



RESEARCH ARTICLE

## Agricultural Water-Saving and Sustainable Utilization of Water Resources Led by Rural Tourism Development

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**ABSTRACT**

In the current era of rapid economic development, rural tourism is highly favored by people. However, with the development and promotion of rural tourism, many water resource problems have also emerged, such as excessive development of water resources, significant increase in sewage discharge, and eutrophication of agricultural water bodies. In order to solve the above problems, this article conducted research on agricultural water-saving and sustainable utilization of water resources led by rural tourism development. Firstly, through investigation and analysis of villagers in different villages, the current situation and specific problems of water resource utilization were understood, and effective ways of sustainable utilization led by rural tourism development were analyzed. Through thin water design, water was saved in landscape design techniques, and in landscape construction, water was saved and rainwater gardens were designed. Rainwater landscaping was utilized to fully utilize water resources, in order to re understand the agricultural water-saving and sustainable water resource utilization model led by rural tourism development. This article investigated the utilization of agricultural water resources in villages 1 and 2 led by rural tourism development. Part of the income from rural tourism in 2021 was invested in the water-saving project in 2022. It was found that before the investment, the highest per capita water waste per month was 34.96 cubic meters and 35.63 cubic meters in Village 1 and Village 2, respectively. After the investment, the highest per capita water waste per month was 20.12 cubic meters and 24.03 cubic meters in Suiyang Ming Village in Guizhou (Village 1) and Tangshan Village in Guizhou (Village 2), respectively. Before the investment, the highest recyclable water volume in Village 1 and Village 2 was 142700 cubic meters and 141400 cubic meters, while after the investment, the highest recyclable water volume in Village 1 and Village 2 was 250700 cubic meters and 253200 cubic meters. It can be found that agricultural water-saving and sustainable utilization of rural water resources led by rural tourism development are effective.

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## INTRODUCTION

With the gradual prosperity of rural tourism, rural natural resources have been overexploited, and the deterioration of the ecological environment in rural tourist attraction has become increasingly prominent. Among them, water environment problems such as water source safety, water pollution and water resource waste have become more prominent. Therefore, it is necessary to focus on

studying agricultural water-saving and sustainable utilization of water resources led by rural tourism, which can provide reliable suggestions for the analysis of sustainable utilization of rural water resources and explore strategies for analyzing sustainable water resources in rural areas. The agricultural water-saving and sustainable utilization of water resources guided by rural tourism has important practical significance in saving water resources in rural areas, alleviating water pressure in rural agriculture and production, and solving many environmental problems caused by rural tourism. At the same time, from an ecological perspective, some suggestions are proposed for the construction of rural water features, which is of great help in protecting and improving the water environment of tourism oriented rural areas. This provides some reference ideas for the sustainable utilization of water resources and the creation of water environment in tourism oriented rural areas.

In order to comprehensively improve the efficiency of crop water use and reduce agricultural water use, programs such as strengthening water management, increasing financial input, strengthening project construction and operation management have emerged, but the shortage of water resources in rural areas is very serious. Kader Mohammad Abdul found that over the years, agricultural water resources have been limited due to global warming and irregular rainfall in arid and semi-arid regions. In order to alleviate the pressure of agricultural water use, covering as a water-saving technology plays a crucial role in rainwater irrigated crop cultivation. He also discussed the future research potential of coverage modeling in quantifying agricultural water loss [1]. Yang Xing believed that the scarcity of water resources posed a serious threat to the sustainable development of agriculture. China is a large agricultural country with a large population, and water-saving irrigation is the main way to achieve sustainable development of water resources and economy. Water conservation policies and measures have a guiding effect on water conservation reform work [2]. The purpose of Uddin Md Taj was to evaluate the economic and environmental impacts of water-saving technologies on rice cultivation. He suggested implementing investment support, incentives, training programs, and promotion services to increase farmers' awareness of water-saving technologies and enrich their knowledge [3]. The purpose of Khamidov Mukhamadkhan was to provide scientific and practical suggestions for farmers to improve soil leaching efficiency and improve soil conditions, using biological solvent compounds to improve arable land during the soil leaching process [4]. Chen Zhisong established, analyzed, and compared water-saving service supply chain equilibrium and cooperative decision-making models under the scenario of no/no social welfare maximization goals. He conducted numerical analysis and sensitivity analysis on all models, and compared them. The research results showed that whether rainwater management was considered or not, the cooperative strategy was better than the balanced strategy in reducing water consumption, corresponding social welfare, consumer surplus and positive externality [5]. The above scholars have proposed that water resources have a strategic impact on the development of rural tourism, and it is imperative to protect and effectively utilize water resources.

