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

Federal Office for the Environment FOEN
Air Pollution Control and Chemicals Division

Swiss contribution to the review of the empirical critical loads for nitrogen

ICP M&M TF Meeting, 21-23 April 2020

Reto Meier



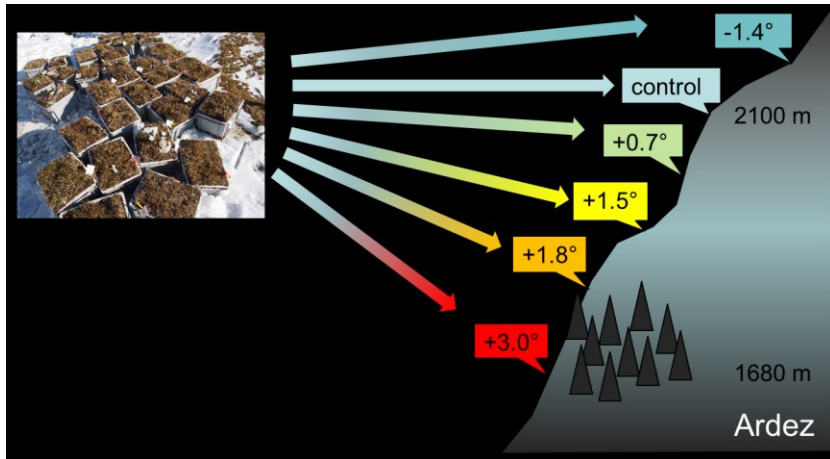
Experimental studies in Swiss (sub)alpine grasslands

Effects of ozone and N deposition: Alp Flix, 2004-2010

- Ozone: free air fumigation at ambient, 1.35 and 1.73 x ambient concentration
- Nitrogen: biweekly irrigation with NH_4NO_3 (+5, +10, +25, +50 kg N ha⁻¹ yr⁻¹)



Effects of climate change and N deposition, Ardez 2011-2018



- Nitrogen: biweekly irrigation with NH_4NO_3 (+3, +15 kg N ha⁻¹ yr⁻¹)
- Warming: transplantation along elevation gradient (6 levels) from +3°C to -1.4°C
- Water: irrigation with +50% of annual precipitation (at 2 levels)

More information: [Agroscope](#) and i.a. [Bassin et al. 2015](#), [Volk et al. 2016](#), [Bassin et al. 2017](#), [Volk et al. 2018](#)



Experimental studies in Swiss (sub)alpine grasslands

Nitrogen addition experiment at the Alpine Research Station «[ALPFOR](#)», 2013-2020
Erika Hiltbrunner, University of Basel

- Three alpine grassland habitats (Caricion curvulae, Nardion, Laserpition-Poion violaceae)
- Nitrogen application (NH_4NO_3 +5, +10, +20 kg N ha⁻¹ yr⁻¹)
- Caricion curvulae: additional phosphorous application ($\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$ +5 kg P ha⁻¹ yr⁻¹)





