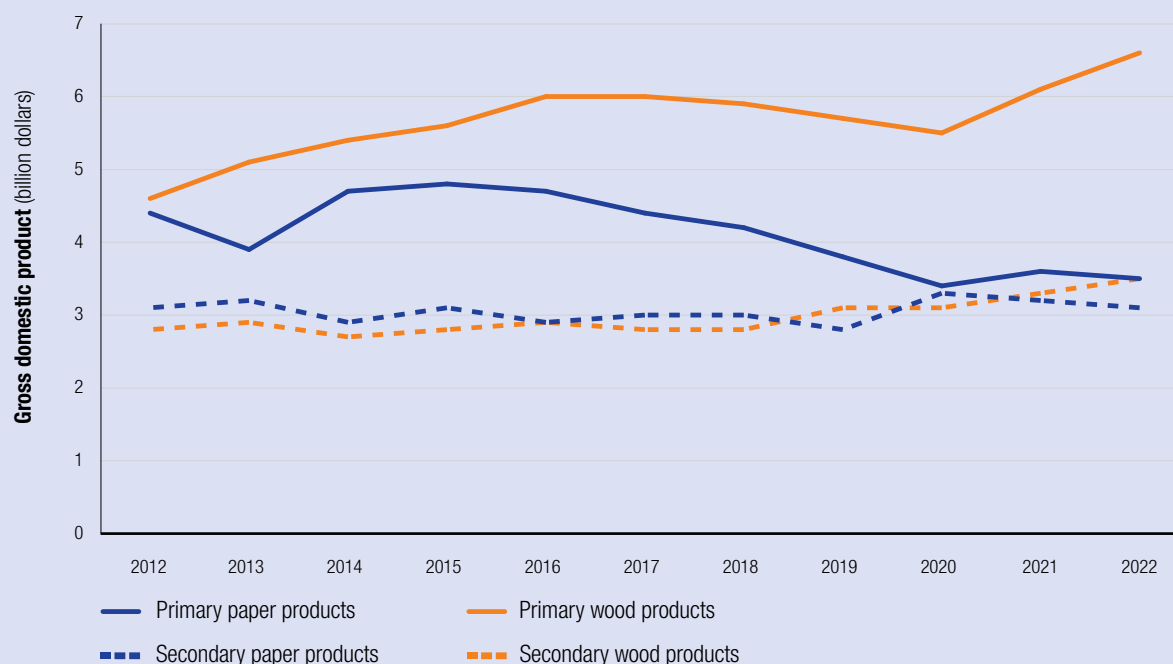
Why is this indicator important?

- Secondary manufacturing of forest products generates additional employment and revenue from Canada's forest resources and helps mitigate risks related to timber supply shocks.
- Secondary manufacturing is domestic market-focused, which is more stable than the international market toward which primary products are geared. It helps diversify forestry-dependent economic regions and mitigate risks related to export markets.

What is the outlook?

- Though the supply chain has normalized post-COVID-19, there is significant uncertainty in the demand for secondary wood and paper products for 2023. Housing construction and the trends in online shopping and health and sanitation will have a big impact on demand.

- Despite Canadian and global economies grappling with the challenges of high inflation and interest rates, we expect an increase in the 2023 secondary wood manufacturing real GDP, although the growth rate of real GDP is likely to slow even further. On the other hand, real GDP for secondary paper products will likely deteriorate further, driven by the ongoing economic slowdown combined with diminishing pandemic-induced demand.
- There are various provincial and federal programs that support the secondary forest products sector in Canada. For example, the Timber Sales Value-Added Manufacturing Program, in British Columbia, aims to accelerate the value-added manufacturing via dedicated timber access, and the federal Forest Innovation Program provides funding for research and development to improve innovation and productivity in the sector.

Source: Statistics Canada. See *Sources and information* for more detail and visit us online at cfs.nrcan.gc.ca/stateoftheforests.

Indicator: Forest sector carbon emissions

Following a pronounced decline between 2005 and 2010, greenhouse gas (GHG) emissions from the use of fossil fuels at forest sector facilities have since been relatively stable. Reductions in GHG emissions were due to improvements in energy efficiency and an increasing use of forest biomass for heat and power generation.

- Bioenergy meets 55% of the total annual energy demand from the forest sector and has reduced forest product facilities' GHG emissions from fossil fuels (direct and indirect emissions) by 53% between 2005 and 2020.

- Direct emissions come from sources that are owned or controlled by the reporting entity. Indirect emissions are emissions that are a consequence of the activities of the reporting entity but that occur at sources owned or controlled by another entity. For this indicator, indirect emissions reported only include emissions from electricity generation.
- Energy efficiency improvements have helped reduce the total energy demand for the sector by 24% between 2005 and 2020.

Trends in forest sector energy use and GHG emissions are affected by:
- **structural decline in the newsprint and publishing industries**
- **related closures of pulp and paper mills**
- **investments in improving environmental performance**

In 2020, the COVID-19 pandemic disrupted global economic activity, resulting in reduced emissions and energy use from Canada's forest sector.

GHG emissions are expressed as carbon dioxide equivalents (CO_2e) to facilitate comparison of different gases based on their relative global warming potentials.

Fossil fuel greenhouse gas emissions and total energy use in Canada's forest sector, 2005–2020
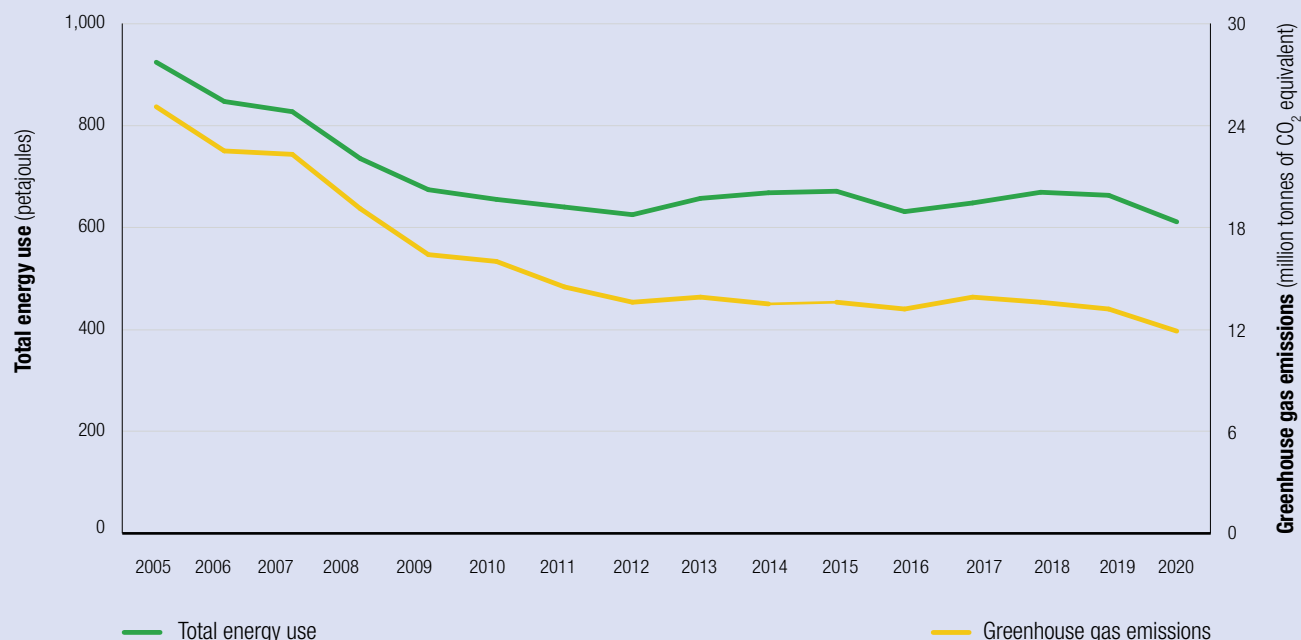
Why is this indicator important?

- Tracking annual emissions from fossil fuels is important for ensuring the forest sector continues to transition to net zero while providing low-carbon forest products to Canada and the world.
- The substitution of fossil fuels with biomass results in net climate benefits. Emissions from biomass are part of the natural carbon cycle, in which carbon removals from forest regrowth occur in parallel with the emissions from bioenergy, unlike GHG emissions from fossil fuels.

What is the outlook?

- Canada's forest sector is poised to continue to reduce its GHG emissions through continued improvements in energy efficiency and increased use of bioenergy and electricity.
- The sector is expected to support the provision of low-carbon biofuels to other sectors across Canada and abroad. For example, wood pellet production in Canada grew from 0.4 million tonnes in 2005 to 3.7 million tonnes in 2021.

