

PALUDICULTURE

PEATLAND REWETTING FOR THE CLIMATE AND WET PRODUCTION



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*EUKI - Stakeholder Workshop
18th of May 2023,
Tartu, Estonia*





What makes peatlands special?



Illustration by: www.sarah-heuzeroth.de

- ⇒ Pristine peatlands are wetlands (Mires)
- ⇒ With site adapted plant species
- ⇒ Primary production > Decomposition
- ⇒ Accumulation of dead plant material (Peat)
- ⇒ Global mire growth has cooled climate by 0.6 °C in the last 10,000 years

Peat formation happens water saturated below the surface...



Bogs – rainwater fed



Fens – ground water fed



Peat is like pickles:
if the (acidic) water is removed,
the organic matter rots away



Peat accumulates in wet mires...



...for utilisation we draine(d) wet mires...

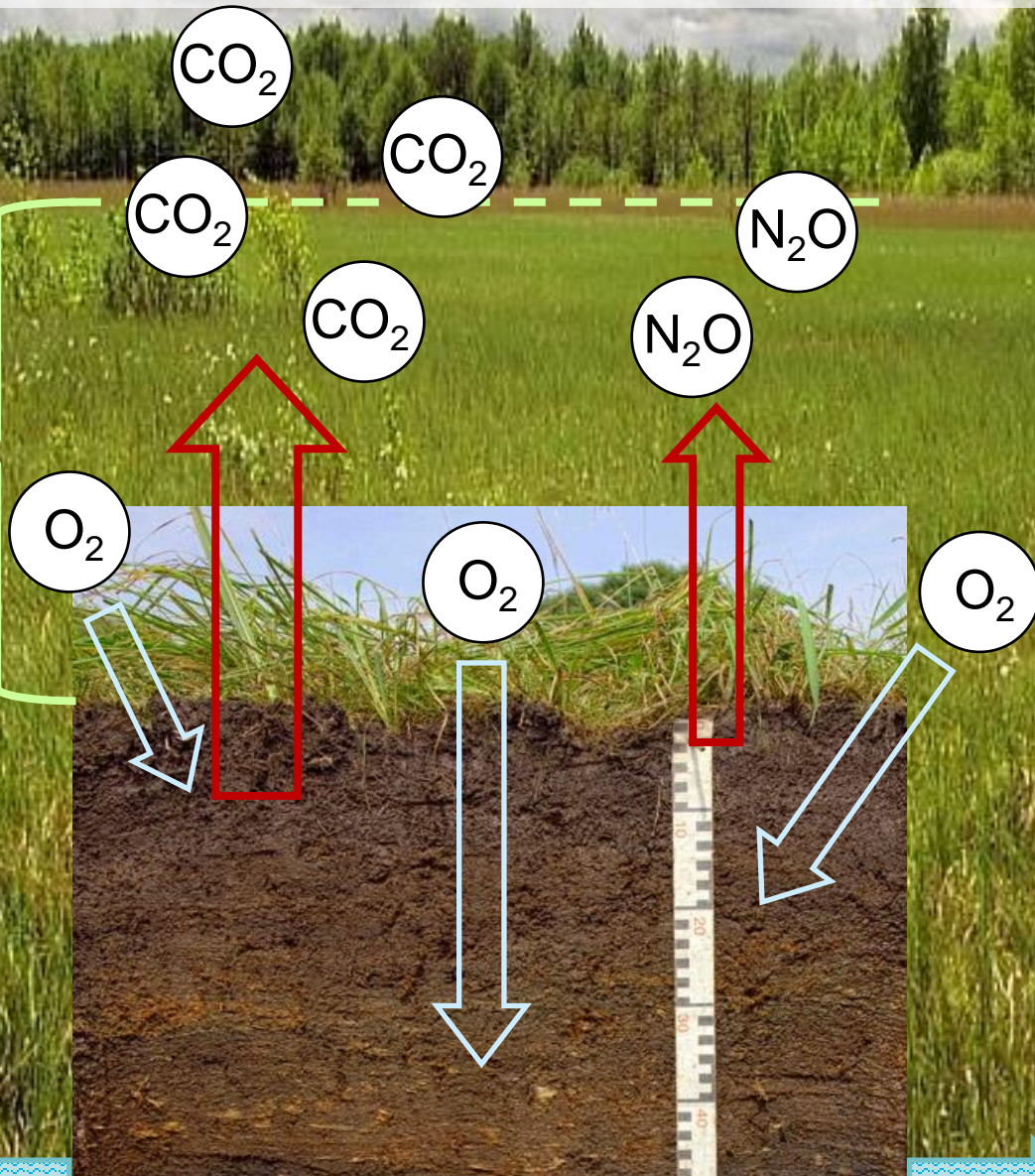


...and drainage brings peatlands down...



...sink ecosystems turn to sources!

Subsidence



Continuation of drainage management constantly degrades peat and releases Green House Gases



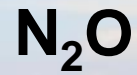
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Carbon Dioxide



