Shuffling water hotspots

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MSU Engineering researcher is helping assess the worldwide impact of human intervention on water scarcity

Water management techniques like reservoirs, dams, and irrigation measures have improved water availability for many around the globe, but they can sweep water scarcity problems downstream for those who live there.

That’s the finding of international research that included the work of MSU water expert Yadu Pokhrel and made public June 15 in the journal, *Nature Communications*.

“This study used five global hydrological models to examine the movement of water scarcity. One was a model that I developed,” said Pokhrel, an assistant professor of civil and environmental engineering and participating member in the Inter-Sectoral Impact Model Intercomparison Project.

“Mine is one of the five modeling groups that provided the data presented in the paper.”

Pokhrel said the overuse of groundwater around the world is an unseen drought.

“The extremes are getting worse,” he warned. “With seven billion plus of us on the planet, we’ve got to start rethinking how we use fresh water,” he added.

That sentiment was confirmed by international researchers who assessed human intervention on water scarcity at a global scale.
"It's common sense that taking water out of a river will leave less for those people downstream. But it's not so straightforward," said Ted Veldkamp, researcher at Vrije Universiteit Amsterdam and guest researcher at IIASA, who led the study.

Seasonal changes in precipitation and water storage make it difficult for modelers to estimate water availability and impacts of interventions, and the effects of climate change can be difficult to tease out from other impacts like human activities.

The new study is one of the first to provide a global accounting of regional and local water impacts, taking into account seasonal changes and different types of intervention, including water withdrawals, reservoir regulation, land-use change, and irrigation.

Using an ensemble of five global hydrological models, the researchers examined the evolution of water availability, demand, and scarcity globally from 1971 to 2010. They also highlighted the separate impact of climate change and human interventions.

This systematic approach allowed the researchers to come up with an estimate that is more realistic than previous approaches—and which also shows greater water scarcity than previous estimates.

From 1971 to 2010, the study found, human impacts have drastically reshuffled water scarcity hotspots, with impacts on approximately one-third of the global population. On average, 20 percent of the global population experienced a significant increase in water availability due to human interventions, such as building water storage, alleviating water scarcity experienced by 8 percent of the population. At the same time, another 23 percent have experienced a significant decrease in water availability, for 9 percent aggravating water scarcity problems.

"The key message from this work is that people need to think about the upstream-downstream linkages: what will the impacts be of the choices they make? You need to have a good overview of all the consequences, not just the local impacts," Veldkamp added.

The international panel of researchers included experts from the Netherlands, Austria, China, Germany, Japan, United Kingdom, and the United States.

For more on water research at MSU, visit the Multi-Scale Hydrological Modeling Lab at: https://water.egr.msu.edu/

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