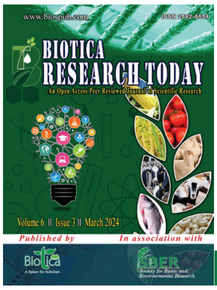
Bio. Res. Today 2024, 6(3):113-116



Biotica Research Today

e-ISSN: 2582-6654

March, 2024

Article ID: RT1592 Popular Article

Floating Wetlands: A Green Oasis for Urban Water Bodies

Jeevitha J.[1*], Akila A.[1], Aruna S.[1] and Sona B.R.[1]

Dept. of Aquatic Environment Management, Dr. MGR Fisheries College and Research Institute, Ponneri, Tamil Nadu Dr. J Jayalalithaa Fisheries University, Tamil Nadu (601 204), India

Corresponding Author

Jeevitha J.

: jeevithanadhiya@gmail.com

Conflict of interests: The author has declared that no conflict of interest exists.

How to cite this article?

Jeevitha *et al*., 2024. Floating Wetlands: A Green Oasis for Urban Water Bodies. *Biotica Research Today* 6(3), 113-116.

Abstract

Urbanization poses challenges for urban water bodies, prompting the adoption of innovative solutions like floating wetlands. These artificial structures mimic natural wetlands, proving effective in mitigating algal blooms, removing pollutants and providing habitat for diverse organisms. This article examines the construction techniques for Floating Treatment Wetlands (FTWs), which have a variety of uses including improving water quality, enhancing biodiversity, managing runoff and fostering community involvement. Naturally occurring plants, floating or supported, play a vital role as hydroponic mats, acting as natural filters. The integration of floating wetlands into urban water management is advocated as a sustainable approach, delivering benefits for water quality, biodiversity and community well-being. This harmonious blend in urban planning ensures a healthier and more vibrant future for urban water bodies.

Keywords: Wetlands, Biodiversity enhancement, Floating treatment, Urban water management

Introduction

Urbanization has brought about numerous changes to our landscapes and as concrete jungles continue to expand, the need for innovative and sustainable solutions to revitalize urban water bodies becomes increasingly crucial. According to World Water Assessment Programme, 80% of home sewage in developing nations is dumped into the Rivers, Lakes and Ocean. The receiving water bodies have higher concentrations of nutrients, organic matter and pharmaceutical and personal care products. To treat this one such solution gaining traction is the implementation of floating wetlands - artificial structures designed to bring the benefits of natural wetlands to the heart of our cities. Floating wetlands are artificial wetlands that utilize plants, typically native species. Researchers have shown that floating wetlands can help to mitigate algal blooms, remove nutrients and contaminants from water and provide habitat for various organisms, thus contributing to the overall ecological health of urban waterways. As these floating wetlands make it easier to remove organic contaminants and nutrients from existing water bodies without compromising their ability to store floodwater, they can be very helpful for the restoration of eutrophic urban water bodies.

Materials Needed

• *Floating Platform*: Buoyant materials, such as pontoons, foam blocks and recycled plastic bottles. Metal, plastic, or recycled wood for the frame. PVC pipes or alternative materials to provide extra buoyancy.

• *Water-Resistant Barrier*: To prevent soil from coming into direct touch with the water, line the top of the platform with a pond liner or thick plastic sheeting.

• *Growing Medium*: Substance that is light and rich in nutrients, such as peat moss, coconut coir, or a combination of these.

• *Plants*: Wetland vegetation that is adapted to floating conditions, including sedges, cattails, bulrushes and other natural aquatic plants.

• *Anchor System*: Anchors or tethers to keep the floating wetland in place and prevent it from drifting away.

Criteria for Constructing Floating Wetlands

Constructing a wetland involves creating a carefully designed ecosystem that mimics natural wetland habitats.

Article History

RECEIVED on 15th March 2024 RECEIVED in revised form 24th March 2024 ACCEPTED in final form 25th March 2024

Site Selection and Planning

A suitable location for the wetland could be selected considering factors such as hydrology, hydric soil, sunlight exposure and proximity to water sources. The size and shape of the wetlands vary based on the available space and desired objectives, whether it's for water quality improvement, habitat creation, or aesthetic enhancement.

Hydrological Design

Analyse the water flow and drainage patterns of the site to design an appropriate hydrological system. Features like berms, swales and channels have to be incorporated in the design for controlling the water flow as well as managing the water levels within the wetland.

Excavation and Shaping

The designated area has to be excavated to create depressions, pools, with varying depths that mimic natural wetland topography. Shape the wetland designed with shallower areas for emergent vegetation, deeper zones for aquatic plants and wildlife habitat and transitional zones between terrestrial and aquatic habitats.

Water Supply and Control

The source of water supply to the wetlands could be surface runoff, groundwater, or diverted water from a nearby water body. The water control structures such as weirs, culverts, or valves to be installed for regulating water levels and maintain a proper hydrology within the wetland.

