Can we enhance nutrient removal in wetland buffer zones by biomass harvesting?

A comparison of restored (Danish) and natural (Polish) sites.

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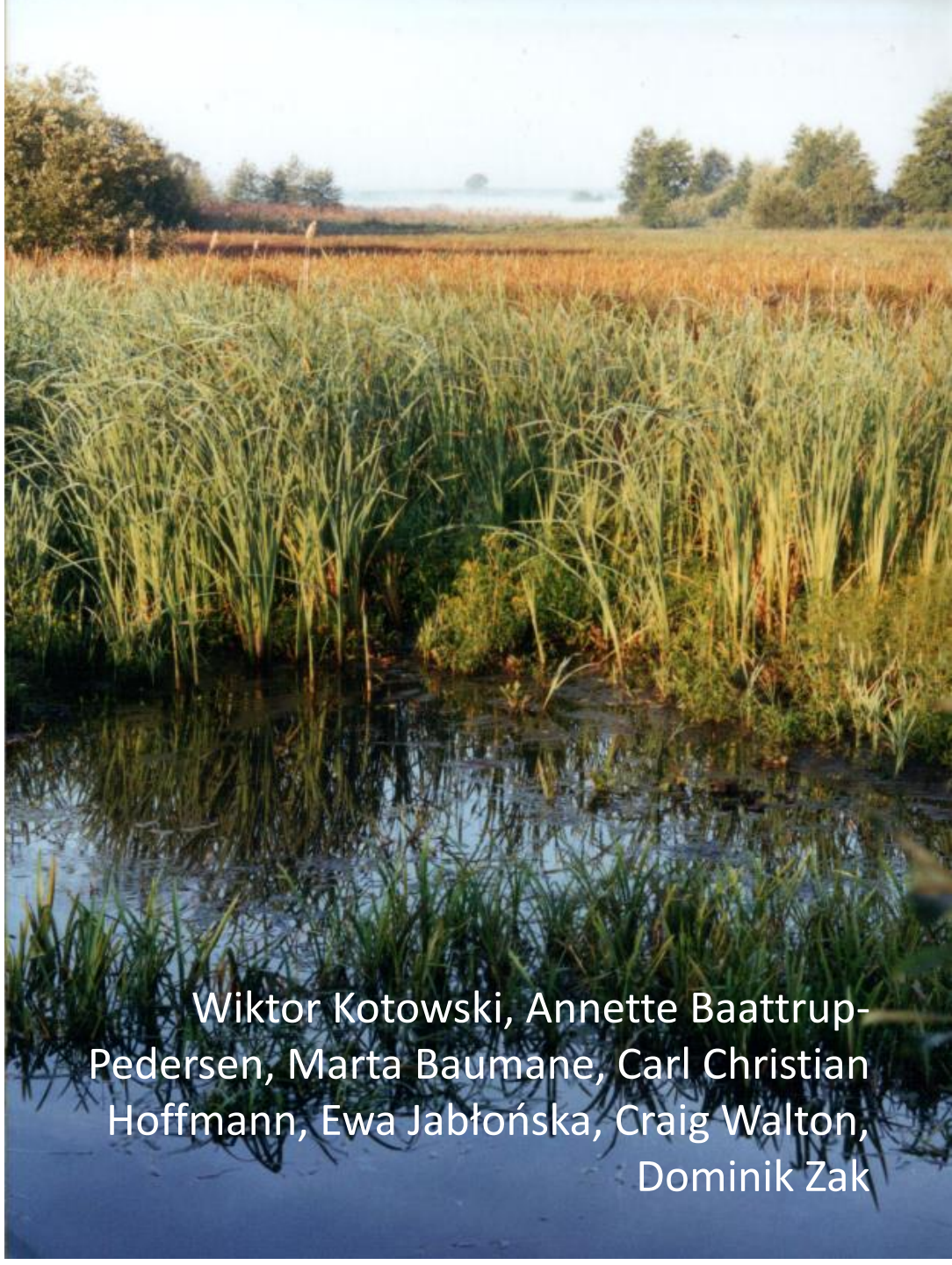

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CLEARANCE

CircuLar Economy Approach to River pollution by Agricultural Nutrients with use of Carbon-storing Ecosystems

Bundesministerium für Ernährung und Landwirtschaft

FNR
Fachagentur Nachwachsende Rohstoffe e.V.

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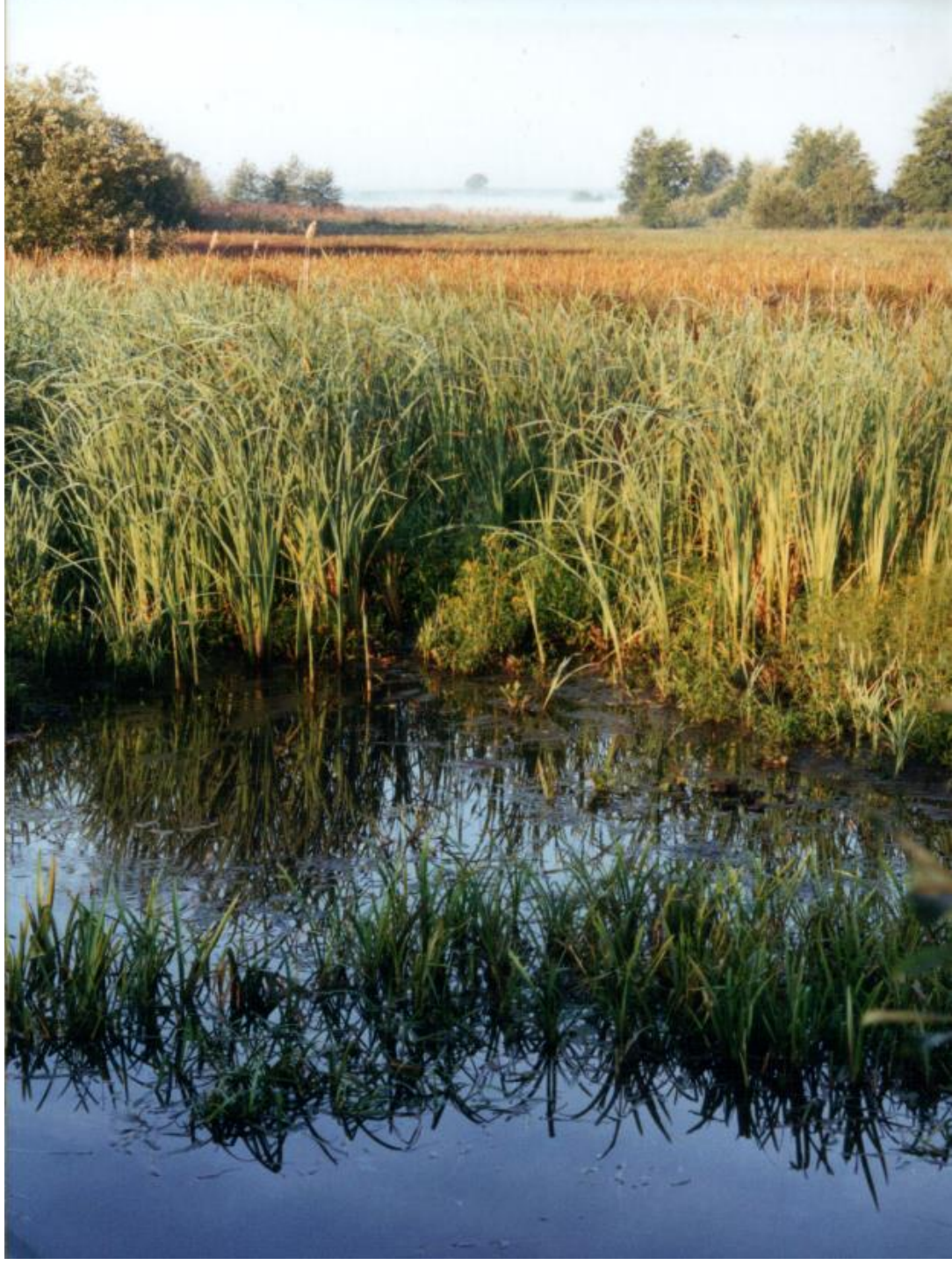
GETIDOS GETTING THINGS DONE SUSTAINABLY

