Scientists discover legacy of past weather in stories of prairie plant restoration

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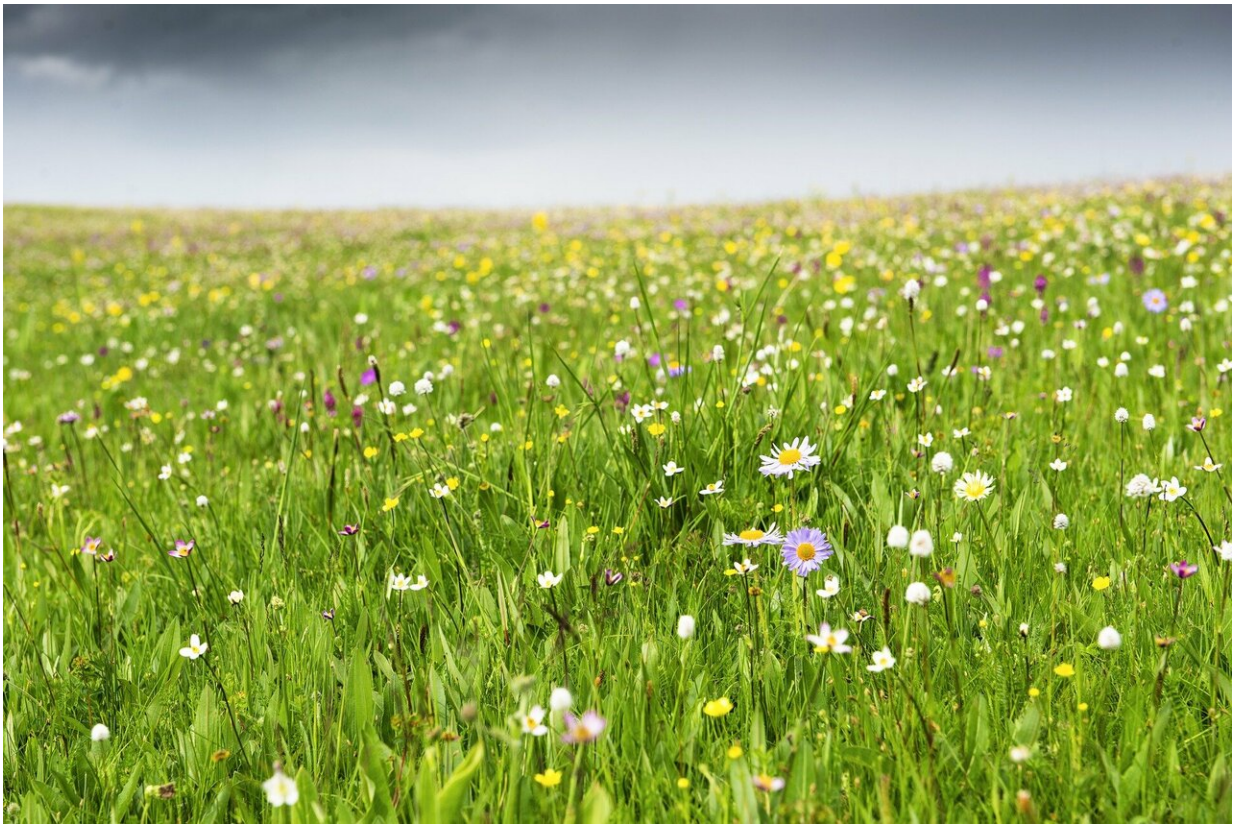

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Before there were farms in southwest Michigan, there were prairies. For thousands of years, tall grass prairies stood undisturbed until European settlers turned the rich, highly productive soils to agriculture.

Today, tall grass prairies East of the Mississippi are virtually extinct.

But some landowners want to return land throughout the Midwest to its incredibly deep roots, converting abandoned, depleted and fallow agricultural fields to native prairie—with varying degrees of success.

Michigan State University's Lars Brudvig, associate professor in the Department of Plant Biology, and former MSU graduate student Anna Funk investigated fields of data going back 20 years to find out why some replanted prairies are healthier than others. Their research is published in *Scientific Reports*.

"Native prairie plants are rare on the landscape, so land managers need to intentionally spread seeds on the ground for them to come back," said Brudvig, whose lab partnered closely with farmers, land managers and various nature conservancies across Illinois, Indiana and Michigan for the study.

Each of the 83 sites Brudvig and Funk studied started from roughly the same point and had similar processes of ecological management. Controlled burning, targeted herbicides and regular mowing were common strategies, but every site had widely different outcomes.

The big question was, why?

"There was a bit of tantalizing evidence from just a couple of studies that suggested the weather you get during a prairie restoration can actually have a long-lasting effect on the success of the project," said Funk, who revisited northern Illinois prairies where she got her start as a plant ecologist with her mentor, Tom Simpson, at the McHenry County Conservation District. "It was an idea that land managers were familiar with anecdotally, but it hadn't been carefully studied."

The researchers looked at a wide swath of restored prairies—the best and the worst—to see if they could identify any patterns in fields planted in a particularly rainy or hot year. They interviewed the people who had planted each of the prairies in order to pinpoint planting dates, the number of prairie species planted and other details about ongoing management at each of the sites.

Then, they went out to each prairie, surveying the abundance and diversity of both weeds and native prairie plants and taking samples of the soil to test how productive each site was.

"When I did a big analysis of all of our data, I hoped to find some effect of the planting year, but I still assumed other factors would be most important, like how often the site had been managed with prescribed fire," Funk said. "I was very surprised to find not only an effect of weather, but that sometimes planting-year weather conditions had the biggest effect of all."

"We expected that in years where it rained more when the prairie was initially planted, it should turn out better because plants need water," Brudvig added. "But it's exactly the opposite because there are not only prairie plants at these sites, but weedy plant species that really respond to precipitation."

Even more surprising was how long the first year's weather left its mark on restored prairie systems.

"We thought rainfall would matter at first, but that we should see that signature in the data become less and less important as the sites got older and older," Brudvig said. "Instead, we saw the first-year weather conditions had a signature that persisted for decades."

The findings may seem disheartening as climate change brings wetter

springs more often to the Midwest but recognizing weather signatures may be an important tool for restoration practitioners who are fighting to re-establish these extremely imperiled ecosystems.

"We suggest they use long-term weather forecasts to help predict if it will be a rainy or dry year so that it might be possible for land managers to focus more effort on starting prairies in what is expected to be a drier year," Brudvig explained. "They may also be able to invest more in weed control during rainy planting years by mowing the weeds above the prairie plants."

"I really hope this knowledge will be helpful to anyone planting prairies, as well as to ecologists more broadly who are doing experiments that could be affected by the weather," Funk said. "The next step will be to figure out how to best mitigate the weed-bomb that extra rain causes. I'm sure prairie managers already have lots of ideas on what to explore next."

More information: Anna M. Groves et al, Lasting signature of planting year weather on restored grasslands, *Scientific Reports* (2020). DOI: 10.1038/s41598-020-62123-7

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