



# Changes in Metal Biogeochemistry Resulting From Wetland Creation: Bioavailability, Toxicity and Risk



Prof. Filip Tack, UGent  
Prof. Patrick Meire, UIA  
Prof. Colin Janssen, UGent





# Wetlands

- Key element in **Integral Water Management**
  - prevent floodings of inhabited areas: **natural storage of water during high water events**
  - increase valuable ecosystem area: **nature development**
    - ecology
    - biodiversity



# “Wetland Creation”

Selection of suitable areas



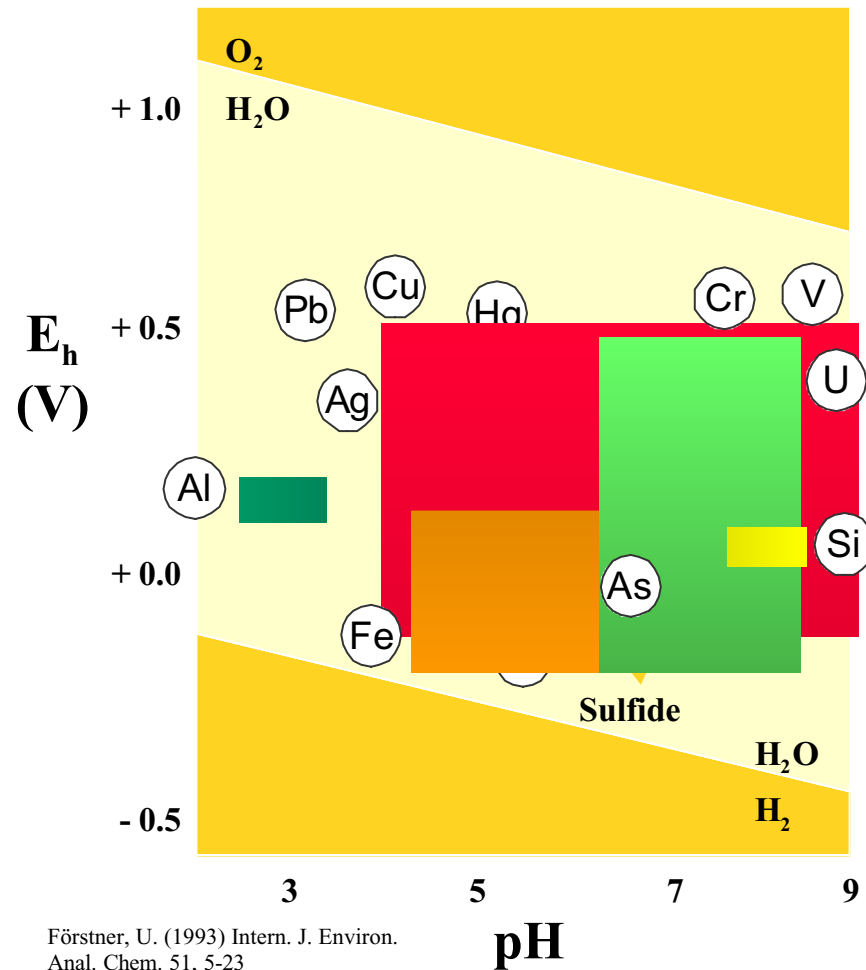
Development scenarios: different flooding regimes



Selected area may be contaminated with metals



# Heavy Metal Mobility as a Function of pH and Redox





# Aims of this Project

- To contribute to **management-oriented models** to predict pollutant behaviour upon changing flooding regimes
- To develop **criteria** to appraise the risk arising from the creation of wetlands in metal contaminated areas

WETMAT - Wetland Management Tools



# Scientific Goals

- **Bioavailability and bioaccumulation** of metals in soil, sediment and biota
- **Ecotoxicological** effects on different key species (reed plants, invertebrates)
- **Models** predicting metal behaviour as a function of applied flooding regime
- Developpement of **guidelines** for assessing risks arising from wetland creation in contaminated areas



# Research Partners

Prof. Patrick Meire  
University of Antwerp  
Research Group Ecosystem  
Management

Prof. Filip Tack  
Ghent University  
Laboratory of Analytical Chemistry and  
Applied Ecochemistry  
Coordination

Prof. Colin Janssen  
Ghent University  
Laboratory of Environmental Toxicology  
and Aquatic Ecology



# Methods

Experimental trials: laboratory and greenhouse

Data and process information

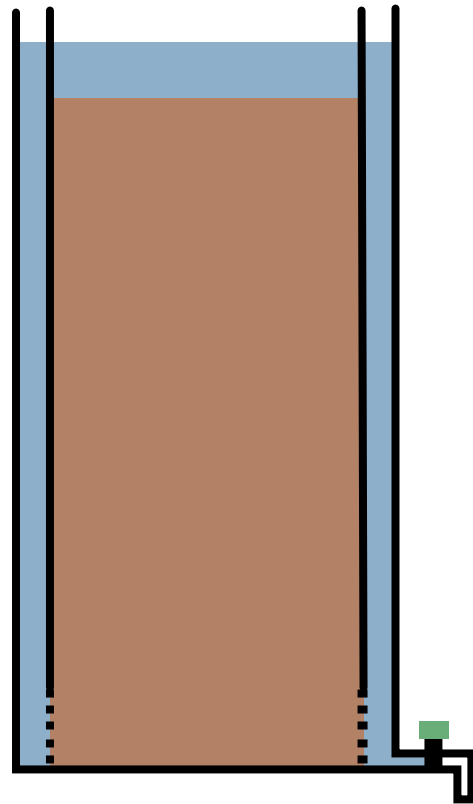
- behaviour of trace metals in abiotic and biotic compartments
- ecotoxicity
- ecosystem development

Modelling

Pilot scale validation



# Experimental Trials



- Barrels filled with sediment
- Moisture regime can be controlled
- Equilibration over extended periods
- Changes in soil physico-chemistry
- Metal total and speciation analysis, mobility, transfer to plant
- Contaminant effects to plants and biota



# Treatments

- Substrates
  - Uncontaminated soil
  - Contaminated soil
  - Scheldt river sediment
- Water
  - Saline water ( $16 \text{ mS cm}^{-1}$ )
  - Brackish water ( $3 - 5 \text{ mS cm}^{-1}$ )
  - Sweet water ( $0.5 \text{ mS cm}^{-1}$ )
- Moisture regimes
  - Continuously inondated
  - Periodically inondated
- Planted and not-planted

# Pilot Scale Experiment

- Installation flooded by Scheldt river (UIA)
- Four tanks





## Expected Outcomes

- Contribute towards development of **management-oriented models**: predict whether and under which conditions ecosystem development may still be acceptable in terms of environmental quality and public health
- Criteria to appraise the risk arising from the creation of wetlands in contaminated areas



# Exploitation

- **Wetland creation/management: also account for metals present!**
- **Wetlands for flooding control** (EU Directive 2000/60/EC Framework for community action in water policy)
- **Wetlands for water treatment** (EU Directive 2000/60/EC)
- **Creation, protection and conservation of valuable ecosystem areas** (RAMSAR Convention; Natura 2000)