Herbivory Network
Newsletter October 2018

Newsletter contents

1. Herbivory Network activity in the last months

- ### Symposium and lunch get together at CSEE meeting in Guelph in July 2018

This year's very successful annual meeting of the Canadian Society for Ecology and Evolution (CSEE). was organized in Guelph (18-21 July 2018) by HN member **Andrew MacDougall**, and included a symposium titled 'Trophic interactions in the changing North' chaired by **James Speed** and **Jean-Pierre Tremblay**. The symposium addressed how changing abiotic conditions and shifting species distributions alter trophic interactions and ecosystem dynamics in the North, and it included presentations by Isabel Barrio (Agricultural University of Iceland), Carissa Brown (MUN), Anne Loison (Université Savoie Mont Blanc, Chambéry France), Rolf Peterson (Michigan Tech), James Speed (NTNU), Jean-Pierre Tremblay (Université Laval) and Katariina Vuorinen (NTNU). We also had a lovely HN lunch get-together, discussing some science while enjoying the sun!

HN lunch get-together in Guelph

- ### UArctic Congress 2018 in Oulu, September 2018. *Jeff Welker*

Jeff Welker organised a session during the UArctic Congress 2018 in Oulu, Finland, title Reindeer and caribou in the Arctic System: Interactions between environmental, social and biophysical processes. There were 10 presentations over two days in our well-attended session. We heard about reindeer systems in Finland, Sweden and Russia, as well as caribou systems in Alaska and the themes were very diverse across the social-landscape-ecological continuum. Topics about reindeer systems and social processes, landscape ecology and climate feedbacks, remote sensing of tundra systems and forage traits, snow attributes across Alaskan caribou ranges and the diet ecology of Svalbard reindeer were some of the highlights. Thank you to those that presented and that attended.

- ### HN side meeting and sessions at ABC Rovaniemi, 8-12 Oct 2018

As part of the Arctic Biodiversity Congress in Rovaniemi, we had a Herbivory Network side meeting. 22 participants attended the meeting, which covered general updates and discussed some new ideas, like organizing the next HN meeting in Yamal (see below). The side meeting included a workshop on using revisitation sites to study the combined effect of vertebrate herbivory and climate change on tundra vegetation, organized by Fran Jaroszynska (University of Bergen) and Katariina Vuorinen (NTNU).

As well, HN hosted a session during the congress, titled Herbivory in the Arctic – understanding large-scale patterns and processes of a key ecological interaction. The session included presentations by Isabel C Barrio (Agricultural University of Iceland), Eeva Soininen (UiT – The Arctic University of Norway), Virve Ravolainen (Norwegian Polar Institute), Elin Lindén (Umeå University) and Katarina Inga (UiT – The Arctic University of Norway). **Bruce Forbes** chaired a session titled Large herbivores as agents of ecosystem based management in the circumpolar Arctic, which included talks by Tim Horstkotte (Umeå University), Howard Epstein (University of Virginia), Shirow Tatsuzawa (Hokkaido University/North-Eastern Federal University), Maria Väisänen (University of Oulu) and Virve Ravolainen (Norwegian Polar Institute). Thank you all for great talks!

2. Updates on ongoing projects

- ### Background invertebrate herbivory in tundra

Following her MSc, **Sarah Rheubottom** has been working on a manuscript on the patterns and drivers of invertebrate herbivory in tundra ecosystems at the plant community level. Her results show that invertebrate herbivory occurs nearly everywhere at low intensity, and it is likely to increase with warmer temperatures. Sarah's work contributes to our understanding of this less conspicuous type of herbivory and will help develop a general protocol to measure invertebrate herbivory in tundra. The manuscript has already been circulated to co-authors.

- ### A systematic map of the evidence of effects of herbivory on Arctic vegetation. *Eeva Soininen et al.*

We have now developed a protocol to conduct a systematic map of studies of herbivory in the Arctic and learn more about the ecological contexts in which herbivory is studied. This protocol was published last month in the journal Environmental Evidence. The next step is to actually do the work. We will be applying for funding to conduct the mapping (approximately ½ years salary) and will be happy to hear if you have any suggestions for potential funding sources. The first part of the project was developed by a smaller team, but in this second part we want to invite all of you who joined the first workshop in Iceland to contribute. If you are interested in participating in mapping the knowledge on herbivory in the Arctic, please get in touch with **Eeva Soininen** (eeva.soininen@uit.no).

