

# Discussion on Influencing Factors of Water Resources Environment and Strategies for Protecting Water Ecology

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**Abstract:** At present, the major problems facing the water resource environment worldwide include water pollution, water resource shortage, and water ecosystem degradation. The discharge of industrial wastewater, agricultural non-point source pollution, and the discharge of urban sewage lead to a serious decline in water quality, which directly affects the safety of human drinking water and the living environment of aquatic organisms. Additionally, the unbalanced distribution and excessive exploitation of water resources lead to the problem of water shortage in many areas, which then leads to social and economic contradictions and ecological crises. In terms of ecosystems, the phenomena of water ecological degradation and reduction of biodiversity are increasingly obvious, and the carrying capacity of aquatic ecosystems are gradually declining. This paper aims to analyze the natural, social, and economic factors affecting the water resource environment, and propose effective strategies to protect the water ecology. To provide a theoretical basis and practical guidance for the sustainable utilization of water resources and the long-term development of the water ecosystem.

**Keywords:** Water resources; Environmental impact; Water ecology; Protection strategy

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## 1. Introduction

As the basis of human survival and development, water resources are related to the stability of the ecosystem and the sustainable development of the social economy. However, with the intensification of global climate change, the acceleration of the industrialization process, and the continuous improvement of urbanization level, the water resource environment is facing more severe challenges. Especially in areas with water shortage, problems such as water pollution and ecosystem degradation have become more prominent, which seriously affects the local ecological balance and the quality of life of residents. Simultaneously, the unreasonable development and utilization of water resources also exacerbate the deterioration of the water ecological

environment and threaten ecological diversity and environmental health. Therefore, it is of great practical significance to study the influencing factors of the water resource environment and propose effective protection strategies <sup>[1]</sup>.

## **2. The importance of water ecological protection**

Water ecological protection is of vital significance because it is directly related to the stability of the ecosystem and the sustainable development of human society. As an important carrier of life on the earth, the water body not only provides a living environment for living things but also participates in the process of global material cycle and energy exchange <sup>[2]</sup>. A healthy water ecosystem can maintain water purification, flood regulation, climate regulation, and play an irreplaceable role in maintaining biodiversity, improving environmental quality, and preventing natural disasters. However, with increasing human activity, aquatic ecosystems face unprecedented threats such as water pollution, ecological degradation, and destruction of aquatic habitats <sup>[3]</sup>. These problems not only affect the ecological function of water bodies but also have a direct impact on human drinking water safety, agricultural irrigation, fishery production, and other effects. By restoring and maintaining the health of the water ecological environment, water ecological protection can effectively reduce water pollution, restore the ecosystem, and promote the harmonious coexistence between man and nature. Concurrently, the protection of water ecosystems also plays an important role in coping with global climate change and preventing environmental damage caused by extreme weather events <sup>[4]</sup>.

## **3. The influencing factors of water resources and environment**

### **3.1. Climate change**

Climate change not only affects the amount of water resources but also has an important impact on water quality. Heavy precipitation events can lead to increased surface runoff, bringing more pollutants into rivers and lakes, and thus exacerbating water pollution <sup>[5]</sup>. Under drought and high temperatures, the evaporation and concentration effect of water increases the concentration of pollutants in the water and deteriorates water quality. At the same time, climate change also harms aquatic ecosystems, and rising water temperatures may lead to the decline of aquatic biological populations, causing ecosystem imbalance <sup>[6]</sup>.

### **3.2. Industrial and agricultural production**

Industrial and agricultural production is the key factor affecting the water resources environment. With global industrialization and the scale of agricultural production, the consumption and pollution of water resources are becoming increasingly serious <sup>[7]</sup>. In the process of industrial production, a large amount of water is used for cooling, cleaning, and processing. When some of the water is discharged back to the natural environment, it often contains a large amount of harmful chemicals, such as heavy metals, waste acids, waste alkali, etc. These pollutants pose a great threat to the ecosystem of water bodies and can lead to water eutrophication, reduced biodiversity, and death of aquatic organisms. Moreover, the untreated or improperly treated sewage discharged by factories not only pollutes rivers and lakes but also pollutes groundwater resources through infiltration, which may have long-term adverse effects on agricultural water use and drinking water for residents <sup>[8]</sup>.

## **4. Specific manifestations of water resources and environmental problems in China**

### **4.1. Water pollution**

Water pollution is mainly reflected in industrial wastewater, agricultural non-point source pollution urban sewage discharge, and other aspects. The discharge of industrial wastewater has caused serious pollution to the water environment. Many industrial enterprises in China, especially heavy industries such as chemical, steel, and textile industries, often discharge a large amount of undertreated wastewater in the production process<sup>[9]</sup>. These types of wastewater contain harmful substances such as heavy metals, ammonia nitrogen, and organic pollutants, which are directly discharged into rivers and lakes, causing deteriorating water quality. For example, in the water pollution incident of the Songhua River, the benzene pollutants discharged by a chemical plant caused a large area of water pollution, seriously affecting the safety of drinking water of residents along the river<sup>[10]</sup>.

