Study on the Restoration of the Water Environment in the Lower Reaches of the Yuan River During the Ming and Qing Dynasties from the Perspective of Water Temples

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Abstract: During the Ming and Qing dynasties, the middle and lower reaches of the Yangtze River were in the "Little Ice Age" with climate fluctuations. The alternating cold and warm periods exerted complex impacts on the regional social economy and ecological environment. However, existing studies still have deficiencies in the historical reconstruction of the water environment in the lower reaches of the Yuan River and the exploration of man-land interaction patterns. Taking the lower reaches of the Yuan River as the research area, this paper explores the interactive relationships between water environment changes and factors such as population, agriculture, and culture during the Ming and Qing dynasties. It achieves this through the spatial distribution and functional analysis of water temple ruins, combined with historical documents, climate data, and geographic information, while integrating multidisciplinary methods from history, environmental history, and geography. The study finds that although climate fluctuations temporarily promoted population growth and agricultural development, excessive reclamation intensified soil erosion and frequent floods, highlighting ecological vulnerability. The site selection, rise and fall of water temples reflect the evolution of hydrological characteristics in the basin and the adaptive strategies of the people in response to disasters. Moreover, the multicultural landscape and regional economic pattern further shaped the man-land relationship through water transportation networks, ethnic migration, and water deity beliefs. The research reveals that the ecological environment evolution in the lower reaches of the Yuan River during the Ming and Qing dynasties was the result of the combined effects of natural conditions, climate fluctuations, and human activities. Its historical experience can provide references for contemporary basin ecological restoration and sustainable development.

Keywords: Water Temple Ruins; Lower Reaches of the Yuan River Basin; Water Environment Restoration; Ming and Qing Dynasties; Multidisciplinary Intersection

1. Introduction

Han Zhaoqing, in his study Research on Abnormal Cold and Warm Winter Climates in the Middle and Lower Reaches of the Yangtze River During the Ming and Qing Dynasties (1440-1899), confirmed that compared with the previous millennium, China experienced a fluctuating “Little Ice Age” over these 500 years [1]. However, the deterioration of the climate did not always bring hardship to people's lives; occasional warm periods also contributed to the recovery of China's

economy. Particularly during the late Ming and early Qing dynasties, the population grew unprecedentedly, but the subsequent excessive reclamation led to frequent flood disasters, which in turn caused severe damage to the ecological environment. The downstream area studied in this paper is the population center of the Yuan River Basin, and it also serves as the leading region for economic, social, and cultural development. As stated in Han Dynasty Tombs in the Lower Reaches of the Yuan River (Volume 1) (compiled by the Changde Municipal Bureau of Cultural Relics, Changde Museum, Dingcheng District Bureau of Cultural Relics, Taoyuan County Bureau of Cultural Relics, and Hanshou County Bureau of Cultural Relics of Hunan Province)", the counties and districts under the jurisdiction of the lower reaches of the Yuan River include: Wuling District (directly administered by Changde City), Dingcheng District, Taoyuan County, and Hanshou County" [2]. This paper aims to restore the water environment of the lower reaches of the Yuan River during the Ming and Qing dynasties more than 500 years ago through the study of water temple sites, and adopts an interdisciplinary approach integrating history, geography, environmental history, and archaeology to analyze the appropriate interaction mode between humans and the environment.

2. Current Status of Research on Water Environment Restoration in the Lower Reaches of the Yuan River During the Ming and Qing Dynasties

At present, domestic scholars have conducted a substantial amount of research on environmental restoration, though from diverse perspectives. However, no research has ever approached environmental restoration from the perspective of water temples—a gap that remains unaddressed to this day.On one hand, this gap exists even as scholars at home and abroad have recognized that a scientific understanding and restoration of the ecological environment must be rooted in grasping the laws of environmental change. On the other hand, it also underscores that the environment indeed contains abundant information, including natural resources, human economic activities, and human reflections on the environment.

