

Letter

Application of Traditional Knowledge of Hani People in Biodiversity Conservation

Jingbiao Yang ¹, Yi-Chen Wang ² , Dan Wang ³  and Luo Guo ^{1,*}

¹ College of Life and Environmental Sciences, Minzu University of China, Beijing 100081, China; king08@126.com

² Department of Geography, National University of Singapore, Singapore 117570, Singapore; geowyc@nus.edu.sg

³ International Doctoral Innovation Centre, Research Group of Natural Resources and Environment, Department of Chemical and Environmental Engineering, University of Nottingham Ningbo China, Ningbo 315100, Zhejiang, China; dan.wang@nottingham.edu.cn

* Correspondence: guoluo@muc.edu.cn; Tel.: +86-135-0117-4091

Received: 30 October 2018; Accepted: 28 November 2018; Published: 3 December 2018



Keywords: Hani terrace; traditional knowledge; biodiversity conservation; compound agroecosystem

Traditional knowledge offers a feasible approach to biodiversity conservation because it not only preserves, but also enriches biodiversity [1–3]. Through ten years of research, including semi-structured interviews with villagers, focus group discussion, and field investigation in Yuanyang County in the Yunnan Province of China, we observe that the Hani people (herein the “Hani”) thoroughly apply their traditional knowledge to biodiversity conservation of their agroecosystems.

The Hani are an ethnic group who have lived for centuries in the southwestern Yunnan province of China, as well as in Laos and Vietnam [4]. They protect biodiversity through their natural religion, environmental ethics and customary laws. In believing that everything has a soul and an equal right with people, the Hani worship many natural creatures or phenomena as deities or spirits. Some families have even regarded a certain animal or plant species as their own ancestors. Each village has one or more holy forests, of which the sizes vary according to the village sizes, ranging from hundreds of square meters to several hectares. The holy forests are for holding annual sacred activities only. During non-worship days, no one is allowed to step into the forests to harvest any plants, even to collect litter. Logging and poaching are strictly prohibited. Consequently, the environments of the holy forests are kept as natural as possible, serving as wildlife sanctuaries. Take for example the holy forest in Quanfu Zhuang Village, Yunnan, though having a small size of less than 0.1 km², it provides the habitat for the relict tree fern species *Cyathea spinulosa* (Wall. ex Hook., family Cyatheaceae), also one of the first-class protected plants in many countries [5].

The implementation of customary laws further protects the holy forests. Independently formulated by all villagers, customary laws are enforced by public opinions, moral constraints, and collective exclusion of offenders, acting as a legal guarantee for the Hani to protect holy forests and other public natural resources. Thanks to these measures, a collective forest area of 936.4 km² is well managed by the Hani. These forests account for 79.9% of the forest land in Yuanyang County, providing a coverage of 53.5% of the whole county. The large forest coverage is crucial to the sustainability of the agroecosystems. Forests intercept precipitation and store water in soils to ensure continuous water supply in the dry seasons for rice farming and village usage. Alternatively, during the wet seasons, forests conserve soils and stabilize water runoff to reduce the risks of natural disasters such as flooding, soil erosion, or landslides [6].

The Hani enrich the diversity of the agroecosystems and mountain landscapes through their traditional knowledge. Their rice seed bank not only preserves hundreds of traditional rice seed

varieties that can withstand extremely cold and dry conditions in mountainous environments, but also enables the ability to breed new rice varieties [7]. In 1984, there were 5285 rice varieties recorded in Yunnan Province. Yuanyang County alone reported 196 traditional varieties in 1984 and 392 varieties (including non-traditional ones) in 2005. In 2010, records of 100 traditional rice varieties were still identified in a survey of 30 villages in the county, despite the practices of hybrid rice breeding worldwide. Various rice farming associated activities, marked by cropping on rice field ridges and fish/duck farming in rice fields, also improve the yield and enhance the stability of the agroecosystems. Furthermore, the application of green manure, such as soaking Compositae and crofton weeds in rice fields, has demonstrated benefits to seedling cultivation due to the increase in soil fertility, the potential elimination of plant diseases and insect pests, and the prevention of biological invasion. The Hani have developed a complex channel system to bring water from forested mountain areas to the rice terraces. For over 1000 years they have managed water resources in such an efficient and effective manner to ensure that the water supply is abundant for the sustainable operation of the rice terrace farming system, without reservoirs [8]. The rice farming system, interspersed with terraces, river channels, villages, and forests, represents a typical mountain landscape of the Hani. The magnificent Hani rice farming system, marked by spectacular rice terraces cascading down the slopes from 2000m above sea level to 800m [9], is a masterpiece of the Hani's wisdom. Indeed, the Honghe Hani Rice Terraces in Yuanyang County have been listed as a World Heritage Site since 2013 [10]. We took many pictures to archive Yuanyang County. Figure 1 shows typical ecosystems and landscapes in Hani's villages.



Figure 1. The typical ecosystems and Landscape in Hani's village. (By Jingbiao Yang).

