

# Assessment of Mercury in Aquatic Vegetation Across Subarctic Lakes and Thaw Ponds

Dennise M. Serra Cordero<sup>1</sup>, M. Florencia Fahnestock<sup>2</sup>, Alanna Nenadich Álvarez<sup>3</sup>, April Mendoza Magaña<sup>4</sup>, Brayden King<sup>5</sup>, Piper Cobak<sup>2</sup>, Michael Palace<sup>2</sup>, Ruth Varner<sup>2</sup>

Inter American University of Puerto Rico – Aguadilla Campus<sup>1</sup>, University of New Hampshire<sup>2</sup>, University of Puerto Rico – Mayagüez Campus<sup>3</sup>, Washington State University<sup>4</sup>, University of Miami<sup>5</sup>



What is the concentration of mercury in different species of aquatic vegetation across the different subarctic lakes and thaw ponds?

## Introduction

- Temperatures in the Arctic have increased three fold compared to the global average, resulting in permafrost thaw that threatens to release previously sequestered mercury (Hg), a powerful neurotoxin, from peatlands.
- Arctic permafrost stores more Hg than all other global reservoirs combined (Schuster et al., 2019).
- As climate warms and permafrost thaws, Hg is transformed and mobilized via different pathways (Figure 1).
- Prior studies have looked at storage of Hg in terrestrial vegetation but the role of aquatic vegetation in the storage is not known.