GREIFSWALD MIRE CENTRE

IGB

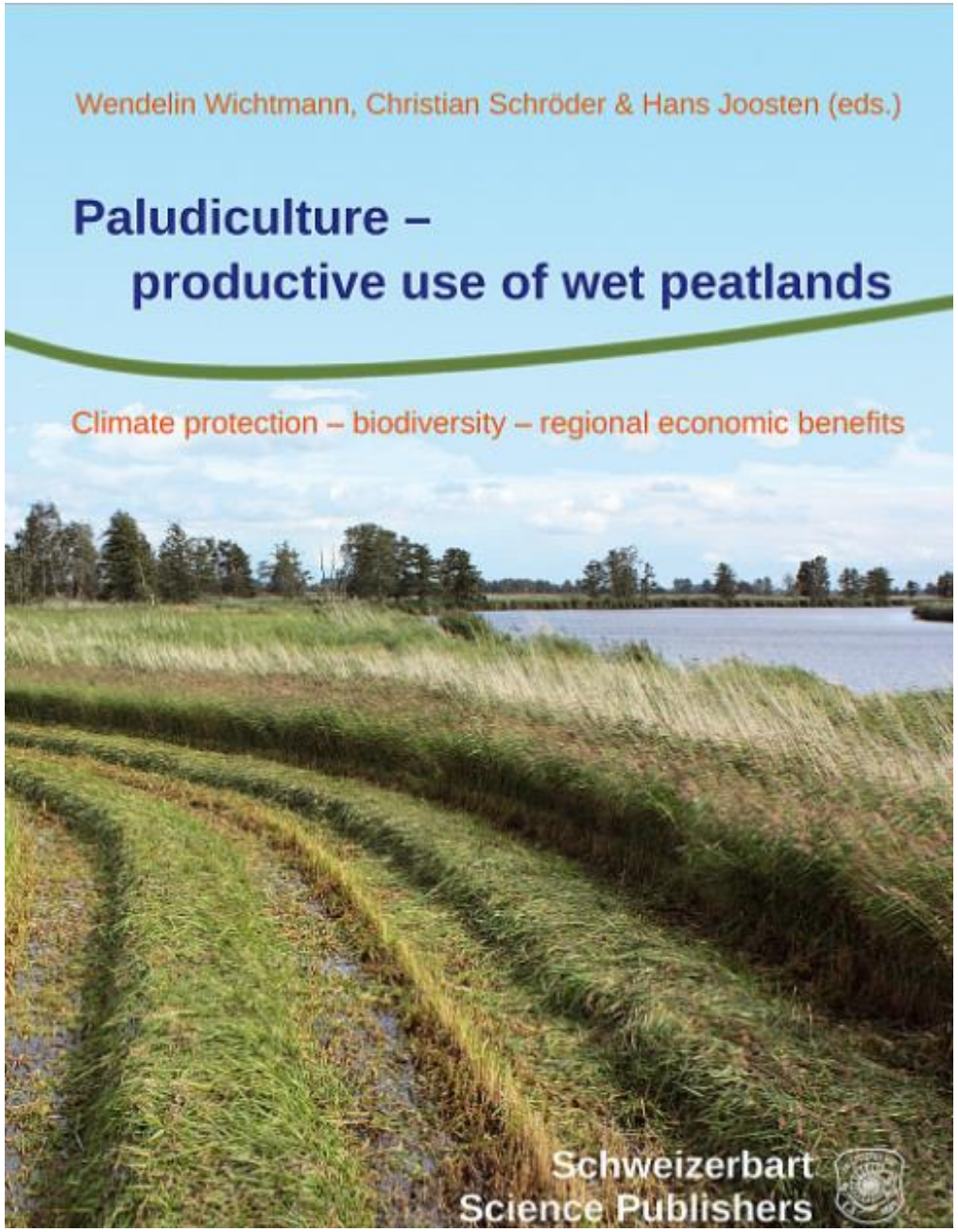
Wetland buffer zone

- Wetland located between agricultural source and water body to capture and remove nutrients



Paludiculture

- Productive use of wet (natural and rewetted) peatlands



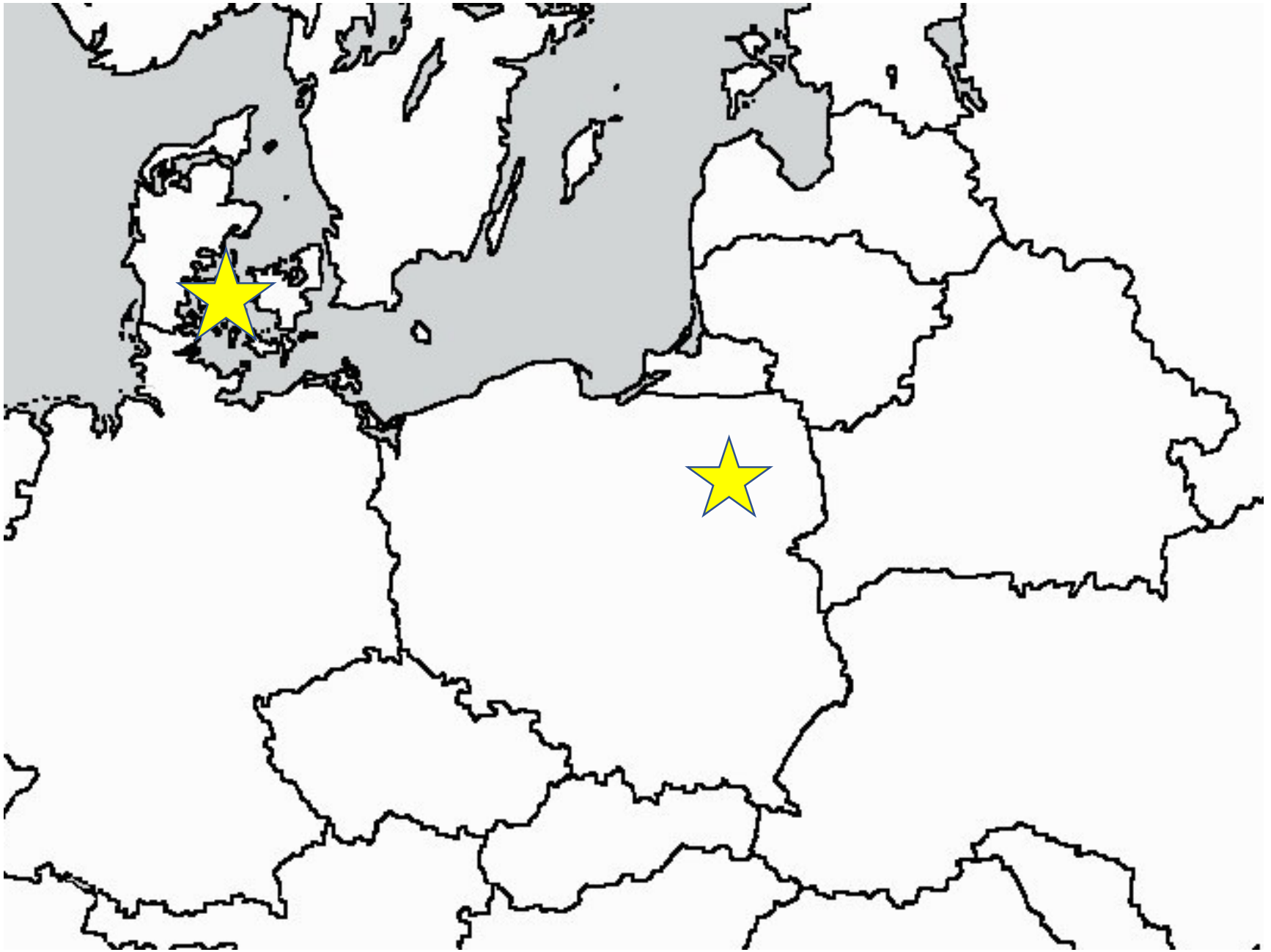
Wetland buffer zones & paludiculture?