Gradient studies based on Swiss monitorings

Investigations based on data from the Swiss Biodiversity Monitoring

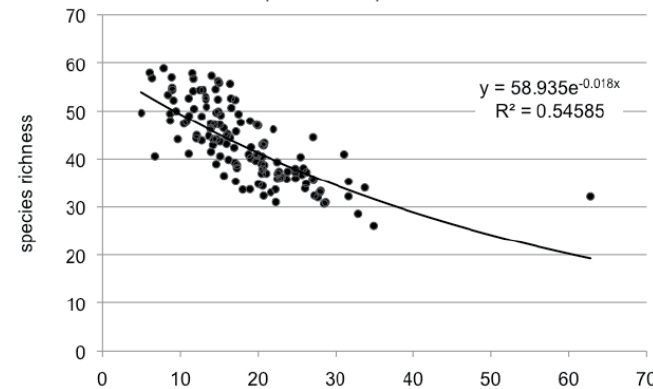


Mountain hay meadows

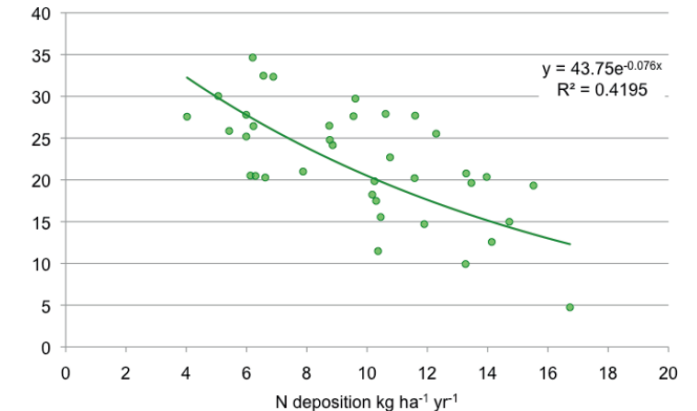
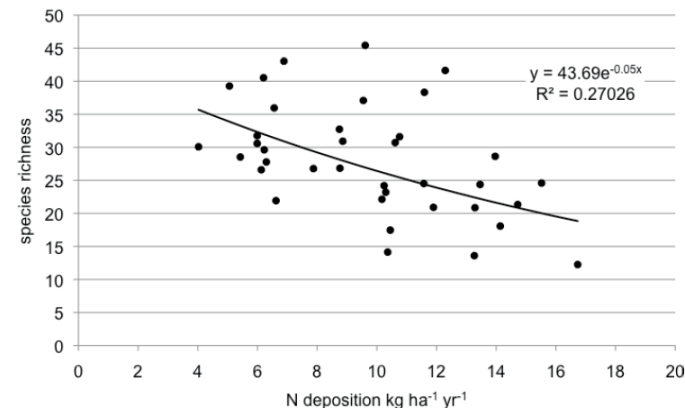
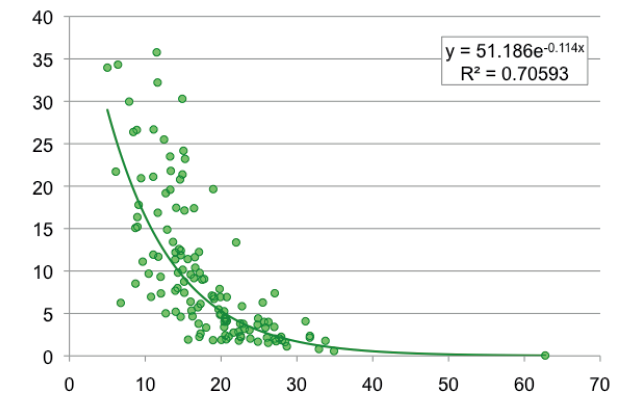