Water is the foundation of agricultural development. Although China has abundant water resources, due to its large population, the per capita water resources are not significant. Water scarcity and waste are two major challenges in the development of modern agriculture. On the one hand, water scarcity restricts the total amount of agricultural water use. On the other hand, the waste of agricultural water is also very serious, and some farmers are still using extensive irrigation methods, which inevitably exacerbates the contradiction between water supply and demand. In such a situation, only by implementing sustainable development strategies in agricultural water resources can the contradiction between supply and demand of water resources be effectively resolved. Therefore, it is necessary to deeply implement sustainable utilization strategies for agricultural water resources, effectively develop, protect, and utilize limited water resources, with the premise of reducing the supply-demand contradiction of water resources, and promoting the further development of modern agriculture [6-7].

## CURRENT SITUATION OF WATER RESOURCES UTILIZATION IN RURAL TOURISM DEVELOPMENT

### Promoting Economic Development

With the promotion of the national tourism development plan and the policy of building a new socialist countryside, rural tourism has become an indispensable part of China's rural development and tourism industry. China's rural tourism industry has superior natural environment and historical and cultural resources, which has been able to develop rapidly and gradually become a leading industry in the new rural economy and construction. The rural tourism industry has made tremendous contributions to rural social life, economic development, cultural revitalization, environmental construction, and other aspects. Farmers can start businesses at home to become wealthy. However, due to the short development period of rural tourism in China, lacking experience and management, and the urgent need for improvement of infrastructure, especially the unclear development direction, in order to achieve long-term and stable development of rural tourism, it is necessary to explore a path suitable for sustainable development of rural tourism based on China's specific national conditions, create a broader development space, and achieve harmonious sharing between humans and nature.

The social stability of a country cannot be separated from food security, and the long-term stability of food security requires sufficient agricultural water resources. It is no exaggeration to say that water is the lifeblood of agriculture and has a significant impact on the overall state of the national economy and industries. In fact, both industrial society and human survival and reproduction depend on water resources, among which agricultural water resources occupy an important place. However, with the development of society, the demand for water resources in other industries is gradually increasing, and agricultural water use is facing severe pressure. Sustainable utilization of agricultural water resources requires reasonable management and allocation, and the promotion of advanced water-saving technologies through policy support and advocacy. Only in this way can not only the current needs of the people for water resources be met, but also the needs of the future generation for water resources be met, while ensuring the economy, feasibility, and rationality of water resource planning and utilization [8-9].

Rural tourism not only meets the entertainment needs of surrounding urban residents, but also provides them with a way of returning to nature as a way of life. With the increase of economic income and changes in consumption structure, coupled with the declining quality of urban environment, more and more people are choosing rural leisure tourism to gain a deeper understanding of rural folk culture, acquire knowledge, relax their body and mind, and enjoy their mood. Rural areas have abundant cultural and natural resources, which provide unique conditions for the development of rural tourism. In order to understand the impact of urban and rural tourism on the economy in recent years, this article conducted a survey on the economic growth rate of urban and rural tourism. The higher the economic growth rate, the greater the economic impact brought by tourism. The economic growth rate of urban and rural tourism from 2018 to 2020 is shown in Figure 1:

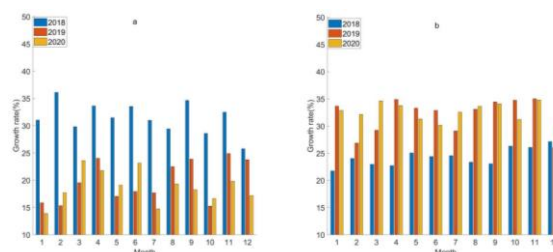


Figure 1. Economic growth rate of urban and rural tourism from 2018 to 2020

Figure 1 (a). Economic growth rate of urban tourism from 2018 to 2020

Figure 1 (b). Economic growth rate of rural tourism from 2018 to 2020

As shown in Figure 1: In Figure 1 (a), the lowest growth rates of urban tourism economy in 2018, 2019, and 2020 were 25.77%, 15.27%, and 13.9%, respectively. The highest growth rates of urban tourism economy in 2018, 2019, and 2020 were 36.11%, 24.9%, and 23.61%, respectively.

