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Relating species change to biodiversity targets

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Relating species change to biodiversity targets

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Mike Ashmore, Arjen van Hinsberg, Pete Henrys, Jane Hall, Chris
Evans & Simon Smart

Outline

1. Effects of nitrogen (N) pollution on habitats and biodiversity
2. Consulting on metrics for the UK response to the UNECE-CCE “Call for Data 2012-14”
3. Predicting habitat quality in 40 (or 480) years using MADOC-MultiMOVE
4. Conclusions

Nitrogen effects on habitats

- Direct toxicity (mainly NH_3)
- Soil acidification
- Increased ground-level ozone
- Ground-level shading

→ Major global driver of biodiversity loss

“For terrestrial ecosystems, land-use change probably will have the largest effect [on biodiversity], followed by climate change, **nitrogen deposition**, biotic exchange, and elevated carbon dioxide concentration.”

Sala et al 2000, Science 287: 1770-1774



UNECE-CCE Call for Data 2012-14

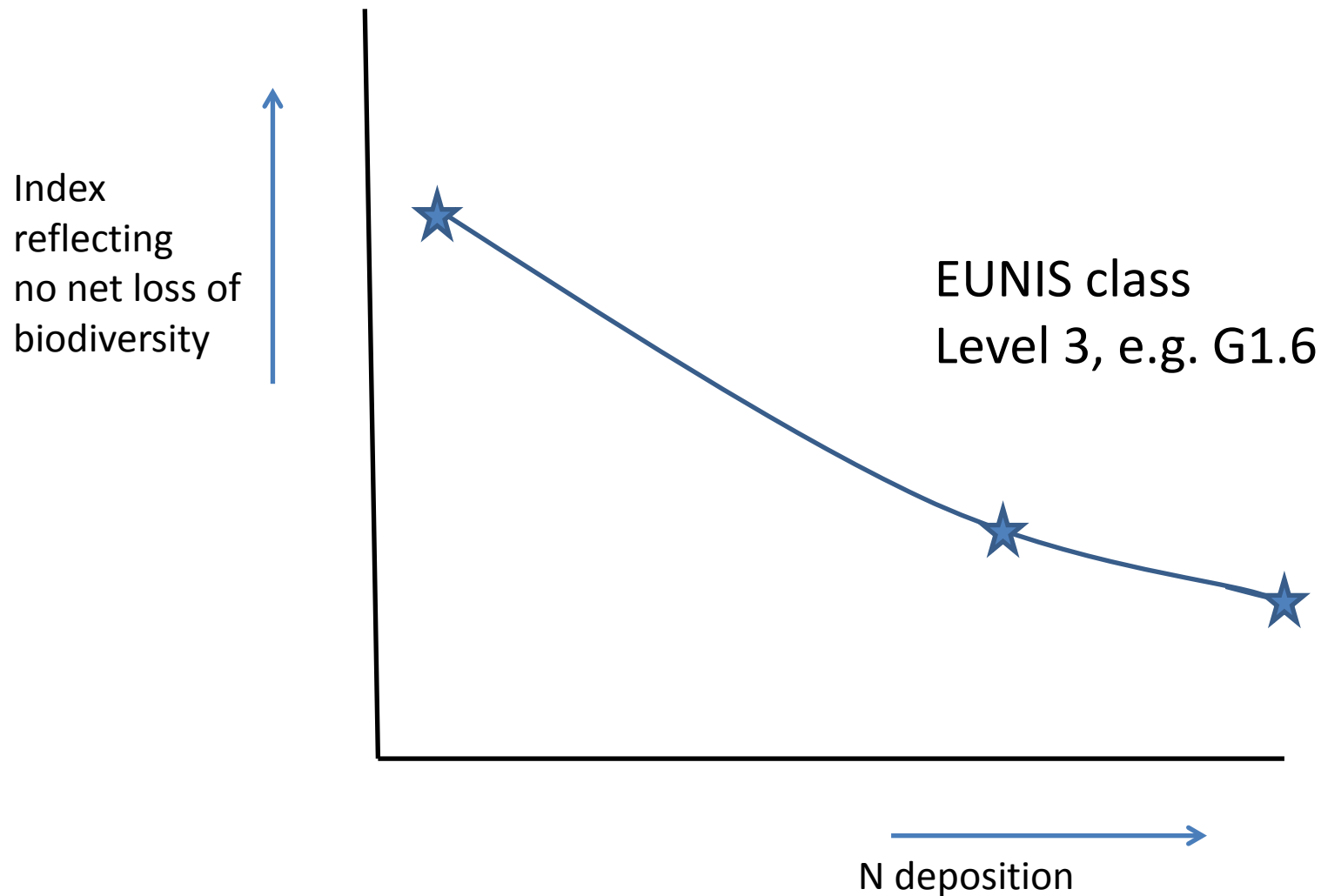
In 2007 the Executive Body of the Working Group on Effects (WGE) under the Convention on Long-Range Transboundary Air Pollution (CLRTAP) agreed to encourage the WGE to “increase its work on quantifying effects indicators, in particular for biodiversity”

