Crop advisers and others who work with farmers in the U.S. Corn Belt know their clients are independent-minded folks who like doing things their own way. But for the rest of the world, it can be all too easy to lump them together, says Lois Wright Morton, an Iowa State University sociologist. “If you’ve met one corn farmer you’ve met them all, right?” she quips.

Jokes aside, new research led by Morton indicates this definitely isn’t true in one critical area: How Midwest farmers perceive and are responding to the extreme weather brought on by climate change. In a recently published article in the *Journal of Environmental Quality*, she and her colleagues report that farmers in six sub-regions of the Corn Belt are not only experiencing impacts such as flooding differently, but their views of the risks and how they’re adapting diverge, as well.

Again, obvious perhaps to crop consultants and extension personnel, but it’s a message that climate scientists need to hear, Morton says. Climate models typically generalize conditions across entire regions, whereas her study indicates that farmers are responding to local climate signals and patterns. “So there’s a big need for what we call ‘downscaled’ climate science,” she says. “Farmers can manage better when they have a lot more local information.”

What’s more, she adds, the human dimensions of climate change need more consideration. Incidents of exceptionally heavy rain- and snowfall have jumped 37% in the last 45 years across the upper Midwest, leading many to ask how agriculture can be made more resilient to these changes. “So, if we care about managing productively under a changing climate and [minimizing] the unintended consequences to our soil and water resources, it makes a lot of sense to pay attention to what farmers are doing,” she says. “What are their concerns and how do they deal with them?”

To answer this, Morton and her colleagues surveyed nearly 5,000 farmers across the Upper Midwest in 2011, including wet states such as Illinois and Indiana, and drier areas like southwestern Minnesota and eastern Nebraska. The team also looked at a specific set of “mainstream” or large-scale producers: To be included, farmers must have planted at least 80 ac of corn and grossed at least $100,000 in the year 2010.

Survey participants were asked about their experiences with problems like flooding, erosion, and wet soils; their perceptions of risk and vulnerability; and their use of four adaptive strategies: artificial (tile) drainage, no-tillage, cover crops, and planting to “highly erodible,” or marginal, land.

Their responses were then combined with soils information and climate data spanning two periods: the past 40 years (1971–2011) and the last five (2007–2011). The latter years are significant because they were exceptionally wet across much of the Midwest.

**Already Adapting**

Overall, the researchers found that Corn Belt farmers are indeed noticing weather and climate shifts, and are already adapting to protect their resources from these changes. Nearly 75% of respondents reported some experience with waterlogged soils, for example, while 25% stated they had problems with significant soil erosion. Most also agreed or
strongly agreed that they’d noticed unusual or more variable weather on their farms. The most commonly reported adaptive strategy was tile drainage, with nearly three-quarters of farmers saying they employed it. This was followed by no-till at 60% and cover crops at around 25%.

More interesting to the researchers than these general trends, however, was how farmers’ experiences with extreme precipitation varied across the Midwest. Certain Indiana watersheds, for example, got as much as 30 inches (750 mm) of rain during the growing season, while parts of Minnesota received half that amount. And farmer responses differed, as well. Across the six sub-regions the scientists examined, wetter conditions were linked to greater adoption of strategies such as tile drainage and no-tillage.

In other words, says Morton, despite a 37% increase in very heavy precipitation across the Corn Belt as a whole, the actual rainfall a farm gets “makes a huge difference” to what farmers do. Other factors that helped explain the variability in farmer actions included their farms’ “geophysical” context (was it situated next to a river, did it include sloping soils?), their personal experiences with concerns like flooding, and the diversity of corn markets available to them.

Another important finding was that nearly 60% of respondents said they’d planted crops to highly erodible land, with their likelihood of having done so increasing with the more precipitation they got. Wetter conditions can cause damage, of course, but more rain also means “you can grow more stuff,” Morton says. That is, higher moisture levels may encourage farmers to cultivate marginal land where planting crops wasn’t profitable before, especially when corn prices are high.

The problem is that while heavier precipitation boosts the chances for a good crop, it also increases the possibility of greater erosion and fertilizer runoff into streams and lakes—issues that are made worse by planting to highly erodible land in the first place. “So I call this a maladaptation to a changing climate,” Morton says, which will need careful monitoring.

There were many other nuanced results, but the big takeaway is this: Better integration is sorely needed between climate science—which makes projections at very large scales—and agronomic science—which deals with the real-world management of individual farms.

“We’re looking at water as central to the climate system and a changing climate,” says Morton, along with carbon and nitrogen. “But the fourth part of that system is humans: Human management systems. We forget them sometimes.”

Adapted from Morton, L.W., J. Hobbs, J.G. Arbuckle, and A. Loy. 2015. Upper Midwest climate variations: Farmer responses to excess water risks. J. Environ. Qual. 44(3). View the full article online at http://dx.doi.org/doi:10.2134/jeq2014.08.0352

---

**Left: Flooded cropland in southwest Iowa. Courtesy of Penn State’s Flickr photostream**

---

**When results matter.**

**AP4 Porometer**

- Excellent performance
- Trusted and reliable
- Direct readout of stomatal conductance
- Minimizes leaf stress during measurement
- Ideal for phenotyping based research
- Award-winning user interface

800-896-7108 • dynamax.com
admin@dynamax.com

Promotional discounts available.
Use Code DYN0315 when requesting a quote

---

April 2015

CSA News 11