Botanica: Paludiculture and microplastics filtering in (former) peat meadows and other restored peatlands

Executive summary

Based on a previous EU(-LIFE) proposal, Botanica focuses on nature restoration in degraded peatlands and similar (former) wetlands, with multiple benefits. One key focus therein lies in creating buffer zones through rewetting former peatlands used as grassland or similar agricultural use, where the only (agricultural) alternative lies in paludiculture, growing "wet" crops such as reeds and cattail. A second focus are restored peatlands and other wetlands.

The core mission of paludiculture is to cultivate wet and rewetted peatlands in a climate-friendly way, recognizing that drained peatlands release substantial amounts of human-induced greenhouse gases. Besides reducing emissions after rewetting, which lead to an increase in carbon capture in both soil and vegetation, the harvestable reeds and cattail and their fibres may be used in building materials such as laminates that can also store carbon (semi-) "permanently", or at least long-term. Also, for freshwater usage and storage such fields can generate multiple benefits, as water buffers but also in their function as so-called helophyte filters, replacing mechanical wastewater plants in rural areas, with little to no infrastructure. Finally, as key element of "Botanica", by adding specific bacteria to these filters they can take out specific pollutants, such micro-/meso- and nano plastics, or PFAS.

The great advantage of cattail is that the storage of PFAS and plastics is only in their root system and not in leaves, flowers or the typical fruit "cigars". This means that the captured biomass above the ground can be fully used in industrial applications, while the root systems can be dredged out and treated as chemical waste. In these filters, these components can be continuously harvested if we make use of an alternating harvesting and growing system.

In the original (EU-) proposal and first redrafts earlier, the focus was on "buffer" zones only, which may be situated in and around both urban areas and agricultural land, and/or nature areas. Through upscaling to cover much larger areas, also fully restored peatbogs have been or will be (stage 2) included, in which larger amounts of carbon will be stored.
This will allow for a "moonshot" type of project, with a large impact in the long-term, both in terms of carbon storage, but also water quality and biodiversity in restored areas.

The partnership has already been extended to other regions and countries, including both buffer zones and peatbogs/wetlands, either in the initial phase or follow-up to the project. For the meanwhile **ca. 2,000 hectares (+ at least an equivalent amount in benches in small waterways, mainly NL) already a total amount of 0.1 to 0.2 Mt CO_2-eq./year of carbon savings and storage** is calculated for the initial stage of 3 years: roughly 30-40% avoided emissions, 40-50% sequestration in plants, remaining in biochar/soil carbon. **This will most likely increase towards several MT/yr, when 10,000s of hectares are added in the following 5-10 years**, given the projects already contacted in other countries in- and outside Europe.

Total budget required (3 years, rounded/ca.): € 5.0 M, plus PM for stage 2.
Co-funding: at least similar, with € 1M (UK) from national funding and comparable amounts elsewhere, including some EU funding, but also through voluntary support!
Future upscaling: additional carbon or public, own (co-)funding, revolving fund model.

Introduction

Cattails do have a multiple contribution in storage of carbon, Nano- and meso plastics, PFAS and serving as valuable construction materials, insolation materials and pavement material for cycling tracks as has been successfully carried out on the island Schiermonnikoog in the Netherlands. Beside this contribution cattails do purify water systems also on bio- and many other drifting and floating pollutants as well.
The great advantage of cattail is that the storage of PFAS and plastics is only in their root system and not in leaves, flowers or the typical fruit cigars, as has been obtained from trial experiments so far. This means that the captured biomass above the ground can be fully used in many applications of industry, while the root systems can be dredged out and treated as chemical waste. In a cattail helophyte filter these components can be continuously harvested if we make use of an alternating harvesting and growing system.
In this approach we can harvest about an average yield of 6 to 12 tons per hectare per year, as obtained from empirical data. This results in annually up to 15 tons of CO2-eq. storage per hectare in plant/building material.

An extra bonus of cattail is the vertical aeration function in the stem and leaves to bring oxygen to the roots where bacteria can thrive well and thus purify the water as living microorganisms.
In addition, it is possible to raise the water-table in waterways and lakes, in particular in peat bog areas, and thus decrease the carbon-dioxide emission significantly.
For a detailed description of this process, we refer to the included, additional document "Micro, meso and nano plastics removal from freshwater systems".

References
R.E. Grosshans, P. Gass, R. Dohan. Cattail harvesting for carbon offsets and nutrient capture: A "lake friendly" greenhouse gas project. International Institute for Sustainable Development, Winnipeg, Manitoba, Canada, 2013

January 2026 (minor update), on behalf of the Botanica project consortium and team,

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The Netherlands, North Holland province

Leading organization for the project in the North Holland province is the NGO "Water, Land and Dykes", where over 600 farmers are active members. In total they cover 5800 hectares of open grass meadows, 40 hectares of open arable land, and in total 87.37 kilometres of water veining, 200 hectares of open water, and finally 92 hectares of area to be treated in climate adaptation.
The use of cattail cultures can be done in the water veining systems, open water and climate adaptive areas, which is in total 292 hectares of area and along water and in smaller waterways for a stretch of 87.37 kilometres of riparian vegetation.
With this knowledge of the total area, we can estimate a growth of nearly 300 hectares of cattail in the North Holland province and thus in principle achieve a carbon storage of 2.4 to 3.0 kt per harvest/year in cattail production.
If we use all the benches of ditches and small canals, we can add about 87 stretching kilometres of cattail in addition. In carbon storage calculation this results in roughly 52.2 to 182.7 kt of additional significant carbon storage per harvest/year in cattail crops.
As the water in the mentioned areas is already raised, there will be no extra raise of the water level as such and no extra carbon emission reduction or additional carbon storage from and in soil. **Hence the total carbon storage on this location is estimated at 55 to 195 kt (up to 0.195 Mt) CO2-eq./year.**
The mentioned areas are directly available, the project hence can start at any moment in time, as soon as funding is available. No additional planning permits or similar preparatory measures are required.
implementation is foreseen through the participating farmers, who provide the areas and take care of the planting. Support is provided by students and staff of the University of Applied Sciences Amsterdam and Aeres University of Applied Sciences at Almere, and coordinated by staff of Secunda B.V. Amsterdam.

Initial costs investments/infrastructure, planting: ca. € 250k
Costs staff/support team of ca. € 200k/y, for 3 years: ca. 600k
Costs for equipment, (initial) harvest/s for research/carbon monitoring, not covered through usable products sales/carbon credits: ca. €150k
Total (based on 3 years from project start): € 1.0M.

Amsterdam, November 2025 (updated).
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The Netherlands, province of Fryslân

The project addresses a combined solution for three separate issues

- Rewetting peatlands to keep carbon in peat locked in the soil. Changing drained grassland into paludiculture with cattail (*Typha sp.*) and reed (*Phragmites australis*) involves raising water levels, which prevents peat oxidation and thus reduces GHG emissions. In the Peat Innovation Polder Hegewarren this involves raising groundwater levels from ca. 60 cm below surface (annual average) to ca. 10 cm above surface (annual average). This reduces GHG emissions from ca. 20 tCO_2-eq. p. ha p. yr to 0 or negative emission (NECB, numbers according to Dutch national inventory).
- Biobased building to turn housing projects from a strong CO_2-source to a CO_2-sink. Cattail and reed produce suitable biomass for the production of biobased building materials, which lock carbon in buildings for 50 – 100 yrs. A (realistic) production of 10 tons dry biomass p. ha contains ca. 5 tons carbon, which if turned to building materials equates to ca. 15-20 tons CO_2-eq. carbon storage.
- PFAS/PFOS, microplastics and nutrient removal in helophyte filters. Properly designed and managed cattail and reed stands can act as helophyte filters. Cattail has been shown to accumulate PFAS/PFOS. PFAS has in recent years been shown to be omnipresent in Frisian surface waters and soils (ambient concentration ca. 30 ng/l PFAS and ca. 2 – 5 ng/l PFOS, data regional water authority), with hot spots with much higher concentrations in water and soil. Micro plastics are omnipresent as well. Rewetting peatlands with a history of agricultural use, to keep carbon locked in the soil, will release nutrients (esp. P) from these soils. This can potentially have negative impact on ecological water quality in the regional water system.

The two main partners at this point are the Peat Innovation Polder Hegewarren and Biosintrum.


Figure 1 – Reed and cattail in peat mesocosms at Biosintrum. The mesocosms contain undisturbed peat soils from polder Hegewarren (photo Biosintrum).

The Peat Innovation Polder Hegewarren works on upscaling cattail production since 2023, and have developed cost-effective, practical solutions for field preparation and starting cattail cultivation. Currently they manage 7.5 ha cattail cultivation, with another 2.5 ha's to be seeded in May 2026. Biosintrum is an expertise centre on biobased building and has a strong track record on biobased building projects, with a number of these focused on materials from cattail and reed. Biosintrum also houses a soil mesocosm lab, which includes cattail and reed mesocosms containing undisturbed peat soils from polder Hegewarren. The Peat Innovation Polder Hegewarren and Biosintrum work together on cattail harvest, processing and production of building materials.

