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The impact of water resources and environmental improvement on the development of sustainable ecotourism

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ABSTRACT

Water resources and the environment is an important basis for human survival and social and economic development, and the sustainable bearing of water resources and the environment is the basic premise of sustainable development of the social economy. The water environment problems caused by the too large scale of social economy, unreasonable industrial structure, inappropriate production layout and ineffective environmental protection measures have become increasingly prominent, which has become a constraint factor for regional sustainable development. Firstly, the total population and economic development scale that the water environment system can sustain is determined, so that the water environment and sustainable ecotourism can develop harmoniously, so as to solve the problem of water environmental pollution. Then, by changing the concept of water intake, water use and drainage, and using the concept of urban sensitive water resources planning in urban comprehensive planning and water resources planning, we can create a new pattern of harmonious water use that adapts measures to local conditions and closely combines with local development characteristics, so as to realize the healthy circulation of water resources and the coordinated development of sustainable ecotourism.

Keywords: Water resources and environment; Sustainability; Ecotourism; Development

1. Introduction

With the rapid development of urbanization, the population is increasing rapidly, the demand for production and living is increasing, the energy consumption is increasing day by day, and the disorder and over-exploitation of water resources are also aggravating. The already overburdened water ecological environment is facing more severe challenges. Although the technology of sewage treatment unit is developing continuously and the policies and regulations on water pollution prevention and control are constantly improved, people's awareness of protecting the water environment is relatively weak. According to the traditional or existing extensive water use mode, as well as the large-scale development process of cities and towns, it will inevitably lead to the destruction of the urban natural water cycle, the deterioration of urban and river basin water environment, and ultimately lead to the unsustainable use of water resources. People have realized that only reasonable and sustainable water resources planning can ensure that we and our future generations can enjoy the limited water resources on the earth and develop sustainable ecotourism. Many scholars have analyzed the relationship between the social cycle of water and the natural cycle of water in the history of water resources utilization, and intentionally refined this set of theory to guide life practice [1]. However,

modern cities are quite different from the cities which used industry or agriculture as the foundation of development in terms of function and the human form. The orderly cycle of the water environment is no longer a single cycle of water intake, water use and drainage. The rigid demand for water resources in urban development has not been reduced but also derived the diversified and dynamic demand for water resources.

The current planning mode of cities, especially emerging cities, is still dominated by the spatial layout and land use planning, with infrastructure, energy and water sources as an auxiliary, rarely taking water resources planning and social, economic, industrial development, human and other factors as an organic whole, and the sustainable water resources planning of most cities and regions is still at the theoretical level [2]. The water crisis is a complex dynamic system problem involving all walks of life, which cannot be solved by a specific technology or theory. Only by changing the concept of water intake, water use and drainage, making full use of the concept of urban sensitive water resources planning in urban comprehensive planning and water resources planning, and shaping a new pattern of harmonious water use based on local conditions and closely combining with local development characteristics, can the healthy circulation of water resources be realized, and then sustainable ecotourism can be developed [3]. At present, there are a large number of planning and construction plans of emerging ecocities in China, most of which are in areas with poor natural conditions, lack of resources and relatively rapid population and economic growth. The planning of an ecological new town aims to follow the principles of resource-saving, environment-friendly and sustainable development. However, the planning of many cities is still dominated by space and land use planning, while the trend of water resources planning, which is the most basic resource of cities, is still not optimistic. How to plan the sustainable utilization of water resources and develop sustainable ecotourism according to local conditions and fully combined with spatial planning, urban development needs, cultural and economic development trends is an urgent issue to be solved.

Ecotourism evaluation can help managers make effective use of natural resources, minimize the negative impact on the environment, and ensure the sustainability of ecotourism. Water environment problems become increasingly prominent and become the constraints of regional sustainable development. The fundamental way to solve the problem of water environment pollution is to determine the total population and economic development scale that the water environment system can sustain. Ensuring the sustainability of the water environment is the premise of sustainable development of the social economy.

2. Impact of ecotourism on the ecological environment

Ecotourism evaluation, in a sense, is the measurement of ecotourism to test whether it meets the standard of ecotourism. The evaluation of ecotourism mainly focuses on the impact of ecotourism activities, including environmental, economic, cultural, resource, etc. these studies combine theory with practice [4]. Ecotourism evaluation includes three elements: evaluator, evaluation object and the evaluation reference frame. The evaluation process is influenced by the utility principle and personal preference of the evaluator and is also limited by the ability to the identification and environmental conditions. The information of evaluation objects is often rough, fuzzy and random, with certain uncertainty [5]. Ecotourism evaluation can help managers make effective use of natural resources, minimize the negative impact on the environment, ensure the sustainability of ecotourism, and help consumers distinguish between real ecotourism and ecotourism only as a marketing slogan.

2.1. Positive impact of ecotourism on the ecological environment

First, the protection of the natural and human ecological environment has been strengthened. This effect reflects the protection function of ecotourism. The development and development of ecotourism have protected some valuable natural habitats, which are often of scientific research value and tourism value. If they are not used to develop ecotourism, they may be destroyed or opened up for other uses. Natural and cultural relics are non-renewable resources, which have important cultural and artistic values. Once damaged, they can never be restored. Through the development of ecotourism, many historic sites, characteristic buildings and monuments have been restored and rebuilt. The second is to promote the economic development of local residents. The development of ecotourism not only solves the employment problem of some local residents, but also brings economic benefits to the local residents, tourism operators and the government, and promotes the local economic development. The third is to strengthen the awareness of ecological environment protection. This effect reflects the environmental education function of ecotourism. Ecotourism enables tourists to receive the ecological education of harmonious coexistence of nature and human beings in the process of tourism. Through ecotourism, tourists can get close to nature, learn and understand the value of nature in nature, so as to consciously protect the environment and improve the awareness of environmental protection. By taking effective management and planning measures, tourism not only improves the environmental quality but also satisfies the tourist experience.

