

## Project information

### Project title

Svalbard terrestrial ecosystem - climate impacts and trophic interactions

### Year

2011/2012

### Project leader

Eva Fuglei, NPI

### Participants

- Eva Fuglei, project leader, NPI
- Audun Stien, NINA
- Ingunn Tombre, NINA
- Jane Uhd Jepsen, NINA
- Pernille Bronken Eidesen, UNIS
- Åshild Ønvik Pedersen, NPI

### Flagship

Terrestrial, Theme: Ecosystem effects of extreme climate events and season

### Funding Source

Fram Centre, internal

### Summary of Results

#### **1. NORKLIMA application for the Norwegian Research Council**

As planned we submitted a research project application with the title: "Svalbard's terrestrial ecosystem - unravelling climate impacts on the herbivore guild" to the NFR program NORKLIMA «*Impacts of climate change on the environment and communities in the polar regions*» August 31 2011.

The main objective of the project is to investigate the impacts of climate variability on trophic and intra-guild interactions affecting key arctic herbivores on Svalbard.

The project have 4 sub-objectives:

1. To investigate fitness effect of match-mismatch between phenologies of Svalbard rock ptarmigan breeding and their forage plants.
2. To investigate climate effects on the intensity of competitive interactions among herbivores.
3. To investigate interacting effects of predation and climate on herbivore reproduction.
4. To provide a statistical approach to historical long-term monitoring data that complements and synthesizes new field studies addressing sub-objects 1-3.

In addition to the active partners from the FRAM Centre the project consortium for the proposed project consist of:

- Leif-Egil Loe (Norwegian University of Life Sciences)
- Jesper Madsen (National Environmental Research Institute, Denmark)
- Rene van der Wal (University of Aberdeen, United Kingdom)
- Niels Martin Schmidt (Zackenbergs Ecological Research Operations, Denmark)
- Karl Arne Stokkan (UiT)

The application decision will be taken during December 2011.

#### **2. Pilot project - testing field methods for ecosystem studies on Svalbard**

In this project we tested the suitability of selected study methods, currently used in an ecosystem study on Varangerhalvøya (EcoFin), mainland, Norway, for ecosystem studies in Svalbard.

The main goals for the pilot study were as follow:

- To determine spatial distribution of herbivores and relative use of habitats by faeces counts.
- To quantify amount of grubbing related to herbivore space use and habitats.
- To quantify availability of forage resources for herbivores in the landscape.
- To investigate phenological development of individual *Bistorta vivipara* plants, which is a key forage resource for the endemic Svalbard rock ptarmigan.

### **Methods**

We conducted the pilot study in Adventdalen and Hanaskogdalen, Svalbard, from July to September 2011. To test the field methods we established 19 transect lines, from the valley bottom to sparsely vegetated areas up the mountain slopes, covering gradients representing differences in: (1) habitat suitability for the herbivore community, in particular Svalbard rock ptarmigan; (2) climate (plant phenological gradients); and (3) altitude (related to the last). A total of 76 sub-plots, 4 along each transect line, of 15x15 m were established. Three sub-plots were placed in areas with > 50 % vegetation cover whereas the last sub-plot in areas with < 25 % cover vegetation. The field work was carried out by 4 people in three separate surveys of 2 weeks each, spanning from 3. July to 1. September.

In survey 1 the following data were collected: (1) Removal of faeces in 8 sampling quadrats of 50x50 cm in each sub-plot; (2) percentage cover of goose grubbing in the same sampling quadrats; (3) collection of faeces to test DNA-techniques to estimate diet of the herbivore community; and (4) phenological development of 15 individual *Bistorta vivipara* in each of 16 the sub-plots along 4 transect lines combined with temperature loggers collecting data on soil temperatures in each sub-plot.

In survey 2 the following data were collected: (1) Availability of forage plants for herbivores by the point intercept method; and (2) phenological data on *Bistorta vivipara*.