Two lines of research:

1. Field scale testing of different layouts of combined reed-cattail plantations to assess
    a. the ability to remove ambient conditions of PFAS/PFOS, microplastics and nutrients from surface water;
    b. where PFAS/PFOS and microplastics end up in the plant, and how this affects suitability for biobased building materials;
    c. how to manage these fields to maximise filtering capacity while minimizing GHG-emissions;
2. Mesocosm experiment using contaminated soils to assess
    a. How fast cattail and reed remove PFAS/PFOS from these soils;
    b. How this varies with contamination levels;
    c. Where this contamination ends up in the plant.

Figure 2. The cattail fields at the Peat Innovation Polder Hegewarren on 17 February 2025, shortly after the first harvest (photo Natuurlijk Spriensma).

Field experiment
3 different layouts of paludi fields, see fig 3.

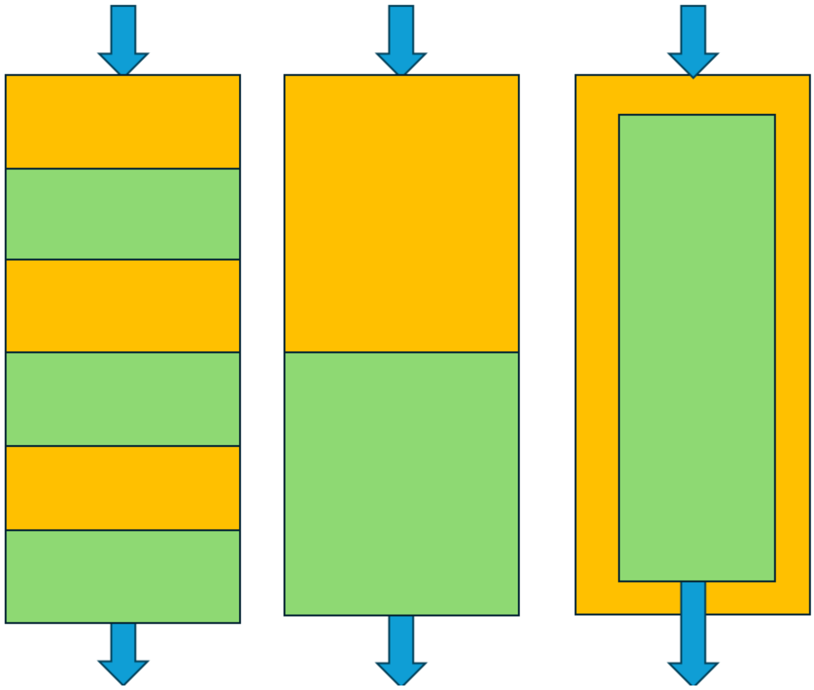

Figure 3 – Layout of helophyte filtering paludi fields. Yellow is reed, green is cattail. Reed is expected to mostly remove particles, whereas cattail is expected to remove chemical contaminants.

Total area to be converted from grassland to paludiculture is **3 ha, resulting in a Co2-eq. avoidance plus storage of ca. 90 t/yr.**
Alternating reed and cattail combines filtering effects of reed (more particle filtering, less chemical filtering) and cattail (more chemical filtering, less particle filtering). Each layout has pros and cons considering field management. The research setting demands good control of water inputs and outflow.
Monitoring focusses on removal rates (mass removed) for each field. A water balance will be determined by controlled inflow (pumps) and measuring outflow (height over weir). This will be combined with assessing concentration changes in surface water, with 2 weekly sampling of inflow and outflow water. Samples will be collected and stored in a freezer, to be analysed in batches (1 or 2 times a year). Samples will be analysed for PFOS/PFAS and microplastics (in Oldenburg) and for total N and total P (t.b.d.). Above- and belowground vegetation samples will be taken in late August (assumed maximum storage in plant) and in October/November (at harvest time). Samples will be stored in a freezer and analysed annually for PFOS/PFAS and tN and tP.

Soils containing three levels of PFOS/PFAS contamination will be transferred to mesocosms (Ø 1m), which will be planted with cattail or reed. 2 repeats per treatment. PFOS/PFAS levels will be determined in soil and in above- and belowground plant material, at the start and end of each growing season. Soil samples will be taken from 2 – 3 different depths to determine how deep soil remediation reaches. Samples will be stored in a freezer and analysed annually for PFOS/PFAS and tN and tP.

Budget

Budget line	Spending type	Budget
Field preparation	Investment	€150,000 (once)
Mesocosm preparation	Investment	€50,000 (once)
Project management, field and experiment maintenance, monitoring and sampling	Labor	€ 100,000 (annual)
Lab analyses, sampling consumables	External expertise / consumables	€60,000 (annual)
Data analysis, interpretation and reporting	External expertise	€5,000 annual + 15,000 final year project
Communication, knowledge sharing, etc.	External expertise / consumables	€5,000 annual
Travel, cooperation with partners, etc.	Consumables	€5,000 annual
Total for 3 yr project		**€ 735,000**

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The Netherlands, Panorama Park/Second Green Ring of Leiden

The blue-green Panorama Project in the Second Green Circle around Leiden forms a **biodiverse corridor 15 to 16 km long** and an **affiliation area of 300–500 hectares**. The wetland system consists of approximately 45–60 km of polder ditches and 12 km of main canals, connected to hundreds of polders and adjustable water levels. Drainage is via the Rhine, directly linking the area to regional water quality and drinking water supplies.
The **fine-grained hydrology and adjustable water flows make the area particularly suitable for pilot projects using cattails as a natural purification method for PFAS and microplastics**. Thanks to its linear structure, cattail zones can be strategically placed for maximum purification and monitoring, comparing the effectiveness of different plant-based purification methods.
The combination of scale, hydrological control, and location within an urban-scientific context makes the Panorama Project an ideal testing ground for innovative blue-green solutions at the intersection of water quality, climate adaptation, and biodiversity.

De route en plannen voor het PanoramaPark zijn nog niet definitief. Deze kaart geeft een indruk.

The short-term goal is to generate support and commitment from key partners.
By the end of 2025, the short-term goal is to assess and **strengthen the willingness and involvement of relevant parties**—including the municipality of Leiden, water boards, water

companies, knowledge institutions, and local, volunteers-based initiatives such as the Remidi foundation, Gemiva (support/inclusiveness of handicapped) and several community gardens and food forests—to participate in this innovative and internationally embedded project. Specifically, we aim for a **joint commitment on a robust scale**, giving wetlands, microplastic filters, and CO_2 storage a structural role within Panorama Park. This includes establishing pilot sites, agreements on monitoring and knowledge exchange, and preparing for scaling up. This collaboration lays the foundation for a long-term program that combines ecology, climate, water management, the production of environmentally friendly building materials, and social participation.

Leiden, therefore, boasts a unique area that can serve as the **foundation for innovative nature and water projects**. The Second Green Circle connects parks, ditches, food forests, and water catchment areas into a single blue-green landscape. The combination of a historic **polder landscape and an excellently manageable water system make this area ideal for controlled ecological experiments**. Water levels and flow can be precisely controlled, which is essential for testing natural filtering techniques such as cattails.
Its location in a **strong scientific context**—with Naturalis Biodiversity Centre, Hortus Botanicus Leiden, and other research institutions—offers **opportunities for thorough monitoring, analysis, and reporting, which are essential prerequisites for reproducible results and scaling up the intended application of natural water purification**.
Within the Green Circle are five food forests, including the Hof van Matilo Food Forest, the first pilot location. Here, nature, heritage (nearby UNESCO-site!), science, and local involvement are already successfully combining. This combination of physical infrastructure, knowledge, and citizen participation makes Leiden particularly suitable for small-scale pilots and large-scale rollouts. This creates a living lab where sustainable water systems are not only conceived but also proven. This makes Leiden a model region for climate adaptation, biodiversity restoration, and natural water purification.
In Matilo, a visitor centre for the project is also foreseen, creating also a local knowledge base for the project as a whole, and Leiden's role in it in particular.
The second pilot site is the Cronesteyn Park, where also a food forest for birds is situated.

Each of the pilot sites also have a large number of voluntary workers, experience in scientific, and include a larger network of smaller and larger water courses and small lakes in an urban or semi-urban setting, making these areas also suitable as pilot areas for the entire project as such.

Collaboration between science, citizens, and policy is a strength.
"What makes this area particularly strong is the knowledge infrastructure and community involvement. Leiden is known as the City of Science for a reason. Institutions like Naturalis and the Hortus Botanicus possess high-quality expertise in ecology, biodiversity, and environmental monitoring, playing a connecting role between citizen initiatives, education, and policymakers. This ensures that innovations are not just theoretical models tested in laboratories but will actually find their way into society. The presence of these parties makes it possible to combine science, citizen participation, and policy. This triangle is essential today if we want to implement, test, and scale up new techniques, such as phytoremediation with cattails."

