

Project information

Keywords

Plant Growth, decomposition, tundra, scaling up

Project title

Growth and Decay: Snow effects on plant growth and decomposition on Arctic tundra. Scaling up from the plot to landscape scale on Svalbard.

Year

2018

Project leader

Elisabeth J. Cooper (UiT)

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

L. Nilsen, F-J. Parmentier, P.R.Semenchuk, M.A. Mörsdorf (UiT), H.

Tømmervik (NINA), S.R. Karlsen (NORUT). F. Gerhmann (Uni Helsinki/UiT)

Flagship

Terrestrial

Funding Source

430.000 kr Total Terrestrial Flagship funding

Research project Support

Summary of Results

Investigation of plant growth and phenology, plant and soil nutrient content and plant decomposition rates and their relationship with snow depth.

Plant and soil nutrient content: we have been analyzing data gathered from our experiment, and writing a manuscript. Deeper snow enhances soil and plant nutrient content, and thereby forage quality.

We are developing the link between nutrients, growth and indices of greenness, using data from our experiment and across a spatial scale. Data analysis and interpretation is currently ongoing.

Growing Season Length studies: we have analysed data collected specifically focusing on the senescence period at the end of the growing season. It appears that an earlier snowmelt leads to an earlier senescence in our studied High Arctic species, and we are working with two manuscripts about this.

Plant decomposition rates: we are carrying out a study as part of a MSc project to investigate decomposition under differing winter snow depths and summer temperature conditions. Tea bags were used as a global standard for litter bags. They were planted out in Adventdalen in September 2017 and collected in June and September 2018. Data analysis and interpretation is currently ongoing.

We are working with scaling up from the plot to landscape scale, using data gleaned over several years of the experiment. Data analysis and interpretation is currently ongoing.

Master and PhD-students involved in the project

PhD students Friederike Gehrman UiT/Uni Helsinki, and Nanna Baggesen UiT.

Masters student UiT Paige Heavyside.

The work is also part of the career development of post-doc M.A. Mörsdorf.

Published Results/Planned Publications

Published

Semenchuk, P.R., **Krab, E.J.**, Hedenström, M., Phillips, C.A., Ancin-Murguzur, F.J., Cooper, E.J. 2019. Soil organic carbon depletion and degradation in surface soil after long-term non-growing season warming in High Arctic Svalbard. *Science of the Total Environment*. 646. 158–167

Lupascu, M., Czimczik, C. I., Welker, M. C., Ziolkowski, L. A., Cooper, E.J., & Welker, J. M. 2018. Winter ecosystem respiration and sources of CO₂ from the High Arctic tundra of Svalbard: Response to a deeper snow experiment. *Journal of Geophysical Research: Biogeosciences*, 123. <https://doi.org/10.1029/2018JG004396>

Bjorkman, A., ...Cooper E.J. et al. 2018. Plant functional trait change across a warming tundra biome. *Nature*. <https://doi.org/10.1038/s41586-018-0563-7>

Bjorkman, A., ...Cooper E.J. et al. 2018. Tundra Trait Team: A database of plant traits spanning the tundra biome. *Global Ecology and Biogeography*.

Thomas, H.J.D.,... Cooper, E.J., et al 2018. Traditional plant functional groups explain variation in economic but not size-related traits across the tundra. *Global Ecology and Biogeography*.

Prevey, J... Cooper, E.J. et al. 2018. Warming shortens flowering seasons of tundra plant communities. *Nature Ecology & Evolution*.

Dornelas, M., Cooper E.J. et al 2018. BioTIME: A database of biodiversity time series for the Anthropocene *Global Ecology and Biogeography*. 27 (7) 760 - 786 (doi) [10.1111/geb.12729](https://doi.org/10.1111/geb.12729)

Under Review

Morsdorf, MA, Baggesen, NS, Yoccoz NG, Michelsen, A, Elberling, B, Ambus, PA, Cooper, EJ. Deeper winter snow increases summer soil nitrogen availability, leaf N concentrations and leaf D15N in high Arctic tundra. *Under review*

Parmentier, F.J., Nilsen, L., Tømmervik, H., Meisel, O.H., Bröder, L., Vonk, J.E., Semenchuk, P.R., Cooper, E.J. Increased snow depth triggers rapid ice-wedge collapse and permafrost carbon loss. *Nature Geoscience. under review*

Wutkowska, M., Vader, A., Mundra, S., Cooper, E.J. Eidesen, P.E. Dead or alive; or does it really matter? Level of congruency between trophic modes in total (rDNA) and active (rRNA) fungal communities in High Arctic soil. *Microbiology Open, accepted*

Cooper, E.J. Little, C.L., et al. High Arctic plant community composition response to experimentally increased snow. *Journal of Vegetation Science, under review*

Kudo, G. and Cooper, E.J. When do spring ephemerals fail to meet pollinators? *Royal Society Proceedings B., under review*

Thomas H.J.D...Cooper et al. Global plant trait relationships extend to the climatic extremes of the tundra biome. *PNAS, under review*

Advanced stage of preparation

Abbandonato, H, Semenchuk, PR, Cooper, EJ. Thermal time drives plant senescence in High Arctic Svalbard. *In prep.*

Gerhmann, F., Cooper E.J. Timing of arctic plant senescence is affected by snowmelt date and summer temperature. *In prep.*

Morsdorf, M.A., Cooper, E.J. et al. High Arctic vegetation responses to climate depend on context- the diversity measure determines the interpretation. *In prep.*

Imperio LD, Frost Arndal M, Baggesen, NS, Rojas, SK, Cooper, EJ. Contrasting plant root responses to winter warming across vegetation types in the High Arctic. *In prep.*

Krab. E., Lundin, E.J., Coulson, S.J., Dorrepaal, E., Cooper, E.J. Arctic microarthropod community responses to snow accumulation are not driven by soil moisture. *In prep.*

In prep

Parmentier, F.J., Nilsen, L, Tømmervik, H., Cooper, E.J. et al. Matching remote sensing scales in High Arctic Svalbard. *In prep.*

Cooper, E.J, Morsdorf, MA, and Moriana Armandiaz, M. Linking nutrients, growth and indices of greenness at different scales on Svalbard's tundra. *In prep.*

Communicated Results

See publications

Interdisciplinary Cooperation

Remote sensing scientists, plant ecologists, also soil scientists, biogeochemists and entomologists.

UiT-NINA-NORUT-Uni Helsinki- Uni Copenhagen Toyama Uni Japan and NIPR Japan

Budget in accordance to results

Our funding was used for field work expenses and salaries, as in our budget.

Could results from the project be subject for any commercial utilization

No

Conclusions

This project is ongoing but we have made good progress this year in developing methodology for upscaling

from plot to landscape level phenology using remote sensing methodology. In addition, we have published many papers from the project and made headway with preparing new scientific papers, as well as contributing to a PhD thesis and starting a Masters project.