2.2. Negative impact of ecotourism on the ecological environment

With the development of the economy, tourist areas will attract a large number of tourists, and tourism activities will have a certain impact on the ecosystem of tourist areas. Whether it is to observe wild animals, catch prey and other active tours, or enjoy the scenery, ornamental plants and other passive tours, or the activities of resource developers and travel agencies, the ecosystem will be disturbed and damaged in varying degrees. The natural and semi-natural ecosystem tour mainly has two environmental results: one is the destruction of vegetation ecological environment. Due to the trampling of tourists and vehicles on the soil and other forms of damage, the plants have direct and indirect changes through the soil: (1) vegetation area reduction. (2) Vegetation height decreased. (3) The density of grassland decreased. (4) There is a lack of comprehensive

evaluation in the analysis and evaluation of plant diversity tourism resources and environmental quality evaluation of tourism areas. The second is the destruction of water quality. The impact on water quality includes the following aspects: (1) the pathogens will be brought into the water after the sewage without treatment or only primary treatment is discharged into the water environment. (2) Sewage discharge accelerates the eutrophication process of the water body. Therefore, the scenic spots based on lakes are greatly affected.

3. Sustainable development of ecotourism

Since the industrial revolution, human material creativity has been greatly enhanced, but the ecological environment and natural resources have been most seriously damaged. The unsustainable economic abnormal increase in production mode and consumption mode makes human survival and development face severe challenges [6]. Industrialization and economic growth, the rapid expansion of population and large consumption of resources have formed great pressure on the environment, forcing people to doubt the traditional mode of "growth equals development", and actively seek new development ideas and models, that is, while improving economic benefits, it can protect resources and improve the environment. Therefore, the idea of sustainable development came into being. At the 1992 United Nations Conference on environment and development, the concept of sustainable development was generally recognized by the participants [7].

3.1. Connotation and characteristics of tourism sustainable development

The survival and development of tourism not only depends on the water resources environment, but also may damage or even destroy the water resources environment. Tourism needs sustainable development, and there is a natural coupling relationship between tourism and sustainable development.

Under the influence of the sustainable concept, people put forward the concept of sustainable tourism and discussed it from two aspects of theory and practice. Various concepts and models have greatly enriched the content of sustainable development and pushed tourism development to a new stage. In 1999, the World Tourism Council (WTTC), the World Tourism Organization (WTO) and the Earth Council (EC) defined sustainable tourism as tourism that meets the needs of modern tourists and tourist areas, while protecting and increasing opportunities for future people [8]. To achieve sustainable tourism, it is necessary to manage all resources to meet people's economic, social and aesthetic needs, while maintaining cultural integrity, basic ecological processes, biodiversity and life support systems. Therefore, sustainable tourism refers to tourism based on natural and human resources. Such tourism contributes to sustainable development and enables tourism activities focusing on natural or cultural heritage resources to existing indefinitely. To achieve this goal, it is necessary to develop in an integrated way and to understand the relationship between the

Table 1
Comparison between sustainable tourism and traditional tourism

	Traditional tourism	Sustainable tourism
Pursuit of goals	Profit maximization	Maximize economic and ecological benefits
	Price-oriented	Value-oriented
	Cultural and landscape resources tour	Complete enjoyment and research of environmental resources and cultural values
Beneficiary	Developers and tourists are net beneficiaries	Developers, tourists, local community residents share benefits
	Community residents' economic benefits and environmental losses	
Management method	Tourists come first, be responsive	Ecosystem capacity first, with options to meet the needs of tourists
	Rendering ads	Moderate publicity
	Unplanned space expansion	Planned time and space arrangements
	No restrictions on transportation	Selective transportation
Positive influence	Create career opportunities	Create opportunities for continuous employment
	Stimulate short-term regional economic growth	Promote economic development
	Get foreign exchange income	Long-term foreign exchange income
	Promote transportation, entertainment and infrastructure improvement	Transportation, entertainment and infrastructure improvement are coordinated with environmental protection. Integration of economic, social and ecological benefits
Negative impact	Negative effect of tourism on the environment is easy	Negative effect of tourism on the environment can be controlled in ecology
	Pollution in tourist areas	Within the scope of system self-regulation
	Tourism activities disturb the normal lives of residents and creatures	Tourism activities are based on the premise that they do not affect the living rules of the inhabitants and creatures

natural and cultural resources, the tourism field and other activities and processes, and value systems in the tourism areas. Sustainable tourism is the embodiment of the theory of sustainable development in the tourism industry. It is the sublation of the traditional tourism development model and a qualitative leap in the history of tourism development. Comparison between sustainable tourism and traditional tourism (Table 1).

