Deutsches Biomasseforschungszentrum
gemeinnützige GmbH

DBFZ

Water plant management for improved water quality and energy recovery

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1 Introduction

Germany:

169.982 km streaming water and **15.653** of bodies of standing water with an area of **388.170 ha** [1]

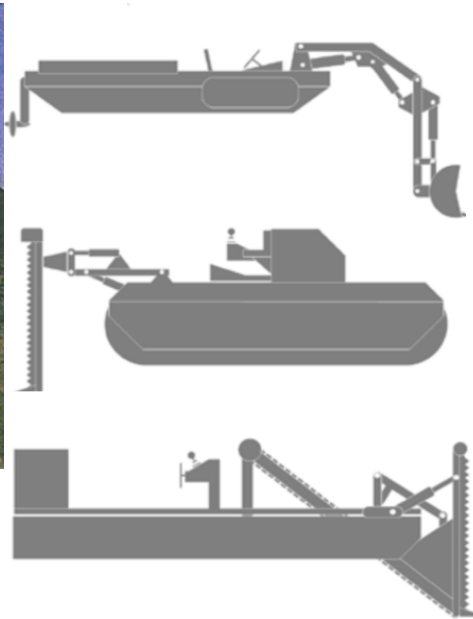
currently no nationwide data about weed control

O_2-consumption during the night by **submers macrophytes** at 250 gDM/m^2 can lead to dangerous low O_2-concentrations [2]

2 Current situation

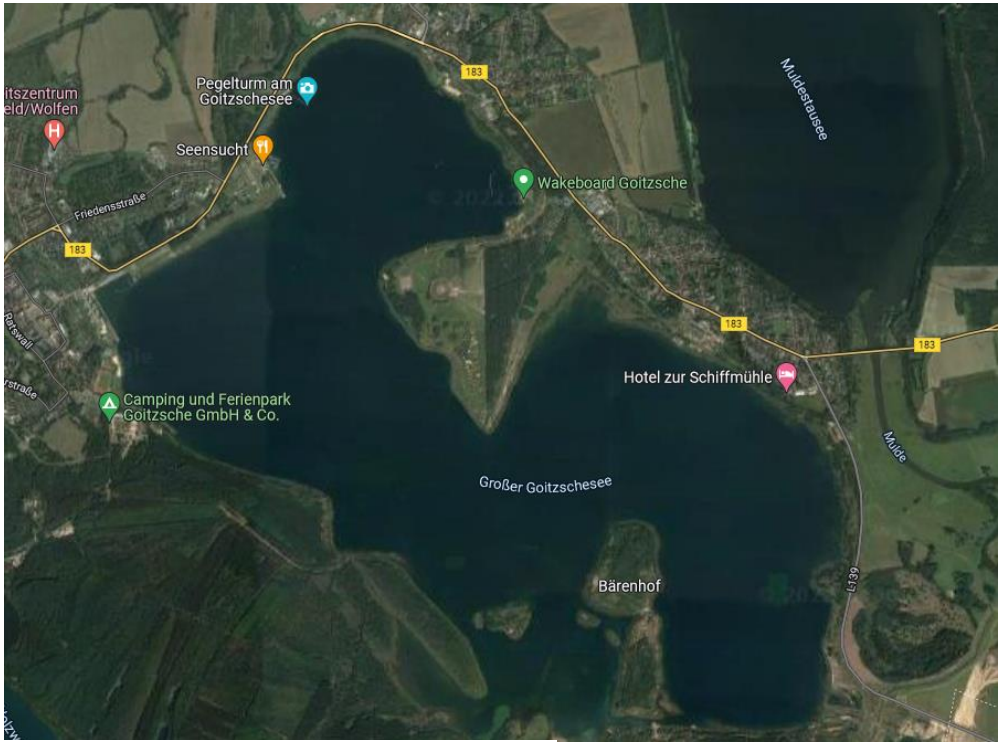
-eutrophication, alien invasive species leads to excessive water plant growth
-water plant management basicaly general removal if necessary
-often complete removal of water plants via use of havy diesel-driven harvesting techniques
→ currently development of a new efficient harvesting technique (non-fossil-driven) at the DBFZ
-gained biomass brought to composting plants or left at shore (re-eutrophication)

picture: water plant management action on a canal [3]



picture: scheme of motor-driven harvesting techniques used on water [4]

Case example: the Goitzschesee



topview of the Goitzschesee [Google-Maps]

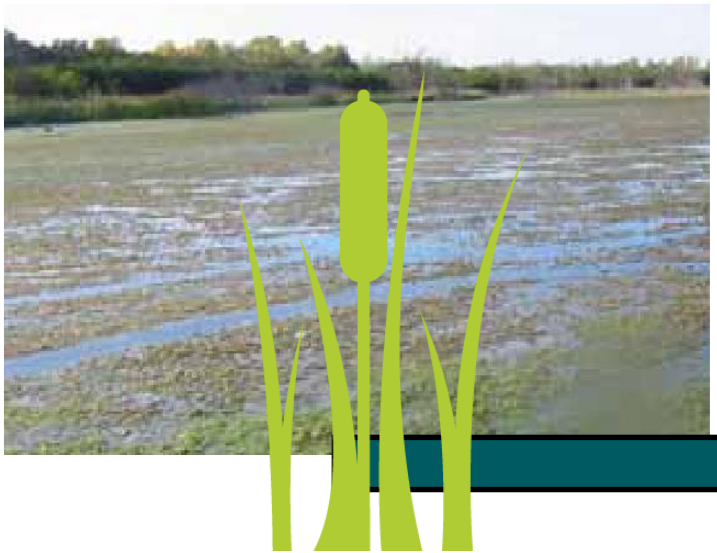
area: **13,3 km²**
area covered with water plants: **3,99 km²**

