

Green islands in blue lagoons: chances and research

Lagoons along the South Baltic Sea have been heavily impacted by humans for decades and too many nutrients have accumulated in the water and sediments. Therefore, actions have to be taken in order to achieve a good ecological status required by the EU Water Framework Directive. One option to remove the nutrients is phytoremediation and the use of 'active barriers' such as floating macrophyte islands.

EUTROPHICATED LAGOONS

Overly enriched water with minerals and nutrients, mainly nitrogen and phosphorus, can induce excessive growth of algae. So called eutrophication can consequently cause oxygen depletion, which can lead to a degeneration of the coastal environment with e.g. plant overcrowding, fish kills and odour issues. The origin of nutrient inputs are mainly from wastewater treatment facilities, runoff from land during rains and ice melting, farming and aquaculture.

FLOATING INSTALLATIONS FOR NUTRIENT MITIGATION

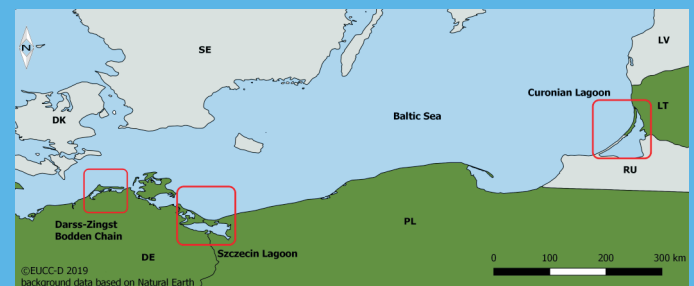
At floating installations, emergent macrophytes are planted on a floating matrix. The plant roots in the water column directly absorb nutrients such as phosphorus and nitrogen and incorporate them into their tissues through biosynthesis and release oxygen into the water. Furthermore, bacteria associated to the plant roots transform nitrate to molecular nitrogen which can leak as a gas from the Baltic Sea and cannot be used directly as a nutrient anymore. Moreover, the reduction of nutrients can directly facilitate the reduction of microscopically small algal biomass and growth. Additionally, due to shading of the water by the floating island, its temperature will be regulated and light availability for extensive algal growth will be limited.

FLOATING WETLANDS ARE A GENUINE ALL-ROUNDER

The green islands create diverse habitats for birds, insects and fish and can represent local biodiversity hotspots. There, protected red listed plant species can grow undisturbed and, at the same time, by integrating nice flowering species, the attractiveness of the location can be raised. Additionally, the islands' harvested biomass can be used as animal feed, fuel or building material (e.g. for thatched roofs or as insulating material). Also, floating islands attenuate wave energy and water flow and thus enhance particle settling and nutrient burial.

PILOT INSTALLATION SITES

Floating islands with emergent plants such as sedges, cattail, reed, yellow and sweet flag or purple and yellow loosestrife have been installed, maintained and harvested in different lagoons along the South Baltic since 2018. The plant roots of so called emergent macrophytes are in the water, but the leaves are above the water surface.



Floating macrophytes islands sites in LiveLagoons

Juodkrante and Nida (Lithuania)

In the Curonian lagoon close to Juodkrante, two islands each of approximately 32 m² were installed at the beginning of May 2019. Both islands' floating matrixes are made of recycled and UV-resistant hollow plastic (HDPE) pipes, which are covered with coconut coir fiber and fastened using a plastic (PP) mesh. Macrophytes like Common rush, Narrowleaf cattail, Flowering rush or Great manna grass were planted individually between extra hollow pipe spaces. Additionally, a net was placed as an active barrier in a small bay between two piers in Nida. The net, a custom-made floating rig with mesh size > 11 cm, 200 m length and 1 m height, placed at 1 m depth has its structure disposed at whole cross-section of the water column. Indigenous plants, such as Common reed (in flower ponds) and willow, were fixed to the net at a minimum spacing of 0.5 m. The floating barriers are expected to protect swimming areas from debris, seaweeds, erosion, excessive silt and sediment concentrations.

Wolin National Park (Poland)

The floating island in Poland is located in a marina on Wicko Lake, in Wolin National Park in the Szczecin lagoon. This floating, 24 m² matrix is of a similar construction to the island in Lithuania and was installed at the end of April 2019: Hollow HDPE pipes are covered with coconut coir fibres and a mesh of PP holds everything together. Emergent macrophytes like Lakeshore bulrush, Carex riparia, Broadleaf cattail and Iris pseudacorus were planted in the determined hollow spaces.

Born (Germany)

Two islands of 4 m² were installed in Born within a drainage flowing into the so called bodden water in April 2018 and 2019. One island's floating matrix is made out of thermowood. With this thermally modified spruce wood the durability and buoyancy is enhanced.

The other island is made of a stainless steel mesh which is filled with dry reed stems and hollow stainless steel buoys to enhance the buoyancy effect. Macrophytes such as the beautiful flowering Purple loosestrife and Yellow flag, but also Lesser pond-sedges and Lakeshore bulrush were pre-grown on coconut coir fibers mats and were laid on the floating matrixes.



Scheme of a floating macrophyte island

ABOUT THE PROJECT

The aim of this three years project is to improve water quality using floating wetlands and to create bathing conditions inside the South Baltic lagoons by reducing algal blooms and sediment resuspension. Coastal municipalities are supported by our project experts to find the best installation sites for the floating wetlands in order to maximize nutrient removal, gain additional aesthetic benefits to boost tourism and prevent spatial conflicts of use. Cross-border co-operation along the South Baltic coast will allow us to test both technological and socio-economical methodologies in different environments. LiveLagoons is supported by the Interreg South Baltic Programme 2014-2020 and co-financed by the European Regional Development Fund.

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