Herbivory Network
Newsletter March 2018

Newsletter contents

1. Herbivore (network) activity in the last year

- Lunch get together at CSEE meeting in Victoria, BC in May 2017.

Some of us met last May 2017 at the Canadian Society for Ecology and Evolution meeting in Victoria, BC. The (herbivory) highlight of the conference was the session "Ecology of Plant-Herbivore Interactions in Cold Places", where we listened to very interesting presentations by Jen Forbey, Greg Henry, John Serafini, Michel P Laforge, Peter Tarleton and Peter Kotanen. We also had a lovely HN lunch get-together, discussing some science while enjoying the sun!

- HN get-together at Nordic Oikos, Trondheim, 19-22 Feb 2018

Quite the number of HN members attended the Nordic Oikos conference Trondheim last February, so we decided to have a brief meet-up. After a short introduction round and welcoming some new faces, we discussed several plans and highlights for the coming year, some of which will be discussed in more detail below in this newsletter.

We would like to organize a HN one-day workshop at the Arctic Biodiversity Congress October 9-11, Rovaniemi, Finland. For more information, see below, point 4. As well, we will apply for a session during the conference, to present some of the ongoing work. Stay tuned! Lastly, Isa and Eeva made a little reminder that the HN would be happy with more people actively engaged in the organizing and managing of the newsletter, meetings, workshops, etc. Any help is welcome!

HN lunch meeting in Trondheim, at Oikos 2018.

2. MSc thesis: Invertebrate herbivory in tundra

Sarah Rheubottom defended her MSc at the University of Alberta last January, on measuring invertebrate herbivory in tundra. Her work was based on the sampling that was coordinated in summer 2015 and to which many of you contributed. Sarah spent hours on end behind the magnifier glass, looking at leaves of 46 species of tundra plants from 22 sites across the tundra. Sarah's work contributes a basic understanding of the occurrence and intensity of invertebrate herbivory at different tundra sites, and will help develop a more general protocol to measure invertebrate herbivory in tundra. If you are interested in getting a copy of Sarah's thesis, please contact her: srheubot@ualberta.ca

3. Updates on ongoing projects

- ## The status of evidence for herbivory in Arctic tundra ecosystems - A systematic map. *Eeva Soininen et al.*

The background of this project is that in general, the effects of herbivores on plants and ecosystem functioning depend on the abiotic and biotic circumstances (i.e. ecological context) where herbivory takes place. Research on herbivory in tundra environments has, until recently, been mainly local in extent. The conclusions of herbivory impact on vegetation are therefore inevitably affected by the ecological contexts of the studies. Hence, the combined coverage of ecological contexts of studies on Arctic herbivory is an essential determinant of **i)** which general conclusions that can be drawn about the role of herbivory for Arctic ecosystems change, and **ii)** how robust such conclusions are. We aim to produce a systematic map the ecological contexts in which we have a possibility to understand the effect of herbivory given current efforts and available evidence.

This project was initiated in the Iceland meeting of HN (2016). In 2017, we received funding from the FramCentre for a small group of authors (Eeva Soininen, James Speed, Isabel Barrio, Virve Ravolainen, Dorothee Ehrich and Jane Jepsen) for the first part of the project, i.e. developing a protocol for the map. The team was set up to encompass expertise on both vertebrate and invertebrate herbivores and includes people from HN and NeAT (Network for Arthropods of the Tundra). In the course of two workshops we have developed a protocol and have a "to-be-submitted-soon" manuscript. The next step will be acquiring funding for using the protocol to conduct the mapping (approximately ½ years salary) – if some of you have good suggestions which funding agency we should try we are more than happy to hear! For the second part of the project, we also aim to invite all of you who joined the first workshop in Iceland to contribute.

- ## Assessing the functional and phylogenetic diversity of Arctic vertebrate herbivores. *James D.M. Speed et al.*

Following on from the first assessment of Arctic vertebrate herbivore species richness (Barrio et al. 2016), members of the Herbivory Network are working towards characterising the functional and phylogenetic diversity of the same group. Ina Åsnes Skjelbred, a masters student at the Department of Natural History NTNU University Museum (Norwegian University of Science and Technology) developed a phylogeny of the Arctic vertebrate herbivores and mapped the phylogenetic diversity of herbivores around the Arctic tundra biome, identifying high phylogenetic diversity in the Nearctic, and higher than expected in High Arctic islands. Ina worked under the supervision of James Speed and Mike Martin, and received a top mark for her thesis in May 2017 – Congratulations Ina!

