Herbivory Research Conducted near Toolik Field Station: A Brief Review

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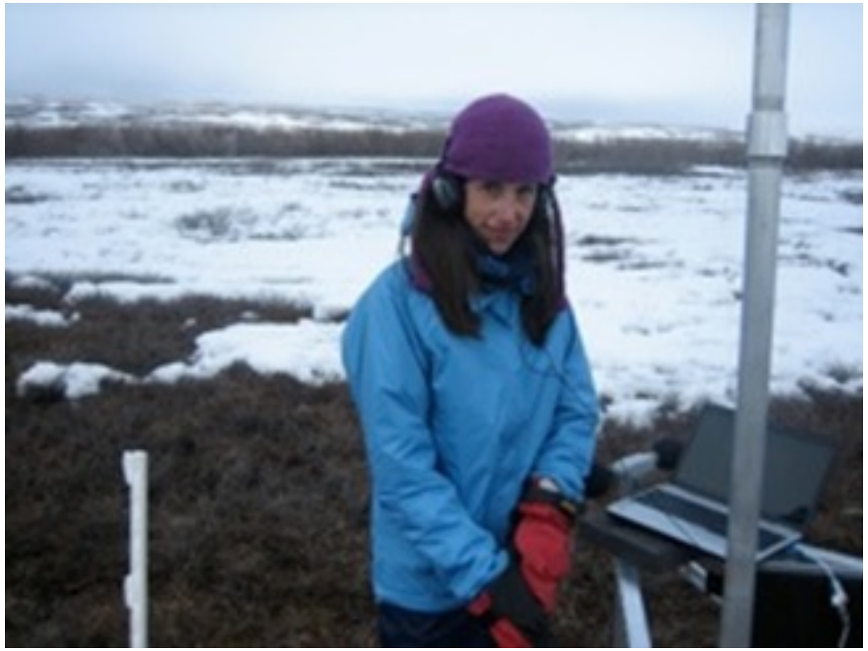
Acknowledgments: Gus Shaver

Setting up Donie's removal experiment, 1997

Acknowledgments: Jim Laundre

Acknowledgments

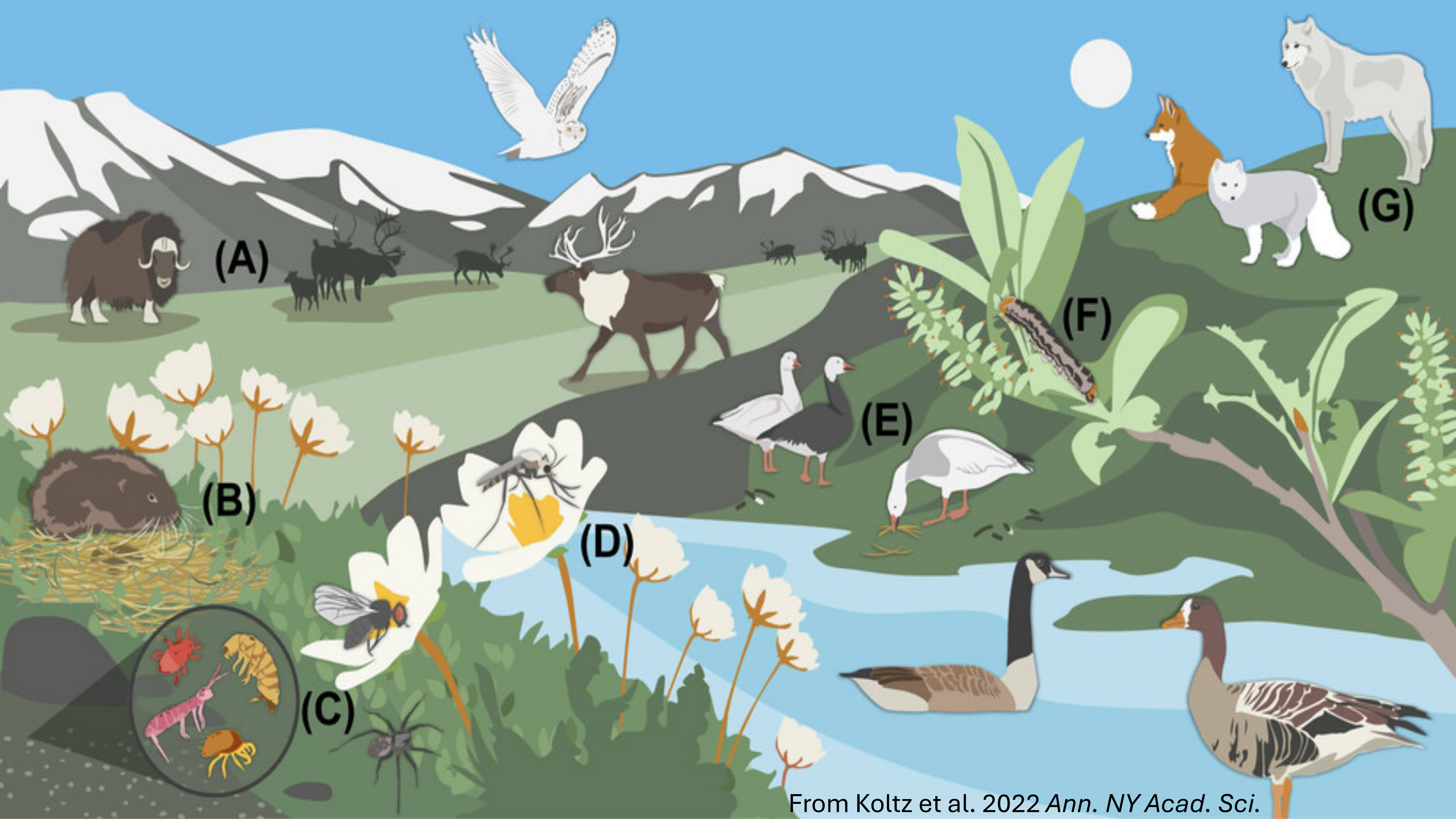


- Gus Shaver
- Jim Laundre
- Team Vole
  - Natalie Boelman
  - Kevin Griffin, Ed Rastetter, Austin Roy, Liz Min, Matt Suchocki, Nicole Williamson, Jess Steketee, Mary Kate Lisi, Andrew Uccello, Lyndsey Marquez

- Multiple grants from NSF to support ARC LTER, Team Vole, and related projects


Tiller
Rhizome
Flower Bud
Root
Infloresence
Anatomy of an Eriophorum Vaginatum Tussock


EXIT
FROOT LOOPS
APPLE JACKS
Biomass and Productivity in Vehicle Tracks



From Koltz et al. 2022 *Ann. NY Acad. Sci.*

THE HERBIVORY NETWORK

Studying herbivory in arctic and alpine ecosystems

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ABOUT US

The Herbivory Network is a collaborative research initiative that investigates the role of herbivory in Arctic and alpine ecosystems.

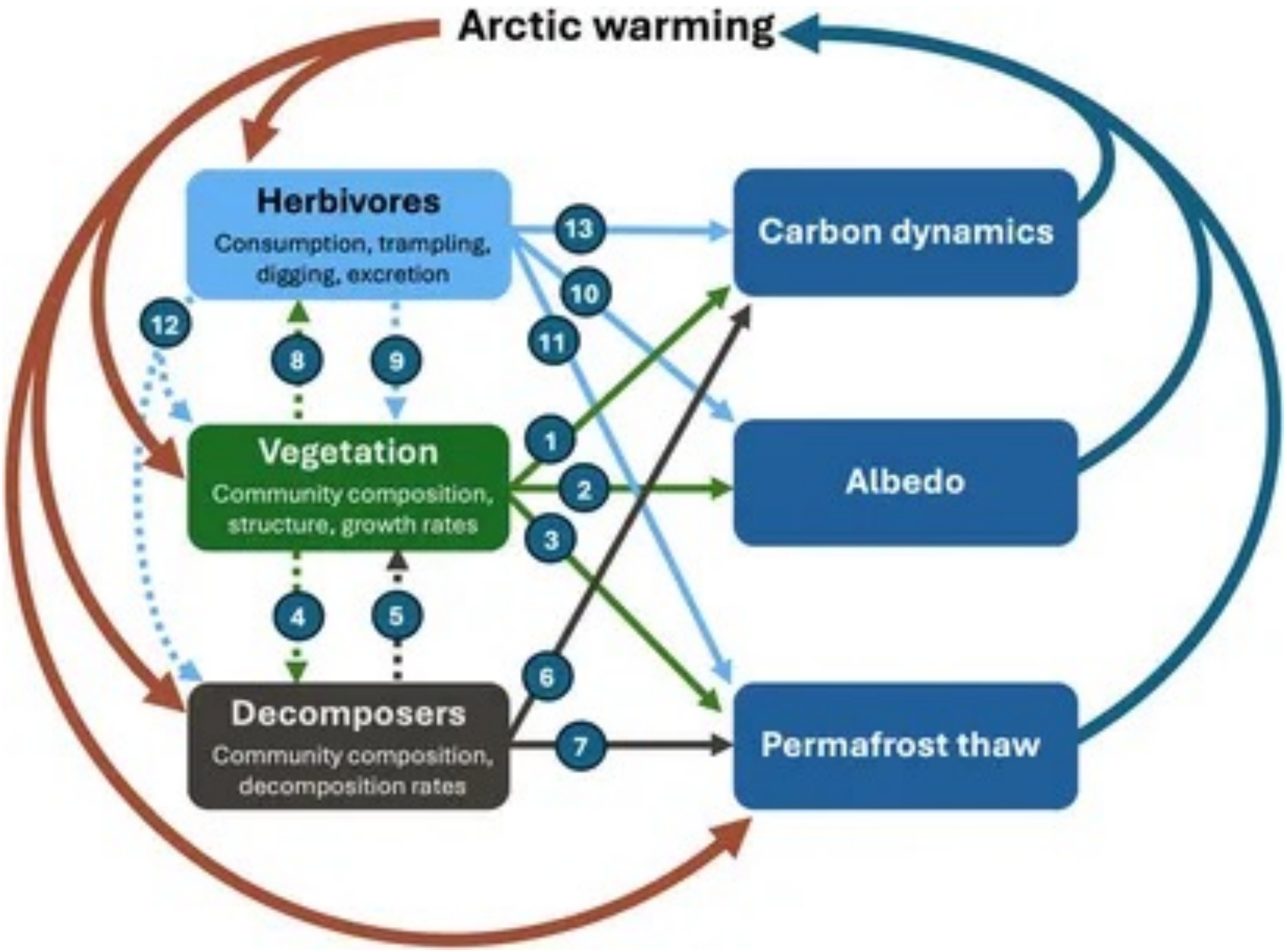
The HN was established in 2014, as the first global initiative to start coordinated research on this topic. The goal of HN is to foster collaborations within and across disciplines, to facilitate multi-site comparisons, and to assist in understanding the complexity and variability of responses of tundra ecosystems to herbivory.

