

Preliminary Exploration on Natural and Scenic Value Protection of Rivers in Qinba Mountain Area

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Abstract: The Qinba Mountain Area is the source of many important rivers in China and possesses abundant natural, historical, and cultural resources related to rivers. In recent years, actions have been taken to restore the natural state of rivers in this area, such as ban on small hydropower stations in nature reserves, and integrated river management has been emphasized. This paper analyzes the natural and scenic value of rivers in the Qinba Mountain Area, highlights the shortcomings of the existing protected area system from the perspective of river protection, summarizes favorable conditions for river management, and proposes preliminary suggestions for the protection of the natural and scenic value of rivers in the Qinba Mountain Area. These suggestions include the following: investigate river resources, implement river protection and restoration based on river classification, build protected river areas, improve management mechanisms and legislative guarantees, and strengthen community reconstruction.

Keywords: landscape architecture; Qinba Mountain Area; river protection; river management mechanism; natural and scenic rivers

1 Introduction

River protection and restoration is one of the core contents of China's ecological civilization construction. Focusing on water pollution control, ecological restoration of large rivers, and water resources protection, China has adopted a series of measures to protect rivers and water resources. The focus of river management is also shifting from river development and utilization to integrated management; however, most of the river-related measures focus on the protection and integrated management of certain sections and specific aspects of some rivers, such as the water volume or quality. A river is a four-dimensional space with space-time continuity [1]. At the same time, rivers also have a variety of ecosystem service functions, i.e., being an important provider of water resources as well as wetlands and terrestrial ecosystems in addition to their cultural and recreational values. In recent years, China has introduced national parks, aiming to improve the current system of protected areas and realize the systematic integration of the dispersed protected areas. This measure will also promote the protection and restoration of river integrity and its associated benefits.

In recent years, some studies have explored the many benefits of natural rivers and have investigated how to protect and restore rivers in China through the construction of river protection areas [2]. Liu et al. proposed a series of landscape measurement parameters to assess the impact of hydroelectric development in the valley region and applied it to the Nu River [3]. Cheng et al. reviewed discussions on the development of the river basins in Western China and emphasized that the aesthetic function of the rivers should be given more attention; they recommended

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building a scenic river protection system with Chinese features and establishing a unified national park management system in China [4]. Liu et al. studied the *Wild and Scenic River Act* and the river protection system in the U.S., emphasizing the importance of decision-making and legislation at the national level for the protection of rivers [5]. Li et al. compared the U.S.'s wild and scenic river system and China's protected areas system, proposed the concept of a national protected river system in China, and outlined an implementation path for this concept [6,7]. Liu et al. analyzed policies and cases in China and the U.S. and proposed three models for river protection and restoration in Western China [8].

The Qinba Mountains are located in Central China and have abundant and unique natural and historical resources [9]. At the same time, the Qinba Mountain Area is one of 11 concentrated contiguous areas that are under-developed in China. The contrast between the abundant ecological resources and underdeveloped economy is prominent, especially when considering river development and protection. The development of small hydropower stations was once an important method for local socioeconomic development, but it also introduced a series of ecological and environmental problems. In recent years, the region has started to clean up small hydropower stations and protect the natural state and ecological value of rivers. Against this background, this paper comprehensively identifies the importance of river protection in the Qinba Mountain Area, analyzes the deficiencies of the current protection system and new opportunities for river protection, and proposes suggestions for protecting the natural and scenic value of the rivers in the Qinba Mountain Area. This paper may guide the next-step work on river protection and restoration in the Qinba Mountain Area.

2 The importance of river protection in the Qinba Mountain Area

The Qinba Mountain Area (Fig. 1) divides the Yangtze River Catchment and the Yellow River Basin. Many rivers, including the Jialing River and the Han River, begin here; in fact, 96 rivers each with a catchment area larger than 1000 km² start here.

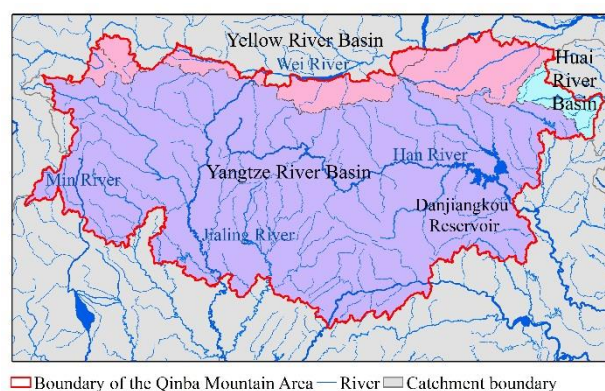


Fig. 1. The river systems in the Qinba Mountain Area.