Alpine scrub habitats

All species



Oligotrophic species

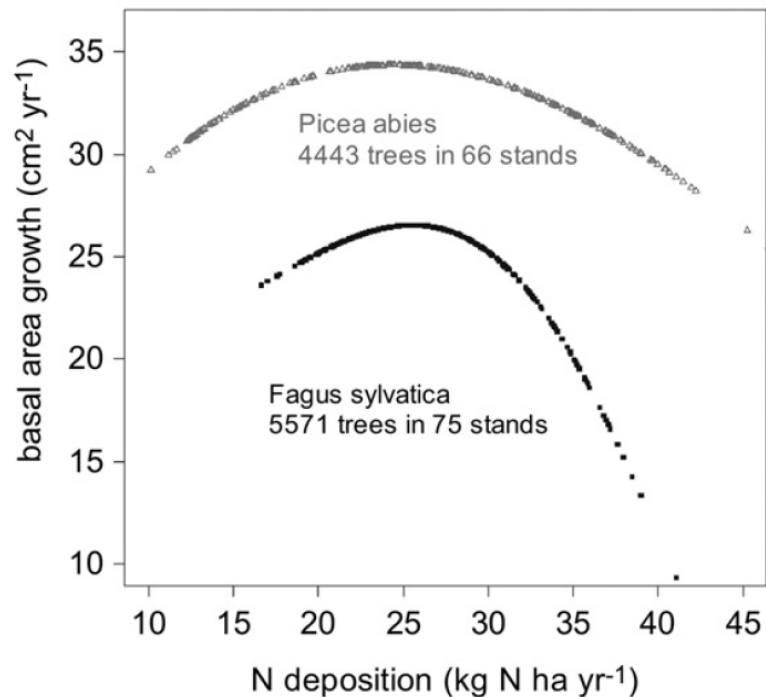




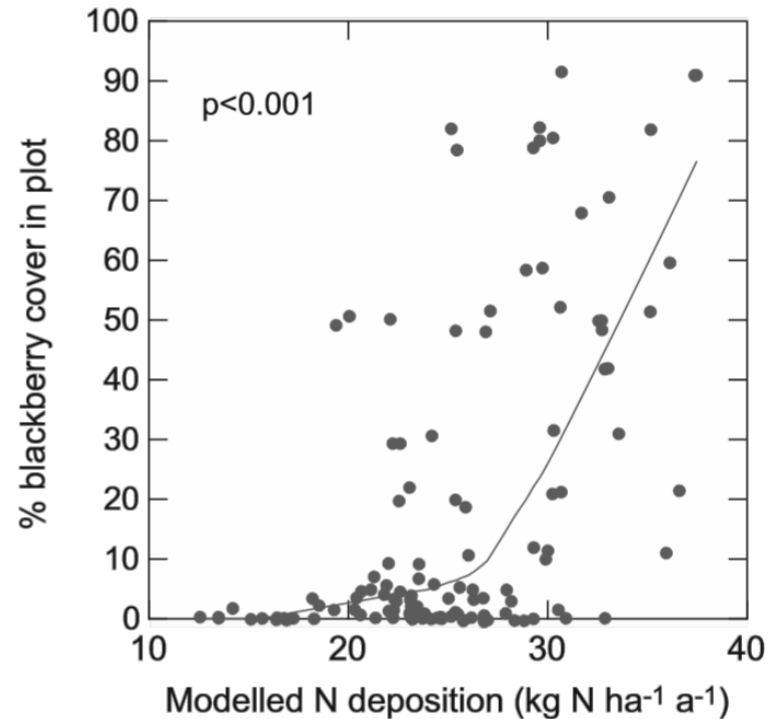
Gradient studies based on Swiss monitorings