Here you can learn more about:

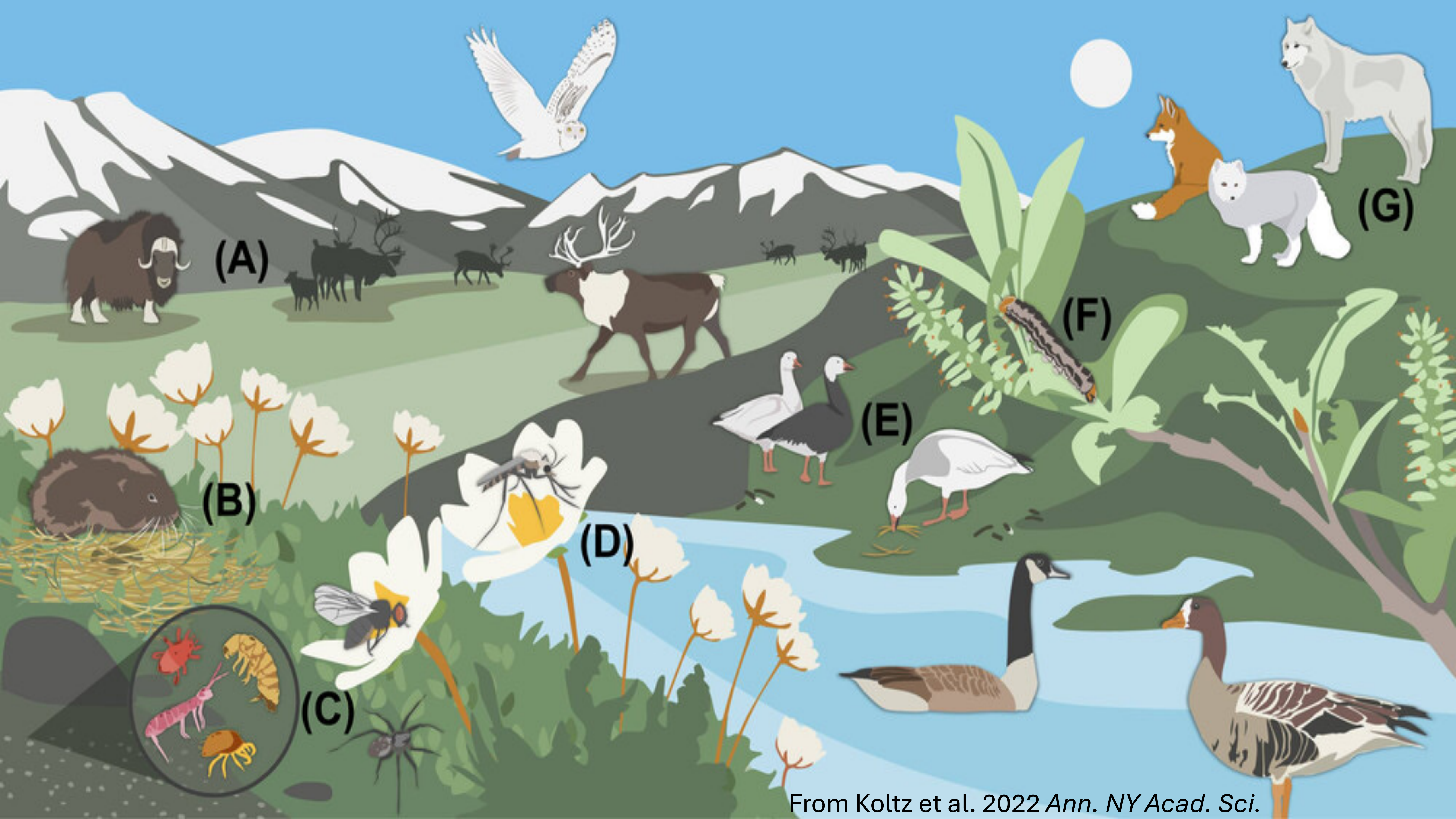
- the story behind the Herbivory Network
- our current members

https://herbivory.lbhi.is/

Biotic Feedback Loops in the Arctic

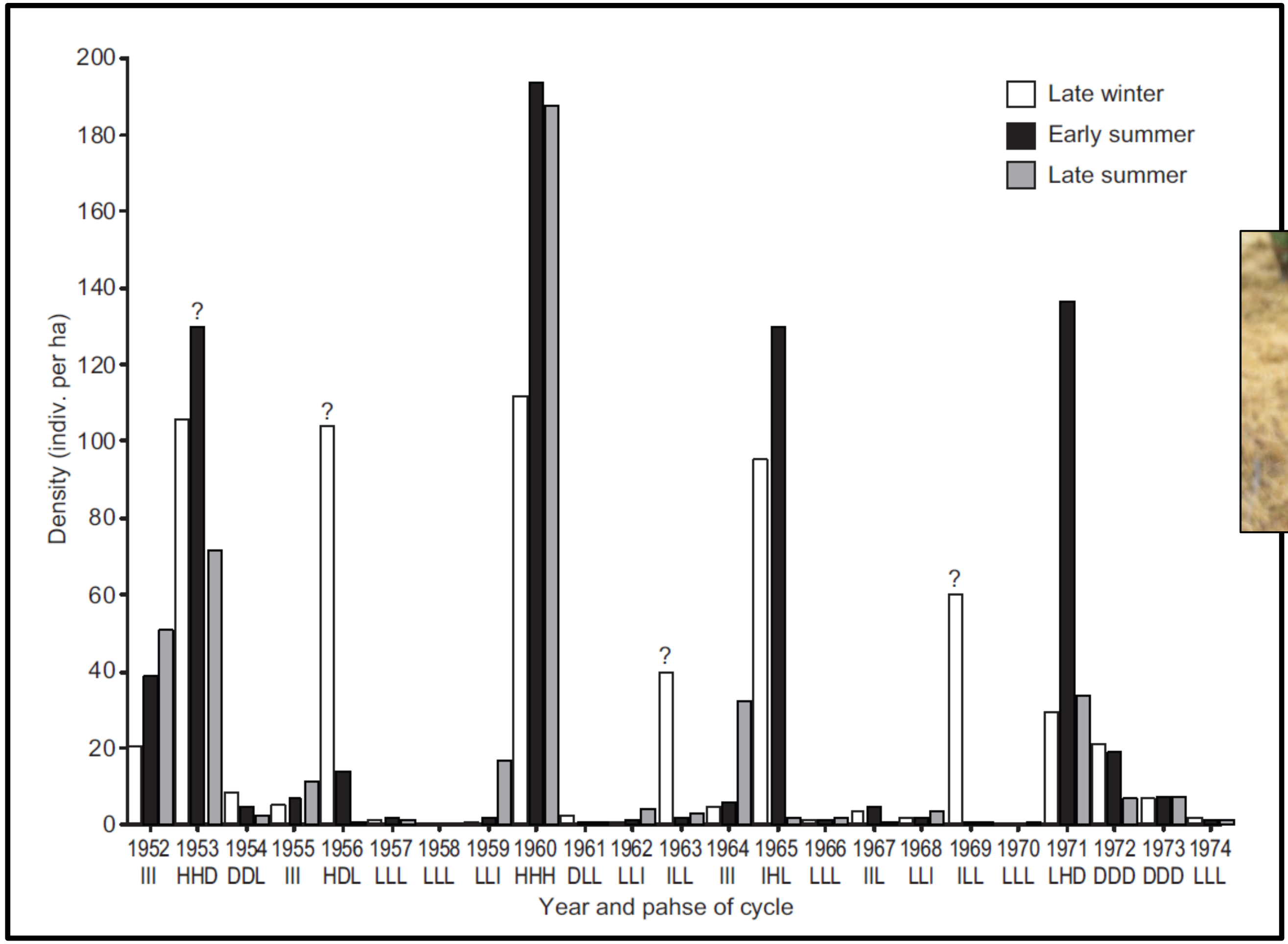


Schmidt et al. 2024 *Front. Environ. Sci.*



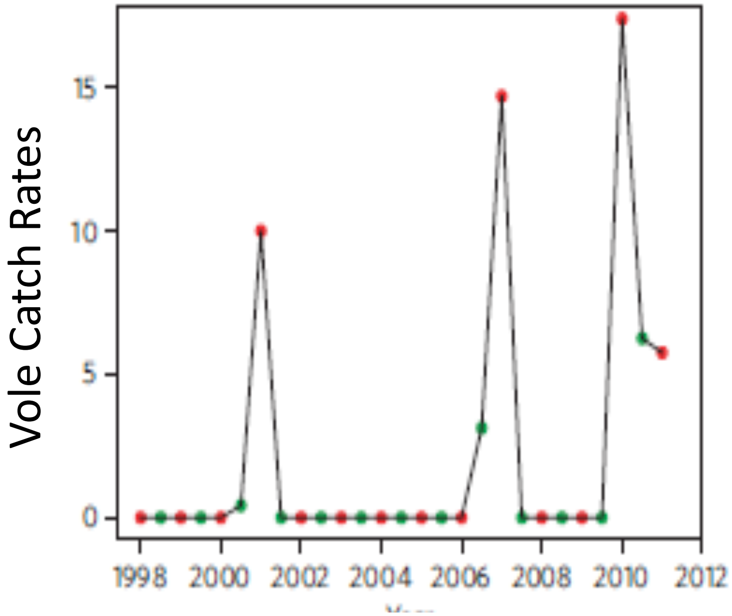
From Koltz et al. 2022 *Ann. NY Acad. Sci.*

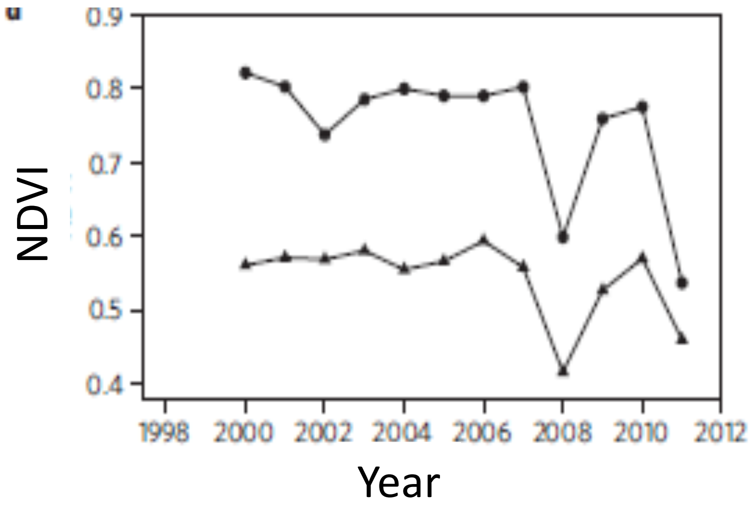
Rodent Population Cycles



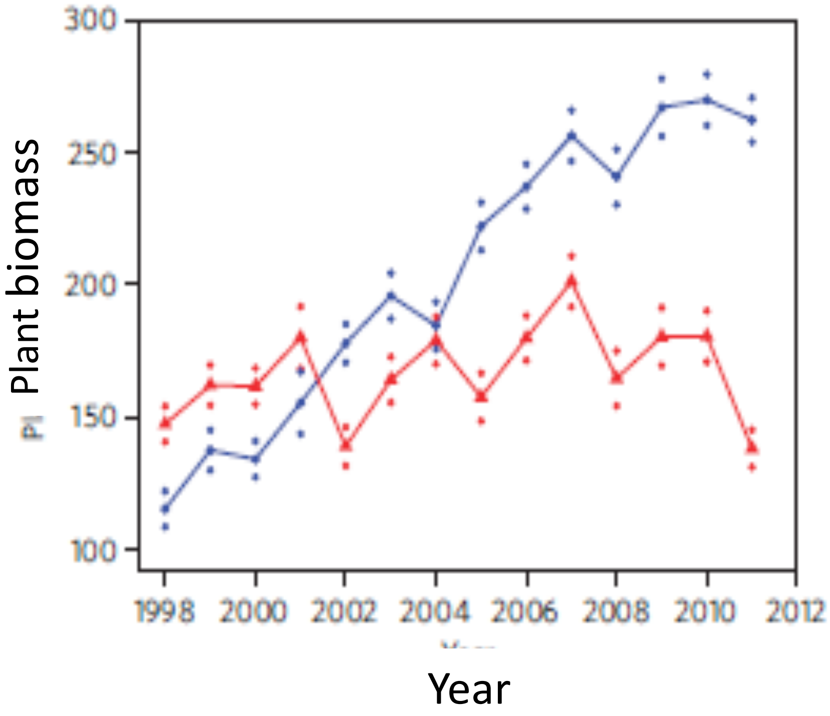
Historic 3-5 year lemming population cycle near Utqiaġvik, AK

