Effects of management and groundwater fluctuations on nutrients availability in two phosphorus-limited rich fens

Mohssine El-Kahloun & Patrick Meire

University Antwerp

Outline

1/ Comparison of nutrient status between two fens

- **How does nutrient availability differ between the two fens?**
- **Which factors control these differences?**

2/ Environemental changes and their impact on vegetation composition

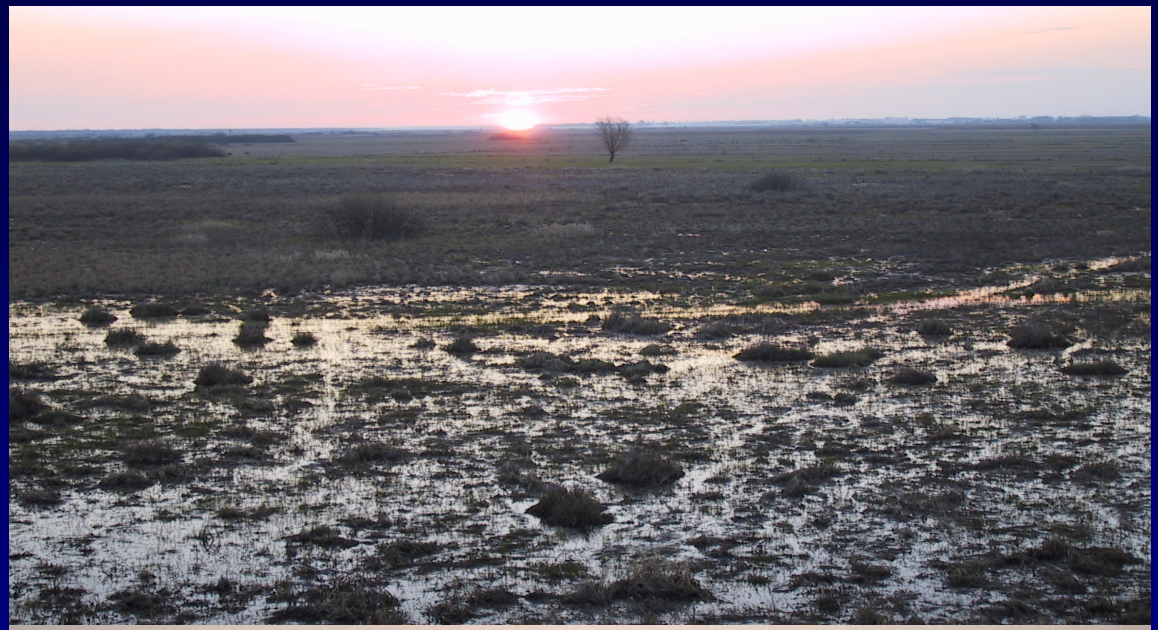
- **Lowering of groundwater**
- **Establishement of invasive species and trees**

3/ Management measures

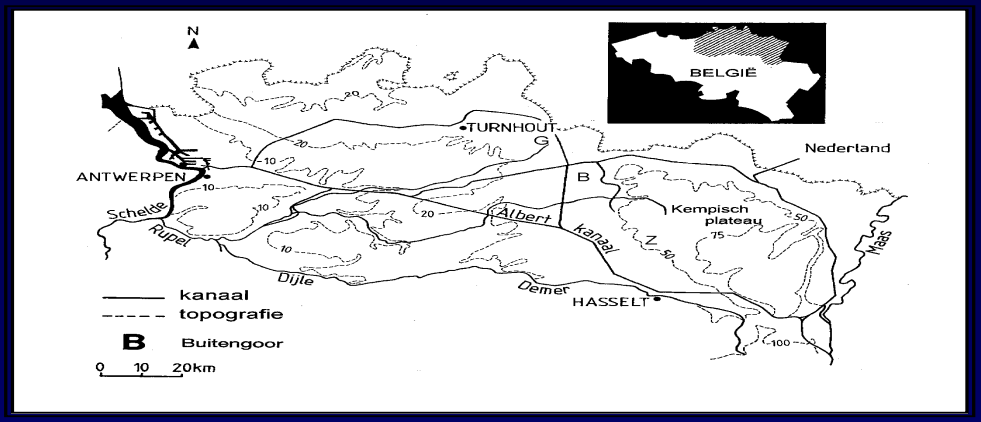
4/ Conclusions

Definition of species rich fens

- lands covered wholly or partially with rich base goundwater
- Low nutrient availability
- Producing low productive vegetation