In Figure 1 (b), the lowest growth rates of rural tourism economy in 2018, 2019, and 2020 were 21.74%, 26.04%, and 30.16%, respectively. The highest growth rates of rural tourism economy in 2018, 2019, and 2020 were 27.13%, 35.02%, and 34.8%, respectively.

The rural landscape stands in a pure natural environment, full of simple folk culture and simple rural customs. It is precisely based on such unique characteristics that rural tourism has gradually formed a diversified activity mode of “eating farmhouse meals, staying in farmhouses, doing farmhouse work, and playing farmhouse fun”. Meanwhile, due to the proximity of tourism oriented rural areas to cities, convenient transportation, and lower travel costs, urban residents generally choose to go to nearby tourism oriented rural areas to relax and get close to nature during holidays.

With the continuous growth of rural tourism industry and changes in market demand, it is developing into a comprehensive and diversified three-dimensional tourism industry model, which integrates elements such as leisure sightseeing, inspection and learning, entertainment and vacation, shopping, etc. However, the rapid development of rural tourism has also brought about the problem of water resource damage, which requires the rural tourism industry to better protect water environment resources and avoid further ecological damage [10].

### Increased Burden on Water Resources

China is a major agricultural country, and the development of agriculture is directly related to people’s livelihoods, price stability, economic development, and social stability. With the rapid increase in the world population and the significant improvement of human development capabilities, agricultural production is constantly breaking through and developing through new technologies such as improved varieties, fertilizers, pesticides, and irrigation. Although water resources have been widely developed, predatory development has also led to negative effects such as environmental damage, further increasing the difficulty of sustainable agricultural development, especially the water-saving problem of dryland agriculture and irrigated agriculture.

The contradiction between supply and demand of water resources in China is very prominent, mainly manifested in the structural, productive, and consumer waste problems that exist in the process of water resource development and utilization. There are a large number of farmers in China, and rural water consumption accounts for a considerable portion of the country’s total water consumption. How to effectively and reasonably utilize water resources in agriculture and even the entire society has received widespread attention. The contradiction between the supply and demand of industrial and agricultural water resources is particularly prominent, with serious overexploitation and waste of groundwater in rural areas. In addition, with the rise of rural tourism industry, the problem of rural water resources has also become more serious [11-12]. This article analyzed two villages before and after the investment in tourism development in a certain region, namely Suiyang Ming Village in Guizhou (Village 1) and Tangshan Village in Guizhou (Village 2). Village 1 and Village 2 have not yet invested the funds for rural tourism development in water-saving projects in 2021. A survey was conducted on the water resources of two villages in 2021, as shown in Table 1:

**Table 1. Water resources of two villages before investment in 2021 (10000 cubic meters)**

Water resources( 10,000 cubic meters)	Village 1	Village 2
Total water volume	542.5	598.7

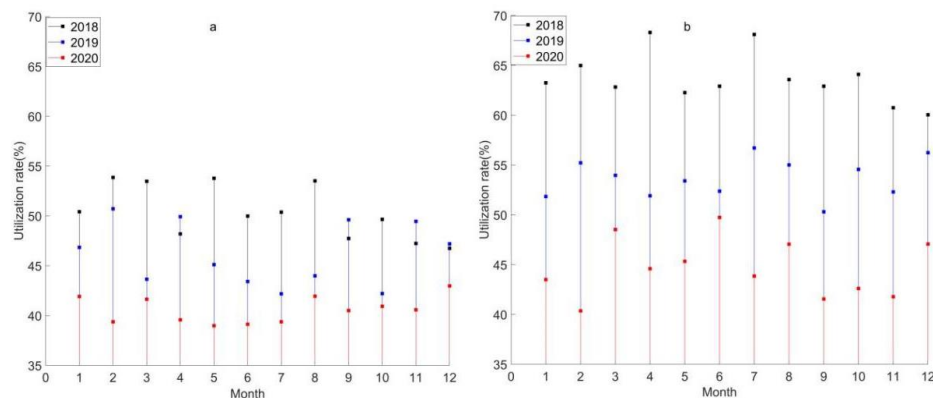
Agricultural water consumption	216.1	245.3
Domestic water consumption	98.5	102.9
Residual water	227.9	250.5

As shown in Table 1, before the investment of funds, the total water consumption of the two villages in 2021 was 5.425 million cubic meters and 5.987 million cubic meters, respectively. The agricultural water consumption of the two villages was 2.161 million cubic meters and 2.453 million cubic meters, respectively. The domestic water consumption of the two villages was 985000 cubic meters and 1.029 million cubic meters, respectively.