Nitrous Oxide

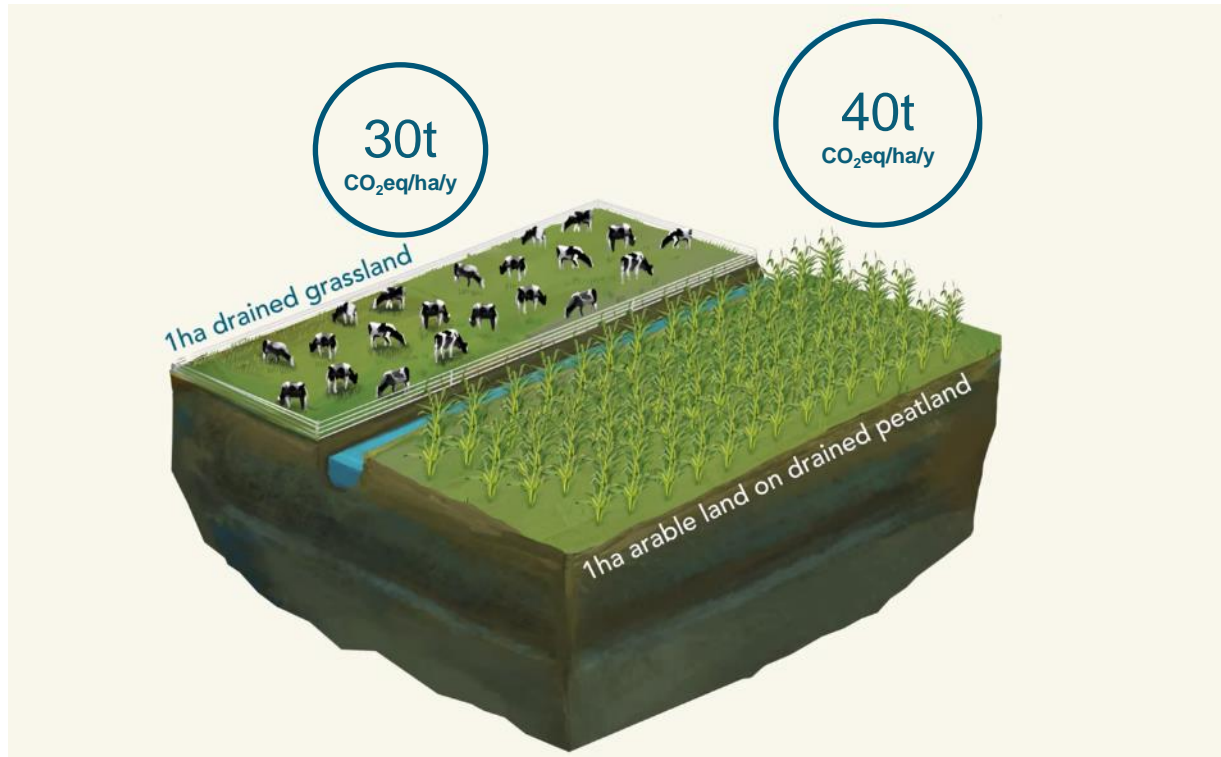


Methane



The Challenge in agricultural peatland use...

...is to come from drained peatlands...



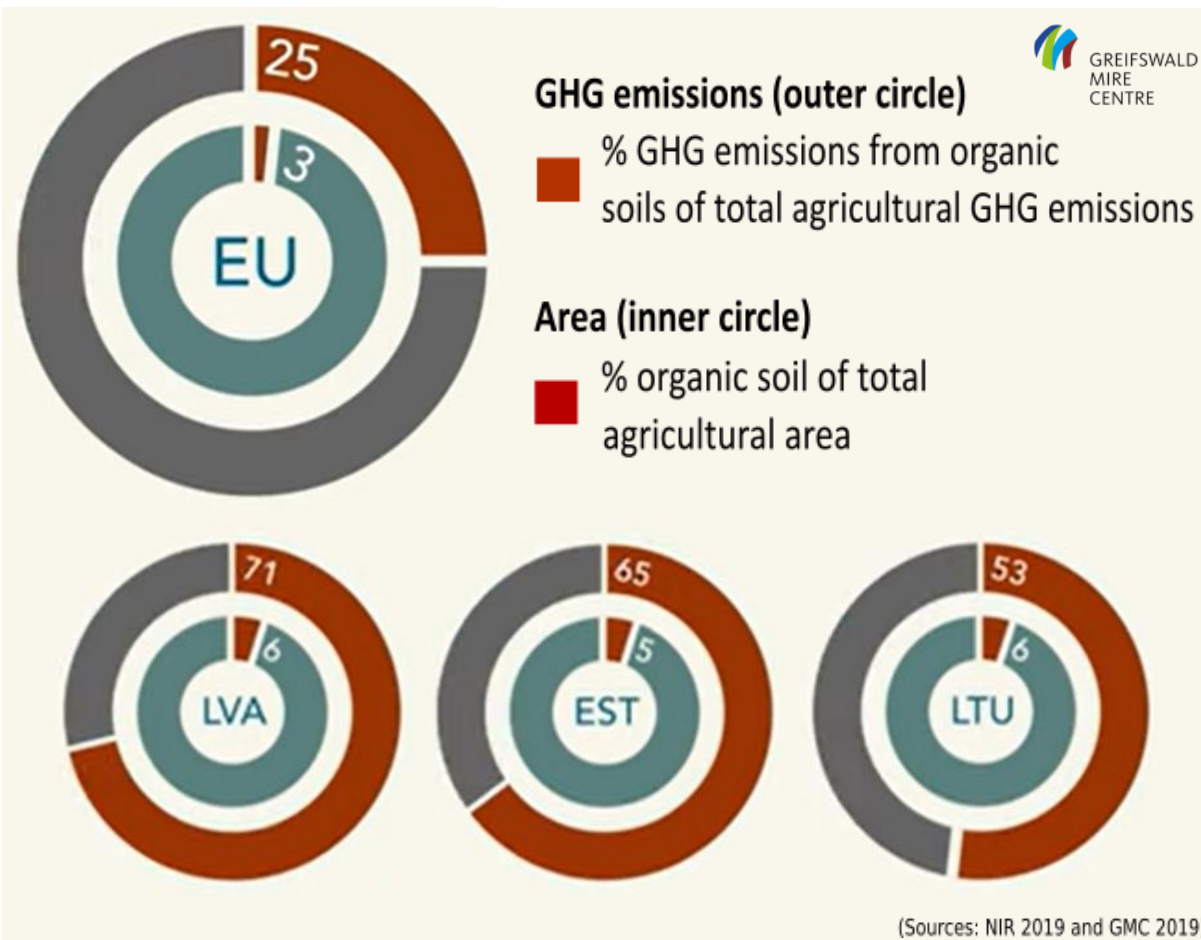
Common drainage based practice on peatlands at high environmental damage (costs).

...to peatlands with paludiculture.



New wet management of peatlands to preserve ecological functions, services and production.

Agricultural GHG emissions from agriculture in the EU and the Baltic countries...



...stem largely from drained peatlands:

EU:

- ⇒ 25% of agricultural emissions,
- ⇒ from 3% of the production area.

Baltic countries:

- ⇒ 53%-71% of agricultural emissions,
- ⇒ from 5%-6% of the production area.

