REPORT

MISSING THE FOREST:

HOW CARBON LOOPHOLES FOR LOGGING HINDER CANADA'S CLIMATE LEADERSHIP

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Executive Summary

Protecting the world's forests, just like a rapid transition away from fossil fuels, is essential to avoiding the worst impacts of climate change. Forests, in addition to their importance in maintaining biodiversity, play an irreplaceable role in global carbon regulation, absorbing one-third of human-caused carbon emissions from the atmosphere annually and storing this carbon long-term in their soil and vegetation. This is why forest protection and restoration are key pillars of international efforts to advance natural climate solutions (i.e., actions that preserve and enhance ecosystems' role in absorbing and storing carbon).[1] Preserving primary forests, which are forests that have never been impacted by significant human disturbance, is particularly critical. These forests, which are rapidly disappearing, hold unique value for the climate and biodiversity. Once gone, they are irreplaceable on any meaningful human timescale.

Canada's boreal forest, which holds some of the world's last large stretches of remaining primary forest, plays a crucial role in achieving a sustainable, livable future. The Canadian boreal is both a biodiversity hotspot and the world's most carbon-dense terrestrial ecosystem, storing twice as much carbon per hectare as tropical forests,[2] making it an essential ally in the fight against climate change. As the steward of this forest, Canada has both a tremendous responsibility and an opportunity to lead on effective, ambitious natural climate solutions that protect the boreal.

Despite the boreal's global importance, it is facing considerable threats from unsustainable industrial logging. While Canada has made leading commitments to a broad portfolio of natural climate solutions, the logging industry continues to clearcut more than 400,000 hectares of the boreal each year—about five NHL hockey rinks every minute[3]—much of this in irreplaceable primary forests.[4] This conversion of primary forests into second-growth forests, which store less carbon, is transferring large amounts of carbon into the atmosphere, driving significant climate impacts.

As this report highlights, the Government of Canada is neither adequately accounting nor regulating these climate impacts. Despite the fact that the atmosphere does not distinguish between carbon released from logging and the carbon emitted by burning fossil fuels, the Government of Canada has crafted a different set of rules for the logging industry that downplay its emissions and exempt them from carbon regulations. In effect, the Government of Canada has skewed the cost-benefit equation underlying its approach to forest policy in a way that misrepresents the actual carbon cost of industrial logging and therefore undervalues the benefit of protecting existing forests.

This report identifies four ways the Government of Canada is effectively giving the logging industry a free pass on its carbon emissions: using an unbalanced accounting approach that hides the full scale of logging emissions, under-measuring emissions associated with industrial logging, using an altered baseline for assessing forestry emission reductions over time, and excluding those logging emissions that it does count from its carbon pricing system. As a result, Canada is inflating the amount of carbon dioxide the "managed" forest removes from the atmosphere by more than 80 million tonnes per year, an amount greater than the annual carbon footprint of Canada's building sector and more than 10 percent of Canada's annual total reported greenhouse gas emissions.[5] At the same time, in failing to put a price on logging's forest carbon impacts, the Government of Canada is effectively subsidizing one of its largest sources of emissions.

This report provides six recommendations that lay a pathway for Canada to become a leader in conserving the boreal as a natural climate solution. The recommendations create a policy framework that better reflects the logging industry's climate impact and the value of primary forest protection. This framework includes rectifying the accounting of forest carbon, placing a price on logging emissions, and supporting the creation of Indigenous Protected and Conserved Areas (IPCAs). By adopting these recommendations, Canada will close the loopholes that warp the incentives at the foundation of its forest policy decisions and currently threaten its commitments to natural climate solutions and climate progress more broadly. It will also incentivize the logging industry to adopt climate-friendlier practices that will help it to remain viable in an increasingly sustainability-focused marketplace. Canada is well placed to lead globally on natural climate solutions, but to do so, it first needs to create a framework that accurately reflects the value of primary forests—and the cost of failing to protect them.

I. Introduction

Scientists agree we must keep global warming below 1.5°C if we want a livable, climate-safe future.[6] Achieving this depends on not just phasing out fossil fuels and embracing clean energy solutions, but also on natural climate solutions that protect and restore ecosystems' ability to absorb and store carbon dioxide.[7] Each year, forests globally absorb one-third of human-caused carbon emissions,[8] significantly slowing the accumulation of carbon dioxide in the atmosphere. Forests also act as giant carbon vaults, storing away in their wood, leaves, and soil more carbon than is found in all currently accessible coal, oil, and gas reserves combined.[9] In recognition of forests' importance to meeting the 1.5°C target, Article 5 of the Paris Climate Agreement calls for parties to "conserve and enhance" forest carbon sinks and reservoirs and to reduce emissions from deforestation and forest degradation.[10]

The Canadian boreal forest holds particular importance for the global climate. The Canadian boreal accounts for a significant portion of the world's largest remaining primary forests.[11] Primary forests are forests that have never been impacted by significant human disturbance and, as a result, have far greater biodiversity and store far more carbon than forests that have been degraded by industry.[12] The boreal's slow-decaying, acidic soils make it the most carbon-dense terrestrial ecosystem in the world, storing twice as much carbon per hectare as tropical forests.[13]

The future of the boreal and much of its carbon stores will be greatly shaped by Canada's policies regarding its logging industry. Each year, industrial logging cuts down more than 400,000 hectares of the forest[14] to manufacture products such as lumber, toilet paper, newsprint, and biomass energy.[15] This equates to logging an area the size of five NHL hockey rinks every minute.[16] Canada ranks third in intact forest landscape loss, behind only Brazil and Russia.[17]

Canada's logging industry is a significant carbon emitter. Since secondary forests store far less carbon than primary forests, the logging of primary forests results in massive net carbon emissions. The Government of Canada reports that annually, the wood products made from Canadian forests release approximately 140 megatonnes (Mt) of carbon dioxide equivalent (CO_2e)[18] into the atmosphere.[19] For comparison, total Canadian emissions from all human activities amount to roughly 700 Mt CO_2e per year—meaning emissions from wood products constitute approximately one-fifth of Canada's total.[20] This figure includes only those products manufactured from the logged trees and does not include the carbon impact of the logging sites themselves. In addition to this, clearcut forests continue to emit carbon from the disturbed soils and biomass debris for years.[21] Logging also undermines the forest's ability to absorb carbon in the years following clearcutting.[22] Later, the growing secondary forest will absorb significant amounts of carbon, but taken together, these impacts result in a carbon debt, or a decrease in the total amount of carbon an industrially logged and managed forest stores relative to an unlogged, primary forest. This carbon debt can last for centuries.[23]

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Clearcut boreal forest near Dryden in Northwestern Ontario.

However, the Government of Canada has, over many years, carved out a unique set of rules for the forestry sector that create dangerous policy gaps in carbon accounting and regulation in the sector. These accounting and regulatory loopholes downplay or write off the industry's impact

on the climate and, in externalizing the full climate cost of logging, lead Canada to undervalue the protection of primary forests. Unlike the fossil fuel industry, which must be phased out, a sustainable logging industry could potentially align with the goal of keeping global warming below 1.5 °C. Reforming Canada's forest carbon accounting system to accurately reflect the logging industry's impact will encourage the sector to properly consider climate impacts in its project planning and align itself with climate-safe emissions reduction targets.