- New technology such as bioenergy with carbon capture and sequestration (BECCS) can support the sector in becoming a net-negative emitter and offset hard-to-abate emissions.
- There are various provincial and federal programs that support innovation in the forest sector and its decarbonization. The federal Investments in Forest Industry Transformation (IFIT) program supports advancing innovation and early adoption of technologies, including to increase process efficiency and decarbonize the forest industry as well as provide decarbonization products for other industries. Another example is Ontario's Forest Biomass Program Support, which supports forest product manufacturing facilities in the implementation of technologies that will make greater use of forest biomass and decrease GHG emissions.
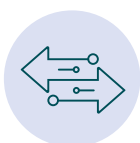
Statistical profiles

Canada

Population (January 2023)	**39,292,355**
Arboreal emblem	**Maple**

Forest inventory

Forest area by classification (hectares)

Forest land	367,329,767
Other wooded land	36,569,830
Other land with tree cover	7,207,960

Forest area change (hectares, 2021)

Afforestation	Not available
Deforestation (total; by sectors below)	50,518
Agriculture	22,378
Mining, oil and gas	15,147
Built-up	9,629
Hydroelectric	2,273
Forestry	1,092

Forest type (forest land only)

Coniferous	67.8%
Mixedwood	15.8%
Broadleaf	10.5%
Temporarily non-treed	5.9%

Forest ownership

Provincial	75.4%
Territorial	13.0%
Private	6.7%
Indigenous	2.1%
Federal	1.7%
Municipal	0.3%
Other	0.7%

Growing stock (million cubic metres, 2022)

Total volume	50,885

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	15,953,011

Fire (2022)

Area burned (hectares)	1,654,255
Number of fires	5,639

Forest management

Harvesting (2021)

Area harvested (hectares)	698,026
Volume harvested (cubic metres)	149,334,361

Regeneration (hectares, 2021)

Area planted	451,722
Area seeded	8,531

Third-party certification (hectares, 2022)

Area certified	155,266,615

Protected forest (IUCN categories and primary management objectives)

Ia Strict nature reserve (science)	0.1%
Ib Wilderness area (wilderness protection)	2.4%
II National park (ecosystem protection and recreation)	6.3%
III Natural monument (conservation of specific natural features)	0.0%
IV Habitat/species management area (conservation through management intervention)	0.3%
V Protected landscape/seascape (landscape conservation and recreation)	0.0%

Greenhouse gas inventory

For forest lands affected by land-use change (2021)

Total removals due to afforestation (million tonnes CO_2e/yr)	0.2
Total emissions due to deforestation (million tonnes CO_2e/yr)	11.5

For managed forests (2021)

Area of managed forests (hectares)	225,472,475
Net emissions or removals, all causes (million tonnes CO_2e/yr)	302.1
Net emissions or removals due to natural disturbances (million tonnes CO_2e/yr)	310.1
Net emissions or removals due to forest management activities and from harvested wood products (million tonnes CO_2e/yr)	-8.0
Transfers from the managed forest sector to the forest products sector due to harvesting (million tonnes CO_2e/yr)	142.4

Domestic economic impact	
Canadian housing starts (number, 2022)	261,849
Contribution to nominal GDP * (current dollars, 2022)	
Forestry and logging	5,896,921,860
Pulp and paper product manufacturing	10,434,080,878
Wood product manufacturing	17,038,984,824
Total contribution to nominal GDP	33,369,987,562
Contribution to real GDP * (constant 2012 dollars, 2022)	
Forestry and logging	3,290,000,000
Pulp and paper product manufacturing	6,528,000,000
Wood product manufacturing	10,079,000,000
Total contribution to real GDP	19,897,000,000
Revenue from goods manufactured (dollars, 2021)	
Logging	10,869,196,000
Pulp and paper product manufacturing	29,062,272,000
Wood product manufacturing	52,900,964,000
Total revenue from goods manufactured	92,832,432,000

Forest sector employment	
Employment (number, 2022)	
Survey of Employment, Payrolls and Hours	182,780
Canadian System of National Accounts	212,660
Natural Resources Satellite Account	231,566
Direct and indirect employment	496,663
Wages and salaries (dollars, 2021)	
Logging	1,831,872,000
Pulp and paper manufacturing	3,811,249,000
Wood product manufacturing	5,919,684,000
Total wages and salaries	11,562,805,000

Trade	
Balance of trade (total exports, dollars, 2022)	30,474,004,065
Value of exports (dollars, 2022)	
Primary wood products	1,568,396,675
Pulp and paper products	19,878,938,545
Wood-fabricated materials	24,112,795,599
Total value of exports	45,560,130,819
Value of imports (dollars, 2022)	
Primary wood products	547,451,509
Pulp and paper products	10,025,664,914
Wood-fabricated materials	4,513,010,331
Total value of imports	15,086,126,754

Domestic production and investment	
Production (2022)	
Hardwood lumber (cubic metres)	858,800
Softwood lumber (cubic metres)	50,552,600
Newsprint (tonnes)	1,839,000
Printing and writing paper (tonnes)	2,599,000
Wood pulp (tonnes)	13,583,000
Structural panels (plywood and oriented strandboard, cubic metres)	8,872,903
Capital expenditures (dollars, 2022)	
Forestry and logging	Not available
Pulp and paper product manufacturing	1,066,200,000
Wood product manufacturing	1,145,500,000
Total capital expenditures	Not available
Repair expenditures (dollars, 2021)	
Forestry and logging	Not available
Pulp and paper product manufacturing	1,452,100,000
Wood product manufacturing	1,189,600,000
Total repair expenditures	Not available

Domestic consumption	
Consumption (2022)	
Hardwood lumber (cubic metres)	1,034,881
Softwood lumber (cubic metres)	17,907,321
Newsprint (tonnes)	-65,078
Printing and writing paper (tonnes)	1,116,036
Wood pulp (tonnes)	5,448,109
Structural panels (plywood and oriented strandboard, cubic metres)	3,786,629

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

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

British Columbia

Population (January 2022)	5,368,266
Arboreal emblem	Western redcedar

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	5,163,393

Fire (2022)

Area burned (hectares)	134,032
Number of fires	1,778

Forest management

Harvesting (2021)

Area harvested (hectares)	134,857
Volume harvested (cubic metres)	58,483,762

Regeneration (hectares, 2021)

Area planted	201,969
Area seeded	408

Third-party certification (hectares, 2022)

Area certified	40,732,576

Domestic economic impact

Housing starts (number, 2022)	46,721

Revenue from goods manufactured (dollars, 2021)

Logging	5,347,796,000
Pulp and paper product manufacturing	4,532,714,000
Wood product manufacturing	16,888,250,000
Total revenue from goods manufactured	26,768,760,000

Forest sector employment

Employment (number, 2022)

Canadian System of National Accounts	56,120
Survey of Employment, Payrolls and Hours	47,563

Wages and salaries (dollars, 2021)

Logging	870,206,000
Pulp and paper product manufacturing	582,876,000
Wood product manufacturing	1,654,766,000
Total wages and salaries	3,107,848,000

Trade

Balance of trade (total exports, dollars, 2022)	12,474,813,295

Value of domestic exports (dollars, 2022)

Primary wood products	1,140,262,345
Pulp and paper products	4,440,881,199
Wood-fabricated materials	9,741,328,775
Total value of domestic exports	15,322,472,319

Value of imports (dollars, 2022)

Primary wood products	114,462,340
Pulp and paper products	1,337,558,516
Wood-fabricated materials	1,395,638,168
Total value of imports	2,847,659,024

Alberta

Population (January 2022)	4,601,314
Arboreal emblem	Lodgepole pine

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	1,173,924

Fire (2022)

Area burned (hectares)	137,310
Number of fires	1,281

Forest management

Harvesting (2021)

Area harvested (hectares)	82,894
Volume harvested (cubic metres)	29,653,479

Regeneration (hectares, 2021)

Area planted	90,525
Area seeded	12

Third-party certification (hectares, 2022)

Area certified	20,471,617

Domestic economic impact

Housing starts (number, 2022)	36,544

Revenue from goods manufactured (dollars, 2021)

Logging	1,168,671,000
Pulp and paper product manufacturing	2,344,508,000
Wood product manufacturing	7,941,859,000
Total revenue from goods manufactured	11,455,038,000

Forest sector employment

Employment (number, 2022)

Canadian System of National Accounts	19,610
Survey of Employment, Payrolls and Hours	17,102

Wages and salaries (dollars, 2021)

Logging	212,523,000
Pulp and paper product manufacturing	263,134,000
Wood product manufacturing	728,421,000
Total wages and salaries	1,204,078,000

Trade

Balance of trade (total exports, dollars, 2022)	5,295,212,221

Value of domestic exports (dollars, 2022)

Primary wood products	36,271,408
Pulp and paper products	2,179,002,745
Wood-fabricated materials	3,444,095,856
Total value of domestic exports	5,659,370,009

Value of imports (dollars, 2022)

