



An Integrated Water System: The Cultural Landscape of Honghe Hani Rice Terraces

Tianchen Dai  & Carola Hein 

Abstract

The Cultural Landscape of Honghe Hani Rice Terraces, inscribed on the World Heritage List in 2013, integrates traditional farming, irrigation, water management and the Hani people's spiritual relationship with nature. It embodies traditional ecosystemic practices and provides a model for sustainable development aligned with the United Nations' Sustainable Development Goals (SDGs). The terraces exemplify a comprehensive water management system (SDG 6), grounded in resilient communities (SDG 11), efficient traditional farming (SDG 12) and climate-resilient water management (SDG 13). This article examines this traditional approach to water management to offer insights regarding the challenges involved in conserving and (re)creating holistic water systems. In the context of climate change, safeguarding this cultural landscape against flooding, drought and socioeconomic pressures is of critical importance.

Policy Recommendations

- Public and private stakeholders – including local farmers, returnees, governments, entrepreneurs and experts – should strengthen climate resilience by reinforcing irrigation canals, dams, ridges and other water conservancy facilities, and by integrating this infrastructure into the daily lives and agricultural practices of nearby communities.
- Local governments should enhance farmers' capacity to adapt to extreme weather by offering training in water-saving irrigation techniques and disaster-resistant crops, and by investing in upgraded monitoring systems, including advanced weather stations and real-time water-flow sensors to facilitate implementation.
- The local government should establish an ecological compensation budget to raise farmers' income, promoting rice–fish co-cropping, reducing reliance on chemical fertilizers, and encourage farmers to plant water-retaining forest species.

KEYWORDS

UNESCO World Heritage
Water system
Cultural landscape
Honghe Hani Rice Terraces
Ecosystem

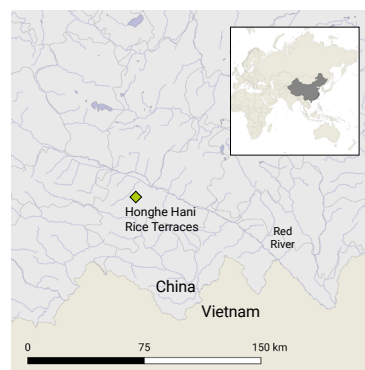
WATER ICONS



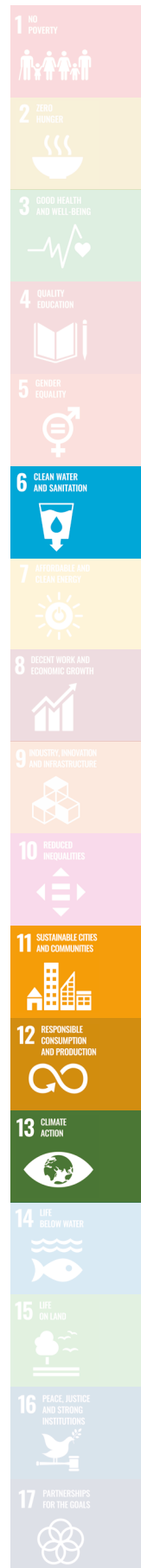
CLIMATE



Cfa: Humid subtropical climate



< Fig. 1 The terraced landscape system in Honghe Hani Rice Terraces in Yuanyang County, Honghe Prefecture, Yunnan, China (Source: Fanghong, 2013. CC BY-SA 3.0, via Wikimedia Commons).



