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ISSUE BRIEF

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

Iowa

Half of total corn/soybean acres planted with cover crops

MORE THAN **4.3 MILLION METRIC TONS** OF GHGs CAPTURED ANNUALLY

234 BILLION GALLONS OF WATER STORED

More than 90 percent of all the land in Iowa is used for agriculture.[1] The state leads the nation in corn and soybean production—the dominant land use—and also in pork production.[2] The state has no shortage of high-quality soil, but Iowa's status as a leading agricultural producer and its rich soil resources may be at risk unless there are effective safeguards for soil health. Changing weather and climate patterns have already affected agriculture in the state, causing costly water quality problems that put public health at risk. While Iowa has increased its focus on building soil health with stewardship practices such as cover crops, significant opportunities remain to increase adoption of these practices to combat climate change and reduce the negative water quality impacts of agriculture.

IMPORTANCE OF THE AGRICULTURAL SECTOR

Agricultural products from Iowa had a value of $30 billion in 2012, ranking the state second in the nation in total market value of products sold. About $17.4 billion of this value came from crops and $13 billion from livestock and poultry products.[3] In addition to being the nation's leading producer and exporter of corn and soybeans, Iowa ranks in the top five states in total value of agricultural exports, number of farms, and average value of cropland.[4]

Table 1. Iowa's Top 5 Crop Commodities by Value in 2014[5]

Commodity	Value
Corn	$8.8 billion
Soybeans	$5.1 billion
Hay	$534 million
Oats	$12.7 million
Wheat	$4.3 million

In 2013, Iowa's 88,000 farms employed nearly 92,000 people.[6] When jobs from agricultural industries (like food processing, farm machinery, and fertilizer) are also taken into account, there are actually more than 400,000 workers, or one in five Iowans, employed in production agriculture or the agriculture industry.[7]

Agriculture represented about 8.5 percent of Iowa's GDP in 2013.[8,9] Looking across the state's economy as a whole, total production agriculture and agriculture-related industries accounted for more than $112 billion—more than one-third of the state's total economic output in 2012. Because agriculture is such a dominant land use in Iowa, it is a significant part of the culture and economy of communities throughout the state. In 37 Iowa counties, at least half of the total economic output comes from agriculture, and agriculture provides at least one-third of total employment in 35 counties.[10]

EXTREME WEATHER AND CLIMATE CHANGE IMPACTS ON AGRICULTURE

Iowa agriculture faces a wide range of extreme weather and climate risks. From 2012 to 2014, the state had 415 USDA county disaster declarations for drought, excessive heat, or flooding.[11] From 2010 to 2014, insured crop losses due to drought, heat, hot wind, extreme precipitation, and flooding events came to nearly $4.5 billion.[12]

The drought of 2012 is a notable example of the impact that extreme weather can have on agriculture in the state. Iowa lost more than $1 billion in corn and soybean crops that year alone.[13] Corn was particularly costly to the Federal Crop Insurance Program—Iowa farmers were paid almost $934 million for claims on damaged corn.[14]

Iowa is also vulnerable to floods. Heavy rains brought widespread flooding to the Midwest in 2008. In Iowa alone,

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more than 1.3 million acres of corn and 2 million acres of soybeans were flooded, representing approximately 16 percent of the state's total farmland.[15] Additionally, flooding along the Missouri River in 2011 caused significant damage to farms in southwestern Iowa and prevented farmers from harvesting. Overall, Iowa farmers experienced an estimated $207 million in lost economic output due to the flooding that year.[16]

Climate change is likely to only worsen extreme weather and climate risks for farmers. Iowa researchers have observed several effects and trends that are likely to continue. These include:

- Higher nighttime minimum temperatures
- Higher winter temperatures
- Higher precipitation and streamflow
- Increasing summer precipitation and flooding
- Increasingly wet field conditions, making it difficult to conduct field work[17]

In the coming decades in Iowa, the number of days each year over 95°F are likely to increase by a factor of 2 to 4; by the end of the century, such days are expected to increase by a factor of 10 to 20.[18] Average annual precipitation is likely to rise across the region, with increases projected in all seasons except summer, when reduced precipitation is likely in Iowa.[19] Because corn is especially sensitive to heat (and less likely to benefit from higher levels of carbon in the atmosphere than wheat and soybeans), corn yields are expected to be dramatically reduced by mid-century. By the end of the century, corn yields could decline by 18 to 77 percent.[20] Overall, climate change–related economic losses in Iowa due to declines in commodity crops are anticipated to be between $850 million and $12 billion annually by the end of the century.[21] More extreme heat will also reduce labor productivity in "high risk" sectors like agriculture, where workers spend significant time outdoors.[22]

In addition to direct impacts on crop yields, climate change is likely to exacerbate existing water quality problems and negatively impact Iowa's public health. Higher soil moisture has led to increasing use of tile drainage, a practice that removes excess water from the soil subsurface. While tile drainage allows farmers to adapt to soil moisture conditions, it contributes to a more concentrated flow of nitrates and possibly phosphorus into rivers and streams.[23] Increased precipitation in the future will likely exacerbate these problems. High nitrate levels are a significant public health concern. More than 60 Iowa towns have experienced high nitrate levels in drinking water supplies, and Des Moines Water Works has paid more than $1 million to treat high nitrate levels since 2013.[24]

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

Farmers in Iowa can build resilience to these growing climate risks by improving soil health through practices like cover cropping. Cover crops increase the water-holding capacity of soil, allowing farmers to capture more water from heavy rainfall events as well as to store water for increasingly hot and dry summers.[25] Using cover crops (and other soil stewardship practices, like no-till farming and applying compost to increase soil organic matter) on half of Iowa's corn and soybean acres would help store an additional 234 billion gallons of water—enough to provide nearly 7.3 million people with water for one year.[26]

Improved soil health from cover crops also can reduce the negative water quality impacts of tile drainage. In fact, cover crops have been shown to decrease nitrate loading from tile-drained systems by 48 percent.[27] Cover crops can also help farmers cope with the increased weed pressures associated with the shifting growing season.[28] Further, cover crops can 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 just half of Iowa's corn and soybean acres could reduce greenhouse gas emissions by more than 4.3 million metric tons each year—the equivalent of taking more than 990,000 cars off the road.[33]

Despite the multiple benefits of cover crops, only about 1 percent of cropland in Iowa is planted with cover crops.[34] There remains a significant opportunity to use cover crops and other soil stewardship practices to improve the health of soils in the state, thereby combating climate change and making farms more resilient to future droughts and floods.

PRACTICAL FARMERS OF IOWA AND FARMER MARK PETERSON SPREAD THE WORD ON COVER CROP BENEFITS[35]

Practical Farmers of Iowa (PFI) is a farmer-led nonprofit organization that specializes in farmer-to-farmer instruction of agricultural stewardship practices and on-farm research. PFI has played a tremendous role in the spread of cover crop adoption in Iowa. Mark Peterson of Bent Gate Farms learned about the benefits of cover crops from PFI and has been growing cover crops for the past few years to improve soil health. Peterson not only sees the soil health and environmental benefits of cover crops on his farm, but also receives additional economic returns by growing cover crop seed and renting his land to a neighbor whose cattle graze on the cover crops. As a National Wildlife Federation Cover Crop Champion, Peterson takes his enthusiasm for soil health on the road, sharing his expertise with other farmers at PFI workshops and in many other venues.

ENDNOTES

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