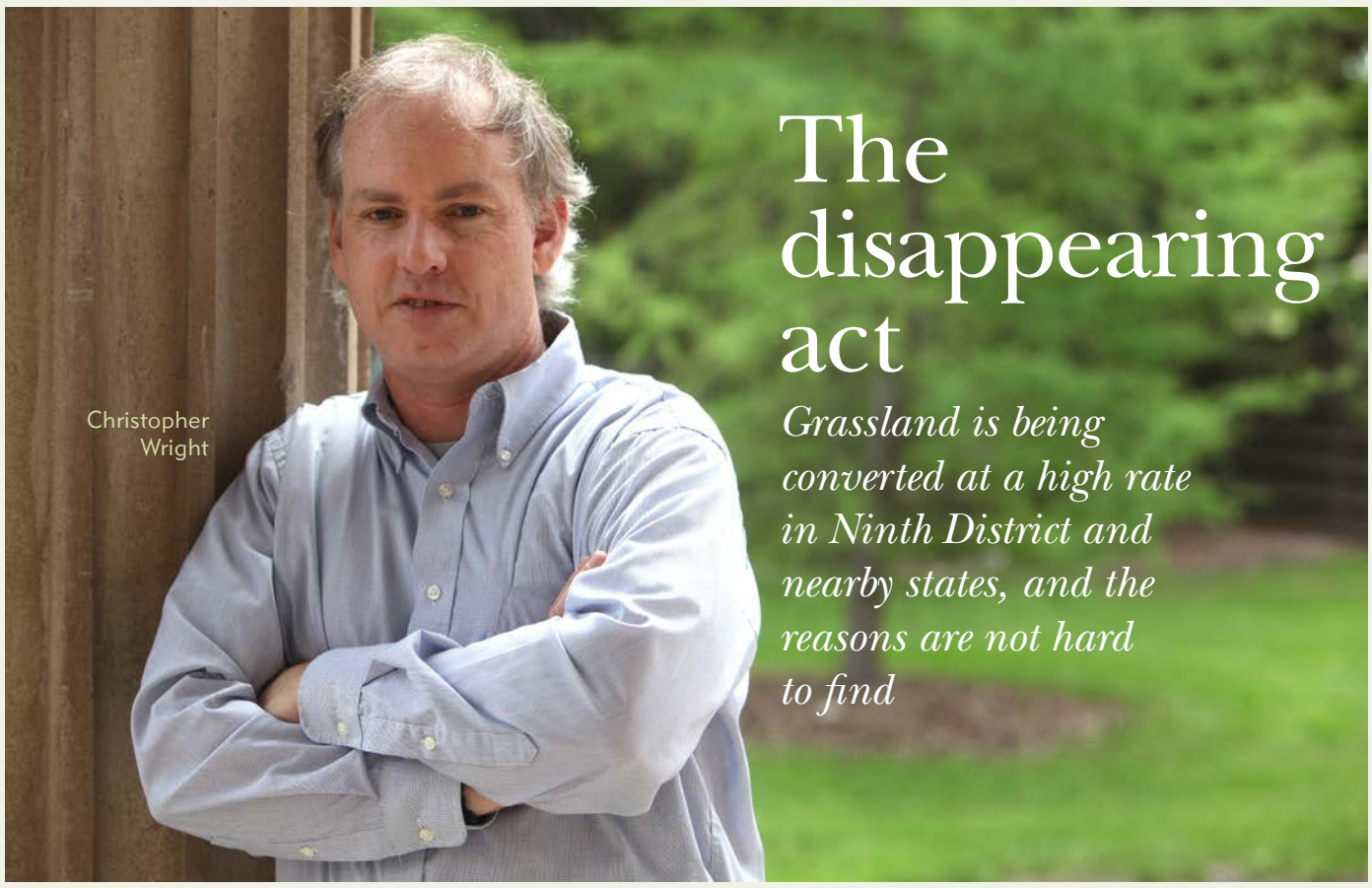


PHOTOGRAPH BY JAY PICKTHORN

The disappearing act

Grassland is being converted at a high rate in Ninth District and nearby states, and the reasons are not hard to find

Anyone with a keen eye on regional topography has noticed that more land has gone into crop production in recent years. The number of acres enrolled in the Conservation Reserve Program (CRP) has been steadily declining, and each year it seems like corn acreage sets a new record. This year, the U.S. Department of Agriculture forecast the highest number of corn acres since 1936, a time when yields per acre were quite a bit lower.

