On the relationship between forest status following bark-beetle disturbance and mineral N in soils of unmanaged mountain catchments: long-term *in situ* monitoring

Dinusha Nikagolla[1)], Petr Čapek[1)], Michal Choma[1)], Jiří Kaňa[1)2)], Eva Kaštovská[1)], Jiří Kopáček[2)], Karolina Tahovská*[1)]

University of South Bohemia in České Budějovice Faculty of Science

[1)] *Faculty of Science, University of South Bohemia, České Budějovice, Czech Republic*

[2)] *Institute of Hydrobiology, Biology Centre CAS, České Budějovice, Czech Republic*

BIOLOGY CENTRE CAS

Opening

Forest dieback leads in reduced N uptake by trees. In the absence of intervention, all plant biomass accumulates in the soil and is transformed by soil microbes. Varying N availability, influenced by vegetation status and microbial litter transformation, shows us how mountain forest soils retain N and produce NO_3^-. It also affects the leaching of other elements and the chemistry of nearby lakes . **The main aim of this study was to monitor inorganic nitrogen (IN) soil flux throughout the forest life.**

Approach

During the period of forest dieback from 2005 to 2020, soil nitrogen fluxes were measured in two spruce forest catchments, Plešné (disturbed) and Čertovo (control), in Šumava National Park using ion exchangers.