Although the public's awareness of ecological and environmental protection has significantly increased in recent years, some enterprises and individuals still discharge industrial and domestic sewage around rural areas at will. In addition, the current water environment governance system is not perfect, and the overall governance efforts are relatively small, further affecting the degree of pollution and damage to the water environment, resulting in a large amount of wasted water. At the same time, some farmers have adopted outdated agricultural production models, which have also led to increased pollution of agricultural water sources, resulting in numerous problems such as eutrophication of water bodies.

### Low Utilization Rate of Agricultural Water Resources

Due to the lack of water resources and the impact of climate change and global warming, agricultural development is facing difficulties, and the technical level of agricultural irrigation facilities is extremely backward, making it impossible to effectively utilize water resources. At present, agricultural irrigation is still carried out through flood irrigation. Due to the low utilization rate, water resources are more scarce and wasted. In addition, due to the aging of water conservancy facilities, many water resources are evaporated and lost during transportation, resulting in a large amount of waste. In summary, there is relatively little effective utilization of agricultural water resources in China, and there is a great waste, which needs to be highly valued. If the utilization rate of agricultural water resources is less than 70%, it indicates that the degree of agricultural water resource utilization is relatively low. The agricultural water resource utilization rates of Village 1 and Village 2 from 2018 to 2020 are shown in Figure 2:



**Figure 2. Agricultural water resource utilization rates of Village 1 and Village 2 from 2018 to 2020**

Figure 2 (a). Agricultural water resource utilization rate in Village 1

Figure 2 (b). Agricultural water resource utilization rate in Village 2

As shown in Figure 2: In Figure 2 (a), the lowest utilization rates of agricultural water resources in Village 1 in 2018, 2019, and 2020 were 46.75%, 42.18%, and 38.98%, respectively. The highest

utilization rates of agricultural water resources in Village 1 in 2018, 2019, and 2020 were 53.86%, 50.71%, and 42.97%, respectively.

From Figure 2 (b), it can be seen that the lowest utilization rates of agricultural water resources in Village 2 were 60.04%, 50.30%, and 40.36% in 2018, 2019, and 2020, respectively. The highest utilization rates of agricultural water resources in Village 2 were 68.30%, 56.71%, and 49.74% in 2018, 2019, and 2020, respectively.

With the rapid development of the economy, the living standards of rural residents have significantly improved. However, urban garbage also affects the environment in rural areas, with weak government management measures and insufficient environmental awareness among villagers, leading to garbage pollution of rural water resources. In addition, the mining output of rural groundwater is excessive, and most rural areas do not have water supply networks, mainly relying on the exploitation of groundwater for production and life. However, due to low water utilization efficiency, severe waste, and excessive groundwater exploitation, rural groundwater levels have decreased.

To better achieve the sustainable utilization of agricultural water resources, it is necessary to start from multiple aspects. For example, in the process of irrigation, irrigation date and water quota can be formulated, and economical irrigation technologies such as furrow and ridge irrigation can be used at the same time. In the field management, efficient water-saving management can be achieved through quantitative allocation, comprehensive utilization, reasonable regulation and storage, and comprehensive planning. With the continuous improvement of information technology, computer networks such as Global Position System (GPS), Geographic Information System (GIS) and remote sensing can also be used to obtain, process and transmit various water-saving information, further strengthen water-saving management, and provide effective ways for the sustainable use of agricultural water resources.

