

Herbivory Network: Advancing research on herbivory in Arctic and alpine ecosystems

David S HIK¹, Isabel C BARRIO², C Guillermo BUENO³, Ingibjörg Svala JÓNSDÓTTIR^{2,4}, Martin A MÖRSDORF⁵, Virve T RAVOLAINEN⁶, Eeva M SOININEN⁵



...why HERBIVORY?

- key biotic interaction in tundra ecosystems, through effects on biodiversity, energy flows and nutrient cycling
- herbivores influence the responses of tundra plant communities to environmental changes
- outcomes of herbivory vary regionally and often depend on site-specific characteristics, e.g. productivity, human management, geological substrate or species diversity

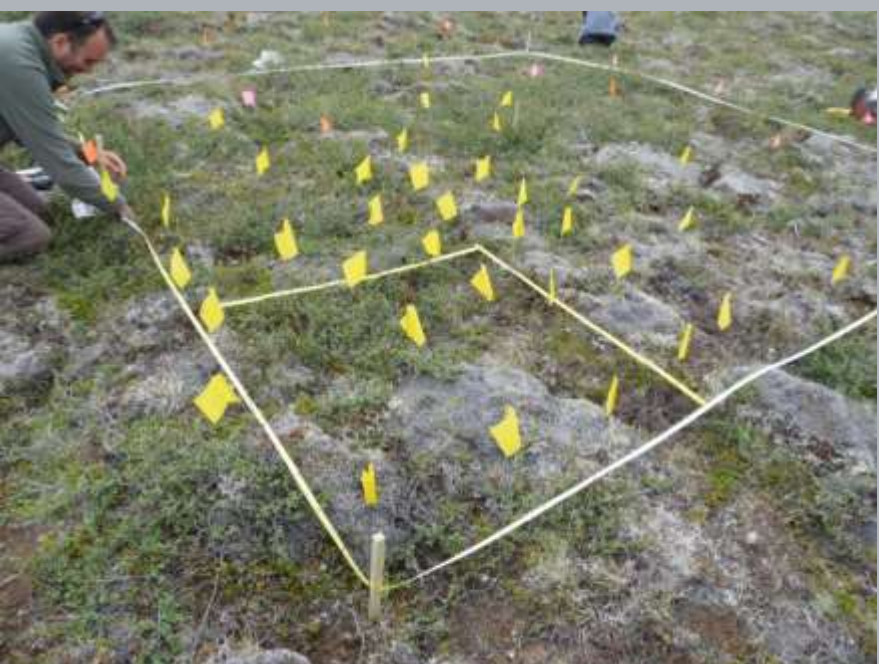
...why a NETWORK?

Understanding the role of herbivory in tundra ecosystems at a global scale, and what drives its spatial and temporal variation requires **coordinated research efforts**.

The Herbivory Network covers this gap, by fostering collaborations within and across disciplines and facilitating synthesis and multi-site comparisons through the use of common standardized protocols¹

The priorities of Herbivory Network are..

- to integrate study sites, **methodologies** and metrics used in previous work
- homogenize data collection and ensure meaningful comparisons across studies
- address **research questions** and synthesize knowledge on the role of herbivory in northern and alpine ecosystems
- serve as communication platform for researchers and stakeholders



Since 2013 the Herbivory Network has contributed to **making research on tundra herbivory more global**. Several **workshops** and **meetings** have been organized, **posters** have been presented at numerous conferences, two conceptual **papers**^{1,2} and a global data synthesis³ have been published, drafts of **common field protocols** have been developed, **students** have been recruited, and the **member** list includes 125 enthusiastic colleagues from 17 countries interested in contributing to new work

The Herbivory Network is an international **collaborative research initiative** that brings together researchers from Arctic and alpine regions to investigate the diverse roles of herbivores in these changing ecosystems

Developing **standardized protocols**



ITEX herbivory protocol

In collaboration with the International Tundra Experiment (ITEX), these measurements will allow understanding the combined effect of warming and herbivory on tundra plants



Soil protocol

Soils are a key element of tundra ecosystems, limiting the survival, growth and reproduction of plants, but the effects of herbivory on tundra soils are still largely unknown



Invertebrate herbivory protocol

Invertebrate herbivory is often overlooked in tundra ecosystems but we still lack basic understanding on how much biomass is actually removed by invertebrate herbivores in tundra



Vertebrate herbivory protocol

Co-occurring vertebrate herbivores feed at different intensities, frequencies and spatial scales. need measurements of *common herbivory currency* to compare vertebrate herbivory among different sites