Introduction

The Cultural Landscape of Honghe Hani Rice Terraces in Southern Yunnan is a unique, comprehensive water system that integrates farming, water management and the Hani people's spiritual connection with nature. It was added to the World Heritage List in 2013 (UNESCO World Heritage Centre 2013). The case of the Honghe Hani Rice Terraces illustrates the importance of integrating both tangible and intangible water practices as a holistic spatial, social and cultural system (Dai and Hein 2023; Dai, Hein, and Baciú 2023; Dai and Hein 2021). This complex system of channels and forests exemplifies an ecosystem approach that secures a reliable water supply for rice terrace irrigation and household needs, supporting SDG 6 (Clean Water and Sanitation). The integration of the traditional "mushroom" house (A unique traditional Hani dwelling, named for its mushroom-like roof, is typically composed of earthen walls, bamboo and wood frames, and thatched roofs) – typology into the rice terrace landscape promotes sustainable living, aligning with SDG 11 (Sustainable Cities and Communities). Using locally sourced, biodegradable materials like wood and thatch, the design of the compact, resource-efficient village minimizes environmental impact, supports the terraces' agricultural and water management systems and strengthens community cohesion. An effective farming system that uses buffalo, ducks and fish to maximize resources and reduce waste in red rice production speaks to the values of SDG 12 (Responsible Consumption and Production). The terraces' strong resilience to climate change and drought makes this landscape a model of ecological sustainability in line with SDG 13 (Climate Action). This ingenious system also highlights the important role of water in preserving and protecting these traditional sites at a time of climate change.

The Honghe Hani Rice Terraces exemplify human creativity in adapting to climate challenges. Their construction originated with the multi-ethnic people (Luo and He 2023), who originally inhabited the Qinghai and Tibetan Plateau. They were highly skilled pastoral nomads with mainly agricultural skills. By the ninth and tenth centuries, they left their homeland and moved to China's Yunnan Province due to pressures from neighboring groups and severe living conditions. In Yunnan Province, starting in the ninth and tenth centuries (UNESCO World Heritage Centre 2013), the Hani people used water from the high mountains to create a terraced landscape system that provided water for drinking, cleaning and irrigation downhill (fig. 1).

The region's steep slopes, heavy rainfall and elevations approaching 3,000 m made it suitable for terracing from forested uplands to valley floors. By reshaping the terrain, the Hani created a resilient agricultural landscape that still functions today and includes mountains, trees and villages (fig. 2).

A crisscross network of irrigation channels directs water into ditches. The Hani people meticulously plan the layout of rice terraces, positioning them on sunny, mid-slope locations at around 800 m above sea level to optimize irrigation and environmental conditions for rice cultivation. Forests, located at the top of the hill, play a vital role by capturing and regulating the water needed for the terraces. A network of channels efficiently distributes water both horizontally and vertically, with sills in terrace bank walls guiding water flow from one level to the next. Sites are selected in winter and spring, when warmer weather and drier soil allow initial dryland cultivation. After three to four years of leveling the terrain, these sites are converted into permanently flooded irrigated terraces.

During winter, the Hani reinforce terrace bank walls using mud from the fields to maintain the system.

The Hani people also developed social structures for water management, as captured in the saying: “Dividing water with woodcuts.” According to the respective number of terraces belonging to each household and the amount of water needed, water was supplied through a piece of wood with several notches to indicate a controlled amount of water that was allowed to flow into the terraced fields, making full use of the mountain springs and minimizing water waste. This method of “dividing water with woodcuts” greatly helped maintain the agricultural system of the terraced fields. Similar water management structures – designed to divert water and regulate the amount allocated to each house-

hold – can be found in villages throughout the Honghe Hani Rice Terraces (fig. 3).

The rice-growing process is sustained by elaborate socioeconomic systems that strengthen people’s relationship with the environment through obligations to both their own lands and to the wider community. It is also sustained by religious practices that inscribe natural processes in spiritual activities, emphasizing the sacredness of nature. The relationship between individuals and their community, as well as between people and their gods, has persisted for at least a millennium and is still a living cultural tradition.

A sustainable agricultural system built on fairness and rationality can inspire contemporary societies. Climate change, modern infrastruc-



^ Fig. 2 Villages above the Honghe Hani Rice Terraces (Source: Tianchen Dai, 2024).



^ Fig. 3 A water diverting and management structure in a village in the Honghe Hani Rice Terraces (Source: Tianchen Dai, 2024).

ture and socioeconomic shifts threaten the ecological and cultural integrity of this UNESCO World Heritage property. Preserving this living heritage requires innovative, community-driven strategies that balance tradition with adaptation, offering a replicable model for global sustainable development.