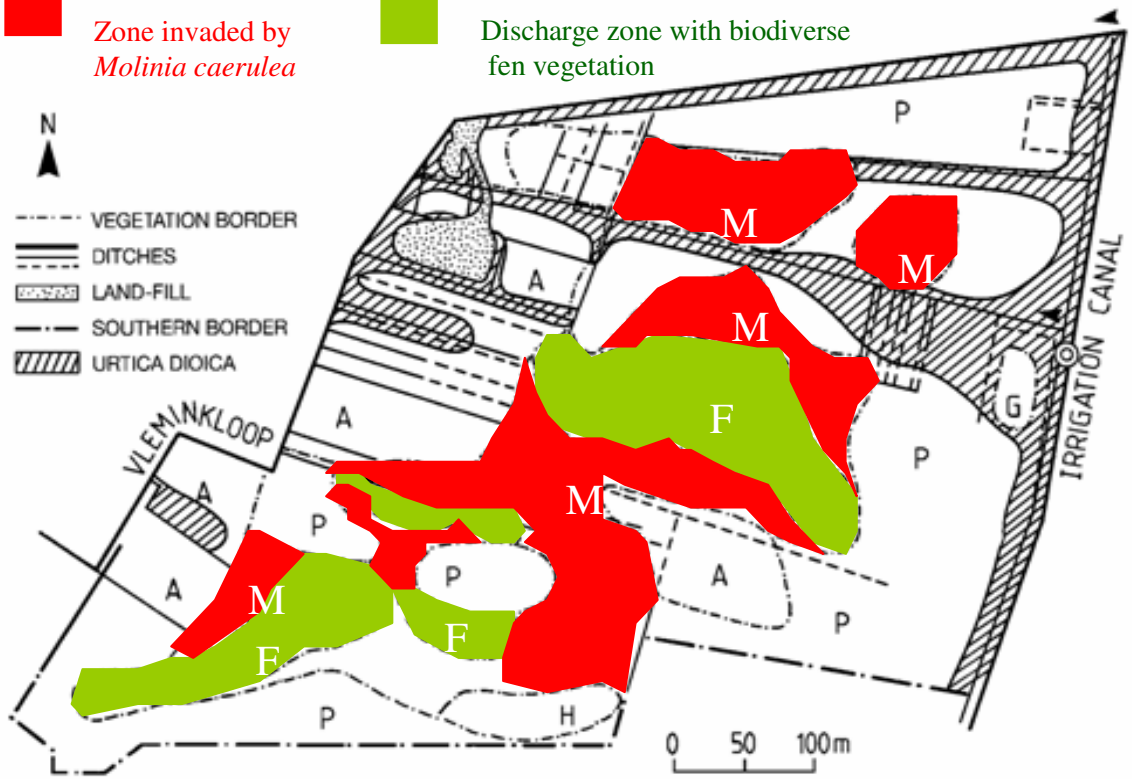


Buitengoor- rich fen



Zone invaded by *Molinia caerulea*

Discharge zone with biodiverse fen vegetation



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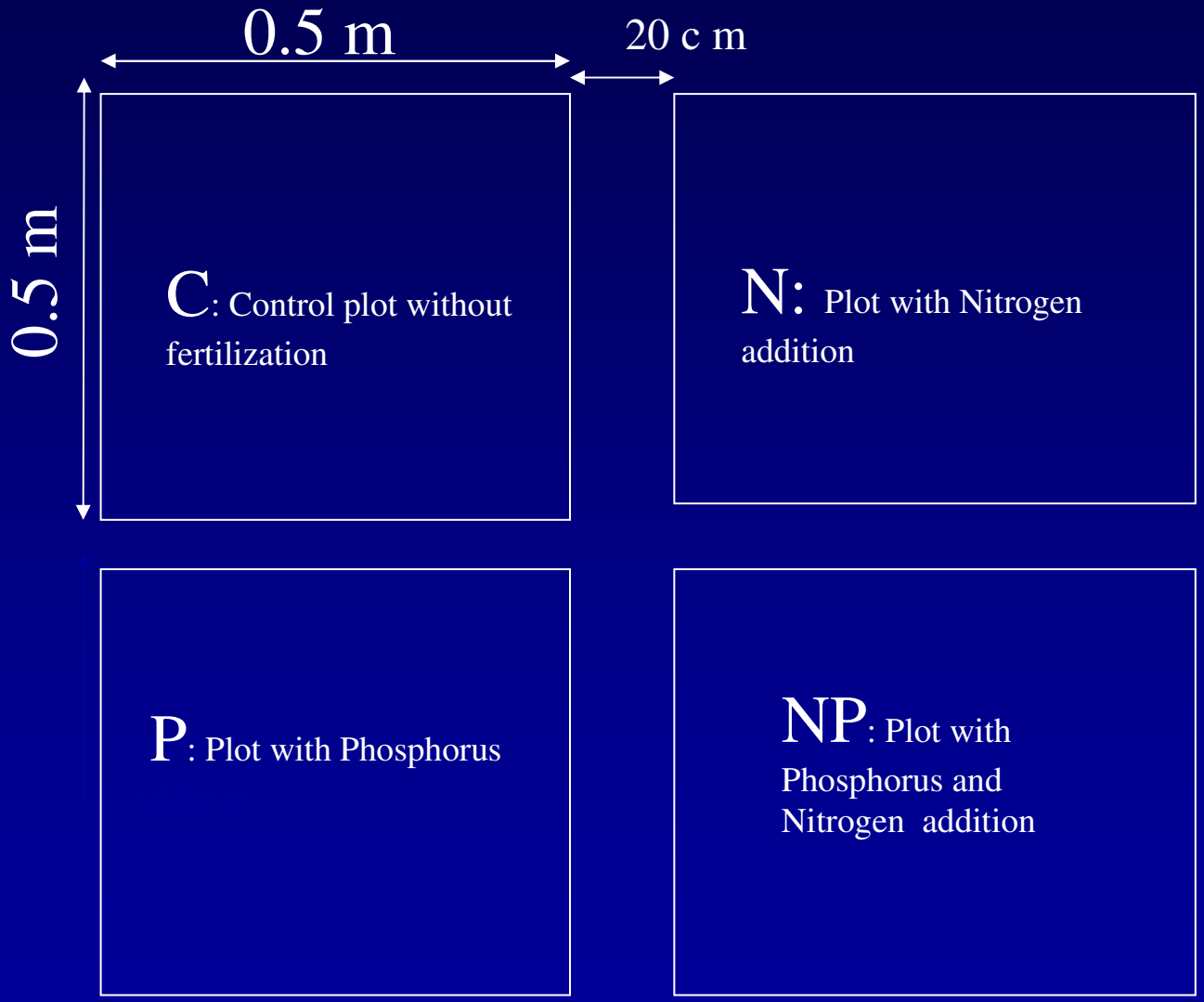
M. El-Kahloun & P. Meire