Soininen EM, Barrio IC, Jepsen JU, Ehrich D, Ravolainen VT, Speed JDM (2018) Evidence of effects of herbivory on Arctic vegetation: a systematic map protocol. Environmental Evidence 7:23

- ## Updates from the Soil Working Group. *Maria Väisänen and Guillermo Bueno*

The Soil Working Group also wants to send greetings to the HN and provide an update since the last HN newsletter in March 2018. The soil working group has been working on the products of the workshop: "A systematic review on the effects of herbivores on tundra soils" organized in Reykjavik, September 2016. We have compiled a conceptual manuscript (short opinion paper) focused on the trampling effect on tundra soil. The manuscript has been offered so far to a couple of journals, Global Change Biology and Functional Ecology. Unfortunately, we had no luck with those. Currently, we are revising the manuscript and turning it to a review paper and aim to submit it within the coming months.

In the HN side meeting, 8 October, **Guillermo Bueno** provided an outline of our activities, including the last advances in our soil protocol. So far, we have explored the heterogeneity of tundra soils at three spatial scales (0.25, 0.5 and 1 m between soil samples) to estimate the spatial resolution needed for sampling each soil parameter. We have done some pilot sampling in areas with and without fences (Auðkúluheiði, Iceland) and in different habitat types (heath and meadow in Abisko, Sweden; Figure 1 shows variation in litter depth). This is work in progress and we are actively looking for funding sources to analyse more soil 'traits' – if anyone is aware of any potential sources please write to us! (maria.vaisanen@ulapland.fi). To our great pleasure, in the meeting there was some interest about the soil protocol. This gave us some positive energy to meet up and plan the next push to analyse our preliminary data regarding the protocol. Stay tuned!

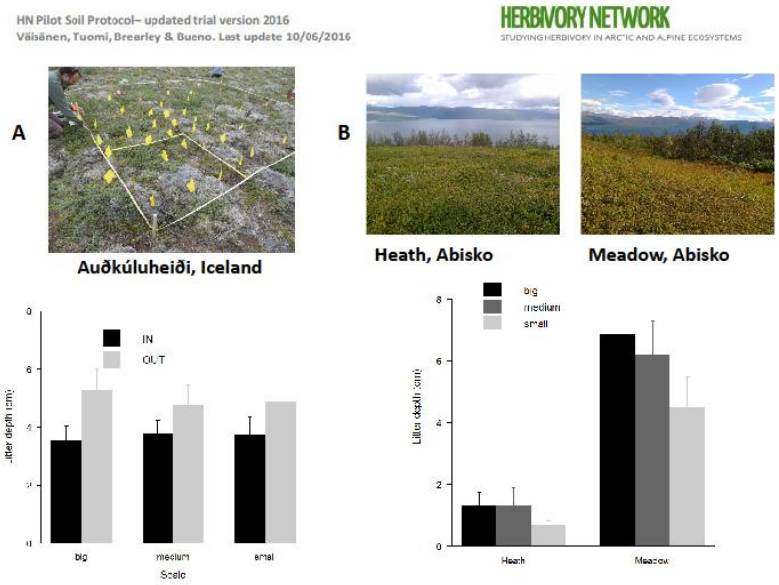

Figure 1. Results of the pilot testing of the HN soil protocol, for litter depth. Samples were collected in a grid at three spatial scales (small: 0.25, medium: 0.5 and big: 1 m between samples) to assess the spatial heterogeneity of each soil parameter and be able to recommend a sampling protocol. Sampling was conducted inside and outside a grazing exclosure in Auðkúluheiði, Iceland, and in different habitats (heath and meadow) in Abisko, Sweden.

- ## Phylogenetic and functional diversity of Arctic vertebrate herbivores.
  James D.M. Speed

A manuscript authored by multiple Herbivory Network members has now been submitted. The study seeks to map phylogenetic diversity and functional diversity of vertebrate herbivores across the Arctic tundra biome, and test hypotheses relating to drivers of these patterns. Exciting results show that both phylogenetic and functional diversity peaks in the Nearctic, but herbivore communities in the Palaearctic are functionally divergent – that is they are more functionally different than expected by their evolutionary history. Trophic interactions, and to a lesser extent, abiotic conditions were key drivers of these patterns.

A master student, Jesus Adrian Chimal Ballesteros, is following up on this work by assessing phylogenetic and functional diversity of both Arctic and boreal herbivore species. He will examine the presence of clusters of herbivore communities in functional and phylogenetic space, and test whether these relate to biome transitions or biogeographic transitions. This work will help understand the likely implications of northward movement of herbivore species from the boreal to Arctic biomes.

- ## ArcRein – A panArctic study of how large herbivores affect tundra vegetation and nutrient cycling. *Elin Lindén*

Elin sampling in Semmeldalen, Svalbard

The ArcRein project focuses on how grazing might affect large-scale vegetation patterns and nutrient cycling in arctic and northern mountainous landscapes. We are re-inventorying 15 to 40 year old reindeer/caribou/muskoxen exclosures across the Arctic, in sites of varying climatic conditions and herbivore densities. At each site, we use standardized methods to measure plant community composition, NDVI, LAI, albedo and soil nutrient availability.

