harmful algal blooms indicate that well-planned wetlands, riparian buffer zones, and reconnecting floodplains can reduce the episodic nutrient load brought by heavy rain, which is a key factor in triggering the "extreme situation" of cyanobacteria blooms (Figure 3) (Huang and Han, 2025).

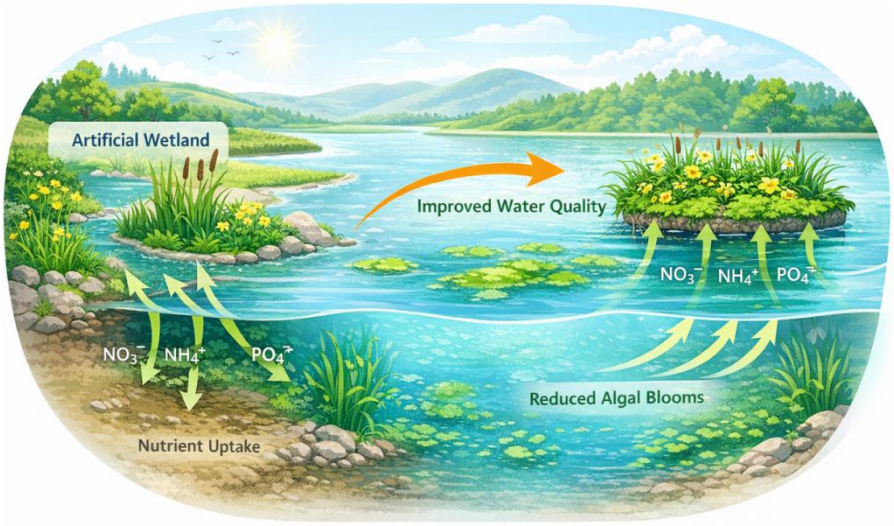

Figure 3 Schematic diagram of ecological restoration mechanism (Adopted from Huang and Han, 2025)

Artificial floating treatment wetlands and ecological floating islands are a type of biological treatment method that can be widely used. They are particularly suitable for application in lakes, especially in small water bodies in cities. In cities such as Baltimore, Boston and Chicago in the United States, the results of long-term pilot projects show that by harvesting the wetland plants grown on these floating islands, approximately 2 grams of phosphorus can be removed per square meter per year. At the same time, the ecological environment around these facilities has also changed, the number and species of large invertebrates, plankton, cyanobacteria and fish in the water have all changed. This indicates that the water quality and ecological environment have indeed improved (Nayak et al., 2025). Although the total amount of nutrients taken away by these floating islands from urban water bodies is not large, they can not only purify the water quality, but also provide habitats for aquatic animals, become an open ecological landscape for the public, and can be used as a test platform to help scientists determine how large the facilities should be built and how they should be designed. It can be said that it brings multiple benefits.

5.3 Typical management cases and regional experience

By comparing cases from different regions, it can be observed that the methods for dealing with algal blooms vary significantly in different areas, but some governance measures are applicable in multiple locations. Researchers analyzed 12 large and medium-sized eutrophic water bodies worldwide and found that most regions would formulate basin management plans based on local water quality standards and carry out governance through means such as regulation, economic measures, risk prevention, and public awareness campaigns. Even if these measures are implemented, algal blooms are difficult to be completely eradicated; they can only reduce the scale of the outbreak but cannot solve the problem at its root. For example, in North America and Europe, early measures relied on controlling nutrient levels to slow down algal blooms, but after the 1990s, due to climate warming and residual nutrients, toxic algal blooms reappeared. This indicates that merely reducing emissions is not sufficient; climate adaptation measures must also be combined (Qiu et al., 2024).

Various on-the-ground projects have also accumulated rich experience. The Domal acid incident caused by the pseudo-Nichols algae in the western United States in 2015 provided an important warning. Washington State, by establishing an early cross-departmental cooperation mechanism, had a higher acceptance rate among the public for fishing bans and risk information. After the Toledo drinking water crisis in Lake Erie in 2014, several international seminars reaffirmed the necessity of reducing emissions, restoring wetlands, and optimizing monitoring systems. The practices in coastal and inland areas have demonstrated that continuously advancing