As much as 85% of the world's protected areas are inhabited by indigenous people [11]. Approximately 11% of the world's and 22% of developing countries' forests are occupied and managed by local communities or minorities [12]. Our field investigation in Yunnan, China, suggests that the Hani's traditional knowledge for environmental protection and conservation, as well as their indigenous rice terrace farming system demonstrate an extraordinary harmony between humans and their environment. The participatory management or autonomous governance of indigenous and local communities through the application of their traditional knowledge can be more effective than simply administrating the protected areas [13,14]. This is evident in the resilient land management system of the Hani rice terraces, based on long-lasting traditional knowledge and established religious beliefs. It is thus imperative to consider and value traditional knowledge, and to incorporate it in managing natural resources and protecting biodiversity. We must act fast, because unfortunately traditional knowledge disappears almost as fast as the biodiversity does [15].

Author Contributions: All authors have contributed to the development of the research and in the elaboration of this article; J.B.Y., D.W. and L.G. developed the conceptual framework; J.B.Y. and L.G. performed data processing and analysis; Y-C.W. and D.W. offered advice on the study; J.B.Y. wrote the paper; Y-C.W. and L.G. gave valuable comments and revised the paper.

Funding: The work presented in this paper was supported by the key research project of Chinese Ministry of science and technology (No:2017YFC0505601) and Minzu university of China world-class universities and first-class disciplines project (Y1dxxk201819).

Acknowledgments: We are grateful for the comments of the anonymous reviewers, which greatly improved the quality of this paper.

Conflicts of Interest: The authors declare no conflicts of interest.

References

- Berkes, F.; Colding, J.; Folke, C. Rediscovery of traditional ecological knowledge as adaptive management. *Ecol. Appl.* **2000**, *10*, 1251–1262. [[CrossRef](#)]
- Parrotta, J.A.; Agnoletti, M. Traditional forest knowledge: challenges and opportunities. *For. Ecol. Manag.* **2007**, *249*, 1–4. [[CrossRef](#)]
- Fukamachi, K. Sustainability of terraced paddy fields in traditional satoyama landscapes of Japan. *J. Environ. Manag.* **2017**, *202*, 543–549. [[CrossRef](#)] [[PubMed](#)]
- Jiao, Y.; Li, X.; Liang, L.; Takeuchi, K.; Okuro, T.; Zhang, D.; Sun, L. Indigenous ecological knowledge and natural resource management in the cultural landscape of China's Hani Terraces. *Ecol. Res.* **2012**, *27*, 247–263. [[CrossRef](#)]
- Yang, J.; Guo, L.; Yin, L.; Xue, D. Application of Hani People's Traditional Knowledge on Forest Management. In Proceedings of the 6th International Conference on Intelligent Networks and Intelligent Systems (ICINIS), Shenyang, China, 1–3 November 2013.
- Jose, S. Agroforestry for ecosystem services and environmental benefits: an overview. *Agrofor. Syst.* **2009**, *76*, 1–10. [[CrossRef](#)]
- Xu, F.R.; Tang, C.F.; Yu, T.Q.; Dai, L.Y.; Zhang, H.S. Diversity of paddy rice varieties from Yuanyang Hani's terraced fields in Yunnan, China. *Acta Ecol. Sin.* **2010**, *30*, 3346–3357.
- Yang, J.; Xia, J.; Feng, J.; Guo, L.; Shi, S.; Xue, D. Water resource management in the Hani Rice Terraces agro-ecosystem from an ethnoecological perspective. *Acta Ecol. Sin.* **2018**, *38*, 3291–3299.
- Jiao, Y.M.; Yang, Y.J.; Hu, W.Y.; Su, S.H. Analysis of the landscape pattern and aesthetic characteristics of the Hani terraced fields. *Geogr. Res.* **2006**, *25*, 624–632.
- Food and Agriculture Organization of the United States. Globally Important Agricultural Heritage Systems. Available online: <http://www.fao.org/giahs/giahsaroundtheworld/designated-sites/asia-and-the-pacific/hani-rice-terraces/en/> (accessed on 18 November 2018).
- Weber, R.; Butler, J.; Larson, P. *Indigenous Peoples and Conservation Organizations Experiences in Collaboration*; World Wild Foundation Report; WWF: Washington, DC, USA, 2000.
- White, A.; Martin, A. *Who Owns the World's Forests? Forest Tenure and Public Forests in Transition*; Forest Trends and Center for International Environmental Law; Forest Trends: Washington, DC, USA, 2002.
- Ellis, E.A.; Porter-Bolland, L. Is community-based forest management more effective than protected areas? A comparison of land use/land cover change in two neighboring study areas of the Central Yucatan Peninsula, Mexico. *For. Ecol. Manag.* **2008**, *256*, 1971–1983. [[CrossRef](#)]
- Ostrom, E. A general framework for analyzing sustainability of social-ecological systems. *Science* **2009**, *325*, 419–422. [[CrossRef](#)] [[PubMed](#)]
- Barnosky, A.D.; Matzke, N.; Tomiya, S.; Wogan, G.O.; Swartz, B.; Quental, T.B.; Marshall, C.; McGuire, J.L.; Lindsey, E.L.; Maguire, K.C.; et al. Has the Earth's sixth mass extinction already arrived. *Nature* **2011**, *471*, 51. [[CrossRef](#)] [[PubMed](#)]