2.1 Maintaining water security

The Qinba Mountain Area (Fig. 1) is rich in water resources and is known as China's central reservoir [10]. The regional annual runoff is 1.532×10^{11} m³, and the annual runoff that discharges into the Yangtze River and Yellow River basins is 1.446×10^{11} m³ and 7×10^9 m³, i.e., 15% and 11% of the total annual runoff, respectively. The Danjiangkou Reservoir, which is the largest artificial freshwater lake in Asia and the source of the mid-line project of the South-to-North Water Transfer Project, is also located in the Qinba Mountain Area. The annual inflow of the Danjiangkou Reservoir is 3.88×10^{10} m³, of which 2.77×10^{10} m³ (71%) of the water is generated from the Qinba Mountain Area.

2.2 Protecting biodiversity

The Qinba Mountain Area has plentiful river systems, including alpine river habitats, which are rare in China. The alpine rivers are narrow and curved, with caves, ponds, beaches, and shores that have maintained their original characteristics. The Qinba Mountain Area also has a confluence of different flora and fauna. This area, with abundant biological species, is one of the functional ecological biodiversity zones in China. The Jialing River and the Han River are abundant in fisheries genetic resources [11]. Meanwhile, there are a variety of river-related national key protected species, including first-class protected animals like the *Crested Ibis* and second-class protected animals

like the *brachymystax lenok tsinlingensis*, *hucho bleekeri*, giant salamander, *cygnus columbianus*, and mandarin duck. Among them, the *Crested Ibis* and *Brachymystax lenok tsinlingensis* are endemic species in the Qinba Mountain Area. The wild population of the *Crested Ibis* is only distributed in Yangxian County of Shaanxi Province, and the number of wild *Crested Ibis* in the Yangxian Nature Reserve exceeds 1500. The *Brachymystax lenok tsinlingensis* is only located in the upper stream of the Wei River and its tributaries as well as upstream areas of the Hushui River and Ziwu River, both of which are the northern tributaries of the Han River. Therefore, the protection of rivers in the Qinba Mountain Area is very important for maintaining China's biodiversity and ecosystem integrity.

2.3 Protecting cultural diversity

The birth and development of the regional civilizations in the Qinba Mountain Area are closely related to the local river systems. The Qinba Mountain Area is one of the main locations of Chinese civilization. The Han Dynasty was established in the Qinling region, and the dynasty completed the first successful integration of multiple cultures in Chinese history. According to historical research, the name of the Han nationality is derived from Hanshui (now the Han River) and Hanzhong [12]. The Qinba Mountain Area also acts as an important channel connecting the Central Plains with the Western Region and Southwestern Region of China, allowing for the interaction of multiple cultures in the region. The river systems provide conditions for ancient people to build road systems for the transport of people and materials. Today, some parts of the ancient plank road systems can still be seen along the riverbanks of the Wei River and Han River, including bridges and stone gates. Therefore, the protection of rivers in the Qinba Mountain Area helps to maintain traditional Chinese civilizations and protect the diversity of Qinba culture.

2.4 Realizing the scenic value of rivers

The natural environment and its associated human activities differ between high- and low-altitude regions and different basins in the Qinba Mountain Area, shaping the spatially variable river landscapes. Rivers in high altitudes, which are characterized by narrow river channels and turbulent water flow, are less frequently disturbed by human activities and have a high degree of naturalness; the rivers in the hills and plains, however, have wide river channels and gentle water flow. The flood plain of these low-altitude rivers gave birth to the earliest farming civilizations in the region, housed generations that experienced the prosperity of multiple dynasties, and served as gathering areas for multiple regional cultures, forming a river landscape in which nature and humans interacted harmoniously. There are 5 national historical and cultural cities, 11 national historical and cultural towns, 5 national historical and cultural villages, and 92 traditional Chinese villages in this region. In addition, the Qinba River inspired the creation of important ancient texts and played an important role in the formation, development, and maturity of China's landscape aesthetics. In particular, the tributaries of the Wei River, such as the Jing, Wei, and Mian, appear extremely frequently in China's earliest poetry collection, the *Book of Songs*.

In summary, the protection of rivers in the Qinba Mountain Area is of great significance for maintaining water security in China, protecting the diversity of animals and plants and the integrity of ecosystems, and maintaining the scenic river resources that connect Chinese nature and culture.

3 The current protected areas system in the Qinba Mountain Area

Guided by national policy related to building protected areas, more than 200 protected areas have been built in the Qinba Mountain Area, including nature reserves, scenic parks, forest parks, wetland parks, geological parks, and water parks. At present, there is no category of protected areas that has rivers as its primary protected object. The current protected areas in the region only protect the river as a byproduct of protecting other natural features [7] (Table 1).

