Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of the Environment,
Transport, Energy and Communications DETEC

Federal Office for the Environment FOEN
Division

Proposed updates for Mapping Manual Chapter V

V.3.1.2	**Acceptable leaching of nitrogen**
V.3.2.2.1	**Aluminium criteria**
V.3.2.2.3	**Critical base saturation**
V.3.2.2.2	**Hydrogen ion criteria, subchapter (a) Critical pH**

Prepared at a CH-Sweden Workshop in June 2015 in Bern and discussed with further experts before TF Meeting in Dessau

Beat Achermann, Sabine Augustin, Sabine Braun, Reto Meier, Harald Sverdrup

26th CCE Workshop and 32nd ICP M&M Task Force Meeting, Dessau
Reto Meier, 21. April 2016

V.3.1.2 Acceptable leaching of nitrogen

- Critical concentrations for N in soil solution of table V.7 for calculating $CL_{nut}N$ are not meaningful in regions with high precipitations or in polar/sub polar regions

- Currently, the Mapping Manual contains no information about how to define acceptable N-leaching in such regions

- We propose to re-include as an additional option the absolute limits for acceptable N-leaching of the 1996-version of the Mapping Manual

CLN in Switzerland resulting from the use of different critical N concentrations

VSD/SMB Model for 260 forest sites in Switzerland, CCE Status Report 2007

Empirical critical load for coniferous woodland 5-15 kg N/ha/a

- Nutrient imbalance
- Change soil processes
- Change ground vegetation
- Change mycorrhiza composition

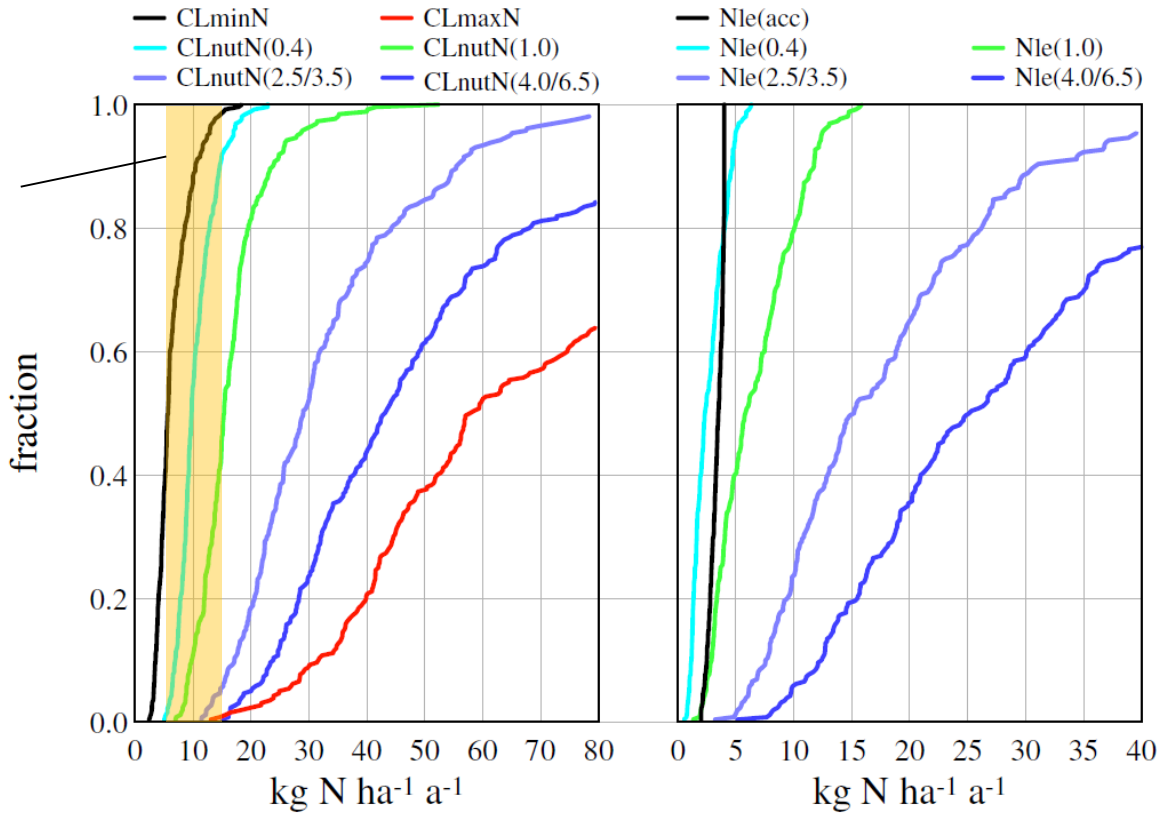


Figure CH-2. *Cumulative frequency distributions of Nutrient N critical loads (left) and N leaching rates (right) under different critical concentrations in soil solution.*

