The State of the Forest in Canada:

SEEING THROUGH THE SPIN

Features

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January 2024

Acknowledgement: The authors thank Ktunaxa Nation Council; David Flood, Matachewan First Nation; and Conservation North for their contributions.

Report and graph design by Erika Rathje

Cover photo by TJ Watt: Old growth logging in Caycuse Watershed, Ditidaht territory, B.C., certified as sustainable forest management.

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Executive Summary

Forests, for generations, have loomed large in Canada's national identity, both for their embodiment of wilderness, and as a source of timber. These two values have co-existed under the myth that forests are an inexhaustible resource. But in recent decades this myth has increasingly unraveled. Many logging companies are running out of easy-to-access timber, and the most ecologically and economically valuable types of forest are being rapidly depleted. In this same period, key species such as caribou have experienced a sharp decline due to logging and other human activity. Meanwhile, societal expectations have increased regarding the diversity of forest values that need to be maintained, including biodiversity and carbon stores, and the need to respect Indigenous Peoples' rights.

Yet the official government account issued by Natural Resources Canada (NRCan) each year of how forests in Canada are faring—*The State of Canada's Forests Annual Report*—fails to provide Canadians with a transparent and credible synopsis of this basic information. By using highly selective statistics and distorting or excluding essential information, the report portrays Canada's forestry industry as a sector with a minimal footprint and an unimpeachable record of environmental stewardship that negligibly impacts forest biodiversity, the climate, and ecosystem services, and operates in complete alignment with Indigenous rights. It leads with data that boosts the forest industry's image, and avoids much-needed candor about its impact on the land. In doing so, it fails to provide the information necessary for informed choices about how to sustainably manage these forests.

This report challenges that narrative, drawing upon scientific evidence, data, and metrics to deconstruct the government's overly positive portrayal of the Canadian forestry sector. It introduces the basic factors Canada omits from these annual reports to arrive at its self-congratulatory conclusions, presenting evidence that the *actual* state of the forests is far more complex and worrisome, and the logging industry far less sustainable, than the government claims.

This report is intended to put the official government narrative into question, and to challenge NRCan and its industry partners to report on the indicators that

will inform Canadians on the real condition of forests in Canada, and the species and communities that depend on them.

Some of the gaps not addressed by the official *State of Canada's Forests Annual Report*, which this report highlights, include:

Forest ecosystem integrity: Primary and old-growth forests have unique and irreplaceable value for the climate, biodiversity, ecosystem services, and communities, yet Canada's report barely mentions them. How much logging occurs in these high-integrity forest areas? What percentage of each type of forest has been logged to date? What percentage has yet to be subjected to industrial logging?

Forest degradation: When a forest is degraded, its ability to provide critical ecosystem services diminishes. What percentage of the forest has been impacted by industrial activity, reducing its biodiversity, carbon stocks, or other ecological values?

Deforestation due to impacts of logging infrastructure: Recent research in Ontario has shown that in logged areas, roads and other infrastructure are responsible for permanently removing an average of 14.2 percent from the area capable of growing trees, with affected land remaining barren decades after logging. This contrasts sharply with the "less than half of one percent" deforestation rate Canada reports. How much area has actually been deforested and is no longer growing trees due to the lasting legacy of roads, slash piles, and other infrastructure?

Biodiversity: The government's report avoids reporting on what we know about the state of key species that depend on high-integrity forest ecosystems, such as caribou, spotted owls, migratory birds, and chinook salmon. How much of these species' critical habitat has been logged, how much remains, how much is protected, and how much is slated to be logged?

Carbon/climate impacts: The system of accounting that Canada uses to report on the forest industry's carbon impact is fundamentally flawed, hiding logging's impact behind carbon sinks in unlogged forests. What is industrial logging's actual carbon footprint? How much of the timber harvest goes into short-lived products such as pulp and paper, as opposed to longer-lived products?

Indigenous Rights: How well are Canadian governments at all levels living up to commitments made under the *United Nations Declaration on the Rights of Indigenous Peoples* and the Truth and Reconciliation Commission of Canada's *Calls to Action*, as relevant to the context of forests and resource development? In addition to the success stories, such as the provision of jobs and training and establishment of partnerships, where has the forest industry come into conflict with Indigenous Peoples asserting their rights and title?

> **This report calls on Canada to meet the moment and provide the information necessary to decision making that ensures the protection of forests and the rights of Indigenous Peoples, now and for future generations**

Until the Canadian government reports on these key indicators, decision makers are essentially flying blindfolded, risking forest depletion, putting the livelihoods of forest-dependent communities at risk, and placing Canada's policies and economies increasingly out of alignment with global commitments to halt and reverse biodiversity loss and the degradation of forest ecosystems and to stave off the worst impacts of climate change. This report calls on Canada to meet the moment and provide the information necessary to decision making that ensures the protection of forests and the rights of Indigenous Peoples, now and for future generations.

Introduction

Clearcut logging in the Caycuse Valley. EMILY HOFFPAUIR

For more than three decades, the Canadian government has published an annual report called *The State of Canada's Forests Annual Report* ("*Annual Forests Report*"), which purports to be a neutral, fact-based account of how forests in the country are faring in the face of both industrial and natural disturbances.[1] Instead, their report has become more akin to an industry ad, promoting questionable and misleading claims that tout Canada's forestry practices as not only sustainable, but also beneficial for biodiversity and the climate. In the face of growing public concern regarding the environmental and social impacts of logging, these claims benefit the forestry industry as well as the federal and provincial entities responsible for overseeing and promoting it, some of which are just as outspoken as industry in perpetuating this narrative. This impacts policymaking in Canada and worldwide.

The *Annual Forests Report*, produced by Natural Resources Canada (NRCan), relies heavily on omission and redirection. It fails to report on indicators that would shed light on industrial logging practices that alter the most critical forests for biodiversity and the climate (e.g., old-growth and primary forests) and redirects attention to statistics that downplay the industry's impacts (e.g., by comparing forest area altered by logging to natural disturbances, like wildfires).

To address the discrepancies between what the *Annual Forests Report* says and what is actually occurring in forests in Canada, this report takes stock of the best available science and knowledge to highlight impacts, metrics, and indicators that the federal government and industry partners hope to minimize or dismiss. It takes a critical look at industry claims advanced by NRCan and exposes the limited or selective information upon which these claims are based. In doing so, this report provides a more comprehensive picture of how forests in Canada, which are supposed to be managed for the public good, are doing. It begins with an overview of how Canada measures forests and how fast forests are being logged,[2] particularly areas previously untouched by industry. It then takes a deeper dive into associated biodiversity and climate change impacts and the degree to which governments and industry claim that the forestry sector upholds Indigenous Peoples' rights.

Through this report, we hope to precipitate more transparent and honest conversations about what needs to be done to promote and protect healthy forests in Canada for generations to come

An increasingly broad cross-section of the public—scientists, NGOs, Indigenous Nations and communities, and intergovernmental bodies—are challenging Canada's assertions of sustainability,[3] despite the *Annual Forests Report's* claims. Through this report, we hope to precipitate more transparent and honest conversations about what needs to be done to promote and protect healthy forests in Canada for generations to come.

For a forest to be considered "deforested", it must be converted to a different land use, such as urban space, farms or roads. In contrast, the term "forest degradation" captures reductions in forest integrity.
STOCKSTUDIOX

I. *"How much forest does Canada have?"*[4] The importance of considering quality versus quantity

The *Annual Forests Report* emphasizes the expansiveness of forests in Canada and low rates of deforestation as the foundational evidence of sustainable management. For example, the 2022 report states that Canada has "the third-largest forest area in the world… with less than half of 1% deforested since 1990."[5] These figures, however, fail to reflect anything about the extent of industrial logging and its impacts on forest quality or actual tree cover. This is because, under Canadian and international policy, even after being clearcut, an area of land is still technically a "forest" so long as it is capable of eventually regenerating tree cover.[6]

For a forest to be considered "deforested," it must be converted to a different land use, such as urban space, farms, or roads.[7] This means that the *Annual Forests Report* can count industrial clearcuts—which typically involve logging the majority of trees in an area and include infrastructure like logging roads—the same as unlogged areas when tallying Canada's forest size. From 2011 to 2020, an average 762,000 hectares of forest in Canada were logged annually[8] (an annual impact more than 12 times the size of the City of Toronto[9])—about 85 percent of which was clearcut.[10]

Instead, it is critical that industrial logging's impacts also be measured by rates of "forest degradation," a term which captures forest integrity and resilience (i.e., a forest's ability to provide a range of diverse ecosystem benefits over time).[11]

While there are a range of formal definitions of "degradation",[12] the term is generally understood to mean the immediate or long-term loss or diminishing of an ecosystem's structure, function, and species composition.[13] According to the Convention on Biological Diversity (CBD) Secretariat's guidance on implementation of the Kunming-Montreal Global Biodiversity Framework, "[h]abitat degradation is the result of human-induced processes that result in a decline in biodiversity, ecosystem functions and services, and resilience…".[14] Alongside loss of biodiversity, it includes, for example, the depletion of carbon stores, and the reduced quality of ecosystem services, such as water filtration.

Unlike deforestation, the term "degradation" captures the impacts of industrial logging in high-integrity forests like primary and old-growth stands. While trees are often regenerated after logging, natural forests, once logged, generally do not regain the same biodiversity, carbon storage benefits, complexity, or

ecosystem services.[15,16] Under the best circumstances, logged forests take decades or longer to even begin approaching their pre-logging ecosystem integrity.[17]

While forest degradation likely has a much more extensive impact than deforestation in Canada, the *Annual Forests Report* may also be downplaying the extent of deforestation by not assessing the full scale of logging roads, slash piles and other logging infrastructure that fail to regain tree cover even decades after logging.[18] Research has shown that this largely undocumented form of what essentially amounts to logging-driven deforestation could be an estimated 21,700 hectares per year across Ontario alone.[19] When this rate is considered over the last 30 years, Ontario may have lost upwards of 650,000 hectares of productive forest to forestry roads and landings if similar management has been applied across the province. Since Ontario is typically only responsible for approximately 15–20% of logging in Canada,[20] the country-wide impact of this type of deforestation is almost certainly much greater than reported. While these are estimates, it shows that these drivers of deforestation are worth further investigation, and must be included in any meaningful account of the status of forests in Canada and in accounting of carbon emissions associated with logging.

In 2020, the International Union for Conservation of Nature (IUCN) adopted a statement calling for policymakers to differentiate primary forests, including intact forest landscapes (IFL), for their unique value and to prioritize their protection. As it stated, these forests "consistently provide benefits and functions that are unique, or of significantly higher quality, than those provided by degraded or plantation forests in the same ecological context across most ecosystem services."[21] Similarly, the CBD, to which Canada is signatory, adopted a resolution highlighting the "exceptional importance of primary forest for biodiversity conservation" and "the urgent necessity to avoid major fragmentation, damage to, and loss of primary forests."[22]

While Canada has signed global commitments to halt and reverse land degradation by 2030, including the Glasgow Leaders' Declaration on Forests and Land Use,[23] it has failed to publish data on the impacts of industrial logging on primary and old-growth forests. As a result, there is no mechanism to accurately track these pledges. Although the *Annual Forests Report* briefly covers the characteristics and the current extent of forests in Canada by age class,[24] it provides no additional context, such as how much of these ecologically significant forests are logged each year, and how much remains. In fact, Canada has aggressively lobbied against policies in the United States and European Union that include standards to limit or halt forest degradation.[25]

The absence of this information makes it difficult to assess the status of primary and old-growth forests in Canada. However, independent scientific studies and mapping paint an alarming picture. Between 2000 and 2013, logging in Canada led to the loss of approximately 5.6 million hectares of IFLs, indicating widespread habitat fragmentation, with an additional 945,000 hectares of IFL lost due to other activities, such as mining, energy, and hydropower.[26] Across seven provinces, forest management units overlap with approximately 15 million hectares of IFLs.[27]

Definitions

Primary forest: There have been several definitions of what, precisely, constitutes a primary forest, but the one most commonly used is that of the Food and Agriculture Organization (FAO), which defines a primary forest as a natural forest of native species with no visible indications of human activity.[28] However, it notes that primary forests include "forests where Indigenous Peoples engage in traditional forest stewardship activities that meet the definition."[29]

Old-growth forest: A structurally complex ecosystem generated by a landscape's natural disturbance regime. Although the term, in Canada, is often associated with the giant trees of the West Coast, "old growth" can look very different depending on the ecosystem.[30]

Intact forest landscape (IFL): Potapov et. al. (2017) coined this technical term, defining it as "a seamless mosaic of forest and naturally treeless ecosystems with no remotely detected signs of human activity and a minimum area of 500 km^2."[31] However, other size thresholds may be more suitable in certain areas, depending on ecological factors.[32]

Managed forest: A government-designated area of land that is managed for logging, natural disturbances like wildfire, and land conservation.[33]

Between 2001 and 2022, Canada consistently ranked third globally for annual gross tree cover loss, with forestry accounting for just under half that loss.[36] One recent study in the central coast of British Columbia showed that the industry continues to target rare, old-growth areas for logging.[37] The BC government's reporting on the status of these forests does not distinguish between big- and small-tree old growth, obscuring the real status of the forests that are most at risk.[38] Additionally, the decline of wildlife such as boreal woodland caribou and some species of migratory birds reflects the impact of industrial activity, including logging, on high-integrity forests.[39]

In recognition of these impacts, scientists around the world are calling on Canada to end primary forest logging. In a 2022 letter to Prime Minister Justin Trudeau, more than 90 members of the global scientific community argued for the protection of primary forests as "central to Canada's climate and biodiversity policies."[40]

Are forests in Canada being managed sustainably?

Where the *Annual Forests Report* does reflect the scale of logging, it employs statistics that attempt to downplay the forest industry's impact. According to the 2022 report, "the area of forest harvested each year is less than 0.5% of Canada's 362 million hectares of forest land."[41] This is misleading in several ways.

