

Principles for Sustainable Peatland Paludiculture



Peatland Programme

© Tom Barrett, Broads Authority



Welcome to the Paludiculture workshop

Nature for Climate: Paludiculture Exploration Fund
www.paludiculture.org.uk

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Join us at slido.com with **#2675524**

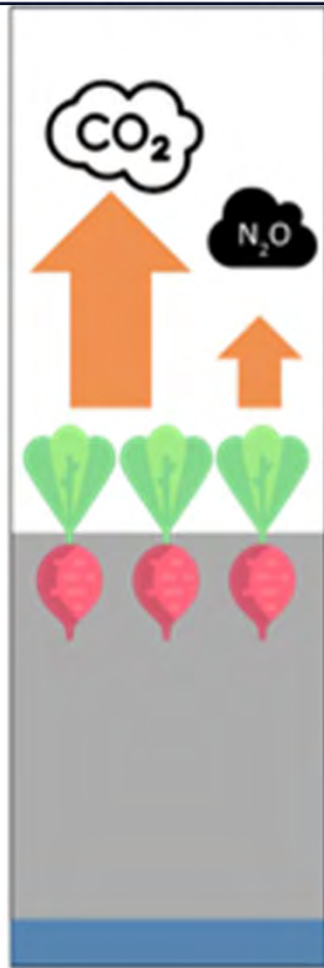
Tell the presenters a bit about yourself

Paludiculture:

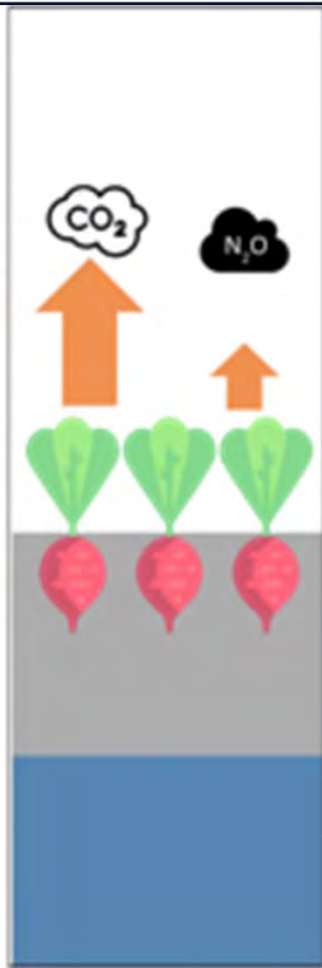
- Producing wetland crops profitably on lowland peats with high water tables
- Reducing GHG
- New crops? or new products from old crops
- Wetter farming



