

The Lake Ecological Water Level Is Regulated Based on The Influence of Water Level Fluctuation on Aquatic Plants

Fusheng Chao

Guizhou Province Key Laboratory for Information System of Mountainous Areas and Protection of Ecological Environment, Guizhou Normal University, Guizhou Guiyang, 550001, China

Abstract

Lake ecosystem is one of the important aquatic ecosystems on the earth, in which aquatic plants, as an important component, play a crucial role in the stability and health of the lake ecosystem. Water level fluctuation is one of the important environmental factors affecting the growth, reproduction and distribution of aquatic plants, and it is of great practical significance to regulate the lake ecological water level based on the influence of water level fluctuation on aquatic plants. This paper first introduces the role of aquatic plants in the lake ecosystem, and the importance and significance of ecological water level regulation. The species and distribution of aquatic plants are summarized, and the effects of water level fluctuations on aquatic plants, including growth, reproduction, community structure and relationship with other organisms are explored. Some strategies for lake ecological water level regulation, including objectives, principles, methods and techniques.

Keywords

Lake ecosystem; Aquatic plants; Water level fluctuation; Ecological water level regulation.

1. INTRODUCTION

The influence of water level fluctuation on aquatic plants is discussed deeply, and on this basis, the strategy of lake ecological water level regulation is proposed. By studying the characteristics of the growth, reproduction and community structure of aquatic plants under different water levels, we can better understand the operation mechanism of the lake ecosystem and provide a scientific basis for the lake ecological protection and management. Summarize the research results, and put forward targeted suggestions and future research directions, in order to contribute to the lake ecological protection and sustainable development.

1.1. The role of aquatic plants in lake ecosystems

Aquatic plants play a crucial role in lake ecosystems. They can not only absorb nutrients and pollutants from the water, and provide a purification function for the lake, but also provide habitat and food sources for fish and other aquatic animals. At the same time, aquatic plants produce oxygen through photosynthesis to provide essential oxygen to other organisms in the lake. Moreover, aquatic plants are also key factors in maintaining lake biodiversity, and the ecological status and environmental quality can be assessed by monitoring their growth and distribution. In addition, aquatic plants also have cultural and leisure value. Many lakes and wetlands are used as tourism and leisure places, where people enjoy the beauty of aquatic plants and experience the fun of being close to nature.

1.2. Effects of water level fluctuations on aquatic plants

Water level fluctuations have profound effects on aquatic plants. It is not only related to the growth and development of aquatic plants, but also determines their distribution and community structure, and also affects the symbiotic relationship with other organisms. Suitable water level conditions can promote the growth and reproduction of aquatic plants, but the excessive fluctuation of water level may damage the plants, destroy their roots, and affect their ability to absorb water and nutrients. At the same time, water level fluctuations can also affect the distribution range and community structure of aquatic plants, leading to the disappearance or decrease of some species and the increase or dispersal of others. Such changes could disrupt the ecological balance or prompt a new balance to establish. Therefore, in the lake ecological protection and management, we must fully consider the impact of water level fluctuations on aquatic plants, and take corresponding measures to protect and restore the population and community structure of aquatic plants to ensure the health and stability of the lake ecosystem.

1.3. The significance and importance of ecological water level regulation

Ecological water level regulation plays a crucial role in the lake ecosystem. It is not only related to the diversity of aquatic plants and ecosystem stability, but also affects the water quality, leisure and landscape value of lakes. By properly regulating the water level, we are able to create a suitable growth environment for aquatic plants, protect and restore their population and community structure, so as to maintain the health and stability of the lake ecosystem. At the same time, ecological water level regulation also helps to regulate the hydrological and physical and chemical properties of lakes and improve the water quality of lakes. More importantly, reasonable ecological water level regulation can show the beautiful landscape of the lake, enhance its leisure and ornamental value, and bring a positive impact on the local economy. Therefore, in the work of lake management and ecological protection, we should attach great importance to the importance of ecological water level regulation, and take scientific and reasonable measures to control the ecological water level, so as to realize the sustainable development of the lake ecosystem.