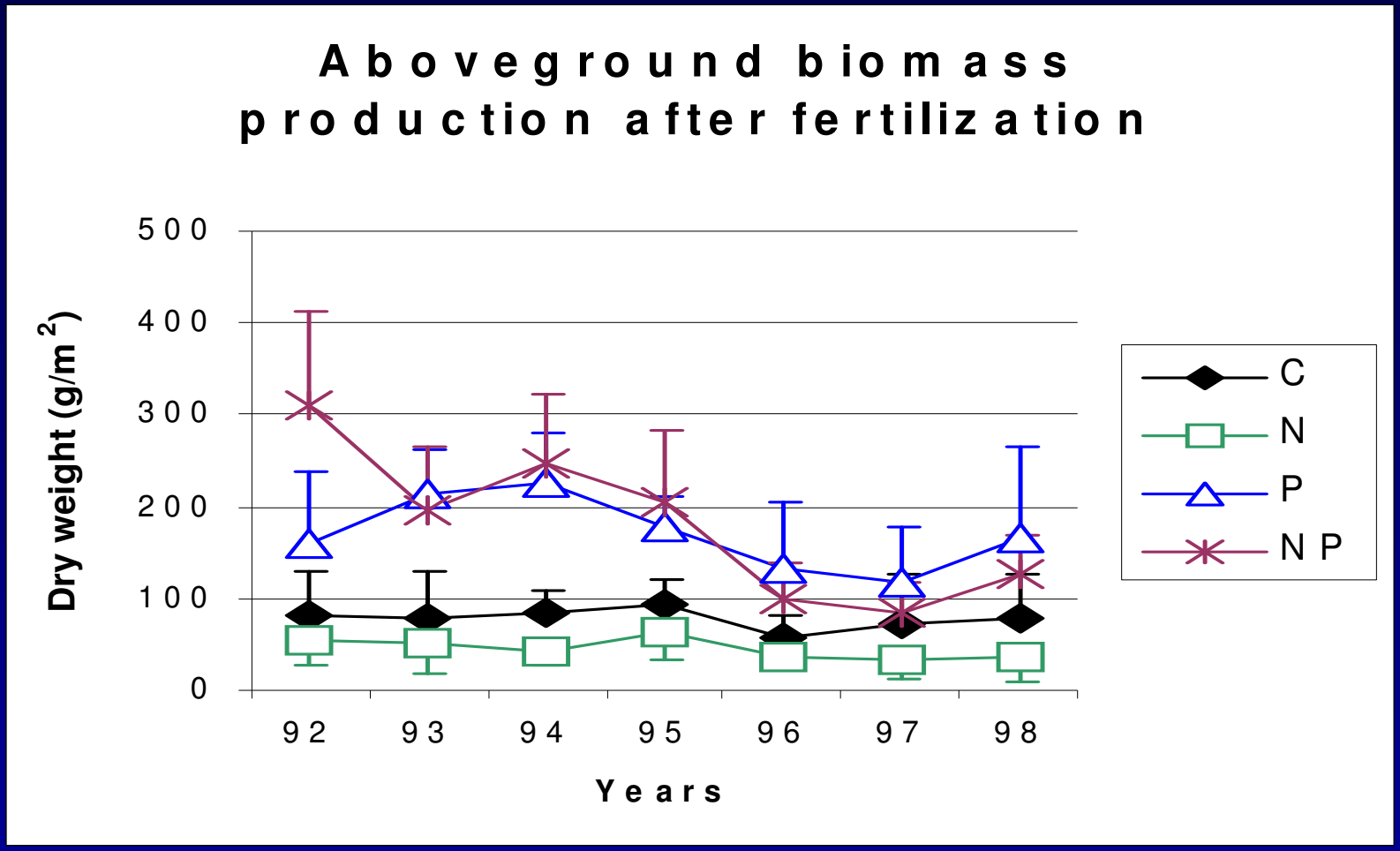
Buitengoor-rich fen

Which factors determines the low productivity in rich fen vegetation in the Buitengoor?