Evidence that Rodents Affect Carbon Cycling



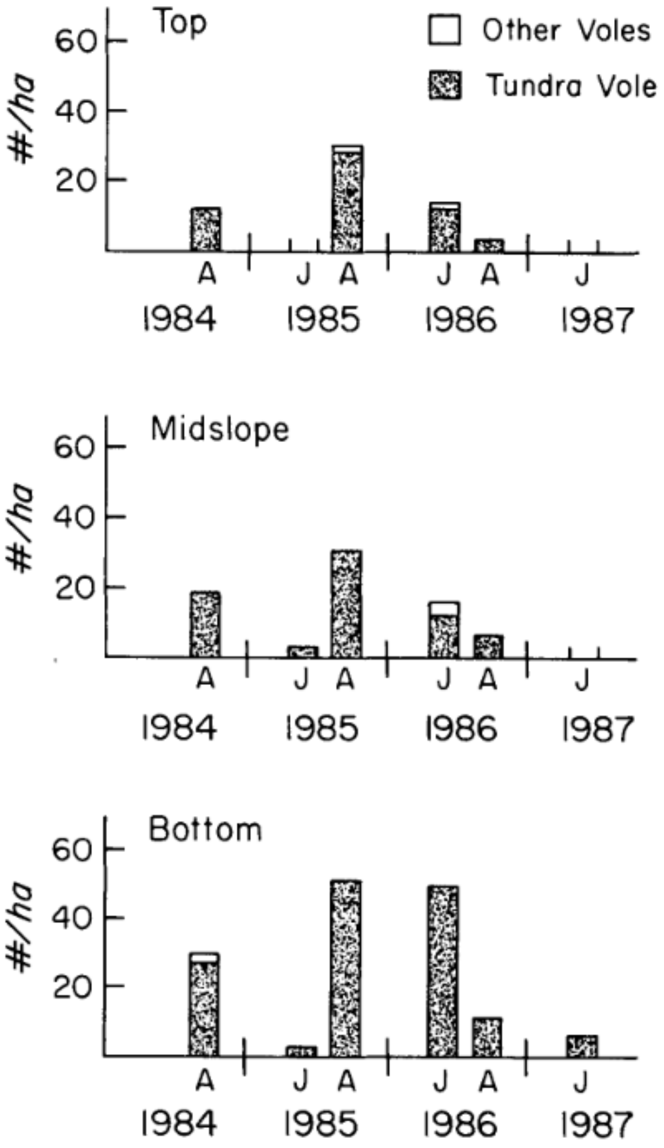


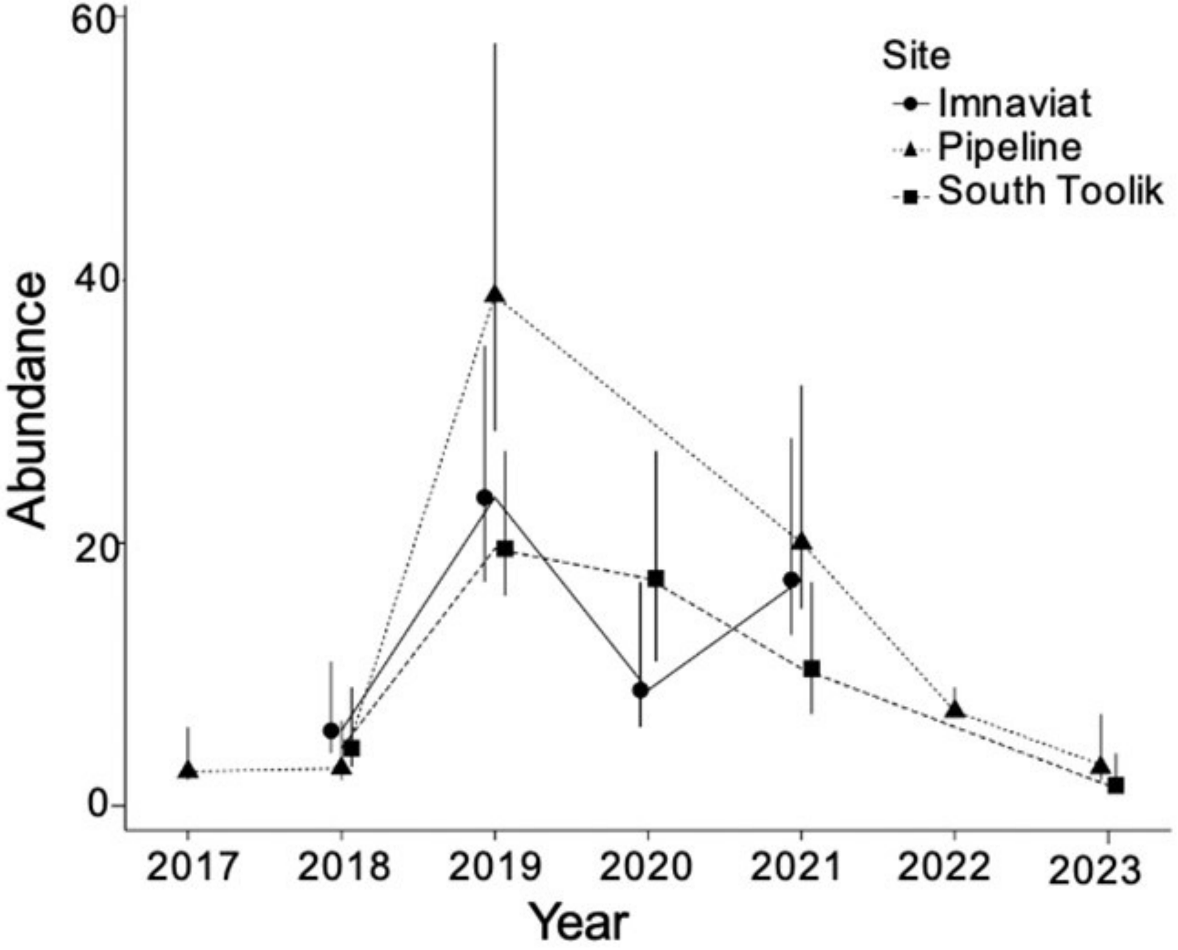
Abisko Region of Northern Sweden



Olofsson et al. 2012 *Nature Climate Change*

Vole Density near Toolik Field Station

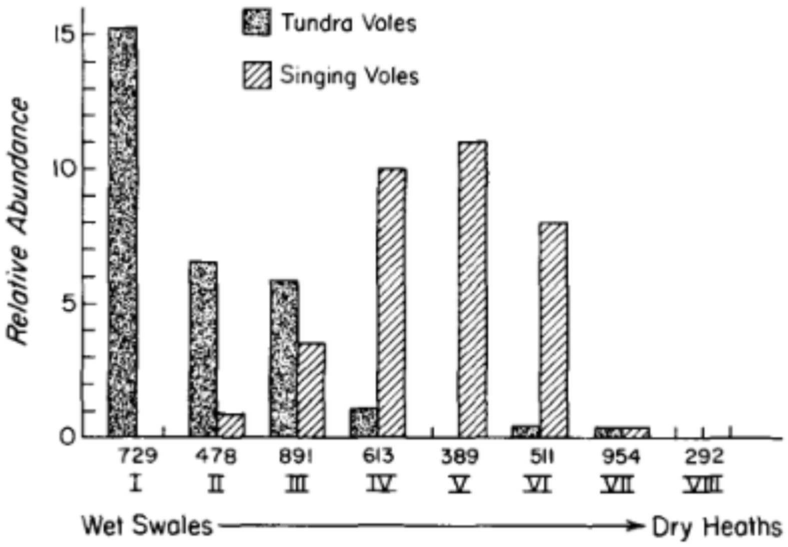


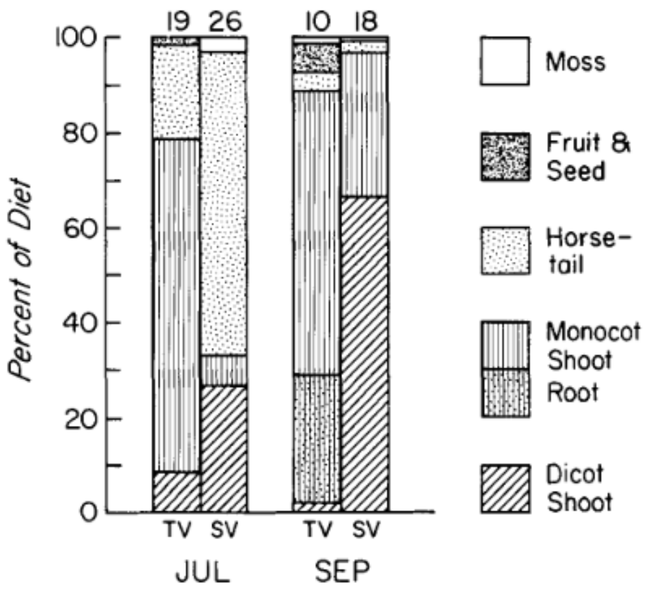


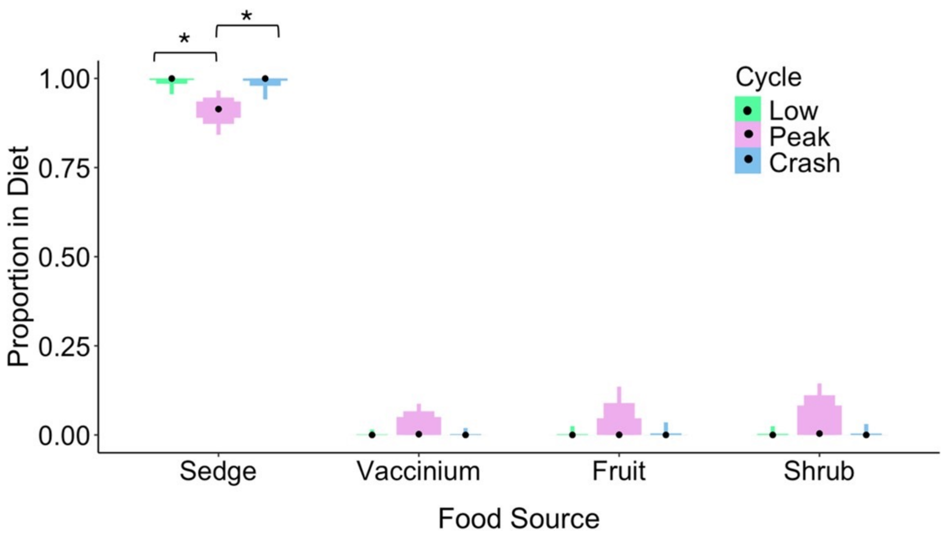
Batzli and Henttonen 1990 *Arc. Alp. Res.*

