Paludicultures for fens in Bavaria - establishment, climate relevance & environmental effects, utilisation possibilities and economic efficiency (MOORuse)

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Dr. Tim Eickenscheidt , Carla Bockermann &
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- **What** is the MOORuse project ?
- **How** to establish paludicultures ?
- **What** is the climatic relevance ?
- **Which** utilization options are available?
- **What** is the economic efficiency ?
- **What** has to be studied further ?

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MOORuse

Paludiculture on fen peatlands in Bavaria

Plant establishment, climate impact and environmental effects, utilisation and economics

- 2016-2022

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Europäische Union
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regionale Entwicklung

EFRE
BAYERN 2014 – 2020
www.efre-bayern.de

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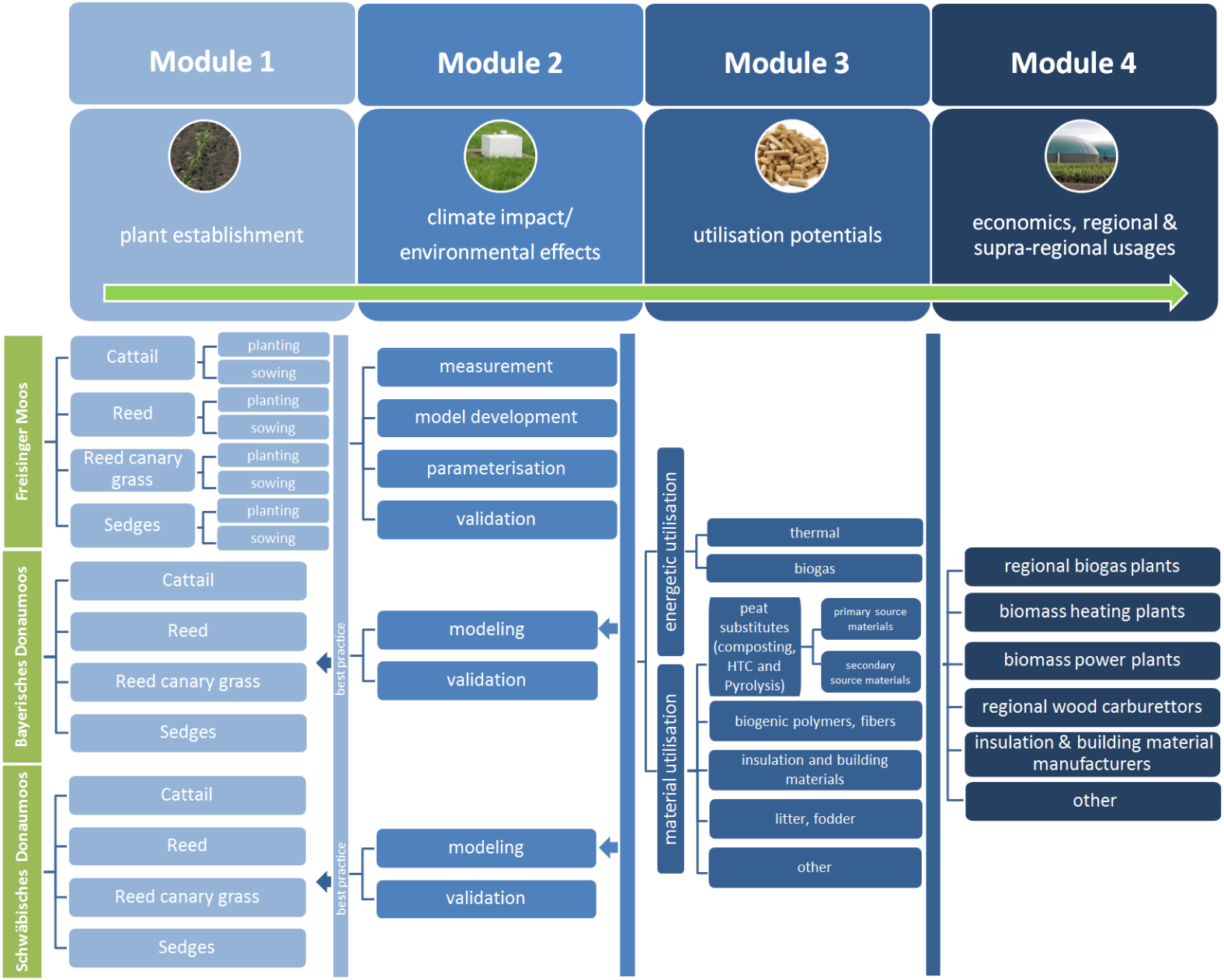
Module 1
Module 2
Module 3
Module 4
plant establishment
climate impact/
environmental effects
utilisation potentials
economics, regional &
supra-regional usages
Freisinger Moos
Cattail
planting
sowing
Reed
planting
sowing
Reed canary grass
planting
sowing
Sedges
planting
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Bayerisches Donaumoos
Cattail
Reed
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Sedges
Schwäbisches Donaumoos
Cattail
Reed
Reed canary grass
Sedges
best practice
best practice
measurement
model development
parameterisation
validation
modeling
validation
modeling
validation
energetic utilisation
material utilisation
thermal
biogas
peat substitutes (composting, HTC and Pyrolysis)
primary source materials
secondary source materials
biogenic polymers, fibers
insulation and building materials
litter, fodder
other
regional biogas plants
biomass heating plants
biomass power plants
regional wood carburettors
insulation & building material manufacturers
other

