Botanica – Carbon storage and Microplastics and PFAS filtering in rewetted or restored peat meadows and (other) Peatlands

Slide-deck with summary, January 2026

Botanica – Carbon storage and Microplastics filtering in rewetted or restored peat meadows and (other) Peatlands

Elements

- **Baseline: degraded peatlands emit 16-20 kt Co2eq./ha/yr**, which can **be reduced to zero and/or additional carbon storage** (in soil and vegetation), through partial (rewetting, replacing grass or other vegetation) and completely restoring
- **In 7+ countries/locations peat meadows or (other, former) peatlands will be rewetted or partly restored**, through paludiculture, planting and using cattail species
- These areas can act as buffer zones and/or helophyte filters in both urban and rural areas, hence bordering housing areas but also agricultural land, nature reserves and/or open (fresh)water systems, and act as water buffer and **carbon storage**
- With the additional use of ammonia-oxidizing and nitrifying bacteria (Bacillus sp., Arthrobacter sp., Pseudomonas sp., Bordetella sp., Nitrosomonas sp. and Ochrobactrum sp.), these helophyte filters can **filter out microplastics and PFAS**
- **Aquatic plants can be harvested, above ground stuffed with carbon,** and **manufactured as source for products in constructions also storing the carbon long-term,** and **with nano- and meso-plastics and PFAS** in their roots.


Helophyte project Delft Botanic Garden.


Cattail filter in a ditch


Harvesting of cattail for fibre production

Botanica – Carbon storage and Microplastics filtering in rewetted or restored peat meadows and (other) Peatlands

Executive Summary

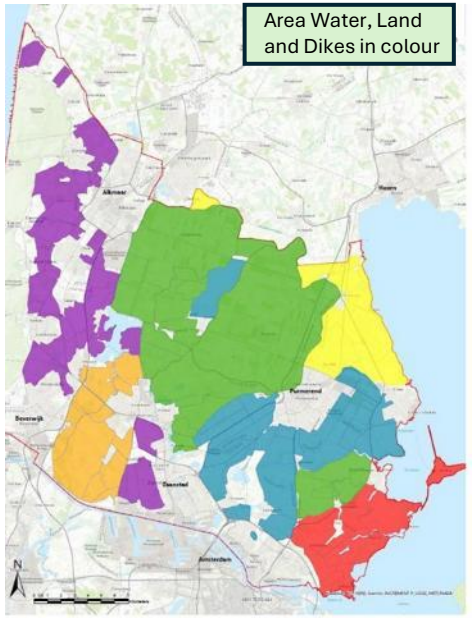
- Baseline (1): **degraded peatlands,** emitting 16-20 kt Co2eq./ha/yr, **will be (partly) restored/rewetted** reducing emissions through additional carbon storage (in soil and vegetation), either through paludiculture or restoration measures.
- **Baseline (2): paludiculture areas** or buffer zones with cattail (species), **will act as helophyte filters** fitted with additional bacteria that can filter out (also) **microplastics and PFAS**
- In 7+ countries/locations **2000+ ha** of peat meadows or (other, degraded) peatlands will be rewetted or (partly) restored, and a **similar area alongside waterways** will be fitted as buffer zone/helophyte filter, acting also as a water buffer
- The initial area will generate a total amount of **0.1 to 0.2 Mt CO2-eq./year of carbon** savings and storage already within the first 3 years: roughly **30-40% avoided emissions, 40-50% sequestration in plants**, remaining in biochar/soil carbon.
- **Total budget required (3 years, rounded/ca.): € 5.0 M. Available co-funding: similar, with € 1M (UK) in national funding and comparable amounts elsewhere, from the EU/public sources, but also through voluntary support!**
- **Future upscaling: additional carbon or public, own (co-)funding, revolving fund model.**
- **Key contacts Botanica: *Dr. MSc. Ing. Bob Ursem, initiator and consortium lead, bobursem@gmail.com, and Wietse W. Hermanns, project manager, wietse@climatevalley.com, +31 653489938***

The Netherlands, Noord Holland – NGO "Water, Land and Dykes"

- Total area: 5800 hectares of open grass meadows, 40 hectares of open arable land, and in total 87.37 kilometers of water veining, 200 hectares of open water, and 92 hectares climate adaptation area; 600 farmers
- **Project location: 292 hectares of area, 87.37 kilometers of riparian vegetation along water** and in smaller waterways
- **Total carbon storage on this location is estimated at 55 to 195 kt/year**, entirely through cattail harvesting
- **Project start/highlights: immediately after funding availability. First harvest after 90 days**, 4 harvests/(project) year
- **Implementation**: farmers/team from "Water, Land and Dykes"; ***Dr. MSc. Ing. Bob Ursem***, bobursem@gmail.com
- **Support team**: students/staff University of Applied Sciences Amsterdam and Aeres University of Applied Sciences at Almere, and coordinated by staff of Secunda B.V. Amsterdam.
- **Costs (indicative): €1.0M**, of which ca. 25% investment/prototype, 60% staff (also monitoring, research); 25% equipment etc.

Cattail growth at KTC Zegveld, South Holland Province, Practical Research Centre for Farmers