Primary wood products	6,496,012
Pulp and paper products	210,489,042
Wood-fabricated materials	147,172,734
Total value of imports	364,157,788

Saskatchewan	
Population (January 2022)	1,205,119
Arboreal emblem	White birch

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	63,531

Fire (2022)

Area burned (hectares)	244,275
Number of fires	445

Forest management

Harvesting (2021)

Area harvested (hectares)	21,599
Volume harvested (cubic metres)	3,809,144

Regeneration (hectares, 2021)

Area planted	5,948
Area seeded	0

Third-party certification (hectares, 2022)

Area certified	5,278,651

Domestic economic impact

Housing starts (number, 2022)	4,211

Revenue from goods manufactured (dollars, 2021)

Logging	160,129,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	1,547,364,000
Total revenue from goods manufactured	Not available

Forest sector employment

Employment (number, 2022)

Canadian System of National Accounts	5,245
Survey of Employment, Payrolls and Hours	1,665

Wages and salaries (dollars, 2021)

Logging	21,913,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	105,801,000
Total wages and salaries	Not available

Trade

Balance of trade (total exports, dollars, 2022)	855,123,282

Value of domestic exports (dollars, 2022)

Primary wood products	4,124,333
Pulp and paper products	334,480,786
Wood-fabricated materials	646,499,605
Total value of domestic exports	985,104,724

Value of imports (dollars, 2022)

Primary wood products	6,043,813
Pulp and paper products	80,659,606
Wood-fabricated materials	43,278,023
Total value of imports	129,981,442

Manitoba	
Population (January 2022)	1,420,228
Arboreal emblem	White spruce

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	2,226,029

Fire (2022)

Area burned (hectares)	165,078
Number of fires	224

Forest management

Harvesting (2021)

Area harvested (hectares)	7,992
Volume harvested (cubic metres)	1,109,789

Regeneration (hectares, 2021)

Area planted	3,797
Area seeded	0

Third-party certification (hectares, 2022)

Area certified	11,373,530

Domestic economic impact

Housing starts (number, 2022)	8,095

Revenue from goods manufactured (dollars, 2021)

Logging	46,193,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	722,602,000
Total revenue from goods manufactured	Not available

Forest sector employment

Employment (number, 2022)

Canadian System of National Accounts	5,730
Survey of Employment, Payrolls and Hours	3,959

Wages and salaries (dollars, 2021)

Logging	11,573,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	123,667,000
Total wages and salaries	Not available

Trade

Balance of trade (total exports, dollars, 2022)	-87,357,104

Value of domestic exports (dollars, 2022)

Primary wood products	1,593,322
Pulp and paper products	346,157,598
Wood-fabricated materials	390,120,109
Total value of domestic exports	737,871,029

Value of imports (dollars, 2022)

Primary wood products	7,824,136
Pulp and paper products	606,038,641
Wood-fabricated materials	211,365,356
Total value of imports	825,228,133

Ontario

Population (January 2022)	15,262,660
Arboreal emblem	Eastern white pine

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	3,510,908

Fire (2022)

Area burned (hectares)	2,561
Number of fires	275

Forest management

Harvesting (2021)

Area harvested (hectares)	119,506
Volume harvested (cubic metres)	14,172,503

Regeneration (hectares, 2021)

Area planted	59,508
Area seeded	8,095

Third-party certification (hectares, 2022)

Area certified	27,566,149

Domestic economic impact

Housing starts (number, 2022)	96,080

Revenue from goods manufactured (dollars, 2021)

Logging	995,780,000
Pulp and paper product manufacturing	9,001,009,000
Wood product manufacturing	8,053,029,000
Total revenue from goods manufactured	18,049,818,000

Forest sector employment

Employment (number, 2022)

Canadian System of National Accounts	47,985
Survey of Employment, Payrolls and Hours	37,343

Wages and salaries (dollars, 2021)

Logging	185,809,000
Pulp and paper product manufacturing	1,320,553,000
Wood product manufacturing	1,223,491,000
Total wages and salaries	2,729,853,000

Trade

Balance of trade (total exports, dollars, 2022)	-1,505,965,031

Value of domestic exports (dollars, 2022)

Primary wood products	65,482,451
Pulp and paper products	3,270,398,681
Wood-fabricated materials	3,035,092,268
Total value of domestic exports	6,370,973,400

Value of imports (dollars, 2022)

Primary wood products	83,179,902
Pulp and paper products	5,841,481,785
Wood-fabricated materials	1,952,276,744
Total value of imports	7,876,938,431

Québec

Population (January 2022)	8,751,352
Arboreal emblem	Yellow birch

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	2,463,419

Fire (2022)

Area burned (hectares)	29,638
Number of fires	449

Forest management

Harvesting (2021)

Area harvested (hectares)	215,592
Volume harvested (cubic metres)	28,438,705

Regeneration (hectares, 2021)

Area planted	69,268
Area seeded	16

Third-party certification (hectares, 2022)

Area certified	42,964,184

Domestic economic impact

Housing starts (number, 2022)	57,107

Revenue from goods manufactured (dollars, 2021)

Logging	2,271,026,000
Pulp and paper product manufacturing	9,419,361,000
Wood product manufacturing	14,171,755,000
Total revenue from goods manufactured	25,862,142,000

Forest sector employment

Employment (number, 2022)

Canadian System of National Accounts	61,000
Survey of Employment, Payrolls and Hours	59,133

Wages and salaries (dollars, 2021)

Logging	372,195,000
Pulp and paper product manufacturing	1,149,675,000
Wood product manufacturing	1,687,848,000
Total wages and salaries	3,209,718,000

Trade

Balance of trade (total exports, dollars, 2022)	10,293,959,202

Value of domestic exports (dollars, 2022)

Primary wood products	208,009,738
Pulp and paper products	7,304,803,663
Wood-fabricated materials	5,403,396,056
Total value of domestic exports	12,916,209,457

Value of imports (dollars, 2022)

Primary wood products	272,288,151
Pulp and paper products	1,678,087,726
Wood-fabricated materials	671,874,378
Total value of imports	2,622,250,255

New Brunswick

Population (January 2022)	820,786
Arboreal emblem	Balsam fir

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	0

Fire (2022)

Area burned (hectares)	176
Number of fires	214

Forest management

Harvesting (2021)

Area harvested (hectares)	79,047
Volume harvested (cubic metres)	9,341,187

Regeneration (hectares, 2021)

Area planted	12,384
Area seeded	0

Third-party certification (hectares, 2022)

Area certified	4,246,501

Domestic economic impact

Housing starts (number, 2022)	4,680

Revenue from goods manufactured (dollars, 2021)

Logging	732,765,000
Pulp and paper product manufacturing	2,241,625,000
Wood product manufacturing	2,667,472,000
Total revenue from goods manufactured	5,641,862,000

Forest sector employment

Employment (number, 2022)

Canadian System of National Accounts	11,280
Survey of Employment, Payrolls and Hours	10,420

Wages and salaries (dollars, 2021)

Logging	118,667,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total wages and salaries	Not available

Trade

Balance of trade (total exports, dollars, 2022)	2,329,923,030

Value of domestic exports (dollars, 2022)

Primary wood products	76,846,696
Pulp and paper products	1,438,797,618
Wood-fabricated materials	1,162,503,172
Total value of domestic exports	2,678,147,486

Value of imports (dollars, 2022)

Primary wood products	57,114,344
Pulp and paper products	227,665,987
Wood-fabricated materials	63,444,125
Total value of imports	348,224,456

Nova Scotia

Population (January 2022)	1,030,953
Arboreal emblem	Red spruce

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	29,683

Fire (2022)

Area burned (hectares)	3389
Number of fires	152

Forest management

Harvesting (2021)

Area harvested (hectares)	25,331
Volume harvested (cubic metres)	2,502,463

Regeneration (hectares, 2021)

Area planted	5,386
Area seeded	0

Third-party certification (hectares, 2022)

Area certified	1,274,764

Domestic economic impact

Housing starts (number, 2022)	5,714

Revenue from goods manufactured (dollars, 2021)

Logging	105,483,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total revenue from goods manufactured	Not available

Forest sector employment

Employment (number, 2022)

Canadian System of National Accounts	3,770
Survey of Employment, Payrolls and Hours	3,076

Wages and salaries (dollars, 2021)

Logging	26,919,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	84,259,000
Total wages and salaries	Not available

Trade

Balance of trade (total exports, dollars, 2022)	552,917,367

Value of domestic exports (dollars, 2022)

Primary wood products	35,785,571
Pulp and paper products	330,402,456
Wood-fabricated materials	251,421,385
Total value of domestic exports	617,609,412

Value of imports (dollars, 2022)

Primary wood products	41,671
Pulp and paper products	36,740,994
Wood-fabricated materials	27,855,380
Total value of imports	64,638,045

Prince Edward Island

Population (January 2022)	172,707
Arboreal emblem	Red oak

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	10

Fire (2022)