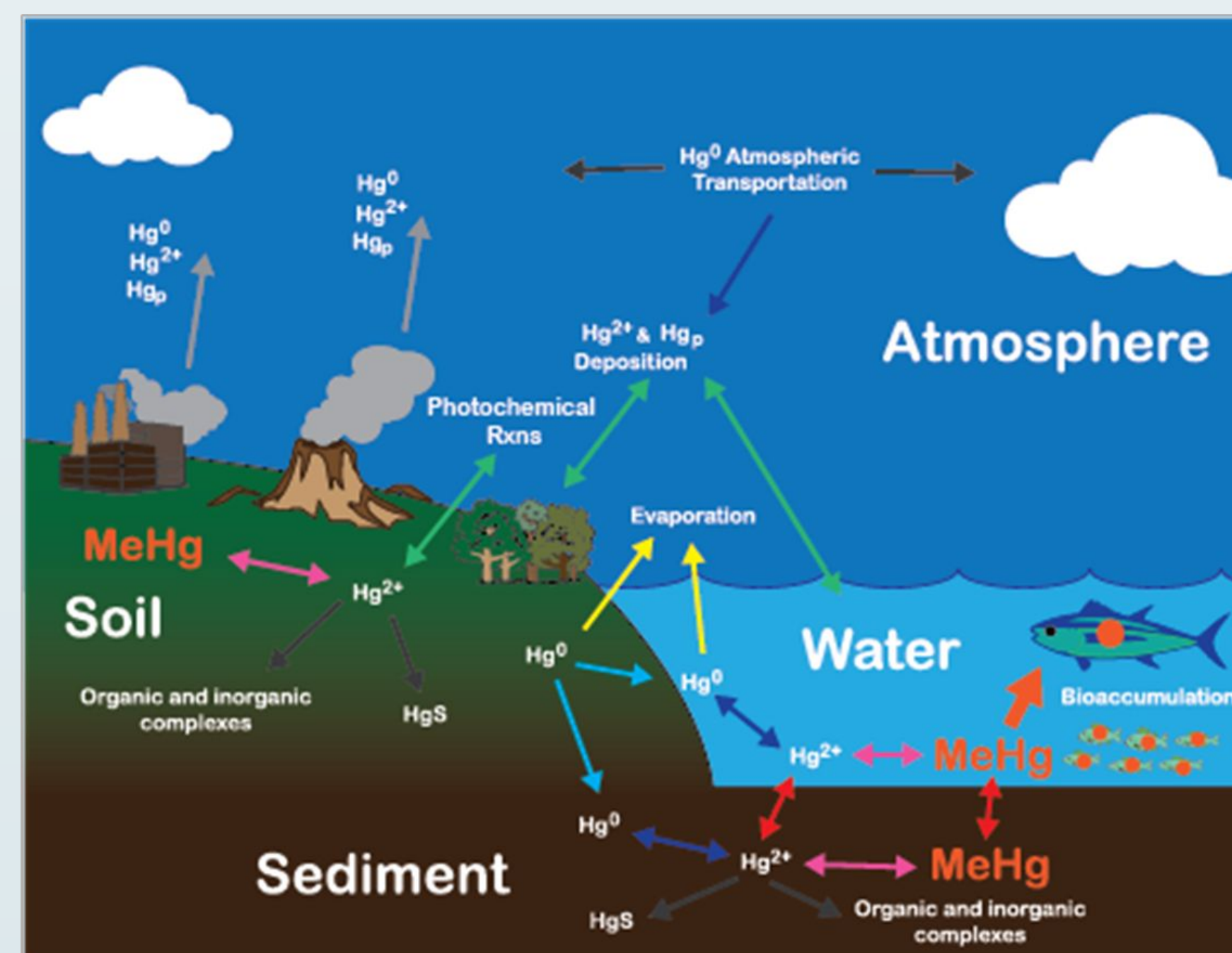


Figure 1. Biogeochemical Cycling of Hg (Fahnestock, 2022)

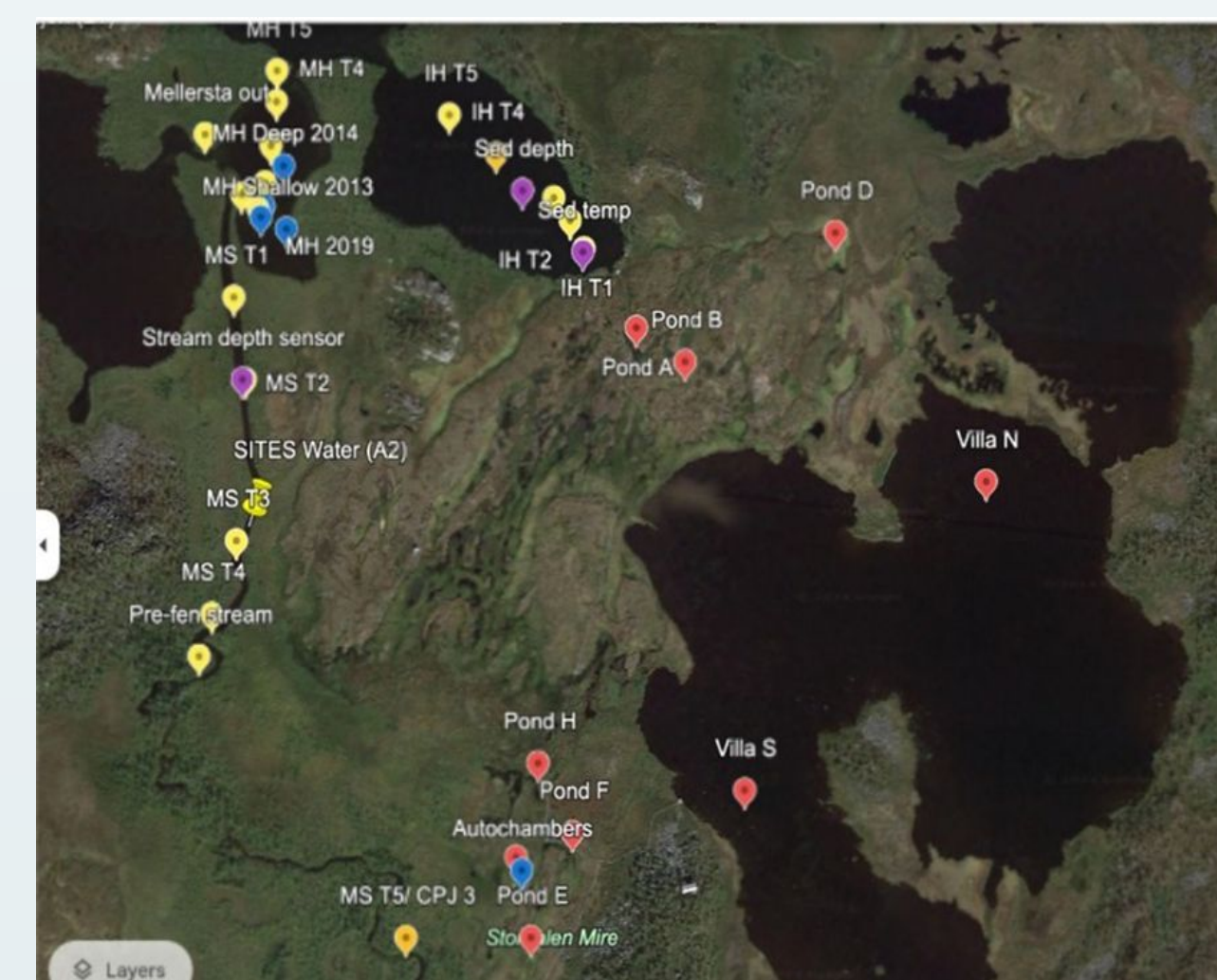
## Objectives

- Measure the concentration of mercury in different aquatic vegetation species.
- Sample different lakes and thaw ponds to understand inter and intra-lake variations.
- Estimate the stocks of Hg stored in aquatic vegetation within Stordalen Mire by obtaining estimates of biomass and % species distribution throughout different lakes.