Cattail harvesting by hand and with various machines



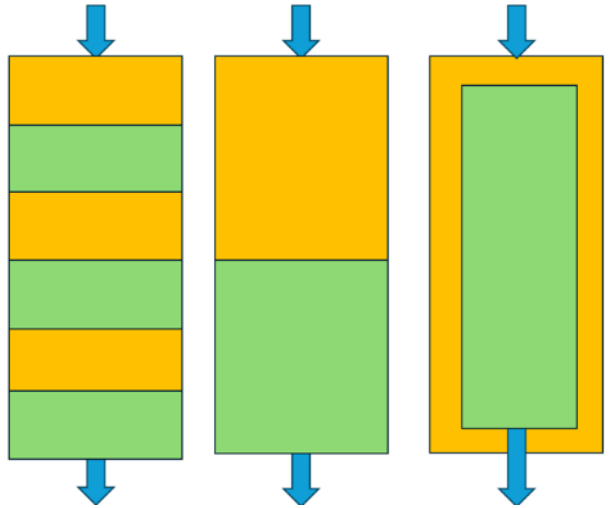
Map of WLD in North Holland Province

The Netherlands, Fryslân – Hegewarren

- **Total area: 400 ha** of mainly drained meadows with existing paludi test farm researching business models for large scale rewetting. Option to rewet ca. 100 ha within 5 yrs. Mesocosms at a nearby research facility.
- **Project location: 3 ha for paludiculture tailored to PFAS scrubbing from surface water**
- **Total carbon storage on this location ca. 0.1 kt CO_2-eq/year**, roughly half from biomass use as building material, and half from rewetting for paludiculture. Upscaling within 5 years foreseen.
- **Project start/highlights: immediately after funding availability. First harvest 1st winter after funding. Rewetting and harvesting combined with research on water quality improvement and suitability for biobased building.**
- **Implementation**: **Peat Innovation Polder Hegewarren** (field tests and management), and **Biosintrum** (mesocosms and usage for building materials); team lead ***Jasper van Belle***, jasper@veenkennis.com
- **Support team**: regional (water) authorities and University of Applied Sciences Van Hall Larenstein.
- **Costs (indicative): €0.75M**, of which ca. 25% investment/prototype, 60% staff (also monitoring, research); 15% equipment etc.

Existing Typha and reed mesocosms at biosintrum

Existing Typha fields at VIP Hegewarren



Field layout: 3 types of paludi plots to test best filtering (green=cattail, yellow=reed)

The Netherlands, Leiden – 2nd Green Ring, Panorama Park

- Total area: 400 hectares of mainly open grass meadows, to be partly restored to peatlands and buffer zones around open water, partly used for paludiculture/water filtering.
- **Project location: small pilot areas for paludiculture (initially), extension up to 10 ha for drinking water purification (Dunea)**
- **Total carbon storage on this location is estimated at up 0.4 kt/year eventually**, roughly half through (cattail) harvesting and use as building material, and a similar amount on carbon avoidance and storage

- **Project start/highlights: immediately after funding availability**

- **Implementation**: mainly volunteers through involved NGOs (food forests etc.), later also through Dunea, City of Leiden
  Team Lead: ***Dr. Walter Schrader***, weslink@wxs.nl
- **Support team**: incl. students/staff University of Leiden, others

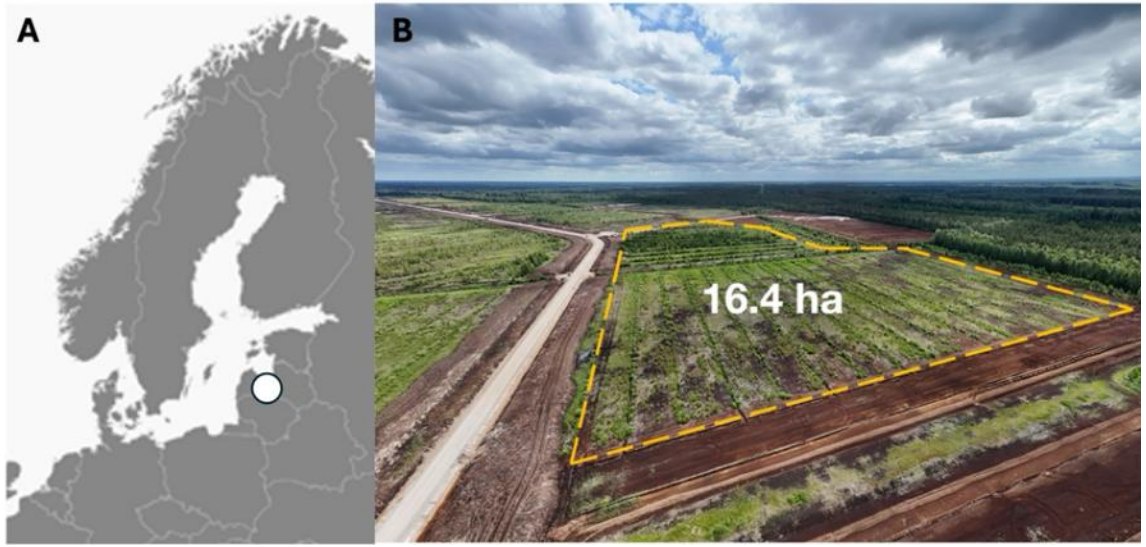
- **Costs (indicative): €0.25M**, of which ca. 40% investment/prototype, 40% staff (also monitoring, research); 20% equipment etc.

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

Latvia – 2 project locations, La Flora peat extraction/restoration company and KORE (eco) industrial park

- **La Flora: 16,4 hectares of peatland restoration at the Kaigu peatland site, also used for filtering water**
- **Carbon storage is estimated 0,3-0.4kt/year, of which ca. 50% through cattail harvesting, and 50% peatland restoration** (avoided emissions and storage in soil/remaining vegetation).
- **Project start/highlights: immediately after funding availability. Restoration** through raising water level and removing existing vegetation; **first harvest after 3 months; first reduction of carbon emissions and first carbon storage in soil/peatmoss after 6-12 months**
- **Implementation**: teams from La Flora and Lietuvos Inzenierijas kolegia LIK; ***Lead: Sabina Alta***, sabina.alta@laflora.lv and ***PhD Normunds Stivrins***, Normunds.stivrins@gmail.com
- **Support team**: also, students/staff of nearby Universities (University of Latvia, Riga; Latvia University of Life Sciences and Technologies, Jelgava), and NGO's (Lake and Peatland Research Centre: http://www.epicentrs.lv/paludiculture/)
- **Costs: Costs (indicative): €0.39M**, of which ca. 35% investment/prototype, 50% staff (also monitoring, research); 15% equipment etc.

