AU- Bioscience - Science for the Environment - Aarhus 5 – 6. October, 2011

Is current management of semi-natura ecosystems short-sighted and limite – rather than science-based and havin a long sight?

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Examples of acid development of other ecosystems

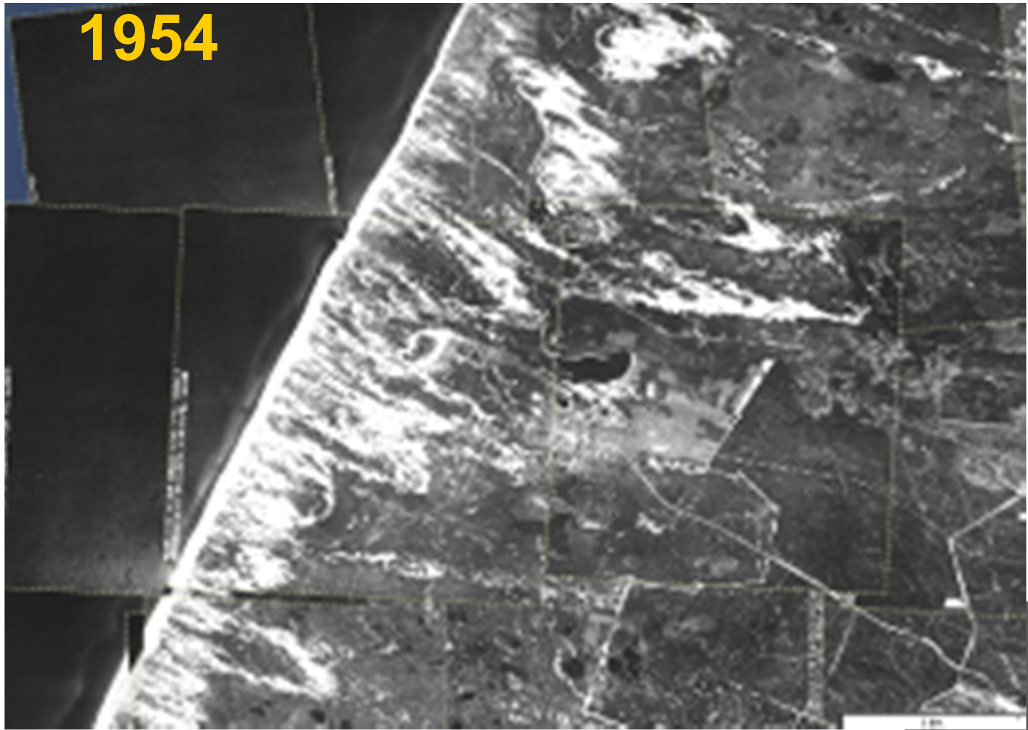
Dune heath develop into grassland heath?

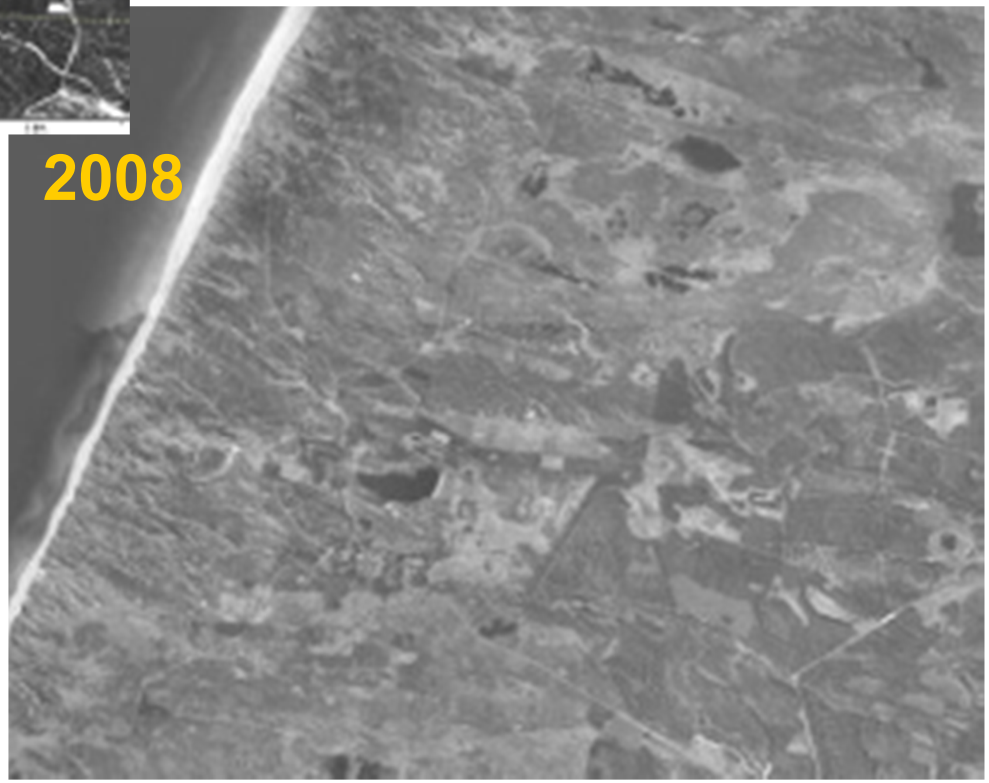
Increased acidification and nutrient levels in dunes