To start, focusing on the percentage of logging relative to overall forest area masks the fact that all logging in Canada is concentrated within its government-designated "managed" forests, which constitute about 62% of the total forest area in the country. This nets out a large area of Canada where it is not economically viable to log at an industrial scale (for example, trees in the far north or at high elevations that do not grow very large).

Additionally, only reporting the annual harvest rate fails to reflect the total impact the forest industry has had over more than a century of logging, or the cumulative impact when combined with the legacy of mining, energy, and other sectors. This is of particular concern for forests that are disproportionately targeted by the forest industry, whether because they are easy to access, or contain industry-favoured species. For example, in Quebec and Ontario, approximately 75 percent of the boreal forest suitable for forestry has already been logged at least once.[42] Shifts in the age-class of forests in Canada toward younger stands due to logging are also not reported despite the fact that they fundamentally alter the broader forest landscape.[43] In many parts of Canada, the rotation age for logging is below the age when trees would naturally die if left unmanaged.[44]

An accurate and credible assessment would indicate the cumulative impact that the forest industry has had to date, and how much forest remains unlogged. In order to be meaningful, this would have to be broken down by forest type and age class and expressed as a percentage of what existed before industrial logging was introduced.

Old growth. AUTUMNSKYPHOTOGRAPHY

CASE STUDY: Old-growth logging in British Columbia

British Columbia has long been the site of some of Canada's most controversial industrial logging,[45] dating back decades, as well as generations of Indigenous-led resistance. The early 1990s saw blockades to halt the clearcutting of Clayoquot South (protests dubbed the "War in the Woods"),[46] and more recently, what has been characterized as the largest act of civil disobedience in Canadian history occurred at Ada'itsx (Fairy Creek).[47] The scale of loss of old growth is clear: a 2021 peer-reviewed study found that the total area of old growth in B.C. declined by nearly half in 20 years.[48] Despite a 2020 commitment to implement all 14 recommendations from its *Old Growth Strategic Review*, a report that provides a three-year timeline for addressing the logging of old-growth forests, the British Columbia government has come under heavy criticism for failing to fully deliver on even a single recommendation, providing incomplete or incorrect information to the public, and allowing significant logging of old-growth to continue.[49,50,51]

Scientists have identified rare and at-risk old growth throughout the province as candidates for "deferrals," to be immediately set aside from logging, stating that "failure to act now could lead to the permanent loss of rare or unique ecosystem components."[52] While the province announced its intention to pursue deferrals in November 2021, a November 2023 report by Stand.earth Research Group combining provincial data and satellite imagery confirmed that at least 31,800 hectares of these rare old-growth stands had been logged since 2020.[53]

This logging in old-growth deferral areas was ongoing as of November 2023.[54]

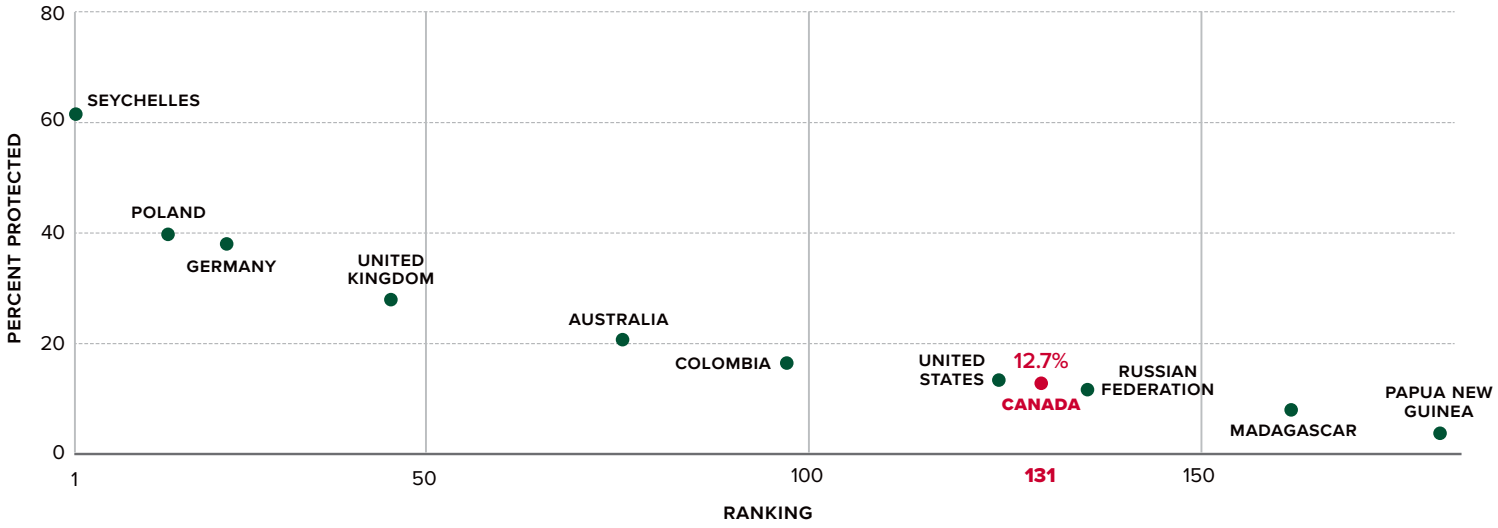
In November 2023, the First Nations Leadership Council, together with the provincial and federal governments, announced a Tripartite Framework Agreement on Nature Conservation that included goals related to fostering the protection of old-growth forests and species habitat.[55] The agreement also included significant funding commitments to support the province's goal of protecting 30 percent of lands, in cooperation with First Nations, by 2030. Shortly after, the B.C. Government released a draft Biodiversity and Ecosystem Health Framework outlining a pathway for the province to deliver on its 2021 promise to maintain and enhance biodiversity and ecological integrity, in alignment with the province's commitment to Indigenous rights.[56] These developments, while positive, have yet to translate to tangible change on the ground.

How much of the forest in Canada is protected?

In 2022, Canada ranked 131 out of 208 countries for the percentage of terrestrial area it protects (12.7 percent).[57] While Canada has committed to protecting 30 percent of its lands and waters by 2030 ("30x30") as part of the Kunming-Montreal Global Biodiversity Framework, there is no guarantee that these protections will encompass its most at-risk, high-integrity primary and old-growth forest areas.[58] What's more, Prime Minister Trudeau has suggested that areas counted toward the country's 30x30 goal could still be open to industrial activity, stating "...there could be various levels of protection within vast conserved areas—strong protection for vulnerable watersheds in one area married with responsible mining or commercial hunting in another."[59]

> **Prime Minister Trudeau has suggested that areas counted toward the country's 30x30 goal could still be open to industrial activity**

RANKS ON % TERRESTRIAL PROTECTED AREA OF SELECTED COUNTRIES, ILLUSTRATING CANADA'S COMPARATIVE GLOBAL RANKING (2022)



Data source: Terrestrial protected areas (% of total land area), The World Bank. https://data.worldbank.org/indicator/ER.LND.PTLD.ZS.

How do industrial logging and wildfire impacts differ?

Both the Government of Canada and industry claim that practices like clearcut logging emulate natural disturbances, such as wildfire. They use this claim to justify why ~85% of logging across Canada uses this approach.[60] As scientific evidence indicates, however, the impacts of clearcuts differ significantly from those of wildfire in several fundamental ways.[61]

Wildfire and industrial logging can differ in several important ways. Roads, for example, fragment habitat that is used for refuge and alter predator-prey dynamics.
DAVE HUTCHISON PHOTOGRAPHY

Greater proportion of young forests: Industrial logging often alters natural stand-age distributions, creating a larger proportion of young forests and reducing mature and old-growth forests and trees.[62] This is because industrial logging typically occurs in addition to, not in lieu of, wildfire, which leads to more widespread area-based changes, and because logging generally occurs more frequently than wildfire. Historically, stand-replacing fires have occurred across a wide range of forest ages every 20 to 500 years in Canada, with longer intervals between fires in the temperate forests of British Columbia and the eastern boreal, and shorter intervals between fires in the western boreal.[63] Industrial logging's harvest intervals, meanwhile, typically range from 40 to 100 years.[64]

Impaired forest regeneration: Following industrial logging, species richness and tree cover are less prone to return to pre-logging conditions than after a wildfire, especially in old-growth forests,[65] for multiple reasons. In some areas, forest management deliberately or inadvertently simplifies post-logging stand composition.[66] For example, glyphosate spraying, which is used to kill vegetation that could compete with a planted stand for nutrients, sunlight, and water, can significantly alter a regrowing forest's structure.[67] Further, unlike wildfire, logging requires infrastructure like roads that can inhibit tree growth for decades.[68]

Altered forest structure: Industrial logging often creates different patterns of disturbance than wildfire, leaving the landscape less suitable as habitat for the species that used to live there. Roads, in particular, fragment habitat that is used for refuge,[69] alter predator-prey dynamics,[70] provide access to hunters and increase their success rates,[71] and leave wildlife vulnerable to being killed by vehicles.[72] Wildfire also tends to create a large number of small disturbances and a small number of large disturbances, which results in a complex spatial pattern of burnt and unburnt forest with irregular boundaries, unlike logging.[73] For example, wildfire often leaves behind large numbers of snags (dead trees left standing) and abundant coarse woody debris, whereas few standing trees and minimal large debris typically remain after logging.[74]

Increased vulnerability to natural disturbance: Primary, intact, or old-growth forests are often more resistant and resilient to ongoing climate risks and feedback loops such as fire, drought, floods, and disease than industrially logged, younger, and/or degraded forests.[75,76,77,78,79] For example, old-growth forests with high densities of large trees and complex canopy structures have been shown to reduce the probability of high-severity fires compared to younger forests, retaining the capacity to provide valuable biodiversity refuge for critical species.[80] In contrast, silviculture practices resulting in young forests and spatially homogenized fuels can intensify wildfire severity.[81] As a result, industrial logging practices can leave forests more vulnerable to future natural disturbance.[82]

Is third-party certification an effective indicator of sustainability?

The Canadian government often points to the large area of certified forests as evidence of sustainability. In its *Annual Forests Report*, it touts that Canada has "35% of the world's certified forest area."[83] However, voluntary initiatives like forest certification have proven to be a poor substitute for government regulation and enforcement. Indeed, across much of Canada, forest certification acts more like an extension of existing forest management practices than a check on industry. Certification systems like the industry-led Sustainable Forestry Initiative (SFI) and the Program for the Endorsement of Forest Certification (PEFC), the global umbrella association of which SFI is a member, provide companies and purchasers of forest products with questionable "sustainability" credentials that are not based on having outcomes beyond that which is already legally required and that are relatively easy for companies to secure. Because it is relatively easy

Reality check on the 2 Billion Trees Program

As part of an initiative called 2 Billion Trees (2BT), the Canadian government pledged to plant two billion trees across Canada by 2031, over an area twice the size of Prince Edward Island, claiming that this will sequester carbon, restore nature, and improve air and water quality.[84] However, the program is already beset by numerous problems that threaten its environmental goals, according to an April 2023 report issued by the Commissioner of the Environment and Sustainable Development. As the report notes, "it is unlikely that the 2 Billion Trees Program will meet its objectives unless significant changes are made."[85]

The report points to inadequate requirements regarding permanence and biodiversity. Currently, NRCan does not require that trees planted under the program be permanently protected,[86] meaning they can ultimately be logged when it is economically viable to do so. This could effectively mean the program is providing public funds to private interests without any meaningful climate change mitigation benefits (see section in this report on the climate caveats of harvested wood products). Additionally, the report indicates that 14.4 percent of trees planted in 2021 were part of monoculture sites, where only one species is planted. These sites typically "do not support biodiversity and other benefits related to environmental and human well-being as much as more diverse plantings do."[87] Lastly, even if fully implemented, the report estimates the program will sequester just 4.3 million tonnes of CO_2e (carbon dioxide equivalent) annually by 2050—significantly less than original estimates of up to 12 million tonnes of CO_2e.[88] Regardless, the mitigation potential of planting trees is highly limited compared with the importance of prioritizing natural forest protection.[89]

Aerial of clearcut in Northwestern Ontario

for companies to obtain certifications, Canada can claim more than one-third of the world's certified forests,[90] despite its borders encircling just nine percent of the world's forest areas.

Canada leans on these certifications both to promote its image of sustainable forestry and thwart international efforts to reduce deforestation and forest degradation in the Global North. For example, in response to California's recently proposed *Deforestation-Free Procurement Act*—which requires state contractors to ensure, among other things, that there is no boreal deforestation or intact forest degradation in their supply chains—the Canadian government sent a letter to lawmakers requesting them to remove reference of the boreal from the bill. Their letter stated that "Canada's robust forest management legislative framework is complemented by the widespread use of third-party forest management certification in Canada, which provides added assurance that a forest company is operating legally, sustainably, and in compliance with world-recognized standards for sustainable forest management."[91]

In 2022, several NGOs launched a legal challenge of the SFI with Canada's Competition Bureau, alleging that SFI makes false and misleading claims regarding sustainability and outlining in detail how the SFI standard itself is incapable of upholding those claims.[92] In response, the Competition Bureau opened an investigation into the SFI, which is ongoing as of December 2023.[93]

Does logging help control insect outbreaks?

One of the most pervasive forestry myths is that logging can help control outbreaks of native forest insects. In fact, human activities like clearcut logging can make forests more vulnerable to insect outbreaks by reducing tree species diversity and age class distributions, in turn making forests less resilient.[94]

Outbreaks of native forest insects have played an important role in the evolution and health of ecosystems for millennia. They help create new habitat and support biological diversity, and outbreaks can also be seen as natural selection events. Evidence indicates that trees that survive spruce and pine beetle outbreaks, for example, may be more genetically resistant to the beetles and climate change.[95] Despite this evidence, in response to a mountain pine beetle outbreak in the British Columbia interior, the provincial government approved increased logging rates, permitting companies to harvest an additional 11 million cubic metres of wood per year,[96] raising important questions as to what degree wood supply, over sound environmental management, is driving decisions on managing insect outbreaks.

