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# B.C. permafrost warming comes with climate warning

*The landscape in the far-northeastern corner of B.C., a broad swath of muskeg and boreal forest shaped by sporadic islands of permafrost, is warming up.*

Derrick Penner  
Feb 26, 2021 • 3 days ago • 8 minute read • [Join the conversation](#)



The ground is collapsing as ancient buried glaciers melt near the Toolik Field Station. The loss of the ice releases sediment and nutrients into the newly formed lake and any downstream rivers. PNG

While academics study the warming planet and governments debate how to deal with consequences, such as the thawing of permafrost, the Fort Nelson First Nation is living climate change.

The landscape in the far-northeastern corner of B.C., a broad swath of muskeg and boreal forest shaped by sporadic islands of permafrost, is warming.

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“People are seeing more muskeg, more swampy areas, which means more bugs,” said Lorna Lowe, director of lands and resources for the Fort Nelson First Nation.

The bugs include ticks that infest moose, making their meat less palatable, Lowe said. The muskeg encroaches on caribou habitat, which Lowe’s department is working on trying to restore after decades’ worth of natural gas exploration.

“There’s all these sort of interrelated things that we are seeing on the ground that make us think more about climate change,” she said.

What to do about it is a bigger issue.

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Lowe’s focus is on adaptation to shifting conditions that the small Dene and Cree Nation of some 640 people have to live within.

Vancouver entrepreneur Michael Brown wants to look at the bigger picture when it comes to climate change, its impact on permafrost and the impact thawing permafrost is having on climate.

“The problem is that permafrost is not included in any of the definitions about nationally determined contributions (to greenhouse-gas emissions),” so permafrost doesn’t show up on agendas when countries sit down to talk about climate change, Brown said.

“One of the things that we’re trying to suggest is that the nations of the world might want to put this problem on those agendas,” he said.

Brown, a longtime venture capitalist who has backed clean-energy cornerstones such as Ballard Power Systems and General Fusion, is trying to make a private-sector start of that by sparking a series of virtual dialogue discussions to better define the problem, and whether anything can be done about it.

There will be four sessions, starting March 4 and ending March 25, which will bring together scientists, ethicists, policy experts and community advocates under the banner of the Permafrost Carbon Feedback Action Group.

The initiative’s hoped-for-outcome will be a preliminary guide to the current state of science and technology around what is referred to as the permafrost-carbon feedback loop, and potential roadmap for interventions.

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“We have to be very careful about what we’re not trying to do,” Brown said. “We’re not trying to tell people what to do,” but are “trying to bring it to the attention of climate-strategy people from a national point of view.”

Generally defined, permafrost is soil or rock that remains at a temperature below freezing for at least two years, though most of Canada’s has existed for extremely long periods.

### **Carbon reservoir is thawing**

According to Natural Resources Canada, permafrost lies under about [half of Canada’s land mass](#), ranging from bands of continuous freezing in the High Arctic to varying degrees of sporadic coverage and intermittent islands farther south.

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sequesters twice as much carbon as is already in the atmosphere — 1.4 billion-to-1.6 billion tonnes.

Schuur heads the Center for Ecosystem Science and Society, Northern Arizona University, and is one of the headline academics taking part in the dialogue series' opening session.

Warming of the Arctic is bringing permafrost in many locations to “record high temperatures,” thawing the “climate-sensitive carbon reservoir,” as Schuur puts it, releasing the stored carbon as greenhouse gases — mostly carbon dioxide but also methane, to a lesser extent.

There is debate around how much additional greenhouse gases are being counteracted by things such as new plant growth in the changing tundra, but fellow ecologist Ben Abbott said, “there’s a relatively high level of consensus that permafrost (melt) will amplify human emissions.”

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“In the scientific community, we still are not able to predict with a high measure of precision how much greenhouse gas will come out, and at what point,” said Abbott, an assistant professor in ecosystem ecology at Brigham Young University in Utah.

While the pool of carbon sequestered in permafrost is huge, Abbott said models have estimated that the additional greenhouse gases contributed by its thaw might be in the single-digits to 15 per cent of the emissions that humans generate. That is about the equivalent of Spain’s greenhouse-gas emissions, Abbott said, which need to be counted, but there “is not strong evidence” that permafrost “will become the driving force behind climate change.”

“The best way to limit emissions from the permafrost zone is to rapidly decrease the dirty fossil-fuel use that we have currently,” Abbott said. “That’s the only way we can be sure to keep the carbon in the ground where it’s been for thousands of years.”

