

AQUAPONICS: A SUSTAINABLE SOLUTION FOR FOOD PRODUCTION AND WATER EFFICIENCY



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Executive summary

TransFarm is a transborder collaborative project that fosters the adoption of aquaponics, a soil-less farming method, in the Baltic Sea Region. Funded by Interreg Central Baltic, the project demonstrates aquaponics in Sweden, Estonia and Latvia as well as tests alternative water sources such as rainwater and reclaimed greywater.

The experiences exchange from the different demos contributes to knowledge co-creation and the facilities will be the opportunity to inspire and educate future aquaponics farmers.

Drawing on lessons learned from the project activities in every participating country, we offer policy messages to promote the adoption of aquaponics in the Baltic Sea Region.

The challenge

There are several environmental and social challenges that the food sector has to face: Agriculture is a sector particularly affected by climate change, our seas are overfished and the world population is estimated to continue growing, being about 9,71billion people by 2050.

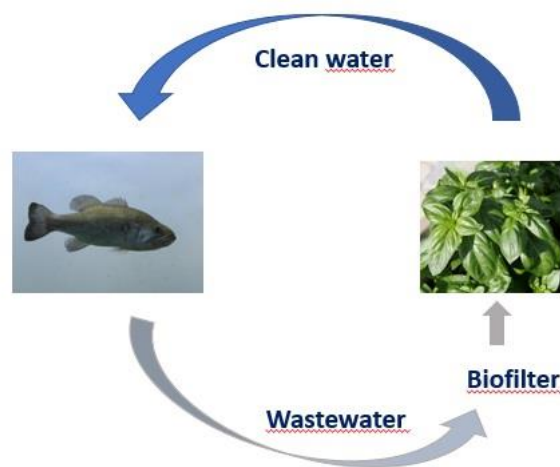
Countries in the Baltic Sea Region are strongly dependent on food import, especially for vegetables, fruit and fish; in recent years the pandemics and the war in Ukraine have exposed the need of more self-sufficient food systems. Moreover, agriculture and aquaculture are among the main contributors to the eutrophication of the Baltic Sea.

To answer these challenges TransFarm project wants to bring food production closer to consumers by promoting soil-less farming methods that can be implemented even indoors and allow to grow all year round. Examples of these methods are hydroponics, where plants are grown in water, and aquaponics, that combines hydroponics with aquaculture.

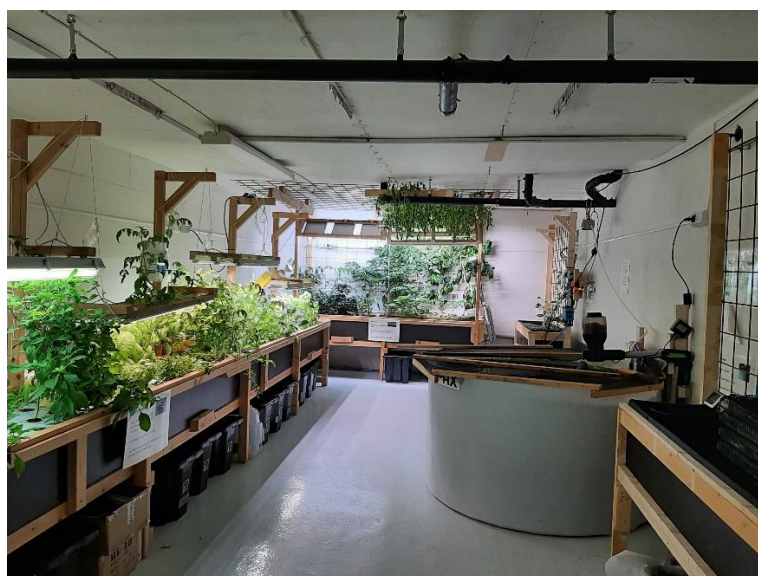
¹ UN DESA publications – World population prospects 2022

What is aquaponics

Aquaponics is a circular, closed-loop system, where water from the fish culture is used to grow plants. The fish waste within the water is microbiologically transformed by a biofilter, absorbed by plants and then cleaner water returned to the fish. The system is completely circular allowing nutrient reuse without emissions of nutrients in the environment. Since the fish, plants and microorganisms in an aquaponics system function in close symbiotic relationship, antibiotics or pesticides are not used, which in turn provides cleaner, healthier produce.



