A scheme to relate nitrogen loads to characteristic plant species of FFH habitat types in Germany

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Abstract

There is growing evidence that high nitrogen loads can change species composition of different FFH habitat types. We developed a scheme especially for the plant species characteristic to the german variety of the habitat type 6230. For the scheme, three trophic levels were defined according to N loads found in literature. These results will be discussed in an expert workshop to revise and verify them. The trophic levels of the scheme are 10-12 N ha^{-1} y^{-1}, 12-14 N ha^{-1} y^{-1} and ≥ 15 N ha^{-1} y^{-1}.

Keywords: FFH habitat type 6230, acid grassland, conservation status

1. Introduction

It is widely acknowledged in the scientific community, that elevated nitrogen (N) deposition can change plant community structure in various ecosystems as for example in the FFH habitat type 6230 (EUNIS category E.1.7) (e.g. reviewed in Bobbink and Hettelingh 2011). Critical loads (CL) were defined to protect such ecosystems from degradation in Europe and were most recently revised by Bobbink and Hettelingh (2011).

However, these empirical CL relate to rather broad habitat type (ht) categories in different regions of Europe. Therefore, we focused on plant species characteristic to the german variety of the FFH ht 6230, aiming to give an orientation how the conservation status of the ht might relate to different nitrogen loads.

2. Material & Methods

The scheme for the FFH ht 6230 was developed by a detailed literature search. Papers were searched for effects of nitrogen on characteristic plant species of the ht. The data was used to order the species by their sensitivity to N and aggregate them into three trophic levels (TL), representing the vegetation dynamics with increasing N deposition. We assigned ranges of N loads (NL) to each TL, according to data found in literature. As a final step the results will be discussed in an expert workshop to revise and verify them.

3. Results

The three TL for the FFH ht 6230 and the assigned plant species and NL are shown in Tab. 1.

4. Conclusion

The scheme could be relevant in terms of Habitat Directive Assessments in Germany and can serve as template to develop similar schemes for other N sensitive FFH habitat types to compare them to current CL. Furthermore, schemes for critical ammonia concentrations can be developed to relate these to critical levels and critical surplus values (ARGE StickstoffBW 2019).

Tab. 1: Plant species of the FFH ht 6230 grouped into TL with NL causing effects; ↓=decline of abundance, cover, biomass or density; ↑=increase of abundance, cover, biomass or density; **change point**: „point along the N deposition gradient at which any systematic difference in cover is maximized“ (Payne *et al* 2013); **Code for references**: Ref1= (Landolt *et al* 2010), Ref2= (Payne *et al* 2013), Ref3= (Henrys *et al* 2011), Ref4= (Pannek *et al* 2015), Ref5= (Tomassen *et al* 1999 as cited in Bobbink and Hettelingh 2011), Ref6=(Stevens *et al* 2011)

TL	Characteristic species (FFH ht 6230) and NL	[kg N ha^{-1} y^{-1}]
1	• *Diphasiastrum alpinum* Landolt indicator value N: 1 (Ref1) • *Racomitrium canescens* Landolt indicator value N: 1 (Ref1) • *Polytrichum formosum* Landolt indicator value N: 1 (Ref1)	10-12
2	• *Vaccinium vitis-idaea* **change point: ~ 12,5 kg** N ha^{-1} y^{-1} (Ref2) Landolt indicator value N: 2 (Ref1) • *Polygala vulgaris* **change point: ~ 14 kg** N ha^{-1} y^{-1} (Ref2) Landolt indicator value N: 2 (Ref1) • *Viola canina* ↓**: 10-25 kg** N ha^{-1} y^{-1} (Ref3) [α] Landolt indicator value N: 2 (Ref1)	12-14
3	• *Scorzonera humilis* **change point: ~ 16 kg** N ha^{-1} y^{-1} (Ref2) Landolt indicator value N: 2 (Ref1) • *Succisa pratensis* **change point: ~ 18 kg** N ha^{-1} y^{-1} (Ref2) ↓**: 2,4-43,5 kg** N ha^{-1} y^{-1} (Ref4) Landolt indicator value N: 3 (Ref1) • *Polygala serpyllifolia* **change point: ~ 19-20 kg** N ha^{-1} y^{-1} (Ref2) Landolt indicator value N: 2 (Ref1) • *Danthonia decumbens* ↑**: 1-40 kg** N ha^{-1} y^{-1} (Ref5) **change point: ~ 22 kg** N ha^{-1} y^{-1} (Ref2) Landolt indicator value N: 2 (Ref1) • *Potentilla erecta* **change point: ~ 23 kg** N ha^{-1} y^{-1} (Ref2) ↓**: 2,4-43,5 kg** N ha^{-1} y^{-1} (Ref4) Landolt indicator value N: 2 (Ref1) • *Deschampsia flexuosa* ↑**: 1-40 kg** N ha^{-1} y^{-1} (Ref5) Landolt indicator value N: 2 (Ref1) • *Holcus mollis, Leontodon hispidus,* ↑**: 2.4 - 43.5 kg** N ha^{-1} y^{-1} (Ref6) Landolt indicator value N: 2 (Ref1) • *Cynosurus cristatus, Rumex acetosella* ↑**: 2.4 - 43.5 kg** N ha^{-1} y^{-1} (Ref4) Landolt indicator value N: 3 (Ref1) • *Nardus stricta* ↑**: 2,4 – 43.5 kg** N ha^{-1} y^{-1} (Ref4, Ref6) Landolt indicator value N: 2 (Ref1)	≥ 15

[α] Decline in probability of presence; Data from lowland heathland

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