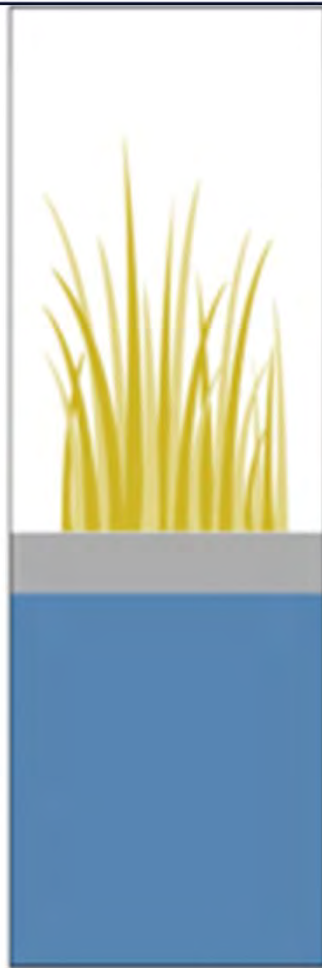
Conventional
Veg Farming

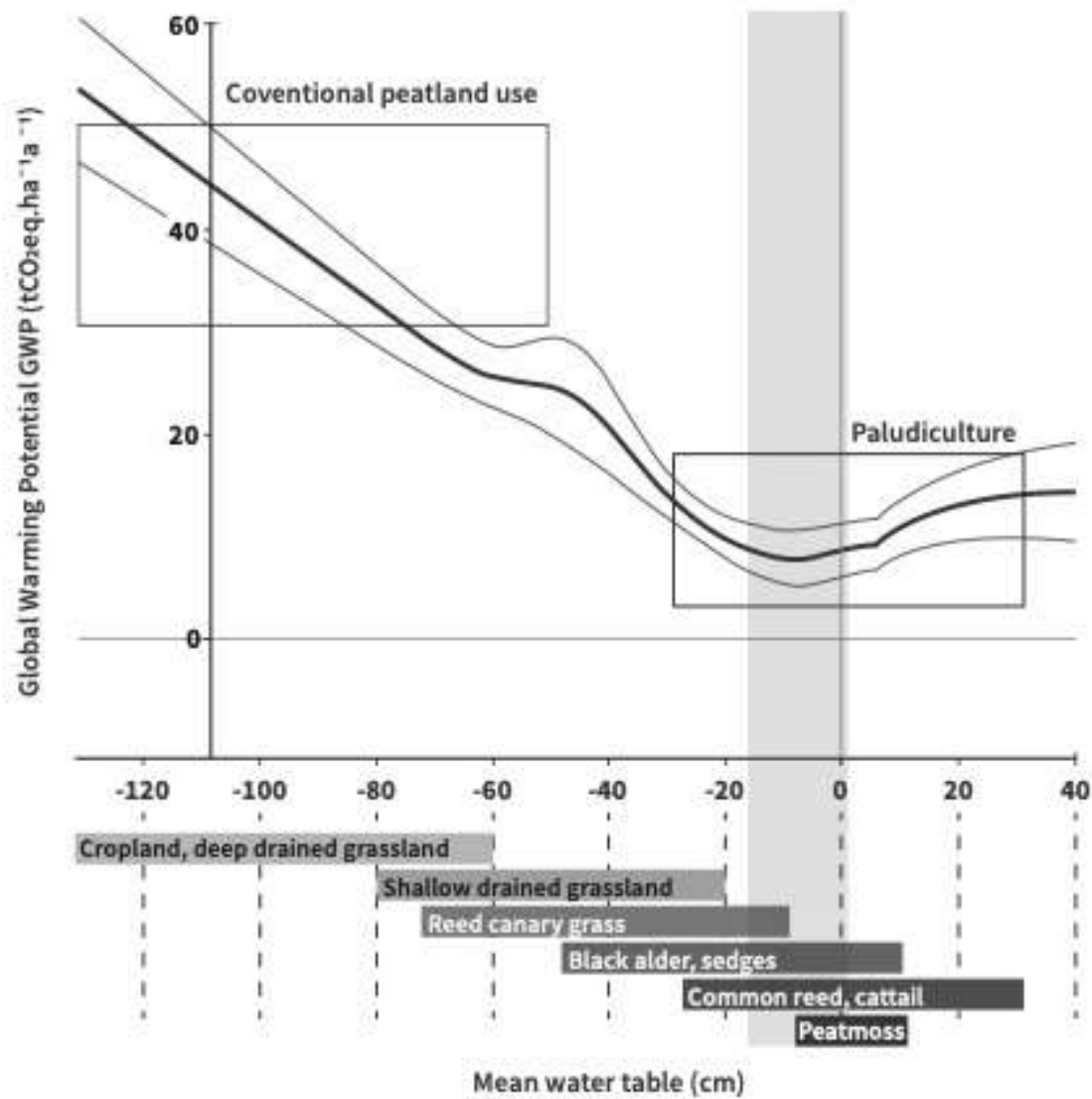


Wetter Farming



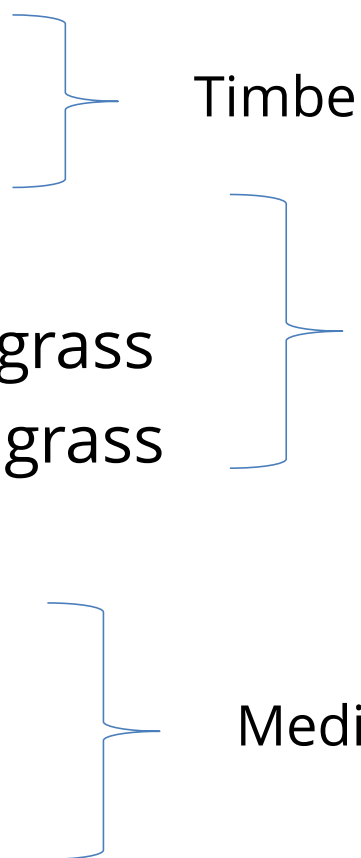
Wetland Management





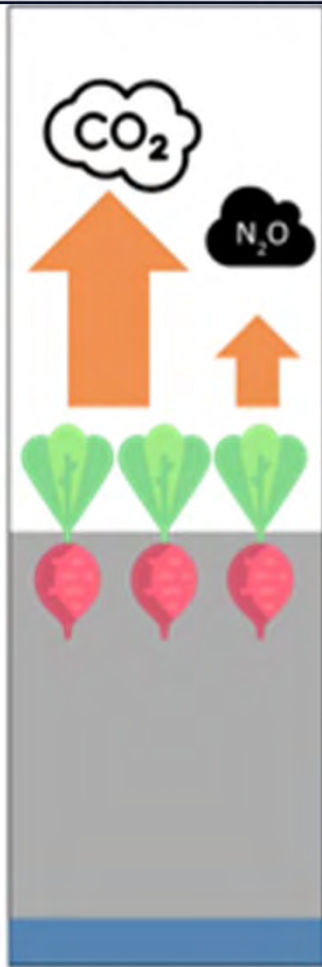
- Reed
- Typha
- Sphagnum

Database of potential paludiculture plants (DPPP)

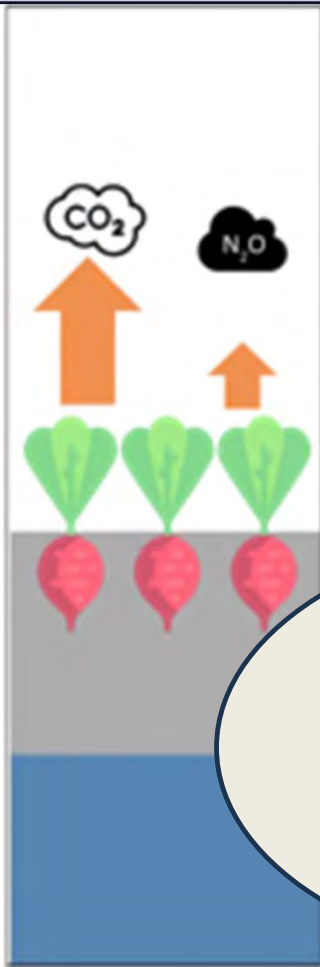
- Willow
 - Black alder
 - Sedges
 - Reed canary grass
 - Reed manna grass
 - Cranberry
 - Bog myrtle
 - Water mint
 - Sundew
- Timber
- Fibre, fodder
- Food
- Medicinal
- 

**Other options for
temperate climates**

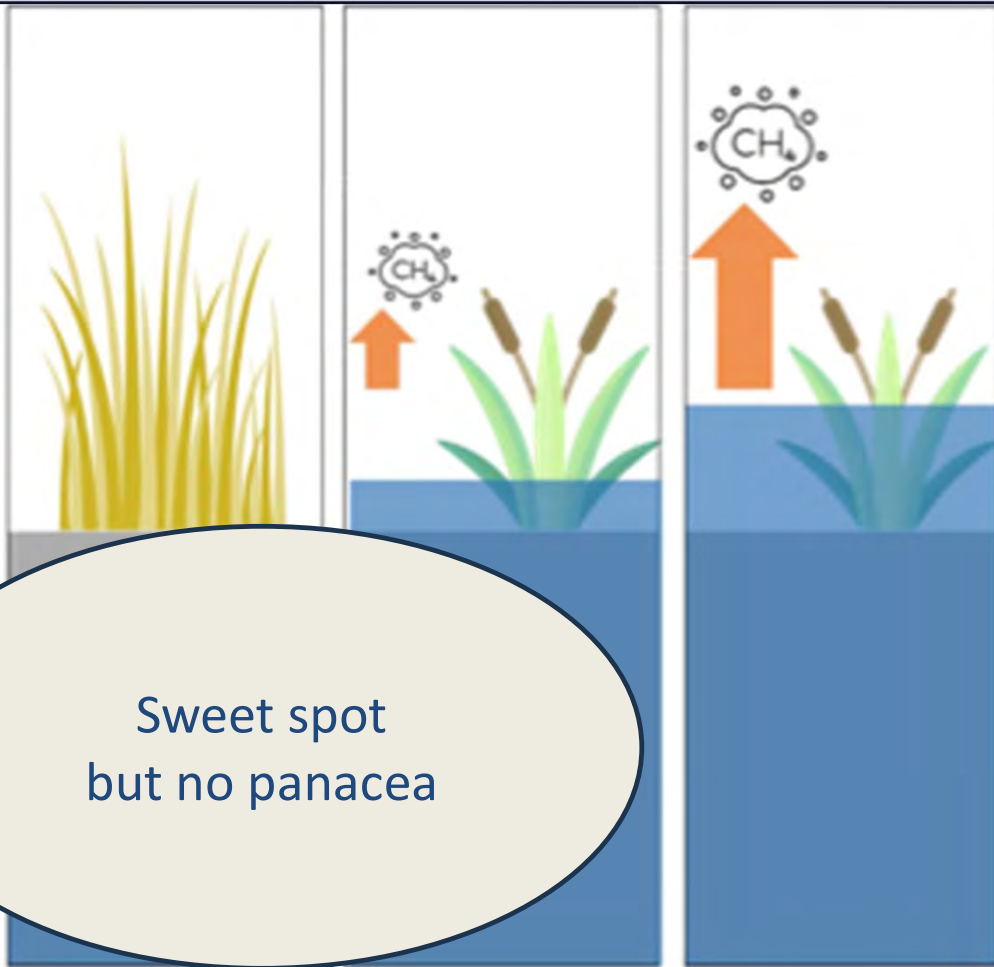
Conventional
Veg Farming



Wetter Farming



Wetland Management



Sweet spot
but no panacea

**Considering the benefits and risks
of paludiculture in a landscape
context**

**Is paludiculture good for natural
lowland peat habitats or does it
bring new threats?**



Requirements, enablers



Outputs, impacts



Share the group's thoughts
at **slido.com** with **#2675524**

Food (and fibre) for thought – provided by our speakers

Sustainable peatland paludiculture: exploring the IUCN UK Peatland Programme principles - [Clifton Bain, IUCN UK PP](#)

Paludiculture and the Paludiculture Exploration Fund - [Jim Milner, Natural England](#)

Paludiculture products as sustainable construction materials - [Anthony Hudson, Hudson Architects](#)

Challenges of putting paludiculture into practice - [Andrea Kelly, Broads Authority](#) and [Aldert van Weeren, Wetland Products](#)

Add to the Q&A at [slido.com](#) with [#2675524](#)

Sustainable Peatland Paludiculture

Clifton Bain, Programme Advisor
IUCN UK Peatland Programme



Somerset Levels: Emma Goodyer



What is the role of paludiculture?

A fundamental shift is needed in the way that peatlands are managed for agriculture as society tackles the climate change and biodiversity crises.