Wood pile. STOCKSTUDIOX

II. What is the status of biodiversity in forests in Canada?


Boreal woodland caribou

Biodiversity in forests is essential to human wellbeing, from insects and rodents helping to disperse seeds and pollinate plants, to birds and bats controlling pest populations by eating insects, to plants helping to reduce soil erosion, clean our air and water, and providing myriad other ecosystem services.[97] It has been estimated that more than half of the world's GDP, or about $44 trillion, depends on nature.[98] According to a recent comprehensive survey, more than 5,000 wild species are at some risk of extinction in Canada.[99] Yet, the *Annual Forests Report* does not reflect on this, nor how much of this problem is linked to forest management. It provides little more than broad commentary around biodiversity. For example, while it states that "maintaining and protecting the biodiversity of Canada's forests is a key priority of sustainable forest management,"[100] it provides no criteria or indicators related to mammals, birds, or other organisms that would shed light on the state of biodiversity in forests.

Primary and old-growth forests provide unique structural and compositional characteristics on which many plant, animal, and fungi species rely.[101] When these forests are logged, species that depend on them are impacted.[102] In British Columbia, for example, a recent study found that logging is the largest contributing factor to the significant decline of the province's southern mountain caribou and spotted owls.[103] While the *Annual Forests Report* includes no mention of this—or any other gauge to indicate how species are responding to Canada's forestry practices—boreal woodland caribou and bird populations provide important insight.

Logging impacts on boreal woodland caribou

Boreal woodland caribou are one of the most iconic and well-researched animals in Canada[104] and serve as bellwethers of ecosystem health and biodiversity[105] since they require large expanses of mature and interconnected forests to survive. They are also an umbrella species, meaning the protection of their habitat indirectly safeguards many other plant and animal species within their shared ecological community.[106]

The *Annual Forests Report* acknowledges the "paramount importance"[107] of quantifying forest biodiversity. However, rather than including caribou as an ongoing indicator of biodiversity and forest health, it scarcely mentions them. In doing so, the report downplays the fact that boreal caribou populations decline when industrial infrastructure like logging roads and clearcuts change and fragment forest habitats.[108] For example, expanses of younger forests, which often result from logging, attract more moose, deer, and elk, which, in turn, draw predator populations, increasing caribou predation. Roads further exacerbate this trend, as they have been shown to increase predators' movement and hunting success.[109,110,111,112]

In 2012, the Canadian federal government released a Boreal Caribou Recovery Strategy, which included the requirement that at least 65 percent of habitat within caribou ranges remain in, or be restored to, undisturbed condition. (It is estimated this affords caribou about a 60 percent chance of persistence.)[113]

Provinces have been slow to implement the federal recovery strategy. In fact, Ontario and Quebec remain noncommittal about protecting critical habitat as defined by the Federal Recovery Strategy or to even develop range plans. A 2017 report found that habitat conditions in the majority of boreal caribou ranges had actually worsened since 2012.[114] It noted, "[m]oreover, the boreal caribou population as a whole has continued to decline." As of 2012, only 15 out of 51 boreal caribou herds had sufficient habitat to be considered "self-sustaining."[115] Remaining herds that have been assessed as "not self-sustaining" are unlikely to survive unless systemic changes occur within forestry operations to halt and reverse the loss of critical forest habitats.[116]

Golden-crowned kinglet

Little Smoky Caribou Herd

The Little Smoky caribou herd, found in Alberta, faces localized extinction. According to federal government data, human activity, including logging, had disturbed 96 percent of the herd's range as of 2017.[117] For the long-term survival of any caribou herd, more than 65 percent of their range must remain in, or be restored to, an undisturbed condition. Yet, industrial logging within the Little Smoky herd's habitat continues, with provincial logging plans outlining rotating cut blocks until 2091.[118]

As it stands, the Little Smoky herd has only survived to date because of predator control initiatives that kill wolves; what remains of the caribou's sparse patches of habitat, which continue to shrink, is not enough for the herd to be self-sustaining. Little Smoky caribou provide a glaring example of the prioritization of industrial interests, even when government is aware that this will drive species' decline.

Forest degradation and bird population decline

The *Annual Forests Report* notes that "[t]here are several ongoing projects that are working to improve our understanding of biodiversity in Canada's forests."[119] For example, the report includes mention of the Boreal Avian Modelling Project, which it describes as collecting and collating bird data in Canada "to create habitat maps that predict how the abundance of birds will change in response to habitat loss and changes in habitat connectivity and fragmentation, among other changes."[120] Yet the report fails to provide any maps, data, or analyses regarding the state of birds in Canada or the impacts of industrial logging on their populations.

Recent evidence, meanwhile, indicates that clearcut logging of mature forests, coupled with an increased replanting of simplified forests with less diverse vegetation, including in the forest understory, has contributed to habitat loss and declining bird populations across Canada. In a study of Acadian forests in eastern Canada, researchers estimated that between 1985 and 2020, the loss of old-growth forests due to clearcut logging and other forestry practices led to breeding habitat loss for 66 percent of the 54 most common birds in Canada—species like the Blackburnian warbler and golden-crowned kinglet—as well as the death of between 33 million and 104 million birds.[121] This study also found that over the past ten years alone, populations of nine bird species declined at a rate of 30 percent or more, meeting the qualification for a species to be considered "threatened" under Canadian endangered species legislation. Meanwhile, another study found that increased fragmentation associated with logging of old-growth forests in British Columbia increased egg predation on marbled murrelets.[122] Despite the mounting evidence linking habitat loss and fragmentation with the decline of species of at-risk Canadian birds, the *Annual Forests Report* includes no analyses of their populations.

III. What are the climate impacts of industrial logging?

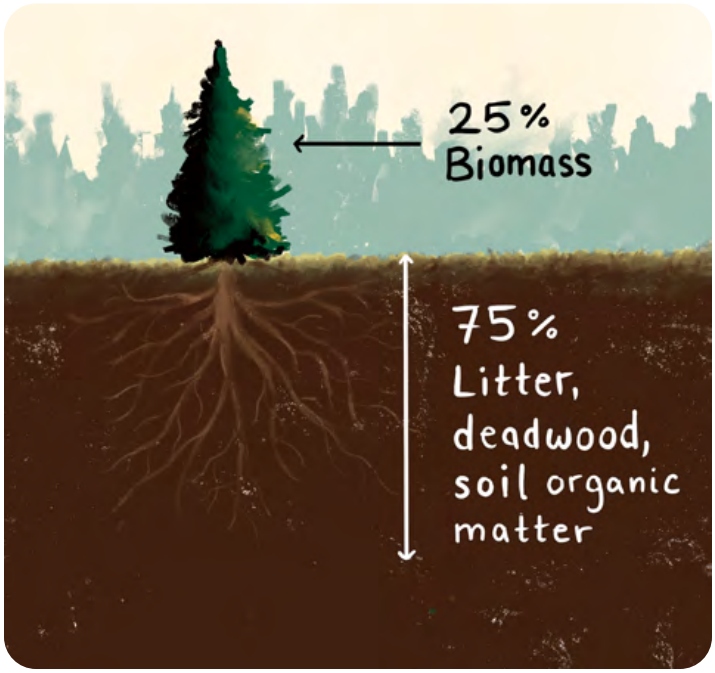
Forests play an essential role in regulating the global climate. In addition to absorbing carbon, forests keep more than 850 gigatons of carbon locked in their vegetation and soils and out of the atmosphere.[123] Recent science has estimated that logging will contribute 3.5 to 4.2 billion metric tonnes of CO_2e to the atmosphere annually over the coming decades, an amount equivalent to approximately 10 percent of recent annual global emissions.[124] Yet Canada, like many other countries, does not transparently report the industry's true carbon impact.[125]

Forests in Canada are especially critical to global climate dynamics. According to a recent study that looked at the world's irreplaceable carbon stores, the boreal peatlands and forests in eastern Canada are among the "largest and highest-density irrecoverable carbon reserves."[126] Post-clearcutting, logging debris and disturbed soils can emit carbon for decades or even centuries, as higher temperatures, hydrological changes, increased sunlight exposure, and weather alterations in the denuded forest further exacerbate the release of carbon.[127,128] Log landings, where cut trees are stacked for transport, have been shown to be a major source of methane for decades following logging.[129]

While some carbon is stored in long-lived harvested wood products, the majority is not.[130] Further, there is a period of foregone carbon sequestration between when a forest is logged and when younger trees are able to meaningfully absorb carbon, further contributing to the carbon debt that can take centuries to repay.[131] Thus, "carbon storage in wood products generally has no direct mitigation effect on climate change."[132] Research has shown, by contrast, that reducing logging rates overall would provide substantial climate benefits, particularly in highly productive forests.[133]

The *Annual Forests Report*, however, reinforces myths about industrial logging's carbon neutrality and makes sweeping claims about logging and harvested wood products as a climate solution, such as "In 2020, Canada's managed forests and the wood products harvested from them removed about 5.3 Mt CO_2e from the atmosphere."[134] These claims rely on misleading forest carbon accounting, and independent analyses of government data has shown that logging is among Canada's highest-emitting sectors, accounting for more than 10 percent of the country's annual emissions (see below).[135,136]

DISTRIBUTION OF CARBON POOLS IN THE BOREAL FOREST



Data source: W.A. Kurz et al, "Carbon in Canada's Boreal Forest—A Synthesis," Natural Resources Canada, Canadian Forest Service, 2013. https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/35301.pdf. INFOGRAPHIC BY COURTENAY LEWIS.

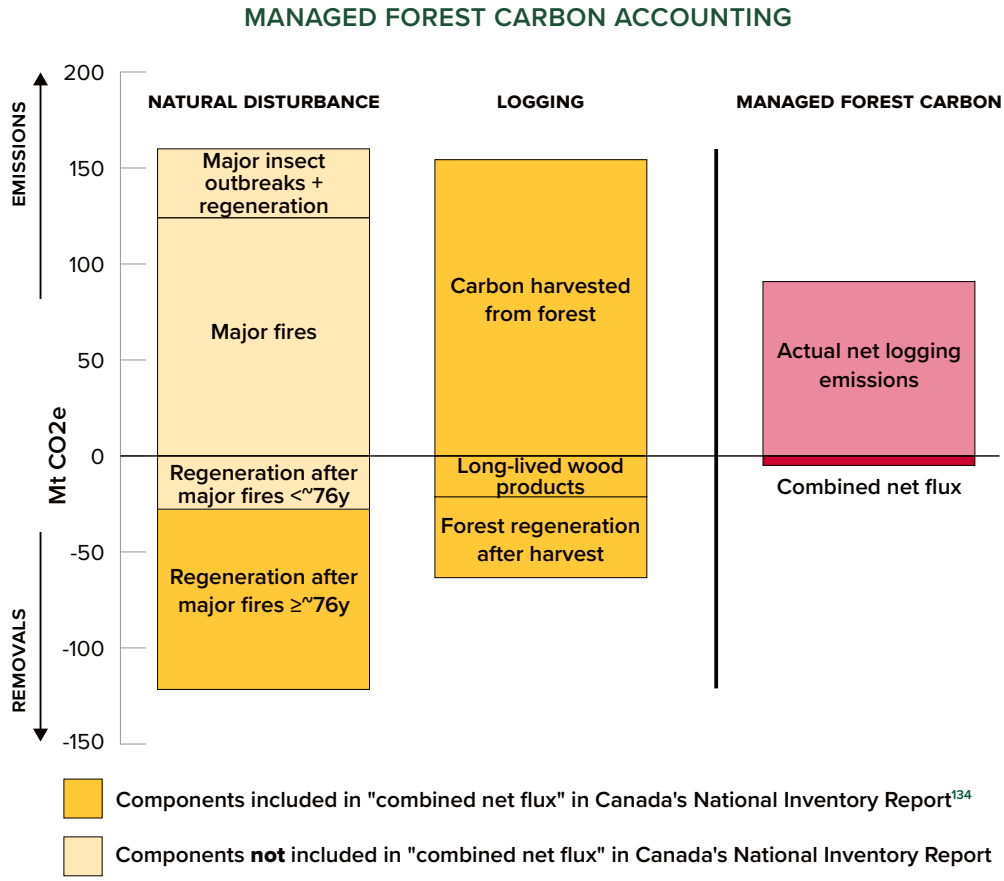
Canada does not transparently report logging emissions

Instead of clearly reporting the greenhouse gas emissions attributable to logging, as it does for other industrial sectors, Canada reports and counts annual greenhouse gas emissions of managed forest lands in terms of "combined net flux"[137]—the rate at which carbon dioxide is added to or removed from the atmosphere due to anthropogenic activities. By reporting on combined net flux, Canada is able to significantly downplay the climate impact of industrial logging through its choice of which carbon emissions and removals are deemed "anthropogenic" and which are deemed "natural." Canada excludes carbon emissions

from natural disturbances, such as stand-replacing wildfires, on the basis that these are not human-caused. However, it includes natural removals of carbon from the atmosphere, such as from post-fire regrowth in vast areas of "commercially mature" forest (i.e., forests that are considered old enough to be logged), as anthropogenic removals.[138] This gives the logging sector credit for carbon removals in forests it has not cut. When these removals are included, they effectively help to "cancel out" the other forest sector emissions, downplaying logging's climate impact. The *Annual Forests Report* relies, uncritically, on this approach.