Sustainable development of tourism emphasizes the development of tourism in a systematic, equal, global and coordinated way. The core of sustainable tourism development is to coordinate the interests of the environment, tourists and local communities. In 1993, the World Tourism Organization (WTO) defined sustainable tourism development as tourism sustainable development is a mode of economic development, which is used to achieve the following purposes: improving the quality of life of local communities; providing tourists with high-quality experience; and maintaining the quality of local communities and the environment that tourists rely on [9]. Of course, there are other definitions, such as the United Nations (UN, 2001): sustainable tourism development refers to the development and maintenance of tourism in a region (community, environment) in such a way and scale, that is, it will remain active in the long term, and will not degrade or change the (human or material) environment in a way that may prevent the successful development of other activities and processes [10]. The concept includes a large number of rules that should be taken as guidelines for action: (1) prudent use of the earth's resources; (2) poverty alleviation and reduction of gender inequality; (3) improvement of the quality of life; (4) protection of biodiversity and life support systems for all natural habitats; (5) simultaneous interpreting of different traditions, protection of local culture and lifestyle; and encouragement of bottom-up participation responsibilities. Decision-making ability.

From the perspective of theoretical inheritance, the concept of tourism sustainability obviously comes from the concept of sustainable development. Both domestic and foreign scholars discuss the issue in this context. The interpretative connotation of the concept of sustainable development has more or less ethical significance than a logical theoretical system, and sustainable development is also related to politics to some extent. At present, the concept of sustainable tourism development has not been unified. Canadian scholars believe that in the tourism industry, sustainable development has a unique meaning: the industry should improve the tourism capacity and product quality, while not having a negative effect on the natural and cultural environment [11]. Tourism sustainable development is a very complex process, involving almost all aspects of human material and spiritual life. It is closely related to the level of human understanding of nature and society and will show new content with the development of human activities and human consciousness or understanding.

3.2. Relevant elements of tourism sustainable development system

The sustainable development of tourism refers not only to the sustainable development of the economy, but also to the sustainable development of society and ecology. It refers to the sustainable development of a "three-dimensional" structure with a human being as the main body and coordinating the relationship between man and land as the core. Only in this way can the sustainable development of tourism be implemented and people's quality of life be improved. Based on the understanding of the sustainable development of tourism, the sustainable development system of tourism is the coordinated development of economy, society, resources, environment and human beings. It is a multi-system and multi-factor system, and there are complex and organic links among various systems and elements. It is the intersection of the economic system, ecological system and social system. The sustainable development of tourism includes three basic elements: the sustainability of the tourism economy, the sustainability of tourism ecological environment and the sustainability of tourism society. These three factors influence and interact with each other. The sustainability of tourism economy refers to the promotion of sustainable economic growth while maintaining the other two aspects unchanged, without affecting tourists' tourism consumption level; the sustainability of tourism ecological environment, that is, the sustainability of tourism resources and environment, means that the development of tourism industry should be based on the actual tourism resources stock, not exceeding the capacity of tourism destination environment and the carrying capacity of resources. The sustainable utilization of tourism resources and the protection and improvement of tourism environment; the sustainability of tourism society thinks that the development of tourism should be in the same direction with social progress, and the goal is to improve the quality of life of the residents in the tourist area and have a positive impact on the regional population quality, openness, social stability and residents' confidence. Fig. 1 shows the operation framework of the tourism sustainable development system.

4. Impact of water resources development on ecological carrying capacity

Water environment carrying capacity is one of the important carriers to characterize the coordinated development of the water environment and social economy. Based on the sustainable development index system, understanding the actual carrying level of water environment in a certain region and evaluating the coordinated development degree of water environment and social economy in a certain stage can provide support for scientific decision-making of regional water environment protection and management. The water resources system is a dynamic and complex ecosystem with multiple feedback connections. It is the basis of studying water environment carrying capacity to make clear the main factors in the system, various feedback relations among subsystems, and understand the internal structure of water environment carrying capacity. The method cannot only be applied to simple prediction but also provide a basic method and platform for quantitative research on internal constraints, main control factors and strategy adjustment. The application software of system dynamics is easy to establish a feedback structure model and has advantages in dealing with nonlinear, high-order, multivariable and multiple feedback problems.

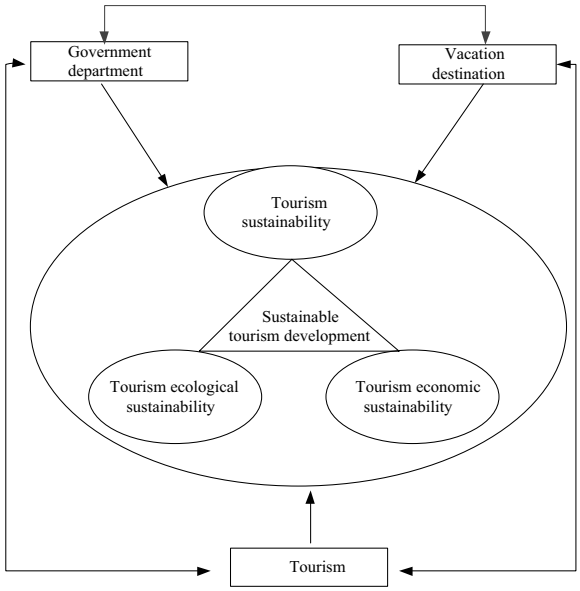

Fig. 1. Operation framework of tourism sustainable development system.