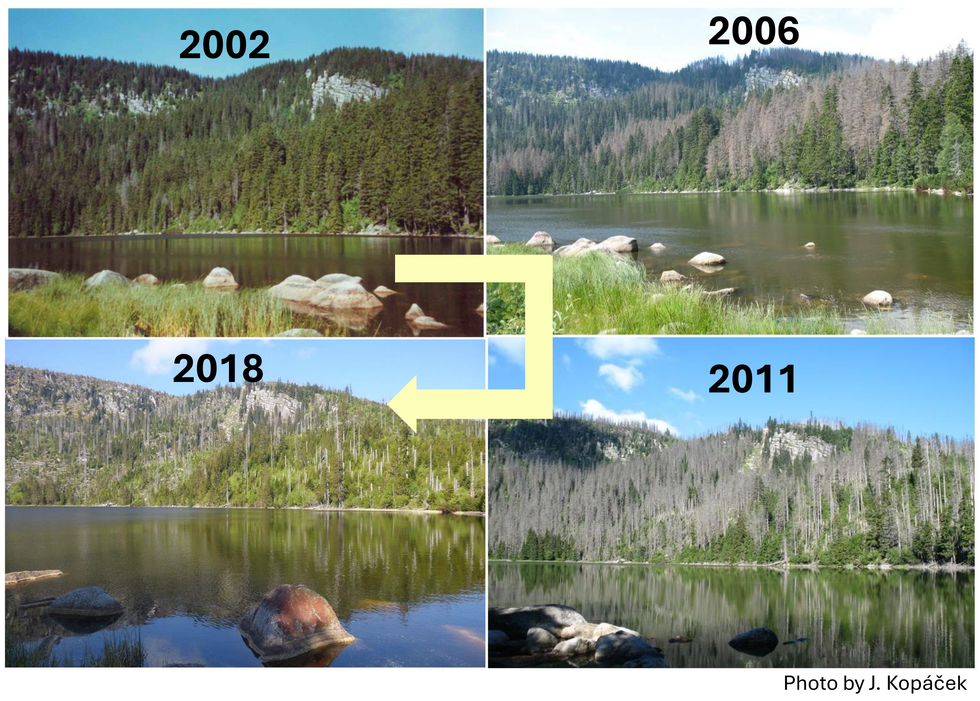


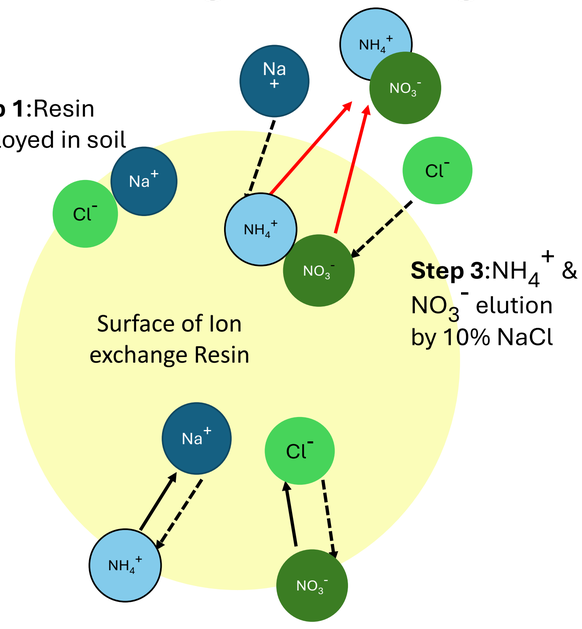
Photo by J. Kopáček

Forest regeneration after dieback in Plešné catchment

***Purolite* @**
A 520E
C 100E

Tahovská et al., (2016)

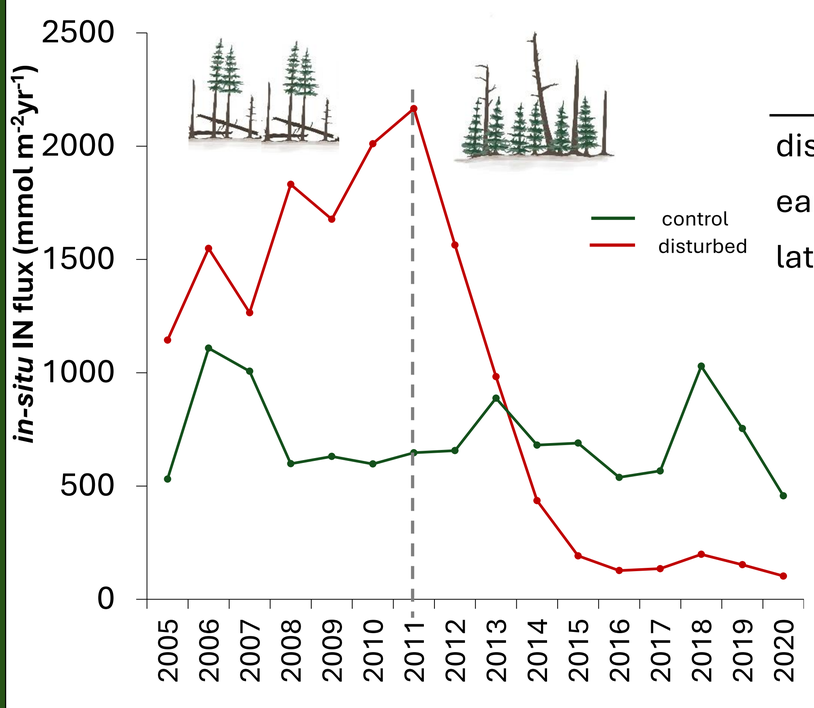
Ion-exchange resin traps (IER), Na^+ & Cl^- form deployed in soil 06-month period in LFH+A horizon



NH_4^+ & NO_3^- elution by 10% NaCl

Findings

Total *in-situ* soil IN flux (2005-2020)



- Forest dieback after five years in the disturbed catchment increased the flux of IN through the soil by up to 400% compared to control catchment
- Five years after the dieback, IN levels peaked and then quickly decreased to below the levels of the control catchment due to uptake by restored vegetation (2011-2016)

Average soil IN flux at different status

(mmol $m^{-2}yr^{-1}$)

status	disturbed	control
disturbation (2005-2011)	1663.30	731.46
early regeneration (2012-2016)	660.24	690.61
late regeneration (2017-2020)	147.45	701.59

- The IN flux in soil remains stable in the control catchment, whereas it decreases in the disturbed catchment