Possible synergies:

- high nutrient availability from peatland rewetting & water input from agriculture
- biomass removal may add to nutrient removal by microbial and chemical mechanisms
- biomass removal may help to avoid P loss to Surface waters

Denmark:
restored wetlands on long-term drained, agriculturally used peatlands

Poland:
natural fen mires



DK

PL

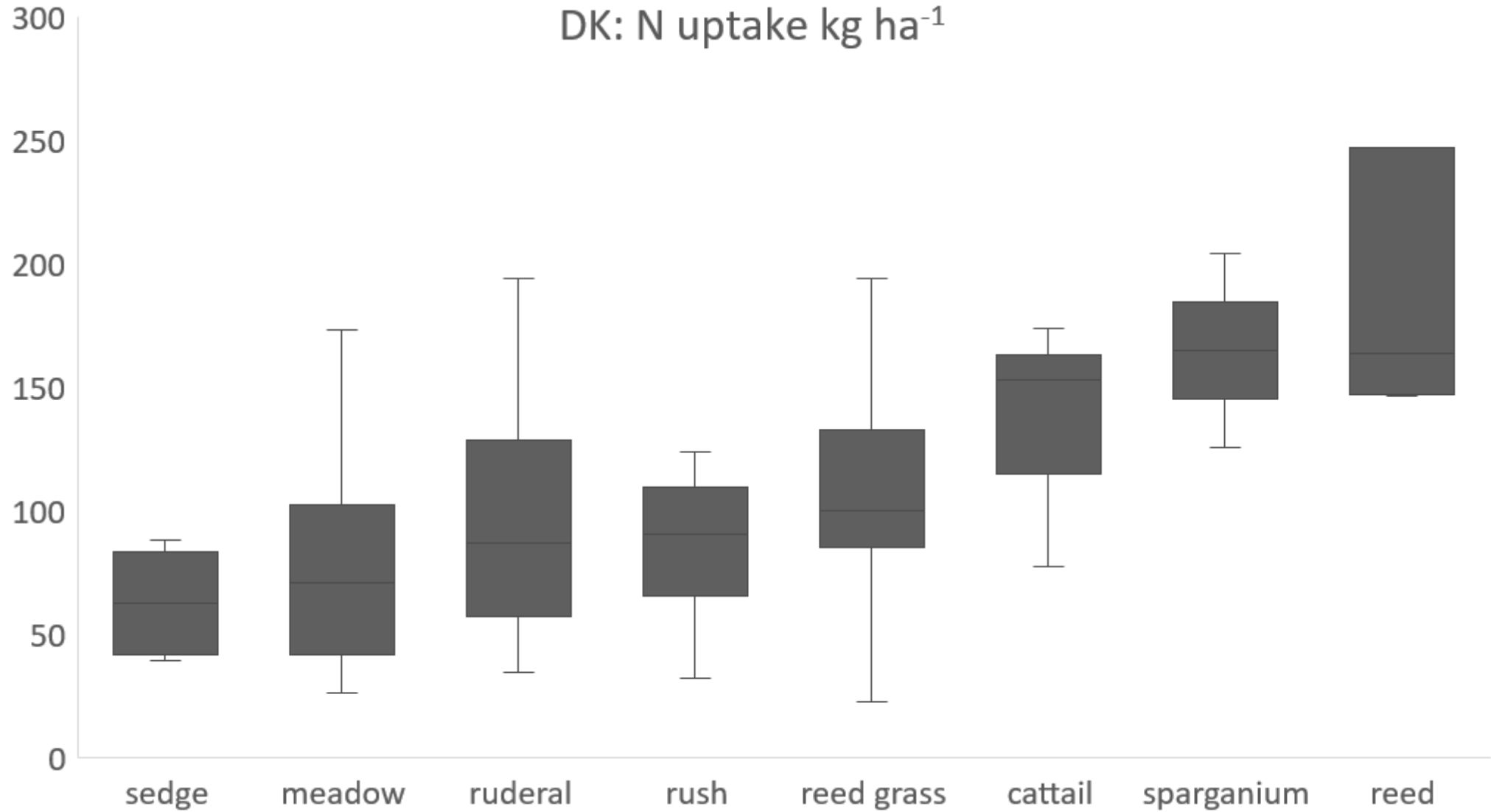
What amount of N and P can be removed from rewetted and natural peatlands by vegetation harvesting?

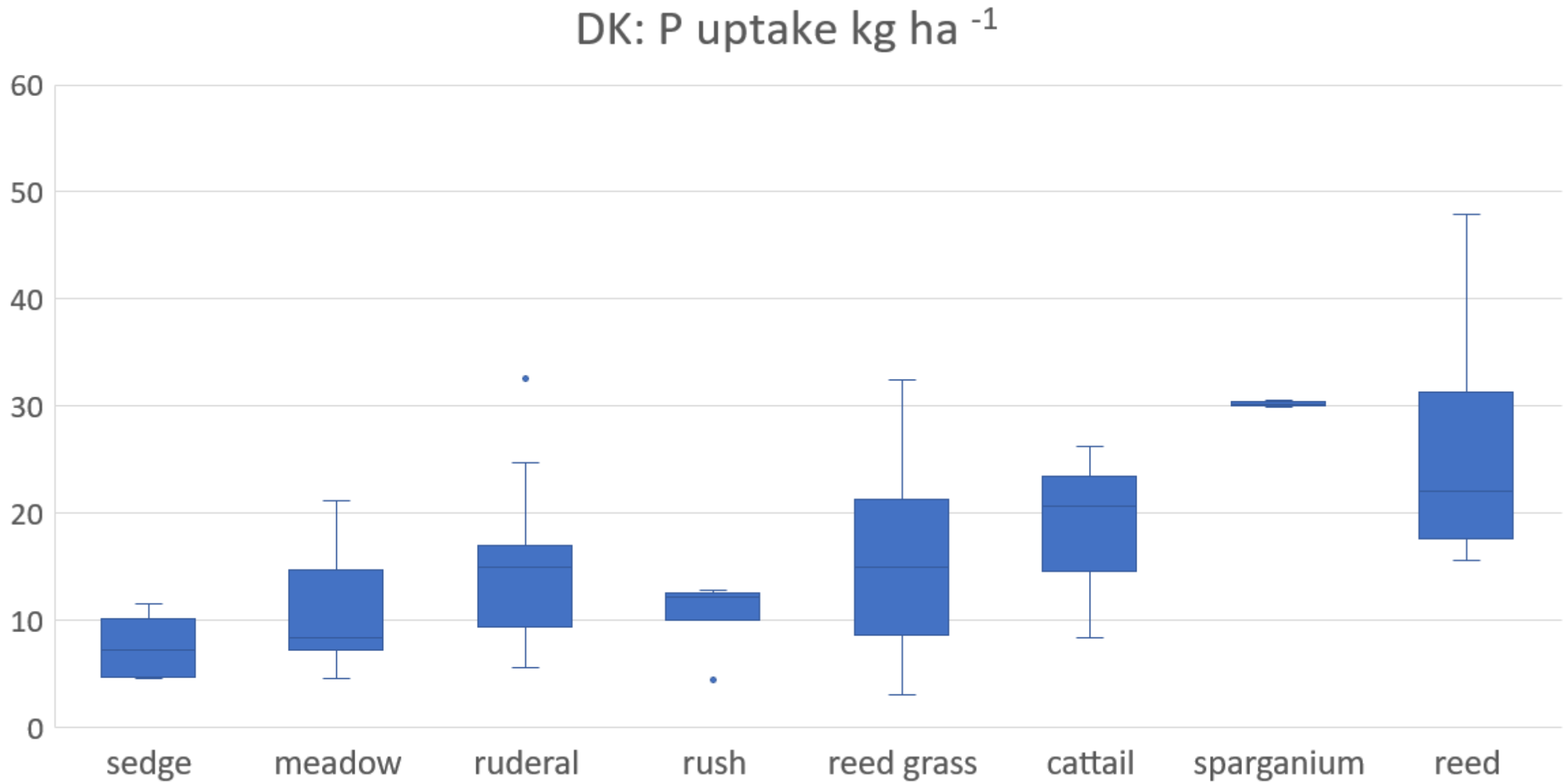
1. Harvesting above-ground biomass
2. Dry mass and NP-content analyses
3. Water leaching experiment to assess strength of nutrient sorption