Proposed re-inclusion of absolute acceptable N-leaching amounts

- Boreal and temperate heaths and bogs: 0 - 0.5
- Managed coniferous forest: 0.5 - 1.0
- Intensive coniferous plantations: 1 - 3
- Temperate deciduous forests: 2 - 4
- Temperate grasslands: 1 - 3
- Mediterranean forests: 1 - 2

[kg N ha^{-1} yr^{-1}]

- ➢ The advice of national experts should be sought when deciding on the most appropriate value
- ➢ CLN based on acceptable N leaching values should be compared with the empirical CLN in order to check the plausibility
- ➢ In view of the precautionary principle it is recommended to use the lowest of the obtained critical load values

Values according to Mapping Manual 1996 based on UNECE Workshops Lökeberg 1992 and Grange-over-Sands 1994

V.3.2.2.1 Aluminium criteria

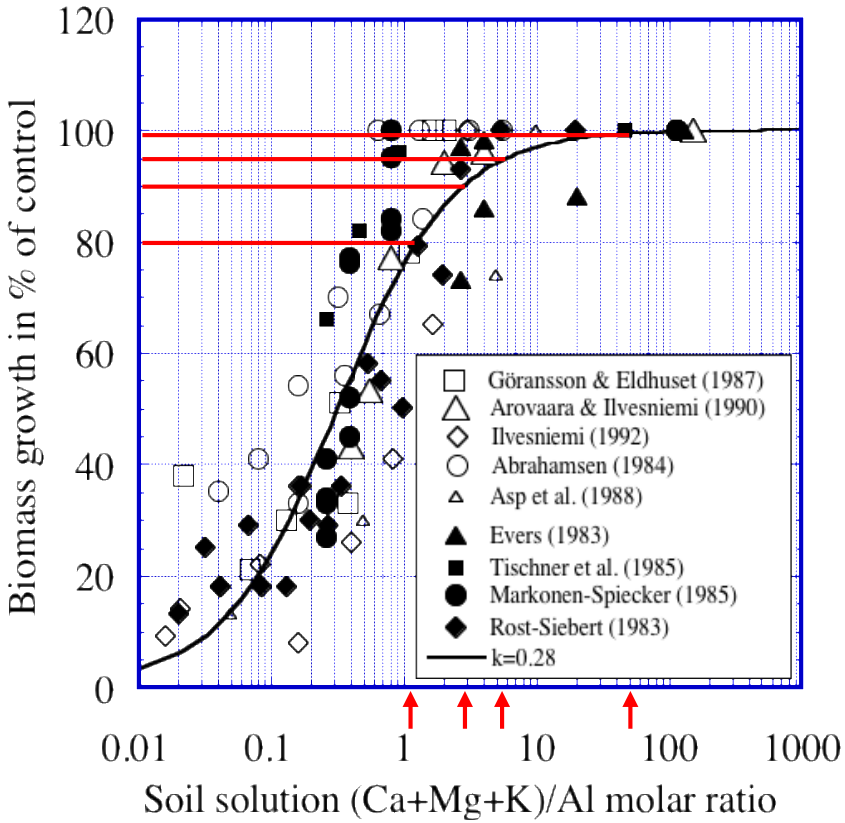
- Currently the Bc/Al criterion is based on one single critical Bc/Al = 1

  → without referring to the accepted quantified growth reductions
  → without considering the plant species specificity of this ratio

- Much more detailed information is available in Sverdrup and Warfvinge (1993) that is referred to for setting the critical Bc/Al = 1

- We propose to provide more detailed information to enable a more differentiated choice of Bc/Al since setting the critical Bc/Al ratio is crucial for protecting sensitive ecosystems from negative effects.

Dose-response curve for Norway spruce



Dose-response curve for the relationship between Bc/Al ratio and biomass growth derived from experimental studies with Norway spruce

Sverdrup and Warfvinge, 1993

Proposed new table with Bc/Al values

Table V.8 Bc/Al values in relation to different growth reductions for examples of European trees and herbs (from Sverdrup and Warfvinge, 1993)

