

Microbial community structure and function in fens: responses to climate change

Lucia Sekulová

Luca Bragazza, Alexandre Buttler, Michal Hájek

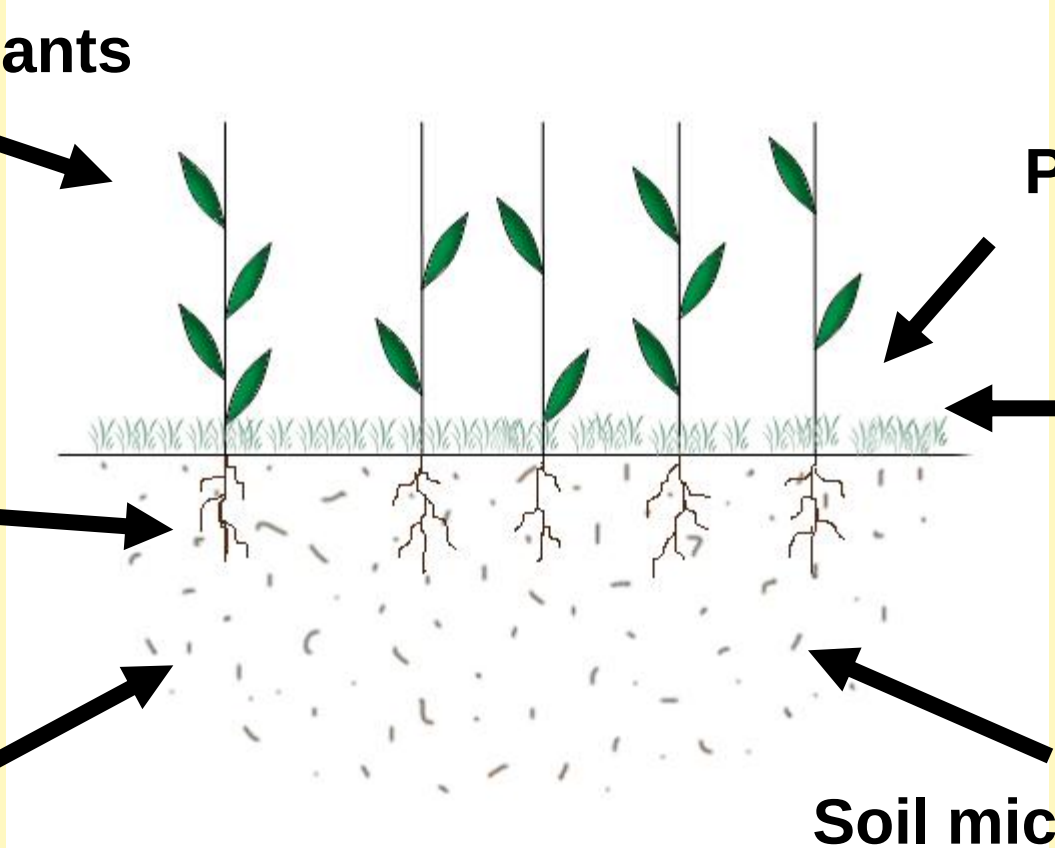
Presentation structure

- Project introduction
- Methods
- Preliminary results
- Conclusions
- What comes next

