



# How Does Canada Report Greenhouse Gas Emissions From Wildfire?

CANADIAN FOREST SERVICE SCIENCE POLICY NOTE

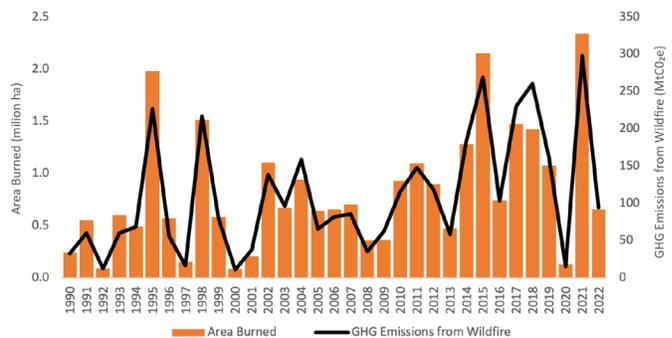
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## Introduction

Wildfire is an essential natural element for maintaining forest health and diversity, especially in the boreal zone. However, wildfires also have a profound impact on forest-based communities, affecting safety, livelihoods, and environmental resources. The scale and severity of wildfires around the world has been increasing, largely due to climate change. Climate change causes warmer temperatures, droughts, increased lightning activities, and changes in vegetation patterns in many forested regions, resulting in large areas burned, events occurring outside of typical seasonal windows, and fires burning in novel geographic locations. Wildfires emit large amounts of greenhouse gas (GHG) in a short period, contributing to a feedback loop of worsening climate change and potentially resulting in even greater wildfires in the future, particularly in boreal forests.

## Wildfires in Canada

Wildfire is a major natural disturbance in Canada's forests. The Government of Canada tracks wildfires every year using the Canadian Wildland Fire Information System, with supporting data from provinces and territories. In Canada's managed forests (forests that are managed for resources, conservation, and fire suppression), despite showing great interannual variability, the trend in annual burned area has increased since 1990 and most of the area burned is ignited by lightning strikes. Wildfire emissions in the managed forests have also shown a corresponding upward trend that is expected to continue in the future, highlighting the significance of the increased scale and severity of wildfires in Canada.



The annual area burned (orange bar) and GHG emissions (black line) in Canada's managed forests over 1990-2022 show strong correlation and a trend upwards with large interannual variability.<sup>1</sup>

## How do wildfires impact carbon in the forest ecosystem?

Forests remove carbon from the atmosphere through photosynthesis and emit carbon through natural mortality and decomposition. Carbon is also emitted through natural disturbances like pest outbreaks and wildfires.

Wildfires cause immediate GHG emissions by combusting live and dead biomass and emitting carbon primarily as carbon dioxide, carbon monoxide, and methane. They

<sup>1</sup> 2022 was the latest year for which data were available at the time of publication.



also kill live biomass, causing delayed emissions as the dead wood decomposes and reducing carbon sequestration in the forest until new trees grow back. Wildfires can consume litter and forest floor soil carbon. Some wildfires can result in a long period of smouldering, which can be significant sources of methane, a GHG with a higher global warming potential than carbon dioxide.

Wildfires also influence forest productivity and carbon dynamics. For example, wildfires can accelerate natural forest regeneration facilitating the germination of pine seeds and creating more open areas for faster tree growth. However, in some cases, severe wildfires can deplete the seed bank enough that planting trees is needed to restore forest.

### How does Canada estimate wildfire emissions?

Canada maintains and operates the [National Forest Carbon Monitoring, Accounting and Reporting System](#) (NFCMARS) to support the estimation of GHG emissions in Canada's managed forests, including those from wildfire. NFCMARS integrates sound and reliable forest information (e.g. forest inventory data provided by provinces and territories) and wildfire event data (e.g. area burned from the [National Burned Area Composite](#)) for carbon dynamics simulation.

NFCMARS utilizes its core model – Carbon Budget Model of the Canadian Forest Sector version 3 (CBM-CFS3) – to simulate the state and transition of carbon following wildfire, in forests and to the atmosphere. The type and amount of GHG emitted from wildfire are estimated annually by modeling how fire burns different forest stand components like branches, stems, litter, and roots. The estimates are then converted to the unit of carbon dioxide equivalent (tCO<sub>2</sub>e) for easy comparison.

### How does Canada report wildfire emissions?

Each year, Canada reports wildfire emissions in managed forests in Canada's [National Inventory Report](#). Wildfire emission estimates include immediate emissions from combustion and post-fire emissions that last for years after the burning due to long-term wildfire impacts on

soil and dead organic matter. The emission estimates also include carbon removals from natural stand regeneration following wildfire. Net GHG emissions from managed forests subject to natural disturbances (including wildfire) are also reported annually in [the State of Canada's Forests report](#)

Emissions from wildfire and other severe natural disturbances are reported separately from emissions from human activities to differentiate trends in human activities and their GHG impacts on forests and harvested wood products from the large interannual variability of natural disturbance emissions. Accordingly, any GHG removals associated with natural regeneration on burned stands are also reported within the natural disturbance component and are not reported in the component of emissions resulting from human activities until the stands reach commercial maturity.

Wildfire emissions in unmanaged forests are currently not reported, largely due to a lack of data and access to those remote areas. Efforts are underway to better understand Canada's unmanaged forest emissions and removals.

### How is Canada improving wildfire monitoring and emissions reporting?

Canada will be launching [WildFireSat](#), which will be the world's first fully dedicated wildfire monitoring system. It will provide detailed near-immediate fire analysis directly to those fighting fires on the ground. The system will also allow Canada to better measure wildfire emissions.

Canada is also investing in research and development to enhance our understanding of wildfires and improve wildfire emissions reporting. The [2023 Blueprint for Forest Carbon Science in Canada](#) outlines research goals for the next decade, aiming to better understand and predict changes in natural disturbance regimes in a changing climate and impacts on carbon pools, transfers, and fluxes. In addition, investments in the Forest Systems Information and Technology Enhancement program, announced in Budget 2023, will improve the capability of NFCMARS in estimating GHG emissions

and include more anthropogenic and natural disturbance types represented in NFCMARS.

Complementing these efforts is the [Wildfire Resilient Futures Initiative](#), which supports collaborative wildfire research projects and mobilizes Indigenous fire knowledge. Together, these initiatives form a comprehensive strategy to improve wildfire monitoring and emissions reporting across Canada.

## Useful Links

[Forest Carbon 101](#)

[Canadian Wildland Fire Information System](#)

[Canadian Interagency Forest Fire Centre](#)

[National Forestry Database](#)

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