Investigations based on data from the cantonal forest monitoring

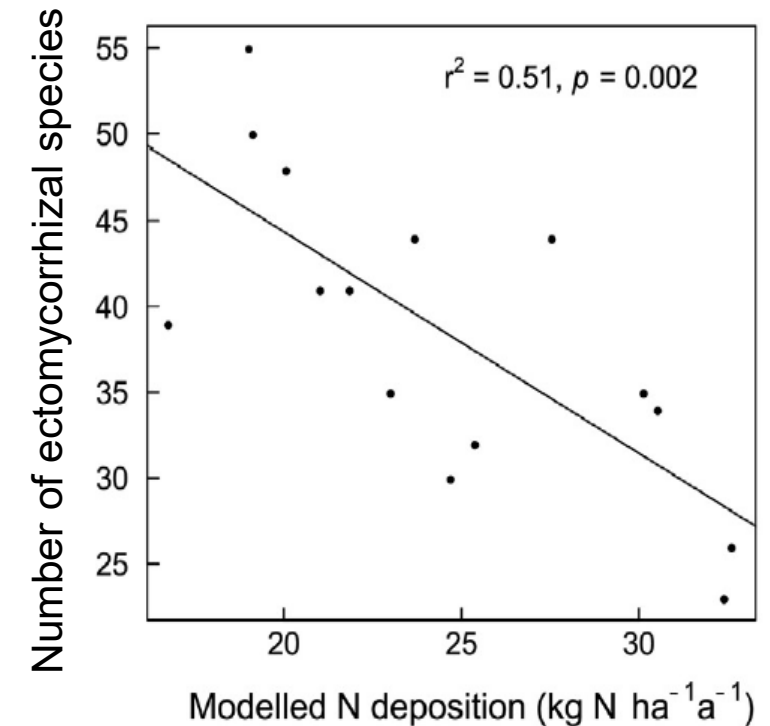
Tree growth



Ground cover



Mycorrhiza diversity

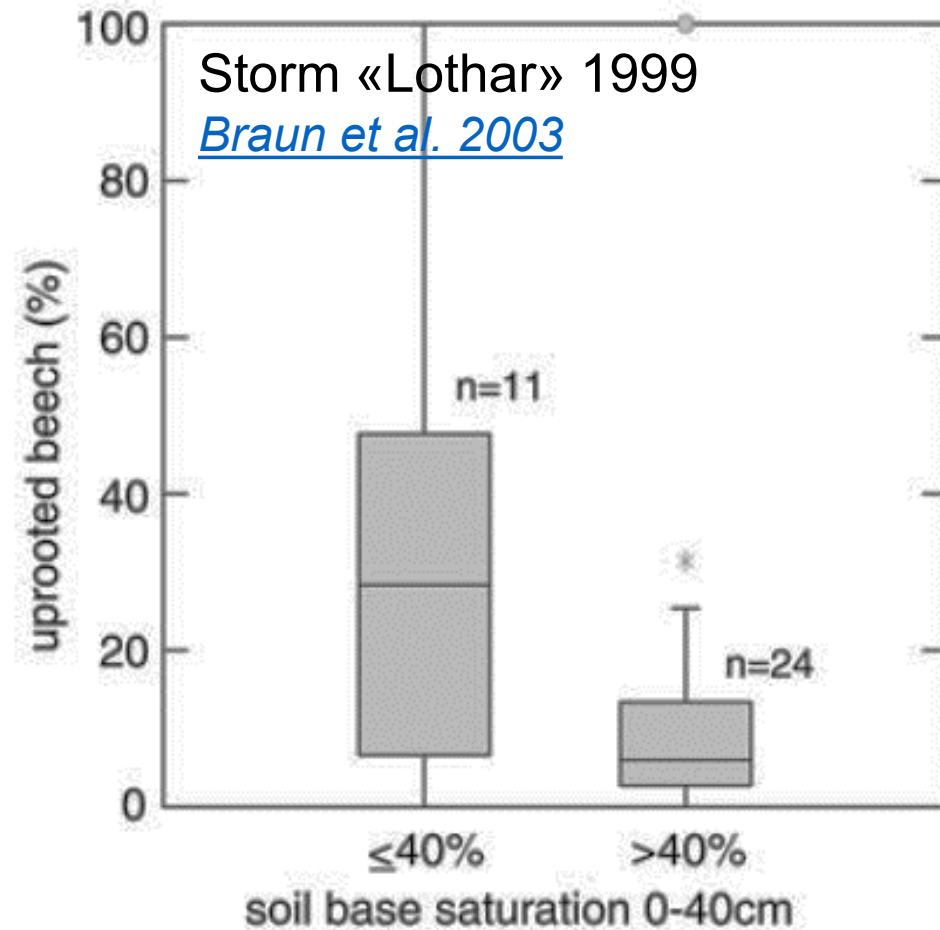
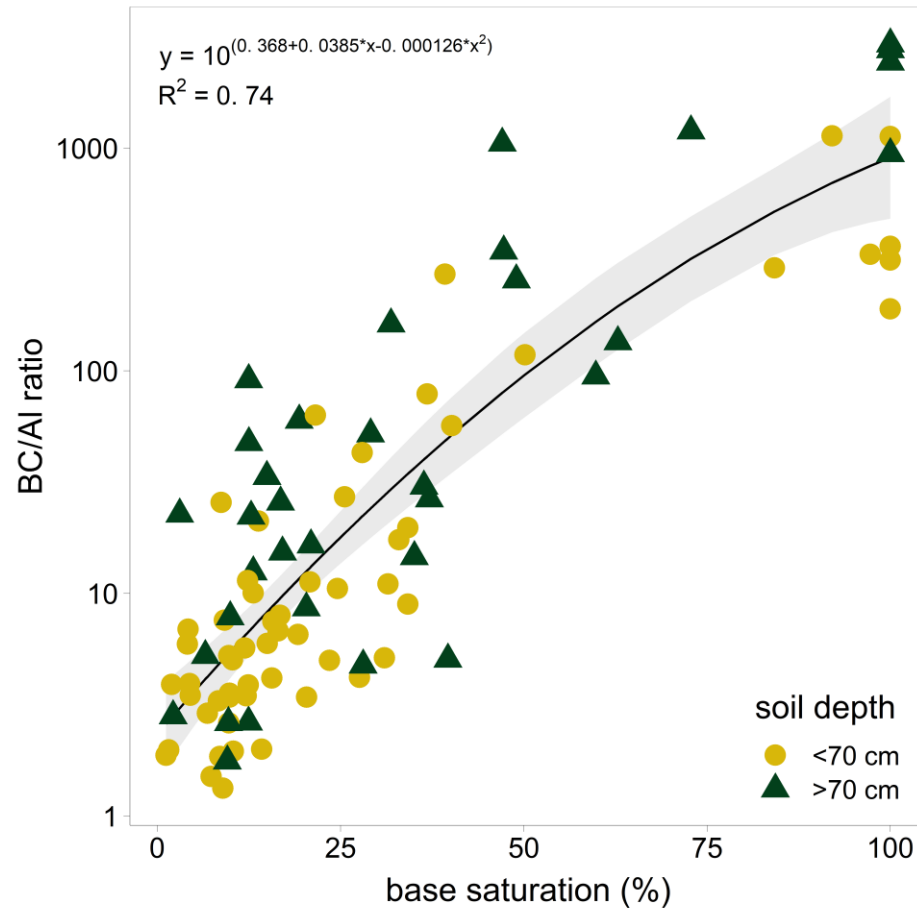


i.a. [Braun et al. 2017](#), [de Witte et al. 2017](#), [Braun et al. 2020](#)



