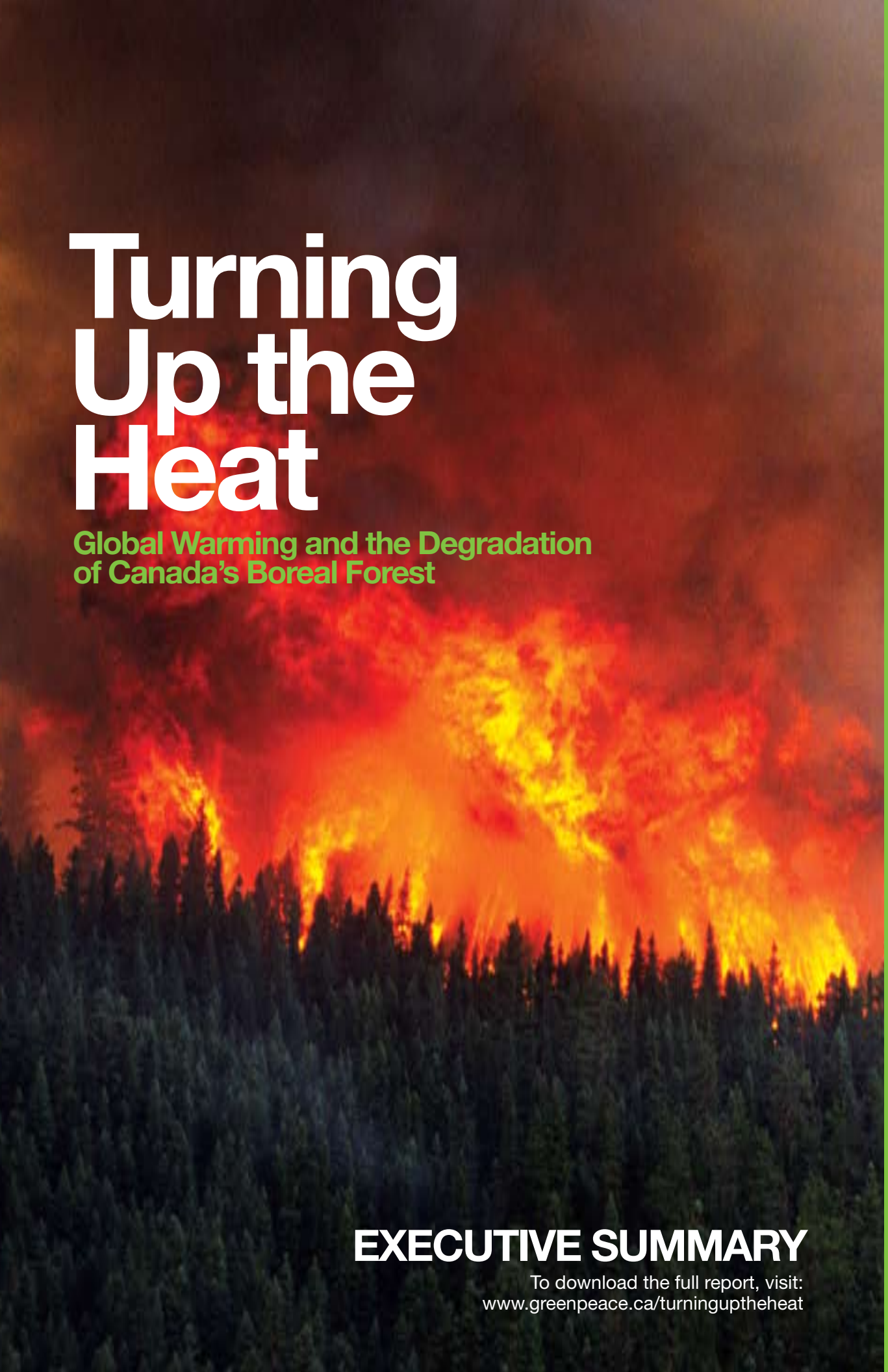

Turning Up the Heat

Global Warming and the Degradation of Canada's Boreal Forest

EXECUTIVE SUMMARY

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"Intact forests give trees, plants, and animals the best chances of surviving in a changing climate."