## **SUSTAINABLE APPROACH TO WATER RESOURCES LED BY TOURISM DEVELOPMENT**

### **Water Conservation in Landscape Design Techniques**

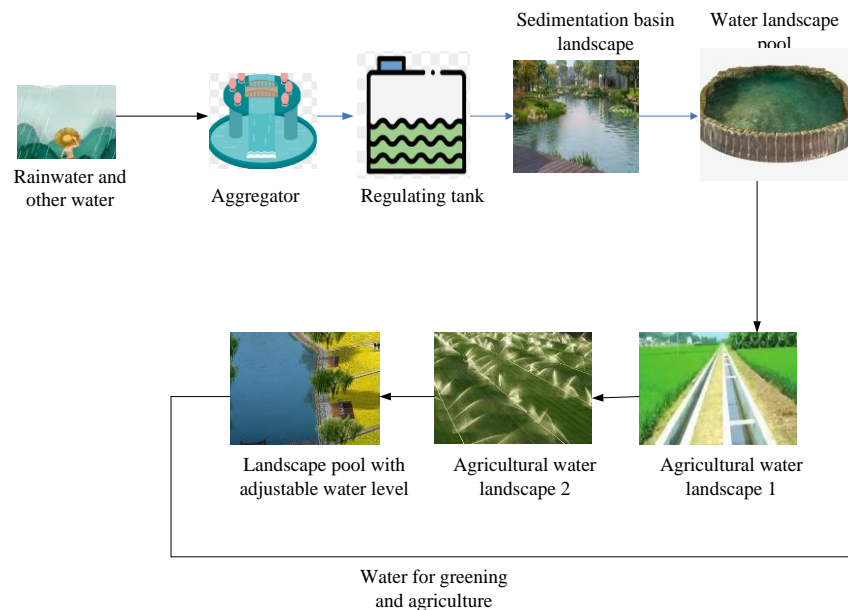
The development of rural tourism has improved the functionality and aesthetics of rural landscapes, and the design of rural water environment can directly affect the sustainable utilization of water required for rural landscapes. When designing the waterscape, the design should first be based on the normal state. The rural waterscape design should try to keep the normal state of water as far as possible, and avoid using excited state waterscape design such as fountains. In the off-season of tourism, although the fountain is not always open, in order to protect the hardened pool bottom, the pool water is usually drained and only the dry pool bottom is left. Therefore, water landscape design techniques are very important, and common water-saving landscape design techniques include thin water design techniques.

At present, thin water design is a popular waterscape design technique. By reducing the height and volume of water structures, and using the beautification effect of underwater pavement or aquatic plant, the decorative effect of waterscape is achieved. Through the thin water design technique, even during winter when the water feature pool is emptied, the pool would not appear ugly, and the pool wall can also be used as a landscape rest facility. In the design of water bodies, the principle of following the principle of "suitable for the lower part but not for the upper part" should be followed, and it should be in line with natural laws and terrain as much as possible to avoid the problem of high design costs. Large fountains should be replaced by wall springs, water drops, small waterfalls, etc., with small water energy consumption. In rural landscape design, it should be avoided to be similar to urban water features as much as possible, and it is not advisable to extensively use water features such as fountains. The design of rural water features should be in line with natural conditions and restore the original state of rural water systems.

## Water Conservation in Landscape Construction

When creating a tourism oriented rural water landscape, priority should be given to the use of ecological embankments. Ecological embankments refer to artificial embankments that are restored to natural riverbanks or have natural riverbank permeability. Ecological embankments not only resist floods, but also have the functions of material exchange and water purification. For the structures required in rural water landscape design, more local materials should be used, which not only saves resources but also ensures the harmonious development of the overall landscape environment. When selecting materials, harmful behaviors such as damaging mountains and trees to obtain stones and wood should be avoided, ensuring that the revetment design, river channel design, and selected materials are conducive to the growth of animals and plants in the water body. High energy consumption water features should be avoided, and as many aspects as possible should be considered to meet the aesthetic, economic, practical, and ecological requirements of the water features.

The sewage discharge in tourism oriented rural areas is very large, and the amount of reclaimed water that can be reused is also huge. Therefore, recycling the usable water from sewage is an important way for rural areas to solve the sustainable use of water resources [13-14]. Reclaimed water can be widely used for watering green spaces, supplementing landscape water systems, and supplementing rivers and lakes when reused in landscapes. Reclaimed water, which has achieved certain achievements, can strengthen people's awareness of water resource protection and become a promising exploration for the development of new water landscape methods in rural areas. The types of reclaimed water reuse landscapes are shown in Figure 3:



**Figure 3. Type diagram of reclaimed water reuse landscape**

As shown in Figure 3, rainwater and other water pass through the aggregator to the regulating tank, forming a sedimentation tank landscape and a water landscape observation tank, and then into an agricultural water landscape. They reach an adjustable water level landscape tank, playing a role in greening and agricultural water use. The design of reclaimed water waterscapes should create different sizes and forms of waterscapes, coordinate and echo each other, and reflect diversity and serialization patterns. Combining the terrain of rural areas, a series of dynamic waterfalls, small waterfalls, and straight water features should be designed using terrain elevation differences.

