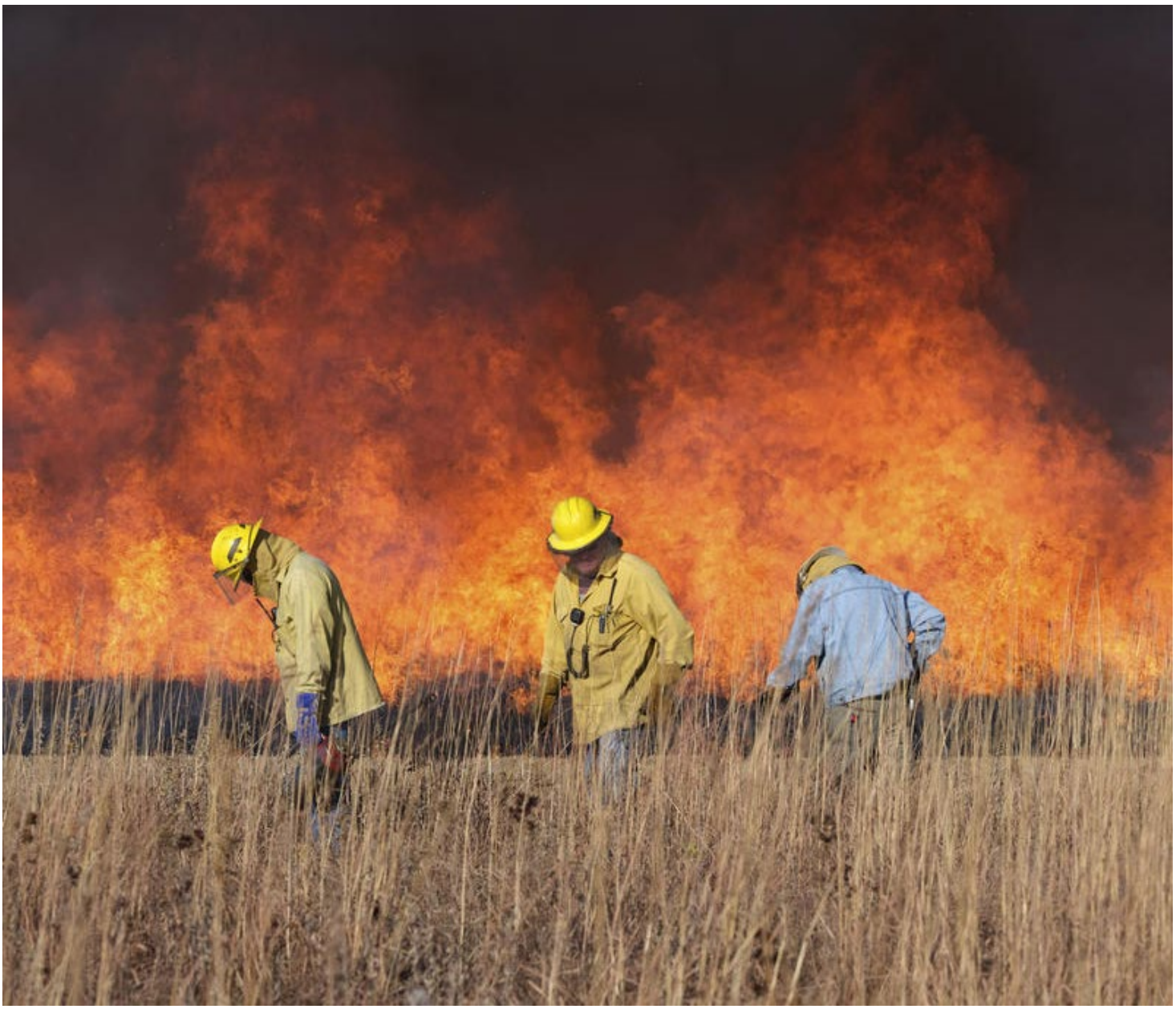
Prairie Research Could Help Farming Become More Resilient, Sustainable

By AMY MAYER • 2 HOURS AGO



Volunteer crews at Konza Prairie Biological Station have a careful system for burning exactly the areas intended.
KYLER ZELENY / FOR HARVEST PUBLIC MEDIA

On a still November day, Patrick O'Neal, the burn coordinator at Kansas State University's Konza Prairie Biological Station near Manhattan, Kansas, convenes a meeting about a planned fire.

"The goal today is to burn about 52 acres," he says, pointing out the specific sections on a map.

The clear blue sky and minimal wind provide inviting conditions. A short time later, the fire crew arrives at the first spot, and members pull on firefighter coats and helmets.