2. VARIETY AND DISTRIBUTION OF AQUATIC PLANTS

2.1. Main types and characteristics of aquatic plants

Aquatic plants are important components of lake ecosystems, which possess special morphological and physiological features adapted to the aquatic environment. According to their growth characteristics, these plants can be divided into standing water plants, floating plants, submerged plants and wet plants. Standing plants grow in shallow water or water, stem upright and straight, large leaves; floating plants float on the water, stem slender and soft, small and thin leaves; submerged plants completely into water, stem short, slender or silky leaves; and wet plants grow in wetlands or near the water, roots, can absorb water and nutrients in the soil. These aquatic plants play an important role in water ecosystems, providing food, habitat and nutrient cycling, as well as purifying water quality and improving the environment. Understanding the types and characteristics of aquatic plants is of great significance for the protection and management of lake ecosystems. Through the rational utilization and management of different types of aquatic plants, the health and stability of lake ecosystems can be maintained, and the diversity and ecological balance of aquatic plants can be promoted.

2.2. Distribution and habitat of aquatic plants in lakes

The distribution and habitats of aquatic plants in lakes are diverse, influenced by various factors such as water depth, light, nutrients and lake hydrological conditions. These plants are distributed in different areas of the lake based on their growth characteristics, from shallow to

deep water, from ample light to shaded environments, and from nutrient-rich to barren areas. Understanding the effects of these factors on aquatic plants can contribute to the better protection and management of lake ecosystems, and maintain lake ecological balance and biodiversity, thus realizing the sustainable development of lake ecosystems.

2.3. Differences between aquatic plants and terrestrial plants

Significant differences between aquatic and land plants in many ways. They grow in completely different environments, with aquatic plants growing in water and terrestrial plants in the soil. This environmental difference causes them to have very different ways of getting water and nutrients. In morphological characteristics, the leaves of aquatic plants are usually larger, flat or filamentary to accommodate the characteristics of the water flow, while the leaves of terrestrial plants are more diverse and thicker. Physiologically, aquatic plants have special ventilated tissues that can obtain oxygen from water and breathe through stomata, while land plants breathe and photosynthesis through stomata on leaves. These differences are the result of their adaptation to their respective living environments and also account for their different importance and role in the ecosystem. Understanding these differences may contribute to a better understanding of the ecological characteristics and biology of aquatic and terrestrial plants for the better conservation and management of different types of plant ecosystems.

3. EFFECTS OF WATER LEVEL FLUCTUATIONS ON AQUATIC PLANTS

3.1. Effects of water level fluctuation on the growth of aquatic plants

Water level fluctuation has a significant effect on the growth of aquatic plants. The physiological activities, photosynthesis, respiration and reproductive processes of aquatic plants are closely related to the water environment, and water level fluctuations have direct or indirect effects on these processes. Long-term water level fluctuations may cause growth obstruction, physiological dysfunction, and even death of aquatic plants. In addition, water level fluctuations may also inhibit photosynthesis or excessive drought, causing damage to aquatic plants. In terms of reproduction, specific water level conditions are crucial for the flowering and fruiting of some aquatic plants, and water level fluctuations may break these conditions and affect their reproductive ability. Therefore, in order to maintain the ecological balance and biodiversity of aquatic plants, we must deeply understand the influence mechanism of water level fluctuation on aquatic plants, and take scientific and reasonable measures for ecological protection and management.

3.2. Effects of water level fluctuation on the reproduction of aquatic plants

The effect of water level fluctuation on aquatic plant reproduction can not be underestimated. The change of water level is not only directly related to whether aquatic plants can blossom and plant smoothly, but also indirectly affects the quantity and quality of seeds, as well as the reproductive strategy of plants. Some aquatic plants are extremely sensitive to water level fluctuations and even require specific water level conditions to complete the reproduction process. Long drastic fluctuations in water levels may cause hindered plant reproduction, decreased seed quality and quantity, and may even force plants to adjust their reproductive strategies to a changing environment. In order to maintain the ecological balance and biodiversity of aquatic plants, we need to deeply understand the influence mechanism of water level fluctuation on aquatic plant reproduction, and take scientific and reasonable measures for ecological protection and management.