Native inland grass *Deschampsia fl*. as invasive in coastal ecosystems

Increase in cover of the dominant species – dwarf scrubs and tall graminoids, decrease in lichens, small herbs, bare san
(Nielsen et al. 2011, Ambio)

Increase in acid tolerant species; build-up of organic layer

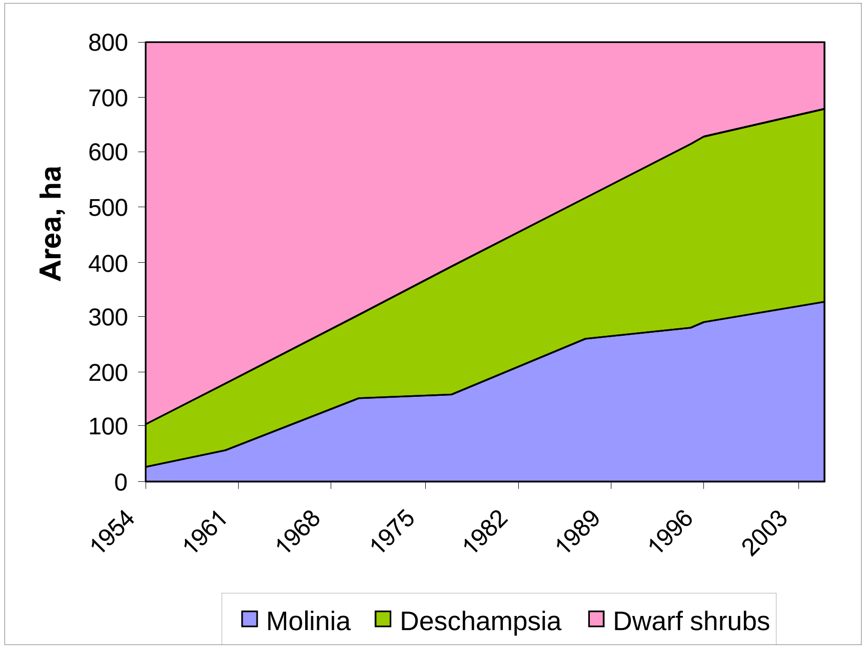

1954


2008

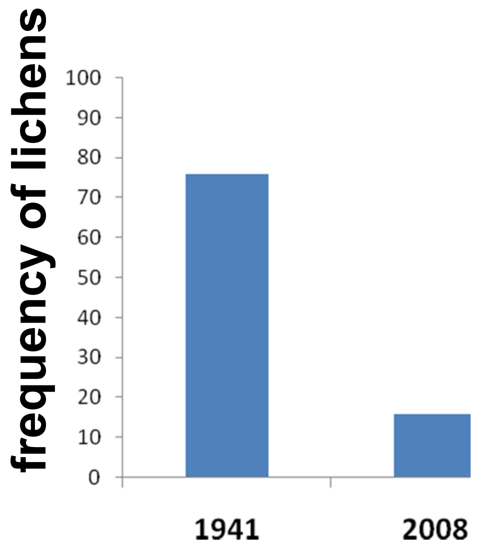
Examples of acid development of other ecosystems

Heathland converge to species-poor grassland

Acid-tolerant grasses increase – decrease in dwarf scrubs, lichens and small herbs in intermediary pH disappears



