

Science and Technology Support for Ecological Restoration and Sustainable Management in the Xinjiang Tarim River Basin: Postprint

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Abstract

The Tarim River Basin is located in Xinjiang, Northwest China, covering an area of approximately 102×10^4 km², and serves as a core region for the construction of China's Silk Road Economic Belt. Over the past 50 years, the basin has experienced large-scale development of water and land resources. While socioeconomic development has progressed, river channels have dried up, lakes have desiccated, desertification has intensified, biodiversity has been impaired, and ecological concerns have escalated, threatening oasis economic development and social stability in the Tarim River Basin and significantly impacting the national "Silk Road Economic Belt" initiative. The State Key Laboratory of Desert and Oasis Ecology has conducted long-term ecological monitoring and scientific research to address the ecological and environmental issues in the Tarim River Basin. Based on multi-year monitoring and survey data, the laboratory has analyzed the relationship between desert riparian forest vegetation and groundwater in the Tarim River, revealed the processes and mechanisms of ecosystem degradation, and proposed reasonable/stress/critical groundwater levels and ecological water requirements for the lower reaches of the Tarim River. The key technologies for degraded ecosystem restoration and reconstruction developed by the laboratory have been promoted and applied; the proposed key ecological engineering construction plan has been incorporated into the "Southern Xinjiang Water Conservancy Plan"; and the proposed watershed water resources management recommendations have been adopted and implemented by the state. This scientific and technological support for ecological restoration and sustainable management of the Tarim River Basin has provided important scientific basis and demonstration models for ecological civilization construction along the Silk Road Economic Belt.

Full Text

Preamble

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Abstract

Located in northwestern Xinjiang, China, the Tarim River Basin covers an area of approximately 102×10^4 km² and serves as the heart of China's Silk Road Economic Belt. Over the past 50 years, the basin has experienced extensive development of water and soil resources. Alongside economic and social development, negative ecological effects have intensified, including terminated rivers, dried-up lakes, accelerated desertification, and loss of biodiversity, threatening socioeconomic development in both the Tarim River Basin and the Silk Road Economic Belt.

In response to these ecological challenges, the State Key Laboratory of Desert and Oasis Ecology has conducted long-term ecological monitoring and investigation. Based on monitoring data and extensive research, the dependence of desert riparian vegetation on groundwater level has been systematically characterized, ecosystem degradation processes have been revealed, and reasonable, stressed, and critical groundwater level thresholds along with ecological water demands have been proposed for the lower reaches of the Tarim River. Additionally, key technologies for ecological restoration and reconstruction of degraded ecosystems have been developed, promoted, and widely applied. The proposed construction plan for key ecological engineering projects has been incorporated into the Water Resources Planning for Southern Xinjiang implemented by the Xinjiang government. Water resource management recommendations have been adopted and implemented at the state level. Science and technology can thus effectively support ecological restoration and sustainable management of the Tarim River Basin, providing an important scientific basis and demonstration model for ecological civilization construction along the Silk Road Economic Belt.

Keywords: desert riparian vegetation; ecological conservation and restoration; desertification prevention and control; Tarim River Basin

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