...rewetting mitigates emissions



Paludiculture on top

↑
**Save the
peat carbon stock**
↓



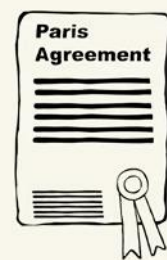
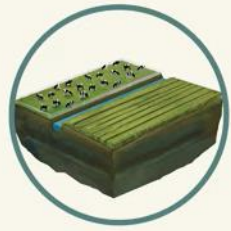
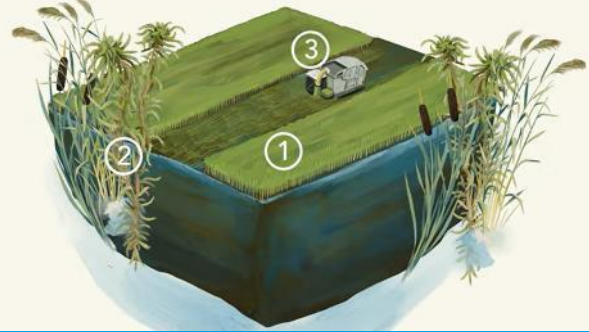
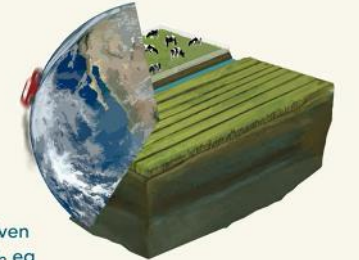
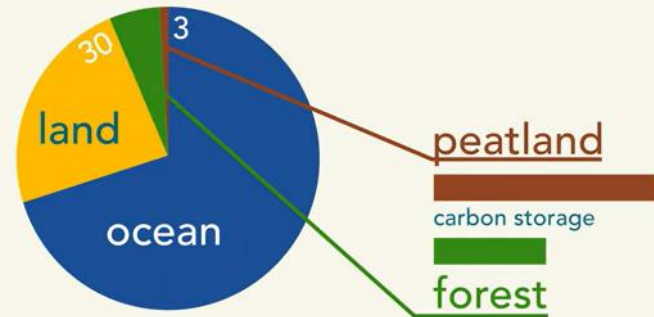
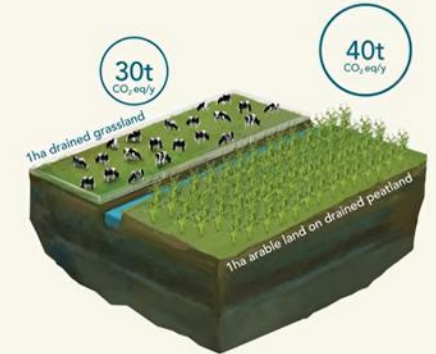
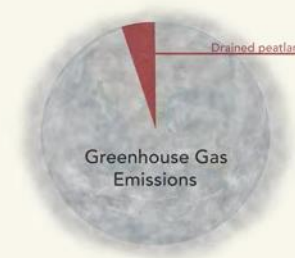
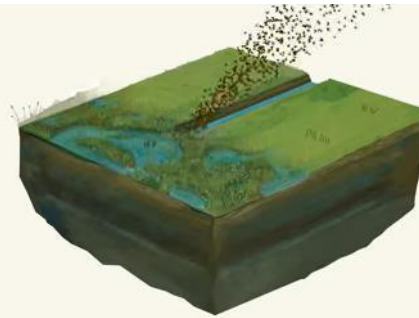
Further Information

Peatlands, Climate, and Paludiculture



www.greifswaldmoor.de

7min Information film online:
<https://www.youtube.com/watch?v=uXuRiLth5ds>



Paludiculture



Wet meadows



Crop cultures



Paludiculture crops - what is possible?

Paludiculture definition:

“Cultivation of biomass on wet and rewetted peatlands with plant species that contribute to the conservation of peat deposits and ideally to the formation of peat”

⇒ Water table close to surface
**during Vegetation period
and harvest!**

Reed



Peat Moss



Black Alder



Cattail



Cranberry



Water Buffalo



Cranberry field in Latvia! **Not paludiculture yet - Right crop to dry!**



Lauga purvs, Latvia



...or Wrong crop to dry!

cf. *Lonicera caerulea* var.



...is not new:

⇒ ~25 years anniversary

...but still has hardly any large scale implementation - we need to find balance for:

- ⇒ The preservation of organic soil,
- ⇒ Minimising GHG Emissions,
- ⇒ Economic viability and business schemes
- ⇒ Social and human well-being



Peatmosse farming pilot, Germany



New management approaches

⇒ “Not the site is adapted to the utilisation but the site management to the wet and soft conditions in peatlands.”



New products and markets

⇒ Development of climate neutral product chains considering full life cycles.
⇒ Involvement of business partners needed



Site Management with adapted conventional equipment

- ⇒ Ground pressure 350-600 g/cm²
- ⇒ Suitable for moist - wet conditions during management period (-20 cm)
- ⇒ Applicable for wet meadow hay making
- ⇒ Dependent on skills and experience of operators!



Site Management with light weight small equipment

- ⇒ Ground pressure 100-250 g/cm²
- ⇒ Soil and root layer stay intact
- ⇒ Suitable for wet site conditions (-10-0 cm)
- ⇒ Limited in performance



Site Management with special and adapted tracked chain vehicles



- ⇒ Ground pressure 100-200 g/cm²
- ⇒ Soil and root layer stay intact
- ⇒ Suitable also for wet & very wet site conditions (0-+30)
- ⇒ one, two or three step operation



Solid fibre boards by Zelfo



What is paludiculture?

Is the productive use of wet peatland sites - In particular, agricultural and forestry production on rewetted organic soils while preserving the peat deposits.

Why hay from wet meadows?

Management of wet meadows is a site-appropriate alternative on rewetted peatlands and has many advantages:

- Maintenance of productive land
- Climate protection by conservation of the peat carbon stock
- Water protection by retention of nutrients
- Sustainable resource production
- Strengthening of regional added value
- Protection of species by creation and conservation of habitat structures

Solid fibre boards from wet meadow hay

- high stability without addition of adhesives
- material fully recyclable & compostable
- good returnability into the natural matter cycle
- storage of CO₂
- easy handling

Cultivation and harvest

Raw material harvest: annually, 1-2 cuts
Yield: 2 - 12 t dry matter/ha/year
Water table: Summer: 0-20 cm below soil surface
Winter: waterlogged conditions

Production

Producer: Zelfo Technology Ltd
Pilot- or Serial production: Pilot production upon request and order

Product properties

Material/Compound material: wet meadow hay
Recyclability: fully recyclable & compostable
Allergy compatibility: very good
Density: 0,4 g/cm³ – 1,5 g/cm³

Further information

paludiculture



<https://kurzelinks.de/0jnc>

producer



<https://kurzelinks.de/0tcf>

wet meadow management for energy



<https://kurzelinks.de/2tka>

Example of application



<https://kurzelinks.de/vif0>



Picture: T. Dahms



Picture: T. Galla



Picture: T. Galla

Acoustic Absorber Element from Hiss Reet



of wet peatland sites - In particular, y production on rewetted organic soils while osites.

