Biomass Types
Policy Brief

Common reed as a potential biomass for symbiosis

This brief is a part of the Blue Green Bio Lab Tool Kit, that represents the findings in the Blue Green Bio Lab project. The project targets the urgent challenges of reducing nutrients to waters of the Baltic Sea Region, limiting greenhouse gas emissions and enhancing European self-supply with food, feed, and energy. Together, aquaculture, agriculture and industry can provide solutions to these challenges through industrial symbiosis based on the sustainable exploitation of local blue and green biomasses initially grown and/or harvested with the objective to produce positive ecosystem services. The Blue Green Bio Lab project is co-financed by Inter-Reg Baltic Sea Region with partners in Denmark, Latvia and Sweden.

Anda Ikauniece, Ph.D., Latvian Institute of Aquatic Ecology, Agency of Daugavpils University.

Description of common reed

The common reed (Phragmites australis) is a cosmopolitan, highly productive grass inhabiting the banks of rivers, lakes, ponds, marshes and also brackish waters like Baltic Sea (Picture 1). It is often the dominating species in the ecosystem it inhabits. Being so widely spread it has a capacity to adapt to various environmental conditions and thus can benefit from the changing climate. In Europe its height is about 2-3,5 m. The reed survives in temperatures from-14 to 27,5°C, while the optimal temperature is around 20°C. Temperature fluctuations induce increased shoot growth, however elevated CO2 levels do not have any specific impacts on shoots but rather below ground where more carbon is stored.

Picture 1. Common reed at the coast of a lake.

The natural salinity range for the reed is between 0 to 18 PSU, but it can change in prevailing local conditions. Reeds, originating from freshwater marshes or coasts, will decline in biomass and survival rate in saline conditions. In high nutrient concentrations the stems of reed may become weaker and more susceptible to mechanical damage, but there is also evidence that no negative effects are observed, and increased growth is recorded. In cases of flood conditions reed cannot withstand permanent flooding and especially juvenile stems have low flooding tolerance. The dynamics of floods determine the occurrence and growth of reed in lakes.

Reeds are considered an option for coastal protection from waves and surge damage during storms, increasing the efficiency of heavy metal removal from wastewater and as a phytoremediator to reduce high concentrations of phosphorus. The reed can remove also other pollutants and various nitrogen compounds from water environment successfully. Reed growth of one hectare can contain 10 kg of phosphorus, 100 kg of nitrogen, and a couple of tonnes of carbon.

Table of contents

Biomass Types

Policy Brief

Climate and environmental goals in the Baltic Sea Region

The European Union's Common Agricultural Policy (CAP) 2023-27 has recognized the need for a more sustainable agricultural sector in Europe. Shifting from drainage-based agriculture to paludiculture is one option and one of the biggest carbon farming game-changers of this decade. Paludiculture is the productive land use of wet and rewetted peatlands that preserves the peat soil and thereby minimizes CO2 emissions and subsidence. Food production might be limited, but high-quality biomass to use as fiber, construction materials, substrates in horticulture etc. can be produced in a potentially carbon-negative way. By rewetting just 3% of EU agricultural land, the EU can cut up to 25% of greenhouse gas emissions from EU agriculture and agricultural land use. Common reed is one of the crops suggested for paludiculture.

Like the European Union's aims for climate neutrality, the Baltic Sea region also has the goal to be a climate neutral region in 2050, according to the European Union Strategy for the Baltic Sea Region. The region has aims for clear water in the sea, rich and healthy wildlife, climate change adaptation, risk prevention and management. The Action Plan of the Strategy includes 9 actions in 3 policy areas, relevant for these aims. The emphasis of actions is on the reduction of nutrient emissions, recycling of nutrients, prevention of pollution and strengthening of a sustainable and circular bioeconomy.

The Baltic Sea Action Plan (BSAP), part of the Helsinki Convention, is the central framework for implementation of the strategy, with the overall objectives of good environmental status for the Baltic Sea by 2030. Actions and measures are designed to strengthen the overall resilience of the Baltic Sea, thus improving its ability to respond to the effects of climate change. The management objective of the BSAP with respect to eutrophication is to minimize inputs of nutrients from human activities. Such actions should help reach the desired state of the marine environment with concentrations of nutrients close to natural levels, clear water, algal blooms at natural levels, plants and animals with natural occurrence and distribution, and natural oxygen levels.