Area burned (hectares)	0
Number of fires	2

Forest management

Harvesting (2021)

Area harvested (hectares)	2,471
Volume harvested (cubic metres)	376,736

Regeneration (hectares, 2021)

Area planted	466
Area seeded	0

Third-party certification (hectares, 2022)

Area certified	0

Domestic economic impact

Housing starts (number, 2022)	1,318

Revenue from goods manufactured (dollars, 2021)

Logging	12,067,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	31,926,000
Total revenue from goods manufactured	Not available

Forest sector employment

Employment (number, 2022)

Canadian System of National Accounts	660
Survey of Employment, Payrolls and Hours	Not available

Wages and salaries (dollars, 2021)

Logging	Not available
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total wages and salaries	Not available

Trade

Balance of trade (total exports, dollars, 2022)	38,496,148

Value of domestic exports (dollars, 2022)

Primary wood products	Not available
Pulp and paper products	38,512,904
Wood-fabricated materials	61,277
Total value of domestic exports	Not available

Value of imports (dollars, 2022)

Primary wood products	Not available
Pulp and paper products	58,750
Wood-fabricated materials	19,283
Total value of imports	Not available

Newfoundland and Labrador

Population (January 2022)	528,818
Arboreal emblem	Black spruce

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	66,500

Fire (2022)

Area burned (hectares)	23,886
Number of fires	103

Forest management

Harvesting (2021)

Area harvested (hectares)	8,200
Volume harvested (cubic metres)	1,393,346

Regeneration (hectares, 2021)

Area planted	2,362
Area seeded	0

Third-party certification (hectares, 2022)

Area certified	1,358,643

Domestic economic impact

Housing starts (number, 2022)	1,379

Revenue from goods manufactured (dollars, 2021)

Logging	27,438,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total revenue from goods manufactured	Not available

Forest sector employment

Employment (number, 2022)

Canadian System of National Accounts	1,005
Survey of Employment, Payrolls and Hours	473

Wages and salaries (dollars, 2021)

Logging	9,567,000
Pulp and paper product manufacturing	Not available
Wood product manufacturing	Not available
Total wages and salaries	Not available

Trade

Balance of trade (total exports, dollars, 2022)	226,515,032

Value of domestic exports (dollars, 2022)

Primary wood products	20,811
Pulp and paper products	195,500,895
Wood-fabricated materials	37,964,401
Total value of domestic exports	233,486,107

Value of imports (dollars, 2022)

Primary wood products	1,140
Pulp and paper products	6,883,795
Wood-fabricated materials	86,140
Total value of imports	6,971,075

Yukon

Population (January 2022)	43,964
Arboreal emblem	Subalpine fir

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	37,814

Fire (2022)

Area burned (hectares)	171,154
Number of fires	295

Forest management

Harvesting (2021)

Area harvested (hectares)	175
Volume harvested (cubic metres)	13,873

Regeneration (hectares, 2021)

Area planted	95
Area seeded	0

Third-party certification (hectares, 2022)

Area certified	0

Trade

Balance of trade (total exports, dollars, 2022)	312,623

Value of domestic exports (dollars, 2022)

Primary wood products	0
Pulp and paper products	0
Wood-fabricated materials	312,695
Total value of domestic exports	312,695

Value of imports (dollars, 2022)

Primary wood products	0
Pulp and paper products	0
Wood-fabricated materials	72
Total value of imports	72

Northwest Territories

Population (January 2022)	45,602
Arboreal emblem	Tamarack

Disturbance

Insects (hectares, 2021)

Area defoliated by insects and containing beetle-killed trees	1,217,800

Fire (2022)

Area burned (hectares)	708,916
Number of fires	262

Forest management

Harvesting (2021)

Area harvested (hectares)	362
Volume harvested (cubic metres)	39,375

Regeneration (hectares, 2021)

Area planted	14
Area seeded	Not available

Third-party certification (hectares, 2022)

Area certified	0

Trade

Balance of trade (total exports, dollars, 2022)	Not available

Value of domestic exports (dollars, 2022)

Primary wood products	0
Pulp and paper products	Not available
Wood-fabricated materials	0
Total value of domestic exports	Not available

Value of imports (dollars, 2022)

Primary wood products	0
Pulp and paper products	0
Wood-fabricated materials	Not available
Total value of imports	Not available

Nunavut

Population (January 2022)	40,586

Trade

Balance of trade (total exports, dollars, 2022)	Not available

Value of domestic exports (dollars, 2022)

Primary wood products	0
Pulp and paper products	0
Wood-fabricated materials	0
Total value of domestic exports	0

Value of imports (dollars, 2022)

Primary wood products	0
Pulp and paper products	0
Wood-fabricated materials	0
Total value of imports	0

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Infographic: Canada's many forest values are created by a rich diversity of relationships

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Ecosystem engineer species—woodpeckers and beavers:

We would like to thank the following external collaborators for their contribution to key facts on engineer species:
- Junior A. Tremblay, Scientific researcher, Environment and Climate Change Canada
- Myriam Lemieux, Master's candidate, Université du Québec à Chicoutimi

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Sources for forest sector gross domestic product, forest sector average earnings, and forest sector employment are found in their respective indicator source sections.

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SUSTAINABILITY INDICATORS

How much forest does Canada have?

Food and Agriculture Organization of the United Nations. 2020. 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.

Food and Agriculture Organization of the United Nations. 2020. Global Forest Resources Assessment 2020: Country report: Canada. Rome, Italy. http://www.fao.org/3/ca9983en/ca9983en.pdf
- Describes the methodology used to adjust the National Forest Inventory baseline estimate of forest area.

Food and Agriculture Organization of the United Nations. 2020. Global Forest Resources Assessment 2020: Main report. Rome, Italy. https://doi.org/10.4060/ca9825en
- This dataset was used to calculate Canada's forest area as a proportion of the world's forest area.

National Forest Inventory. 2021. Canada's National Forest Inventory business process, Version 8.0. National Forest Inventory (NFI) Project Office. March 31, 2021. https://nfi.nfis.org/resources/general/NFI-Business-Process-Version-8.0.pdf
- Description of the procedure and means by which the NFI collects, validates, stores, uses and disseminates National Forest Inventory data.

National Forest Inventory. Standard reports, Version 2.0, Table 4.0, Area (1000 ha) of forest and non-forest land in Canada. https://nfi.nfis.org/resources/general/summaries/t1/en/CA/html/ca_t4_for_area_en.html (accessed May 5, 2023).
- Remeasurement (2017) estimate of Canada's forest area.

National Forest Inventory. Standard reports, Version 2.0, Table 4.4, Area (1000 ha) of forest and non-forest land by managed forest region in Canada. https://nfi.nfis.org/resources/general/summaries/t1/en/MF2/html/mf2_t4_for_area_en.html (accessed May 5, 2023).
- Remeasurement (2017) estimate of Canada's forest area by CCFM Forest Management Designation.

National Forest Inventory. Standard reports, Version 2.0, Table 12.0, Area (1000 ha) of forest land by ownership in Canada. https://nfi.nfis.org/resources/general/summaries/t1/en/CA/html/ca_t12_forown_area_en.html (accessed May 5, 2023).
- Remeasurement (2017) estimate of Canada's forest area by ownership type.

Indicator: Forest area

Dyk, A., Leckie, D., et al. 2015. Canada's national deforestation monitoring system: System description. (Information Report BC-X-439). Victoria, BC: 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. 2020. 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. Note that this report uses National Forest Inventory Baseline data. National greenhouse gas inventory and forest carbon accounting uses a slightly different definition of forest and deforestation.

Food and Agriculture Organization of the United Nations. 2020. Global forest resources assessment 2020: Country report: Canada. Rome, Italy. http://www.fao.org/3/ca9983en/ca9983en.pdf
- Describes the methodology used to adjust the National Forest Inventory baseline estimate of forest area.

National Forest Inventory. 2021. Canada's National Forest Inventory business process, Version 8.0. National Forest Inventory (NFI) Project Office. March 31, 2021. https://nfi.nfis.org/resources/general/NFI-Business-Process-Version-8.0.pdf
- Description of the procedure and means by which the NFI collects, validates, stores, uses and disseminates national forest inventory data.

National Forest Inventory. Standard reports, Version 2.0, Table 4.0, Area (1000 ha) of forest and non-forest land in Canada. https://nfi.nfis.org/resources/general/summaries/t1/en/CA/html/ca_t4_for_area_en.html (accessed May 5, 2023).
- Remeasurement (2017) estimate of Canada's forest area.

Indicator: Deforestation and afforestation

Dyk, A., Leckie, D., et al. 2015. Canada's National Deforestation Monitoring System: System description. (Information Report BC-X-439). Victoria, BC: Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/publications?id=36042
- National deforestation estimates are calculated on a periodic basis using the method described in Canada's National Deforestation Monitoring System: System description. Figure data provided by Canada's National Deforestation Monitoring System, special tabulation, May 11, 2022.