The autumn landscape is mostly beige and brown — until it's burning. Quickly, orange flames and dark plumes of smoke transform the view and briefly blacken the sky in places.

The Konza Prairie on the edge of the Flint Hills region of northeast Kansas is underlain with rock, making it inhospitable to farming. That helped establish it as a premier research location for the tallgrass prairie ecosystem.
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"Fire is a critical component to the landscape," says Jesse Nippert, a professor at Kansas State, who is also the lead scientist for the Konza Prairie Long Term Ecological Research project, "because without fire, the grasses lose their dominance. Like, if you stopped burning this, the grasses would start to disappear." Shrubs and eventually trees would take over.

Fire, climate and grazing are the primary drivers of the prairie ecosystem, Nippert says.

For decades, he and other scientists have probed the prairie, asking about its plants, animals, microbes and soil. What they learn can influence how we grow food and how the region adapts to a changing climate.

Controlling when, and how often, fire comes through certain sections of the prairie allows scientists to explore its impacts and importance. To understand climate, they have to get a bit more creative.

Leaving behind a perfect black polygon of scorched earth when the fire fizzles out, Nippert climbs into a Jeep and bounces up and down rutted gravel roads to a different section of prairie that wasn't burned on this day.

“One of the climate change predictions for this region really wasn’t a change in total annual amount of precipitation,” Nippert says. “It was this idea that when it rains, it’s gonna be a bigger rain event, and then in between them we’ll remove a lot of those smaller rain events.”

He and his colleagues erect structures with metal tubing and plastic sheets that let them simulate those trends experimentally on certain plots.

Fire burns through grasses, most of which will grow back quickly. But without regular fire, trees and shrubs can overtake the landscape.

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“Even though they got the exact same amount of total water, how you package that water and deliver it matters,” Nippert says.

Lessons from the Dust Bowl

That’s something farmers in the Midwest are already experiencing. Heavy spring rains might delay or prevent them from planting their crops. Then it can dry up for weeks until a sudden heavy rain hits the dry soil. (Kansas State has an interactive map showing changes in precipitation by county over time here.)

Nippert’s colleague Melinda Smith, from Colorado State University, conducts prairie ecosystem research in Kansas, New Mexico, Colorado and Wyoming. Her work on Konza simulated drought conditions, mimicking the hot, dry years of the 1930s.

“What we were able to do is just pretty much replicate what happened during the Dust Bowl, but do it experimentally,” Smith says. “And we were able to see the same kind of responses.”

Those included the loss of certain plants and increasing amounts of others. Smith points to blue grama grasses, which are normally found at sites farther west than Konza but showed up here after her experiment.

“The only reason they’re in those plots is because we droughted them,” she says. “The fact that we could get even such a small-scale conversion of the [plant] community—it took several years for that to occur, but it did occur within the timeframe of our drought experiment—suggests to me that it could occur at a larger scale. And it was a surprising outcome.”

During the Dust Bowl, precious soil blew away, but the natural ecosystem of native plants recovered within about 20 years.

“The species that live here in the Great Plains, these native species, are tremendously resilient,” Nippert says. The farming practices of the early 20th century, however, were not sustainable.

In 1935, partially in response to the devastation of the Dust Bowl, President Franklin Roosevelt signed the Soil Conservation Act, which led to the creation of soil and water conservation districts. Still in action today, these groups promote practices such as reducing tillage, which keeps more soil in place.

Conservation today also means preventing chemicals used on fields from washing off and polluting streams and rivers, eventually contributing to the Dead Zone in the Gulf of Mexico.

That water quality factor inspired research at Iowa State University on the use of prairie plants as a conservation practice for farm fields.

Kansas State University professor Jesse Nippert, pictured with structures that can be used to manipulate sun and rainfall on prairie plots, is the principal investigator of the Konza Prairie Long Term Ecological Research site, which is part of a national network.

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Protecting cropland with prairie

“The idea was, can we be really smart about reintegrating Iowa's native ecosystem to try to achieve our goals, as a state, for clean water and building soils and maintaining our native, wildlife populations in a way that had as little impact on the agricultural portions of the landscape as possible?” says Iowa State’s Lisa Schulte Moore, a member of the team that spent more than a decade developing prairie strips, small patches of native grasses and flowers integrated into farmland. The answer was an unqualified yes.

Schulte Moore says putting 10 percent of a field into prairie strips keeps 95 percent of the soil in place. The strips contain a mix of different native plant species, which are appropriate for the specific location.

“So if you have a cool year, if you have a wet year, if you have a drought year, that diversity conveys resilience,” Schulte Moore says. “You have some of those plants that are going to do well regardless of the kind of weather conditions that Mother Nature is throwing at it.”