HELCOM Baltic Sea Regional strategy for Nutrient Recycling is another tool for improving nutrient use and reducing leakage to the Baltic Sea environment from agriculture. The Nutrient Recycling Strategy aims for closing nutrient cycles, reducing greenhouse gas emissions, improving soil quality and enhancing carbon sequestration. The circular use of nutrients should be safe and secure, based on the best available knowledge and should encourage new business models together with improved policy coherence. The Strategy has a list of possible measures in the form of tool box with ideas for nutrient recycling development in the region. The emphasis is on the use of organic fertilizers and nature-based solutions for achieving the objectives.

Climate and environmental goals for Skive Municipality and Zemgale Planning Region

This section looks at the translation of goals at the Baltic Sea level to the local scale, through the objectives and actions of two project partner regions of the Blue Green Lab project.

Skive Municipality in Denmark adopted a new climate action plan in 2022 with the goal of a 70% reduction in CO2 emissions by 2030 and climate neutrality by 2050. These climate targets are in accordance with international agreements and with national targets established for greenhouse gas reduction formulated in the Danish Climate Act. To reach the 70% reduction target by 2030, Skive Municipality must half their CO2 emissions per year by 2030, i.e., by 314,000 tonnes CO2/year. The large reduction in CO2 emissions up to 2030 in Skive Municipality is expected largely due to the development of the Power-to-X industry (PtX) in the Skive region and the transition of the agricultural sector.

Skive Municipality's goals aim toward significant CO2 reductions from land use and plant cultivation up to 2030. Removal of 30% of lowland soil will result in reduction of 24,000 tonnes CO2/year in 2030 and removal of 52% of lowland soil will bring a reduction of 42,000 tonnes CO_2/year in 2050. Skive Municipality has a number of wetland projects in the pipeline, including a major project on the Røddinge River with approximately 280 ha of lowland soil to reduce the leaching of nutrients from cultivated areas. Furthermore, the goal of conversion of 4% of agricultural land to forest by 2050 will provide a reduction of 11,000 tonnes CO_2/year in 2050.

Zemgale Planning Region has adopted a development programme for the period 2021-2027. Sustainable development is a horizontal priority in the programme to achieve climate, environmental and biodiversity goals in accordance with the European Union's Green Deal policy. "Environment, nature and climate change" is one of the development priorities. The programme emphasizes that the region's development requires smart and sustainable governance, the introduction of green development principles into management and everyday life, and adaptation to climate change.

The region aims for a reduction of CO_2 emissions from 230,229 t in 2020 to 190,000 tons CO_2 by 2027. Activities to reduce CO_2 emissions include increasing energy efficiency of buildings and using a larger share of renewable energy sources, though without any numerical targets mentioned. Better protection of biodiversity should occur through the enlargement of protected and forest areas, as well as the restoration of natural riverbeds. Adaptation to climate change is planned through the establishment of green and blue infrastructure and improving the environmental status of water ecosystems. Furthermore, the volume of inflowing nutrients with wastewater should be reduced from an estimated 3322 tons in 2019, though no numerical targets are given for 2027.

Options of biomass use for achieving the climate and environmental goals

The common reed could be a truly good biomass to use to reach climate and environmental goals. The ability of the common reed to capture CO_2 and store carbon was recently assessed at the coastal wetlands along the Southern Baltic Sea bordering land areas with various uses- arable land, woodland, pasture and urban. It was found that these wetland sites stored, on average, 17.4 kg C m^{-2} with large variability between sites, ranging from 1.76 to 88.6 kg C m^{-2}. It was also estimated that according to widths of the reed belts and carbon stocks at the sampled sites, approximately 264,600 t of blue carbon could be stored in the coastal reed belts along a typical lagoon system of the southern Baltic. Additionally, since 2020 a project on reed mowing has been initiated in Finland to reduce the nutrient loads to the water as the reed stores substantial amounts of nitrogen and phosphorous. Reed mowing thus removes nutrients from water decreasing the eutrophication and improving water quality. In areas where reed has been out competing other vegetation, mowing restores the previously more diverse landscape and improves biodiversity.

