Potential for Methylmercury Production in High Elevation Beaver Ponds

Clifford Adamchak[1,2], Katherine B. Lininger[3], Eve-Lyn S. Hinckley [1,2]
[1]Department of Ecology and Evolutionary Biology, University of Colorado, Boulder, [2]Cooperative Institute for Research in Environmental Sciences, [3]Department of Geography, University of Colorado, Boulder

University of Colorado Boulder
CZNet DYNAMIC WATER
Environmental Biogeochemistry Group
CIRES

Overview

- Atmospheric deposition of mercury (Hg) is **increasing** in the western U.S.
- Wetland environments transform Hg into **methylmercury** (MeHg), **a neurotoxin**.
- Beavers create wetland environments **conducive to MeHg production** and their **populations are increasing.**
- **How does beaver activity alter the storage of MeHg within the river corridor?**

Methods

- Sites in Crested Butte (**CB**), CO, and Manitou Springs (**MEFO**), CO.
- Water and sediment samples collected in Summer 2023.
- Sampled old and young beaver ponds.
- 4 ecogeomorphic units (**EGU**) within each pond. Areas on the landscape with unique ecology and geomorphology.
- ~190 sediment cores and 230 water samples.
- Analyzed for MeHg and THg among other constituents.

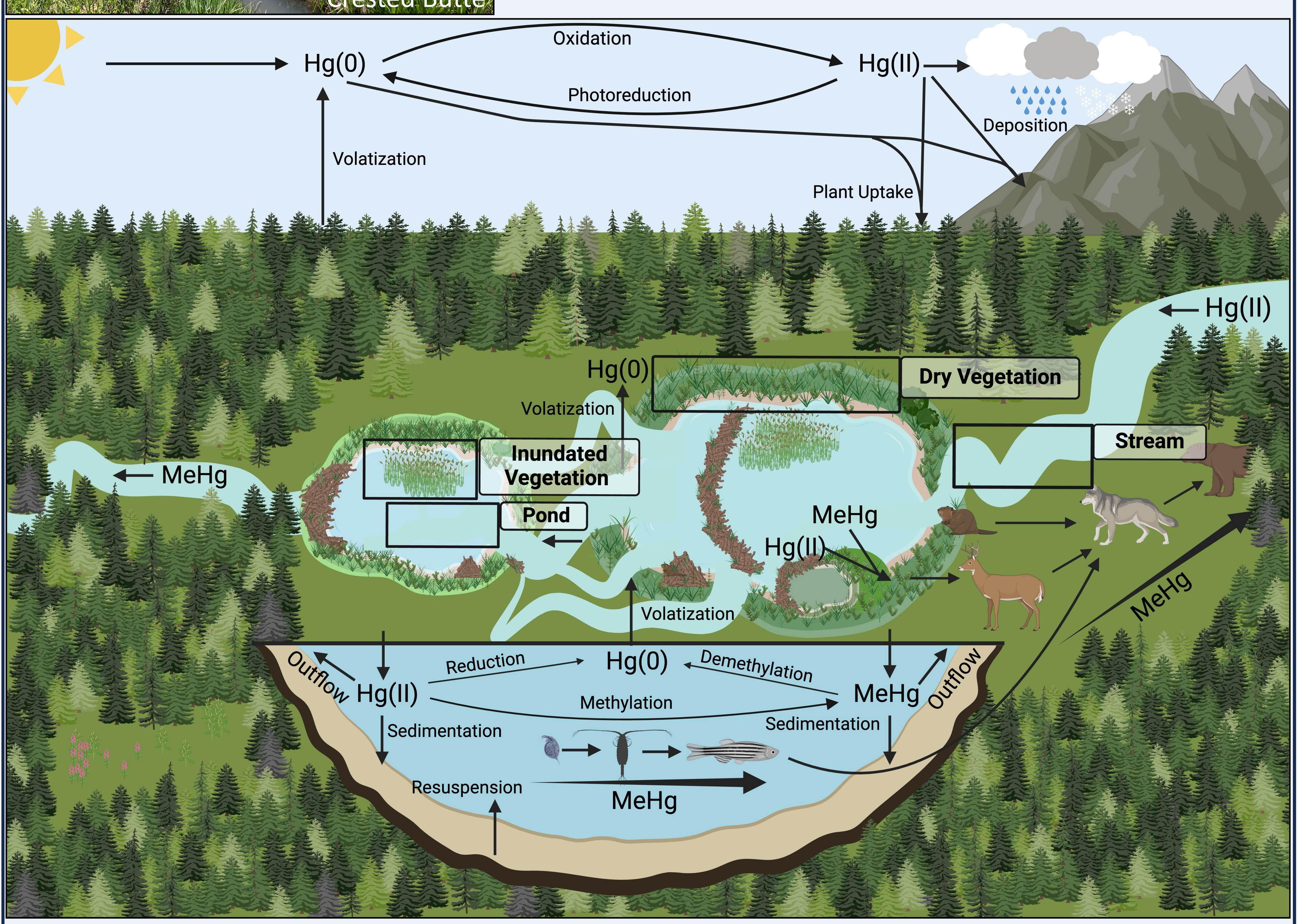
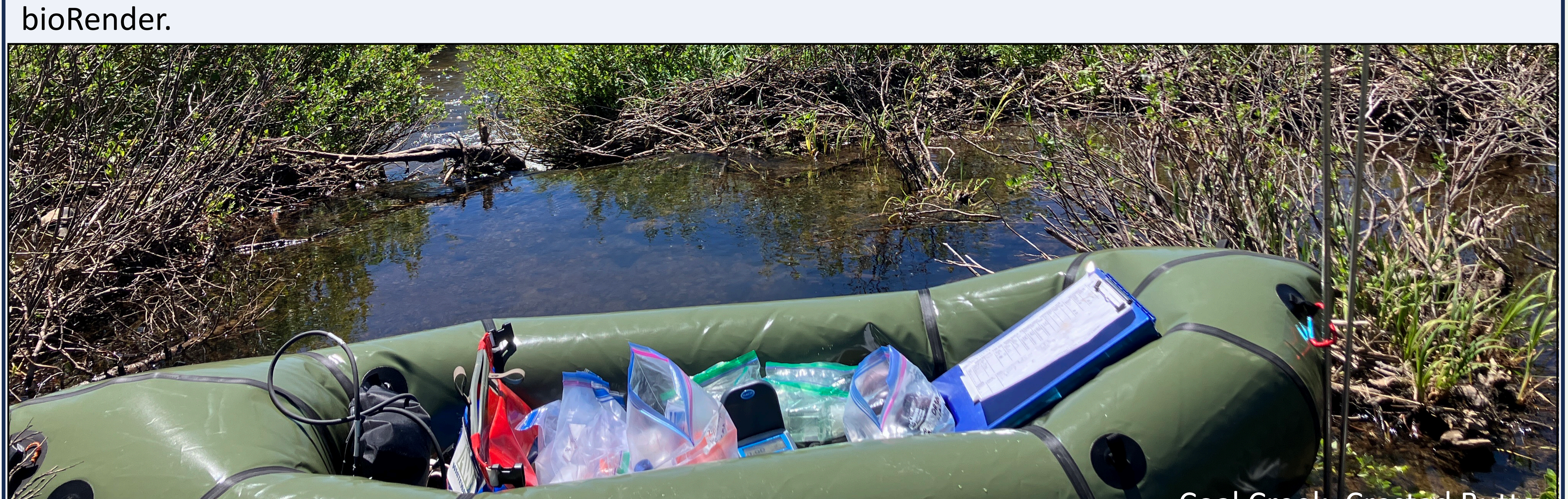


Figure 1: Conceptual model of Hg cycling in beaver ponds and the eco-geomorphic units (EGU) used in this study (white boxes and insets). Arrows indicate transformations, storage, or export of Hg. Created with bioRender.



Findings

1. Dry vegetation has the highest sediment MeHg, potentially driven by wetting and drying cycles.

2. No clear effect of beaver pond age on sediment MeHg concentrations.

3. Sediment MeHg is highest in the ponds compared to the inlet and outlet suggesting they act as a source of MeHg in the river corridor.

