ISSUE BRIEF

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

Indiana

Half of total corn/soybean acres planted with cover crops

NEARLY **2.1 MILLION METRIC TONS** OF GHGs CAPTURED ANNUALLY

113 BILLION GALLONS OF WATER STORED

The value of Indiana's agricultural sector is the tenth-largest in the United States, and farms cover nearly two-thirds of the state's total land area.[1] Top crop commodities, including corn and soybeans, generate billions of dollars in income annually for farmers throughout the state. While Indiana planted more cover crops in 2012 than any other state but Texas,[2] there are additional opportunities for Indiana farmers to plant more cover crops to maintain the strength of the Hoosier State's agricultural sector, build soil health, and improve their ability to weather future droughts and floods.

IMPORTANCE OF THE AGRICULTURAL SECTOR

In 2014, Indiana's farms and ranches produced nearly $14 billion in agricultural goods and services.[3] Of this total, $8.3 billion came from crops, $4.3 billion came from livestock, and the remainder came from farm-related income (e.g., forest products, rental of farm dwellings).[4] Indiana's top commodities include corn, soybeans, and hogs.[5] Other major commodities include wheat, poultry, beef, and dairy.[6]

Table 1. Indiana's Top 5 Crop Commodities by Value in 2014[7]

Commodity	Value
Corn	$3.9 billion
Soybeans	$3.2 billion
Hay	$281 million
Wheat	$131 million
Melons	$27 million

Agriculture and related industries in Indiana directly and indirectly generate approximately $44 billion in economic activity annually and support nearly 189,000 jobs.[8] The grain and soybean industries generate 40 percent of these jobs.[9] The contributions of agriculture also vary regionally throughout Indiana. The central, north central, northeast, and southwest regions of the state contribute the most to the agricultural economy, while the south central and southeast regions contribute the least due to a lack of high-quality farmland.[10]

EXTREME WEATHER AND CLIMATE CHANGE IMPACTS ON AGRICULTURE

Agriculture in Indiana has been heavily impacted by both floods and droughts. From 2012 to 2014, the state had 242 USDA county disaster declarations for drought or excessive heat.[11] From 2010 to 2014, insured crop losses due to drought, heat, hot wind, extreme precipitation, and flooding events totaled nearly $1.6 billion.[12] The 2012 drought, which affected nearly the entire U.S. Midwest, caused a 40 percent drop in corn production in Indiana.[13] At the drought's peak, more than 81 percent of the state was in severe to exceptional drought, and overall, more than $1 billion in crop insurance was paid out for drought impacts on corn, soybeans, and wheat that year.[14] Major floods have also inflicted significant damage to the state's agriculture. Severe floods cost farmers $840 million in lost farm revenue in 2008.[15] In 2015, heavy rains and subsequent flooding destroyed as much as 5 percent of the state's corn and soybean crops, causing approximately $300 million in crop damage.[16]

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

For more information, please contact:

Ben Chou
bchou@nrdc.org
switchboard.nrdc.org/blogs/bchou

Claire O'Connor
coconnor@nrdc.org
switchboard.nrdc.org/blogs/coconnor

Lara Bryant
lbryant@nrdc.org
switchboard.nrdc.org/blogs/lbryant

www.nrdc.org/policy
www.facebook.com/nrdc.org
www.twitter.com/nrdc

NOVEMBER 2015
IB:15-11-F

Climate change will most likely exacerbate drought and flood risks for Indiana's agriculture. Spring and fall precipitation is expected to increase by 20 to 30 percent, with slight decreases expected in the summer.[17] The frequency and intensity of extreme precipitation events are also expected to increase.[18] Spring floods could delay planting, and extended dry periods coupled with hotter temperatures during summer could have a negative impact on crops. Additionally, these changing weather conditions are likely to adversely affect soil health, resulting in lower soil moisture and decreases in soil organic matter.[19]

Indiana is expected to see a dramatic increase in the average number of days each year above 95°F. Currently there are about two days per year above this temperature threshold in the state. This will likely increase to 8 to 30 days per year by mid-century and 21 to 92 days by the end of the century.[20] Further, the time period for peak summer temperatures is expected to triple or quadruple from two and a half weeks to nearly two months or more per year.[21] This could result in a longer growing season and, when combined with the fertilizing effect of increasing atmospheric carbon, could lead to higher production of soybeans and winter wheat.[22] However, heat waves during the time when field crops like corn and soybeans pollinate would reduce yields.[23] Overall, Indiana corn yields could decline by up to nearly 33 percent by mid-century and as much as 82 percent by the end of the century due to the effects of hotter temperatures and precipitation changes.[24] More extreme heat will also reduce labor productivity in "high risk" sectors like agriculture, where workers spend significant time outdoors.[25]