In survey 3 the following data were collected: (1) Counts of faeces in 8 quadrats of 50x50 cm in each sub-plot to determine summer accumulation; (2) re-sampling of percentage cover of goose grubbing; and (3) phenological data on *Bistorta vivipara*.

#### **Preliminary results**

Limited number of faeces had accumulated over the summer, and the spatial scale of data collection, considering the low abundance of most herbivore species, must be further evaluated. In total 608 small sampling quadrats were surveyed, but only few faeces had accumulated (presence of faeces; ptarmigan n=5; reindeer n < 10; geese n=31). We believe the season for accumulation was too short and the spatial scale too small (50X50 cm), and better results are likely by extending the season for accumulation and survey for instance again next summer (i.e. accumulation from autumn to early summer). Goose grubbing, despite the relatively short timeframe for this activity, varied in the sub-plots (range 0-100%; 5 classes; no grubbing=68%; 25% grubbing=29%; 50% grubbing=0.025; 75% grubbing=0.003%; 100% grubbing=0.003% ). We will combine this information with data on habitat composition and forage plant availability (i.e. plant abundance survey) to investigate goose grubbing in relation to the various habitat types along the altitudinal gradient (see point 6). The pilot studies of *Bistorta vivipara* individuals is new on Svalbard and the various way/experiences to collect data on this key forage plant of the Svalbard rock ptarmigan, is of high value in the continuation of developing studies to test the hypothesis regarding a potential mismatch between ptarmigan reproduction and quality/quantity of the *Bistorta vivipara* bulbils. All data sets are digital and quality assured and results will be processed in the two first quarters of 2012.

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#### Published Results/Planned Publications

Published results:

We have not published results yet.

Planned publications:

In the proposed NFR NORKLIMA project we plan to publish 8 scientific articles in high-quality international peer-reviewed journals in addition to one final article synthesizing the research study.

We plan to publish 2 scientific articles/research notes from the pilot field study.

The first with working title "Pink footed goose grubbing in relation to habitats along an altitudinal gradient". The manuscript will be based on the collected datasets on goose grubbing and plant abundance and composition along the altitudinal gradients. We plan to submit the manuscript in 2. Quarter of 2012 to Polar Research or Polar Biology.

The second manuscript has working title "*Bistorta vivipara* spatial distribution and phenological development – the potential for a trophic mismatch with ptarmigan reproduction", and is based on the datasets collected on *Bistorta vivipara* individuals, soil temperature data and plant abundance data. We plan to submit the manuscript in 4. Quarter of 2012

#### Communicated Results

None so far

#### Interdisciplinary Cooperation

The project is based cooperation between different biological disciplines, and cannot be characterized as a multi-disciplinary or interdisciplinary project.

#### Budget in accordance to results

The FRAM Centre funding has been essential for the project "Svalbards terrestrial ecosystem – climate impacts and trophic interactions". By the incentive funding from the FRAM centre in 2010 we planned and conducted a workshop (March 2011; Final report submitted by J. U. Jepsen Oct 13. 2011) with invited researchers which became partners in the project consortium for the NORKLIMA project application submitted to NFR in August 2011. The FRAM centre funding therefore helped to complete our NFR application. Furthermore, the pilot project conducted in Svalbard would not have been possible without this funding. This project has provided important datasets and experiences which we will use in future projects to validate and develop methods for studying climate impacts on the herbivore guild in Arctic tundra in Svalbard.

#### Could results from the project be subject for any commercial utilization

No

#### Conclusions

If our NFR application will be funded, we will be able to conduct a 3-year study on climate impacts on Svalbard's terrestrial ecosystem involving funding for one post doctoral position.

We have developed/tested new methods to collect data on the key forage plant of the Svalbard rock ptarmigan, the *Bistorta vivipara*. This is of importance for testing hypothesis regarding a potential mismatch between ptarmigan reproduction and quality/quantity of the *Bistorta vivipara* bulbils. This is new on Svalbard and will be of importance in future climate impact studies both in Svalbard and on the mainland of Norway.