Eco-geomorphic Unit

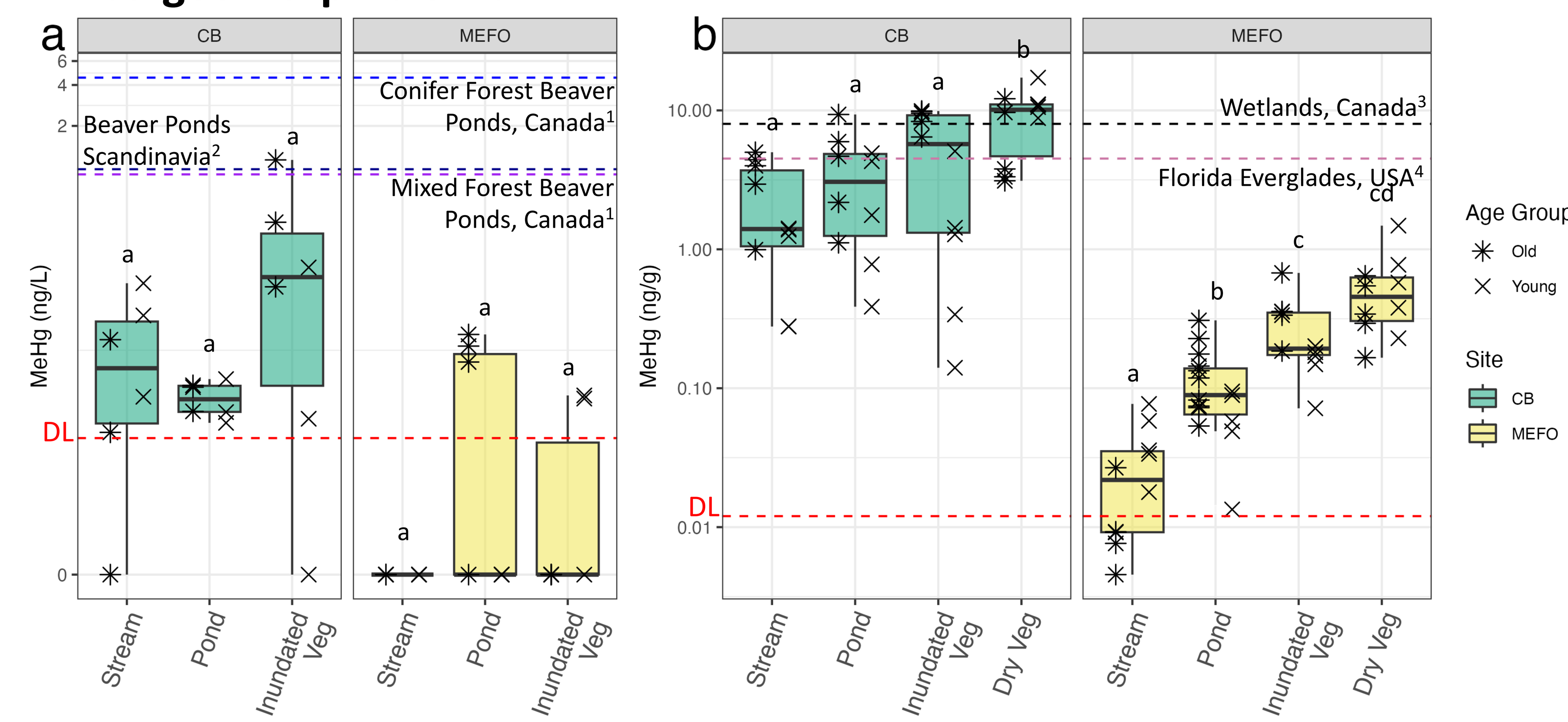


Figure 2: Water MeHg (ng/L) (**a**) and sediment MeHg (ng/g) (**b**) on a log scale y-axis for the four ecogeomorphic units by site (colored).