Leaching experiment

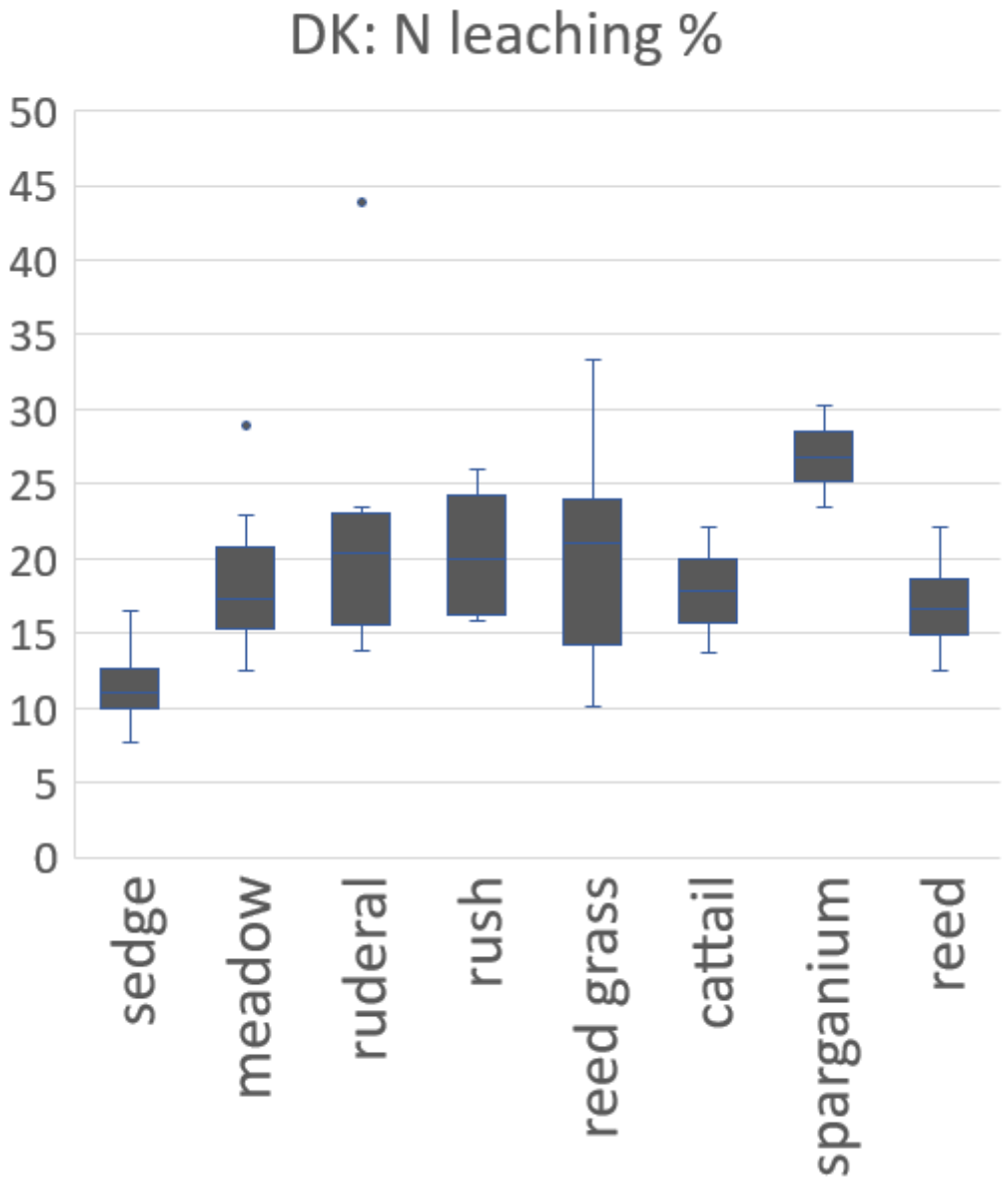
- plant litter cut in 5 cm pieces
- incubated 24h in 0.02%-solution of NaCl (shaking tables in dark)
- solution filtered and analysed for dissolved N, PO_4-P and organic C.

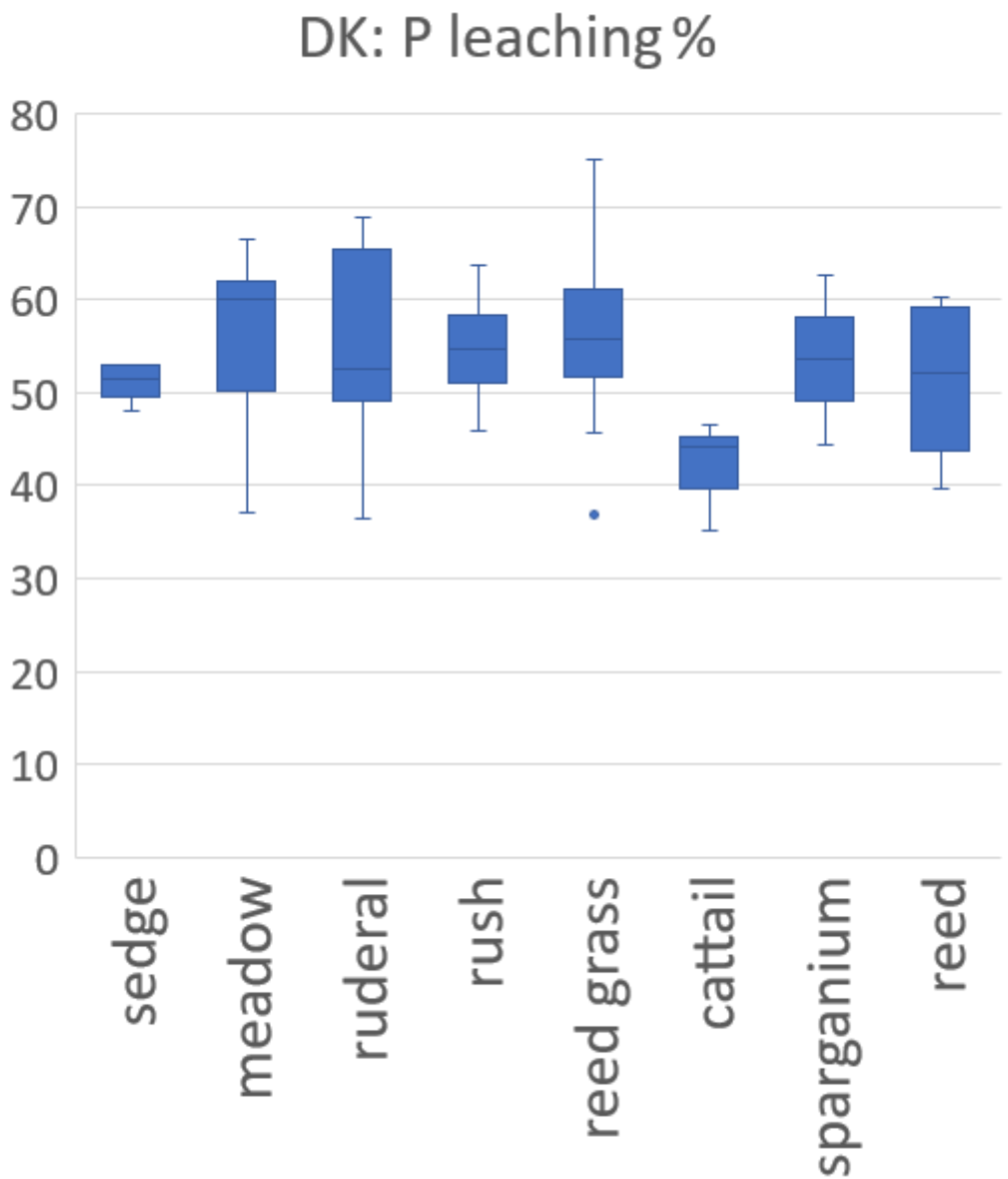
Results


DK: N uptake kg ha-1
300
250
200
150
100
50
0
sedge
meadow
ruderal
rush
reed grass
cattail
sparganium
reed