However, by taking into account tree harvesting, post-harvest forest regeneration and growth, and carbon storage in long-lived harvested wood products, it is possible to piece together all emissions and removals reasonably attributable to industrial logging to determine the net impact for the sector. Recent research indicates that between 2005 and 2021, industrial logging in Canada has actually represented a net *source* of carbon emissions equal to an annual mean of 90.8 Mt CO_2e, roughly consistent with earlier estimates[139,140] and far exceeding the net *sink* of 5.2 Mt CO_2e claimed in the *Annual Forests Report*.[141]

> **By reporting on combined net flux, Canada is able to significantly downplay the climate impact of industrial logging through its choice of which carbon emissions and removals are deemed "anthropogenic" and which are deemed "natural"**



▲ **Components of forest carbon flows in Canada's GHG inventory averaged from 2005–2021.** Components that Canada reports to the UN and includes in the inventory's "headline" numbers have darker shading (left two columns); components not reported have lighter shading (in left column). Net reported emissions are very close to zero, portraying the managed forest as almost carbon neutral. The right-hand column shows the sum of what Canada reports (dark red, below the line), versus what net emissions are actually attributable to industrial logging (light red, above the line, which is the net sum of the middle column).

The climate caveats of harvested wood products

Harvested wood products are wood-based materials that are logged, moved off-site, and converted into products like lumber, biomass, pulp, and paper, all of which have a different carbon storage lifespan. Long-lived harvested wood products, such as lumber, may retain carbon for many years, providing the basis for the government-promoted narrative that, because harvested wood products theoretically store carbon while trees planted to replace harvested stands absorb carbon, logging is a beneficial emissions mitigation strategy. However, Canada's simplified and incomplete depiction of carbon cycles associated with harvested wood products and their burning or disposal further obscures the climate impacts associated with industrial logging.

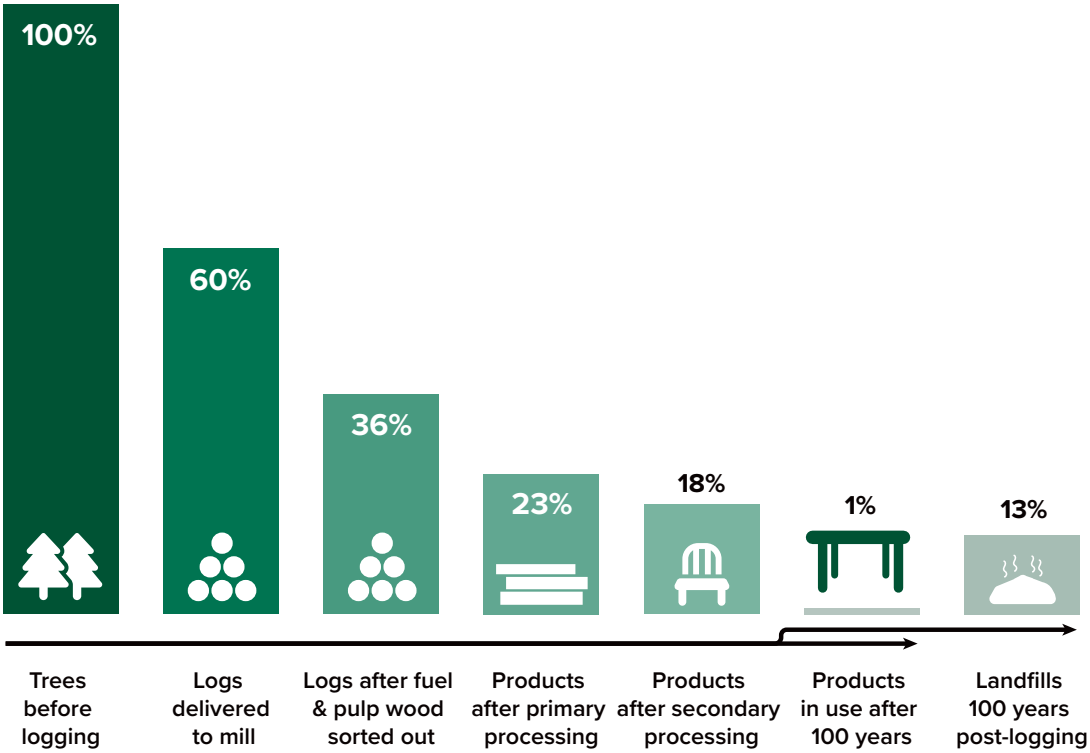
A significant proportion of harvested wood products store carbon for much shorter periods of time. Pulp and paper products release their carbon within a matter of years, while wood burned as biomass releases its carbon instantly upon incineration. Even when trees are turned into longer-lived products like lumber rather than wood pulp or biomass, these products still contain much less carbon than the original trees from which they came.[142] Approximately 40 percent of carbon from a logged tree is left to decompose on the forest floor, and, during manufacturing, as much as 22 percent of a tree's original biomass is lost.[143] After a century, even products still in use may contain as little as just one percent of their original carbon.[144]

A recent study based on data from over 30,000 forest inventory plots found that of all the forest carbon removed from West Coast forests in the United States since 1900, 81 percent has already returned to the atmosphere, or been deposited in landfills.[145] The *Annual Forests Report* does not report on what this figure is for Canada, but it is reasonable to presume it is similar.

While long-lived harvested wood products may have greater climate mitigation value when considered as substitutes for materials like steel and concrete, that value is contingent on numerous factors that the

Canada downplays climate impact of industrial logging by selectively choosing which carbon emissions and removals are deemed "anthropogenic" or "natural." Post-fire regenerating forests that have reached "commercial maturity" (~76 years average across Canada) are deemed anthropogenic removals, creating, on paper, a carbon sink that obfuscates emissions from industrial logging. SHAUNL

PERCENTAGE OF A TREE'S CARBON RETAINED AT EACH STAGE OF A LONG-LIVED FOREST PRODUCT'S LIFESPAN



Percentages do not include carbon lost from the soil post-logging, only the amount remaining in the tree.

Data source: Ingerson, A. (2011). Carbon storage potential of harvested wood: summary and policy implications. *Mitigation and Adaptation Strategies for Global Climate Change*, 16, 307-323. https://doi.org/10.1007/s11027-010-9267-5.

Annual Forests Report does not acknowledge. For example, assumptions related to replacing steel and concrete with harvested wood products include that: a) changes in harvest or production rates will lead to a corresponding change in wood product consumption, as well as an opposite response in concrete, steel, or fossil fuel use, b) wood building products are substitutable for concrete and steel, c) the same mix of products could be produced from increased harvest rates of a given area, and d) there are no market responses to increased wood use (e.g., that a subsequent fall in the price of steel and concrete does not increase the use of such materials elsewhere).[146] According to a recent study, product substitution estimates are actually extremely uncertain, and previous estimates from research on long-term mitigation benefits related to product substitution may have been overestimated two to 100-fold.[147]

▲ Even longer-lived wood products, such as furniture, often end up in landfills. Their carbon, which is often buried with garbage, also counts toward the carbon "benefit" of industrial logging.
ANNELIESE GRUENWALD-MAERKL

The dangers of using industrial-scale biomass for electric power generation

The *Annual Forests Report*'s emphasis on the carbon storage of long-lived products elides the growing dominance of forest biomass (often in the form of wood pellets), which is being touted internationally as a green alternative to fossil fuels and used as a utility-scale replacement for coal-powered electricity generation.[148] Canada is the world's second-largest wood pellet producer, after the United States.[149] While the *Annual Forests Report* acknowledges that "unlike most other renewable energy sources, bioenergy creates direct GHG [greenhouse gas] emissions," it goes on to say "these emissions are part of the natural carbon cycle, in which carbon removals from forest regrowth occur in parallel with the emissions from biomass combustion."[150] However, the notion that burning biomass can be offset by tree regrowth is based on misleading carbon accounting. This is because, in the near-term, biomass-burning smoke stacks produce significant amounts of greenhouse gas emissions—in fact, more than coal.[151] But newly planted trees require many decades before they sequester carbon dioxide in substantial quantities, beyond a meaningful timeframe for addressing climate change, and even longer to make up the carbon debt. Further, there is no guarantee that forests will be regrown or regenerated to achieve the ecologically beneficial complexity of their pre-logged state, particularly in a changing climate. In February 2021, more than 500 scientists signed a public letter calling on global leaders to "preserve and restore forests and not to burn them," emphasizing that "regrowth takes time the world does not have to solve climate change."[152,153]

Additionally, while it is often suggested that biomass is generated only from post-harvest waste, an investigation into Canada's expanding wood pellet export sector found that in British Columbia (the country's leading exporter) whole trees are also used, including from the habitat of threatened species.[154]

Forest regeneration assumptions

The *Annual Forests Report* notes that, in Canada, "forests harvested on public lands must be regenerated."[155] This requirement, however, provides no guarantee that logged forests will return to their pre-harvest conditions. Complex forest ecosystems are often irrecoverable no matter the regrowth practices. In some cases, forest cover never returns. In a study that examined logged areas in Northwestern Ontario, an average 14 percent did not regain tree cover, even up to 30 years post-logging, due to roads, slash piles, and other industry infrastructure and the "logging scars" they left.[156] This type of failed forest regeneration counters the premise that forests are inherently renewable—or carbon neutral.

Indeed, forests logged today will continue releasing carbon for years, and, even assuming successful regrowth, will only return to a net carbon sink in the few years before 2050.[157,158] Further, research has shown that the overall carbon debt can persist far longer.[159] Waiting for this carbon recapture requires time we do not have. As the Intergovernmental Panel on Climate Change (IPCC) has indicated,[160] the global community must act quickly to avoid exceeding the global carbon budget to avoid cataclysmic climate change. Near-term emissions, such as those generated by the forestry industry, increase the risk that the planet will reach climate tipping points, with severe, irreversible consequences.

◂ Logging roads in Northwestern Ontario. The province boasts that it maintains 21,000 km of Forest Access Roads, enough to drive across Canada and back. SIMON BROTHERS/POWERLINE FILMS

The myth of younger forests' climate value

One of the forestry industry's most common arguments is that logging older forests and replacing them with younger, faster-growing trees increases carbon sequestration. As the *Annual Forests Report* notes, "because older trees don't grow as fast as they did when they were young, they have a limited ability to remove additional carbon from the atmosphere."[161] However, focusing on carbon absorption rates ignores the fact that the act of logging itself releases vast amounts of carbon stored in forest ecosystems, creating a carbon debt that far exceeds what even fast-growing trees can quickly recoup.[162] Recent research demonstrates that allowing forests to grow old is a better strategy for climate mitigation than the mass planting of monocultures.[163]

Slash piles build up along logging roads in BC. Burning these piles releases carbon into the atmosphere, and if not properly restored, they can leave long-term scars in forests that do not properly regenerate forests. KATRINE KAARSEMAKER

Protection is the best form of mitigation

While Canada's *Annual Forests Report* emphasizes the renewability of forests and replanting programs like "2 Billion Trees," protecting existing forests is the most effective and efficient nature-based climate solution at our disposal. Unlike replanting, forest protection provides immediate carbon mitigation benefits by maintaining existing carbon stores as well as the ability of forests to absorb future emissions. As a result, scientists are increasingly calling for a "protect, manage, and then restore" approach to forest management.[164] Known as the "mitigation hierarchy," this approach aims to maximize the mitigation potential of forests by prioritizing the protection of existing old-growth stands, followed by the management of other forests, and finally, the replanting of forests when necessary.

IV. How well is Canada upholding Indigenous Rights?

For millennia, Indigenous Peoples have managed forest ecosystems in ways that sustain their livelihoods and cultures and maintain healthy forests for future generations. In addition, it has long been recognized that advancing Indigenous-led forest conservation and stewardship is critical to protecting human rights and halting the acceleration of forest loss and climate change. As the *Annual Forests Report* aptly notes, "[b]y incorporating Indigenous and local perspectives and knowledge into forest management, restoration and conservation, we are strengthening the resiliency of our forests and communities."[165]

More than four decades ago, in order to protect the unique constitutional rights of Indigenous Peoples, Canada's Supreme Court established the requirement that Indigenous Peoples be consulted and accommodated when their treaty or Aboriginal rights could be impacted by government actions.[166] These rights have since been reaffirmed and strengthened by several subsequent landmark decisions, including *Delgamuukw v. British Columbia* (1997),[167] *Haida Nation v. BC Ministry of Forests and Weyerhaeuser* (2004),[168] and *Tsilhqot'in Nation v. British Columbia* (2014),[169] all of which pertained to disputes over logging on traditional territory. In the years since, however, myriad policies and industrial forestry practices continue to fail to fully recognize the right of Indigenous Peoples to determine the future of their territories or to adequately comply with internationally recognized standards for protecting Indigenous rights.

The United Nations Declaration on the Rights of Indigenous Peoples Act

In 2010, the Canadian federal government endorsed the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP),[170] an international resolution that requires member states to ensure that Indigenous Peoples participate in decision-making about issues that affect them, including the use of their land and natural resources, in order to obtain free, prior, and informed consent (FPIC). In June 2021, Canada's federal government turned UNDRIP into law.[171]

While the *Annual Forests Report* says that UNDRIP has brought about "a wind of change with greater recognition and commitments to reconciliation and respect for Indigenous rights in Canada,"[172] progress toward implementing UNDRIP has, in fact, been limited. This is because while Canada's federal government now mandates UNDRIP be integrated into federal laws, provincial governments and territories—which have jurisdiction over the majority of the forests in Canada—develop and enforce regional forestry-related laws, regulations, and policies. A 2023 Canadian UNDRIP action plan for implementation even states, "the Government of Canada acknowledges that provincial, territorial and municipal governments each have the ability to establish their own approaches to contributing to the implementation of the Declaration by taking various measures that fall within their authority."[173] At present, British Columbia is the only province to have passed an UNDRIP law, although it has not been incorporated into forest management planning.