During the Herbivory Network workshop in Reykjavik in September 2016, participants started to develop a functional classification of Arctic herbivores. Eeva Soininen followed up on this work,

and developed, with the help of many Arctic herbivore expert ecologists, a table of functional traits for the species list. Eeva produced a hierarchical cluster dendrogram based on the herbivore functional traits, allowing us to analyse the spatial distribution of functional diversity across the Arctic alongside the phylogenetic diversity.

A draft manuscript has now been produced and circulated to coauthors. The results suggest that the Nearctic herbivore communities are more phylogenetically diverse than expected, but more functionally constrained, with species closer in functional trait composition than expected. This suggests that herbivore communities here are subject to environmental filtering and convergence of traits. Meanwhile the herbivore assemblages in the High Nearctic, Iceland, and parts of the Palaearctic have a greater spread of functional traits than expected, indicating the strength of environmental limitations acting on these communities.

Barrio I. C. et al. 2016. Biotic interactions mediate patterns of herbivore diversity in the Arctic. Glob. Ecol. Biogeogr.: 10.1111/geb.12470.

- ## Project focussing on interactions between herbivory and climate in northern ecosystems. *James D. M. Speed*

A new project started in 2017 is investigating interactive effects of herbivory and climate on northern ecosystems. The project 'Disentangling the impacts of herbivory and climate on ecological dynamics' is hosted by the NTNU University Museum, Norwegian University of Science and Technology, and led by James Speed. Partners include Isabel Barrio (University of Iceland), Alison Hester (James Hutton Institute, Scotland), John-Arvid Grytnes (University of Bergen), Jean-Pierre Tremblay (Université Laval) and Gunnar Austrheim & Mike Martin (NTNU).

There are three components to the project, the first uses dendroecology to tease apart the effects of herbivory and climate on woody plant growth in boreal and tundra ecosystems, and long-term plant community data to investigate the herbivore and climate impacts on vegetation change. Katariina Vuorinen, a PhD student at the NTNU University Museum leads this work. The second aspect of the project will investigate how herbivores affect the distribution of plant species. The third section of the project maps out herbivore communities across the boreal and tundra biomes. The work in the Arctic is summarised elsewhere in the manuscript. A master student, Jesus Adrian Chimal Ballesteros has started work on developing a phylogeny and functional classification of herbivores in the boreal biome.

If you would like to contribute to developing a functional classification of vertebrate herbivores in the boreal biome please contact James (James.Speed@ntnu.no). Those contributing will be invited to co-author resulting papers.

- A request for dendroecological data or shrub samples: Investigating interactions between herbivores and climate in determining shrubification of the tundra. *Katariina Vuorinen*

As part of her PhD project, Katariina Vuorinen is developing a network of sites across the tundra biome to investigate the relative sensitivity of shrub growth to herbivory and climate. If anyone has any dendroecological data, or samples, from shrubs (anything from prostrate shrubs, to small trees) growing in tundra regions with either spatial or temporal contrasts in large vertebrate herbivore density that they would like to contribute to this analysis, please contact Katariina (Katariina.Vuorinen@ntnu.no). Useable data can come from regions where the main herbivore population(s) have undergone substantial changes in density in time, or from regions with spatial differences such as exclosures, natural exclosures (e.g. islands), across reindeer-fences or similar. Those providing data will of course be invited to be a co-author of resulting publications.

- Updates from the Soil Working Group. *Guillermo Bueno*

In the last two years, the Soil Working Group (SWG) has grown and now we are very happy to introduce two new members, who have consolidated the core group. In chronological order, Francis Brearley is a senior lecturer at Manchester Metropolitan University, UK, with expertise in soils and plant communities, with a main focus on soil parameters and soil biota: he brings his tropical experience to new arctic questions. Henni Ylänne defended her PhD last year (Herbivory control over tundra carbon storage under climate change) at the University of Oulu, Finland, and has recently started a postdoc position about plant strategies and carbon storage at Lund University, Sweden.

Following the main aim of the SWG, understanding the effect of herbivores and their activities on tundra soils, the group has been developing a soil protocol to measure this influence (http://herbivory.biology.ualberta.ca/files/2016/11/herbivory-network-pilot-soil-protocol.pdf).