Current and Future Challenges to this Water System

Today, this sophisticated traditional water management practice faces multiple challenges. Fewer people and communities are willing to follow the traditional way of life, leading to a decline in terraced fields that cannot be adapted to mechanical production methods. Furthermore, traditional communities are disappearing as the area has seen an influx of new immigrants who have settled to work in the local tourism and leisure sectors (Zhang et al. 2017). Tourism has also disrupted the Honghe Hani Rice

Terraces by adding road and parking infrastructure—which in turn alters traditional settlement layouts—transforming social relationships and resource allocation within villages, and upsetting the ecological balance.

Extreme droughts and floods are exacerbated by climate change and the destruction of the forests that traditionally capture and regulate water for the Honghe Hani Rice Terraces. The internal structure of the terraced fields has been damaged by newly built viewing platforms for tourists, ditches and rivers and other water conservancy facilities have been damaged, and problems have arisen with the natural irrigation system structure. These artificial changes have severely impaired the inner balance and the ecological and cultural integrity of the traditional irrigation system, thereby compromising its ability to sustain the natural and cultural landscape.

Current Approaches to Preserving and Managing Water Heritage

Terraced farming is a climate-resilient practice that plays a vital role in the sustainability of the Cultural Landscape of Honghe Hani Rice Terraces. The protection of the cultural landscape relies heavily on sustaining terraced farming, which requires a comprehensive understanding of the natural and cultural nexus supporting the local practice and its potential evolution in the face of climate change and shifts in consumption patterns, economic structures, demography and information dissemination. Given the awareness of the values of terraced farming and the heritage status of Honghe Hani Rice Terraces, multiple stakeholders have been interested in and have been making efforts to protect the site. Local government, academic institutions, cultural foundations, tourism organizations and agricultural institutions (Zhang 2023), have all

become involved in the conservation and management of the Honghe Hani Rice Terraces.

A notable example is a project focused on one of the nominated villages within the UNESCO property boundary, the Azheke Village. The Cultural Landscape of Honghe Hani Rice Terraces includes eighteen villages within the property's designated boundary, and five additional villages that have been nominated. Other villages lie in the properties' buffer zone. The Azheke Plan, launched in 2018 by a team from Sun Yat-sen University, focuses on tourism-driven poverty alleviation for heritage preservation (Zhang 2023). The project established a village-run tourism company, funded partly by the government (30 per cent) and the villagers' resources (70 per cent), with 30 per cent profits of the profits supporting operations and 70 per cent to preserving traditional homes and rice terraces. This innovative model avoids external investment, directly linking income to the upkeep of cultural and ecological resources, while experts from Sun Yat-sen University guide operations and train villagers.

Tourism interventions, as part of the Azheke Plan, include cultural experiences such as terrace hikes and Hani song performances, promoting living heritage. More young farmers have returned to the village for tourism development and to the terraced fields for traditional farming, attracted by the profits generated by the plan. This self-reliant, community-led approach combines protection with development, offering a replicable model for sustainable rural revitalization in China and beyond. The plan is both successful and innovative in terms of heritage protection, as Sun Yat-sen University has recognized that the villages inhabited by local people are key to preserving and revitalizing the Honghe Hani Rice Terraces, serving as a vital link between the tangible and intangible elements of

the agricultural and water management system. However, the commercialization of cultural practices risks commodification, potentially diluting authenticity if not carefully managed to prioritize community values over profit.

