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4. WATER:**China faces a water crisis that could worsen without coordinated government response -- study**

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China's current water crisis could escalate into a large-scale water catastrophe unless federal and state government agencies begin to better coordinate their development and environmental quality work, say a pair of researchers in an article published in the journal *Science*.

"The central message that we want to convey is there's an interaction between humans and nature," said **Jianguo Liu**, lead author of the article and director of the Center for Systems Integration and Sustainability at Michigan State University.

China already faces a daunting list of water-related challenges that highlight the human impacts on the landscape and the unevenness of China's rapid urbanization.

Two-thirds of its cities suffer from a shortage of water. Forty percent of its rivers are severely polluted, while eutrophication affects 80 percent of the country's lakes. Three hundred million rural residents lack access to safe drinking water.

Floods frequently wreak havoc across the country, most recently in late July, when 77 people died in Beijing during the heaviest rainfall in 60 years. The deluge overwhelmed stormwater and transportation lines and crippled power supplies. In 1998, flooding along the Yangtze River killed 4,000 people and left 15 million others homeless. Economic damages reached \$26 billion.

Global warming, combined with growing demand for water due to a booming economy and an increasingly prosperous -- and consumptive -- population of 1.34 billion people, will exacerbate these already sobering challenges.

According to the most recent assessment report from the Intergovernmental Panel on Climate Change, an enhanced hydrological cycle due to global warming may increase flooding in Asia, particularly during the summer monsoon season, while leading to the expansion of deserts and heightened water stress in arid areas of the region.

Regulatory approach not always effective

"Climate change is projected to have huge impacts on water supply and demand," said Liu, adding that more than 80 percent of the glaciers in western China are retreating.

The floods of 1998 were a wake-up call, according to Liu. In their aftermath, the central government imposed a natural forest conservation plan. Land degradation was a central cause for the flooding, **Liu** said, and the ban on logging is an example of the central government's ability to respond quickly to an environmental crisis, despite the economic impacts on domestic timber production.

More recently, the central government has responded to growing concerns over natural resources with an ambitious water conservation plan. In January of last year, it proposed to quadruple investment in water management, which is the equivalent of a \$635 billion increase over 10 years.

The funds will go to repairing and reinforcing aging dams, reservoirs and canals as well as schemes to transport water from one region to another. China is currently constructing the longest and largest water transport project in the world -- the South-North Water Transfer Scheme, which is projected to cost \$77 billion and will divert 45 billion square meters of water annually.

In the article, **Liu** and co-author Wu Yang, also of Michigan State, call the conservation plan "laudable, but not sufficient."

They say many government agencies oversee water issues but lack a coordinated approach to their work and are often without adequate resources to punish lawbreakers or monitor regulatory compliance.

In 2004, for example, the central government issued a decree banning construction of golf courses. Since then, however, more than 400 have been built.

The government encourages urbanization, the authors say, yet overlooks the impact of development on water quality, while at the same time promoting green building codes. This rapid expansion of the built environment, they add, increases the amount of impermeable surfaces and leads to greater run-off, which, in turn, can cause floods and surface water and groundwater contamination.

Coal mining and agriculture expand problem

In the agricultural sector, China has boosted food production, in part through expanded use of pesticides and chemical fertilizers, which has heightened water pollution and depleted water supplies. Expanded coal production, say the authors, only adds to the problem.

Water transfer projects like the South-North Water Transfer Scheme are a poor strategy, they say. "Tianjin built a canal that was able to provide a sufficient amount of water for a while," said Liu, mentioning one of the projects' beneficiaries. "But now it's not enough again. They will need more water after the South-North Water Transfer Scheme. It's not a long-term scheme."

In addition to better coordination of their efforts, government agencies need to improve data collection, the authors suggest. The central government is in the process of conducting a national water census of water resources -- essentially establishing a catalog of water supply -- but is not examining water demand.

"We need to understand people's attitudes, their intentions in terms of water use in order to achieve sustainability," said Liu. He said developing future water plans requires establishing a baseline for demand. Then the government will better understand the dynamics of water usage and plan for the future.

Liu and Yang spent four years analyzing government water data and conducting field research in China for their report. Funding for their work was provided by the National Science Foundation and Michigan State's AgBioResearch.

Liu said the pair's findings could be applied in other water-stressed nations.

"India, for example, has a lot of similar challenges," he said. "Its population and economy are growing. It's building water transfer projects. ... These are temporary solutions. If people don't find ways to reduce water use or apply more efficient usage, then we're in for a real catastrophe."

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