In 2017-2018, we have re-inventoried exclosures in Alaska, northern Finland, Greenland and Svalbard. During the summer of 2019, we plan to complete the fieldwork and visit additional exclosures in Greenland and Canada. With over 100 exclosures, more than 50 arctic ones and 54 Fennoscandian ones inventoried with the same standardized methods during 2014-2015, ArcRein will generate a large database of comparable circumpolar data. This project will help us better understand how the features that characterize a grazed landscape and the effects of larger herbivores on plant communities varies between sites, regions and grazing/management regimes. Elin Lindén is doing her PhD on the ArcRein project in Umeå University, under the supervision of Johan Olofsson, Maja Sundqvist and Mariska Te Beest, and the re-inventories are carried out in close collaboration with the responsible PIs at each site.

3. Other updates

- ## Communication: new website and the tweeting marmot

The new website of the Herbivory Network is nearly there! The website will be hosted by the Agricultural University of Iceland. You will receive an email once it is up and running, for comments and suggestions. Also, if you want to be involved with maintaining the website, please let us know (isabel@lbhi.is).

Since July 2018 the Herbivory Network has a Twitter account @HerbivoryN! Please follow us to be updated on our activities.

- ## Changes in jobs and positions

Isabel C Barrio is now an Associate Professor at the Agricultural University of Iceland. **David Hik** has moved to Simon Fraser University, in Burnaby, BC, Canada.

Henni Ylänne is now working in the Centre for Environmental and Climate Research at Lund University; in collaboration with Dan Metcalfe and Karina Clemmensen, she's monitoring how reindeer grazing and the presence of mountain birches affect belowground communities.

Dagmar Egelkraut has recently started a post-doc position at the University in Bergen, in the group of Vigdis Vandvik. She will be part of the new project INCLINE, which takes place in the SeedClim infrastructure and studies how with climate change, alpine species will respond to new neighbors, and how the interactions may be explained by plant functional traits. She will also work with Jake Alexander's group at the University of Lausanne, Switzerland.

- ## New online course on sheep grazing in Iceland

SAUÐFÉ | SHEEP
Í LANDI ELDS OG ÍSA | IN THE LAND OF FIRE & ICE

Over the last year, **Isabel C Barrio** and **David Hik** have been developing a short Massive Open Online Course (aka micro-MOOC) on sheep grazing in Iceland. The course, titled *Sheep in the Land of Fire and Ice* will consist of a series short videos, reviewing the history, socioeconomic factors and environmental conditions that have influenced the management of grazing resources in Iceland. You can now watch the trailer here. The course and associated educational materials will be freely available online. If you think this is a good idea that could be applied to your research or teaching, please be in touch with Isabel (isabel@lbhi.is)– maybe we can develop this further into a series of herbivory case studies around the Arctic!

4. What's next?

- ## HN meeting in Yamal

We would like to organize a HN meeting in Yamal, in the Fall 2019 (tentative dates are 18-20 September). **Sasha Sokolov**, **Natalya Sokolova** and **Svetlana Sokovnina** will be the local organisers. We will need

participants to confirm their attendance by March 1 because we need some time to arrange travel visas and such, before the field season. The idea is to have this meeting as a hands-on workshop to finish off several of the ongoing HN projects. If you are interested in contributing to the scientific programme or help organize the meeting, please let us know!

- ### Funding applications, PhD and postdoc opportunities

Isabel C Barrio is planning on applying for funding for HN related activities in the next call of the Icelandic Research Fund. Deadline for these applications will be in June 2019, but it is worth thinking ahead! Some of the types of grants include PhD and postdoc funding. If you are in a position to apply for these grants and you would be interested in developing a HN-related project in Iceland (or know somebody who might be), please be in touch with Isabel (isabel@lbhi.is).

- ### Other important dates and interesting meetings

February 11-13, 2019. Norwegian Oikos meeting in Tromsø
March 3-5, 2020. Nordic Oikos meeting in Iceland

5. Recent papers

Limited dietary overlap amongst resident Arctic herbivores in winter: complementary insights from complementary methods

Schmidt NM, Mosbacher JB, Vesterinen EJ, Roslin T, Michelsen A (2018) Oecologia 187:689–699.

Snow can limit access to food during winter for resident Arctic herbivores, forcing them to aggregate in the few patches with limited snow. This study used molecular analysis and stable isotope ratios of carbon and nitrogen of fecal samples of Arctic hare, rock ptarmigan and muskox in High Arctic Greenland to assess their diet overlap, and if this overlap increased as winter progressed. The results show that despite foraging in the same areas and generally feeding on the same plant taxa, the quantitative dietary overlap between these three herbivores was limited. This may be attributable to species-specific consumption rates of plant taxa. You can read the full article here.