But just how much land is being switched to crops, and where? To get the details, geographers Christopher Wright and Michael Wimberley of South Dakota State University, Brookings, dug into new high-resolution satellite imagery from the USDA that classifies land by its use. The data were available beginning in 2006, so they were able to compare that year with 2011 and by coincidence capture the change in land use over a period of rapidly rising crop prices, focusing on the western Corn Belt, a region that includes Minnesota, the Dakotas, Kansas and Iowa.

What they found was a remarkable reduction in the amount of grassland in this region—both native prairie and pastureland—and a concomitant increase in corn and soybean acres. Their research appeared in the prestigious Proceedings of the National Academy of Sciences.

Wright is a postdoctoral fellow at SDSU's Geographic Information Science Center of Excellence. He studies the interaction of landscapes with their broader ecosystems, particularly wetlands and grasslands, both in natural areas like Yellowstone National Park and in those heavily altered by humans like the Great Plains. Wright has a B.A. in biology from Williams College and earned his M.S. in agronomy and Ph.D. in biological sciences from Montana State University.

The fedgazette *sat down with Wright to discuss these findings and what they mean for agriculture, the environment and policy.*

fedgazette: Where do you see the heaviest concentration of conversion?

Wright: Out on the periphery of high-producing farmland. The Corn Belt is expanding north and west into the Dakotas and then south into the southern parts of Iowa that aren't as suitable for corn production. Basically, what we found was that the grassland conversion was occurring in sort of a bathtub ring around the core corn and soybean region in southwestern Minnesota and northern Iowa.

fedgazette: Can you give us a sense of the scale of this land-use shift?

Wright: Well, the net change in that five-state region is about 1.3 million acres of grassland lost. But that's net, so there's almost 2 million going from grassland to corn and soy, but conversely there's 660 million going from corn and soy to grassland.

fedgazette: Is some of the land converted from crops to grassland due to normal crop rotation?

Wright: Yes. Historically, there's been a fair amount of conversion from pastures and hay into corn and soybeans. In the historical data, that tended to balance out; there's a loss, but then the gains would offset it. Now there appears to be a shift toward a net loss of grassland.

fedgazette: You argue in the study that this net shift away from grassland is a persistent shift, not just due to crop rotation.

Wright: In Iowa, there are basically negative grassland trends covering the entire state, even though there isn't a lot of grassland in most of Iowa. So there's a general loss of grassland in Iowa, but where the grass is going to corn and soybeans is concentrated in southern Iowa.

fedgazette: So if it was just standard land-use conversion due to crop rotation, you wouldn't be seeing it concentrated in any one particular area.

Wright: Yes, exactly. Then in North Dakota, you see lots of grassland concentrated in the Red River Valley and eastern North Dakota [in 2006] and then corn and soybean increases in those same areas [by 2011]. These two states are really representative of the two trends—one occurring out on the periphery of corn and soybean country, and the other occurring in the core region of corn and soybean farmland.

fedgazette: For the grassland being converted, is it the same kind of land everywhere? Is it all marginal land on the periphery of more fertile land?

Wright: Well, that was something that was really interesting, and it varies quite a bit from state to state. In Minnesota, we found that most of the conversion was occurring on lands that have poor soils and are subject to wetness, from either flooding or a high water table. So conversion in these areas suggests that there's been an increase in drainage in Minnesota. In the Dakotas, you see more conversion occurring on erodible lands and areas where the climate is less suitable. In South Dakota, you're moving westward into areas where there's typically not enough precipitation for those crops. Then in North Dakota, the expansion is northward into shorter growing seasons.

Another thing we noticed in the Dakotas was that the conversion was concentrated on class 2 lands [a crop capability classification by the USDA], which are relatively good lands. So that suggested to us that there were combined livestock/crop operations probably shifting toward more crop production and less livestock.

fedgazette: So it's fairly high-quality land that had been used for pasture.

Wright: Exactly. And there are a number of econometric models that suggest that kind of shift would occur at higher crop prices. In Iowa, the conversions are concentrated on class 3 land, which is relatively poorer land compared to what you see in the Dakotas. The idea is that that's basically all that's left for corn in Iowa.

fedgazette: Because in Iowa, corn production is already so intensive that it can be expanded only to lower-quality land.

Wright: Right. And then in Nebraska, we see a conversion out to even poorer lands, which definitely suggests more irrigation in Nebraska.

fedgazette: The period you're looking at is fairly recent. Because the data we have now are better, is it possible to put this into historical context? Is this conversion unprecedented?