In addition, to protect the environment, the Honghe Prefecture Committee, the Prefecture Government and Yuanyang County have promulgated and implemented a series of regulatory documents such as the "Regulations for the Protection of Honghe Hani Terraces" and the "Guidelines for the Preservation, Restoration and Environmental Management of Traditional Hani Houses in Honghe" to facilitate converting farmland back into forests and restricting access to certain mountains to allow forest recovery. These efforts have significantly expanded forest cover in the region, which is essential to the functioning of the Hani rice terrace system. Furthermore, the local government has strictly protected the terraces to maintain the traditional rice farming method and the agricultural cultural landscape; therefore, the cultivated land area in the core area of Hani Terraces remains intact (Ma et al. 2024). The substantial increase in forest area enhances landscape connectivity and reconnects to the historic landscape pattern of the Hani Terrace core area. This not only improves the stability and security of the Hani Terrace ecosystem but also enhances its aesthetic landscape function, which plays a positive role in protecting Hani Terrace's cultural heritage and the development of ecological tourism.

Since 2020, several institutions have provided diverse non-fiscal funding sources for the preservation of both tangible and intangible heritage related to the ancient agriculture system of Honghe Hani Rice Terraces. For instance, the China Foundation for Poverty Alleviation has backed the establishment of the Heritage

Protection and Inheritance School. Academic institutions, including Yunnan University, Yunnan Normal University, Honghe University, the Chinese National Academy of Arts and the Yunnan Academy of Social Sciences, have conducted extensive research on the intangible cultural heritage of Yuanyang County, including Pu'er tea-making skills, a ceremony to honor the village's patron saint "Angma" and the nature god and the traditional multi-voice folk singing. The research has led to publications (Zhang 2023), as well as audio and digital materials planned for publication, featuring Hani folk literature and art, with the goal of promoting the inheritance and development of Yuanyang County's farming culture to the world. Publication projects include "On the Fields of Hope: An Ethnographic Documentary on Green Agricultural Development in Yunnan" and "The Collection of the Musical and Dance Traditions of the Hani and Yi Ethnic Groups on the Southern Bank of the Red River." Such actions effectively enhance the visibility and recognition of terraced fields as a living product of human culture. This process of cultural empowerment and branding can facilitate the transformation of terraced rice farming into a high-value-added compound agricultural culture system, thereby increasing the income from agricultural production and sustaining its development.

Local farmers, who consider themselves the creators and custodians of this heritage (Wu and Sun 2022), should be at the center of the region's sustainable development. Their participation is essential in maintaining terraced agriculture, improving agricultural marketing, promoting heritage tourism and supporting related cultural industries. This can be facilitated through capacity-building programs as well as by reforming local economic and environmental policies and restructuring community governance.

Policy makers can help address ecological degradation and promote ecological compensation by encouraging farmers to engage in traditional agricultural practices, modify their planting choices, and reduce chemical use, thereby improving forest water retention and minimizing chemical pollution (Liu et al. 2020). As a practical example, Yuanyang County Government distributed fish seedlings as part of physical ecological compensation to promote the rice-fish co-cropping mode in the Honghe Hani Rice Terraces. The economic benefits of this action were considerable, and the net income to the Hani terrace area was greatly increased compared with that of rice mono-cropping between 2020 to 2021 (Xu et al. 2024). This co-cropping mode is beneficial for improving the income and living quality of local farmers, alleviating the outflow of the rural labor force to a large extent, and thereby maintaining the unique four-element isomorphic agricultural ecosystem of the Hani Terraces and ensuring the stability of the terrace landscape.

As part of community restructuring, it is important to attract and support talented, educated young people, especially those with entrepreneurial skills and experience in digital media, who are interested in the terraces. Some university graduates, drawn by the unique culture and lifestyle of the Hani Rice Terraces, have already joined local communities and initiated new forms of entrepreneurship that integrate culture, agriculture and tourism. The People's Government of Honghe Hani and Yi Autonomous Prefecture has also introduced policies to encourage university graduates to return to their hometowns in Honghe Prefecture to start businesses. These include measures such as guaranteed loans and one-time startup subsidies for entrepreneurs (People's Government of Honghe Hani and Yi Autonomous Prefecture 2025).