Steketee 2024

Vole Habitat Preference and Diet







Batzli and Henttonen 1990 *Arc. Alp. Res.*

Lisi et al. 2025 *Arc. Ant. Alp. Res.*

Simulated Herbivory with Nutrient Addition

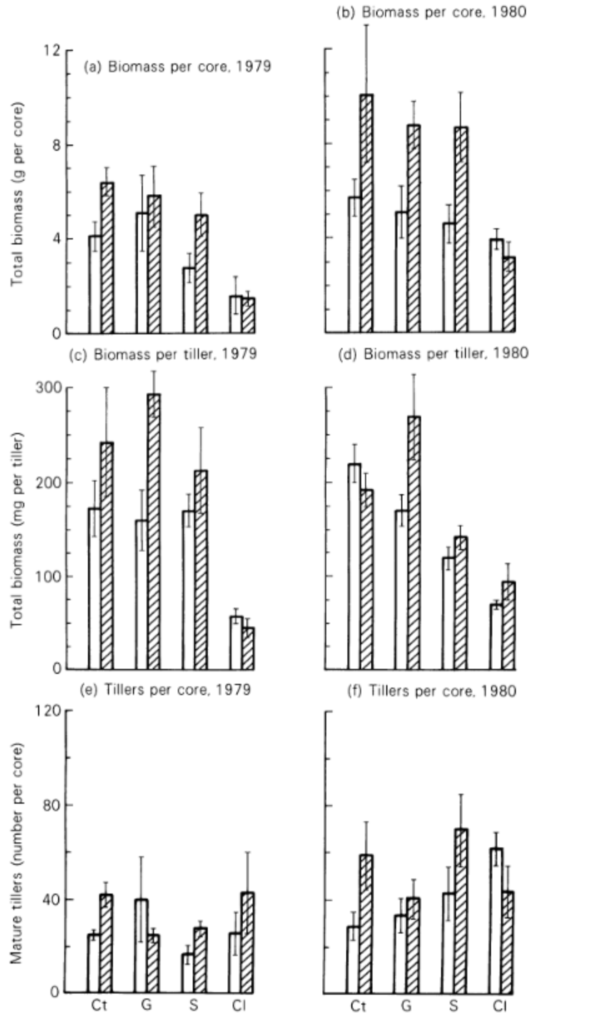
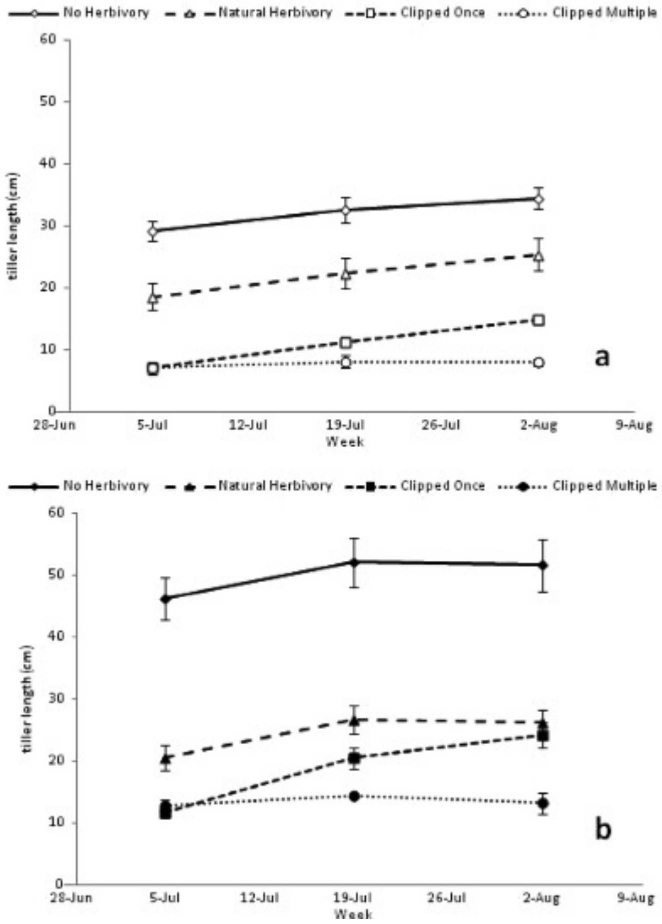


FIG. 6. Treatment effects on (a, b) total biomass per core, (c, d) total biomass per mature tiller, and (e, f) number of mature tillers per core in *Eriophorum vaginatum* at the peak-season harvests (27 July–1 August 1979 and 24 July–1 August 1980) at Toolik Lake, Alaska. Unfilled bars indicate unfertilized treatments; hatched bars indicate fertilized treatments. Symbols: Ct, control and fertilizer only; G, glasshouse; S, shade; Cl, clipped. The range bars are ±1 S.E.

Shaver et al. 1986 *J. Ecol.*

Fig. 2. Mean *Eriophorum vaginatum* tiller size (*n* = 4, error bars ± 1 SE) in (*a*) control and (*b*) fertilized plots following biomass removal by experimental clipping and natural herbivory. Clipping occurred 15 June 2004 for "clipped once" and additionally on 29 June and 13 July 2004 for "clipped multiple"). See text for description of treatments.



Johnson and Gough 2013 *Botany*

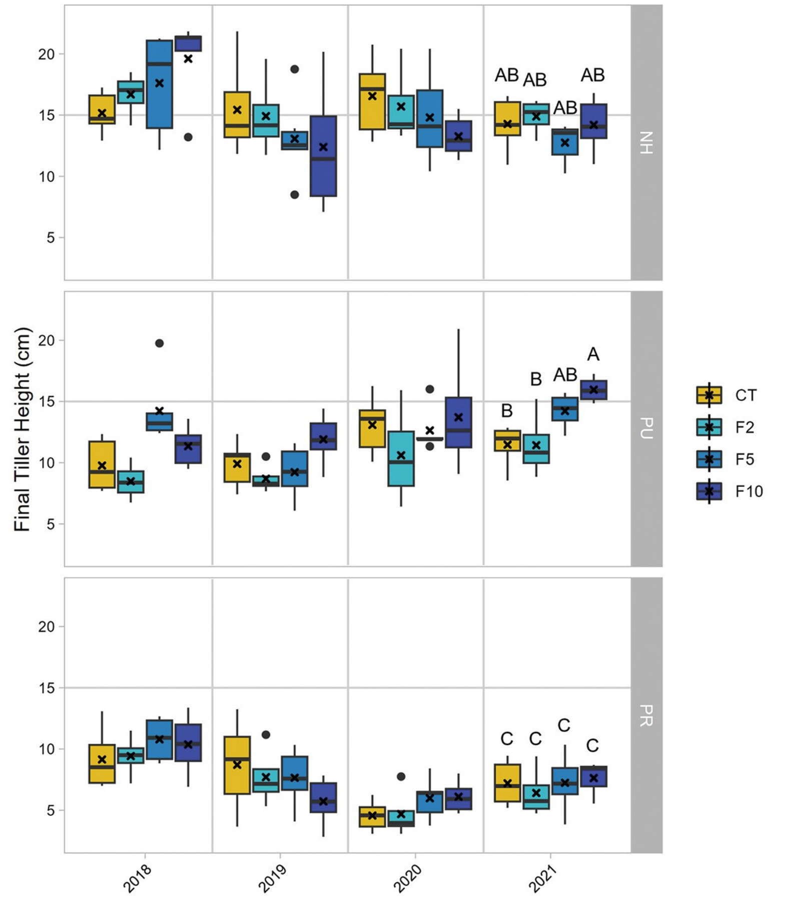


Figure 5. Final tiller heights (n=3 except n=2 in F2) among simulated herbivory and fertilization treatments for four growing seasons (2018-2021); NH=no herbivory; PU=pulse; PR=press

Williamson et al. 2024 *Arc. Alp. Ant. Res.*

OIKOS 71: 193-

MINI-
REVIE

Vertebra
influence

R. L. Jefferies

ree levels) and

PLUCKING

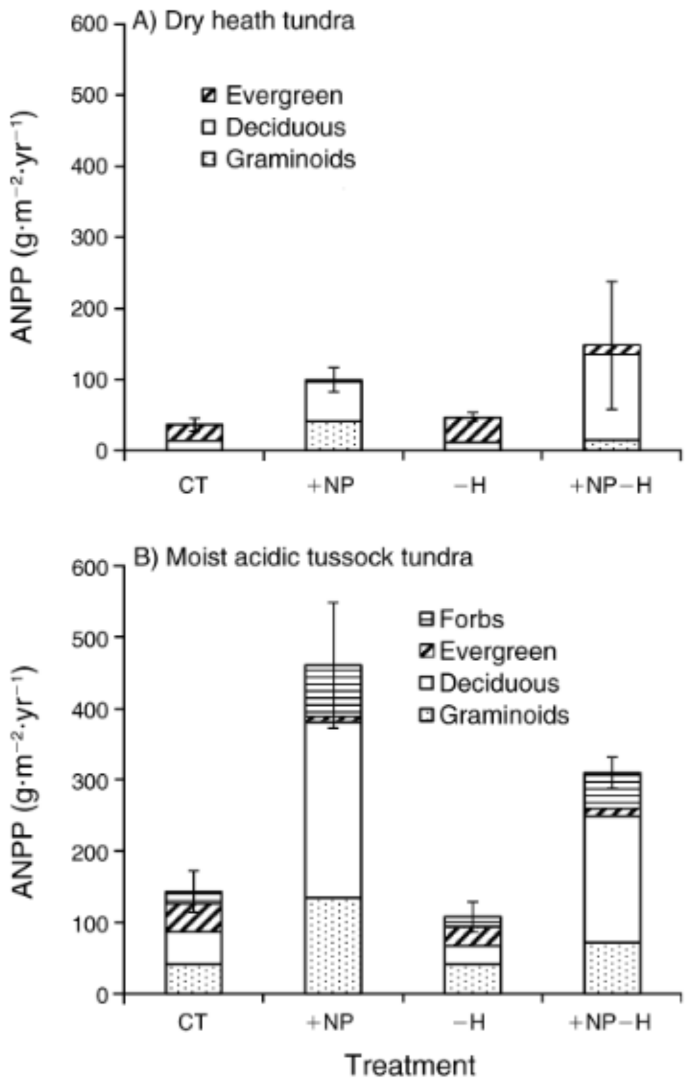
Gus Shaver and Laura Gough (2012)