2007-2012 many discussions

In 2012 the Co-ordination Centre for Effects (CCE) issued a Call for Data to help assess the extent to which “no net loss of biodiversity” is achieved.

Objective: “to compile output variables of soil-vegetation models for every EUNIS class (level 3) within the country (preferably in Natura2000 or other protected areas). This should enable the calculation of (country-specific) biodiversity indicators for (scenario) assessment of changes in biodiversity on a regional scale.”

UNECE-CCE Call for Data 2012-14



“Why don't we just...”

...use species-richness?

Valued habitats are sometimes relatively species-poor.

...use an index of even-ness, e.g. Shannon or Simpson?

Valued habitats are sometimes dominated by one species.

...use scarce / protected species

Scarce species are often not present.

Methods

Defra (UK government Department for the Environment, Food and Rural Affairs) funded two projects:

- **DivMet1** (May-Oct 2013) operationalising a metric
- **DivMet2** (Feb-May 2014) scenario modelling to meet the Call for Data

DivMet1 methods

- **Key informants:** Habitat Specialists from the Statutory Nature Conservation Agencies
- **Semi-structured interviews** to elucidate the thinking that underlies habitat assessment
- Habitat Specialists were asked to **rank a set of examples** of their habitat (species lists with abundances), and these rankings were compared with rankings based on:
 - species-richness
 - similarity to a reference assemblage (NVC community)
 - abundance of functionally/structurally important groups (e.g. *Sphagnum* in bogs)
 - presence of positive and/or negative indicator-species
 - mean 'Ellenberg N' score

Semi-structured interviews

JS: There's work done, was it Holland, on whether heathlands are becoming more grassy, which suggests that where you gave them the opportunity, which is after management, that grasses could become prevalent with nitrogen deposition. But I don't think that's been repeated in the UK.

ER: I get the impression that their heaths are much more inclined to be invaded.

JS: Yeah, you know we sometimes think that it might be happening here, in terms of some upland areas where we do management, where we see grasses becoming more prevalent, but we don't know actually whether we can separate the impacts of management such as changes in sheep grazing, nitrogen or other impacts. So it's quite a difficult one. But obviously management, that kind of drastic management, is quite a key component, particularly from that point of view. Less so for us than in lowlands, although we do do some management like burning, and some very severe cutting of our heathlands. That's obviously also changes the structural component of the heathland.

ER: It's kind of what makes it a heathland, resetting it.

JS: Yeah. I mean some of our heathlands possibly, again particularly the maritime ones and some of the ones that are very close to the montane, actually really need management. But that I suppose is an account of nitrogen deposition, or again climate change and how species. That's probably getting a bit complex now.

[5:45]

ER: And do you think it's enough to look at those groups, ever assess quality on the specific species. So you could have Calluna [6:00 ?species name], or you could have more in cranberry and...?

IA: So there's the vegetation structure as one of the attributes the other. And we like to see a minimum number of species occasional or frequent graminoids- the grasses and sedge minimum. And then, for us the targets have to be tailored

MR Well... if it's got drainage in it it'll fail on that. Even if it's... but it tends not to happen like that. Normally if you go on a blanket bog it'll fail for everything!