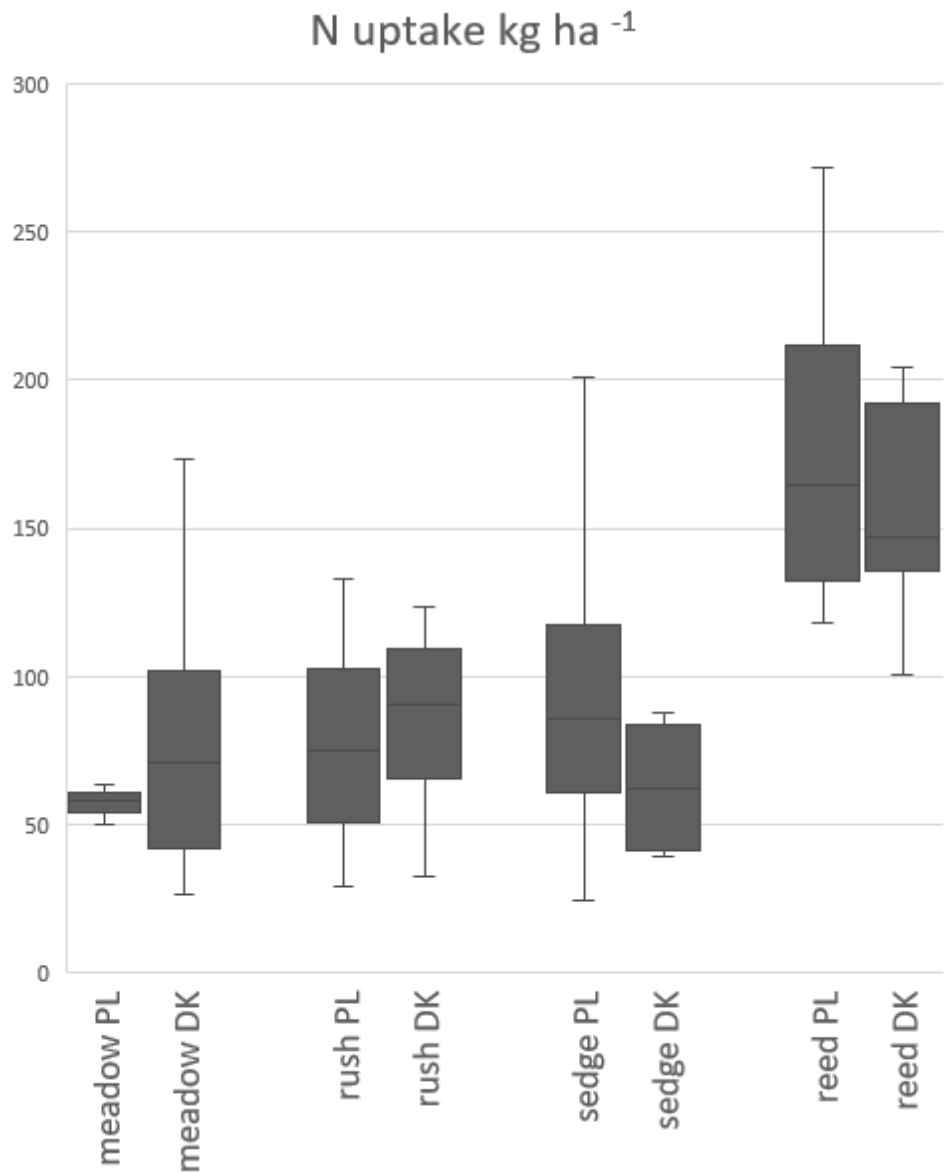

DK: P uptake kg ha -1
60
50
40
30
20
10
0
sedge
meadow
ruderal
rush
reed grass
cattail
sparganium
reed

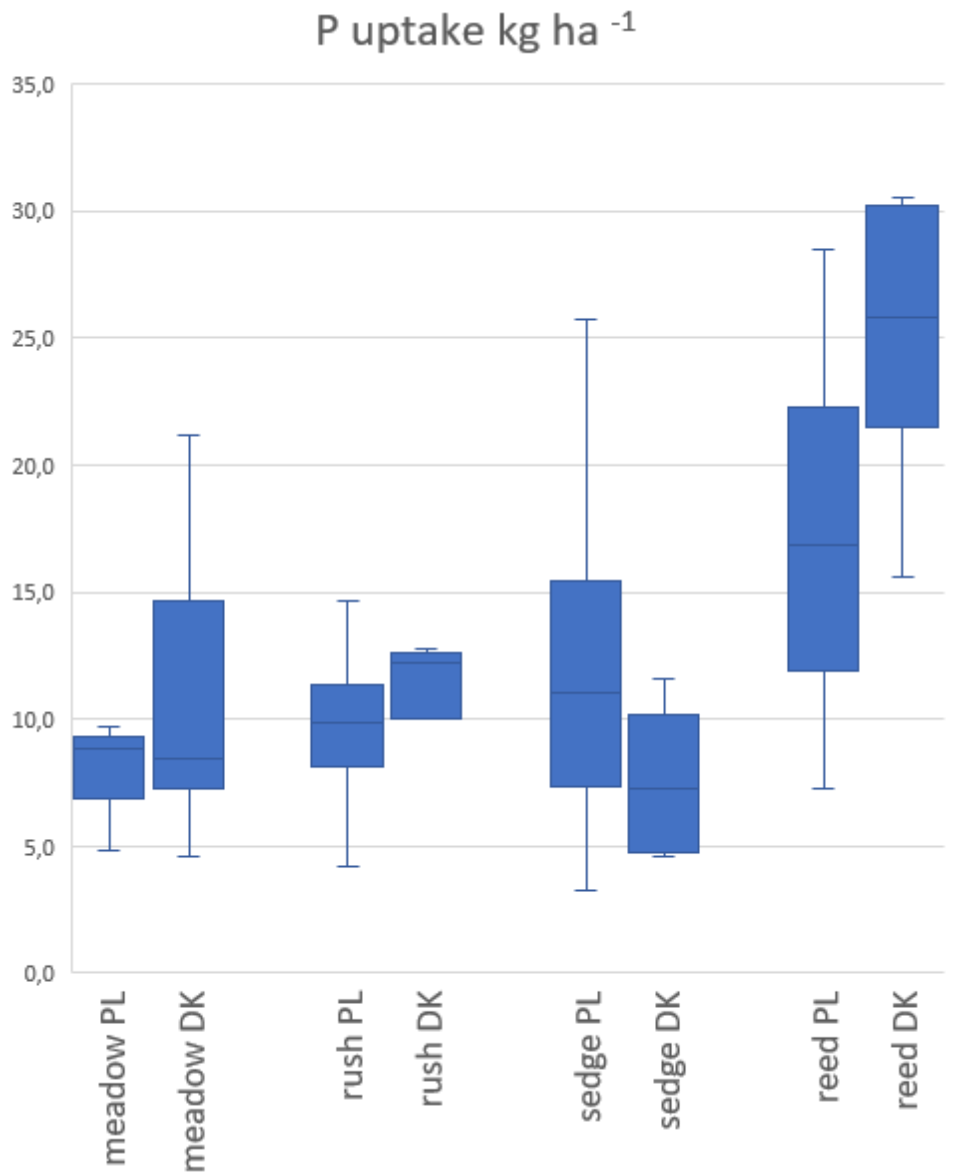
Higher leaching of N than P (under N-limited conditions?)



