

Ectomycorrhizal community composition and function across a forest-heath ecotone in northern Sweden

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Background

Widespread warming in the Arctic is occurring at faster rates and higher magnitudes than in lower latitudes. Consequently, shrubs are expanding into the tundra. Forest-heath ecotones provide a 'space for time' glimpse of warming impacts on these ecosystems and their processes



Tundra heaths store a large amount of carbon in soils and relatively little in aboveground biomass.

Subarctic *Betula pubescens* forests have more aboveground biomass, but less net carbon than heaths. The mechanisms involved with the shift in carbon storage from below to above ground are poorly understood.

Ectomycorrhizal fungi (ECM), which are symbiotically associated with shrubs and trees expanding into tundra heaths, may differ in community composition and function as ecosystems become woodier.

A natural defoliation event thought to increase with warming provides an additional factor to explore how ECM communities may be altered by climate change.

Objectives

Characterize changes in:

- Ectomycorrhizal community composition and function
- Soil properties and nutrient content
- Dominant vegetation and shrub cover

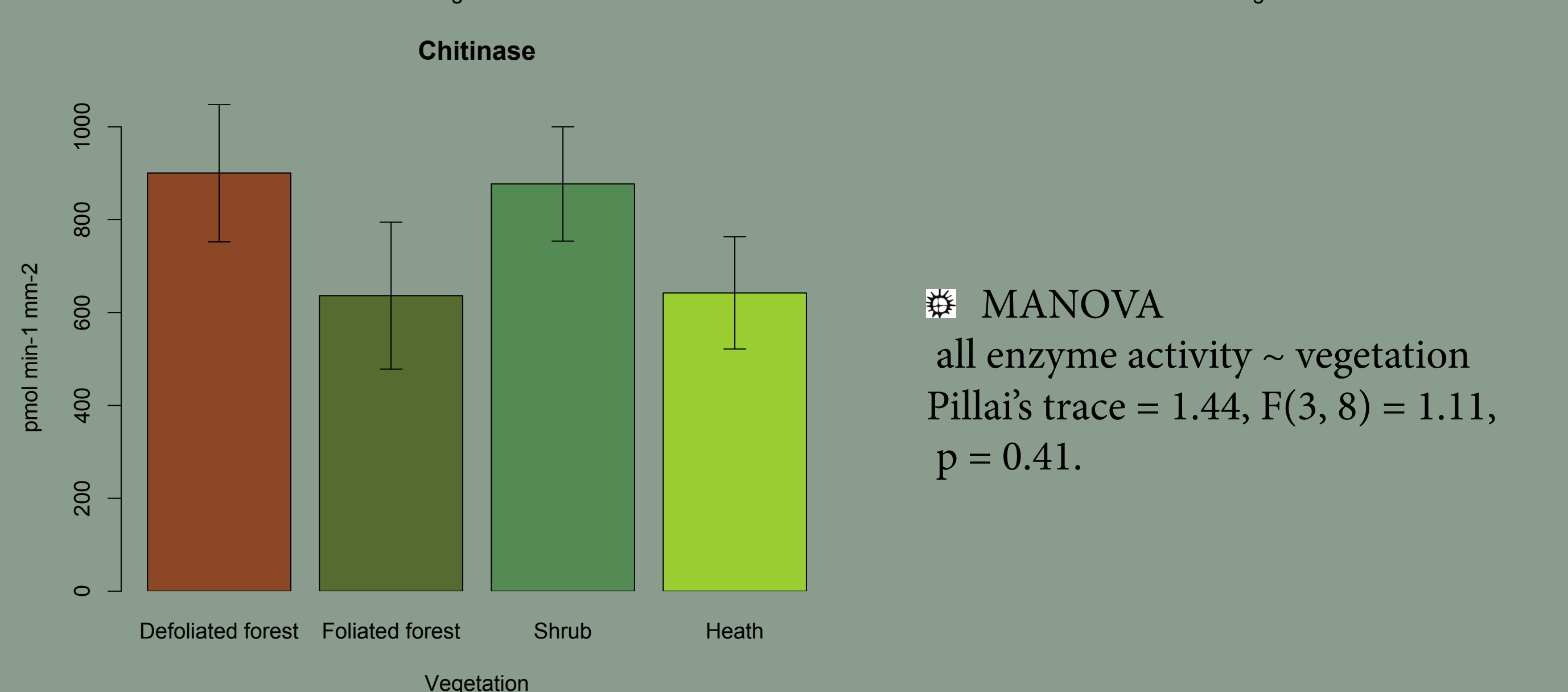
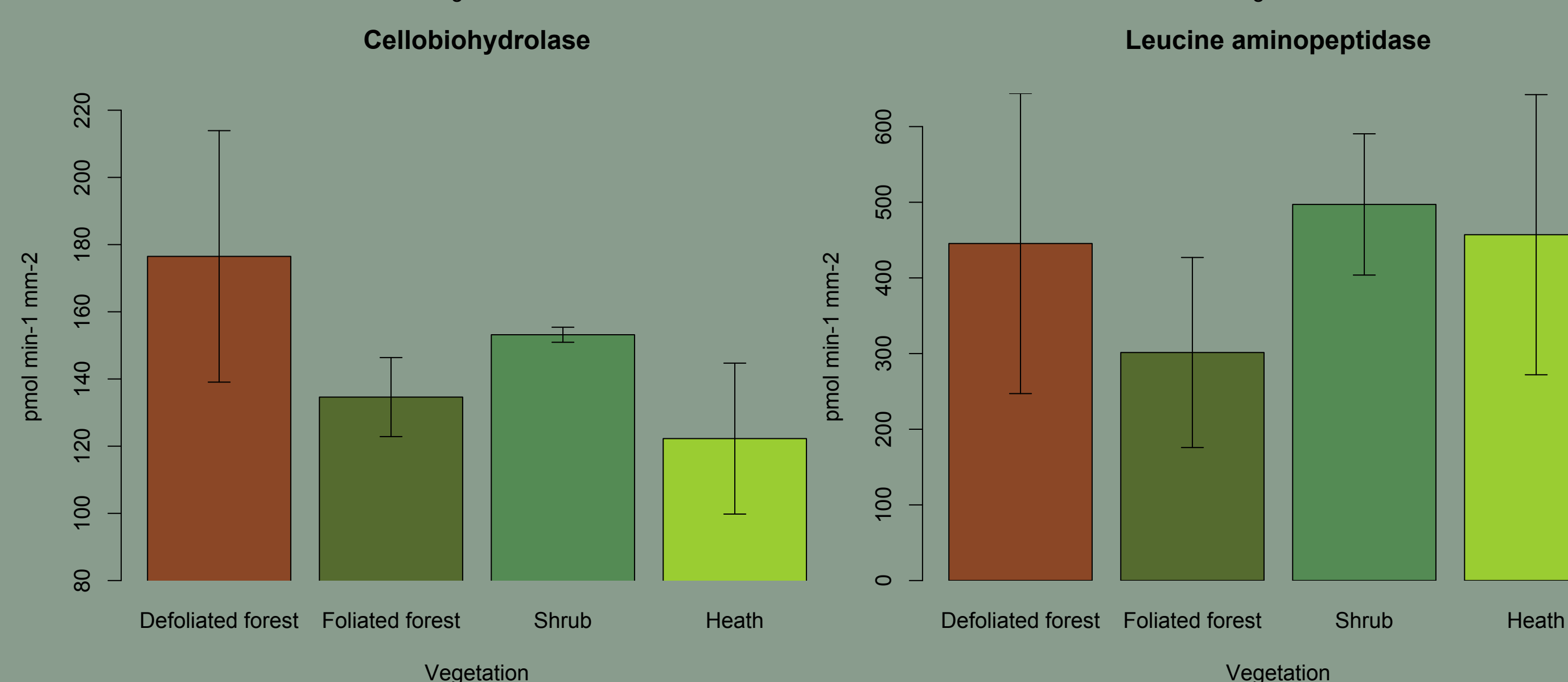
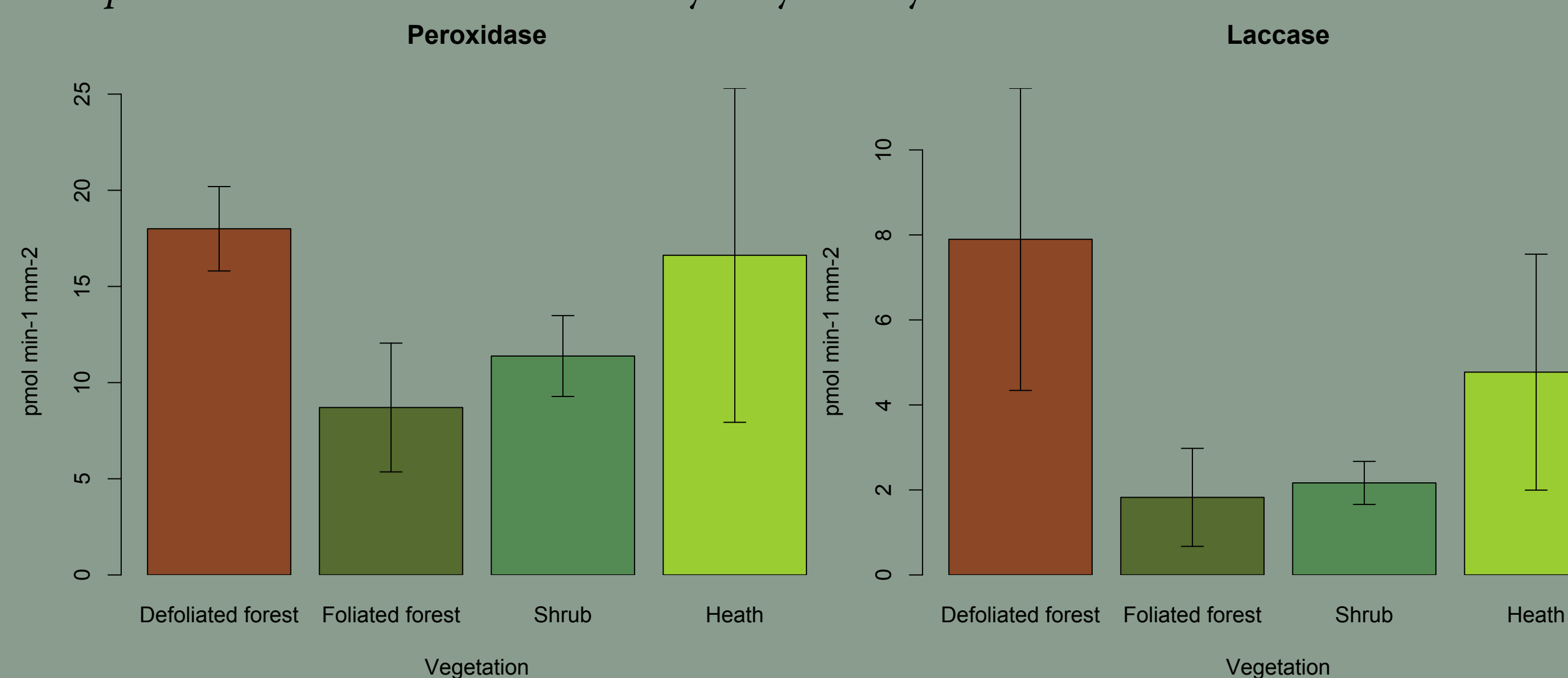
across a forest-heath ecotone and among foliated and defoliated *Betula pubescens* forest in subarctic uplands near Abisko, Sweden.

