Phosphorus leaching in beech forest soils as affected by fertilization and seasons

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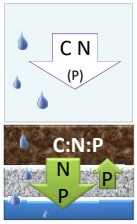
SPP 1685

Background

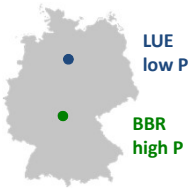


- Soil phosphorus (P) can become depleted during ecosystem development and may (co-)limit plant and soil microbial communities
- Leaching is a key pathway of P depletion, however can vary seasonally
- Anthropogenic activities may alter the balance between P and other major nutrients, such as nitrogen (N)

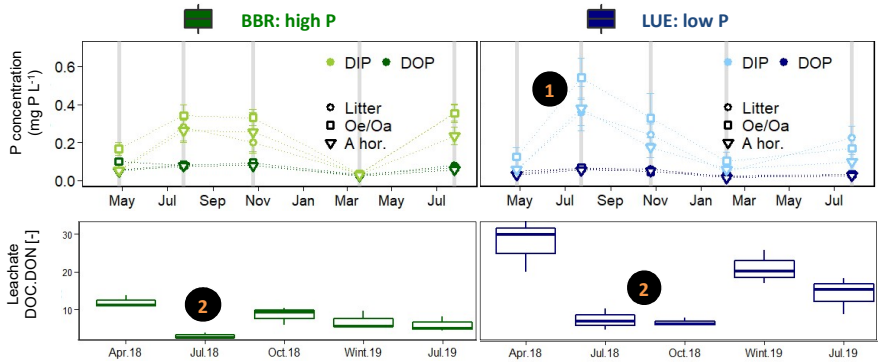
Aim: Quantify organic and inorganic N and P leaching as affected by **seasons** as well as **N and P fertilization**, and related to site specific C:N:P ratios

Methods

- 2 beech forest sites of **high** and **low** P stock with zero-tension lysimeters
- 3 fertilization treatments (N, P, and NxP) + control (3 reps)
- (150 kg/ha N as NH_4NO_3, in 5 applications, starting 2016, 50 kg/ha P as KH_2PO_4, 1 application in 2016)
- 3 soil depths
- 4 seasons
- Controlled irrigation, 20 L m^{-2} h^{-1}

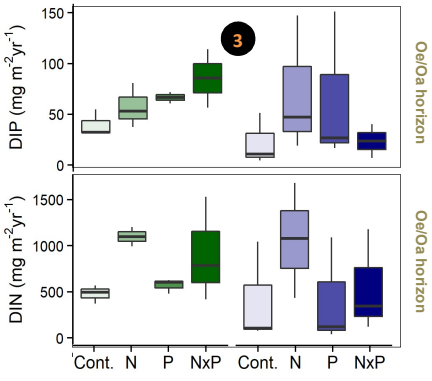


Results



1. Inorganic nutrients showed strong seasonal patterns, whereas organic forms remained rather constant
2. Particular narrow DOC:DON ratios in the hot and dry summer 2018 suggest a release of microbial N and P due to cell lysis by drying an rewetting (increased P leaching)
3. **Increase in total P leaching with fertilization in the Oe/Oa horizons**

	High P (BBR)	Low P (LUE)
+ N	+ 33%	+ 198%
+ P	+ 51%	+ 156%
+ NxP	+75%	+ 10%



Fertilization effects on inorganic P leaching were site dependent and stronger at the low P site. N leaching increased consistently with N fertilization. Organic nutrients were not (DOP) or less (DON) affected.

References

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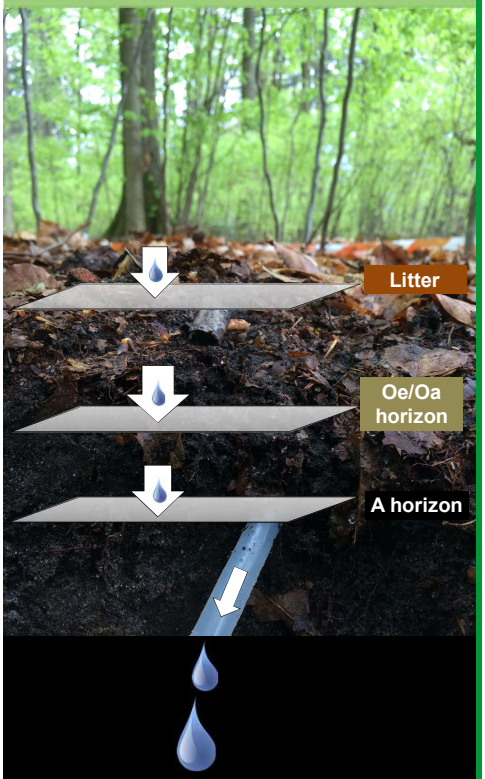
Main findings

Susceptibility to climatic changes

Inorganic nutrient leaching	>	Organic nutrient leaching
Phosphorus	>>	Nitrogen



Conclusions

- **Nutrient-limited** ecosystems are especially **susceptible** to changes in N and P input and in the nutrient balance
- Estimated **P fluxes** from the organic layers were **comparable** in magnitude to reported **inputs**
- Changes in climate towards more frequent dry and hot extremes seem to **accerlate N and P leaching**