



Socio-hydrologic Perspectives of the Co-evolution of Humans and Water in the Tarim River Basin, Western China

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Socio-hydrology studies the co-evolution of coupled human-water systems, which is of great importance for long-term sustainable water resource management in basins suffering from serious eco-environmental degradation. Process socio-hydrology can benefit from the exploring the patterns of historical co-evolution of coupled human-water systems as a way to discovering the organizing principles that may underpin their co-evolution. As a self-organized entity, the human-water system in a river basin would evolve into certain steady states over a sufficiently long time but then could also experience sudden shifts due to internal or external disturbances that exceed system thresholds. In this study, we discuss three steady states (also called stages in the social sciences, including natural, human exploitation and recovery stages) and transitions between these during the past 1500 years in the Tarim River Basin of Western China, which a rich history of civilization including its place in the famous Silk Road that connected China to Europe. Specifically, during the natural stage with a sound environment that existed before the 19th century, shifts in the ecohydrological regime were mainly caused by environmental changes such river channel migration and climate change. During the human exploitation stages in the 5th and again in the 19th-20th centuries, however, humans gradually became the main drivers for system evolution, during which the basin experienced rapid population growth, fast socio-economic development and intense human activities. By the 1970s, after 200 years of colonization, the Tarim River Basin evolved into a new regime with vulnerable ecosystem and water system, and suffered from serious water shortages and desertification. Human society then began to take a critical look into the effects of their activities and reappraise the impact of human development on the ecohydrological system, which eventually led the basin into a treatment and recovery stage. Since then, the basin has shown a reverse trend of regime shift towards healing of the environmental damage that was inflicted in the previous stage of human development. In this paper we analyze the recasting effect of human activities on the water system and provide explanations on how human activities influence the co-evolution of human-water system from a broader perspective.