Age

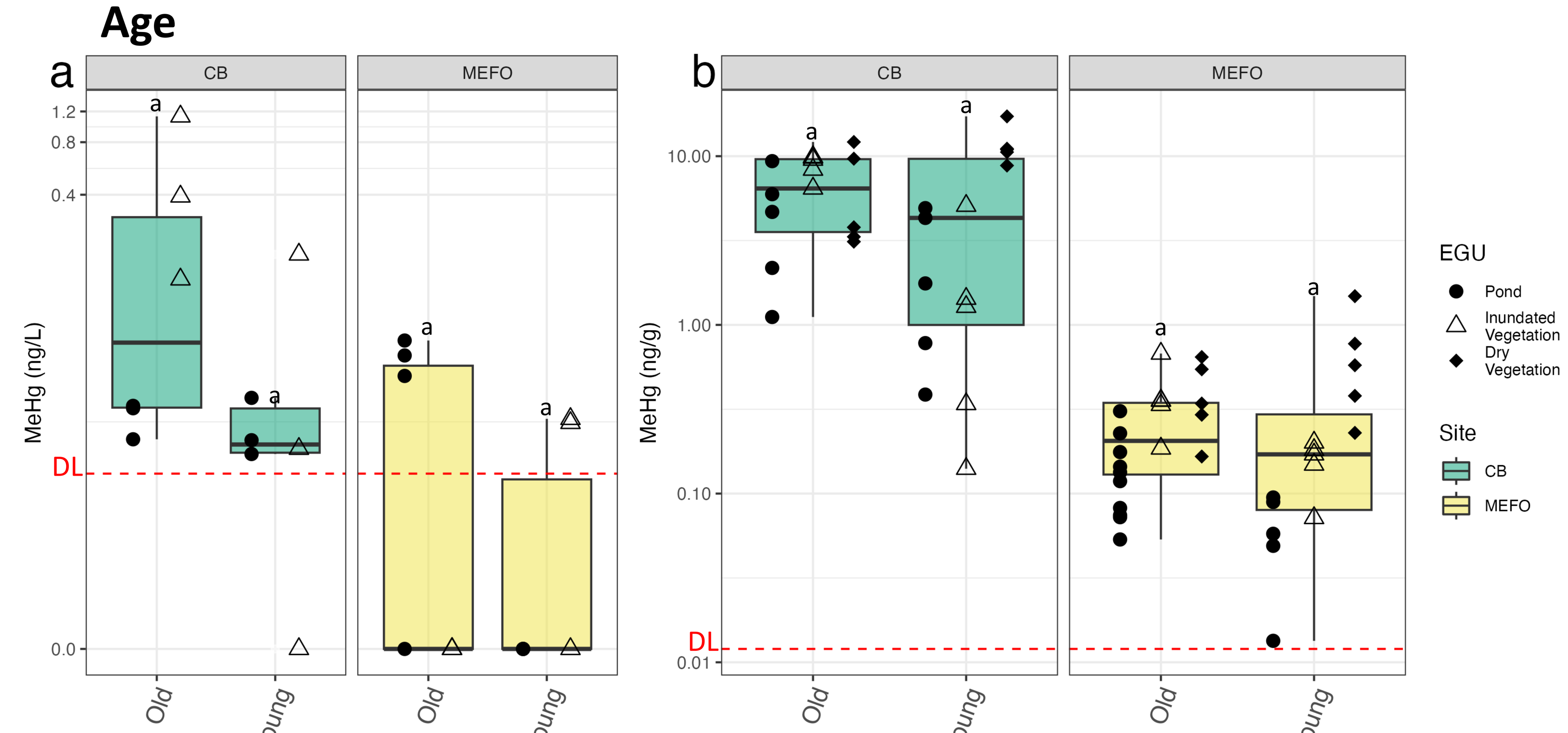


Figure 3: Water MeHg (ng/L) (**a**) and sediment MeHg (ng/g) (**b**) for young and old ponds by site (colored).