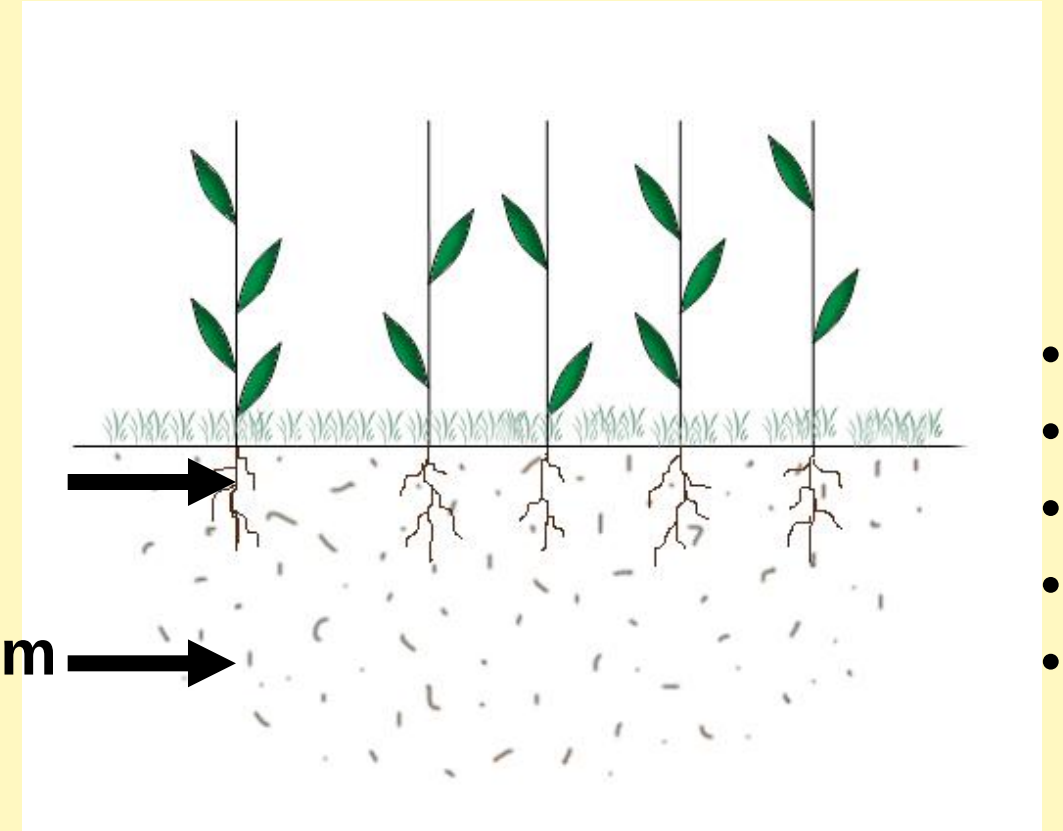
Introduction of the projects

- Response of peatlands to climate change-crucial for global C cycle
- Complexity of organic-mineral layered soil
- Aboveground-belowground traditionally considered isolated
- Microorganism-plant interactions still unclear

Aboveground and belowground feedbacks for nutrient acquisition in fens



Enzymatic activity in upper peat layer and below lying mineral layer of fens



3 to 8 cm

20 to 25 cm

- **Phenol oxidase**
- **β-glucosidase**
- **Phosphatase**
- **Chitinase**
- **Leucine aminopeptidase**

Introduction

- Mineral-rich fens (*Caricion davallianae*)
- *C. flava, C. panicea, C. flacca, Parnassia palustris, Potentilla erecta*
- *Palustriella commutata,*

  Scorpidium cossonii

Introduction

- 4 sites along the altitudinal gradient

  (815 to 2080 m a.s.l.)
- pH 6.5 to 8
- Conductivity 80 to 120 $\mu S.cm^{-1}$

Hypotheses

- (i) Microbial biomass is higher at lower altitudes which is reflected in higher enzymatic activities.
- (ii) Nutrient uptake by microbes decreases with altitude and soil depth.
- (iii) Microbial enzymatic activity is inversely correlated with the microbial nutrient biomass for each specific nutrient.

Study sites

Enney 815 m a.s.l.

Queue de Perche (1700 m a.s.l.)

Marais de la Lia 2080 m a.s.l.

Methods

- Enzymatic activity: extraction of peat samples

  -Phenol oxidase: spectrophotometrically by using 10 mM L-dopa (dihydroxyphenylalanine) solution as substrate according to Pind et al. (1994)

  -Hydrolase activities: using fluorescent substrate according to Freeman et al. (1995)

Methods

- Total microbial nitrogen: Shimadzu TOC-TN analyzer
- Microbial biomass: Phospholipid fatty acid analysis (PLFA)

Results

Microbial biomass (PLFA) in November

Site	Layer	Gram +	Gram-	Bacteria (Gram + & Gram -)	VAM	Fungi	Fungi/ Bacteria	Total abundance
815 m	Organic	0.100	0.201	0.302	0.040	0.025	0.099	0.336
815 m	Mineral	0.070	0.196	0.267	0.032	0.026	0.090	0.355
2080 m	Organic	0.068	0.160	0.228	0.045	0.036	0.147	0.309
2080 m	Mineral	0.014	0.031	0.045	0.004	0.007	0.178	0.056

µmol (FAME).g-1 dry soil

Results

Microbial biomass (PLFA) in November

Site	Layer	Gram +	Gram-	Bacteria (Gram + & Gram -)	VAM	Fungi	Fungi/ Bacteria	Total abundance
815 m	Organic	0.100	0.201	0.302	0.040	0.025	0.099	0.336
815 m	Mineral	0.070	0.196	0.267	0.032	0.026	0.090	0.355
2080 m	Organic	0.068	0.160	0.228	0.045	0.036	0.147	0.309
2080 m	Mineral	0.014	0.031	0.045	0.004	0.007	0.178	0.056