Recently, the Government of Canada, recognizing the climate importance of protecting natural ecosystems like the boreal, has made unprecedented commitments to natural climate solutions. Canada has committed to protecting 30 percent of its lands and oceans by 2030 (a policy known as 30x30),[24] and to planting two billion trees over the same time period.[25] the current rate, intensity, and extent of logging in the Canadian boreal is incompatible with a goal of maximizing the boreal forest's critical role in carbon storage and threatens long-term, global climate stability Without addressing the loopholes that give the logging industry a free pass for its carbon emissions, Canada will be unable to develop natural climate solution policies that appropriately value the climate benefits of its primary forests and chart a path toward a safe and sustainable future. The current rate, intensity, and extent of logging in the Canadian boreal is incompatible with a goal of maximizing the boreal forest's critical role in carbon storage and threatens long-term, global climate stability.

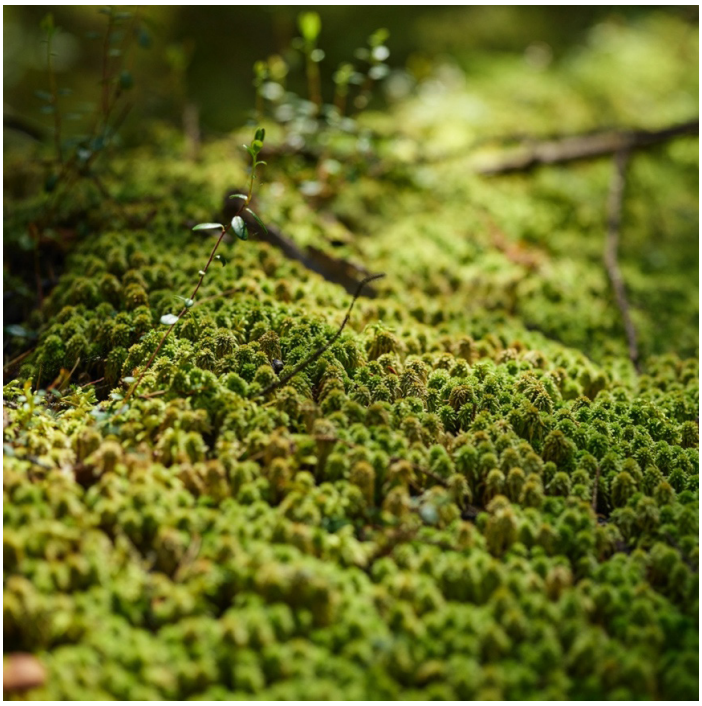
A boreal woodland caribou in Grands-Jardins National Park, Quebec, Canada.

The American marten (Martes americana), also referred to as the pine marten, climbing a tree in Ontario, Canada.

II. The Canadian Boreal Forest Plays a Critical Role in Climate Protection

Unlike tropical forests, which store most of their carbon in vegetation, the vast majority of the boreal's carbon is locked up in its soils.[26] The boreal's cold climate slows the decomposition of organic matter on the forest floor, trapping the carbon in place.[27] Just like the burning of fossil fuels, its release would introduce a vast new flow of carbon into the atmosphere.

The boreal forest's function as a carbon storehouse, along with its ongoing role in carbon removal, or sequestration, from the atmosphere (adding more carbon to the storehouse), makes its protection integral to reaching domestic and international climate targets. A recent report from Nature United found that the annual protection of an additional 88,000 hectares (ha), or 10 percent of each year's logging cut, of old-growth forests across Canada, would, alongside improved forest regeneration and other forest management changes, cumulatively capture a total of 470 Mt of CO_2e between 2021 and 2050 (about 16 Mt per year on average).[28] This represents only a small proportion of possible carbon benefits from avoiding logging in old-growth or primary forests, since this models only a 10 percent decrease in logging in old-growth each year relative to historic trends.[29] The potential emissions savings from expanding old-growth protection, therefore, are significantly larger.



The richly coated floor of a primary boreal forest.

WILDFIRE

Boreal forests are fire-dependent, with species and natural dynamics reliant on a regular fire cycle. While wildfires can vary in intensity and impact, in terms of ecological disturbance, fires are not biologically, chemically, or structurally equivalent to clearcut logging.[30] Forests recover differently following fires,[31] and charred dead wood can continue to store carbon longer than logged wood products.[32] In addition, industrial logging's infrastructure and reliance on heavy machinery impacts forests differently.[33] Recent studies have shown that logging infrastructure leaves a significant portion of the impacted area essentially barren, even decades following clearcutting.[34] Unlike wildfire disturbance, these compacted areas are not suitable for forest regeneration.[35]

As discussed below, industrial logging is also lowering the average age of forest stands relative to when the forest was subject only to natural disturbances. Not only is industrial logging expanding the total forest area disturbed each year, but intervals between wildfires are also typically longer than the time forests are left to regrow between logging operations.[36] Wildfires, unlike industrial logging, also do not specifically target older stands.[37]

As the climate changes and wildfires become more frequent and more extreme,[38] industry often claims that logging prevents wildfires from raging out of control. However, in the face of wildfires, protecting primary forests only becomes more urgent.[39] While some forestry activities can be helpful in reducing the frequency of fires,[40] intensive logging practices like clearcutting are often associated with more frequent and intense blazes.[41]

Furthermore, the increase in fires is not occurring uniformly across Canada. This is especially true in the eastern boreal forest, which is less fire-prone.[42] Models forecasting climate change impacts show that this trend will continue, with eastern forests far less impacted by future fires than western ones.[43] This only increases the need to protect primary forests in eastern provinces, where the majority of boreal logging occurs, as critical bastions for carbon and biodiversity in a changing climate.

PRIMARY FORESTS

Primary forests, which are forests that have never been impacted by significant human disturbance, play an outsized role in global climate and biodiversity protection. These forests, which now compose only one-third of global forests, hold irreplaceable biodiversity and provide unique ecosystem services, including storing 30-50 percent more carbon than previously logged forests.[44] They develop over a long period, as species of plants, animals, and fungi interact and form complex relationships across decades and even centuries.[45] Forests that have regrown after logging are called secondary forests.

Protecting primary forests, especially under the leadership of Indigenous Peoples, is essential to combating climate change[46] and is, in fact, one of the cheapest and most technologically feasible climate solutions.[47] These forests contain a diversity of species and habitats that is missing in areas that have been logged or impacted by other industries such as mining and oil and gas.[48] They also typically store far more carbon than their degraded counterparts (secondary forests).[49] They are often also more resilient to natural disturbances like fires,[50] which is increasingly important as climate impacts worsen.

III. Logging in the Canadian Boreal Has a Massive Impact on Forest Carbon

Industrial logging is one of the largest threats to the Canadian boreal's carbon stores and ability to continue to sequester additional carbon. More than 90 percent of the logging in Canada is in the form of clearcutting,[51] a practice in which the logging operation removes nearly all the trees from a given area.[52] Much of this occurs in carbon-rich, biodiverse primary forests.