La Flora pilot area



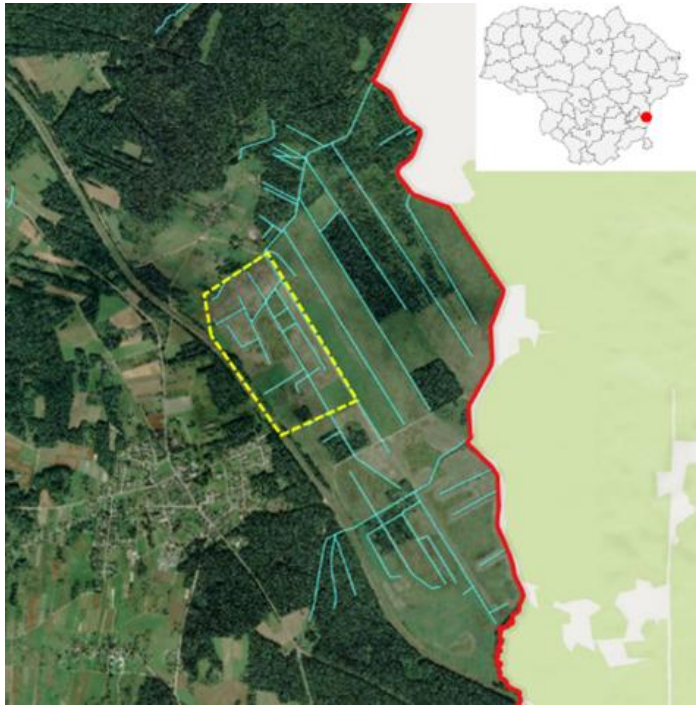
Latvia – 2 project locations, La Flora peat extraction/restoration company and **KORE (eco) industrial park**

- **KORE industrial park near Salaspils: 50 ha, ca. 25 ha green/blue with up to 5 ha helophyte water filter/buffer zones**
- **Total carbon storage is estimated 0.1-0.3kt/year, of which ca. 50% through cattail harvesting, and 50% peatland restoration** (avoided emissions and storage in soil/remaining vegetation).
- **Project start/highlights: immediately after funding availability. Restoration** through raising water level and introducing helophyte filters; **first filtering KORE and harvest after 3 months; first reduction of carbon emissions and first carbon storage in soil/peatmoss after 6-12 months**
- **Implementation**: teams from KORE industrial park/NP Properties; **Lead: *Gunita Kiesnere***, gunita.kiesnere@npp.lv
- **Support team**: through/in cooperation with La Flora, also students/staff of nearby Universities and NGO's (such as Lake and Peatland Research Centre: http://www.epicentrs.lv/paludiculture/)
- **Costs: Costs (indicative): €0.3M**, of which ca. 35% investment/prototype, 50% staff (also monitoring, research); 15% equipment etc.

KORE
#1 BALTIC CIRCULAR INDUSTRIAL PARK

Lithuania – Margiai pilot site

- **Margiai pilot site: ca. 100 ha, as part of 400ha peatmeadows, a former peatland on the Belarus border,** where the water level is raised and paludiculture is established with reed canary grass
- **Total carbon emission reduction is estimated at initially 0.4kt/year, of partly through read canary grass harvesting, and other peatland restoration measures** (avoided emissions and storage in soil/remaining vegetation).
- **Project start/highlights: immediately after funding availability. Restoration** through raising water levels; **first harvest after 3 months; first reduction of carbon emissions and first carbon storage in soil/reed after 6-12 months**
- **Implementation**: teams from Pelkių Fonds; **Lead: *Nerijus Zableckis***, nerijus@pelkiufondas.lt
- **Support team**: also, students/staff of nearby Universities, other NGOs
- **Costs: Costs (indicative): €0.3M**, of which ca. 35% investment/prototype, 50% staff (also monitoring, research); 15% equipment etc.



Germany – University of Oldenburg

- **Project location: --, university premises and 20 ha of plant biodiversity monitoring NW Germany;** location of RoNNI project owned by 3N.
- **Research, no restoration and/or carbon restoration as such.**
- **Project start/highlights: immediately after funding availability, monitoring starts at project location, also through/at other partner areas – including several species of cattail** in terms of yield, plastic storage, biomass production/growth (incl. carbon storage) under different environmental circumstances

- **Implementation**: (support) teams from University of Oldenburg; 3N/RoNNi project.
  Lead: Prof. Dr. Dirk Carl Albach, Universität Oldenburg, dirk.albach@uni-oldenburg.de

- **Costs: Costs (indicative): €0.37M**, of which ca. 85% staff (also monitoring, research); 15% equipment etc.

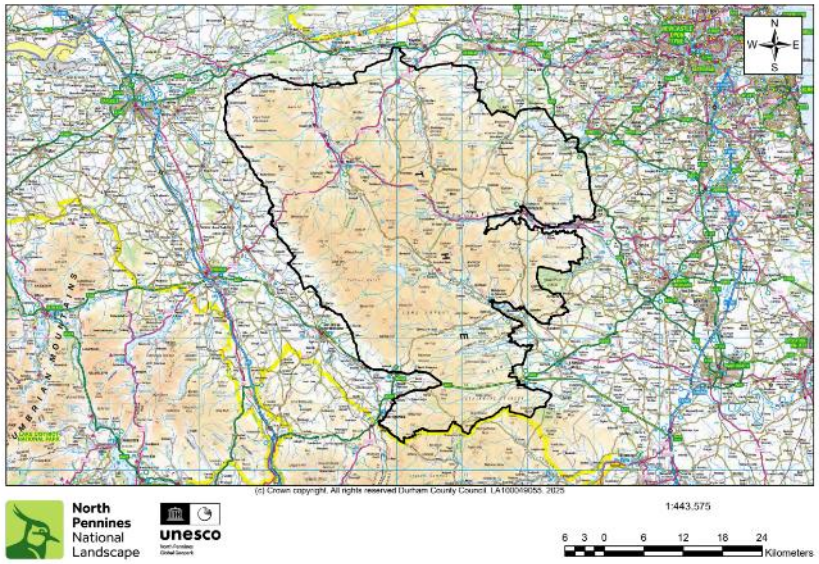
Carl von Ossietzky
Universität
Oldenburg

UK – North Pennines National Landscape

- **Project location: 1000 hectares of peatland restoration, as part of a 50,000 hectares+ scheme under development**
- **Mainly peatland restoration, larger pilot plots on mainly (micro)plastics monitoring and filtering**
- **Total carbon storage on this location is estimated with up to 40kt CO2/y in avoided CO2 emissions**, entirely through peatland restoration
- **Project start/highlights: immediately after funding availability, first carbon avoidance within months after start.**

