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REPORT

COUNTING ON CANADA'S COMMITMENTS:

TO HALT AND REVERSE FOREST DEGRADATION BY 2030, CANADA MUST FIRST ADMIT IT HAS A PROBLEM

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EXECUTIVE SUMMARY

Forests are an integral part of Canada. They protect biodiversity, regulate climate, provide jobs, and sustain Indigenous knowledge systems. Yet despite Canada's claims that its laws protect the ecological integrity of its forests, forest degradation has occurred across Canada with insufficient government acknowledgement, scrutiny, or recourse. The loss or deterioration of ecological integrity has led to widespread fragmentation of primary and natural forests, reduced carbon storage capacity in plants and soils, shifts in age class and tree species composition, and declines in specific forest-dwelling animal species such as the spotted owl and boreal woodland caribou. It has also led to observed loss of abundance of forest foods and medicines by Indigenous knowledge holders.

Addressing forest degradation is essential for Canada to fulfill its commitments to the Paris Climate Agreement (2015), the Kunming-Montreal Global Biodiversity Framework (2022), and the Global Stocktake (2023). However, Canada, like many other Global North nations, has not publicly recognized that forest degradation is an issue within its own borders. Instead, government agencies and the forestry industry largely focus on *deforestation*—the conversion of forests to non-forested areas like cities or farmland—and claim victory for the limited amount of deforestation occurring under their watch.[1] However, this approach gives credit for simply maintaining designated forestlands as "forest" and largely ignores the quality of those forest ecosystems.

At the same time, forest industry lobbyists and natural resource policymakers continue to claim—directly and indirectly—that forests in Canada are not experiencing degradation and are in fact protected against degradation and loss of ecological integrity, often citing current provincial forestry regulations as a safeguard.[2] However, research shows that forest degradation is occurring even in areas where provincial forestry regulations exist.[3]

This report explores specific examples of forest degradation using empirical evidence of the loss of structure, function, and/or composition in various forest ecosystems across Canada. These include 1) degradation of forest ecosystems (forest fragmentation, species composition outside the natural range of variation, impairment of function of belowground ecosystems), 2) degradation of wildlife habitats (affecting boreal caribou, bird species dependent on mature forests, and the amount of coarse woody debris), and 3) degradation of ecosystem services (increased risk of extreme flooding and wildfires).

Without fundamental changes in forest management practices, incentives, and policy structures, forest degradation will continue to occur—unchecked and largely unmonitored—causing potentially irreversible harms to Canada's forests and damaging Canada's ability to meet its biodiversity and climate change commitments.

INTRODUCTION

FOREST DEGRADATION AND THE WORLD

Most terrestrial biodiversity on earth is found in forests.[4] Forests help maintain water quality and regulate water cycles and supply essential goods such as lumber and paper products. Forests also hold spiritual and cultural importance to many Indigenous Peoples, and they provide recreational opportunities, including hiking and wildlife observation. The world's forests, from the canopy to the soil beneath them, are also essential for storing and sequestering carbon, which helps slow the atmospheric buildup of greenhouse gases that drive climate change.[5]

For forests to continue to provide these essential values, it is critical to maintain their ecological integrity—that is, the degree to which an ecosystem's composition, structure, and function are similar to its natural or reference state. *Forest degradation* generally refers to a loss or deterioration of that ecological integrity. Degradation is a significant factor in the decline of biodiversity and contributes to the loss of carbon stores, among other ecosystem services.[6] Forest degradation can at times be difficult to detect, because loss of ecological integrity can be incremental (e.g., a slow-moving, decades-long loss of species abundance) or largely invisible to human perception (e.g., belowground ecosystem damage).[7] Additionally, conceptualizations of forest degradation can be subject to the "shifting baseline" syndrome, whereby forest managers gradually forget what a non-degraded ecosystem looks like and therefore continually lower their expectations, without ever realizing this is occurring.[8]

Forest degradation occurs on a spectrum ranging from minimal to severe and sometimes irreversible.[9] At the lowest level of harm on the spectrum, forests can recover within a short time, while severe degradation causes longer-lasting changes that can be difficult or nearly impossible to reverse within a meaningful time frame and without massive investments. Even then, the ability to sufficiently restore ecological integrity is uncertain. Degradation can also happen at multiple spatial scales—from individual sites to entire landscapes.[10]

Key indicators of forest degradation include depletion of old-growth forest ecosystems, fragmentation of primary and natural forests, reduction of carbon storage capacity in forest plants and soils, shifts in age class and tree species composition, shifts in predator–prey dynamics, and declines in forest-dwelling species. Degradation also diminishes forest resilience (the ability of forests to recover) as climate change makes natural disturbances such as extreme flooding and wildfires more frequent and severe.

Scientists have warned about the impacts of ecological degradation for more than 30 years. More than 1,700 independent scientists and the Union of Concerned Scientists wrote and signed the World Scientists' Warning to Humanity in 1992, urging individuals and organizations to take steps to lessen environmental degradation.[11] The international community has agreed on the imperative of halting and reversing deforestation and forest degradation, as well as biodiversity loss, by 2030, as reflected in the Paris Climate Agreement (2015), the Kunming-Montreal Global Biodiversity Framework (2022), and the Global Stocktake (2023).[12] Yet many nations, including Canada, fail to fully acknowledge that forest degradation is an issue—or, despite empirical evidence to the contrary, suggest that the risks of forest degradation have been resolved.

FOREST DEGRADATION AND CANADA

To date, the Canadian government has neither publicly defined degradation and acknowledged where and to what extent it is occurring domestically, nor recognized it as an issue to be addressed.[13] Instead, Canadian government agencies and the forestry industry focus on the country's relatively low rates of *deforestation* (the conversion of forests to non-forested areas like cities or farmland) in communications about forest management, using this as a pillar of their sustainability claims.[14] This type of accounting claims credit for simply how much land remains designated as "forest" and largely ignores the quality of those forest ecosystems. The result is a misconception that industrial activities have not detrimentally impacted forests' ecological integrity. Meanwhile, the dominant forestry practices in Canada—clearcut logging, often combined with herbicide spraying and conifer planting—focus on maximizing timber production and regrowing commercially valuable fiber. Research shows that forest degradation has occurred and continues to occur across forest ecosystems in Canada, in some cases even potentially irreversibly (e.g., where species have been extirpated or are at risk of extirpation), even under provincial regulations that are assumed to offer safeguards against such degradation.[15] This suggests that rules governing forest management are either poorly enforced; inadequately implemented; or lacking in evidence-based targets, baselines, and reasonable timelines to meet ecological objectives.

Natural Resources Canada highlights that Canada's "forest areas" have remained constant over time (see Figure 1). This indicator emphasizes forest quantity, (which includes both areas with current forest cover and recently clearcut or disturbed forests that are expected to grow back to forests in the future), over quality (high ecological integrity). This approach overlooks the cumulative footprint and associated impacts of decades of industrial logging and other development activities that have degraded forests across Canada—for example, how the combination of simplified forest structure, fragmentation, and younger forests have impacted biodiversity.[16] Additionally, governments rarely acknowledge that the design and implementation of forest management policies, as well as indicators measured to determine sustainability, are deeply influenced by political and economic systems significantly shaped by the very industry they seek to regulate.[17]

This report examines key indicators of forest degradation in Canada and offers recommendations for a more effective approach to addressing this problem—one that recognizes the need for fundamental changes in current forest management planning and practices. Tackling forest degradation requires expanding the concept of "sustainability" beyond the forestry sector's emphasis on maintaining a steady-state supply of fiber for mills while attempting to mitigate impacts on other economic, environmental, social, and cultural benefits. Instead, forest management must apply a whole-of-government approach that prioritizes maintaining and restoring the ecological integrity of forests, ensuring their ongoing ability to provide a wide range of ecosystem services, protecting biodiversity, and preserving resilience.[18] This will require leveraging the best available science to deepen our understanding of forest degradation and developing and implementing transparent, monitored, and adaptive strategies to halt and reverse it. Indigenous Peoples, as long-term stewards of the land, bring distinct perspectives and indicators of forest health; therefore, respect for and integration of Indigenous knowledge and governance frameworks are necessary to develop effective responses to forest degradation.

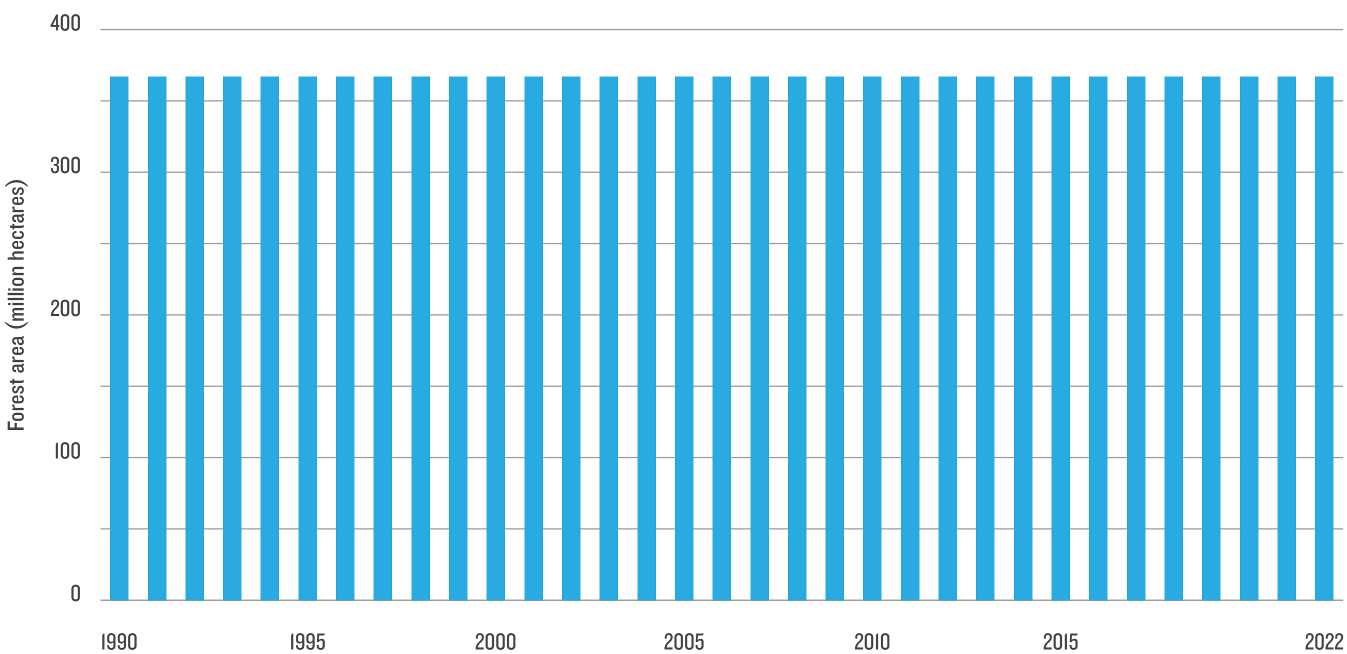
THE DIFFERENCE BETWEEN DEFORESTATION AND FOREST DEGRADATION

Deforestation: The conversion of forest to another land use (e.g., the clearcutting of tropical forests for agriculture).