Methods

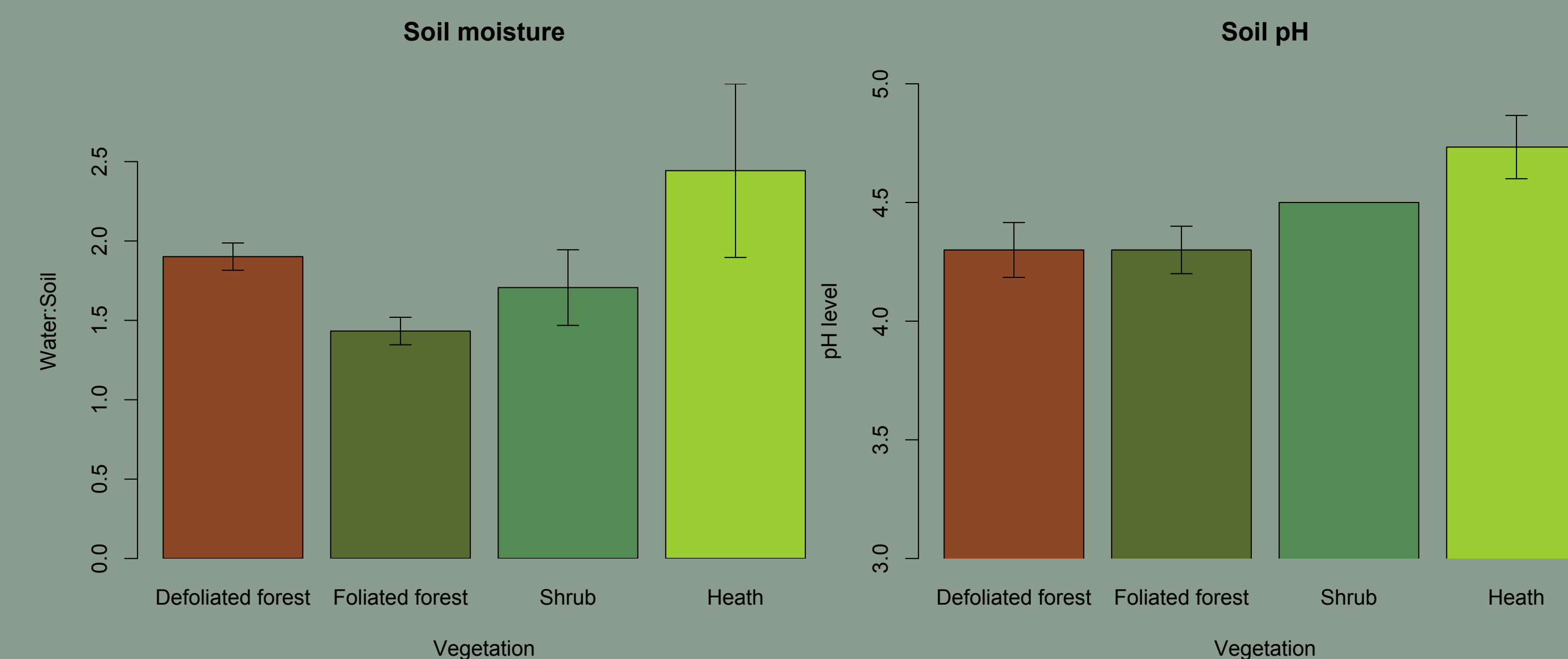
- Collected soil cores from four vegetation sites—heath, shrub, defoliated forest, and foliated forest—along three transects across the ecotone.
- Isolated 48 healthy ECM root tips per soil sample for enzyme assays and DNA sequencing
- Determined soil moisture and pH and prepared soils for nutrient analysis
- Recorded and photographed dominant vegetation in each cell of two 8 x 8 grid quadrats per sample site.
- Measure stem heights of ECM shrubs in each quadrat

