Relating self-regulation with ecosystem structure and function in northern peatlands

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Peatlands

- Net Primary Production ➔ Decomposition
- 2-3% of total land surface; store 25-30% of the world’s soil carbon
- Carbon patterns and drivers related to internal feedbacks and external factors
Peatlands

- Carbon patterns and drivers related to internal feedbacks and external factors
- Peatlands are considered to be self-regulated systems
- Important to understand self-regulation, given climate change scenarios
Core of research proposal

Structure
1) Vegetation
2) Microtopography
3) Water table

Function
1) Net Ecosystem Exchange
2) Decomposition

Figure modified from Dr. Melanie Vile
Study Sites

Stordalen Mire, Sweden
- Primary site
- Steep ecological gradients
- Variable degrees of self-regulation within site: permafrost, hydrology

Mer Bleue Bog, Canada
- Ombrotrophic bog without steep ecological gradients
- More self-regulated and homogeneous
Stordalen Mire

Photo: J. Åkerman (Courtsey: David Olefeldt)
Preliminary Data: Relationship between Vegetation and Microtopography

- Point intercept method + Elevation data
- Stordalen and Mer Bleue (different spatial scales)
Vegetation and Microtopography

Elevation and # of species:
No longer significant!

Elevation data courtesy of Dr. Andreas Persson
Vegetation and Microtopography

Elevation and # of species:
No significant relationships at Mer Bleue (sub-site level)

Elevation data courtesy of Paul Wilson
Stordalen veg. overview
(Site Level Scale)

Number of hits per species per quadrat

Litter
Lichens
Moss

Elevation data courtesy of Dr. Andreas Persson
Mer Bleue veg. overview: sample transect
(Sub-site Level Scale)

Bryophyte layer (percent cover)

Eriophorum vaginatum

Vaccinium myrtilloides
Ledum groenlandicum

Kalmia angustifolia
Oxycoccus microcarpus

Chamaedaphne calyculata
Maianthemum trifolium

Elevation (m)

Quadrat number

Litter $R^2 = 0.56$ (p=0.01)

$R^2 = 0.54$ (p=0.01)

$R^2 = 0.46$ (p=0.03)
Preliminary Data Conclusions

1. Number of species better correlated to elevation at Stordalen at site level than at sub-site level and not at MB sub-site level.

2. More individual species abundance correlated to elevation at MB compared to Stordalen - but at MB spatial autocorrelation included as scale level is lower.
Next steps:
• Relationship with water table
• Veg. community level questions
• Relating to functional processes

Preliminary Data Conclusions

\[
R^2 = 0.86 \ (p<0.0001)
\]
Broad Research Objective: Understand self regulation in peatlands by observing the relationship between structure and function across areas of different self regulation.

<table>
<thead>
<tr>
<th>Structure</th>
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<tbody>
<tr>
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Expect to find that in a more self-regulated system:
1) Stronger structure-function relationship
2) More up-scalability
3) Less steep gradients
Thank you!

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Site Set-up: Sample S1-2Transect