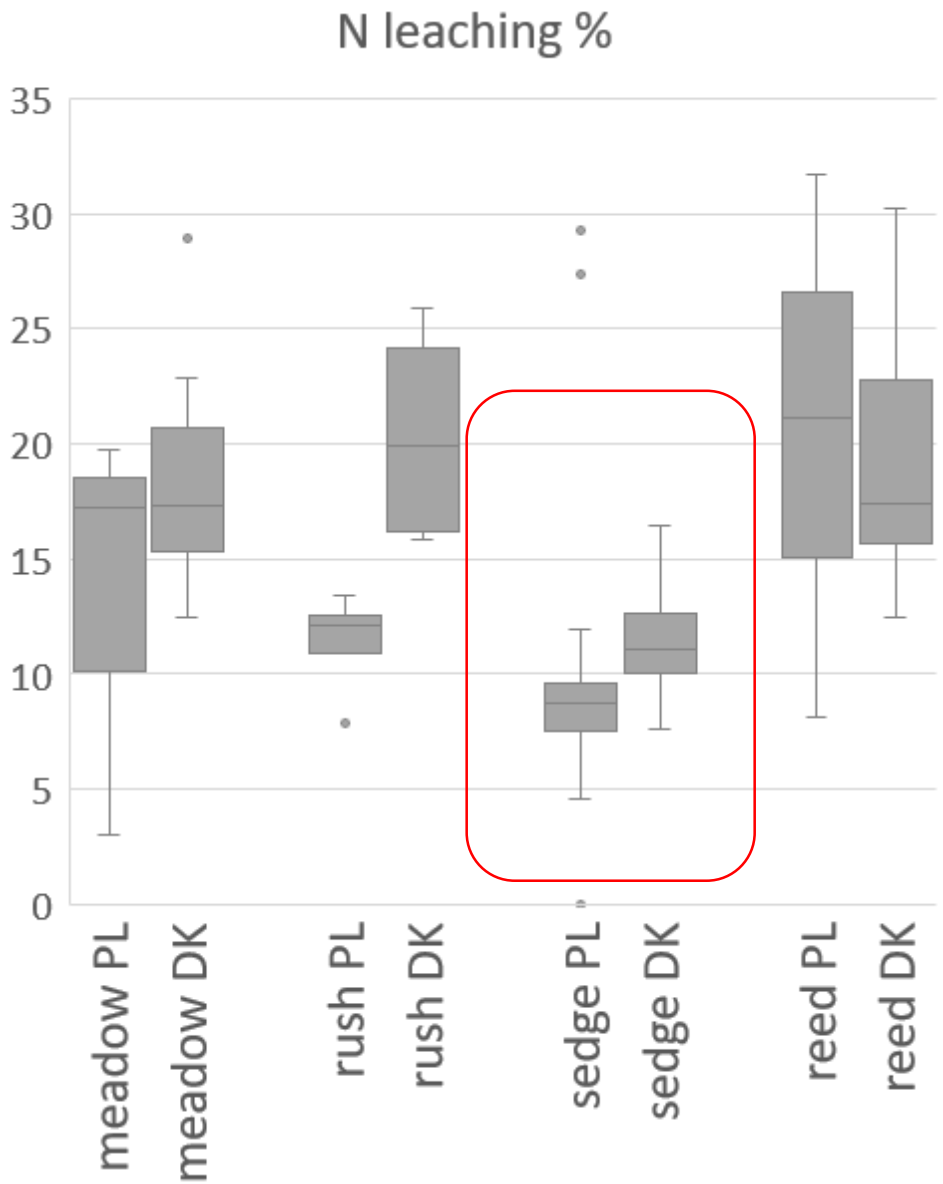


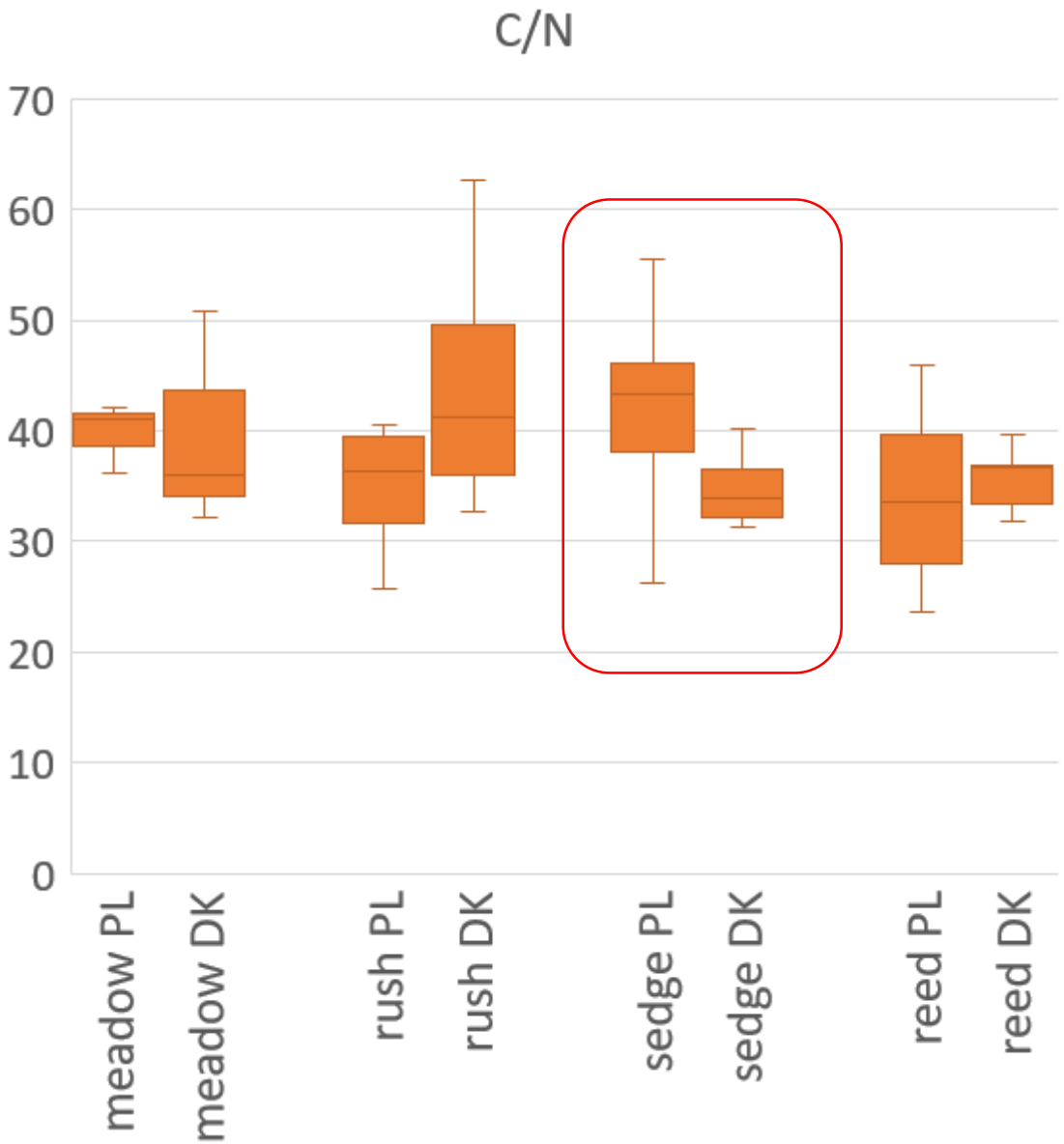
Not much difference between countries





Natural fens with sedges have higher C/N and lowest N-leaching %





Is this much?

