

The New York Times

These forests below the Arctic Circle are  
designed to burn.

But not this often.

# Parts of Canada's Boreal Forest Are Burning Faster Than They Can Regrow

The delicate balance of one of the planet's largest natural systems for storing carbon depends on the humble black spruce tree.



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Aug. 12, 2024

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The dead black spruce looked like a collection of giant burned matchsticks standing tall above the gray landscape as far as Jennifer Baltzer could see. But here, at the edge of one of the largest areas of scorched forest that scientists have ever documented in Canada, what caught Dr. Baltzer's attention was closer to the ground.

The spruce seedlings were gone.

Dr. Baltzer, a professor of forest ecology, was a few hundred miles below the Arctic Circle, where for over a decade she has studied the health of the black spruce and the boreal forests. It was a scorching late spring morning, and she and three of her students from Wilfrid Laurier University in Waterloo, Ontario, were in the Northwest Territories to document what could grow from the ashes of the record-breaking fire season that had ravaged the forest almost a year earlier.

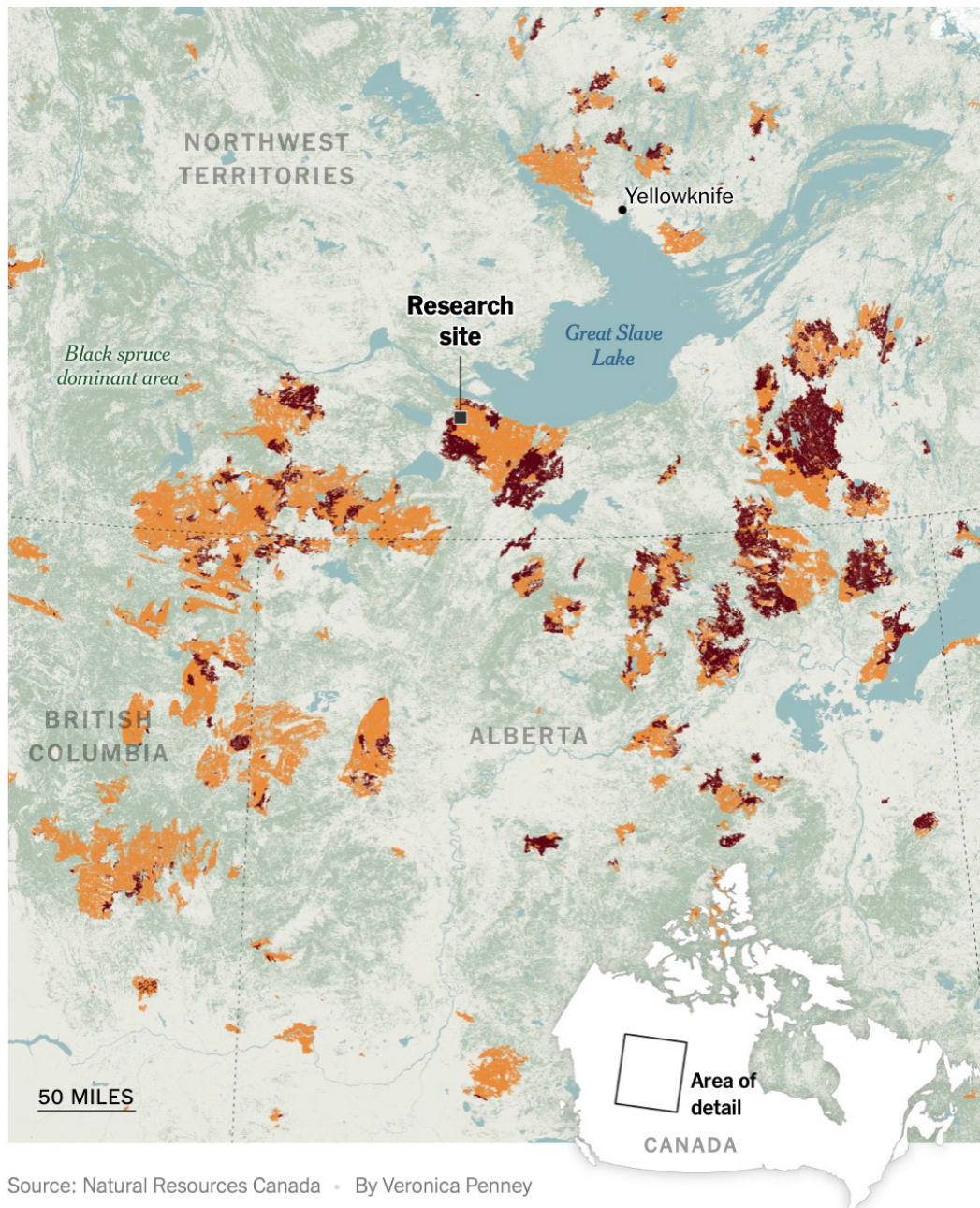
"Wow, it's kind of crazy in here," Dr. Baltzer said as she inspected the blackened landscape. She had never seen trees burn this soon after a previous fire.