Experimental design

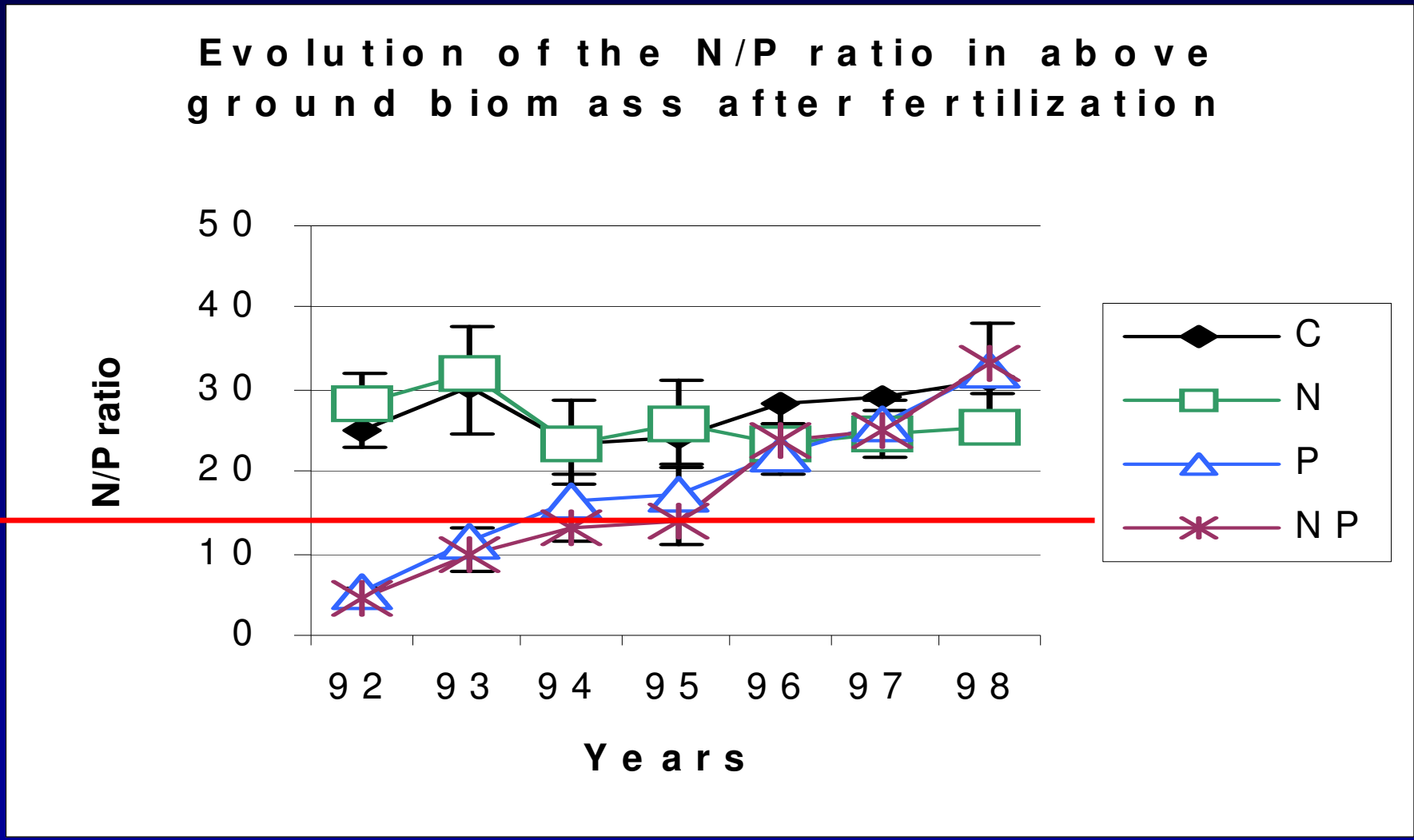


Which factors determines the low productivity in rich fen vegetation in the Buitengoor?



Which factors determines the low productivity in rich fen vegetation in the Buitengoor?

P-limitation



Which factors determines the low productivity in rich fen vegetation in the Buitengoor?

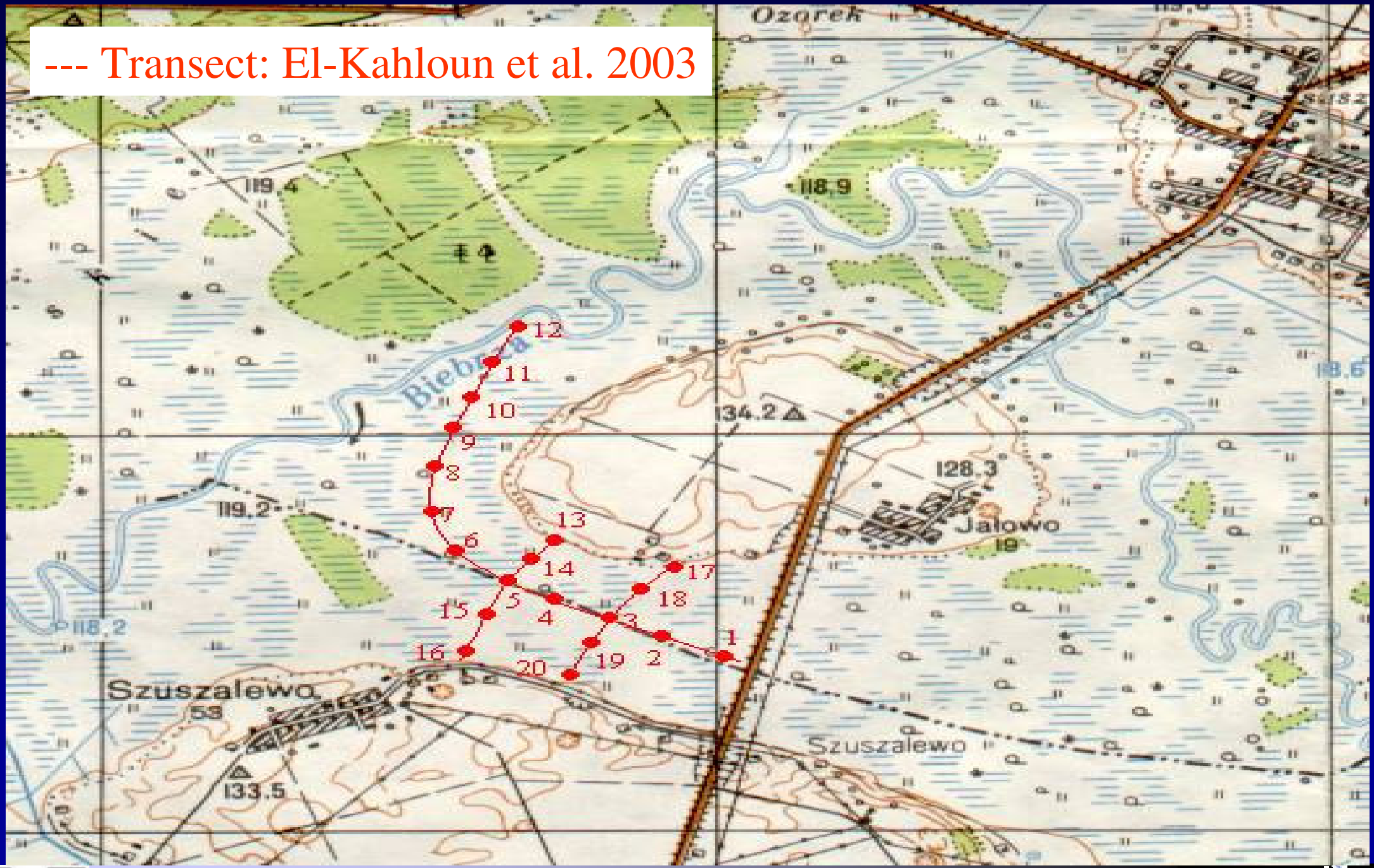
Conclusion

1/ P is the limiting nutrient for the fen vegetation

2/ N addition has a negative effect on aboveground biomass production in the discharge zones, N addition increase dead roots biomass