- **Implementation**: (support) teams from the North Pennines National Landscape.
  Lead: *Paul Leadbitter*, pleadbitter@northpennines.org.uk

- **Costs (indicative): ca. €1.0M**, mainly restoration (investments, some staff) and some GIS/microplastics (equipment, research); **similar national co-financing!**



UAV image of restored peatland

before/after restoration

Ireland – several project locations, National Botanical Garden Dublin, UC Dublin, possibly larger elsewhere

- **Project location NBG Dublin/University College of Dublin (UCD): smaller research pilots on germination, growth, biomass measurements and plastic filtration and storage aspects,** potentially creation of an information centre on helophyte filter (research) and peatland restoration
- **Project locations Bord na Mona/Peatland Council NWPS: to be determined at a later stage**

- **Total carbon storage on these locations: not relevant initially (research only), to be determined at a later stage**

- **Project start/highlights: immediately after funding availability, also initial testing in plots**

- **Implementation**: teams from NBG Dublin and UC Dublin initially, in exchange with partner Oldenburg University/DE; potentially both Bord na Mona and/or Peatland Council/NWPS at a later stage.
  Lead: *Noeleen Smyth*, UCD, noeleen.smyth@ucd.ie

- **Costs (indicative): €0.3M**, of which ca. 10% investment/prototype, 60% staff (also monitoring, research); 30% equipment etc.

University College Dublin
An Coláiste Ollscoile, Baile Átha Cliath

national botanic gardens

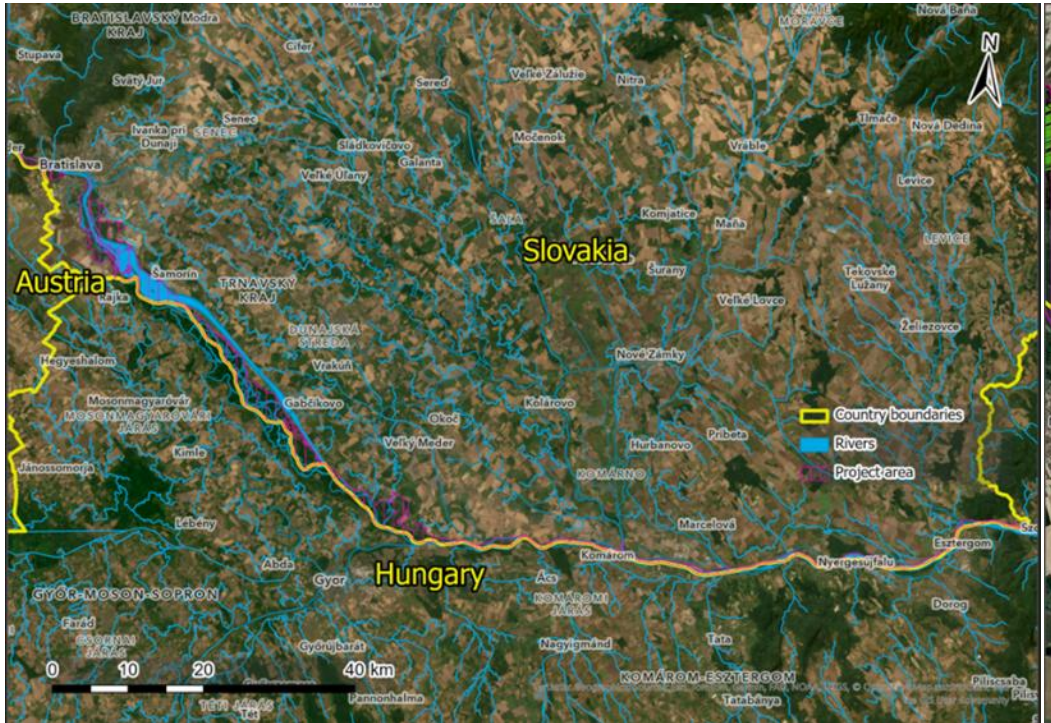
OPW Oifig na nOibreacha Poiblí Office of Public Works

BnM

Páirceanna Náisiúnta
National Parks

Slovakia – Danube Inland Delta

- The **Danube inland delta represents the most important wetland in the Central Europe**, the second largest system of islands, floodplain forests, river branches, wetlands and water bodies after the real Danube delta in Romania
- **Pilot site: ca. 41 ha, as part of 18 000ha floodplains, of which over 3000 ha is managed by BROZ,** which is a key plot as part of a larger area currently being restored
- **Total carbon emission reduction is initially up to 0.1 kt/y, in a larger area carbon emissions are reduced through wetland and other restoration measures** (avoided emissions and storage in soil/remaining vegetation).
- **Project start/highlights: immediately after funding availability. Restoration** through raising water levels
- **Implementation**: teams from BROZ, volunteers/students; **Lead: *RNDr. Tomáš Kušík, PhD.,*** kuzik@broz.sk
- **Costs: Costs (indicative): €0.4M**, of which ca. 85% investment/land purchase, -- staff (other funding); 15% equipment etc.



Upscaling: other future locations, to be added:

- **Ireland, the Netherlands: possible upscaling** in the pilots or elsewhere, from 2026/27 onwards

- **Lithuania (through Pelkiu Fondas/Peatlands Restoration and Conservation Foundation): additional sites, potentially up to 300 ha,** possibly already from 2026/27 onwards