Reed is a site-appropriate alternative on d has many advantages:

ductive land
y conservation of the peat carbon stock
y retention of nutrients
e production
gional added value
s by creation and conservation of habitat

ion material

ffect
ion during production
o the natural matter cycle

Turkey
Mowing in winter
Interior acoustic absorption

Hiss Reet Schilfrohrhandel Ltd
Serial production
Bad Oldesloe, Germany

Material: Reed culms + special foam on gypsum plasterboard
50x50x18 cm
C (highly absorbent)
allergy-friendly
good
Reed recyclable & compostable
640 €/m²
+/- low emissions during harvest and production
- emissions due to long transport of raw material



Picture: Holopglls



Picture: GMC



Picture: Hiss Reet

Further information

paludiculture
<https://kurzelinks.de/0jnc>



the product

<https://kurzelinks.de/8qkx>

Acoustic Panel by Naporo



of wet peatland sites - In particular, y production on rewetted organic soils at deposits.

yppha latifolia or T. angustifolia) is a site-appropriate alternative on rewetted peatlands and has many advantages:

ductive land
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y retention of nutrients
e production
gional added value
s by creation and conservation of habitat

aterial

ctic protection and summer thermal insulation with all common tools
to diffusion and capillary-active
tion during production
to the natural matter cycle

Mowing in winter
Sound absorption, insulation

Naporo Klima Dämmstoff Ltd
Braunau am Inn, Austria

Material: Cattail chaff + Poly-lactic acid (PLA) + ammonium salt
B2
625 x 1200 x 20/40/50/60/80/100 mm
0,040 W/mK
E – ammonium salt as fire protection agent
1
recyclable & biodegradable
100 kg/m³
t: 1 gzw - full absorption
low emissions during harvest and production



Picture: Kjetil Larsen



Picture: JN Kampelenzentrum



Picture: Naporo

Further information

paludiculture
<https://kurzelinks.de/0jnc>



material characteristics

<https://kurzelinks.de/8qkx>

Reed Construction panels by Egginger



of wet peatland sites - In particular, y production on rewetted organic soils at deposits.

Reed is a site-appropriate alternative on d has many advantages:

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aterial

ctic protection and summer thermal insulation with all common tools
n to diffusion and capillary-active
ption during production
into the natural matter cycle

Lake Balaton (Hungary)
Mowing in winter
5 – 20 t/ha/a
Construction panel for thermal and sound insulation, plaster base panel

Egginger Naturbaustoffe Ltd
Serial production
Maching, Germany

Material: Reed culms + galvanised steel wire
1500 x 1000 x 50 oder 20 mm
0,055 W/mK
good
good
fully recyclable & compostable
2 €/m² - 14,50 €/m²
+ low emissions during harvest and production
- emissions due to transport of raw material from harvest site to production site
- unknown emissions of the harvest site



Picture: Holopglls



Picture: GMC



Picture: Egginger

Further information



paludiculture
<https://kurzelinks.de/0jnc>

the producer

<https://kurzelinks.de/8qkx>



the product

<https://kurzelinks.de/8qkx>

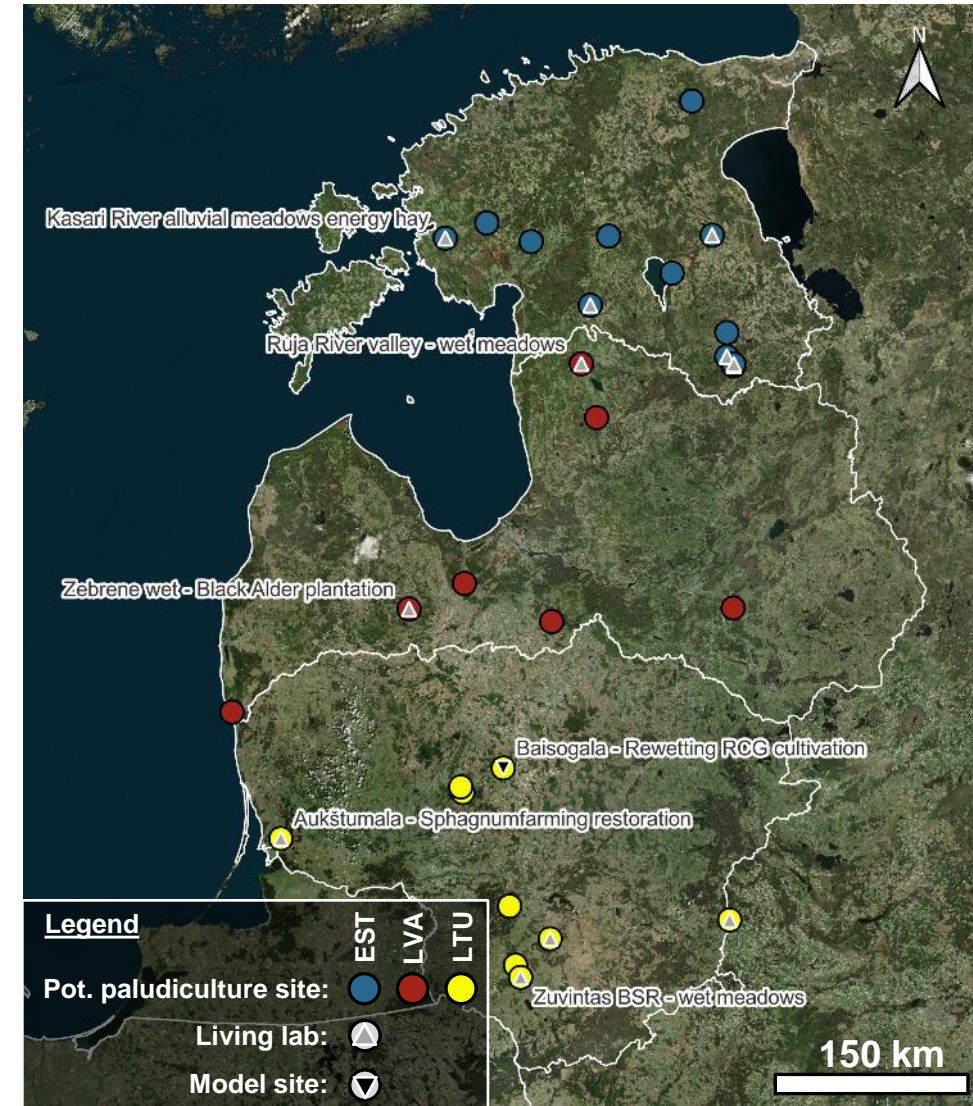
Identified potential and applied Baltic paludiculture sites

⇒ Different level of readiness for implementation.