2.1 Research Overview

Regarding the lower reaches of the Yuan River during the Ming and Qing dynasties, "Wang Shaowu and others conducted a systematic study on China's Little Ice Age, arguing that it spanned from 1450 to 1890—starting from the first year of the Jingtai reign of the Ming Dynasty—and covered South China, Fujian-Taiwan region, and Southwest China". [3] Undoubtedly, Hunan Province also entered the Little Ice Age during the Ming and Qing dynasties. Dushi Fangyu Jiyao (Notes on the Historical Geography of the Empire), a monumental work on military geography compiled by Gu Zuyu in the late Ming and early Qing dynasties, records that "Chisha Lake is located west of Baling County and thirty li southeast of Longyang County in Changde Prefecture, with a circumference of 470 li"—a description that reflects the actual state of Dongting Lake in the late Ming Dynasty. The ecological environment of the Ming and Qing dynasties was built on the cumulative evolution of China's living environment over thousands of years. In particular, the Qing Dynasty, as the last dynasty in Chinese history, witnessed significant changes: "During the Ming and Qing dynasties, the rapid growth of population led to large-scale land reclamation, which resulted in the deterioration of Hunan's natural ecological environment—evidenced by the destruction of vegetation in Hunan and the frequent occurrence of disasters in the Dongting Lake area" (Figure1) [4]. Undoubtedly, the outcomes of climate and environmental evolution during this period also exert a relatively direct impact on the current ecological environment. The analysis of ecological and water environments

aims to better guide the future planning of a society with sound ecology and harmonious coexistence between humans and nature. Therefore, the research on restoring the environment of the lower reaches of the Yuan River during the Ming and Qing dynasties holds significant practical value.

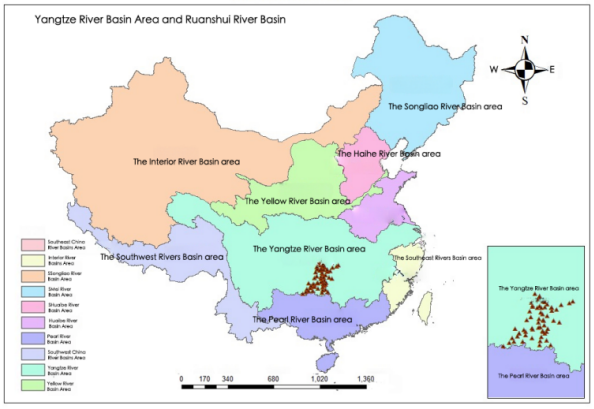

Figure 1: Yangtze River Basin Area and Ruanshui River Basin. [5,6]
(Resource from National Earth System Science Data Center)

What factors are associated with environmental restoration? (Figure 2) This paper intends to take the water temple ruins in the lower reaches of the Yuan River as the entry point, and conduct an in-depth discussion on the environmental restoration of Changde City and its subordinate counties and townships in northwestern Hunan Province during the Ming and Qing Dynasties by carefully examining the population, agriculture, ports, forest vegetation, climate, and water environment within the lower reaches basin". As an independent geographical unit, a river basin is a collection composed of two parts: one part includes the water-dependent ecosystem, terrestrial organisms, and aquatic organisms; the other part consists of human activities related to water. Water is not only the link for the internal connection between the two parts, but also the focal point of contradictions between them, which requires coordination among various parts" [7]. (Figure 3) Taking the water temples distributed in the lower reaches of the Yuan River as nodes, this paper expounds on the interactive relationship between water temples and the restoration of the environment in the lower reaches of the Yuan River during the Ming and Qing Dynasties, thereby presenting vivid pictures of the water environment in that period and offering a glimpse into the climate, forests, population, water transportation, traffic, agriculture, culture and other aspects of the time.