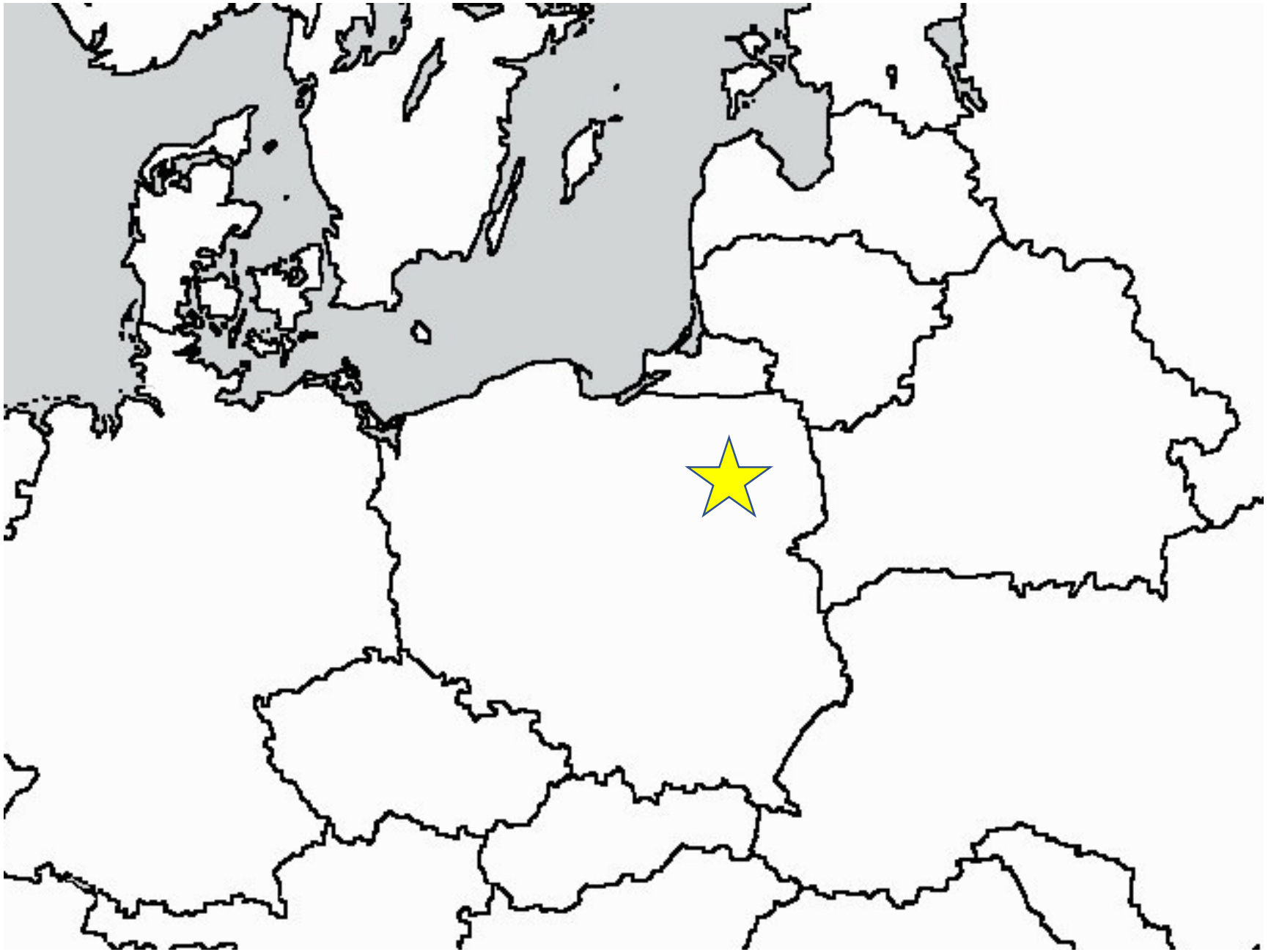
Wymazal (2007):
N uptake 1000-2000 kg N ha^{-1}
P uptake 100-200 kg P ha^{-1}

in constructed wetlands

Which share of biomass is in aboveground vascular plants?

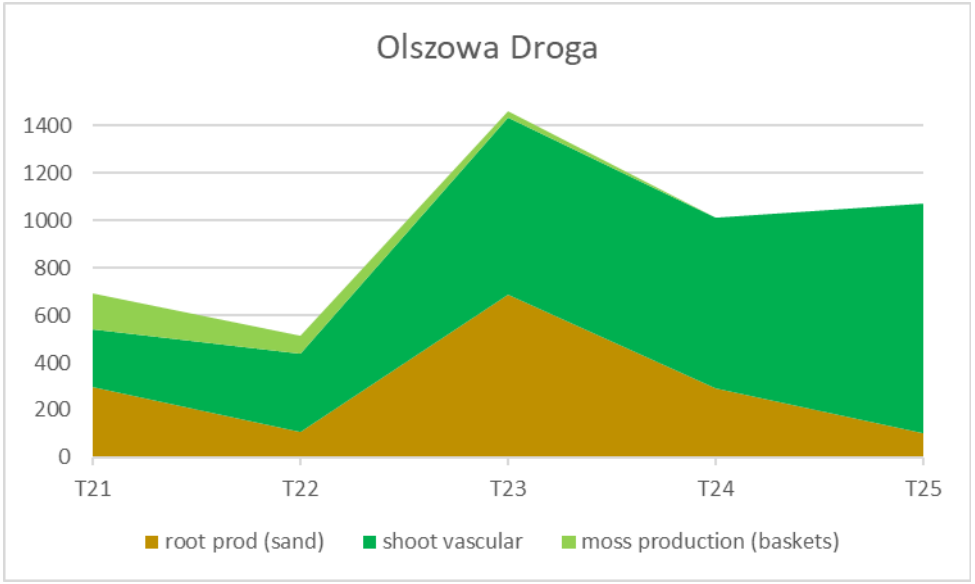
1. Above-ground biomass harvest
2. Root ingrowth cores
3. Bryophyte growth measurements

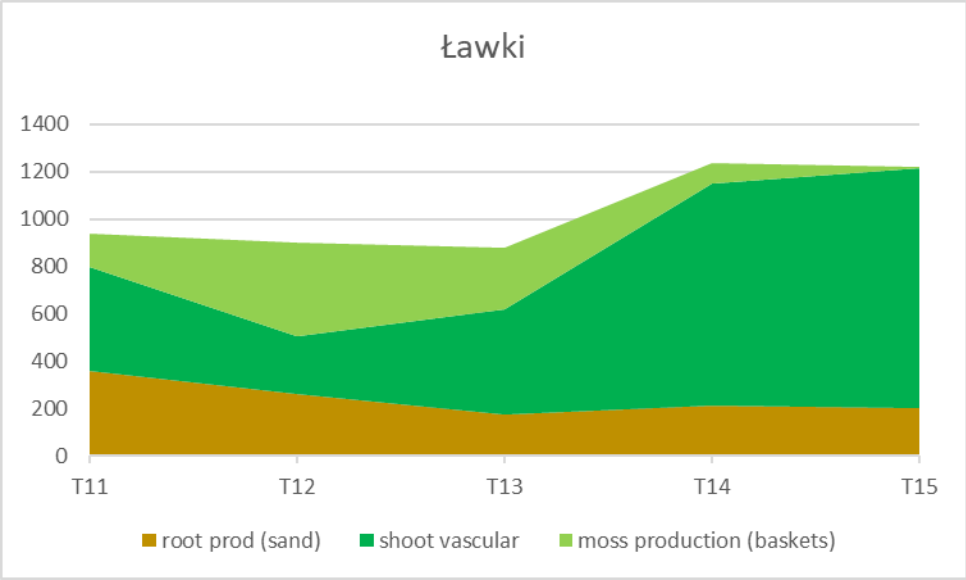
Poland:
transects in
natural fen mires
in Biebrza valley

