Connecting swamps with streams: restoration of alder carrs by flooding

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streams, land, and alder carrs were interrelated

anastomosing systems are vanished and forgotten

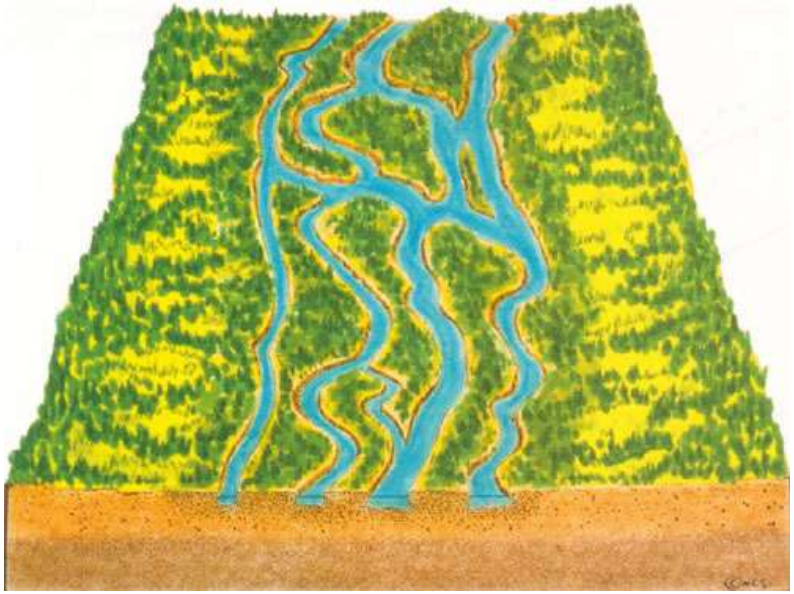


Image by Rosgen

The Gearath (Cork, Ireland) was described in the 17th century as "an immense plain covered with trees and divided by the River Lee into 1,000 islands"

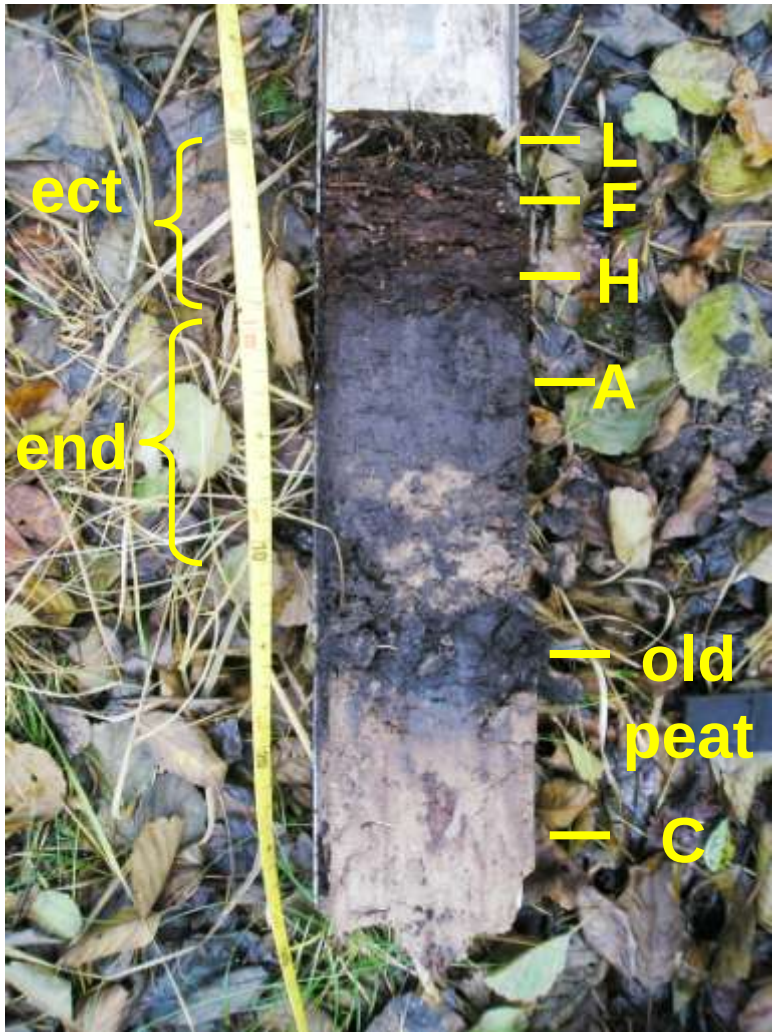
... and are now isolated

seepage and
flooded disappeared

digged ‘stream’

last 50-100 y:
peat decomposition
severe biogeochemical
changes

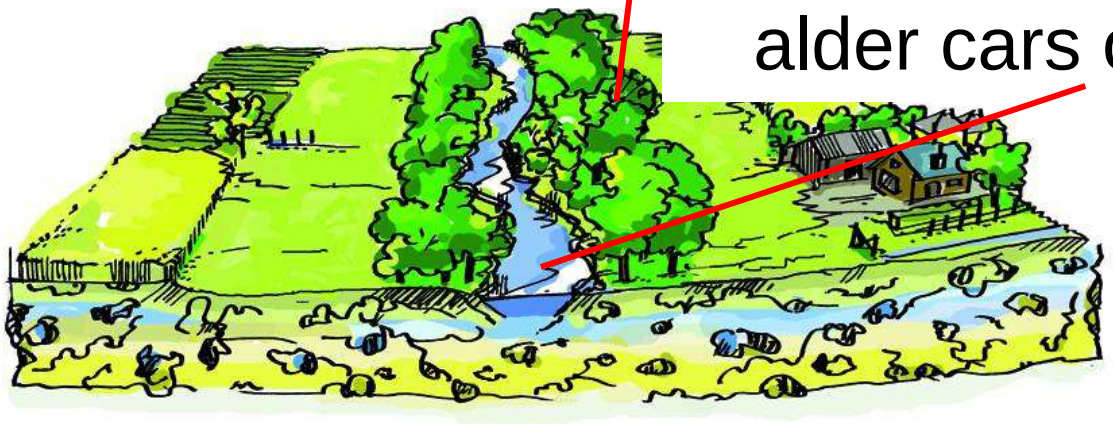
desiccated and acidified alder cars



solution? just flood it artificially

Questions

- Can we restore abiotic conditions and vegetation of alder cars by artificial flooding?
- Which processes enhance or restrict alder car restoration?
- Streams not to eutrophic for alder cars or visa versa?



