



How Canada reports on forest greenhouse gas (GHG) emissions

CANADIAN FOREST SERVICE SCIENCE-POLICY NOTE

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What is forest greenhouse gas (GHG) emission reporting and why does Canada do it?

Forests are dynamic ecosystems. They change over time as they are affected by natural processes of growth, decay and death by natural disturbances such as wildfire, insects, disease and windstorms. They are also affected by human activity. Canada's forests play an important role in the global carbon cycle due to their large area and high amount of carbon stored. Our forests both remove carbon from the atmosphere as they grow (they act as a carbon sink) and emit it when they die and decay or burn (they act as a source of GHG emissions).

Each year, the Canadian Forest Service (CFS) of Natural Resources Canada (NRCan) uses its state-of-the-art methodologies to update estimates of the net sink or source in our managed forest (Figure 1) and the changes over time. Environment and Climate Change Canada (ECCC) then combines the estimates with those from other land categories and incorporates all of the estimates in Canada's GHG inventory. The inventory is submitted annually to the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC organizes international expert teams to review our GHG inventory and ensure that it complies with the reporting requirements. NRCan also includes these estimates in its annual State of Canada's Forests report.

NRCan develops its estimates using the science-based National Forest Carbon Monitoring, Accounting and Reporting System (NFCMARS) and its Carbon Budget Model. This NRCan-developed model is internationally recognized and used in many countries around the world to estimate and understand forest emissions and removals. NFCMARS estimates forest carbon stocks, changes in carbon stocks and emissions of other GHGs in the 226 million hectares of Canada's managed forest. The modelling framework integrates information on forest growth and disturbance from a wide variety of sources. Data are derived from provincial forest inventories, temporary and permanent sample plots, forest growth and yield estimates, remote sensing measurements and statistics on natural disturbances such as wildfire and insect infestations. Information about harvesting and other forest management activities are used to track trends in forest management.

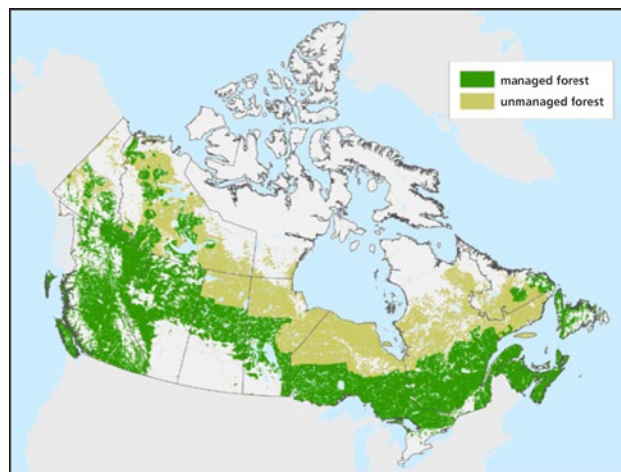


Figure 1. Canada's managed forest includes all forests under direct human influence. It is a subset of Canada's total forest area and includes forests managed for harvesting, forests subject to fire or insect management, and protected forests.

The modeling framework also makes use of the best available data and scientific understanding of ecological processes that affect forests, and tracks what happens to forest carbon when harvesting or natural disturbances occur. Specifically, the framework includes assessments of carbon in all parts of living trees (tree trunks, branches, roots), as well as the carbon in dead wood, litter (leaves, twigs, small branches on the forest floor) and soil.

Do the forest GHG estimates include the impacts of natural disturbances?

Yes. NRCan quantifies the GHG impacts of natural disturbances such as wildfire and severe insect outbreaks, because it is important to understand total emissions and removals from our managed forest. The UNFCCC focuses on anthropogenic (human-caused) GHG emissions and removals. This is because the UNFCCC goal is to reduce anthropogenic GHG emissions to limit climate change. Therefore, it requires that countries report the emissions

and removals resulting directly from human activity such as harvesting or land-use changes like conversion of forest to agricultural lands. In keeping with this, the focus of Canada's GHG inventory report is the emissions and removals that are a direct result of management of our forests. They are used to provide a clear picture of the impacts of human activity over time. This focus is vital, because having a clear understanding of direct human impacts can inform how we develop approaches to reduce carbon emissions and increase the carbon sequestered by our forests.

Do the forest GHG estimates include the impact of logging?

Yes. The estimates incorporate emissions resulting from annual logging operations, such as the decay or burning of harvest residues (e.g., tree tops, stumps, branches and roots) left in the forest. The regeneration of forest after harvest is also included. This regeneration, which is part of the impact of logging, can result from tree planting activities or natural regeneration. A regenerating forest typically will be a net source in the first few years after harvest but it then transitions to an increasingly larger net sink as the young trees grow. Emissions from fuels used by equipment in logging and other forestry operations are not included in the estimates for the managed forest, as the GHG inventory includes these emissions in the energy sector. For example, emissions from vehicles used in forestry operations are included in transportation emissions in the GHG inventory.

What about harvested wood products (HWP)? Are they included?

Yes. Each year, the forest sector converts a substantial portion of the wood harvest into products that store carbon for varying periods depending on their use. NRCan estimates the GHG emissions from HWP as the products go out of use. For example, using wood for firewood/fuelwood results in immediate emissions, and the disposal of many paper products results in emissions of the carbon within a few years after the harvest. In contrast, products like lumber used in housing can last for a long time, with emission of the carbon occurring only many decades after the harvest. NRCan estimates take all of these factors into account to quantify the emissions from HWP as accurately as possible as they occur over time. This means that a substantial portion of Canada's HWP emissions in any year reflect past HWP production and use. Not only does this accurately reflect the HWP emissions as they occur, but it can also encourage using wood in ways that delay emissions, such as for construction of buildings. As with all of its GHG emission estimates, NRCan ensures that estimates for emissions associated with carbon stored in HWP are consistent with the detailed technical guidance of the Intergovernmental Panel on Climate Change (IPCC), which sets the scientific standards for GHG estimation.

Is Canada's forest GHG emission reporting being improved over time?

Yes. Working with ECCC, NRCan is committed to continually improving Canada's approach to forest GHG estimation and reporting using the best available information and scientific knowledge. In fact, the IPCC and UNFCCC require this. Each year, NRCan and ECCC determine priority improvements to implement using available data and scientific understanding, and establish regularly updated multi-year improvement plans requiring data and scientific development.

Spatially-explicit forest carbon modeling is important for achieving many significant improvements to forest GHG estimates. NFCMARS incorporates information that varies across Canada at the scale of forest management units but it cannot provide estimates for specific locations. NRCan's next version of NFCMARS will include spatially-explicit forest carbon models and make greater use of remote sensing data.

For example, governments in Canada are exploring and implementing initiatives aimed at increasing forest carbon removals and reducing emissions. Once the necessary information is available, NRCan will include the impact of these investments in the forest GHG inventory estimates. Ongoing research is being conducted to improve estimates of the carbon impacts of forest management from activities that improve tree growth, or from delayed or non-existent forest regeneration on logging access roads and landings. In addition to this research, work is ongoing to better quantify the impacts of natural disturbances and climate change on forest growth and decomposition rates.

Sources

Environment and Climate Change Canada. *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada*. <https://unfccc.int/ghg-inventories-annex-i-parties/2020>.

Natural Resources Canada. *The State of Canada's Forests*. <https://www.nrcan.gc.ca/our-natural-resources/forests-forestry/state-canadas-forests-report/16496>.