AC I don't know how familiar you are with blanket bog in England...

ER Not terribly. I'm thinking of the Migneint, there's drains there that affect the habitat for a metre either side but it's so wet that...

AC We'd be quite happy if most of the bog in England was like the Migneint frankly, even with drainage. The problem with English blanket bogs is that there's a much greater history of intensive use, in some cases in the S Pennines going back a thousand years. And that use is basically grazing, historic wildfires have been a problem; and then rotational burning, for grouse and sheep management – mainly grouse now rather than sheep. So most of our bogs are modified in some way, and you do get pockets of really nice bits of bog. So if you're looking at something like drainage... research shows that you have this corridor several metres either side of each drain, which is modifying the vegetation. But that's on a factor on the back of 200 years of grazing and burning. So heather dominance, which we take as an indicator of overgrazing or burning or both, in the S Pennines particularly you've got deep sites dominated by Calluna, and perhaps some spreading mosses under there; but not much else. When you go out you can see pretty quickly that it's... very...

ER That it's missing something obvious.

ER: And would you attach more value to more scarce species than these distinctive species?

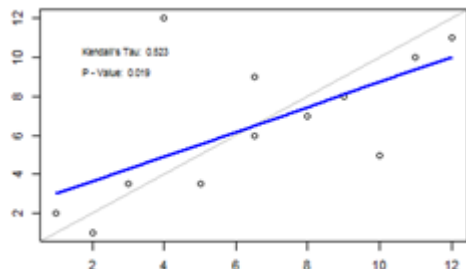
GS: You would... Scarce species aren't unimportant about habitats more broadly – I'm required in a lot of level of Scotland- then generally you're going to the in all or most examples of those habitats. That do level, for particular sites there often will be rare species account of in relation to those sites, and the form the habitat but they are not necessarily typical of which as I say, quite often the way we need to look where it's really the scarce species that are effective. montane willow scrub there are half a dozen rare makes the habitat what it is.

ER: I guess usually those structural species aren't s

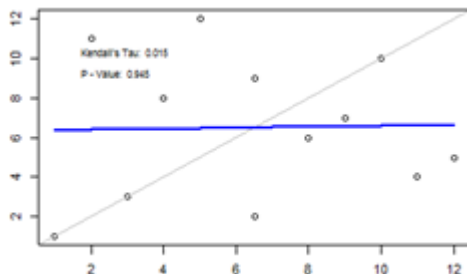
Which metrics corresponded to Specialists' assessments?