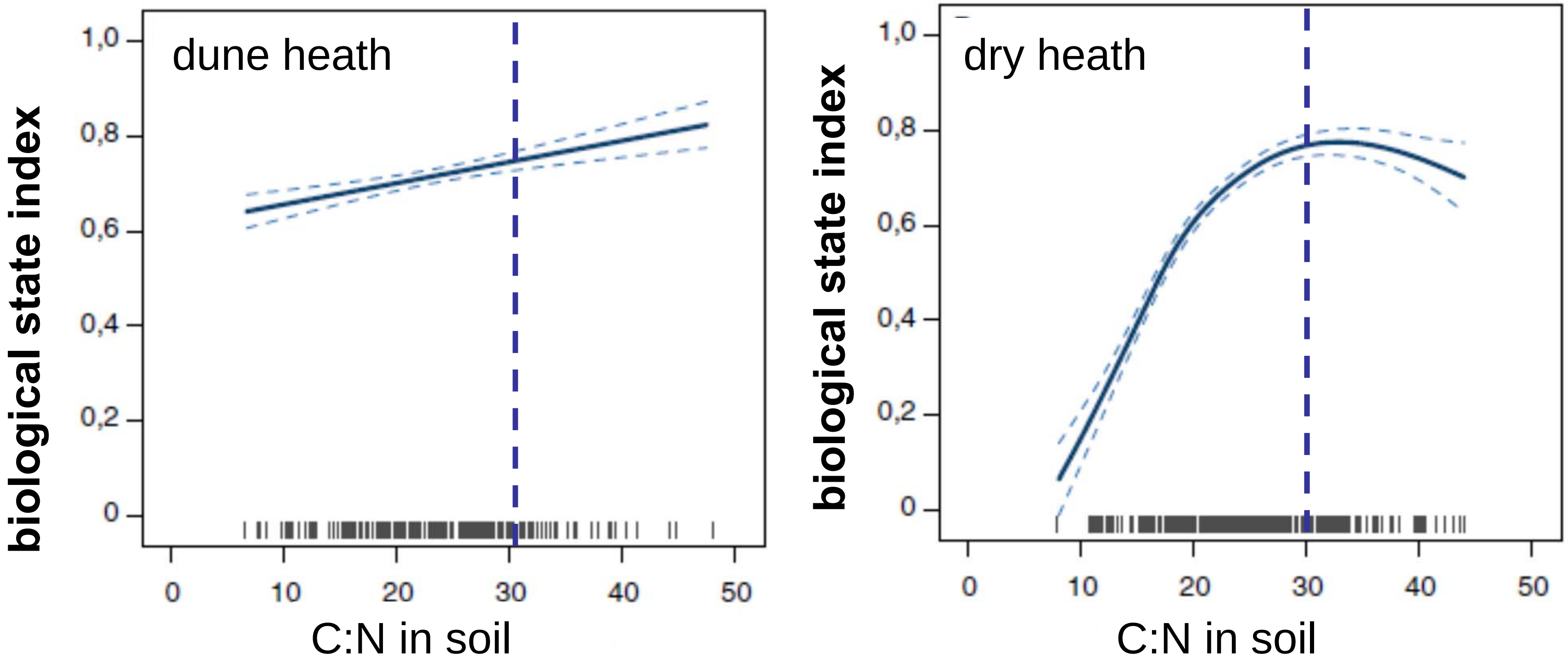
Development in cover of dwarf shrubs, grasses and lichens on Randbøll heath 1954 – 2008.
(H. J. Degn and U. Søchting (in prep.)



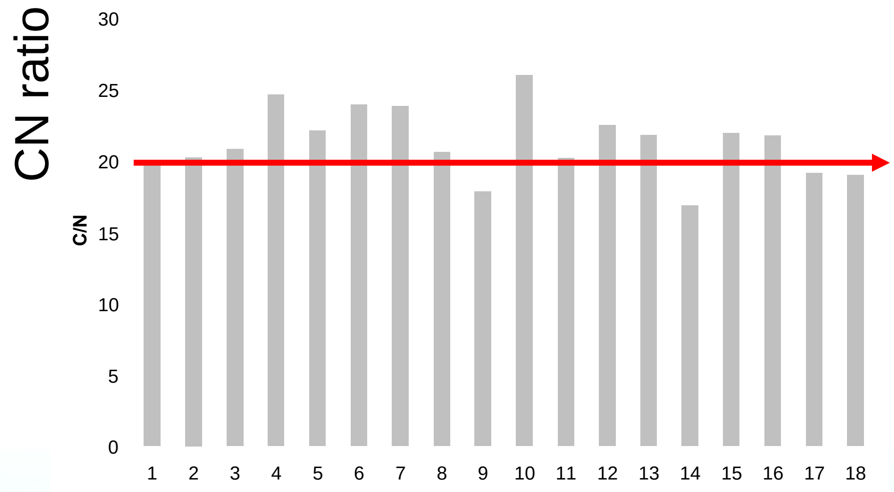
Pool of knowledge - C/N ratio in the mor layer

Coastal heath no threshold

Inland heath – clear threshold



* **The biological state index is a combination of cover of dwarf scrubs with number of indicator species. The range is from 0 to 1.** faglig rapport fra DMU 712