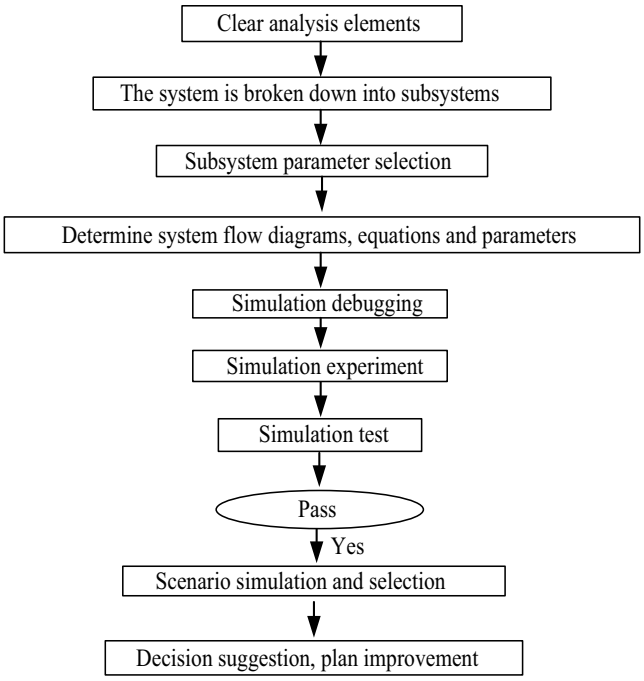

Fig. 2. System dynamics modeling steps.

Wang Qifan, vector model method is simple and easy to calculate water environment carrying capacity index [12]. Therefore, on the basis of summarizing the previous research results, this paper establishes a scientific evaluation index system, finds out the relationship between the factors affecting the water environment carrying capacity by using mathematical methods, and then analyzes the water environment carrying capacity of inland lakes in a certain period of time.

When constructing the system dynamics model of water environment carrying capacity, it is necessary to clarify the problems to be solved and the factors to be analyzed in the system, and to analyze the feedback relationship between the factors restricting and promoting each other, as well as the operation mechanism and control mechanism of the system, so as to reveal the carrying capacity of the water environment system to the regional social economy and the bearing trend in the future, so as to formulate the regional water scientifically Environmental protection and management decisions [13]. The general procedure of establishing a system dynamics model is shown in Fig. 2.

4.1. Model construction and main equations

The research of water environmental carrying capacity system involves a social system, economic system and environmental system, and is affected by many factors, such as the level of social and economic development, the functional requirements of water environment, environmental protection, management objectives and so on. These factors are dynamic variables that change with time, and there are interdependent and restrictive relationships among the factors. According to the actual situation of inland lakes and the needs of model design, the boundary of the research system is defined as lakeside and the land area connected with it. The interaction of various factors in the system boundary is mainly considered. The overall change of the system within the boundary is taken as the research core. The system is divided into three parts: socio-economic subsystem, water environment pollution subsystem and water resources subsystem. Based on each subsystem, the parameters of each subsystem are selected and the causal relationship between them is found out. On this basis, the system structure system dynamics flow chart is drawn by using software to describe and express the nature, characteristics and mutual relationship of different variables. The quantitative relationship between. The flow chart can clearly reflect the transmission direction of the material, information and energy in the whole system as well as the feedback loop of the system. It can correctly distinguish the internal components of each subsystem and their own interaction, as well as the feedback relationship between the main factors that restrict and promote each other.

4.1.1. Population submodule

The ultimate goal of water environment carrying is to promote sustainable economic development and improve human survival ability, quality of life and health level. The population is an indispensable condition for economic development, which is closely related to economic development and plays an important role in promoting or delaying economic development. The population system not only provides a labor force for social and economic development but also improves the efficiency of resource utilization, changes the mode of production that produces pollution and improves the ecological environment. The uncontrolled development of natural resources by the population system will cause an imbalance of ecological balance, and a large amount of waste produced in the process of production and life will cause serious environmental pollution.

And ecological destruction is not conducive to the sustainable development of the economy and society. The submodule reflects its own state change and its internal relationship with social economy, resources, environment and other factors. The urban-rural structure of the population is affected by the level of social and economic development and industrial structure. The improvement of population quality can not only directly improve the production efficiency and create more economic value, but also contribute to the implementation of environmental protection policies and measures, and help to improve or improve regional environmental quality, which belongs to the positive feedback loop in system dynamics. The increase of population leads to the increase of domestic water demand and the decrease of the ratio of supply and demand; the increase of domestic water consumption leads to the increase of domestic sewage discharge and the decline of water environment quality; the increase of population will reduce the per capita gross national product and the per capita water resources; the increase of urban population is conducive to the centralized treatment of sewage and reduce the sewage discharge, which belongs to the negative feedback loop [14]. The main equations of the population subsystem are as follows:

$$\begin{aligned}
&\mathrm{TP}(t) = \mathrm{TP}(t-dt) + \mathrm{TP}\cdot\mathrm{PR}\times dt\\
&\mathrm{UL} = \alpha_1 \ln(\overline{\mathrm{GDP}}) + \alpha_2\\
&\mathrm{RP} = \mathrm{TP}\times\mathrm{UL}\\
&\mathrm{UP} = \mathrm{TP} - \mathrm{RP}\\
&\mathrm{EIR} = \alpha_3 \times \overline{\mathrm{GDP}}^{\alpha_4}\\
&\mathrm{PM} = \mathrm{TP}/A
\end{aligned} \tag{1}$$

In Eq. (1), TP, RP and UP are the total population, rural population and urban population respectively; PR is the natural growth rate of the total population (%); EIR is the proportion of education investment (%); UL is the level of urbanization (%); PM is the population density (person/km^2); $\overline{\mathrm{GDP}}$ is the per capita GDP (yuan); A is the administrative area, α_1, α_2, α_3, α_4 are undetermined constants.