Forest degradation: The loss of a forest ecosystem's ability to provide essential goods and services to both nature (such as wildlife habitat) and people (such as reduction of extreme flood risk). Degradation drivers include multiple forms of industrial development, which can include clearcutting and road building that alters native species composition, structure, and functionality.[19]

FIGURE 1: CANADA'S SEEMINGLY UNCHANGING FOREST

Using this graph, the 2023 *State of Canada's Forests* report emphasizes the lack of significant change in forest area across Canada but obscures change in forest quality, including forest fragmentation and shifts to younger forests. Canada has made a commitment to halt and reverse forest degradation by 2030, yet public reporting focuses on the comparatively small percentage of the entire managed forest that is logged each year and ignores the cumulative footprint and associated impacts of decades of industrial logging and other development activities.



Graph credit: Natural Resources Canada (2023)[20]

HOW FORESTRY ACTIVITIES HAVE DEGRADED FOREST ECOSYSTEMS

Among the most readily identifiable indicators of forest degradation are the fragmentation (by logging roads and other infrastructure) of intact forests upon which many wildlife species depend, changes to the natural composition of tree species and age-class variations, and the depletion of carbon stored in underground root networks and associated mycorrhizal fungi.

EVIDENCE OF FOREST FRAGMENTATION AND EXPANSION OF THE INDUSTRIAL FOOTPRINT

One of the main pillars of the forestry sector's claim to sustainability is that its practices emulate natural disturbances.[21] Logging roads are a stark example of how this claim often fails in practice. Natural disturbances do not generate roads, whereas industrial development activities, including logging, do.

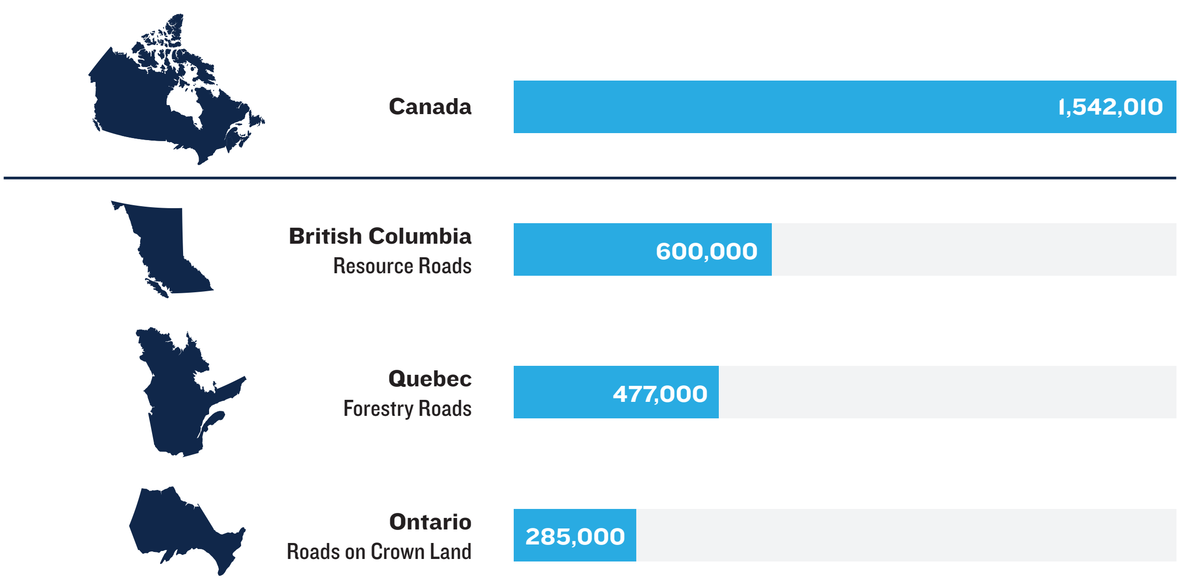
According to CBC News, Canada has more than 1.5 million kilometers of logging and resource access roads.[22] That's almost enough to circle the earth 37 times. About 88 percent of these roads are in three provinces: British Columbia, Quebec, and Ontario (see Figure 2). Decades of research illustrate the significant impact of logging and resource access roads on both wildlife populations and forest structure.[23]

While some logging and resource access roads are slated for decommissioning and potential restoration activities, the monitoring of restoration efforts is highly inconsistent and often fails to align with key wildlife conservation goals, such as maintaining and restoring critical caribou habitat, or with federal objectives to halt and reverse nature loss.[24]

Logging roads contribute to wildlife decline in many ways, including through increased mortality from vehicle collisions.[25] To adapt, many species, such as wolverine and boreal caribou, generally avoid roads, which can alter their natural behaviors and vastly decrease their geographic range.[26] However, direct mortality and reduced range are just two of the ways roads drive wildlife decline. Roads also impact forest structure and have cascading impacts on ecosystems (see Figure 3).[27]

FIGURE 2: CANADA'S LOGGING AND RESOURCE ACCESS ROADS

More than 1.5 million kilometers (932,000 miles) of logging, mining, and oil and gas exploration roads—often referred to as resource roads—snake across Canada, enough to circle the earth nearly 37 times.



Credit: CBC Investigates, 2022[28]

FIGURE 3:

Logging roads can degrade forest ecosystems in several ways. They fragment habitat, increase predator access, and raise the risk of erosion and sedimentation deposits in waterways. Additionally, they create edge habitats that decrease habitat quality for species dependent on interior forest environments. Roads also have cascading effects by enabling the construction of more roads and supporting further development, increasing cumulative impacts on forested landscapes.

Credit: Courtenay Lewis

Logging roads increase predation risks and predator success rates. For instance, wolves are more successful at hunting caribou in areas where roads and other linear features fragment their habitat.[29] Roads also affect other fish and game species, such as lake trout and moose, where increased forest accessibility can lead to overexploitation through unsustainable levels of hunting and fishing.[30] Additionally, habitat fragmentation caused by roads creates more edge habitat than would exist in roadless forests, which can negatively impact species that depend on interior forest areas.[31] In British Columbia, for example, increased fragmentation from old-growth forest logging has led to higher predation rates on the eggs of the marbled murrelet—a threatened seabird that relies on coastal old-growth, interior forests for nesting.[32]

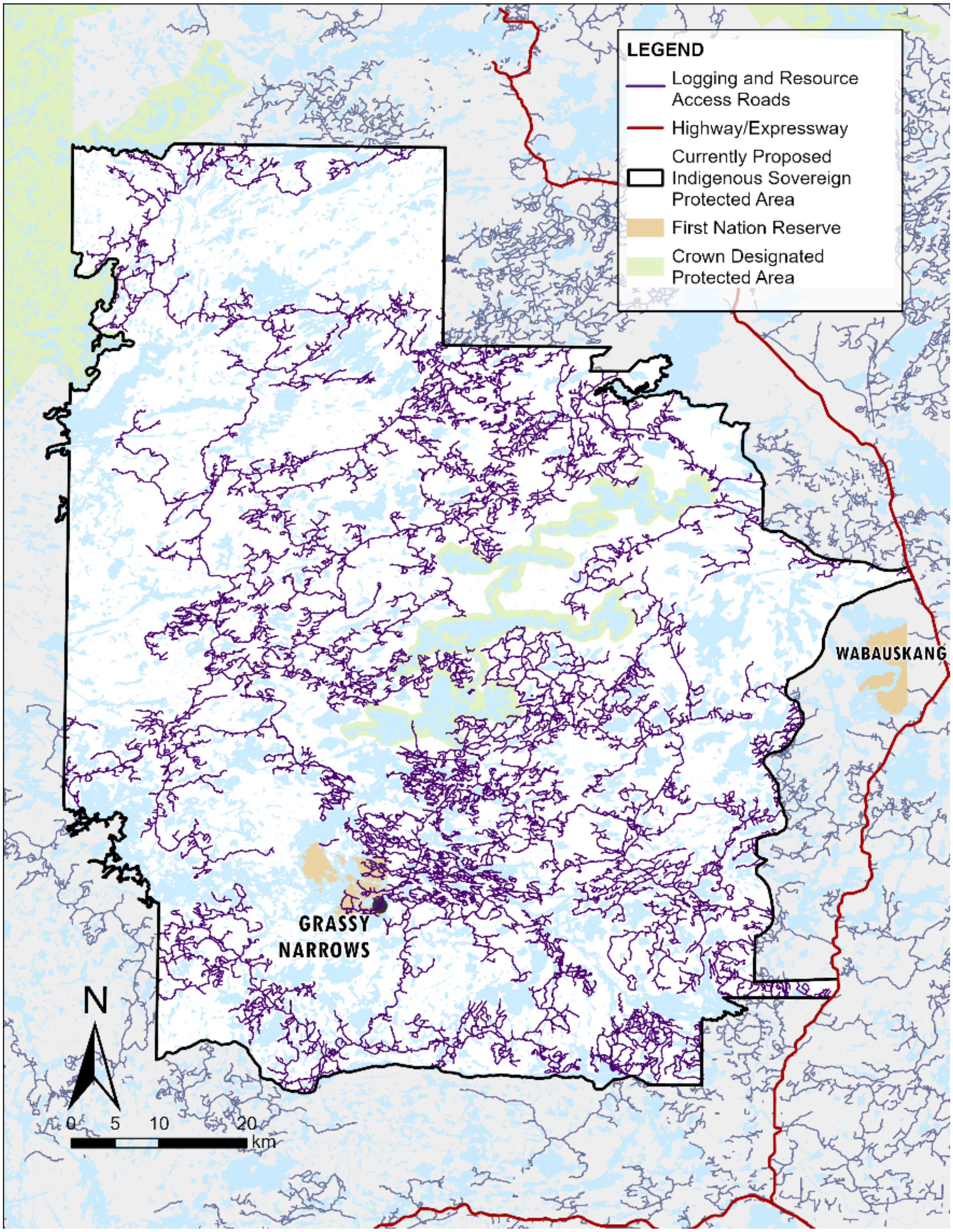
Logging roads can also accelerate the growth of industrial infrastructure, supporting ever-increasing expansion and changes in where and how natural resources are exploited.[33] However, the role of roads in spurring new, often unrelated development is frequently ignored in assessment processes and planning decisions.

> ***"The direct or primary impacts of large-scale infrastructure projects are well recognized, with policies designed to mitigate these in land use and resource management planning. However, proactive measures to prevent unsustainable cumulative impacts, particularly from roads and transmission lines that open new areas for development, are sorely lacking. Decision makers frequently overlook the secondary effects of enabling new development, leading to long-term environmental and social consequences."*** —Justina Ray, president and senior scientist, Wildlife Conservation Society Canada

The proliferation of logging roads in forests across Canada is inconsistent with efforts to halt and reverse forest degradation and biodiversity loss, yet a recognition of the ecological impacts of logging roads remains largely absent from public reports on the state of forests in Canada. Several First Nations across Canada have challenged both federal and provincial governments claiming that cumulative impacts to the lands and waters of their territories, accelerated by the proliferation of resource access roads without their input or consent, have infringed on treaty and inherent rights (see Figure 4).

FIGURE 4:

The Whiskey Jack Forest in Ontario overlaps with the traditional territory of the Grassy Narrows First Nation (*Asabiinyashkosiwagong Nitam-Anishinaabeg*). For over 20 years, Grassy Narrows members have maintained a blockade to prevent clearcut logging from continuing in their traditional territory, but the legacy of logging roads (shown in purple), developed without their input or consent, continues to contribute to cumulative impacts on their lands and waters.



Map credit: Nikita Wallia, David Suzuki Foundation, 2024

EVIDENCE OF CHANGES IN FOREST TYPE AND AGE CLASS OR SUCCESSIONAL STAGE

In forests that are logged, an industry-accepted approach to sustainable management is to attempt to emulate natural disturbances such as wildfires. The rationale is that, since forest species have adapted to and co-evolved with natural disturbances, logging and regeneration practices that mimic them should enable the diversity of fungi, plants, and animals originally found in unlogged forests to recover after logging.