"Lipsk-rich fen" Poland

Biebrza Upper Basin



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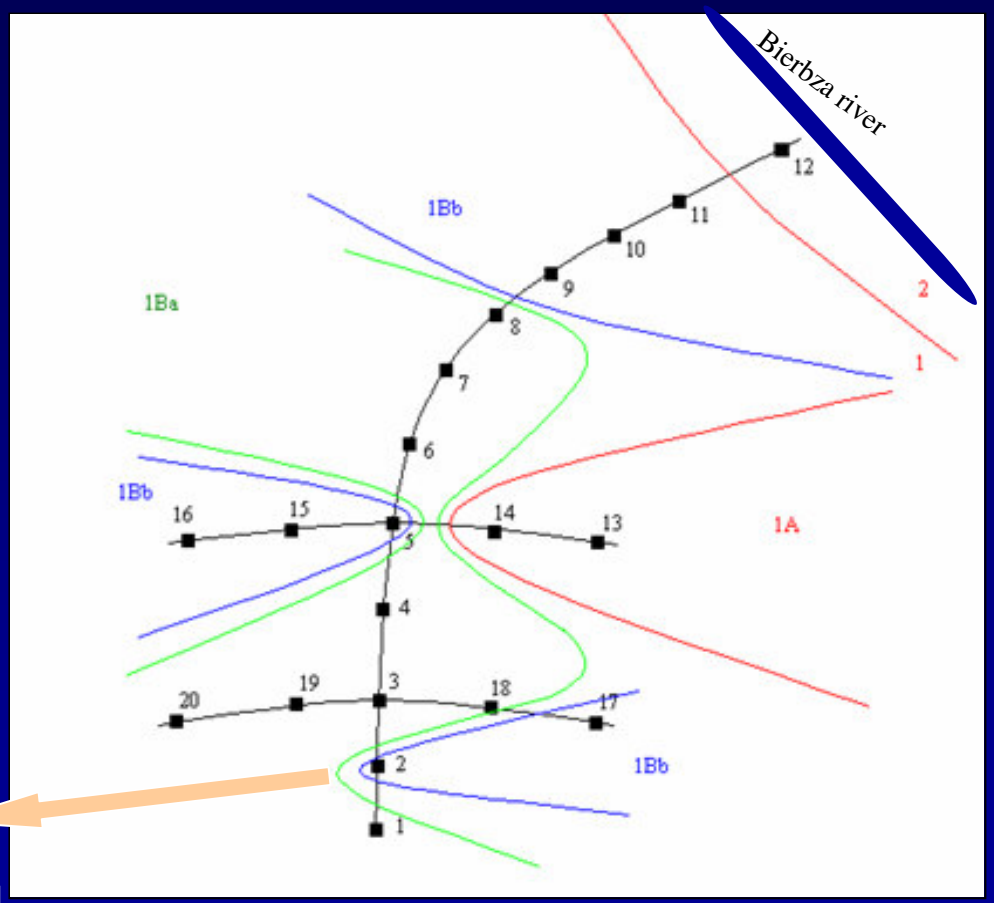
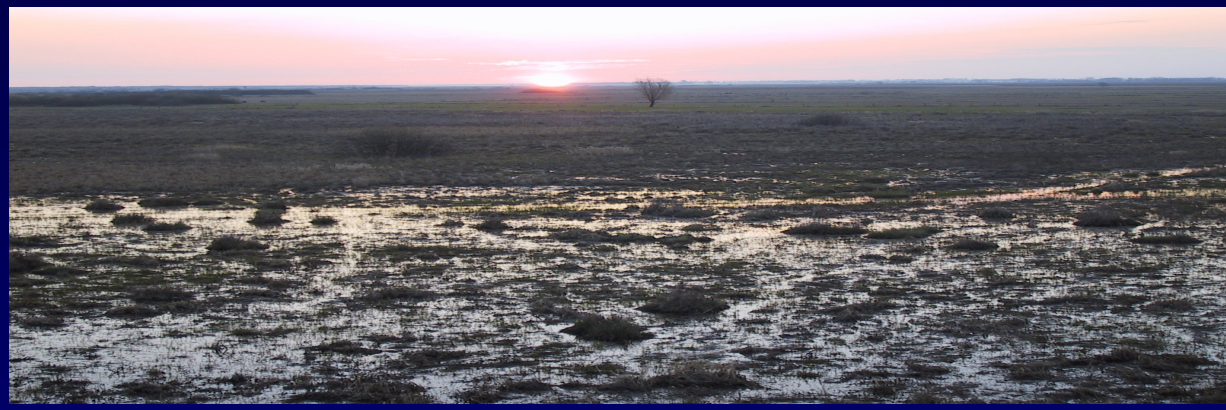
M. El-Kahloun & P. Meire

- Species Rich fen (*Caricetum limoso diandrea*)