Wright: Well, there's not a lot of data to make those comparisons, but there was one paper that had done a decade-by-decade analysis of grassland conversion,

and it was interesting that the rates we saw hadn't been observed since the '20s and '30s, which was when widespread mechanization occurred in the Great Plains.

fedgazette: You mentioned that in the paper. You also say in the paper that this land use conversion is comparable to the rate of deforestation in Brazil, Malaysia and Indonesia in the 1980s and 1990s. That sounds pretty alarming. Is that a fair comparison?

Wright: Yeah, that might be overly dramatic. They are comparable, but the rates we see in the Corn Belt are relatively localized. So you may have a high relative rate over a very small area; whereas, in the rain forest you would have high rates over a relatively large area.

fedgazette: And what is that conversion rate in the Corn Belt?

Wright: We find these localized rates between 1 percent and 5 percent annualized. So a 5 percent rate is pretty fast. But when you look at the rates by state, they range between a half percent and almost 1.5 percent.

fedgazette: If the shift in land use has been accelerating, what do you think are the underlying factors? Is it all just crop prices?

Wright: Crop prices are the primary driver. We don't have the ability to differentiate between biofuel demand and other reasons for higher prices. But, obviously, I think the main driver is high prices—and then insurance.

fedgazette: I want to ask what role insurance plays. Can you explain why crop insurance might make it more attractive to put grassland into crop production?

Wright: I think the evidence is that it's occurring on marginal lands, and insurance mitigates their downside risk. The issue of drought might be the main risk for these farmers, and with insurance you're not taking such a risk—not just from climate, but from soil. These conversions are occurring on poor soil that would be more prone to drought risk as well. Those soils are shallow typically and gravelly and have low water-holding capacities.

fedgazette: The comparison to deforestation and the rain forest raises some obvious questions about the environmental impact of this kind of conversion. This is an economically sensible decision for farmers to make, looking at the costs and benefits of putting another acre into production. But what are the bigger-picture costs that might be associated with such a major shift in land use?

Wright: Especially in North Dakota and South Dakota, we're in the prairie pothole region, which produces half the ducks in North America. And so grassland conversion in the vicinity of wetlands can have a dramatic effect on duck reproduction. They need that grassland as cover from predators. Hunting is a big economic concern in our region.

And then there are other externalities of sedimentation of wetlands from soil erosion on nearby land that is being actively farmed. There are also issues of nitrogen input into the Mississippi River and the dead zone in the Gulf of Mexico, and carbon balance and sequestration associated with the conversion process.

fedgazette: Is the idea that from a carbon standpoint, an acre of grassland and an acre of cropland put out different amounts of carbon and can sequester different amounts of carbon?

Wright: Grasslands have built up soil carbon, and when you till them to convert them to cropping, you release carbon dioxide from the land during that process. Then you have a lower sequestration capability in cropland relative to grassland. People have done life-cycle analyses looking at the net carbon benefits associated with biofuels for use in petroleum. Corn ethanol has a net [carbon] benefit, but with the carbon release that occurs during the conversion process, you end up spending a couple of decades of making ethanol to overcome that carbon debt.

fedgazette: You mention in the paper that your methods might actually help assess the impact of biofuel policy in terms of climate change and other issues. How might that work?

Wright: With the ability to actually identify the amounts and rates of land-cover change, you could use published values of carbon sequestration and differences between land-cover types to make projections. A lot of the carbon impact studies of biofuels in the Corn Belt have been based on projections that all the CRP land gets converted to crops. We found that's not always the case that all the CRP land gets converted; instead, some of the CRP land and then a lot of the pasturelands get converted. That would give you a more realistic picture of what's going on, and that gives you better estimates of the impacts.

fedgazette: You also make an argument that greater production of cellulosic ethanol might actually help mitigate this phenomenon of grassland conversion. How would that work?

Wright: The idea there is that you wouldn't accrue the carbon debt associated with conversion because you're not tilling the soil to convert it to a different type of grass that could be a perennial feedstock for ethanol. Say you could take a pasture and instead of grazing cattle on it, you could seed crops like switchgrass into it, harvest that biomass and then use that as your feedstock. I think that's the hope.

But the adaptation of that technology has been slow. Crop prices are so high right now that one of the points we wanted to make in the paper is the rapid rate of change that's occurring under this current biofuel strategy. If we don't get out ahead of it, we're going to lose that opportunity to try a different strategy. And even if you took that converted land and put it back into perennial feedstock, you'd still have that carbon debt from the original conversion to corn or soybeans.

fedgazette: Moving to the issue of erosion, another comparison you made a moment ago was that we're seeing probably the highest rate of grassland conversion since the '20s and '30s when agriculture became mechanized. Historically, we know that was the era that preceded the Dust Bowl. Is there a potentially higher risk now of a catastrophic erosion episode?