Environment and Climate Change Canada. 2023. National Inventory Report 1990–2021: Greenhouse gas sources and sinks in Canada. https://unfccc.int/documents/627833 (accessed April 24, 2023).
- Environment and Climate Change Canada's National Inventory Report 1990–2021: 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.

Natural Resources Canada. 2 Billion Tree Commitment. https://www.canada.ca/en/campaign/2-billion-trees.html

United Nations Framework Convention on Climate Change. Report on the conference of the parties on its seventh session, held at Marrakesh from October 29 to November 10, 2001; Addendum, part 2: 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 ha with tree crown cover of more than 25%, and with trees having the potential to reach a minimum height of 5 m 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.
- Deforestation is the conversion of forest to non-forest land uses. Consistent with international definitions, deforestation does not include harvest followed by forest regrowth.
- Data have been updated with new mapping from hydroelectric reservoirs.
- Deforestation by the forestry sector includes the creation of new permanent forestry access roads and landings.
- 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.
- Afforestation is the conversion of non-forest land to forest through the planting or seeding of trees.

Indicator: Wood volume

Environment and Climate Change Canada. 2023. National Inventory Report 1990–2021: Greenhouse gas sources and sinks in Canada. https://unfccc.int/documents/627833 (accessed April 24, 2023).

- Environment and Climate Change Canada's National Inventory Report 1990–2021: 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. 2021. Canada's National Forest Inventory business process, Version 8.0. National Forest Inventory (NFI) Project Office. March 31, 2021. https://nfi.nfis.org/resources/general/NFI-Business-Process-Version-8.0.pdf

- Description of the procedure and means by which the NFI collects, validates, stores, uses and disseminates National Forest Inventory data.

National Forest Inventory. Standard reports, Version 2.0, Table 15.0, Total tree volume (million m^3) on forest land by forest type and age class in Canada. https://nfi.nfis.org/resources/general/summaries/t1/en/CA/html/ca_t15_forage20_vol_en.html (accessed May 5, 2023).

Methodology used to adjust National Forest Inventory point estimates of wood volume to annual values:

- Canada's National Forest Inventory completed the data processing, quality control, compilation and estimation for its first remeasurement cycle (2008 to 2017). Canada is therefore able to report national wood volume estimates using higher quality and more recent data than in previous reports. The wood volume estimate based on these data is reported for 2017 and using this more accurate and updated value, wood volume for previous years have been adjusted according to the methods described below.

- Forecasting and backcasting from 2017 was done using above-ground biomass carbon stock estimates from Canada's National Forest Carbon Monitoring Accounting and Reporting System (NFCMARS), NIR 2023 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 2017 was used to calculate wood volume in all other reporting years using the change in above-ground biomass carbon stock relative to 2017, as follows:
  ° Wood volume in [year] = (wood volume in 2017) x (aboveground biomass in [year]/above-ground biomass in 2017)
- Wood volume data are typically used to derive above-ground biomass and carbon data, but the opposite was done here to utilize NFCMARS annual time series data from 1990 to 2021.
- 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, all this 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).

National Forest Inventory. Standard reports, Version 2.0, Table 15.4, Total tree volume (million m^3) on forest land by forest type, age class, and managed forest region in Canada. https://nfi.nfis.org/resources/general/summaries/t1/en/MF2/html/mf2_t15_forage20_vol_en.html (accessed May 5, 2023).

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LégisQuébec. 2010. Sustainable Forest Development Act. Publication A-18.1. https://www.legisquebec.gouv.qc.ca/en/tdm/cs/A-18.1 (accessed April 25, 2023).

Nova Scotia Legislature. 1989. Forests Act: An act respecting forests. https://nslegislature.ca/sites/default/files/legc/statutes/forests.htm (accessed April 25, 2023).

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Gauthier, S., Kuuluvainen, T., et al. 2023. Ecosystem management of the boreal forest in the era of global change. In M.M. Girona, H. Morin, S. Gauthier and Y. Bergeron (eds.), Boreal forests in the face of climate change, 3–49. Springer Nature.

Thiffault, N., Coll, L., et al. 2015. Natural regeneration after harvesting. In K.S.-H. Peh, R.T. Corlett and Y. Bergeron (eds.), Routledge handbook of forest ecology, 371–384. Oxford, United Kingdom: Routledge.

Thiffault, N., Lenz, P.R.N., et al. 2023. Plantation forestry, tree breeding, and novel tools to support the sustainable management of boreal forests. In M.M. Girona, H. Morin, S. Gauthier and Y. Bergeron (eds.), Boreal forests in the face of climate change, 383–401. Springer Nature.

Indicator: Forest area harvested

National Forestry Database. Harvest, Table 5.2, Area harvested by ownership, management and harvesting method. http://nfdp.ccfm.org/en/data/harvest.php (accessed September 20, 2023).

- 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.

Indicator: Forest regeneration

Government of British Columbia. 2021. A billion trees planted will benefit BC for generations. https://news.gov.bc.ca/releases/2021FLNRO0091-002141 (accessed April 3, 2023).

Government of Canada. 2 Billion Trees Program. https://www.canada.ca/en/campaign/2-billion-trees/2-billion-trees-program.html (accessed: April 13, 2023)

Government of Canada. 2 Billion Trees program. Planting the right tree in the right place for a better tomorrow. https://www.canada.ca/en/campaign/2-billion-trees/how-we-plant-trees-and-how-it-helps.html (accessed: May 5, 2023).

National Forestry Database. Regeneration, Table 6.3, Area of direct seeding by ownership and application method. http://nfdp.ccfm.org/en/data/regeneration.php (accessed September 20, 2023).

National Forestry Database. Regeneration, Table 6.4, Number of seedlings planted by ownership and species group. http://nfdp.ccfm.org/en/data/regeneration.php (accessed September 20, 2023).

National Forestry Database. Regeneration, Table 6.5, Area planted by ownership and species group. http://nfdp.ccfm.org/en/data/regeneration.php (accessed September 20, 2023).
- Data are for forests on provincial and territorial Crown lands across Canada. Federally and privately owned lands are excluded.
- Natural regeneration is often the most efficient approach for regenerating harvested areas. One scenario is when there is abundant existing understory 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.

Indicator: Volume harvested relative to the sustainable wood supply

National Forestry Database. Wood supply, Table 2, Wood supply estimates by ownership and species group. http://nfdp.ccfm.org/en/data/woodsupply.php (accessed September 20, 2023).
- 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 results from 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 ownership, category and species group. http://nfdp.ccfm.org/en/data/harvest.php (accessed September 20, 2023).
- 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" results from a very small amount of harvest categorized as "unspecified." Typically, this harvest occurs in mixed wood forests where neither softwood nor 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.

How does disturbance shape Canada's forests?

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Kurz, W.A., Dymond, C.C., et al. 2008. Mountain pine beetle and forest carbon feedback to climate change. *Nature* 452, 987–990.

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Warren, F.J., and Lemmen, D.S. (eds.). 2014. Canada in a changing climate: Sector perspectives on impacts and adaptation. Ottawa, ON: Government of Canada, 286 pages.

Indicator: Forest insects

National Forestry Database. Forest insects, Table 4, Area of moderate to severe defoliation (including beetle-killed trees) by insects. http://nfdp.ccfm.org/en/data/insects.php (accessed September 20, 2023).
- Forest area disturbed by defoliators (e.g., budworms, spongy moth) includes only areas with tree mortality or moderate to severe defoliation. Defoliation does not always result in mortality. Several factors, including defoliation severity, duration and frequency, or presence of other stressors (e.g., drought), can affect the level of mortality.
- Forest area disturbed by bark beetles (e.g., mountain pine beetle, spruce beetle) is derived from aerial surveys that map trees that are dead or dying from successful beetle attack.
- Summing the areas affected by more than one insect to create a grand total can result in an overestimate if more than one insect species occurs in the same stand in the same year. For example, in a mixed wood forest, spruce budworm may defoliate balsam fir in the same stand where forest tent caterpillar is defoliating the aspen trees.

Note: "Spongy moth" was adopted by the Entomological Society of Canada and the Entomological Society of America in March 2022 as the new official common name for *Lymantria dispar*. The species was formerly known as gypsy moth and as "LDD moth" in some reports. https://esc-sec.ca/2022/03/02/new-common-name-forlymantria-dispar/

Indicator: Forest diseases

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Indicator: Forest fires

National Forestry Database. Forest fires, Table 3.1.1, Number of fires by cause class. http://nfdp.ccfm.org/en/data/fires.php (accessed September 20, 2023).