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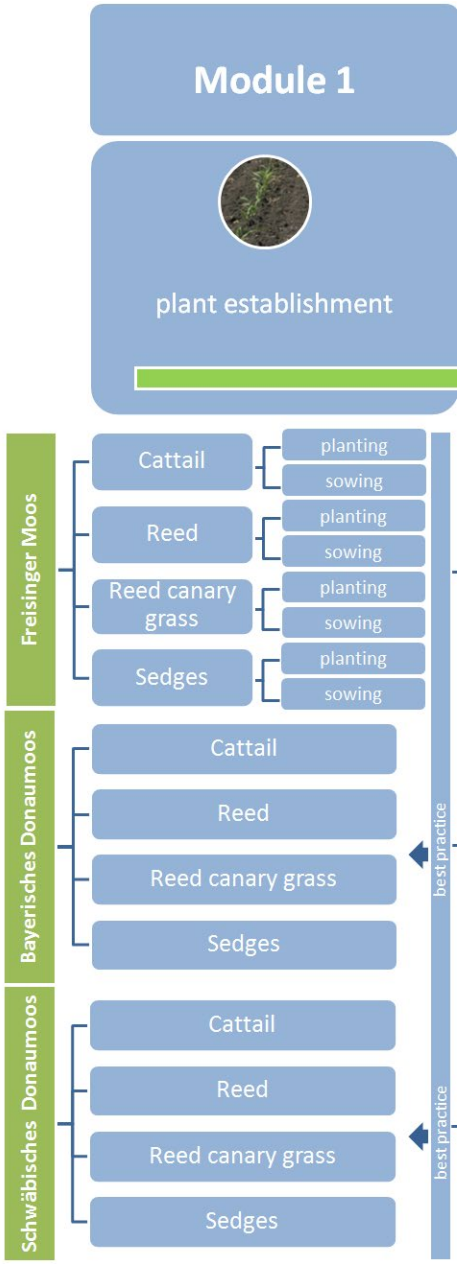
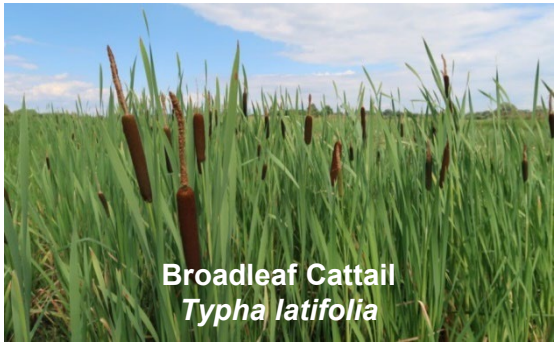
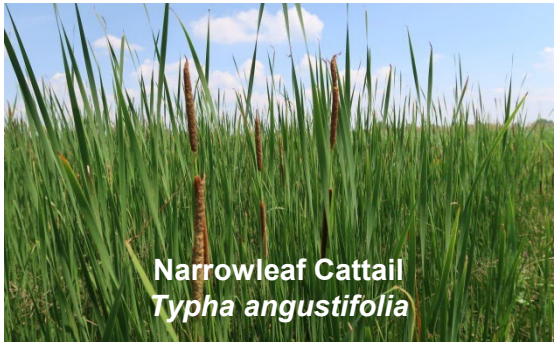


