Farming for the Future

How science, data, and location intelligence support sustainable U.S. agriculture

Meet the Prevo brothers, fifth-generation farmers managing their family's century farm in Iowa. These soybean farmers are bucking the trend in conventional farming to invest in soil health—and they're seeing record yields doing it.

Brothers Kevin, Jason, and Kyle Prevo own and operate their family's century farm with their wives and families. A century farm is an operation which has been owned by the same family for at least 100 years.

Planning for an uncertain future

Even with many local successes, Iowa soybean farmers face challenges related to weather, fluctuating markets, and changing technology. That's why government agencies, nonprofit organizations, and private industry partners--like Esri, Microsoft, and John Deere--are providing farmers with the right tools and technology for environmental and economic sustainability.

What's the greatest challenge facing farmers in the Midwest?

Many would say the erratic weather. In 2019, farmers in the Corn Belt experienced some of the rainiest springs on record, leaving many fields unplanted because of flooding and excess moisture. According to the USDA, farmers affected planted only 71% of their planned soybean crop in May. And by mid-June, Iowa temperatures generally become too high for successful planting. Nationwide, nearly 20 million acres were prevented from planting.

Despite the challenges, the Prevo brothers are managing their land and business to support their next generation of farmers, and the generations to come.

Soil health improves yields

If you drive past Prevo Farm in late summer, rather than an empty, harvested field, you'll see a mixture of plants including sorghum, millet, turnips, radishes, buckwheat, sunflowers, and sun hemp.

That's because the Prevo family in 2011 changed their crop management system from conventional tillage to no-till farming with cover crops. With the next generation of farmers in mind, the family aimed to reduce runoff and improve water infiltration in their fields.
Although they expected an initial decrease in crop yields, Kevin Prevo says it was just the opposite.

“I always heard at least five years yield drag on no-till, but we never saw that. We actually had our best ever average yields in 2014, until we topped it in 2016 for both corn and soybeans.”

The Prevo family also runs livestock on their farm and now lets the cattle graze the cover crops from late summer into the winter, which reduces feed costs. In fact, soil health management practices offer a wide range of benefits for farmers like the Prevo.

Jason Steele, soil scientist for NRCS in Iowa, says the Prevo's system is sustainable, one that allows them to plan for the future.

“The crop management system they have in place will allow them to market good farm grain yields year after year… It allows them to better plan and prepare. They don't have to ride the roller coaster of highs and lows every other year that makes it really hard to market grain and be profitable.”

"Farmers implementing conservation practices that improve soil health aren't just hoping for better crop yields, they're banking on them," said NRCS.

That's why NRCS and American Farmland Trust recently teamed up to quantify the economic and environmental benefits of soil health management practices.

**Economic Benefits**

Through a USDA Conservation Innovation Grant, the American Farmland Trust estimated the economic benefits of soil health management practices for four farmers, including two soybean farmers in the Midwest. They also utilized two publicly-available USDA tools - the [Nutrient Tracking Tool](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils.nutrienttracking) and [COMET-Farm Tool](https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/cometfarm) - to measure water quality and climate impacts.

These case studies showed the following outcomes for the farmers.

- Farmers saw an average increase in crop yield of 12%...
- An average return-on-investment of 176%...
- And greater ground infiltration, eventually leading to a reduction in water runoff and soil erosion.

"Quantifying these economic benefits of soil health management systems across the nation's diverse soils, climates, and production systems has been one of the critical gaps in rapidly increasing their adoption,” says NRCS Soil Health Division Director Bianca Moebius-Clune.
"Although many farmers are strong conservationist, a deciding factor is how the cost compares to the return."

Read the case study

The NRCS-American Farmland Trust research reflects a growing trend in agriculture today—using science, data, even geospatial technology to help America’s farmers and ranchers make sound business decisions.

The right tools in a new age of agriculture

The recent Esri article *How Data-Driven John Deere Wins the Market* by Marianna Kantor and Fritz van der Schaaf takes a look at John Deere's business intelligence model.

The article portrays farmers as innovators who use predictive intelligence—whether bird patterns or analytics—to drive work on the ground. John Deere builds upon that data-driven sensibility by creating machines and technologies that utilize soil, water, temperature, and other measurable scientific variables.

“As our CEO recently said, we’re a technology company,” says Angela Bowman, a research scientist for John Deere, in a recent interview. “That’s it, first and foremost.”

And John Deere delivers the right technology, to the right farmers based on business intelligence and location data through Esri tools. In this way, John Deere—much like the familiar Farmer’s Almanac—becomes a reliable source of predictive intelligence for the family farm.

Read the article

Listen to the related podcast

Powering the farm with the Internet of Things

As reported by *Federal News Network*, the researchers at USDA Agricultural Research Service have traditionally written down data points in field books, also called green books, and then entered them by hand into a central database.

But that’s all about to change.

Recently USDA, together with Microsoft, Esri, and other private sector partners, launched a Data Innovations project to capture farm data in-real-time through technology.

This vision is taking shape at USDA’s 7,000 acre farm in Beltsville, Maryland. Under the public-private pilot program Farmbeats, partners are implementing an ag-centric technical framework
that includes drones, sensors, and farm equipment enabled with the Internet of Things or IoT. Through an automated cloud upload and AI, the resulting data will become a shared data visualization for farmers and researchers alike.

Read the article

Living Atlas

Along with USDA and John Deere, Esri brings The Science of Where to the current challenges facing American soybean farmers. This important union of science and technology is improving yields on farms across the nation while also addressing soil health and vitality.

Find out more by visiting ArcGIS Living Atlas of the World and see firsthand maps, apps, and map layers are supporting sustainable American agriculture.

Explore data and resources on agriculture

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This story map was created in collaboration with U.S. Department of Agriculture and Esri’s StoryMaps team and Esri’s Living Atlas team. We want to thank the Prevo family for contributing to this story.