# AquaMak – economic and ecological perspectives on using aquatic Macrophytes for energy production

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Funded by

# Type of Example & Status

- AquaMak is a publicly funded research project
  - Funded by the Federal Ministry of Food and Agriculture via FNR (Fachagentur für nachwachsende Rohstoffe e.V.)
- The project is ongoing (2014 – 2017)
- The project is run as a co-operation:

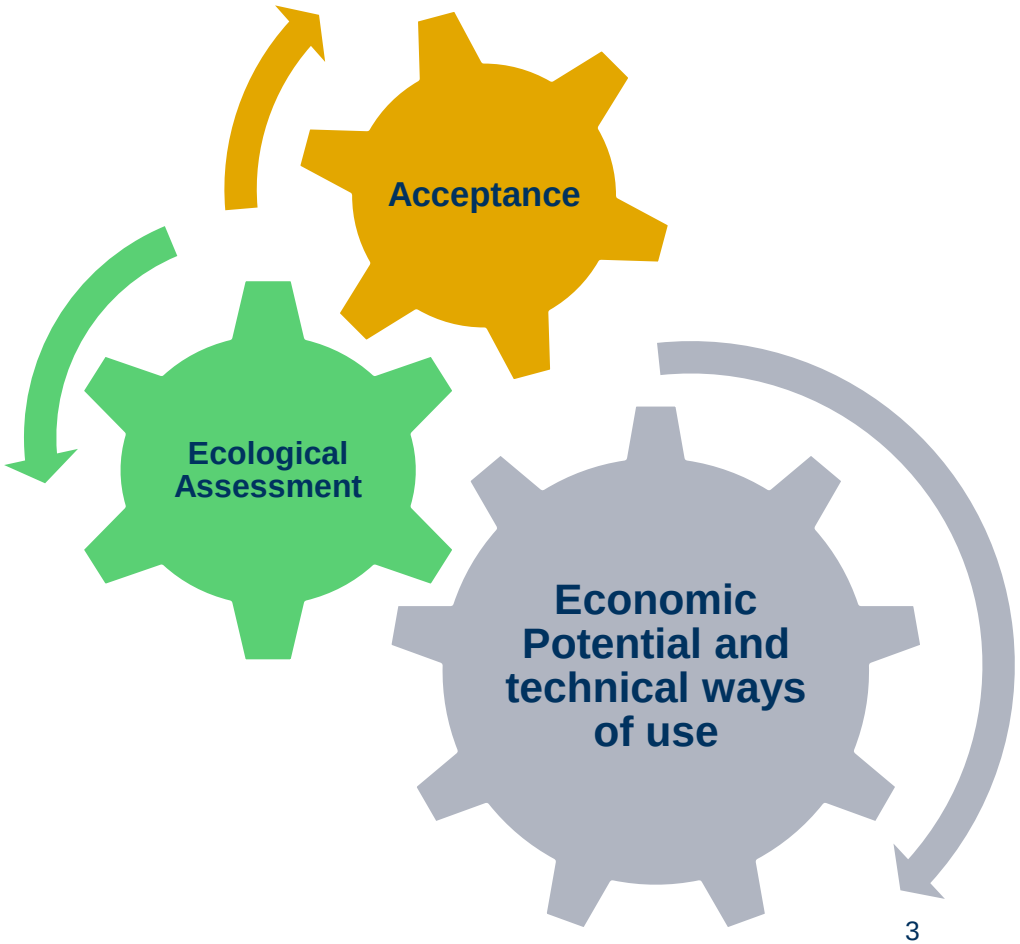
➢ Helmholtz Centre for Environmental Research (Leipzig)

➢ German Centre for Biomass Research (Leipzig)

➢ Nürtingen-Geislingen University, Institute for International Research on Sustainable Management and Renewable Energy (ISR) and Institute for Landscape and Environment (ILU)

# Project Goals

- To identify the economic potential and utilization options of aquatic macrophyte use (amounts, substances, possible ways of usage in biogas power plants, incorporation into existing supply chains)
- Ecological assessment of aquatic macrophyte usage
- Acceptance assessment of aquatic macrophyte usage for different utilization paths



# Positive impacts for water quality

- Removing nutrient overload, especially phosphate, which improves chemical water quality
- Ensuring adequate oxygen levels for water fauna
- Maintaining biodiversity and controlling neophyte dispersal (*elodea nuttalii*), thus keeping a functioning ecosystem and its services working

Source: Ruhrverband

Source: Prof. Albert Stoll, HFWU

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# Positive impacts for water availability

- Utilizing biomass from water plants for energetic purposes in biogas plants can improve water availability by replacing energy crops such as maize which require a large amount of water (1 to of dry matter of maize requires around 200 tons of water).
- Water availability in Germany is not a problem, rather flood protection. De-weeding of streams helps to ensure unhindered drainage.