6 different Plant species





WEIHENSTEPHAN · TRIESDORF
University of Applied Sciences

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Samen und Pflanzen
für naturnahes Grün

GUIDELINE FOR THE ESTABLISHMENT OF FEN PALUDICULTURES

T. Eickenscheidt, J. Krimmer, M. Drösler

Available at researchGate

https://www.researchgate.net/publication/372627906_Guideline_for_the_establishment_of_fen_paludicultures#fullTextFileContent

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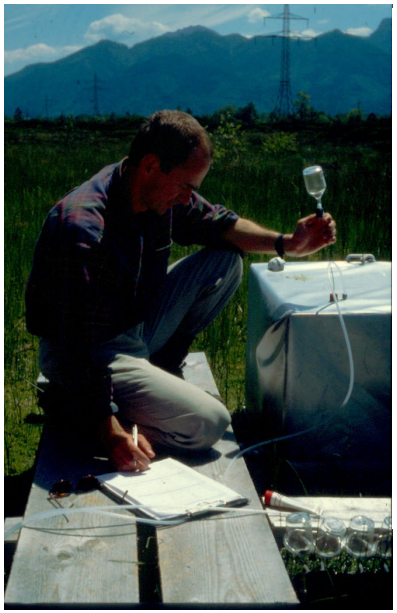
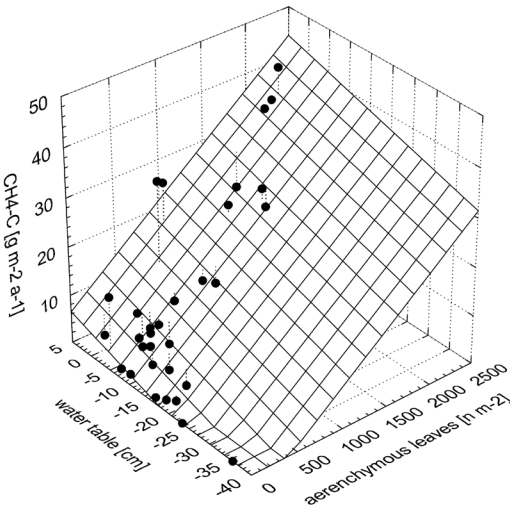
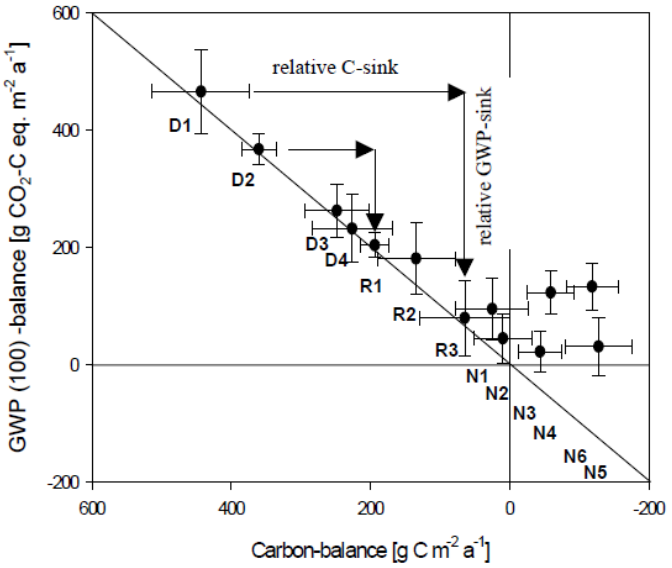
PSC - History