Key findings:

- Warming conditions are causing more droughts, forest fires, and insect outbreaks in parts of the Boreal Forest, and are reducing the growth and survival of some Boreal trees.
- The area of North American Boreal burned by forest fires doubled between 1970 and 1990. When forest fires become larger, more frequent, and more intense, correspondingly larger amounts of carbon dioxide are released into the atmosphere.
- Intact areas of the Boreal Forest resist and recover from fires, insect outbreaks, and other impacts better than fragmented areas. These areas also give trees, plants, and wildlife the best chances of migrating, adapting, and ultimately surviving in a changing climate.
- Logging removes roughly 36 million tonnes of aboveground carbon from Canada's Boreal Forest each year—more carbon than is emitted each year by all the passenger vehicles in Canada combined.
- Logged areas continue to emit carbon dioxide long after the trees are gone—often for 10 years or more.
- Logging accelerates permafrost melt. When permafrost melts, carbon dioxide and methane—a greenhouse gas 21 times more potent than carbon dioxide—are released into the atmosphere. Intact forest cover may delay this melt for decades or even centuries.
- Logging reduces the diversity of a forest, making it more vulnerable to forest fires, insect outbreaks, and other disturbances, and therefore increasing the likelihood and extent of future emissions.
- If current trends continue, a widespread outbreak of forest or peat fires in the Boreal could cause a rapid release of carbon into the atmosphere. Because Canada's Boreal Forest contains 186 billion tonnes of carbon—27 times the world's annual fossil fuel emissions—this could cause a disastrous spike in emissions.
- Preserving what remains of the biologically rich southern areas of the Boreal Forest is essential to protecting the viability of its vast northern expanses.

Forests play an essential role in regulating the global climate. They sequester and store carbon, they conserve biodiversity, and they stabilize local climates. But the world's last great forests—the Amazon, the Congo, the Boreal, the Paradise forests of Asia-Pacific—are all actively threatened by logging and other industrial activity. While due attention is starting to focus on tropical forests, the role of northern forests in mitigating global warming continues to be underestimated.

Based in part on a comprehensive review of scientific literature by researchers at the University of Toronto[1], *Turning Up the Heat* explores the complex relationship between global warming and Canada's Boreal Forest. It finds that the intact areas of Canada's Boreal Forest are not only helping to slow global warming by storing massive amounts of carbon and slowing permafrost melt, but they're also helping the forest itself to resist and recover from global warming impacts.

When the Boreal Forest is degraded through logging and industrial development, not only are massive amounts of greenhouse gases released into the atmosphere, but the forest becomes increasingly vulnerable to global warming impacts like fires and insect outbreaks—in many cases, impacts that themselves cause more greenhouse gases to be released, creating a vicious circle wherein global warming degrades the Boreal Forest and Boreal Forest degradation contributes to global warming. If left unchecked, this could culminate in a catastrophic release of greenhouse gasses known as "the carbon bomb".

The report also finds that logging reduces the stability that animals, birds, and plants need in order to adapt to changing climate conditions, and eliminates the corridors they need in order to migrate. In short, when the Boreal Forest is degraded by logging, both the climate and the forest face dramatic consequences.

Global warming is already having an impact on Canada's Boreal Forest

With global warming causing warmer, drier conditions in parts of the Boreal Forest, droughts, forest fires, and insect infestations are all on the rise. Drought stress has already increased, particularly in western Canada[2, 3], and tree growth and carbon absorption have begun to suffer as a result. Even more alarming, these warm, dry conditions are creating a tinderbox, laying the groundwork for bigger, hotter fires. While fires are a natural part of the Boreal ecosystem, they're becoming longer, more frequent, and more intense as time goes on[4, 5, 6]—and the more intense forest fires get, the more carbon they release into the atmosphere[7]. According to one study, the area of North American Boreal Forest burned by forest fires doubled between 1970 and 1990[8].

Warmer temperatures are also leading to destructive insect outbreaks like the mountain pine beetle outbreak ravaging western Canada. Already, the area of Boreal Forest lost to insects is up to eight times greater than the area burned by forest fires[9], and the damage caused by the mountain pine beetle and the other major defoliating insects in the Boreal is projected to increase as temperatures continue to rise[10, 11]. Lastly, while early predictions suggested that warmer temperatures would enhance tree growth, recent research shows that higher temperatures are actually reducing the growth and survival of some Boreal trees[12, 13].

Global warming is predicted to cause additional problems in the Boreal as well. As temperatures rise, wildlife, trees, and plants are expected to migrate northward to cooler regions. Unfortunately, the migrations of different plant and animal species are unlikely to happen at the same rates, and as a result interdependent relationships like that between an animal and the plants it eats, or between a predator and its prey, could be disrupted[14]. These disruptions, combined with the fire- and insect-related disturbances described above, could lead to die-offs in species already at risk, including the woodland caribou, the wolverine, and the American marten.

" Warm, dry conditions are creating a tinderbox, laying the groundwork for bigger, hotter fires."

Large intact areas of the Boreal Forest better resist and recover from global warming impacts

Research shows that intact areas of the Boreal Forest—those areas that remain in their natural states—will be better able to resist and recover from global warming impacts than those areas fragmented by roads, logging, mining, or other human activity.

By maintaining stable local climates, intact forests shield the trees, plants, and animals within them from the rapid and sometimes erratic changes happening in the broader climate, giving them more time to migrate and adapt[15]. And, with more mature trees and higher levels of biodiversity than areas that have been logged, intact forest areas are better able to resist and recover from global warming impacts such as fires and insect outbreaks. Lastly, intact forests provide the contiguous corridors that trees, plants, and animals need in order to successfully migrate north[16].