With farm futures threatened by soil loss and wasted peat, paludiculture presents an opportunity to secure farm incomes and deliver peatland goals.

Sustainable Paludiculture

Benefits

A wide range of paludiculture opportunities and benefits across the UK

Delivery

Implementing a paludiculture strategy at scale requires cooperation and planning.

Sustainable

IUCN UK PP
5 Principles for sustainable peatland paludiculture

Key Recs.

Research and survey to learn from and expand early work

Paludiculture

Farming and agroforestry systems that produce biomass from peatlands under conditions that maintain the peat body and facilitate peat accumulation.

- Hundreds of potential products - Greifswald University (2023) 'Database of potential paludiculture plants'

- Applicable on fens and bogs in lowlands and uplands across UK



Opportunity not a panacea

- IUCN UK PP Strategy Goal - shifting management of drained peatlands under intensive productive use to deliver wetter ways of farming'
- Potential for significant biodiversity benefits but production led focus is not applicable on all peatland areas and different crops/management have different impacts.
- Now is the time to start planning for sustainable paludiculture to get the best for this emerging farming approach

Sustainable Peatland Principles

Principle 1

Prioritise rewetting that halts peat degradation through appropriate, stable water level management

Principle 2

Develop a planned approach to paludiculture activity appropriate to local circumstances

Principle 3

Recognise the full range of public benefits in economic assessment and support for paludiculture.

Principle 4

Plan and manage paludiculture with regard to biodiversity objectives

Sustainable Peatland Principles

Principle 5

Engagement at catchment scale for the potential benefits of paludiculture to be fully realised

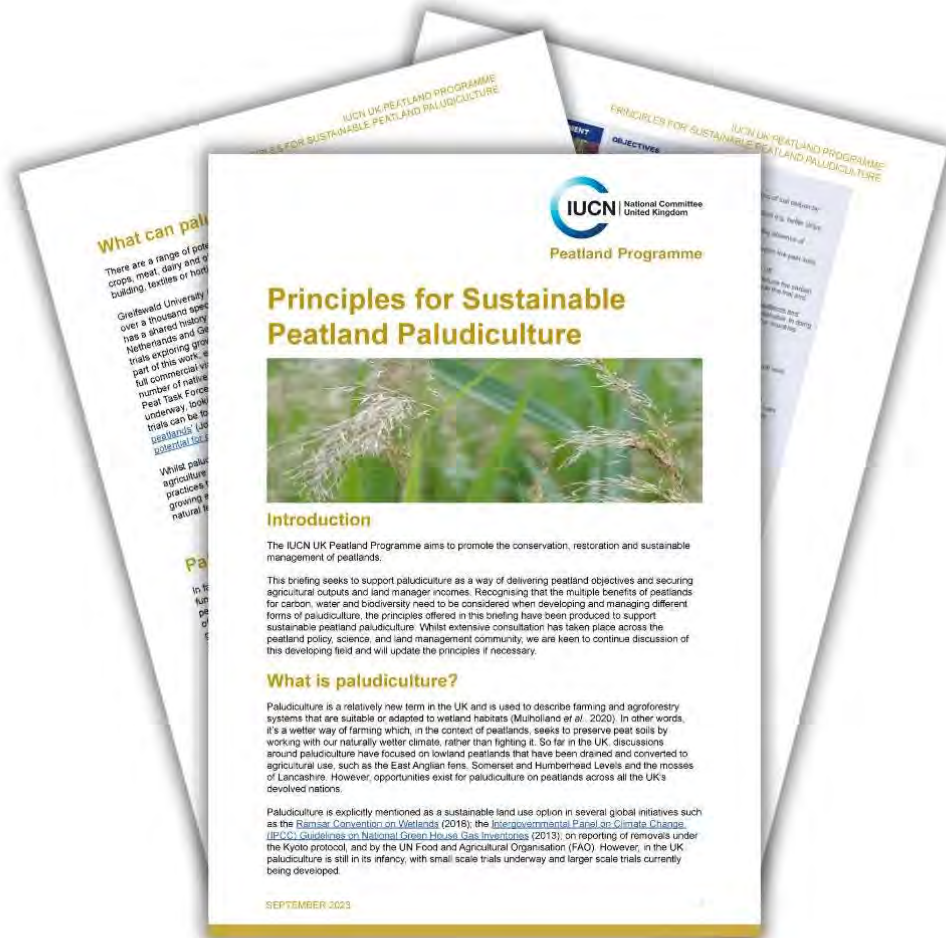


Sustainable management of peatlands requires a collective approach, with landowners and wider stakeholders adopting a shared view of water level management which is no longer drainage-based, but aims to ensure a consistent supply of water within an area and shares the benefits and opportunities of doing so.

Recommendations

- Research to understand and maximise co-benefits.
- Funding support to help transition to paludiculture and promote the long-term health of peatland habitats.
- Research to inform and design new hydrological management systems





Contact us to get more info

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Download this and all our other briefings here:



Paludiculture and the Paludiculture Exploration Fund Jim Milner, Natural England



The Paludiculture Exploration Fund



- An Engagement contract with NIAB to;
 - Encourage discussion
 - Share knowledge
 - Respond to the paludiculture community
- A grant offer
 - £5m over 2 years on 12 projects
 - To explore different aspects of paludiculture
 - Promote and develop products that use wet soil crops



PEF - what is it aiming to do



PEF Grants aim to help unlock barriers to the development of commercially viable paludiculture.

The focus of the grants offered through PEF is tackling the whole value chain;

the growing and harvesting of paludiculture crops and/or the development of products based on those crops.



Agricultural Method

Paludiculture is the practice of farming on wetlands, such as rewetted peatlands, bogs and fens. Peatlands are naturally some of the oldest and most healing environments on our planet. They sequester and store 3-5% more carbon than any other terrestrial land or forest. However, due to centuries of irresponsible drainage of peatlands for industrial farming, these precious wetlands are being destroyed turning them into carbon emitters.

Healing Properties

Saltyco is currently working alongside partnered farmers to reverse the negative impact in peatlands located in Cambridgeshire, England. This year we visited The Great Fens and cultivated thousands of our native plants to help re-wet and restore these ecosystems and return them to their original healing state.



PALUDICULTURE

Within the Nature for Climate Fund, Natural England is delivering the Paludiculture Exploration Fund (PEF) for England. This website provides a hub for the PEF projects and also provides links for the wider Paludiculture Community.

[Join the community](#)

EVENTS

- Access details of future and past events relating to Paludiculture in England.
- Find the latest information about future events.
- Access reports from past Events and Workshops.

[More](#)

PROJECTS

- Access details of on-going and completed projects relating to Paludiculture in England.
- Find out more about the Paludiculture Exploration Fund
- Share reports and updates from the range of ongoing Paludiculture projects

[More](#)

RESOURCES

- Access more information relevant to the growing opportunity for Paludiculture in England
- Find summaries of academic research on a range of relevant topics including the agronomy and use of paludiculture crops, together with the impacts of paludiculture on GHG emissions, biodiversity and water resources.
- Share reports and guidance from research in practice

[More](#)

ABOUT PALUDICULTURE

Paludiculture, or farming with high water tables, is a system of agriculture for the profitable production of wetland crops under conditions that support the competitive advantage of these crops. While the term "paludiculture" is a recent one, its practice in England goes back generations.