- **GHG-measurements and Modelling - Kendlmühlfilze 1999/2000**



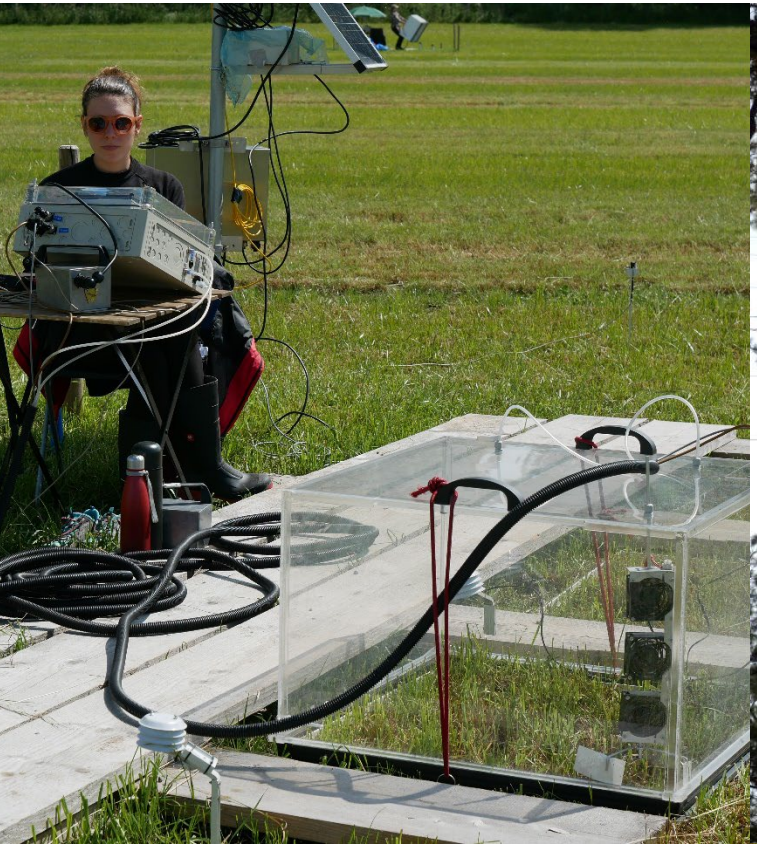




(Drösler 2005)

GHG-database - Bavaria

- Measurements since 1999
- Covering almost all landuse types on bavarian peatlands
- Manual chambers, Eddy-Covariance, automated chambers
- More than 160 site years with complete CO_2, CH_4 and N_2O balances
- Including ancillary data (climate parameters, water-table, soil)

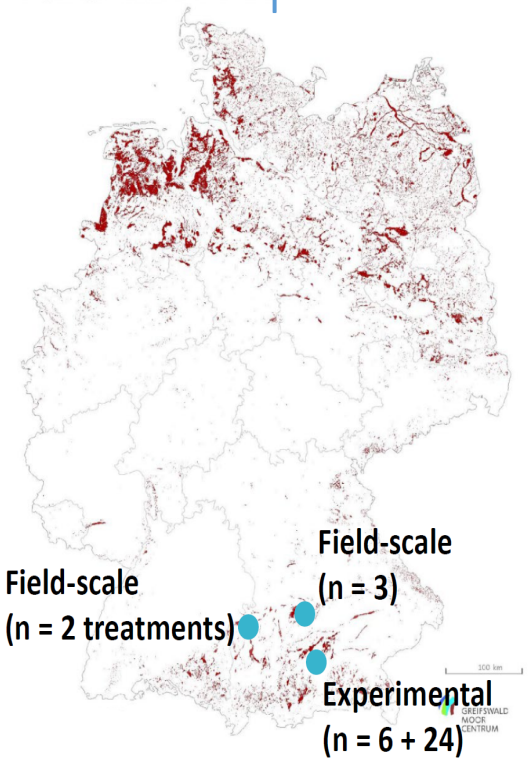


Module 2

climate impact/
environmental effects

- measurement
- model development
- parameterisation
- validation
- modeling
- validation
- modeling
- validation