Results

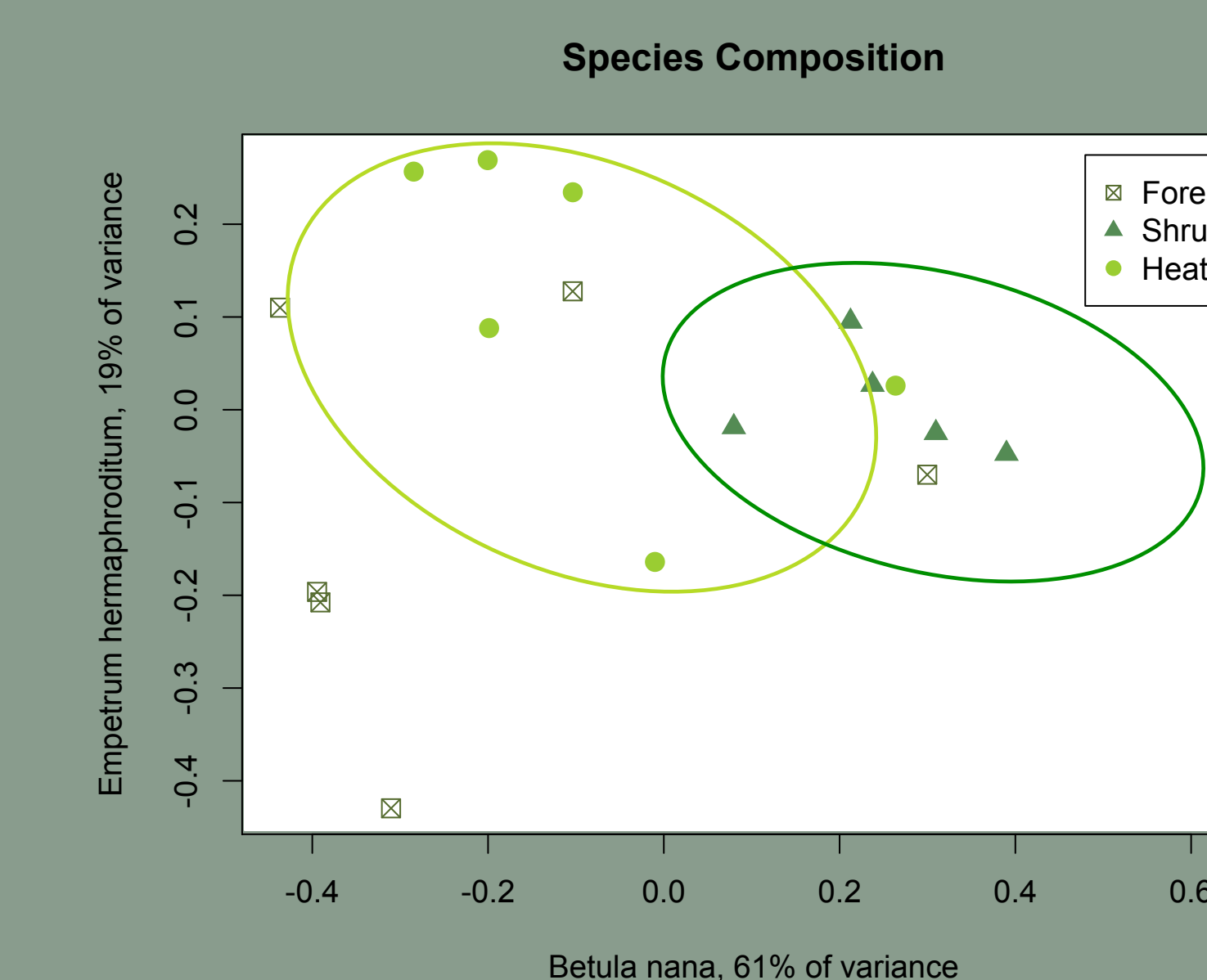
- Oxidative enzyme activity decreased as ecosystem shifted from tundra heath to birch forest.
- Defoliated *Betula pubescens* had higher enzyme activities compared