Aquaponics scheme



Source: Campus Roslagen's aquaponics demo, Norrtälje. D. Acquaviva, 2023

Evidence and benefits of aquaponics

Compared with traditional agriculture aquaponics provides the following benefits:

- Aquaponics, and in general soil-less methods, use only 10% of the water used in traditional agriculture (FAO, 2014);
- The harvest is 2 – 5 times higher (FAO, 2014);
- It allows to grow food closer to the consumers, in the city, and to use the unused space (e.g. abandoned barns or buildings);
- It fosters the creation of local jobs;
- Requires no pesticides nor antibiotics;
- Operates in controlled environment, ideal for Nordic climates

Relevance for the Baltic Sea Region

➤ **Environmental benefits:**

- Prevents nutrient runoff to the Baltic Sea;
- Encourages reuse of water and waste streams;
- Fits circular economy strategies at regional and municipal level

➤ **Educational and social impact:**

- Offers practical learning opportunities in rural schools and training centers;
- Supports youth engagement in green innovation and entrepreneurship

➤ **Economic potential:**

- Encourages small-scale, local food production close to consumers;
- Can be adapted to underused buildings, farms, or urban land;
- Supports diversification for farmers and new business models

TransFarm pilots' insights

In addition to these aspects, the TransFarm project is also demonstrating the use of alternative water sources in aquaponics: Harvested rainwater and reclaimed greywater. To be able to use reclaimed water to replace the quantity that goes lost because of evapotranspiration and plant adsorption is a step forward towards sustainability.

Researchers in Estonia are also testing how to reuse the sludge obtained from the aquaculture unit. Using the sludge as a growing media would make the system even more circular: In this way a waste material can be reused as a product, reducing the use of other material as growing media.

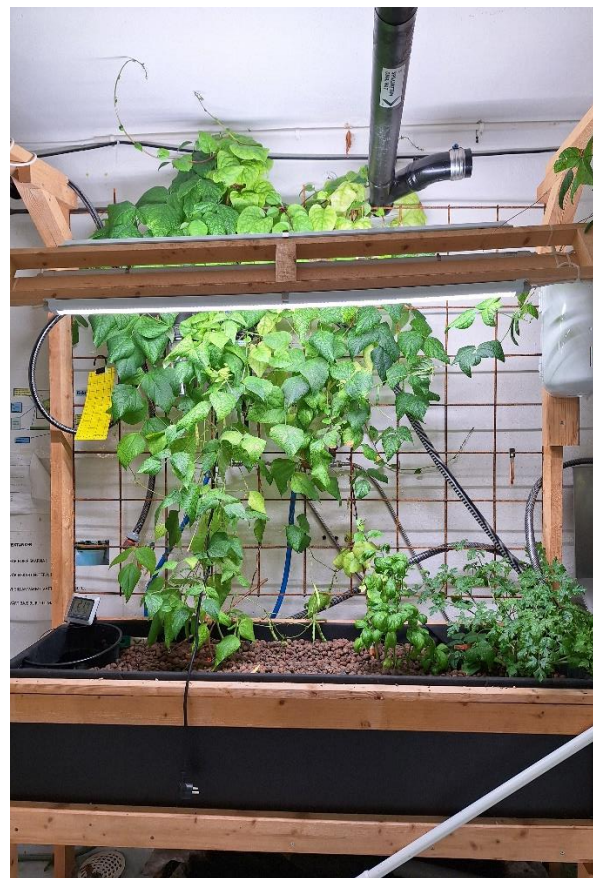
Another aspect relevant to the sustainability question is fish feed. TransFarm researchers are testing black soldier fly larvae as an alternative protein source for aquaponic fish feed. Conventional fish feed often relies on fishmeal and soy, both of which have significant environmental footprints—including overfishing and deforestation. By using insect larvae raised on food waste or organic side streams, the system becomes more circular and less dependent on imported or ecologically harmful inputs. There are several ongoing initiatives in the aquaculture sector across Europe that aim to make fish feed more sustainable, and TransFarm contributes to this effort by exploring locally available, low-impact feed solutions tailored to small-scale and decentralized systems.

Key policy messages

Aquaponics is a strategic fit for the Central Baltic region's goals: Reducing nutrient leakage to the Baltic Sea, creating resilient food systems, and fostering innovation in rural and urban communities alike. With policy support, aquaponics can become a model of sustainable production and cross-border learning within TransFarm and beyond.

To scale aquaponics as a regional innovation, we recommend that policymakers and stakeholders:

- ✚ **Support cross-border pilot projects** through EU, municipal or national funding
- ✚ **Include aquaponics in green transition strategies** and local development plans
- ✚ **Simplify regulatory pathways** for small-scale, recirculating food systems
- ✚ **Promote skills development and training**, especially for youth and rural entrepreneurs
- ✚ **Strengthen cooperation** between education, municipalities, and SMEs



Source: Campus Roslagen's aquaponics demo, Norrtälje. R. Nordin, 2025