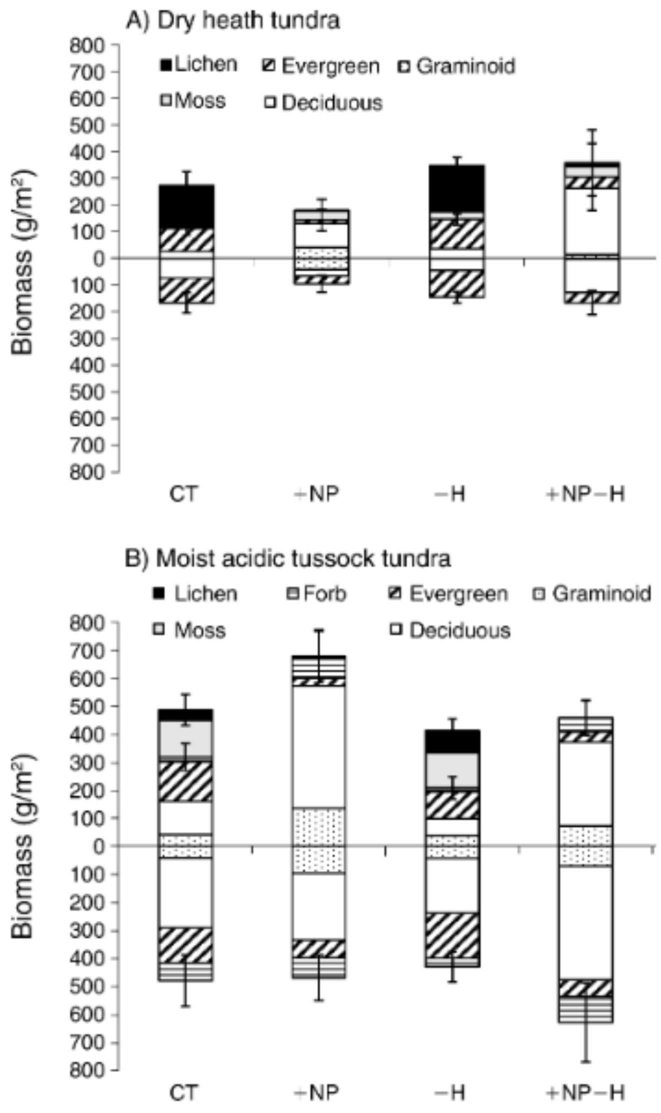
Mat Williams and Ed Rastetter (1997)

Anne Giblin (1997)

Sarah Hobbie and Laura Gough (2000)

Herbivore Exclosure with Nutrient Addition



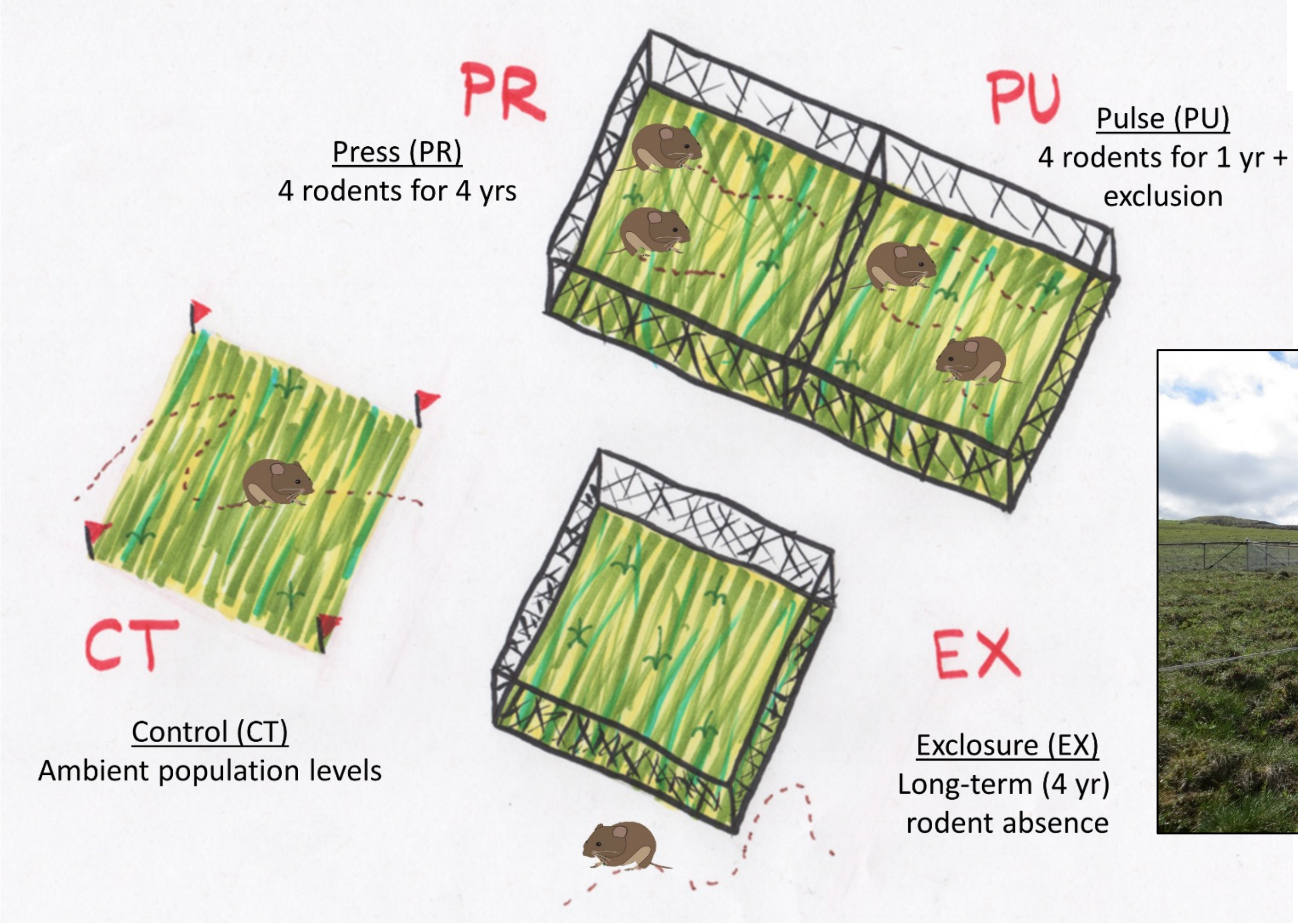


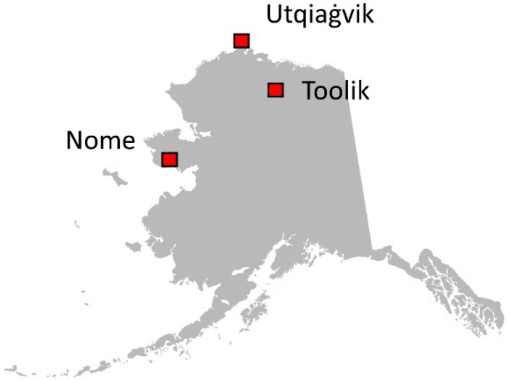
CT = control
+NP = added N and P
-H = exclosure
+NP-H = added N and P inside exclosure