When these forests are clearcut, carbon in the soils and remaining biomass is released into the atmosphere.[53] The wood products removed from the forest, meanwhile, will release their stored carbon over varying spans of time (wood used to make short-lived products such as toilet paper and tissue products will release stored carbon more quickly than wood milled into lumber).[54] Logging doesn't just impact the vegetation but also undermines the integrity of the boreal's soil carbon vault. The heavy equipment, logging infrastructure, and logging itself disturb the soil, exposing previously covered strata and compacting the soil.[55] The change in forest cover also exposes the soils to sun and increased temperatures and leads to other changes that can impact decomposition and soil microbial communities and increase soil carbon releases.[56]

In addition, scientific research shows that, while the trees regrow, the forest takes a long time before it returns to being a net absorber of carbon.[57] Boreal forests logged today will not return to a net carbon sink for decades[58]—beyond timeframes relevant for climate action under the Paris Agreement.[59] Even if the forest eventually returns to maturity, it can take centuries to compensate for clearcutting's impact on the climate.[60]

Clearcut boreal forest in Waswanipi Cree territory in Quebec.

Over the past decades, the logging industry has been transforming the Canadian boreal, replacing carbon-rich, older primary forests with younger stands.[61] The addition of industrial logging on top of the natural wildfire regime has increased the annual rate of tree loss, reducing the average age of forests across the boreal. Industrial logging's impacts on stand age are exacerbated by the fact that the "harvest rotation," meaning the time industry leaves a forest to regrow before logging again, is typically shorter than the mean interval between fires.[62] In addition, industrial logging, unlike fires, specifically targets older forest stands.[63] Particularly in the eastern part of the Canadian boreal, where fire rates are relatively low, the addition of modern clearcutting practices on the forest has dramatically altered the age distribution of forest stands, resulting in a much younger forest overall.[64]

Forest age is a primary factor in its carbon storage capacity: the older the forest, the more carbon it stores.[65] As industrial logging has lowered the mean age of forests in Canada, it will necessarily have also substantially reduced the overall amount of carbon the forest stores.[66] This means that the ongoing transformation of primary forests into secondary forests must be producing massive net carbon emissions. While industry leaders often tout the value of younger, replanted trees in removing atmospheric carbon as they grow, this is highly misleading as it ignores the vast emissions from the original destruction of primary forest. Older trees not only store more carbon, but also, according to new studies, can remove significant amounts of carbon from the atmosphere until they are aged up to centuries old.[67]

Furthermore, any carbon removed from the forest that remains stored in longer-lived harvested wood products will only be sequestered temporarily. As discussed below, there are a number of uncertainties around the benefit of this storage capacity, including regarding the proportion of wood that ends up in these longer-lived products and the rate at which the carbon is released from them.

In addition, primary forests are more resilient to natural disturbances like wildfires and invasive species than are previously logged, secondary forest areas.[68] Studies have generally shown that industrial logging can exacerbate fire risk and increase fire intensity.[69] As a forest loses its ability to fend off or recover from these disturbances, it will experience even greater carbon loss relative to a primary forest.

DEFORESTATION VS. FOREST DEGRADATION

Canada claims that there is nearly zero deforestation of its forests—and proudly holds itself up in contrast to countries like Brazil and Indonesia that have much higher rates of forest loss. However, this claim relies upon the fact that under many international definitions, "deforestation" is narrowly defined in a way that excludes much of the clearcutting in Canada. The Food and Agriculture Organization of the United Nations, for example, defines deforestation as the conversion of a forest to another non-timber land use, such as farmland or a city development. Because the logging industry in Canada, like that in many other Northern countries in temperate and boreal latitudes, clearcuts with the intention of allowing the forest to regrow and still considers clearcut landscapes to be healthy forests, most of the clearcutting in Canada would instead be classified as "forest degradation."

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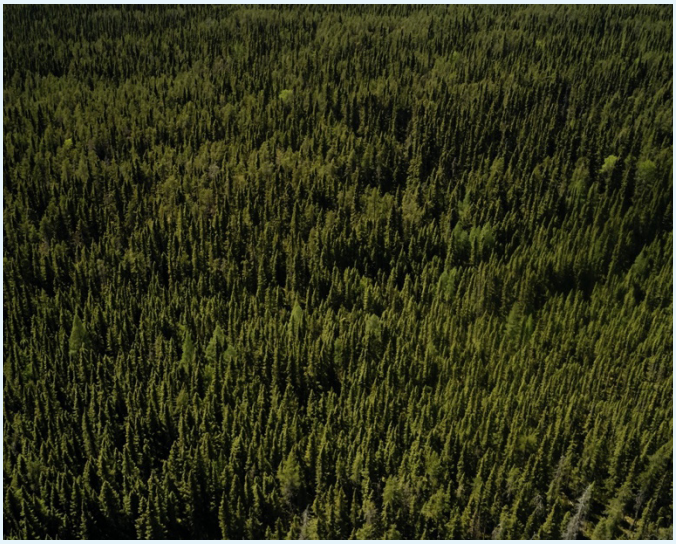

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Replanted trees (left) vs. primary forest (right).

IV. Canada Has Created Accounting and Regulatory Loopholes for the Logging Industry's Carbon Impacts

Canada, like other countries under the United Nations Framework Convention on Climate Change (UNFCCC), which governs global climate agreements, tracks its progress on meeting its climate targets through the annual submission of a National Inventory Report ("inventory").[70] The inventory documents all of Canada's sources of greenhouse gas emissions and removals (i.e., carbon sequestration), separating them by sector, and can then gauge whether the country is on track to meet its Nationally Determined Contribution (NDC),[71] or its climate commitments under the Paris Agreement.[72] Canada, like all countries, separates out its emissions into different categories, including one for Land Use, Land Use Change and Forestry (LULUCF), which includes an inventory of its emissions and removals from the forest sector.[73]

While Environment and Climate Change Canada (ECCC) is the government body charged with compiling and submitting the inventory, Natural Resources Canada (NRCan) carries out all the carbon modelling and calculations related to forestry. NRCan has developed a National Carbon Monitoring, Accounting and Reporting System (NFCMARS) to produce the inventory's forest carbon figures, which includes a detailed model, CBM-CFS3, used to estimate changes in carbon stocks on forest land.[74]

The emissions inventory and decisions about how to integrate forest carbon data into Canada's emissions targets in its NDC are not simply a set of scientific conclusions, but a series of policy choices. Choices such as what forests to include in the inventory and the kinds of data to integrate impact the numbers in the inventory, the determination of Canada's progress towards meeting its targets and, ultimately, forest policy and climate policy more broadly.

This report's analysis of Canada's forest sector emissions accounting is based on a new technical analysis from Nature Canada, Environmental Defence Canada, Nature Québec, and NRDC.[75] This analysis finds that the Government of Canada's current accounting practices include a number of loopholes and that, as a result, forestry emissions are severely undercounted in Canada's inventory, while the contribution of forests to meeting Canada's 2030 emissions target is significantly overstated.