3.1 Protected objects

Current protected areas usually only protect river components that are related to their primary protection objects. In other words, rivers are only protected to preserve other natural features. Nature reserves mainly protect rare or endangered animals, plants, and their habitats. There are eight national nature reserves aiming to protect wetland habitats in the Qinba Mountain Area, and the main protected objects are the *Crested Ibis*, giant salamander, *Brachymystax lenok tsinlingensis*, and their habitats. Scenic parks mainly protect natural and cultural landscapes with outstanding scenic values. There are six national scenic parks relying on rivers and lakes in this area. They mainly protect the natural and cultural landscapes and are available for people to visit or utilize for scientific and

cultural activities. Water-based parks mainly protect various types of landscapes related to water bodies (rivers and lakes) or water projects and are categorized into six types, of which the “natural rivers and lakes” type emphasizes the protection of river landscapes in a natural state and has the closest relationship with the protection of natural and scenic rivers. There are 14 “natural rivers and lakes” type water-based parks in this area.

Table 1. Information on national protected areas involving river protection in the Qinba Mountain Area.

Types	Protected objects	Legal basis	Legal level	Number	Representative protected areas
Nature reserve	Rare wildlife, nature relics, etc.	<i>Regulations of the People's Republic of China on Natural Reserves</i>	Administrative regulations	8	Hanzhong National Nature Reserve of Crested Ibis; Taibai County Xushui River National Nature Reserve of Rare Aquatic Organisms
Scenic park	Mountains, rivers, cultural relics, historical sites, etc.	<i>Provisional Regulations of Scenic and Historic Areas</i>	Administrative regulations	6	Three Gorges Scenic Area; Jianmenshudaο Scenic Area
Water-based park	Reservoirs, lakes and rivers, irrigated areas, etc.	<i>Administrative Measures for Water-Based Parks</i>	Department rules	14	Zhashui County Qianyou River Water-Based Park; Qingchuan County Qingzhu River Water-Based Park

3.2 Management institutions

Protected area administrations have been established for most of the protected areas in China to perform resource protection and integrated management functions. The authors investigated more than ten protected areas in the Qinba Mountain Area. Other than the management institutions of some national scenic parks and national nature reserves that belong to national or provincial resource management departments, the management institutions of other protected areas are all affiliated with city and county governments. In addition to taking on the responsibility of ecological protection, local governments also undertake functions such as economic development and social security. When there is a conflict among the three, the management institutions may prefer economic development, social security, and other options, thereby relaxing the protection of these areas [6].

The development and management of protected areas, nature reserves, and scenic parks in China are bound by administrative regulations or department rules, which means that all resource development activities (such as hydropower development) within the core areas and buffer zones of nature reserves and scenic parks are restricted by relevant laws and regulations. Water-based and forest parks are built and managed according to department rules, which have limited legal effectiveness [13].

In general, the current protected area system in the Qinba Mountain Area is relatively dispersed and lacks systematization. The management institutions of protected areas involving rivers are complex and diverse, and the legislative levels and regulation strengths are variable, which hampers the comprehensive protection and management of rivers.

4 Favorable conditions for river protection in the Qinba Mountain Area

4.1 Enhanced environmental awareness

In response to the national call for the development of ecological protection measures, the Qinba Mountain Area has entered a new stage characterized by ecological restoration and protection, during which water-focused ecological restoration and protection have received special attention. In 2017, the Ministry of Environmental Protection and three other ministries and commissions issued the *Environmental Protection Plan for the Yangtze River Economic Belt*. In 2019, Shaanxi Province issued the *Regulations on Ecological and Environmental Protection in Qinling Mountains, Shaanxi Province (Draft Amendment)*. A key task of ecological restoration in the Qinba Mountains is to clean up small hydropower stations in a holistic way. In 2018, four ministries, including the Ministry of Water Resources, issued *Suggestions on Carrying out the Cleaning and Rectification of Small Hydropower Stations in the Yangtze River Economic Belt*, and then Shaanxi Province issued *Suggestions on Rectification and Ecological Management of Small Hydropower Stations in the Qinling Region and Nature Reserves of Shaanxi*

Province.” Both documents require that, within a certain period of time, illegal hydropower stations that are located in the core areas or buffer zones of nature reserves or seriously damage the ecological environment be cleaned up.

4.2 Management organization reform and management model innovation

In response to the reform of national institutions, the Departments of Natural Resources have been established successfully in the provinces in the Qinba Mountain Area, integrating the ecological protection and restoration functions that used to belong to several departments, including the Department of National Territory Recourse, Department of Development and Reform, Department of Agriculture, and Department of Forestry. The goal of establishing this department was to solve the confusion in river planning and management approaches and to successfully establish the overall protection, systematic restoration, and comprehensive management of the natural systems of mountains, rivers, forests, fields, lakes, and grasses. At the same time, the Department of Forestry and Grassland was established, which also acts as the Department of the National Park Service, integrating the management responsibilities of all protected areas, including scenic parks and water-based parks.