- **Slowakia: additional areas to be restored by BROZ, starting as of 2026**

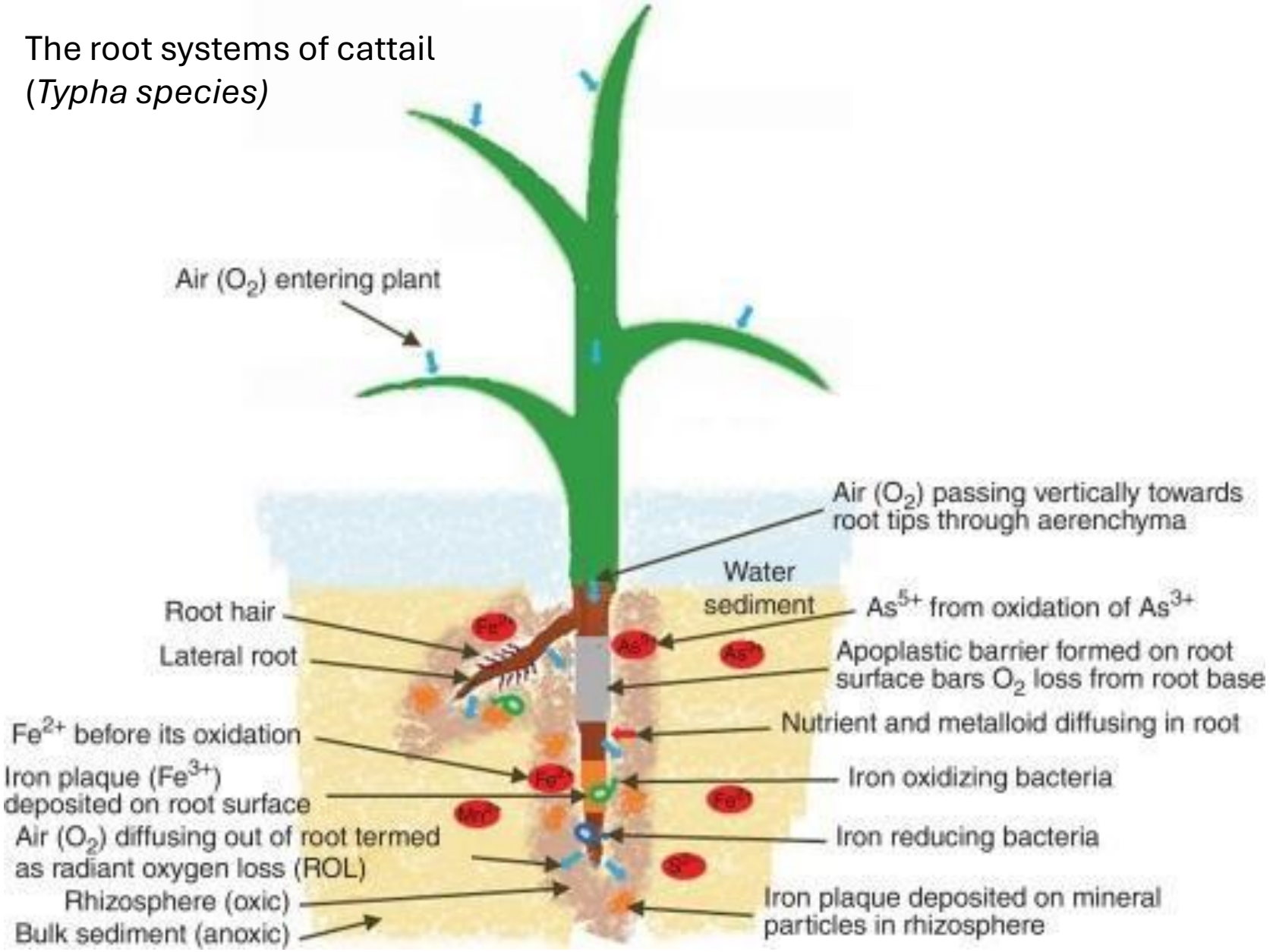
- **Ukraine: projects for water purification through helophyte filters, and peatland and river/floodplain restoration initiated by the Coalition Clean Baltic, first of all in the Lviv agglomeration, Western Ukraine. Here the project can be initiated short-term, as soon as funds are available, and include 2 river catchment restoration programmes, the restoraration of a large, degraded reservoir and (re)building or upgrading of a large number of (natural, helophyte) wastewater treatment plants in rural settlements (200,000 inhabitants)**

- **Other projects in Europe: around the Baltics and Central Europe, including Albania, Italy and Romania**

- **Outside Europe: contacts with national and regional governments in (so far) Costa Rica, Cuba, Ghana and India; timing potentially from 2026/27 onwards.**

Annex: helophyte filter system and microplastics

The root systems of cattail (*Typha species)*



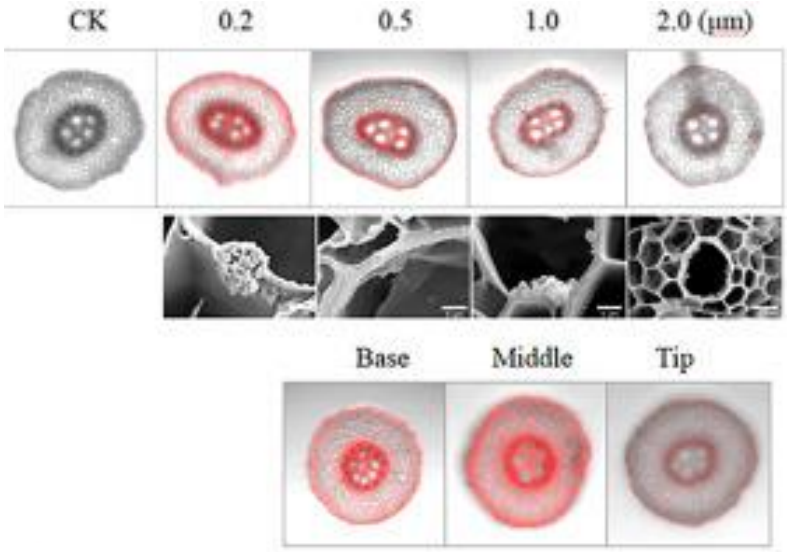


Figure above: Plastic particles up take into the root system. Red indicates the uptake rate of plastics in the root tip, middle root and the base, included size distribution of plastics (μm) inside the root.

Figure left: The oxygenation of the root system via aerenchyma or air trespassing tissue from the leave intake of outside air. The oxygenation via a root system provide oxygen in the surrounding soil and thus support aerobe bacteria activity.

Microplastics in nature can be purified by an up take into the root systems of plants and especially aquatic plants.

- Aquatic plants accumulate Nano-plastics and meso-plastics into root systems of plants as shown in the first slide of this Annex, and filter microplastics between their roots, similar as an air fibre filter (i.e. HEPA filter).
- Aquatic plants can be harvested stuffed with Nano- and meso-plastics and between their roots microplastics and manufactured as source and fixing products in constructions or (if unused otherwise) treated as chemical waste.
- With the use of aquatic plants, and in particular cattail or *Typha* species *(Typha latifolia, Typha angustifolia, Typha domingensis, Typha laxmannii, Typha orientalis* and *Typha minima*), we can create a helophyte filter system.

