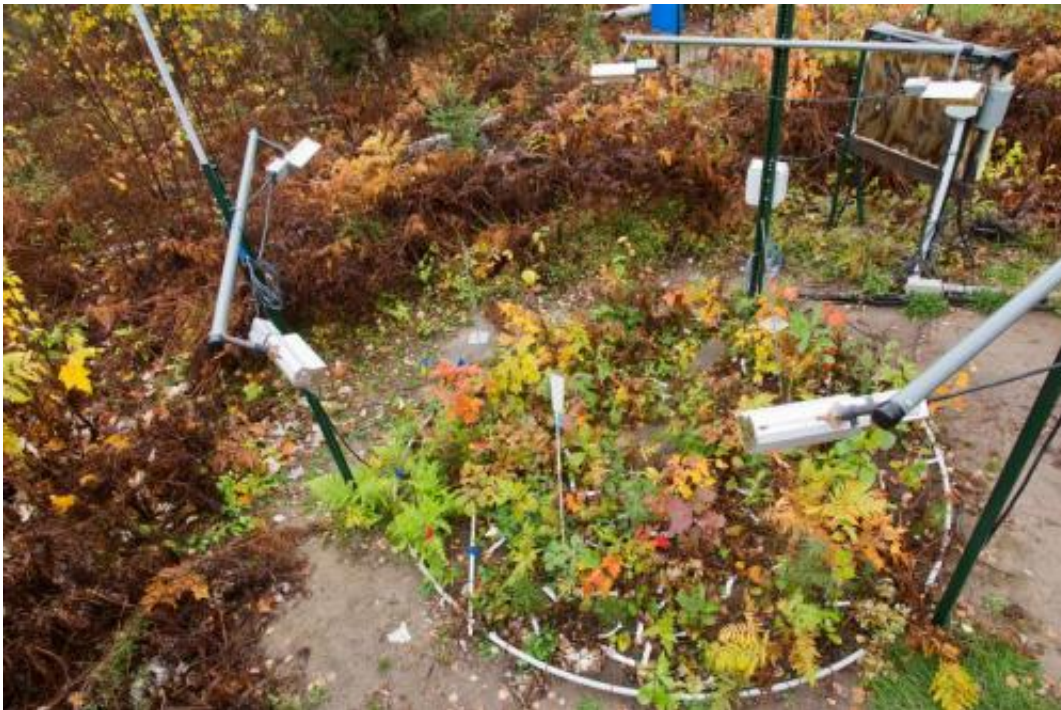


# Warming climate likely will change the composition of northern forests, study shows

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Credit: David Hansen, University of Minnesota

Visitors to northern forests in coming decades probably will see a very different set of trees as the climate warms, a new University of Minnesota study shows.

The study, published this week in the journal *Nature Climate Change*, used a unique long-term outdoor experiment to examine the [effects of](#)

[climate change](#) on trees in the boreal forest along the U.S.-Canadian border. Some [species](#) in the [boreal forest](#) are at the far northern range of their growing area, while others are at the far southern edge of their range. Species like spruce and fir that thrive in cooler areas to the north in Canada suffered poorer growth and survival when warmed by a few degrees, while trees like oaks and maples that prefer a more temperate [climate](#) performed better when warmed. Other species like aspen, birch, and pine, had a more neutral response. While all of these species may continue to co-exist, at least for a time, in a warmer climate, the study found that the balance of power, competitively speaking, shifted from the boreal species to the oaks and maples. In addition to being directly affected by warming, spruce and fir might also struggle to compete for sunlight and water with neighboring trees and plants as climate changes.

The scientists, led by Peter Reich of the forest resources department at the university, simulated the effects of a warmer climate on 10 native and 1 non-native species over three growing seasons at the University's research sites near Cloquet and Ely, Minn, and did so in both recent clearings and in shady understories. The project, known informally as "B4WarmED," used infrared heating lamps and soil heating cables to simulate the effects of just a few degrees of climate warming on 72 plots containing about 4,100 young trees of local Minnesota origin. For this paper, researchers monitored growth rates of the trees as well as how efficiently they converted sunlight into energy, the process known as photosynthesis.

The project did not examine how warmer winters might affect [trees](#) and other plants, but the researchers note that winter conditions could amplify the effects being seen in this study.

The results also indicated that a [warmer climate](#) is likely to accelerate the northward invasion of non-native species like buckthorn. Buckthorn has slowly increased in abundance in northern Minnesota in recent decades,

perhaps slowed by cool summers, but it thrived in warmer experimental conditions. This is bad news, as it suggests that buckthorn and other invasive species might take advantage of [climate change](#) and more aggressively move up north.

"In the best case scenario," Reich says, "oaks and maples will become more dominant as boreal species decline, and we will have a different, but still functional forest. In the worst-case scenario, oaks and maples will not replace the declining species fast enough, and our forests will be patchy and perhaps filled with invading buckthorn. The change in the forest will influence everything from the supply of timber to habitat for wildlife to its allure for recreational use and tourism. Will people flock to the northern lake country if the woods are full of buckthorn and scattered oaks and maples?"

A number of University of Minnesota colleagues, including Rebecca Montgomery from the forest resources department, collaborated on the project with Reich.

**More information:** *Nature Climate Change*,  
[www.nature.com/nclimate/journal/article/11/nclimate2497.html](http://www.nature.com/nclimate/journal/article/11/nclimate2497.html)

Provided by University of Minnesota

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