4.1.2. Economic submodule

In the economic subsystem, economic development and ecological environment protection are complementary and interdependent. The improvement of the environment is conducive to the healthy development of the economy. The rapid development of the economy can provide more funds and technical support for environmental protection. The increase of investment in environmental protection infrastructure, science and technology and education can increase the rational use of natural resources, improve the level of productivity, create more material wealth and economic value, improve the ability of environmental protection and provide a good life Environment, promote resource regeneration, better achieve sustainable development. In the process of economic development, increasing investment in environmental protection, controlling environmental pollution, improving and protecting environmental quality has become the key to environmental protection. Therefore, the submodule will reflect the economic development status of the whole research area through GDP, GDP growth rate, per capita GDP, proportion of industrial output value, proportion of tertiary industry, and environmental protection investment [15]. The main equations are as follows:

$$\begin{aligned}
&\mathrm{GDP}(t) = \mathrm{GDP}(t-dt) + \mathrm{GDP}\times\mathrm{GR}\times dt\\
&\overline{\mathrm{GDP}} = \mathrm{GDP}/\mathrm{TP}\\
&\mathrm{TIOV} = \mathrm{GDP}\times R_{\mathrm{TIOV}}\\
&\mathrm{ITR}_{\mathrm{TIOV}} = \mathrm{TIOV}/\mathrm{GDP}\\
&\mathrm{TAOV} = \mathrm{GDP}\times R_{\mathrm{TAOV}}\\
&\mathrm{ATR}_{\mathrm{TAOV}} = \mathrm{TAOV}/\mathrm{GDP}\\
&\mathrm{TTIOV} = \mathrm{GD}P\times R_{\mathrm{TTIOV}}\\
&\mathrm{TTR}_{\mathrm{TTIOV}} = \mathrm{TTIOV}/\mathrm{GDP}\\
&\mathrm{EIP} = \mathrm{GDP}\times\mathrm{EIIS}\\
&\mathrm{EIIS} = b_1\times 1n\mathrm{GDP} + b_2\\
&\mathrm{RIIS} = \frac{\mathrm{IIS}}{\mathrm{EIP}}\times 100\%\\
&\mathrm{IIS} = b_3\times 1n\mathrm{EIIS} + b_4
\end{aligned} \tag{2}$$

In Eq. (2), GDP, $\overline{\mathrm{GDP}}$, TIOV, TAOV and TTIOV are GDP (100 million yuan), per capita GDP (10,000 yuan), gross industrial output (100 million yuan), the agricultural output value (100 million yuan), and tertiary industry output value (100 million yuan); GR is GDP growth rate % and TP is the total population (person); R_{TIOV}, R_{TAOV} and R_{TTIOV} are the proportion of total industrial output value, agricultural output value and tertiary industry total output value in GDP (%); $\mathrm{ITR}_{\mathrm{TIOV}}$, $\mathrm{ATR}_{\mathrm{TAOV}}$ and $\mathrm{TTR}_{\mathrm{TTIOV}}$ are the growth rates of industrial output value, agricultural output value and tertiary industry output value respectively; EIP and EIIS are environmental protection investment of industrial wastewater of 100 million yuan and the percentage of industrial wastewater investment in environmental protection investment and environmental protection investment index (%). b_1, b_2, b_3 and b_4 are undetermined constants.

4.1.3. Water resources and water environment quality submodule

Water resources is an important factor in social and economic development, is the material basis of water environment carrying capacity, and are an important indicator to support the sustainable development of the regional social economy. The growth of economy and population leads to the increasing demand for water resources; at the same time, with the improvement of people's living standards, the impact of water resources on population and economy is increasing, especially the lack of water resources directly affects the economic instability and the sustainable development of the regional economy. Like other natural resources, the support capacity of regional water resources to population and economic development is also limited. If we only pay attention to the demand of production and domestic water, lack of understanding of water resources protection and ecological environment protection, and ignore the water consumption of ecological environment in the development and utilization of water resources, it will bring about

the imbalance of ecosystem and the deterioration of water environment. This shows that the rational development and utilization of water resources is an important factor that cannot be ignored in the study of water environment carrying capacity. Therefore, the sustainability of water resources utilization is the way to realize the ecological environment and social economy. The development and utilization of water resources can ensure the sustainable and healthy development of social economy only under the premise of protecting the ecological environment and within the allowable range of water environment carrying capacity. The increase of GDP will inevitably lead to the increase of water demand and water consumption, which will lead to the decrease of water resources supply-demand ratio; the decrease of water supply-demand ratio will affect the speed of regional economic development, and the increase of water consumption will lead to the increase of wastewater and pollutant emissions, which will affect the quality of water environment. At the same time, economic development can increase the investment in sewage treatment and water resources protection and increase the supply of water resources. The per capita water resources is a positive index, while the increase of water consumption and the decrease in the ratio of supply and demand are negative indicators. Therefore, the submodule takes the total consumption of water resources as the state variable and connects with the economic, population and environmental subsystems through a variety of auxiliary variables, so as to reflect the satisfaction degree of water resources development and utilization to the needs of industry, agriculture, human life and ecological environment, and further express the dynamic constraint relationship between water resources, social economy and ecological environment Water resources per capita, water demand, water consumption and ecological environment water demand are used to reflect the supply and demand of water resources in the whole region.