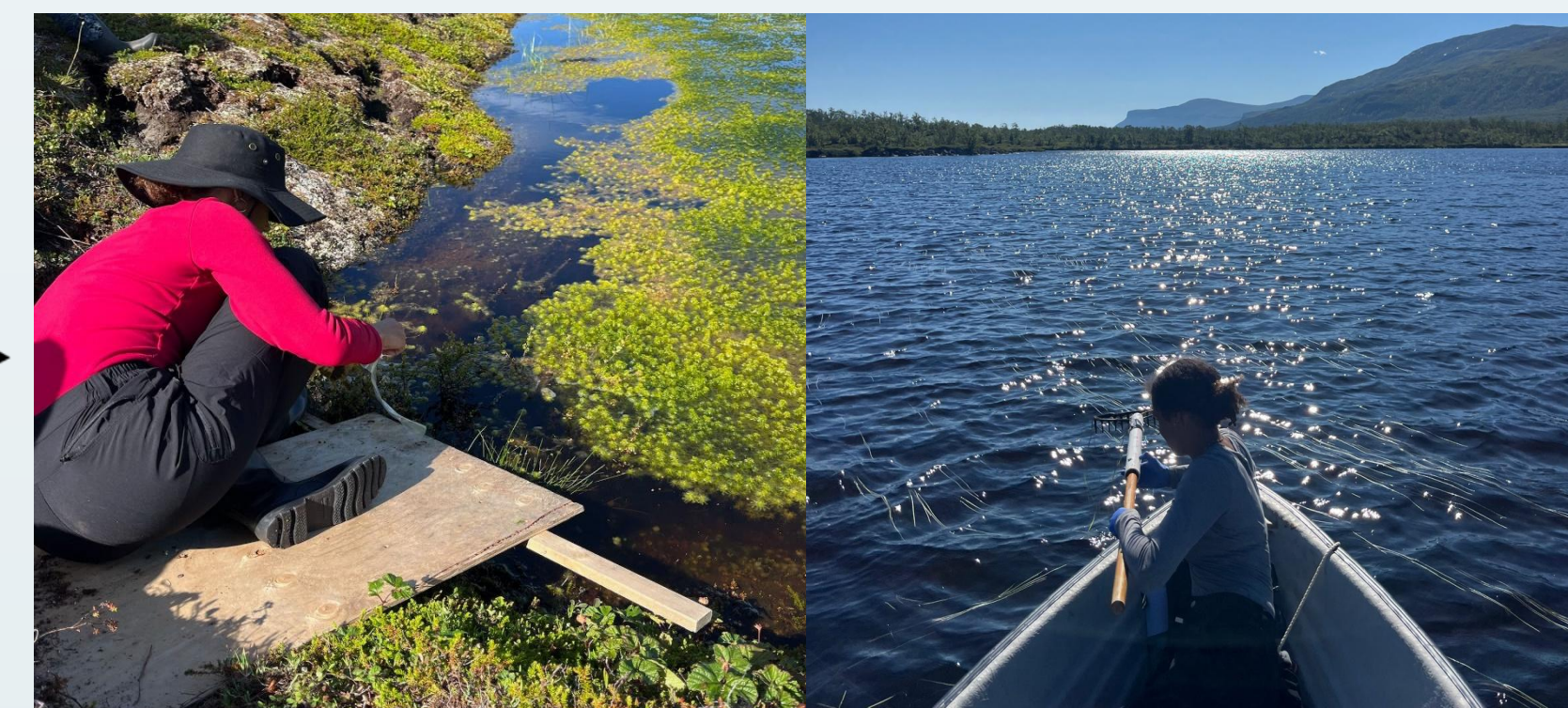
## Methodology

### Collecting and identifying samples

Submerged, emergent and edge aquatic vegetation was sampled in Inre Harrsjön, Mellersta Harrsjön, Villasjön, the mire stream and 7 thaw ponds.



