

Critical Loads for Biodiversity

CCE work $\leq$ 2017 & view on future (sort of)

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Source: CCE Final Report 2017

Whereas 2017 CLs on acidity and eutrophication were approved by the WGE for use under the Convention (and with CIAM), **biodiversity CLs** were not ...

More work on them was recommended ...



History

While 'classical' CLs (especially CLaci) have been investigated/used ≈ 30 years, biodiversity (CLs) were 'considered' only during the last 10 years ...

At first, no biodiv CLs defined, but vegetation models linked to dynamic soil-chemistry models
(e.g., ForSAFE-Veg, VSD-Veg, MADOC-MultiMOVE, ...)

Also, search for proper biodiversity indicators, i.e. measures to quantify biodiversity

Also, Dose(=N-load)-Response(=Sprich) functions investigated
(e.g., C. Stevens et al.)

Sources: CCE Status Reports ≥ 2009 ; www.icpmapping.org leads to https://www.umweltbundesamt.de/en/Coordination_Centre_for_Effects

First step: Modelling (probability) of occurrence of plant species →

Example: PROPS model (version PROPS2s):

Probability y for occurrence of a plant modelled as:

$$z = \text{logit}(y) = \log \frac{y}{1-y} = a_0 + \sum_{i=1}^n a_i \cdot x_i + \sum_{i=1}^n q_i x_i^2$$

Number of variables x_i is $n = 5$ (normalized/log-transformed):
soil solution pH, C:N ratio, N deposition, precipitation, temperature.

Probability y obtained as: $y = \frac{1}{1 + \exp(-z)}$

The 11 coefficients needed are derived for many plant species from relevés with both biotic and abiotic observations and extrapolated ...