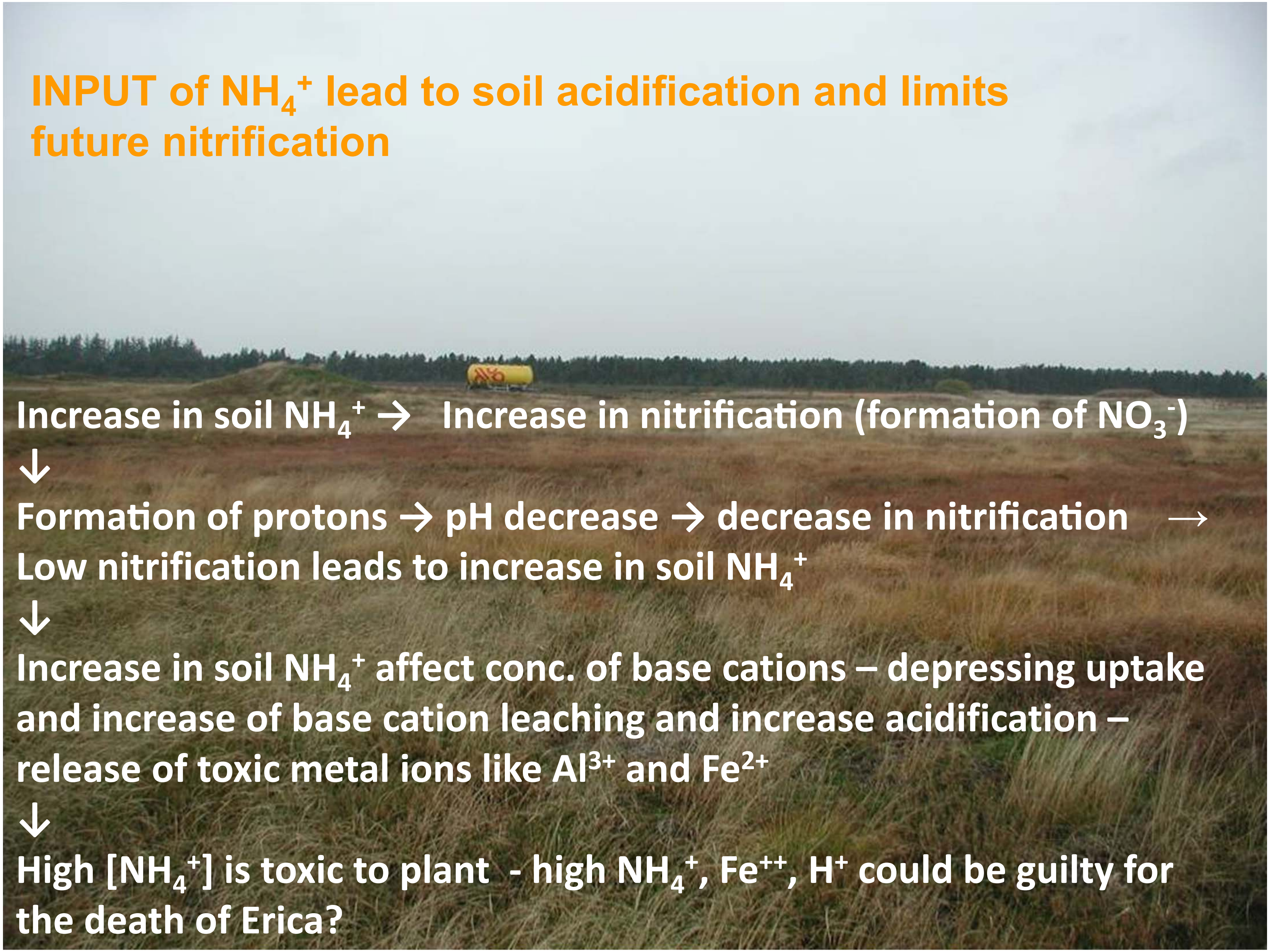


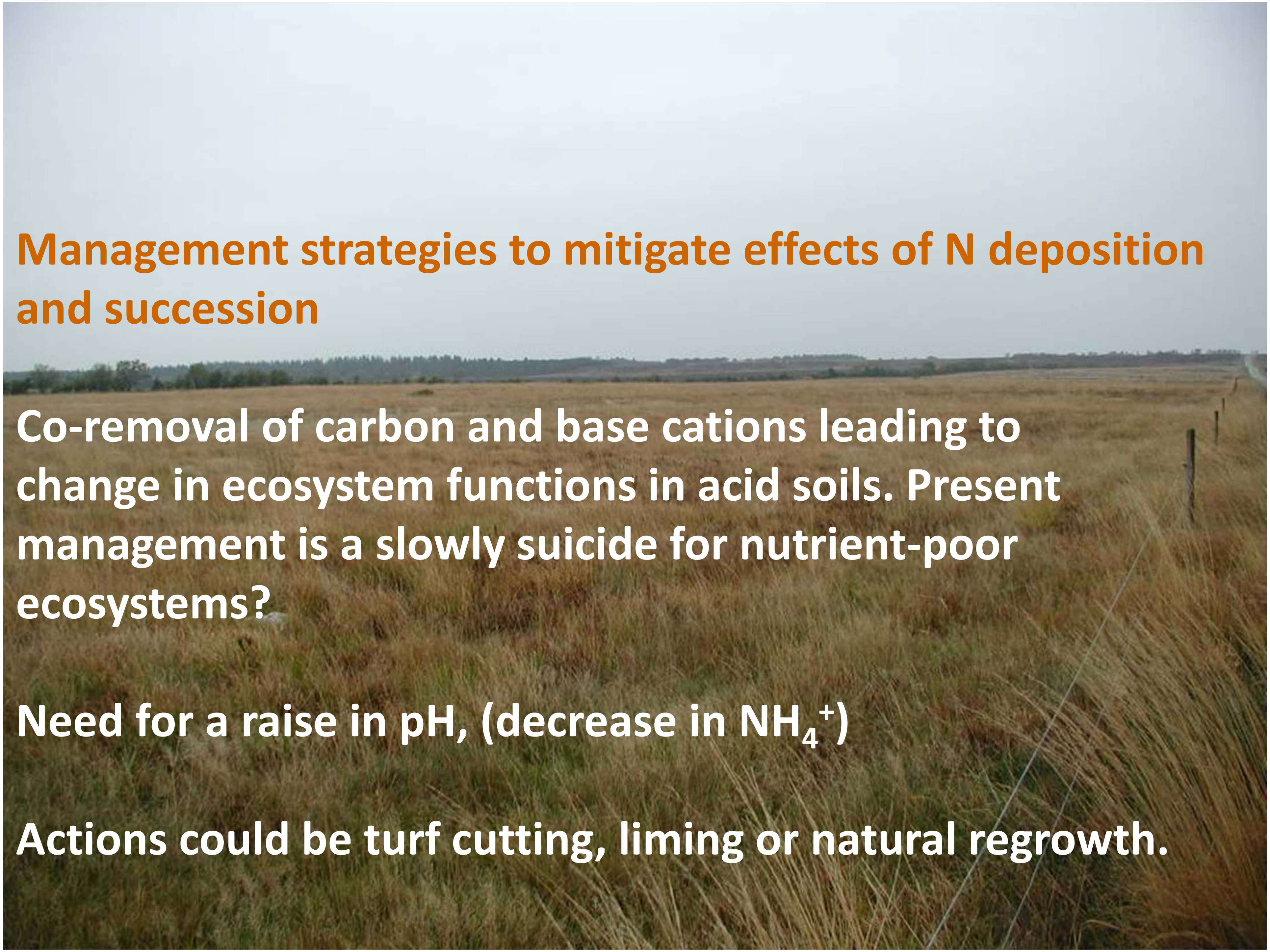
Idom Hede, Calluna heath with
***Chamaenérion angustifólium* (rosebay) !**

Faglig rapport fra DMU, nr. 453

Factor known to affect plant species (loss of species)

1 light exclusion due to increased biomass
2 soil acidification – a pH decrease on heathlands of ≈ 0,5 pH-units
3 ammonium toxicity
4 nutrient imbalance
5 Increased susceptibly to pest and frost, drought etc


INPUT of NH_4^+ lead to soil acidification and limits future nitrification
Increase in soil NH_4^+ → Increase in nitrification (formation of NO_3^-)
↓
Formation of protons → pH decrease → decrease in nitrification →
Low nitrification leads to increase in soil NH_4^+
↓
Increase in soil NH_4^+ affect conc. of base cations – depressing uptake and increase of base cation leaching and increase acidification – release of toxic metal ions like Al^{3+} and Fe^{2+}
↓
High $[NH_4^+]$ is toxic to plant - high NH_4^+, Fe^{++}, H^+ could be guilty for the death of Erica?



Management strategies to mitigate effects of N deposition and succession

Co-removal of carbon and base cations leading to change in ecosystem functions in acid soils. Present management is a slowly suicide for nutrient-poor ecosystems?

Need for a raise in pH, (decrease in NH_4^+)