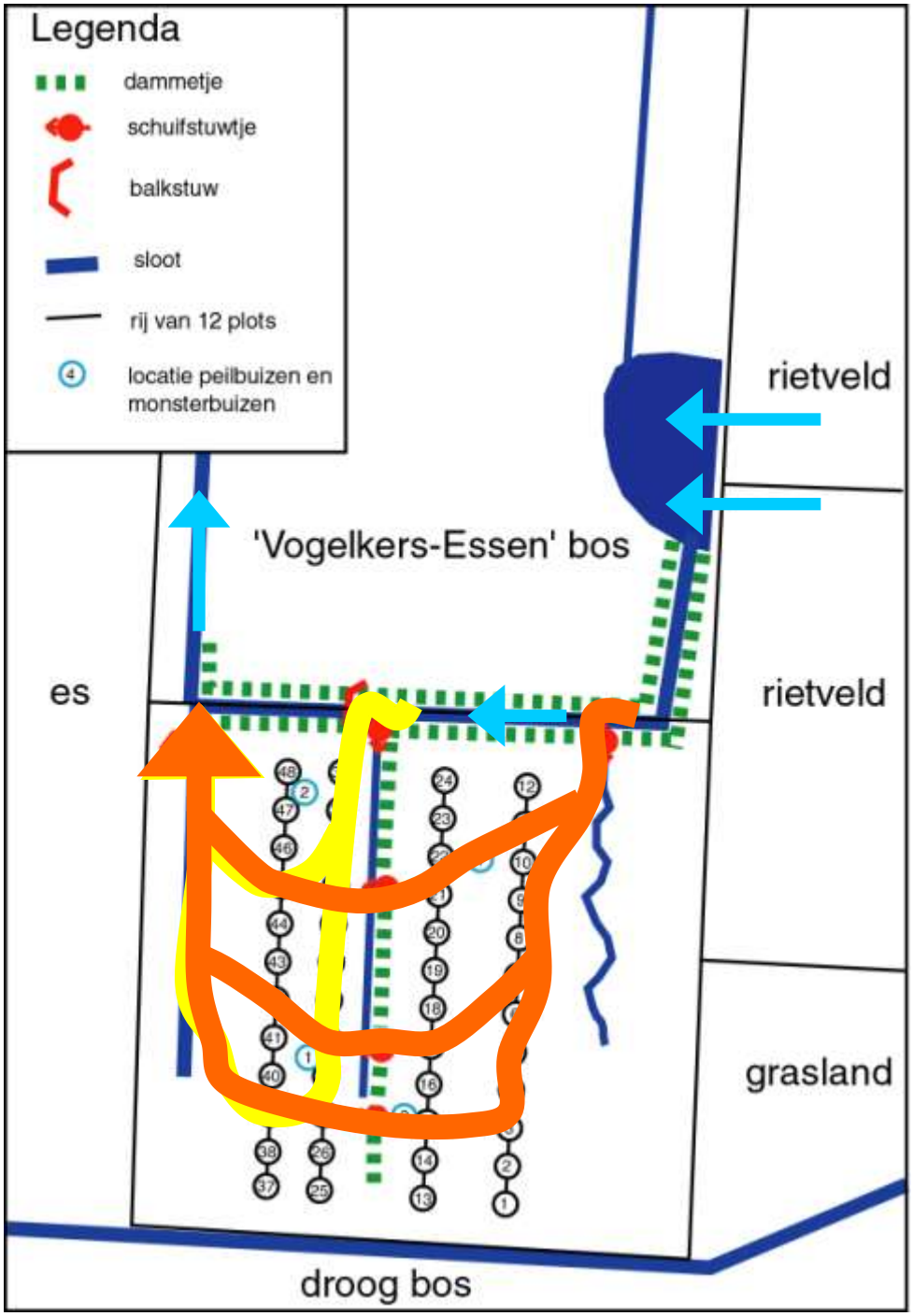
Field experiment

flooding

6 month compartment

flooding

3+6 month compartment



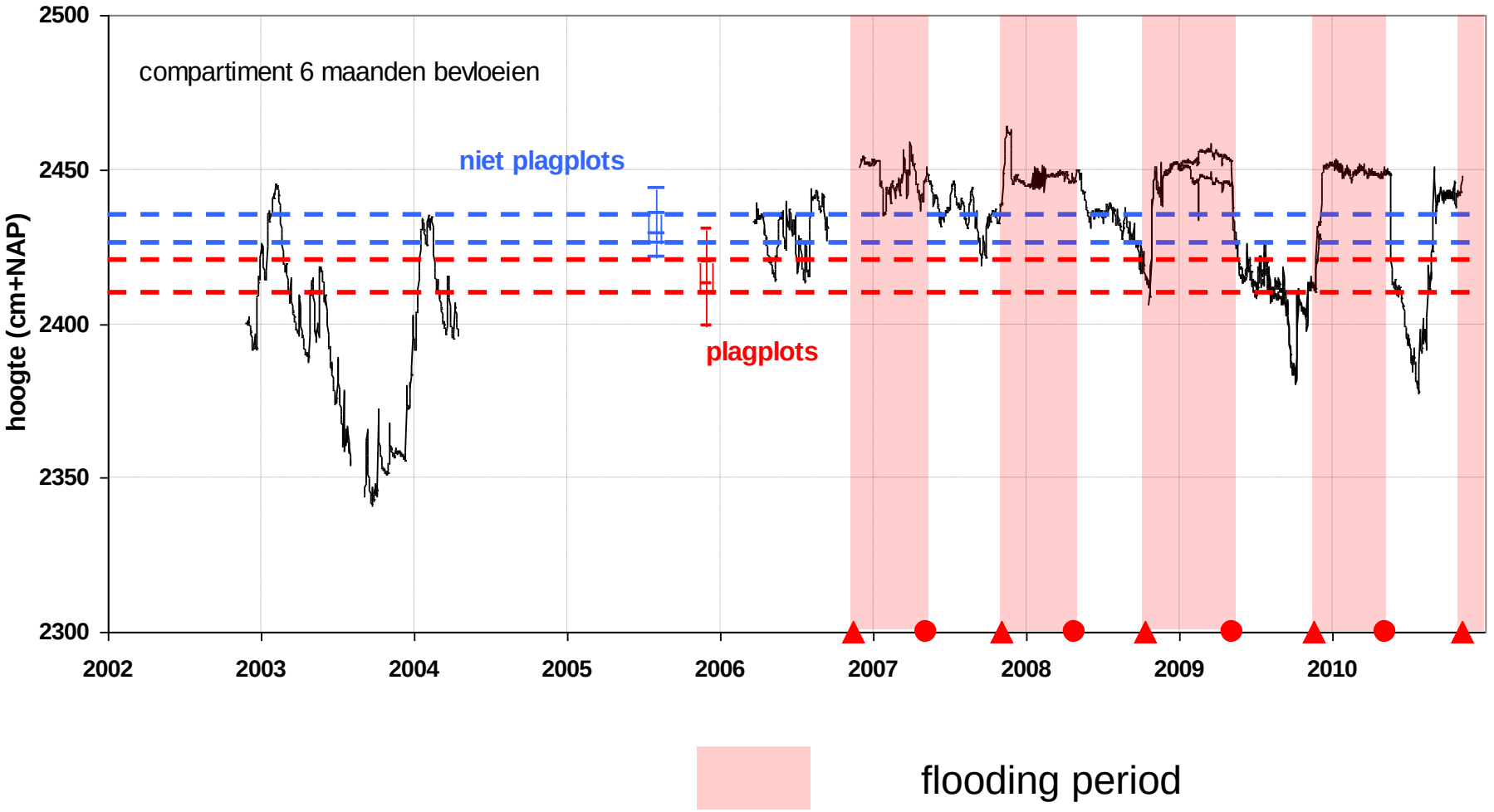
2005: before flooding