<p>IUCN UK Peatland code</p> <p>Action now to invest in peatlands will avoid far greater future costs to businesses and wider society from climate change and environmental harm resulting from damaged peatlands.</p> <p>Read More →</p>	<p>Overcoming financial barriers with biochar integration</p> <p>Identifying cost-effective biochar application methods and biochar types to reduce input costs, whilst maximising carbon finance revenues by identifying management practices, that offers optimum carbon removal and storage.</p> <p>Read More →</p>	<p>Typha seed heads for textile production</p> <p>Developing the supply and processing of typha seed heads for use as an insulation material for outdoor clothing.</p> <p>Read More →</p>	<p>Drone RePeat</p> <p>Promoting sustainable land use practices by introducing, developing and scaling Unmanned Aerial Agricultural techniques for Paludiculture.</p> <p>Read More →</p>
<p>Paludiculture Innovation Project (PIP)</p> <p>Aiming to create a facility for paludiculture research, development, demonstration and knowledge transfer.</p> <p>Read More →</p>	<p>FibreBroads</p> <p>Unlocking paludiculture 'the profitable production of wetland crops' as a new opportunity for farmers in the Broads and Norfolk.</p> <p>Read More →</p>	<p>Fenland SOIL Fens Paludiculture Opportunity Exploration</p> <p>Expanding Fenland SOIL's opportunity mapping project to four new drainage boards using the methodology developed by Fenland SOIL.</p> <p>Read More →</p>	<p>OPENpeat</p> <p>Promoting paludiculture in the North West region by actively engaging with the farming demographic to develop the paludiculture knowledge base.</p> <p>Read More →</p>

12 Projects



It's not all about Typha...

Sphagnum – Horticultural peat substitute and potentially other uses...

Food crops - Celery, Blueberries, Cranberries...

Other fibre crops – sedge, common reed, miscanthus...

... and many more see

[An assessment of the potential for paludiculture in England and Wales](#)

Literature Review: Defra Project SP1218
An assessment of the potential for paludiculture in England and Wales
Authors:
Dr Barry Mulholland, ADAS, Boxworth, UK
Islam Abdel-Aziz, ADAS, Boxworth, UK
Richard Lindsay, Sustainability Research Institute, University of East London, UK
Dr Niall McNamara, UKCEH, Lancaster, UK
Dr Aidan Keith, UKCEH, Lancaster, UK
Professor Susan Page, School of Geography, Geology and the Environment, University of Leicester, UK
Jack Clough, Sustainability Research Institute, University of East London, UK
Ben Freeman, Bangor University, UK
Professor Chris Evans, UKCEH, Bangor, UK

April 2020



NE role



Why are we involved?

- Economically viable ?

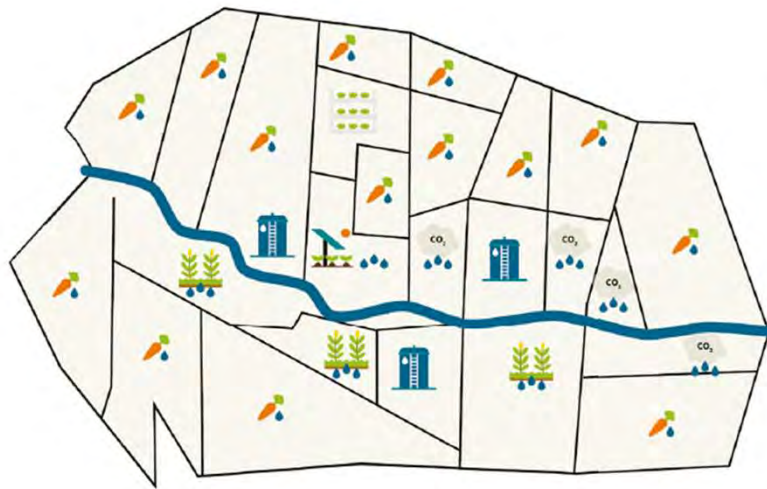
Practically

- Funded through the Nature for Climate Fund
- Synergies with the other peatland grants NE are delivering
- Deliver the project
- Peat loss mitigation

But also

- Opportunities to understand this new area of knowledge
- Explore the potential impacts on NE's remit
- Engagement/grant offer

Paludiculture in the agricultural landscape



LAND USE

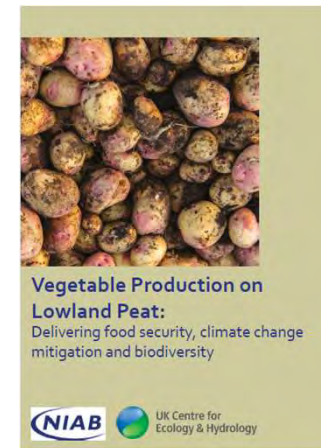
- Regenerative vegetable farming combined with water management
- Wetland restoration/Carbon Farming
- Paludiculture – Biomass crops
- Indoor/vertical farming
- Solar farming

WATER MANAGEMENT

- Wetter soils – that still allow for crop production
- Very wet soils

WATER STORAGE

- Water storage (eg. reservoir)



Paludiculture and Natural Environment



'Paludiculture is one of the tools to help deliver peatland objectives; it is not a panacea for peatland management and will not be applicable across all peatland, but represents a potentially more sustainable way of managing our agricultural peatlands.'

'Principles for Sustainable Paludiculture' -IUCN

Paludiculture does not *focus* on nature conservation but its practices may *contribute* to nature conservation by creating new wetlands, and as an intermediate stage between drainage-based agricultural use and nature conservation. Paludiculture may, for example, contribute to nutrient removal and vegetation management and act as a buffer surrounding, or acting as corridor between, wet conservation areas.²²

Global guidelines for peatland rewetting and restoration - Ramsar

- To protect (current water stressed sites)
- To restore
- Functioning Habitats
- To create nature based solutions
- Plan/use infrastructure to build in connectivity

Opportunities for the Natural Environment



Water

- Different water management approaches and retain more water in the landscape
- More connected and resilient landscapes
- Design for Nature based solutions
- Wetter peat

Nutrients

- Cropping solutions to remove nutrients
- Buffers

Income

- Income from cropping natural sites



Threats for the Natural Environment



- Nutrient hungry crops
- Agronomy needed for viable crops
- Focus is not Nature
- Can a balance be found
- Water stress
- Economics supply/demand



Discussion



In the context of the natural environment

- What are the risks and benefits of paludiculture
- What could we focus evidence gathering on
- What could we focus monitoring on
- What could we promote
- What could we discourage
- Can we maximise benefits by design

The logo for Natural England, featuring the words "NATURAL" and "ENGLAND" stacked vertically in white, uppercase, sans-serif font, centered within a solid green square.

NATURAL
ENGLAND

The intention of PEF is to help develop the knowledge base and create the conditions for paludiculture enterprises in England to develop. To facilitate this, outputs generated by PEF Grants will be made available to others. For example, data gathered in projects and/or other knowledge gained is shared as a case studies and other formats.



(left) inspecting seed heads of *Typha latifolia* and (right) fibre board and insulation from this crop – Jim Milner

Paludiculture products as sustainable construction materials

By Anthony Hudson from
Hudson Architects

Photo: International Peatland Society (IPS,
2023). Available at: <https://peatlands.org>

HUDSONArchitects

Hudson Architects



Who we are:

A design-focused architectural practice, based in Norwich, Norfolk, with a keen awareness of context and environmental responsibility.

Previous research project: CobBauge

- Interreg funded project from 07/2017 – 06/2023
- Bringing earth into the 21st century
- A natural building material made from earth, water and fibrous organic material (such as straw & hemp shiv)



Fakenham, Norfolk, UK
By Hudson Architects



CobBauge System

A 600mm bio-composite wall consisting of two different material densities containing earth

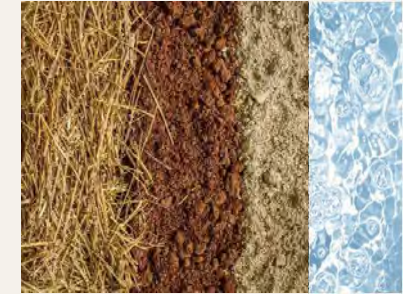
Light-Earth Insulative Mix (External 300mm)

- Clay slip & Hemp Shiv
- Lightweight



Structural Cob (Internal 300mm)

- Earth, Straw, Water (+ aggregate)
- Dense



Current research project: Fibre Broads

- DEFRA funded project from 06/2023 – 03/2025
- Making land rewetting & wetland crops (paludiculture) form commercially viable & sustainable solutions
- HA are investigating how the harvested wetland crops can be used for sustainable building materials.