In parallel, the SWG has been preparing a review paper about the effects of herbivores on tundra soil. In September 2016, the SWG organized a workshop at the latest HN meeting in Reykjavik, Iceland. The workshop was entitled “A systematic review on the effects of herbivores on tundra soils”. During this workshop, the participants developed plenty of materials including models about herbivory-induced changes in soil. These materials have now been used for a manuscript that has been sent for the first round of comments among the participants. The manuscript is planned to a be a short one that highlights the need to properly account for the effect of trampling of large herbivores in herbivory studies on tundra soils.

Francis and Henni, the new bright members of the soil working group.

4. Call for workshop proposals for HN2018 in Rovaniemi

The Arctic Biodiversity Congress 2018 will take place 9-11 October 2018 in Rovaniemi, Finland. We would like to organize a one-day HN workshop the Monday before (October 8, 2018). The idea would be to have a similar format to the meeting in Reykjavík in 2016, with a general overview of HN activities and ongoing projects, and time for more specific discussions and launching of new ideas in parallel micro-workshops. We would like to invite you to suggest ideas (see call for workshop ideas below), and also if you are interested in helping out with organizing the event, please let us know!

CALL FOR MICRO-WORKSHOP PROPOSALS

The HN2018 meeting in Rovaniemi will host thematic micro-workshops led by experts on each topic. Two-hour slots will be available. The micro-workshops will split participants into smaller working groups according to their interests and expertise. A summary of the activities of each working group will be presented to the larger group at the end of the meeting. If you are interested in organizing a workshop, please contact us at herbivory.network@gmail.com by May 1, 2018.

5. Call to submit abstracts and attend UArctic Congress 2018 – Session on reindeer and caribou systems. *Jeff Welker*

The UArctic Congress 2018 (https://congress.uarctic.org/program/science-section/call-for-abstracts/) will be held in Oulu, Finland this September. Jeff Welker is organising a session titled: *"Reindeer & caribou in the Arctic System: Interactions between environmental, social and biophysical processes"* and is inviting people to submit an abstract to the session. This will be a very good opportunity for graduate students, postdoctoral and young scientists and faculty to present their findings as well as a venue for the senior members of the community to share their wisdom and programs of study.

If interested, do not hesitate to contact Jeff (jmwelker@alaska.edu).

6. What's next?

- ## Symposium at Canadian Society of Ecology and Evolution Annual Meeting 2018: Trophic interactions in the changing north

There will be a symposium titled 'Trophic interactions in the changing north' during the CSEE annual meeting at Guelph (18-21 July 2018).

Northern ecosystems are experiencing great change. Climatic warming alters the intensity of abiotic limitation factors, while the northward migration of species changes biotic interactions. Together these changes affect the balance of top-down and bottom-up regulating forces in boreal and Arctic ecosystems. This symposium addresses how changing abiotic conditions and shifting species distributions alter trophic interactions and ecosystem dynamics in the north. Community ecology, network ecology and biogeographical approaches to studying trophic interactions will be united and talks will cover trophic levels from producers, to herbivores and carnivores as well as soil ecology. The symposium will therefore provide a holistic venue for synthesizing understanding the regulation of northern ecosystem dynamics and communities in a period of intense environmental change.

Confirmed speakers include Isabel Barrio (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). Hopefully many Herbivory Network members will be able to join!

- ## Sessions and workshop at the Arctic Biodiversity Congress in Rovaniemi

During the Arctic Biodiversity Congress in Rovaniemi next October 9-11 we are applying for a session titled "Herbivory in the Arctic – understanding patterns and processes of a key ecological interaction" that will highlight recent advances in the understanding of biome-wide patterns related to herbivory. As well, Bruce Forbes is organising a session on the social-ecological importance of large herbivores. Together with the HN workshop, this will make a great opportunity to visit Rovaniemi in the fall!

- ## Other important dates and interesting meetings

April 25-27, 2018. 19th ITEX meeting, Stirling, UK
June 15-26, 2018. Polar 2018, Davos, Switzerland
March 3-5, 2020. Oikos meeting in Iceland (I know it is way too far, but save the date!)

7. Recent papers

- *Wildlife species benefitting from a greener Arctic are most sensitive to shrub cover at leading range edges.*
  Wheeler HC, Høye TT, Svenning J-C. (2018) Global Change Biology 24:212–223.

Through meta-analysis of existing literature we investigated the evidence for links between shrub cover and indicators of population performance in arctic and sub-arctic wildlife. Species from greener habitats (higher NDVI) were more likely to respond positively to shrub cover indicators demonstrating the potential for boreal species to expand northward. Populations at leading edges of species ranges with respect to greenness (low NDVI relative to species range) were more likely to respond positively to shrub cover, showing how shifts at leading edges of species ranges may be particularly rapid. To date, few studies assess how arctic specialists might respond to shrub change. The study also highlights the complexities of discriminating between herbivore responses to shrub and herbivore effects on vegetation and the need for further research to evaluate the relative influence of these two processes on shrub-wildlife associations.