3.3. Effects of water level fluctuations on the community structure of aquatic plants

Water level fluctuations have profound and complex effects on aquatic plant community structure. As an important factor in water environment, water level not only affects the

distribution, richness and growth of aquatic plants, but also their reproduction and diffusion. Different plants have different adaptability to water level, so that water level fluctuations may change the distribution pattern of aquatic plants and affect the community richness and diversity. At the same time, water level fluctuations may also break the competitive balance among plants and affect the stability and diversity of communities. In order to maintain the health and stability of aquatic plant communities, we need to understand the mechanism of water level fluctuations on the structure of aquatic plant communities and take scientific and reasonable measures for ecological protection and management. Through rational lake management and scheduling, reduce the impact of water level fluctuations on the aquatic plant community structure and protect their ecological balance and biodiversity.

4. LAKE ECOLOGICAL WATER LEVEL REGULATION STRATEGY

As an important natural ecosystem, lakes play a crucial role in maintaining biodiversity, water resources supply and ecological balance. However, due to the influence of human activities and climate change, the water level of many lakes has suffered different levels of disturbance and damage. Therefore, it is of great significance to formulate scientific and reasonable lake ecological water level control strategies to protect the lake ecological environment.

4.1. The goal of ecological water level regulation

Ecological water level regulation is a complex process involving many factors. Its main goal is to maintain the health and stability of aquatic ecosystems, ensure the rational and effective use of water resources, and also take into account the needs of human activities. To achieve these goals, ecological water regulation needs to follow a series of principles.

Aquatic ecosystems are a complex biological community that includes aquatic plants, animals, and microorganisms. These biological communities are interdependent and interdependent, forming a stable ecological balance. Therefore, the regulation of ecological water level should minimize the impact on the ecosystem and avoid the destruction of this ecological balance. Specifically, it is necessary to meet the needs and adaptability of different organisms to meet the needs of their normal growth and reproduction. Water resources are an important basis of human production and life, and also an important part of the ecosystem. Therefore, the regulation of ecological water level should fully consider the sustainable utilization of water resources while meeting human needs. This includes the rational allocation of water resources, improving the utilization efficiency of water resources, and reducing the waste of water resources. Only on the premise of reasonable and effective utilization of water resources, can the long-term stability of the ecosystem and the sustainable development of human beings be realized. The influence of human activities on the ecosystem is inevitable, so the regulation of ecological water level should meet the needs of human activities and minimize the influence on the ecosystem.

4.2. The principle of ecological water level regulation and control

The ecosystem is an organic whole, and the various components are interdependent and mutually influential. Therefore, in the regulation of ecological water level, we should start from the whole, comprehensively consider the needs and adaptability of each component, avoid ignoring one and losing the other; follow the principle of integrity ecosystem is a dynamic process, which is constantly affected by various factors. Therefore, when regulating the ecological water level, the dynamic changes of the ecosystem should be fully considered, and the water level should be adjusted in time to adapt to the changes of the ecosystem.

The regulation of ecological water level needs to be established on the basis of science and master the laws and characteristics of the ecosystem through in-depth research and exploration. Only making decisions based on scientific data and analysis can ensure the effectiveness and

accuracy of ecological water level regulation. At the same time, we should continue to strengthen scientific research to deeply understand the needs and trends of the ecosystem, so as to provide scientific basis for the regulation of ecological water level.

4.3. Methods and techniques of lake water level regulation

There are various methods and technologies for lake water level regulation. According to different lake types and ecological environment problems, different regulation methods and technologies need to be adopted. By regulating the water level of the lake, meet the needs of different organisms and maintaining the ecological balance of the lake. For example, when the lake water level is too high, the water level can be lowered by releasing water and increasing displacement, and when the lake water level is too low, the water level can be raised by replenishing water and limiting drainage.