Additionally, although the *Annual Forests Report* states that "[the] process of creating forest management plans involves the consultation and participation of Indigenous Peoples and partners interested in forest management on public lands and often include (sic) efforts to integrate Indigenous ways of knowing and traditional knowledge in the decision-making process,"[174] many Indigenous Nations do not feel that their vision of forest management is being included in provincial practices (see, for example, Ktunaxa Nation case study).

Indigenous Rights and forest stewardship obligations: a Ktunaxa case study

The Ktunaxa Nation, comprised of the Ktunaxa First Nations of **ʔakisq̓nuk**, **Yaq̓it ʔa·knuqƚi'it**, ʔaq̓am, and Yaqan Nuʔkiy, occupy 83,257 km^2 of unceded territory in ʔamakʔis Ktunaxa (Southeastern British Columbia).

Ktunaxa have been excluded from meaningful participation in the forest economy since its inception, as provincial laws and policies displaced Ktunaxa laws and governance authority. This exclusion has contributed to a steady erosion of the ecosystems on which the exercise of Ktunaxa rights depends. Ktunaxa have repeatedly voiced concerns about overcutting and its associated effects, which degrades lands and waters and puts forest biodiversity and cultural conservation values at concerning levels of risk.

These unaddressed concerns, coupled with the lack of capacity to respond to high volumes of "block-by-block" referrals, prompted the Ktunaxa Nation to develop a consensus-based *Forestry Standards Document* (FSD). The *Ktunaxa FSD* clearly articulates a "current blueprint" for improved forest management applied across ʔamakʔis Ktunaxa, which is based on Ktunaxa stewardship obligations, cultural and ecological values, and a commitment to ʔa·kxam̓is q̓api qapsin ("All Living Things"). This refers to the root of, and relationship between, all things, including land, water, animals, Indigenous Peoples, and air they breathe; it describes the living balance which connects all things with the Creator, and with one another, and is linked to Ktunaxa language and culture. Values considered in the *FSD* include old growth, caribou, grizzly bear, species at risk, priority wildlife guilds and habitats, and other components of biodiversity, most of which overlap with Ktunaxa cultural conservation values.

The *Ktunaxa FSD* is intended to create certainty and assist Licensees and the Province with alignment of timber harvesting laws, policies, planning, and practices with Ktunaxa law and the Province's legal obligations to the Nation. To facilitate implementation, *FSD* content is comparable to that in legally binding Forest Stewardship Plans (FSPs); however the *FSD* identifies both Licensee and Provincial Ministry responsibilities for forest management improvements. Unfortunately, since the *FSD* release in spring of 2022, there has been little or no tangible uptake of *FSD* objectives, results, strategies and practices into new Licensee FSPs. Despite Ktunaxa efforts, status-quo road building and logging permits continue to be approved by the Ministry of Forests (MOF). While MOF continues to focus on impediments to *FSD* implementation, the impacts to ecosystems (on which the exercise of Ktunaxa rights depends) continue to accumulate.

The Ktunaxa Nation acknowledges a disconnect between expectations articulated in the *Ktunaxa FSD* and current legal requirements of the forest industry operating in ʔamakʔis Ktunaxa. This disconnect ultimately undermines the ability for Ktunaxaniḿtik to exercise their land use rights, and negates assurances made to First Nations via British Columbia's Declaration on the Rights of Indigenous Peoples. As the Province and Licensees begin to incorporate the *Ktunaxa FSD* into their approach, these fundamental differences are expected to be reconciled. However, until this occurs, the onus continues to fall on First Nations to defend their right to improved stewardship on a case by-case basis.

Grizzly bear in Canada.
LUNKENBEIN PHOTOGRAPHY

Forest tenures and Indigenous Protected and Conserved Areas

To reflect the fact that many Indigenous Nations are interested in the conservation of forests, Indigenous Protected and Conserved Areas (IPCAs)[175] are briefly mentioned in the *Annual Forests Report*. It states, "Given the different values and uses of the territory, collaboration between multiple stakeholders and land users is also important to develop more holistic and interdisciplinary approaches."[176] There is no mention of the challenges Indigenous Nations encounter in asserting their jurisdiction over land stewardship, or the significant barriers many Indigenous Nations face when trying to implement their conservation priorities with provincial governments, particularly in forests managed for industrial logging.[177] This tracks with the government's "clear unwillingness to recognize Indigenous jurisdiction and Indigenous understandings of land as systems of reciprocal relations"[178] in its advancement of nature-based solutions, including IPCAs.

The Canadian government, and its provincial government counterparts, are increasing Indigenous-held rights to access lands for industrial forestry. This shift in forest tenures represents an important step forward; however, progress has varied significantly between provinces. According to the National Aboriginal Forestry Association, while approximately 17 percent of forest tenures in Ontario and 29 percent of forest tenures in Saskatchewan were Indigenous-held in 2019, Nova Scotia still has no Indigenous-held tenures, and Quebec, Manitoba and Alberta had three percent or less.[179]

Further, these forest tenure developments have served Indigenous Nations that are seeking or have approved industrial logging on their lands. New forestry tenures have not fundamentally benefited Indigenous Nations engaged in unresolved disputes with forestry companies or federal and/or provincial governments where these Nations do not want industrial logging at all in their territories, want more areas where industrial logging and/or mining are prohibited, or prefer to log at lower levels than provinces demand.[180,181,182]

Doig River First Nation member points to IPCA sign. RACHEL PLOTKIN

Leading Toward a Better Future

Statement from David Flood, Registered Professional Forester (RPF), *Matachewan First Nation, General Manager at Wahkohtowin Development GP*

Too often, forest management plans fail to reflect and address ecological reality—reality that then becomes the lived experiences of First Nation peoples whose territories overlap with managed forests. Our inherent rights to sovereignty and jurisdiction remain despite centuries of colonialism. First Nations still live with the indelible legacy of assimilation, from the reserve system and the residential schools, to the medical experiments and physical sterilization. The trauma is experienced intergenerationally.

Mother Earth is in a state of imbalance, and it is known that where Indigenous Peoples have control over managing the landscape (approx. 5% of the globe) biodiversity is most intact. Indigenous Peoples know that a Conservation Economy way of life requires adherence to Natural Law principles—take care of the land and the land will take care of us.

The lands of North America have seen on average an 80% decline in its mammal populations and 50% of its birds as a result of the loss and degradation of habitats. We need Indigenous leadership.

Canada has adopted UNDRIP into its laws and has taken action to ensure Indigenous-led solutions are a key part of its policy fabric. This, however, does not address that Provinces are in various stages of understanding and progressing towards a more contemporary relationship with Indigenous Peoples. We need all governments to keep working to develop a relationship that respects our Treaty rights, our need to care for the land. Indigenous Peoples still live with the legacy of the past, but can lead the way to a better future.

Glyphosate herbicide spraying is not even mentioned in the *Annual Forests Report*, despite the fact that it is one of the most contentious issues for Indigenous Nations across many parts of Canada. MULTIART

Glyphosate spraying

To eliminate plants that would otherwise compete with commercially valuable trees for sunlight, nutrients, and other natural inputs, logging companies across much of Canada aerially spray cut blocks with the herbicide glyphosate. While glyphosate spraying for industrial forestry operations has been approved by Health Canada and is legal in all provinces and territories except Quebec, Indigenous communities have raised myriad concerns about its use.[183,184] Glyphosate reduces plant species like raspberries, elderberries, and salmonberries that are important to Indigenous communities, impacting traditional foraging practices.[185,186] Indigenous hunters and knowledge-keepers have also raised concerns that the spray indirectly affects aquatic ecosystems,[187] as well as the health and/or foraging patterns of small mammals, birds, insects, and game animals, such as moose.[188] Studies indicate that forests of naturally occurring black spruce have decreased in areas where glyphosate spraying programs have been used.[189] In New Brunswick, Indigenous leaders have likened the spray to "eco-genocide" for native flora and fauna and have drawn attention to its impacts on traditional harvests and have also called attention to the lack of consultation prior to usage.[190]

The application of glyphosate is not even mentioned in the *Annual Forests Report*, despite the fact that it is one of the most contentious issues with Indigenous Nations. Further, Indigenous Peoples who oppose glyphosate spraying have little to no recourse in many forest management planning processes. This means that communities must challenge its usage via other means, such as through legal action, resolutions, and protests. For example, in 2022, three First Nations —the Chapleau Cree, Missanabie Cree and Brunswick House First Nation—launched a suit challenging Ontario's approach to its forestry operations and method of consultation.[191] They specifically cited treaty infringement through the aerial spraying of herbicides, among other cumulative impacts of logging operations. Likewise, another group of Indigenous elders in Ontario has issued position papers, held demonstrations, and endorsed petitions calling for an end to glyphosate spraying in their territories.[192]

Glyphosate Spraying in Ma'amtagila Nation Territory

In the summer of 2023, glyphosate spray plans were revealed for more than 500 cut blocks throughout Ma'amtagila Nation territory in British Columbia. These plans were issued without consent, despite documentation by members of the Ma'amtagila Nation that the regrowing forests within the spray zone include myriad varieties of plants traditionally used for food and medicine. Members of the Ma'amtagila Nation have been outspoken against the spray plans and are coordinating with other First Nations to collectively push for updated policies to stop glyphosate spraying from happening.[193]

VI. Conclusion

In order to enable informed decision making, foster marketplace transparency, and ensure public accountability, it is essential that Canada provide an accurate, holistic, and honest account of how forests in Canada are doing. Instead, the government's *Annual Forests Report* paints a deceptively positive picture and omits critical information that would shed light on the real condition of forests in Canada.

In addition to touting its successes, Canada needs to transparently and comprehensively report on the impacts of its policies and industry practices on forests and people. This should include the objective reporting of how industrial logging impacts biodiversity, the climate, and Indigenous rights.

A key part of reconciliation with Indigenous Peoples in Canada relies upon achieving Free, Prior and Informed Consent in matters related to land use, including forestry. This, in turn, relies on everyone involved having access to accurate, unbiased information that reflects the full suite of forest values, not just timber. Furthermore, adaptive management, a philosophy of learning and changing to which many governments in Canada claim commitment, requires a high standard of transparent and unbiased evaluation.

Aerial herbicide spraying

There are many ways to improve the management of forests Canada. However, myths, obfuscation, and selective information will lead to perverse, dangerous policy outcomes. If Canada is going to do its part to address the biodiversity and climate crises and ensure it upholds Indigenous rights, it has to report the outcomes of forest policies and management using accurate and meaningful indicators to develop a common understanding of how forests are faring. That means asking the questions, facilitating the scrutiny, and fostering the transparency to truly understand the state of forests in Canada.

Recommendations

To improve credibility and relevance, future *Annual Forests Reports* must report on:

- The cumulative impact of logging to date, not just annual rates;
- Rates of degradation, including the loss of primary and old-growth forest;
- A comprehensive accounting of how much forested area has been removed from the managed forest due to logging infrastructure impacts;
- The relative proportion of timber volumes that go into short-lived products, such as pulp, paper, and biomass;
- Carbon emissions attributable to industrial logging;
- The ecosystem impacts of glyphosate spraying, and how many hectares of forest have been sprayed in the past year;
- The performance of Canadian governments at all levels on commitments made under the UN Declaration on the Rights of Indigenous Peoples, as relevant to the context of forests and resource development, as well as where the forest industry has come into conflict with Indigenous Peoples' assertion of their rights and title and its response.

Notes

1 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

2 The *Annual Forests Report* uses the term "harvesting" instead of "logging." This report occasionally uses "harvested" when quoting its use elsewhere, when necessary for clarity, and as part of distinct terms in common parlance like "harvested wood products" and "harvest intervals."

3 See, for example, Weber, B. (2023, August 24). *Canadians unified on forest protection although wildfire cause divisive*. City News. https://toronto.citynews.ca/2023/08/24/canadians-unified-on-forest-protection-although-wildfire-cause-divisive-poll; Saxifrage, B. (2023, August 28). *Managed to Death, How Canada Turned its Forests into a Carbon Bomb*. Bulletin of the Atomic Scientists. https://thebulletin.org/2023/08/managed-to-death-how-canada-turned-its-forests-into-a-carbon-bomb/; Turner, L. (2023, January 2). *Grassy Narrows marks 20 years of the blockade protecting its land from logging: Community members say the blockade is as urgent now as it was in 2000s*. CBC News. https://www.cbc.ca/news/canada/thunder-bay/grassy-narrows-blockade-20-anniversary-1.6699763; Omstead, J. (2023, November 8). *Scientists call on Canada to adopt ecologically minded forest degradation definition*. CTV News. https://www.ctvnews.ca/mobile/climate-and-environment/scientists-call-on-canada-to-adopt-ecologically-minded-forest-degradation-definition-1.6635698?cache=/7.383921.

4 This is the original header used by *the State of Canada's Forests Annual Report*. NRCAN, 2022 *Op Cit.* In this report, we have avoided the use of possessive terminology to reflect that much of this forest area lies within traditional and/or unceded territory of Indigenous Peoples.

5 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. pp. 13, 27. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

6 NRCAN, 2022, *Op Cit*. p. 28. Notes that Canada uses the FAO's definition of forest, and that this includes "Forest area is still considered to be forest after a temporary loss of tree cover, such as after wildfire or clearcut harvesting." p. 28.

7 Food and Agriculture Organization of the United Nations. (2018). *Terms and definitions—FRA 2020*. Rome. https://www.fao.org/3/I8661EN/i8661en.pdf.

8 Canadian Council of Forest Ministers. (2023). *Harvest*. National Forestry Database. Accessed November 2023. http://nfdp.ccfm.org/en/data/harvest.php.

9 Based on City of Toronto being estimated at 630 km^2. See: https://www.toronto.ca/city-government/data-research-maps/toronto-at-a-glance/.

10 Canadian Council of Forest Ministers. (2023). *Harvest*. National Forestry Database. Accessed November 2023. http://nfdp.ccfm.org/en/data/harvest.php.