Gough et al. 2012 *Ecology*

Team Vole: Changing Rodent Density

Exclosures AND Enclosures across multiple ecosystems

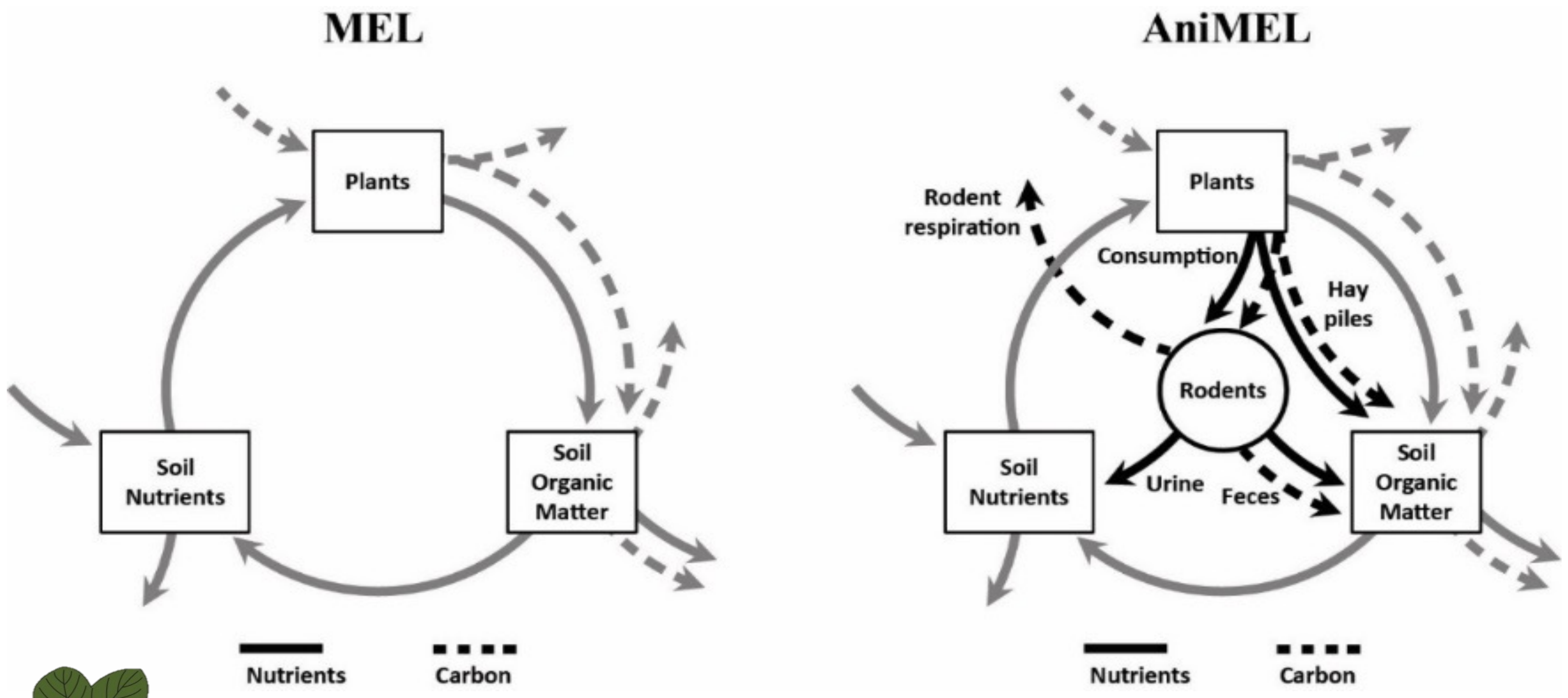




Team Vole

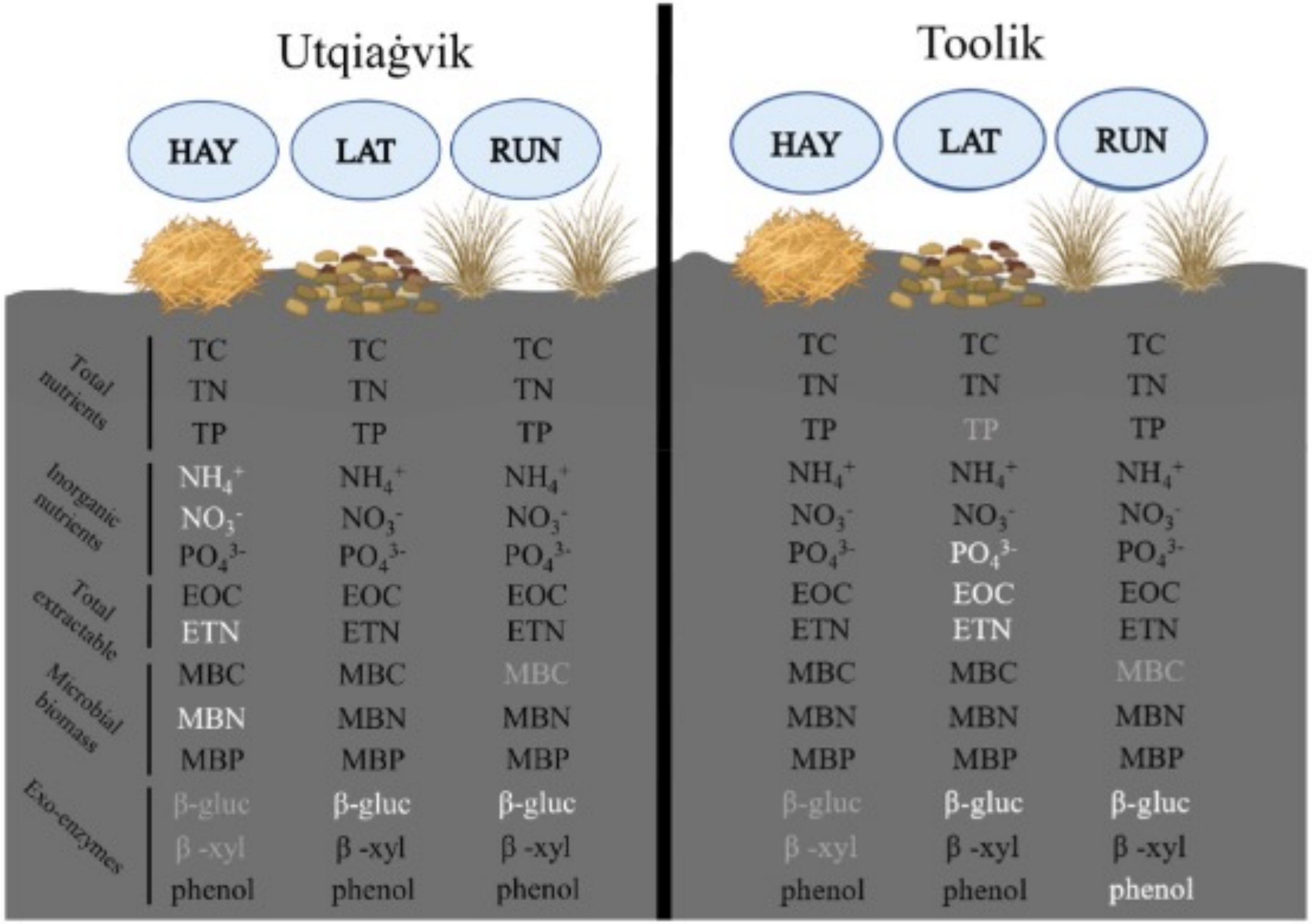
“Animating” the Carbon Cycle

Quantify and model impacts of rodents on carbon & nutrient cycling



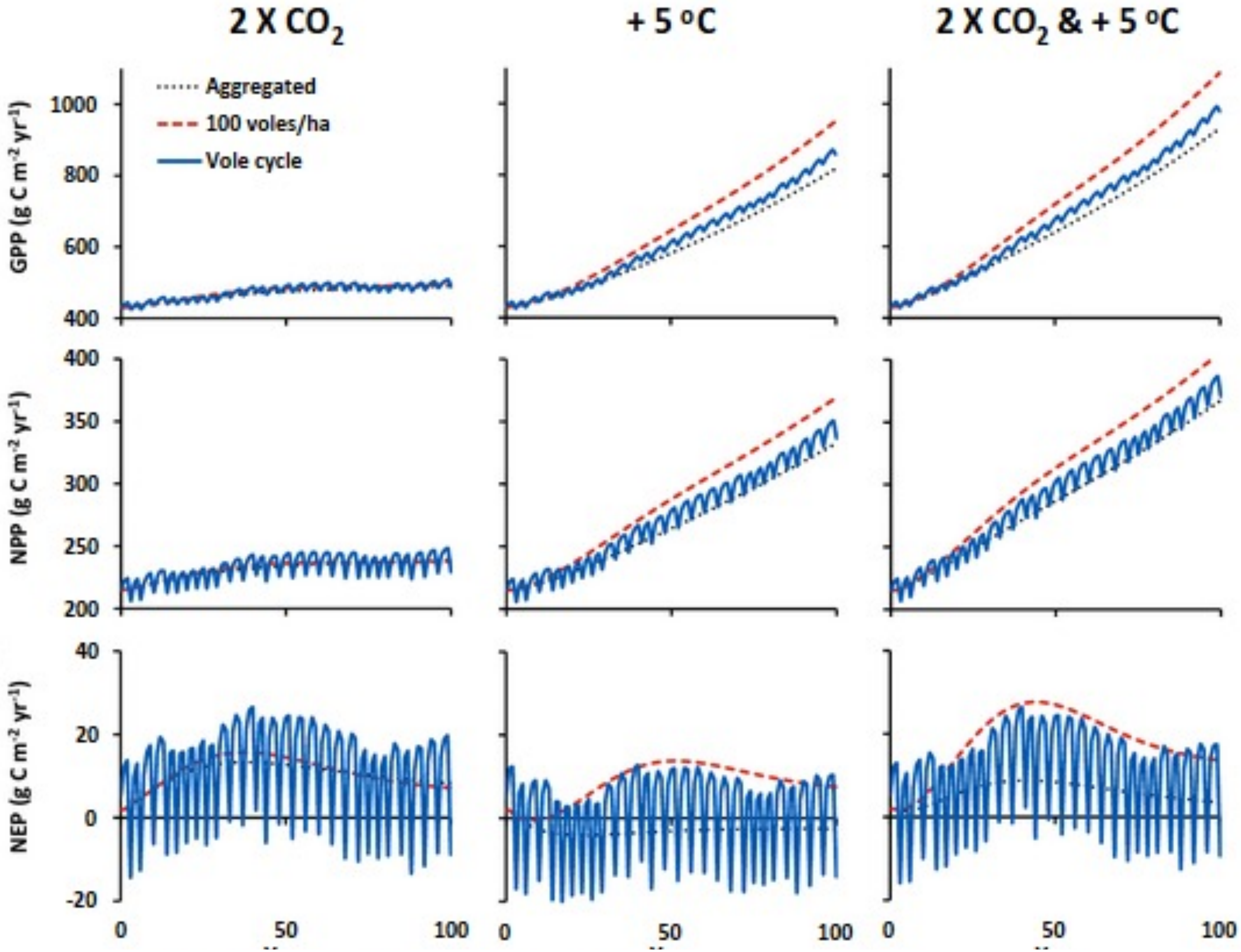
Project future climate & vegetation

Non-consumptive Effects of Voles (and Lemmings)



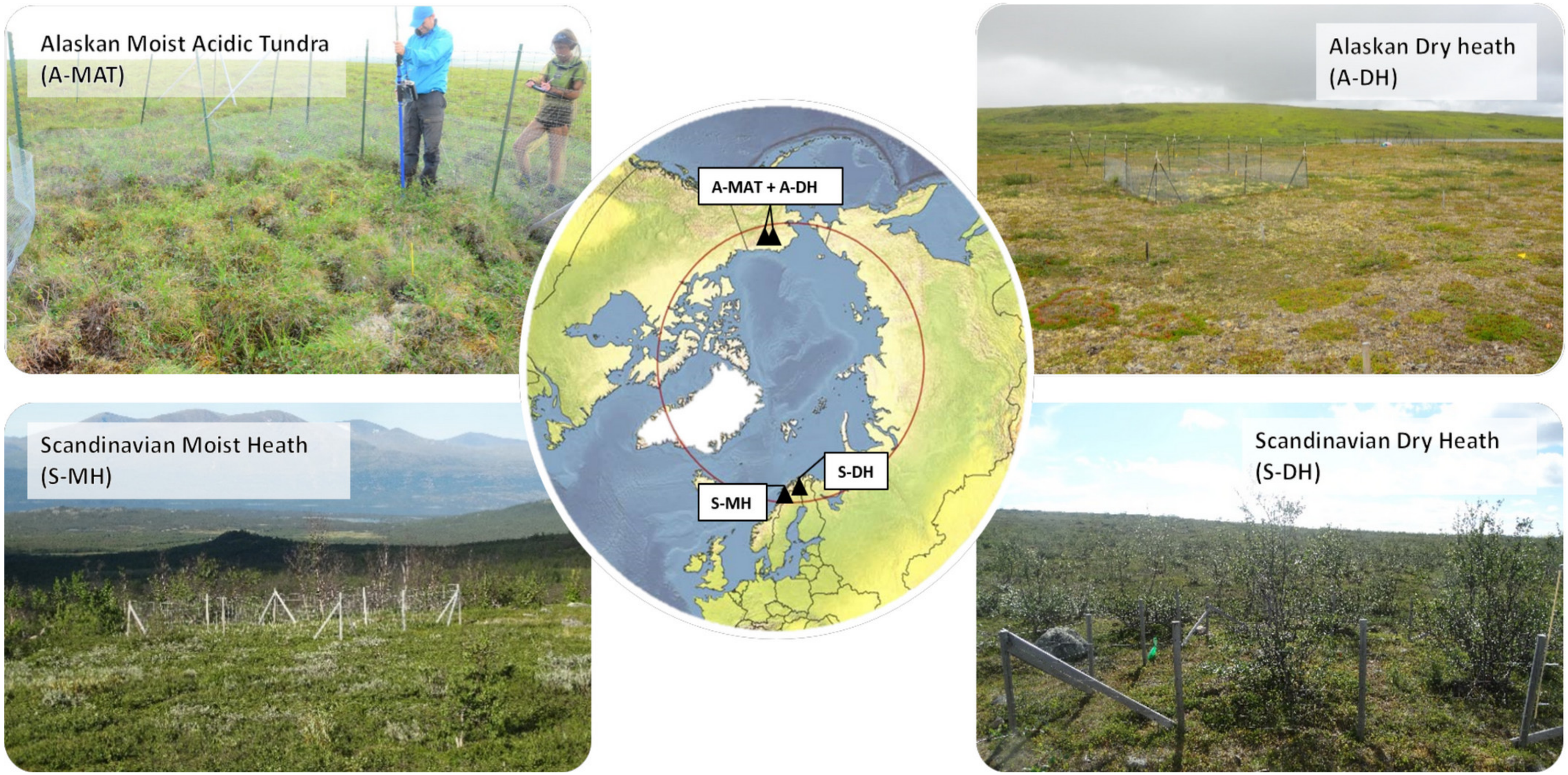
Roy et al. *Functional Ecology* 2022

AniMEL – Adding Animals to the Equation



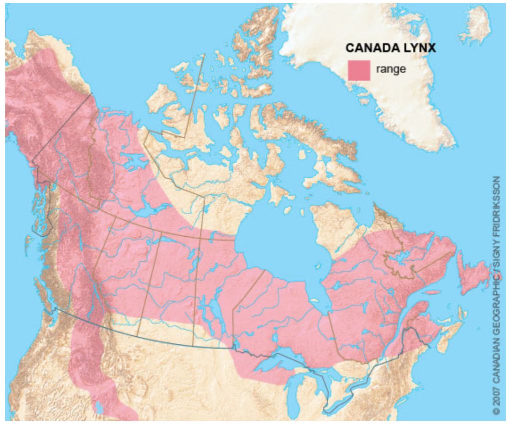
Rastetter et al. 2021 *Ecological Applications*