In response to the State’s *Suggestions on the Full Implementation Of the River Chief System* [14], a four-level river chief system at the provincial, municipal, county, and township levels has been established, and local government leaders at all levels were appointed as river chiefs in the Qinba Mountain Area. Provincial-level river system plans involve the delineation of river management boundaries and the determination of protected areas. At the same time, it also emphasizes the maintenance of healthy and natural rivers, lakes, shallow shoals, and floodplains as well as the protection of ecological rivers and lakes, thereby restoring the ecological functions of damaged rivers and lakes, strengthening the conservation of aquatic biological resources, and improving aquatic biodiversity [15].

These measures have all emphasized the ecological value of the river in the natural state from the governmental perspective and have been promoting the restoration of the natural flow state and ecological process of the river that has been damaged by small hydropower stations. At the same time, after the reform of management institutions, protected areas that were originally managed by different departments such as the Department of National Territory Recourse, Department of Development and Reform, and Department of Water Resources will be managed by the Department of the National Park Service. These measures have helped to solve the problems in the current river protection and management approach, thereby providing favorable conditions for the protection and management of rivers’ natural scenic value in the Qinba Mountain Area.

5 Preliminary suggestions for the protection of the natural and scenic value of rivers in the Qinba Mountains

5.1 Investigating river resources

A comprehensive survey of 96 rivers each with a catchment area larger than 1000 km² in the Qinba Mountain Area should be conducted. Based on the existing evaluation methods of river “naturalness,” combined with the available climate, land-use, and socioeconomic data in the Qinba Mountains, the degree of naturalness of these rivers can be evaluated. At the same time, considering the importance of maintaining water security, biodiversity and ecosystems, historical culture, and cultural diversity, the natural and scenic value of rivers can be evaluated. Based on the evaluation of naturalness and its associated value, rivers with high natural and scenic value can be selected. Furthermore, river resources survey work can be one future responsibility of the Department of Natural Resources.

5.2 River protection and restoration based on river classification

Three types of rivers, i.e., natural rivers, cultural rivers, and restored rivers, can be identified; rivers in each of these three types should be protected and restored using certain models.

5.2.1 Natural rivers

Natural rivers should be minimally affected by human activities and have a high value in maintaining biodiversity and ecosystem integrity. The protection boundaries of these rivers should be delineated considering the horizontal and vertical connectivity of the hydrological and ecological processes as well as the flow temporal variability. Such rivers are the natural heritage of the Qinba Mountain Area. Activities that may destroy rivers’ natural flow states and ecological value should be strictly forbidden, and only low-impact science and education activities should be carried out.

5.2.2 Cultural rivers

Cultural rivers should be less disturbed by modern civilization, and they played an important role in the birth and development of traditional Qinba civilization. There should be, but not limited to, ancient ancestors' relics, stone carvings, and historical and cultural villages along the riverbanks. Such rivers should be protected from the perspective of human–water symbiosis, and the scope of protection should be able to cover the harmonious coexistence between man and water. Activities that destroy their value should be strictly forbidden, and scientific, educational, and recreational activities that can promote water culture and ecological development should be carried out.

5.2.3 Restored rivers

Restored rivers have been damaged by human activities but have high ecological and/or cultural value. Typical examples are rivers in nature reserves that are affected by dams. Although actions have been taken to clean up small hydropower stations in the protected area, this is only the first step towards river ecological and landscape restoration. River ecological restoration is a cross-disciplinary issue, so a multi-disciplinary cooperative team should be established to guide the restoration of the river ecology and landscape.

5.3 Building protected river areas and improving management mechanisms and legislative guarantees

By integrating the three types of rivers outlined herein, a natural and scenic river protection system can be established in the Qinba Mountain Area. In the process of the construction of China's national parks and the integration of the current system of protected areas, we should continue to promote the natural and scenic river protection system in order for it to become a significant part of the national parks system. It is recommended that all the national parks and nature reserves, including natural and scenic rivers, should be managed by the Department of the National Park Service. All activities that may damage the mountain, forest, river, lake, and grass ecosystems and associated communities should be prohibited. At the same time, the “river chief system” will be implemented in the river sections within each protected area, with a focus on monitoring the protection and restoration of the river's natural value. On this basis, we will promote legislation of the natural and scenic river protection system to provide strong legal support for river protection.

5.4 Strengthening community participation

Considering the poverty issues in the Qinba Mountains, more attention should be paid to community participation in the areas in which the protected areas are located. On the one hand, by increasing the level of urbanization and implementing targeted poverty alleviation projects, the dependence of local residents on the use of natural resources such as river resources can be reduced; on the other hand, local residents should be encouraged to take part in the environmental protection efforts and change their livelihoods from the original agricultural model to that of ecotourism.

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