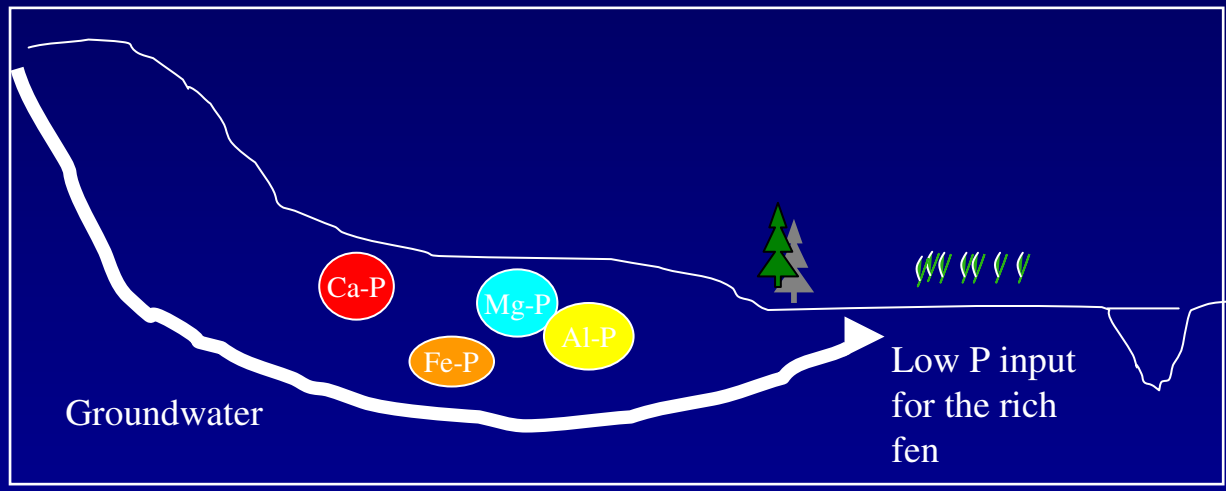


« Lipsk-rich fen »

1. **High water table maintaining anaerobic conditions - low mineralization**

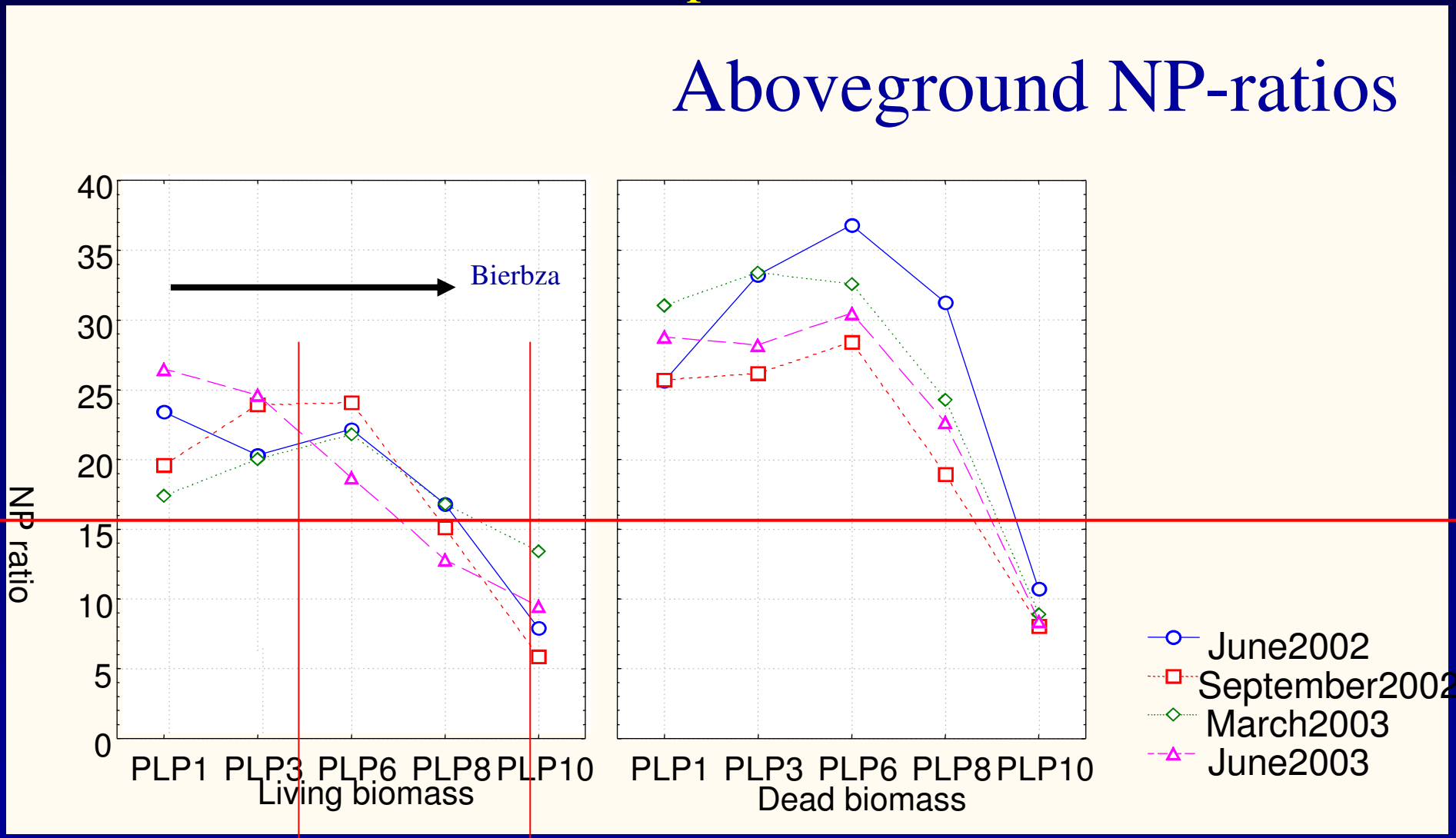


2. Low P and N input through groundwater (precipitation of P-Ca complex)



3. Management practices: nutrient removal through grazing, mowing

Which factors determines the low productivity in rich fen vegetation In the Lipsk-rich fen?



Which factors determines the low productivity inboth rich fens ?