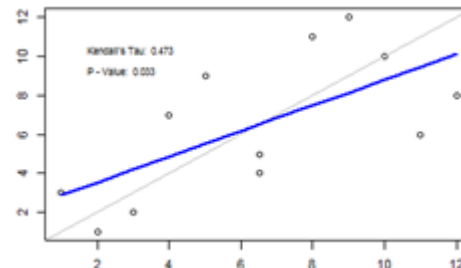
Species-richness



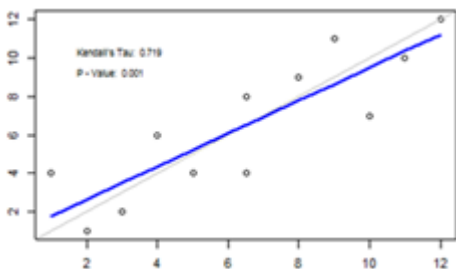
Forb / Total cover



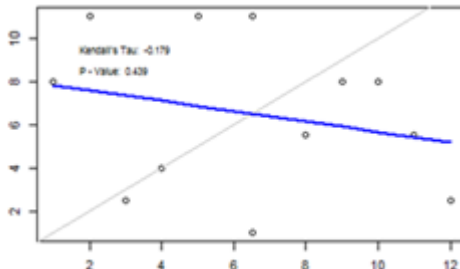
Mean Ellenberg N



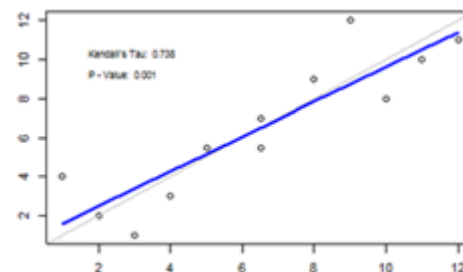
CSM positives



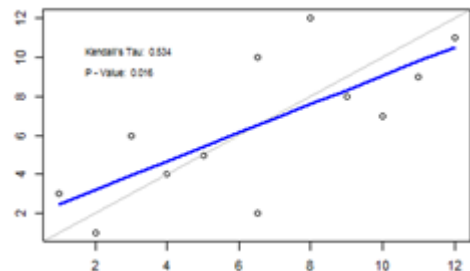
CSM negatives



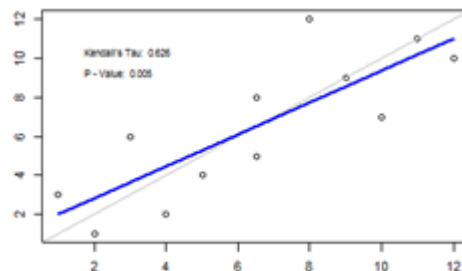
CSM +ves minus -ves



Similarity to reference (mean)



Similarity to reference (max)



E1 Dry grasslands

Rowe et al. 2014

DivMet1/AQ0828 report

Ranking according
to metric

Ranking according
to specialists



Positive indicator-species

e.g. Positive indicator-species for D2.2 Poor fens and soft-water spring mires

<i>Aulacomnium palustre</i>	<i>Menyanthes trifoliata</i>	<i>Sphagnum palustre</i>
<i>Carex rostrata</i>	<i>Potentilla erecta</i>	<i>Sphagnum subnitens</i>
<i>Carex lasiocarpa</i>	<i>Potentilla palustris</i>	<i>Sphagnum squarrosum</i>
<i>Carex nigra</i>	<i>Ranunculus flammula</i>	<i>Sphagnum teres</i>
<i>Epilobium palustre</i>	<i>Rumex acetosa</i>	<i>Stellaria uliginosa</i>
<i>Eriophorum angustifolium</i>	<i>Sphagnum cuspidatum</i>	<i>Succisa pratensis</i>
<i>Galium palustre</i>	<i>Sphagnum denticulatum</i>	<i>Viola palustris</i>
<i>Lychnis flos-cuculi</i>	<i>Sphagnum fallax</i>	