References

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Typha latifolia

Typha angustifolia

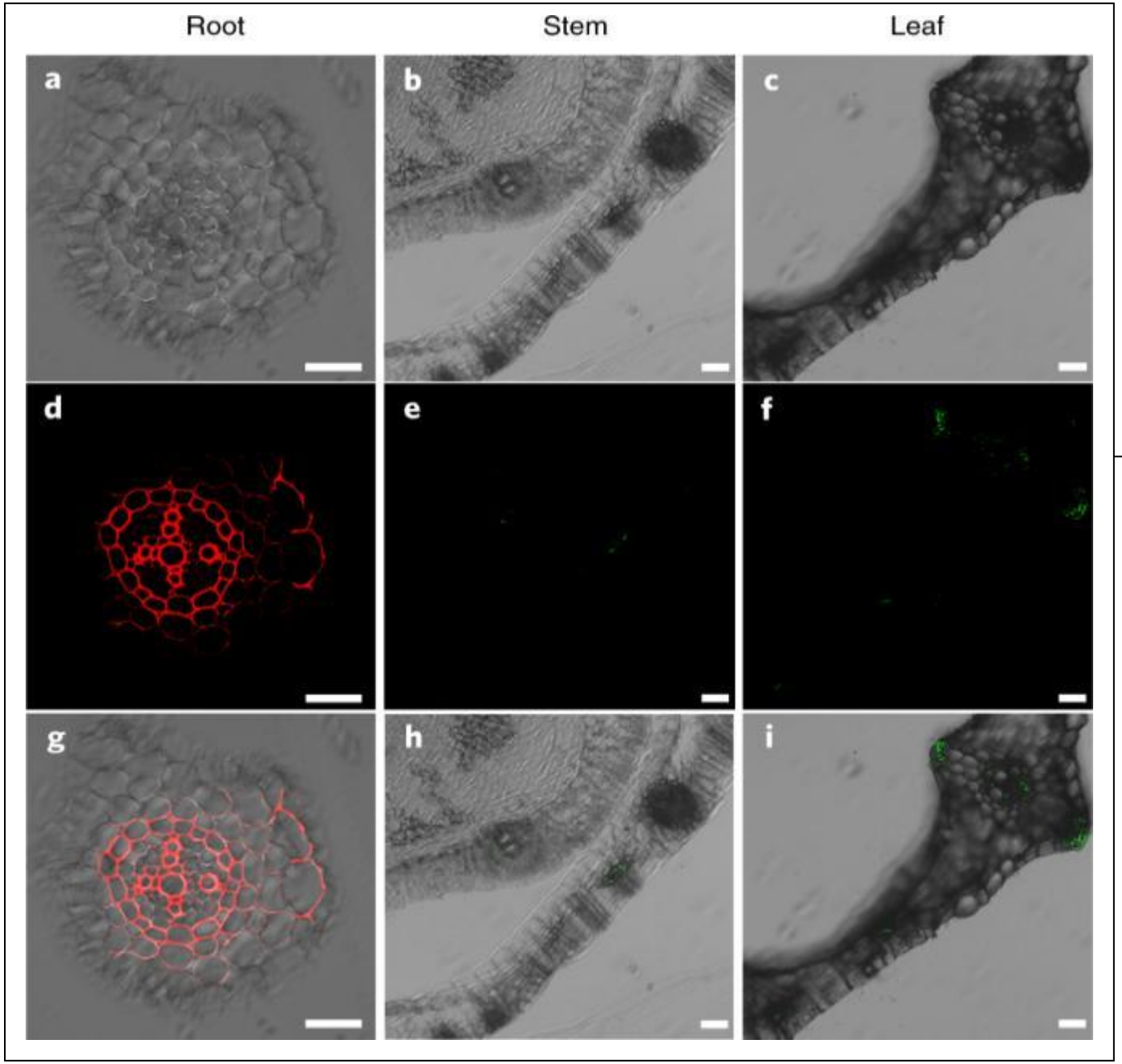
Typha domingensis

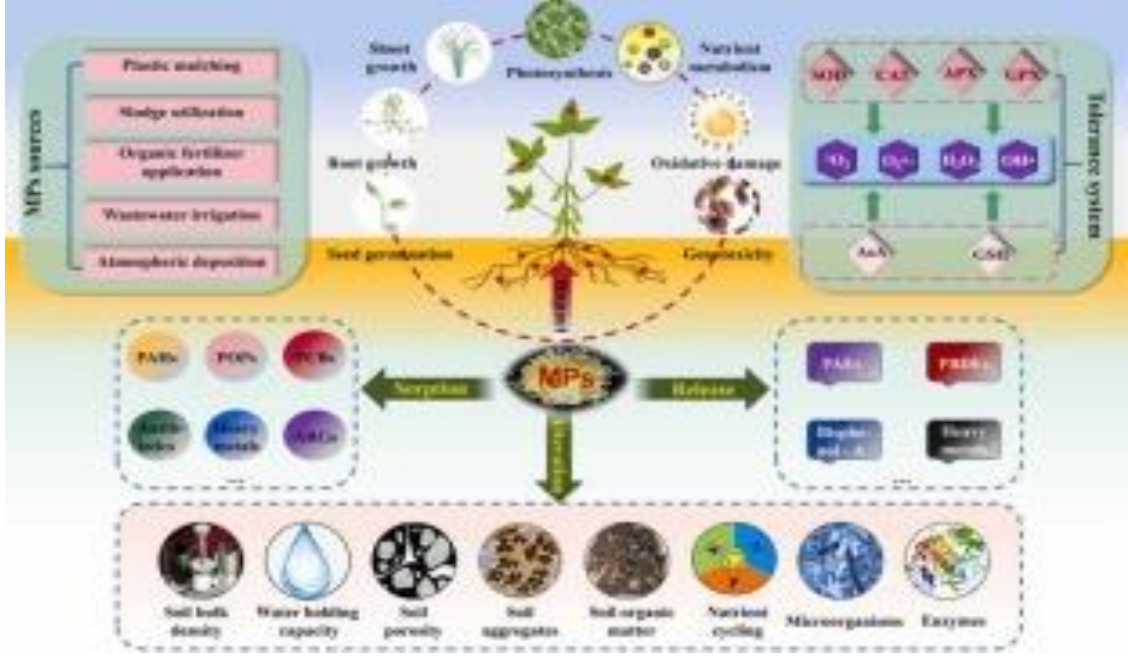
Typha laxmannii

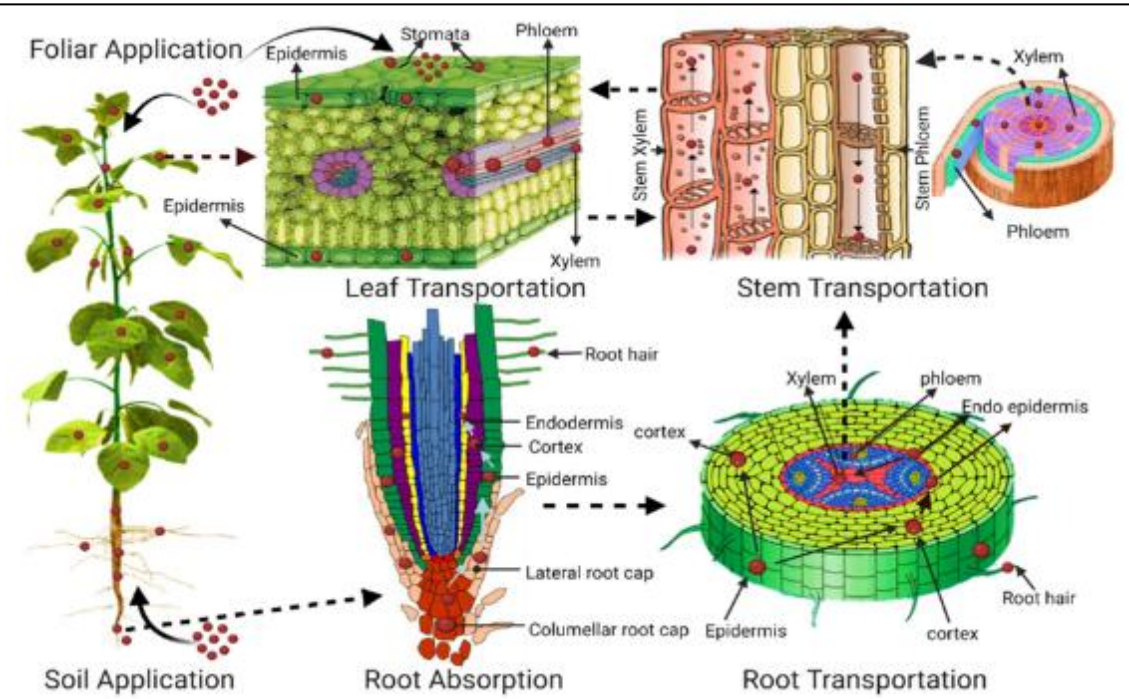
Typha orientalis

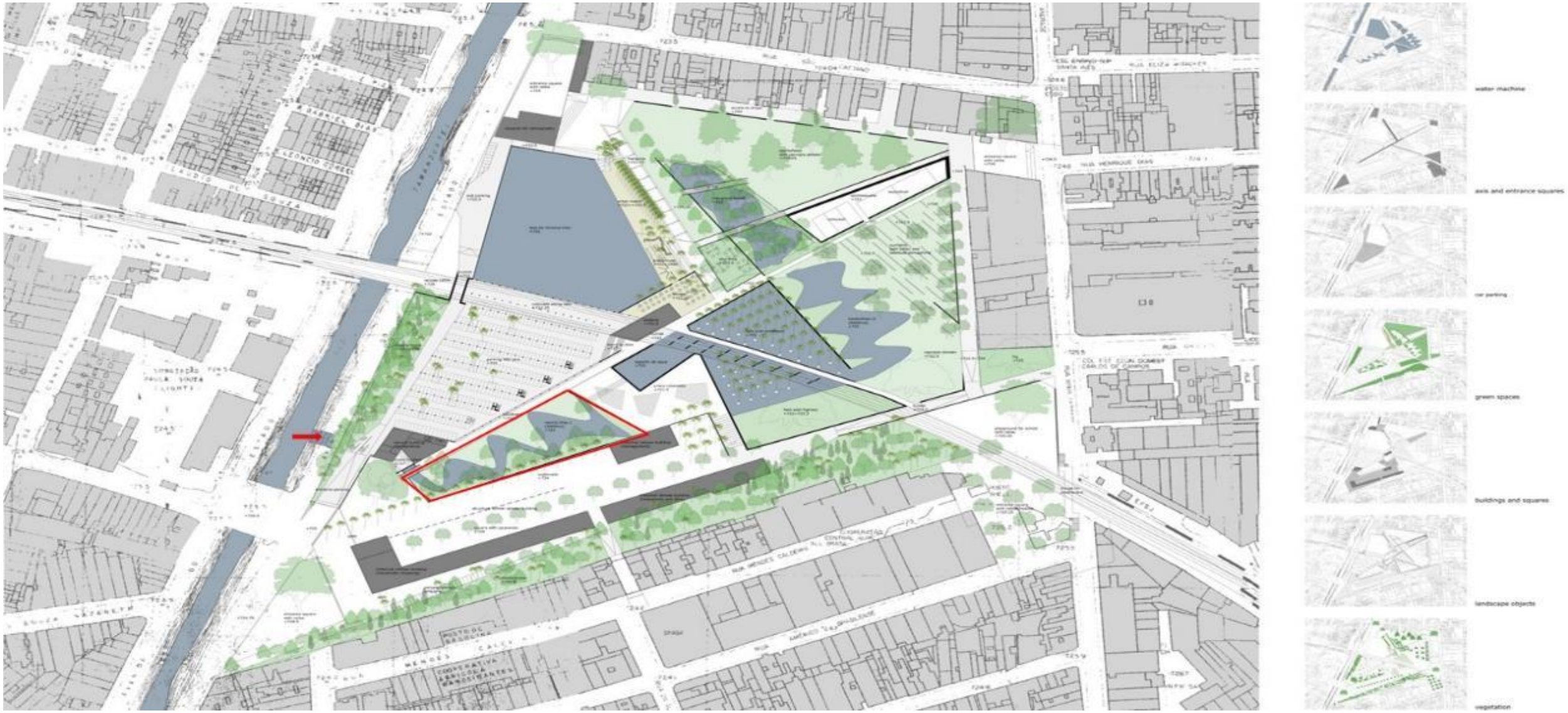
Typha minima

Up take of meso- and Nano – plastics in root and leaves of plants







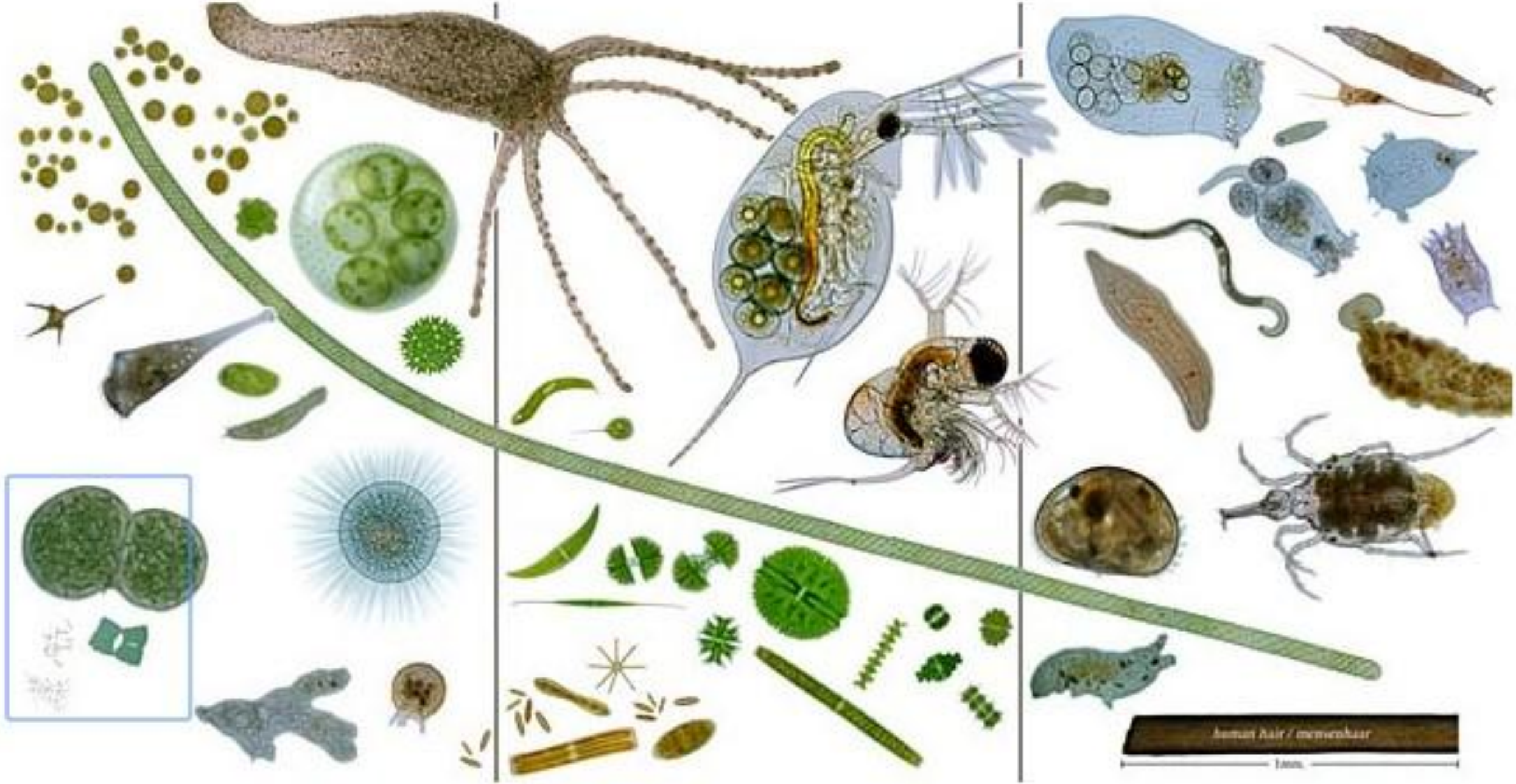


A helophyte filter in a park near Rio Tietê in Sao Paulo Brasil. The red arrow is the inlet towards the helophyte filter. The red outlined area is the helophyte filter of *Typha domingensis* as applied in a winding water system to enlarge the interaction between cattail and the purification of inlet water. The water purification passes several other plant filter systems and end in a recreational pool of swimming water quality and overflows back into the Rio Tieté (Source: drawing by Ir. Sander Troost, 2009)

