

Research on Water Resources Protection and Utilization Strategies for Water Ecological Civilization Construction in Xinjiang (Postprint)

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Abstract

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Full Text

Water Resources Protection and Utilization Strategy for Water Ecological Civilization Construction in Xinjiang

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Abstract

Water ecological civilization construction is the key to ecological civilization development in Xinjiang’ s arid regions. The “five-in-one” overall layout for

socialism with Chinese characteristics has made strategic deployments for ecological civilization construction. However, issues such as what should be prioritized in arid region water ecological civilization construction, and how water resources can guarantee and serve this construction, remain unclear. This paper reviews research on the ecological environmental effects of water resources development and water ecological civilization in arid regions from the perspective of water ecological civilization construction. It focuses on the important principles that must be upheld in Xinjiang's water ecological civilization construction and proposes water resources protection and utilization strategies to coordinate economic-social and ecosystem systems.

Keywords: water ecological civilization construction; water resources; arid zone; Xinjiang

1 Overview of Water Ecological Civilization Construction Research

Water resources are the primary limiting factor for socio-economic development in Xinjiang. The quantitative relationship between water resources and land use shows that for every unit increase in irrigated farmland, 7500~17500 m² of natural oasis degrades correspondingly [1]. Yang Xiaoli et al. [2] linked water resources with economy and ecology to explore the interdependent and mutually restrictive quantitative relationships and transformation laws of water resources as both an important material foundation for national economic development and the most active factor in ecological environment systems, initially revealing the mechanism of water-ecology interaction in Xinjiang's arid regions.

Since the 18th National Congress of the Communist Party of China incorporated ecological civilization construction into the five-in-one overall layout, numerous scholars have conducted research on ecological civilization construction. The Ministry of Water Resources issued the "Opinions on Accelerating Water Ecological Civilization Construction," pointing out that water ecological protection is key to ecological civilization building. Competition for water between economic-social development and ecological environments represents the focal contradiction in water ecological civilization construction in arid regions. Xinjiang's rapid economic and social development has simultaneously led to water resource shortages, aquatic ecosystem degradation, and severe water pollution. Research on water ecological civilization construction in Xinjiang's arid regions and exploration of water resources protection and utilization strategies are crucial references for achieving high-quality economic and social development in the region.

Scholars have proposed rational water allocation schemes and overall sustainable utilization strategies for ecologically fragile areas. Qian Zhengying et al. [3] argued that establishing a development policy of harmonious coexistence between

humans and nature is essential for ensuring sustainable socio-economic development in Northwest China, proposing ten strategic countermeasures including strengthening unified water resources management. The Chinese Academy of Engineering suggested that water consumption should be equally divided between Xinjiang's economic-social system and natural ecosystem, with total irrigated area controlled within 500×10^3 ha and total irrigation water use limited to 400×10^8 m³, while industrial layout should coordinate with water resource conditions [].

Deng Mingjiang analyzed Xinjiang's water resources and ecological environment characteristics, proposing countermeasures for ten major ecological environment protection targets []; explored water demand for ecological protection in the northern foothills of the Tianshan Mountains and proposed water allocation schemes []; and suggested that by 2030, Xinjiang's agricultural and economic system water use should be controlled within 540×10^8 m³, with irrigated area appropriately controlled within 540×10^4 ha []. Using Xinjiang's inland river basins as examples, strategic approaches for water issues in Northwest China's arid inland regions have been proposed []. Chen Xi et al. [] examined Xinjiang's land cover changes over 40 years since reform and opening-up, concluding that the region's development model is transitioning toward sustainable development that balances ecological civilization construction.

Jiao Wei et al. [] analyzed land development and ecological spatiotemporal succession in the Tarim River Basin, finding that land development in some areas has approached or exceeded ecological risk warning thresholds. Wang Jie et al. [] applied water footprint theory to demonstrate that Xinjiang's economic development is shifting toward secondary and tertiary industries, with agricultural economy no longer significantly affecting overall economic growth. Wang Jing [] explored suitable oasis scales in the Manas River Basin under climate change. Other scholars have investigated Xinjiang's water resources quantity, ecological water demand, and water conservancy development approaches []. While international scholars have quantitatively studied coordinated development between ecological environments and socio-economies [], research explicitly addressing ecological civilization remains limited, primarily because international mainstream academia has yet to fully accept the concept of ecological civilization amid complex attitudes toward China's rise.