Although the reclaimed water landscape meets the standards for landscape water use, it still cannot directly contact the human body, so it is mainly for viewing.

Rural water resources have enormous ecological functions. In the rural water resource ecosystem, a large number of phytoplankton can absorb carbon dioxide in the air and regulate the atmospheric environment in rural areas. The rural water resource ecosystem can not only promote the circulation and flow of materials and energy, but also purify organic pollutants, regulate floods, and have functions of water storage and replenishment. In addition, water vapor can increase negative ions in the air, increase atmospheric humidity, and purify the air through evaporation. Rural water scenic areas are typical ecological ecotones, where artificial and natural environments are intertwined and communicate closely. Fish and birds choose to inhabit lakesides, wetlands, rivers, and other places, which is also the best embodiment of harmonious coexistence between humans and nature in rural environments. Therefore, developing rural water resources reasonably, fully protecting and utilizing water resources, and creating an ecological rural tourism environment are also important parts of rural tourism development.

### **Designing the Rainwater Garden and Utilizing Rainwater to Create Scenery**

In the process of constructing rural tourism landscapes, attention should be paid to the utilization of rainwater and the design of rainwater landscapes. Rainwater resources can supplement groundwater resources. At the same time, rural areas have good conditions for utilizing rainwater, which can be introduced into the rural landscape system to alleviate the freshwater resources in rural areas and create a unique landscape water environment. Rainwater gardens are a new type of rainwater garden that can effectively reduce rainwater runoff, regulate indoor and outdoor temperatures of buildings, and collect and pre-treat rainwater. With the vigorous development of rural tourism and the entry of the new rural construction into the white-hot stage, the construction and renovation of rainwater parks can not only play their ecological functions, but also become a beautiful scenery for tourism oriented rural areas. The selection of topsoil and vegetation for rain garden style green roofs is crucial. The topsoil must have high porosity, low density, and suitable erosion resistance for plant growth. Rainflower garden style roof greening often uses brightly colored low tree species, mainly small shrubs, ground covers, etc.

Driven by the development of tourism, farmland has been transformed into many rural hotels and squares, and urbanization has emerged in the development of tourism oriented rural areas. To achieve the maximum utilization of rainwater in rural areas, natural green roofs should be restored to increase the permeability of rainwater. In residential and square areas, rainwater depressions are constructed and utilized to collect rainwater. During the dry season, rainwater from depressions is used to irrigate vegetation. Plants should choose varieties that are resistant to moisture and drought. When constructing rural roads, consideration should be given to the design of sunken green spaces, which are efficient, economical, and practical.

## **TOURISM DEVELOPMENT AS THE LEADING EFFECT**

### **Promoting the Protection of Water Resources**

Rural tourism is one of the important opportunities for China's rural development, because China's rural areas have rich natural landscape and rich resources for tourism development. After the 1990s, Chinese rural areas began to develop some tourism oriented small villages with distinct local characteristics and regional culture. The rural tourism industry is thriving in rural China, driving the development and construction of rural areas, improving the economic income level of villagers, and providing leisure and entertainment venues for urban tourists.

According to national financial policies, the government can provide funding for large-scale water conservancy facilities and embankment projects, making it difficult for water-saving irrigation



projects to receive government funding support. Rural irrigation facilities can only rely on self construction. However, outdated farmland water conservancy cannot meet the irrigation needs of agricultural production. In addition, farmers are less willing to self pay for repairing water conservancy projects because they require a lot of funds and negate their enthusiasm. In the early stages of agricultural development, due to the lack of advanced technology, many water conservancy facilities were no longer able to meet the development needs of modern agriculture, and were aging and approaching retirement. Therefore, these facilities have hindered the sustainable use of agricultural water resources [15].