with flooding:
eutrophic vegetation, with alder car species

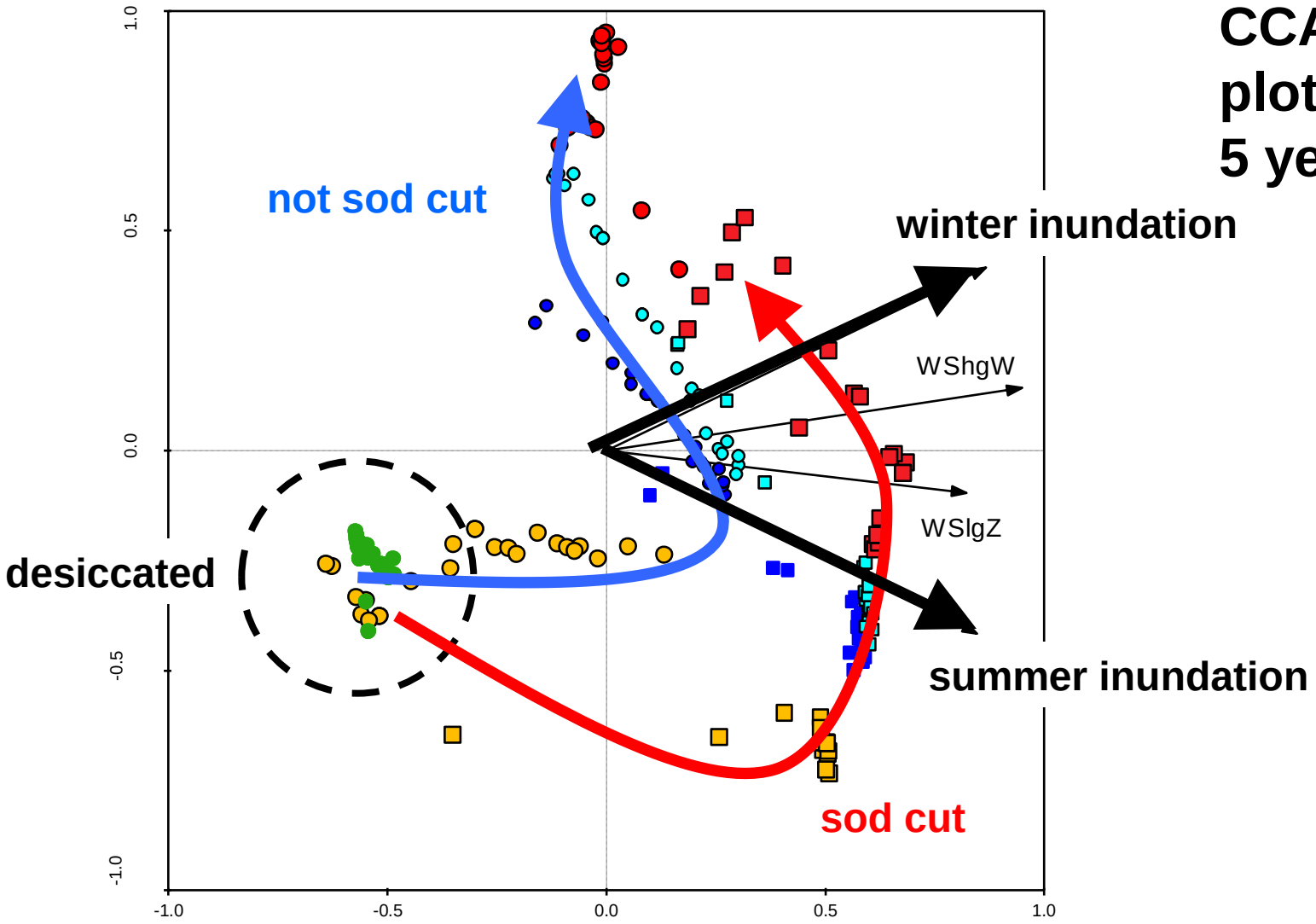
2007 stagnant surface water in summer

2009 no inundation in summer

Water levels