National Forestry Database. Forest fires, Table 3.2.1, Area burned by cause class. http://nfdp.ccfm.org/en/data/fires.php (accessed September 20, 2023).
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Indicator: Forest carbon emissions and removals

Environment and Climate Change Canada. 2023. National Inventory Report 1990–2021: Greenhouse gas sources and sinks in Canada. https://unfccc.int/documents/627833 (accessed April 14, 2023).
• 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_2 greenhouse gases (carbon monoxide, methane and nitrous oxide) 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, including 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 one hectare or more having the potential to develop forest cover, with a minimum crown closure of 25% and a minimum tree height of five metres at maturity in situ.
• Managed forest land is further divided into an anthropogenic partition (those lands predominantly influenced by human activities) and a natural partition (those lands predominantly influenced by large-scale natural disturbances). When stands are affected by stand-replacing wildfires, the emissions and subsequent removal during post-fire regrowth are reported in the "natural partition." After regrowing stands reach commercial maturity (45 to 100 years), the emissions and removal are reported in the "anthropogenic partition." Stands affected by partial disturbances that cause more than 20% mortality are reported in the natural partition until the biomass reaches pre-disturbance levels.

- The first figure includes the entire managed forest, while the second figure includes only the anthropogenic partition (areas impacted by management and by insect disturbances causing 20% or less tree mortality). The third figure includes only the natural partition (areas impacted by stand-replacing wildfires or insect disturbances causing greater than 20% tree mortality). The sum of figures 2 and 3 is reported in figure 1.
- Harvested wood product emissions are estimated using the "simple decay" approach of the Intergovernmental Panel on Climate Change (IPCC) and include annual end-of-life emissions from all wood harvested in Canada since 1900 and used to produce products or energy anywhere in the world. In contrast, the emissions from other Canadian natural resources (e.g., oil and gas) are reported by the country in which they are consumed. Transfers of wood and paper products to landfills are assumed to instantly oxidize as CO_2.
- 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.
- Emissions bear a positive sign and removal bear a negative sign, in accordance with international reporting standards.

Note: A review of historic harvesting activity (1890 to 1989) in Canada has recently been completed and will be implemented in NIR2024. This data improvement will affect the disaggregation and reporting of the emissions in the anthropogenic and natural components.

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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(8), 1082–1094. https://cdnsciencepub.com/doi/full/10.1139/cjfr-2017-0088

Natural Resources Canada, Canadian Forest Service. Carbon budget model. https://www.nrcan.gc.ca/climate-change/impacts-adaptations/climate-change-impacts-forests/carbon-accounting/carbon-budget-model/13107 (accessed May 18, 2022).

Natural Resources Canada, Canadian Forest Service. Inventory and land-use change, Forest Inventory. https://www.nrcan.gc.ca/climate-change/impacts-adaptations/climate-change-impacts-forests/carbon-accounting/inventory-and-land-use-change/13111 (accessed May 18, 2022).

Ogle, S., Domke, G., et al. 2018. Delineating managed land for reporting national greenhouse gas emissions and removal to the United Nations Framework Convention on Climate Change. *Carbon Balance Management* 13(9). https://cbmjournal.biomedcentral.com/articles/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(6), 2227–2244. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3597256/

How do forests benefit Canadians?

Sources for the forest-reliant communities can be found in the Forest communities indicator source section; sources for total and Indigenous employment in the forest sector can be found in the Forest sector employment indicator source section.

Indicator: Forest sector employment

Government of Canada. Indigenous Forestry Initiative. https://natural-resources.canada.ca/science-and-data/funding-partnerships/funding-opportunities/forest-sector/indigenous-forestry-initiative/13125

Total employment:

Statistics Canada. 2021 census of population. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/index-eng.cfm (special extraction, March 24, 2023).

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 May 24, 2023).
- 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.

Indigenous employment in the forest sector:

Statistics Canada. 2021 census of population. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/index-eng.cfm (special extraction, March 24, 2023).
- Natural Resources Canada, Canadian Forest Service calculations for Indigenous employment are based on Statistics Canada's 2021 census of population.
- These values refer to the number of people in the labour force, which includes those unemployed.
- "Indigenous" refers to people who are First Nations (North American Indian), Inuk (Inuit), or Métis. "Indigenous" also refers to people who are Registered or Treaty Indians (i.e., registered under the Indian Act) and/or those who have membership in a First Nation or Indian band.

Statistics Canada. Table 14-10-0326-01 (formerly CANSIM 285-0002): Job vacancies, payroll employees, job vacancy rate and average offered hourly wage by industry sector, quarterly, unadjusted for seasonality. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410032601 (accessed March 30, 2023).

Indicator: Forest sector average earnings

Government of Canada. Indigenous Forestry Initiative. https://natural-resources.canada.ca/science-and-data/funding-partnerships/funding-opportunities/forest-sector/indigenous-forestry-initiative/13125

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, 2023).

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 January 27, 2023).

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 March 30, 2023).
- The data exclude overtime.
- Starting in 2020, the average earnings were calculated using the Consumer Price Index re-based to 2012 values. This method matches the one used for the previous reports in which all data prior to 2019 were updated as well according to the 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 uses 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:
- Random Lengths. Various weekly reports on North American forest products markets, including the one dated May 13, 2022 (compensation survey).
- Packaging Europe. April 27, 2022. War in Ukraine could add to negative earnings outlook for paper and forest products industry, according to Moody's. https://packagingeurope.com/news/war-in-ukraine-could-add-to-negative-earnings-outlook-for-paper-and-forest-products-industry-according-to-moodys/8150.article (accessed May 7, 2023).
- Packaging Europe. March 17, 2022. Moody's: Rising energy prices and falling profit margins could accelerate paper mills' transition to packaging grades. https://packagingeurope.com/news/moodys-rising-energy-prices-and-falling-profit-margins-could-accelerate-paper-mills-transition-to-packaging-grades/8001.article (accessed April 23, 2023).
- Forest2Market. January 08, 2022. Predictions for the global forest, pulp and paper, and chemical industries in 2022. https://www.forest2market.com/blog/predictions-for-the-global-forest-industry-in-2022 (accessed May 11, 2021).
- Fastmarket. December 8, 2021. How labor shortages could prolong forest products supply chain woes. https://www.fastmarkets.com/insights/supply-chain-challenges-continue-to-plague-forest-products-market (accessed May 19, 2022).
- Natural Resources Canada, Canadian Forest Service. Overview of Canada's forest industry. Canada's forest industry by the numbers. https://www.nrcan.gc.ca/our-natural-resources/forests-forestry/forest-industry-trade/overview-canadas-forest-industry/13311 (accessed May 19, 2023)

Indicator: Forest communities

Forest-reliant communities:

Government of Canada. Indigenous Forestry Initiative. https://natural-resources.canada.ca/science-and-data/funding-partnerships/funding-opportunities/forest-sector/indigenous-forestry-initiative/13125

Government of Canada. Green Construction through Wood (GCWood) program. https://natural-resources.canada.ca/science-and-data/funding-partnerships/opportunities/forest-sector/green-construction-through-wood-gcwood-program/20046

Natural Resources Canada, Canadian Forest Service. Calculations based on Statistics Canada's 2021 census of population.

Statistics Canada. 2021 census of population. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/index-eng.cfm (special extraction, March 24, 2023).
- The Forest community 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 2021, 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 whether the forest sector provides a high number of jobs relative to the average Canadian community. The calculations also determine if there are many other sectors that are also an important source of jobs for 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 2021 census of population refers to the number of people employed, as opposed to the size of the labour force (which also includes unemployed individuals).

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

Natural Resources Canada, Canadian Forest Service. Calculations based on Statistics Canada's 2021 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. 2021 census of population. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/index-eng.cfm (special extraction, March 24, 2023).
- 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.

Statistics Canada. Table 14-10-0326-01 (formerly CANSIM 285-0002): Job vacancies, payroll employees, job vacancy rate, and average offered hourly wage by industry sector, quarterly, unadjusted for seasonality. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410032601 (accessed March 30, 2023).

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

National Forestry Database. Download, Table 7, Statement of revenues from the sale of timber from provincial Crown land. http://nfdp.ccfm.org/en/download.php (accessed September 20, 2023).

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 May 24, 2023).

Statistics Canada. 2021 census of population. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/index-eng.cfm (special extraction, March 24, 2023).

Environmental and clean technology products:

Estimates are from the Environmental and Clean Technology Products Economic Account (ECTPEA). ECTPEA GDP estimates are in nominal terms. Estimates for 2020 and 2021 are preliminary. Environmental and clean technology products are defined as any process, product or service that reduces environmental impacts through any of the following three strategies:
- Environmental protection activities that prevent, reduce or eliminate pollution of any other degradation of the environment.
- Resource management activities that result in the more efficient use of natural resources, thus safeguarding against their depletion.
- The use of goods that have been adapted to be significantly less energy or resources intensive than the industry standard.