Image: Broads Authority (2023) Aerial view of the Horsey wet farm



HUDSONArchitects Wetland Products



Raw Materials



What can
the crops
be used
for?

Photo: Andrea Kelly

Typha particle sizes



(LEFT) From left to right:

- Cigar seeds
- Typha leaves cut 0-10
- Typha leaves cut 0-20
- Dihlo
- Pierre T
- Mouse - processed

(ABOVE) From left to right:

- Processed Typha for fibre boards
- Chopped Typha for particle boards
- Typha stalk

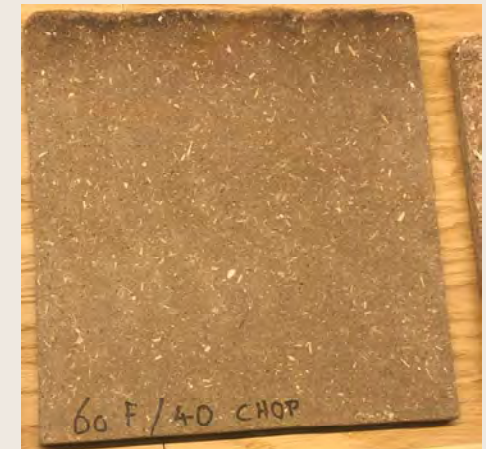
Product Applications

Fibre boards

- **Company:** Zelfo Technology
- **Process:** Adhesive-free binding technology
- **Application:** Wall, floor, furniture & finishes surfaces
- **Qualities:**
 - Versatile range of densities & finishes
 - Water resistant
 - 100% biodegradable
 - 100% toxin free



100% processed Typha



60% processed Typha
40% chopped Typha



40% processed Typha
60% chopped Typha



Typha & Calcium Carbonate
- creates a stronger
cementitious-like board

Wall

Particle boards

- **Company:** Aldert van Weeren collaboration with Kingsport
- **Process:** Magnesite-bound cattail chips
- **Application:** potential replacement to OSB to be used as sheathing in walls, flooring, and roof decking.
- **Qualities:**
 - Insulative
 - Structural
 - Versatile

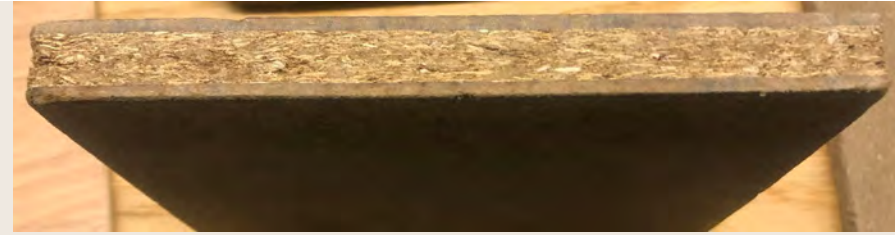


Wall

Composite boards

- **Company:** Zelfo Technology and Aldert van Weeren collaboration
- **Process:** Particle board with glued fibre boards either side
- **Application:** Construction wall, floor
- **Qualities:**
 - Insulative
 - Structural

Wall



Cavity Wall Insulation

- **Materials:** Typha leaves cut 0-20mm
- **Application:** Cavity wall blow-insulation
- **Qualities:**
 - Insulative
 - Similar U value to wood fibre.



Photo: Coen Verboom, Bouwgroep Dijkstra Draisma

Ridged Insulation

- **Company:** Material Cultures + Bauhaus Earth, in collaboration with Experimental
- **Process:** Whole-reeds paludiculture biomass panel
- **Application:** Wall & roof insulation
- **Qualities:**
 - Ridged
 - Insulative



Photo: Material Cultures (2023). Wetlands & Construction: An opportunity for Berlin-Brandenburg

Floor slab / tile

- **Company:** Aldert van Weeren development
- **Materials:** Reclaimed ink sludge mixed with fibres
- **Application:** Floor surfaces
- **Qualities:**
 - Durable
 - Stiff
 - Waterproof



Floor

Modular building / wall system

- **Company:** Zelfro Technology Collaboration
- **Materials (from interior to exterior):** Inner face fibreboard/ chopped typha cavity insulation/ clad with typha-ink hybrid board
- **Application:** Wall construction
- **Qualities:**
 - Structural
 - Insulative
 - Water resistant



Wall System

Bio Laminates

- **Company:** Huisveendam, Netherlands
- **Process:** Bio-based particles binded with potato starch technology & adhered onto plywood
- **Use:** Internal finishes
- **Qualities:**
 - Versatile; wide range of colours, textures & finishes
 - Interior biophilia
 - Water resistant

Finishes



Photo: MaterialDistrict (2014)

Bio PVC

- **Company:** Bio-Lutions
- **Process:** Bio-based compressed under high pressure
- **Application:** Packaging & Utensils
- **Qualities:**
 - Mouldable shapes
 - Ridged
 - Smooth
 - Water resistant
 - Dense



Disposables & Packaging

Clothing

- **Company:** Saltyco®
- **Process:** Using the fluffy Bulrush seeds for coat quilting
- **Application:** Stuffing
- **Qualities:**
 - Insulative
 - Soft
 - Warm
 - Lightweight
 - Water resistant

Goosedown out, bulrush in: the plant refashioning puffer jackets

By 2026, a rewetted peatland site in Greater Manchester will be harvesting bulrushes in a trial that aims to boost UK biodiversity, cut carbon emissions and provide eco-friendly stuffing for clothes



📷 The BioPuff jacket made by UK startup Saltyco using bulrushes as a filler material. Photograph: BioPuff

Photo: Biopuff®, from The Guardian Article

Textiles

Review

Wetland Crop Biomaterials – Benefits

- Reduces construction waste by avoiding the conventional alternatives
- Large potential market
- Low tech & simple
- Low carbon
- Materials sourced locally
- Good insulation for low energy buildings
- Sustainable life cycle assessment
- Natural & renewable material
- Often biodegradable & toxin free
- Supports the remediation of peatlands
- Supports local biodiversity & habitats



Image: Ionescu, (2022) available at: <https://www.earth.com/news/marsh-plant-can-effectively-clean-contaminated-soil/>

Wetland Crop Biomaterials – Current barriers

There is a lack of:

- Established farming supply chains
- Typha demand for raw materials
- Material testing to gain certification
- Scale of production
- Production cost calculations
- Practised business cases
- UK fibre-industry establishment
- Agreement of land-use i.e., balancing efficient land production with society demands



Image: Canape, Interreg North Sea Region (2019)



Photo: International Peatland Society IPS, (2023) available at: <https://peatlands.org/peatlands/responsible-management/>

Challenges of putting paludiculture into practice

Andrea Kelly
Environment Policy Adviser
Broads Authority
andrea.kelly@broads-authority.gov.uk

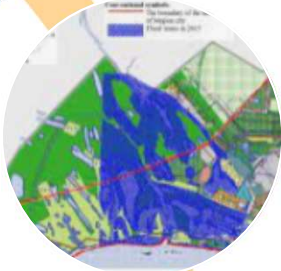


FibreBroads

Lead Partner: Broads Authority
Partners: Palladium, Norfolk FWAG, Norfolk County Council, Norwich University of the Arts, Hudson Architects, Wetland Products
Supported by: Defra, Natural England, Environment Agency, Broads IDB, NFU, Horsey Estate, Fenland Soil