Wright: That was funny—that got picked up in a number of media outlets. We didn't even make that connection. We probably should have. We didn't really mean to suggest that there was a Dust Bowl on the horizon. I don't think there's a chance of another Dust Bowl to speak of. Our cropping practices are so different now in the sense that most farmers are doing no till or limited tillage. So I don't think you would get wind erosion like you did during the Dust Bowl.

fedgazette: That's comforting.

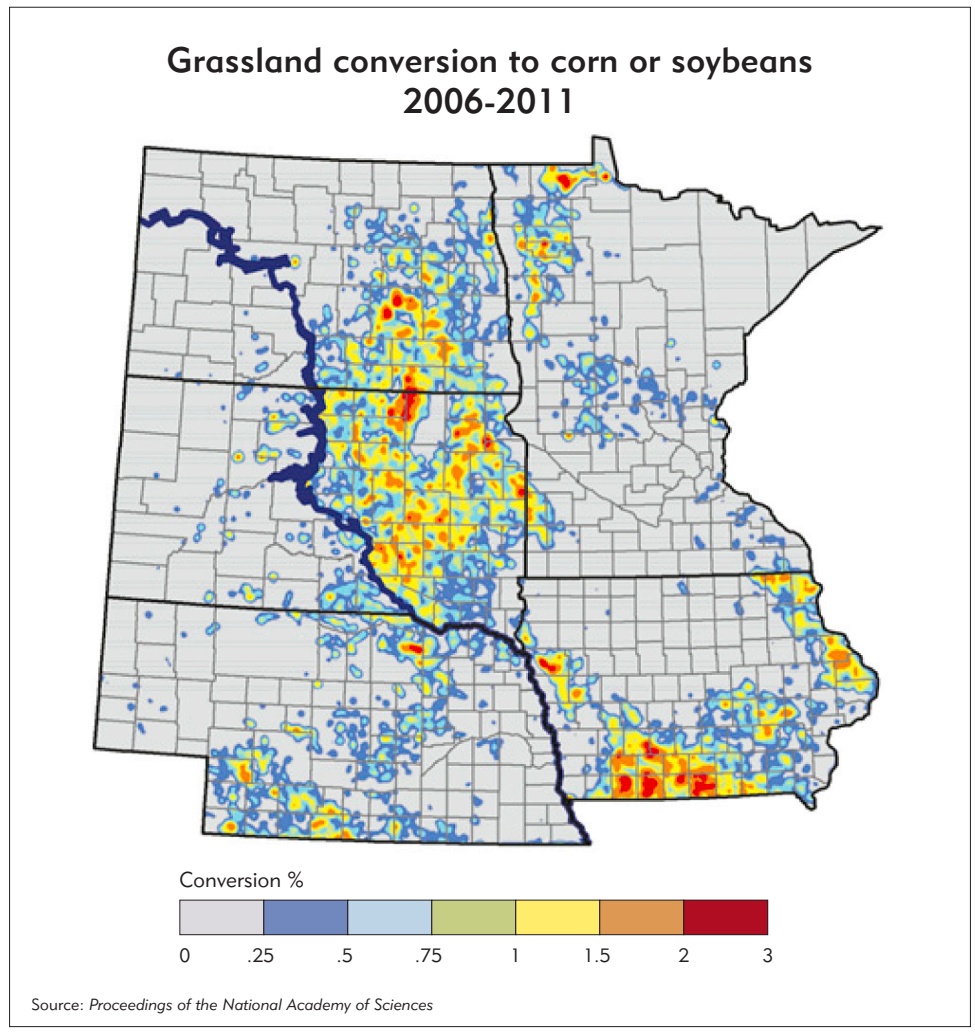
I know you probably don't think of yourself as a policy wonk, but given what we know about how the policy environment may have encouraged this shift and some of the potential costs associated with it, what are some policy options that might slow the rate of conversion?

Wright: I think increasing CRP payments would be appropriate. It seems like support for CRP is on the wane. I think we have to compensate farmers for the ecosystem services that these grasslands provide. And then there have been proposals to limit crop insurance in the period immediately following grassland conversion. I think they were talking about a five-year window where you wouldn't be eligible for crop insurance. That would be a way to discourage people from converting land.

And I guess another one would be if we had a better carbon market. That might be a way for farmers to get compensated for sequestering carbon. I think basically the bottom line is you've got to make it more profitable to keep land in grass than it is to put land into corn. That's really the main issue.

fedgazette: Thank you.

—Joe Mahon



Source: *Proceedings of the National Academy of Sciences*