11 Thompson, I. (2011). Biodiversity, ecosystem thresholds, resilience and forest degradation. *Unasylva*, *238*(62), 25–30. https://www.fao.org/3/i2560e/i2560e05.pdf.

12 Food and Agriculture Organization of the United Nations. (2020). *Global Forest Resources Assessment 2020: Main report*. Rome. https://doi.org/10.4060/ca9825en.

13 Vásquez-Grandón, A., Donoso, P. J., & Gerding, V. (2018). Forest degradation: when is a forest degraded?. *Forests*, *9*(11), 726. https://www.mdpi.com/1999-4907/9/11/726.

14 United Nations Convention on Global Biodiversity. Framework Guidance Notes prepared by the Secretariat for Target 2. https://www.cbd.int/gbf/targets/2/.

15 Bergeron, Y. & Fenton, N.J. (2012). Boreal forests of eastern Canada revisited: old growth, nonfire disturbances, forest succession, and biodiversity. *Botany*, 90(6), 509–523. https://doi.org/10.1139/b2012-034.

16 Watson, J. E., Evans, T., ... & Lindenmayer, D. (2018). The exceptional value of intact forest ecosystems. *Nature Ecology & Evolution*, 2(4), 599–610. https://doi.org/10.1038/s41559-018-0490-x.

17 McRae, D. J., Duchesne, L. C., Freedman, B., Lynham, T. J., & Woodley, S. (2001). Comparisons between wildfire and forest harvesting and their implications in forest management. *Environmental Reviews*, 9(4), 223–260. https://cdnsciencepub.com/doi/pdf/10.1139/a01-010.

18 Hesselink, T. (2019). *Boreal Logging Scars*. Wildlands League. https://loggingscars.wpengine.com/wp-content/uploads/MyUploads/Summary-for-Decision-Makers.pdf.

19 Ibid.

20 Canadian Council of Forest Ministers. (2023). *Harvest*. National Forestry Database. Accessed November 2023. http://nfdp.ccfm.org/en/data/harvest.php.

21 International Union for the Conservation of Nature. (2020). *IUCN Policy Statement on Primary Forests Including Intact Forest Landscapes*. p. 4. https://www.iucn.org/sites/default/files/2022-05/iucn-policy-statement-for-primary-forests.pdf.

22 Convention on Biological Diversity (2018). *Decision COP XIV/30*. Fourteenth meeting of the Conference of the Parties to the Convention on Biological Diversity. https://www.cbd.int/decisions/cop/14/30.

23 Glasgow Leaders' Declaration on Forests and Land Use. (2021). https://webarchive.nationalarchives.gov.uk/ukgwa/20230401054904/ https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use/.

24 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 6. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

25 Fortune, L., & Matteis, S. (2023, March 10). *Canada, home to a massive boreal forest, lobbied to limit U.S., EU anti-deforestation bills*. CBC News. https://www.cbc.ca/news/canada/canada-boreal-deforestation-lobbying-1.6773789.

26 Kan, S., Chen, B.,... & Du, M. (2023). Risk of intact forest landscape loss goes beyond global agricultural supply chains. *One Earth*, 6(1), 55–65. Supplemental information, Table S3, page 10. Region 27 (Canada). https://doi.org/10.1016/j.oneear.2022.12.006. Calculation is based on a combined value of the loss associated with domestic use and export. For logging, this is 217,000 hectares and 219,000 hectares, amortized per year, respectively, for a total of 436,000 hectares; therefore, the total loss for 2000–2013 period is 5.6 million hectares (communication with lead author).

27 Williams, J., Lapointe, U., Paixao, C., Zanotta, D., & Clark, T. (2021). *Assessing the Impact of Implementing FSC's Protection Measures for Intact Forest Landscapes in Canada*. https://fsc.org/sites/default/files/2021-10/FSC%20CA%20Final%20M34_%20IFL%20_102521.pdf.

28 Food and Agriculture Organization of the United Nations. (2018). *Terms and definitions—FRA 2020*. Rome. https://www.fao.org/3/I8661EN/i8661en.pdf.

29 Ibid. p. 8.

30 Price, K., Holt, R. F., & Daust, D. (2021). Conflicting portrayals of remaining old growth: the British Columbia case. *Canadian Journal of Forest Research*, 51(5), 742–752. https://doi.org/10.1139/cjfr-2020-0453.

31 Potapov, P., Hansen, M. C., ... & Esipova, E. (2017). The last frontiers of wilderness: Tracking loss of intact forest landscapes from 2000 to 2013. *Science Advances*, 3(1), e1600821. p. 1. https://doi.org/10.1126/sciadv.1600821.

32 International Union for the Conservation of Nature. (2020). *IUCN Policy Statement on Primary Forests Including Intact Forest Landscapes*. p. 4. https://www.iucn.org/sites/default/files/2022-05/iucn-policy-statement-for-primary-forests.pdf.

33 Stinson, G., Kurz, W. A., ... & Blain, D. (2011). An inventory-based analysis of Canada's managed forest carbon dynamics, 1990 to 2008. *Global Change Biology*, 17(6), 2227–2244.

34 E.g., Pendril, F., Persson, U. M., ... & Kastner, T. (2019). Deforestation displaced: trade in forest-risk commodities and the prospects for a global forest transition. *Environmental Research Letters*. https://iopscience.iop.org/article/10.1088/1748-9326/ab0d41; Curtis, P. G., Slay, C. M., ... & Hansen, M. C. (2018). Classifying drivers of global forest loss. *Science*. https://www.science.org/doi/10.1126/science.aau3445; Henders, S., Persson, U. M., & Kastner, T. (2015). Trading forests: land-use change and carbon emissions embodied in production and exports of forest-risk commodities. *Environmental Research Letters*. https://iopscience.iop.org/article/10.1088/1748-9326/10/12/125012; Regulation (EU) 2023/1115. https://eur-lex.europa.eu/eli/reg/2023/1115/oj; Forest 500. (2023). 2023: *A Watershed Year for Action on Deforestation*. https://forest500.org/sites/default/files/forest_500-2023_annual_report.pdf.

35 E.g., Curtis, P. G., Slay, C. M., ... & Hansen, M. C. (2018). Classifying drivers of global forest loss. *Science*. https://www.science.org/doi/10.1126/science.aau3445; Hosonuma, N., Herold. M., ... & Romijn, E. (2012). An assessment of deforestation and forest degradation drivers in developing countries. *Environmental Research Letters*. https://iopscience.iop.org/article/10.1088/1748-9326/7/4/044009.

36 World Resources Institute. (2023). *Top 10 Lists*. Global Forest Review. https://research.wri.org/gfr/top-ten-lists#the-top-10-countries-for-total-tree-cover-loss-from-2001-to-2022.

37 Benner, J., & Lertzman, K. (2022). Policy interventions and competing management paradigms shape the long-term distribution of forest harvesting across the landscape. *Proceedings of the National Academy of Sciences*, 119(41), e2208360119. https://doi.org/10.1073/pnas.2208360119.

38 Price, K., Holt, R. F., & Daust, D. (2021). Conflicting portrayals of remaining old growth: the British Columbia case. *Canadian Journal of Forest Research,* 51(5), 742–752. https://doi.org/10.1139/cjfr-2020-0453.

39 See, e.g., Hobbs, J., & Mahon, T. (2023). *Species-At-Risk Recovery in BC—Case Study*. https://www.wildernesscommittee.org/sites/default/files/2023-07/Species-at-risk-Recovery-in-BC_Case-Studies2023FINAL.pdf; Bichet, O., Dupuch, A., Hébert, C., Le Borgne, H., & Fortin, D. (2016). Maintaining animal assemblages through single-species management: the case of threatened caribou in boreal forest. *Ecological Applications*, 26(2), 612–623. https://doi.org/10.1890/15-0525.

40 Anderson, W., Baker, W. L, ... & Wood, P. (2022, March 23). [Letter from Scientists to Prime Minister Justin Trudeau Regarding the Protection of Canada's Primary Forests]. p. 1. Retrieved from https://www.nrdc.org/sites/default/files/media-uploads/primary_forest_scientist_letter-final.pdf.

41 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 37. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

42 Venier, L. A., Thompson, I. D., … & Brandt, J. P. (2014). Effects of natural resource development on the terrestrial biodiversity of Canadian boreal forests. *Environmental Reviews*, 22(4), 457–490. https://doi.org/10.1139/er-2013-0075.

43 Timoney, K. P. (2003). The changing disturbance regime of the boreal forest of the Canadian prairie provinces. *The Forestry Chronicle*, 79(3), 502–516. https://doi.org/10.5558/tfc79502-3; Mackey, B., Campbell, C., … & Drapeau, P. (2023). Assessing the cumulative impacts of forest management on forest age structure development and woodland caribou habitat in boreal landscapes: a case study from two Canadian provinces. *Land*. https://www.mdpi.com/2073-445X/13/1/6.

44 McRae, D. J., Duchesne, L. C., Freedman, B., Lynham, T. J., & Woodley, S. (2001). Comparisons between wildfire and forest harvesting and their implications in forest management. *Environmental Reviews*, 9(4), 223–260. https://doi.org/10.1139/a01-010.

45 Pierce, D. (2018, May 14). *25 Years after the War in the Woods: Why B.C.'s forests are still in crisis*. The Narwhal. https://thenarwhal.ca/25-years-after-clayoquot-sound-blockades-the-war-in-the-woods-never-ended-and-its-heating-back-up/.

46 Wood S. K. (2021, August 28). *How Clayoquot Sound's War in the Woods Transformed a Region*. The Narwhal. https://thenarwhal.ca/clayoquot-sound-tofino-after-war-woods/.

47 Larsen, K. (2021, September 9). *Fairy Creek protest on Vancouver Island now considered largest act of civil disobedience in Canadian history.* CBC News. https://www.cbc.ca/news/canada/british-columbia/fairy-creek-protest-largest-act-of-civil-disobedience-1.6168210.

48 Price, K., Holt, R. F., & Daust, D. (2021). Conflicting portrayals of remaining old growth: the British Columbia case. *Canadian Journal of Forest Research*, 51(5), 742–752.

49 Gorley, A. & Merkel, G. (2020). *A New Future for Old Forests: A Strategic Review of How British Columbia Manages for Old Forests Within its Ancient Ecosystems*. Government of British Columbia. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/old-growth-forests/strategic-review-20200430.pdf.

50 Labbe, S. (2023, March 17). *55% of B.C.'s most threatened old-growth forest still open to logging, says report card*. Times Colonist. https://www.timescolonist.com/resources-agriculture/55-of-bcs-most-threatened-old-growth-forest-still-open-to-logging-says-report-card-6719536.

51 Pawson, C. (2023, October 5). *Provincial data shows increase in old-growth logging, contrary to B.C.'s earlier figures: conservationists*. CBC News. https://www.cbc.ca/news/canada/british-columbia/old-growth-logging-british-columbia-how-much-is-harvested-each-year-1.6987777.

52 Old Growth Technical Advisory Panel. (2021). *Priority Deferrals: An Ecological Approach.* Government of British Columbia. p. 3. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/old-growth-forests/summary_for_g2g_package.pdf.

53 Robertson, A. & Hansen, T. (2023). *Forest Eye: An Eye on Old Growth Destruction*. Stand.earth Research Group. https://stand.earth/wp-content/uploads/2023/11/Forest-Eye-Report-Nov-8-2023.pdf.

54 S. Labbé. (2023, Nov. 8). *Satellite imaging contradicts B.C. government claims on old-growth logging, says group.* Glacier Media, Nov. 8, 2023, https://biv.com/article/2023/11/satellite-imaging-contradicts-bc-government-claims-old-growth-logging-says-group.

55 Government of Canada (2023). *Tripartite Framework Agreement on Nature Conservation*. https://www.canada.ca/en/environment-climate-change/services/integrated-nature-initiatives/nature-agreements/canada-british-columbia-nature-agreement.html.

56 British Columbia Ministry of Water, Land and Resource Stewardship. (2023). *Draft B.C. Biodiversity and Ecosystem Health Framework*. https://www2.gov.bc.ca/assets/gov/environment/biodiversity-habitat-management/draft_biodiversity_and_ecosystem_health_framework.pdf.

57 The World Bank. (2023). *Terrestrial protected areas (% of total land area)*. Accessed November 2023. https://data.worldbank.org/indicator/ER.LND.PTLD.ZS.

58 Lo, V. & Jang, N. (2022, December 6). *The Global Biodiversity Framework's "30x30" Target: Catchy slogan or effective conservation goal?* International Institute for Sustainable Development. https://www.iisd.org/articles/insight/global-biodiversity-framework-30x30-target.

59 Cruikshank, A. (2022, December 8). *Trudeau's conservation promises met with questions about how Canada defines protected areas*. The Narwhal. https://thenarwhal.ca/cop15-trudeau-conservation-goals/.

60 Long, J. N. (2009). Emulating natural disturbance regimes as a basis for forest management: a North American view. *Forest Ecology and Management*, 257(9), 1868–1873.

61 McRae, D. J., Duchesne, L. C., Freedman, B., Lynham, T. J., & Woodley, S. (2001). Comparisons between wildfire and forest harvesting and their implications in forest management. *Environmental Reviews*, 9(4), 223–260.

62 Cyr, D., Gauthier, S., Bergeron, Y., & Carcaillet, C. (2009). Forest management is driving the eastern North American boreal forest outside its natural range of variability. *Frontiers in Ecology and the Environment*, 7(10), 519–524.

63 Parisien, M. A., Peters, V. S., Wang, Y., Little, J. M., Bosch, E. M., & Stocks, B. J. (2006). Spatial patterns of forest fires in Canada, 1980–1999. *International Journal of Wildland Fire*, 15(3), 361–374.