Horsey wet farming & filtration demonstrator



Test case for Wetland Water & Spatial Planning



Farming options development



Product engagement & development



FibreBroads

Grow Paludiculture Crops

Funded by:

- Defra/Natural England
- Broads IDB
- Environment Agency
- Anglian Water
- Broads Authority

Engaging about:

- propagation, planting, harvesting
- carbon emissions and nutrient filtration
- fibre products and economics



Interreg
North Sea Region
CANAPE
European Regional Development Fund



EUROPEAN UNION



Environment Agency



Broads Authority



Broads Drainage Board

Wet Farming Demonstration
Horsey Wetland Project | March 2022



Sprouted seedlings



Plug plants

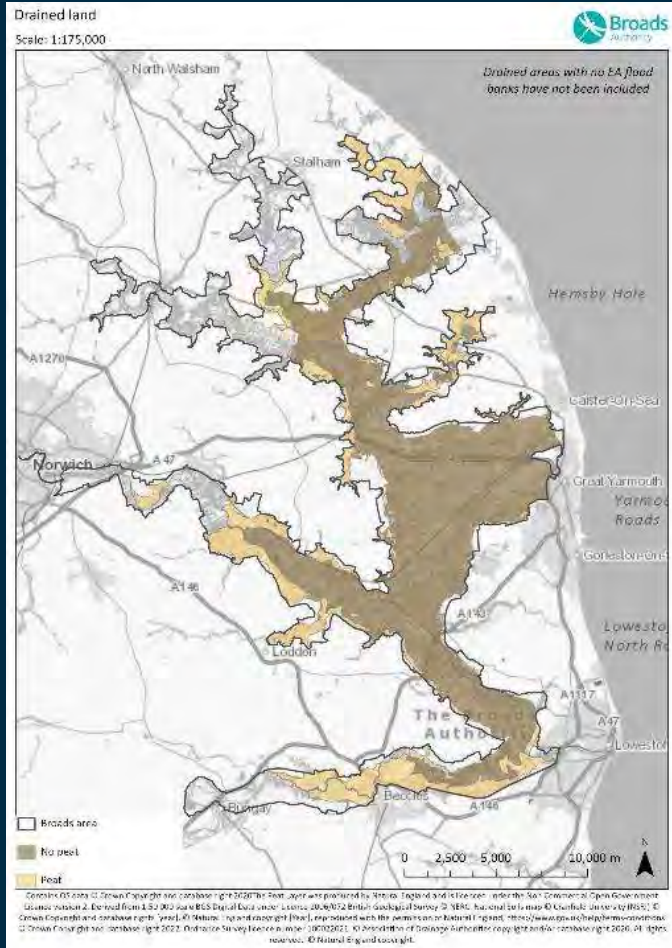


FibreBroads

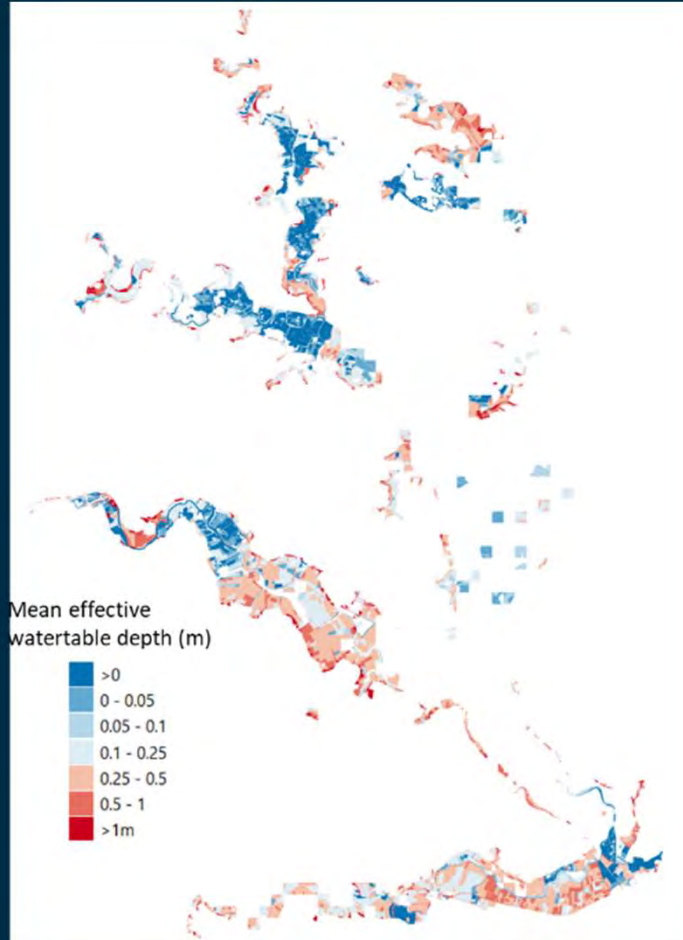
Test Case for Water Management and Permissions

- Reducing the barrier around water management, including testing the processes for assessing volumes, storage, flood risk
- Develop guidance for interested parties on paludiculture
- Testing if it is possible to gain the permissions to abstract water and enhance its quality

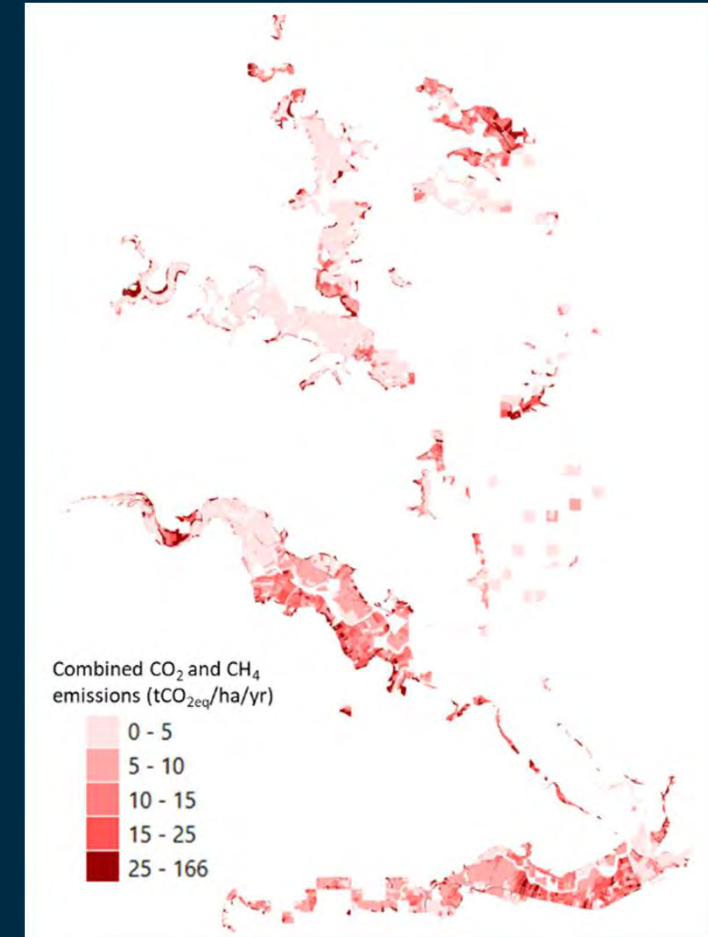
Drained peat in the Broads



Simulated average effective water table depth



Combined emissions of CO₂ and CH₄



Farming options development



Challenge areas

- Policy
- Engineering
- Finance
- Social, landscape
- Product development

Policy 1



Licences are often allocated to historic demands and there is no planning, yet, for the floodplain/peatland



