Scattered nature of Wisconsin's woodlands could complicate forests' response to climate change

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If a warmer Wisconsin climate causes some northern tree species to disappear in the future, it's easy to imagine that southern species will just expand their range northward as soon as the conditions suit them.

The reality, though, may not be nearly so simple. A model developed by UW-Madison forest ecologists Robert Scheller and David Mladenoff suggests that while certain northern species, such as balsam fir, spruce and jack pine, are likely to decline as the state's climate warms, oaks, hickories and other southern Wisconsin trees will be slow to replace them.

Why? Not only is warming expected to outpace the speed at which southern trees can migrate northward, but barriers to dispersal — particularly agricultural lands — will also likely delay their progress, says Mladenoff.

"The result is that northern forest biomass in the future — that is, the standing amount of forest — could decrease, because the trees that are there now will be experiencing less than optimal conditions," he says. "And the southern species aren't going to fill in as quickly as we'd like." He and Scheller report their findings in the current issue of Climate Research.

Mladenoff explains that trees "move" into new areas by producing seeds, which are then carried over short distances by wind, birds or mammals. Under the right conditions, dispersed seeds then grow into seedlings and eventually mature trees, which produce their own seeds to start the process all over again.

Already a slow process, dispersal becomes even slower when forests are broken up by farmland and urban areas — or fragmented — like they are in Wisconsin. Not only is less suitable habitat available overall, but patches of it can also be widely scattered, making it tough for seeds to cross the gaps. In particular, Mladenoff points to the wide band of agricultural land that runs across the middle of the state as a major obstacle to the northward migration of southern trees.

To arrive at their conclusions, Scheller and Mladenoff fed current satellite classification and forest inventory data for a 1.5 million-hectare area of northwestern Wisconsin into a model, LANDIS-II, that's designed to predict how landscapes will respond to climate shifts. Using two well-established sets of future climate predictions, they then examined changes in parameters such as forest succession, seed dispersal and tree growth during the next 200 years.

In the face of the scientists' predictions, is there anything woodland managers can do now? Mladenoff cautions people not to make any drastic management changes. But one thing managers might begin to try is assisted migration: testing how certain southern Wisconsin species — or even different genetic stocks of the same species — do when planted up north on a trial basis. A prime candidate for experiments like this might be sugar maple, says Mladenoff, which is already widely distributed across Wisconsin and is projected to "do OK" on moist soils in the north when the climate warms.

The state might even consider bringing back the field trials that used to go on routinely in the 1950s and '60s, he says, in which researchers would collect genetic variants of individual tree species all over the state and then plant them in many locations to see where they did best. Although time-consuming, an approach like this could help ease some of the uncertainty we're facing now.

"A lot of this is about our incomplete knowledge of how genetically diverse some species are," Mladenoff says, "and how adaptable they may be in different climates."

Source: UW-Madison