

A forest dilemma: What will grow in a changing climate?

By Dan Kraker · Two Harbors, Minn. · Feb 3, 2015

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One of nine overlooks on Oberg Mountain near Tofte, Minn. The overlooks are a popular destination to view fall colors. *Derek Montgomery / For MPR News*

Minnesota's iconic northern forests are undergoing a gradual shift as the climate warms. Aspen, birch, balsam fir and black spruce, for example, are projected largely to vanish from the state by the end of the century.

But some foresters are suggesting a more radical shift in approaching what to do about it. Although not everyone agrees, some in forestry are stressing urgency and experimenting with bringing new species from hundreds of miles away, betting that with a helping hand those trees stand a better chance of producing a healthy diverse forest than existing species.

For proponents, bringing oaks and even ponderosa pines from as far away as the Black Hills is the best way to ensure Minnesota and its sizable forest industry will have thriving forests many decades from now. Others worry that the idea is too much of a gamble and could wind up essentially introducing troublesome invasive species.

One place to see this approach in action is a recently logged clearing north of Two Harbors in the Superior National Forest.



Meredith Cornett, director of conservation science with The Nature Conservancy, examines a tree in one of its research plots near Two Harbors, Minn., in September. The group is experimenting with shifting more temperate trees north. *Derek Montgomery / For MPR News*

Ecologists with The Nature Conservancy have planted 108,000 seedlings on 2,000 acres here and elsewhere in northern Minnesota. Last fall, in a forest of spruce, fir, birch and aspen, Mark White, a forest ecologist with the group, and Laura Kavajecz, a University of Minnesota-Duluth graduate student, were monitoring oak, white pine and basswood seedlings.

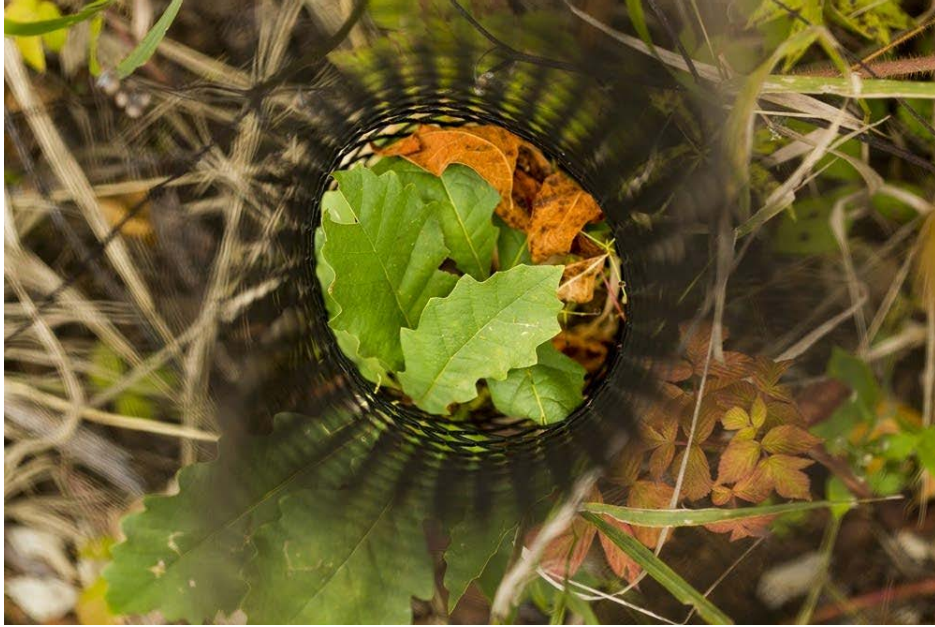
"We're measuring the total height of each tree, the diameter and then the distance to the bud scale scar, so we can get at how much it's grown this season," Kavajecz said.

In that particular plot, White said, trees were growing from seeds taken from areas south and west of the forest about 200 miles away.

"These trees may have some characteristics that make them better suited to these sites in a warmer, drier future," White said, referring to the possibility of longer dry spells between rains and greater evaporation rates that would dry out forests even in an era of increased rainfall.

A few of the seedlings came from even farther away - white pines from the lower peninsula of Michigan.

This represents a big change in the forestry world, where the longstanding practice has been to plant only local trees. But models predict in the next several decades those trees that have flourished here for centuries likely won't be able to survive in great numbers.



A protective cage keeps out hungry deer from The Nature Conservancy research trees near Two Harbors, Minn. *Derek Montgomery / For MPR News*

Minnesota is unique because it lies at the convergence of three distinct ecosystems, or biomes. And the boundaries among those three - boreal forests of spruce, fir, pine and birch; deciduous forests of maple and oak and basswood; and prairie grasslands - are very sensitive to climate changes, said Lee Frelich, the director of the University of Minnesota Center for Forest Ecology.

In addition, Minnesota has been warming faster than most other states. In particular, northern Minnesota is heating up faster still - by nearly three degrees over the past century.

“I'm not wild about the idea of using our native forests as the place to experiment.”

John Almendiger, forest ecologist, Minnesota DNR

"So we can expect the boreal forest with a business as usual climate scenario for CO₂, for example, to virtually disappear from Minnesota," Frelich said.

Although he and others believe boreal trees will hang on in pockets of the state, he has already documented some deciduous species, like red maple, invading patches of boreal forest.

The notion that boreal forests will decline in a warmer climate has gotten support from a University of Minnesota research project near Cloquet and Ely, where scientists used infrared lamps to artificially warm eight-by-eight-foot plots of forest by as much as seven degrees, trying to simulate future conditions.