The problem of microplastics and PFAS affects nature, food security, and public health.
"The reason we're setting up these projects is simple but urgent. Micro- and nanoplastics and PFAS are everywhere. They end up in ditches, groundwater, and food chains via our rivers and rainwater.
PFAS doesn't break down and accumulates in organisms, from insects to birds and ultimately in humans. Microplastics are also increasingly found in agricultural land, drinking water, and even placentas.
Traditional water treatment has great difficulty completely removing these substances. What we need are solutions that can function within the landscape itself—continuously, cost-effectively, and without heavy infrastructure.
That's where cattails come in. This wetland plant can help capture and concentrate pollution, thus improving water and soil quality."

Cattail, or Typha, is a plant that thrives in wet areas and can be used as a living filter system – a natural filter for a clean water system, in filtering also PFAS and microplastics.

For this, a close cooperation with both the "Hoogheemraadschap van Rijnland" Water Board (water management) and regional drinking water company Dunea is foreseen.
As for drinking water, the area is part of the water supply route between the Rhine River basin and the dunes, where this water is processed into drinking water for a larger part of the province of South Holland, acting – potentially – as a "first filtering zone" pilot area.
The pilots would possibly also be foreseen as a testing ground also for using cattail planted in mobile containers, alongside in a denser and fully grown water fringe or border zone.

The carbon storage, also through rewetting of nearby peatlands (grazing areas) and in building materials that can be used locally, will also in Leiden create an additional benefit.

Total area of the first pilots to be converted from grassland to paludiculture is relatively small, the Dunea area initially up to ca. **10 ha, resulting in a Co2-eq. avoidance plus storage of up to 400 t/yr., increasing to at least 100kt/y once extended to the Green Ring and/or (Dunea, other) surrounding areas.**

For the costs, first of all a calculation for the pilot areas has been made:

Initial costs investments/infrastructure, planting: € 100k
Annual costs support team (**volunteers-based, similar amount in co-financing**), € 100k (3y)
Costs for research, not covered through usable products sales/carbon credits: € 50k Euro

Total for 3 yr project – ca. € 250k

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Latvia

La Flora – Kaigu peatland

The planned Latvian pilot site at Kaigu peatland covers 16.4 ha (Fig. XX) of former peat extraction fields. Under current drained conditions (Stivrins et al. under review[1]), peat oxidation and unstable hydrology result in substantial GHG emissions. **Currently site emits 166 t CO_2-eq yr^{-1}** (Stivrins et al., 2024[2]), corresponding to an average of 10 t CO2 ha^{-1} yr^{-1} (~2.8 t C ha^{-1} yr^{-1}). **The remaining peat deposits contain an estimated 14 347 t C (~52 654 t CO_2)**, representing the total carbon stock that would be lost over time if drainage continued in its current form.

The restoration strategy focuses on rewetting and establishing paludiculture with Phragmites australis (common reed) to reduce emissions and enhance carbon sequestration in vegetation, new peat formation, and biochar. The expected climate benefits include avoided soil oxidation, CO_2 uptake in reed biomass, soil carbon accumulation, and long-term carbon storage in biochar derived from harvested biomass.

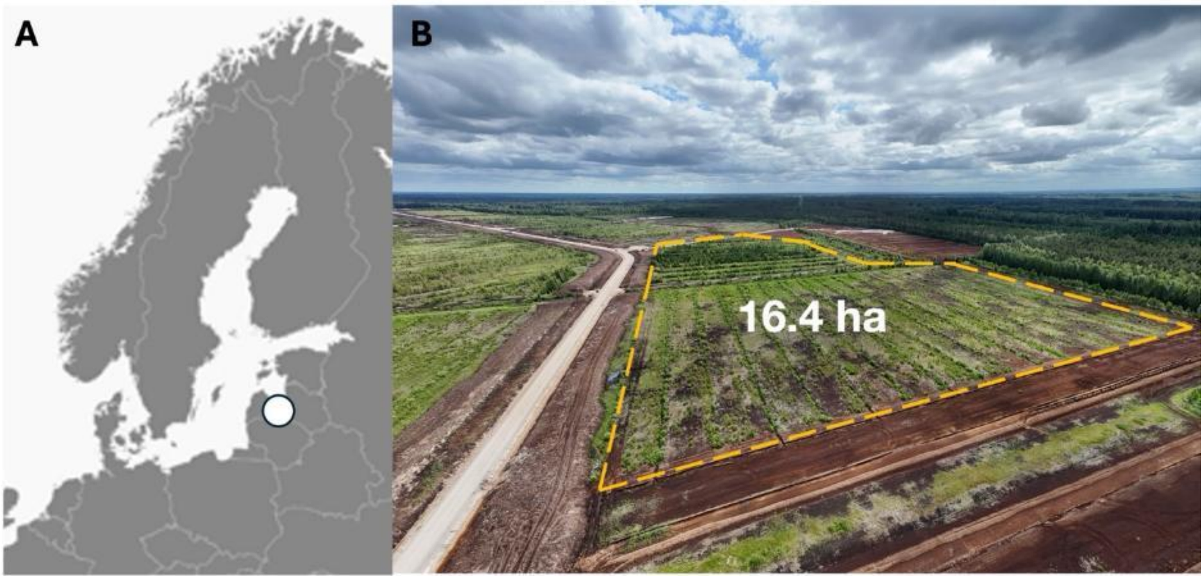


Figure XX. Location of Kaigu peatland (A) and project field (B).

Rewetting and maintaining a high-water table (close to peat surface) will reduce aerobic decomposition of peat. Based on verified emission factors for rewetted peat extraction fields, avoided CO_2 emissions are estimated at 6-8 t CO_2 ha^{-1} yr^{-1}, equivalent to 1.6 – 2.2t C ha^{-1} yr^{-1}. For the 16.4 ha site, this equals 100-130 t CO_2 yr^{-1} (~27-36 t C yr^{-1}) of avoided emissions.

It is expected that after rewetting, reed and microbial productivity will gradually increase. Average reed yield is expected to reach 4-6 t dry matter ha^{-1} yr^{-1}, containing 1.8-2.7 t C ha^{-1} yr^{-1} (~6.6-10 t CO_2 ha^{-1} yr^{-1}) in aboveground biomass. Part of this carbon will return to the system through litter deposition, contributing to new peat formation and soil organic matter.

[1] Stivrins, N., Bikse, J., Grinfelde, I. Groundwater dynamics and ecohydrological responses in an extracted peatland in Central Latvia: high-frequency monitoring and GEST classification. Hydrology, under review.

[2] Stivrins, N., Bikše, J., Jeskins, J., Ozola, I. 2024. Hands-on approach to foster paludiculture implementation and carbon certification on extracted peatland in Latvia. Land, 13, 188. https://doi.org/10.3390/land13020188

Meanwhile, **at the site scale** (16.4 ha), total annual carbon capture in biomass and soil is estimated at **130-200 t CO_2 yr^{-1} (~35-55 t C yr^{-1})**.

Harvested reed biomass will be tested for biochar production at pilot scale. Assuming 4 t dry biomass ha^{-1} yr^{-1} (we use lower yield in our estimates as a caution; in reality biomass can be higher), a biochar yield of 35% and a carbon content of 70%, approximately 1 t C ha^{-1} yr^{-1} (~3.7 t CO_2 ha^{-1} yr^{-1}) will be converted into stable biochar carbon that remains locked for over 100 years at least. For the full 16.4 ha area, this corresponds to 16 t C yr^{-1} or 60 t CO_2 yr^{-1} of durable carbon storage, see table below.

Combining avoided peat oxidation, biomass sequestration, and biochar storage yields and overall **net benefit of 17-24 t CO_2 ha^{-1} yr^{-1}, equivalent to 4.6-6.5 t C ha^{-1} yr^{-1}. At the pilot scale (16.4 ha), this represents a total annual climate benefit of 290-390 t CO_2 yr^{-1} or 80-106 t C yr^{-1}**.

To validate these estimates, continuous GHG flux monitoring will be conducted using a Picarro system (or similar high-precision analyser) before, during, and after rewetting implementation. Data will be processed according to voluntary carbon certification protocols (e.g., Verra VM0036, MoorFutures or SocialCarbon if applicable). This will enable robust calculation of verified emission reductions (avoiding carbon double-counting) and potential integration into carbon crediting schemes. Additionally, samples will be sent to Oldenburg, Germany, annually to investigate microplastics content in above- and belowground samples.

Table: Estimated carbon balance of the Kaigu peatland (16.4 ha) under Botanica project implementation.