µmol (FAME).g-1 dry soil

Results

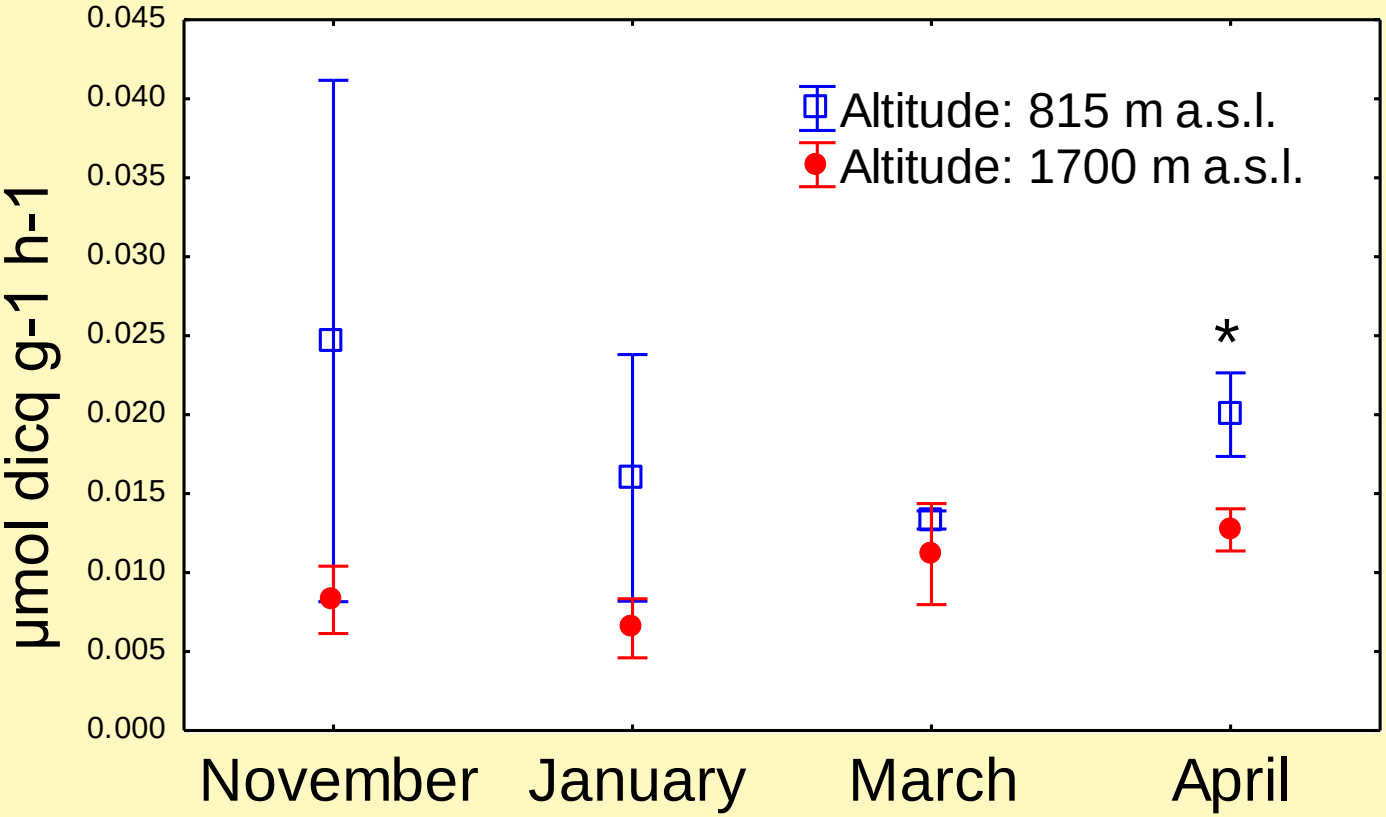
Microbial biomass (PLFA) in November

Site	Layer	Gram +	Gram-	Bacteria (Gram + & Gram -)	VAM	Fungi	Fungi/ Bacteria	Total abundance
815 m	Organic	0.100	0.201	0.302	0.040	0.025	0.099	0.336
815 m	Mineral	0.070	0.196	0.267	0.032	0.026	0.090	0.355
2080 m	Organic	0.068	0.160	0.228	0.045	0.036	0.147	0.309
2080 m	Mineral	0.014	0.031	0.045	0.004	0.007	0.178	0.056