The boreal forests are the largest forests in the world, and in Western Canada they evolved to burn once every century or so. But this patch of forest had just burned for the second time in a decade. As a result, many trees would struggle here, she explained. The slow-growing black spruce didn't stand a chance.



## Where Canada's Monster Fires Burned — and Re-Burned

■ Area burned in 2023 ■ Burned in 2023 and at least once in past 50 years



Source: Natural Resources Canada • By Veronica Penney

More frequent, bigger wildfires, fueled by climate change, are a formidable challenge to the black spruce, a species that has dominated these landscapes for thousands of years. Their gradual decline, now accelerated by last year's fire season, is one of the strongest pieces of evidence that the new age of

wildfires aren't just overwhelming people with the smoke and destructive blazes now raging across North America — they are overwhelming nature, too.

The dwindling number of black spruce trees, scientists say, is deeply transforming an ecosystem that is one of Earth's biggest storage systems for planet-warming carbon dioxide, a crucial tool to keep the atmosphere from warming even more than it already has.

Last year's fires engulfed a stretch of forest the size of the Netherlands for at least the second time in 50 years, according to an analysis by Natural Resources Canada, a federal government department.

What was troubling, Dr. Baltzer noted, is that fire isn't supposed to make life harder for the black spruce tree. Quite the opposite.



Jennifer Baltzer, a professor of forest ecology, in a spruce stand that burned last year outside Behchoko, Northwest Territories.



Black spruce cones, which open and release their seeds with the help of fire.

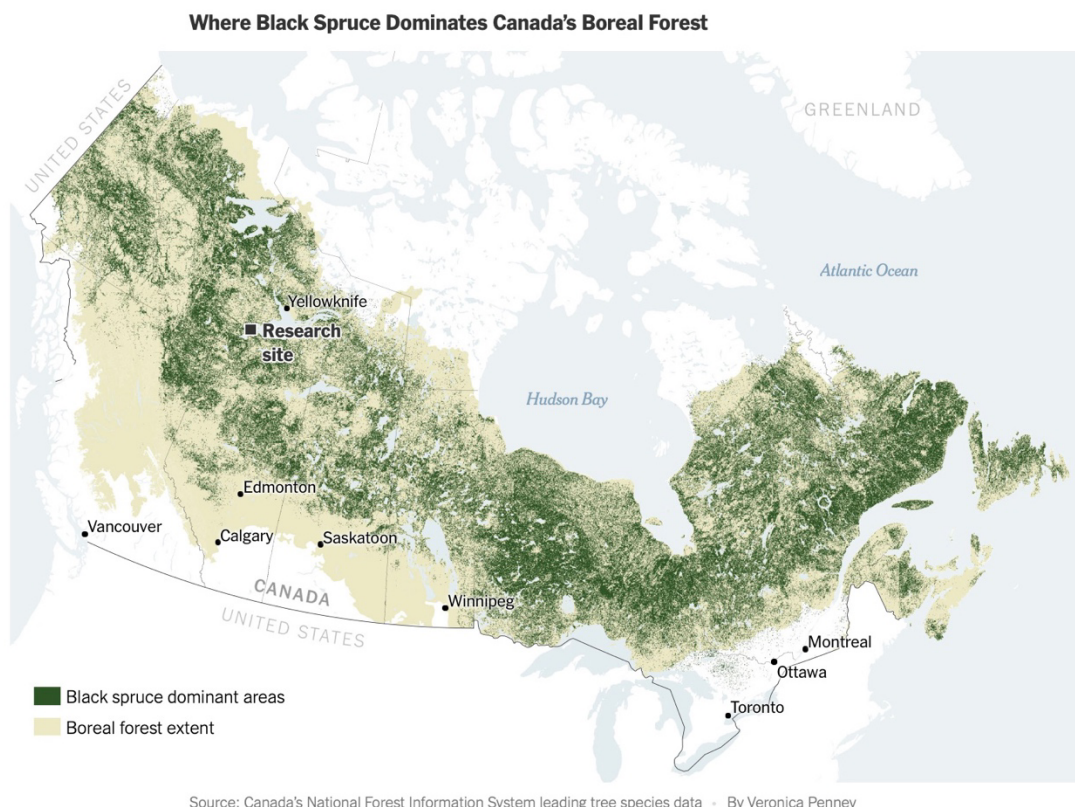


Black spruce forests didn't just evolve alongside fire, they depend on it. The tree is a natural bonfire of sorts. Its branches are covered with flammable resin that fuels the flames of forest fires right up to the tree's crown. Fires help melt the waxy coating of black spruce cones until the trees release seeds onto the soil where seedlings can grow.

