information

Keywords
Remote sensing, nutrient dynamics, phenology, arctic vegetation, Svalbard, snow cover, growing season length
Project title
SenNuFen: Remote sensing, nutrient dynamics and phenology of Svalbard tundra in relation to changing snow cover
Year
2016
Project leader
Elisabeth J. Cooper
Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)
Adventdalen: N 78.1702, Ø 16.0387
Participants

Project leader: E.J. Cooper (UiT)

Project participants: L. Nilsen, H.B Anderson, P.R.Semechuk, M.A. Mörsdorf (UiT),

B.Elberling (Copenhagen University), H. Tømmervik (NINA),

Stein Rune Karlsen (NORUT)

Flagship
Terrestrial
Funding Source

Terrestrial Flagship WP2: Effekter av endringer i årstider og frekvens av ekstremhendelser

Summary of Results

1. We have analysed a long-term phenology data set to elucidate and better describe the drivers of plant phenological phase shifts for 8 common Svalbard vascular plants. The timing of phenological events is dependent on the timing of snowmelt, but the amount of thermal time needed to complete each phase is fixed. This means that the species we studied are periodic and their growing season length is fixed and does not get longer with an earlier snowmelt.
2. Winter snow depth controls soil temperature, which in turn determines soil microbial activity, decomposition rates, and soil nutrient availability. We sampled and analysed the nutrients in soil and plants from our snow manipulation experiment in Adventdalen.
3. Determination of growing season length changes require accurate recording of plant developmental timing. Remote sensing technologies offer novel methods of

continuously recording these processes and other environmental features with minimal disturbance. However, in order to produce of robust landscape level mapping products detailing length of the growing season it is necessary to validate the data by in-situ measurements. We carried out such plot-scale measurements and compared methodology and instruments for use it the field. We will later be able to incorporate the findings of our phenological studies at the plot and plant community scale to the landscape level and set them within a wider spatial and ecosystem context.

Master and PhD-students involved in the project

PhD student: Baggesen, N.S.

For the Management

This project provided methodology and data to aid in (a) describing the changing timing of High Arctic plant phenology and effects on growing season length and (b) in understanding the impacts of such changes on nutrient dynamics and herbivore forage availability and quality.

Published Results/Planned Publications

Anderson, H.B., Nilsen. L., Tømmervik, H., Karlsen, S. R., Nagai, S. and Cooper E.J. 2016 Using ordinary digital cameras in place of near-infrared sensors to derive vegetation indices for phenology studies of High Arctic vegetation. *Remote Sensing*

Gillespie, M.A.K, Baggesen, N.S. and Cooper, E.J. 2016. High Arctic flowering phenology and plant-pollinator interactions in response to delayed snow melt and simulated warming *Environmental Research Letters*

Morsdorf MA, Elberling B, Baggesen NS, Cooper EJ. Nutrient dynamics during growing season are determined by snow depth

during the wintertime – evidence from the high Arctic tundra. *In prep.*

Semenchuk, P.R; Gillespie, M.A.K; Rumpf, S.B.; Baggesen, N.S.; Elberling, B.; Cooper, E.J. 2016. High Arctic plant phenology is determined by snowmelt patterns but duration of phenological periods is fixed: an example of periodicity. *Env. Res. Let. In press*

Communicated Results

see published results

Interdisciplinary Cooperation

UiT has worked together with NINA, NORUT, Copenhagen, and UNIS. Plant ecologists have worked together with remote sensors and chemists.

Budget in accordance to results

We have carried out what we intended to do with the funding. However, we will need to seek further funding for continuation of the analyses.

Could results from the project be subject for any commercial utilization

No

Conclusions

This project successfully carried out its aims. It provided methodology and data to aid describing the changing timing of High Arctic plant phenology and effects on growing season length and to understand the impacts of such changes on nutrient dynamics and herbivore forage availability and quality.