Update of Swiss critical loads including biodiversity as criterion

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ICP M&M Task Force Meeting,
Wallingford (UK), 4.-6. April 2017
Overview:

- Sensitive ecosystems in Switzerland
- Update of critical loads of nutrient nitrogen (CLacid not changed)
- Calculating S and N critical loads for forests considering ground-vegetation
  - Model setup
  - Results
  - Conclusions
Sensitive ecosystems, data sources

- Dynamic modelling, forest sites IAP/WSL
- Alpine lakes (ICP Waters), FAB and empirical CL
- Alpine/species-rich vegetation ('Hegg-Atlas')
- Bogs/fens (National nature protection)
- Dry grassland (TVWW, National nature protection)
- Mountain hay meadows (Biodiversity Monitoring)
- National Forest Inventory (NFI, WSL), SMB method

Map: FOEN, H&W, EKG, Meteotest, 15.03.2017
Sources: Terrain BFS-Geostat. Forest grid WSL/NFI 1990/92
Updates CLempN, data call 2015-17 (1)

- Alpine oligotrophic softwater lakes, new CLempN: 4 kg N/ha/a according to range 3 – 5 kg N/ha/a proposed by:

Updates CLempN, data call 2015-17 (2)

- (Sub-)alpine scrub habitats: Mapping Manual 5-15 kg N/ha/a. CLempN is set to 10 kg N/ha/a (formerly 7) for *Juniperion nanae* and *Loiseleurio-Vaccinion* according to:
Remarks: CL nutrient N

- For productive forests, Switzerland restricts the range of validity of the SMB method to values >10 kg N/ha/a (lack of empirical evidence for lower values). The corresponding empirical critical load is taken (=10 kg N/ha/a), if the result of the SMB is <10 kg N/ha/a.

- New report on CL of nutrient N and exceedances:

Critical loads for biodiversity

Background

- Biodiversity critical loads were calculated for 79 forest plots in Switzerland (a subset of the 319 sites used for static and dynamic modelling) using PROPS-CL (2D), habitat-specific plant communities, a limit of 0.4 eq ha\(^{-1}\) a\(^{-1}\) for deposition and 0.8•HSI\(_{\text{max}}\) as critical limit

- Required input was extracted from input/output of the acidity critical load run submitted in compliance with the Call for Data 2014-15

- Procedure for calculating biodiversity critical loads as suggested by the CCE (Status report 2014) / Call for Data 2015-17 covered:
  - species selection dependent on vegetation type
  - plant response in the S\(_{\text{dep}}\)-N\(_{\text{dep}}\) matrix (transfer of S\(_{\text{dep}}\)-N\(_{\text{dep}}\) into required [H\(^+\)]-N\(_{\text{dep}}\) or [H\(^+\)]-[NO\(_3\)] matrix via SMB)
  - mean habitat suitability index (HSI)
  - protection level isolines in the S\(_{\text{dep}}\)-N\(_{\text{dep}}\) “plane” (protection level = fraction of HSI\(_{\text{max}}\))
  - CL-functions derived from the isolines

- Same procedure was implemented in the Veg-CL and VeCH-CL models
Model framework
Model chain for critical load modelling
Plant community response
Topologies in the $S_{\text{dep}}$-$N_{\text{dep}}$ “plane”
Critical loads for biodiversity
Protection levels distribution functions

79 sites; deposition limit 0.4 eq m\(^{-2}\) a\(^{-1}\)

Fraction of \(H_{\text{max}}\):
- 0.99
- 0.95
- 0.90
- 0.85
- 0.80
- 0.75
- 0.70
- 0.60
- 0.50
- 0.40
- Aci

Scatter of Aci CL vs biodiversity CL (0.8 \(H_{\text{max}}\))
Critical loads for biodiversity
Compared with acidity and nutrient critical loads
Critical loads for biodiversity

Summary and open topics

• Summary of the impact of biodiversity critical loads on the conventional acidity critical load function (limit of loads 0.4 eq m⁻² a⁻¹):

<table>
<thead>
<tr>
<th>CL</th>
<th>No of sites</th>
<th>%</th>
<th>avg correction [%] all</th>
<th>avg correction [%] sites</th>
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<tr>
<td>maxS</td>
<td>9</td>
<td>11.4</td>
<td>-4</td>
<td>-33</td>
</tr>
<tr>
<td>minN¹</td>
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<td>20.3</td>
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<td>-42</td>
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<tr>
<td>maxN²</td>
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<td>57.0</td>
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<td>-31</td>
</tr>
<tr>
<td>nutN¹</td>
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<td>1.3</td>
<td>0</td>
<td>-17</td>
</tr>
<tr>
<td>nutN²</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

• Missing vegetation types made it impossible to calculate biodiversity critical loads for all forest plots available for SMB calculations
• Proper integration of climate change effects, i.e. change in the ground vegetation composition not only due to change in environmental drivers, but also due to change in forest type
• For other ecosystems than forests, currently necessary input for critical loads calculations, i.a. soil data, still is lacking
Thank you for your attention!

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