Canada's accounting policies then compound with loopholes in the regulation of that forest carbon. Because the Government of Canada's carbon pricing policy does not include a price on forest carbon emissions, the logging industry is exempt from any regulation of emissions from its logging practices. From accounting to regulation, the logging industry benefits from a policy regime that allows it to avoid accountability for its climate impacts. As a result, these impacts are borne instead by other industry sectors, Canadians, and the global community.

CANADA USES A MISLEADING APPROACH TO FOREST CARBON ACCOUNTING

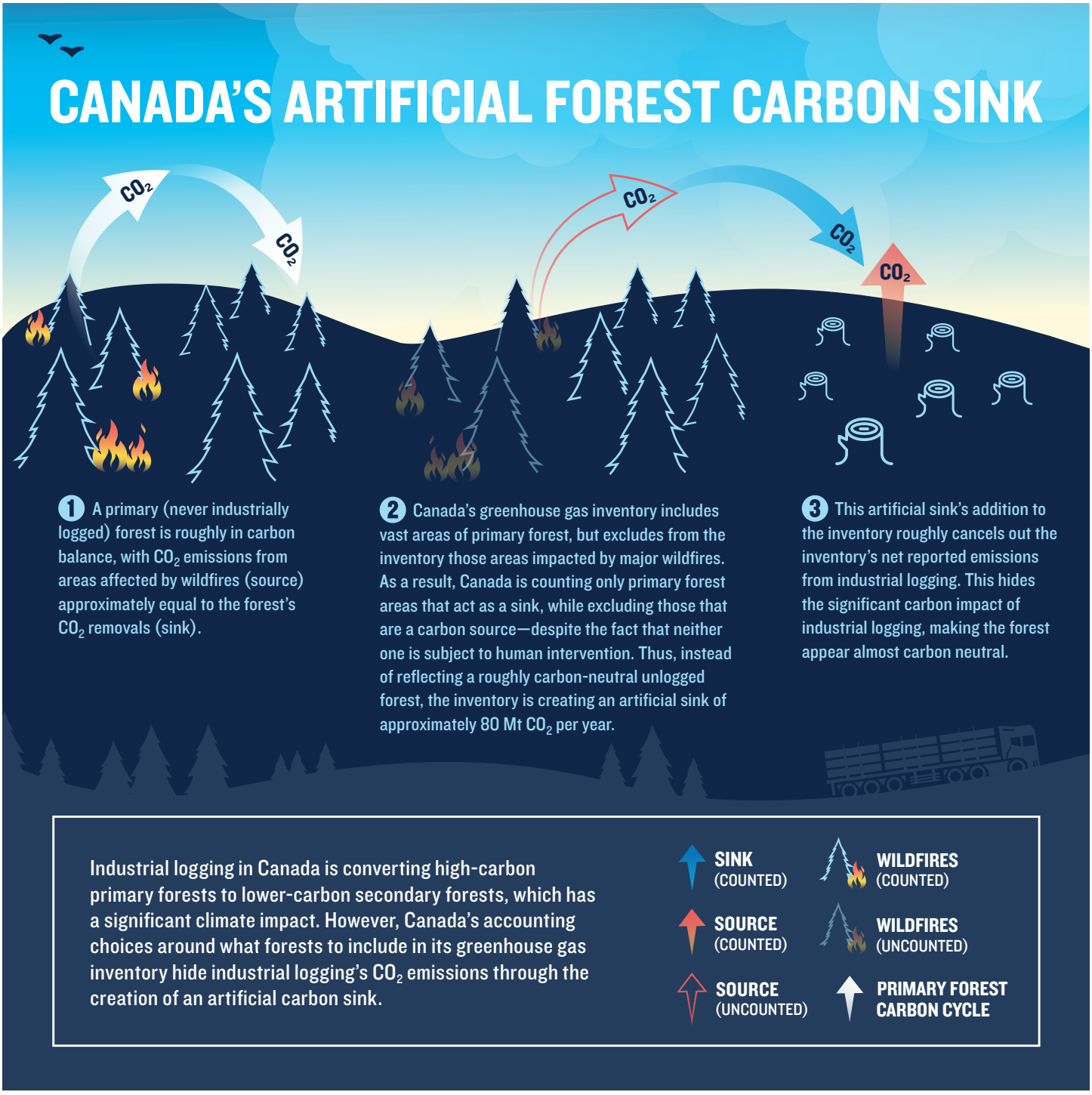
The greenhouse gas inventory is meant to capture only anthropogenic climate impacts, meaning human-caused greenhouse gas sources and sinks such as a logged area or a landscape that industry has replanted.[76] As a result, the international guidelines for national emissions inventories (as established by the Intergovernmental Panel on Climate Change, or IPCC), require countries to designate which forests they considers to be "managed," defined as "land where human interventions and practices have been applied to perform production, ecological or social functions."[77] Countries are then supposed to count all emissions and carbon sequestration (or "removals") occurring in that managed forest.[78]

NRCan has chosen to define its "managed forest" very broadly, including within its managed forest a large proportion of areas that have never been logged.[79] This means Canada is including in its inventory large areas of primary forests where the carbon being absorbed or emitted is completely independent of human interference; these forests are not permanently protected from logging, nor are they the product of post-clearcut regeneration. Under a straightforward interpretation of the IPCC's guidelines, such primary forests should be classified as unmanaged.

In another, even more misleading accounting approach, NRCan is including these primary forests when they "benefit" the inventory and excluding them when they do not. Ordinarily, the inclusion of large areas of primary forest might have little impact on the inventory, as such forests tend toward a carbon equilibrium where carbon emissions from major wildfires balance out the carbon removals by growing trees.[80] However, NRCan has decided to skew that balance by excluding all areas of its "managed" forest that have been significantly affected by carbon-emitting natural disturbances such as fire, insects, and disease, which are all parts of the background carbon cycle.[81] Most egregiously, NRCan excludes areas recently impacted by major wildfires but adds them back into the inventory when the forest has reached "commercial maturity"—on average, after 76 years.[82] This means that in

primary forest areas, NRCan is excluding the main source of emissions (major wildfires) but retaining a large portion of removals (those by older trees).

The result is a vastly misleading portrait of Canada's forests, which artificially inflates the "managed" forest's carbon removals by about 80 Mt CO_2 per year. The 2019 inventory showed Canada's managed forests to be a net annual carbon source of 5 Mt CO_2,[83] when a more accurate assessment would place net annual forest emissions around 85 Mt CO_2 per year. The uncounted 80 Mt CO_2 represents more than 10 percent of Canada's annual total recorded greenhouse gas emissions—an extremely significant omission in the context of Canadian commitments under the Paris Agreement.



THE CANADIAN GOVERNMENT HAS MOVED THE GOALPOSTS ON ITS FOREST EMISSIONS BASELINE

Canada, under the Paris Agreement, has committed to reducing its greenhouse gas emissions by 40 to 45 percent between 2005 and 2030 across all sectors.[84] Excluding forest and other land-based emissions, this means Canada needs to reduce its emissions from the 2005 level of 739 Mt CO_2e to at most 443 Mt in 2030. Known as a net-net approach, under which the net emissions in a base year (in this case, 2005), are compared to net emissions in the target year (2030), this method is the standard means of calculating countries' emissions reduction requirements.