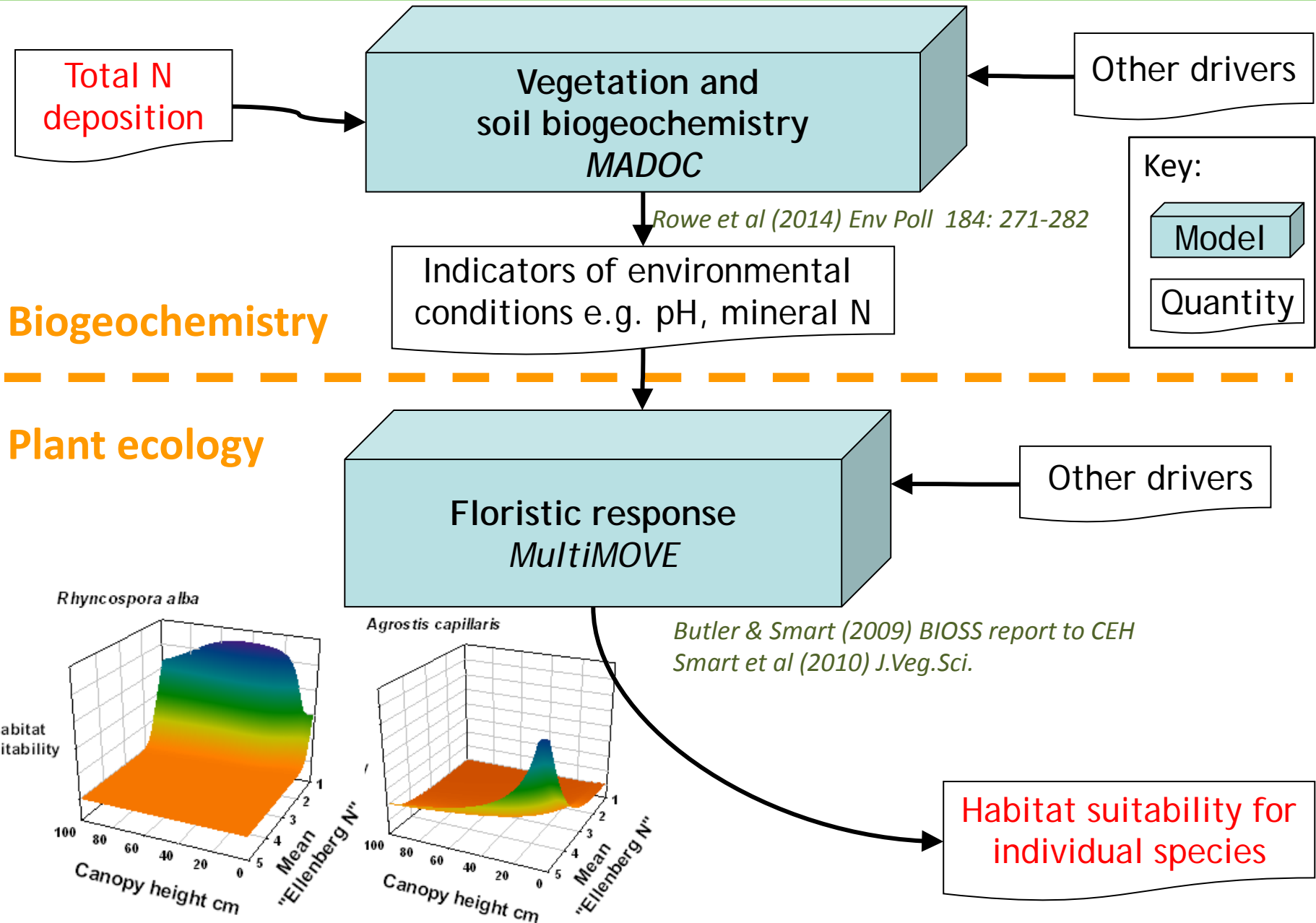
- 20-40 (-80) species per habitat
- Selected by habitat specialists
- Generally *typical* or *distinctive* for the habitat, but not very scarce

Issues:

- Not always well-defined (e.g. “*Carex* spp.”)
- Habitat classes do not always map easily onto EUNIS
... but current JNCC project will define indicators for EUNIS classes
- Algorithm for ranking used *number* of positive indicators