Some of the prairie plants have stiff stems, too, which help protect the land when those intense rain events pour down because they slow the movement of the water. The prairie plants also have characteristic deep roots, which continue to grow throughout the year, year after year.

“You have biological function happening all year long that you just don't in an annual system,” like row crops, Schulte Moore says.

Prairie strips proved so effective that they caught the attention both of farmers eager to try them and the U.S. Department of Agriculture. The 2018 farm bill added prairie strips to the Conservation Reserve Program, which is one of the federal government’s biggest efforts to improve the environmental quality of agricultural lands.

Still, farming in the Great Plains remains largely dependent upon annual monocultures: plants grown from seed each year, typically across wide swaths of land that may only rotate between two or possibly three crops.

A perennial solution

But some plant breeders see a future in which perennial crops become an option.

The Land Institute, about an hour’s drive west of Konza in Salina, Kansas, is a place that has dedicated its own decades of research to exploring how agriculture can be more sustainable. Researchers there bred a perennial wheat variety, Kernza, which is now available commercially. Chinese collaborators have demonstrated a possible perennial rice.

Plant breeder David Van Tassel of The Land Institute in Salina, Kansas, is working with silphium, a native plant related to sunflower. His goal is to create a perennial crop that could become a player in global agriculture.

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For nearly 20 years, David Van Tassel has been working, first as a side project and now as his main focus, on a particular wild relative of sunflower called silphium. It caught his eye growing wild adjacent to plots on the windy plains where he was conducting other experiments.

“Watching it go through droughts and doing very well compared with many other plants, noticing the seeds were large, noticing that they tasted good, seeing butterflies being attracted to them,” he says, all inspired him to see whether silphium could become a perennial crop.

Over time, his team has selected for larger seeds that grow closer to the top of the plant, among other traits that would suit it to agriculture. They’ve developed a silphium variety that’s promising enough that they recruited volunteers to grow a few samples in a wide variety of locations and report back how it

does.

Van Tassel says for a new crop plant to take off and really make a dent in agriculture, it will need to be viable in temperate regions around the world. So even before he has a seed he thinks is ready to be commercialized, he wants to identify possible pitfalls.

“We don't know what kinds of things would bring down silphium in Seattle or in Ontario or in northern Mexico or any number of places,” he says.

From his earliest days dabbling with the idea of perennial crops, though, he’s found receptive ears among some farmers. Each year, timing their spring planting can be a struggle.

“It's often very wet for a while, and cold, and then suddenly it'll dry out. And then suddenly it's too dry,” he says. “And so they immediately realized that if the plant was already there, just dormant, it would come up at the right time, and they wouldn't have to have all this stress every spring about knowing exactly when the optimal time to plant is.”

There’s still a ways to go before the seeds and oil from silphium would be competitive with crops like sunflower and canola. But researchers at The Land Institute have already recruited volunteers in a variety of places to grow the plant and report back how it does.

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Not having to plant every year offers several environmental benefits. Heavy equipment that compacts the soil doesn’t have to make as many passes across a field. Less tillage or drilling in of seeds decreases damage to soil structure. And with less turning of the soil, there’s the potential that less carbon gets released into the atmosphere.

Smith, the Colorado State ecologist, is intrigued with the prospect of perennial agriculture.

“That would be awesome,” she says. “If they could get perennial cropping systems in place that could replace some of the annual systems, that would be huge.”

Amy Mayer is the Harvest Public Media reporter at Iowa Public Radio.

This is the fourth story in a five-part series, "Change at the Climate Divide," about climate change and the Great Plains.

This reporting project was supported by a grant from the Pulitzer Center.

Fire, climate and grazing are the primary drivers of the Konza prairie ecosystem. A small herd of bison live on the research station land.

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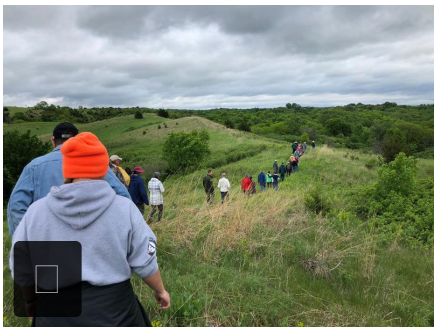

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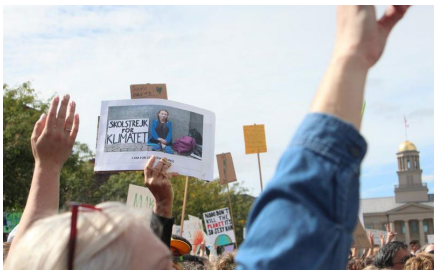

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retool the economy. But there are real questions about if the country can transition as quickly as Democrats are proposing.