High Arctic ecosystem
responses to changes in snow cover

SnoEco: -a study at the plot and landscape scale

Elisabeth J. Cooper

and lots of others…

UiT- The Arctic University of Norway
Tromsø, Norway

Masters: Paige Heavyside, Holly Abbandonato, Judith Winkler, Cecilie Amtorp, Sabine Rumpf, Elke Morgner, Mats Björkman

PhDs: Philipp Semenchuk, Nanna Baggesen, Friederike Gehrmann, Sunil Mundra, Magdalena Wutkowska

PostDocs: Mark Gillespie, Helen Anderson, Daan Block, Marie Frost, Martin Mörsdorf, Frans-Jan Parmentier, Eva Krab
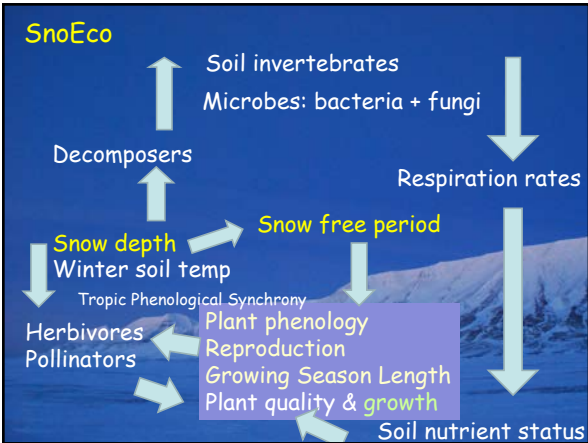
Collaborators: Bo Elberling, Steve Coulson, Pernille Bronken Eidesen, Jeff Welker, Lennart Nilsen, Hans Tømmervik, Chelsea Little, Max Lupascu, Claudia Czimczik, Agata Buchwal ++

Morgner et al 2010
Björkman et al 2010
Cooper et al 2011
Mallik et al 2011
Semenchuk et al 2013, 2015a,b, 2016a,b
Rumpf et al 2014
Block et al 2015
Anderson et al 2016 & 2017
Gillespie et al 2016
Mundra et al 2016
Cooper et al (in review)
Mörsdorf et al (in review)
Wutkowska et al (sub)
Lupascu et al (sub)
Mörsdorf et al (in prep)
Krab et al (in prep)
Tojo et al (in prep)
Frost et al (in prep)
Parmentier et al (in prep)

Snow depth

moderates soil & plant winter temp

Timing of snowmelt

..is a very important determinator of start of growing season.

=> How do these affect plant development and growth ?

SnoEco

Soil invertebrates
Microbes: bacteria + fungi

Decomposers

Respiration rates

Snow depth
Winter soil temp

Snow free period

Tropic Phenological Synchrony

Herbivores
Pollinators

Plant phenology
Reproduction
Growing Season Length
Plant quality & growth

Soil nutrient status

Experimentally manipulated snow
in Adventdalen, Svalbard, 78N

12 Snowfences and 12 controls, 2 vegetation types (Heath and Meadow). Also naturally early melt and removed snow plots.

Fences: 6m x 1,5m Perpendicular to main winter wind direction - from east

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Phenology: timing of development responds quickly to climatic factors

24 July 2008
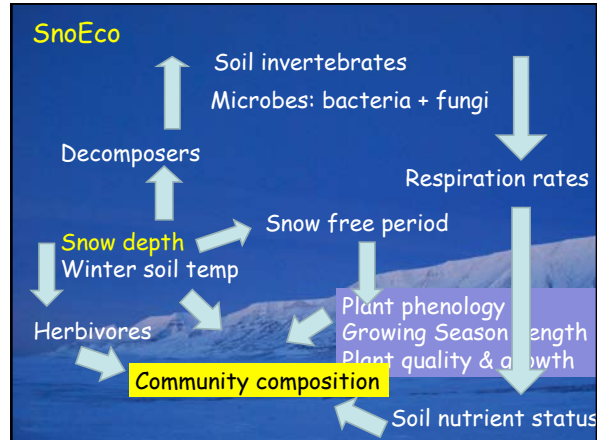
Experimentally manipulated snowdepth and melt

Phenology: earlier green up with early melt if subsequent warmer temps, late melt delayed early season phenology.

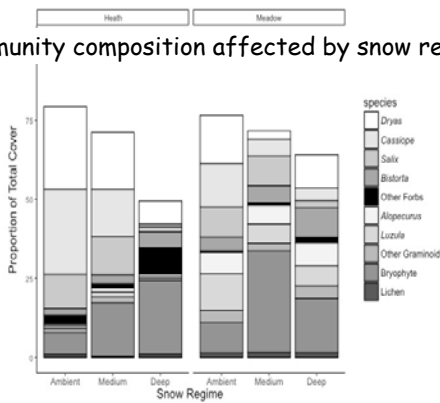**Senescence:** some response to snow melt, only partly light controlled.

GSL: species specific: majority are periodic species, others just kept growing..

Growth: related to Thawing Degree Days: generally reduced growth and higher % BG with later snow melt- BUT deeper snow => higher nutrients, some species benefitted (eg *Bistorta, Luzula*).

Reproductive success: generally related to GSL => reduced flowering and viable seeds with later melt- BUT deep snow protected flower buds in mild periods with snow melt mid- winter.
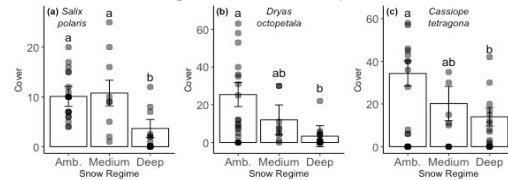

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Community composition

Soil nutrient status

Community composition affected by snow regime

Cooper et al, under review

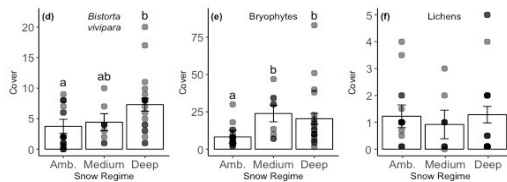
Snow regime affects plant cover

Dwarf shrub cover reduced in Deep snow regime
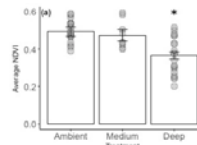- For *Salix, Dryas* and *Cassiope*

Cooper et al, under review

Snow regime affects plant cover

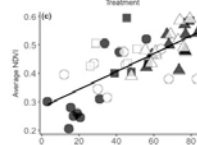Increase in *Bistorta* and Bryophyte cover.

No change in Lichen cover

Cooper et al, under review

NDVI reduced in deep snow regime

NDVI related to vascular plant cover

No relationship between mid-season soil moisture and NDVI