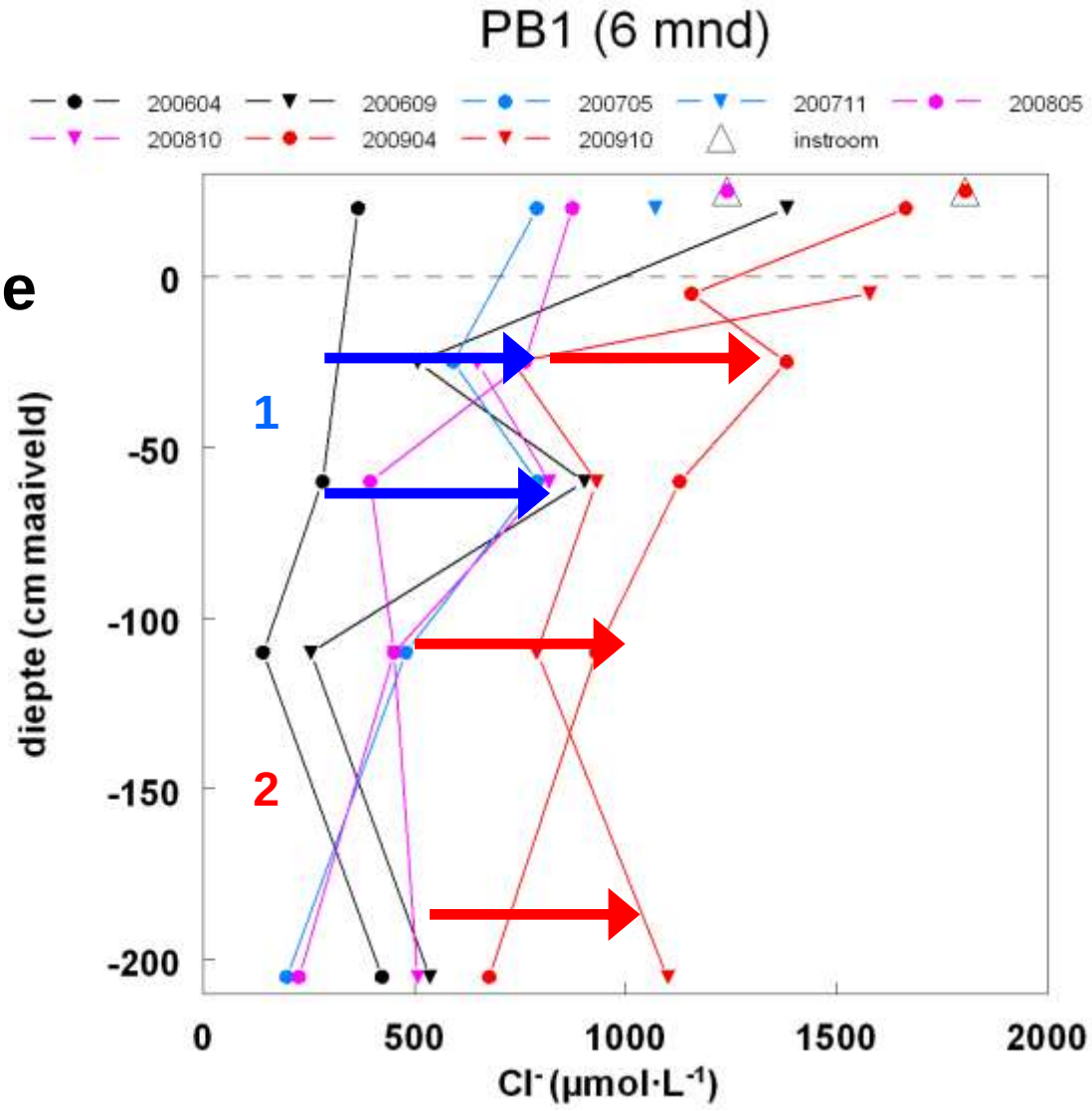
Water levels and vegetation development



CCA on plots during 5 years

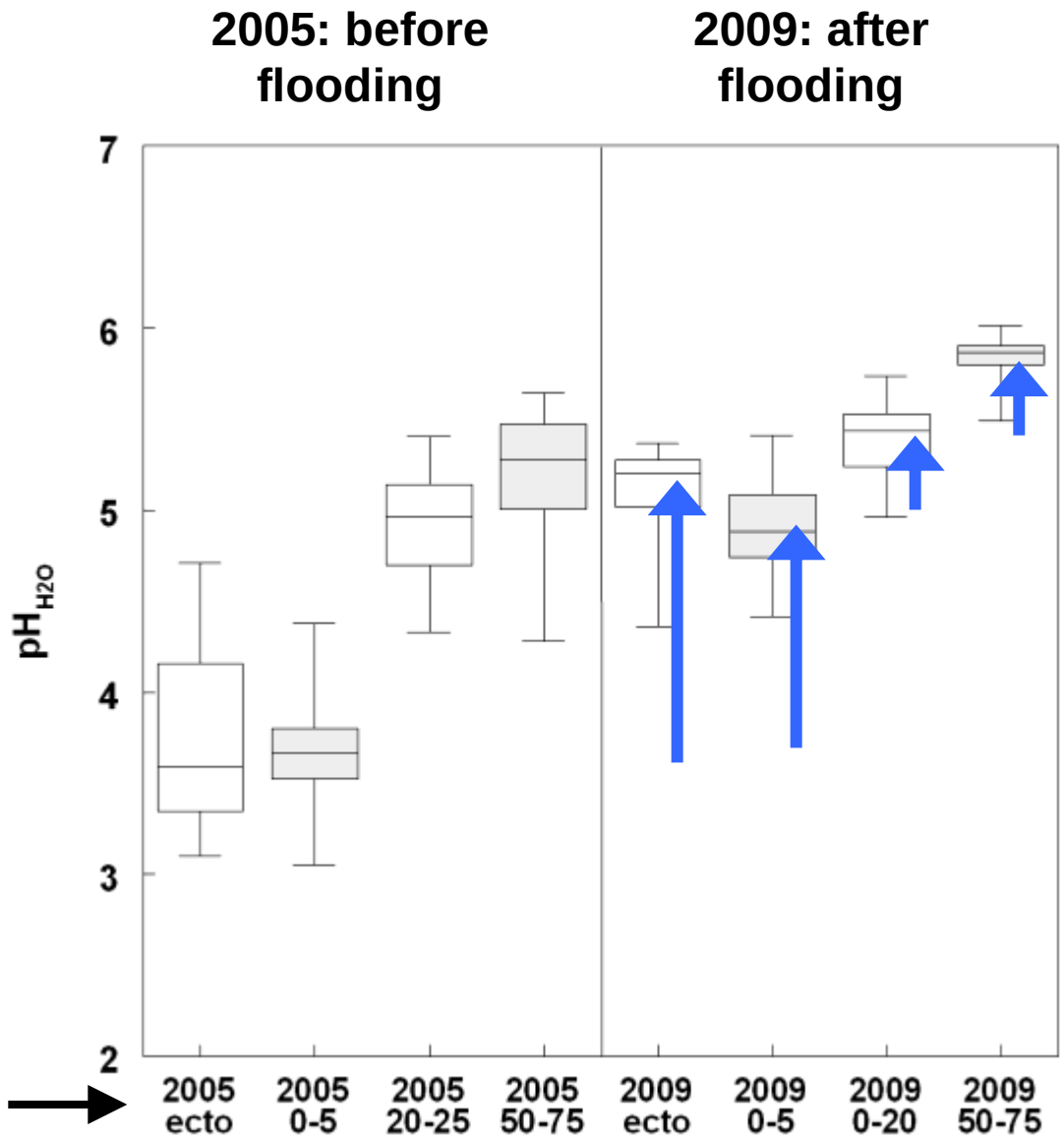
Infiltration of floodwater?