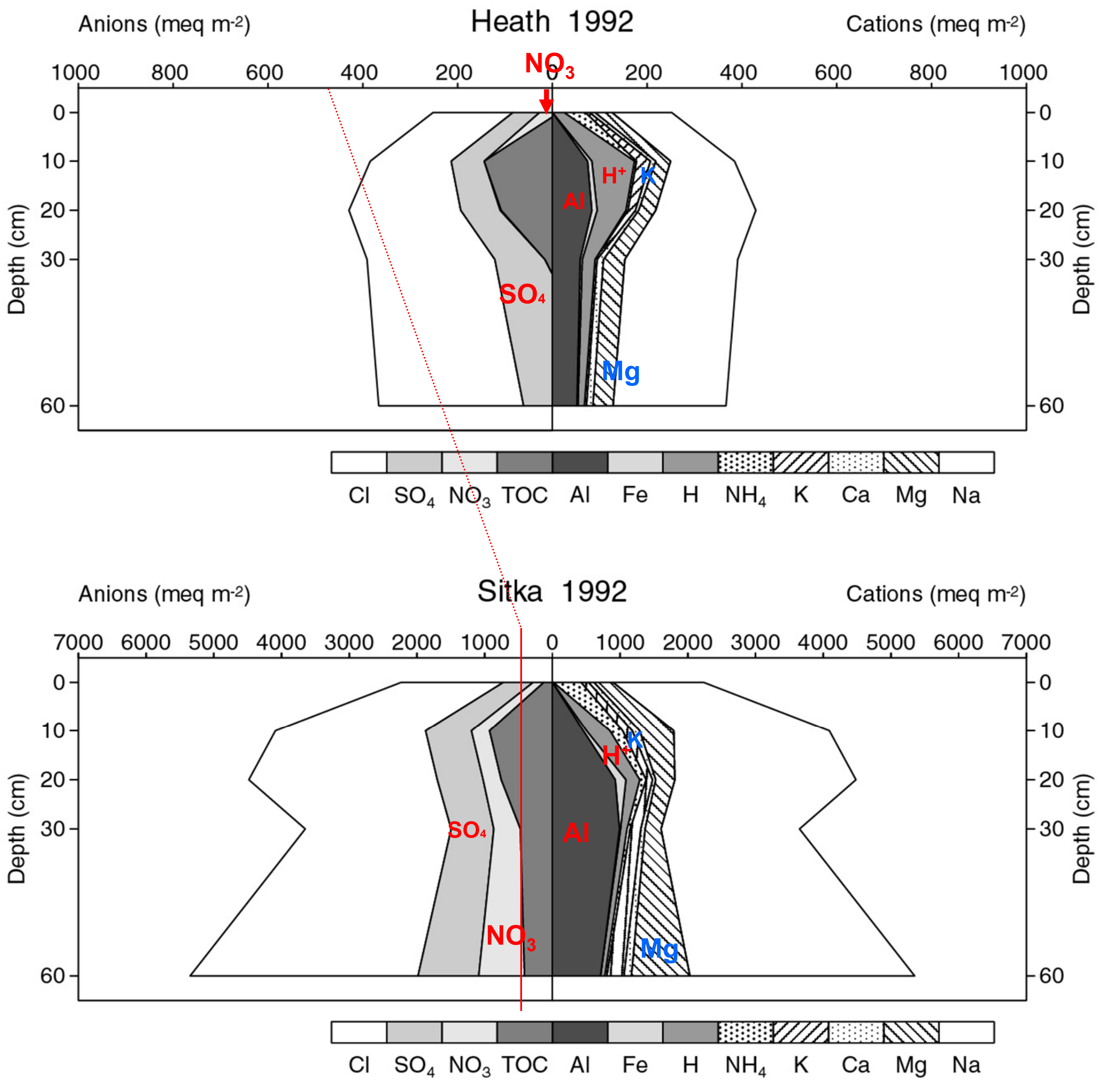
Actions could be turf cutting, liming or natural regrowth.

Base cation removal??

	yearly removal of N and P
Sheep grazing	**16 kg N – 1,4 kg P**
Burning:	**10 kg N – 0,1 kg P** 10 yrs cycles
Cutting:	**10 kg N – 0,4 kg P** -
Sod cutting*:	**60 kg N – 2,7 kg P** 30 yrs cycles