Field setup to determine mitigation potentials of paludicultures



- 3 field sites: fen peatland formerly drained for cropland or grassland
- 5 paludiculture plants (with different management in *P. arundinacea*)
- Rewetting: active pumping and/or blocking drainage
- Water tables: ~constant or fluctuating spanning mean annual GWL of −22 to +4 cm

Methods

GHG quantification

CO_2 , CH_4 and N_2O

- manual chamber measurement to capture spatial variability
- automated chamber measurements to capture temporal dynamics
- Auxilary data
  - air and soil temperatures, PAR, GWL
  - vegetation indices, **biomass yield** and soil analyses (and fertilizer Corg analysis)

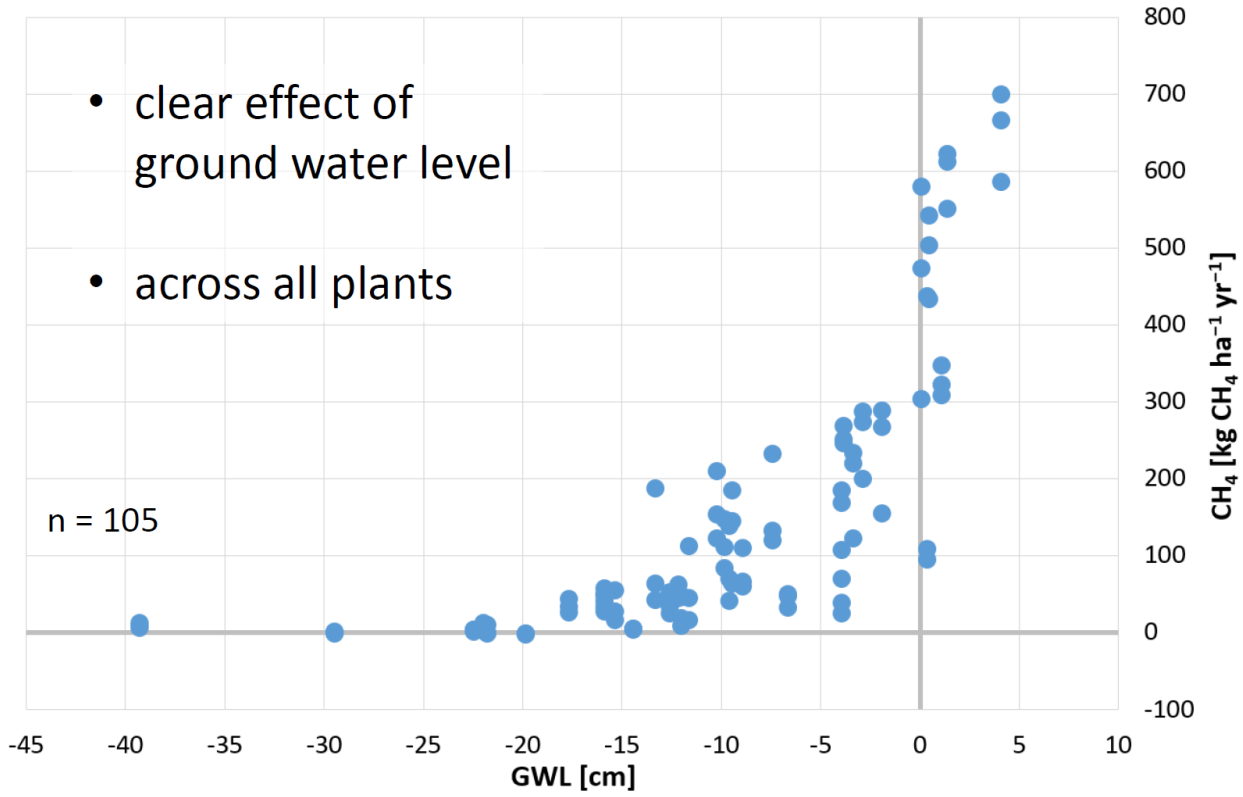
GHG balance: GWP100 (IPCC AR4 / NIR 2022) =