However, forests are dynamic and complex and hard to replicate. In natural ecosystems, tree and forest regeneration follows a more or less cyclical pattern. When trees die—whether due to old age, forest fires, or insect/disease outbreaks—an ecological process called succession occurs.[34] During this process, different species gradually replace one another over time, each filling a specific role as the ecosystem evolves. As long as a forest is not converted to another use (i.e., deforested), it usually continues this cycle, maintaining its ecological structure, function, and natural yet dynamic composition over time.

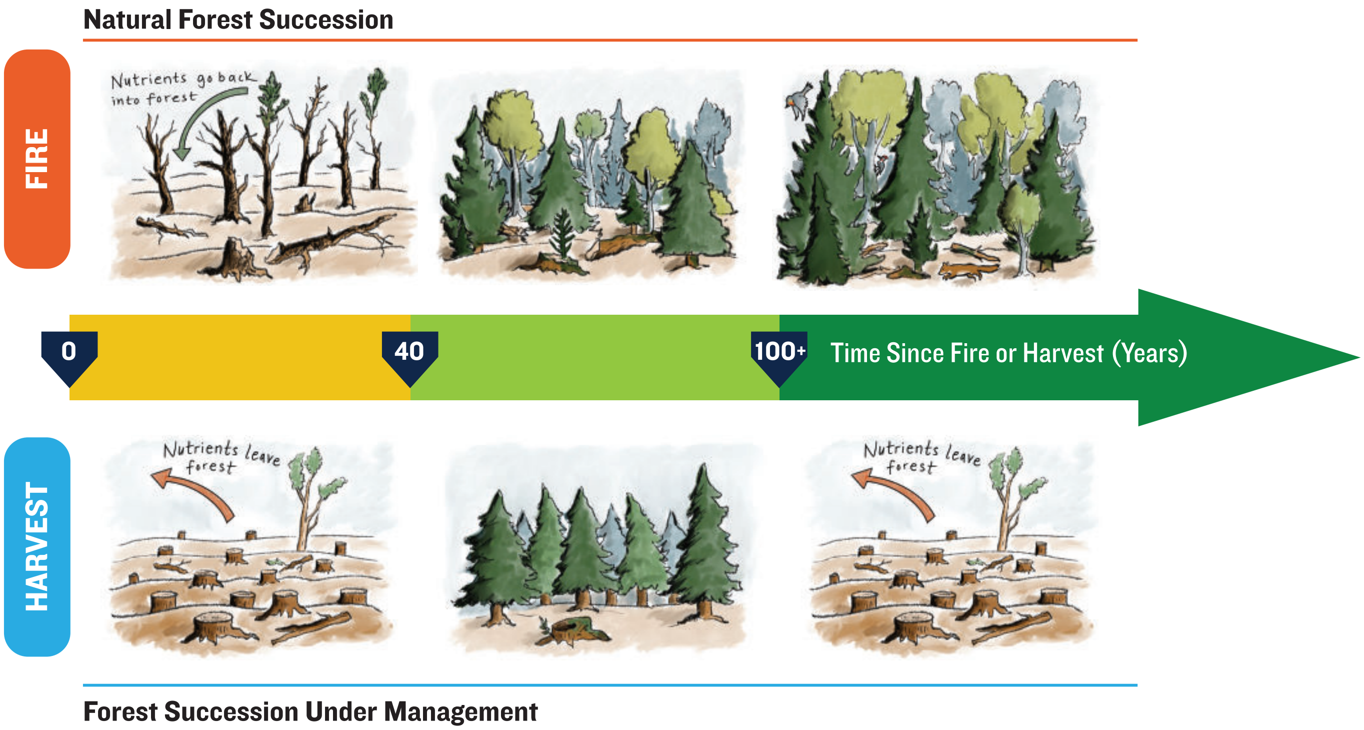
Sustainably managing forests that are logged while maintaining their ecological integrity—rather than merely regrowing trees for future logging—is a significant challenge. A growing body of research (see below) suggests that many logged forests do not maintain species composition (the types of trees that grow over time through succession) or age classes that resemble those expected under natural succession processes.

Many studies have shown that logging has led to a higher proportion of younger forest stands than would be expected with natural disturbance.[35] For example, studies of eastern boreal forests in Canada indicate that the amount of forest more than 60 years old declined throughout the 20th century. Before logging began in the region, regenerating stands (i.e., young stands) rarely made up more than 30–38 percent of the landscape, whereas in 2009, regenerating stands covered about 47 percent.[36] Additionally, any remaining relatively old forest (more than 100 years old) was highly fragmented.[37] This decline in old and mature forests is largely due to harvesting cycles that occur more frequently than fire cycles and therefore exceed the forests' ability to fully regenerate to an old growth state (see Figure 5).[38] The succession period for forests returning from wildfire and other natural disturbances varies widely but is often much longer than the cycle for harvested forests. For instance, a study in Canada's east-central boreal forest reported that while harvest rotation ages averaged around 80 to 100 years, the average fire return cycle was closer to 166 years.[39] Research in Canada's southern boreal region has also connected shifts in age class toward younger forests with poorer habitats for species such as boreal caribou, American marten, flying squirrels, and boreal chickadees.[40]

A recent clearcut in northwestern Ontario

FIGURE 5:

A conceptual diagram of forest succession after natural disturbance (e.g., wildfire) and typical succession after harvesting (e.g., clearcutting). Research has shown that in many areas managed for harvesting, forests have become younger and less complex, often lacking layered canopies and rich understory vegetation usually associated with old-growth forests. This has negative impacts on biodiversity, including that of birds, mammals, and other species that require older, more complex forest ecosystems.[41]



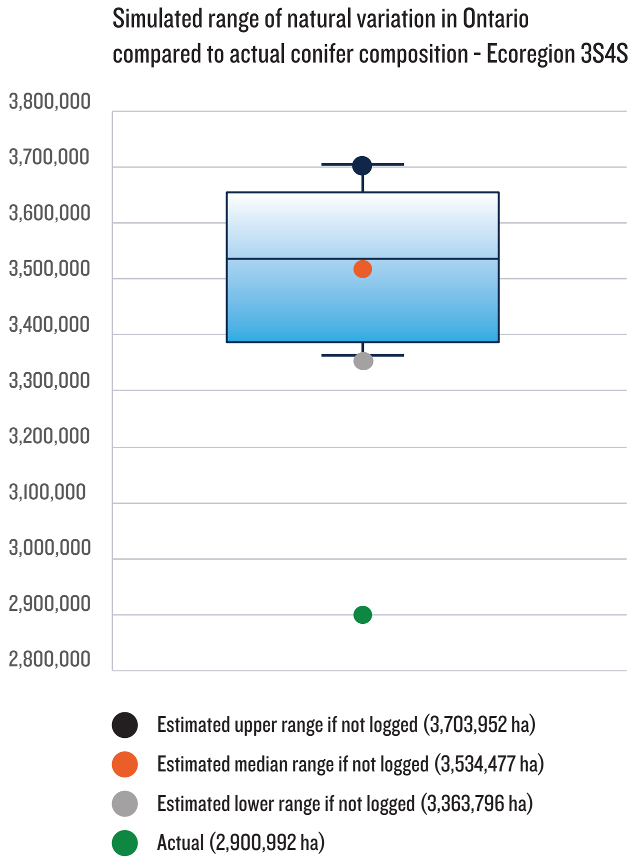
Studies of managed forests show that, when compared with forests under natural succession, silvicultural practices to regenerate trees after logging can shift forest composition toward significantly more conifer or deciduous tree dominance at the landscape level, depending on a range of factors including the original tree species diversity prior to logging, the intensity of management intervention, and other economic and environmental factors.[42] Research has shown that shifts in tree species composition can have direct impacts on biodiversity, including the diversity of birds, mammals, and other species.[43]

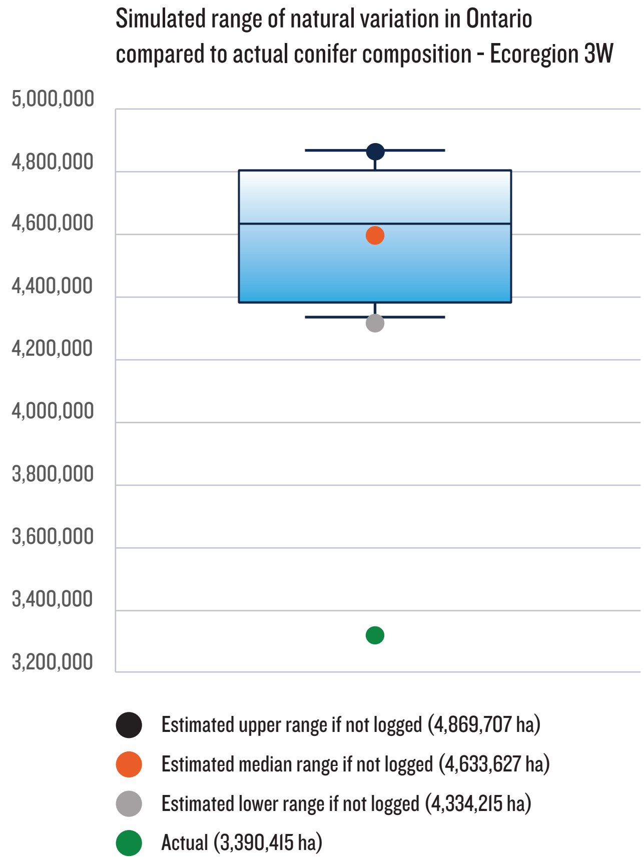
In Ontario, for example, forest managers use models that simulate forest species and age classes before industrial logging and the expected changes to those forests over time. These simulations guide harvesting and forest regeneration plans. Reports from Ontario's Ministry of Natural Resources suggest that conifer regeneration in many logged areas has fallen far short of what would be expected in a naturally disturbed forest and that old and mature forests are in decline in areas with extensive logging. In 19 of the 35 forest management areas reported on, there was less mature conifer than would be expected under natural disturbance (i.e., outside the 75th and 25th percentiles of the data range in the model used for forest management planning) (see Figure 6). In nine of those forests, the extent of the difference is of significant or severe concern—not within the modeled range of variation at all.[44]

"Almost all the forests in three of the four landscape regions in boreal Ontario were considered to be of significant or severe concern regarding the extent of loss of all-aged conifer forests. The decline in old and mature forests is because recruitment into these classes has not kept pace with the loss of these forests due to harvesting. The crises regarding extent of forest fires in the boreal forest now will likely exacerbate this situation." —Chris Wedeles, ecologist, ArborVitae Environmental Services

FIGURE 6: TRACKING RANGE OF NATURAL VARIATION

The green dots show hectares of conifer forest at the time of analysis. The blue boxes represent the modeled interquartile range (25–75 percent) to identify the amount of conifer-dominated forest if the forest were not influenced by industrial logging or fire suppression. Black dots indicate the extreme highs and grey dots indicate extreme lows of the range of this variation, and red dots indicate the median. The 25–75 percent interquartile ranges are the targets used in developing the long-term management direction for forests in Ontario. In both of the eco-regions shown, the current hectares of conifer forests amount to far less than what would be expected in the absence of industrial logging.