Evaluation model based on factor analysis.

Based on factor analysis, the evaluation model is determined as follows:

- Evaluation model of bearing capacity of the index layer: in practice, understanding the bearing capacity of the index layer is helpful for people to adjust and optimize the system and improve the carrying capacity of the water environment. According to the relevant literature [16], on the basis of the above index weight determination, the bearing capacity of the index layer can be defined as:

$$w_i = \sum_{i=1}^{n} \omega_i x_i \left(i = 1,2,...,n\right) \tag{3}$$

In Eq. (3), ω_i is the weight of a single indicator; x_i is the value of a single indicator after pretreatment. In order to determine the bearing capacity of the index layer, the ideal value of the index after dimensionless treatment is assumed to be 1,1,1, 1 (n in total), then the ideal bearing capacity of the index layer is:

$$w_{i0} = \omega_{i0} x_{i0} = 1 \tag{4}$$

In Eq. (4), w_{i0} is the bearing capacity of the i-th ideal index. ω_{i0} is the ideal index value; x_{i0} is the ideal index weight. Due to the difference between the actual bearing capacity and the ideal bearing capacity, the deviation reflects the actual bearing status. In order to evaluate the bearing state and bearing potential of the index layer, the bearing capacity of the index layer is divided into two states: "loadable" and "overloaded" [17]. "Loadable" means that the water environment carrying capacity is greater than the development scale of the index layer; "overload" means that the water environment cannot meet the development needs of the indicator layer. Let I will be the bearing capacity index of the index layer, thus the following evaluation method can be obtained. It is expressed as follows:

$$I_i = w_i - 1\left(i = 1,2,...,n\right) \tag{5}$$

In Eq. (5): I_i is the bearing capacity index of the index layer; w_i is the bearing capacity of the index layer. When $I_i > 0$, it is "overload"; when $I_i < 0$, it is "loadable"; when $I_i = 0$, it is "full load".

- Evaluation model of bearing capacity of criterion layer:

The pressure index p is defined as:

$$p = \sum_{i=1}^{n} \omega_i x_i \left(i = 1,2,...,n\right) \tag{6}$$

The support index F is defined as:

$$F = \sum_{j=1}^{n} \omega_j x_j \left(j = 1,2,...,n\right) \tag{7}$$

The greater P is, the greater the pressure on the water environment is; and the greater f is, the greater the supporting force of the water environment is.

- Evaluation model of bearing capacity of target layer:

Since the carrying capacity of the regional water environment is related to the pressure and supporting capacity of the water environment, the system bearing capacity can be expressed as a function of pressure and support capacity.

$$W = f\left(P,F\right) \tag{8}$$

$$W = \frac{F}{P} = \frac{\sum_{j=1}^{n} \omega_j x_j}{\sum_{i=1}^{n} \omega_i x_i} \left(i,j = 1,2,...,n\right) \tag{9}$$

When $W \geq 1$, it is "loadable"; $W = 1$, it is "full load"; $W < 1$, it is "overload".

4.2. Impact analysis of water resources development on ecological carrying capacity

According to the development planning of a river basin in China and relevant national policies, the constants,

initial values and table functions of the model are determined. In the model, constant variables and table functions can be used as decision variables. By changing their values, different schemes are designed to simulate the changes of main variables in the basin. The comparative analysis results of water resources carrying capacity under different measures are shown in Fig. 3.

It can be seen from Fig. 3 that if the above economic indicators are controlled within a reasonable development rate, the water resources carrying capacity of the basin will maintain a downward trend year by year under the condition that the industrial water reuse rate and sewage treatment rate are very low. After taking different adjustment measures, the carrying capacity of water resources has been improved compared with the current situation, and it is on the rise after four years. The open-source measures mainly increase the water supply capacity of water resources by providing the development rate of surface water [18,19]. It can be seen from the figure that the water resources carrying capacity of the scheme have been improved to a certain extent than the current situation. However, in the long run, the development degree of water resources in this basin is limited after all. With the increasing water demand of various industries in the city, it will be difficult to meet the sustainable development of urban water resources carrying capacity of the whole basin, especially in the middle and lower reaches of Hanjiang River Basin, only relying on the development of surface water resources. The core of throttling measures is water-saving and pollution control [20–22].

It can be seen from Fig. 4 that the water resources carrying capacity calculated under the open-source measures have been greatly improved compared with the current situation. This measure is a better way to solve the shortage of water resources in the basin. It not only reduces the consumption of water resources but also greatly reduces the discharge of wastewater, which has a great effect on improving the water resources carrying capacity of the basin. Open source, water-saving and pollution control measures can increase the water resources carrying capacity of Hanjiang River Basin more than that of other schemes, and the improvement range is better than other measures. The main measures such as developing surface water resources, saving water and treating sewage are comprehensively considered, which not only improves the available quantity of water resources but also strengthens the strength of sewage treatment, which greatly improves the carrying capacity of water resources in the whole basin, which well reflects the supporting role of water resources for the regional natural population, environment, social and economic complex system The economic and social development of the basin is sustainable.