Component	T CO_2 ha^{-1} yr^{-1} (min-max)	C ha^{-1} yr^{-1} (min-max)	**Total (16.4 ha): t CO_2 yr^{-1}** (min-max)	**Total (16.4 ha): t C yr^{-1}** (min-max)
Avoided peat oxidation	6-8	1.6-2.2	100-130	27-36
Biomass + soil accumulation	7-12	2.2-3.3	130-200	35-55
Biochar (long-term storage)	3.7	1	60	16
Total	17-24	4.6-6.5	**290-390**	**80-106**

It is very important to underline that the projected values represent net ecosystem effects, that is, total emissions avoided plus carbon accumulated in biomass, soil, and biochar. These estimates are ground in field data, peer-reviewed emission factors, and measured reed productivity. The resulting carbon balance demonstrates that even small, well-managed pilot sites can deliver substantial and verifiable GHG mitigation, while also serving as a model for scalable carbon certification in rewetted peatlands.

Activities

The following activities are planned within the project:

1) Field preparation. The surface of the peat fields will be levelled to create uniform topography suitable for water management and mechanized harvesting. Levelling will also ensure even water distribution across the site.
2) Hydrological system installation. A detailed hydrological design will be prepared, and the required permits obtained. Inflow and outflow control structures (pipes, gates,

valves) will be installed to regulate water levels, allowing seasonal control of water inflow and outflow.

3) Monitoring wells and hydrological observations. Monitoring wells will be installed near inflow, outflow, and central zones. Automatic loggers will record water-table depth and temperature at 30-minute intervals to evaluate the success of rewetting and monitor short- and long-term variability (e.g. due to climate extremes).
4) Reed planting. Phragmites australis will be planted using donor material collected from nearby natural stands. Planting will be done in spring, with full coverage expected within two years.
5) Water-system maintenance. The hydrological system will be inspected and maintained seasonally to ensure stable water levels and to prevent blockages or leakage.
6) Water-quality monitoring. Inflow and outflow water will be sampled several times per year and analysed for dissolved organic carbon (DOC), pH, and major nutrients (e.g., N, P, K) to assess water-purification and nutrient-retention capacity.
7) Biomass and carbon calibration. During the first two years, reed biomass and carbon content will be measured three times per year (mid-summer, late summer, and winter before harvest). These data will be used to calibrate drone and satellite remote-sensing models for estimating biomass and carbon stocks.
8) Remote-sensing monitoring. From the third year onwards, reed growth, biomass, and carbon storage will be assessed primarily by satellite and drone imagery, supported by field calibration data.
9) Decomposition experiments. Standardized “tea-bag” experiments will be deployed to determine organic-matter decomposition rates in rewetted and adjacent dry peat areas. Results will support soil-carbon-accumulation modelling using YASSO-type models, later incorporated as science-based estimation for new formation of peat and GHG release during litter organic decomposition at site.
10) Harvesting. Reeds will be harvested annually preferably in winter or early spring when biomass is dry and field conditions allow machinery access. Harvested material will be weighed and documented, and stored at nearby storage-drying facility before further processing.
11) Drying and storage facility. A ~100 m^2 reed-drying and storage shed will be constructed to enable efficient conditioning, storge, and handling of harvested biomass prior to processing or transport.
12) Biochar production testing. Harvested reed biomass will be tested for biochar production at a pilot-scale pyrolysis facility in Latvia or the Baltic region. Approximately 150 kg of biochar is expected per 1 t dry reed. For the 16.4 ha site (4 t dry reed ha^{-1} yr^{-1}), around 10 t biochar yr-1 will be produced, containing 6.8 t C yr^{-1} (~25 t CO_2 yr^{-1}) of stable carbon, of which about 80% remains stable for over a century.
13) Alternative biomass use. If project partners express interest, part of the harvested reed biomass may be sold for biobased material production (e.g. boards or insulation).
14) Carbon certification. Over the three-year period, all hydrological, biomass, and GHG data will be compiled to prepare the site for certification under voluntary carbon standard (e.g., Verra, MoorFutures, or SocialCarbon). Third-party verification will ensure methodological compliance and transparency.

Budget

To implement all the mentioned activities, we estimated a necessary budget for our 16.4 ha sized rewetting subproject activity amounting to EUR 383 000.00 (see table below), whereby we assumed it will be carried out within 3 years.

Budget for Kaigu peatland 16.4 ha rewetting subproject within the Botanica project.

No	Position	Cost, EUR
1	Field planning, preparation & rewetting infrastructure, permits	78 400.00
2	Monitoring equipment & installation, permits	22 500.00
3	Planting & establishing	16 800.00
4	Water-quality & soil monitoring	11 200.00
5	Biomass & carbon calibration	13 000.00
6	Remote sensing & modelling	22 300.00
7	Biochar pilot & testing	28 000.00
8	Drying & storage facility	39 500.00
9	GHG monitoring	16 000.00
10	Carbon-credit preparation (incl. scenarios) & verification	26 700.00
11	Personnel & project management	94 600.00
12	Travel & coordination	5000.00
13	Maintenance of field & infrastructure	9000.00
TOTAL (3 year project)		EUR 383 000.00

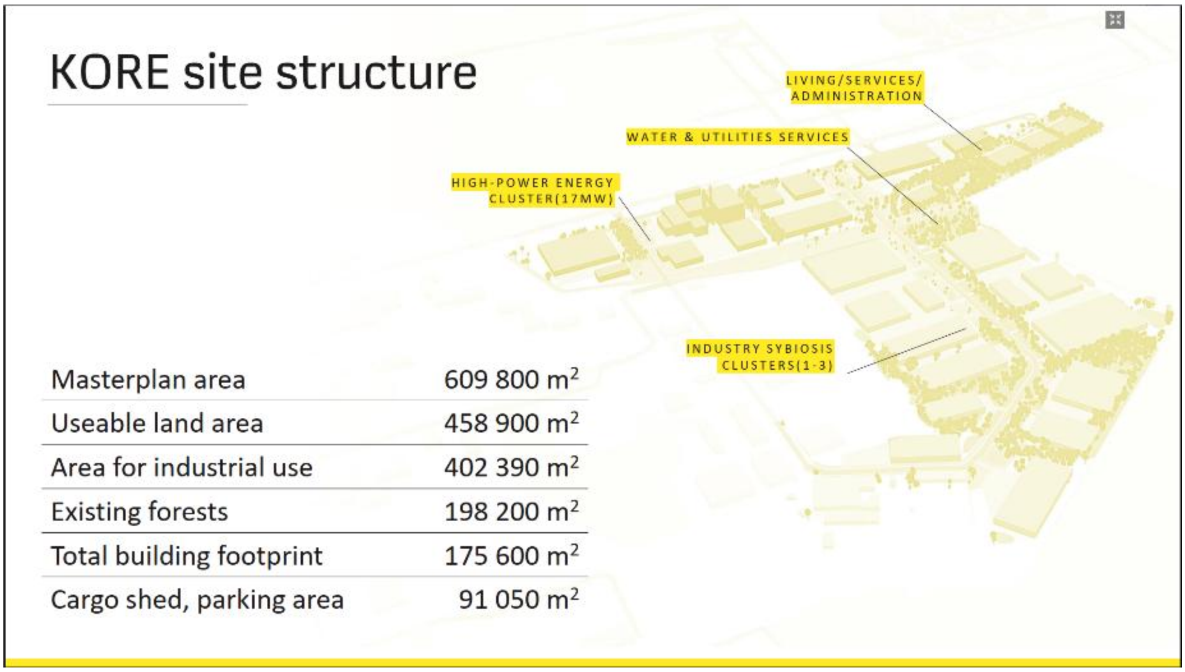
We are planning two involved parties in Kaigu peatland rewetting activities

(1) Laflora Ltd. as the owner of the Kaigu peatland (https://laflora.lv/en; *Development director **Sabina Alta**, sabina.alta@laflora.lv, and Scientific consultant PhD **Normunds Stivrins**,* Normunds.stivrins@gmail.com - overview, administration, implementation , and

(2) Lietuvos Inzenierijas kolegia LIK (https://www.lik.tech/en) ***Prof. Inga Grinfelde*** will be responsible for water management planning, its implementation and monitoring activities.

Latvia, KORE Eco-Industrial Park (Salaspils)

The **KORE Eco-Industrial Park** in Acone, Salaspils (Latvia) represents a pioneering model for **integrating industrial development and ecological regeneration**. Covering a total of 50 ha, the park is being developed as the **first industrial area in the Baltic region designed fully according to ESG, circular economy, and climate resilience principles**.



Half of the park area (approximately 25 ha) will be dedicated to **blue-green infrastructure**—a system of interconnected wetlands, vegetated corridors, and water-retention basins. Within this network, **a 5 ha wetland and water buffer zone will be implemented as a helophyte filter** system, functioning as a **natural water and soil treatment facility for the wider 100 ha** hydrological basin shared by three municipalities.
The site features naturally peated and partially degraded soil, which would typically be drained and filled for construction. Instead, KORE's development concept aims to **rewet and restore these soils using cattails (Typha spp.) and reeds (Phragmites australis),** transforming them into a **living infrastructure** for stormwater management, carbon sequestration, and pollution control.