> *"The almost ubiquitous influence of fire throughout the boreal forest has fostered a false perception of unlimited resilience vis-a-vis these dramatic disturbances. However, this quality has been abused to justify the systematic use of clearcuts with relatively short rotations."* —Cyr et al., *Frontiers in Ecology and the Environment*, 2009[45]

> *"Our results highlight the failure of existing forest management regimes to emulate the effects of natural disturbance regimes on boreal forest composition and configuration. This illustrates the risks to maintaining ecosystem goods and services over the long term and the exacerbation of this trend in the context of future climate change."* —Molina et al., *Forests*, 2022[46]

EVIDENCE OF BELOWGROUND ECOSYSTEM DEGRADATION

Beneath the trees, undergrowth, and fallen branches of a forest lies a complex world, a network of root systems, fungi, and microscopic life that is crucial to the health of forests and the planet. The thin topsoil layer is critical for regulating interactions among the atmosphere, vegetation, and water. Within this soil, a biologically diverse community of macro- and microorganisms work to process water, nutrients, and contaminants, providing essential ecosystem services.

Preventing the degradation of forest soils is critical to maintaining ecological integrity. In Canada's managed forests, industrial logging disrupts and can degrade fragile belowground ecosystems. This problem is likely to worsen as Canada actively promotes increasing the sale of forest-derived biofuels, such as wood pellets, to international markets for large-scale electricity generation, which will likely result in removing more woody materials that would otherwise decay and provide nutrients to soils.[47] Without healthy soils, forests cannot thrive, putting at risk the interconnected web of life they support, from plants and animals to humans. To reduce this risk, it is essential to understand the immediate and cumulative impacts of logging on soil quality.

SOIL EROSION

Tree roots play a vital role in soil stability, especially on steep slopes. By intertwining with soil particles, roots anchor soil and reduce the risk of erosion from wind and rain. When trees are removed, this nutrient-rich topsoil—crucial for plant growth—is left exposed and vulnerable to erosion.[48] Erosion can also damage aquatic ecosystems through sedimentation runoff, where eroded soil ends up in rivers, lakes, and streams.[49] The accumulation of soil particles in water can smother aquatic plants and harm fish and other organisms. In 2020 British Columbia's Forest Practices Board found that while forestry licensees were largely meeting or exceeding legal requirements for riparian buffers (vegetated areas alongside waterways, designed in part to help reduce erosion), sediment from logging roads was still negatively impacting fish habitats.[50]

DEPLETED NUTRIENTS

Trees are critical to belowground nutrient cycling. As their fallen leaves decompose, they enrich the soil with organic matter—an important source of energy and nutrients for soil microbes, a buffer for soil pH, and a stabilizer for soil structure. Logging can disrupt this process, particularly when branches and bark are gathered into slash piles and piled or burned in one spot alongside a logging road rather than left to decompose across the entire forest floor. Without this organic material, the microbial communities that are essential for nutrient cycling and soil health can be disrupted.[51] This can lead to a decrease in soil fertility and ecosystem stability over time, as well as an increase in exposed mineral soil. Research has shown that the extent of exposed mineral soil after industrial logging, excluding haul roads and landings, can be as high as 70 percent.[52] This can lead to further nutrient loss.

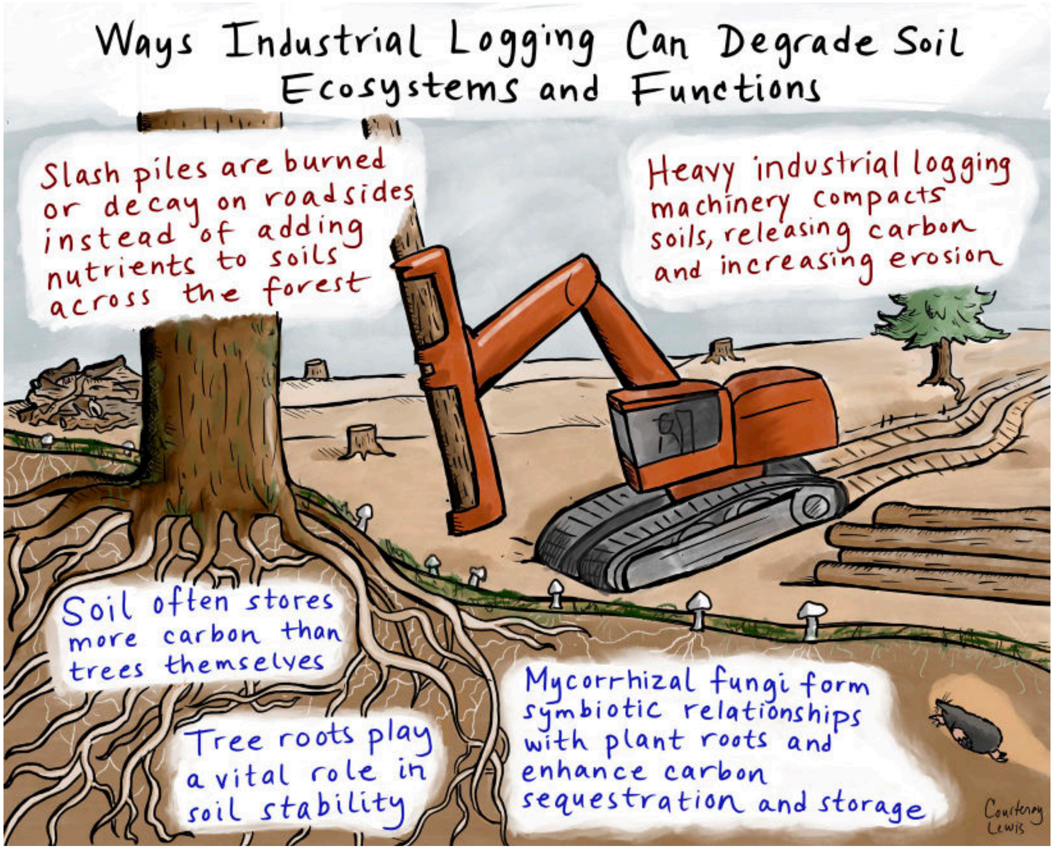
COMPACTED SOIL

Over the past several decades, logging machinery has become increasingly heavy, sometimes weighing up to 80,000 pounds.[53] This, along with vehicle traffic and road construction, can lead to soil compaction, reducing soil porosity and permeability.[54] This makes it harder for water to move through the soil and for roots to grow, negatively affecting plant regeneration wherever heavy machinery has moved across the forest floor. Compacted soil can also quickly become waterlogged, suffocating plants and other organisms.[55] These impacts are especially pronounced along logging roads, where soil compaction persists even after logging operations are complete.[56]

INCREASED CARBON RELEASE

Canada holds about one-fifth of the world's soil carbon, second only to Russia.[57] In Canada's carbon-rich boreal forests, only about 15 percent of carbon is stored in the trees; 85 percent is stored belowground where it is deposited by decaying plant and organic matter, root systems, and microorganisms.[58] Logging causes changes in environmental conditions that lead to the release of this stored carbon (see Figure 7). For example, clearcutting strips the forest of its ability to photosynthesize and transport carbon from aboveground plant matter to the soil.[59] It also removes mature trees that, with their extensive root systems, play a key role in sequestering and cycling carbon through the ecosystem. Additionally, logging's removal of overstory (the trees that make up the forest canopy) exposes soil to more sunlight, which results in higher temperatures and altered moisture levels. This in turn affects the type of carbon the soil can absorb and the rate at which it can do so. Research has found that harvesting intensity is an important driver of carbon loss, with up to 60 percent of soil carbon in a stand released after clearcutting.[60] This loss continues for years, as logging machinery also disturbs shrubs and forest floor vegetation, releasing carbon and increasing risk of erosion. Finally, soil compaction from heavy machinery can reduce the flow of carbon into the soil during regrowth, further compounding the original carbon loss. After logging, it can take decades for trees to regain their carbon absorption capacity and centuries for soil carbon levels to fully recover.[61]

FIGURE 7: INDUSTRIAL LOGGING HAS IMPACTS FAR LESS VISIBLE THAN THE TREES THAT ARE CUT; IT DEGRADES SOIL THAT WOULD OTHERWISE SUPPORT NEW VEGETATION, RECYCLE NUTRIENTS, AND SERVE AS A SIGNIFICANT CARBON STOREHOUSE.



Credit: Courtenay Lewis

> ***"Trees get old. They do eventually decline. And dying is a process, and it takes a long, long time. It can take decades for a tree to die. . …. . . . We found that about 10% of the carbon was transmitted through [soil] networks into their neighboring trees. And in this way, these old trees are actually having a very direct effect on the regenerative capacity of the new forest going forward. This is a completely different way of understanding how old trees contribute to the next generations."*** [62] —Suzanne Simard, Faculty of Forestry, University of British Columbia.

DISRUPTED MYCORRHIZAL FUNGI

Mycorrhizal fungi are vital for soil health and carbon sequestration. They form symbiotic relationships with plant roots, exchanging carbon from plants for help with nutrient absorption. Their threadlike networks that connect individual plants to one another create pores and channels in forest soil that improve aeration and water infiltration and enhance carbon storage. Some mycorrhizal fungi also produce a protein resistant to decomposition that can accumulate in the soil and contribute significantly to carbon stores. This carbon is stored in both the fungi and the soil, becoming part of stable soil matter.[63] By reducing understory plant richness and the trees and plants that mycorrhizal fungi rely on, industrial logging impairs the ability of forest soils to support and regenerate these critical fungi.[64]

HOW FORESTRY ACTIVITIES HAVE DEGRADED WILDLIFE HABITATS

Forests are home to myriad wildlife species, from caribou to pine marten to birds. Research has shown that industrial logging has had significant impacts on how well forests are providing habitats for wildlife, particularly those species that are adapted to older forests.

EVIDENCE OF FOREST DEGRADATION DRIVING CARIBOU DECLINE

Boreal woodland caribou require large expanses of mature, interconnected forests to survive. Because of this, they are considered an umbrella species, meaning that the protection of their habitat indirectly safeguards many other plant and animal species within their shared ecological community.[65] They are also among the most iconic and well-researched animals in Canada, and the impacts that logging and logging roads have on their population trends are well documented.[66] Boreal caribou populations decline when logging roads and clearcuts change and fragment their forest habitat. This is largely because expanses of younger forests, which regrow after logging, attract more moose, deer, and elk, which in turn draw predator populations, such as wolves, increasing caribou predation.[67] Roads further exacerbate this trend, as they increase predator movement and hunting success.[68]

In 2012 the Canadian federal government released a Boreal Caribou Recovery Strategy, which directed provinces to maintain or restore caribou habitat within each range (the geographic area used by different populations of caribou), ensuring that at least 65 percent of it is undisturbed.[69] Research suggest that this percentage of undisturbed habitat affords caribou about a 60 percent chance of long-term population survival. At the time, only 15 out of 51 boreal caribou herds had sufficient habitat to be considered self-sustaining. Remaining herds assessed as not self-sustaining were unlikely to survive unless systemic changes occurred within industrial operations to halt and reverse the loss of critical forest habitats.