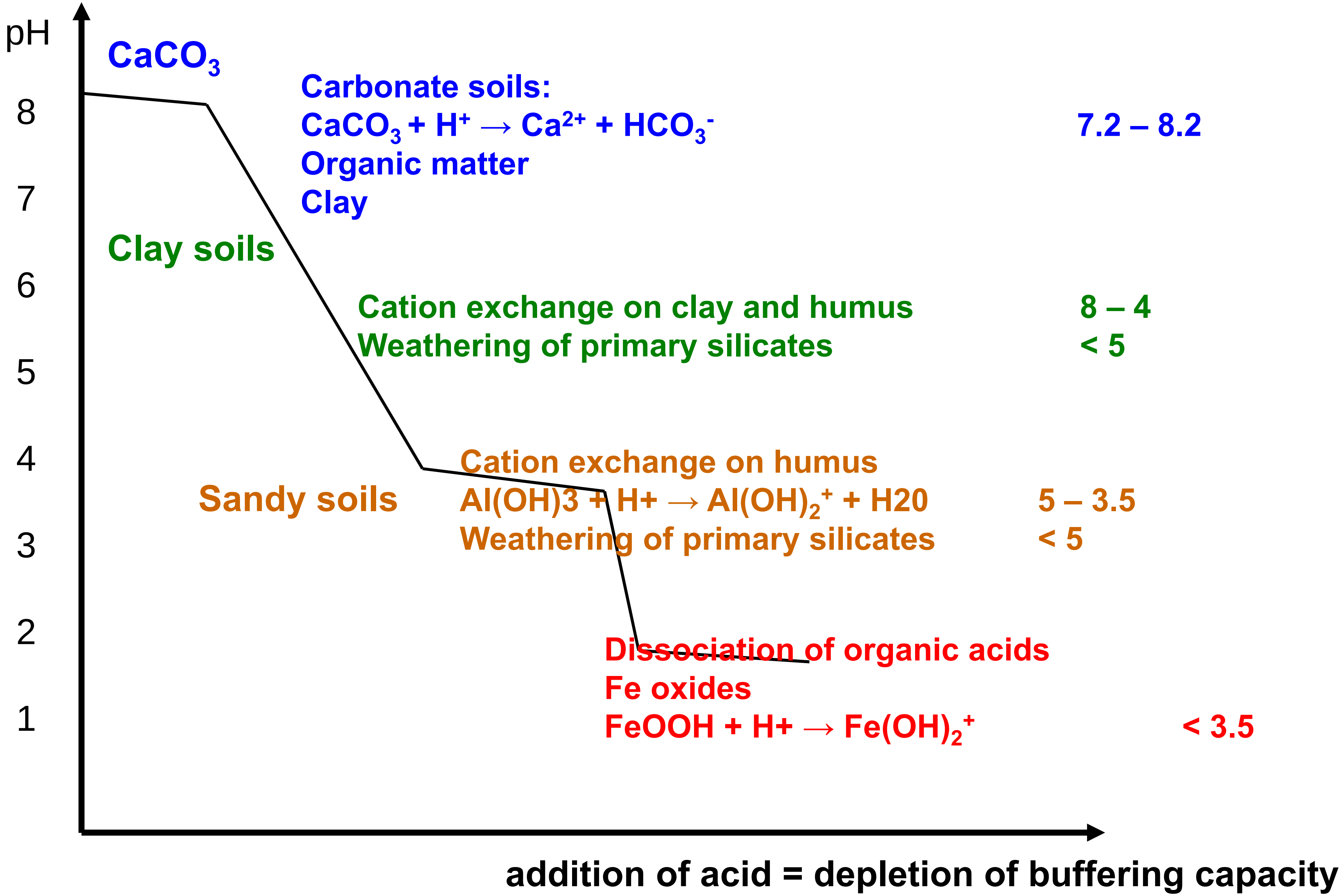
Härdtle et al. 2006 J. App Ecol 43

Flux of Ions through heath and sitka forest



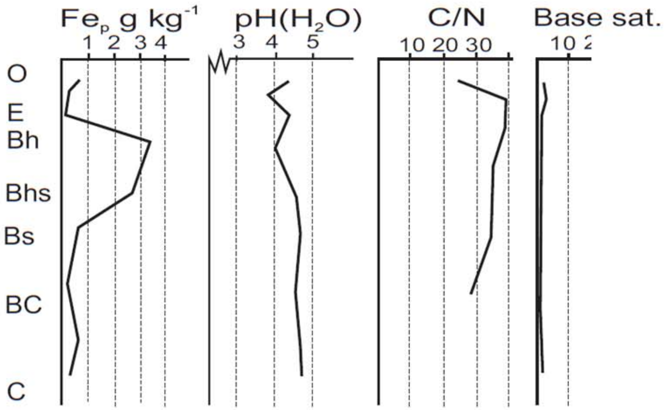
Nielsen et al. 1999

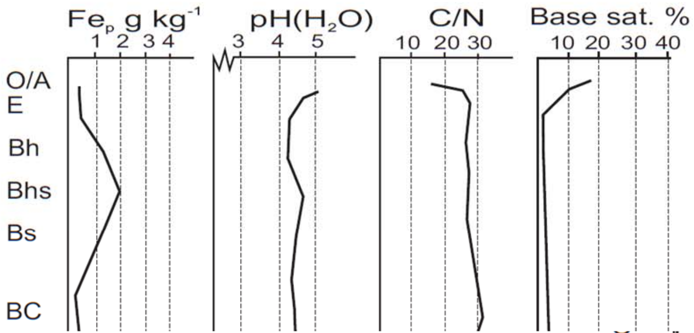
Most important pH buffering systems in soils

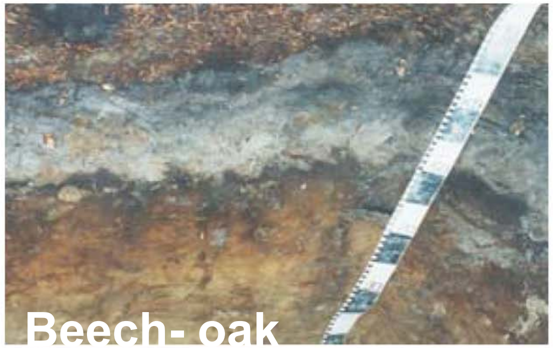


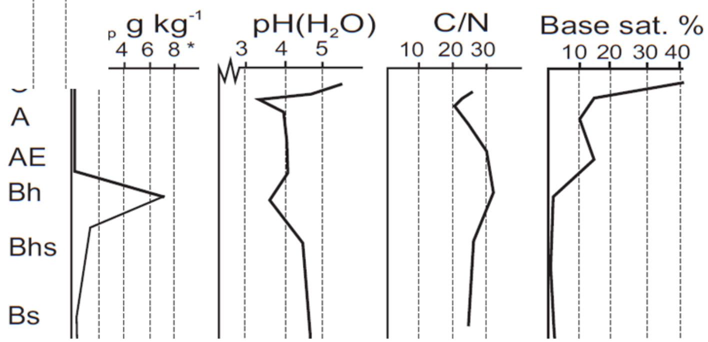
- Succession from heath to forest
- Creates natural variation in acidity
- A natural alternative to liming?
- Roots act as base cation pumps