But if they burn too often, there aren't enough viable seeds to reproduce. Burn too hot, and the seeds are killed. Burn too deeply, and the organic layer of soil where black spruce trees thrive, and which takes decades to accumulate, is gone.

In recent years, the black spruce failed to regenerate after fire in a fifth of the hundreds of sites Dr. Baltzer and other researchers monitored in North America's boreal forests. And that was before the fire season of 2023.

The black spruce's struggles are a gradual break to an ancient natural cycle, one that releases planet-warming carbon into the atmosphere as old trees burn, and then gradually returns that carbon to the land, in the form of new trees and new soil. Any imbalance in this tug of war between life and death can threaten the boreal forests' ability to store heat-trapping carbon.



Last summer, temperatures in Canada were more than 2.2 degrees Celsius, or 4 degrees Fahrenheit, above the historical average of the past few decades. Around the Northwest Territories, it was even hotter. The heat is largely why fires as severe as last year's happened many years before scientists anticipated. Most climate projections didn't expect these kinds of fires until later in the century, a new preprint study found.

"The entire bloody country was hot and dry at the same time," said Marc-André Parisien, a senior researcher at the Canadian Forest Service and an author of the study. "If you would have told me that a few years ago, I'd be like no, that doesn't really make sense."

Forest fires are burning more than twice as much tree cover [as they did 20 years ago](#). They have also become more intense and frequent, especially in the boreal forests, according to [a recent study](#). Increasing temperatures, fueled by the burning of oil, gas and coal, are the biggest culprit.



A wildfire burning south of Enterprise, Northwest Territories, last August.  
Jeff McIntosh/The Canadian Press, via Associated Press

In the Northwest Territories, as Dr. Baltzer drove through the burned forests on her way to visit another site, she recalled the moment the scope of the 2023 tragedy became clear. She was reading headlines about the immense blazes when it hit her that the planet had briefly reached the temperature at which countries had agreed in the Paris Agreement to cap warming: 1.5 degrees Celsius, or 2.7 degrees Fahrenheit, above preindustrial levels.



Temperatures would need to be at that level for several years for the global target to be breached. But for a scientist who had spent much of her career tracking fire, the consequences of a planet that was warming this quickly were clear.

If the world continued on this trajectory, it didn't matter how hard she or anyone worked to protect the boreal forests.

"Everything will burn," she said.

### ***'The trees melted'***



A single burned tree near Kakisa, Northwest Territories, an area that has burned twice in the last 10 years.

The scraggly, skinny black spruce trees may not be much to look at. But what lies in the soils below them is one of nature's biggest gifts to living things, a vault of the forest's past lives, in icy slow decomposition, that stores immense amounts of planet-warming carbon.

The researchers were on their way to document another area that had burned in 2023 when they walked into an ancient black spruce stand. As they stepped on the ground, it sank several inches below their feet. Then it bounced right back.

The cold temperatures of northern Canada slow down the microbes that eat the dead moss and leaves on the ground. Inches, or sometimes several feet, of organic matter remain on the soil even as new trees, moss and lichen, one of the caribou's favorite foods, grow on top.

The black spruce is one of the few trees that can grow on such spongy soils. The acidic nature of the trees' needles helps slow down decomposition and its bushy branches help catch snow, making soils colder during winter.

The black spruce is one of the few trees that can grow on such spongy soil. As the researchers approached the burned patch, walking became harder. The ground was now full of enormous potholes covered by thin layers of singed plants. The black spruce trees, many more than a century old, had all fallen, their blackened roots sticking up to the sky, many of their seeds dead.

"It looks like the trees melted," Dr. Baltzer said.

Austin McIntosh, a technician, and Kyle Fennig, a research assistant, grabbed a tool to measure how much of the soil had combusted. In some patches, more than half of the organic matter in the ground was gone.

Their measurements were perhaps a glimpse into the future of that ecosystem. The amount of carbon that soils hold after the spruce trees are gone [can fall by up to 80 percent](#), a recent study showed. It then takes several decades for the forest to restore it.



Kyle Fennig, left, and Maya Provenzano, students at Wilfrid Laurier University, gathered data in a stand of black spruce that burned during the 2023 fire season, near Behchoko.





The top of a soil core sample is dotted with organic material, including *Geopyxis carbonaria*, pixie cup lichen and green *polytricha* moss.

When fires kill off black spruce trees, they are often replaced by other native trees, such as birch or aspen. These species survive in part because they grow a lot faster. But because they drop their leaves every year, which stops mosses from growing, the soil around these trees doesn't store as much carbon.