The system will serve **dual purposes**:

1. **Treatment of industrial and stormwater effluents** through helophyte filtration, **reducing PFAS, microplastics, nutrients, and heavy metals**, and
2. **Biomass production for low-load infrastructure materials** (such as pedestrian and cycling paths), biochar, and biobased insulation materials, **creating a closed-loop biomass value chain** within the park.

In synergy with **the Botanica project's Latvian pilot at Kaigu peatland**, the KORE site demonstrates the application of paludiculture and water purification concepts within a **semi-urban, industrial setting**. It extends Botanica's approach beyond restoration into industrial symbiosis and resource-efficient urban water management.

The project **will include comprehensive hydrological monitoring, biomass and carbon calibration, and remote-sensing data collection** to enable carbon credit preparation and verification under voluntary certification systems (Verra, MoorFutures, or SocialCarbon). Results from KORE will contribute to the development of **scalable models for nature-based water treatment in industrial zones** across the EU.

The expected climate and ecological benefits include:

- **Avoided emissions and carbon storage**: 90–300 t CO_2-eq. per year through cattail and reed biomass and soil carbon accumulation.
- **Reduction of microplastics and PFAS** in runoff from the surrounding industrial and municipal areas.
- **Rehabilitation of degraded peat soils**, increasing biodiversity and water retention capacity.
- **Circular use of biomass for low-carbon infrastructure and material** applications within KORE.
- **Demonstration of industrial ecosystem regeneration**, linking climate resilience and green innovation.

Activities

1. Baseline analysis of pollutants in soil and water systems.
2. Detailed hydrological and rewetting design; permitting procedures.
3. Field preparation, rewetting infrastructure, and monitoring equipment installation.
4. Planting and establishment of cattail and reed stands.
5. Continuous monitoring of water quality, soil parameters, and biomass growth.
6. Calibration of carbon capture and sequestration data.
7. Remote-sensing and digital monitoring setup.
8. Pilot production of biomass-based pedestrian and bike path elements (in collaboration with park tenants).
9. Construction of a drying and storage facility for harvested biomass.

10. Preparation of carbon credit scenarios and third-party verification.
11. External expertise, personnel, and maintenance of infrastructure.

Budget

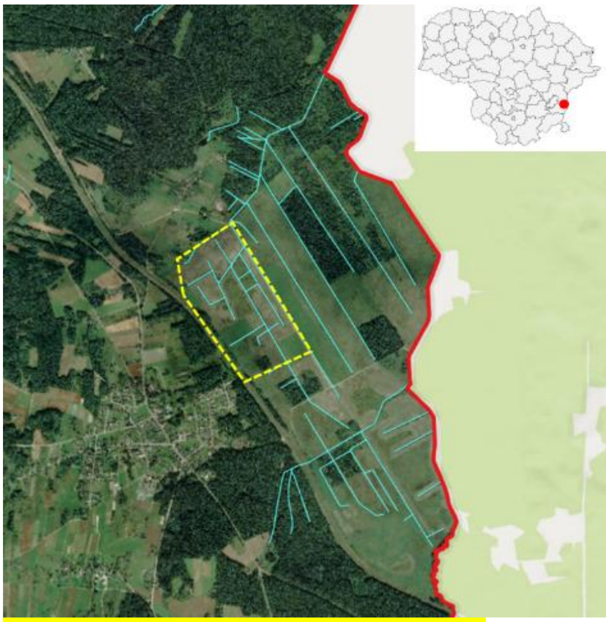
No.	Position	Cost, EUR
1	Field planning, preparation & rewetting infrastructure, permits	38,400.00
2	Monitoring equipment & installation, permits	12,500.00
3	Planting & establishing cattails and water-treating vegetation	16,800.00
4	Water-quality & soil monitoring	6,200.00
5	Biomass & carbon calibration	13,000.00
6	Remote sensing & modelling	22,300.00
7	Piloting biomass-based mobility infrastructure testing	28,000.00
8	Drying & storage facility	39,500.00
9	GHG monitoring	16,000.00
10	Carbon-credit preparation (incl. scenarios) & verification	26,700.00
11	External expertise, personnel	54,600.00
12	Travel & coordination	5,000.00
13	Maintenance of field & infrastructure	9,000.00
	Total (3-year project)	**EUR 288,000.00**

***Gunita Kiesnere**, KORE project responsible board member NP Properties*, Founder New Building School, November 2025, gunita.kiesnere@npp.lv, +37126881469

Lithuania

Margiai pilot site (approximately 100 ha; images below) is located within Margiai peatland in eastern Lithuania, near the border with Belarus. This area forms part of a **larger, 400-hectare fen peatland** that has been intensively drained and currently consists of perennial grasslands. Since the early 20th century, the site has been **used for industrial peat extraction**. Once peat mining ceased, the area **was converted into intensively managed grasslands**. Currently, the site is divided into several parcels but is predominantly managed by only one farmer who **maintains perennial grasslands and practices extensive management of the former wetland.** To date, no measures have been taken to raise the water level in the drained area. Due to intensive drainage, unstable hydrological conditions and peat layer mineralization the Margiai **pilot site is emitting approx. 950 t CO_2-eq yr^{-1}** corresponding to an average of 19 t CO_2 /ha/yr (Based on the GEST approach)[3].

Foreseen area management actions include **improving the hydrological conditions of the drained peatland and developing paludiculture through the establishment of reed canary grass** (*Phalaroides arundinacea*) plantations. These measures aim to **reduce GHGs emissions and enhance carbon sequestration**. Phytomass harvested from rewetted fen meadows will be utilized as cattle fodder and bedding material. In addition to this, the remaining or unused biomass can be used for composting as it is currently tested in ongoing EU-Horizon project (Paluwise).



Project area, needing to be improved

Improvement of hydrological conditions at Margiai pilot site will include blocking the drainage system and installing water regulation structures (constructions). These measures are expected to positively impact the GHG balance (reduction of GHG emissions) and create

[3] Birr F., Abel S., Kaiser M., Narmann F., Oppermann R., Pfister S., Tanneberger F., Zeitz J., Luthardt V., 2021: *Zukunftsfahige Land- und Forstwirtschaft auf Niedermooren - Steckbriefe fur klimaschonende, biodiversitatsfordernde Bewirtschaftungsverfahren, Hochschule fur nachhaltige Entwicklung Eberswalde und Greifswald Moor Centrum*. - Eberswalde, Greifswald.

favorable conditions for managing the rewetted fen meadow through paludiculture. **Foreseen rewetting will help to establish very moist grassland habitats (GHG emission coefficient - 7 t CO_2 ha^{-1} yr^{-1}) and thus reduce GHG emissions in the site by 420 t CO_2-eq yr^{-1} (including 30% non-permanence risk).** Reed canary grass yield is expected to vary from up to 15 t dry matter ha^{-1} yr^{-1} depending on site specific conditions[3].
Currently preliminary assessment and modelling of rewetting of the Margiai peatland is being prepared. It will include suggestions on possible dam location.

Activities
The following activities are planned within the project:

1) Preparation of documentation for rewetting. A detailed hydrological design will be prepared, and the required permits obtained. The documentation will include modelling of water level changes, locations of dams and technical solutions how to regulate water, taking into account what is necessary for paludiculture activities. Data and materials from previously prepared preliminary rewetting assessment will be used.
2) Installation of hydrological monitoring system. Monitoring wells will be installed near inflow, outflow, and central zones. Automatic loggers will record water-table depth at certain intervals to evaluate the success of rewetting and monitor short- and long-term variability (e.g. due to climate extremes).
3) Field preparation. The site will be prepared for the establishment of perennial wet grasslands dominated by reed canary grass.
4) Establishment of perennial wet grasslands dominated by reed canary grass. Purchase and sowing of reed canary grass seeds. **Part of the seeds will be used from other paludiculture pilot site from Lithuania.**
5) Implementation of restoration of hydrological regime. Besides regular dams, inflow and outflow control structures (pipes or sluices) will be installed to regulate water level and to make rewetted site accessible by machinery for the management.
6) Harvesting and collecting of reed canary grass biomass.
7) Assessment of GHG balances. Assessment will be done using the GEST approach. In addition to GEST unit mapping, peat depth measurements, agrochemical analysis of peat samples and data from hydrological monitoring will be obtained, which will help to make GHG balance assessment more accurate.
8) Assessment of water quality. Sampling of water will be done in the ditches (lower the site) before the restoration of hydrological regime and after (several times) to monitor and assess the changes of nutrients (N, P) and dissolved organic carbon (DOC).