Cross-Site Studies: Large Mammals



Lindén et al. 2021 *Ecology and Evolution*

Arctic Animals & Climate Change



Climate change

Spatial distribution

Timing of activity

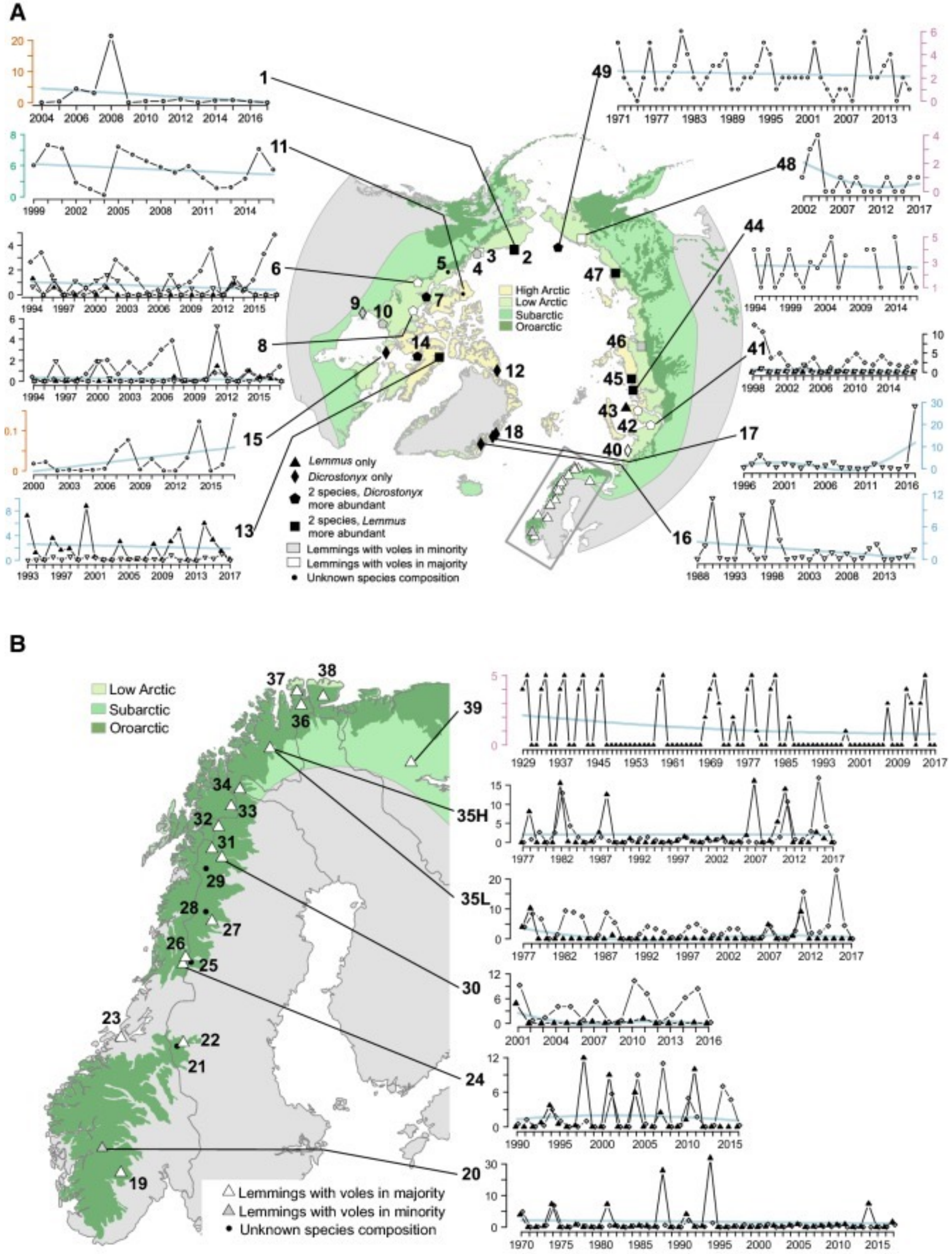
Local density and activity

Consumptive and non-consumptive effects on element cycling

Koltz, Gough & McLaren. 2022 *Ann. NY Acad. Sci.*

Mysteries

- Will boom-bust cycles continue?
- How are predators involved?
- Are parasites/disease involved?



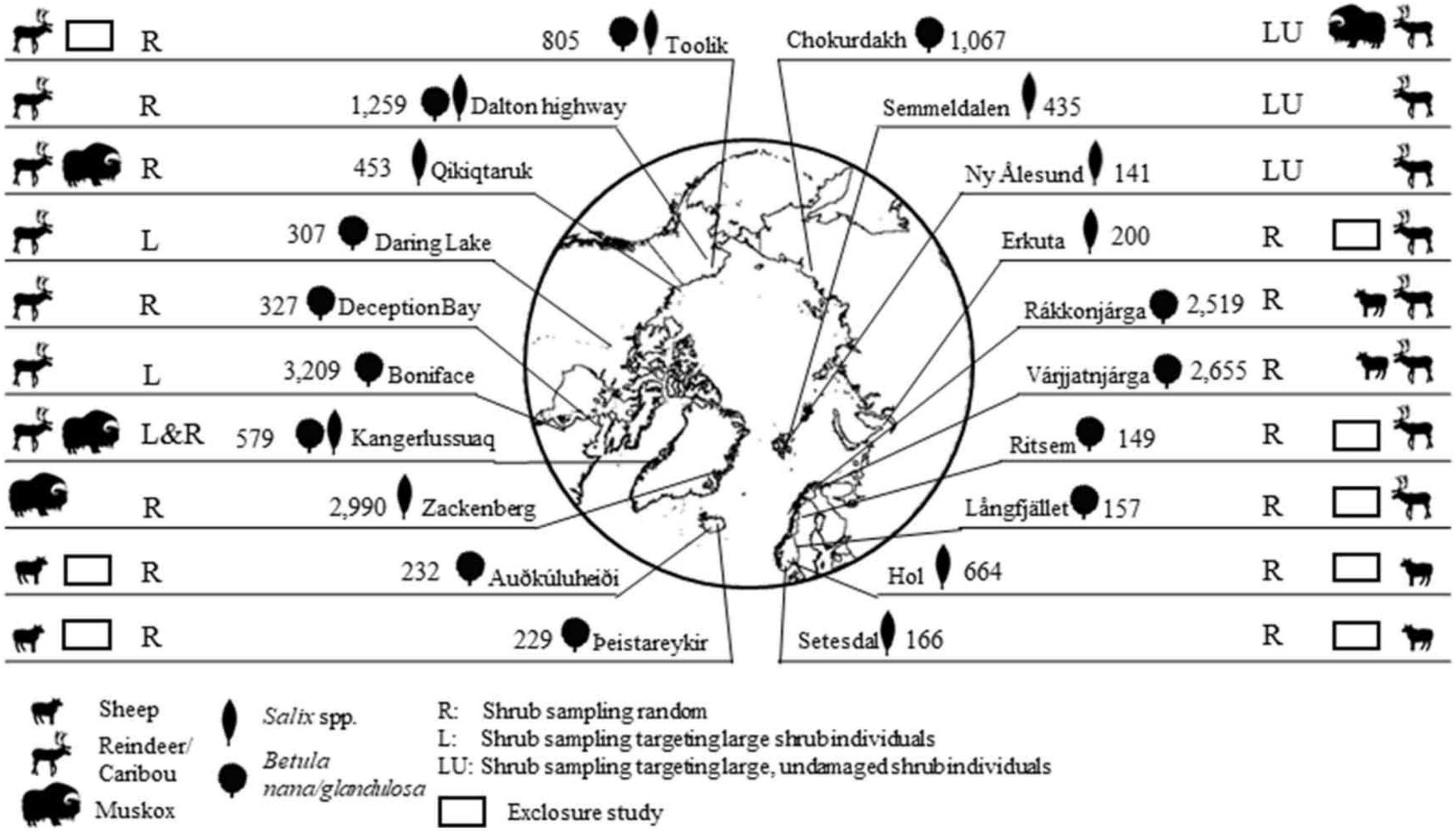
Ehrich et al. 2019 *Ambio*


Thank you!