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

To manage the increased challenges associated with climate change, Indiana farmers can turn to practices that build soil health, like cover cropping. Cover crops have been shown to increase soil's water-holding capacity, allowing farmers to capture more water from heavy rainfall events and store that 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 Indiana's corn and soybean acres could help store an additional 113 billion gallons of water—enough to meet the needs of more than 3.5 million people for a year.[27]

Cover crops can also help farmers cope with the increased weed pressures associated with a 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, cover crops 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 Indiana's corn and soybean acres could reduce greenhouse gas emissions by nearly 2.1 million metric tons each year—the equivalent of taking more than 440,000 cars off the road.[33]

Due in part to greater emphasis on cover crops by several state and local agencies, Indiana is ahead of other states when it comes to cover crop adoption. In 2012, nearly 600,000 acres of cover crops were planted—the second-highest state total in the nation.[34] However, cover crops remain vastly underutilized: 600,000 acres constitutes less than 5 percent of Indiana's total cropland.[35] Cover crops and other soil stewardship practices can help to improve the health of soils and make farmers more resilient to growing extreme weather risks.

INDIANA'S CONSERVATION CROPPING SYSTEMS INITIATIVE[36]

Indiana is widely credited for being a pacesetter in the Midwest when it comes to growing cover crops. The secret for success appears to be strong leadership and cooperation from local farmers, the Indiana Association of Soil and Water Conservation Districts, multiple state agencies, the Natural Resources Conservation Service, and Purdue University Extension, among other organizations. The Conservation Cropping Systems Initiative (CCSI), a partnership among these organizations, focuses on improving soil health. CCSI has created four regional hubs in Indiana to better conduct outreach to farmers and coordinate data collection for best management practices and soil indicators. CCSI advocates for the use of four primary conservation practices (continuous no-till/strip-till, cover crops, precision farming, and nutrient and pesticide management) to improve soil health, water quality, and increase profits. More than 8,000 producers have been reached in 131 meetings, and since the initiative began in late 2009, the cover crop acreage in the state has increased by 400 percent.

ENDNOTES

1 Timothy F. Slaper, Matt Kinghorn, and Grace Otruzar, "Beyond the Farm: A State and Regional Report on the Economic Contribution of Farms, Forests and Related Industries," prepared for Indiana Soybean Alliance by Indiana Business Research Center, Kelley School of Business, Indiana University, March 2015, www.ibrc.indiana.edu/studies/BeyondTheFarm.pdf.

2 Calculated using Quick Stats 2.0 from *2012 Census of Agriculture*, National Agricultural Statistics Service, U.S. Department of Agriculture (USDA), quickstats.nass.usda.gov/?source_desc=CENSUS.

3 Economic Research Service, USDA, "Farm Income and Wealth Statistics," www.ers.usda.gov/data-products/farm-income-and-wealth-statistics/farm-finance-indicators-state-ranking.aspx#P306c61b678334197bd741313545e8e5e_5_184iT0R0x3, accessed August 23, 2015.

4 USDA, "2014 State Agriculture Overview: Indiana," www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=INDIANA, accessed August 5 2015.

5 Ibid.

6 Ibid.

7 Ibid.

8 Slaper, Kinghorn, and Otruzar, "Beyond the Farm," at 1.

9 Ibid.

10 Ibid., at 7-8.

11 Calculated using 2012-2014 "Disaster Designation Information" from Farm Service Agency, USDA, "Disaster Assistance Program,"www.fsa.usda.gov/programs-and-services/disaster-assistance-program/index, accessed April 15, 2015.

12 Calculated using 2010-2014 data from Risk Management Agency, USDA, "Cause of Loss Historical Data Files," www.rma.usda.gov/data/cause.html, accessed April 16, 2015. Causes of loss include drought, excess moisture/precipitation/rain, excess sun, failure of irrigation supply, flood, heat, hot wind, hurricane/tropical depression, and inability to prepare land for irrigation.