Outlook
In a next stage, **other remaining parts of the 400 ha site and/or other areas may be added**, also depending on the results of this pilot area.

Budget

No	Position	Cost, EUR
1	Field planning, preparation & rewetting infrastructure, permits	50 000.00
2	Monitoring equipment & installation, permits	10 000.00
3	Planting & establishing paludiculture	40 000.00
4	Water-quality & soil monitoring	10 000.00
5	Biomass & carbon calibration	13 000.00
6	Remote sensing & modelling	
7	Biomass harvesting, preparation of fodder	28 000.00
8	composting experiment (equipment for composting)	10 000
9	GHG monitoring	16 000.00
10	Carbon-credit preparation (incl. scenarios) & verification	40 000.00
11	Personnel & project management	90 000.00
12	Travel & coordination	5 000.00
13	Maintenance of field & infrastructure	8 000.00
TOTAL (3 year project)		EUR 320 000.00

Nerijus Zableckis, *Direktorius, Pelkių atkūrimo ir apsaugos fondas (Foundation for Peatland Restoration and Conservation)*; nerijus@pelkiufondas.lt

Germany

The research group Plant Biodiversity and Evolution at the University of Oldenburg is focusing on topics of plant biodiversity, especially investigating the importance of intraspecific variation. In the framework of the project RoNNI (funded by the German Federal Ministry of Food and Agriculture, running from 2023-2032), the group already monitors the Typha establishment and biodiversity on approximate 20 hectares of cattail paludiculture in northwestern Germany, established by 3N (Competence Centre Lower Saxony Network Renewable raw materials and bioeconomy). Based on the expertise and experience in this project, the German group aims to investigate the effect of different genotypes of cattail on yield and microplastic storage in the paludiculture areas established in the Botanica project. Differences in growth and biomass production and different reactions to environmental parameters between species of cattail are well established (Bunbury-Blanchette et al. 2015; Haldan et al. 2022) and so is genetic diversity, especially in *T. angustifolia* (Lamote et al. 2005).
Initial observations by the group from Oldenburg in the RoNNI-project suggest that such **intraspecific genetic variation translates to different ecological preferences**. Choosing the right genotype for the paludiculture project may, therefore, be important for the success of paludiculture projects focusing on yield and/or microplastics cleaning. In the framework of the Botanica project, the group in Oldenburg aims **to sample genotypes from across the project partners range (Ireland to Latvia) and genotype them using the MIG-Seq method (Suyama et al. 2015) established in the lab and shown in preliminary work to be useful to identify intraspecific variation in cattail species.**
In parallel, we will investigate in a common garden and climate chamber approach, growth rate, yield, and microplastics of different genotypes **under different water levels, temperatures, and nutrient availability** following the experimental setup of Haldan et al. (2022).

Budget
Initial costs investments/infrastructure, planting: none
Annual costs staff/support team: 107,000 Euro
Costs for research, not covered through usable products sales/carbon credits: 50,000 Euro
Total for 3 yr project – ca. € 370k

Prof. Dr. Dirk Carl Albach*, Universität Oldenburg*, dirk.albach@uni-oldenburg.de

1. Bunbury-Blanchette AL, Freeland JR, Dorken ME. Hybrid Typha×glauca outperforms native T. latifolia under contrasting water depths in a common garden. Basic and Applied Ecology. 2015;16(5):394-402.
2. Haldan K, Köhn N, Hornig A, Wichmann S, Kreyling J. Typha for paludiculture—Suitable water table and nutrient conditions for potential biomass utilization explored in mesocosm gradient experiments. Ecology and Evolution. 2022;12(8):e9191.
3. Lamote V, De Loose M, Van Bockstaele E, Roldán-Ruiz I. Evaluation of AFLP markers to reveal genetic diversity in Typha. Aquatic Botany. 2005;83(4):296-309.
4. Suyama Y, Matsuki Y. MIG-seq: an effective PCR-based method for genome-wide single-nucleotide polymorphism genotyping using the next-generation sequencing platform. Scientific Reports. 2015;5(1):16963.

UK – North Pennines National Landscape

The North Pennines National Landscape peatland programme is one of the UK's most successful large-scale environmental restoration initiatives. Over 19 years of dedicated work, this ambitious programme has transformed the landscape of England's highest National Landscape, restoring damaged peatland ecosystems that are vital for climate regulation, biodiversity, and natural flood management. **These restored peatlands provide multiple environmental benefits: they act as massive carbon sinks, reduce flood risk downstream, are the source of drinking water to millions, support unique wildlife habitats, and help regulate local climate conditions.**

The programme's achievements are remarkable in scale. In 19 years of restoration the peatland programme in the North Pennines National Landscape (NPNL) team has successfully **brought under restoration management over 50,000 hectares of damaged peat within the protected landscape**; an area more than three times the size of the city of Newcastle. The restoration work involves many different techniques including drain blocking and revegetating some of the UK's most degraded peatlands. Despite this work the job is only half complete with and **estimated 40,000 hectares of peatlands still in need of restoration.**

The financial investment brought into the region by the NPNL team has been significant, with over £42 million invested in restoration, supporting jobs in conservation and contractors, with funding secured from UK government and its agencies, the EU, and private sector investment. This funding has enabled collaboration with over 60 land managers, ensuring restoration work is carried out with local community support and expertise.
The **work extends beyond pure restoration work. It has supported a wide range of scientific research projects, including the National Peat Depth Survey, contributing valuable knowledge to the wider conservation community and runs an ongoing education/engagement programme**.

The North Pennines National Landscape peatland programme has become a **model for peatland restoration across the UK**, demonstrating how strategic investment and collaborative working can successfully restore these irreplaceable landscapes. Its **proven techniques and partnerships have now been scaled up through the Great North Bog** to create one of the world's most ambitious peatland restoration projects, ensuring these vital ecosystems are conserved for future generations.

The objectives for this project:

1) **Restore 1000 ha or heavily degraded blanket bog in the North Pennines, with up to 10kt CO_2/y in avoided CO_2 emissions.**
2) Develop and 'mainstream' an automated GIS model that assesses peatlands in terms of the saleable carbon credit potential as part of the UK peatland code process.
3) Assess the level of microplastics on North Pennines peatlands and associated water supply (together with partners in Oldenburg, Germany).

1) Restoration
The North Pennines will restore 1,000 hectares of damaged peatland, addressing decades of degradation caused by historical drainage, overgrazing, and atmospheric pollution. This large-scale initiative will focus on rewetting dried peat and stabilizing eroding surfaces across one of England's most extensive upland peat landscapes.
The restoration strategy will employ proven techniques including blocking drainage grips and ditches with peat dams or heather bales to raise water tables and recreate the waterlogged conditions essential for peat formation. Severely eroded areas will receive treatments such as lime and seed application to stabilize bare peat and encourage revegetation with sphagnum moss and other peat-forming species. Working collaboratively with moorland estates, farmers, and conservation partners, the project will prioritise sites where intervention can deliver maximum carbon and biodiversity benefits. Careful grazing management will be implemented to allow vegetation recovery while maintaining the area's agricultural heritage.
This restoration effort **will reduce significant amounts of being released into the atmosphere, reduce downstream flooding risks by improving water retention, and enhance habitat quality** for priority species including curlews, golden plovers, and mountain hares. The programme represents a crucial investment in natural climate solutions, demonstrating how targeted landscape-scale intervention can reverse peatland degradation and restore these globally important carbon stores for future generations.

2) GIS Model
The North Pennines has pioneered an innovative Geographic Information System (GIS) model to streamline the assessment of peatland restoration projects under the Peatland Code, a voluntary certification standard for quantifying carbon benefits from peatland conservation. This automated approach significantly reduces the time and resources traditionally required for carbon credit validation. The GIS model integrates **multiple spatial datasets—including peat depth surveys, vegetation classifications, hydrology maps, and historical land use records**—to calculate baseline carbon emissions and projected sequestration rates across restoration sites.
By automating calculations that previously required extensive manual fieldwork and analysis, the model enables faster, more consistent assessments of carbon credits. It standardizes methodology across different sites, reducing subjectivity and improving the reliability of carbon accounting. The system can process large areas simultaneously, identifying priority zones for intervention and estimating the carbon benefits of various restoration techniques such as grip blocking, revegetation, and rewetting.
This technological advancement **makes peatland restoration projects more financially viable by reducing verification costs and accelerating the timeline from restoration to credit generation**. The North Pennines' GIS model demonstrates how spatial technology can support nature-based climate solutions, making it easier for land managers to access carbon finance while contributing to biodiversity recovery and water quality improvements across degraded peatland landscapes.

3) Microplastics
Establishing **a microplastics monitoring project in the North Pennines' blanket bog presents a unique opportunity to understand plastic pollution in one of England's most remote upland ecosystems**. These pristine peatlands, despite their isolation, are vulnerable to

atmospheric deposition of microplastics transported by wind and precipitation from distant urban and agricultural sources.