While the more southern areas of the Boreal Forest have already been severely fragmented by logging and development, research shows that protecting what remains of these biologically rich areas is essential for facilitating the adaptation and migration that will allow the vast intact areas of the northern Boreal to survive in a changing climate[17, 18].

Intact areas of the Boreal Forest are helping to mitigate global warming

The Boreal plays a vital role in curbing global warming by absorbing carbon dioxide out of the atmosphere and storing it in the forest's trees and soils. Canada's Boreal Forest stores an estimated 186 billion tonnes of carbon[19], an amount equal to 27 years' worth of carbon emissions from the burning of fossil fuels worldwide[20]. Eighty-four per cent of this is stored in the forest's soils.

Intact areas of Canada's Boreal Forest are also helping to mitigate global warming by slowing the melt of Canada's expansive areas of permafrost (soil that remains frozen throughout the year). When permafrost melts, large quantities of carbon dioxide and methane—a greenhouse gas 21 times more potent than carbon dioxide—are released into the atmosphere[21, 22]. Given the rapid warming happening across the Boreal, widespread permafrost melt is likely—increases in air temperature of only 1–2 degrees Celsius have the potential to thaw out large expanses of discontinuous permafrost[23]. But research shows that intact forest cover may delay thawing by decades or even centuries[24, 25, 26].

Logging is destabilizing the Boreal Forest and contributing to global warming

With nearly 900,000 hectares (2.2 million acres) cut every year[27], logging in Canada's Boreal Forest is exacting a considerable toll on the climate. An estimated 36 million tonnes of aboveground carbon is directly removed from the Boreal every year by logging alone—more carbon than is emitted each year by all the passenger vehicles in Canada combined[28]. And this number doesn't account for the additional carbon lost from the forest's soils, or for the 68,000 hectares (168,028 acres) deforested each year through the construction of logging roads and landings[29, 30].

Further, research shows that forests continue to emit carbon long after they've been logged—often for 10 years or more—as the amount of carbon emitted through decomposition and decay outstrips the amount of carbon absorbed by young, growing trees[31, 32].

Logging also contributes to carbon dioxide and methane emissions by accelerating permafrost melt, and increases the likelihood of future emissions by reducing the forest's ability to resist and recover from forest fires and other disturbances. And by eliminating the intact corridors that animals, trees, and plants need in order to migrate and adapt, logging in the intact areas of the forest reduces the ability of the ecosystem as a whole to function and thrive.

Large intact forest landscapes in Canada's Boreal Forest

Government and industry arguments are misleading

Recently, government regulators and the Canadian forest products industry have been denying that logging in the Boreal Forest contributes to global warming, primarily by arguing that when forests are logged, the carbon within them is stored for long periods of time in forest products[33, 34, 35]. This argument does not live up to scientific scrutiny.