Since the Recovery Strategy was released, provinces have made insufficient progress in implementing it, and efforts to maintain and restore caribou habitat have remained minimal nationwide, as reflected in federal progress reports.[70] In 2017, for example, a report on the Recovery Strategy's implementation found total habitat disturbance had actually increased in 30 caribou ranges, while decreasing in 14 and remaining stable in 7. The majority of the caribou ranges in Canada did not provide enough undisturbed habitat to sustain their populations.[71] The 2024 progress report further revealed that anthropogenic disturbance had increased in more than two-thirds of boreal caribou ranges since the previous reporting period.[72]

In addition, the federal minister of environment and climate change has determined that insufficient efforts were made in Ontario and Quebec to maintain/restore the boreal caribou habitat necessary for recovery and survival.[73] The federal progress reports on caribou conservation agreements with Alberta and Ontario, also released in 2024, documented ongoing habitat fragmentation and loss in both provinces.[74]

That same year, in an assessment of caribou recovery and forest management policies for Ontario, industry, government, academics, and conservation experts all agreed that higher levels of cumulative disturbance have led to a reduced probability of population persistence for caribou in Ontario, similar to that demonstrated in the federal framework. However, the assessment confirmed that no explicit management threshold was being implemented to maintain undisturbed habitat within the Ontario forestry policy regime.[75]

In Quebec the federal threat assessment for boreal woodland caribou reached similar conclusions, stating, "The anthropogenic activities taking place in Quebec that have contributed the most to habitat disturbance to date are logging and the road network."[76] It further noted that "the impact of at least two threats—logging and the road network—is intensifying, particularly in the case of the Val-d'Or, Charlevoix, Pipmuacan and Témiscamie populations" of boreal caribou.

In late 2024, many sectors called for improved forest management in regard to the protection of boreal caribou at committee hearings on a potential emergency order in Quebec.[77] Notably, the forestry labor unions acknowledged that the industry had reached a critical juncture. It implored the Quebec government to address the issue seriously.

> ***"Faced with this untenable situation, François Legault's government remains silent and stands still, claiming to be saving jobs. Its inaction and attitude are exacerbating the situation and turning workers into an instrument of political discord. We, the unions representing these people, believe it's long past time for the federal government to stop issuing ultimatums on a stance it knows to be unreasonable, and for the Quebec government to take the issue seriously and implement an organized, smart plan, to protect woodland caribou, ensure a sustainable future for the forestry industry and adequately support the workers who make it prosper."*** —Dominic Lemieux, Quebec director of the United Steelworkers; Daniel Cloutier, director of Unifor Quebec; Kevin Gagnon of the Fédération de l'industrie manufacturière; and Luc Vachon of the Centrale des syndicats démocratiques, September 10, 2024

The declining status of most caribou populations across Canada, which in some cases has been precipitous, provides incontrovertible evidence that unfragmented, mature conifer forests have been degraded. Moreover, the science linking habitat disturbance and diminished caribou calf survival rates has been publicly available since 2008.[78] Despite this, provinces and industry have largely ignored the directive to maintain undisturbed caribou habitat, as it is fundamentally at odds with status quo forestry practices. (The Forest Stewardship Council, which has incorporated caribou indicators into its certification system, is one notable exception.[79]) Both provinces and the federal government, along with industry, continue to deflect responsibility despite the clear decline in caribou populations and its well-established link to industrial disturbance.

EVIDENCE OF DEGRADATION CONTRIBUTING TO BIRD SPECIES DECLINE

Birds, which occupy nearly every ecological niche in forests across Canada, are strong indicators of ecosystem health, which is why they are among the most monitored classes of animals. Recent research shows a significant decline in bird populations throughout North America.[80] This loss in avian abundance can profoundly impact ecosystems. This is because birds are not simply passive users of their habitat; they also shape the ecosystems of which they are a part (e.g., through seed dispersal and insect regulation). Bird declines can begin feedback loops that contribute to further changes in function of forest ecosystems, disrupting their integrity, functionality, and the essential services they provide.

One of North America's tiniest birds, the golden-crowned kinglet is strongly associated with old-growth conifer forests and is adversely affected by certain logging operations.

The causes of these large-scale bird declines are varied and include habitat loss and use of pesticides that kill insects that some birds eat. Additionally, in urban environments there is increasing mortality from cats and building collisions.[81] However, numerous studies from across Canada, some summarized below, indicate that forest degradation—in part driven by ongoing expansion of industrial development—is also an important driver of bird decline.[82]

EASTERN CANADA

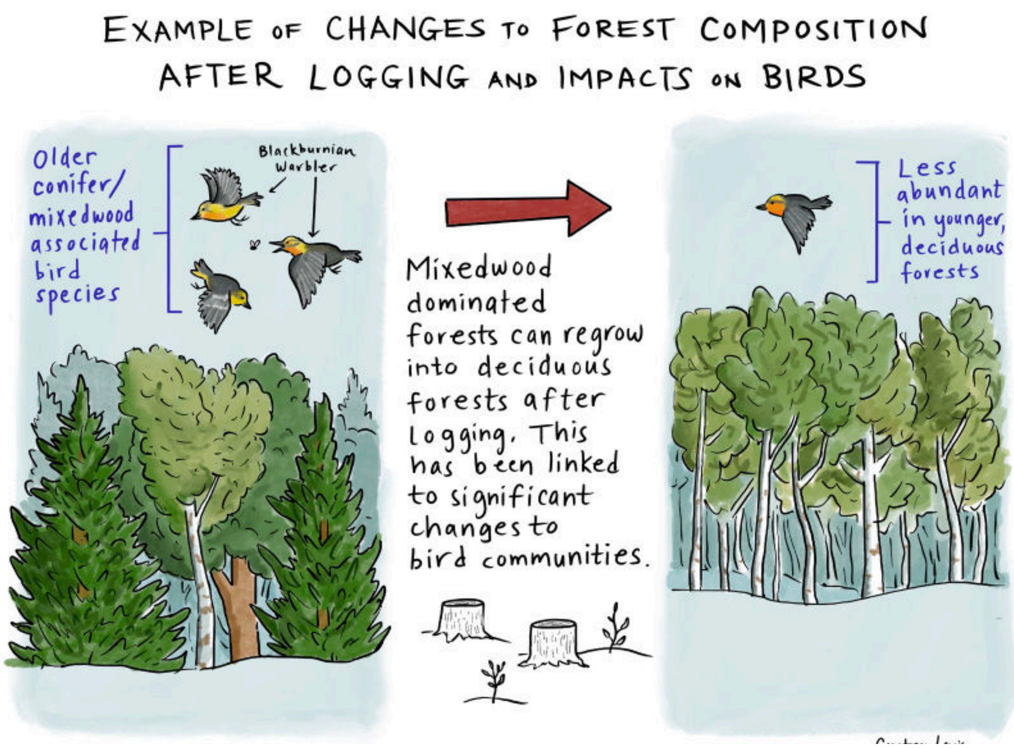
Bird decline has been explicitly linked to degradation of the Acadian forests of the Maritime provinces of Nova Scotia, Prince Edward Island, and New Brunswick. A 2022 study showed that this degradation has resulted in habitat declines for most forest bird species, particularly species associated with older forests (see Figure 8).[83] While trees in this region regrew after logging (and there was no significant decline in the area covered by forests), logging changed the forest composition, which impacted bird populations. The study noted too that between 1985 and 2020, old forest declined by 39 percent. As a result of these shifts, it is estimated that the Maritime provinces have lost between 30 million and 100 million birds since 1985. The researchers also noted that nine bird species, including the golden-crowned kinglet and the Blackburnian warbler, declined at rates exceeding 30 percent over 10 years, meeting the criteria to be listed as threatened under Canadian endangered species legislation.[84]

> ***"Old forest declined by 39% over the period we observed. Over the same period, forest cover actually increased by a net 6.5%. That pattern of extensive harvest of old forest, followed by rapid regeneration of young forest and then subsequent harvest before maturity is attained, seems to be common in many forest regions of North America and northern Europe."***[85] —Matthew Betts, Oregon State University College of Forestry, 2022

NORTHWEST QUEBEC

Research in northwestern Quebec on mixed-wood boreal forests (which include both conifer and deciduous trees) found that shifts from mixed-wood to deciduous forests in human-disturbed landscapes were the main cause of declines in mature-forest bird communities.[86] Additionally, logging increasingly impacted forest structure by reducing the amount of coarse woody debris, including rotting logs and standing dead trees. Research suggests that in Quebec's conifer forests, resident birds that do not migrate are particularly affected by these changes, as many are cavity-nesters that rely on the structural features of older forests.[87]

FIGURE 8: RESEARCH IN NORTHWESTERN QUEBEC SHOWED THAT LOGGING IN MIXED-WOOD FORESTS LED TO A SHIFT TOWARD DOMINATION BY DECIDUOUS TREES AND DECLINES IN SOME MATURE-FOREST BIRD COMMUNITIES.



Credit: Courtenay Lewis

ONTARIO

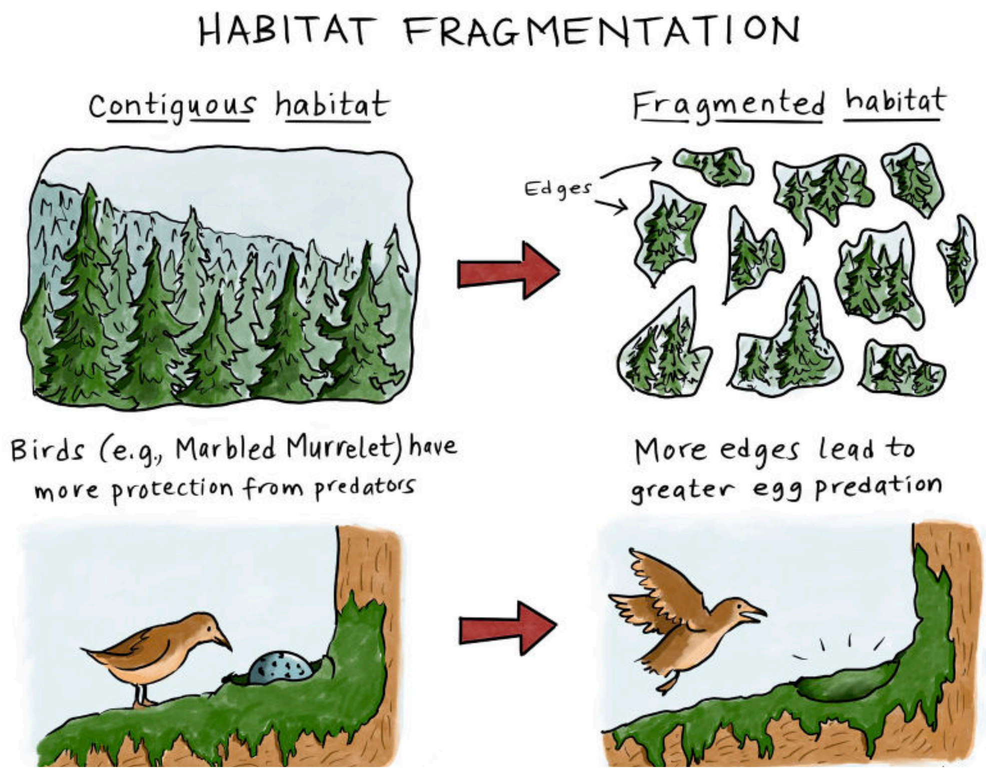
Research on Ontario's managed forests shows that total bird abundance and species richness are lower in mid-regenerating, post-logging stands (21 to 80 years after harvest) compared with those regenerating after fire.[88] Eight percent of native bird species usually observed in young stands and 34 percent of native bird species usually observed in mid-regenerating stands were found less often after logging than after wildfire.[89] These findings suggest that the widespread replacement of fire with logging as the dominant disturbance type is shifting the relative abundance of species in Ontario's forest-dwelling bird community.