The monitoring framework would involve systematic **sampling across representative bog sites, collecting peat cores at varying depths to assess historical accumulation patterns and surface samples to measure current deposition rates**. Water samples from bog pools and drainage channels would reveal microplastic concentrations in aquatic environments, while vegetation and invertebrate sampling could indicate biological uptake and food chain contamination.

Laboratory analysis, would identify **polymer types, particle sizes, and potential sources—distinguishing between textile fibres, tire fragments, and agricultural plastics**. Establishing baseline data is crucial for tracking temporal trends and evaluating whether peatland restoration activities inadvertently introduce microplastics through materials like geotextiles or seed treatments.

Collaboration with the partners in Oldenburg and universities would ensure robust scientific methodology, while engaging local communities and land managers would **raise awareness about plastic pollution pathways.** Results could inform management practices, highlighting the need for plastic-free restoration materials and demonstrating how even remote ecosystems face plastic contamination pressures. This pioneering research would contribute to **understanding microplastic distribution in upland environments while supporting evidence-based conservation strategies**.

Budget

Item	Year 1	Year 2	Year 3	
Restoration	160,000	360,000	240,000	
GIS Modelling	30,000	40,000	35,000	
Microplastics	35,000	40,000	30,000	
Total	225,000	440,000	305,000	970,000.00

This budget will be match funded with 1,000,000 euros of additional funds from the North Pennines National Landscape.

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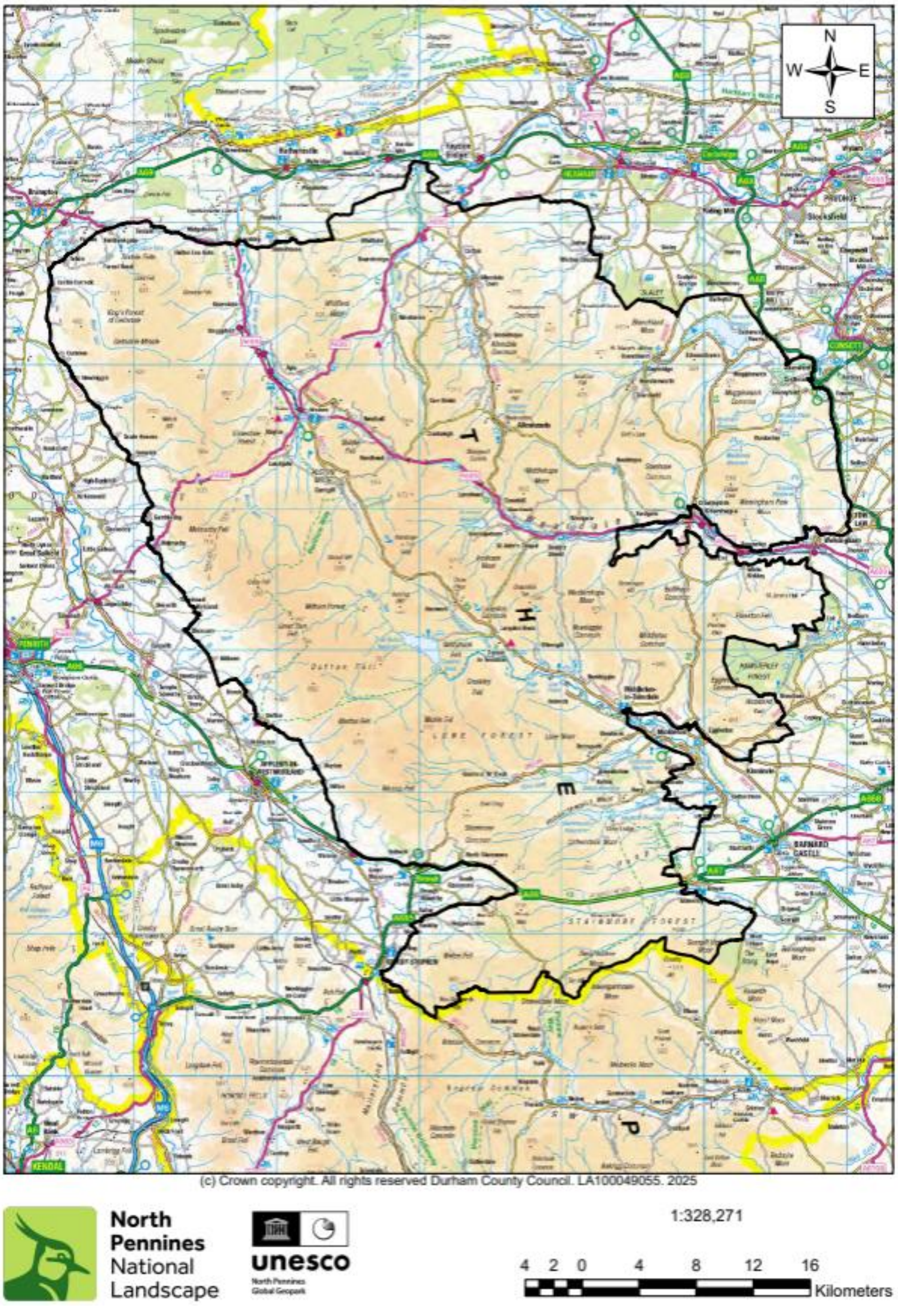
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Area map



Before and after restoration

Ireland

University College Dublin (https://www.ucd.ie/) one of Irelands largest universities and ranked within the top 1% of higher education institutions globally, and the National Botanic Gardens of Ireland (https://www.botanicgardens.ie/) at Glasnevin is renowned as Irelands premier scientific botanic gardens with internationally and nationally important plant collections.

This research project will harness strengths from both institutions with National Botanic Gardens Glasnevin **leading investigation into the taxonomy of T*ypha* species in Ireland and their distributions** and UCD supporting a PhD student to **work on germination, growth, biomass measurements and plastic filtration and storage aspects**. There are two species of *Typha* found in Ireland, *Typha latifolia* and *Typha angustifolia* and their interspecific hybrid *T x glauca* is considered overlooked. Both species also differ in their scale and habitats preferences, however this is not also completely defined and differing ecotypes and genotypes could occur (Stace 2019).

This project aims to clarify the taxonomy of *Typha* in Ireland and **select forms most suited for further research to meet the aims of the *Botanica* project in yield, plastics uptake and storage**. This will link well to the research happening also within this project across Europe and at the University of Oldenburg, Germany. The observations by the German group also suggest that such intraspecific genetic variation **translates to different ecological preferences**. As both Irish *Typha* species overlap in their habitat types of reed swamps, lakes, ponds, ditches there might be a lot more subtlety in hybrids and genotypes between the two species some might be more suited to acidic organic conditions which could be use then in larger scale Irish paludiculture projects.

Selected taxa, ecotypes and genotypes will be trialled for gemination, growth rate and biomass production along with their plastics and other pollutants filtration and storage ability for at University College Dublin. These trails and also provide the base line **data for nature based solutions for clean water though uptake of plastic particles and other plastic pollutants**. Selected forms from the UCD trials will be put forward **for larger scale trails in areas of paludiculture and peatland restoration in Ireland at a later stage**. There are many **existing large scale national nature restoration projects happening in Ireland with Bord na Mona and National Parks and Wildlife Service (NPWS)** with whom the project partners have strong links to.

Noeleen Smyth, *Assistant Professor Environmental & Sustainable Horticulture, Head of Subject & Program Director Horticulture Degree Program UCD,* noeleen.smyth@ucd.ie

Stace, C,A. 2019. New Flora of the British Isles. 4th Edition. C & M Floristics. UK.