Different herbivores will respond differently to changes in shrub cover.
Photos: Helen Wheeler.

- Rangifer management controls a climate-sensitive tundra state transition.
  Bråthen, K. A., Ravolainen, V. T., Stien, A., Tveraa, T. and Ims, R.A. (2017) Ecological applications 27:2416-2427.

This paper looks at how tall shrubs respond to reindeer herbivory and climate. These drivers were assessed based on a large-scale quasi-experimental study design that spanned a wide range of Rangifer population densities and summer temperatures. The response of shrubs was studied both in terms of distributional limit (from aerial photographs) and density and height of small shrub life stages (from a ground survey). Where Rangifer densities were above a threshold of approximately 5 animals/km2, the small life stages of shrubs in grasslands were at low height and low abundance. Thus, abundant reindeer appear to keep shrubs in a “browse trap” independent of temperature. The altitude of shrubline was affected by both reindeer (decrease) and temperature (increase).

- Assessing the Ecological Impacts of Extensive Sheep Grazing in Iceland
  Marteinsdóttir B, Barrio IC and Jónsdóttir IS (2017) Icelandic Agricultural Sciences 30:57-72.

This paper, which was published in December 2017, compiled all available information on the effects of sheep grazing on vegetation, soil properties and other organisms in the rangelands of Iceland. While the scarcity of studies prevented them from drawing general conclusions, there were some consistent trends. The extent of bare ground was significantly higher in grazed areas and grazing affected plant community structure. This indicates that sheep grazing increases the potential for soil erosion in Icelandic rangelands. In the end of the paper they emphasise that a better understanding of the ecological impacts of sheep grazing is required to inform sustainable grazing practices adapted to the local conditions of this region.

- Multiple Feedbacks Contribute to a Centennial Legacy of Reindeer on Tundra Vegetation.
  Egelkraut D, Aronsson K-A, Allard A, Åkerholm M, Stark S, Olofsson J. Ecosystems (in press).

The article explores long-term stability of reindeer-induced vegetation shifts by addressing "Historical Milking Grounds" (HMGs): patches in the Scandinavian tundra that were subject to high reindeer concentrations until 100 years ago, but still show a striking similarity to actively grazed areas. Next to providing a detailed description in terms of vegetation, soil and reinvasion rate of the surrounding tundra, the study reveals that several ecological drivers, such as increased nutrient turnover rates and a preference of rodents to feed on shrubs inside the HMGs, contribute to the stability of this vegetation type.

This paper is the first chapter of Dagmar's PhD thesis to be published. She defended her PhD thesis, called 'Long-Lasting Ecological Legacies of Reindeer on Tundra Vegetation' recently. Please find here a link to the PhD thesis, or email Dagmar if you are interested in the full PDF or a paper copy (dagmaregelkraut@gmail.com).

- Cervid Exclusion Alters Boreal Forest Properties with Little Cascading Impacts on Soils.
  Kolstad AL, Austrheim G, Solberg EJ, Venete AMA, Woodin SJ, Speed JDM. Ecosystems (in press)

This new paper sheds new light on how moose affects forests. In a recently published article in the journal Ecosystems, Kolstad *et al.* showed the impact moose browsing has on boreal forest structure, tree species composition, and soil temperature and processes. Understanding the effect moose have on forest ecosystems is crucial for guiding how we manage their populations, as moose have no natural predators in most of Scandinavia.

The article showed that chronic moose browsing has caused developing forest to become more open and considerably warmer. The researchers did not find any change in belowground

parameters such as soil nutrient dynamics, in contrast to previous studies which showed that the conifer dominated forest associated with larger moose presence also comes with a reduction in soil fertility. This discrepancy may be a product of soils generally taking a long time to change in response to pressures, which makes way for exciting research in the future. We hope the large experimental infrastructure underpinning this study can continue for many more years so that we can increase our understanding of the functional role that moose has in the forest.

Picture of a moose exclosure 8 years after it was built on a recent boreal forest clear cut site, Trondheim, central Norway. Photo: Audun Hageskal.

You will be kept updated about all ongoing activities via our homepage or our newsletters. If you have any content that you would like profiled on our website, please contact us at herbivory.network@gmail.com.