64 McRae, D. J., Duchesne, L. C., Freedman, B., Lynham, T. J., & Woodley, S. (2001). Comparisons between wildfire and forest harvesting and their implications in forest management. *Environmental Reviews*, 9(4), 223–260

65 Martin, M., Grondin, P., Lambert, M. C., Bergeron, Y., & Morin, H. (2021). Compared to wildfire, management practices reduced old-growth forest diversity and functionality in primary boreal landscapes of eastern Canada. *Frontiers in Forests and Global Change*, 4, 639397.

66 Timoney, K. P. (2003). The changing disturbance regime of the boreal forest of the Canadian prairie provinces. *The Forestry Chronicle*, 79(3), 502–516.

67 Hunt, J., & Matute, P. (2019). Review of glyphosate use in British Columbia Forestry. FPInnovations. https://library.fpinnovations.ca/media/FOP/TR2019N21.PDF.

68 St-Pierre, F., Drapeau, P., & St-Laurent, M. H. (2021). Drivers of vegetation regrowth on logging roads in the boreal forest: Implications for restoration of woodland caribou habitat. *Forest Ecology and Management*, 482, 118846.

69 Clevenger, A. (1997). *Highway Effects on Wildlife in Banff National Park: A Research, Monitoring and Adaptive Mitigation Program*. Research Links. https://publications.gc.ca/collections/Collection/R61-16-5-1E.pdf.

70 Whittington, J., Hebblewhite, M., DeCesare, N. J., Neufeld, L., Bradley, M., Wilmshurst, J., & Musiani, M. (2011). Caribou encounters with wolves increase near roads and trails: a time-to-event approach. *Journal of Applied Ecology*, 48(6), 1535–1542.

71 Rowland, M. M., Nielson, R. M., ... & Naylor, B. J. (2021). Influence of landscape characteristics on hunter space use and success. *The Journal of Wildlife Management*, 85(7), 1394–1409.

72 Burke, D. (2017, October 7). *Roadkill deaths driving some species to the edge*. CBC News. https://www.cbc.ca/news/canada/nova-scotia/roadkill-deaths-driving-some-species-to-the-edge-1.4343495.

73 McRae, D. J., Duchesne, L. C., Freedman, B., Lynham, T. J., & Woodley, S. (2001). Comparisons between wildfire and forest harvesting and their implications in forest management. *Environmental Reviews*, 9(4), 223–260.

74 Pedlar, J. H., Pearce, J. L., Venier, L. A., & McKenney, D. W. (2002). Coarse woody debris in relation to disturbance and forest type in boreal Canada. *Forest Ecology and Management*, 158(1–3), 189–194.

75 Watson, J. E., Evans, T., ... & Lindenmayer, D. (2018). The exceptional value of intact forest ecosystems. *Nature Ecology & Evolution*, 2(4), 599–610.

76 Thompson, I., Mackey, B., McNulty, S., & Mosseler, A. (2009). *Forest resilience, biodiversity, and climate change*. United Nations Convention on Biological Diversity, United Nations Environment Programme. Montreal. https://www.cbd.int/doc/publications/cbd-ts-43-en.pdf

77 Martin, M., Grondin, P., Lambert, M. C., Bergeron, Y., & Morin, H. (2021). Compared to wildfire, management practices reduced old-growth forest diversity and functionality in primary boreal landscapes of eastern Canada. *Frontiers in Forests and Global Change*, 4, 639397.

78 Moomaw, W. R., Masino, S. A., & Faison, E. K. (2019). Intact forests in the United States: Proforestation mitigates climate change and serves the greatest good. *Frontiers in Forests and Global Change*, 2, 27.

79 Barredo, J., Mansuy, N., & Mubareka, S. (2023). *Primary and old-growth forests are more resilient to natural disturbances—Perspective on wildfires*. Joint Research Centre—The European Commission's science and knowledge service. https://www.researchgate.net/publication/371911463_Primary_and_old-growth_forests_are_more_resilient_to_natural_disturbances_-_Perspective_on_wildfires.

80 Lesmeister, D. B., Sovern, S. G., Davis, R. J., Bell, D. M., Gregory, M. J., & Vogeler, J. C. (2019). Mixed-severity wildfire and habitat of an old-forest obligate. *Ecosphere*, 10(4), e02696.

81 Zald, H. S., & Dunn, C. J. (2018). Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape. *Ecological Applications*, *28*(4), 1068–1080.

82 Lindsay, B. (2018, November 17). *'It blows my mind': How B.C. destroys a key natural wildfire defence every year.* CBC News. https://www.cbc.ca/news/canada/british-columbia/it-blows-my-mind-how-b-c-destroys-a-key-natural-wildfire-defence-every-year-1.4907358.

83 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 8. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

84 Government of Canada. (2023). *2 Billion T rees Commitment*. Accessed November 2023. https://www.canada.ca/en/campaign/2-billion-trees.html.

85 Commissioner of the Environment and Sustainable Development. (2023). *Report 1: Forests and Climate Change*. 2023 Spring Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada, Office of the Auditor General of Canada. p. iii. https://www.oag-bvg.gc.ca/internet/docs/parl_cesd_202304_01_e.pdf.

86 Ibid.

87 Ibid. p. 13.

88 Ibid.

89 Moomaw, W. R., Masino, S. A., & Faison, E. K. (2019). Intact forests in the United States: Proforestation mitigates climate change and serves the greatest good. *Frontiers in Forests and Global Change*, 2, 27; Cook-Patton, S.C., Drever, C.R., … & Ellis, P. W. (2021). Protect, manage and then restore lands for climate mitigation. *Nature Climate Change*, 11, 1027–1034. https://doi.org/10.1038/s41558-021-01198-0.

90 Government of Canada. (2022). *Forest management certification in Canada*. Accessed November 2023. https://natural-resources.canada.ca/our-natural-resources/forests/sustainable-forest-management/forest-management-certification-canada/17474.

91 Beaulieu, Y. (2021, April 21). [Letter from Consul Yves Beaulieu to Chair of the California Assembly Accountability and Administrative Review Committee]. p. 1. Retrieved from https://www.documentcloud.org/documents/23701064-consul-letter-to-california-assembly-april-2021.

92 Labee, S. (2022, December 2). *Canada's largest sustainable forestry program accused of greenwashing*. Business Intelligence for BC. https://biv.com/article/2022/12/canadas-largest-sustainable-forestry-program-accused-greenwashing.

93 Weber, B. (2023, February 1). *Canada's Competition Bureau to probe forestry industry ads on sustainable management*. Global News. https://globalnews.ca/news/9453158/canadas-competition-bureau-forestry-industry-ads-sustainable-management/.

94 Black, S. H. (2005). *Logging to Control Insects: The Science and Myths Behind Managing Forest Insect 'Pests' —A Synthesis of Independently Reviewed Research*. The Xerces Society for Invertebrate Conservation. Portland, Oregon. https://xerces.org/sites/default/files/2018-05/05-001_01_XercesSoc_Logging-to-Control-Insects_web.pdf.

95 Six, D. L., Vergobbi, C., & Cutter, M. (2018). Are survivors different? Genetic-based selection of trees by mountain pine beetle during a climate change-driven outbreak in a high-elevation pine forest. *Frontiers in Plant Science*, 9, 993.

96 Parfitt, B. (2022, April 14). *The Looming Crash Facing Down BC's Forest Industry*. The Tyee. https://thetyee.ca/Analysis/2022/04/14/Looming-Crisis-Facing-BC-Forest-Industry/.

97 Thompson, I. D., Okabe, K., … & Nasi, R. (2011). Forest biodiversity and the delivery of ecosystem goods and services: translating science into policy. *BioScience*, 61(12), 972–981.

98 World Economic Forum. (2020). *Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy*. Geneva. https://www3.weforum.org/docs/WEF_New_Nature_Economy_Report_2020.pdf.

99 Canadian Endangered Species Conservation Council. (2022). *Wild Species 2020: The General Status of Species in Canada*. National General Status Working Group. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/reports/Wild%20Species%202020.pdf.

100 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 12. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

101 Frank, D., Finckh, M., & Wirth, C. (2009). Impacts of land use on habitat functions of old-growth forests and their biodiversity. *Old-Growth Forests: Function, Fate and Value*, 429–450.

102 Bridger, M. C., Johnson, C. J., & Gillingham, M. P. (2016). Assessing cumulative impacts of forest development on the distribution of furbearers using expert-based habitat modeling. *Ecological Applications*, 26(2), 499–514.

103 Hobbs, J., & Mahon, T. (2023). *Species-At-Risk Recovery in BC—Case Study*. https://www.wildernesscommittee.org/sites/default/files/2023-07/Species-at-risk-Recovery-in-BC_Case-Studies2023FINAL.pdf.

104 Environment and Climate Change Canada. (2017). *Report on the Progress of Recovery Strategy Implementation for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population in Canada for the Period 2012-2017*. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada. Ottawa. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/woodland-caribou-report-2012-2017.html.

105 Bichet, O., Dupuch, A., Hébert, C., Le Borgne, H., & Fortin, D. (2016). Maintaining animal assemblages through single-species management: the case of threatened caribou in boreal forest. *Ecological Applications*, 26(2), 612–623.

106 Ibid.

107 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 10. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

108 Whittington, J., Hebblewhite, M., DeCesare, N. J., Neufeld, L., Bradley, M., Wilmshurst, J., & Musiani, M. (2011). Caribou encounters with wolves increase near roads and trails: a time-to-event approach. *Journal of Applied Ecology*, 48(6), 1535–1542.

109 Serrouya, R., Dickie, M., … & Boutin, S. (2021). Trophic consequences of terrestrial eutrophication for a threatened ungulate. *Proceedings of the Royal Society B*, 288(1943), p.20202811.

110 DeCesare, N. J., Hebblewhite, M., Robinson, H. S., & Musiani, M. (2010). Endangered, apparently: the role of apparent competition in endangered species conservation. *Animal Conservation*, 13(4), 353–362.

111 Serrouya, R., McLellan, B. N., van Oort, H., Mowat, G., & Boutin, S. (2017). Experimental moose reduction lowers wolf density and stops decline of endangered caribou. *PeerJ*, 5, e3736.

112 Mumma, M. A., Gillingham, M. P., Parker, K. L., Johnson, C. J., & Watters, M. (2018). Predation risk for boreal woodland caribou in human-modified landscapes: Evidence of wolf spatial responses independent of apparent competition. *Biological Conservation*, 228, 215–223.

113 Environment Canada. (2012). *Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada*. Species at Risk Act Recovery Strategy Series. Environment Canada. Ottawa. https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/plans/rs_caribou_boreal_caribou_0912_e1.pdf.

114 Environment and Climate Change Canada. (2017). *Report on the Progress of Recovery Strategy Implementation for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population in Canada for the Period 2012-2017*. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada. Ottawa. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/woodland-caribou-report-2012-2017.html.

115 Environment and Climate Change Canada. (2020). *Amended Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada*. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada. Ottawa. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/woodland-caribou-boreal-2020.html.

116 Stewart, F. E., Nowak, J. J., Micheletti, T., McIntire, E. J., Schmiegelow, F. K., & Cumming, S. G. (2020). Boreal caribou can coexist with natural but not industrial disturbances. *The Journal of Wildlife Management*, 84(8), 1435–1444.

117 Environment and Climate Change Canada. (2020). *Amended Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada*. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada. Ottawa. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/woodland-caribou-boreal-2020.html.

118 *Little Smoky / A La Peche Caribou Compartment Series—operational guidelines*. (2018). See: https://albertawilderness.ca/wp-content/uploads/2018/06/20180601_doc_lsmalp_goa_forestry_compartmt_access.pdf.

119 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 10. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496

120 Ibid.

121 Betts, M. G., Yang, Z., … & Gerber, B. D. (2022). Forest degradation drives widespread avian habitat and population declines. *Nature Ecology & Evolution*, 6(6), 709–719.

122 Burger, A. E., Masselink, M. M., Tillmanns, A. R., Szabo, A. R., Farnholtz, M. A. T. H. E. W., & Krkosek, M. J. (2004, March). Effects of habitat fragmentation and forest edges on predators of marbled murrelets and other forest birds on southwest Vancouver Island. In *Species at Risk 2004 Pathways to Recovery Conference*.

123 World Resources Institute, Forest Carbon Stocks, https://research.wri.org/gfr/biodiversity-ecological-services-indicators/forest-carbon-stocks.

124 Peng, L., Searchinger, T. D., Zionts, J., & Waite, R. (2023). The carbon costs of global wood harvests. *Nature*, 620(7972), 110–115.

125 Commissioner of the Environment and Sustainable Development. (2023). *Report 1: Forests and Climate Change. 2023 Spring Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada, Office of the Auditor General of Canada*. https://www.oag-bvg.gc.ca/internet/docs/parl_cesd_202304_01_e.pdf.

126 Noon, M. L., Goldstein, A., … & Turner, W. R. (2022). Mapping the irrecoverable carbon in Earth's ecosystems. *Nature Sustainability*, 5(1), 37–46. p. 39.

127 Dean, C., Kirkpatrick, J. B., & Friedland, A. J. (2017). Conventional intensive logging promotes loss of organic carbon from the mineral soil, *Global Change Biology*, 23(1), 1-11. https://doi.org/10.1111/gcb.13387.

128 James, J. & Harrison, R. (2016). The Effect of Harvest on Forest Soil Carbon: A Meta-Analysis, Forests. 7(12), 308. https://doi.org/10.3390/f7120308.

129 Vantellingen, J., & Thomas, S. C. (2021). Log landings are methane emission hotspots in managed forests. *Canadian Journal of Forest Research*, 51(12), 1916–1925.

130 Ingerson, A. (2011). Carbon storage potential of harvested wood: summary and policy implications. *Mitigation and Adaptation Strategies for Global Change*, 16, 307–323.

131 Malcolm, J. R., Holtsmark, B., & Piascik, P. W. (2020). Forest harvesting and the carbon debt in boreal east-central Canada. *Climatic Change*, 161, 433–449.