Soil Preparation

If the soil is fertile and suitable for growth of aquatic plants and have good water retention capacity, this ensures optimal conditions for plant growth and nutrient cycling. If not so, soil amendments such as organic matter, perlite, biochar can be added then remove any debris, rocks, or contaminants from the soil to create a clean substrate for plant roots.

Planting

A diverse mix of native wetland plant species could be selected based on their suitability to the hydrology of the site and soil conditions. Based on their tolerance to water depth and duration of inundation, the plants have to be selected while planting proper spacing between plants should be ensured to allow growth and expansion of plants over time.

Establishment and Monitoring

During the establishment phase the wetland has to be monitored regularly to assess plant growth, water quality and wildlife utilization. Control invasive species and manage vegetation as needed to promote biodiversity and ecological function.

Maintenance and Management

Implement ongoing maintenance practices such as periodic mowing, weeding and debris removal to keep the wetland healthy and functioning optimally. Conduct routine inspections of water control structures and infrastructure to ensure proper operation and prevent potential issues.

Why Plants?

In FTW systems, naturally occurring plants are applied to the water's surface as hydroponic floating mats. According to Chen *et al.* (2016), these floating macrophytes encourage the hydraulic movement of water through the plants and below them, with the root system acting as a natural filter. The leaves and shoots of emergent plants in these systems grow above the water line, while the root system descends farther into the water column. The plants are placed in a buoyant mat suspended in a floating structure. The primary purpose of their design and operation is to eliminate various pollutants and nutrients, including N and P, from water (Chance *et al*., 2019).

Plants used in Floating Wetland

FTWs commonly consist of emergent vegetation growing on a mat or structure floating on the surface of a water body. These wetlands can include a variety of plant types, such as emergent, floating and submergent plants, each serving different ecological functions. Therefore, all three types of plants can be incorporated into floating wetlands to create a diverse and effective ecological system for water treatment and habitat enhancement.

Among the significant plants frequently found in floating wetlands are:

• *Phragmites australis,* or common reed, is a plant that is useful in floating wetlands to enhance water quality because of its capacity to absorb nutrients and pollutants from the water.

• *Typha latifolia* or Broadleaf cattails, are commonly utilised in floating wetlands because of their ability to filter out extra nutrients and impurities, thereby helping to purify the water.

• *Iris pseudacorus* or Yellow Flag Iris, is prized for its capacity to absorb heavy metals and other contaminants, which helps to enhance the water quality in floating wetlands.

• *Pontederia cordata* or pickerel weed, is a plant that is frequently found in floating wetlands. It is well-known for its ability to support aquatic life and increase biodiversity.

Construction of Artificially Created Floating Wetlands

In the construction of artificially created Floating Wetlands, plants can either float directly or be supported above the water surface through various methods:

• *Buoyant rafts*: A buoyant raft or framework that upholds a net or mesh containing soil or media, like coco-peat. This structure serves as a foundation for plant growth.

• *Artificial mats*: An artificial mat or matrix with inherent buoyancy where plants grow directly. This eliminates the need for additional support structures.

• *Rigid frames*: A rigid frame positioned just above the water surface, providing support for plant growth. This system demands a consistent water depth and is less suitable for Stormwater applications.

• *Suspended cables*: Cables suspended above the water surface that hold plant containers, allowing lateral plant spread. However, this system has limited adaptability to variable water depths and is not particularly well-suited for Stormwater applications.

• *Self-buoyant endogenous mats*: The development of a self-buoyant endogenous mat consisting of intertwined roots, rhizomes, plant litter and organic matter, akin to a natural floating wetland. Natural buoyancy is maintained through air within hollow or spongy roots and rhizomes, along with the entrapment of gas bubbles, such as methane, released from sediments (Hogg and Wein, 1988). In these cases, initiating self-buoyancy may require the provision of small buoyant structures or suspended cables, facilitating the development and expansion of the plant root and organic matter mat to cover the water surface.

Urban Water Benefits from Floating Wetlands

Benefits of floating treatment wetlands are given in figure 1; urban water managements are given in figure 2 and model of floating treatment wetlands are given in figure 3.