Two villages invested the funds brought by tourism development in 2021 into agricultural water-saving and sustainable water resource utilization in 2022. Moreover, in 2022, some of the water-saving measures analyzed above were taken, such as rainwater gardens, reclaimed water reuse landscapes, etc., while the rest was used for other expenses. The investment situation of water-saving projects in 2022 announced by village officials is shown in Table 2:

**Table 2. Investment in water-saving projects in 2022 (10000 yuan)**

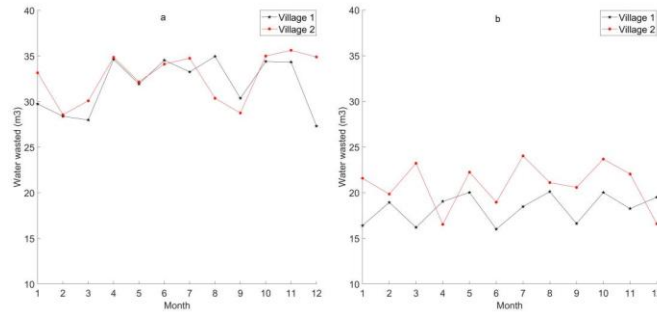
Fund situation	Village 1	Village 2
Revenue from tourism in 2021	35.8	33.2
Investment in water-saving projects	20	20
Other expenses	15.8	13.2

As shown in Table 2, the revenue generated by tourism development in 2021 was 358000 yuan and 332000 yuan, respectively. In order to ensure agricultural water use, two villages voted to invest 200000 yuan in the 2022 water-saving project, indicating that the majority of the funds were invested in the 2022 water-saving project.

If there is a lack of advanced technology and investment, relying solely on outdated irrigation and planting methods, it results in serious water resource waste. Once water resource waste occurs, it not only affects the ecological environment, but also causes various problems, such as land salinization and increased demand for freshwater resources. This vicious cycle continues to exacerbate the damage to the ecological environment.

The natural environment, cultural traditions, and living environment of rural areas are closely related to the development of rural tourism. If only economic benefits are considered while ignoring natural and cultural conditions when developing rural tourism, then the rural tourism industry inevitably finds it difficult to develop for a long time [16-17]. The tourism industry is a consumption oriented industry. If blindly pursuing development speed and scale and plundering rural tourism resources, the rural tourism industry can only be a flash in the pan [18]. Therefore, in the development of rural tourism, it is necessary to adhere to the principle of sustainable development, moderately develop rural tourism resources, control the speed and scale of rural development, and maintain stable and long-term development momentum. In rural planning and construction, attention should be paid to the sustainable development of water resources, following the concept of sustainable development, and making reasonable planning based on the local water resource situation. Under the impact of the tourism wave, rural construction has begun on a large scale, and the development momentum of rural tourism industry is good. However, it is necessary to keep in mind the requirements of sustainable development and strive to use green building systems as much as possible in rural construction. Energy conservation and emission reduction should be given top priority. Only the sustainable development of natural resources can ensure the sustainable development of rural tourism.

The per capita water waste per month (cubic meters) of the two villages before and after investment is shown in Figure 4:



**Figure 4. Monthly per capita waste of water in two villages before and after investment (cubic meters)**

Figure 4 (a). Per capita waste of water per month before investment (cubic meters)

Figure 4 (b). Per capita waste of water per month after investment (cubic meters)

As shown in Figure 4: In Figure 4 (a), the lowest per capita water waste per month in Village 1 and Village 2 before investment was 27.32 cubic meters and 28.56 cubic meters, respectively. The highest per capita water waste per month in Village 1 and Village 2 before investment was 34.96 cubic meters and 35.63 cubic meters, respectively.

In Figure 4 (b), after investment, the lowest per capita water waste per month in Village 1 and Village 2 was 16.01 cubic meters and 16.53 cubic meters, respectively. After investment, the highest per capita water waste per month in Village 1 and Village 2 was 20.12 cubic meters and 24.03 cubic meters, respectively.

In practice, it is possible to strengthen the construction of sewage treatment facilities and introduce advanced sewage treatment technologies to efficiently treat urban and rural wastewater, which can then be used for irrigation in farmland to improve water resource utilization efficiency. Surface water can also be utilized, because compared to other types of water resources, surface water collection is relatively easy and has become the main type of water used for agricultural irrigation. In response to the current shortage of agricultural water resources, it is necessary to comprehensively understand the distribution of various surface water resources such as rivers, lakes, and reservoirs in the region, and then fully utilize these water resources.