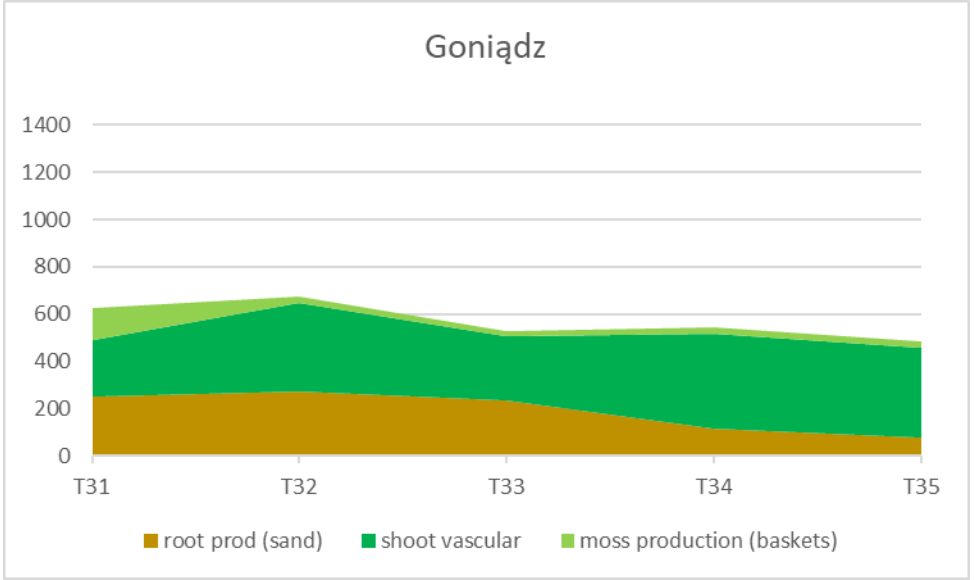


Transect study

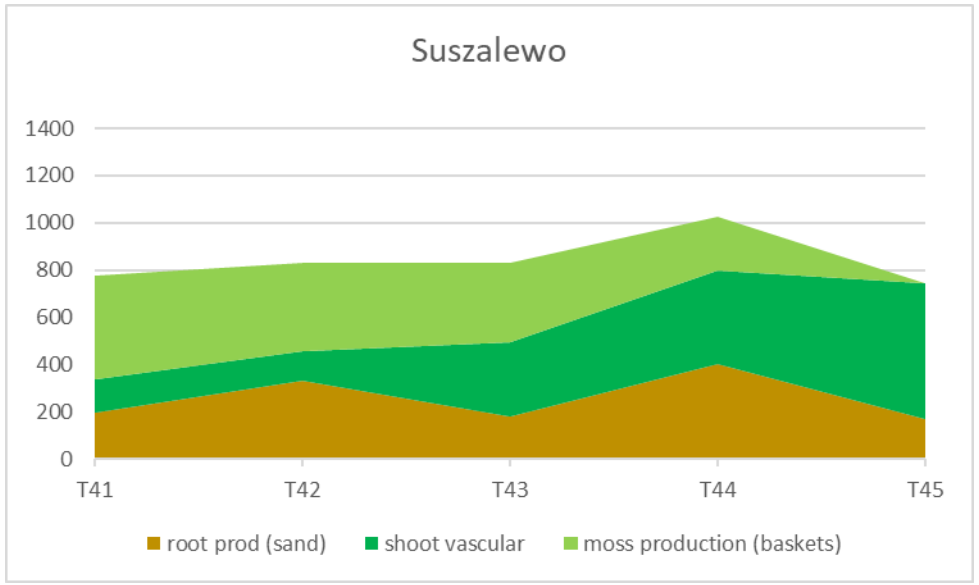
Share of production in more eutrophic / dry transects

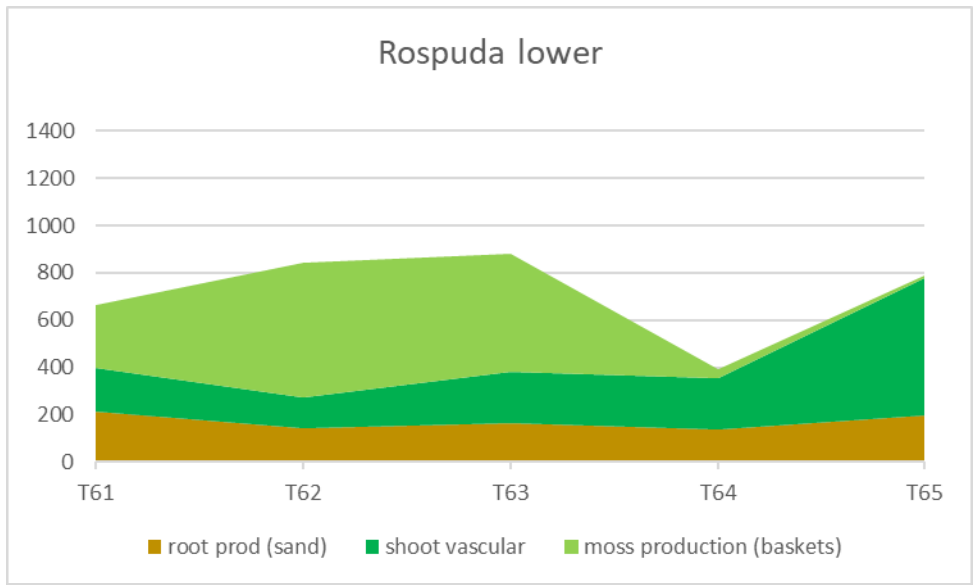


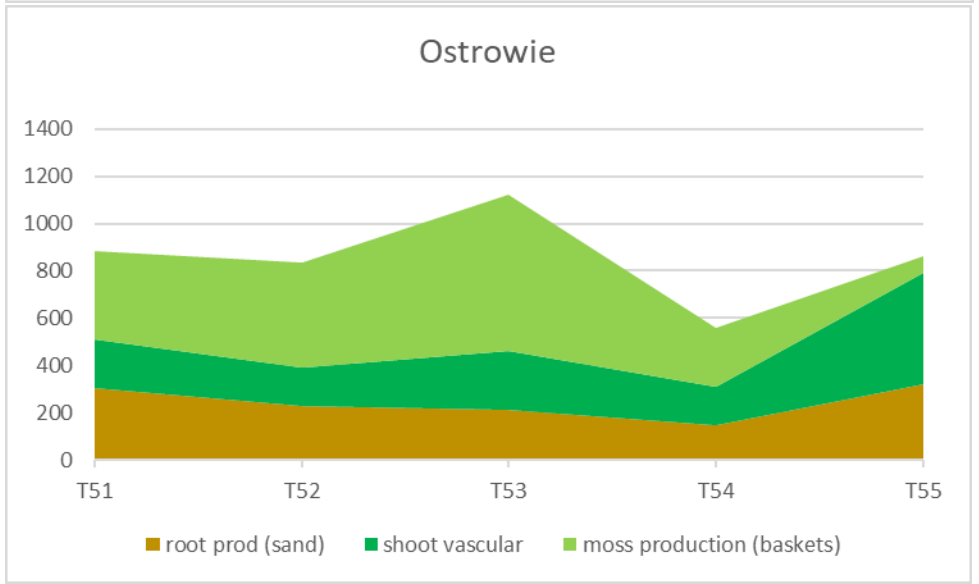


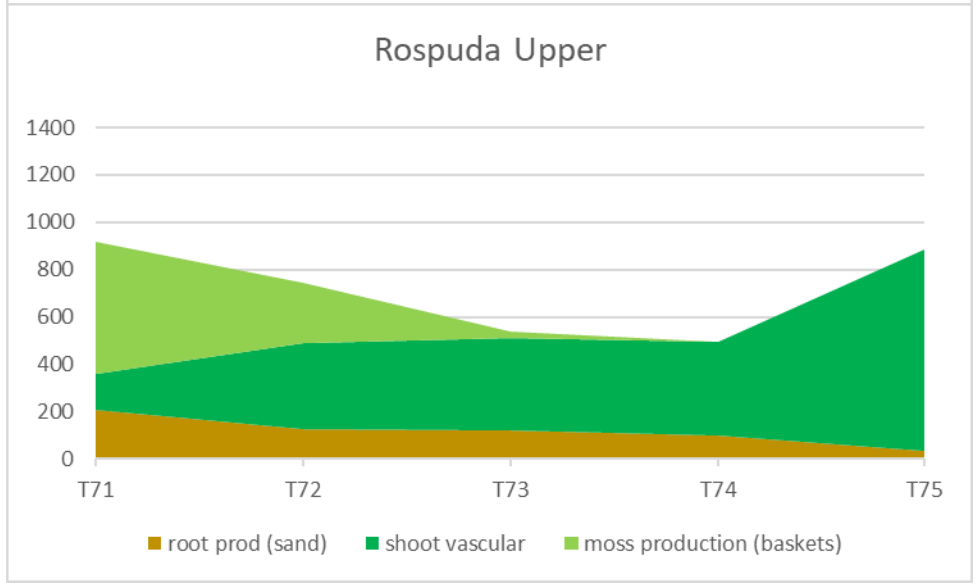


Share of production in less productive / wetter transects









Conclusions

- Nutrient removal by mowing spontaneous vegetation in fens << constructed wetlands
- No difference between restored and natural fens (countries)
- Not much difference between vegetation types, except Phragmites and other tall grasses
- High leaching of P from biomass (under N-limited conditions)
- High C/N ratio of sedges from natural fens -> low N leaching?
- In high-productive fens most production aboveground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Thank you