Applying the principle to MADOC-MultiMOVE outputs



Floristic responses

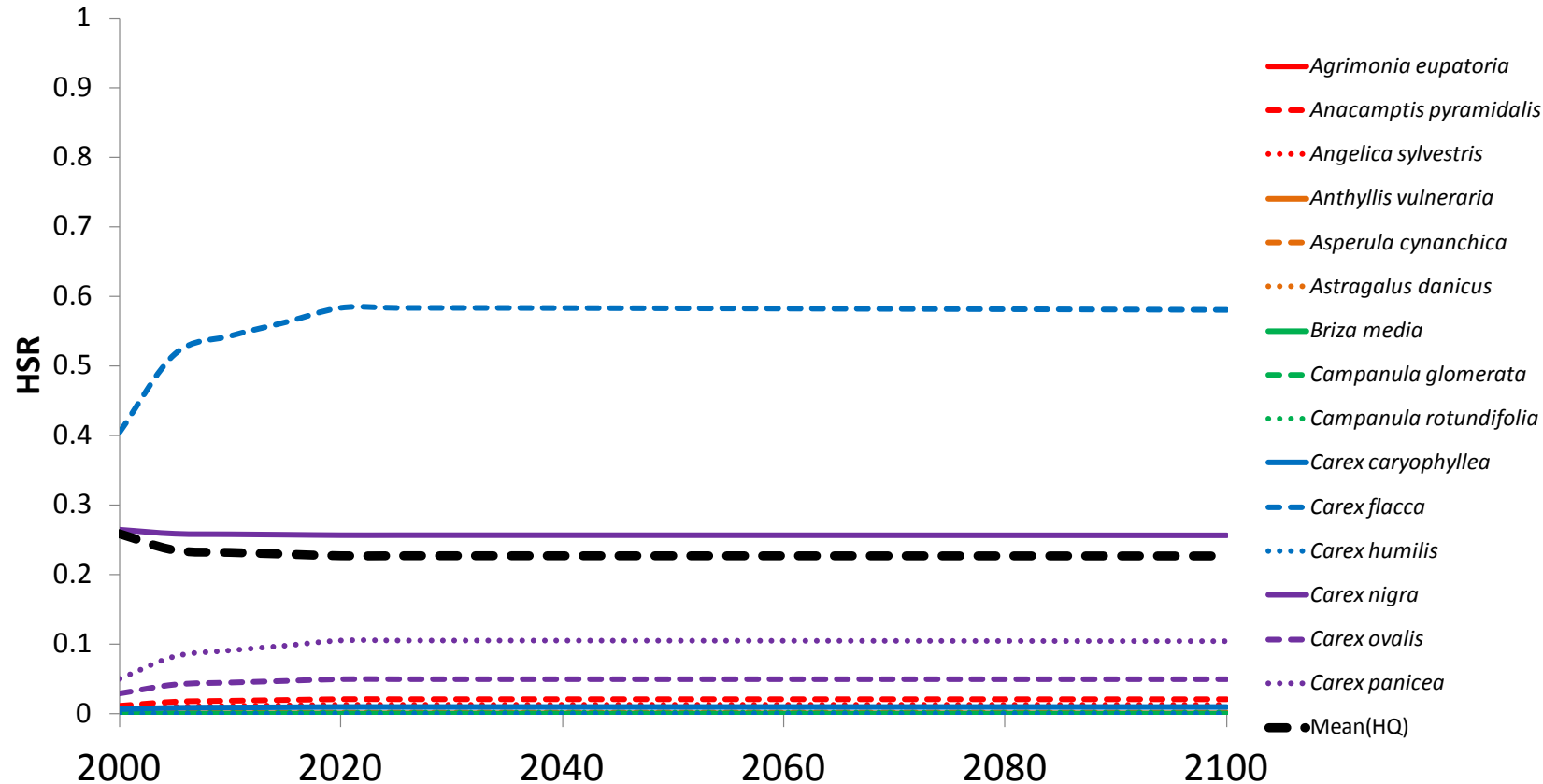
Porton Down (E1.2 calcareous grassland)