⇒ Living labs for paludiculture:

- Contracts with farmers who have experience with wet peatland sites (soil data, additional operation costs, limits),
- Examples from peatland restoration or nature conservation (rewetting and management costs).

⇒ Model sites – so far one implemented paludiculture case study – Baisogala, Lithuania



Baisogala 7 ha restoration of a fen for wet Reed Canary Grass Cultivation



Partner in the

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2020 11



2022 05

Partners:

Sponsored by:



Wet Reed Canary Grass in Lithuania! Paludiculture knowledge site



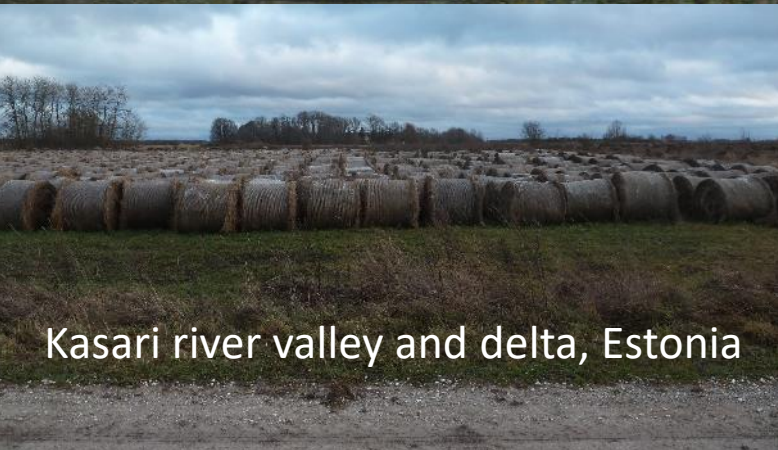
Baisogala, Lithuania May 2023

Wet Reed Canary Grass in Latvia! Paludiculture – **but Natura2000!**



Ruja river valley, Latvia

Wet meadow management for energy hay for Lihula biomass heating plant – **Not Paludiculture yet!** – mineral alluvial soils!



Kasari river valley and delta, Estonia



EU Horizon Green Deal Projekt



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WaterLANDS

Exchange of experience between .

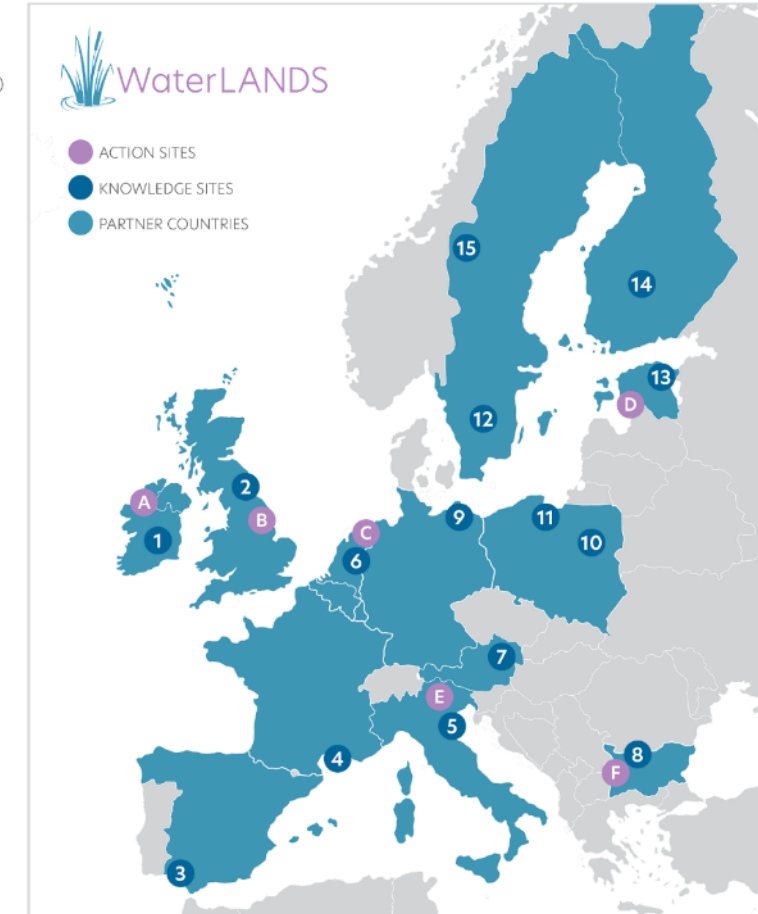
- **6** Action Sites
 - **15** Knowledge Sites
 - **14** Partner countries
- ⇒ Tackling also policy challenges

ACTION SITES

- A** LIFE-IP Wild Atlantic Nature (Ireland)
- B** Yorkshire iCASP (The United Kingdom)
- C** Eems-Dollard Estuary (The Netherlands)
- D** Pärnu Catchment (Estonia)
- E** Venice Lagoon (Italy)
- F** Dragoman Marsh (Bulgaria)

KNOWLEDGE SITES

- 1** Abbeyleix Bog (Ireland)
- 2** Water@Leeds (The United Kingdom)
- 3** Doñana Wetland (Spain)
- 4** Camargue (France)
- 5** Venice Lagoon (Italy)
- 6** Engbertsdijkvenen (The Netherlands)
- 7** Landscape Finance Lab (Austria)
- 8** Belene Island (Bulgaria)
- 9** M. Succow Foundation (Germany)
- 10** Wetlands around Warsaw (Poland)
- 11** Mazury Forest Mire (Poland)
- 12** Store Mosse (Sweden)
- 13** Sirtsu and Tudusoo Mires (Estonia)
- 14** Siikaneva (Finland)
- 15** Jämtland Mountains (Sweden)

