

Researchers create global maps to show changes in irrigation across the planet

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Piyush Mehta, a doctoral student at the University of Delaware's College of Earth, Ocean and Environment pictured here in Hansen, Idaho, served as the lead author on a paper that looked at how and where irrigated areas have expanded globally from 2000 to 2015 and whether that expansion has occurred in a sustainable or unsustainable fashion. Credit: Piyush Mehta/University of Delaware

Of all the ways that humans consume water, there is no practice that uses more water than irrigation, which accounts for more than 90% of humanity's water consumption. While irrigation is necessary to help increase global crop production, it can simultaneously lead to stress on freshwater resources if it is not done in a sustainable manner—leaving insufficient supply for nature and for other human needs.

Because of this, University of Delaware researchers investigated how and where irrigated areas have expanded globally from 2000 to 2015 and whether that expansion has occurred in a sustainable or unsustainable fashion.

[The paper](#) was recently published in *Nature Water*, with Piyush Mehta, a doctoral student at UD's College of Earth, Ocean and Environment, serving as the lead author. Kyle Davis, assistant professor in the Department of Geography and Spatial Sciences and the Department of Plant and Soil Sciences, as well as a resident faculty member with UD's Data Science Institute and Mehta's advisor, served as a co-author on the [paper](#).

Gathering irrigation statistics for 17,298 administrative units from various global and national sources, the researchers developed spatial maps corresponding to the years 2000 through 2015 that showed how the global area equipped for irrigation (AEI) expanded or declined in different parts of the world.

They found that from 2000 to 2015, AEI increased by 11%, from 297 million hectares in the year 2000 to 330 million hectares by the year 2015.

"About 50% of the irrigation expansion that happened has been unsustainable, meaning that it took place in areas that were already experiencing some kind of water stress," Mehta said. "Most of the irrigation has expanded in Asia where India and China contributed the most to irrigation areas and irrigation expansion. We also saw that India and Pakistan experienced the most unsustainable expansion, with 86% and 87% of their respective expansion taking place in areas that were already experiencing water stress."

In addition, regions in eastern China also experienced unsustainable irrigation expansion, as did the central United States, specifically in areas around the Ogallala Aquifer.

Conversely, countries that experienced sustainable irrigation expansion, at least from the perspective of available water resources, included Brazil, Indonesia, Peru, Italy and France.

Davis said this points to the complicated nature of irrigation expansion.

"Piyush's research provides great insights into the extent to which these irrigation changes are taking into account whether the water is going to be renewably available in a particular place," Davis said. "Piyush has found that outcomes are mixed. Some places are doing a better job at taking such considerations into account when expanding their irrigation infrastructure, but then other places have decided that despite the water sustainability challenges, priorities related to food security and rural development are more important and they are willing to accept that tradeoff for the time being."

To determine whether an area was practicing sustainable or unsustainable irrigation, the researchers looked at how much water an area had "either from rainfall, surface or groundwater sources.

They also pointed out that you can have the same volume of irrigation water that is used in two different places but depending on how much water is available, that can change whether that irrigation use is sustainable or unsustainable, as it is a question of the relative water demand versus the water that is available in a particular place.

Mehta said the results of the paper demonstrate how sustainable and unsustainable shifts in irrigation patterns all occurred in diverse geographies and contexts.

"These findings provide a critical understanding of where irrigation trends have been on a sustainable trajectory and also highlight the regions where interventions are needed to address these unsustainable practices," Mehta said. "With this dataset, you can look regionally, or by a country-by-country level. Now that we have this information that tells us where irrigation is happening sustainably and where [irrigation](#) is happening unsustainably, policymakers can use this information to identify the places where they can irrigate sustainably in the near future."

In addition to this paper, the research done by Mehta and Davis' lab group for this paper also uncovered a lack of global agricultural data, which led to another [recently published paper](#).

More information: Piyush Mehta et al, Half of twenty-first century global irrigation expansion has been in water-stressed regions, *Nature Water* (2024). [DOI: 10.1038/s44221-024-00206-9](https://doi.org/10.1038/s44221-024-00206-9)

Provided by University of Delaware

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