

# Sustaining Northern hardwood forests

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Maija Erikson, a 2010 Michigan Tech alumna, collects field data during the northern hardwood forests study.

Northern hardwood forests give many gifts to many people. Natural beauty, recreation, a source of lumber, wood pulp for paper products, raw material for biofuels. They also generate jobs and sustain rural economies.

There's a system in place for assuring the productivity of northern hardwood forests. It's called the selection silviculture system, a method of using partial harvests done to a strict formula to sustainably manage the trees. It's been around centuries, and it works. There's only one problem.

A study by Michigan Technological University researchers found that the system generally isn't being used.

"This could be because nobody ever really used it, or because it isn't used anymore, or because it's too much trouble to use it strictly as it was designed," says Robert Froese, associate professor at Michigan Tech's School of Forest Resources and Environmental Science and author of a paper titled "Sustainability of the Selection System in Northern Hardwood Forests," published in the April 2014 issue of the journal *Forest Science*. "If that's true, then we should stop acting like the system is commonly used," Froese goes on to say. "Also, if true, we should consider what the implications are for the wide range of values that our forests provide. If harvests are too gentle, then it's likely that there isn't enough light reaching the [forest](#) floor to ensure regeneration. Over time, that will lead to forests that look quite different from the old-growth northern hardwood forests that are considered self-sustaining."

Nan Pond and Linda Nagel, both of Michigan Tech, were co-authors on the study. Nagel now works at the Cloquet Forestry Center at the University of Minnesota. Funding for the study was provided by Frontier Renewable Resources and a State of Michigan 21st Century Jobs Trust Fund grant.

Silviculture is the applied science of impacting how forests establish and grow, to meet diverse needs. This could be by planting seedlings in rows with fertilizer and thinning to grow trees valuable for lumber or veneer. It could also involve tending natural stands to accelerate the development

of "old-growth" character, or to conserve biodiversity. What distinguishes silviculture from forest ecology is the idea of managing the forests to preserve or produce some value. And that value doesn't have to be timber. It can be producing the smaller "pole" trees that provide wood for the pulp and paper industry. It could be assuring that enough seedlings are taking root, or it could be preserving the forest as a natural recreation location.

The "selection silviculture system" is a particular method for tending forests where repeated partial harvests are used to manage the trees. Usually, a specific structure (amount of trees by size and arrangement) is desired, and trees are removed to produce this structure. One critical factor is that to be selection silviculture, one of the goals must be providing for the regeneration of new trees (i.e., to create conditions where new seedlings establish).

In 1957, a research forester named Carl Arbogast wrote a guide for the selection system for managing northern hardwoods. The guide has become the core of northern hardwood silviculture, particularly in the Great Lakes region.

Froese and his colleagues set out to discover whether Arbogast's selection system is widely applied in the Great Lakes northern hardwood forests.

They studied recent timber harvests on state forest lands, forests under corporate ownership and privately owned forests. They measured the trees in 10 randomly located circular plots under all three kinds of ownership, and measured stumps to reconstruct what the stands looked like before the harvest. Then they relocated and enlarged the plots, analyzing them in 2010 and 2011.

They expected to find that state forests were most compliant with the

Arbogast guidelines and corporate forests were the least compliant.

What they actually found surprised them. Only 22 of 96 stands of trees studied were harvested in compliance with the guidelines that have been shown to create a balanced and sustainable structure that assures the future productive potential of the forests. The other 74 stands were being overcut or undercut.

Overcutting ultimately results in diminished yield and quality of the wood, but the effects of undercutting are subtler. Undercutting could mean that an opportunity was missed to harvest more wood without harming the forest. There could also be an ecological cost. For seedlings to survive and grow in northern hardwoods, there must be gaps big enough to allow light to reach the [forest floor](#). Without enough light, seedlings might not establish and thrive.

Another surprise: The variation within forests owned by each type of landowner was much more substantial than the variation between kinds of landowners. "There are no significant differences among the three landowner types compared," Froese says in the journal article.

The researchers spoke with forest managers, almost all of whom claimed that production of high quality timber and revenue was their primary management objective. Yet the way they were managing their forests did not reflect the Arbogast guideline.

"Stated goals, objectives and management plans do not necessarily translate to activity in the woods," Froese notes. "This raises the question of whether the guideline, although widely promoted, has ever been widely and effectively applied."

What do the researchers recommend? "Improved education for private landowners and accountability for public managers would help ensure

the future productivity of the northern hardwood resource," says Froese. "We need to understand why Arbogast isn't being followed even though people think it is, and we need to realize the economic, social and economic consequences of not following the selection silviculture system."

Terry Sharik, dean of Michigan Tech's School of Forest Resources and Environmental Science, called the study important. "I think this work is significant because it suggests that large expanses of forests managed by the graduates of our forestry programs in the US are not being managed to their optimum with respect to long-term sustainability of goods and services. This in turn begs the question of why this is the case. The answer is undoubtedly complex, given the host of ecological, social and economic factors that come into play. This would make an interesting study in its own right."

**More information:** "Sustainability of the Selection System in Northern Hardwood Forests." Pond, Nan C.; Froese, Robert E.; Nagel, Linda M. *Forest Science*, Volume 60, Number 2, 19 April 2014, pp. 374-381(8)

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