BRITISH COLUMBIA

The marbled murrelet—a threatened seabird that relies on coastal old-growth forests in British Columbia for nesting—demonstrates how increased fragmentation associated with logging of old-growth forests can increase the threat of predation and degrade forest function.[90] A study by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) concluded that predation risk at marbled murrelet nests is likely to be higher near clearcuts and roads than in interior forests, as well as higher in fragmented landscapes than in relatively undisturbed old-growth forests (see Figure 9).[91] In part because of fragmentation, the species lost approximately 22 percent of its habitat over three generations.[92] In February 2024, a federal court judge concluded that Canada's minister of environment and climate change, who oversees the federal Species at Risk Act, should have considered habitat loss and degradation as key drivers in the decline of the marbled murrelet; this ruling sets a precedent for other at-risk bird populations as well.[93] Logging in British Columbia's old-growth forests has also driven the local extinction of wild populations of the spotted owl.[94]

Blackburnian warbler.

FIGURE 9: WHERE HARVESTED AREAS AND LOGGING ROADS HAVE FRAGMENTED FORESTS IN BRITISH COLUMBIA, EGG PREDATION HAS INCREASED AND BIRD SPECIES SUCH AS THE MARBLED MURRELET HAVE DECLINED

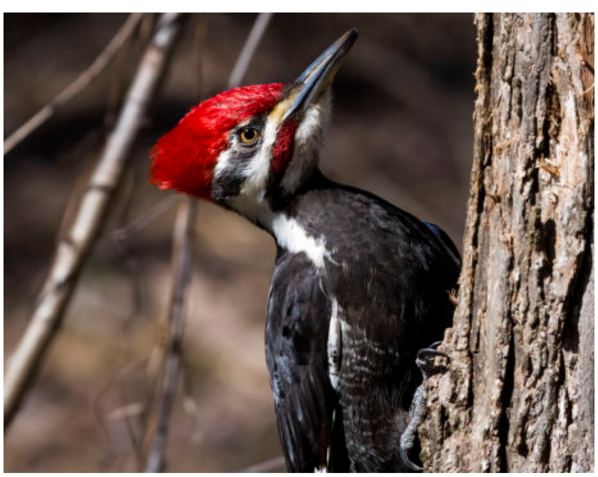


Credit: Courtenay Lewis

> ***"Industrial-scale logging has caused profound changes in forest landscapes across many parts of the world, including in Canada, and those changes have major impacts on bird populations. It's time for an open and honest discussion about these issues to improve industrial forestry management practices for a healthier and more sustainable future."***
> —Jeff Wells, National Audubon Society

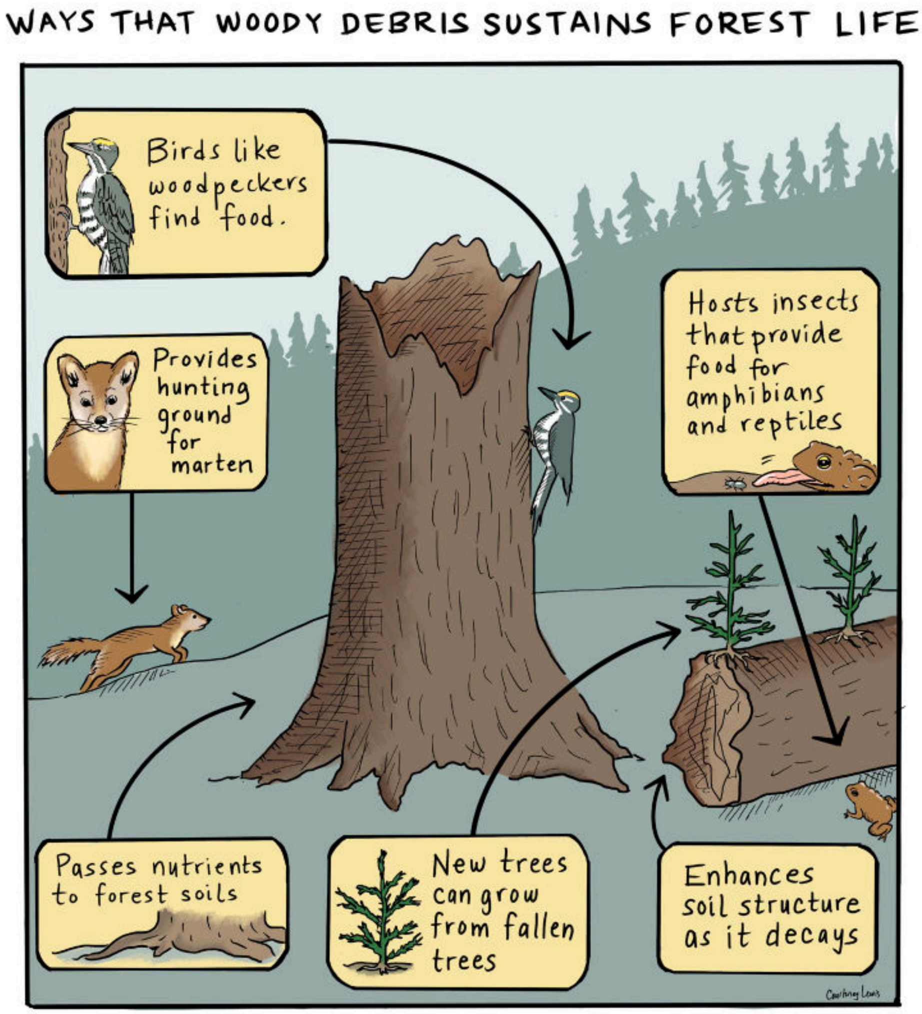
EVIDENCE OF THE LOSS OF CRUCIAL WOODY DEBRIS

The relationship between new forest life and the woody debris that old and fallen trees leave behind provides a striking example of forest dynamics that have developed over hundreds, if not thousands, of years. Woody debris—which includes logs, snags (standing dead trees), fallen trees, stumps, and so on—plays a critical role in the nutrient cycle as it decays, enriching the soil and supporting new plant growth.[95] It also provides habitat and/or food for numerous organisms, including bacteria, fungi, lichens, mosses, plants, insects, and small mammals (see Figure 10). Grouse, for example, use coarse woody debris for shelter, while American pine martens, important to many northern Indigenous cultures, rely on subnivean habitat (openings beneath fallen snow supported by woody debris or other structures) for hunting small prey in winter.[96] Snags feed insects that feed other creatures. Some bird species, like woodpeckers and northern flickers, excavate cavities in dead or decaying trees, which other species then use for homes. In the British Columbia interior, about one-third of forest vertebrates depend on these structures for survival.[97] However, logging operations are removing this debris in increasingly large amounts, with negative impacts for the species that depend on it.



Pileated woodpecker.

FIGURE 10: WOODY DEBRIS IS A CRITICAL COMPONENT OF DYNAMIC FOREST ECOSYSTEMS



Credit: Courtenay Lewis

Natural disturbances leave biological and/or structural legacies that are distinct from those left from industrial logging. For instance, windstorms often result in uprooted trees, while insect outbreaks and wildfires typically produce large numbers of snags.[98] Wildfires in particular generate substantial coarse woody debris, as many trees fall or break without fully burning, while other dead trees are left standing. In contrast, logging often removes most woody debris by clearing existing material and harvesting large, old trees that would otherwise contribute to future woody debris.[99] Research shows that clearcuts can have less than one-third as much coarse woody debris as areas affected by wildfires.[100] Moreover, the debris that remains after logging consists primarily of stumps and small logs, which lack the snag characteristics of fire-affected forests.[101] This reduction in dead wood has contributed to the decline in abundance of some species in logged forests. For example, the loss of subnivean foraging sites caused by clearcutting is believed to be a key factor in the decline of marten populations.[102]

Decaying logs, known as "nurse logs," can support new tree growth. The relationship between new trees and old provides a striking example of nutrient cycles and forest dynamics in action.

Additionally, salvaging wood from areas after wildfires to prevent it from "going to waste" is a common practice. As climate change drives an increase in wildfires, efforts to salvage economically viable wood from burned forests are expected to rise.[103] However, the reduction in woody debris that can result from post-fire salvage logging can negatively impact biodiversity.[104] Research has shown that salvage logging consistently reduces the abundance of large live trees and snags and contributes to long-term declines in both total snags and the volume of woody debris.[105] Research has also shown that salvage logging can decrease the nesting density of cavity-nesting birds that rely on fire-killed trees for breeding.[106]

In short, industry's handling of woody debris has a significant impact on the maintenance of forest structure and the wildlife populations it supports.[107] Some degradation can be decreased by forest management practices, such as sustaining at least half of the naturally occurring amount of down wood at the landscape level and maintaining a range of size and decay classes of down wood. But the extent of the application of these strategies and their efficacy are not sufficiently monitored.[108] This underscores the importance of setting aside high-integrity forests from logging as part of a broader, landscape-scale approach for preserving forest structure over time and across regions.

> ***"With increasing interest in shipping wood pellets from Canada to international markets, there is increasing pressure to remove wood fibre from our forests, including woody debris. This important forest structure should not be considered waste. It is habitat for many species, including American marten, and critical in maintaining forest biodiversity."*** —Jay Malcolm, Daniels Faculty's Forestry, University of Toronto

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The American pine marten prefers habitats with an abundance of fallen trees and branches, as well as large-diameter dead and dying cavity trees. These areas provide shelter for resting and breeding and support small prey.

HOW FORESTRY ACTIVITIES HAVE DEGRADED CLIMATE CHANGE RESILIENCE

As Canada becomes more aware of the deleterious and interconnected long-term effects of human activities on ecological integrity, the government is paying renewed attention to how to best manage Canada's vast tracts of forest.[109] This section explores several current industrial forest management practices that have degraded ecosystem services such as climate change resilience and exacerbated community risks from wildfires and extreme flooding.

EVIDENCE OF INCREASED RISK OF EXTREME FLOODING

Flooding is one of climate change's most catastrophic impacts. Floods, driven by intense, prolonged, and frequent precipitation events, pose significant threats to people and ecosystems—and are likely to get worse as climate change intensifies.[110] One study examining the ecological impact of floods concluded that extreme floods resulted in losses in almost every aquatic ecosystem service studied.[111]

Forests with high ecological integrity are very effective at flood mitigation, while degraded forests elevate the risk and severity of potential flood events. By degrading forest ecosystems, clearcut logging in Canada can leave communities and ecosystems more exposed to risks of extreme flooding.