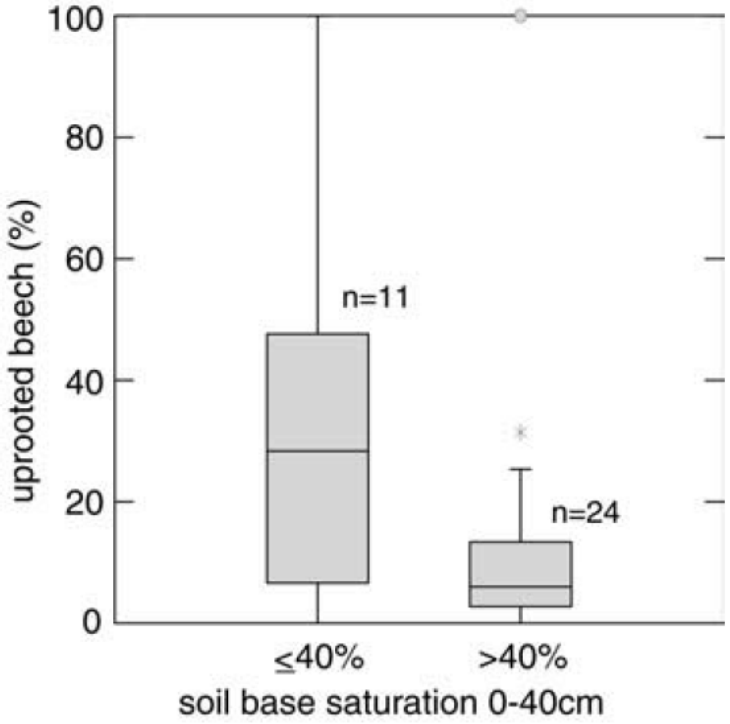
Latin name	**Trivial name**	**$(BC/Al)_{Crit:}$ % growth impact**			
		20%	**10%**	**5%**	**2%**
Coniferous trees					
Picea abies	Norway spruce	1.2	2.7	5.7	15
Pinus sylvestris	Scots pine	1.2	1.8	3	5
Deciduous trees					
Fagus sylvatica	European beech	0.6	0.8	1.2	2.5
Quercus robur	Oak				
Betula pendula	Silver birch				
Ground vegetation					
Deschampsia flexuosa	Wavy hairgrass	0.5	1.2	2.5	6.4
Calluna vulgaris	Common heather	0.8	1.8	3.8	10

V.3.2.2.3 Critical base saturation

- Currently the mapping manual states that a critical base saturation could be chosen as a criterion for calculating critical loads of acidity - without elaborating on it.
- The UNECE workshop held at York (UK) in 2001 recommended to include base saturation as a potential criterion in the Mapping Manual
- Scientific data on this topic is available and we propose to refer to this information

Uprooted trees after storm / fine root length and base saturation

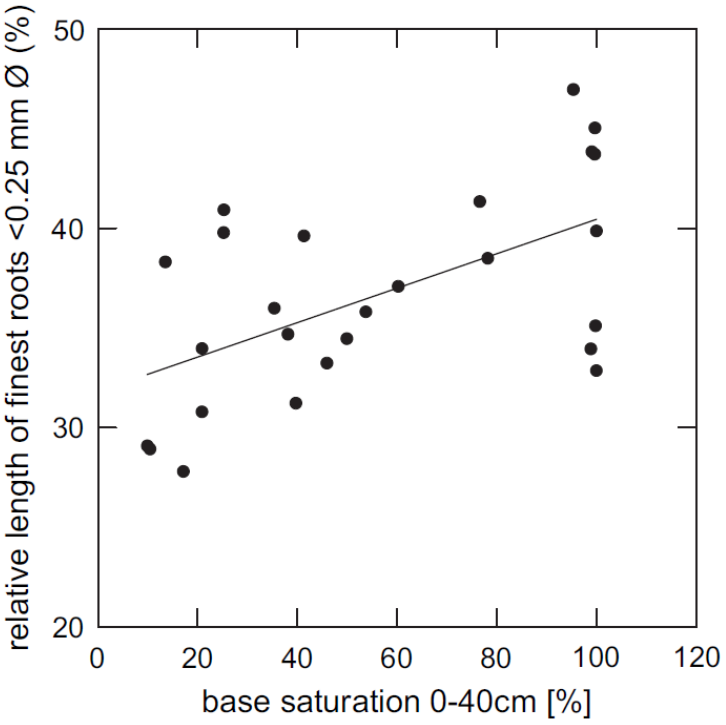
Uprooted beech in Switzerland after storm Lothar 1999



Braun et al. Water, Air and Soil Pollution 2003

Relative fine roots length of young beeches (in % of total root length)

Averages from five plants/plot (26 plots)



Braun et al. Environmental Pollution 2005

Proposed addition to chapter V.3.2.2.3

- Based on field observations in Swiss forest ecosystems effects-based base saturation values were found between 20% and 40% below which harmful effects [...] are documented

- More frequent forest storm damages on acidic soils were also found by Mayer et al. (2005) on sites in France, southern Germany and Switzerland, with comparable explanatory power of pH and base saturation.

V.3.2.2.2 Hydrogen ion criteria subchapter (a) „Critical pH“

- The hydrogen ion criterion has a strong link to the aluminium problem.
- We propose to add this information and to mention the link to the section on the aluminium criteria.
- We propose to add that for forest soils a pH limit of pH_{crit} = 4.2 avoids considerable increase of Al concentration in soil solution (Lindsay 1979, Ulrich 1981) and that critical pH values can be found for different plant species (Sverdrup and Warfvinge 1993). Reference to chapter V.3.2.2.1 on aluminium criteria.

Thank you for your attention!