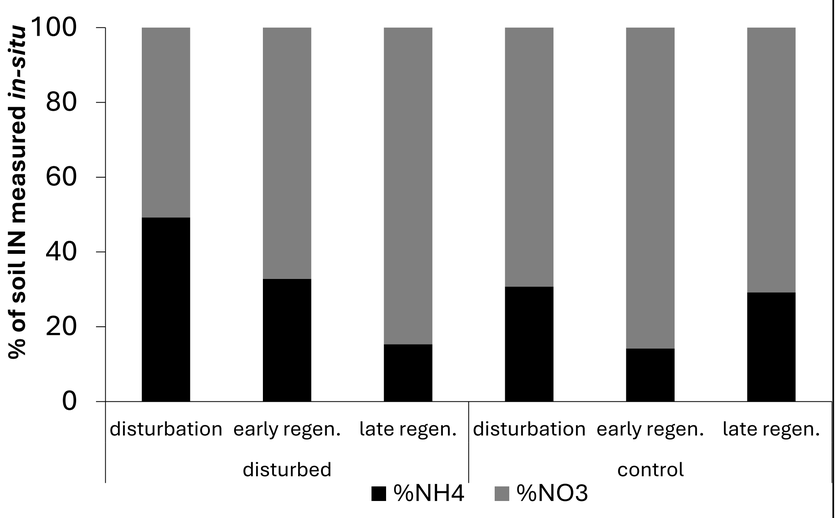
IN Catchment fluxes comparison

(mmol $m^{-2}yr^{-1}$)

year	catchment	terrestrial export	deposition forest floor	in-situ soil flux
2005	disturbed	125	98	1144
	control	86	109	531
2010/ 2011	disturbed	151	63	2166
	control	70	101	647
2016	disturbed	94	72	127
	control	69	94	538

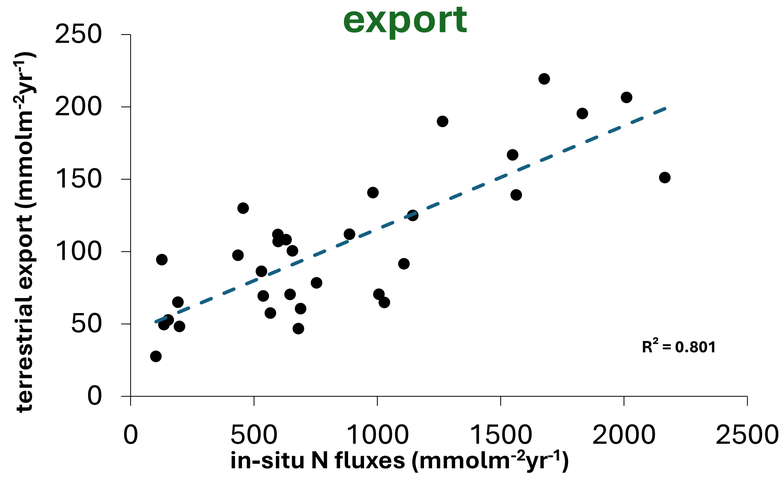
- The N flux through the soil was more than ten times higher than the terrestrial export of N at the peak of the disturbance, indicating a relatively effective use of N in the soils

Relative % inorganic N forms



- During forest disturbance, the ratio of NO_3^- to NH_4^+ in the soil was more or less similar, indicating a high rate of N mineralization

in-situ soil IN flux vs. terrestrial IN export



- The IER bag method is a valuable predictor of N losses to water bodies, as indicated by the significant regression between the soil flux data and catchment N export

Conclusion

The measured fluxes represent the maximum potential of such an ecosystem to supply a new generation of trees with available N if all biomass is left on site. This potential should be considered when defining management measures following disturbances in production forests.

Acknowledgement: This work was supported by the Czech Science Foundation, Project: 22-05421S

ICP FORESTS · MINISTRY OF AGRICULTURE OF THE CZECH REPUBLIC · Ministry of the Environment of the Czech Republic · Forestry and Game Management Research Institute

FORECOMON, PRAGUE, 11th JUNE 2024