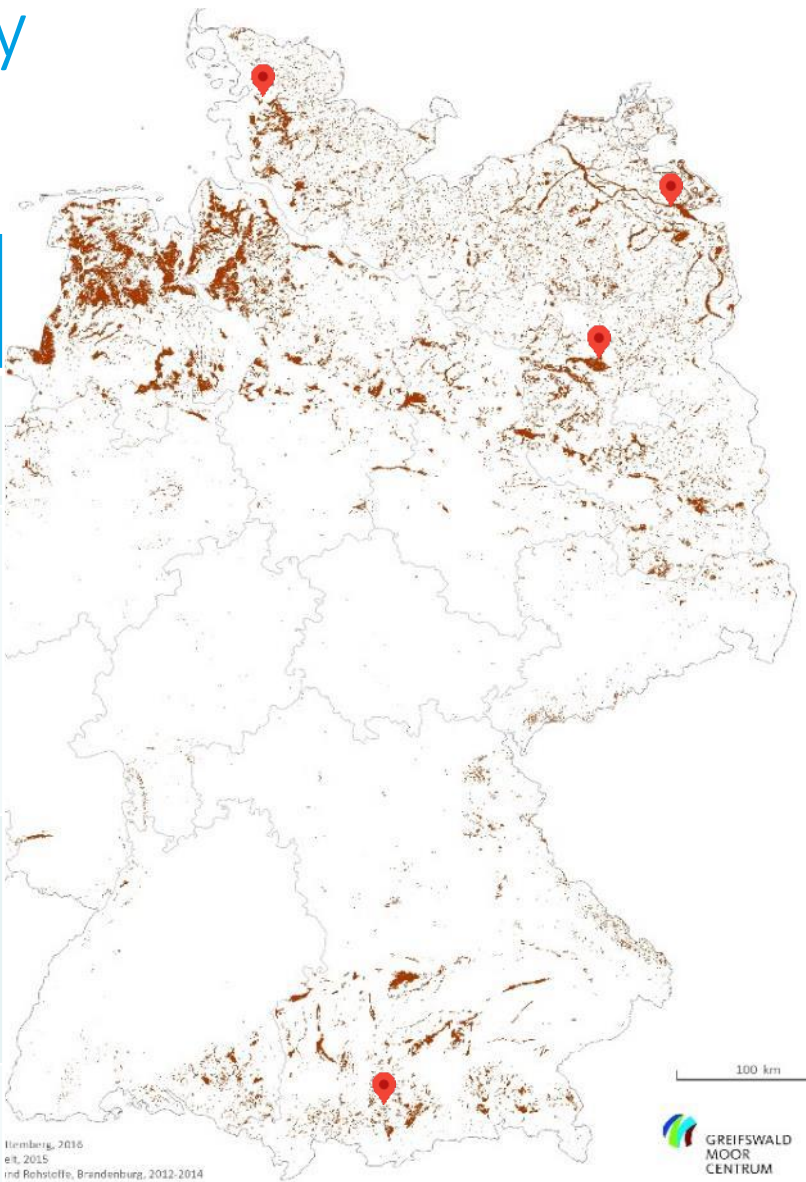


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Filling gaps Large scale Peatland pilots in Germany

10 year funding by Ministry of Agriculture

Pilot	Federal state	Area	Target paludiculture crop(s)
Klimafarm	Schleswig - Holstein	~400 ha, partly rewetted already	Wet meadows
BLuMo	Brandenburg	749 ha in 3 project sites, not finally selected, not yet implemented	Wet meadows, cultivation of cattail, test Reed and RCG, water buffalo
MoorWERT	Bavaria	~60 ha total area in 7 Project areas, not yet implemented	Wet meadows, wet grassland, paludi-crop cultivation
Paludi MV	Mecklenburg – Western Pomerania	2 sites with 520 ha and 388 ha, not yet implemented	Wet meadows, Paludi-crop cultivation



Helmberg, 2016
 et, 2015
 und Rehschleife, Brandenburg, 2012-2014
 utz, Umwelt und Geologie, 2002-2019
 iz und Geologie, Mecklenburg-Vorpommern, 1998, 2016, 2017
 stfain, 2017
 an, Rheinland-Pfalz, 2019