µmol (FAME).g-1 dry soil

Results

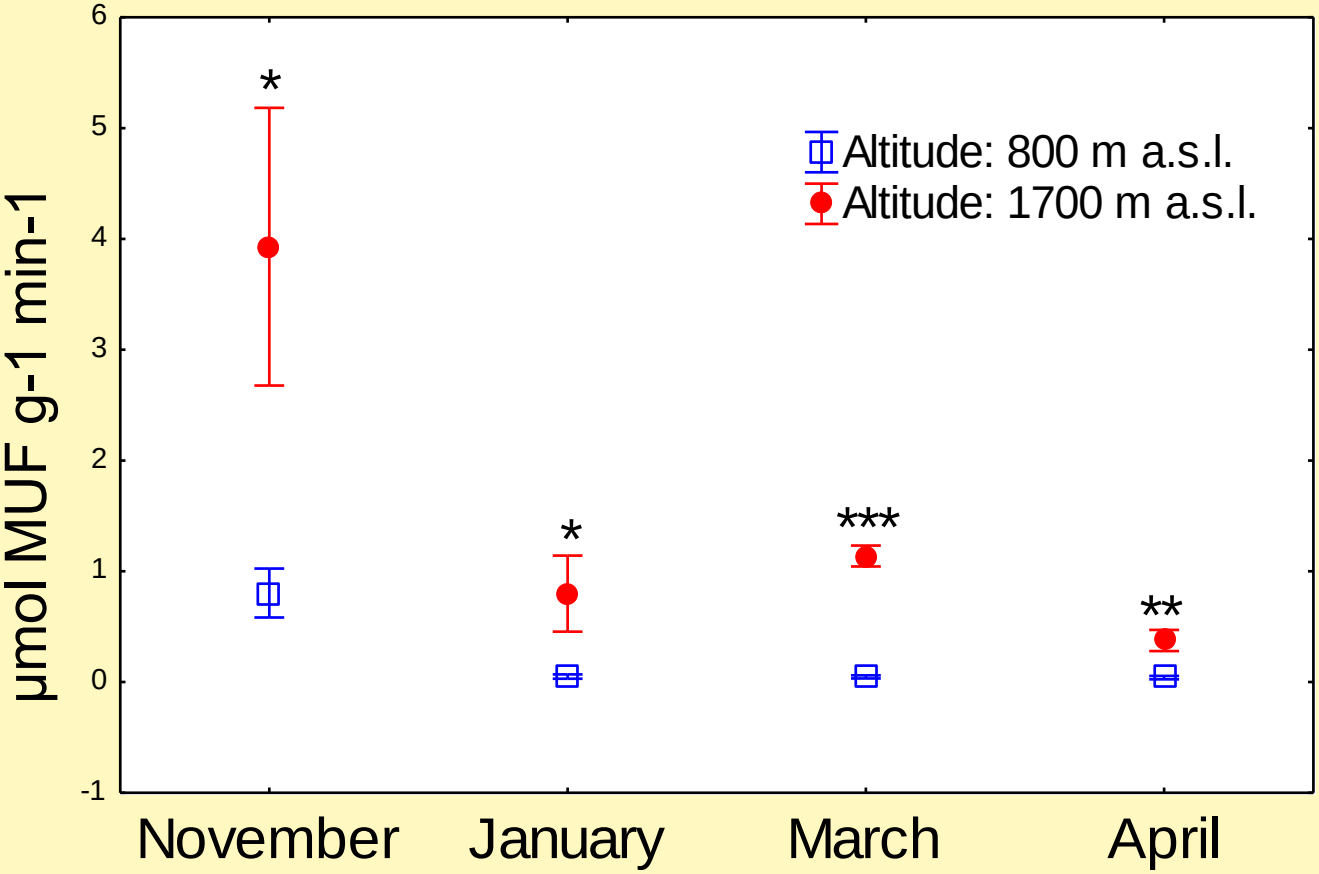
Enzymatic activity of phenol oxidase