Habitat Suitability Index

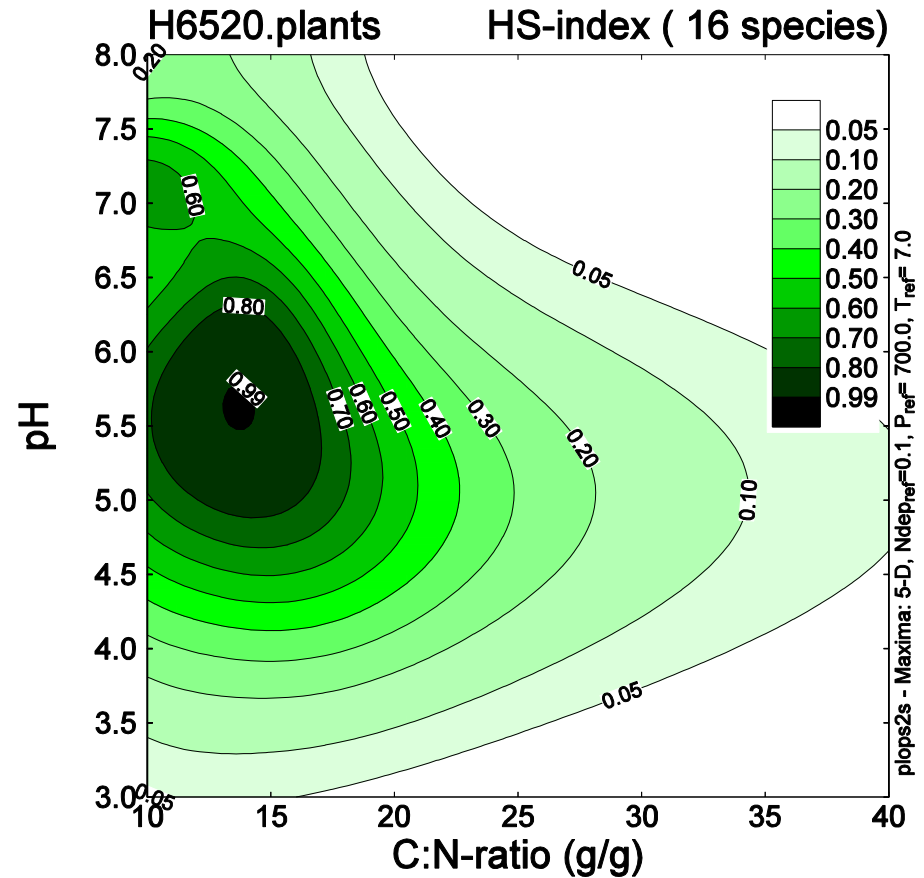
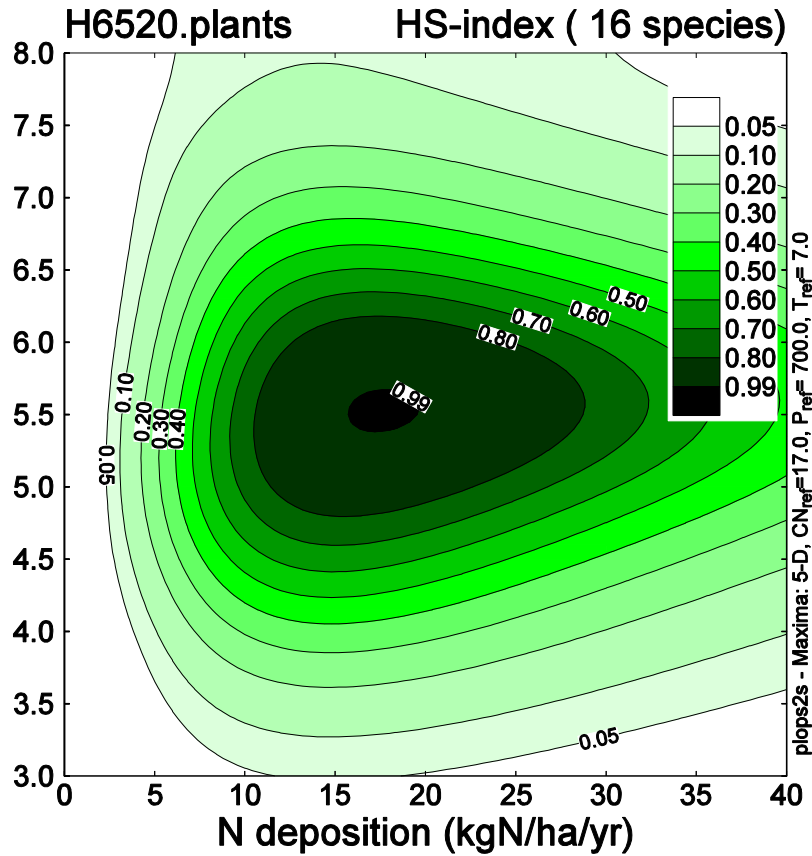
Agreed at the 2014 ICP M&M TF Meeting ...

The HS index is defined as the arithmetic mean of the 'normalised' probabilities (suitabilities, possibilities) of occurrence of the species of interest:

$$HSI = \frac{1}{n} \left(\frac{p_1}{p_{1,opt}} + \frac{p_2}{p_{2,opt}} + \dots + \frac{p_n}{p_{n,opt}} \right)$$