Cattail cultivation on fen: 10 ha paludiculture pilot area in NE Germany

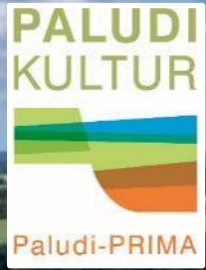


Foto AESA aerial

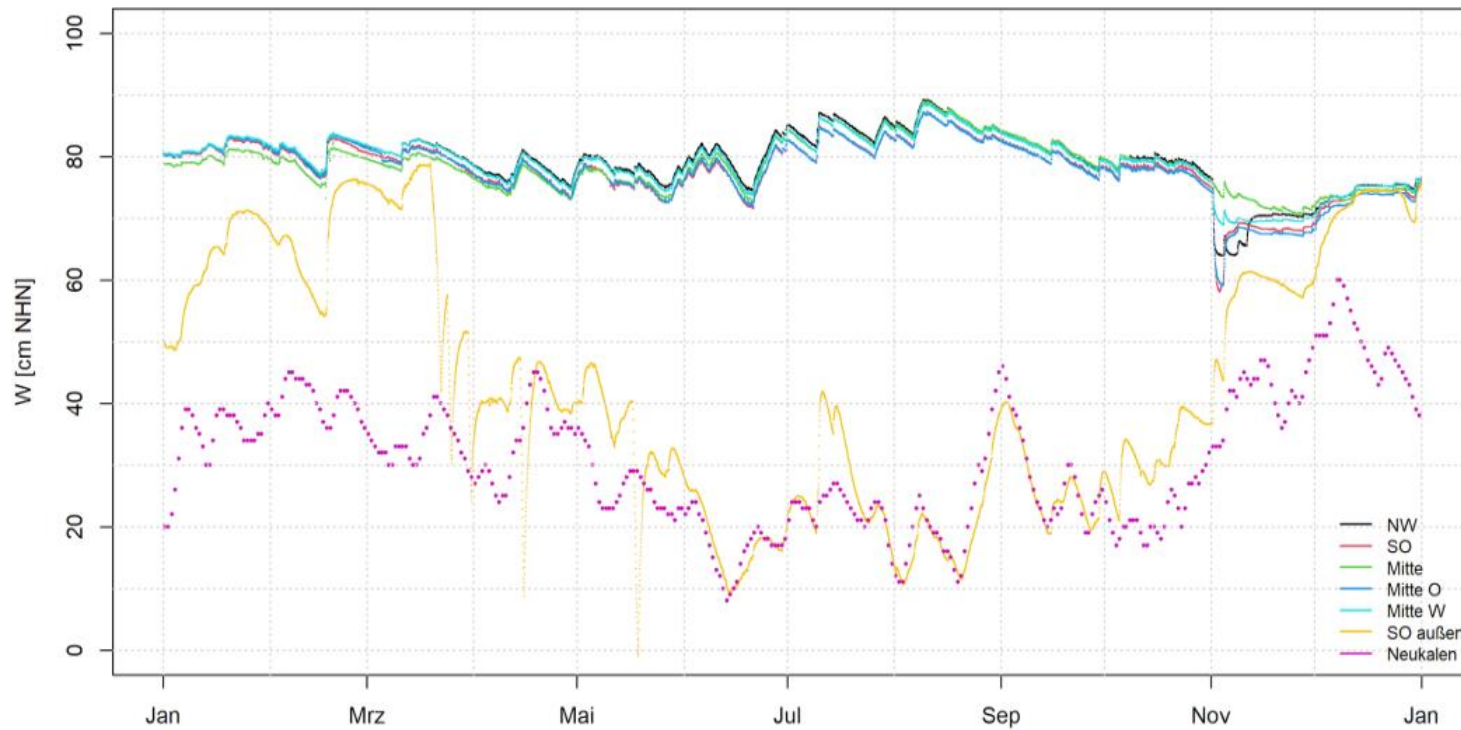
Site preparation in 2019

- Previous: Suckler cow farming, winter fodder
- Dams for waterretention
- Adjustable overflow (monks)
- Reservoir + tubing for inlet



Water management

- Water retention
- Plus irrigation in summer:
 - Solar powered pump
 - Diesel generator
 - Better option: free inflow (channel)
 - Challenge wetter depressions



