

Canadian forests a refuge as warming creeps north

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Black spruce. Credit: Loïc D'Orangeville

In the Canadian province of Quebec, a study of more than 26,000 trees across an area the size of Spain forecasts potential winners and losers in a changing climate.

The study, published today in the journal *Science*, shows that boreal forests in far-northern latitudes may one day act as a [climate](#) refuge for black spruce, the foundational tree for the northwoods ecosystem - a major source of the world's paper; home to caribou, snowshoe hare, lynx, and sable; and nesting site for dozens of migratory bird species.

"During this century, the northwoods will experience some of the Earth's largest increases in temperature," says Loïc D'Orangeville, postdoctoral researcher at Université du Québec à Montréal and Indiana University, who led the collaboration of scientists from six institutions in the U.S. and Canada.

Northern boreal forests are a crucial part of the global climate puzzle, comprising nearly 30 percent of the Earth's forested area and storing at least 20 percent of its carbon. The study's tree ring analysis revealed these forests' sensitivity to changes in temperature and precipitation.

"A warming climate increases the amount of water boreal forests need to survive," explains D'Orangeville. "It's possible that only a relatively small part of North America's boreal forest will have enough water to compensate for the increased demand."



Boreal forest. Credit: Loïc D'Orangeville

North of a certain latitude (broadly 49 degrees North), the study showed, warming melts snow earlier and lengthens the growing season: [good news](#) for tree growth. "Right now - June and July - is when most of the annual [tree growth](#) takes place in the boreal forest," says D'Orangeville. Climate models predict that by 2050, the growing season in the study area will have expanded by 3 weeks.

South of the 49th parallel, however, warming and the lengthened [growing season](#) are more likely to cause drought stress that could overwhelm black spruce. The researchers say this may explain increased tree mortality already being observed in the region.

"But as you move northwards, temperatures cool, and evaporation diminishes," says D'Orangeville. As climate warms through 2070, more than two-thirds of the forested territory just above the 49th parallel should still be showing a positive response.

"This part of the forest could adapt to climate change in our lifetime, if future warming stays below the temperature threshold," says Neil Pederson, co-author of the study and a senior ecologist at Harvard Forest. "But the future cannot be perfectly predicted." And, he cautions, unpredictable factors, such as the recent mega-fires in boreal regions of western Canada and Alaska, could disrupt this dynamic.

Still, the study offers a note of hope. "In a world where many ecological forecasts appear dire for plants, animals, and people," says Pederson, "identifying areas that could serve as potential havens for biodiversity during potentially tumultuous times is good news."

More information: Northeastern North America as a potential refugium for boreal forests in a warming climate, *Science*, [science.sciencemag.org/cgi/doi ... 1126/science.aaf4951](https://science.sciencemag.org/cgi/doi/10.1126/science.aaf4951)

Provided by Harvard University

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