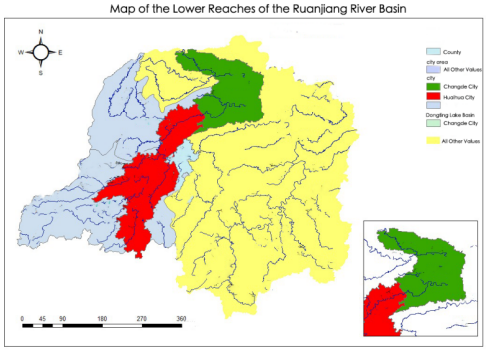

Figure 2: Map of the Lower Reaches of the Ruanjiang River Basin.
(Resource from National Earth System Science Data Center)

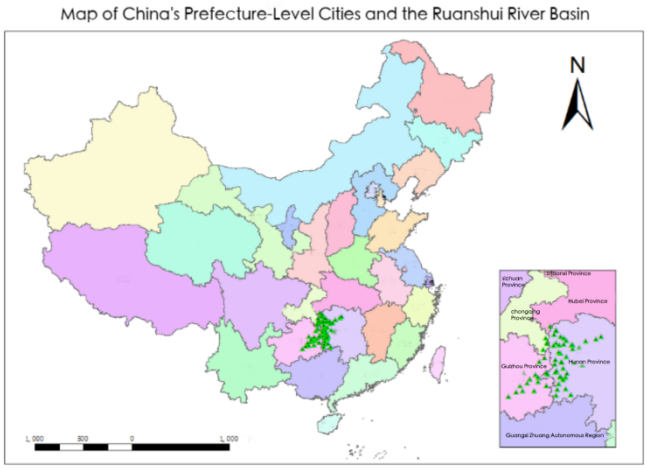

Figure 3: Map of China's Prefecture-Level Cities and the Ruanshui River Basin. [8]
(Resource from National Earth System Science Data Center)

"The period from the Jiajing to the Wanli reigns of the Ming Dynasty was the most prosperous stage for the society and economy of the Ming Dynasty. However, environmental problems—or rather, issues related to people's livelihoods—were also most acute during this period. The deterioration of the environment was profoundly manifested in aspects such as the silting of river ports and water conservancy projects, the occurrence of floods, droughts and plagues, and the excessive reclamation of mountain forests and vegetation" [9]. During the Ming and Qing Dynasties, China had a vast territory. To gain an in-depth understanding of the environmental history of this period, it is essential to attach importance to the study of the water environment. The primary task of water environment research is to conduct a thorough and detailed investigation into the distribution of water temple ruins in the river basin under study, and analyze aspects such as the geographical environment around each water temple, climate changes, ethnic migration, and people's production and living conditions. Only by fully revealing the actual connotations of these environmental elements and their interconnections can we conduct reliable local-level discussions on national environmental issues.

2.2 Research Theme

This study mainly adopts the bibliometric content analysis method. Its data source is the retrieval of all journals in CNKI (China National Knowledge Infrastructure), with the retrieval time set to the relevant literature on this topic published in the past decade. Through focused retrieval of relevant themes, 13 papers were retrieved by inputting "the Yuan River Basin during the Ming and Qing Dynasties", 307 papers by inputting "climate during the Ming and Qing Dynasties"(including 14 papers from CSSCI journals), 53 core journal papers by inputting "the Yuan River Basin", and 71 papers by inputting "environmental restoration"(including only 4 papers from CSSCI journals).The small number of relevant studies indicates that there is still significant room for further research. The author roughly sorts out the following two aspects:

2.2.1 Restoring the Ancient Environment From Two Perspectives

Through the review of core literature, the restoration of the ancient environment is generally