to foliated *B. pubescens* for both oxidative and hydrolytic enzymes.



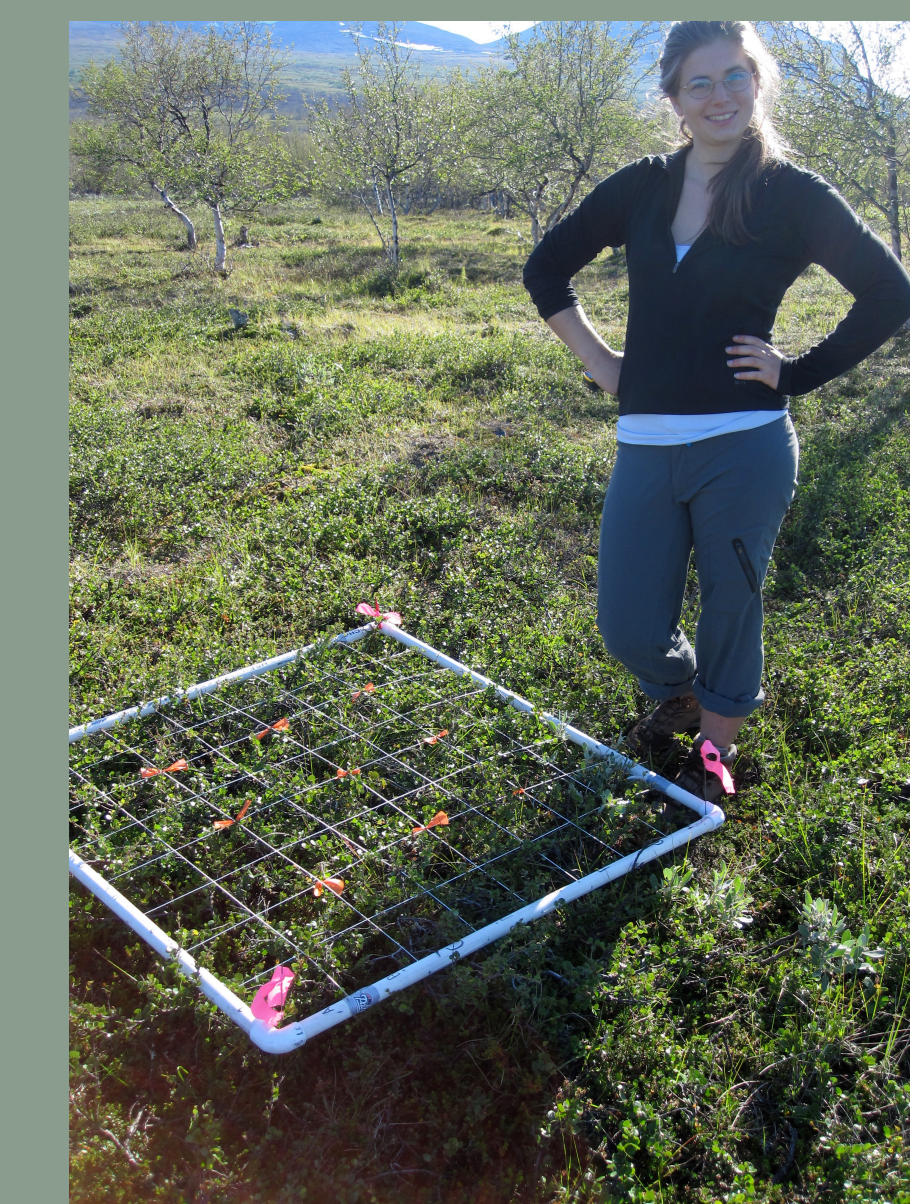
MANOVA
all enzyme activity ~ vegetation
Pillai's trace = 1.44, F(3, 8) = 1.11,
p = 0.41.