Estimates presented in this report are special extractions that relate to the tables below:

Statistics Canada. Table 36-10-0645-01: Environmental and Clean Technology Products Economic Account, output, gross domestic product, and compensation of employees per industry (special extraction). https://doi.org/10.25318/3610064501-eng (accessed April 5, 2023).

Statistics Canada. 2022. Table 36-10-0630-01: Environmental and Clean Technology Products Economic Account, employment (special extraction). https://doi.org/10.25318/3610063201-eng (accessed: April 5, 2023).

Nominal GDP:

Natural Resources Canada, Canadian Forest Service's calculations for nominal GDP are based on Statistics Canada's tables 36-10-0434-04, 18-10-0267-01, 18-10-0268-01 and 18-10-0265-01.

Statistics Canada. Table 36-10-0434-04: Gross domestic product (GDP) at basic prices, by industry, monthly, industry detail (x 1,000,000). https://doi.org/10.25318/3610043401-eng (accessed March 3, 2023).

Statistics Canada. Table 18-10-0267-01: Industrial product price index, by industry, monthly. https://doi.org/10.25318/1810026701-eng (accessed March 3, 2023).

Statistics Canada. Table 18-10-0268-01: Raw materials price index, monthly. https://doi.org/10.25318/1810026801-eng (accessed March 3, 2023).

Statistics Canada. Table 18-10-0265-01: Industrial product price index, by major product groups, monthly. https://doi.org/10.25318/1810026501-eng (accessed March 3, 2023).

IHS Connect. Global Trade Atlas (accessed March 24, 2023).
• Forest products include HS Codes 44, 47 and 48.

Indicator: Forest sector gross domestic product
British Columbia Forestry Innovation Investment. Wood First. https://www.bcfii.ca/our-funding-programs/wood-first/

Government of Canada. Green Construction through Wood (GCWood) program. https://natural-resources.canada.ca/science-and-data/funding-partnerships/opportunities/forest-sector/green-construction-through-wood-gcwood-program/20046

The World Bank. Databank: World development indicators. https://databank.worldbank.org/reports.aspx?source=world-development-indicators (accessed March 20, 2023).

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 November 8, 2022).

• For nominal GDP up to (and including) 2017.
Statistics Canada. Table 36-10-0434-04: 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=3610043404 (accessed February 28, 2023).

Statistics Canada. Table 18-10-0267-01: Industrial product price index, by industry, monthly. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810026701 (accessed February 17, 2023).

Statistics Canada. Table 18-10-0268-01: Raw materials price index, monthly. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810026801 (accessed February 17, 2023).

Statistics Canada. Table 18-10-0265-01: Industrial product price index, by major product group, monthly. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810026501 (accessed February 17, 2023).
• Natural Resources Canada, Canadian Forest Service's calculations of nominal GDP for 2018 to the latest year are based on Statistics Canada's tables 36-10-0434-04, 18-10-0267-01, 18-10-0268-01 and 18-10-0265-01: GDP in 2012 constant prices and estimated industry price deflators indexed to 2012.

Real GDP:
Statistics Canada. Table 36-10-0434-04: 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=3610043404 (accessed February 28, 2023).
• 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 periods (e.g., comparing the previous two years' 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 $39.9 billion to Canada's nominal GDP (1.5% of total GDP) in 2022.

Indicator: Production of forest products
APA–The Engineered Wood Association. Quarterly production reports.
• For production data of structural panels (plywood and oriented strand board).

British Columbia Ministry of Forests. 1998. Forest Renewal BC Operational Tree Improvement Program (Project Report 1997/98). Victoria, British Columbia. https://cfs.nrcan.gc.ca/publications?id=32742

Pulp and Paper Products Council, in Forest Renewal BC Operational Tree Improvement Program
• For production data of newsprint, printing and writing paper, and wood pulp.

Statistics Canada Table 16-10-0045-01: Lumber, production, shipments and stocks, monthly (x 1,000). https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610004501 (accessed April 8, 2021).

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 3, 2023).
• For production data of lumber, which includes 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 2010 to 2013 (inclusive) comes from the older Table 16-10-0045-01.
• Lumber production data for years 2014 to 2022 (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.

Indicator: Exports of forest products
Government of Canada. Canada's free trade agreements. https://www.tradecommissioner.gc.ca/fta-ale-canada.aspx?lang=eng

IHS Connect. Global Trade Atlas (extracted March 21, 2023)
• Forest Products include only HS Codes 44, 47 and 48.
• Softwood Lumber includes only HS Codes 440710, 440711, 440712, 440713, 440714 and 440719.
• Global value comparisons are on a United States dollar basis.
• Statistics Canada. Merchandise trade data (special extraction, March 8, 2023).
• Each product in this dataset represents the total for a custom grouping of HS codes.

How is the forest sector changing?

Canadian Council of Forest Ministers. 2022. Renewed forest bioeconomy framework. https://www.ccfm.org/releases/renewed-forest-bioeconomy-framework/

Ellen MacArthur Foundation. The biological cycle of the butterfly diagram. https://ellenmacarthurfoundation.org/articles/the-biological-cycle-of-the-butterfly-diagram (accessed April 25, 2023).

Foresight Cleantech Accelerator Centre. 2021. Accelerating the circular bioeconomy market in Canada. 12 pages.

Innis, H.A. 2001. The fur trade in Canada: An introduction to Canadian economic history. Toronto, ON: University of Toronto Press.

World Business Council for Sustainable Development. 2019. CEO guide to the circular bioeconomy. https://www.wbcsd.org/Archive/Factor-10/Resources/CEO-Guide-to-the-Circular-Bioeconomy

Indicator: Forest Sector Financial Performance

Statistics Canada. Quarterly balance sheet and income statement, by North American Industry Classification System (NAICS) (special extraction, March 10, 2020).

- For data before and including 2019, as Statistics Canada discontinued the use and update of this source (to be replaced with Table 33-10-0225-01).

Statistics Canada. Table 33-10-0225-01: Quarterly balance sheet, income statement and selected financial ratios, by non-financial industries, non-seasonally adjusted (x 1,000,000). https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3310022501 (accessed February 23, 2023).

- For data including and beyond 2020.

Indicator: Forest sector secondary manufacturing

Statistics Canada. Table 36-10-0434-04: Gross domestic product (GDP) at basic prices, by industry, monthly, industry detail. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610043404 (accessed February 28, 2023).

Statistics Canada. Table 12-10-0136-01: Canadian international merchandise trade by industry for all countries. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1210013601 (accessed March 6, 2023).

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 February 15, 2023).

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.

Additional information on the regional secondary wood manufacturing industries can be found within these six publications:

- Bogdanski, B.E.C., Sun, L., et al. 2020. Secondary manufacturing of solid wood products in Ontario 2017: Structure and economic contribution (Information report BC-X-451). Victoria, BC. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/publications/centre/pfc?sort=date&format=citation
- Bogdanski, B.E.C., Wong, L., et al. 2020. Secondary manufacturing of solid wood products in Québec 2017: Structure and economic contribution (Information report BC-X-453). Victoria, BC. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/publications/centre/pfc?sort=date&format=citation
- Sun, L., and Bogdanski, B.E.C. 2019. Secondary manufacturing of solid wood products in Alberta 2017: Structure and economic contribution (Information report BC-X-448). Victoria, BC. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/publications/centre/pfc?sort=date&format=citation
- Sun, L., Bogdanski, B.E.C., et al. 2019. Secondary manufacturing of solid wood products in Saskatchewan and Manitoba 2017: Structure and economic contribution (Information report BC-X-449). Victoria, BC. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/publications/centre/pfc?sort=date&format=citation
- Wong, L., Stennes, B., et al. 2019. Secondary manufacturing of solid wood products in British Columbia 2016: Structure, economic contribution and changes since 1990 (Information Report BC-X-447). Victoria, BC. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/publications/centre/pfc?sort=date&format=citation
- Wong, L., and Bogdanski, B.E.C. 2019. Secondary manufacturing of solid wood products in New Brunswick and Nova Scotia 2017: Structure and economic contribution (Information Report BC-X-452). Victoria, BC. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/publications/centre/pfc?sort=date&format=citation

Indicator: Forest sector carbon emissions

Natural Resources Canada. Comprehensive Energy Use Database. https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/trends/comprehensive_tables/list.cfm (accessed May 30, 2023).