MICROPLASTICS DO HARM OUR ENVIRONMENT AND HEALTH OF PEOPLE AND OTHER CREATURES IN NATURE

In total more than 500 microplastic ingredients (polyethylene, polypropylene, polymethyl methacrylate, nylon and more) can be found in nature in size distributions that exceed 25 millimetres, between 5 till 25 millimetres (meso-plastics) and Nano-plastics less than 100 Nanometres. We drink, eat, breath and accumulate over a 100.000 of these plastics per year.

Microplastics in fresh water can be purified by an up take into iron stuffed microorganisms and the use of electrodes



Microorganisms are propagated in cultivation basins with a high content enriched iron and free-floating green algae. Each few days these microorganisms duplicate and thus provides a continue yield of iron enriched microorganisms. These iron enriched microorganisms will be released in a fresh-water plastic polluted systems. In a short time all these iron enriched microorganisms incorporates the available Nano- and meso-plastics. These plastic stuffed iron containing microorganisms will be attracted and caught with the use of charged electrodes and removed.

Bacterial adhesion is a common phenomenon in metal fundament support and thus excellent for adhesion of microorganisms with the use of a charged high Voltage with an extreme low Amperage (almost static electricity).
By attracting all iron stuffed microorganisms after a period of meso- and Nano-plastic intake. These will stick to the electrodes and can be easily removed with all incubated plastics as construction material or treated as chemical waste.