Gothenburg scenario

15 of 80 positive indicator-species

Many species show flat responses

The few species that are at the edge of their niche respond



Floristic responses

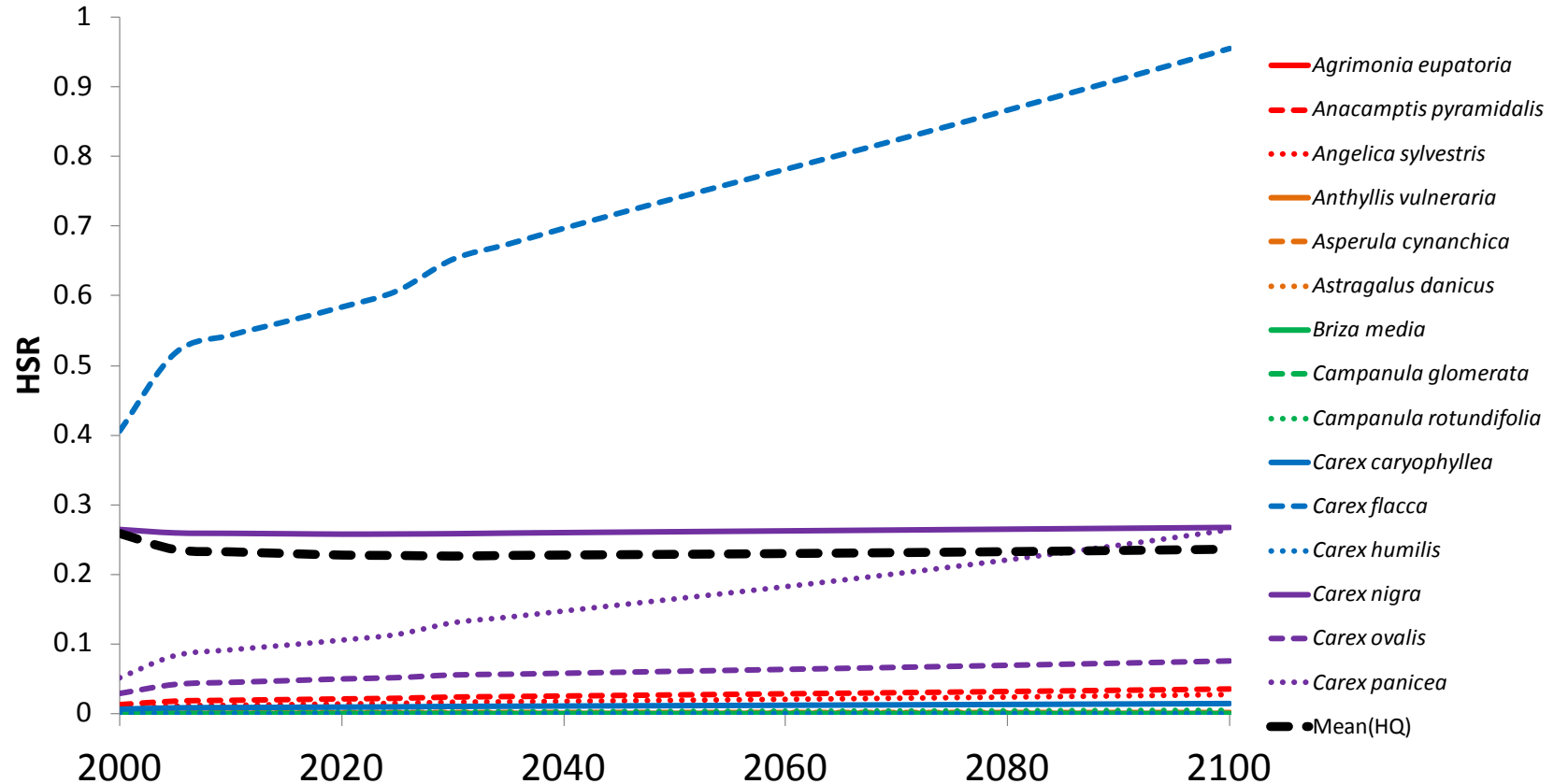
Porton Down (E1.2 calcareous grassland)