- NRCan's Comprehensive Energy Use Database is compiled using the following sources:
  ° The Canadian Energy and Emissions Data Centre (CEEDC), Simon Fraser University. 2022
  ° Statistics Canada. 2022. Report on Energy Supply and Demand in Canada 2000–2020
  ° Natural Resources Canada. 2022 Industrial End-Use Model
  ° Environment and Climate Change Canada. 2022. National Inventory Report 1990–2020: Greenhouse Gas Sources and Sinks in Canada
  ° 2022 Bioenergy Survey, Canadian Forest Service
  ° 2021 Wood Pellet Trade Data, Global Trade Atlas (accessed March 21, 2023)

Notes:

The Office of Energy Efficiency at Natural Resources Canada (NRCan) has changed the base year related to its National Energy Use Database (NEUD) from 1990 to 2000, beginning with the release of 2018 data. This change in methodology has resulted in minor changes in the energy use and GHG emissions data back to 2000. This rebasing is to ensure that NEUD reflects developments in trends and structures of Canada's energy end use and efficiency across sectors. It also synchronizes Canada's energy use data reporting with changes recently made by the International Energy Agency. While new estimates are no longer made available for years prior to 2000, data with the new base year are expected to better service the development, implementation and monitoring of government policies, programs and projects; evidence-based decision-making; industrial and market analysis and projection; and energy use literacy, education and stakeholder engagement.

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 March 3, 2023).

Forest inventory

Forest area by classification:

Food and Agricultural Organization of the United Nations. 2020. Global forest resources assessment 2020: Country report: Canada. Rome, Italy. http://www.fao.org/3/ca9983en/ca9983en.pdf

National Forest Inventory. Standard reports, Version 2.0, Table 12.0, Area (1000 ha) of forest land by ownership in Canada. https://nfi.nfis.org/resources/general/summaries/t1/en/CA/html/ca_t12_forown_area_en.html (accessed May 5, 2023).

- Remeasurement (2017) estimate of Canada's forest area by ownership type.
- 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 five 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 five 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% to 10% of the total area and the trees, when mature, can grow to a height above five 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. 2023. National Inventory Report 1990–2021: Greenhouse gas sources and sinks in Canada. https://unfccc.int/documents/627833 (accessed: April 24, 2023).

- Environment and Climate Change Canada's National Inventory Report 1990–2021: 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.

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/t1/en/CA/html/ca_t5_forage20_area_en.html (accessed May 9, 2023).

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/t1/en/CA/html/ca_t12_forown_area_en.html (accessed May 9, 2023).

Growing stock:

National Forest Inventory. Standard reports, Table 15.0, Total tree volume (million m^3) on forest land by forest type and age class in Canada. https://nfi.nfis.org/resources/general/summaries/t1/en/CA/html/ca_t15_forage20_vol_en.html (accessed June 29, 2023).

National Forest Inventory. Standard reports, Table 16.0, Total tree volume (million m^3) by species group and age class in Canada. https://nfi.nfis.org/resources/general/summaries/t1/en/CA/html/ca_t16_lsage20_vol_en.html (accessed June 29, 2023).

Disturbance

Forest insects:

National Forestry Database. Forest insects, Table 4, Area of moderate to severe defoliation (including beetle-killed trees) by insects. http://nfdp.ccfm.org/en/data/insects.php (accessed September 20, 2023).

- Forest area disturbed by defoliators (e.g., budworms, spongy moth) includes only areas with tree mortality or moderate to severe defoliation. Defoliation does not always result in mortality. Several factors, including defoliation severity, duration and frequency, or presence of other stressors (e.g., drought), can affect the level of mortality.
- Forest area disturbed by bark beetles (e.g., mountain pine beetle, spruce beetle) is derived from aerial surveys that map trees that are dead or dying from successful beetle attack.
- Summing the areas affected by more than one insect to create a grand total can result in an overestimate if more than one insect species occurs in the same stand in the same year. For example, in a mixed wood forest, spruce budworm may defoliate balsam fir in the same stand where forest tent caterpillar is defoliating the aspen trees.

Note: "Spongy moth" was adopted by the Entomological Society of Canada and the Entomological Society of America in March 2022 as the new official common name for *Lymantria dispar*. The species was formerly known as "gypsy moth" and as "LDD moth" in some reports.

Forest fires:

National Forestry Database. Forest fires, Table 3.1.1, Number of fires by cause class. http://nfdp.ccfm.org/en/data/fires.php (accessed September 20, 2023).

National Forestry Database. Forest fires, Table 3.2.1, Area burned by cause class. http://nfdp.ccfm.org/en/data/fires.php (accessed September 20, 2023).

- The National Forestry Database sources the latest year's fire data from the Canadian Interagency Forest Fire Centre, and all years prior to the Canadian Wildland Fire Information System.

Forest management

Forest harvesting:

National Forestry Database. Harvest, Table 5.1, Net merchantable volume of roundwood harvested by ownership, category and species group. http://nfdp.ccfm.org/en/data/harvest.php (accessed September 20, 2023).

National Forestry Database. Harvest, Table 5.2, Area harvested by ownership, management and harvesting method. http://nfdp.ccfm.org/en/data/harvest.php (accessed September 20, 2023).

- The national and provincial/territorial profile figures for harvesting volumes include data for industrial roundwood, fuelwood and firewood from provincial and territorial Crown land and from private land.
- Area harvested data include federal, provincial, territorial and private forest lands.

Forest regeneration:

National Forestry Database. Regeneration, Table 6.3, Area of direct seeding by ownership and application method. http://nfdp.ccfm.org/en/data/regeneration.php (accessed September 20, 2023).

National Forestry Database. Regeneration, Table 6.5, Area planted by ownership and species group. http://nfdp.ccfm.org/en/data/regeneration.php (accessed September 20, 2023).

Third-party certification:

Certification Canada. Canadian statistics. 2022 year-end statistics. http://certificationcanada.org/en/statistics/canadian-statistics (accessed September 20, 2023).

- 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:

IUCN: International Union for Conservation of Nature (http://www.iucn.org).

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

Greenhouse gas inventory

Environment and Climate Change Canada. 2023. National Inventory Report 1990–2021: Greenhouse gas sources and sinks in Canada. https://unfccc.int/documents/627833 (accessed: April 24, 2023).

- Environment and Climate Change Canada's National Inventory Report 1990–2021: 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_2 equivalent (CO_2e) emissions and removal reflect the current year plus the previous 20 years. Thus, the figures for CO_2e emissions include residual emissions from areas deforested over the past 20 years, and the figures for CO_2e removal include ongoing removal by all areas afforested over the past 20 years.
- See the sources and information for the sustainability indicator Forest carbon emissions and removal for more detail.

Domestic economic impact

Canadian housing starts:

Statistics Canada. Table 34-10-0126-01 (formerly CANSIM 0277-0009): 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: January 18, 2023).

Forest sector contribution to nominal GDP:

Statistics Canada. Table 36-10-0434-04: Gross domestic product (GDP) at basic prices, by industry, monthly, industry detail (x 1,000,000). https://doi.org/10.25318/3610043401-eng (accessed March 3, 2023).

Statistics Canada. Table 18-10-0267-01: Industrial product price index, by industry, monthly. https://doi.org/10.25318/1810026701-eng (accessed March 3, 2023).

Statistics Canada. Table 18-10-0268-01: Raw materials price index, monthly. https://doi.org/10.25318/1810026801-eng (accessed March 3, 2023).

Statistics Canada. Table 18-10-0265-01: Industrial product price index, by major product groups, monthly. https://doi.org/10.25318/1810026501-eng (accessed March 3, 2023).
- Natural Resources Canada, Canadian Forest Service's calculations for the latest year's nominal GDP are based on Statistics Canada's tables 36-10-0434-04, 18-10-0267-01, 18-10-0268-01 and 18-10-0265-01: GDP in 2012 constant prices and on estimated industry price deflators indexed to 2012.

Forest sector contribution to real GDP:
Statistics Canada. Table 36-10-0434-04: Gross domestic product (GDP) at basic prices, by industry, monthly, industry detail (x 1,000,000). https://doi.org/10.25318/3610043401-eng (accessed: March 3, 2023).
- 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 periods.

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 2, 2023).

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 2, 2023).
- 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 March 30, 2023).

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 May 24, 2023).

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 March 24, 2023).
- Employment includes jobs held by people employed directly in the following subsectors: forestry and logging, support activities for forestry, pulp and paper product manufacturing, and wood product manufacturing.
- 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 Natural Economic Accounts (e.g., GDP, national wealth).
- Employment data can also be sourced from Statistics Canada's Survey of Employment, Payrolls and Hours (SEPH) and the Natural Resources Satellite Account (NRSA).
  ° SEPH data focus on industry and can be used for comparing direct company employment in forestry with that in other sectors.
  ° Data from Statistics Canada's 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—Canadian Forest Service 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. Retroactive changes to data from previous years 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 2, 2023).

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 2, 2023).
- 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, March 8, 2023).
- 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 of forest products:
APA—The Engineered Wood Association. Quarterly production reports.
- For production data of structural panels (plywood and oriented strand board).

Pulp and Paper Products Council.
- For production data of newsprint, printing and writing paper and wood pulp.

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 3, 2023).
- For production data of lumber, which includes 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.
- Because of changes in sampling and estimation methods in the Sawmills survey, readers should exercise caution in comparing data from different sources directly.

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 March 2, 2023).
- 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 on 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.