According to NRCan's carbon inventory calculations, the managed forest was a 10 Mt CO_2e sink in 2005, and is projected, in the absence of any new policies, to be a net 16 Mt sink in 2030.[85] If applied to the forest sector, the net-net approach therefore results in a 6 Mt contribution toward 2030 emissions reduction targets.

However, the Government of Canada has adopted a different approach for calculating its emissions reduction target for forests and harvested wood products. Instead of net-net, Canada has chosen to use a less ambitious "reference level" method that moves the goalposts in a way that both overstates Canada's actual progress on reducing the logging industry's climate impact and allows Canada to misleadingly claim a larger contribution toward meeting its overall 2030 commitments.

Rather than measuring its emissions and removals in 2030 relative to emissions and removals in 2005, under the reference level approach Canada is proposing to measure them against the emissions and removals of a "business as usual" baseline that NRCan has calculated based on what emissions would have been in 2030 had logging continued at its historic rate, calculated as the mean logging rate from 1990–2016.[86] Under this approach, the government expects the managed forest to make a 25 Mt CO_2e contribution toward its 2030 emissions reduction target, rather than the 6 Mt CO_2e contribution it would have made under a net-net approach. As a result, by using the reference level approach, Canada appears, on paper, to gain 19 Mt of "free" reductions in annual emissions in 2030.[87]

The result is that Canada's forest emissions reduction accounting no longer reflects an emissions cut that the atmosphere actually sees relative to 2005, but rather a reduction relative to a chosen baseline. It also means that, when Canada claims to reduce 2005 emissions by 40 to 45 percent by 2030, this claim comes with a 19 Mt asterisk that puts its actual commitment closer to a 37 to 42 percent reduction.

The government's justification for using a reference level approach is to remove "the effects of past management and natural disturbances"[88] from the calculation. It's true that, in a net-net approach, the 2005 base year net forest emissions and removals figure would depend, in part, on the continued impact of logging activities from previous decades. However, historical decisions have affected 2005 base year emissions across all sectors, not just logging. The potential for abuses and inconsistencies in the reference level approach far outweigh any potential justification. Ultimately, the reference level approach is a self-serving contrivance that cheats the atmosphere, decreases transparency, and increases the likelihood that countries can inflate their progress using arbitrary baselines.

MODEL AND DATA EXCLUSIONS, PARTICULARLY AROUND DEFORESTATION, UNDERMINE THE INVENTORY'S ACCURACY[89]

Canada, as allowed under the IPCC rules, relies heavily on modelled estimates rather than directly measured data to calculate its annual forest sector emissions. As noted earlier, NRCan has crafted a model known as CBM-CFS3 to estimate changes in carbon stocks on forest land. The model is sophisticated and detailed but, as the modelling team itself acknowledges, has "large uncertainties and knowledge gaps" around carbon fluxes and environmental changes.[90] While a degree of uncertainty is inevitable, investments in more on-the-ground measurements of carbon fluxes would provide additional empirical data and greater clarity.

Notably, the model omits certain dynamics related to permafrost, mosses, lichens, earthworms, soil carbon, and other factors. For example, neither the IPCC guidelines nor the NRCan model considers methane emissions from the forest, except for small amounts emitted by fires.[91] Methane (CH_4) is second only to CO_2 in its overall climate impact. A recent study in Ontario showed that the impacts of methane fluxes in forests can be even greater than that of CO_2, and new research has shown that methane emissions are particularly substantial from "landings," where logs and unwanted logging residue are processed with heavy equipment and stacked.[92]

In one significant omission, the NRCan model currently does not account for the long-term loss of trees associated with certain types of forest infrastructure including most logging roads, landings, and seismic lines for oil and gas exploration. NRCan's definition of deforestation is limited only to areas where there has been "permanent forest removal wider than 20 m from tree base to tree base and at least 1 ha in area."[93] However, in many cases, deforestation from linear infrastructure—such as a logging road—is narrower than this threshold, meaning the emissions from this deforestation are not included in the inventory.

A study from the environmental nonprofit Wildlands League indicates how significant this omission may be.[94] In an examination of more than two dozen clearcuts in northwestern Ontario, Wildlands League found that, on

© Google Earth, with original site documentation from Trevor Hesselink, Wildlands League

Logging scars from a clearcut from 1989, with scars covering approximately 13% of the clearcut area.

average, more than 14 percent of the logged area within a clearcut was essentially barren 20 to 30 years after the logging occurred. These long-term scars are due to the creation of logging roads and landings.

While that research covered only one region of Ontario, the full-tree logging practice that led to this deforestation, in which the entire logged tree is stacked on the roadside, is the dominant approach in Ontario and accounts for about 50 percent of logging in Quebec.[95] It is also used in British Columbia, Alberta, and the other prairie provinces,[96] meaning it is likely these scars will be found across much of Canada's forests.

However, even if NRCan wanted to include logging scars in the inventory, they would be unable to do so using the data sources they have chosen to use. The integrity of the inventory's findings depends not only on the accuracy of the CBM-CFS3 model itself, but also just as much on the data they're inputting into the model, such as the Landsat satellite imagery NRCan relies on for deforestation monitoring.[97] As the Wildlands League report showed, NRCan's use of imagery is too low-resolution to capture logging scars, meaning that the inventory cannot include these emissions.[98]

The inclusion of these logging scars and other linear deforestation could significantly impact the inventory's findings. Using mean emissions estimates from the inventory to obtain a rough estimate, in a conservative scenario where logging scars constitute just 7 percent of clearcut areas, which is half the proportion found in the Wildlands League report, these scars would result in annual emissions of 13 Mt CO_2 Canada-wide.[99]

Recent whistleblower testimony in Quebec also raises additional questions about the integrity of data inputs into NRCan's model. Former logging industry and provincial employees shared that Quebec has decreased its industry oversight and that, as a result, companies in Quebec are undercounting their annual logging in reports to the province by as much as 25 percent.[100] Because these are the numbers NRCan then feeds into the model, Canada may be significantly undercounting its logging rates, particularly if other provinces share similar trends.

THE INVENTORY HAS SIGNIFICANT UNCERTAINTIES SURROUNDING LONG-LIVED WOOD PRODUCTS

Logged trees are processed and turned into a variety of products, including both short-lived products such as toilet paper and biomass, which consists of plants and plant by-products to be burned for energy,[101] and long-lived wood products that are designed to last, such as lumber. While short-lived products quickly release to the atmosphere the carbon that had been stored in the live tree, long-lived wood products can, depending on their use, continue to store carbon for a longer period.

Because of this, the Canadian emissions inventory, as allowed under IPCC rules, does not count emissions from long-lived wood products such as lumber at the time of logging. Instead, it defers these emissions for a duration based on estimates about the half-life of how long this carbon remains stored.[102] This means that a proportion of the carbon included in each year's inventory is based on carbon emitted from wood products harvested in prior years, while a proportion of the wood logged in the current year is deferred for a specified amount of time. In recent years, the inventory has deferred a net amount of around 25 Mt of CO_2 emissions each year.[103] However, given the uncertain science around the true length of carbon storage in harvested wood products, the inventory could be deferring some of these emissions from the inventory until long after they have entered the atmosphere. It is, however, also possible that the inventory considers some emissions to enter the atmosphere earlier than they actually do.