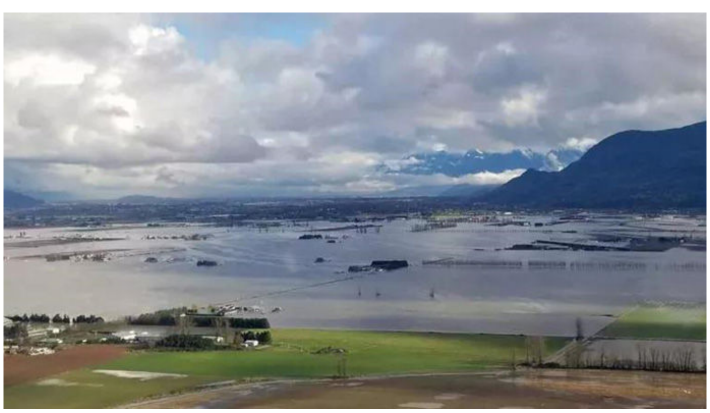
OLDER, MORE COMPLEX FOREST ECOSYSTEMS CAN HELP MITIGATE FLOODING

Forests, particularly older, more complex forest ecosystems, play a critical role in mitigating flood risk. They act as natural managers of rainwater and snowmelt, helping to slow the pace of water movement. Their leaves and needles help to decrease the intensity of rainwater as it hits the ground, while larger tree canopies, especially those of older trees, help to disperse rainfall. Conifer trees, specifically, provide shade that moderates the rate of snowmelt during spring. Older trees and complex forest ecosystems also provide greater soil stability, with expansive root networks that anchor the ground and help absorb water.[112]

> ***"Forests play a vital role in climate regulation, and left intact, serve as giant sponges, absorbing, storing and then releasing water slowly, providing for year-round moisture, cool micro-climates, and water purification."***
> —Peter Wood, Faculty of Forestry, University of British Columbia

INDUSTRIAL LOGGING CAN IMPAIR FORESTS' ABILITY TO REGULATE WATER MOVEMENT

British Columbia's coastal and inland temperate rainforests offer stark examples of how clearcut logging can degrade forest ecosystems by destabilizing rainwater and snowmelt movement through landscapes. Tree removal reduces a watershed's ability to moderate the flow of water and is associated with faster runoff and more frequent surges in water volume. Historical research in British Columbia's interior found that where clearcut logging occurred in more than 30 percent of a 33.9-square-kilometer watershed, the watershed experienced increases in annual and monthly water yields (the amount of water that runs off the land into waterways) and annual peak flows (the maximum flow of a stream or river in response to snowmelt and rainfall), as well as earlier annual peak flows compared with those of similar, unlogged watersheds (see Figure 11).[113] The link between logging and flooding is also demonstrated in numerous other studies on forests in Canada.[114] Further, vulnerability to increased flooding is higher in larger watersheds.[115]

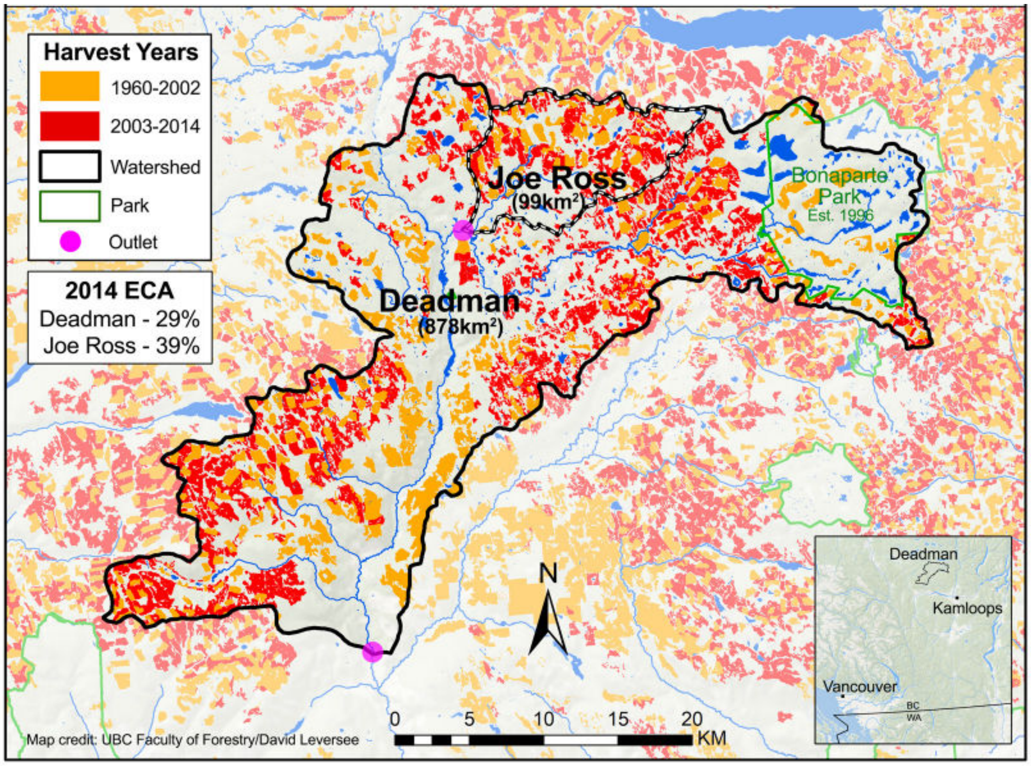


Flooding in British Columbia's Fraser Valley in November 2021.

These issues are particularly concerning on steep slopes, where gravity can amplify the impacts of logging and increase the risk of landslides. Internationally, research in subalpine forests found that root reinforcement of soils decreased to 40 percent within five years of logging and was entirely lost after 15 years.[116] Furthermore, the volume of landslides in clearcut areas was four times greater than in unlogged areas, with this effect persisting for up to 45 years.[117] Despite these risks, sloped areas in British Columbia are increasingly being logged as flatter, more accessible areas have already been harvested.[118]

FIGURE 11: LOCATIONS OF CUT BLOCKS IN DIFFERENT YEARS IN THE DEADMAN AND JOE ROSS WATERSHEDS

Research by the University of British Columbia showed clearcut logging practices are connected to more frequent flooding and extreme flooding events. The study showed that when 21 percent of trees were harvested by clearcutting, the average flood size increased by 38 percent in the Deadman River watershed and 84 percent in the Joe Ross Creek area. This map shows the extent of clearcuts in the Joe Ross Creek and Deadman River watersheds. The equivalent clearcut area (ECA) is the percentage of each watershed that has been clearcut with a reduction factor to account for hydrological recovery due to forest regeneration and subsequent growth.



Credit: David Leversee, Faculty of Forestry, University of British Columbia

The implications of increased flood intensity and frequency are far-reaching. For example, in addition to affecting human lives, extreme flood events can have significant negative impacts on water bodies by increasing sediment loads, eroding riverbanks (which can alter a river's natural flood mitigation capacity), and initiating algal blooms.

CURRENT FORESTRY PLANNING PRACTICES DO NOT ADEQUATELY MITIGATE IMPACTS OF INDUSTRIAL-SCALE LOGGING ON THE RISK OF EXTREME FLOODS

Natural resource management practices often adopt a reductionist approach, simplifying complex systems into easily quantifiable measurements. This tendency to oversimplify has plagued studies evaluating the relationship between logging and increased flooding events. While scientists have, for example, determined a causal link between logging—especially on slopes—and flood events, conventional forestry planning largely fails to incorporate such data.[119]

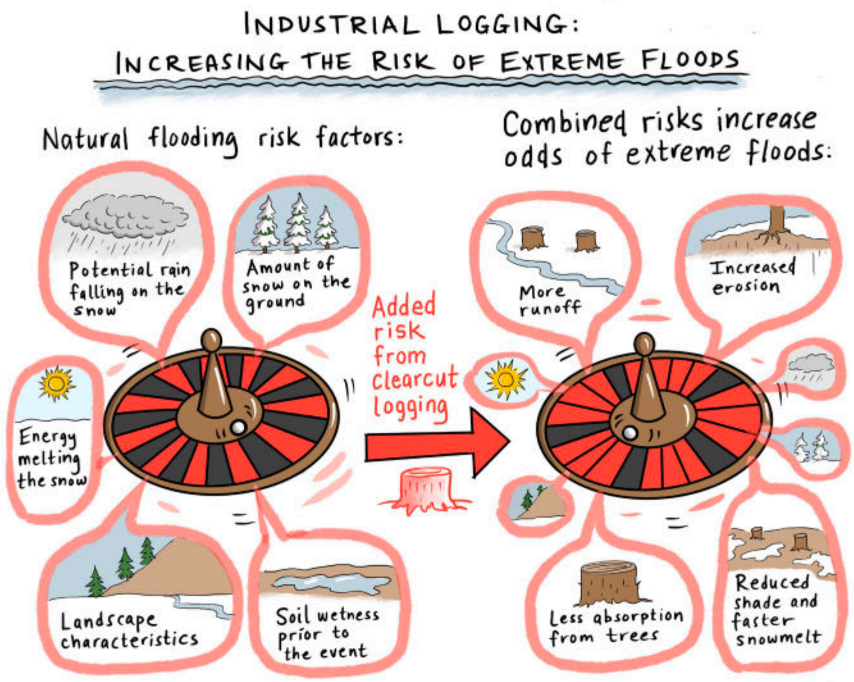
Of course, many factors besides logging affect flood risk. These include soil moisture levels, soil compaction, snow depth, timing of snowmelt, slope aspect (whether a slope faces east or west), slope angle, rainfall levels, and more. These factors are considered subject to chance and vary considerably over time and space (see Figure 12). More accurate accounting for how these factors, along with logging, contribute to flooding requires probabilistic modeling. This approach accounts for the random nature of the various influences on flooding to generate projections about the likely severity and frequency of flood events.[120]

© TJ Watt

Clearcut logging in Caycuse Valley, British Columbia.

FIGURE 12:

The historical approach to incorporating flood management into forestry planning has been overly simplistic. As a result, flood projections have often failed to reflect the true risk of flooding after logging, particularly in relation to extreme weather.



Credit: Courtenay Lewis

PLANNING APPROACHES TO REDUCE EXTREME FLOODING RISKS

While forests managers cannot control nature itself, they can decide where, when, and how much forest cover is removed from each watershed through logging. Forest management planning must adopt a more proactive, risk-based approach that accounts for multiple variables, cumulative impacts, and the precautionary principle (the notion that, if scientific research has exposed a plausible risk with severe consequences, it should not be necessary to complete further research before taking action). This approach must include modern, robust flood modeling techniques and integrate appropriate risk models into forestry planning.

> ***"It all starts with a fundamental shift in mindset. Logging practices within the province's Timber Supply Areas need to be updated in favour of abandoning clear-cut logging for biodiverse-friendly, restorative practices, including selective, strip-cut, and small-patch logging. We must synchronize our flood management strategy in the more populated lowlands with our land use, forest resources, and water resources management policies in the uplands."***
> —Younes Alila, Faculty of Forestry, University of British Columbia

EVIDENCE OF INCREASED RISK OF WILDFIRE

The unprecedented rise in wildfires in Canada underscores the urgent need to reassess forest management strategies to prioritize both the long-term health of forests and the well-being of communities.[121] The impacts of these escalating wildfires have been devastating—lives lost, evacuations, costly suppression efforts, and damage to air quality and ecosystems. Research suggests that decades of clearcut logging, conifer planting, and extensive fire suppression have more likely exacerbated, rather than diminished, wildfire risk to communities.[122]

In fire-adapted forests, such as boreal forests, natural cycles of wildfire caused by lightning have played an integral role in maintaining ecosystem health for millennia. Wildfires, for example, help to remove "ladder fuels" (low-growing vegetation that allows fire to climb from the forest floor to the tree canopy), clear sick and dying vegetation, and stimulate natural regeneration, creating habitat for a range of species over time and supporting biodiversity.[123]

Like flooding, the drivers of wildfires are complex and influenced by many variables. For one, climate change is directly driving more frequent, intense wildfires through hotter temperatures and increasingly dry and windy conditions.[124] Additionally, for more than a century, Canadian governments have focused on trying to control fires to protect communities, infrastructure, and wood supply, with fire-suppression efforts varying widely across the country. While these efforts have been essential for protecting people and communities, they also carry unintended consequences. Suppression strategies may slow the spread of wildfires in the immediate term but can create conditions—including the accumulation of forest fuels—that lead to more severe fires in the future, a phenomenon known as the fire paradox.[125]

Research shows that industrial logging practices can also exacerbate wildfire risk, particularly in the near term. For example, clearcut logging often leaves behind smaller trees, branches, needles, and stumps, which can dry out and contribute fuel to wildfires.[126] Dense conifer plantings to replenish wood supply can also be highly fire-prone (see Figure 13). Research has shown differences between logging disturbance and fire disturbance in terms of risks that fires will start. Wildfires have been found to start more often in forests with more area recently harvested, and to start less frequently in forests recently disturbed by fire.[127]

Forest age can also be a factor. The multilayered canopies of many older, mixed-wood forests, which provide shade and retain moisture, can naturally mitigate fire risks. Many old-growth forests also exist in wetter, cooler areas that have been naturally spared from wildfire (such as British Columbia's coastal, temperate rainforest). Although older forests naturally accumulate biomass over time, which increases the availability of forest fuel and can increase wildfire risk, younger forests that have been logged are also vulnerable to fire, especially in warmer, drier regions.[128]

Instead of accelerating clearcutting, there are forest management strategies that can mitigate wildfire impacts. Reducing fuel on the forest floor, for example, by removing smaller trees and using low-intensity burning tailored to each ecosystem can help reduce the likelihood of high-severity wildfires.[129] Long before the arrival of European settlers, Indigenous Peoples in North America stewarded the land through controlled, low-intensity burns, and revival of these practices is underway.[130] Some communities are also creating buffers of more fire-resistant deciduous trees.