# Main drivers for implementing the project

- Municipal  administration and agriculture
  - Flood protection and groundwater level management calls for regular de-weeding
- Hydro Power
  - Aquatic weeds rise maintenance costs and in extreme cases lower water availability
- Tourism (water sports & activities)
  - Aquatic weed mass growth is seen as highly damaging to tourism interests and touristic value of streams and lakes
- Fishery
  - Aquatic weeds are seen as both helpful as fish sanctuary and damaging as oxygen levels are lowered by degradation after mass growth
- Nature conservation
  - Strong interest in ecological balance, which includes conservation of habitats, water quality, containment of invasive species and maintenance measures

# Key enabling factors and limitations

- Biogas power plants
  + Low material costs, as aquatic biomass is mostly seen as waste
  + Some interesting substances (trace elements) that otherwise had to be added
  + Positive image of biogas power, as “waste” is used for renewable energy
  - Low dry matter content
  - Raw material with high water content
  - Raw material unfit for ensiling, but a mix with straw and additives shows promising results
  - Logistics problems as occurrence and needs do not necessarily match
  - No steady flow of input material, as “production” is not managed

- Cosmetic industry

  Use of aquatic weeds as source material calls for consistent material quality and composition, which is problematic as it can not be controlled on-site

- Generally, excessive growth of water plants costs about 100 M € each year in Germany

# Achieved outcomes so far (Project is still ongoing)

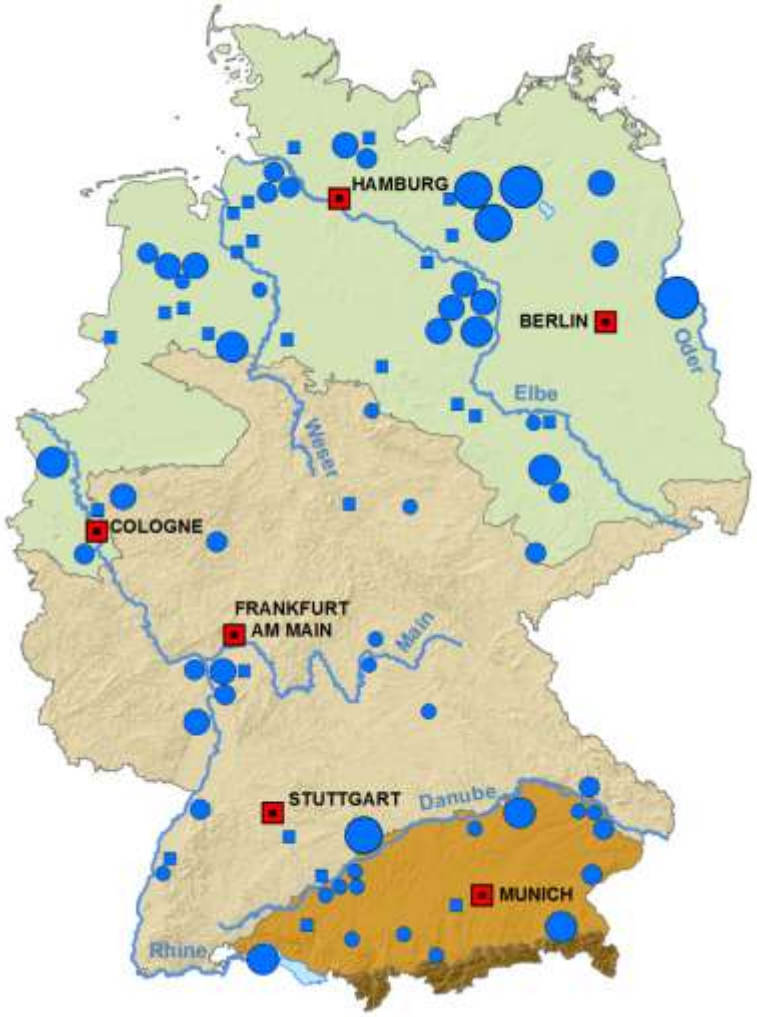
- Nation-wide survey (Germany) of 900+ stakeholders
  - Excessive growth is seen as a problem by many stakeholders

  <u>Economic assessment:</u>
  - Costs for de-weeding are high
  - Ways of usage have not been fully developed so far

  <u>Acceptance assessment:</u>
  - Conflicts of interest are manifest

- Material testing
  - Aquatic biomass shows promising first results in silage test combined with straw (30/45 % of silage dry matter)
  - High buffer capacity needs adequate ensiling

# Overview of Survey results




**Harvested Aquatic Macrophyte Biomass**

- unknown
- up 1 to
- > 10 to
- > 50 to
- > 150 to
- > 500 to
- > 1000 to

**Natural Regions of Germany**

- The North German Plain
- The Central Uplands
- The Alpine Foreland
- The Alps

Sources:

Nation-wide AquaMak survey

Natural Regions of Germany © Federal Agency for Nature Conservation 2012

Digital Landscape Model 1:250,000 © GeoBasis-DE / BKG 2014

Digital Terrain Model Grid Width 200m © GeoBasis-DE / BKG 2015

Map designed by: Dipl.-Ing (FH) Sandra Roth (ILU)

# Main challenges encountered

- Three main challenges for harvesting and utilizing water plants in biogas processes:
  - low dry matter content
  - ensiling water plants
  - nature-conservation and potential ensuing issues of public acceptance of harvesting water plants

# Potential for scaling-up and replicability

- Demand-side potential in Germany is high, other countries e.g. France are evolving in the biogas sector
- Technical problems can be solved
- Supply side in Germany is limited, as so far no supply-side management is planned, this could be different in other countries
- Aquatic biomass cultivation could improve water quality (de-eutrophication) but lead to conflict, as there are already a multitude of stakeholders involved

# AquaMak Research Team

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