SHAVER'S
PLUCK-N-SUCK


GPS USERS
NATIONAL
COLLEGIATE
CYCLING
ASSOCIATION

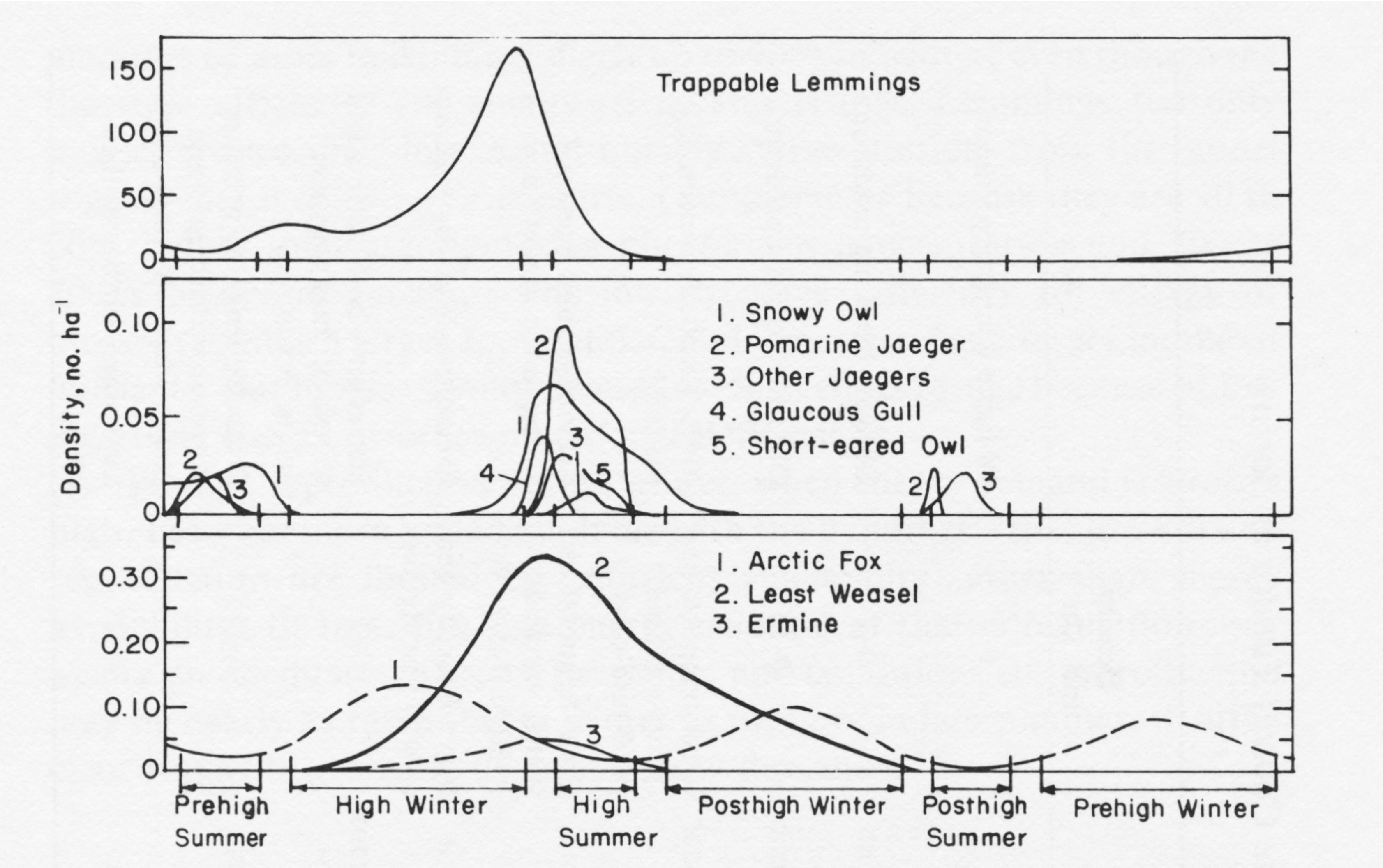
Cross-Site Studies: Large Mammals



Vuorinen et al. 2022 *Environ. Res. Lett.*

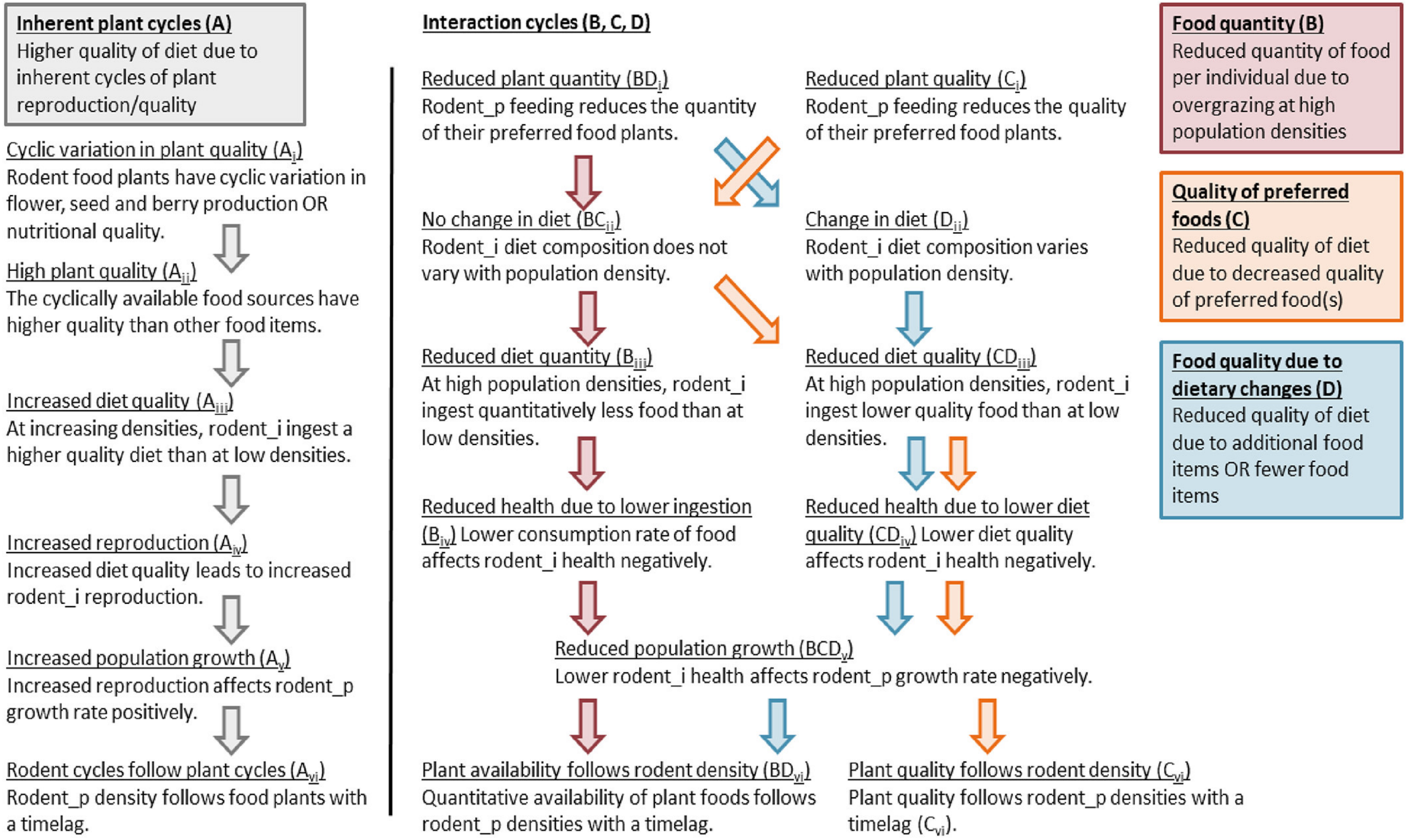

iFish

Top-Down Pressures on Lemmings



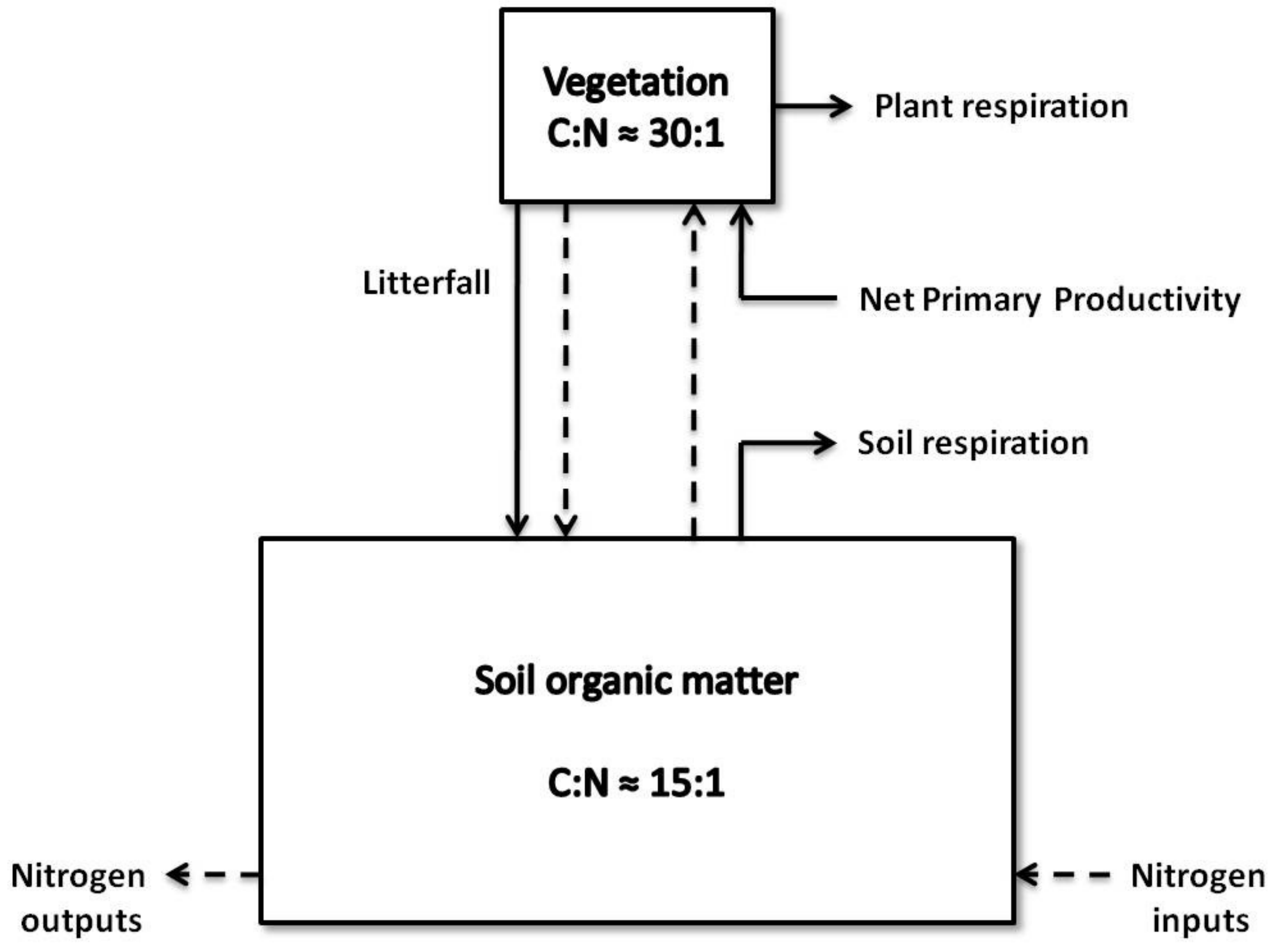
Batzli et al. 1980

Small rodent population cycles and plants – after 70 years, where do we go?



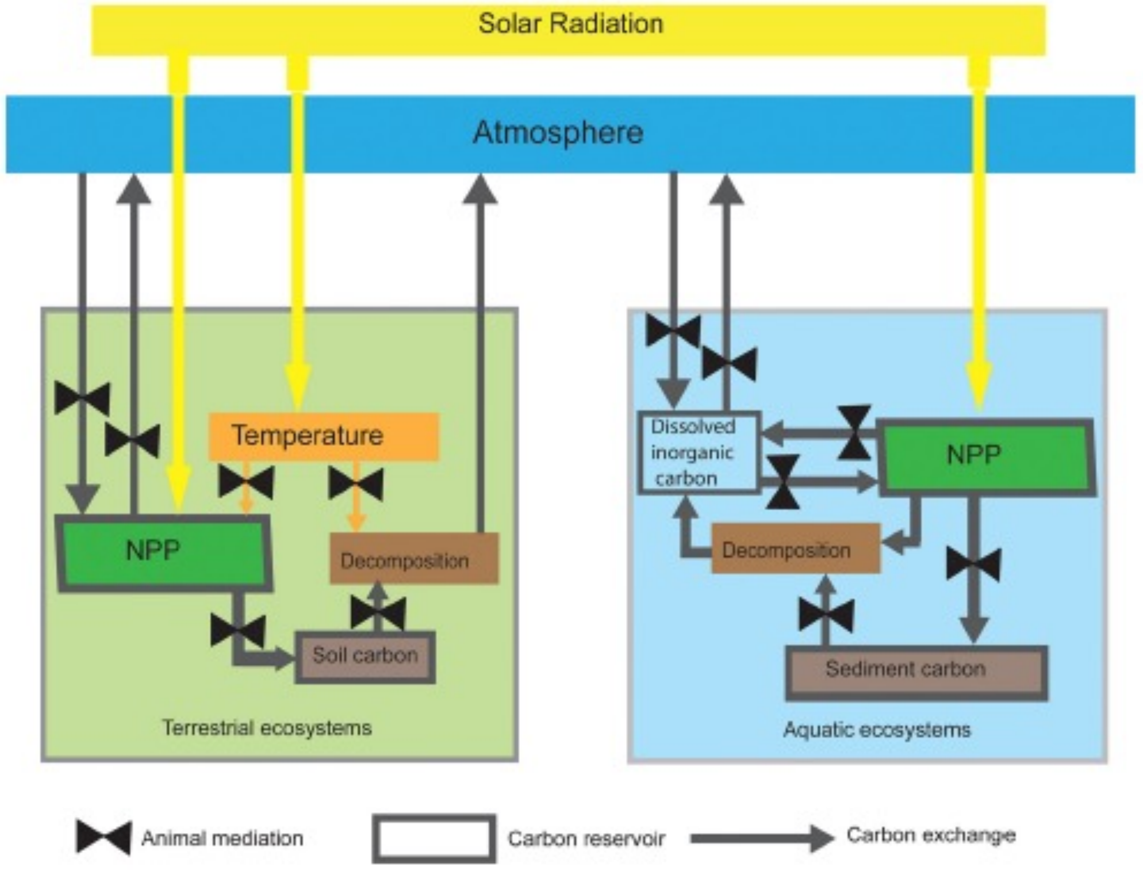
Biological Reviews, Volume: 99, Issue: 1, Pages: 265-294, First published: 12 October 2023, DOI: (10.1111/brv.13021)

Simple Arctic Model



Adapted from Shaver et al. 1992 *BioScience*

Animals Can Affect Carbon Cycling



Schmitz et al. 2014 *Ecosystems*