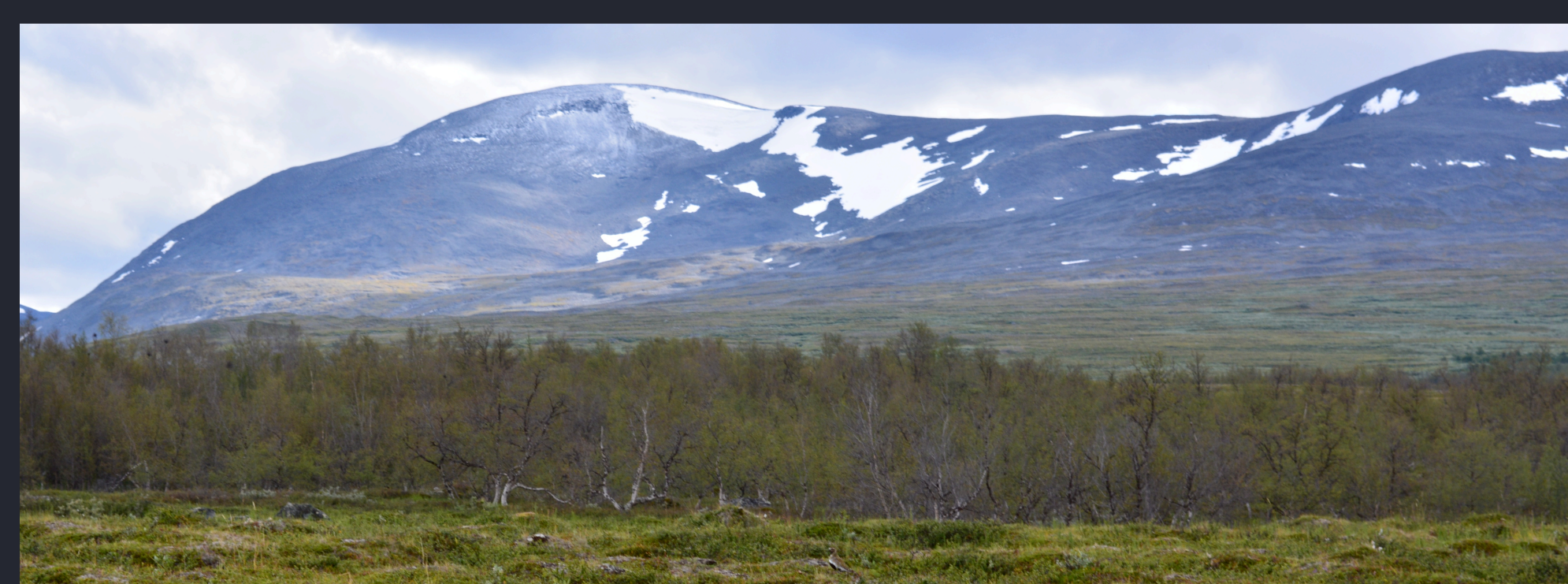
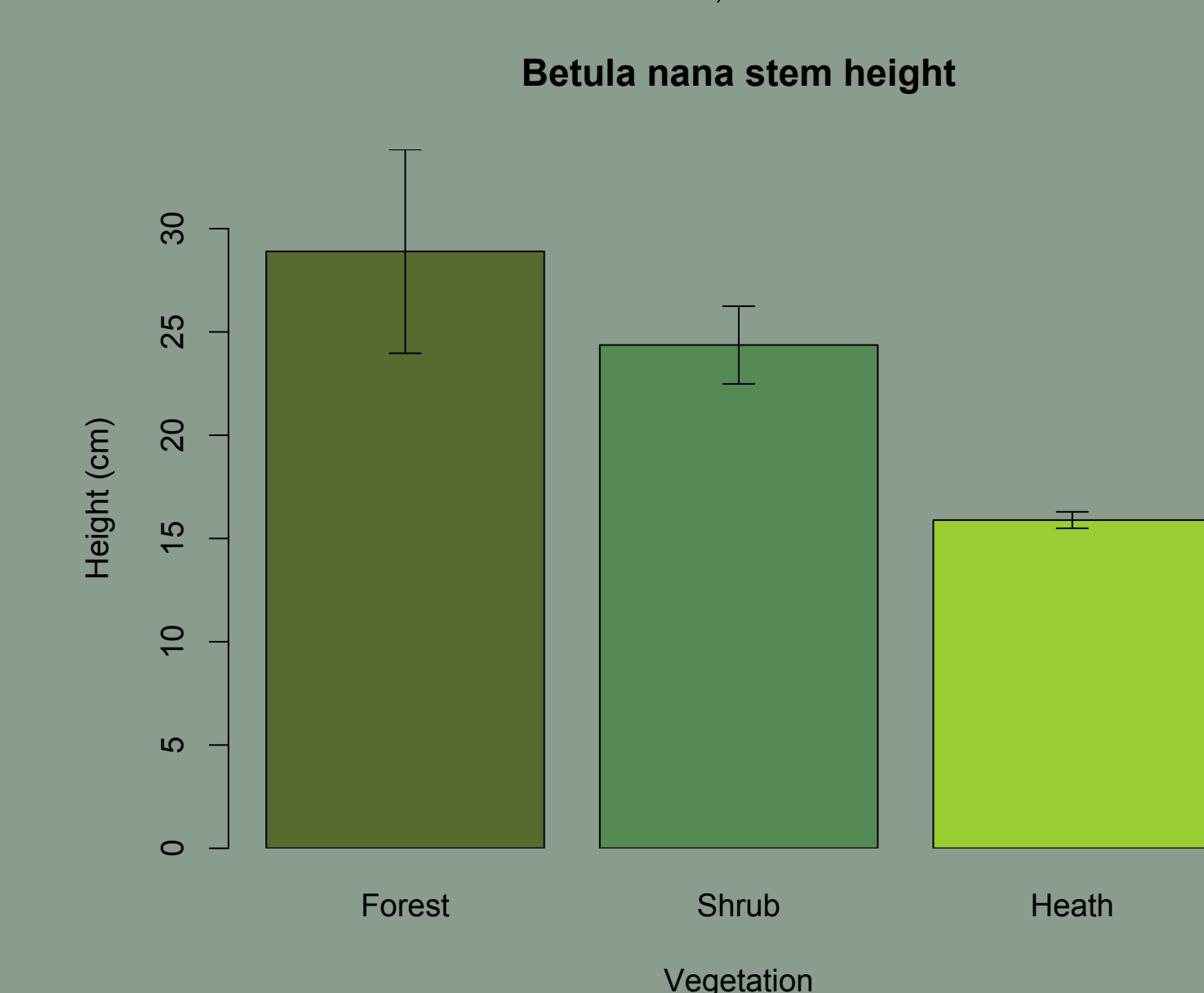
Soil was moister and less acidic from birch forest to tundra heath.



Principle components analysis based on dominant vegetation percent cover



Heath sites were dominated by *Empetrum hermaphroditum*, shrub sites by *Betula nana*, and forest site understories were sparse
Betula nana height significantly decreased from forest to heath (p = .004).



Conclusions

Woody encroachment may significantly alter ECM function.

Further community composition and soil nutrient content results as well as remote sensing applications will provide more detailed insight into the processes at work.

Acknowledgements

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