Interactive effects of nitrogen enrichment, sulphur pollution and increased drying-rewetting dynamics on fen meadow vegetation productivity and nutrient dynamics

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Introduction

- Nitrogen deposition, sulphur pollution and alterations in water availability are among the most important external threats to plant species diversity in fens.
- Through their potential to increase plant nutrient availability, all of these environmental problems can increase vegetation productivity, which may have marked effects on plant species diversity.
- The specific nutrients that are affected and the mechanisms by which their availability is controlled, however, differ greatly between these three environmental problems, making the net outcome of their combined impact on fen vegetation unpredictable.

Aim and approach

- Our aim was to assess the interactive effects of nitrogen deposition, sulphur pollution and increased drying-rewetting dynamics on hydrochemistry, fen vegetation biomass and N:P stoichiometry and plant acces to soil P through root phosphatase activity.
- We performed a 3-year field experiment in a rich fen meadow in the Biebrza valley, Poland. Nitrogen and sulphur were applied at levels comparable to current atmospheric deposition levels in Western Europe (30 and 32 kg • ha^{-1} • yr^{-1} respectively).
- We increased drying-rewetting dynamics with drainage ditches to mimic the effects of climate change.

Results

Soil moisture dynamics

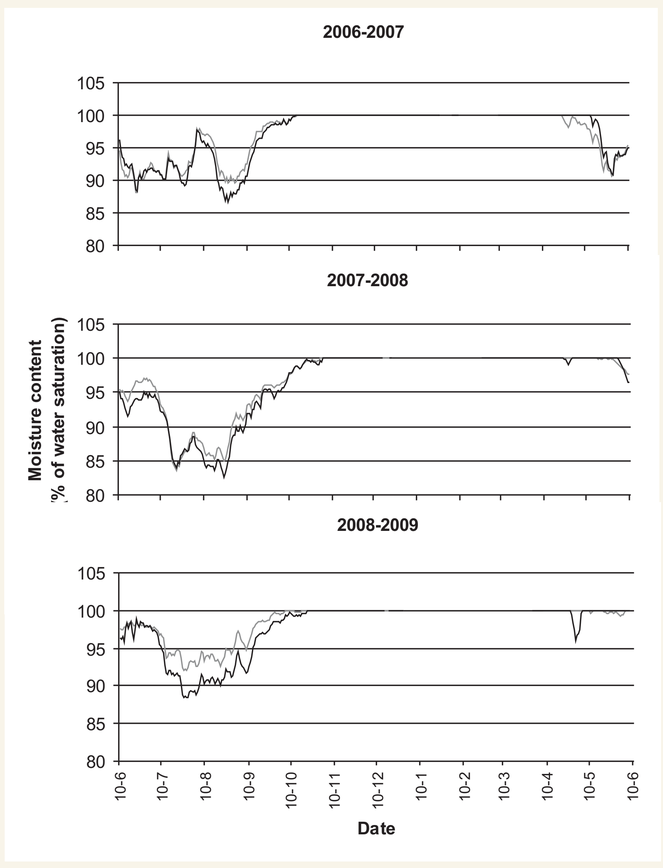

Fig. 1. The soil moisture treatment amplified soil moisture decreases in dry periods while maintaining the average soil moisture content of the control.

N:P stoichiometry

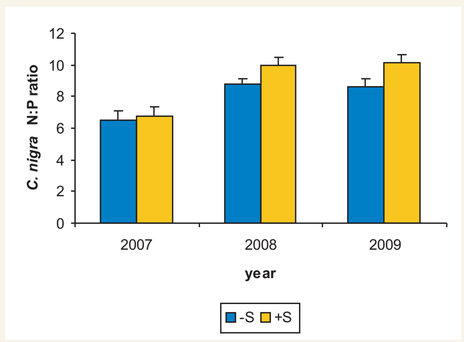

Fig. 2. S-addition significantly increased N:P ratios of phytometer species *Carex nigra* by reducing P-uptake.

Vegetation productivity

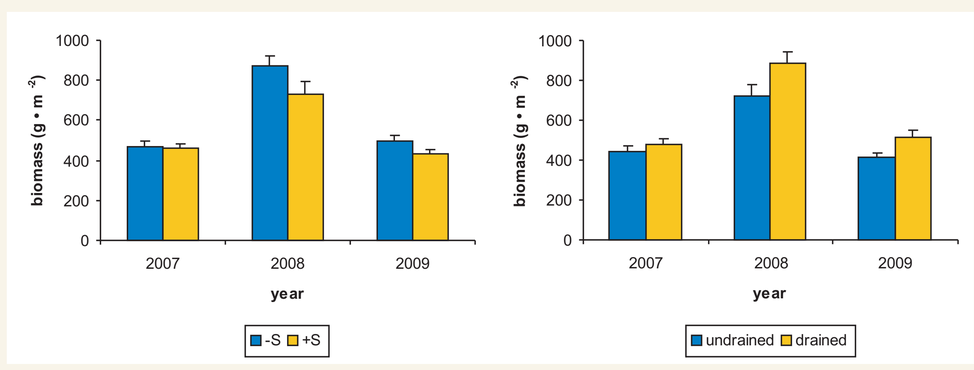

Fig. 3. S-addition significantly reduced vegetation productivity. Increased soil moisture dynamics significantly increased vegetation productivity up to 20%.

Conclusions

Interactive effects of N-addition, S-addition and increased drying-rewetting dynamics had no impact on N:P stoichiometry or vegetation productivity.

The fen meadow ecosystem is robust against current levels of N-deposition, confirming critical loads defined for this

Current levels of S-deposition have negative effects on fen meadow vegetation productivity and plant access to soil nutrients, indicating toxic effects. We found no eviidence for interference of S-enrichment with soil P-availability.

Even slightly increased drying-rewetting dynamics due to climate change poses a serious new threat to fen meadow plant species diversity by significantly increasing vegetation productivity.

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