

Bottom-up Quantification of Mega Inter-Basin Water Transfer Vulnerability to Climate Change

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Abstract : Large numbers of inter-basin water transfer (IBWT) projects are constructed or proposed all around the world as solutions to water distribution and supply problems. Nowadays, as climate change warms the atmosphere, alters the hydrologic cycle, and perturbs water availability, large scale IBWTs which are sensitive to these water-related changes may carry significant risk. Given this reality, IBWTs have elicited great controversy and assessments of vulnerability to climate change are urgently needed worldwide. In this paper, we consider the South-to-North Water Transfer Project (SNWTP) in China as a case study, and introduce a bottom-up vulnerability assessment framework. Key hazards and risks related to climate change that threaten future water availability for the SNWTP are firstly identified. Then a performance indicator is presented to quantify the vulnerability of IBWT by taking three main elements (i.e., sensitivity, adaptive capacity, and exposure degree) into account. A probabilistic Budyko model is adapted to estimate water availability responses to a wide range of possibilities for future climate conditions in each region of the study area. After bottom-up quantifying the vulnerability based on the estimated water availability, our findings confirm that SNWTP would greatly alleviate geographical imbalances in water availability under some moderate climate change scenarios but raises questions about whether it is a long-term solution because the donor basin has a high level of vulnerability due to extreme climate change.

Keywords : vulnerability, climate change, inter-basin water transfer, bottom-up

Conference Title : ICEESD 2017 : International Conference on Ecosystems, Environment and Sustainable Development

Conference Location : Sydney, Australia

Conference Dates : January 26-27, 2017