Background scenario

15 of 80 positive indicator-species

Many species show flat responses

The few species that are at the edge of their niche respond

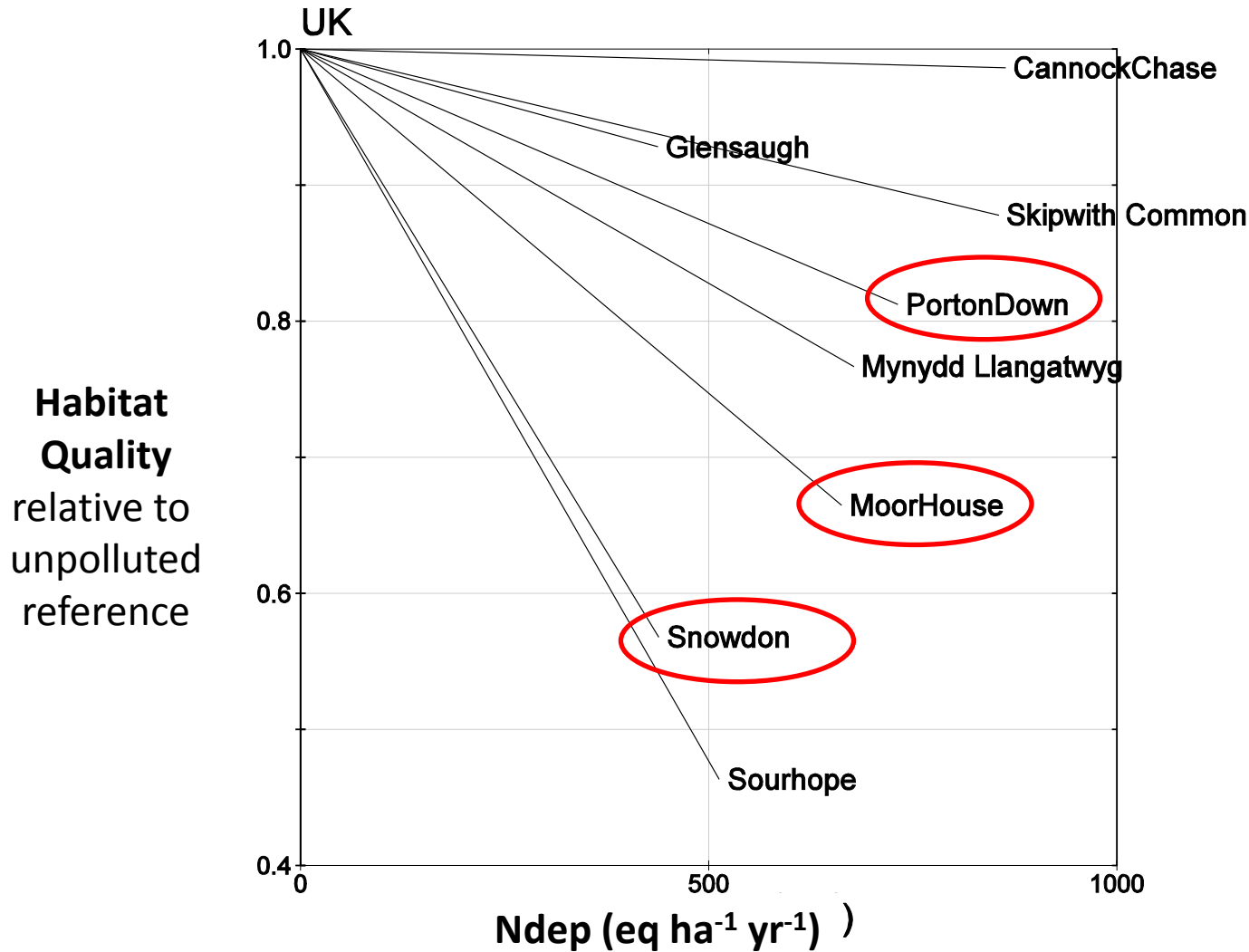


Response to the Call for Data 2012-14

Habitat Quality

EUNIS	Site	GOT2500	BKG2500	% change
D1.1 raised bogs	a) Whim Moss	1.34	1.86	39
	b) Thorne Moor	1.40	2.15	54
D1.2 blanket bogs	a) Moor House	3.01	4.70	56
	b) Mynydd Llangatwyg	1.15	1.50	31
D2.2 poor fens and soft-water spring mires	a) Esgyrn Bottom	0.84	1.27	52
	b) Cors Llyn Farch a Llyn Fanod	3.64	4.80	32
E1.2 perennial calcareous grassland and basic steppes	a) Porton Down	3.86	7.64	98
	b) Newborough	3.80	7.43	96
E1.7 closed dry acid and neutral grassland	a) Snowdon	3.02	3.08	2
	b) Friddoedd Garndolbenmaen	1.57	3.03	93
E2.2 Low and medium altitude hay meadows	a) Eades Meadow	0.25	1.01	304
	b) Piper's Hole	0.27	0.94	249
E3.5 moist or wet oligotrophic grassland	a) Sourhope	0.95	0.99	4
	b) Whitehill Down	2.75	11.30	311
F4.1 wet heath	a) Glensaugh	1.32	1.86	41
	b) Cannock Chase	0.48	0.65	35
F4.2 dry heath	a) Skipwith Common	0.79	1.28	62
	b) Eryri	1.50	3.11	108

Response to the Call for Data 2012-14



Thank you

A close-up photograph of a bird's nest in a dense, green forest. The nest is built on a mossy branch and contains several small, white, downy chicks. The text "Thank you" is overlaid in white on the upper portion of the image.