In addition, there is significant uncertainty around the proportion of Canada's total harvested wood products that are long-lived. For example, the Ontario government estimates that 35 percent of the wood harvested in the province was converted into solid wood products from 1999 to 2010,[104] while a recent Wildlands League analysis found that typically under 20 percent of wood harvested in a conventional Ontario context ends up in long-lived products.[105] If the inventory is overestimating the proportion of long-lived wood products, this would similarly mean Canada is deferring emissions that have already occurred.

A logging road and landing in a clearcut boreal forest in Ontario.

CANADA HAS GIVEN FOREST CARBON A FREE PASS

While Canada has a carbon pricing framework under the federal Greenhouse Gas Pollution Pricing Act's Output-Based Pricing System (OBPS) and provincial systems considered to be equivalent, the logging sector's carbon impact on forests, including net emissions from the forest following logging and from its harvested wood products, is excluded.[106] This means there are no mechanisms to hold the industry accountable for its net forest and wood product emissions or to incentivize the adoption of climate-friendlier logging practices, such as avoiding primary forests and adopting longer harvest rotations. As a result, the logging industry is able to externalize a significant portion of its climate impact to other industry sectors, Canadians, and the global community.

Instead of implementing a carbon price for the logging industry, the federal government has proposed an offsets plan for the forest sector.[107] This plan proposes, in effect, treating forest protection as an optional write-off for major industrial producers and users of fossil fuels, rather than as its own independent climate priority. Under an offsets system, landowners and lease-holders can generate "credits" for avoiding logging and sell these credits to any fossil fuel-burning industry sectors to help them to meet their climate obligations. Not only are offsets strategies notoriously prone to abuse—for example, through crediting forest protections that would have happened even in the absence of a carbon credits market[108]—but safeguarding climate-critical forests isn't an optional strategy that can substitute for reductions in fossil fuel emissions. To meet the level of ambition needed to keep warming under 1.5 °C, Canada needs to both achieve a decarbonized energy economy *and* maximize the carbon storage in its forests.[109]

V. Canada's Discreditable Carbon Accounting Practices Have Vast Policy Implications

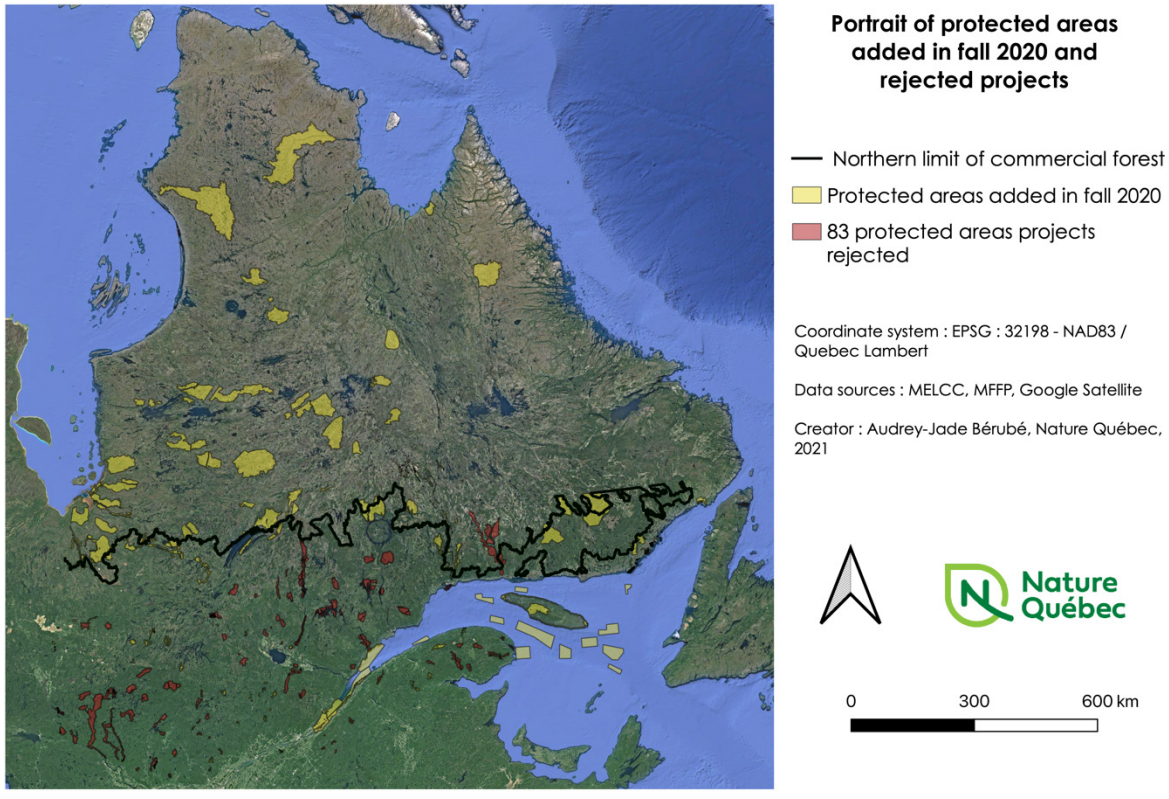
Canada's federal government has made significant commitments to natural climate solutions that have the potential to not only benefit the global climate, but also help advance urgently needed biodiversity protections. For example, its commitment to protect 30 percent of its lands and oceans by 2030 ("30x30")[110] aligns Canada with other high-ambition countries under the Convention on Biological Diversity and provides a strong platform for Canada to invest in Indigenous Protected and Conserved Areas (IPCAs)[111] and the creation of sustainable, equitable economies based around land protection and restoration.

However, the strength of Canada's commitments to natural climate solutions depends on Canada properly valuing the carbon benefits of primary forest protection and the carbon costs of industrial logging, and then appropriately regulating the logging industry's climate impact. Failing to address the logging sector's current accounting and regulatory loopholes risks undermining these larger climate policies through ill-informed and skewed decisions around protected area designations, subsidies, and investments that favour business-as-usual extraction over protection.

CANADA'S ACCOUNTING IMPACTS THE RIGOUR OF 30X30 IMPLEMENTATION

The strength of Canada's 30x30 pledge will depend not just on achieving that numerical goal of 30 percent protection, but on protecting high-carbon, biodiverse regions threatened by industrial extraction— as opposed to regions that may be less ecologically valuable and/or less threatened—and by prioritizing the creation of IPCAs as the primary means of protection. The logging industry's accounting and regulatory loopholes, however, undermine the climate and economic incentives to protect high-carbon areas and restrict logging's footprint.

Quebec has already demonstrated the dangers of failing to capture the true cost of logging's climate impact. In December 2020, Quebec announced the creation of a suite of new IPCAs in an attempt to meet its target of protecting 17 percent of its lands by the end of that year.[112] While these IPCAs are an important measure, there were 83 other proposed protected areas that Quebec opted not to protect, despite the fact that it still fell short of its 17 percent protection goal.[113] Almost all of the new protected



areas were north of the logging limit, and off-limits to logging. The 83 rejected proposals were almost exclusively found within the bounds of where logging is allowed to take place.[114] Essentially, Quebec refused to set aside areas for protection when doing so would impact the logging industry's business-as-usual practices.

