

Overpumping threatens to deplete US high plains groundwater

The former dust bowl's lone water source could run dry without a change in agricultural practices.

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Patrick Bolduan/Patrick Yodarus

Farmers have used wind pumps to extract groundwater from the High Plains Aquifer System.

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Midwestern Farmers have relied on the High Plains Aquifer System since they first discovered the solution to their drought woes nearly six decades ago. The massive underground water source has turned a vast dry swath of the Great Plains from North Dakota to Texas into arable farmland. But in recent years reliance on the aquifer has skyrocketed—leading scientists to project that, barring a change in current irrigation trends, nearly 70 percent of the resource could be depleted in the next half century.

Scientists studying groundwater declines in western Kansas who published their results in the August 26 *Proceedings of the National Academy of Sciences* found that farmers had tapped close to 3 percent of the aquifer's supply by 1960 and 30 percent by 2010. At current usage rates, they estimate that an additional 39 percent of the water in the aquifer will disappear by 2060. Once depleted, the aquifer could take anywhere from 500 to 1,300 years to completely refill.

Even as improvements in irrigation technology over the next two decades enable farmers to do more with less, conceivably leading to a dip in groundwater extraction, the number of corn crops and cattle fields—which currently account for the majority of water usage in the US—are expected to multiply well into 2040.

If farmers agree to use less water now, however, they could safeguard future stores, says lead study author David Steward, a civil engineering professor at Kansas State University. It would take a concerted effort—the researchers calculated that farmers would need to reduce their pumping of the aquifer by roughly 80 percent to withdraw water at the rate that could be replenished naturally by rainfall.

Using data collected by the US Geological Survey, Steward and his colleagues measured the water-level change in all of its 3,025 wells at the beginning and end of five-year periods between 1960 and 2010. Then they used the pattern to predict future use for the five-year periods between 2060 and 2110. Next, they compared those results with data on corn and cattle production collected annually by

the US Department of Agriculture. Whereas farmers are using water more efficiently, the researchers found, they are also dedicating more and more land to corn and cattle. Because corn is a highly water-intensive crop, and cattle feed extensively on corn, raising both in this region puts the aquifer at risk of depletion.

Americans and Europeans did not begin farming in the Great Plains until the 1890s, when rising land prices, coupled with fears of food shortages and attractive government incentives, compelled them to set up camp in the arid Great American Desert, as it was known then. Although they knew groundwater existed just below their feet, they lacked the technology to pump significant quantities to the surface. Instead, those early farmers used deep plowing, a practice that enabled grain roots to tap the moisture in the soil, to grow crops able to survive the dry conditions. Because the technique removed the native grasses holding the soil in place, however, it left the ground vulnerable to the region's severe winds. In the 1930s long-term drought led to massive dust storms that rendered the Plains barren. In the late 1950s, with the advent of groundwater pumping and sprinkler irrigation, farmers returned to the land to grow corn and wheat using the aquifer's seemingly endless water supply.

Sixty years later that supply is in jeopardy, says Cornell University professor of crop and soil sciences Harold Mathijs van Es, who was not involved in the study. "We need to think about what's being grown here and how we're growing it. This is the Dust Bowl we're talking about," he says.

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The problem of water overuse is not unique to the High Plains region. In California's Central Valley, where farmers use water flowing from the Colorado River Basin for irrigation, they are learning to do more with less, because saltwater from the west coast began seeping into groundwater as a result of overdrawing. If farmers using water-efficient irrigation methods are similarly encouraged to grow less water-intensive crops, the situation may be salvageable, says Samuel Sandoval Solis, an assistant professor and specialist in environmental and water resources at the University of California, Davis. "The agricultural community is catching up," says Solis, who was not affiliated with the study. "In general they are more informed about the environment, and that's good. People are starting to think ahead and act proactively."

Rather than suggesting that farmers turn away from the High Plains Aquifer completely, Steward hopes that the study will encourage people to find better ways to use the limited resource. "We developed this study to help people plan for the future," he says. "We wrote it for the family farmer who wants to be able to pass on his or her farm to future generations."

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