R. Varner, 2024



P.C.: A. Nenadich

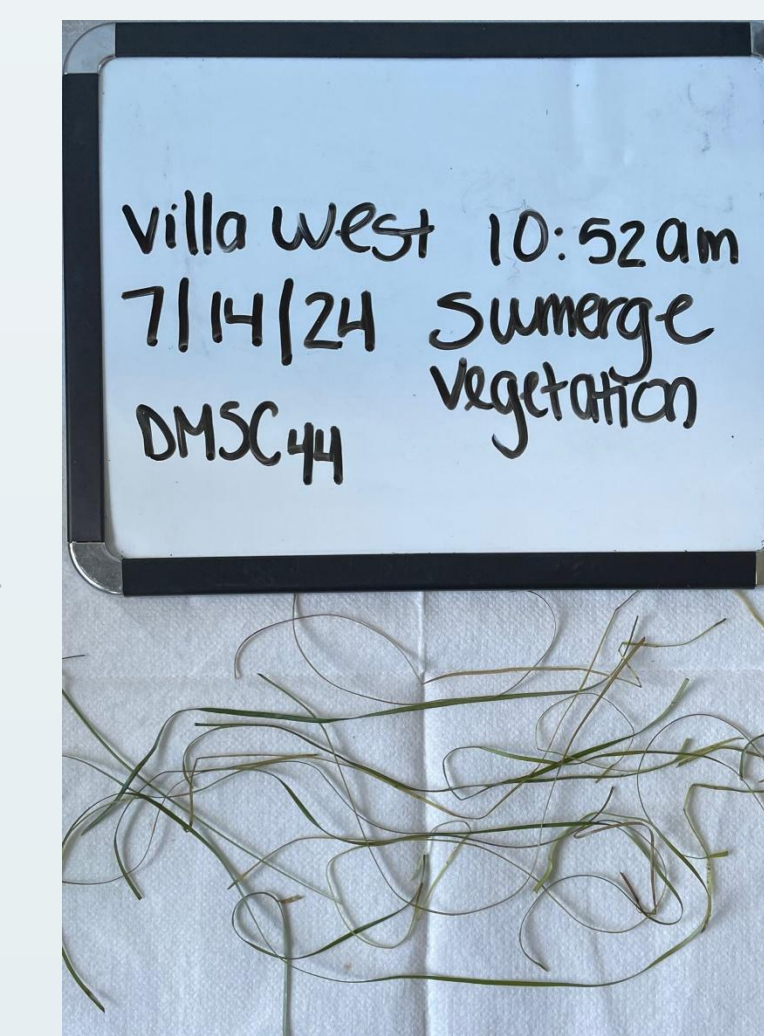


Figure 2. Vegetation samples were collected with an extended rake or with the gloved hands, following trace element clean protocols. Grab samples containing multiple species were identified, sorted and frozen. Species identification assisted by Horruitiner, 2018.