depth profile chloride in water

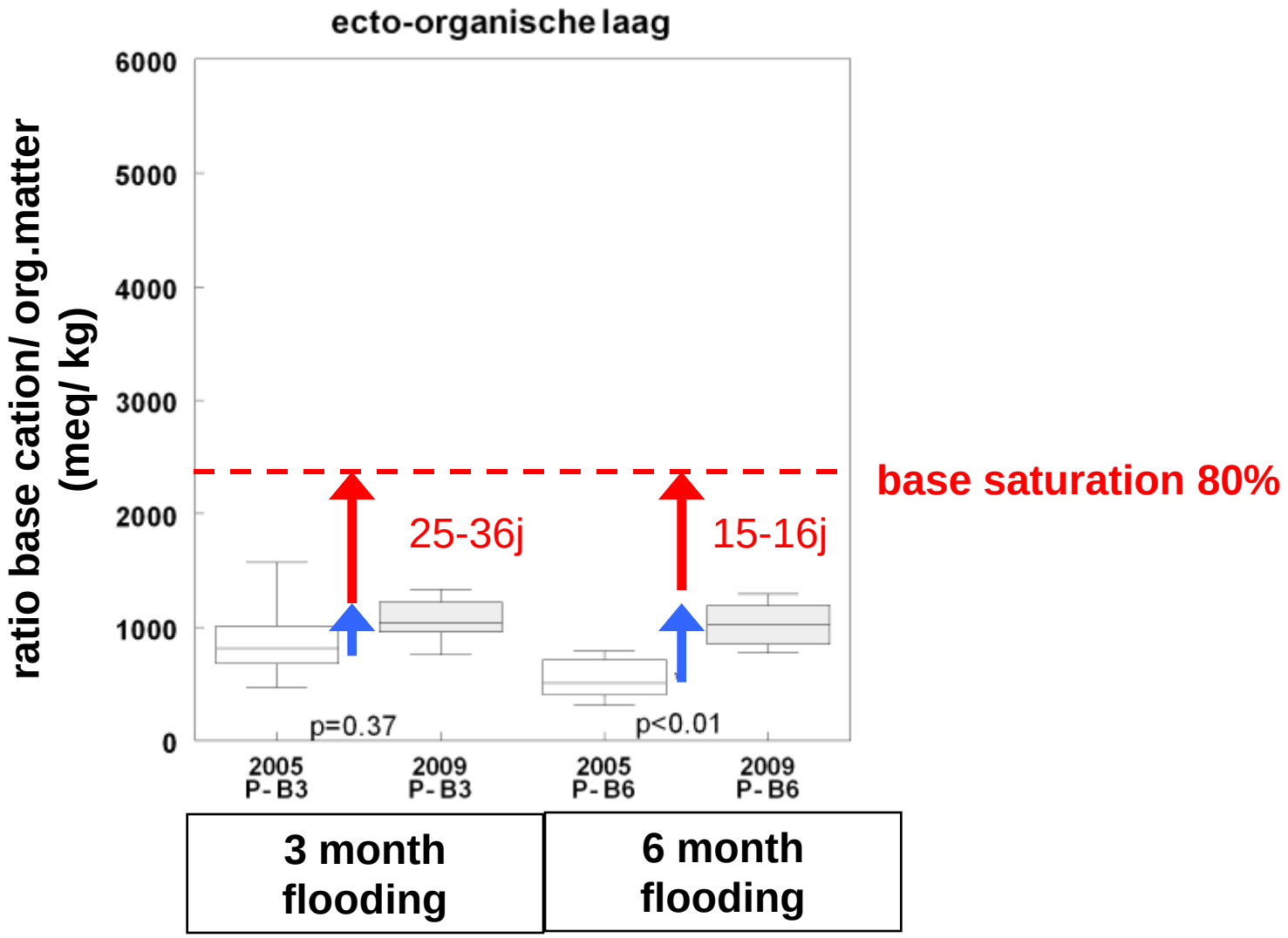


Recovery of high base status?

soil acidity

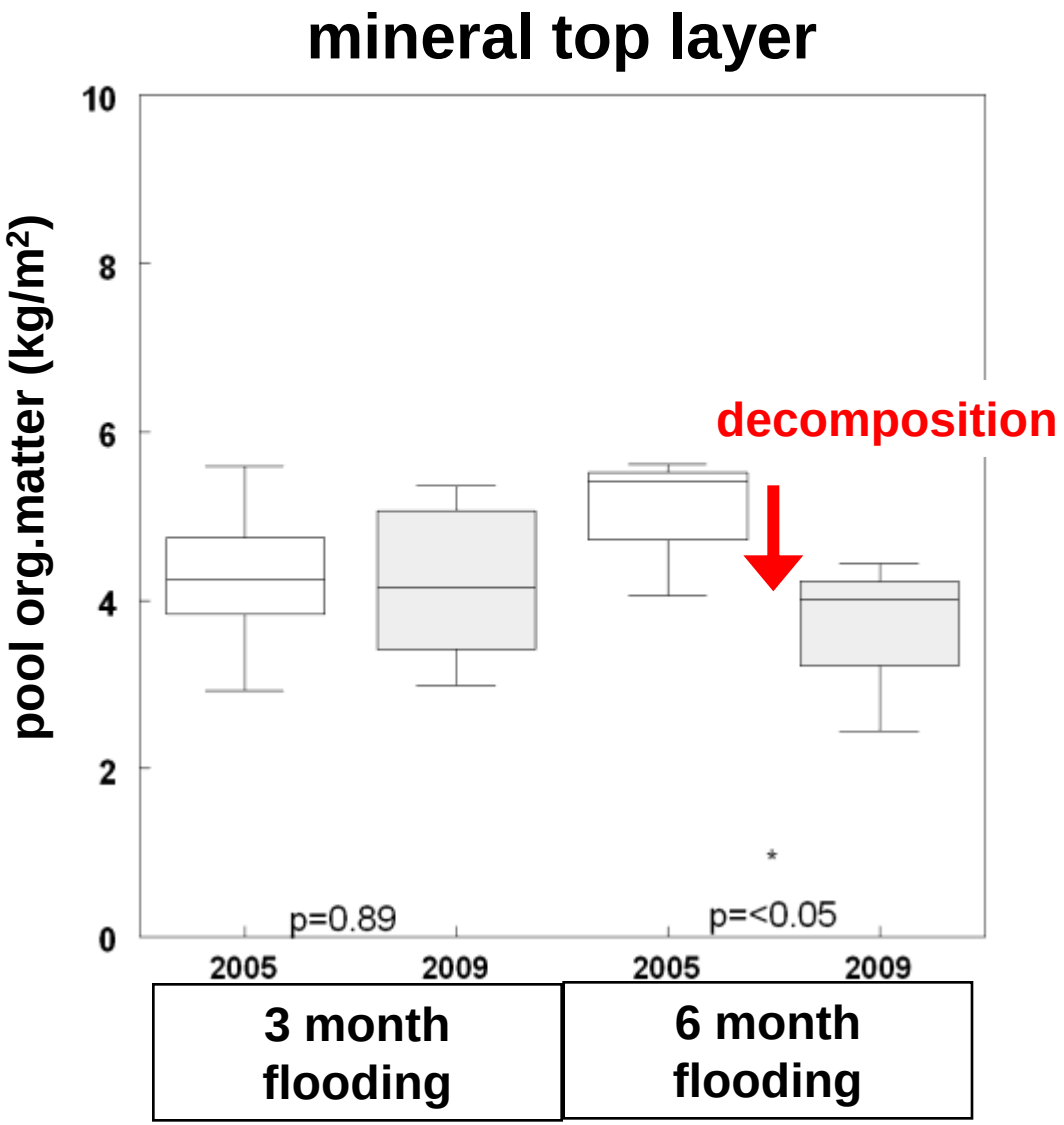


Recovery of high base status?