2 Important Principles for Xinjiang Water Ecological Civilization Construction

2.1 Fundamental Measure for Xinjiang's High-Quality Economic and Social Development

Water ecological civilization construction has been a research hotspot since 2013. Scholars have analyzed the concept and connotation of water ecological civilization [], with the most accepted definition being: a systematic project that achieves sustainable water resource utilization through scientific alloca-

tion, conservation, and effective protection; improves water environmental quality through effective protection and comprehensive management; and enhances water ecological service functions through effective protection and systematic restoration. Water ecological civilization construction constitutes the most important and fundamental content of ecological civilization building, serving as a pioneering, key, and basic domain. Researchers have examined existing problems and countermeasures [19,21-24]. Wang Jianhua et al. [] proposed a water ecological civilization evaluation index system including water ecosystem, water supply-use system, water management system, and water culture system. Zuo Qiting [] developed quantitative evaluation methods and completion indices for water ecological civilization. Wang Hao [] explored the theoretical basis of water ecological civilization, emphasizing its core principle of following the evolution laws of “nature-society” dual multi-processes.

Xinjiang faces coexisting resource-based, engineering-based, management-based, and pollution-based water shortages. To achieve high-quality development, Xinjiang must implement the water management policy of “prioritizing water conservation, balancing spatial distribution, systematic governance, and leveraging both government and market forces,” ensure natural ecological water consumption, and use the 50-50 division of water consumption between ecological environment and socio-economic systems as a baseline for ecological restoration [], thereby limiting economic and social water withdrawal and consumption to effectively curb the “danger of continued natural ecological deterioration” [].

2.2 Establishing the Concept of Harmonious Coexistence Between Humans and Nature

Guided by Xi Jinping’s ecological civilization thought, we must respect the water resource endowment of arid regions and the ecological pattern where oases exist within and coexist with deserts. Over millennia, arid region flora and fauna have adapted to this special natural environment. Only by respecting natural laws can we prevent detours in natural resource utilization. For example, some cities have blindly constructed large-scale water landscape projects exceeding local water resources and environmental capacity, artificially creating water surfaces of 3-5 km². With evaporation rates of 1500-3400 mm in Xinjiang, such projects undoubtedly cause enormous water waste, violating the concept of harmonious human-nature coexistence.

2.3 Managing the Relationship with Economic Development

Xinjiang’s fragile ecological environment urgently requires strengthened ecological civilization construction and environmental protection, as evidenced by the Tarim River Basin comprehensive management project that achieved good ecological and social benefits. Conversely, Xinjiang’s location in China’s northwest borderland makes accelerated development imperative under the background of building a moderately prosperous society in all respects and the Belt and Road Initiative core area construction. The situation of relying on heavy chemical

industry, coal, and mineral resources development to enhance local financial resources is difficult to change in the short term, creating prominent contradictions between economic development and ecological environmental protection. To resolve this contradiction, we must firmly establish the concept that lucid waters and lush mountains are invaluable assets, shifting from emphasizing economic growth while neglecting ecological environment to prioritizing both environmental protection and economic development, and making strengthened ecological civilization construction an important means for adjusting economic structure and transforming growth patterns.

3 Water Resources Protection and Utilization Strategies

3.1 Strengthening Institutional and Legal Guarantees

Building water ecological civilization and protecting/utilizing water resources involves revolutionary changes in production modes, lifestyles, thinking patterns, and value concepts that require institutional and legal guarantees. Under the framework of the Water Law, Soil and Water Conservation Law, Water Pollution Prevention and Control Law, and related regulations, we must strictly implement the “three red lines” and “four systems” of water resources management, refine indicator systems, implement responsibility and assessment systems, and improve water resources protection and utilization governance systems through laws, regulations, and policies to make institutions untouchable red lines.

3.2 High-Quality Top-Level Design

Top-level design should systematically plan from multiple domains including economic structural adjustment, water resources protection and rational utilization, water ecological environment protection and restoration, and water pollution prevention and control to fundamentally resolve accumulated problems and avoid piecemeal solutions. Governments must guarantee ecological water rights during planning and design stages, implementing Qian Zhengying et al.’s [] proposal of 50-50 water consumption division between ecological and socio-economic systems as a key target for ecological water rights protection. We should coordinate the “three red lines” of water resources management with ecological protection red lines, carry out ecological protection and restoration in an orderly manner, strengthen research on major water resources issues, and revise and improve water resources protection and utilization plans to form a complete water ecological civilization institutional and technical support system.