Planting – 2019 & postseeding – 2020

50.000 Seedlings → 0,5 and 1 plant per m² → post-seeding with drone



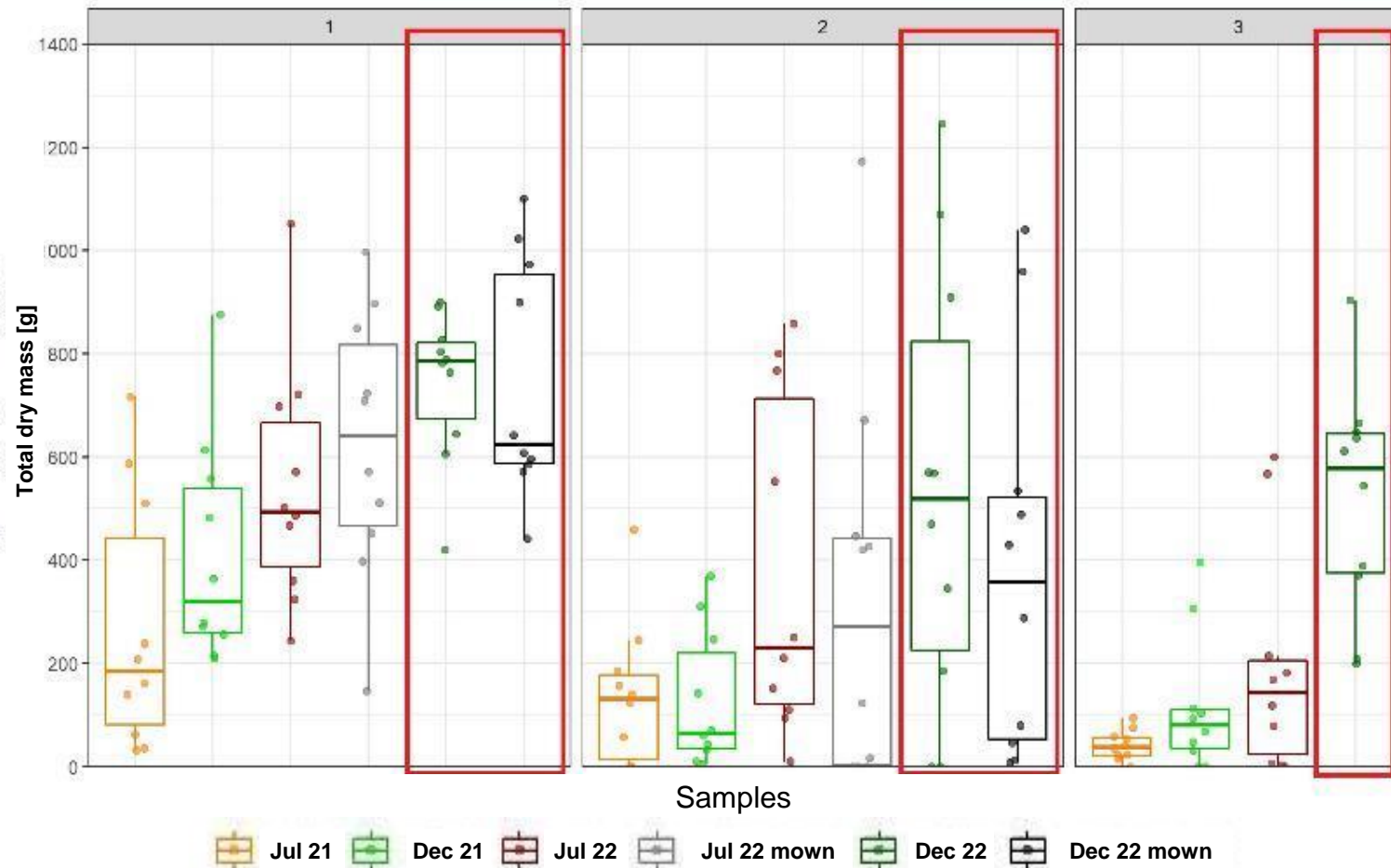
Stock development

Increasing yields Dec. 2022: Ø 5,0 t DM/ha

1 = dense cattail stock: Ø 7,4 t TM/ha

2 = mixed stock cattail + reed canary grass

3 = loose cattail stock



September 2018



Juni 2020



November 2020

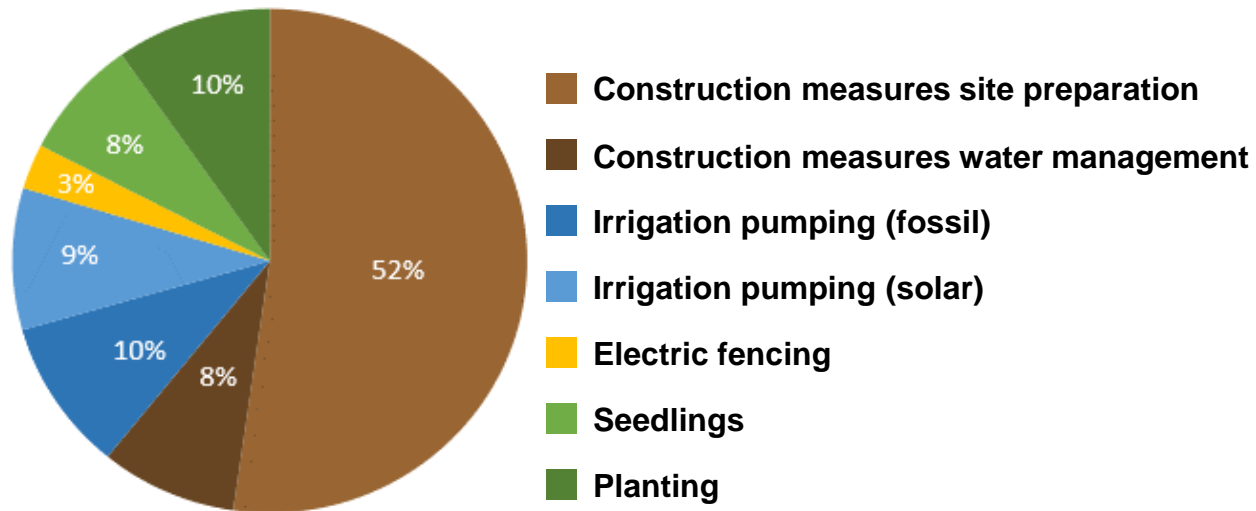
Harvesting tests

- Dec. 2021: one step approach
- Jan. 2023: two step approach
- Regional agricultural service contractor
→ high machine transport costs

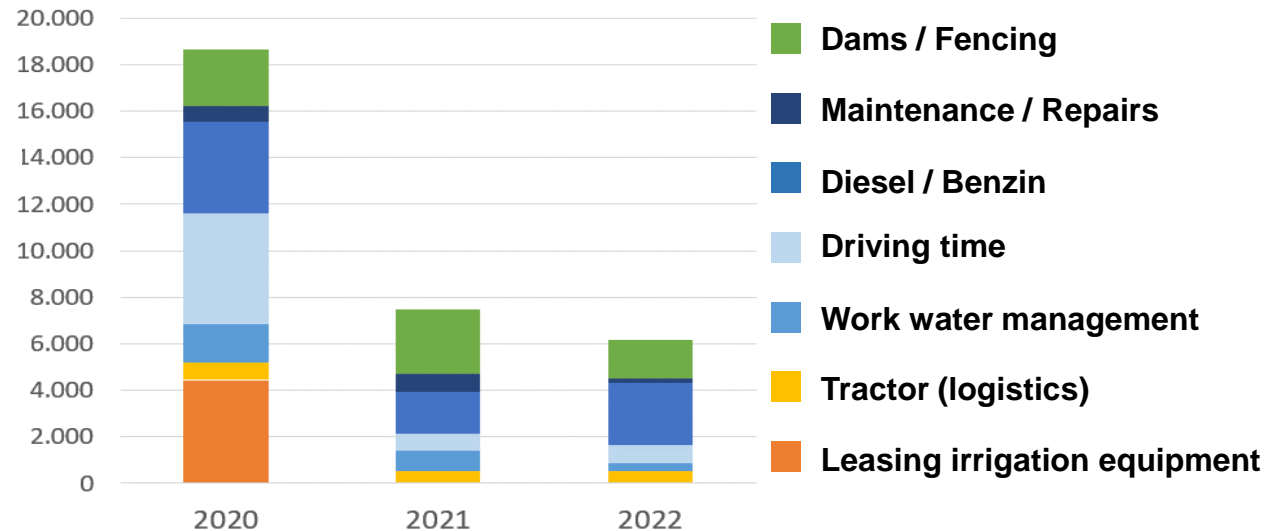


Preliminary pilot costs

Site preparation + planting 2019 (~22 000 €/ha)



Management 2020 - 2022



- **Permanent culture:** one off establishment, permanent management, annual harvest
→ calculation of investment costs (duration 10–15–20 years)
- **Revenues:** Dependent on value creation chains and non market funding (CAP, PES (Payments for Ecosystem Services))

Cattail (*Typha latifolia*, *T. angustifolia*) – products

- Force bearing and insulation construction boards
- Inblow insulation
- Seed wool as stabiliser for loam plaster
- Horticultural substrat raw materials
- Traditionally: leaves as braiding material



© typha technik Naturbaustoffe

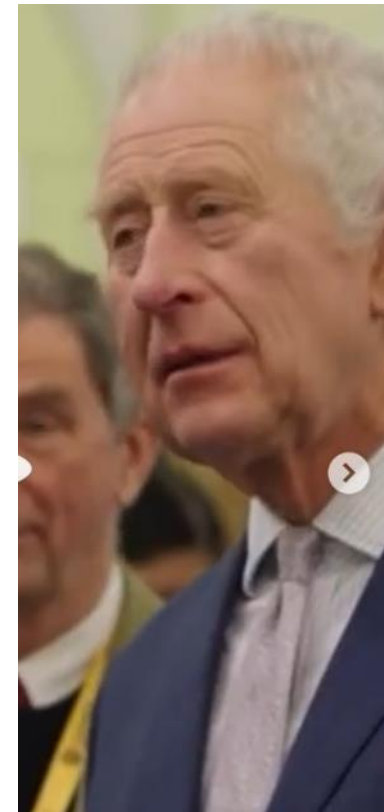
Cattail in the textile industry for batting (Typha latifolia)

Company FLUFFSTUFF in Finland uses Typha seed wool for stuffing textiles

Material send from PRIMA MV → UK: Ponda (Biopuff®) "A jacket fit for a king!"

FLUFFSTUFF
<https://fluffstuff.fi/>

 **ponda**



Fotos: Sabine Wichmann

<https://www.instagram.com/saltyco.uk/>

Further Information



Partner in the



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6 min promo film is online:
https://www.youtube.com/watch?v=_VivPsrww74





All peatlands must be wet! - Thanks for your attention!

<https://www.succow-stiftung.de/en/peatland-climate/euki-carbon-capturing-by-baltic-peatland-farmers>