Improved carbon accounting for the forest sector, along with a price on its climate impact, will help Canada properly value placing high-carbon areas off-limits to industrial extraction and meet its 30x30 goals in a way that maximizes climate and biodiversity protection. Because high-carbon forest areas also significantly overlap with habitat for boreal caribou and other at-risk species, more accurate valuation of these forests' carbon benefits will also help to incentivize the urgently needed caribou protections that the provinces have almost uniformly failed to implement.[115]

IMPROVED ACCOUNTING AND MORE ACCURATE DATA WILL CREATE NEW OPPORTUNITIES AROUND THE TWO BILLION TREES COMMITMENT

Canada has also committed to planting two billion trees over ten years as part of its Growing Canada's Forests Program.[116] Tree planting is not a substitute for primary forest protection given the unique and irreplaceable value of primary forests and the fact that young trees take decades to achieve their full climate benefit.[117] However, if done in a way that restores native tree species in critical ecosystems and leads to permanent protection of the restored areas, tree replanting can provide valuable long-term climate and biodiversity protection.

The long-term value of the two billion trees program depends on allowing these trees to grow into older, more carbon-rich forest landscapes. Closing logging's carbon accounting loopholes will incentivize allowing these planted trees to reach maturity beyond the age at which they become valuable as forest products.

Additionally, improving the accuracy of the logging and forest recovery data used in the greenhouse gas inventory will allow Canada to take credit for the climate benefits of restoring deforested landscapes such as logging roads and seismic lines through tree planting. Because many of these logging scars predate 2005, their restoration would, under an improved accounting framework, contribute to meeting Canada's 2030 and 2050 climate targets.

To meet its full climate mitigation and biodiversity potential, the two billion trees program must be accompanied by policies that accurately incentivize rigorous implementation. As with 30x30, addressing the forest carbon accounting and regulatory loopholes will help to create a framework that properly captures the value to the government and industry of maximizing the two billion trees program's long-term carbon benefits.

CANADIAN POLICIES RELY ON FOREST CARBON MODELS WITH HIGH UNCERTAINTY

The forest carbon numbers Canada reports in its national greenhouse gas inventory come with a high level of uncertainty. The latest inventory, for example, assumes a 50 percent uncertainty about the rate of tree growth.[118] It also estimates that the level of uncertainty in its reported emissions from harvested wood products ranges from ±10 percent[119] to ±24 percent.[120] However, the government has not incorporated these uncertainties into broader policy decisions.

In the face of scientific uncertainty, policymakers should make decisions about the logging industry based on the worst-case projections of what is possible, not on the middle of a range of uncertainty (known as the "precautionary principle").[121] In the case of boreal carbon, this likely means a greater emphasis on forest protection.

Policymakers have been particularly egregious in ignoring uncertainty around emissions from long-lived wood products and making unnuanced, problematic arguments about using these products as a rationale for expanding industrial logging. The logging industry and the federal and provincial governments often point to these products as a climate solution that justifies continuing or expanding current logging rates. For example, the Ontario government has claimed that "when carbon stored in harvested wood products is factored into carbon accounting, sustainably managed forests are always a carbon sink."[122] Canada's "Mid-Century Long-Term Low-Greenhouse Gas Development Strategy"[123] and its "Pan-Canadian Framework on Clean Growth and Climate Change"[124] similarly emphasize the role of harvested wood products in carbon storage and achieving its promised emissions reduction targets. However, these claims ignore the inventory's own statements about its significant level of uncertainty in its reported emissions from harvested wood products.

Primary forest loss and its climate consequences are irreversible on normal human timescales. Without properly considering the inventory's uncertainties and minimizing climate risk, policymakers ignore key caveats to claims about the benefits of harvested wood products and logging's climate impacts. Ultimately, this may dramatically obscure the true repercussions of industry-friendly policy decisions and lock Canada into climate pathways incompatible with meeting its climate targets.

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POLICIES PROMOTING BIOMASS ENERGY ARE BASED ON ERRONEOUS ASSUMPTIONS

The inventory's underestimation of logging's emissions also contributes to dangerous investments and carve-outs for the biomass sector. Biomass energy, which is derived from burning plants such as trees, is not a clean energy alternative to fossil fuels, even though industry often claims it is carbon-neutral.[125] Setting aside the impact that logging forests for biomass has on forest biodiversity, and even without considering the large supply chain emissions in processing and transporting wood pellets, burning biomass for electricity generation is not carbon-neutral. First, biomass plants emit CO_2 at the smokestack, immediately releasing the harvested forest carbon into the atmosphere. In addition, demand for biomass is driving more logging, exacerbating the industry's overall climate impact through reducing the carbon stored in forests. Industry often frames biomass energy as a way to utilize logging's "scraps," but this is misleading—not only do these "scraps" have economic value that itself incentivizes logging expansion, but, in many regions, the logging industry is creating biomass pellets from whole trees.[126]

Canada's forest inventory helps to buttress the biomass industry's "zero-carbon" and "carbon-neutral" claims by misrepresenting the true impact of the logging sector. This leads to perverse policy decisions in support of biomass expansion. The Output-Based Pricing System, for example, requires that facilities pay a carbon price for their use of fossil fuels, but deems emissions from burning biomass to be net zero.[127] Troublingly, Canada's most recent climate commitments submission to the UNFCCC mentions investments in biomass expansion as evidence of its climate progress.[128]

VI. Recommendations for the Government of Canada

Canada is extremely well placed to lead globally on natural climate solutions because its unusually large carbon stores and flows provide a significant opportunity for improved practices. However, it first needs to address the serious accounting and regulatory weaknesses that warp the incentives at the foundation of its policy decisions. To do so, Canada must close the loopholes that insulate the logging industry from accountability and create a policy framework that will properly recognize the value of primary forests and the cost of their loss. Ensuring the climate impact of industrial logging is accurately accounted for and mitigated will create a space for more diverse and sustainable economies, allowing Canada to build on its natural climate solutions commitments and achieve the transformative change essential to achieving a climate-safe future.

To address the loopholes in its forest carbon accounting and regulation, the federal government should pursue the following recommendations:

1. Ensure unbiased accounting of logging emissions

In its recent Nationally Determined Contribution (NDC), Canada has committed to reduce its annual greenhouse gas emissions from 2005 levels by 40 to 45 percent by 2030. However, biased emissions accounting practices that overestimate the forest's annual carbon removals reduce the true ambition of this target as seen by the atmosphere. To avoid undermining the integrity of its global climate commitments, Canada should shrink its definition of "managed forest" and stop counting carbon removals from older trees in primary forest areas so that only truly human-caused carbon emissions and removals are included in the national greenhouse gas inventory. At the same time, Canada needs to fully account for—and report in its inventory—all carbon emissions and removals on managed forest lands that have been logged by including emissions from major wildfires on those lands. Once land has been industrially logged, there should be permanent accountability for all emissions and removals on that land.

