

Nitrate leaching and soil acidification in a long-term N-addition experiment to a sub-alpine forested catchment on Gleysol



Swiss Fed. Inst. for Forest, Snow and Landscape Research (WSL), Birmensdorf, Switzerland



Nitrogen addition experiment Alptal, central Switzerland

Picea abies forest on Gleysol over Flysch, 1200 m a.s.l., average temperature 6°C, precipitation 2300 mm/y. Paired-catchment experiment: addition of 22 kg N/ha/year as NH_4NO_3 dissolved in rain water. Control catchment with ambient deposition of 12 kg N/ha/year. Start of the experiment: 1995.

Precipitation chemistry

3 main trends:

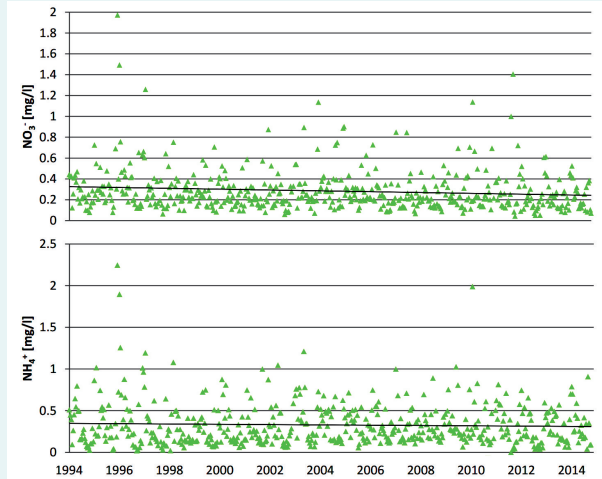
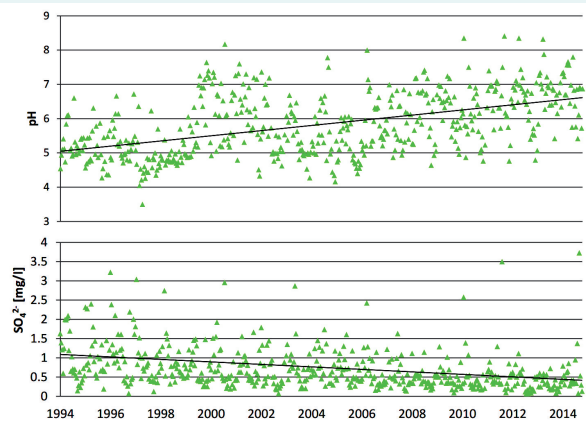
- pH ↑
- SO_4^{2-} ↓
- NO_3^- ↓

Also:

- Mg^{2+} ↑

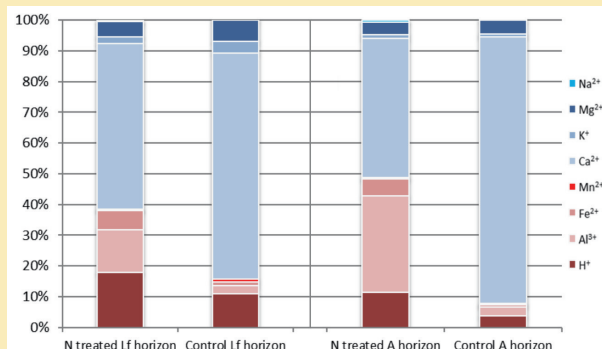
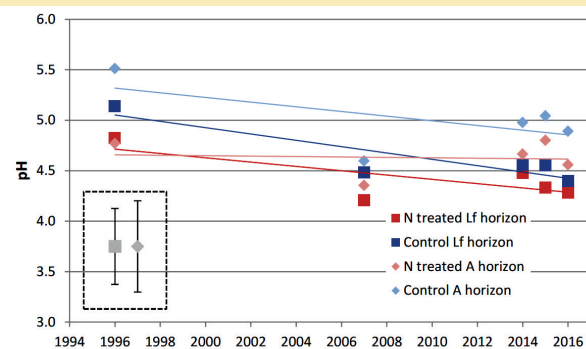
Not significant:

NH_4^+ , Ca^{2+} ,
 Na^+ , Cl^- , DON



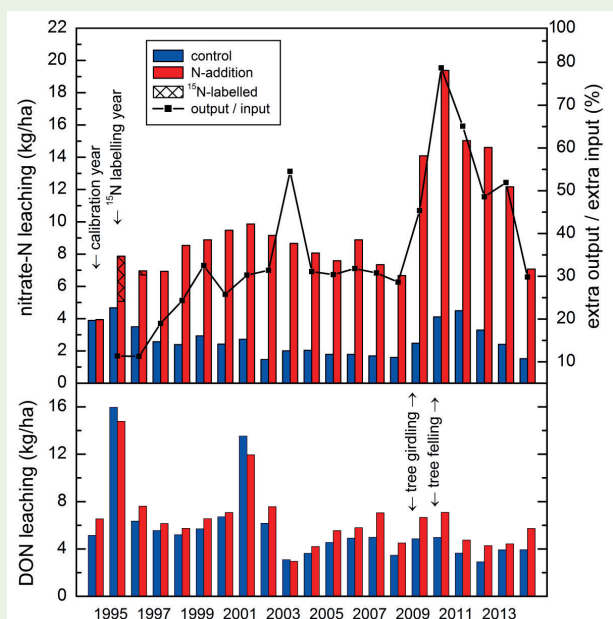
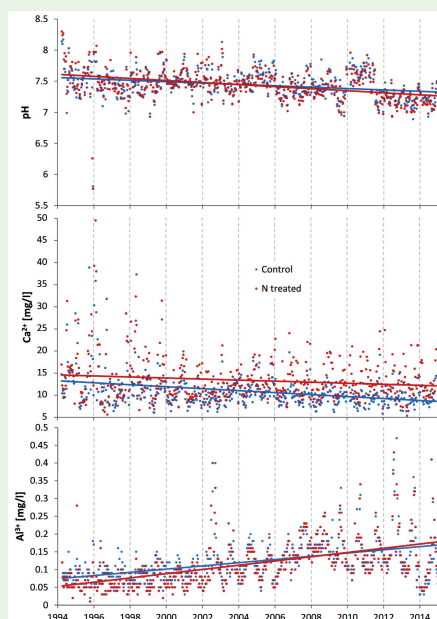
Soil acidification

pH ↓ in control and N-addition catchments.
N addition => loss of base saturation on mounds.



Runoff chemistry

Water pH ↓. Shift from Ca^{2+} to Al^{3+} leaching (also Fe^{3+} in the N-addition catchment). Strong increase in NO_3^- leaching due to N addition, also after tree girdling and felling 1/2 of the trees. NO_3^- leaching controlled by precipitation NO_3^- (fast preferential flow) and by tree uptake, as shown by ^{15}N labelling. Most of the added N retained in the ecosystem, mainly in soil.



Conclusions

Signs of soil and water acidification in spite of a well-buffered bedrock and decreasing acid deposition rates. N accumulation in the soil makes the forest more susceptible to NO_3^- leaching after disturbances.