132 Leturcq, P. (2020). GHG displacement factors of harvested wood products: the myth of substitution. *Scientific Reports*, 10(1), 20752. p. 5.

133 Skytt, T., Englund, G., & Jonsson, B. G. (2021). Climate mitigation forestry—temporal trade-offs. *Environmental Research Letters*, 16(11), 114037.

134 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 9. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

135 Bramley, M., & Saul, G. (2022). *What are the net greenhouse gas emissions from logging in Canada?* Nature Canada and NRDC. https://naturecanada.ca/wp-content/uploads/2022/10/Report-What-Are-Net-GHG-Emissions-From-Logging-in-Canada.pdf.

136 Bysouth, D., Boan, J., Malcolm J., & Taylor, A. (in press). High emissions or carbon neutral? Inclusion of "anthropogenic" forest sinks leading to underreporting of forestry emissions. *Frontiers in Forests and Global Change*.

137 Government of Canada. (2021). *National Inventory Report 1990–2021: Greenhouse Gas Sources and Sinks in Canada*. https://publications.gc.ca/collections/collection_2023/eccc/En81-4-2021-1-eng.pdf.

138 Bysouth, D., Boan, J., Malcolm J., & Taylor, A. (2024). High emissions or carbon neutral? Inclusion of "anthropogenic" forest sinks leading to underreporting of forestry emissions. *Frontiers in Forests and Global Change*. https://doi.org/10.3389/ffgc.2023.1297301

139 Ibid.

140 Bramley, M., & Saul, G. (2022). *What are the net greenhouse gas emissions from logging in Canada?* Nature Canada and NRDC. https://naturecanada.ca/wp-content/uploads/2022/10/Report-What-Are-Net-GHG-Emissions-From-Logging-in-Canada.pdf.

141 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 9. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

142 Ingerson, A. (2011). Carbon storage potential of harvested wood: summary and policy implications. *Mitigation and Adaptation Strategies for Global Change*, 16, 307–323.

143 Ibid.

144 Ibid.

145 Hudiburg, T. W., Law, B. E., Moomaw, W. R., Harmon, M. E., & Stenzel, J. E. (2019). Meeting GHG reduction targets requires accounting for all forest sector emissions. *Environmental Research Letters*, 14(9), 095005.

146 Howard, C., Dymond, C. C., Griess, V. C., Tolkien-Spurr, D., & van Kooten, G. C. (2021). Wood product carbon substitution benefits: a critical review of assumptions. *Carbon Balance and Management*, 16, 1–11.

147 Harmon, M. E. (2019). Have product substitution carbon benefits been overestimated? A sensitivity analysis of key assumptions. *Environmental Research Letters*, 14(6), 065008.

148 Stand.earth Research Group. (2020). *Canada's Growing Wood Pellet Export Industry Threatens Forests, Wildlife and our Climate*. https://stand.earth/wp-content/uploads/2022/10/report-canada-wood-pellet-industry.pdf.

149 United States Department of Agriculture. (2023). *Canada Wood Pellet Annual*. https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Canada%20Wood%20Pellet%20Annual_Ottawa_Canada_CA2023-0002.pdf.

150 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 71. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

151 Sterman, J. D., Siegel, L., & Rooney-Varga, J. N. (2018). Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy. *Environmental Research Letters*, 13(1), 015007.

152 World Energy Data. (2022). *Could Or Should Wood Be A Climate Solution?* https://www.worldenergydata.org/could-or-should-wood-be-a-climate-solution/.

153 Raven, P., Berry, S., ... & Settele, Josef. (2021, February 11). [Letter Regarding Use of Forests for Bioenergy, addressed to President Biden, President von der Leyen, President Michel, Prime Minister Suga, and President Moon]. p. 1. Retrieved from https://www.dropbox.com/s/hdmmcnd0d1d2lq5/Scientist%20Letter%20to%20Biden%2C%20von%20der%20Leyen%2C%20Michel%2C%20Suga%20%26%20Moon%20%20Re.%20Forest%20Biomass%20%28February%2011%2C%202021%29.pdf?dl=0.

154 Cox, S. (2020, April 23). *B.C. giving millions to transform rainforest into wood pellets for export, new report documents*. The Narwhal. https://thenarwhal.ca/climate-bc-millions-rainforest-wood-pellets-export-report-documents/.

155 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 8. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

156 Hesselink, T. (2019). *Boreal Logging Scars*. Wildlands League. https://loggingscars.wpengine.com/wp-content/uploads/MyUploads/Summary-for-Decision-Makers.pdf.

157 Coursolle, C., Margolis, H. A., ... & Lafleur, P. M. (2012). Influence of stand age on the magnitude and seasonality of carbon fluxes in Canadian forests. *Agricultural and Forest Meteorology*, 165, 136–148.

158 Kurz, W. A., Shaw, C. H., ... & Neilson, E. T. (2013). Carbon in Canada's boreal forest—a synthesis. *Environmental Reviews*, 21(4), 260–292.

159 Malcolm, J. R., Holtsmark, B., & Piascik, P. W. (2020). Forest harvesting and the carbon debt in boreal east-central Canada. *Climatic Change*, 161, 433–449.

160 Rogelj, J., Shindell, D., ... & Zickfeld, K. (2018). Mitigation pathways compatible with 1.5 C in the context of sustainable development. In *Global warming of 1.5 C* (pp. 93–174). Intergovernmental Panel on Climate Change.

161 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 6. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

162 Malcolm, J. R., Holtsmark, B., & Piascik, P. W. (2020). Forest harvesting and the carbon debt in boreal east-central Canada. *Climatic Change*, 161, 433–449.

163 Mo, L., Zohner, C. M., ... & Ortiz-Malavasi, E. (2023). Integrated global assessment of the natural forest carbon potential. *Nature*, 1–10.

164 Cook-Patton, S. C., Drever, C. R., ... & Ellis, P. W. (2021). Protect, manage and then restore lands for climate mitigation. *Nature Climate Change*, 11(12), 1027–1034.

165 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 1. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496

166 Government of Canada. (2023). *Government of Canada and the duty to consult*. Accessed November 2023. https://www.rcaanc-cirnac.gc.ca/eng/1331832510888/1609421255810

167 Borrows, J. (1999). *Sovereignty's Alchemy: An Analysis of* Delgamuukw v. British Columbia. Osgoode Hall LJ, 37, 537.

168 United Nations Environment Programme. (2004). Haida Nation v. British Columbia (Minister of Forests). https://leap.unep.org/en/countries/ca/national-case-law/haida-nation-v-british-columbia-minister-forests.

169 Supreme Court of British Columbia. (2014). Tsilhqot'in Nation vs. British Columbia. https://www.crownpub.bc.ca/content/documents/williams_decision.pdf.

170 Government of Canada. (2010). Canada Endorses the United Nations Declaration on the Rights of Indigenous Peoples. https://www.canada.ca/en/news/archive/2010/11/canada-endorses-united-nations-declaration-rights-indigenous-peoples.html.

171 Government of Canada. (2023). *United Nations Declaration on the Rights of Indigenous Peoples Act (S.C. 2021, c. 14)*. Justice Laws Website. Accessed November 2023. https://laws-lois.justice.gc.ca/eng/acts/U-2.2/.

172 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 23. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

173 Government of Canada. (2023). *United Nations Declaration on the Rights of Indigenous Peoples Act: Action Plan*. p. 12. https://www.justice.gc.ca/eng/declaration/ap-pa/ah/pdf/unda-action-plan-digital-eng.pdf.

174 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 36. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

175 IPCAs are areas of land and water managed by Indigenous governments according to Indigenous laws, governance, and knowledge systems. *We rise together: achieving pathway to Canada target 1 through the creation of Indigenous protected and conserved areas in the spirit and practice of reconciliation: the Indigenous Circle of Experts' report and recommendations.* (2018). https://publications.gc.ca/site/eng/9.852966/publication.html.

176 Natural Resources Canada. (2022). *The State of Canada's Forests Annual Report*. p. 24. https://natural-resources.canada.ca/our-natural-resources/forests/state-canadas-forests-report/16496.

177 McIntosh, M. (2023, June 15). *Ontario is ignoring internal advice that supported Indigenous-led conservation*. The Narwhal. https://thenarwhal.ca/ontario-indigenous-conservation-recommendations/

178 Reed, G., Brunet, N. D., McGregor, D., Scurr, C., Sadik, T., Lavigne, J., & Longboat, S. (2022). Toward Indigenous visions of nature-based solutions: an exploration into Canadian federal climate policy. *Climate Policy*, 22(4), 514–533.

179 National Aboriginal Forestry Association. (2020). *Fifth Report on Indigenous-held Forest Tenures in Canada*. 2020. https://www.nafaforestry.org/pdf/2020/NAFA%20Fifth%20Report%20on%20Indigenous-Held%20Forest%20Tenures%20in%20Canada%202020.pdf.

180 Turner, L. (2023, January 2). *Grassy Narrows marks 20 years of the blockade protecting its land from logging*. CBC News. https://www.cbc.ca/news/canada/thunder-bay/grassy-narrows-blockade-20-anniversary-1.6699763.

181 Cox, S. (2021, July 1). *Inside the Pacheedaht Nation's stand on Fairy Creek logging blockades*. The Narwhal. https://thenarwhal.ca/pacheedaht-fairy-creek-bc-logging/.

182 The Canadian Press. (2021, November 5). *Indigenous leaders concerned over B.C.'s process for old-growth logging deferrals*. CTV News. https://vancouverisland.ctvnews.ca/indigenous-leaders-concerned-over-b-c-s-process-for-old-growth-logging-deferrals-1.5653831.

183 Patterson, H. (2023). *Environmental and socio-cultural impacts of glyphosate-based herbicides: Insights from Indigenous Knowledge and Western Science* [Doctoral dissertation, University of Guelph]. https://atrium.lib.uoguelph.ca/server/api/core/bitstreams/94975db5-d313-45a2-a8f6-6ddf96def521/content.

184 Kayahara, G. J., & Armstrong, C. L. (2015). Understanding First Nations rights and perspectives on the use of herbicides in forestry: A case study from northeastern Ontario. *The Forestry Chronicle*, 91(2), 126–140.

185 Saw Sha Bwe Moo, X. X. X. (2022). *Impacts of Silvicultural Herbicides on Indigenous Ethnobotanical Species of the Boreal Forest Region of Canada* [Doctoral dissertation, University of Guelph]. https://atrium.lib.uoguelph.ca/server/api/core/bitstreams/288c4b65-9b03-4948-bc93-7785547e2b5a/content.

186 Cruickshank, A. (2022, April 12). *Spraying herbicides from helicopters? Concerns mount over plans for southern B.C. forests*. The Narwhal. https://thenarwhal.ca/glyphosate-southern-bc-forests/.

187 Pérez, G. L., Vera, M. S., & Miranda, L. A. (2011). Effects of herbicide glyphosate and glyphosate-based formulations on aquatic ecosystems. *Herbicides and Environment*, 16, 343–368.

188 Arangio, S. (2021, January 23). *'It's a dead forest': northern bush pilot, First Nations decry herbicide spraying*. CTV News. https://northernontario.ctvnews.ca/it-s-a-dead-forest-northern-bush-pilot-first-nations-decry-herbicide-spraying-1.5279546.

189 Pitt, D. G., Wagner, R. G., & Towill, W. D. (2004). Ten years of vegetation succession following ground-applied release treatments in young black spruce plantations. *Northern Journal of Applied Forestry*, 21(3), 123–134.

190 Donovan, M. (2022, June 1). *Glyphosate spraying in N.B. akin to 'eco-genocide,' Indigenous communities say*. Canada's National Observer. https://www.nationalobserver.com/2022/06/01/news/glyphosate-spraying-akin-eco-genocide-nb-indigenous-communities-say.

191 CBC News. (2022, October 6). *3 northern First Nations take Ontario to court over environmental protection, treaty rights*. CBC News. https://www.cbc.ca/news/canada/sudbury/first-nations-ontario-court-1.6608276.

192 Chiblow, S. (2021, November). *Traditional Ecological Elders Group Update*. RHW Treaty Times—Dagwaagin/Biboon. https://issuu.com/waawiindamaagewin/docs/rhw_treatytimes_issue2/s/13684528.

193 Dawe, C. (2023, August 2). *Toxic glyphosate to be sprayed over Ma'amtagila Nation territory*. Wilderness Committee. https://www.wildernesscommittee.org/news/toxic-glyphosate-be-sprayed-over-maamtagila-nation-territory.

194 E.g., Pendril, S., Persson, U. M., … & Kastner, T. (2019). Deforestation displaced: trade in forest-risk commodities and the prospects for a global forest transition. *Environmental Research Letters*. https://iopscience.iop.org/article/10.1088/1748-9326/ab0d41; Curtis, P. G., Slay, C. M., … & Hansen, M. C. (2018). Classifying drivers of global forest loss. *Science*. https://www.science.org/doi/10.1126/science.aau3445; Henders, S., Persson, U. M., & Kastner, T. (2015). Trading forests: land-use change and carbon emissions embodied in production and exports of forest-risk commodities. *Environmental Research Letters*. https://iopscience.iop.org/article/10.1088/1748-9326/10/12/125012; Regulation (EU) 2023/1115. https://eur-lex.europa.eu/eli/reg/2023/1115/oj; Forest 500. (2023). *2023: A Watershed Year for Action on Deforestation*. https://forest500.org/sites/default/files/forest_500-2023_annual_report.pdf.

195 E.g., Curtis, P. G., Slay, C. M., … & Hansen, M. C. (2018). Classifying drivers of global forest loss. *Science*. https://www.science.org/doi/10.1126/science.aau3445; Hosonuma, N., Herold. M., … & Romijn, E. (2012). An assessment of deforestation and forest degradation drivers in developing countries. *Environmental Research Letters*. https://iopscience.iop.org/article/10.1088/1748-9326/7/4/044009.