



ISSUE BRIEF

CLIMATE-READY SOIL: HOW COVER CROPS CAN MAKE FARMS MORE RESILIENT TO EXTREME WEATHER RISKS

Minnesota

Sixty-six percent of all the grain exported from the United States is transported on the Mississippi River, which originates in Minnesota.¹ That alone would make Minnesota a central player in U.S. agriculture, but the state is also a major agricultural producer in several areas: first in the nation in turkey production, third in soybeans and wheat, and fourth in corn.² Extreme weather and climate change impacts have already begun to ripple through Minnesota’s agricultural industry and will most likely create turbulence in the years ahead. Farmers can, however, adopt soil stewardship practices to build soil health and become more resilient to floods, droughts, and other extreme weather risks.

IMPORTANCE OF AGRICULTURE

In 2014, the total agricultural sector production value of Minnesota’s 74,000 farms and ranches was approximately \$21.5 billion, ranking fifth among all U.S. states. Nearly \$14 billion in farm income in Minnesota in 2012 came from crop sales and more than \$7 billion from livestock sales.³ Leading crops include corn, soybeans, forage crops, and wheat; top livestock products include hogs, milk, poultry, and cattle.⁴ Additionally, the state exported more than \$8 billion worth of agricultural products in 2013, making Minnesota the third-largest agricultural exporter among states.⁵ Soybeans, corn, and wheat are among the top export commodities.⁶

Table I. Minnesota’s Top 5 Crop Commodities by Value in 2014⁷

Commodity	Value
Corn	\$4.3 billion
Soybeans	\$3.1 billion
Hay	\$579 million
Wheat	\$368 million
Potatoes	\$164 million

Half of total corn/soybean acres planted with cover crops

2.9 MILLION
METRIC TONS
OF GHGs CAPTURED ANNUALLY



BILLION
GALLONS OF
WATER STORED

Agriculture and related industries are an important part of the state’s economy, generating an estimated \$75 billion per year in economic output and employing more than 340,000 people.⁸ Corn production and processing are particularly significant, providing direct and indirect economic benefits of more than \$12 billion and 70,000 jobs in 2007.⁹

EXTREME WEATHER AND CLIMATE CHANGE IMPACTS ON AGRICULTURE

Agriculture in Minnesota, as in many other states, is vulnerable to extreme weather and climate risks. From 2012 to 2014, the state had 315 USDA county disaster declarations for flooding, drought, or excessive heat.¹⁰ From 2010 to 2014, insured crop losses due to drought, heat, hot wind, extreme precipitation, and flooding events came to nearly \$2.3 billion.¹¹ Climate change is likely to exacerbate these risks and lead to a significant shift in Minnesota’s agricultural industry.

Of Minnesota’s 10 hottest years on record, 7 have occurred in the past 15 years, and the trend of extreme heat will likely continue.¹² Rising temperatures and heat waves will have negative impacts for crop and livestock production. During the extreme heat wave of 1988—the worst in memory for most Minnesota farmers—corn, wheat, and soy production declined precipitously.¹³ In the coming decades, the number of days per year that exceed 95°F could be double or triple the current average of just two days a year. By the end of the century, the state could experience more than two weeks to two months of extreme-heat days each year.¹⁴ These changes in extreme temperature will affect crop production and agricultural workers. By mid-century, Minnesota’s corn yields could decline by up to 22 percent due to a

Additional information on this topic is available for download at www.nrdc.org/water/climate-ready-soil.asp

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combination of hotter temperatures and precipitation changes.¹⁵ More extreme heat will also reduce labor productivity in “high risk” sectors like agriculture, where workers spend significant time outdoors.¹⁶

Warmer temperatures and longer growing seasons likely will also allow corn and soybean production to expand northward. Minnesota’s growing season has already increased by nearly two weeks since the 1950s, and it is likely to increase by an additional three to seven weeks by the end of the century.¹⁷ While longer growing seasons may provide some benefits for crop production, extreme heat and weather events combined with an expanded range for pests like corn rootworm could offset these benefits.¹⁸

