

Maple syrup production declines after big seed year

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Maple syrup production depends on the number of seeds trees produce the year before. Photo by Josh Rapp

For decades, maple syrup producers have eyed the weather to help understand spring sugar yields. But new research in the journal *Forest Ecology and Management* reveals a more valuable metric for understanding – and even predicting – syrup production: how many seed

helicopters rained down from the trees the year before?

"Weather affects how much sap will flow out of the tree, but sap volume is only one piece of the puzzle," says Josh Rapp, who as a postdoctoral fellow with Elizabeth Crone, associate professor of biology at Tufts University and senior author on the paper, analyzed the factors influencing 17 years of maple syrup production at 28 sites in Vermont.

What really matters to maple syrup producers, Rapp explains, is the amount of sugar in the sap: "Sugar maple sap is 2 to 3 percent sugar. The rest is just water to boil off. Sweeter sap is more profitable. If you start with sap that's 3 percent sugar, it takes a third less sap to make a gallon of syrup."

So, what predicts how much sugar is in the sap? "Not weather," says Rapp. "Weather alone was a surprisingly bad predictor of how much sugar came out of the taps over those 17 years," says Rapp. "That tells us there is something else at play."

For several years, Rapp and Crone have been studying "mast" seeding events—years when trees collectively produce far more seeds than usual—at the Harvard Forest in Massachusetts. In sugar maples, mast seeding tends to occur every 2 to 5 years.

Recent mast seeding events occurred in Vermont in 2000, 2006, and 2011. Rapp's research shows that in Vermont, syrup production declined following every mast seed year.



A heavy sugar maple seed crop. Credit: Josh Rapp

"Both seeds and sugar are made from carbohydrates stored in trees," explains Crone. "When a tree produces a lot of seeds one summer, then the next spring, the carbohydrate bank account is low for making [sugar](#). It's a matter of budgeting resources."

Looking ahead to next year's harvest, Rapp notes: "At the Harvard Forest, and likely throughout the northeast, the seed crop was small this year, suggesting the 2015 [maple syrup](#) harvest should be a good one."

Rapp explains weather's role in these predictions: "The best way to

predict syrup production is actually a combination of factors: proportion of trees with seeds, minimum and maximum March temperatures, and maximum April temperature. Those factors together explained 79% of the variation in syrup production in Vermont from 1998 to 2014."

Because seeds develop a full six months before syrup harvest, Rapp hopes this study can help syrup producers plan ahead. "Maple syrup is a complicated natural resource," he says. "Hopefully this research can give producers a window into the upcoming season."

"The idea of looking at the costs of seed production came from very abstract models developed by mathematicians in Japan," adds Crone. "One of the purposes of academic science is to come up with general insights that help us see applied problems in new ways. This is a good example of that kind of insight."

More information: JRapp and ECrone. 2014. Maple syrup production declines following masting. *Forest Ecology and Management* 335(1): 249-254. Available online 27 October 2014. [DOI: 10.1016/j.foreco.2014.09.041](https://doi.org/10.1016/j.foreco.2014.09.041)

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