

Progress with metrics and biodiversity-based critical loads

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What metrics should we predict and report?

Defra (UK government) Clean Air Strategy: “***we propose to reduce damaging deposition of reactive forms of nitrogen by 17% over England’s protected priority sensitive habitats by 2030***”



- A clear target
- Deposition is a ***pressure*** metric, not an ***endpoint*** metric that directly reflects effects on e.g. biodiversity
- This target does not consider ***Critical Load***

Evaluating metrics – understandable, reliable, sensitive...

DRAFT, DO NOT CITE

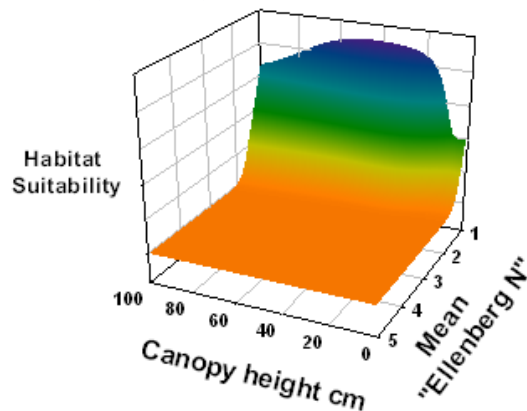
Metric	Evaluation criteria (and weights)												Total	Weighted Total
	Clear (3)	Open (2)	Targets (3)	Scenarios (1)	Sensitive (3)	Scales (3)	Easy (3)	International (2)	Charismatic (3)	Sites (2)	Endpoint (3)	Cross-cutting (2)		
Emissions - National (UK) Emissions reductions (NH ₃ , NO _x)	2	2	1	2	2	1	0	2	0	0	0	0	12	28
Exposure - Annual deposition of total N	2	2	2	2	2	2	2	2	0	2	0	0	18	44
- Cumulative N deposition in preceding 5 years	2	2	1	2	1	2	1	0	0	0	0	1	12	29
Vegetation effects (cf. Critical Load / Critical Level) - AAE of CL _{nutN} ("Excess Nitrogen")	1	2	1	2	2	2	1	2	0	1	0	1	15	35
- Area of sensitive habitat where CL _{nutN} is exceeded	2	2	1	2	2	1	1	2	0	0	0	1	14	33
Ecosystem condition - N content of moss tissue	1	0	0	0	2	0	0	1	0	0	0	1	5	13
- Species richness	2	1	1	0	2	2	1	1	0	2	2	2	16	42
- HQI: mean habitat suitability for indicator spp. (MADOC-MultiMOVE)	1	1	2	0	2	2	0	2	1	2	1	1	15	39

Dragosits et al. (in prep.) Nitrogen Futures. Report to UK Joint Nature Conservation Committee (JNCC)

“Biodiversity-based” critical loads – history

- In 2011, the WGE tasked TF M&M with linking to **biodiversity** responses and targets
- Empirical models (MultiMOVE, PROPS) can predict habitat suitability for **species**.
- Best predictor of experts’ rankings of habitat quality was ***n positive indicator species***

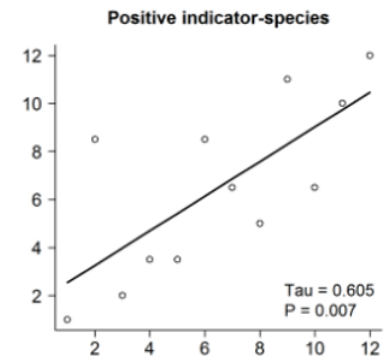
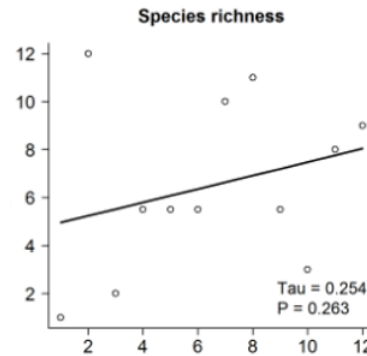
MultiMOVE niche model
for *Rhynchospora alba*



https://shiny-apps.ceh.ac.uk/find_your_niche/



Ranking
according
to metric



Ranking according to specialists

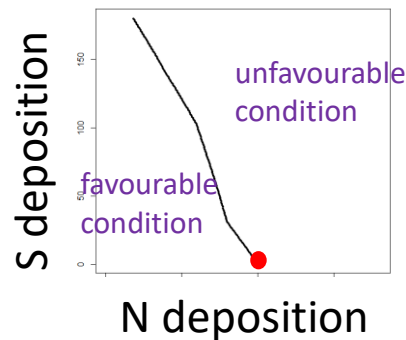
HSI (mean habitat suitability for positive indicator species) was approved by TF M&M as an appropriate metric of biodiversity (Rome, 2014)