CO_2 + CH_4 + N_2O + C exports and imports

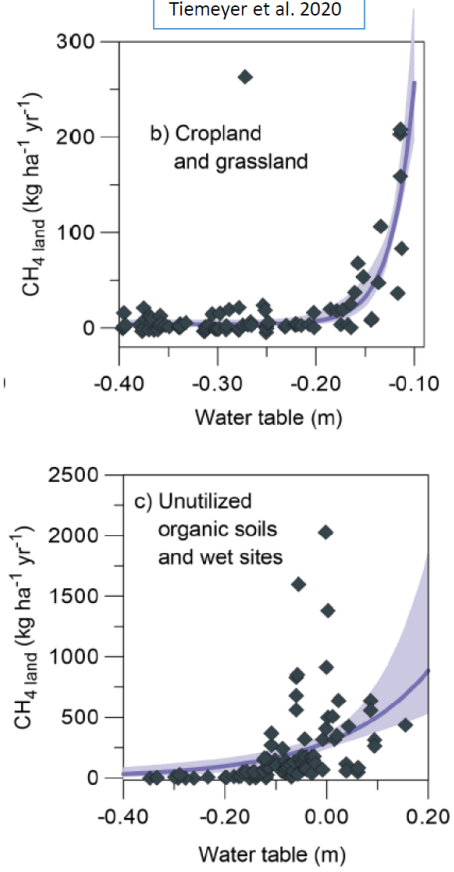
Results & discussion CH_4 annual balances