achieved from two aspects: the technical level and documentary materials. The technical level involves using various scientific and technological means and data derived from experimental analyses to restore the ancient environment or study the process of environmental evolution. However, the review shows that only a few earlier scholars have conducted discussions on this issue. For instance, Jia Weiming [10] emphasized the importance of applying environmental archaeology theories and methods in archaeological research. Taking the restoration of the ancient environment of the Upper Liao River Basin as a case study, he used technical data such as oxygen isotope analysis and sporopollenin analysis to advance the development of Chinese environmental archaeology. Zhao Junlin [11] proposed that the biogeochemical indicator element method has opened up a new path for restoring the environment in the Antarctic region. His paper pointed out that the restoration of the ancient environment mainly relies on the calcium (Ca) content in plant residues in various sedimentary layers, and the environmental characteristics of ancient times are indicated by extracting elements from plants and conducting chemical experimental analyses. Lan Yong [12] attempted to analyze from the perspective of historical geography and used modern ecological theories to identify historical tiger infestations. Since the South China tigers inhabiting this area required a forest coverage rate of approximately 50%, he further explored and restored the ecological environment of Sichuan during the late Ming and early Qing dynasties. Wang Yongli started from imagery materials such as frontier fortress poems by literati, supplemented by other documentary historical records, and applied modern humanistic geography theories to restore the geographical environment of the Longshan Area during the Tang Dynasty [13]. He found that the actual natural features and geographical environment were not as extremely cold and desolate as depicted in the poems, which indeed carried a strong subjective bias. Overall, these studies either adopt different scientific methods—qualitative research and quantitative research—or a combined approach of the two. Nevertheless, all of them can achieve the goal of restoring the ancient environment.

2.2.2 Discussing Ecology and Culture From the Perspective of the Yuan River Basin

This section focuses on the Yuan River Basin—the specific region targeted for environmental restoration—and this is an indispensable and crucial part of the research. The literature retrieved regarding the lower reaches of the Yuan River mainly concentrates on three aspects: First, flooding. The tail section of the Yuan River is a key area prone to frequent floods. Wang Guoping and Chen Wenping elaborated on the negative impacts brought by the Wuqiangxi Reservoir, which was built to enhance flood control capacity [14]. In particular, although the construction of the reservoir has alleviated the flood control pressure on the lower reaches during high flood periods, it has caused greater changes to the hydrological regime of the lower reaches. The authors also proposed solutions to address this situation. Second, ancient town construction in the Yuan River Basin. Regarding the construction of new-type urbanization in the Yuan River area of western Hunan, scholars such as Zhou Hong and Li Baihao [15] analyzed the distribution characteristics of ancient towns, examined the difficulties faced in the current construction of new-type urbanization, and put forward corresponding suggestions and countermeasures. They advocated that while planning new-type urbanization, attention should be paid to inheriting the local residential culture, protecting the ecological environment, and coordinating the construction of new and old urban areas. When discussing the traditional market towns in the Yuan River Basin, Yu Hanwu's [16], works share common ground with scholars like Zhou Hong: both argue that against the backdrop of rapid urbanization, the protection of regional culture, the exploration of cultural value, and the sustainable

development of the local economy are mutually prerequisite. Their difference lies in the starting point—Yu Hanwu's discussion is from the perspective of regional architecture and regional culture. Third, analyzing population migration and economic development in the Yuan River Basin during the Ming and Qing Dynasties based on ancient documents. Luo Yunsheng [17] argued that population changes inevitably affected the development of the local social economy and culture. According to records in historical annals and documents, the rapid population growth in the Yuan River Basin from the Qing Dynasty to the late 20th century also led to complex population migration phenomena. These population changes were related to factors such as geographical conditions, political environment, immigration, and ethnic minorities—and the lower reaches of the Yuan River became the core area of population migration.

3. Development Trends of Scientific Research on Water Environment Restoration in the Lower Reaches of the Yuan River During the Ming and Qing Dynasties

The construction of the ecological environment is a crucial strategic decision for the country to achieve sustainable development". On January 5, 2016, General Secretary Xi Jinping clearly emphasized at the symposium on promoting the development of the Yangtze River Economic Belt held in Chongqing Municipality: To promote the high-quality development of the Yangtze River Economic Belt, we must consider the long-term interests of the Chinese nation, follow the path of prioritizing ecological conservation and pursuing green development, so that the 'lucid waters and lush mountains' can generate enormous ecological, economic, and social benefits, and ensure that the mother river maintains its vitality forever" [18]. The Yuan River Basin is an important part of the development of the Yangtze River Economic Belt and a key national ecological function zone. Within this region, an ecological governance mechanism led by the central government and managed hierarchically by local governments has been established. Restoring the ecological environment of the lower reaches of the Yuan River during the Ming and Qing Dynasties through the study of the water environment, exploring how to better balance economic development and environmental protection, and figuring out how to restore the ecological environment of the Yangtze River—these are urgent issues to be addressed in the academic community.