By weaving together culture, agriculture and tourism, these approaches can transform everyday life in the locality. This reimagined way of life in revitalized communities ensures that the cultural landscape not only endures but thrives, boldly adapting to the dynamics of climate, environment and society with resilience and innovation. However, the success of these strategies ultimately depends on their active engagement, motivation to improve their livelihoods and commitment to preserving the land and water.

In terms of capacity building, training sessions and lectures can enhance local farmers' awareness of extreme weather and improve their ability to manage agricultural production, including techniques for water-saving irrigation and the cultivation of crops resistant to disasters like droughts and heavy storms. To counter the decline in terraced farming and boost income from agricultural products, farmers can be taught skills in advertising and packaging, and how to expand sales through e-commerce (Lu 2012), thereby adding commercial value to their agricultural products. In 2017, Honghe County launched a large-scale terraced red rice-processing plant as part of an "e-commerce poverty alleviation project." Online sales of e-commerce not only revitalize the idle assets of old red rice-processing plants but also broaden the sales of red rice (Zhang 2023). Such approaches can also be inspirational for institutions that promote the preservation of terraced landscapes more generally, notably the International Terraced Landscape Alliance (<https://www.itla.si/art-home-page.html>).

Current Approaches to Preserving and Managing Water Heritage

The Hani Rice Terraces will benefit from future-oriented engagement through capacity

building, ecological compensation and support for young entrepreneurs, all of which will also aid community revitalization. These strategies should be further promoted and financed by the local governments. In addition, the governments should improve meteorological and hydrological monitoring in the Honghe Hani Rice Terraces area by installing advanced weather stations and real-time water flow sensors across key terrace zones; improve the extreme weather warning system with a dedicated mobile app and SMS alerts for farmers; repair and reinforce existing irrigation canals, dams, ridges, and other water conservancy facilities by enhancing flood control and drought resistance capabilities and initiate new water conservancy projects to increase water storage capacity, ensuring sufficient supply during droughts and effective drainage during heavy rainfall.

Recommended Future Approaches

The government could set up a fund to continuously provide entrepreneurship guaranteed loans and one-time subsidies to university graduates annually who return to Honghe Prefecture to start ventures in heritage tourism, cultural industries, or social media focused on the terraces. They could establish a mentorship network, pairing returnees with local leaders and businesses, aiming to retain them in the region for the long term. Finally, the government could expand the rice-fish co-cropping initiative by distributing fish seedlings to terrace farmers, backed by an annual ecological compensation budget, increasing net income, and introduce policies for reducing chemical fertilizer use and planting water-retaining forest species, with the goal of improving forest water retention across the terrace region.

Acknowledgment

This contribution was peer-reviewed. It was edited by members of the editorial team of the UNESCO Chair Water, Ports and Historic Cities: Zuzanna Sliwinska.