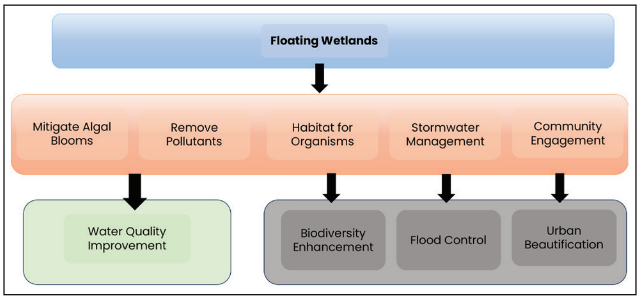


Figure 1: Benefits of floating treatment wetlands

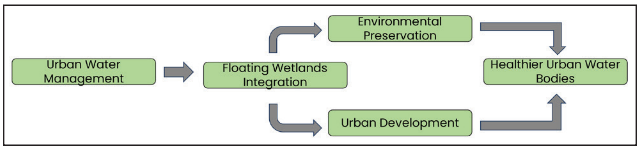


Figure 2: Urban Water Management

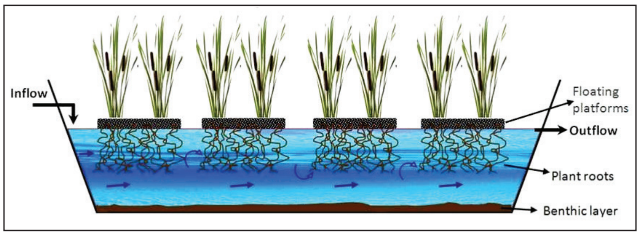


Figure 3: Model of Floating Treatment Wetlands (Source: Stefanakis, 2020)

The Need for Urban Water Revitalization

Urban water bodies often encounter issues such as habitat destruction, pollution and nutrient runoff. Traditional management methods may not be adequate to address these problems. However, floating wetlands offer a promising and environmentally responsible alternative that not only addresses environmental concerns but also enhances the overall urban environment.

Water Quality Improvement

The primary advantage of floating wetlands is their potential to function as natural filters. The plant life on these floating platforms absorbs and eliminates contaminants such as heavy metals, organic pollutant, pesticides, herbicides and excess nutrients.

Biodiversity Enhancement

For many different aquatic species, floating wetlands provide new habitats. The roots of the plants provide shelter for fish and other small creatures, fostering biodiversity in urban water bodies. By supporting a more balanced ecosystem, floating wetlands contribute to the resilience of urban aquatic environments.

Stormwater Management

In urban areas, stormwater runoff poses a significant threat to water quality as it carries pollutants into water bodies. It acts as buffers, capturing and filtering pollutants before they reach the main water body. This proactive approach to stormwater management helps to mitigate the impact of urban runoff on water quality.

Community Engagement and Education

Incorporating floating wetlands into urban water bodies presents a unique chance for community involvement. By actively participating in the design, construction and upkeep of these structures, residents can promote environmental stewardship and a sense of ownership. Moreover, communities can learn about the value of wetlands, water ecosystems and sustainable urban practices by using floating wetlands.

Aesthetic Value and Green Spaces

Beyond their ecological benefits, floating wetlands contribute to the aesthetic appeal of urban water bodies. These artificial islands can be designed with a variety of native plant species, creating visually pleasing green spaces in the heart of the city. Such additions not only enhance the urban landscape but also provide recreational opportunities for residents.

Conclusion

Floating wetlands (FTWs) are increasingly recognized as a transformative tool in urban water management, providing a sustainable and versatile approach for rejuvenating our water bodies. These innovative systems not only improve water quality through natural filtration, but also promote biodiversity by offering a habitat for various aquatic species. Moreover, FTWs effectively manage stormwater runoff, thereby minimizing the impact of pollutants on water quality. In addition to their ecological advantages, FTWs encourage community participation through involvement in their design, construction and maintenance, fostering environmental stewardship and educational opportunities. Furthermore, they enhance the visual appeal of urban landscapes, creating green spaces and recreational areas. The cost-effectiveness and scalability of FTWs further enhance their potential, making them suitable for implementation in a wide range of settings. In the future, research and development can explore the integration of FTWs with other green infrastructure components and the utilization of advanced materials for their construction. By embracing FTWs, we can establish healthier, more vibrant and resilient aquatic ecosystems in our cities, thus contributing to a sustainable urban future.

References

Chance, L.M.G., Van Brunt, S.C., Majsztrik, J.C., White, S.A., 2019. Short-and long-term dynamics of nutrient removal in floating treatment wetlands. *Water Research* 159, 153-163. DOI: https://doi.org/10.1016/j.watres.2019.05.012.

Chen, Z., Cuervo, D.P., Müller, J.A., Wiessner, A., Köser, H., Vymazal, J., Kästner, M., Kuschk, P., 2016. Hydroponic root mats for wastewater treatment - A review. *Environmental Science and Pollution Research* 23, 15911-15928. DOI: https://doi.org/10.1007/s11356-016-6801-3.

Hogg, E.H., Wein, R.W., 1988. The contribution of Typha components to floating mat buoyancy. *Ecology* 69(4), 1025-1031. DOI: https://doi.org/10.2307/1941258.

Stefanakis, A.I., 2020. Constructed wetlands: description and benefits of an eco-tech water treatment system. Chapter 25. In: *Waste Management: Concepts, Methodologies, Tools, and Applications*. (Ed.) Information Resources Management Association. IGI Global. pp. 503-525. DOI: https://doi.org/10.4018/978-1-4666-9559-7.ch012.