3.1 Analysis of the Development Trend of Water Environment Under Climate Warming

"Against the background of continuous greenhouse gas emissions, the Earth has experienced very rapid warming in the past few decades" [19], "A large number of scientific studies have proved that if humans do not take effective carbon emission reduction measures, the global surface temperature will continue to rise by 0.75—4.0°C by 2100" [20]. Due to the continuous accumulation of the greenhouse effect, global climate warming occurs. The rise in temperature leads to the melting of glaciers and snow in the polar regions, the rise in sea level, and the corresponding rise in the water levels of various river basins, which has an important impact on crops". The increase in water temperature not only affects the hydrological and hydrodynamic characteristics of water bodies, but also has an important impact on dissolved oxygen (DO) and nutrients in water bodies, thus indirectly affecting the aquatic ecosystem (Arvola et al, 2010)".[21] Hunan Province is located in the middle reaches of the Yangtze River, in the transition zone from the southwest plateau to the plains and hills. "It belongs to the subtropical monsoon humid climate, with large annual rainfall, fertile soil, abundant sunshine, and an excellent agricultural ecological environment (Figure 4)" [22]. The climate here can meet the growth of heat - loving crops such as rice and cotton. There is no doubt that Hunan

is one of the major agricultural provinces in China. The lower reaches of the Yuan River in Hunan Province are suitable for the cultivation of double—cropping rice, and in areas below 100 meters above sea level, a three - crop system in paddy fields can also be implemented. However, the increase in temperature will not only lead to a reduction in rice yield, but also affect the taste quality of rice.

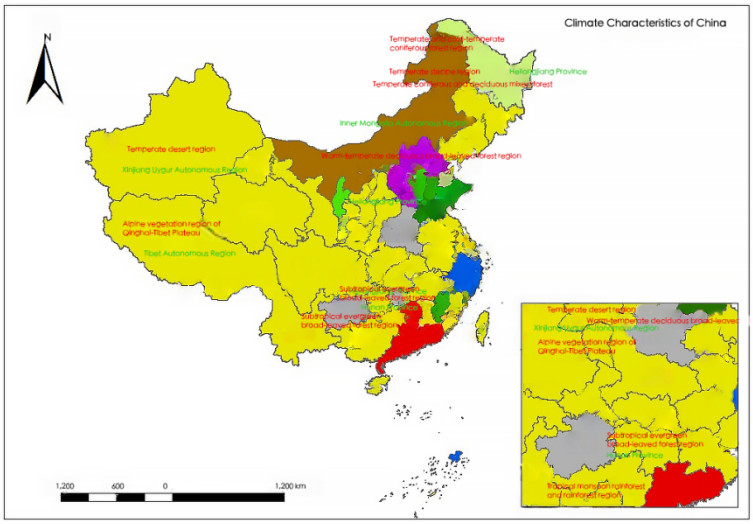

Figure 4: Climate Characteristics of China. [23]
(Resource from National Earth System Science Data Center)

Climate Warming Also Tends to Create Conditions of Abundant Rainfall, Frequent Floods and Easy Droughts，"Under the influence of such changes in temperature and precipitation, the frequency of disastrous weather events such as seasonal droughts and extreme temperature changes also shows an increasing trend" [24]. According to statistical data, since 1949, the probability of floods occurring in the lower reaches of the Yuan River has reached 32%, while the probability of droughts has reached 48%. Therefore, scientists have conducted extensive research on future climate change. Al Gore, former Vice President of the United States, put forward his views on how to address global climate warming: "The only meaningful solution for humanity is to change its own thinking habits and behavioral habits, alter its ways of energy use and economic development, and shift its mindset from a short-term benefit-oriented one to a long-term sustainable development-oriented one" [25].