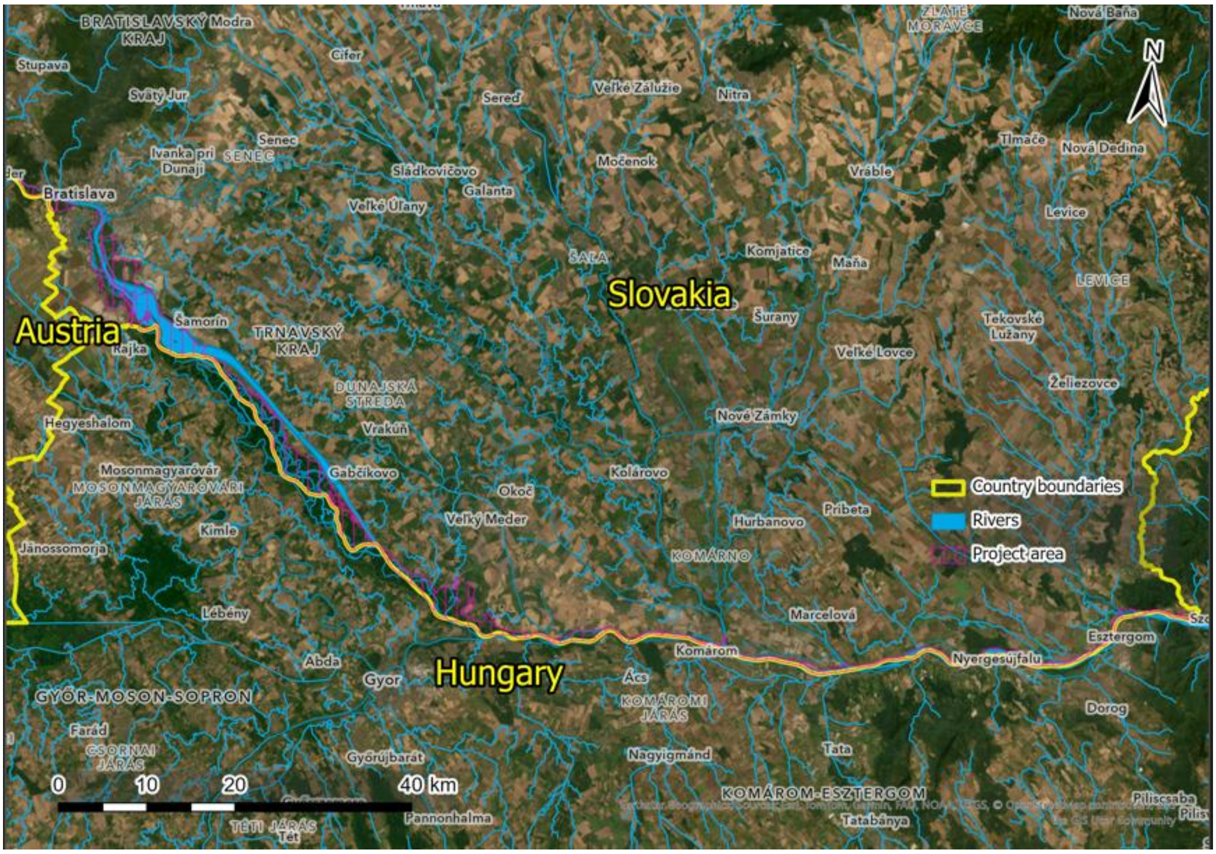
Budget

Item	**Detail**	**Cost**
Field sample collection (Across Ireland)	Samples consumables, travel, accommodation x 50 sites across the species distribution in Ireland (~@50 X €600)	€30,000
Molecular and Morphological Characterisation of material (NBG Glasnevin)	Molecular laboratory work and consumables	€50,000
Experimental tanks and equipment at UCD	40 tanks (~€350) for randomised block experiments	€14,000
Water quality sampling	laboratory water quality sampling (estimate ~ 500 X €150)	€75,000
PhD Student registered at UCD	Annual Stipend (€25,000), Annual Fees (€6,000), computer, software, training & conference (€4,000) + €35,000 per annum x 4.	€140,000
	Total	**€274,000**

Slowakia, Danube Inland Delta

The Danube inland delta represents the most important wetland in the Central Europe. **It's the second largest system of islands, floodplain forests, river branches, wetlands and water bodies after the real Danube delta at the Black sea in Romania**. Interspersed with patches of wet and dry grasslands, sand dunes and salt marshes, it hosts extremely high biodiversity. Floodplain habitats nowadays cover rather narrow area along the river. As they are located in the lowland and along the Danube, its size has been reduced for centuries.

It hosts also several critically endangered species - such as the European pod turtle, "Danube dragon" crested newt or the glacial relict and endemic Tundra vole, which occurs only in this region in the world. It's also an important fish spawning and breeding area for the upper section of the Danube.
The project is **focusing on the Danube floodplains in the Slovak republic**. It is an area of about 18 000 hectares. The vast system is **directly connected also to protected areas and National parks in the neighbouring countries - Austria and Hungary, creating a large and continuous ecological corridor along the river**. These precious ecosystems do not exist in Europe in larger areas anymore. Therefore, this project site represents already a very significant and crucial size of Danube floodplains.



Most of the project site has a formal low level of protection as the **Protected landscape area**. It is also **part of the European network Natura 2000**. Softwood floodplain forests are declared as the so-called EU priority habitats for conservation. Despite of this, the real protection and land management is very poor. Especially forestry and logging still present a threat, mainly for the remaining old growth natural forest stands.

There is a long-term **vision and effort for the establishing of the National park**. The key reason for not designating it yet, was also the negative statement of the private owners. This is being continuously solved with land purchase by BROZ – conservation association. BROZ is the leading conservation NGO in Slovakia. BROZ is very experienced in this issue, for three decades, we have been working to protect Danube nature. So far, we own **almost 1 500 hectares along the Danube river and we have another 1 600 hectares in long-term lease (30 years). It represents deals and contracts with hundreds of landowners.**

BROZ now has a unique opportunity to **buy 41,1 hectares of valuable habitats** of Danube floodplain forests and wetlands. This land acquisition is only a small piece of the big picture and would **perfectly fit into our surrounding land ownership, creating a much larger zone of river floodplains, forests and wetlands**.
About 15 ha are non-forest permanent or temporary wetlands. The remaining 26,1 ha is mixture of natural floodplain forest and hybrid poplar plantations. Hybrid poplars will be gradually removed and replaced by natural tree species - willows and domestic poplars.
All land is managed primary for restoring and maintaining the nature and biodiversity. Mostly this management has also positive **CO_2** avoidance or sequestration impact, for the 41.1 ha up to 0.1 kt **CO_2-eq./y in avoided CO_2 emissions** is expected.

Our main funding source so far is the European Union (mainly LIFE). Therefore, we fulfil various administrative and legal requirements, including specific guarantees for sustainability of land purchase.

Funds for land purchase are not available at this moment, we **are however able to cover all other related costs (administration, personnel, restoration measures – if needed, costs for maintenance, overheads, etc.) from other sources**.

Budget
Initial costs in land purchase, investments, planting: € 350k
Annual costs for staff/support team ca. € 100k/year – largely covered: --
Costs (initial) harvest/s for research/carbon monitoring (not covered through usable products sales/carbon credits): € 50k
Total (3 years): € 400k

RNDr. Tomáš Kušík, PhD., predseda/chairman, November 2025; kuzik@broz.sk

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https://broz.sk/; https://linktr.ee/broz_ngo

Short overview, overall budget and outlook

In the Netherlands, Germany, and Ireland, the main focus is initially on water purification, though the larger area in North Holland also contributes largely to the total carbon storage of the project. In the UK the main focus is on peatland restoration initially, in Latvia both are covered likewise.
The total project area will initially cover ca. 2,000 hectares (mainly NL+UK), **plus at least an equivalent amount in benches in small waterways**, which are mainly situated in the Netherlands . **Apart from (also research pilots on) water purification, the CO_2 storage in the first 3 years of the project will amount to 90-220 kt (0.09-0.2 Mt) CO_2-eq. per year.**

The overall budget related to the measures in the first 3 years, will amount to:
Initial costs in investments/infrastructure, planting: € 1.6 M
Annual costs for staff/support team ca. € 0.75M/year - € 2.25M
Costs (initial) harvest/s for research/carbon monitoring (not covered through usable products sales/carbon credits): € 1.1 M
Total budget required (3 years, rounded/ca.): € 5.0 M.
Co-funding: at least similar, with € 1M (UK) from national funding and comparable amounts elsewhere, also from the EU, but also through voluntary support!

Future upscaling: additional carbon or public, own (co-)funding, revolving fund model.

Future upscaling in Lithuania, Ukraine and elsewhere in- and outside Europe

In a follow up stage, several next stage projects have already been discussed, **including some (additional) areas in the Netherlands, Latvia, UK and Ireland mentioned above**, and extended contacts to other countries in or outside Europe, which will **multiply both the area up to 10,000 of hectares within 5-10 years, and the connected carbon storage/avoidance, alongside the water purification and other additional benefits**.

In Europe these include at least an **additional area of 100s of hectares in Lithuania**, possibly as soon as 2026-2028, once more through the Pelkiu Fondas/Foundation for Peatland Restoration and Conservation.
In **Slovakia, potentially larger riverside (Danube floodplain) wetlands and other areas may be included**. Other areas around the Baltic, that are closely connected to the abovementioned partners, are situated mainly around the Baltic Sea, and in Central Europe.

Through a project with **Coalition Clean Baltic in (mainly Western) Ukraine, the existing mainly helophyte filters in larger rural areas**, including several towns and villages, will be upgraded to also manage larger concentrations of (heavier, chemical) pollutants. Alongside, the restoration of (also war-damaged) peatlands, floodplains and other (riverside) wetlands are foreseen.

Outside Europe, direct government contacts in, currently, Costa Rica, Cuba, Ghana and India foresee in a potentially large-scale deployment of the “Botanica” approach, both in applying the cattail or similar helophyte filters, and large-scale wetlands or river restorations with (optional) buffer zones/helophyte filters.