### **4.2. Water resource shortage**

The water shortage is primarily caused by the uneven distribution of water resources, over-exploitation, and waste. The spatial distribution of water resources is extremely uneven, particularly between the north and south. Southern China experiences abundant precipitation and plentiful water resources, while northern regions face significant water shortages. For example, the Yellow River basin, an important water source in northern China, supports extensive agricultural, industrial, and domestic water needs. However, in recent years, due to water scarcity, the Yellow River has frequently experienced dry spells, especially in its downstream regions. This water shortage has severely impacted local economic development and the lives of residents<sup>[4]</sup>.

### **4.3. Water ecological degradation**

Water ecological degradation is mainly manifested by the destruction of aquatic ecosystems and the reduction of biodiversity. The destruction of aquatic ecosystems is widespread throughout the country, especially in areas where water resource development and utilization are concentrated. Engineering activities such as reservoir construction, river reconstruction, and excessive sand mining have led to a change in the natural form of rivers and destroyed the original ecological balance. For example, although the construction of the Three Gorges Dam on the Yangtze River has brought a positive effect on power generation and flood control, its impact on the downstream river ecosystem cannot be ignored. The storage and regulation of the reservoir changed the hydrological cycle of the Yangtze River and affected the habitat of aquatic organisms, especially the spawning place of fish, leading to the sharp decline of the fish population.

## **5. Water ecological protection strategy**

### **5.1. Rational development and utilization of water resources**

Rational development and utilization of water resources aim to minimize the negative impact on the environment and ensure the sustainable supply of water resources through scientific planning and sustainable management methods. Strengthen the planning and management of water resources development, reasonably formulate the priority of all kinds of water demand, and ensure the balance between water resources development and natural supply. In areas rich with water resources, rainwater, and floods can be stored through the construction of reservoirs and reasonable water conservancy projects to meet the needs of agricultural, industrial, and domestic water use, but the scale of development must be controlled to avoid excessive

interference to the water ecosystem. In areas with water resource shortages, restrictive development measures should be taken to give priority to domestic water use and promote water-saving technologies in agriculture and industry.

## **5.2. Effective control of pollution sources**

The effective control of pollution sources focuses on the comprehensive treatment and prevention of industrial, agricultural, and domestic pollution sources, and reduces the chance of pollutants entering water bodies. Industrial pollution is one of the main sources of pollution. To control industrial pollution needs to start from the pollution source and strengthen the supervision and environmental protection requirements of enterprises. Enterprises should strictly abide by the national discharge standards in the production process, especially for highly polluting industries, such as chemical, paper, steel, etc., and should strengthen the supervision of pollutant discharge to ensure that the wastewater is discharged after full treatment. The construction of efficient sewage treatment facilities and the implementation of clean production technology can significantly reduce the toxic and harmful substances in water bodies. For example, in chemical enterprises, advanced wastewater treatment technologies such as biological treatment and physical and chemical treatment can be used to ensure that heavy metals and organic pollutants meet the discharge standards.

## **5.3. Develop and optimize sewage treatment and reuse technology**

Effective sewage treatment can not only reduce the pollution to water bodies but also maximize the utilization efficiency of water resources through reuse technology, to reduce the pressure on natural water bodies. Improving sewage treatment technology is the basis of optimizing sewage management. Traditional sewage treatment methods mainly include primary treatment, secondary treatment, and tertiary treatment, but with the improvement of water quality requirements and the increase of pollutant types, a single treatment method has been unable to meet the needs of modern environmental protection. Therefore, advanced wastewater treatment technologies, such as membrane bioreactor (MBR), advanced oxidation technology (AOP), and biological filters, must be introduced. By combining the membrane separation technology with the traditional activated sludge process, the membrane bioreactor can achieve more efficient sewage purification and solid-liquid separation, and the treated water quality is close to the drinking water standard. Advanced oxidation technology uses strong oxidants such as ozone and hydrogen peroxide, which can effectively remove refractory organic matter and micro-pollutants in sewage. The biological filter uses specific microbial groups to decompose pollutants, which can effectively remove nutrients such as nitrogen and phosphorus in the water and prevent water eutrophication.

## **6. Conclusion**

Looking into the future, the protection of water resources environment and water ecological restoration will face more challenges, but it also contains new opportunities. With the acceleration of climate change and the industrialization process, the problem of water shortage and water pollution will become more and more serious, and we urgently need to adopt comprehensive solutions. Future research and practice should pay more attention to technological innovation and application, especially in the aspect of sewage treatment and reuse technology. The new treatment process and reclaimed water utilization scheme will further improve the use

efficiency of water resources and reduce the pressure of water pollution. Simultaneously, the development of ecological restoration technology will make the effect of water restoration more significant. Through scientific and reasonable restoration measures, a healthy water ecosystem will be rebuilt, and biodiversity protection will be brought into the core of water resources management. Additionally, public participation and policy support will become an important force in promoting water ecological protection.

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## Disclosure statement

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