Organic layer

Results

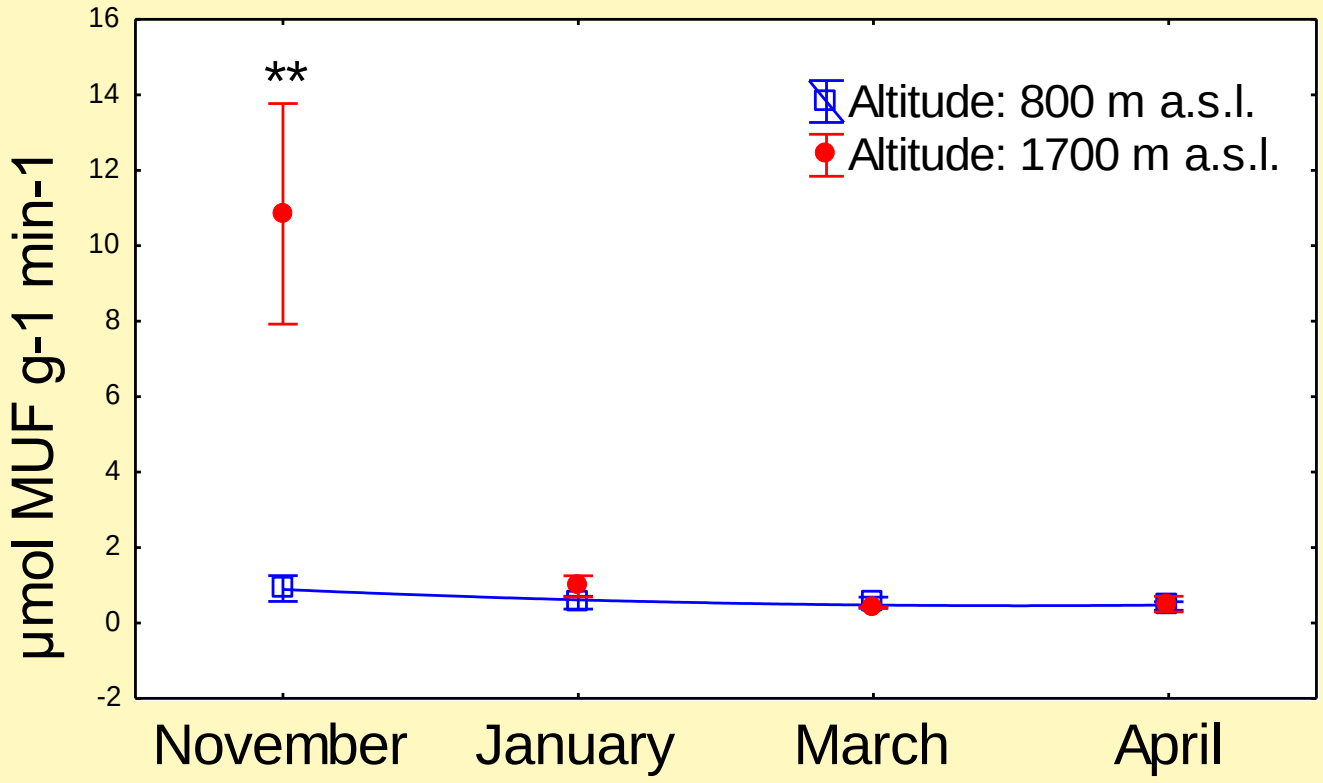
Enzymatic activity ofβ-glucosidase