After five years, a difference is clear.



Karen Rice, project manager for a University of Minnesota project called B4WARMED, explained the process of artificially heating forest plots near Cloquet. Species like oak and maple performed better when warmed a few degrees. *Derek Montgomery / For MPR News*

In the warmed plots, the maples and oaks tower over their boreal cousins, while in an unwarmed plot nearby, the conifers were nearly as tall as the temperate species. In results reported in January in the journal *Nature Climate Change*, investigator Rebecca Montgomery said spruce and firs fared especially poorly in the warmed plots.

But some foresters fear that the naturally occurring deciduous trees won't be able to move fast enough on their own to replace the more cold-climate adapted trees. Frelich thinks parts of the Boundary Waters could be transformed into an oak savannah.

Climate models predict, for example, red oaks will love northern Minnesota in half a century. But Meredith Cornett, director of science for The Nature

Conservancy in Minnesota, says they can't just hop on Interstate 35 and drive north.

“The time to be thinking about how to act is now, and the time to act even beyond experimentation is rapidly approaching.”

Brian Palik, scientist, U.S. Forest Service

"You think about an acorn and it drops right there, and animals might scatter it and carry it further, but not at a pace that is going to allow us to keep up with a changing climate."

That poses a potential problem and not simply for academics and environmentalists. Trees support multi-billion dollar tourism and forest products industries.

"Forest products in Minnesota is the fourth or fifth largest manufacturing industry, employing some 30,000 people statewide, with a value of manufactured products of about \$9 billion," said Wayne Brandt with Minnesota Forest Industries.



From left: Chris Kottke, Josh Kragthorpe and Doug Kastendick look over a map of a U.S. Forest Service test plot. Kottke is a timber sale administrator with the forest service; Kragthorpe is a biological technician, and Kastendick is an ecologist

with the service's Northern Research Station. *Derek Montgomery / For MPR News*

In addition to a steady supply of everything from construction lumber and utility poles to paper products and wine barrels, the state's 17 million acres of forest also provide a host of ecological benefits. They suck up carbon dioxide, support birds and other wildlife and filter water, said Dave Zumeta, executive director of the Minnesota Forest Resources Council said.

With all that at stake, it's important how land managers like the Minnesota Department of Natural Resources, the U.S. Forest Service and private landowners try to sustain the state's forests.

Zumeta suggested that a mix of species and ages of trees is important, as it is in a stock portfolio.

"If all you own in this last month is oil stocks, your portfolio isn't looking too good right now," he said.

"These climate change modelers, even the best and the brightest, they don't know exactly what's going to happen," Zumeta said. "It's common sense that you'd want to manage complex ecosystems like forests for diversity and for resilience."

Not all the state's forest managers agree on how to favor trees projected to do better in a warmer climate. Some private landowners are planting white pine, a native tree expected to be a climate change "winner."



Logging is under way to clear part of the Chippewa National Forest near Grand Rapids, Minn, where a U.S. Forest Service climate adaptation study is being conducted. The Forest Service is looking at what trees might be best suited for a warmer climate. *Derek Montgomery / For MPR News*

But in another experiment just underway in the Chippewa National Forest, researchers will be planting trees from much farther afield.

Earlier this winter loggers felled red pines - a potential "loser" as the climate warms -- and sliced them into eight-foot sections to haul away. In their place, said U.S. Forest Service scientist Brian Palik, scientists this spring will plant a dozen different species.

That includes ponderosa pine, which grows well in drier, warmer climates like in the Black Hills in South Dakota, Palik said. "So we think it might be something that could be a potential replacement for red pine."

The Forest Service is also planting bitternut hickory and black cherry, species that live south of the experiment.

That is the first of four climate adaptation studies the U.S. Forest Service is planning around the country. The goal is to test a range of methods, like thinning trees to reduce competition for native trees, and planting a range of new species. They want to see what strategies might work best for helping the forest adapt to a rapidly changing climate.



The spray-painted yellow mark on this tree indicates a border between different areas of a U.S. Forest Service climate adaptation study in the Chippewa National Forest. *Derek Montgomery / For MPR News*

This controlled experiment in moving trees hundreds of miles beyond their native range -- often called "assisted migration" -- is controversial in the forestry world.

Rick Klevorn, silviculture manager for the DNR thinks it's risky. "We don't really know if they'll do well here," he said. "Or maybe they'll overly do well, maybe they'll become invasive."

Klevorn says the DNR is taking a more conservative approach. It is managing for more diversity in the woods by, in the past 10 years, planting mixed stands of trees, rather than the old style plantations of red pine or spruce planted in neat rows.

But it does not plant trees in climate zones outside of where they were grown, he said.

"We manage for native plant communities as we know them now," he said. "We're getting close to doing things like that. But no, we're not moving species around."

DNR forest ecologist John Almendinger said, "I'm not wild about the idea of using our native forests as the place to experiment. I don't like the concept right now of moving trees that have shown no ability to perform in those kinds of habitats."

Palik at the Forest Service said planning for the uncertainty of how rainfall and temperature might change is the challenge. But he believes forest managers need to be more urgent and have little time to pause.

"I've had the realization that we are faced with something potentially very radical and unprecedented, in terms of the future climate scenario and habitat suitability for species we have here," Palik said. "The time to be thinking about how to act is now, and the time to act even beyond experimentation is rapidly approaching."