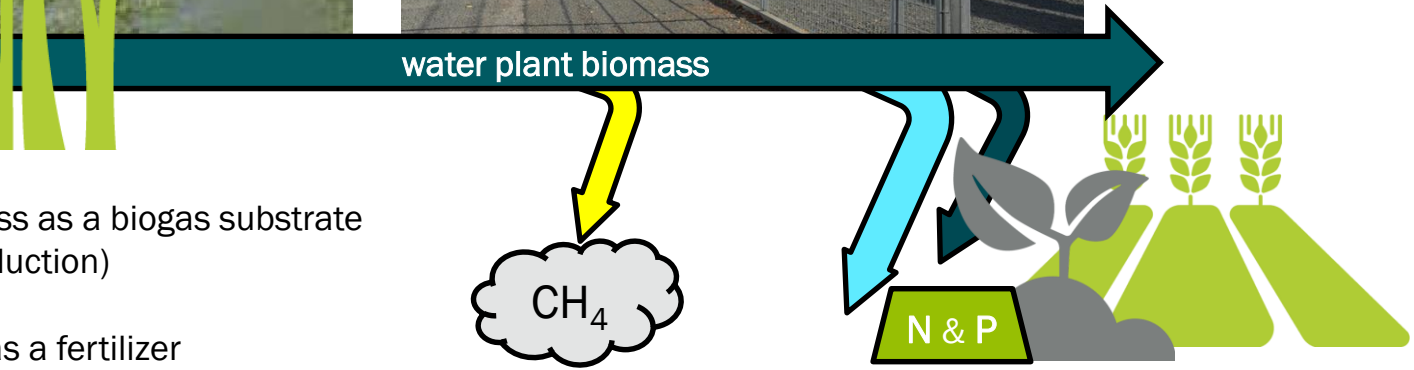
solid data base on water plants

mainly occuring water plant: *Elodea nuttallii*
(ø 26.000 t/y)

picture: Elodea nuttallii [5]

general idea:





→ use of water plant biomass as a biogas substrate (additional biomethane production)

→ digestate (N, P-content) as a fertilizer

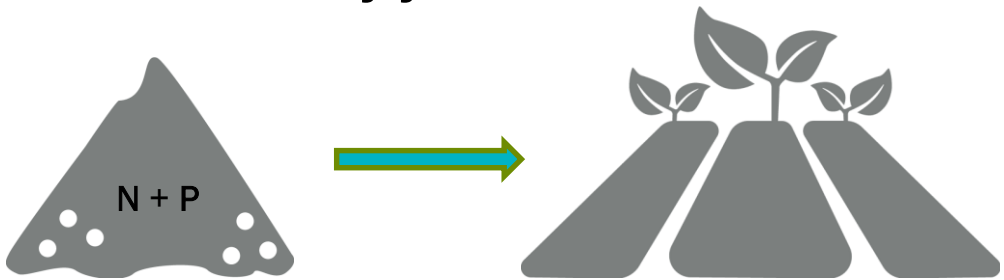
picture: water plant biomass from the Goitzschesee can be used in biogas plants (image: Bilddatenbank DBFZ, [5])

3.2 Withdrawal of nutrients

P-content: 0,23 %DM [ø dry matter content (DM) of *Elodea Nuttallii*: 8,2 %]

N-content: 3 %DM

→**4,8 t P and 63 t N every year!**



3.3 Energetic value

average plant mass harvested: 26.000 t (per year)

mean dry matter content (DM): 8,2 % → 2.100 t

organic dry matter content (oDM): 65 % → 1.365 t

biomethane potential (BMP): 250 m^3/t_{oDM}

→341.250 m^3 CH_4

comparison:

benchmark substrate –maize silage

BMP: 325 m^3/t_{oDM} oDM: 80 % DM: 30-35 %

→ substitution of 3.880 t maize per year

4 Conclusions

-reduction of costs (shorter paths of transport to biogas plants than compost facilities) possible

-permanent outtake of nutrients on regular base can lead to better water quality (reduction of eutrophication, better redox potential)

-additional value by using water plant biomass as a biogas substrate (heat and electricity)

-substitution of the benchmark substrate maize silage

5 Outlook

-currently development of new water plant management techniques (sustainable, zero-CO_2)

-closing of nutrient cycles

-step forward to zero-waste stategies

-contribution to a new bio-economy

Sources

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[2] Jorga, W.; Weise, G. (1978): Beziehungen zwischen Kohledioxidgasstoffwechsel submerser Makrophyten und Sauerstoffproduktion in langsam fließenden Gewässern. In: Acta Biochem. Hydrobiol. 6: 199-266
[3] DVWK_224-1992_Merkblätter_MaschinelleGewässerunterhaltung, DK 627.1.004.58 Gewässerunterhaltung, DK 574 Ökologie; Verlag Paul Parey
[4] Stoll, A.; Bayer, H. (2017): Arbeitswirtschaftliche Untersuchungen von Mähbooteinsätzen in Stillgewässern, in: LANDTECHNIK 72(4), 2017, 165–175
[5] Zehnsdorf, A., Moeller, L., Stärk, HJ. et al. The study of the variability of biomass from plants of the Elodea genus from a river in Germany over a period of two hydrological years for investigating their suitability for biogas production. Energ Sustain Soc 7, 15 (2017).

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