

A warming Midwest increases likelihood that farmers will need to irrigate

June 18 2019



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If current climate and crop-improvement trends continue into the future, Midwestern corn growers who today rely on rainfall to water their crops will need to irrigate their fields, a new study finds. This could draw

down aquifers, disrupt streams and rivers, and set up conflicts between agricultural and other human and ecological needs for water, scientists say.

The study, reported in the journal *Ecosphere*, calculated the extent to which hotter conditions expected by midcentury will draw more moisture out of [corn plants](#), said University of Illinois plant biology professor Evan DeLucia, who led the study.

"As the atmosphere warms, it dries, and so the draw for water to go from [plants](#) to the atmosphere increases," DeLucia said. "The ability of the atmosphere to draw water from plants is determined by its 'vapor pressure deficit.'

"If you add to this the decades-old trend toward bigger, more productive [corn](#) plants, you see an overall increase in [water use](#) and water loss through plant leaves—without comparable increases in rainfall to counter the deficit," he said.

Today, average corn yields across the Midwest are roughly 170 bushels per acre, DeLucia said. [This is up](#) from about 120 bushels per acre in 1990.

"If this trend continues, the projected yield in 2050 would be 230-240 bushels per acre averaged across the Midwest," he said. "If you want more corn, then you have to have a bigger plant, and a bigger plant is going to use more water."

Precipitation is not expected to increase enough in the Midwest to compensate for the drying conditions of the warmer atmosphere, the researchers found.

"We are getting more intense storms in the spring and less rain in the late

summer," DeLucia said. But the overall amount of precipitation is not expected to change much in the coming decades.

Even without increases in plant size and productivity, warming conditions alone will necessitate a much greater demand for water, the team found.

"We show that as vapor pressure deficit increases, maintaining current maize yields will require a large expansion of irrigation, greater than threefold, in areas currently supported by rain," the researchers wrote.

Some strategies can help counter the drying conditions, DeLucia said. The use of minimum tillage and mulches can reduce the rate of [water](#) loss from the soil. And breeding or genetically modifying plants to sequester more chlorophyll in their lower leaves and less in the top will allow photosynthesis to proceed more efficiently closer to the ground, where conditions are more humid. This will lessen the amount of moisture lost when plants open the pores in their leaves to take in carbon dioxide during photosynthesis. A [research effort](#) to do this is underway in the laboratory of U. of I. plant biology professor Donald Ort.

More information: "Are we approaching a water ceiling to maize yields in the United States?" *Ecosphere* (2019). [DOI: 10.1002/ecs2.2773](https://doi.org/10.1002/ecs2.2773)

Provided by University of Illinois at Urbana-Champaign

Citation: A warming Midwest increases likelihood that farmers will need to irrigate (2019, June 18) retrieved 19 April 2024 from <https://phys.org/news/2019-06-midwest-likelihood-farmers-irrigate.html>

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