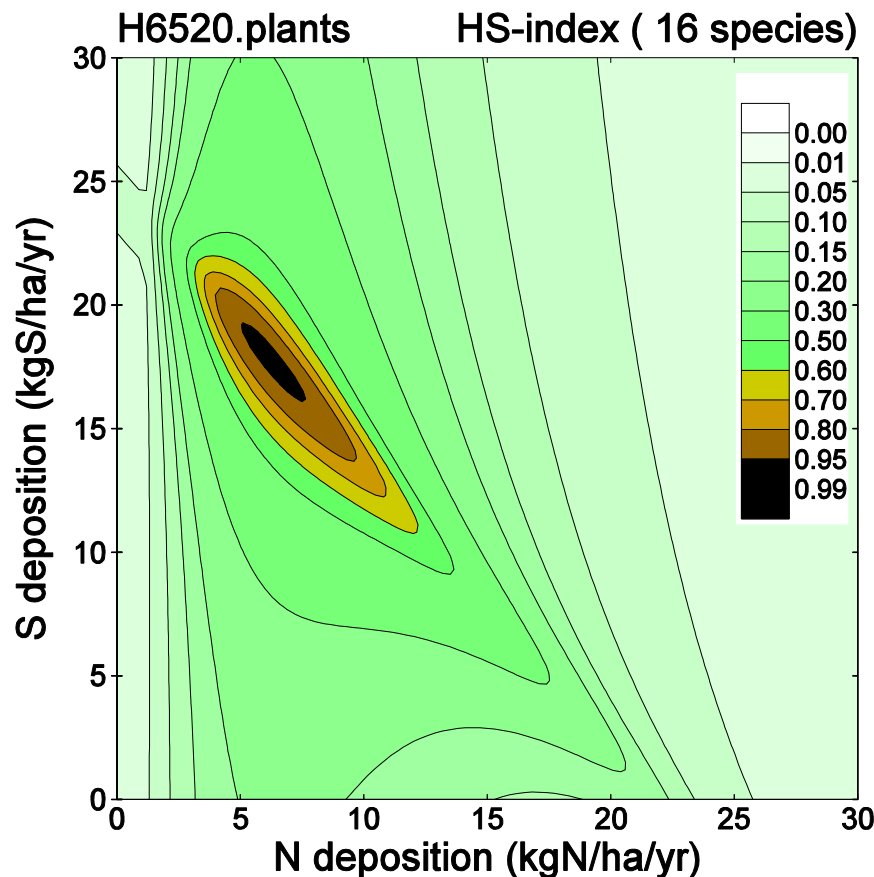
where n is the number of species, p_j the occurrence probability of species j , and $p_{j,opt}$ the optimum/maximum occurrence probability of species j .

HSI isolines for habitats (BioScore):