Winter water storage needs detailed planning



Investment in water management systems and infrastructure



Confidence in long term support of paludiculture

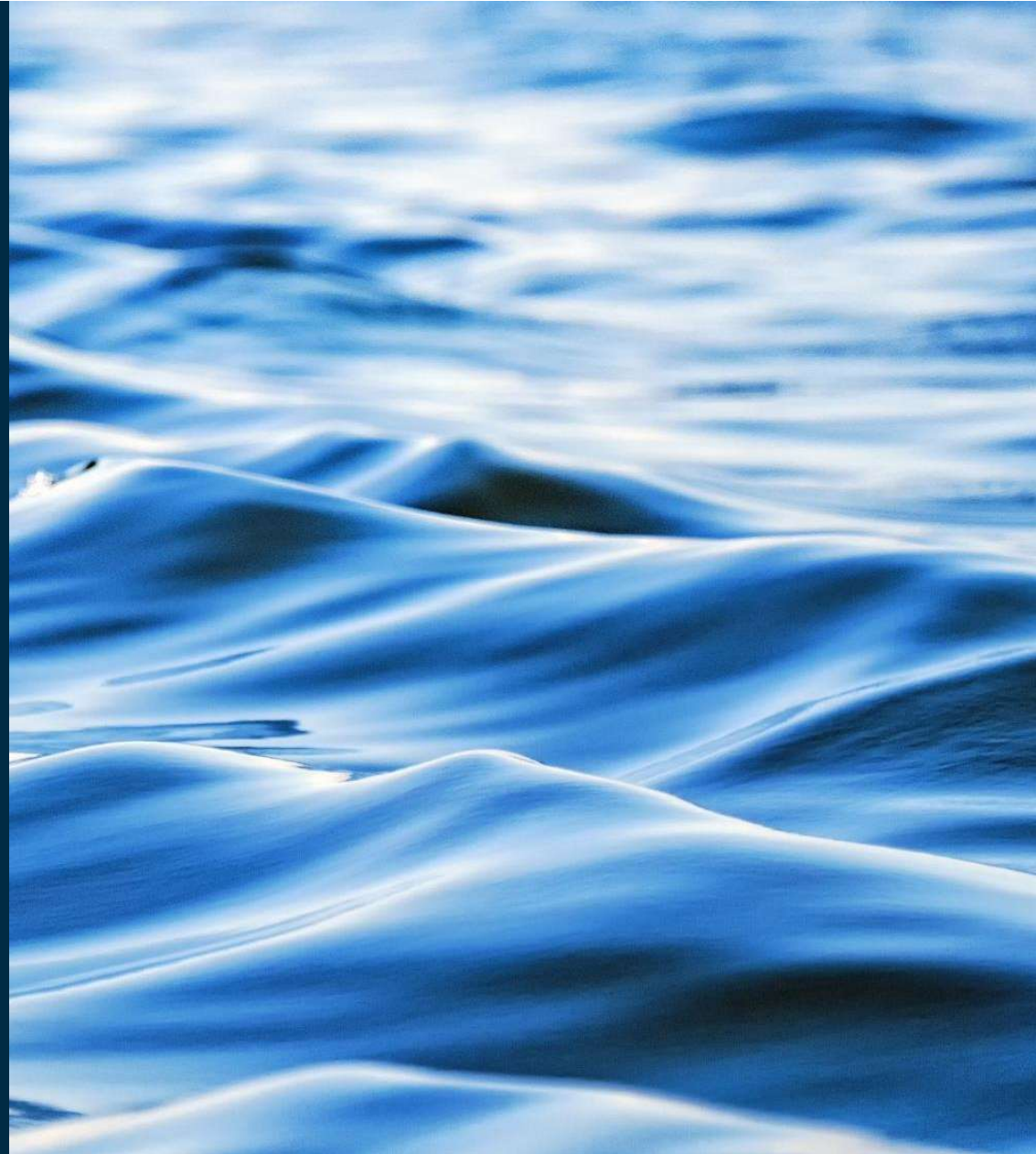


Apparent lack of policy coherence and consistency across different departments

Policy 2

Permits, Licences & Permissions

- Flood Risk Activity Permit
- Water Resources Licence
- Ordinary Water Consent
- Land Drainage Consent
- Planning Permission





Mark
Spencer

Minister
State for
Food,
Farming and
Fisheries





Rebecca Pow

Minister
Environmental
Quality and
Resilience





Anna Hill

BBC Radio 4
Farming Today



Engineering

- Peat Conditions
 - Stability and loadings
 - Excavation
 - Maintaining in-field wetness
 - Foundation design
- Topography
 - Splitting levels
 - Compartmentalizing design
 - Surface removal only as last resort
- Summer Conditions
 - Maintaining water supply and levels
 - Wind speed
- Winter Conditions
 - Solar capacity
- Water Voles
 - Ground works

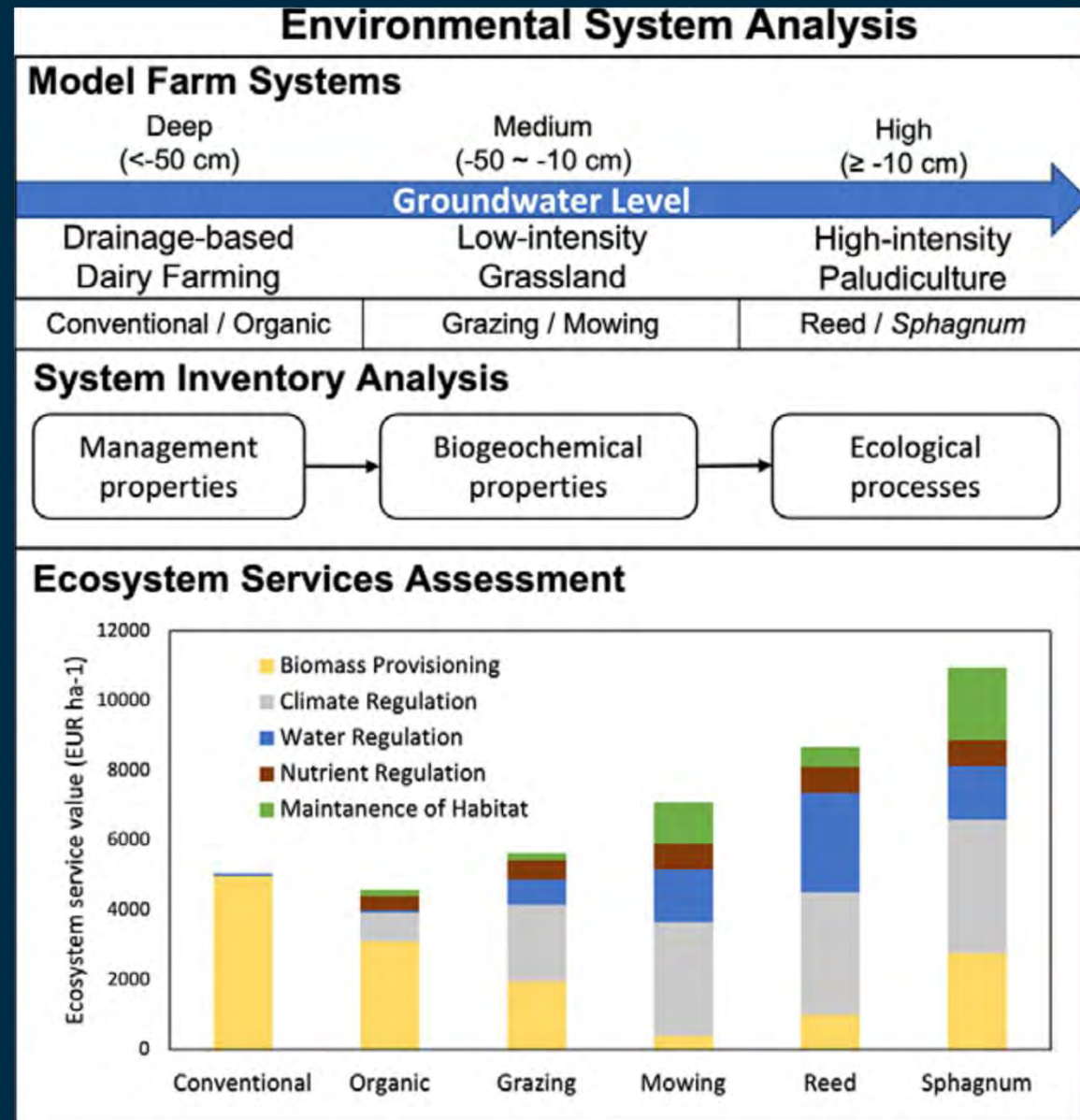


Finance 1

Product alone is not expected to generate viability

Conventional = Dutch intensive dairy production

Weier Liu, Christian Fritz, Jasper van Belle, Sanderine Nonhebel
 Science of the Total Environment 875 (2023) 162534