### ‘It’s going very quickly’

However, governments and decision-makers need to consider whether additional mitigation measures such as solar geo-engineering are possible let alone feasible, considering the speed at which the Arctic is warming. The main techniques involve putting aerosol materials into the atmosphere or seeding clouds over the ocean to reflect solar radiation back into space, which are controversial in some circles for the unknowns involved in altering the atmosphere.

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But “if you could do that, you’re going to keep the scale of emissions down,” Brown said of techniques for what is also referred to as proactive solar management.

The entrepreneur agreed that whatever action that happens down the road can’t distract from the overall objective of reducing human emissions to net zero, but argued additional measures to preserve permafrost need to be better understood.

“Maybe the first thing to do is for the nations of the world to get together, the ones that care at least, the ones in the north, (and) decide how to share the cost of making sure we’ve got the science right,” Brown said.

Whatever is discussed, northern communities, the ones built on top of permafrost and dependant on its stability, need to be included in the discussions, said Tony Penikett, a former Yukon premier and advocate for Arctic issues.

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on which they lived.”

And what northern communities don't need, Penikett added, is to be “told what some scientists are going to do, but to be involved in very early stages in discussions about the possible solutions.”

And when it comes to technological ideas, such as solar geo-engineering, “I don't think (they) have been respectfully introduced to people in the north yet.”

Such radical interventions aren't the only ideas for potentially mitigating permafrost melt, said forestry researcher Werner Kurz, but there are few options and people are running out of time.

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Kurz, a senior research scientist with Natural Resources Canada and the Canadian Forest Service, isn't affiliated with the dialogues, but is familiar with the permafrost carbon feedback, which is an unknown he has been warning people about as “an alarming issue” for two decades in his own presentations.

“I completely agree that this is probably one of the biggest positive feedback loops and contributor to huge uncertainties in our forecasts about how the global climate system will work,” said Kurz, who is also a leader for a research project at the Victoria-headquartered consortium, the Pacific Institute for Climate Solutions.

In northeastern B.C., where the peaty, boggy, boreal forest straddles a border with the Northwest Territories at what researchers call the southern frontier of the permafrost, there is a clear transition when the frozen landscape thaws.

“It sets off this kind of chain reaction,” said hydrologist William Quinton.

The land above the ice subsides and floods, new wetlands encroach on the boreal black-spruce forests, which die off, “so you have a pretty dramatic landscape change,” said Quinton, now an associate professor at Wilfrid Laurier University in Waterloo, Ont., who has observed such a change in this corner of the sub-Arctic north for two decades.

Quinton is lead researcher on a project sponsored by Geoscience B.C. aimed at mapping and understanding the changes over time. In one section, the landscape was once 70 per cent permafrost when researchers first measured it in the middle of the 20th century.

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“(Now) it's a little less than half that, it's about 30 per cent permafrost over a square kilometre,” Quinton said. “So it's going very quickly.”

He added that it has particular implications for the climate question because thawing permafrost that transitions into wetlands tend to give up more of their carbon as methane, which is a more potent greenhouse gas.

### Communities want help to adapt

Lowe, however, doesn't want efforts to lose track of their need to adapt to changes.

“I think government could assist local communities in understanding the changes that are happening,” Lowe said. “Part of the issues is, we don't know if it's climate change effects we're seeing or you know (the result of) industry activity.”

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rehabilitate caribou habitat.

Lowe said the Nation is also re-establishing a historic fishing camp on the Tlue Tlue lake, known by the non-Dene name Maxhamish Lake, to help make up for the loss of moose-hunting opportunities.

A warmer climate, however, is bringing spring breakup a month-to-six weeks earlier, meaning fishermen have to leave the camp by mid-March when, in the time of Lowe’s grandfather, roads would have been still frozen and firm enough to stay until the third week of April.

“We’re thinking more about adapting rather than trying to stop (permafrost melt),” Lowe said. “It’s almost like trying to stop the snow from melting. Landscapes change over time and yeah, (we’ve) never even thought about trying to stop it.”

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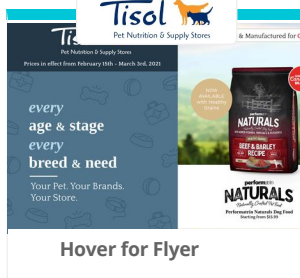
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