... for CLRTAP applications link to N and S deposition!

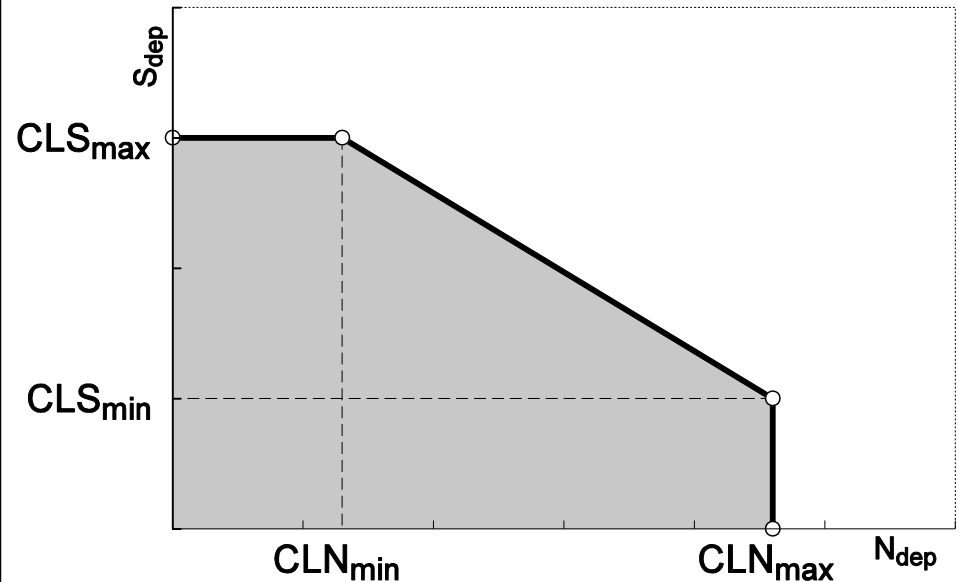
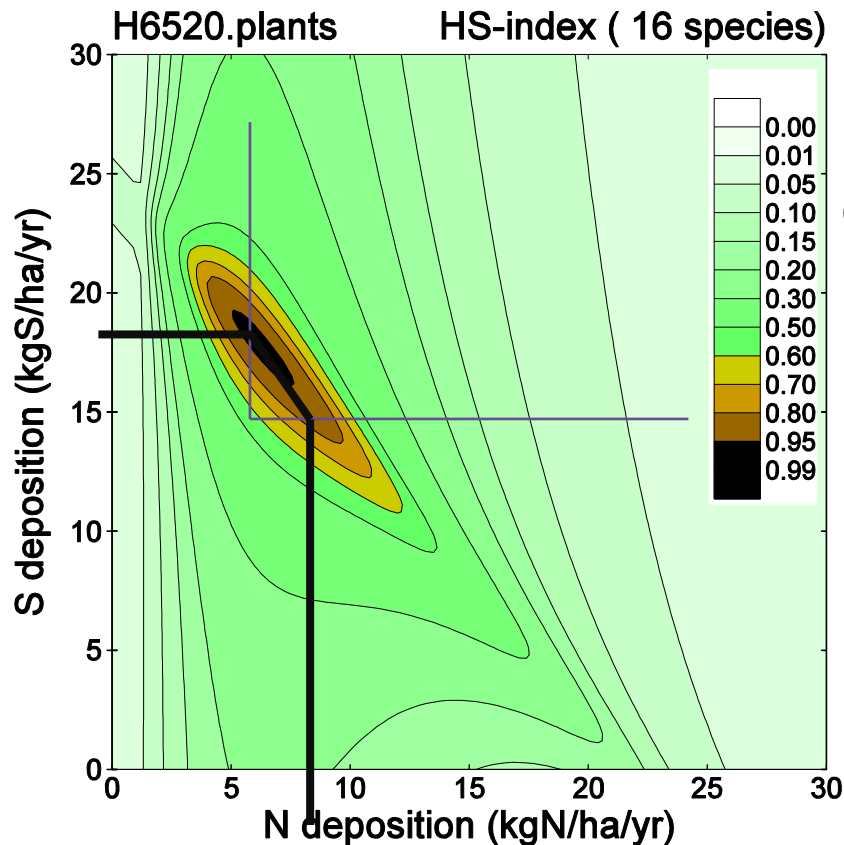
- N_{dep} primary variable (fine!)
- S_{dep} computed from pH & N_{dep} with SMB *using site properties*