Organic layer

Results

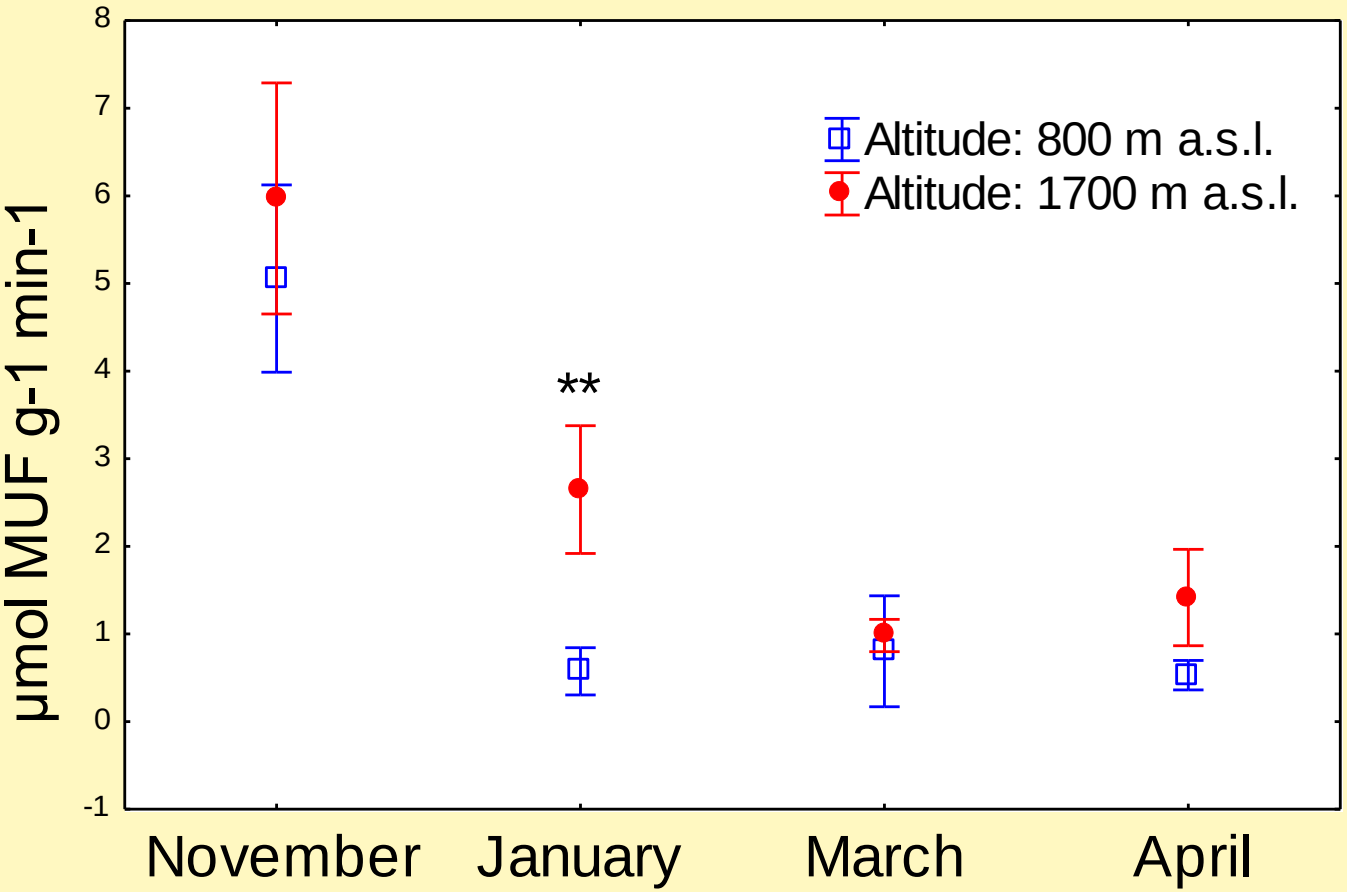
Enzymatic activity of leucine aminopeptidase