3.3 Adjusting Water Use Structure to Promote Economic Restructuring

Grasping the connotation of high-quality development from the reality of arid regions allows limited water resources to achieve maximum benefits. Addressing Xinjiang’s excessively high agricultural water use ratio, we should actively

yet prudently implement farmland reduction plans, scientifically formulate supporting policies, solve employment transfer for reduced farmland populations, improve compensation policies, and ensure successful implementation and stability. Continue implementing agricultural water-saving and characteristic forestry fruit water-saving irrigation projects to greatly improve agricultural water use efficiency and output value per unit of water. Vigorously adjust economic structure, accelerate transformation of development modes, continuously increase the proportion of secondary and tertiary industries in the national economic structure, accelerate new urbanization, reduce dependence on land development from population growth and economic development, and continuously decrease the agricultural water use ratio. Actively promote industrial and urban water conservation, water recycling, and reclaimed water reuse, while strictly prohibiting high water-consumption and high-pollution projects.

3.4 Strengthening Water Conservation and Intensive Use

Adhering to water resources as the most rigid constraint, we must implement annual water use quotas, water use efficiency, and water function zone compliance rate indicators for Xinjiang. Establish dual control systems for both irrigated area and irrigation water volume, reduce irrigated area, and vigorously develop efficient water-saving measures such as drip and micro-sprinkler irrigation to effectively reduce agricultural water proportion. Implement dual control systems for groundwater extraction volume and water level, strengthen groundwater management and protection, and accelerate comprehensive management of groundwater over-extraction areas. Strictly implement groundwater prohibition and limitation requirements, comprehensively clean up illegal wells, and complete rectification within set timeframes to prevent new over-extraction areas. Strictly review water resource 论证 for planning and construction projects and strengthen supervision of water withdrawal permits. Enhance water-saving economic and social development system construction, implement water-saving actions across society, and promote the transformation of water use patterns from extensive to conservation-intensive.

3.5 Strengthening Water Resources Protection

Fully implement the river (lake) chief system, strengthen target assessment and accountability mechanisms, and incorporate water resources protection and utilization measures into annual performance assessments. Continuously advance systematic river-lake protection and overall water ecological environment improvement to maintain healthy river-lake ecosystems. Strengthen drinking water source protection, complete the demarcation of protection zones for urban centralized drinking water sources in key counties (cities) across Xinjiang, and ensure drinking water source safety. Determine ecological protection red lines at the autonomous region level, actively promote protection and restoration of important ecological protection areas, water source conservation areas, and wetlands to maintain oasis ecological environments.

3.6 Strengthening Water Pollution Source Control

Strictly implement pollution discharge restrictions, strengthen management of river (lake) discharge outlets, and strictly supervise water function zones to achieve full monitoring coverage. Standardize the approval, registration, and supervision of discharge outlets and comprehensively clean up illegally set outlets. Prevent following the old path of “pollute first, govern later,” and control industrial wastewater pollution from the source by adopting the most advanced water-saving and pollution-control technologies to enhance internal water conservation, clean production, and pollution control in enterprises. Focus on water pollution prevention in key industries such as petrochemicals, coal chemicals, textiles, papermaking, and thermal power; improve water resources comprehensive utilization efficiency and benefits in industrial parks; introduce advanced wastewater treatment and reuse technologies from developed arid regions like Israel to improve reclaimed water utilization efficiency; and incorporate urban sewage treatment construction into overall urban development planning while strengthening pipeline network and supporting facility construction and implementing sewage charging systems.

4 Conclusion

Water ecological civilization construction and water resources protection and utilization are crucial for Xinjiang’ s social stability, long-term peace, and major goals such as Belt and Road Initiative core area construction. This paper discusses important principles and water resources protection and utilization strategies for Xinjiang’ s water ecological civilization construction. The author believes that water ecological civilization construction in Xinjiang’ s arid regions is extremely urgent. We must firmly establish the concept of harmonious human-nature coexistence, properly handle relationships with economic development, and adopt comprehensive measures including legal guarantees, top-level design, water use structure adjustment, water resources conservation and protection, and water pollution control to improve economic and social water use efficiency and benefits. These measures will ensure reasonable water demands for harmonious and healthy natural ecosystems, achieve strategic transformation from agricultural water use to economic-social and ecological water use, and support and guarantee Xinjiang’ s high-quality economic and social development through water ecological civilization.

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