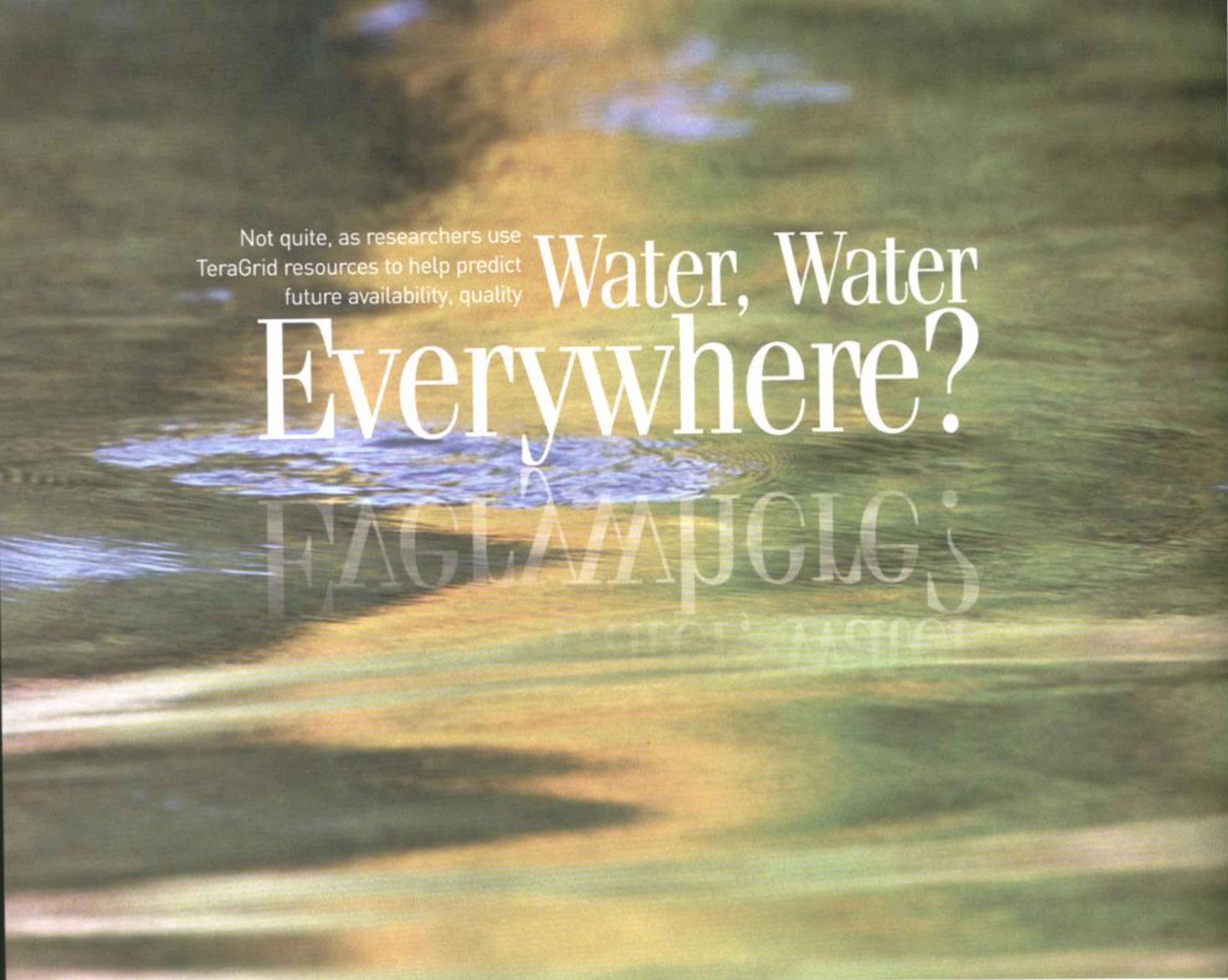
Water, Water Everywhere?

Not quite, as researchers use TeraGrid resources to help predict future availability, quality



From a population of roughly 6.7 billion globally, more than one billion people—or 15 percent—already lack access to clean water, according to World Bank estimates. Now, with the help of TeraGrid computing resources, researchers are developing new ways to better understand the myriad of factors and the interplay among them, which affect water availability and quality, such as population growth, urbanization trends, climate change, and rising demand for biofuels.

Indrajeet Chaubey, Purdue University

The goal, of course, is to improve how we manage our precious water resources and avoid a natural resource crisis that looms larger than that other precious liquid—oil.

At Purdue University, Professor Indrajeet Chaubey and colleagues have been performing unprecedented levels of computer modeling in this field to pose numerous "what if?" questions about future water supplies, given the various changes in, and interactions among, these factors and many more. The researchers run their models tens of thousands of times while adjusting parameters to capture the complexity and time scales involved.

"This level of analysis has not been undertaken previously because of its complexity and computationally intensive nature," says Chaubey, lead investigator for the study, and a professor of agricultural and biological engineering, as well as earth and atmospheric sciences, at Purdue. "This is the only way one can get a much more comprehensive picture and reach more accurate conclusions."

Using TeraGrid high-throughput computing resources such as Purdue's *Condor* pool, Chaubey and his team reduced the time needed to run those scenarios from years to a matter of weeks or days, depending on the given scenario and its level of complexity, by running large numbers of them simultaneously.

As part of the research, Chaubey and his collaborators analyzed Best Management Practices (BMPs) for controlling pollution in a watershed, considering different weather scenarios over a quarter century, and quantifying relationships between water quality and different management practices. The work, outlined at the 2008 American Society of Agricultural and Biological Engineers Annual Conference and in *Water Resources Research* in June 2009, was among the most comprehensive watershed modeling of its kind ever done.

Chaubey's research employs computer models such as the U.S. Department of Agriculture's Soil Water Assessment Tool (SWAT), which was integrated into the TeraGrid by Mohamed Sayeed, a research staff member on Purdue's TeraGrid team. The researchers use modeling to examine the effects of changes in various conditions in addition to weather and climate changes, such as modifications in land cover from urban development, the installation of filter strips, grazing or crop rotation, or the planting of previously marginal lands for biofuels.

Already, the team's research has produced a computerized tool that assesses which management practices will result in the most pollution control for the amount of money available with as little disruption to agriculture as possible. "Ultimately, the goal is to perform such analyses on a regional scale where they can have real policy implications," says Chaubey.

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More information:
https://engineering.purdue.edu/~ichaubey/

A sign promoting an Arkansas program designed to encourage farming practices that mitigate agricultural impacts on water quality. Water could become as big an issue, or bigger, than oil in decades to come, a factor driving research to identify the best ways to preserve water quality, and availability given changing conditions in climate, land use, and other factors.
Image courtesy of **Indrajeet Chaubey.**