Some researchers have found these fast-growing, less flammable trees can help protect black spruce seedlings. But researchers fear that the era of more frequent fires has broken that balance because spruce trees are killed off too quickly.

When Dr. Baltzer pulled on one section of burned soil, as if it were a thick wool rug, there was ice below. But it wouldn't stay that way for long, she told the team. Now that the organic layer protecting the frozen soil was gone, it would thaw quickly, completely changing this corner of the ecosystem. What would happen next would depend on how wet the soil would become.

"I would expect this to get wetter," she said. Maybe other trees, like larch, could grow here then. "But possibly not black spruce."

At scale, the implications of how well the black spruce fares in places like this could change how scientists expect global warming to play out in the future. Put together, the soils of the Arctic and the boreal forests, which stretch from North America to Asia and Europe, store almost twice as much carbon [as now exists in the atmosphere](#).

## **‘No more water’**



Chief Fred Sangris of the community of Ndilo.

For the Dene First Nations, which have lived in the boreal forests of the Northwest Territories for centuries, the menacing forces of the new age of wildfires are a consequence of the deep transformations they have watched unfold around them for years.

Chief Fred Sangris, of the community of Ndilo on the edge of Yellowknife, the territorial capital, has seen the permafrost melt into large ponds, and ancient trees sink as their roots lost their grip on the mushy soils. He noticed new islands emerging when the water levels at the Great Slave Lake sank to record lows. And he felt the peat soils, once as soft as mattresses, dry up and harden.

As Chief Sangris walked in the old-growth forests of Dettah, the hamlet where he grew up some 15 miles south of Yellowknife, he couldn't find any of the black spruce gum that the Dene people use to make teas that help treat upset stomachs. The trees had all turned gray.

“These trees are dying because there’s no more water,” he said, as the soil crackled below his feet. “We’ve never seen anything like this.”

The ecosystem that is a central part of much of Dene culture had changed before Chief Sangris’s eyes. He grew up collecting berries, fishing and hunting caribou in these lands. But caribou populations have long been declining and finding ripe berries in drier forests has become harder.



More than [half the population](#) in the Northwest Territories' 42,000 people are Indigenous. First Nations officials are now pushing for a bigger role in shaping policy on topics like fire management and evacuation strategies.

They are worried about protecting communities that had never been under wildfire threat. The Dene hamlets of Dettah, Behchoko and Ndilo were [evacuated for the first time last year](#). So was Yellowknife, a city of 20,000 that has historically been a safe harbor to communities deeper in the forest.



The burned remains of a gallery and gift shop in Enterprise.



A section of forest that burned in last year's fires is visible from the road between Kakisa and Enterprise.

Weeks after the trip to the Northwest Territories, Dr. Baltzer said, the images of the burned forests were still in her mind. She felt confident that the data her team collected would help manage wildlife and protect First Nations communities. Given how huge the boreal forests are, her research could help shed light on which parts of the ecosystem were most important to protect.

The research is also poised to help improve the global models that forecast how climate change will affect the planet. Estimates from a United Nations panel of experts project that, sometime in the next decade, [global temperatures will rise to a sustained level of 1.5 degrees](#) Celsius above preindustrial levels, from the current level of about 1.2 or 1.3 degrees. If temperatures rise above that, scientists say, the effects of catastrophic heat waves, flooding, drought, crop failures and species extinction will become significantly harder for humanity to handle.

Extreme fires like last year's that ravage enormous tracts of forests are "completely absent from the current climate models," said Philippe Ciais, a researcher at the Laboratory of Climate and Environmental Sciences, near Paris, who tracks carbon dioxide emissions.

Because of that, he said, "the models are probably too optimistic."

As he stood at the edge of the lake by Dettah, Chief Sangris watched small fishing boats cross the blue waters, glistening in the sun. He recounted his community's efforts to adapt to the changes around them across several generations. They built fire breaks, found evacuation routes, fought mining interests and developed programs to grow more food locally so they wouldn't need to rely on the forest as much as they have in the past. Their goal was to stay on their ancestral land.

"You put your canoe here, you're in the wilderness," he said. "We're not moving. This is our home."





**Correction:**

Aug. 13, 2024

*An earlier version of this article stated incorrectly the status of the Northwest Territories in Canada’s federal system. It is a territory, not a province.*

<https://www.nytimes.com/interactive/2024/08/12/climate/canada-wildfires.html>

Again, as Canadians, we say American lack of knowledge of us, and interest in us as a country, is exposed. If it is called the “Northwest Territories” it might be a good idea to fact-check if it is a “province” before publishing. In Australia, the Northern Territory is indeed “just” a territory in another federal system. TJB