Water supply and demand: Scenarios to project global demand water use over the 21st century

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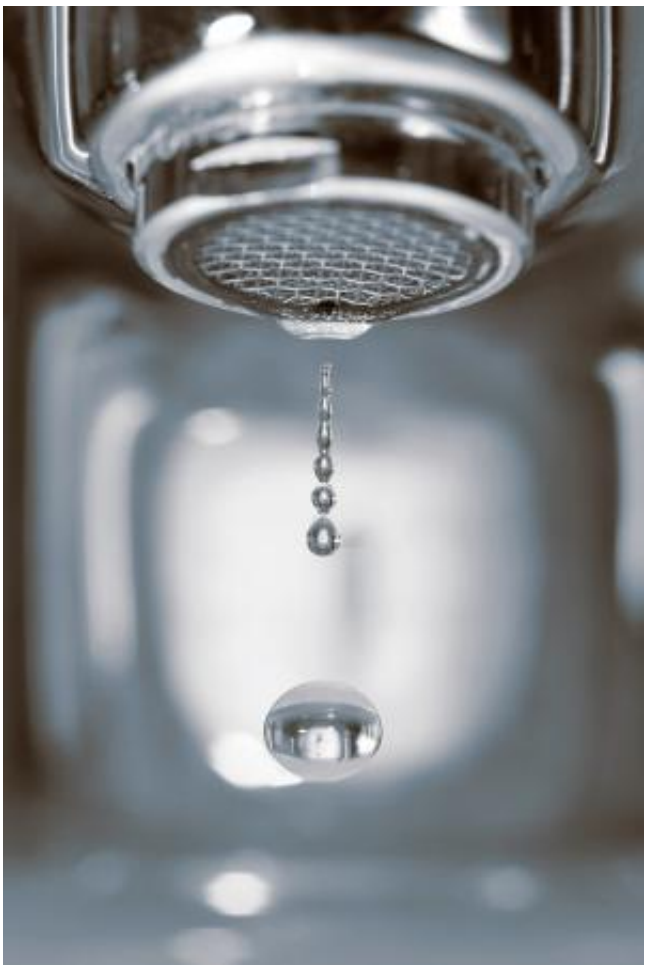

Rising population and economic growth around the world is driving up water demands. Over the 20th century, domestic water use increased the equivalent of ten times the storage capacity of the Hoover Dam. Researchers are now focusing on developing accurate future water use projections and the effects they pose on the climate.

Water is an essential resource. Future demands for drinking water, energy production, and manufacturing prompted researchers working at the Joint Global Change Research Institute (JGCRI) and University of Alberta to develop global domestic water use projections through the 21st century. They linked water price information through the Global Change Assessment Model (GCAM), an integrated model of the human and Earth system, developed at Pacific Northwest National Laboratory (PNNL). JGCRI is a partnership between PNNL and the University of Maryland.

Human choices and their impact on water supply and water-dependent systems will affect climate change. Rising population and economic growth around the world is driving higher water demands for households, farming, energy production, and manufacturing. Until now, no existing global integrated assessment models include analysis of water supply and demand. Over the 20th century, domestic water use increased from about 22 km3 to 345 km3 per year, primarily due to population and income growth. That's almost ten times the storage capacity of the Hoover Dam.

Researchers from PNNL and the University of Alberta addressed two primary research questions: how may global domestic water use grow by year 2100, and which use factors (population, income, technology, or efficiency) dominate the direction of change? Constructing scenarios of future water demand requires research projections of different variables including population, technological change rate, and efficiency rate for each studied region. The team established a set of three representative scenarios to simulate all variables: business-as-usual (BAU), low-tech, and high-tech.

The team found in the BAU scenario that water use is projected to

increase at a slower rate than historical estimates. Only under the high-tech scenario is the global water use-per-capita in the year 2100 projected to be lower than in the year 2005. Such a decline in water use has been observed historically for some developed countries, where per-capita water use declined despite rising populations, likely due to technological improvements and conservation measures.

The newly established model structure now incorporates the effect of water's price on water use demand and is calibrated to existing observations from many countries. Their results demonstrate the importance of accounting for both socioeconomic and technological measures to more accurately assess future domestic water use projections. Because the current water demand model includes socioeconomic variables like population, income, water price, and end-use technology and efficiency improvement rates, projections of those input variables are adopted to characterize the uncertainty in future water demand estimates. Finally, they assessed the sensitivity of the results to population, income, technology, and efficiency.

Even when reaching critical limits, water-use behavior remains consistent. As accuracy in water price and water-dependent variables change, the assessment model will need to account for those future changes.

More information: Hejazi, M. et al. Scenarios of global municipal water-use demand projections over the 21st century. *Hydrological Sciences Journal* 06 March 2013. DOI: 10.1080/02626667.2013.772301

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