Water Security and Adaptive Management in the Arid Americas

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Abstract

Societal use of freshwater, ecosystems’ dependence on water, and hydroclimatic processes interact dynamically. Changes in any of these subsystems can cause unpredictable feedback, resulting in water insecurity for humans and ecosystems. By drawing on resilience theory, we extend current productive–destructive framings of water security to better address societal–ecosystem–hydroclimatic (SEH) interactions, dynamics, and uncertainties that drive insecurity but also offer response opportunities. Strengthening water security in this sense requires strategies that (1) conceptually and practically interlink SEH subsystems; (2) recognize extreme conditions and thresholds; and (3) plan for water security via structured exchanges between researchers and decision makers in ways that account for institutions and governance frameworks. Through scrutiny of case evidence from water-scarce regions in western North America and the Central Andes, we assert that ensuring water security requires adaptive management (interactive planning that accounts for uncertainties, initiates responses, and iteratively assesses outcomes). Researchers and stakeholders from these regions are pursuing a multiyear series of workshops that promote science-based decision making while factoring in the political implications of water planning. This study briefly reviews an emerging water security initiative for the arid Americas that aims to enhance understanding of adaptive approaches to strengthen water security. Finally, by synthesizing efforts in the arid Americas, we offer insights for other water-insecure regions.