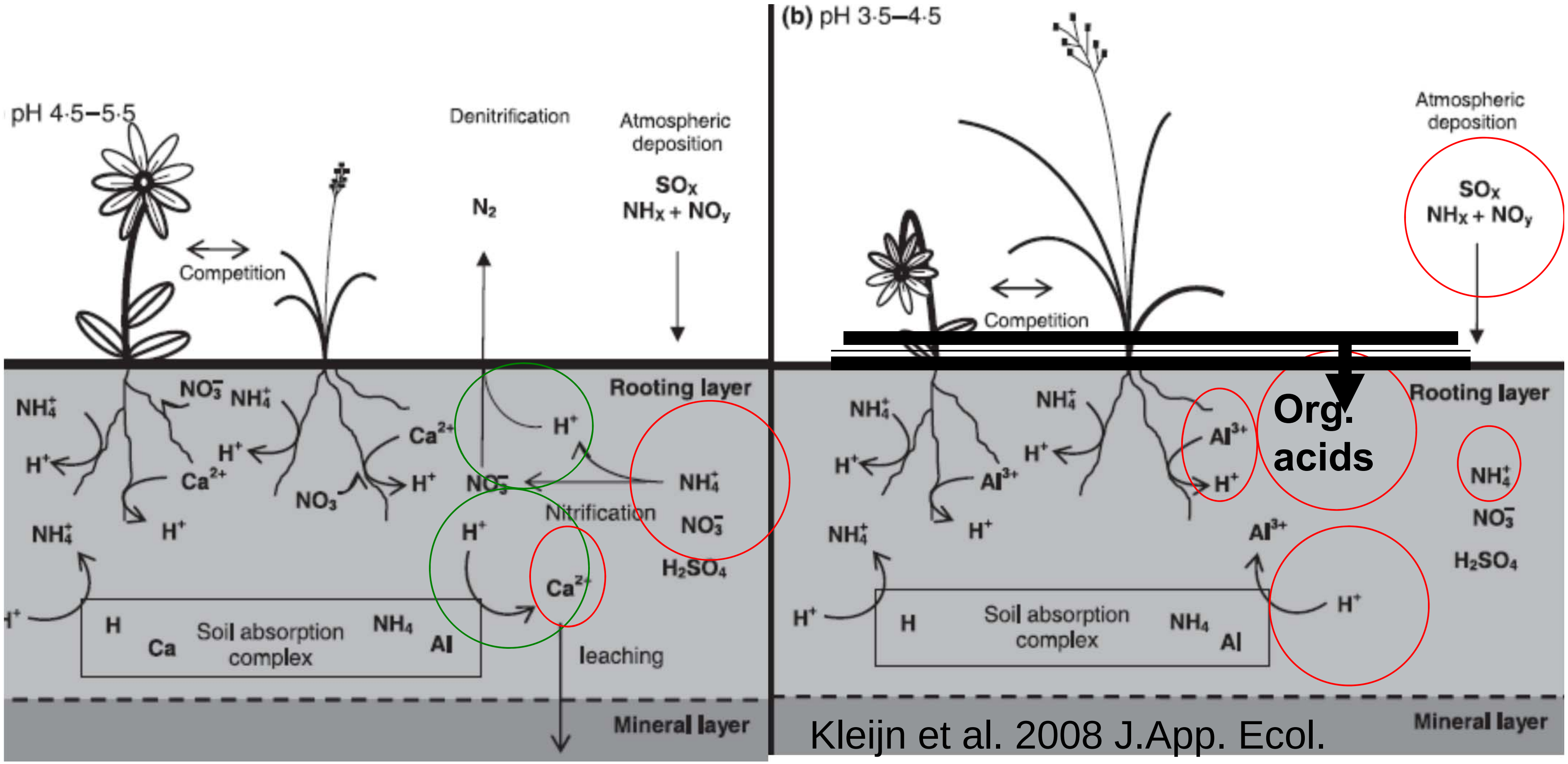
Nielsen et al. 1987. Geoderma; Kristiansen, 2001, Aarhus Geoscience











Liming prevent NH4+ accumulation, restore nitrification, base ions and nutrient availabily.

Counteracting management-acidification, acid deposition and natural acidification.

Who and where is the secret heather beetle of *Erica tetralix*??

Save the buffer systems

Give nature a powder!

Let nature be wild!