At the same time, scientific management and monitoring of water storage projects should be implemented, and efforts should be made to increase the construction of reservoirs and rivers. Regular reinforcement and dredging work should be carried out to promote the increase in water storage capacity of water conservancy projects such as reservoirs and fully play their role in flood control and drought resistance. By reasonably developing and utilizing groundwater, the current situation of water resource shortage can be effectively alleviated. Of course, it should be noted that excessive exploitation of groundwater can lead to a water resource crisis. Therefore, in practice, it is necessary to coordinate the relationship between mining, management, and protection, adhere to the principle of moderate development, and avoid adverse situations such as excessive mining.

### Changes in Water Resource Utilization Rate

All designs centered around the rural water environment revolve around the input, output, morphology, and physical changes of water. The input channels of rural water resources include pipe network water supply, natural precipitation, natural river supply, and groundwater supply, while their discharge methods mainly include pipe network drainage, river water system, land infiltration, and transpiration evaporation. The design scheme aims to achieve sustainable development of water resources in rural areas through various technological means, and maximize the utilization rate of water resources. Due to the fact that the recycling of rural water resources involves cycles in buildings, rural areas, and nature, it is necessary to consider the overall water

environment landscape when designing rural water environments. Domestic water, production water, and landscape environmental water are interrelated and influence each other, and their degree of correlation is interrelated. Therefore, it is necessary to comprehensively achieve the circular utilization of water resources by combining rainwater collection, reclaimed water reuse, and landscape water body construction.

For a more intuitive experiment, this article investigated the recyclable water volume of two villages before and after investment. The recyclable water volume of the first two villages invested is shown in Table 3:

**Table 3. Circulating water volume before investment (2021) (10000 cubic meters)**

Month	Village 1	Village 2
1	8.86	8.99
2	11.15	13.18
3	9.25	11.92
4	14.27	11.30
5	12.39	10.04
6	9.65	11.13
7	7.87	11.79
8	8.34	14.14
9	7.57	10.85
10	7.02	12.34
11	10.48	9.70
12	9.57	13.08

According to Table 3, it can be seen that before the investment, the highest recyclable water volume in Village 1 was 142700 cubic meters, while before the investment, the highest recyclable water volume in Village 2 was 141400 cubic meters.

The recyclable water inflow of the two villages after investment is shown in Table 4:

**Table 4. Recyclable water volume after investment (2022) (10000 cubic meters)**

Month	Village 1	Village 2
1	22.89	17.86
2	20.50	21.59
3	22.21	22.19
4	20.30	19.67
5	20.58	18.35
6	25.07	18.96
7	23.00	25.32
8	20.86	19.21
9	23.87	18.39
10	17.72	18.45
11	19.39	22.11
12	24.36	22.63

As shown in Table 4: According to the table, the highest recyclable water volume after investment in Village 1 was 250700 cubic meters, and the highest recyclable water volume after investment in Village 2 was 253200 cubic meters.

To solve the problems of water scarcity and waste in agriculture, it is necessary to accelerate the development speed of water-saving agriculture and promote water-saving irrigation technology. Nowadays, many rural people use methods such as flood irrigation in the practice of agricultural irrigation, resulting in serious waste of water resources. To solve this problem, relevant functional

departments should strengthen the promotion of water-saving irrigation technology and prevent the waste of water resources caused by agricultural irrigation. Although these water-saving technologies require some investment in the early stage, in order to alleviate the economic pressure on local villagers, government departments can implement targeted support policies and provide appropriate economic subsidies to farmers to promote the active application of water-saving technologies by villagers.

## CONCLUSIONS

Nowadays, with the rise of rural tourism, achieving sustainable development of water resources led by rural tourism has become an urgent problem to be solved. Water resources are the foundation of human survival and national economic development. In order to improve the sustainable utilization rate of agricultural water resources in China and promote the improvement of agricultural development level, this article analyzed and explored the problems faced by China's agricultural water-saving and sustainable utilization of water resources, such as waste and low utilization rate of water resources, and analyzed corresponding countermeasures, aiming to provide effective assistance and support for relevant departments. Through some water-saving methods in rural tourism, problems such as water resource waste can be alleviated. Agricultural water-saving and sustainable water resource utilization led by rural tourism development have improved the utilization rate of water resources and reduced water resource waste. Therefore, in the future, sustainable rural tourism development should be implemented in the process of agricultural water-saving and sustainable utilization of water resources, increasing the protection of agricultural water resources, effectively improving their utilization efficiency, and alleviating the problem of water resource scarcity.

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