3.2 Analysis of the Development Trend of the Water Environment Amid Multiculturalism

The Yuan River Basin is the largest multi-ethnic settlement area in the middle reaches of the Yangtze River [26]". Today's ethnic corridor areas are not only the settlements of multiple ethnic groups in China, but also 'cultural sedimentation belts' where diverse cultures converge". The relatively fast population growth rate and large population size in the lower reaches of the Yuan River are closely related to its geographical environment. The central part of this region is a hilly basin; its general landform is composed of mountains, hills, plains, and river valleys, with the most developed river deposits in the lower reaches". In terms of landform types, the upper and middle reaches of the Yuan River can be roughly divided into two geomorphic zones: the upper reaches are mid-mountain areas with high mountains and deep valleys, where rivers flow relatively rapidly and show a slope from southwest to northeast. This area has many canyons, few basins, a relatively high

altitude, and abundant heat; the terrain of the middle reaches of the Yuan River gradually lowers, belonging to a parallel ridge-valley low-mountain and hilly zone, where mountains, hills, flatlands, and basins alternate, with larger river valley basins interspersed (Figure 5) [27]". In fact, historically, the population density of the lower reaches of the Yuan River accounted for the largest proportion in the entire basin during the same period. This is mainly due to its geographical location, which is more suitable for crop cultivation; compared with the upper and middle reaches, the lower reaches had an earlier-developed agricultural economy, as well as more diverse crop varieties and a larger scale of agricultural production.

City Center Population (2016)

Cities and Prefecture	Average Population (10 000 persons)	Resident Population (10 000 persons)	Households (10 000 households)
Changde	141.06	156.61	47.32
Zhangjiajie	52.72	52.57	20.55
Yiyang	136.84	128.67	45.13
Chenzhou	86.05	86.42	29.07
Yongzhou	116.99	109.91	40.46
Huaihua	38.50	60.96	15.73
Loudi	49.21	51.36	20.71
Xiangxizhou	30.56	33.65	10.82

Figure 5: City Center Population [28].

Due to the unique geographical location of the Yuan River Basin, a large number of ethnic minorities reside here, including the Miao, Dong, Tujia, Hui, and Uyghur ethnic groups". The Wuling Mountain Area concentrates rich Tujia folk resources and profound historical and cultural resources represented by the Laosi City Ruins (a world cultural heritage site), Liye Ancient Town, Furong Town, and Rebala (all listed as 'Top Ten Cultural Heritage Sites of Hunan Province') In addition, the 'Hundred-Li Dong Cultural Corridor'—a candidate for China's World Cultural Heritage List—represents the profound and rich cultural resources of the Dong ethnic group [29]". Historically, multiple ethnic groups such as the "Wuling Barbarians", "Wuxi Barbarians" and "Qian'an Barbarians" emerged in the Wuling region. Among these groups were both local inhabitants who had lived there for generations and ethnic minorities who migrated from other regions; they have cohabited with the Han people from the Central Plains to this day. Wu Yongzhang pointed out: "The northward movement of the 'Wuling Barbarians' not only facilitated ethnic integration but also directly influenced the ethnic composition of residents in regions such as Nanjun" [30].

The interactive and communicative relationships formed through migration, integration, and differentiation in the lower reaches of the Yuan River Basin in history, combined with the unique cultural pattern of the Wuling region, have shaped the distinctive multicultural pattern and unique ethnic relational environment of the lower Yuan River Basin today. "Against the development background of the 'Belt and Road Initiative,' cities are not only gathering places for the mobility of people from all ethnic groups but also practical venues for them to expand exchanges and deepen

integration".

