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Floating wetland islands as nature-based solutions for rural agriculture: A case study

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INTRODUCTION

Floating Wetlands Islands (FWI) support plant growth on floating platform, where roots are directly exposed to the water column, facilitating nutrient uptake and interactions with microbial communities through a system composed of floating support media and submerged root zones (Figure 1). This configuration enables crops to efficiently access dissolved nutrients while reducing fertilization requirements (Batista *et al.,* 2025). By integrating ecological and productive functions, FWIs can improve the quality of irrigation water, reduce pollution loads, promote biodiversity, and generate biomass with agricultural, forestry, or energy value, among other benefits (Carrillo *et al.,* 2026; Calheiros *et al.,* 2025). Due to their adaptability and low maintenance requirements, FWIs are particularly suitable for rural settings. Therefore, this study evaluates the feasibility of FWIs cultivated with lettuce as a nature-based solution to support sustainable agriculture and water management in a rural agrotourism context.

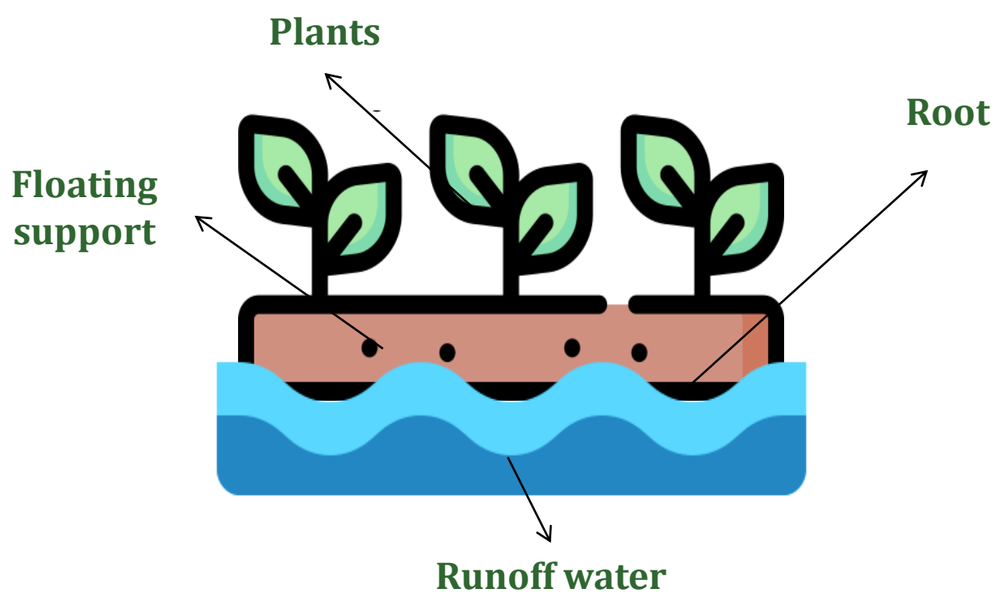

Figure 1. Structural scheme of the Floating Wetland Island (FWI) system

FWI DESIGN AND FEATURES

- Materials: PVC pipes and Plastic Net Cups Pots
- Substrate: Leca® L (10 - 20 mm), Specific gravity (275 kg/m^3)
- Area: 0.5 m^2 (1.0 x 0.5 m)
- Plant*: Lactuca sativa* var. crispa
- Growth period: 45-60 days
- Number of plants: 15 per raft
- Total number of plants: 45
- Plant density: 30 plants/m^2
- Plant area per raft ≈ 0.15-0.30 m^2
- Coverage ≈ 30-60% per raft

A CASE STUDY: IN RURAL AGROTOURISM

A FWI system was installed in an artificial pond at Paço de Calheiros, Ponte de Lima, Portugal, a rural landscape characterized by agriculture, forests, and agrotourism (figure 2). Water quality and lettuce performance were monitored throughout the cultivation cycle to assess the feasibility of FWIs as nature-based solutions for rural agriculture. By transforming underused water bodies into productive spaces, FWIs can support local food production, improve water quality, and enhance the environmental sustainability and ecological value of agrotourism sites. This ongoing work highlights the potential of FWIs for future integration into local agricultural water management strategies, nutrient recovery approaches, and multifunctional rural landscapes, contributing to enhanced environmental sustainability, resource efficiency, and climate resilience.

Figure 2. Experimental setup of the floating wetland islands at the study site.

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