5. CHALLENGES AND FUTURE DEVELOPMENT DIRECTION OF ECOLOGICAL WATER LEVEL REGULATION

5.1. Challenges of ecological water level regulation

The impact of climate change: Global climate change leads to the increase of extreme weather events, such as heavy rain and drought, which brings great uncertainty to the ecological water level regulation. How to predict the water level change according to the trend of climate change and formulate the corresponding regulation strategy is a major challenge. With the development of social economy, the demand for water resources is increasing, leading to the increasing shortage of water resources in many lakes and reservoirs. How to realize the effective regulation of ecological water level while ensuring the water supply demand has become an urgent problem to be solved. Water ecosystems such as lakes and reservoirs are a complex and fragile system, in which biological, chemical and physical processes are intertwined. The regulation of ecological water level should not only consider the direct impact of water level, but also consider its indirect influence on other elements of the ecosystem. How to formulate a scientific and reasonable ecological water level control strategy on the basis of grasping the integrity of the ecosystem is a challenging task. At present, the management system and policies of many lakes and reservoirs are not perfect, which leads to many restrictions on ecological water level regulation in practical operation. How to establish and improve the relevant management system and policy system to provide a strong guarantee for the regulation of ecological water level is also a major challenge at present.

5.2. Future development direction

Scientific research is an important force to promote the regulation of ecological water level. In the future, we should further strengthen the basic research on water ecosystem and have a deep understanding of the interaction mechanism in hydrology, ecology and environment. Through the transformation and application of scientific research results, it provides scientific basis and technical support for the regulation of ecological water level. With the development of science and technology, more and more new technologies can be applied to the ecological water level regulation. For example, remote sensing technology, Internet of Things technology, artificial intelligence and so on. In the future, the application potential of these new technologies should be actively explored to improve the efficiency and accuracy of ecological water level regulation.

6. CONCLUSION

In the face of challenges such as climate change, water shortage and ecosystem complexity, the practice and case analysis of ecological water level regulation show that we need to further

strengthen scientific research, innovate technological means, strengthen international cooperation and exchanges, promote interdisciplinary cooperation, and improve relevant policies and regulations. Through these efforts, we can more effectively respond to the challenges of ecological water level regulation, and provide strong support for maintaining the ecological balance and sustainable development of lakes, reservoirs and other water bodies. In the future, we expect that the ecological water level regulation can play a greater role in addressing the global lake ecological environment challenges, and jointly protect our water resources and ecological environment.

REFERENCES

- [1] Wang Xiao. Study on the plant distribution pattern and water level fluctuation demand in the lower reaches of the Yangtze River [D]. Anqing Normal University, 2023.
- [2] Sun Zeyue, Jiang Cuiling. Study on the ecological water level of Xuanwu Lake based on aquatic phytoremediation [J]. *Technological Progress of Water Conservancy and Hydropower Technology*, 2023,43 (03): 49-54 + 76.
- [3] Yao Xiaochen. Effect of different water level environment on the growth of gray moss grass in Poyang Lake [D]. Jiangxi Normal University, 2021.
- [4] Wang Guoxiang, Wang Lei, Gao Yuxuan, etc. Water level fluctuation of rivers and lakes —— an important way of ecological regulation [J]. *Environmental Ecology*, 2020,2 (07): 1-7.
- [5] Wang Huake, Wang Cheng. Dynamic regulation mode of water level in Chaohu Lake [J]. *Zhihuai*, 2018, (08): 8-10.
- [6] Guo Wei, Gong Xusheng, Deng Xuwei and so on. Aquatic plant communities and succession in the middle and lower reaches of the Han River [J]. *Journal of Botany*, 2016,51 (06): 782-789.
- [7] Yao Xin, Yang Guishan, Wan Rongrong, etc. The influence of water level change on the vegetation in the wetlands of rivers and lakes [J]. *Lake Science*, 2014,26 (06): 813-821.
- [8] Wu Xiaodong. Effect of water level and harvesting on the growth of submerged plants [D]. Nanjing Normal University, 2012.
- [9] Wei Hua, Cheng Level, Wu Zhenbin. The effects of hydrological characteristics on aquatic plants [J]. *Modern Agricultural Science and Technology*, 2010, (07): 13-16.
- [10] Yang Yongqing. Experimental ecology of the effects of water level fluctuations on aquatic plant growth [D]. Wuhan University, 2003.