- clear effect of ground water level
- across all plants

n = 105



Tiemeyer et al. 2020

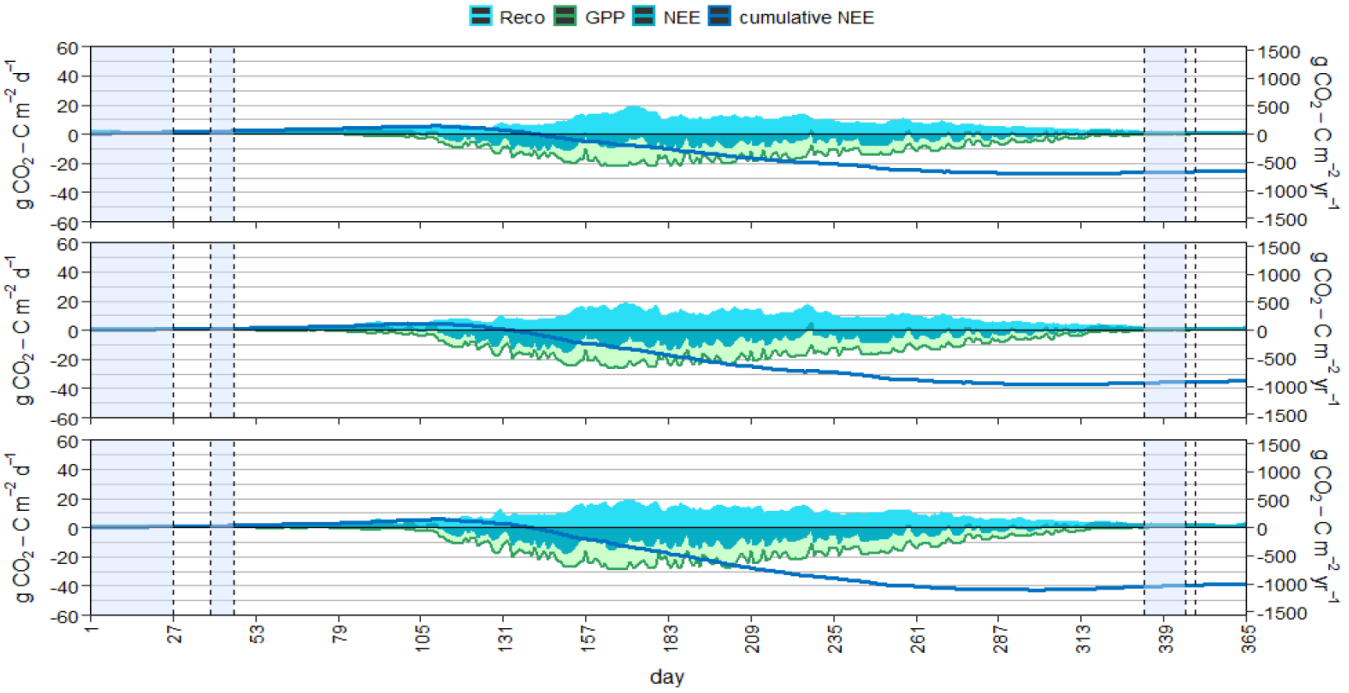


Results & discussion CO_2 timeseries & balances – autochamber *Carex acutiformis* example