13 Slaper, Kinghorn, and Otruzar, "Beyond the Farm," at 3.

14 Olivia Kellner, "Section 3.3: Indiana," *From Too Much to Too Little: How the Central U.S. Drought of 2012 Evolved out of One of the Most Devastating Floods on Record in 2011*, National Integrated Drought Information System, National Climatic Data Center, National Drought Mitigation Center, University of Nebraska-Lincoln, Brian Fuchs, Deborah Wood, and Dee Ebbeka, eds., 2012, 31, 35, www.drought.gov/media/pgfiles/CentralUSDroughtAssessment2012.pdf.

15 Bryan Corbin, "Official: Flood One of the State's Worst-Ever Agricultural Disasters," *Evansville Courier & Press*, June 19, 2008, www.indianaeconomicdigest.net/main.asp?SectionID=31&subsectionID=135&articleID=41658.

16 "About $300 Million in Indiana Crops' Value Lost to Flooding So Far," *Agriculture News*, June 26, 2015, Purdue University, www.purdue.edu/newsroom/releases/2015/Q2/300-million-in-indiana-crops-value-lost-to-flooding-so-far.html.

17 Purdue Climate Change Research Center, "Impacts of Climate Change for the State of Indiana," February 2008, 5, www.purdue.edu/discoverypark/climate/assets/pdfs/ClimateImpactsIndiana.pdf.

18 Sara C. Pryor et al., "Chapter 18: Midwest," *Climate Change Impacts in the United States: The Third National Climate Assessment*, 2014, 424, doi:10.7930/J0J1012N.

19 Ibid., at 1.

20 "Heat in the Heartland: Climate Change and Economic Risk in the Midwest," *Risky Business: The Economic Risks of Climate Change in the United States*, Risky Business Project, 2015, 27, riskybusiness.org/midwest-report/pdf.

21 Purdue Climate Change Research Center, "Impacts of Climate Change," at 3.

22 Ibid., at 11.

23 Pryor et al., "Chapter 18: Midwest," at 420-421.

24 "Heat in the Heartland," at 17.

25 Ibid., at 18.

26 Humberto Blanco-Canqui et al., "Addition of Cover Crops Enhances No-Till Potential for Improving Soil Physical Properties," *Soil Science Society of America Journal* 75, no. 4 (2011): 1471-1482.

27 Ibid.

28 E.A. Nord et al., "Integrating Multiple Tactics for Managing Weeds in High Residue No-Till Soybean," *Agronomy Journal* 103, no. 5 (2011): 1542-1551.

29 Sustainable Agriculture Research and Education (SARE), "2015 Cover Crop Survey Analysis," www.sare.org/Learning-Center/From-the-Field/North-Central-SARE-From-the-Field/2015-Cover-Crop-Survey-Analysis, accessed August 7, 2015.

30 SARE, "2012 Cover Crop Survey Analysis," www.sare.org/Learning-Center/From-the-Field/North-Central-SARE-From-the-Field/2012-Cover-Crop-Survey-Analysis, accessed August 7, 2015.

31 Kenneth Olson, Stephen A. Ebelhar, and James M. Lang, "Long-Term Effects of Cover Crops on Crop Yields, Soil Organic Carbon Stocks and Sequestration," *Open Journal of Soil Science* 4 (2014): 284-292.

32 Todd W. Andraski and Larry G. Bundy, "Cover Crop Effects on Corn Yield Response to Nitrogen on an Irrigated Sandy Soil," *Agronomy Journal* 97, no. 4 (2005): 1239-1244.

33 See Appendix for explanation of methodology.

34 Calculated from Quick Stats 2.0 from *2012 Census of Agriculture*, National Agricultural Statistics Service, USDA, www.nass.usda.gov/Quick_Stats/.

35 USDA, "Table 1. Historical Highlights: 2012 and Earlier Census Years," and "Table 50. Land Use Practices by Size of Farm: 2012," *2012 Census of Agriculture: Indiana State and County Data,* Volume 1, Geographic Area Series, Part 14, 2014, www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/Indiana/.

36 Conservation Cropping Systems Initiative (CCSI), "What is CCSI?" 2015, ccsin.iaswcd.org/?page_id=518, accessed August 5, 2015. U.S. Environmental Protection Agency, "The Indiana Conservation Cropping Systems Initiative," water.epa.gov/type/watersheds/named/msbasin/in_03.cfm, accessed August 20, 2015.