While it is sensible to promote active forest management near vulnerable communities, forestry industry lobbyists appear to be seeking approval to harvest more trees from healthy forests in the name of reducing wildfire risk.[131] This could ultimately undermine efforts supporting long-term forest health and resilience and enable further forest degradation.

FIGURE 13:

The drivers of wildfires are complex, influenced by many variables. However, several studies show that current forest management practices—including extensive clearcut logging, road building, herbicide spraying, and fire suppression—can exacerbate wildfire risks, and that expanding clearcut logging of healthy trees will not protect communities from wildfire in the long term. Focusing on managing forests near vulnerable communities can help reduce the impacts of wildfire on people and infrastructure.

Credit: Courtenay Lewis

RECOMMENDATIONS

We can better understand the complex systems of nature and our connections to them through science and Indigenous knowledge. It is our responsibility to apply this knowledge to ensure that forest management does not contribute to further degradation or compromise the recovery of already degraded forest ecosystems.[132] This responsibility will become increasingly important as a changing climate—marked by warming temperatures and extreme weather—places additional pressure on forests, including those in Canada.

The dominant forestry practices in Canada—clearcut logging, often combined with herbicide spraying and conifer planting—are focused on maximizing timber production and regrowing commercially valuable fiber. Forest management's current provisions that attempt to mitigate impacts on non-timber forest values (such as protecting fish and wildlife, water resources, and forest foods, and mitigating negative impacts on and ensuring benefits for local and Indigenous Peoples) fall short of the necessary measures to halt and reverse forest degradation and uphold Indigenous rights and responsibilities. Minor adjustments to current status quo industrial logging practices will not be sufficient. Achieving the necessary change will require a fundamental shift in approaches to forest management.[133]

This report has explored three important categories of forest degradation and loss of ecological integrity: structure and function of forest ecosystems, wildlife habitats, and resilience to climate change impacts. Below are broad recommendations for strategies that Canada can implement to halt forest degradation and, where ecologically appropriate, restore degraded forests.

DEFINE, MONITOR, AND REPORT ON ACTIVITIES LIKELY TO DEGRADE FOREST ECOSYSTEMS

While many international policy instruments include measures to address forest degradation, the term has not yet been formally defined by the Canadian government. Furthermore, degradation monitoring has received much less investment than deforestation monitoring, resulting in significant information gaps about its scale and impact, particularly in temperate and boreal forests. The absence of internationally agreed-upon definitions, established methods and best practices for monitoring forest degradation has enabled some countries, including Canada, to propose definitions that would accommodate, and possibly accelerate, business-as-usual industrial practices, and to fail to adequately track impacts to forests' ecological integrity.[134]

For Canada to effectively understand where, why, and how forest degradation is occurring, it needs to develop and apply a definition based on the best available Western science and Indigenous knowledge. This definition must include clearly articulated, scientifically defensible indicators and ecologically relevant thresholds—such as the habitat disturbance threshold outlined for boreal caribou in the federal Recovery Strategy—to help determine when forest degradation has occurred.[135]

Moreover, certain elements should not be included in assessments of forest degradation. These include economic factors (e.g., revenue, industry growth, and efficiency) and criteria that solely value maintaining "forest cover" while ignoring the loss of mature, old-growth, and primary forests and landscape-scale shifts to younger age classes. Though relevant in policymaking contexts, direct economic indicators are not appropriate in scientific assessments of the loss of ecological integrity.

ASSESS CUMULATIVE IMPACTS AND ESTABLISH LIMITS

Current forest management planning largely ignores the cumulative impacts of forestry operations by: 1) evaluating projects on a site—or "forest management unit"—basis rather than at the landscape scale; 2) assessing projects in a sector-by-sector approval process (with mining and logging approvals granted in separate proceedings) rather than through a coordinated approach; and 3) approving projects without considering the combined effects of past, present, and future activities.[136] To address these shortcomings, cumulative assessment frameworks must be applied at various stages and scales to ensure that both past and future resource extraction activities from all sectors are considered when assessing the impacts of forestry activities and logging approvals on ecological integrity.

Specifically, one major driver of cumulative disturbance and subsequent forest degradation is the increasing expansion of logging and resource access roads. Only a portion of these roads are ever effectively decommissioned after use, so roads and their impacts tend to steadily accumulate over time and space. Yet, according to prevailing views in the scientific literature, reducing human disturbance of landscapes and habitat fragmentation is the best way to maintain and restore ecological integrity.[137] To reduce cumulative impacts, governments and industry must: 1) recognize that the expansion of new roads in unfragmented, intact forests is incompatible with Canada's international nature commitments; 2) limit new roads into unfragmented forests; 3) develop transparent decommissioning targets in accordance with other values such as wildlife habitat needs; and 4) monitor how resource access roads contribute to cumulative impacts at the landscape level.

TRANSPARENTLY ACKNOWLEDGE THE RISKS AND UNCERTAINTIES OF CLIMATE CHANGE

Many current forest management practices—such as clearcut logging, herbicide spraying, and dense conifer planting—can exacerbate the effects of climate change, including by increasing wildfire risk and extreme flooding in heavily logged watersheds. To address this, an assessment of climate risk should be mandatory across Canada and used to both guide forest management decisions and report on the state of forests in Canada. Such an assessment could help forest managers, Indigenous Peoples, stakeholders, and the public determine whether a proposed development would increase the vulnerability of forests and adjacent ecological and human communities to climate change impacts. In addition, climate change should not be used to obfuscate the consequences of industrial activities (e.g., suggesting that climate change is the key driver of boreal caribou decline and downplaying the demonstrated role of anthropogenic disturbance), or to make those impacts seem less relevant (e.g., arguing that it will "burn anyway.")

ELEVATE INDIGENOUS RIGHTS, KNOWLEDGE, AND GOVERNANCE SYSTEMS

The Kunming-Montreal Global Biodiversity Framework (2022) places a strong emphasis on the value of inclusive, participatory management practices that uphold the rights of local communities and Indigenous Peoples.[138] Reciprocity with nature and responsibility are the two key tenets of many Indigenous land governance systems. Indigenous communities are well suited to make choices that support long-term conservation objectives, including protecting ecological integrity, when secure land tenure and Indigenous land rights are acknowledged. Landscape-scale planning should also adopt more inclusive and respectful engagement strategies that foster shared learning and co-management. Achieving this requires the recognition that Western science is only one of many knowledge systems and that the incorporation of Indigenous knowledge into degradation assessments can align forest management in Canada with Indigenous rights. Additionally, federal and provincial governments must meet the expectations of Indigenous Peoples to be included in the development of definitions and indicators of forest degradation, as well as in shaping proposed solutions.

SHIFT SCALE AND PURPOSE OF FOREST PLANNING AND MANAGEMENT

To halt and reverse further forest degradation, Canada must move away from forestry planning processes based on the largely arbitrary boundaries of forest tenures (which determine who can use and benefit from forest lands and resources) toward ecosystem-based planning at the watershed or eco-region scale. Forest management decisions must shift from focusing on how much fiber can be extracted from forests to first determining what must be maintained to support forest integrity, resilience, and functionality. This includes forests' ability to provide critical ecosystem services such as habitat, carbon storage, and flood mitigation.

This approach would prioritize the protection of biodiversity and safeguard communities from climate change impacts. Key measures could include reducing the percentage of each watershed harvested to address cumulative impacts and recognizing that some forests should not be logged at all. Wildlife habitat needs, such as those of indicator species like boreal woodland caribou, must be better integrated into landscape-scale plans. Additionally, employing a precautionary approach could help to ensure that forest recovery is supported in the face of climate change and other uncertainties.

Planning at this scale could help to dismantle power structures that prioritize timber extraction over Indigenous rights, ecological values, and the needs of other forest users, ensuring that decision making is no longer dominated by government and industry interests. Such a shift could reduce new degradation by enabling greater protection of old-growth and primary forests and the adoption of more biodiversity-friendly, restorative practices.

CONCLUSION

Canada has aligned itself with the globally recognized need to halt and reverse forest degradation, deforestation, and biodiversity loss by 2030 as part of its effort to address the global climate and biodiversity crises. However, degradation continues in many of Canada's primary, old-growth, unfragmented, and other high-integrity forests. This degradation persists with little government recognition, oversight, or remedial action as policymakers largely ignore—or deny—the consequences.

The assumption that no forest degradation is occurring—or that existing policies are sufficient to prevent it—fails to account for the long-term, and often permanent, effects of industrial logging and other extraction activities. It also delays the adoption of practical regional, provincial, national, and international solutions. Moreover, there is a clear disconnect between government agencies that promote Canadian wood products and those tasked with protecting biodiversity, advancing reconciliation with Indigenous Peoples, and meeting climate targets. This approach is wholly insufficient given the immediate need for action to prevent climate and biodiversity catastrophes.

As the climate continues to change, forests will face growing pressures from natural disturbances, including extreme wildfires like those in Canada in 2023, and rising demands for forest products. Some jurisdictions, such as British Columbia, have committed to adopting improved forest management practices. However, if only minor adjustments are made to existing frameworks, results on the ground will likely remain unchanged. Systemic shifts in current forest management planning and practices are required in order to protect biodiversity, increase climate resilience, safeguard the vitality of forests, restore degraded habitats, and promote the regeneration of complex ecosystems. To effectively manage and restore Canada's managed forests, it is crucial for jurisdictions to fully acknowledge the extent of current forest degradation, including changes in tree age classes and composition. Only then can we truly safeguard the complexity and health of these forests for the future.

Additionally, climate change mitigation and adaptation policies for forests in Canada must be embedded into an overall framework of ecological sustainability that does not further simplify forest structure and the biodiversity it supports. Federal and provincial governments must set a higher bar for monitoring systems that assess the extent to which forest management policy outcomes align with international commitments to halt and reverse land degradation and must push for new strategies where these goals are not being met.

Ultimately, Canada must rethink how it manages its forests. Too often, governments and industry claim that change is unnecessary, impossible, or too expensive. Yet history has shown that when the need for change is fully embraced, effective solutions can be found. Now, more than ever, it is critical to prioritize the health of forests in Canada and take bold, meaningful action to ensure their protection and sustainable management for generations to come.

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