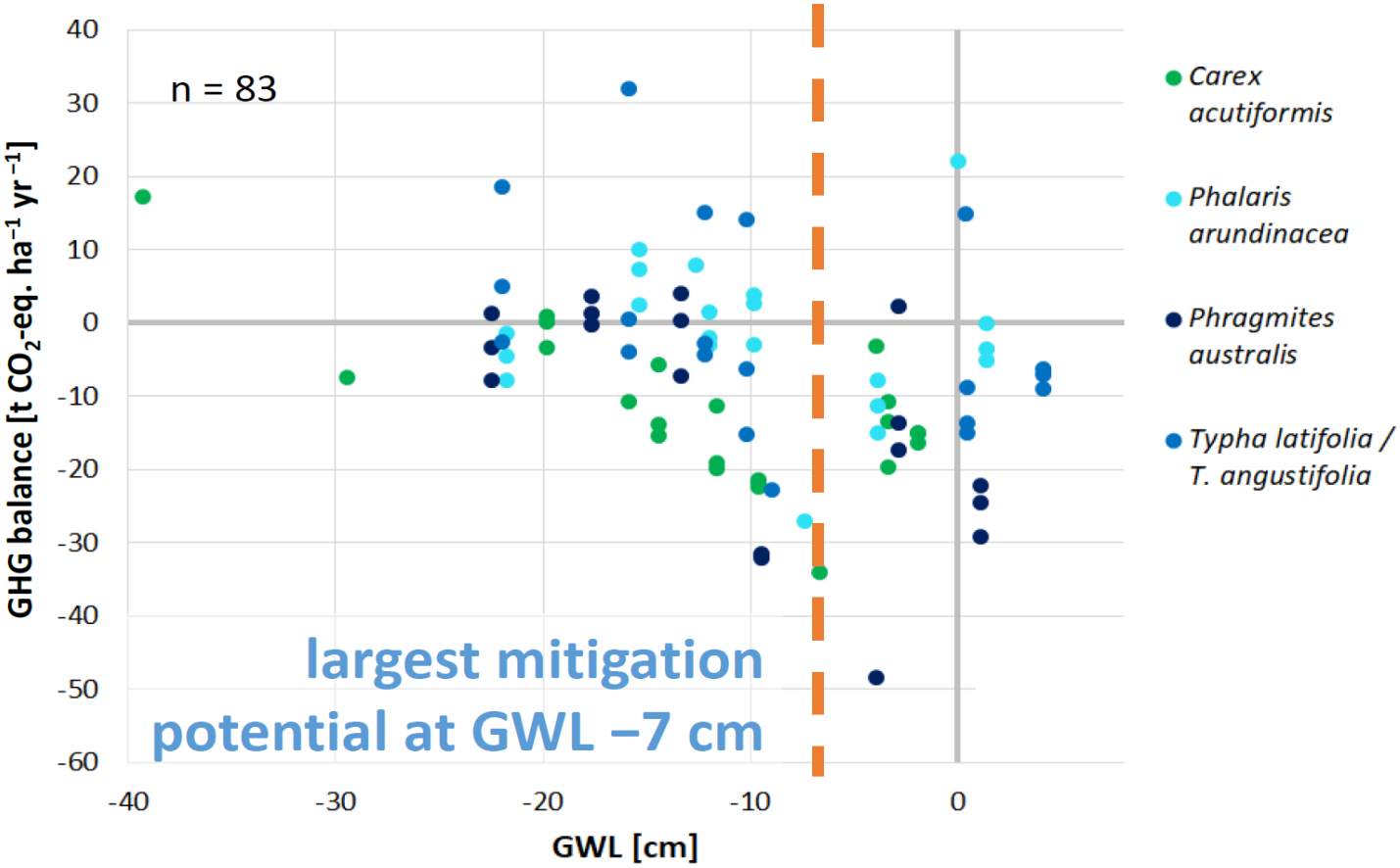
Treatment: Carex moderately rewetted

Treatment: Carex rewetted

Treatment: Carex flooded



Results & discussion Global warming potentials



Results & discussion Emission factors for paludicultures

Land use category	CO_2-$C_{organic}$ (t C ha^{-1} yr^{-1})	CH_4 organic (kg CH_4 ha^{-1} yr^{-1})	N_2O-$N_{organic}$ (kg N ha^{-1} yr^{-1})	GHG (t CO_{2eq} ha^{-1} yr^{-1})
Forest land	7.0	6.0	1.7	26.6
Cropland	9.5	20.6	11.1	40.4
Grassland	8.0	21.7	4.2	31.7
Drained unutilized land	5.7	55.3	0.5	22.5
Peat extraction*	1.6	11.2	0.9	6.5
Settlement	8.6	23.4	4.6	34.2
Rewetted organic soils	−0.4	279	0.1	5.5

Tiemeyer et al. 2020

* without extracted peat, emissions from peat deposits only.

restoration

max. reduction potential

−53.4

t CO_2-eq ha^{-1}

Paludiculture rewetted (n=43, GWL 4 to −10.2 cm)	**−6.0** (± 3.1)	**270.5** (± 184.3)	**0.2** (± 0.4)	**−13.0** (± 13.9)
Paludiculture moderately rewetted (n=38, GWL −11.7 to −22.5 cm)	**−0.7** (± 2.9)	**30.7** (± 36.1)	**1.5** (± 1.6)	**−1.0** (± 9.8)

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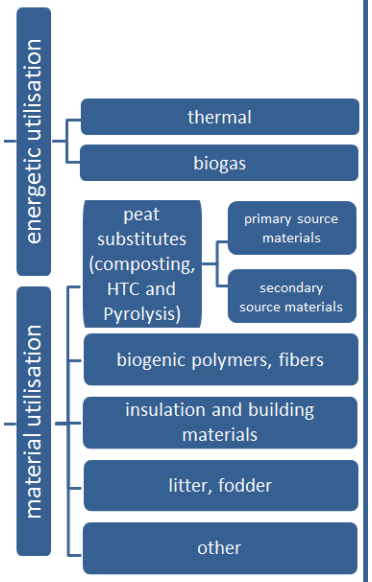
Module 3

utilisation potentials



- Energetic:
  - Thermal: with limitations (NOx emissions, slag)
  - Biogas: good potential in reed canary grass (20 % reed canary grass/ 80 % maize: no Gas reduction!)

- Material:
  - big potential of a diverse upcoming market
  - Many companies tested successfully for
    - construction
    - insolation
    - wrapper
    - biochar
    - …

products from paludiculture:

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Financing the options towards Paludicultures

- EU-subsidies
- Peatland farmers programme (KULAP, Moorbauernprogramm)
- Certificates (moorbenefits2.0)
- Carbon farming

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Paludicultures and

- Biodiversity
- Peat-Soil restoration
- Watermanagement
- Widening the spectrum of species and
- Products
- Long term GHG-balances and Life cycle assessment
- Landscape scale effects
- Sustainable long term productivity and economic sustainability (see NAPALU-project FNR)
- …

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