Organic layer

Results

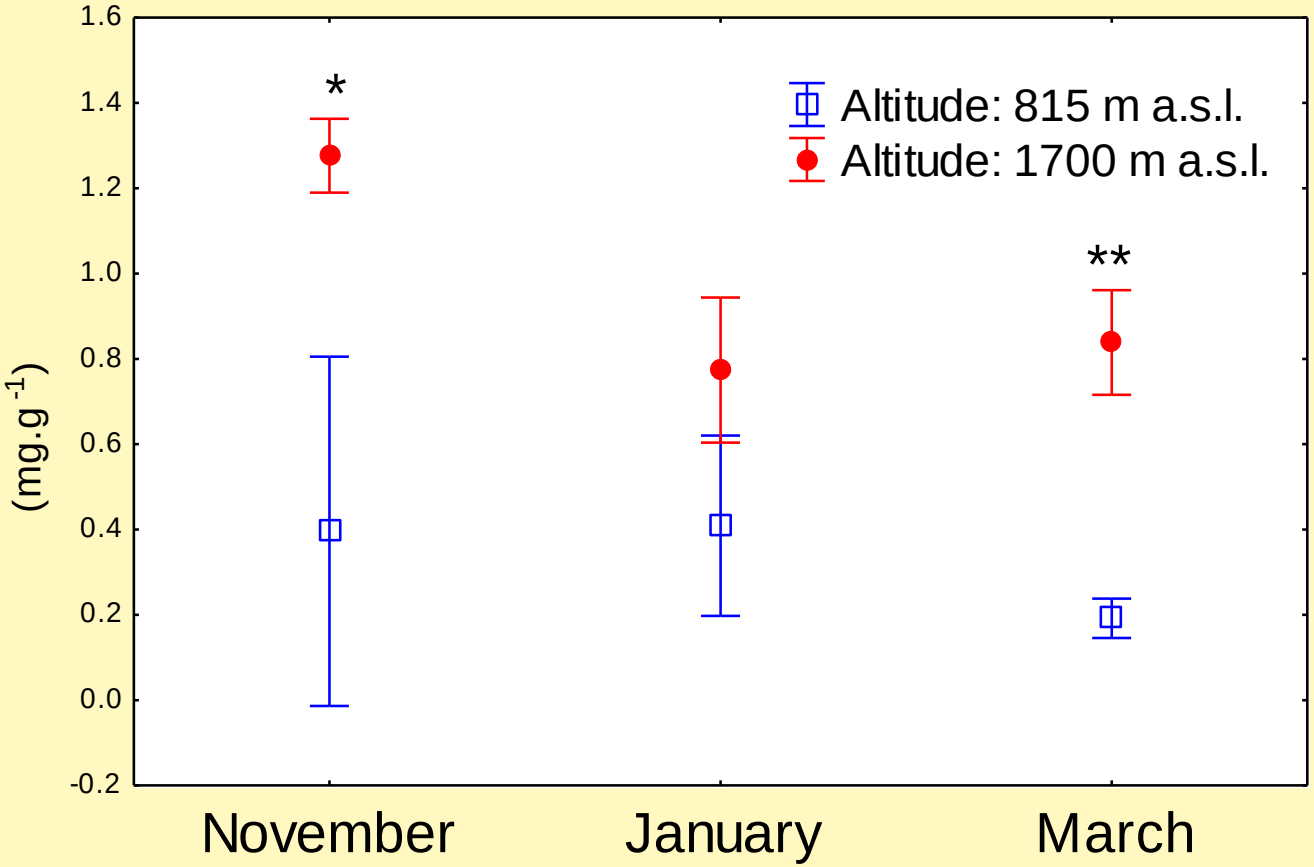
Enzymatic activity of phosphatase



Organic layer

Results

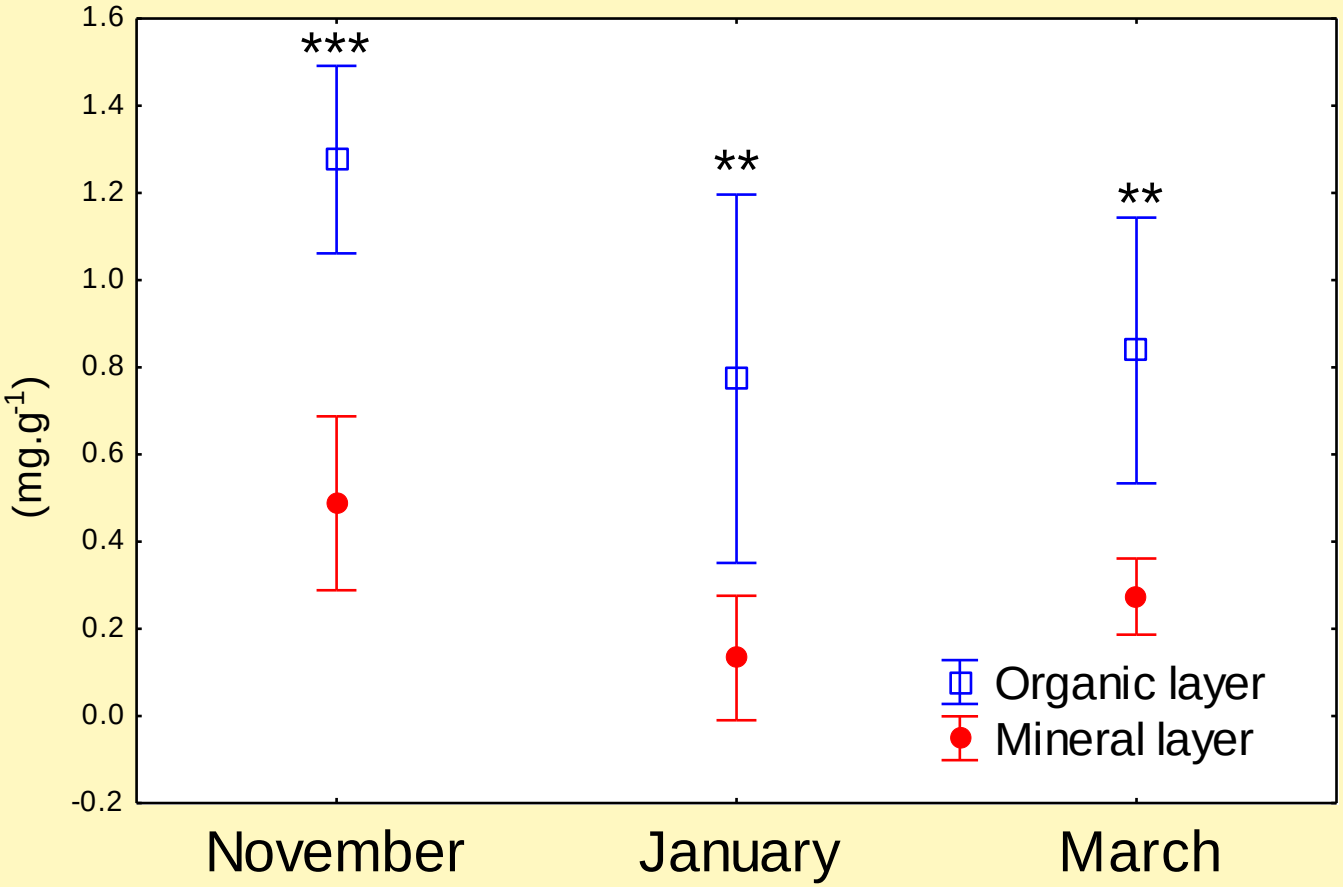
Total microbial nitrogen



Organic layer

Results

Total microbial nitrogen



Altitude:
1700 m a.s.l.

Conclusions

- (i) Microbial biomass is higher at lower altitudes which is reflected in higher enzymatic activities.

- True for microbial biomass, not true for all enzymes in winter