In addition, Canada should abandon its "reference level" approach to calculating the contribution of forests towards the national emissions target for 2030, and instead account for forests in the same way as all other sectors: by comparing net emissions in 2030 with those in 2005. This will remove the distortion caused by the use of a fictitious, arbitrary baseline that reduces Canada's actual climate ambition and obscures emissions from logging, ensure Canada's emissions targets reflect the carbon the atmosphere sees, and align the forest sector with the way the rest of Canada's economy is treated.

2. Improve accuracy of carbon emissions measurements associated with industrial logging through investment in on-site monitoring and more detailed imaging

The government should commit the necessary resources to testing and improving its forest carbon model through significantly increased on-site monitoring of forest carbon fluxes and forest recovery rates. The NRCan modelling team wrote in 2013, "in recent years, the numbers of climate-monitoring stations, permanent sample plots, and flux towers in Canada's boreal forest have all decreased while the need for monitoring data has increased."[129] Canada should invest in an expansive carbon monitoring program to provide more inputs for testing its model and reduce the uncertainty in its outputs.

In addition, the federal government should begin measuring and accounting fully for the carbon impacts of long-term loss of forest cover from infrastructure such as logging roads, landings, and seismic lines. This will require employing higher-resolution imaging that will allow the inventory to accurately reflect forest regeneration rates and tree cover.

The Government of Canada should also take measures to address potential shortcomings in provincially reported data. This should include auditing provinces' reported harvest rates given concerns that they are not adequately scrutinizing industry's submitted data and independently verifying provinces' methods for calculating the proportion of wood products that are long-lived.

Where uncertainties remain in the model or the data inputs, the government should clearly communicate these uncertainties and articulate standards for the adoption of the precautionary principle in logging and forest management policies.

3. Ensure better governance and oversight of logging's carbon emissions

While ECCC is responsible for the annual submission of Canada's greenhouse gas inventory to the UNFCCC and accounting around fossil fuel emissions, NRCan determines the practices around forest carbon accounting and carries out the calculations.[130] Not only does this divide itself exacerbate disparities between how Canada views and accounts for fossil fuel and forest emissions, but it also creates a structural conflict of mandates within NRCan. NRCan's minister is charged in his mandate letter with "supporting and promoting the competitiveness of our Canadian companies" and with working "to strengthen the competitiveness and overall health of Canada's forest

sector."[131] The fact that NRCan is also responsible for determining the logging industry's environmental impact raises significant concerns with how it reconciles these two mandates and undermines confidence in their findings, particularly given the bias outlined in this report.

ECCC should have responsibility for measuring forest-related carbon emissions and oversee the work of quantifying and accounting for carbon flows and other environmental consequences of logging. This will provide better clarity of roles and help support the harmonization of accounting practices. In addition, it will ensure there are no conflicting mandates in light of NRCan's assigned role to support the development of the Canadian logging industry.

The government should also create adequate opportunities for input from the public and independent experts to ensure best practices in its National Forest Carbon Monitoring, Accounting, and Reporting System (NFCMARS). This includes creating a regular and transparent process for stakeholder input and ordering a comprehensive, independent audit to determine whether both the input data and subsequent calculations are of the best available scientific quality. The audit should seek input from the full range of expert stakeholders, including those from nongovernmental organizations.

4. Regulate logging emissions consistently with other key industrial sectors

Like all other industry sectors with major emissions, forest management activities—including emissions from harvested wood products and biomass combustion—should be included in Canada's carbon pricing framework and added to the federal Output-Based Pricing System regulations as part of the revision of those regulations that ECCC is currently conducting.[132]

Pricing net forest carbon emissions and removals would hold the logging industry accountable for its climate impacts and provide incentives to both provincial governments and industry to adopt climate-friendlier forest management practices that reduce impacts on the ecosystem's stored carbon and improve forest regeneration. Such practices include avoiding primary forests, adopting longer harvest rotations, avoiding full-tree logging, practicing selective harvesting, and facilitating regeneration centered on biodiversity and climate considerations. This pricing mechanism would also generate revenue to fund the creation of Indigenous Protected and Conserved Areas (IPCAs), Indigenous Guardians programs,[133] and other Indigenous-led stewardship initiatives. It could also support broader forest restoration projects, including efforts to restore tree cover in scarred areas that have not successfully regenerated, and fund on-site monitoring and improvements in the use of satellite imagery.

5. Prioritize forest protection and restoration under Indigenous leadership

In lockstep with reforms to ensure the carbon value of primary forests is accurately reflected in policymaking, the federal and also provincial governments should prioritize at-risk, high-carbon, and high-biodiversity areas in the boreal forest for protection as part of Canada's 30x30 target—including areas currently slated for logging. This should also be complemented by the prioritization of the restoration of deforested areas in the boreal such as along seismic lines and logging roads, through Canada's two billion tree planting program.

Forest protection and restoration initiatives should centre Indigenous-led solutions. Strong Indigenous land rights are not only critical to Indigenous self-determination and sovereignty, but are also correlated with better protections for forest carbon and biodiversity.[134] In Canada, Indigenous leadership is providing strong models for sustainable economic development, including plans for land use, boreal caribou management, Guardians programs, and IPCAs.

The Government of Canada has already taken positive initial steps to support Indigenous leadership. In August 2021, it announced an investment of up to C$340 million over five years to support Indigenous-led nature conservation.[135] This included C$173 million for new and existing Indigenous Guardians initiatives and C$166 to fund IPCAs.[136] While this funding is significant, it is a fraction of what Indigenous communities across Canada need to create and manage these initiatives. Additional funding for Indigenous-led management should come from diverted logging subsidies for non-Indigenous led operations, carbon pricing for logging impacts, and other sources.

6. Provide global climate leadership by setting a new international standard for forest carbon accounting

Canada's natural climate solutions commitments are part of a global effort to protect and enhance forest carbon stores. Many of the logging sector loopholes in Canadian policy are also found elsewhere, particularly in other Northern countries at temperate and boreal latitudes. A 2021 study found that, globally, there is a gap of 5.5 billion tons of CO_2 between countries' reported annual emissions and those calculated by independent models.[137] This discrepancy is almost entirely due to irregularities and loopholes in how countries account for their forest carbon removals.[138] The Biden Administration has committed to prioritizing natural climate solutions, including 30x30 and reducing emissions from forests.[139] Canada should work with US counterparts and key international leaders to establish new best practices for forest carbon quantification and accounting.

VII. Conclusion

Canada's commitments on natural climate solutions, and its large forest carbon flows and stores, could position it as a true global leader on forest protection and climate-friendlier logging practices. However, loopholes in the country's current forest carbon accounting and regulatory practices make it impossible at present for Canada to fulfill its potential. These loopholes undermine its climate commitments, placing Canada on a dangerous trajectory.

While fossil fuels can't coexist with a climate-safe future, the logging industry can. Canada has a window of opportunity to reform its carbon accounting and regulatory practices and set a global example for how the right forest policies can genuinely help meet international climate targets and advance a resilient and sustainable economy. By closing its logging loopholes, Canada will open up unprecedented pathways toward climate leadership, marketplace sustainability, and the protection of the forests that are vital to preserving a safe, healthy future.

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