5. Some suggestions on improving water resources and promoting sustainable ecotourism

5.1. Protection of original wetland, restoration of ecological decline wetland and construction of constructed wetland should be paid equal attention to

The primary wetlands all over the world are in the trend of degradation and reduction. The main reason is that human abuse of wetlands for land development and disorderly discharge of pollutants lead to the degradation of the wetland ecosystem. Aware of such environmental problems, the ecocity planning area has set a zero net loss of natural wetlands to protect wetland systems and species. The so-called net loss is zero, that is to say, the existing natural wetland area in the ecocity planning area should be equivalent to the wetland area in the urban area after completion, but this does not mean that no development can be made within the existing wetland boundary, but the original wetland should be retained as far as possible, and the wetland system with declining ecological function should be restored and replaced, and large-scale introduction should be made Constructed wetland system to reconstruct wetland biosphere.

After a systematic background survey of natural wetlands, the existing wetlands in the planning area are labeled and classified. The wetland boundaries with degraded ecological functions but still possible to be restored will be preserved and implemented with ecological restoration and conservation plans. For those floodplain wetlands whose ecological functions have been basically lost, the principle of the ecological replacement shall be followed, and the same rules shall be applied in suitable river sections and bank sections. The original wetland boundary will be included in the river ecological embankment regulation plan. Such a wetland growth status survey is planned to be conducted every five years, and the wetland boundaries of the ecological restoration conservation area and the ecological replacement area are re-divided according to the ecological function of the wetland and the growth status of the newly added wetland. In addition, because the water system in the ecocity has to accept the effluent from the sewage treatment plant which is slightly worse than that of the class IV water body, and the non-point source pollution carried by natural precipitation will also flow into the river channel through surface runoff, resulting in some potential factors that may lead to water quality deterioration of the water system. Therefore, the construction of a constructed wetland system is particularly urgent and necessary. We hope to apply the principles of species symbiosis and material recycling in the ecosystem to further treat the source water flowing into the water system and improve the water quality. The constructed wetlands in the ecocity are mainly divided into three categories: one is to treat the tailwater of the sewage treatment plant discharged into Qingjing Lake; the other is to treat the initial rainwater along the inlet of each rainwater pump station and rainwater drainage pipe network along the old Ji canal. The constructed wetland is a kind of purification function facility for rational utilization of the ecosystem. It is characterized by low construction investment, low energy consumption and low operation cost. The basic principle is as follows: plant bed is built according to certain technical parameters, oxygen-enriched zone is formed in root zone and root net zone through photosynthesis, and microorganisms in bed are propagated in large quantities, and water body is purified through the decomposition of microbial activities, absorption and absorption of plants and sterilization of secretions. The process of constructed a wetland treatment system is a complete ecosystem, which has the advantages of low investment, good effluent quality, strong impact

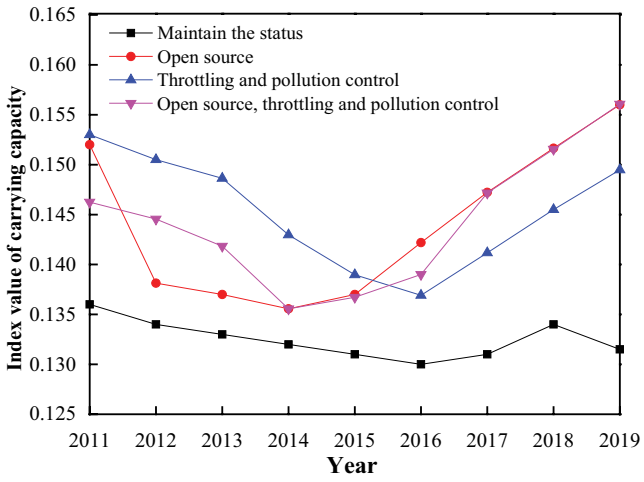

Fig. 3. Comparative analysis of water resources carrying capacity under different measures.

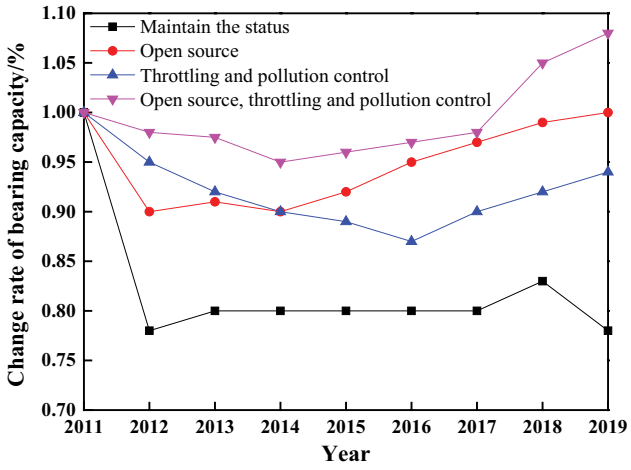

Fig. 4. Variation trend of water resources bearing capacity under different measures.

resistance, simple operation, low maintenance and operation costs. At the same time, it can help to increase the green area, improve and beautify the ecological environment.

5.2. Giving priority to ecology and paying equal attention to development and protection

The sustainable development of ecotourism must adhere to the principle of giving priority to ecology, paying equal attention to development and protection, strictly controlling environmental capacity, effectively controlling and dealing with all kinds of tourism pollutants in a timely and scientific way, increasing ecological compensation, improving environmental quality, and finally realizing the harmonious development of tourism activities and nature.