Gradient studies based on Swiss monitorings

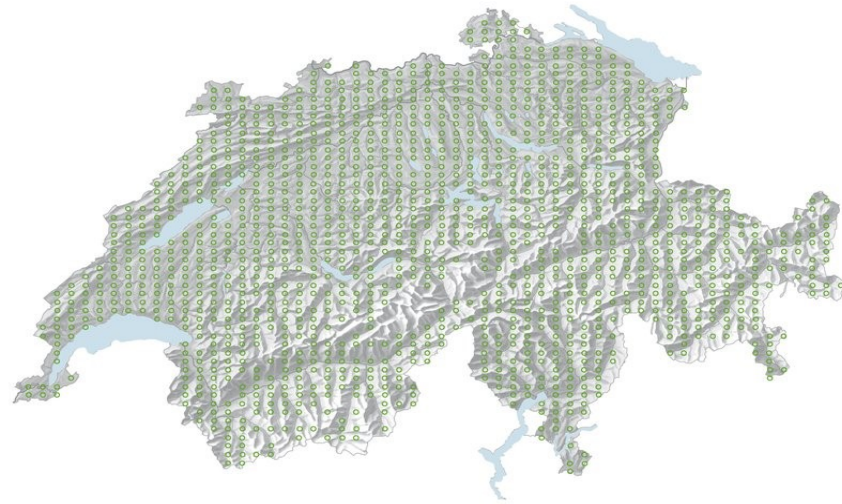
Investigations based on data from the cantonal forest monitoring



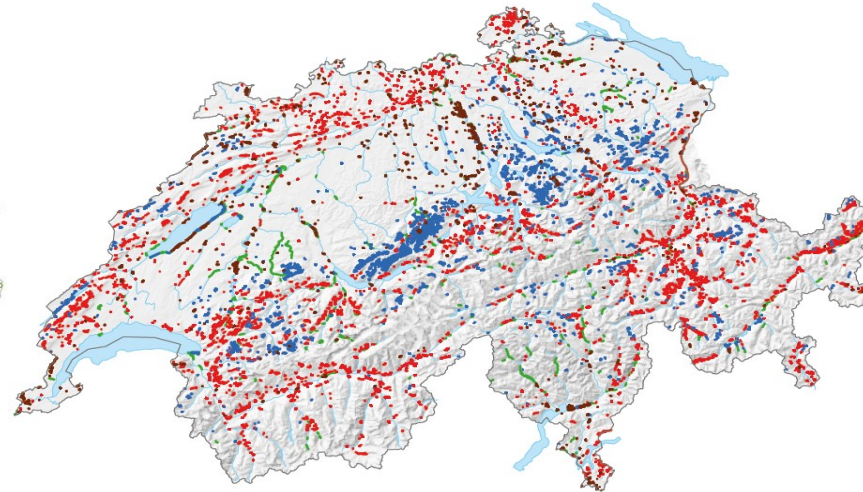


Objective: Combine information from Swiss monitorings

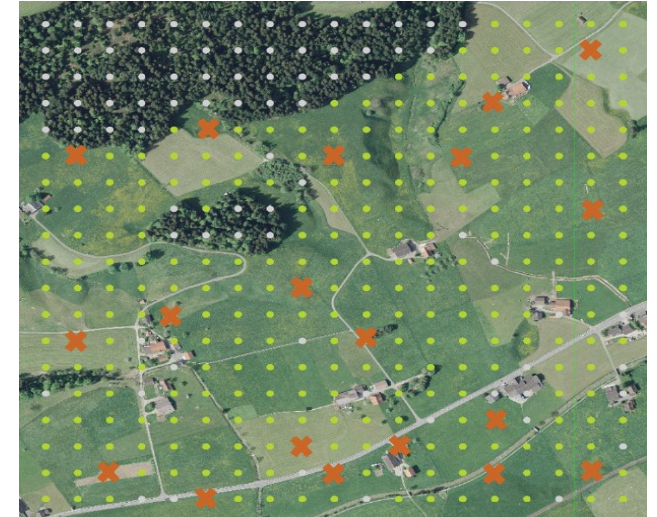
Swiss Biodiversity Monitoring



Monitoring the Effectiveness of Habitat Conservation in Switzerland



Agricultural Species and Habitats' Monitoring Programme



- ⇒ **Select ecosystems of interest with sufficient monitoring plots**
- ⇒ **Use change point models to determine critical loads for nitrogen**

Contribution to the review process

- Swiss Experts

Grassland-Ecosystems

Alpine Ecosystems

Forest Ecosystems

Fenlands

Lukas Kohli / Tobias Roth, Hintermann&Weber

Erika Hiltbrunner, University of Basel

Sabine Braun / Lucienne de Witte, IAP

Ariel Bergamini, WSL

- Contribute to coordination of review-work
- We offer to host a workshop for the review of the empirical critical loads in Switzerland