### Preparing and analyzing samples

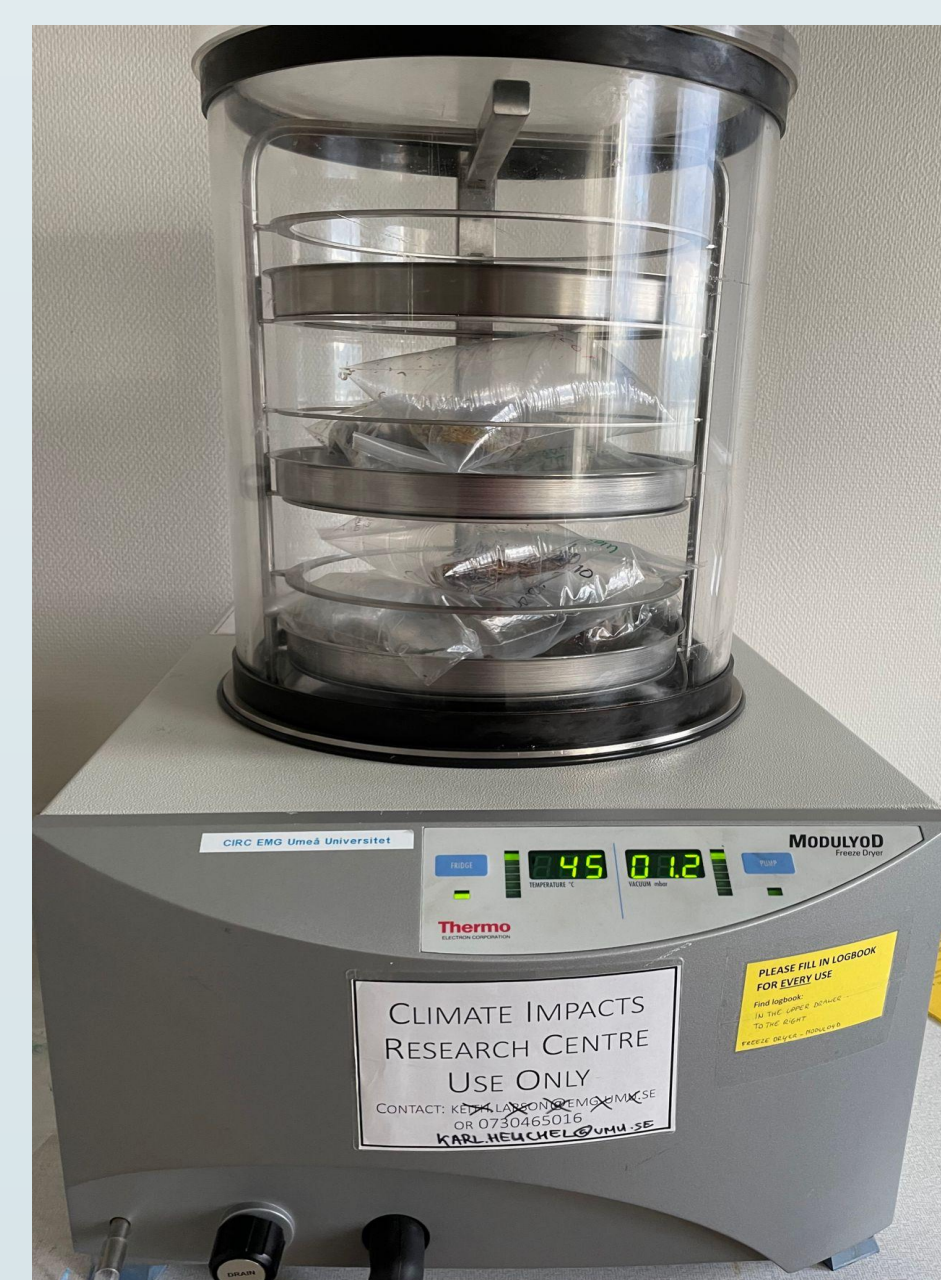


Figure 3. Sample preparation was conducted with freeze dryer and subsequently, ground and shipped to the University of New Hampshire. Total Hg analysis were carried out via thermal decomposition, amalgamation/atomic absorption spectrophotometer (TDA/AAS) with a Milestone Direct Mercury Analyzer (DMA – 80) following EPA Method 7473.

## Next Steps

- Samples are currently being analyzed for total Hg at UNH to be completed in Fall 2024.
- Data analysis will be carried out in R.
- Total Hg results will be paired with aquatic vegetation mapping data and biomass estimates to calculate stocks of Hg.
- The results of this study will grow our understanding of the importance of Hg in aquatic vegetation.
- Future field seasons can continue to monitor changes to species abundance to understand how this reservoir of Hg is changing over time.

## Acknowledgements

- EMERGE Biological Integration Institute funded by NSF- DBI 2022070.
- The Swedish Polar Secretariat and SITES for the support of work done at the Abisko Research Station.
- We express our heartfelt gratitude to the Sámi people since this research took place on indigenous lands in Sápmi, where Sámi people have lived since time immemorial.
- Diana Lo from the UNH Leitzel Center.

## References

- Schuster, P. F., Schaefer, K. M., Aiken, G. R., Antweiler, R. C., Dewild, J. F., Gryziec, J. D., Gusmeroli, A., Hugelius, G., Jafarov, E., Krabbenhoft, D. P., Liu, L., Herman-Mercer, N., Mu, C., Roth, D. A., Schaefer, T., Striegl, R. G., Wickland, K. P., & Zhang, T. (2018). Permafrost stores a globally significant amount of mercury. *Geophysical Research Letters*, 45(3), 1463–1471. <https://doi.org/10.1002/2017gl075571>
- Fahnestock, M. F. (2022). COMPOUND, ELEMENTAL, AND ISOTOPIC PERSPECTIVES ON MERCURY MOBILIZATION DURING THAW IN A DISCONTINUOUS PERMAFROST ZONE. In University of New Hampshire & University of New Hampshire Scholars' Repository, Doctoral Dissertations.
- Horruitiner, C. D. (2018). ASSESSING THE IMPACT OF SUBMERGED VEGETATION ON METHANE DYNAMICS IN A DISCONTINUOUS PERMAFROST LAKE SYSTEM, ABISKO, SWEDEN (By University of New Hampshire). Master Thesis.