



BUCEFALOS - BIUe ConcEpt For A Low nutrient/carbOn System –regional aqua resource management

LIFE11 ENV/SE/000839



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Project description:

Background

Aquatic environments hold large volumes of biomass, such as algae and reedbeds. These could be used as resources to promote a more sustainable management of aquatic biomass, for example, for energy production, animal feed, chemicals production, and water purification. A more sustainable management approach for aquatic biomass could serve to remove pesticides and heavy metals from water, to prevent eutrophication, and for storing nutrients and CO₂. Aquatic biomass resources are generally regarded as waste, mainly because of a lack of knowledge and strategies regarding appropriate resource management.

Objectives

The BUCEFALOS project's overall objective was to demonstrate a holistic approach for the regional coordination of sustainable resource management of aquatic biomass. The project aimed to do this through the implementation of innovative methodologies and technological applications for cultivating and harvesting mussels, on a full-scale demonstration site using vertical harvesting in the Baltic Sea. The project also aimed to restore wetlands and to establish algae cultivation sites with a view to cleaning freshwater and providing efficient yields of biomass for biogas production. A full-scale biogas plant was planned to utilise aquatic biomass, as an alternative to its disposal as waste.

Results

BUCEFALOS involved a collaboration between the city authority of Malmö, the regional authority of Skåne, and the city of Trelleborg, in southern Sweden. The project team demonstrated methodologies, tools and communication strategies with stakeholders, to achieve a regional coordination for the sustainable resource management of aquatic biomass.

The project established a demonstration mussel cultivation site, with vertical harvesting of mussels from innovative submerged artificial constructions attached to the pillars of the Öresund Bridge. The project demonstrated that it is feasible to cultivate mussels for nutrient reduction and biomass production. In total, the project established 13 wetlands (12 small and 1 larger). In addition, four different types of wetland were created for demonstration purposes next to the River Tullstorps. The project utilised innovative approaches to wetland construction, such as a two-stage ditch design. From this experience, the project team produced a technical report on wetland design for water purification and reed biomass production. BUCEFALOS created a microalgae facility near the wastewater treatment plant in Trelleborg, and produced a technical report on microalgae cultivation for cleaning effluents and producing algal biomass. This approach is being further developed in a national research and investment project.

The project built a full-scale demonstration biogas plant, for the production of biogas from aquatic biomass, near the Smyge wastewater treatment plant. A full production cycle was demonstrated, involving algae collection, transport, analysis, biogas process and the recycling of nutrients. A technical study was done for five aquatic substrates: mussels, beach-collected algae, wetland plants (reeds), microalgae grown in effluent at the Smyge wastewater treatment plant, and fish waste (cod) received from the coastal city of Simrishamn. The results indicated that none of the samples exceeded the SPCR 120 (Swedish voluntary certification system for digestate from biogas plants) certification values for heavy metals and pesticides in biofertilisers. The residuals from the process were spread on agricultural land, though the project's technical report on the mineral composition of substrates provides a basis for exploring alternative applications. To disseminate their findings, project staff attended around 38 conferences, made 15 project presentations, and organised study visits to BUCEFALOS demonstration sites. If the project's innovative solutions were to be mainstreamed, it would lead to more efficient means of nutrient reduction in aquatic environments. The mussel cultivation site resulted in an average biomass of 23.5 kg per m² for the most efficient and smallest (of 3 tested) mesh net size used. This equates to a total reduction of 176 kg of nitrogen and 17.6 kg of phosphorus from mussel-harvesting activities. The microalgae cultivation site resulted in above 90% phosphorus removal, and above 60% inorganic nitrogen removal from effluents. By the end of the project, the project's wetlands had produced a biomass of between 1 200 and 2 100 kg dry weight per hectare, which is expected to increase as the vegetation reaches its full potential. The biogas facility has, using beach algae, produced 85 l CH₄/kg VS (volatile solids).

The project demonstrated different methods for municipalities and regions to utilise existing aquatic biomass as a way of reducing the nutrient content in the aquatic system, while producing valuable products. The project therefore

contributes to achieving the goals of “good environmental status” set out in the Water Framework Directive (WFD). As a direct outcome of this and other similar demonstrative projects, the Swedish national water authority proposed that all coastal municipalities implement nutrient-reducing activities, such as the operation of mussel cultivation sites. These types of activity could also make a valuable contribution to the Baltic Sea Action Plan. Furthermore, producing biogas from aquatic substrates could contribute to the implantation of the Renewable Energy Directive, while reducing dependence on cultivation arable farmland for substrates.

Eutrophication along Baltic Sea coasts has several economic consequences, such as declines in tourism and property value. Methods to combat excessive nutrients therefore help municipalities’ combat this problem. As well as environmental benefits, the project methodology opens up new commercial possibilities. In the case of mussel cultivation, for instance, there is a potential for the production of environmentally-friendly fish or chicken feed. Although margins would be very tight, if municipalities reimbursed for the environmental service (i.e. nutrient-removal from water) provided by mussel cultivation sites, the margins would improve.

Further information on the project can be found in the project's layman report and After-LIFE Conservation Plan (see "Read more" section).

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Environmental issues addressed:

Themes

Energy - Supply

Water - Water quality improvement

Keywords

eutrophication, use of waste as energy source, wetland, biomass energy, water resources management

Target EU Legislation

- Climate Change & Energy efficiency
- Directive 2009/28 - Promotion of the use of energy from renewable sources (23.04.2009)
- Water
- Directive 2000/60 - Framework for Community action in the field of water policy (23.10.2000)
- COM(2012)673 -"A Blueprint to Safeguard Europe's Water Resources"

Natura 2000 sites

Not applicable

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Beneficiaries:

Coordinator	Skåne Regional Council
Type of organisation	Local authority
Description	City of Malmö is the local authority in the third largest city of Sweden. It is responsible for the provision of school, day care and care of the elderly, infrastructure, water and waste management and environmental control. It is also the authority responsible for urban planning, with the master plan as the main outline for future development.
Partners	Region Skåne, Sweden. Municipality of Trelleborg, Sweden

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Administrative data:

Project reference	LIFE11 ENV/SE/000839
Duration	01-SEP-2012 to 31-AUG -2015
Total budget	3,681,067.00 €
EU contribution	1,634,311.00 €
Project location	Sydsverige(Sverige)

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Read more:

Brochure	Title: Wetlands production brochure Year: 2014 No of pages: 2
Brochure	Title: Biogas brochure Year: 2014 No of pages: 2
Brochure	Title: Microalgae brochure Year: 2014 No of pages: 2
Project web site	Project's website

Publication: After-LIFE
Communication Plan

Title: After-LIFE Communication Plan
Year: 2015 No of pages: 4

Publication: Layman report

Title: Layman report Year: 2015 No of pages: 8

Publication: Technical report

Title: Project's Final technical report Year: 2015
Editor: City of Malmö No of pages: 65

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