Due to dependence on site properties, it varies from place to place

... How to get CLs from that?

Define critical/acceptable value of index ... and simplify



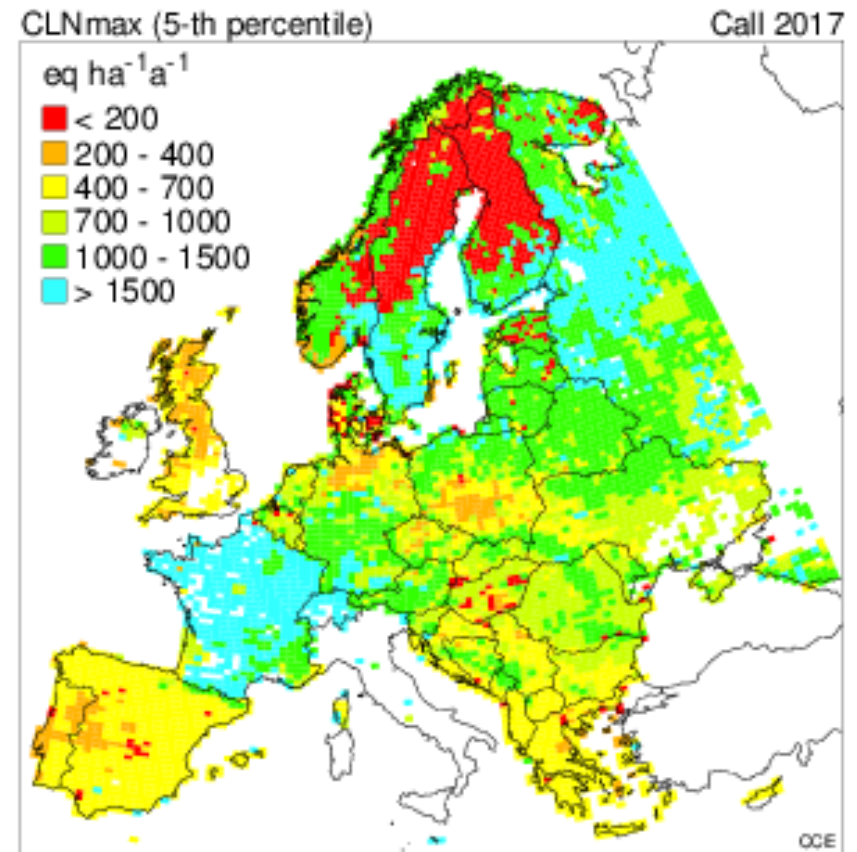
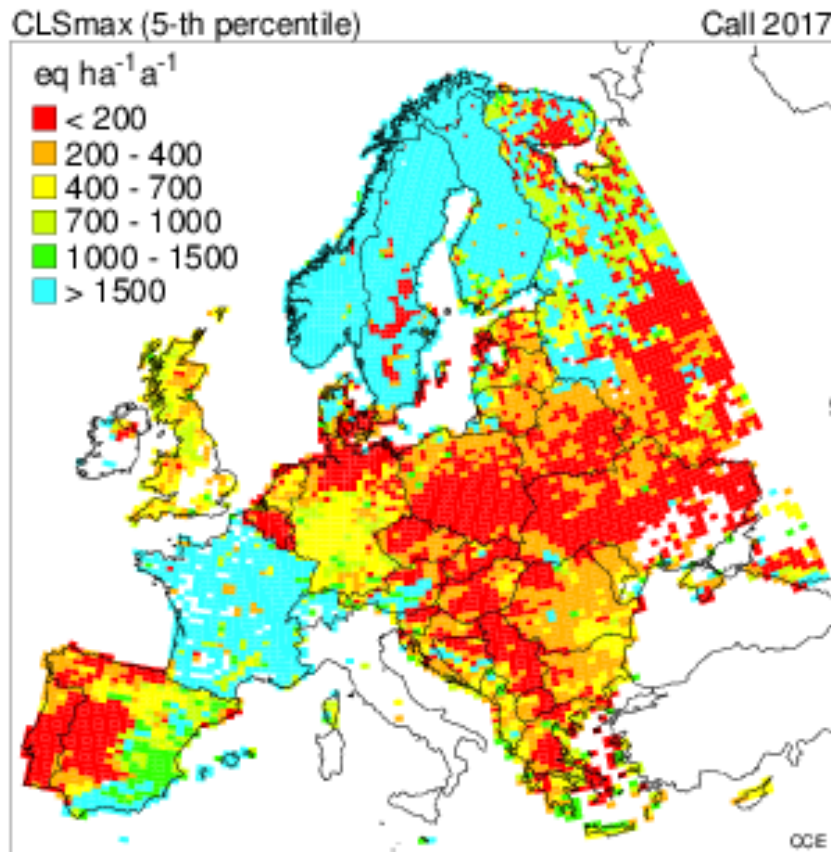
4 numbers (CLs): $0 \leq \text{CLN}_{\min} \leq \text{CLN}_{\max}$
and $0 \leq \text{CLS}_{\min} \leq \text{CLS}_{\max}$

Note: 'Similar' procedures to derive CLFs from other biodiv. models, such as Veg, BERN, MultiMOVE, US-PROPS(v2), etc ...

European database of CLs of biodiversity

Call for Data 2015-2017

NFC data (FR,GE,IE,IT,NL,CH,UK)+ **CCE background data** for other Parties



Summarising:

- 'Plant occurrence' models exist ...
- ... but data often lacking, esp. for some 'remote' areas
- 'Easy' to link to dynamic soil chemistry models (if no feedbacks!)
- Biodiv. indicator not necessarily a CL, but how to link it otherwise to CIAM work (N_{dep} and S_{dep})?
- Deriving CLs from biodiversity indicators non-trivial (but done)
- Biodiv. CLs for Europe have been derived, but not many national contributions (and not yet 'in use')

What next ('way forward')?

- Continue pushing biodiv. indicators (CLs), since biodiversity is now a 'hotter' issue than, e.g., acidification. TFIAM/CIAM would like to incorporate a 'biodiversity indicator' into the GAINS model.
- Seek links (also on national level!) to other international organisations working on biodiversity ... (CBD, EU policies)
- Encourage all modelling activities in that direction (e.g. also Dose-Response functions?)
- Alternative: Translate biodiversity change/loss into chemical criterion/criteria for classical SMB CLs
- Note: Biodiversity as endpoint not entirely new:
Many empirical CLs have it as endpoint ...

Thank You! 😊

...

Comments? 😐

Questions? 😞

All on CLs, and much more, to be found in:

De Vries W, Hettelingh J-P, Posch M (eds), 2015.

Critical Loads and Dynamic Risk Assessments:

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