Finance 2

Financial viability modelling – The BNG income and Peatland Carbon estimator Tool



Rough
Cashflow
estimator

	Yr1 Costs	Annual Costs in Subsequent Years	Plot Size (Ha)	Summary BNG Units if sold in 2025	Summary Carbon Credit after 30 years
Total	£139,985	£35,068	20	31	4,492
Credit Sales required to breakeven on cash in Year	4.0	1.0			



Finance 3

- Investment
 - Long-term public funding for sector development and grower confidence
 - Market development requires direct investment
- Decrease in land valuation for wetlands
 - Affects tenancy agreements, mortgages, rent
 - Legal recognition of paludiculture as a form of agriculture
- HMRC recent update Inheritance Tax Manual
- Scoring to enter CS: 'Raised water on peat soils' only entering Mid-Tier, but 'Major preparatory works' only funded in Higher-Tier
- Paludi Business Case yet to be developed in the UK

Social & landscape

- Unacceptable to raise water table on surrounding land and assets
- Protected Landscapes
- Growing awareness of the benefit of lowland peatlands



Product development

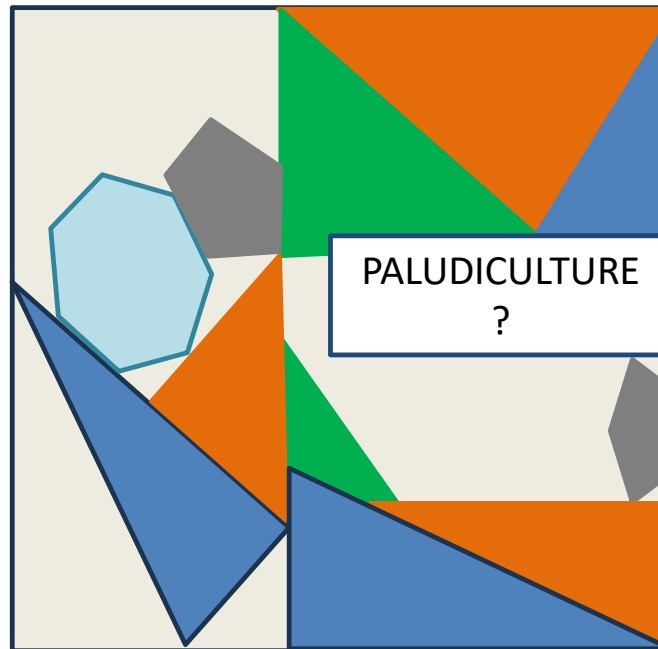
- Limited livestock paludicultural options apart from the growing of fodder crops
- Development, testing and use of product
- Development of new markets and supply chains
- Large scale demonstrator sites for harvesting (over 10ha)
- Product quality assurance (e.g. hazardous chemicals, structural stability)

Over to Aldert!

Questions and discussion

Add to the Q&A at slido.com with #2675524

What do we need to know to decide if, where and how?



Where are the gaps in knowledge to maximise benefits and reduce risks?

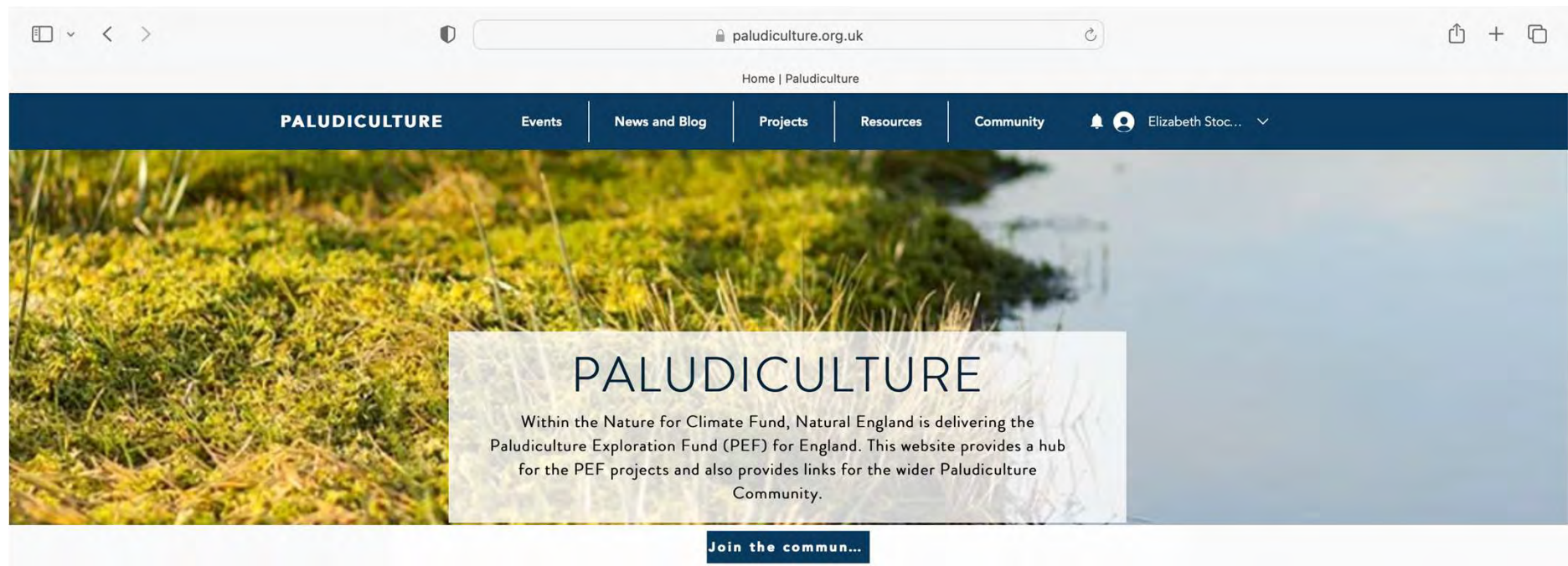


Share the group's thoughts
at **slido.com** with **#2675524**

Discussion – filling the evidence gaps

What, who, how?

Add to the Q&A at [slido.com](https://www.slido.com) with #2675524



EVENTS

- Access details of future and past events relating to Paludiculture in England.
- Find the latest information about future events.
- Access reports from past Events and Workshops.

PROJECTS

- Access details of on-ongoing and completed projects relating to Paludiculture in England.
- Find out more about the Paludiculture Exploration Fund
- Share reports and updates from the range of ongoing Paludiculture projects

RESOURCES

- Access more information relevant to the growing opportunity for Paludiculture in England
- Find summaries of academic research on a range of relevant topics including the agronomy and use of paludiculture crops, together with the impacts of paludiculture on GHG emissions, biodiversity and water resources.
- Share reports and guidance from research in practice

paludiculture.org.uk

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