IWRM Action Hub

CASE STUDY

China: The Functional and Protective Mechanism of Gravity Irrigation System in Ziquejie Terrace

Summary

The Ziquejie Terrace is one of the three famous Chinese ancient terraces in Hunan Province. The crops cultivated in the terraces can manage to thrive through drought and flood without reservoir or other water storage constructions. This traditional primitive gravity irrigation system is a model for ecological construction of irrigation systems. However, the mechanism is not well developed, which affects the efficiency of environmental protection for this natural reserve.

Background

Ziquejie Terrace, also known as Ziquejie Primitive Terraced Field, is a fascinating natural reserve area located in Loudi Town of Xinhua County, Hunan Province. Farmlands of Ziquejie Terrace cascade down along the slopes of Ziquejie Mountain, covering an area of 9,390 acres on over 500 terraces at the altitude between 500-1,000 m. All paddy fields are irrigated by natural water flows without being affected by droughts or floods.

Ziquejie Terrace reflects the advanced agricultural civilization of ancient China, as well as the great achievement in ancient agriculture. However, the economic development, the reforms on agricultural sector and the exploitation of the terrace areas make it hard for people to sustain and protect the terraced fields.

The balance between exploitation and protection of the terraced fields becomes the challenge in terms of sustainable development. Ziquejie Primitive Terraced Field, with a history of thousands of years, provides valuable experience and can be seen as an example for terraced projects development and water and soil conservation. Quantitative and qualitative methods and investigations have been performed to reveal the mechanism of gravity irrigation system, based on which, the water balance model for groundwater irrigation is created to better develop and protect the terraced areas.

Actions taken

To better understand the mechanism of Gravity Irrigation and water resource allocation and provide the background for future systematic managements within the Ziquejie Terrace, large amounts of observational data were collected and processed. The nonlinear autonomic regulation theory and the groundwater reservoir on the same slope position theory have been applied to model the water supply-demand balance model for

groundwater irrigation.

Based on the formation of the primitive gravity irrigation system of Ziquejie Terrace and comprehensive consideration of the local background of history and culture, a reasonable division of functional zones of the scenic spot has been proposed: the core scenic zones, the protection zones and buffering zones (i.e., protection through coordination).

Based on the result of functional zoning, the key factors that influence the primitive gravity irrigation system have been analyzed. In consultation processes of local farmers, researchers and the local government the related measures have been proposed and targets identified. The core zone should remain its primitive landscape without constructions. All protection measures must be non-engineering and adapted to the natural environment. Any construction that interrupts the overall landscape of the terrace should be reformed or dismantled. In protection zones, any facility that is irrelevant to the protection, management or development of the terrace should be forbidden. In buffering zones, any projects that have the potentials to damage the terrace environment should be prohibited.

Outcomes

The mechanism of gravity irrigation system within the area has been revealed based on the establishment of the nonlinear autonomic regulation theory and "the groundwater reservoir on the same slope position" theory. It also has been proved accurate by the computation of the proposed water supply-demand balance model.

The map for the division of the functional zones has been derived on the basis of the formation of the primitive gravity irrigation system, local background and the farming culture. Based on this, multiple studies regarding to crop selection, visual effects and utilization can be conducted to improve the economic growth and residential living standards within the scenic area, and finally finalize the protection system within the terraced area The results have already been implemented in "The Planning Report of the Water Conservancy Project of Ziquejie Terrace Scenic Spot" and "The Implementation Plan of 2012 Waterwheel Project of Xinhua County".

Moreover, the outputs have also been adopted by the local government for preparing the application of the world heritage of irrigation projects. In September 2014, Ziquejie Terrace was added to the World Heritage List by the International Irrigation Commission, being one of the four projects on this list in China. These outputs have also been implemented by the local tourism department as the technical support for sustainable utilization and tourism development of Ziquejie Terrace.

Lessons Learned

The gravity irrigation mechanism of Ziquejie Terrace has been proven correctly.

The protection strategy and measures of functional zones are relevant and have been promoted among local farmers.

The outcomes serve as the technical support for the sustainable development.

The land protection and nature protection measures were linked through wise use of water resources.

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Year
2017

Country
China

Region
Asia

Keywords
Floods and Droughts , Climate Resilience

Thematic Tagging
Climate , Ecosystems/Nature-based solutions , Gender , Private Sector , Transboundary , Urban , Water services , Youth
Language English

Supporting Materials
GWP China
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