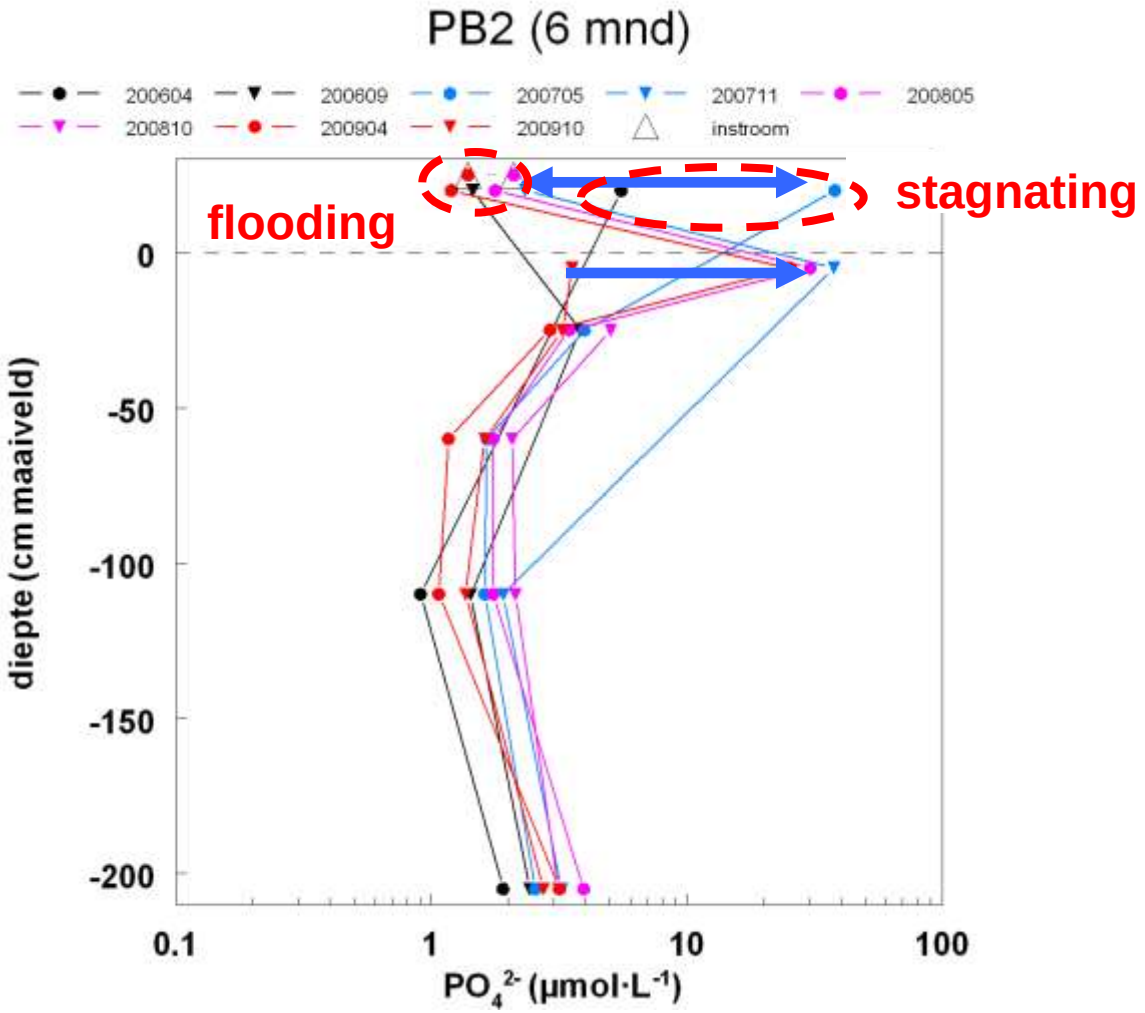
Organic matter dynamics

plots without sod cutting



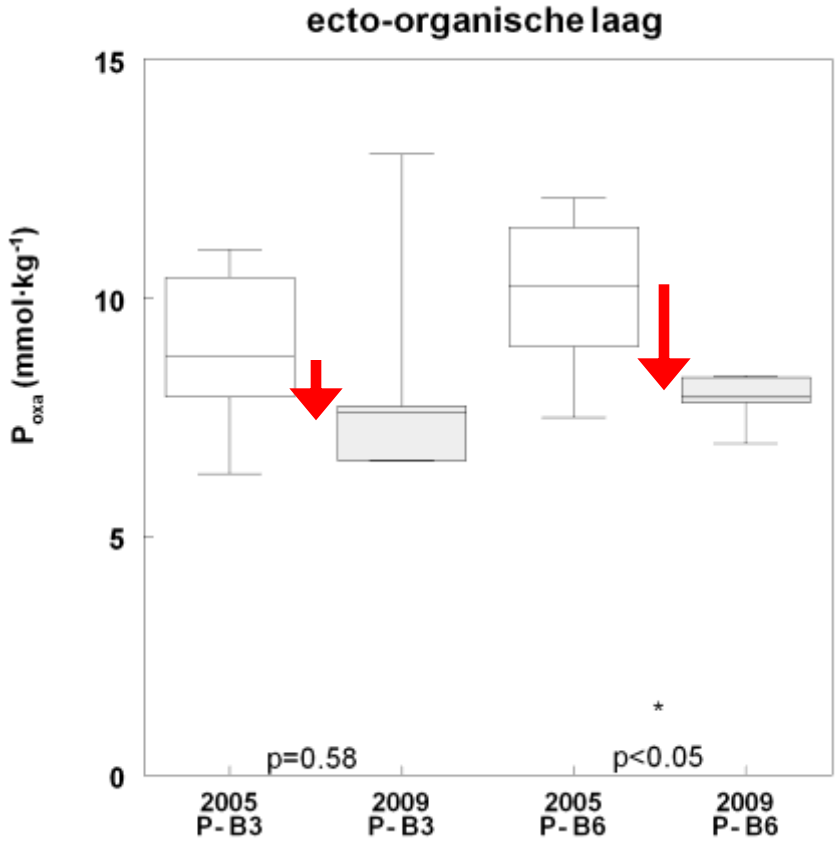
nutrient dynamics

depth profile PO4 in water

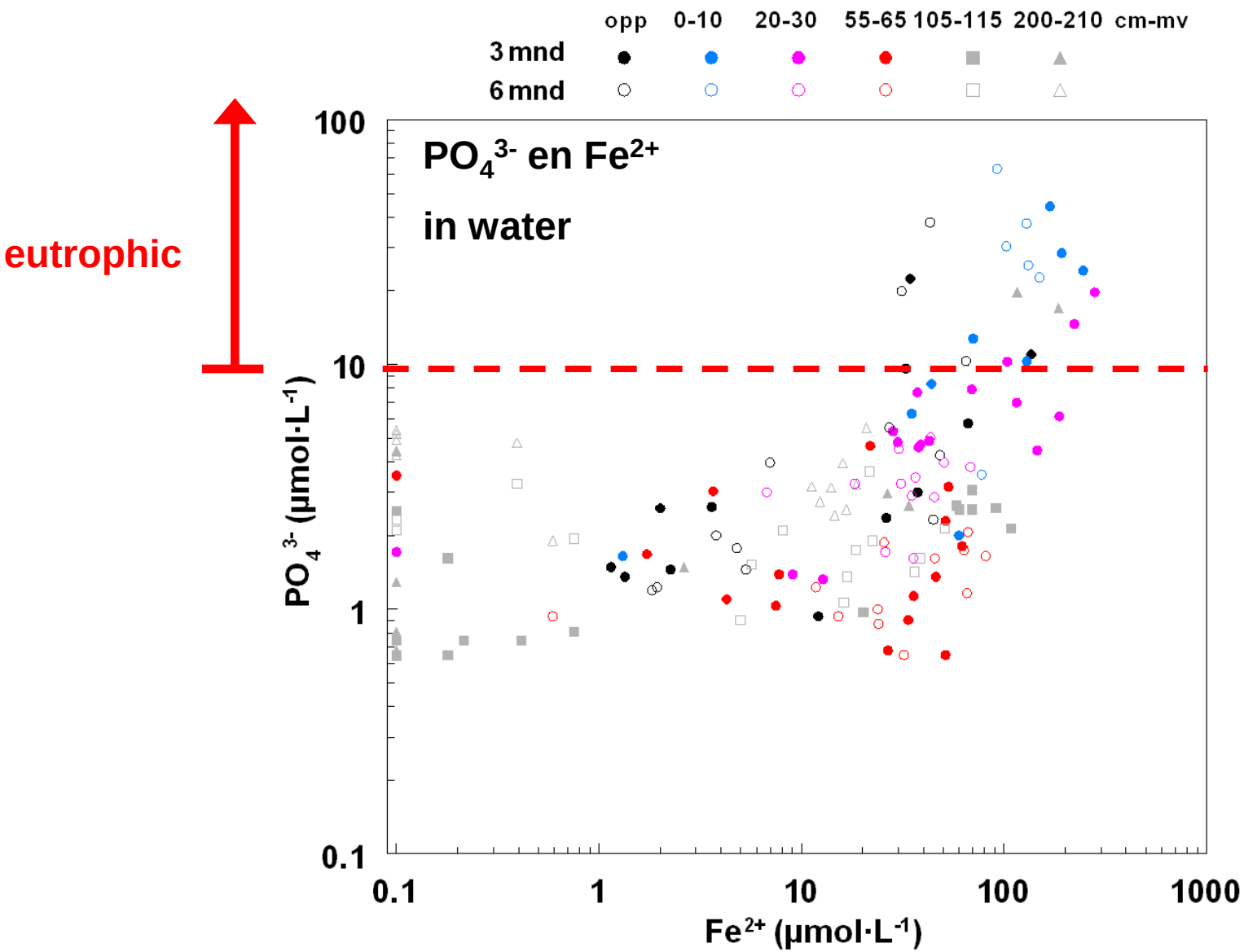


nutrient dynamics

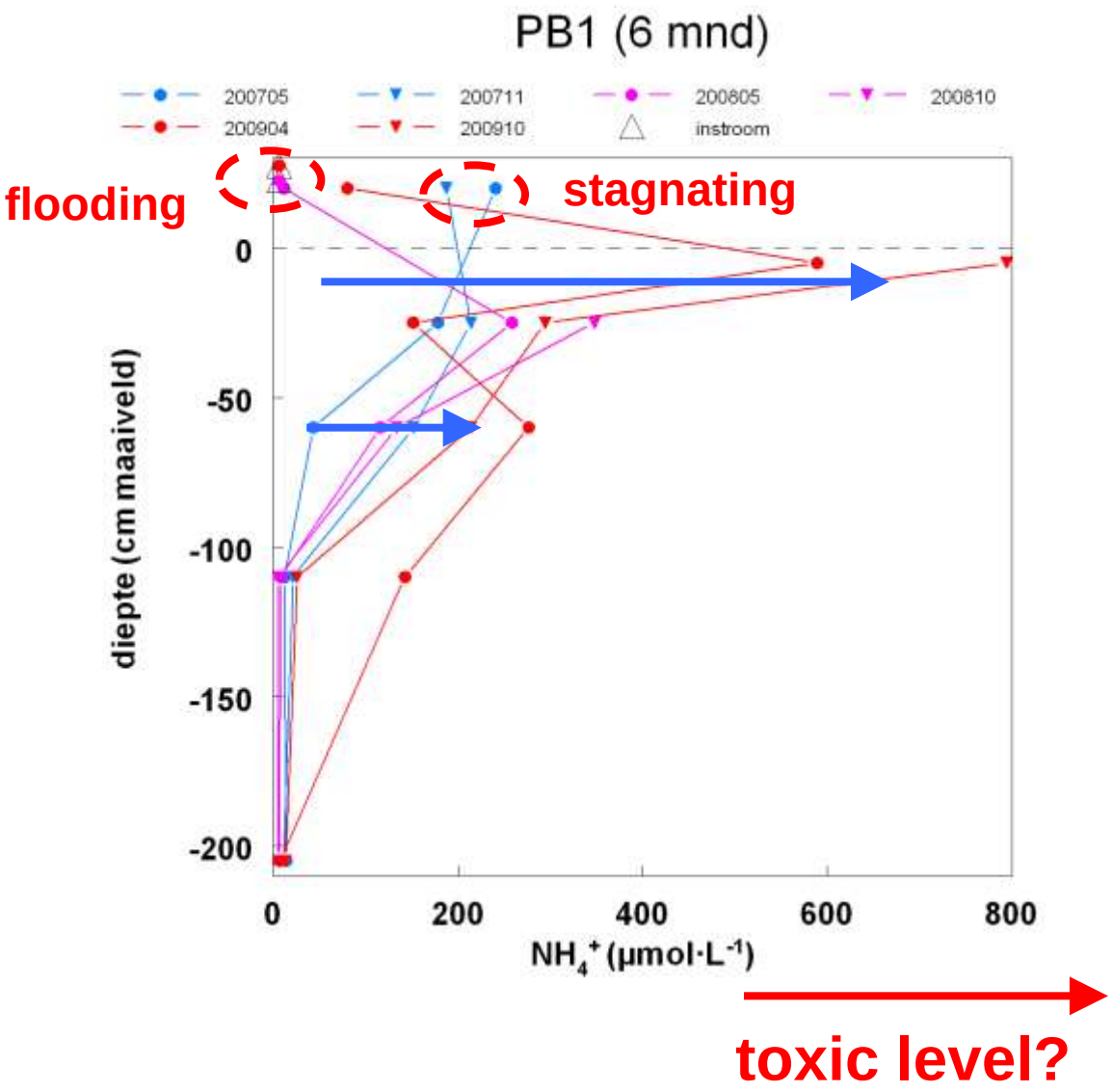
oxalaat-PO4 in ectorganic layer



nutrient dynamics

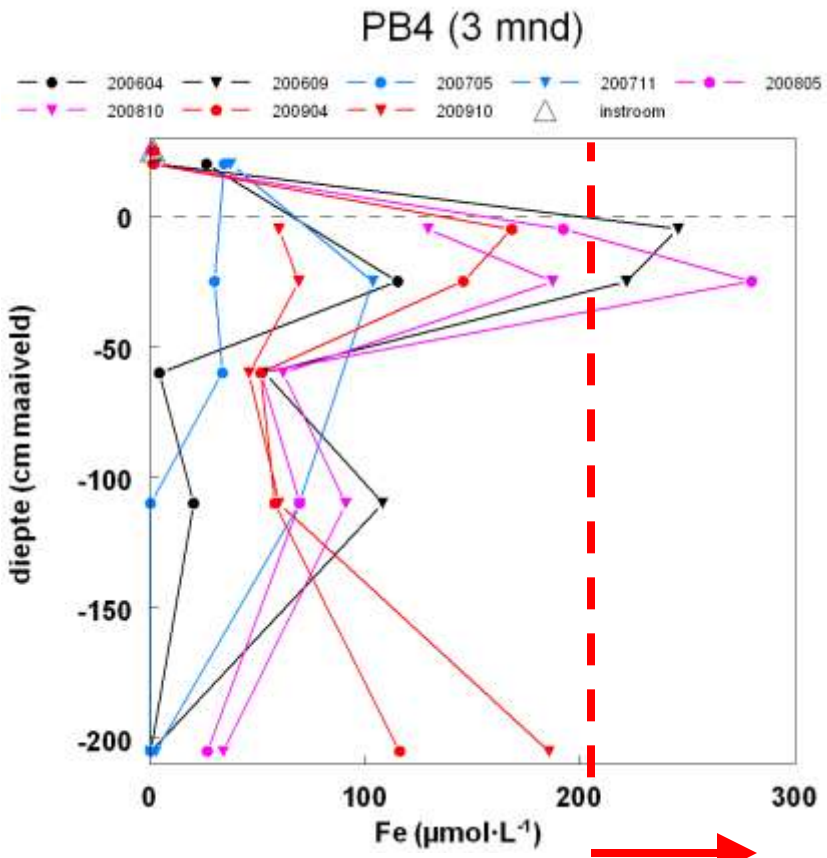


nutrient dynamics



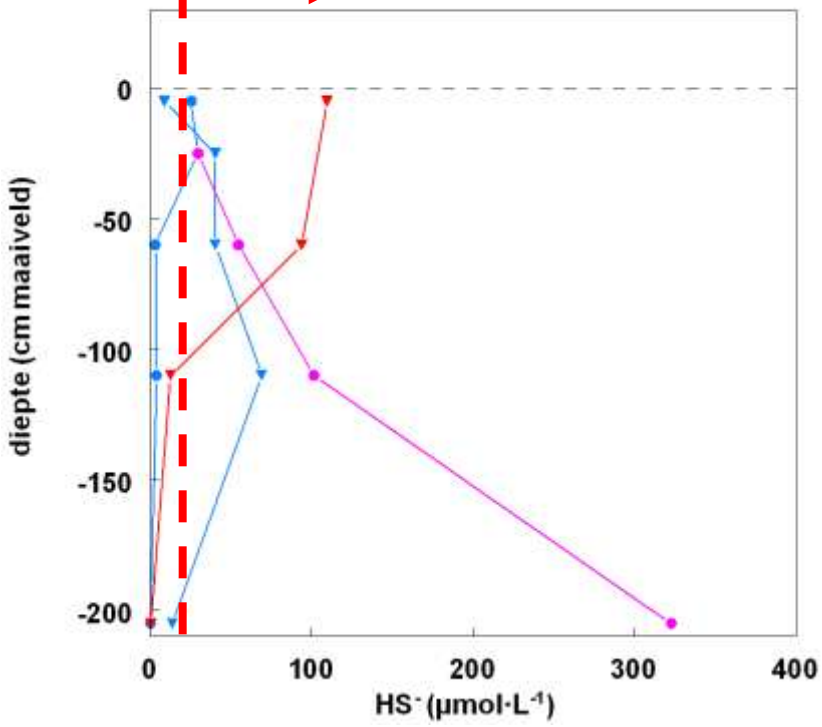
toxicity?

Fe in water



HS- in water

toxicity?



toxicity effects in rich fens

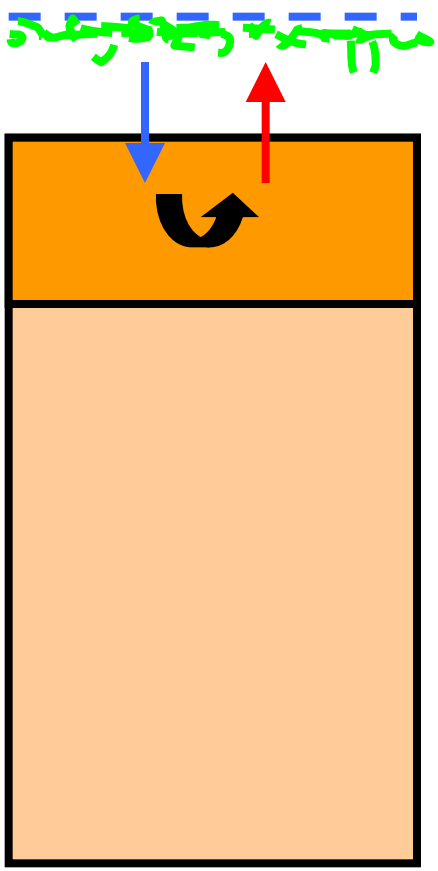
processes

Ca+K+HCO3+SO4

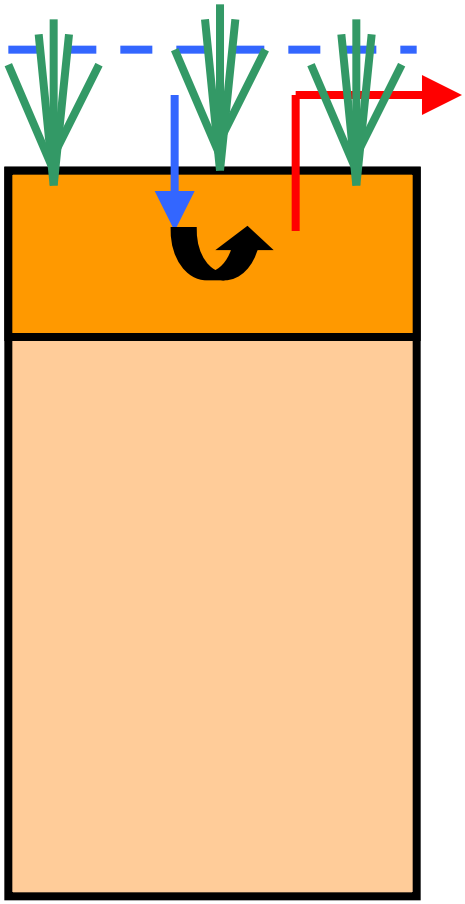
PO4+NH4

decomposition

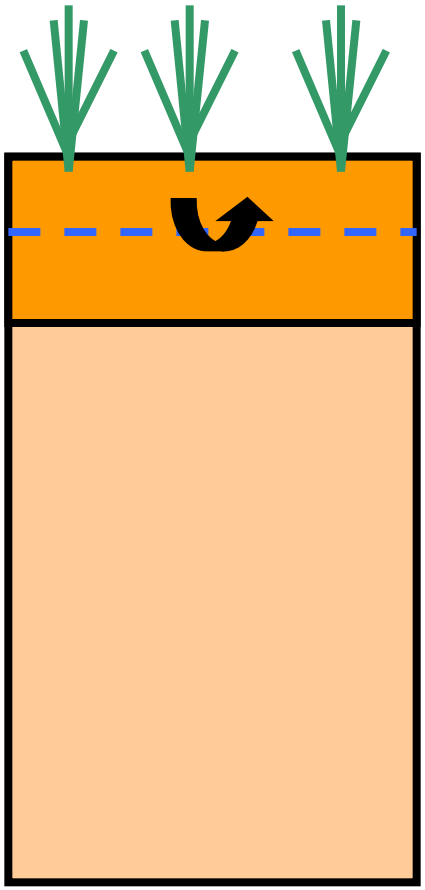
stagnant
high summer
water table



flooding