Conclusions

- (ii) Nutrient uptake by microbes decreases with altitude and soil depth.

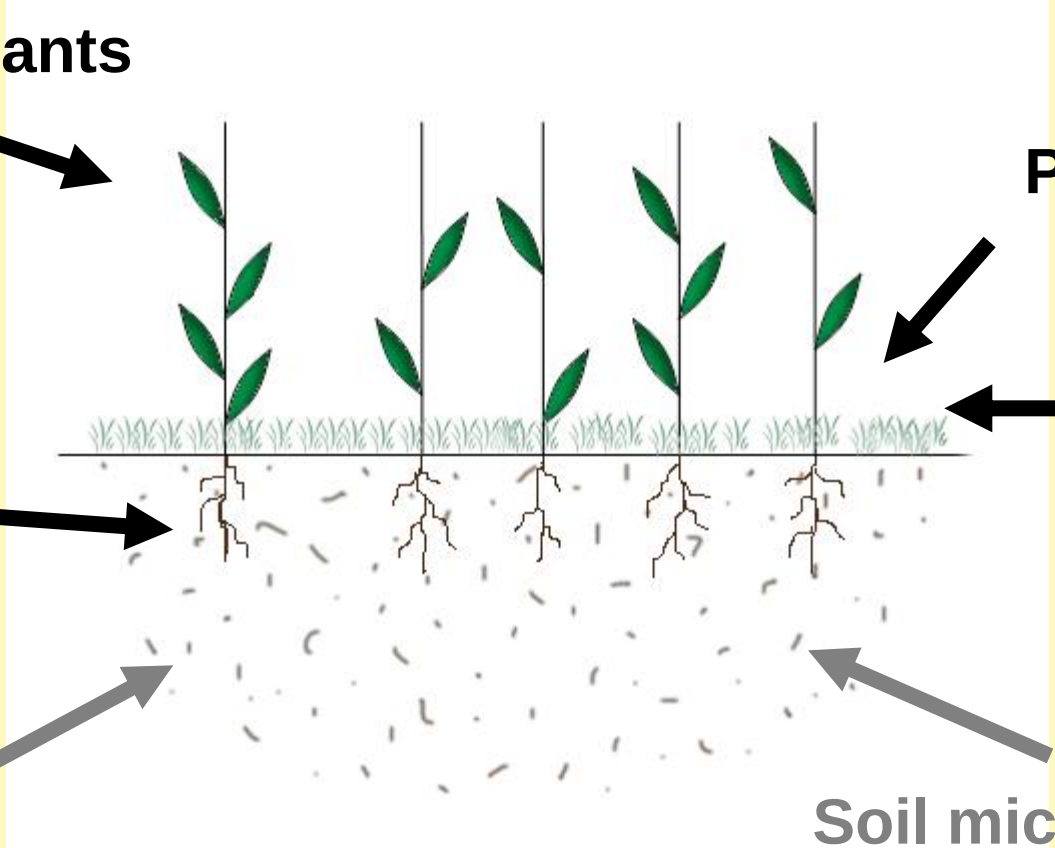
- True for soil depth, not true for altitude in winter

Conclusions

- (iii) Microbial enzymatic activity is inversely correlated with the microbial nutrient biomass for each specific nutrient.

- More data needed

What comes next



Thank you for your attention...

SCIEX projects NUTRIF and ENZYFEN