The sheep in wolf's clothing? Recognizing threats for land degradation in Iceland using state-and-transition models

Barrio IC, Hik DS, Thórsson J, Svavarsdóttir K, Marteinsdóttir B and Jónsdóttir IS (2018) Land Degradation and Development 29: 1714-1725.

Many old stories include warnings to beware of nasty surprises that can appear harmless, like the wolf disguised as a sheep to better sneak up on the unknowing flock. But what if the sheep themselves are actually the nasty surprise? In some parts of Iceland, extensive land degradation has been linked to overgrazing by livestock, as well as land clearing and natural processes including a harsh climate and frequent volcanic activity. Identifying the factors responsible for ecosystem changes in these environments is essential for making good management decisions. In this paper, we use state-and-transition models, a simple representation using boxes and arrows, to describe ecosystem changes in Iceland over three periods

with different human influence, from pre-settlement times to present days. The results suggest increasing complexity in recent decades where the models include stronger human influences, particularly sheep grazing. These models can be used to make predictions about possible management interventions, so they can help farmers, managers and researchers identify realistic and achievable restoration goals. You can access the full publication here.

The role of plant–soil feedbacks in stabilizing a reindeer-induced vegetation shift in subarctic tundra

Egelkraut D, Kardol P, De Long JR, Olofsson J (2018) Functional Ecology, 32:1959-1971.

Herbivores can have large impacts on the composition and functioning of plant communities and may even drive the vegetation towards a different state. For example, grazing by reindeer can result in a shift from relatively unproductive dwarf shrub vegetation to a more nutrient rich vegetation type dominated by herbaceous plants. We studied so-called historical milking grounds (HMGs) in northern Sweden: old reindeer herding sites that were subject to high numbers of reindeer for many centuries, up to a century ago. The high reindeer concentrations in the past caused the vegetation to shift locally to small meadow-like patches, which are still clearly discernible in the otherwise heath-and shrub dominated tundra, a century after their active use.

One possible mechanism for the long-term stability of HMG vegetation is the interaction with biotic and abiotic components of the soil. More specifically, a positive interaction between the vegetation and associated soil biota would help stabilize the current vegetation and slow down invasion rates of other plant species. We tested this assumption by growing seedlings representative of HMG vegetation (*Potentilla crantzii*) and control vegetation (*Betula nana*) in soils from HMGs and control sites, in a climate chamber. By sterilizing the soils, we could separate the biotic from abiotic drivers, to try and understand the different growth responses of plants in different soils. We found that, although both the typical control- and HMG plant species grew well in HMG soils due to the increased nutrient availability, microorganisms in the HMG soil provided an additional benefit for the typical HMG plant species. This was mostly the case when soils from nutrient poor habitats (heath) were considered. In summary, we conclude that positive interactions between plants, soils and soil organisms can explain the long-term stability of vegetation shifts that were caused by reindeer many centuries ago. You can access the full publication here.

Transferability of biotic interactions: temporal consistency of arctic plant-rodent relationships is poor

Soininen EM, Henden JA, Ravolainen VT, Yoccoz NG, Brathen KA, Killengreen ST, Ims RA (2018) Ecology and Evolution, 1-15

Predictive modelling is increasingly common in ecology, and statistical models created in one context are often used to predict the state of the system in other contexts. However, the fast development of predictive ecology calls for caution, as it is not always clear whether the current understanding of ecological processes is comprehensive enough to warrant predictions. The amplitude of rodent population cycles (i.e., peak-phase abundances) has been hypothesized to be determined by vegetation properties in tundra ecosystems. We assessed the spatial and temporal predictability of food and shelter plants effects on peak-phase small rodent abundance during two consecutive rodent population peaks.

During the rodent population peak in 2007 at Varanger peninsula, rodent abundance was related to the abundance of food and shelter plants. Still, plants alone were not enough to predict how high the rodent peak in 2011 was. The role of plants was then likely to be overdriven by other food web components (like predators) and weather. This study highlights two challenges for predicting food web functioning to the future: i) gathering long enough time-series to include different situations in the predictive models and ii) including several key interactions instead of isolating one of them from the remaining food web.

You can access the full publication here.

High resistance towards herbivore-induced habitat change in a high Arctic arthropod community.

Schmidt NM, Mosbacher JB, Eitzinger B, Vesterinen EJ, Roslin T (2018) Biology Letters 14: 20180054.

Muskox grazing can drive large changes in vegetation in the long term, but these changes do not seem to influence the composition of arthropod communities nor the structure of their predator –prey interactions. This surprising result implies that high Arctic arthropod communities might be highly resistant to changes in their habitat, possibly due to the high connectance of their food webs. You can find more about this interesting study here.

You will be kept updated about HN ongoing activities via our homepage or our newsletters. If you want to get actively involved we warmly welcome your help in the organizing and managing of the newsletter, meetings, workshops, etc. If you have any content that you would like profiled on our website, please contact us at herbivory.network@gmail.com.