Conclusion 2

1/ P is the limiting nutrient for both fens vegetation

2/ This P-limitation is due a low **P input through groundwater (precipitation of P-Al complex (Buitengoor) and P-Ca (Lipsk)**

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Problem of Eutrophication

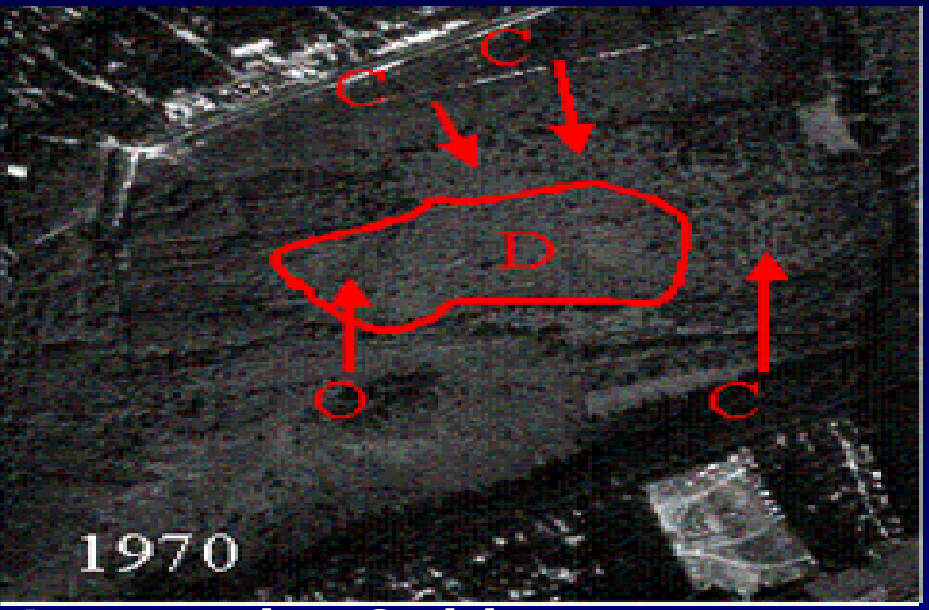
Pressures

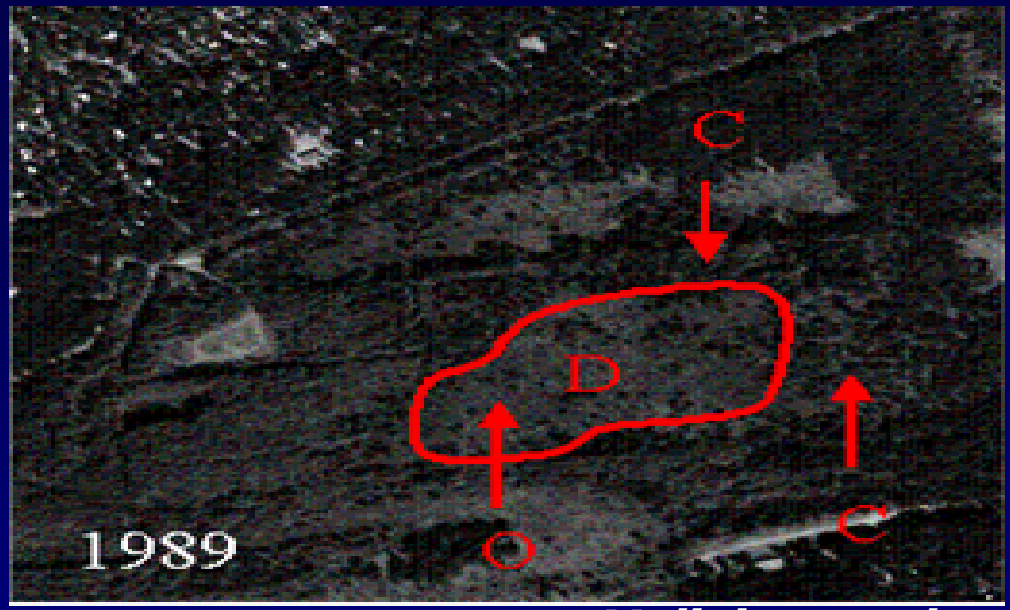
- Abandonment of traditional management
- Ground water depletion
- Global change
- Non point pollution: (atmospheric N deposition, nutrient input: groundwater and surface water

Degradation

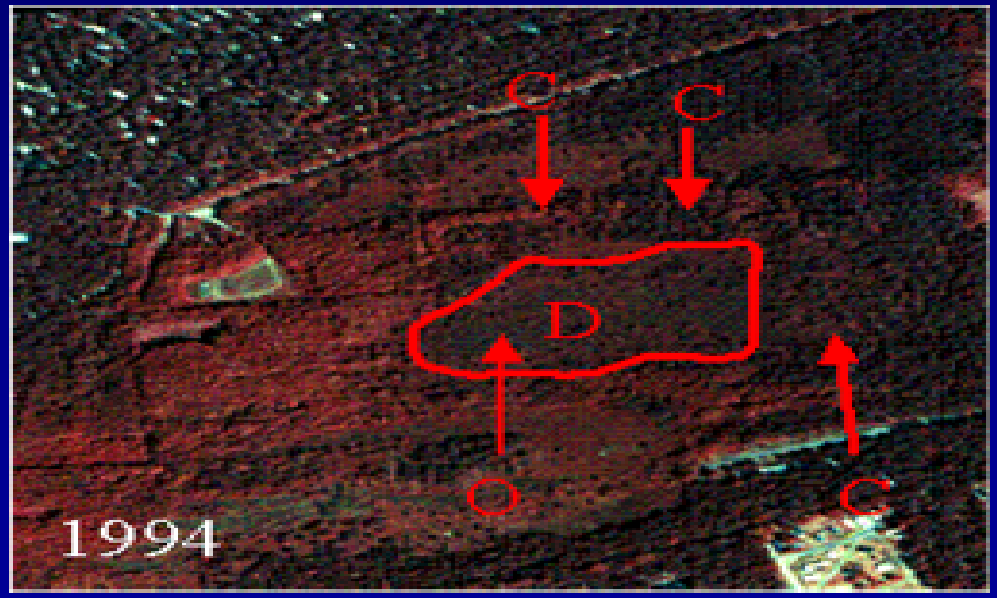
- Increase of nutrient availability
- Acidification
- short flooding period

Invasion of *Molinia caerulea* in the dry zones in Buitengoor





Low growing *Caricion davalliance* vegetation has become rare in the fen and have been replaced by fast growing grass *Molinia caerulea.*