Harvested reed biomass provides a climate-friendly alternative for peat in the manufacture of growing substrates, drying agents, and absorbent materials. Reed has historically been used as roof material in coastal villages and can also be a substrate for building blocks (Picture 2). Furthermore, a 2004 study in Sweden proposes the harvesting and processing of reed for use in organic farming as fertilizer. The study concluded that this may be a particularly useful approach, where reed growth is dominating an ecosystem to the detriment of biodiversity and therefore harvesting will be beneficial for the environment and crop growth. Using reed as fertilizer can also be beneficial when reed growth is positive factor to help needed decreases in nutrient concentrations in water bodies.

Picture 2. A barn with reed roof in Kurzeme, Latvia. Photo: Andris Gertsons.

Interreg Baltic Sea Region | Co-funded by the European Union

Circular Economy Blue-Green Bio Lab

Biomass Types

Policy Brief

Relevant sources

Cun, D., Dai Y., Fan Y., Li, T., Song, X., Wang, F., Liang, W. 2022. Response of the common reed (Phragmites australis) to nutrient enrichment depends on the growth stage and degree of enrichment: A mesocosm experiment, Science of The Total Environment.
http://dx.doi.org/10.1016/j.scitotenv.2022.158098

Buczko, U., Jurasinski, G., Glatzel, S., Karstens, S. 2022. Blue Carbon in Coastal Phragmites Wetlands Along the Southern Baltic Sea, Estuaries and Coasts.
https://doi.org/10.1007/s12237-022-01085-7

Hansson, P.A., Fredriksson, H. 2004. Use of summer harvested common reed (Phragmites australis) as nutrient source for organic crop production in Sweden, Agriculture, Ecosystems & Environment.
https://doi.org/10.1016/j.agee.2003.08.005

Rodríguez, M., Brisson, J. 2015. Pollutant removal efficiency of native versus exotic common reed (Phragmites australis) in North American treatment wetlands, Ecological Engineering.
http://dx.doi.org/10.1016/j.ecoleng.2014.11.005

Coastal Reed Project.
https://johnnurmisensaatio.fi/en/projects/coastal-reed-project/

Opportunities for Peatlands and Paludiculture in the EU Common Agricultural Policy (2023-2027)
https://greifswaldmoor.de/files/dokumente/Infopapiere_Briefings/202111_Opportunities-for-paludiculture-in-CAP-1.pdf

European Union Strategy for the Baltic Sea Region.
https://www.eusbsr.eu/about/about

HELCOM. Baltic Sea Action Plan.
https://helcom.fi/baltic-sea-action-plan/

HELCOM. Baltic Sea Regional Nutrient Recycling Strategy.
https://helcom.fi/wp-content/uploads/2021/10/Baltic-Sea-Regional-Nutrient-Recycling-Strategy.pdf

Skive Municipality. Skive 2050: Klimahandlingsplan for Skiveegnen. 2021.
skive-2050-klimahandlingsplan-for-skiveegnen-enkeltsidet-04112022.pdf

Zemgales plānošanas reģiona attīstības programma 2021.–2027.
https://www.zemgale.lv/lv/media/98/download?attachment

Project facts

The Blue-Green Biolab project is co-financed by Interreg Baltic Sea Region.

Total budget: 499,399.60 Euro.
Project period: October 2022 - March 2024.

Homepage: https://interreg-baltic.eu/project/blue-green-bio-lab/

Lead partner: Energibyen Skive, Skive Municipality.

Contact person: Cathy Brown Stummann,
cstu@skivekommune.dk

Blue Green Bio Lab Partners:

Lysekils Kommun | Skive Kommune | Klimafonden Skive | Zemgale Planning Region | Latvian Institute of Aquatic Ecology | LEVA i Lysekil

Blue Green Bio Lab Associated Partners:

Food & Bio Cluster Denmark | Kurzeme Planning Region | innovatum science park | Chalmers Industriteknik | CBIO Aarhus University Centre for Circular Bioeconomy