Similar to other states in the region, Minnesota will be subject to more frequent droughts and floods. Short-term summer droughts can be expected, and consequently, lower water levels in Minnesota lakes and streams.¹⁹ On the other hand, winter and spring precipitation will increase in the form of rain (with less snow), making those seasons 30 percent wetter, which will increase flood risks.²⁰ Minnesota weathered the drought of 2012 fairly well compared with other states, producing 14 percent more corn than in the previous year.²¹ However, the livestock industry in Minnesota and elsewhere suffered tremendous losses after the drought, when grain prices increased and the cost of feed grew very high.

Minnesota has already experienced an increase in heavy precipitation events and more frequent floods over the past half-century.²² Minnesota’s Red River Valley has been plagued by major floods since 1997, when a flood that constituted its worst natural disaster in memory resulted in 11 deaths and \$5 billion in damages.²³ The Red River Valley flooded again in 2001, 2006, 2009, and 2013.²⁴ Heavier rainfall events and increased flooding will increase soil erosion and agricultural runoff and negatively impact water quality.²⁵

COVER CROPS CAN HELP COMBAT THE PRESSURES OF CLIMATE CHANGE ON MINNESOTA AGRICULTURE

To manage the increased challenges associated with climate change, Minnesota farmers can turn to practices that build soil health, like cover cropping. Cover crops have been shown to increase the water-holding capacity of soil, allowing farmers to capture more water from heavy rainfall events as well as store water for increasingly hot summer days.²⁶ In fact, using cover crops (and other soil stewardship practices, like no-till farming and compost application) to

increase soil organic matter on just half of Minnesota’s corn and soybean acres could help store an additional 157 billion gallons of water—enough to meet the needs of nearly 4.9 million people for a year.²⁷

Cover crops can also help farmers cope with the increased weed pressures associated with the shifting growing season, as well-managed cover crops can be used to suppress unwanted weeds.²⁸ Further, cover crops have been shown to increase yields: during the 2012 drought, they demonstrated their ability to build agricultural resiliency by providing the greatest yield benefit in areas that were hardest hit by extremely dry weather.^{29,30}

Cover crops can also help to reduce emissions of greenhouse gases that contribute to climate change by sequestering carbon and reducing the need for synthetic fertilizers, whose production and transport result in more greenhouse gas emissions.^{31,32} Growing cover crops on half of Minnesota’s corn and soybean acres could reduce greenhouse gas emissions by 2.9 million metric tons each year—the equivalent of taking almost 611,000 cars off the road.³³

Despite the benefits of cover crops, their adoption in Minnesota remains low—less than 2 percent of the state’s total cropland is planted with cover crops.³⁴ More widespread adoption of cover crops and other soil stewardship practices that build soil health will better equip Minnesota’s farmers to deal with the weather and climate risks that come with hotter temperatures and more extreme precipitation events.

STATE AGENCIES IN MINNESOTA RECOGNIZE THE IMPORTANCE OF SOIL STEWARDSHIP

The Minnesota Department of Agriculture (MDA), the Minnesota Pollution Control Agency (MPCA), and the Minnesota Board of Water & Soil Resources (BWSR) are all working to help farmers prepare for climate change and address water quality impacts.³⁵ While the state does not have specific goals for increased cover crop adoption, these agencies recognize the benefits of cover crops for reducing soil erosion and building soil health.³⁶ In particular, BWSR has a Soil Health Initiative coordinated with the USDA’s – Natural Resources Conservation Service (NRCS) to implement best management practices including cover crops and no-till, among others.³⁷ This initiative provides grants to promote cover crops and conservation tillage in order to protect soil carbon and to help reduce nitrous oxide emissions from fertilizer.³⁸ BWSR estimates that 28,000 to 56,000 metric tons of carbon dioxide per year have been sequestered through the grants program alone.³⁹

ENDNOTES

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