5.2.1. Define the protected objects and establish the tourism capacity

Firstly, the specific ecological conditions of estuaries, wetlands, nature reserves, islands and urban coastlines in tourist areas are investigated and summarized, and the carrying capacity of natural ecosystems is evaluated scientifically. On this basis, the key coastal tourism protection objects with natural landforms, rivers, island environment and lakes as the main body are identified, and then the tourism development mode, intensity and reasonable capacity of the above-mentioned areas are determined according to the classification, so as to avoid the ecological damage caused by excessive bearing capacity reception, unreasonable and excessive development and utilization.

5.2.2. Identify main factors and control pollution emission

According to the above analysis, all kinds of pollutants discharged in the development of ecotourism can be understood from both direct and indirect aspects, mainly including all kinds of pollutants directly discharged by tourists and various pollutants indirectly discharged in the process of tourism reception. The sustainable development of coastal tourism must improve the control and treatment of various pollutants discharged by the tourism industry to CNEs, and reduce the environmental pollution degree of coastal tourism. It is suggested to control the pollution of coastal tourism from both internal and external aspects: internal control refers to the direct pollution control of tourists through specific strategies such as ecological education, garbage purchase and vehicle transfer; while external control refers to the establishment of special institutions or departments to control various pollutants in the process of tourism development and reception, such as hotels sewage, garbage, smoke and dust emissions from hotels, tail gas and noise emissions from tourist vehicles, especially avoid direct discharge of sewage and solid wastes into the sea.

5.2.3. Moderate development

In a certain sense, the sustainable development of tourism is actually a moderate development, not a vigorous development. Because vigorous development may lead to the saturation of environmental carrying capacity, so that it is difficult to accept more tourists, or it cannot be sustainable because of too many tourists. In addition, moderate development is also to ensure the integrity of the natural and cultural features of tourist destinations. In recent years, governments all over the world are keen to declare the world heritage of local natural and cultural resources, but their original intention is to increase the attraction of tourists. Therefore, they spare no effort to develop the approved world heritage as tourism resources. As a result, the heritage itself and its surrounding environment have undergone irreversible environmental degradation or cultural characteristics This is in contradiction with the purpose of the world heritage organization to protect the world's natural and cultural heritage resources.

5.3. Strengthen the coordination function of the government

In order to study the sustainable development of tourism or to promote the sustainable development of tourism,

relevant policy analysis must be carried out. There is a great contradiction between tourism development and environmental protection. On the one hand, in order to develop tourism, make contributions to the local economy and improve the quality of life of local residents, it is necessary to expand the reception capacity and attract more tourists. On the other hand, the increase of tourists will have a negative impact on the local environment. How to eliminate the negative factors that affect the sustainable development of tourist destinations in the shortest time depends on the timely response of the government, including the rapid formulation of various policies. The decline of tourist destinations or the bankruptcy of tourism enterprises may be only local problems, but there are many factors that affect the sustainable development of tourism, which requires the coordination of local government, central government and even international organizations. In China, in order to realize the sustainable development of tourism, we must break through the restrictions of administrative divisions and the shackles of local protectionism, because sometimes a large tourism destination often belongs to different provinces, such as the great Shangri La region. If local governments are allowed to plan by themselves, there will be a phenomenon of plundering or even plundering tourism resources, which will eventually lead to the destruction of tourism resources. Therefore, it is necessary to establish institutions and mechanisms coordinated by local governments.

Compared with the tourism enterprises and local residents, the government has more information, so it should have a basic and correct judgment on the sustainable development of tourism in this region, and on this basis, formulate the tourism strategy and tourism planning of sustainable development, and guide and regulate the tourism activities of the region. Tourism development has a certain limit. It is subject to the local social and economic development in a certain period of time, including the relevant infrastructure and management level, but also subject to the local ecological and natural resources carrying capacity, so it is impossible to develop indefinitely. Because there is a certain limit of tourism resources in a region, specifically, the problem of tourism capacity. Beyond this limit, tourism will develop in an unsustainable direction. In order to avoid this situation, the government needs to determine the appropriate number of tourists, assess the material and cultural impact of tourism on tourist spots, implement quotas and charge entry fees, etc. in this way, the sustainability of tourism destinations can be enhanced by reducing or controlling the number of tourists.

6. Conclusion

Based on the index system of sustainable development, this paper understands the actual carrying level of the regional water environment. Taking the total consumption of water resources as the state variable, and through a variety of auxiliary variables related to the subsystems of economy, population and environment, this paper reflects the satisfaction degree of the development and utilization of water resources to the needs of industry, agriculture, human life and ecological environment, and then expresses the relationship between water resources, social economy and health. The dynamic restriction relationship between the state and environment reflects the supply and demand of water resources in the whole region through the indexes of available per capita water resources, water demand, water consumption and ecological environment water demand. The degree of coordinated development of the water environment and social economy in a certain stage is evaluated, which provides support for scientific decision-making of regional water environment protection and management. In order to improve water resources and promote sustainable ecotourism, we should also protect the original wetland, repair the ecological recession wetland, construct artificial wetland, give priority to ecology, pay equal attention to development and protection, define the protection object, establish tourism capacity, moderately develop, control pollution discharge and strengthen the coordination function of the government.

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