3.3 Analysis of the Development Trend of the Water Environment in Regional Economy

As a core link connecting the southwest economic circle with the middle and lower reaches of the Yangtze River, the Yuan River Basin has formed a unique water transport commercial culture in history. During the Ming and Qing Dynasties, the urbanization process of the Yuan River Basin was faster than in other periods. As G. William Skinner pointed out: "When explaining the reason for the dense urban construction in the Yuan River Basin in the late imperial period, we must remember that during the Ming and Qing Dynasties, the population of this region, like that of Yunnan-Guizhou and western Lingnan, was only partially sinicized" [31]. This indicates that ethnic sinicization was not a decisive factor in urban development; the strongest driving force for urban growth was the development of the regional economy. In fact, the economic development level of the lower reaches of the Yuan River was far higher than that of the upper and middle reaches. This is not only due to its unique geographical advantages, but more importantly, the coordinated development of local characteristic tourism industries and the regional economy is more conducive to promoting sustained and rapid economic growth". The balance of economic development in the entire middle reaches of the Yangtze River urban agglomeration has no significant impact on the balance of tourism development, but the balance of tourism development will affect the balance of regional economic development" [32]. The northwestern part of Changde City, located in the lower reaches of the Yuan River, is a low-lying area of the Wuling Mountains, the southwestern part is a branch of the Xuefeng Mountains, and the eastern part is the Dongting Lake Plain. The Yuan and Li river systems run through Changde, along with first-level tributaries such as the Xie River, Lou River, and Dao River. It can be said that these numerous water systems have formed the regional tourism characteristic of a "water town". As can be seen from the figure below, the growth rate of Hunan's tourism economy is extremely fast (Figure 6) [33].

Basic Situation of Tourism Industry in Hunan Province

Item	2000	2005	2014	2015	2016
Number of Tourists (10 000 persons)	**4695.40**	**7180.98**	**41202.53**	**47330.73**	**56547.79**
# International Tourists	45.40	71.98	100.07	118.19	127.41
# Domestic Tourists	4650.00	7109.00	40982.98	47104.68	56306.98
Income of Tourism (100 million yuan)	**148.80**	**453.57**	**3050.70**	**3712.91**	**4707.43**
# Earnings from International Tourism (USD 100 million)	2.21	3.90	8.00	8.58	10.05
#Earnings from Domestic Tourism (RMB 100 million yuan)	130.46	421.20	3001.54	3659.96	4640.73

Figure 6: Basic Situation of Tourism Industry in Hunan Province. [34]

When comparing Changde City and Huaihua City, the economy in the lower reaches of the Yuan River remains more developed than that in the middle reaches." Due to the uniqueness of Changde's geographical location and natural conditions, the interdependent relationship between rural and urban areas, as well as between industry and agriculture, is determined. Developing a circular economy is conducive to achieving the coordinated development of the economy, society, ecology, and environment." Agriculture remains the economic foundation of the Yuan River Basin, and the agricultural sector in Changde City has generally been at the forefront of the basin's agricultural

development since ancient times. However, relying solely on the original agricultural foundation for development is obviously relatively slow. Instead, various characteristic economic sectors should coordinate with and serve as the foundation for each other, forming an industrial model of resource recycling. Together with the development of the tourism economy, this model will further protect and improve the ecological environment, ultimately realizing the high-quality and coordinated development of the tourism economy and the ecological environment.

4. Conclusion

The water temples in the lower reaches of the Yuan River during the Ming and Qing Dynasties were not merely "faith-based products under environmental stress" or "instrumental symbols of state rule" as traditionally perceived. Instead, they served as the core of a "faith-practice" network through which the river basin society proactively adapted to the dynamic thresholds of the water environment. [35] This adaptation was not a passive response to extreme events such as floods and droughts. Rather, by means of the spatial layout of water temples, the evolution of rituals, and social organization, the society transformed ecological awareness into daily water conservancy cooperation, ultimately achieving a dynamic balance in the human-water relationship. This conclusion not only revises the one-way logic of "environmental determinism" in environmental history research but also breaks through the one-sided interpretation of water deity beliefs confined to the "state-local" dual framework. It thus provides a new analytical path for understanding human-water interactions in water-rich river basins of southern China.

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