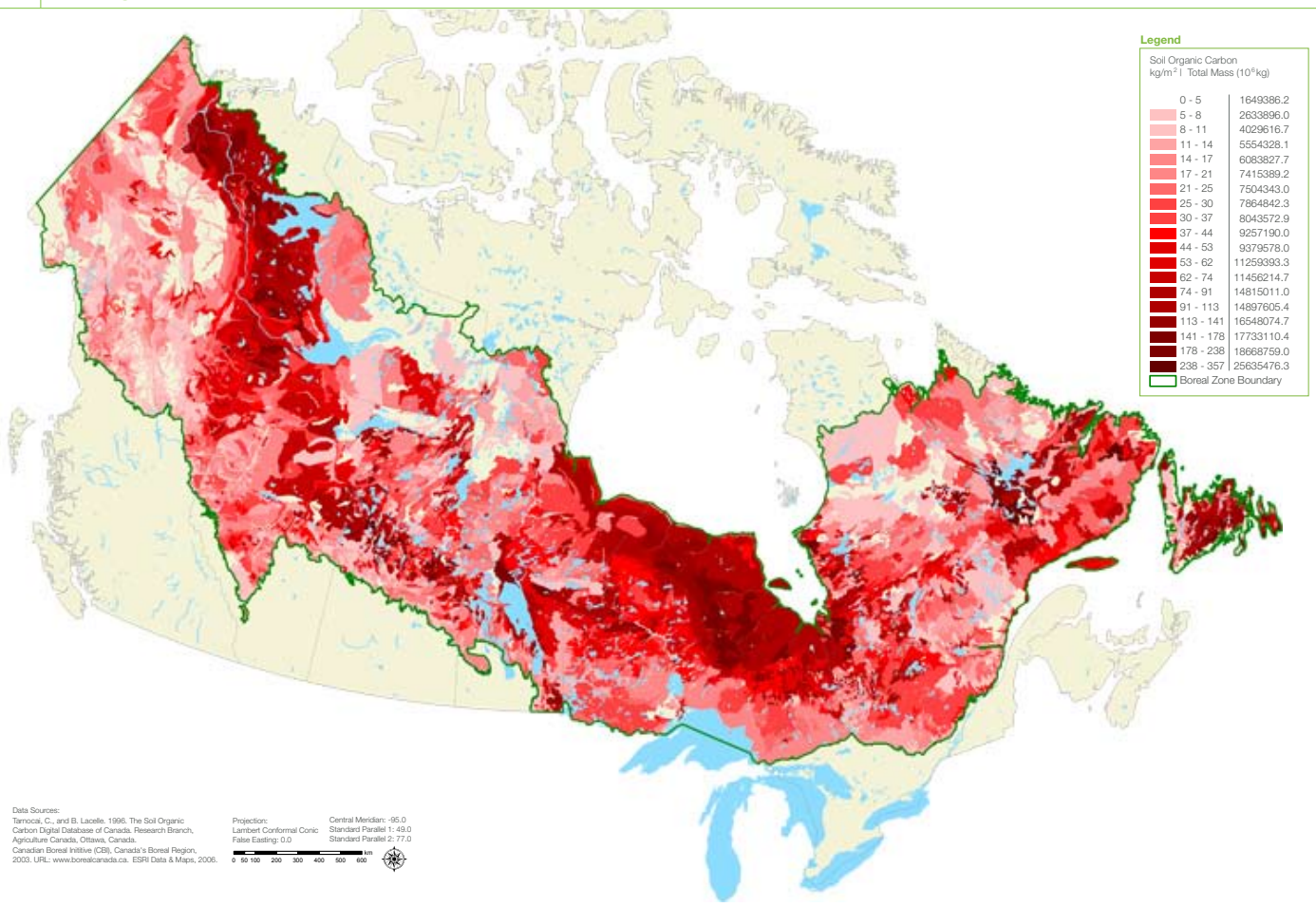
Not only is it based on a number of false assumptions (for example, that most or all of the trees logged end up in long-lasting products like dimensional lumber), but it paints a simplistic picture of logging that fails to account for important factors such as the carbon lost from soils during logging, the carbon emitted for years after logging ends, the areas permanently deforested through the building of roads and landings, and the carbon dioxide and methane emitted as permafrost melts and as products decompose in landfills. This argument also fails to account for the many consequences of fragmentation on the health of the forest as a whole, including increased vulnerability to global warming impacts, and reduced ability of animals and trees to migrate, adapt, and survive under warming conditions.

The carbon bomb

Forest fires, insect outbreaks, permafrost melting, and logging in Canada's Boreal Forest have the potential to worsen global warming, while industrial development has the potential to weaken the Boreal's resistance and resilience in the face of global warming's intensifying impacts. If left unchecked, these problems could culminate in a scenario known as "the carbon bomb": a massive release of greenhouse gasses into the atmosphere, driven, for example, by a widespread outbreak of forest or peat fires. Because Canada's Boreal Forest contains 186 billion tonnes of carbon, a rapid release of its carbon into the atmosphere could cause a disastrous spike in global emissions, comparable to the 1997 peat fires in Indonesia that accounted for an estimated 13–40 per cent of global carbon emissions from fossil fuels in that year[36].

"Because Canada's Boreal Forest contains 186 billion tonnes of carbon, a rapid release of its carbon into the atmosphere could cause a disastrous spike in global emissions."

Soil organic carbon in Canada's Boreal Forest



Solutions

Nothing less than comprehensive, global solutions is sufficient in the face of global warming. Reducing greenhouse gas emissions from fossil fuels and stopping tropical deforestation have both been recognized internationally as essential measures. In addition, the remaining intact areas of Canada's Boreal Forest must be protected—both to help avert catastrophic global warming, and to protect the Boreal Forest from global warming's intensifying impacts.

Currently, only 8.1 per cent of the large intact areas of Canada's Boreal Forest are protected from industrial development[37]. Meanwhile, 45 per cent, or 154 million hectares (382 million acres), of the treed area of the Boreal is under license to logging companies, mainly in the biologically diverse southern areas of the Boreal Forest[38].

That's why Greenpeace is calling for a moratorium on industrial development in all intact areas of Canada's Boreal Forest. A moratorium would make the most important areas of the Boreal off-limits to logging and other industrial development until an acceptable, comprehensive, science-based plan for the forest's future management and protection is agreed to by First Nations, communities, governments, environmental organizations, and industry—a plan that's sustainable for people, for wildlife, and for the planet.

“Intact areas of Canada’s Boreal Forest must be protected—both to help avert catastrophic global warming, and to protect the Boreal from global warming’s intensifying impacts.”

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