Designing a **coordinated experiment**



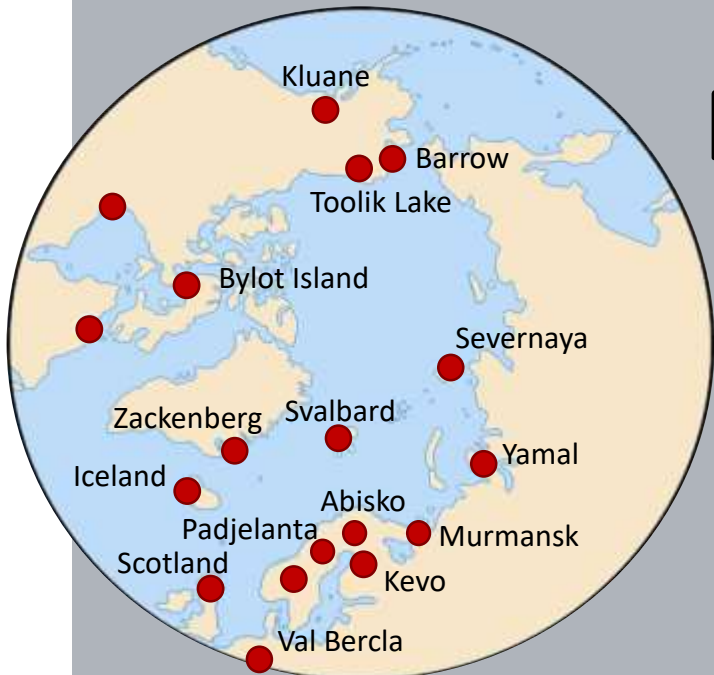
The implementation of a geographically-balanced, coordinated experiment will ultimately enhance our understanding of the role of herbivory in northern and alpine environments



photo: Eeva Soininen

Answering **research questions**

Some examples of ongoing research projects within HN are:

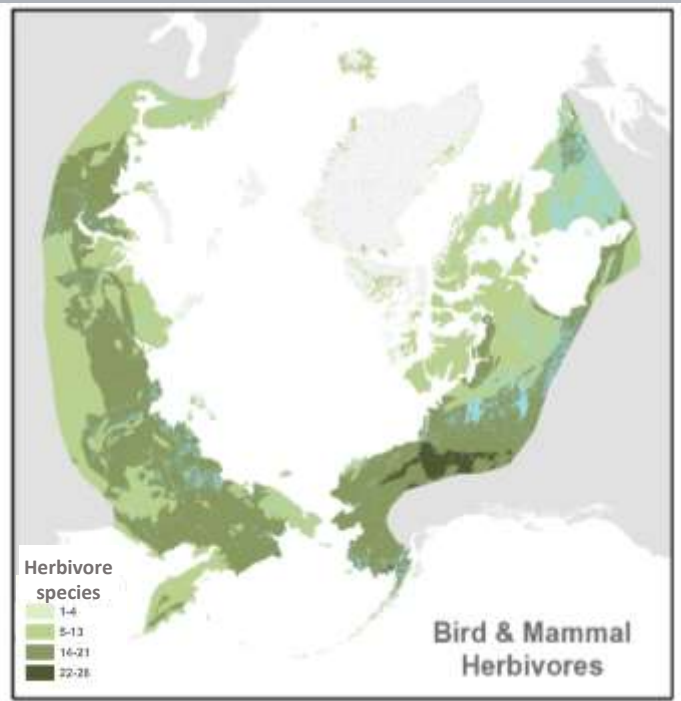


Mapping our knowledge on herbivory in the Arctic

Synthesizing knowledge using systematic maps will increase our understanding of context-dependence herbivory research carried out at many Arctic sites

What drives functional and phylogenetic diversity of herbivores in the Arctic?

Functional and phylogenetic diversity of herbivores can ultimately influence their role in tundra ecosystems, and their resilience



How does invertebrate herbivory vary across the tundra biome?

Two ongoing projects assess patterns of invertebrate herbivory across the tundra biome focusing on a common tundra plant, the dwarf birch, and estimating biomass losses at the plant community level

Can we increase comparability between studies of herbivory through better study designs?

Plant-herbivore studies involve sessile and mobile organisms and effective study designs remain challenging. We need common tool-sets to increase comparability of studies



References

¹BARRIO, IC, HIK, DS, JÓNSDÓTTIR, IS, BUENO, CG, MÖRSDORF, MA, RAVOLAINEN, VT (2016) Herbivory Network: an international, collaborative effort to study herbivory in northern and alpine. Polar Science 10(3):297-302; ²BUENO, CG, BARRIO, IC, RAVOLAINEN, VT, MÖRSDORF, MA, JÓNSDÓTTIR, IS, HIK, DS (2014) Herbivory de zonas árticas y alpinas en el contexto del cambio global. Ecosistemas 23(2):163; ³BARRIO, IC, BUENO, CG, GARTZIA, M, SOININEN, EM, CHRISTIE, KS, SPEED, JDM, RAVOLAINEN, VT, FORBES, BC, GAUTHIER, G, HORSTKOTTE, T, HOSET, KS, HØYE, TT, JÓNSDÓTTIR, IS, LÉVESQUE, E, MÖRSDORF, MA, OLOFSSON, J, WOOKEY, PA, HIK, DS (2016) Biotic interactions mediate patterns of herbivore diversity in the Arctic. Global Ecology and Biogeography 25(9):1108-1118

For more information:

<http://herbivory.biology.ualberta.ca>



herbivory.network@gmail.com

¹Department of Biological Sciences, University of Alberta, Edmonton AB, T6G 2E9 Canada; ²Institute of Life and Environmental Sciences, University of Iceland, Askja, Sturlugata 7, Reykjavík IS-101, Iceland; ³Institute of Ecology and Earth Sciences, Department of Botany, University of Tartu, Lai 40, Tartu, 51005, Estonia; ⁴University Centre in Svalbard (UNIS), Longyearbyen N- 9171, Norway; ⁵Department of Arctic and Marine Biology, UiT – The Arctic University of Norway, NO-9037, Tromsø, Norway; ⁶Norwegian Polar Institute, Fram Centre, NO-9296 Tromsø, Norway