References

- Dai, Tianchen and Carola Hein. 2021. "Port Cities UNESCO World Heritage News: Removing Liverpool and Adding Quanzhou." *PortCityFutures* (November 13th). <https://www.portcityfutures.nl/news/port-cities-unesco-world-heritage-news-removing-liverpool-and-adding-quanzhou>.
- Dai, Tianchen and Carola Hein. 2023. "Exploring the Descriptions of World Heritage Properties through the Perspective of Water using a Narrative Approach." *International Journal of Heritage Studies* 29 (12): 1–24. <https://doi.org/10.1080/13527258.2023.2252792>.
- Dai, Tianchen, Carola Hein and Dan Baci. 2021. "Heritage Words: Exploring Port City Terms." *European Journal of Creative Practices in Cities and Landscapes* 4 (2): 36–59. <https://doi.org/10.6092/issn.2612-0496/12149>.
- Liu, Moucheng, Bai Yunxiao, Lun Yang and Jiao Wenjun. 2020. "Effect of Ecological Compensation Standard on Farmers' Production Behavior: A Case Study of Hani Rice Terraces in Honghe County, Yunnan Province." *Journal of Chinese Ecological Agriculture* 28 (9): 1339–49.
- Lu, Peng. 2012. "Ecological Problems and Solutions of Hani Terrace in Honghe River." *Agricultural Archaeology* 4: 195–98.
- Ma, Xinying, Zhao Yangling, Guo Luo, Yang Jingbiao. 2024. "Spatial-Temporal Changes of Land Use and Ecosystem Service Value in Hani Terrace from 2005 to 2020." *Journal of Minzu University of China (Natural Science Edition)* 33 (3):14–23.
- People's Government of Honghe Hani and Yi Autonomous Prefecture. 2025. "What are the Assistance Policies Implemented by Mengzi City for College Students who Return Home to Start their Own Businesses?" https://www.hh.gov.cn/lcxx_xx.jsp?urltype=leadermail.LeaderMailContentUrl&wbtreeid=8791&leadermailid=326F1BC6BE3E43D065CB1C95167AFDF.
- UNESCO World Heritage Centre. 2013. *Cultural Landscape of Honghe Hani Rice Terraces*. UNESCO World Heritage Centre. <https://whc.unesco.org/en/list/1111/>.
- Wu, Wenjia and Sun Juixia. 2022. "The Mechanism and Effect of World Cultural Heritage Site of Honghe Hani Rice Terraces in the Context of Tourism-Based Poverty Alleviation." *Journal of South China Normal University (Natural Science Edition)* 54 (5): 108–16. DOI: 10.6054/j.jscn.2022077.
- Xu, Ke, Yi Xiaoyan, Zhang Yingnan, and Yin Changbin. 2024. "Comprehensive Evaluation of Carbon Footprint and Economic Benefits of Rice-Fish Co-Culture in the Hani Terraced Fields." *Acta Ecologica Sinica* 44 (23): 10619–30.
- Zhang, Duo. 2023. "The Road to the View of Grand Heritage: The Experience and Enlightenment of Honghe Hani Terrace under the Overall Protection of Multiple Types of Heritage." *Northwest National Research* 6: 118–28.
- Zhang, Shengrui, Zhong Linsheng, Zhou Rui and Wang Yingjie. 2017. "Ecotourism Monitoring in the Yunnan Honghe Hani Rice Terraces Heritage Property." *Journal of Geographical Research* 36 (5): 887–98. <https://doi.org/10.11821/dlyj201705007>.



© Author(s) 2025. This work is distributed under a Creative Commons Attribution 4.0 license (unless otherwise indicated). This license allows anyone to redistribute, mix and adapt, as long as credit is given to the authors.



Tianchen Dai has a PhD in architecture from Southeast University, China, an M.Arch from Bartlett School of Architecture, UCL, and a B.Arch from the University of Nottingham, UK. She has been a visiting researcher (2016–2018) and postdoctoral researcher (2020–2021) at Delft Technical University, Netherlands. She worked as an associate professor at East China Normal University, Shanghai (2021–2024), and now holds the same position at Harbin Institute of Technology (Shenzhen). Her research explores the cultural connotations of historic urban landscapes, focusing on port and waterfront cities. She has published over 20 articles and chapters in Chinese and international journals.

Contact: daitianchen@hit.edu.cn



Carola Hein is Professor History of Architecture and Urban Planning at Delft University of Technology, Professor at Leiden and Erasmus University, and UNESCO Chair Water, Ports and Historic Cities and serves as director of the PortCityFutures Center. She has published and lectured widely on topics in contemporary and historical architectural, urban and planning history and has tied historical analysis to contemporary development. Among other major grants, she received a Guggenheim and an Alexander von Humboldt fellowship. Her recent books include: *Port City Atlas* (2023), *Oil Spaces* (2021), *Urbanisation of the Sea* (2020), *Adaptive Strategies for Water Heritage* (2020), *The Routledge Planning History Handbook* (2018), *Port Cities: Dynamic Landscapes and Global Networks* (2011) and *Hustle and Bustle: The Vibrant Cultures of Port Cities* (2024).

Contact: c.m.hein@tudelft.nl