no flooding
low summer
water table



Can we restore abiotic conditions and vegetation of alder cars by artificial flooding?

- sustainable recovery of high base status
- strong eutrophication with P and N
- but also strong leaching of P and N
- fast recovery of alder car species
- but strong increase of eutrophic species
- toxicity for plants not a big deal?
- long term recovery vegetation unclear
- prospects aquatic fauna???

Which processes enhance or restrict alder car restoration?

- proportional to flooding time:
  - **loading with base cations**
  - **leaching of N and P**
- surface water must flow:
  - **keeps [PO4] and [NH4] in surface water low**
- recovery herb layer dependent on summer tables below soil surface:
  - **for seedlings**
  - **no dominance of Lemna and algae**
- eutrophication by:
  - **strong anaerobic decomposition + mineralization**
  - **desorption of PO4 and NH4**
- sod cutting is useless
- excavating the organic soil is an option

Streams not to eutrophic for alder cars or visa versa?

- relatively low content dissolved P is a pre
  - **fertilizer budgets catchment**
  - **better sewage purification**
  - **alternative purification**
- P-input by sedimentation must be low
  - **brook valley design: spatial differentiation in sedimentation**
- flooded deteriorated alder carrs are nutrient sources
  - **brook valley design: depends on balance between flooding flux and alder carr surface**
  - **option: get rid of the nutrient pool before flooding**