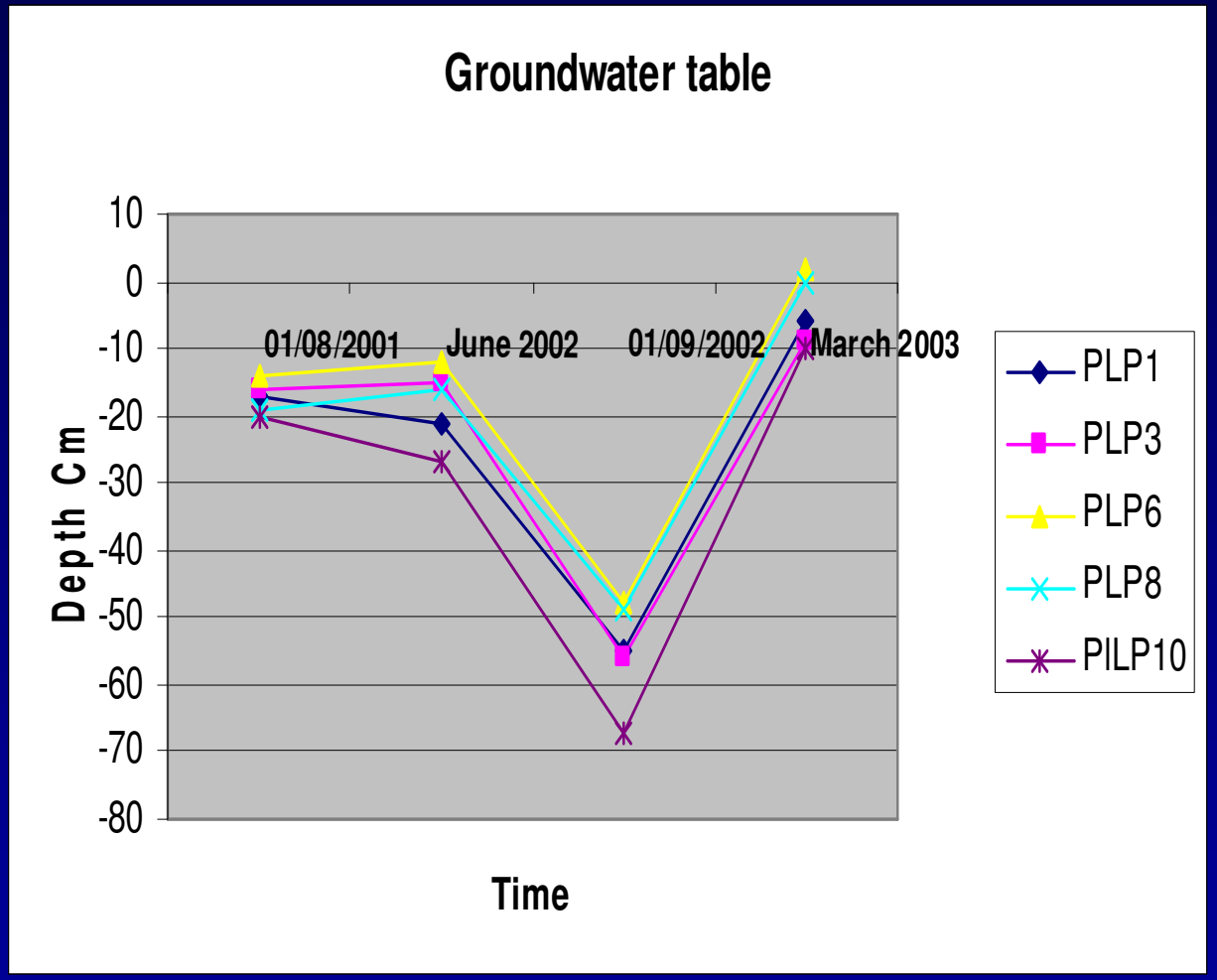
***Molinia caerulea* produces carpets in the drier marginal zones, that facilitate the invasion of shrubs and trees.**

Lowering of groundwater levels in Lipsk-rich fen

El-Kahloun et al, 2003

Wassen et al, 1998:

rich fen:
+19 cm in April
- 8 cm in July



Invasion of *Betula pubens* in the Lipsk-rich fen

Environemental changes and their impact on vegetation composition

Conclusion 3

Lowering of groundwater induced the invasion of some species and establishment of trees: closed vegetation with decease of biodiversity in both fens

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Peat removal in the drier zones

Removal of the top peat soil

Possible effects

Direct:

1. **Decrease of nutrients availability** (P)

Indirect:

1. **Hydrological**: rise in the water table: airation, pH, redox potential, chemisorption.
2. Deficit in other non-limited nutrient
3. Generation of heterogenity in habitats: possible biodiversity increase.

Sod-cutting in the drier areas

In dry marginal zones, sod-cutting was very successful, after a few years we noted establishment of low productive rich fen vegetation and a colonisation of some of threatened species (carex dioica).

Summary of the restoration prescriptions Buitengoor

- Management to protect the P-limited rich fen vegetation should not attempt the total eradication of *M. caerulea*-tussocks in the discharge zone, but should only strive to reduce its dominance.

- Summer grazing with smal animals or irregular mowing seems to be the adequate management for the discharge zones.

- In dry conditions, sod-cutting was very successful and we noted establishment of low productive rich fen vegetation and a colonisation of some of the threatened species.

Possible managements inthe Lipsk rich fen

- It is not possible to practice sod-cutting in this big areas to create more anaerobic conditions (rising water table). Mowing can be a good way to decease the nutrient availability.
- The most effecient measure at that moment is to stop the development and invasion of *Betula pubens* in this dry area by cutting.
- Drainage can also play a crutial role by decreasing water table and inducing internal eutrophication.
- Rewetting ? Impossible in this big areas

DZIENKUJE