“Biodiversity-based” critical loads - progress

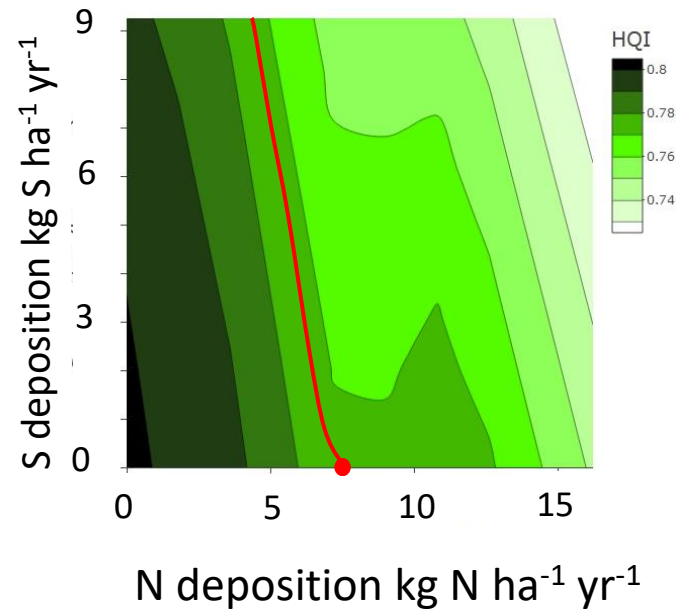
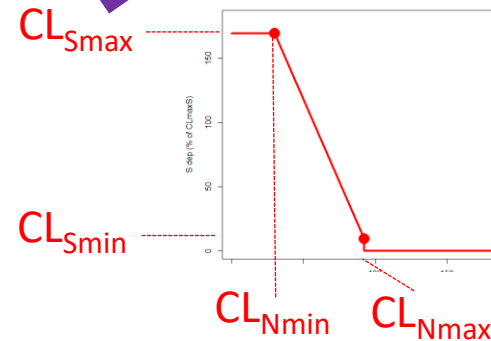
Response of *HSI* to N and S deposition

+

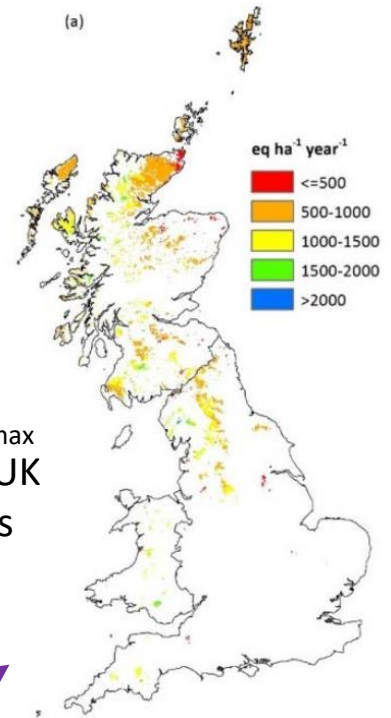
Threshold value • for
for HQI, from CL_{empN}



Simplified into a
Critical Load function



CL_{Smax}
for UK
bogs



HSI response calculated with MADOC-MultiMOVE. See e.g. UK section of CCE “Final report” 2017

Biodiversity-based critical loads – next steps

- Assess **positive indicator species lists** per habitat (existing, Bioscore, future?)
- Refine **dynamic biogeochemistry** models and **species niche** models, and test against empirical data e.g. from new experiments
- Communicate progress already made
- Concepts (e.g. **Critical Load, Empirical CL for nutrient-N, HSI**) can be very effective for linking science and decision-making



Typical bog species:
Heather Calluna vulgaris



Rare: a sundew,
Drosera intermedia



Distinctive: White beak-sedge
Rhynchospora alba

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