Inlet and Outlet

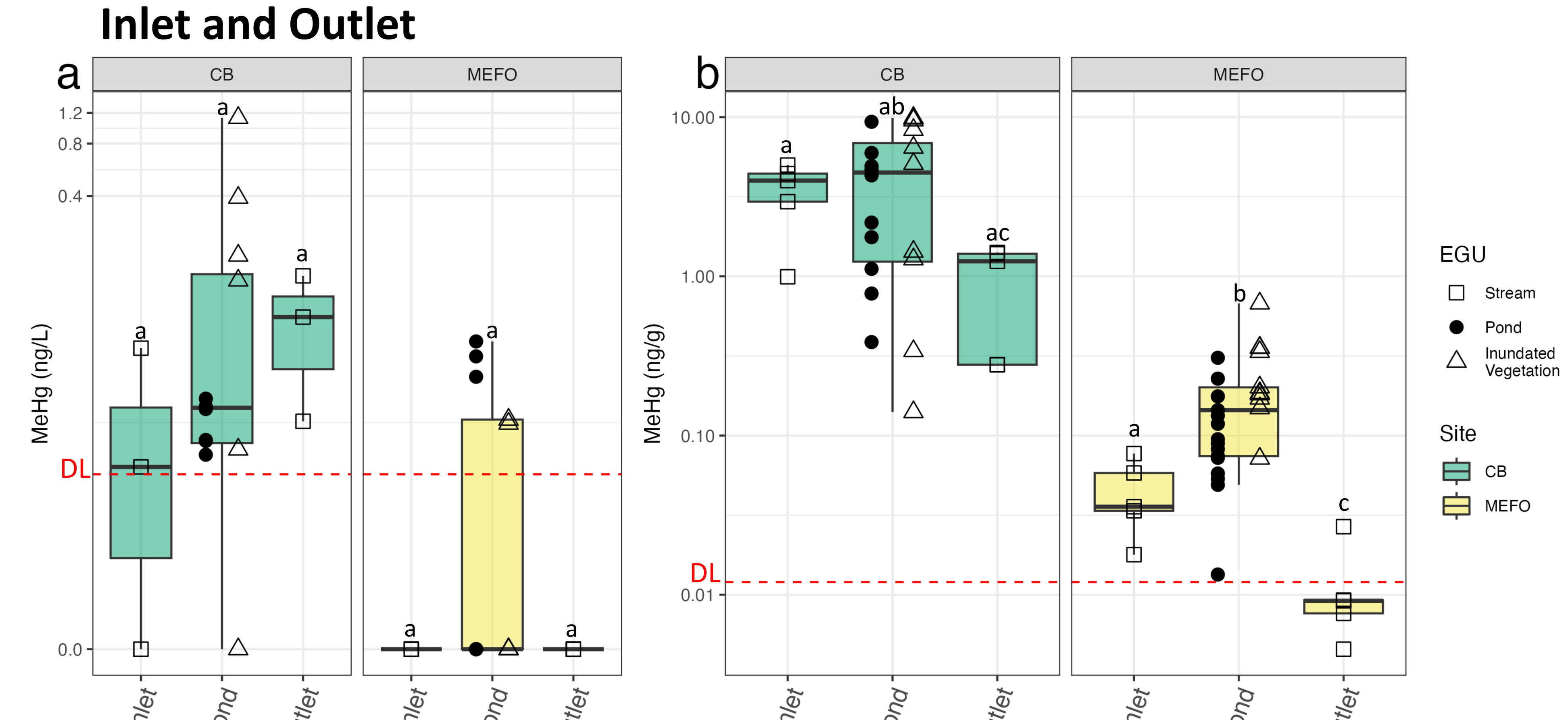
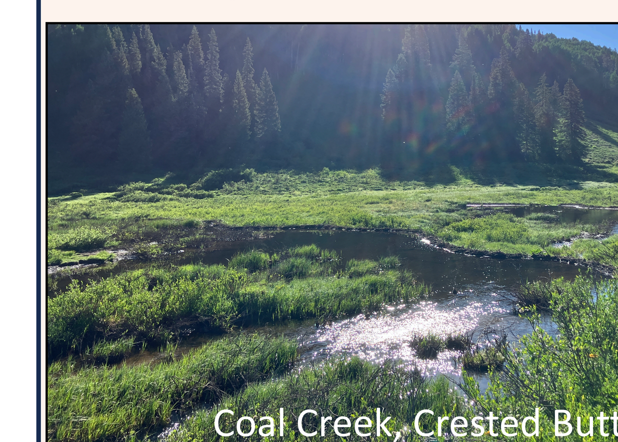
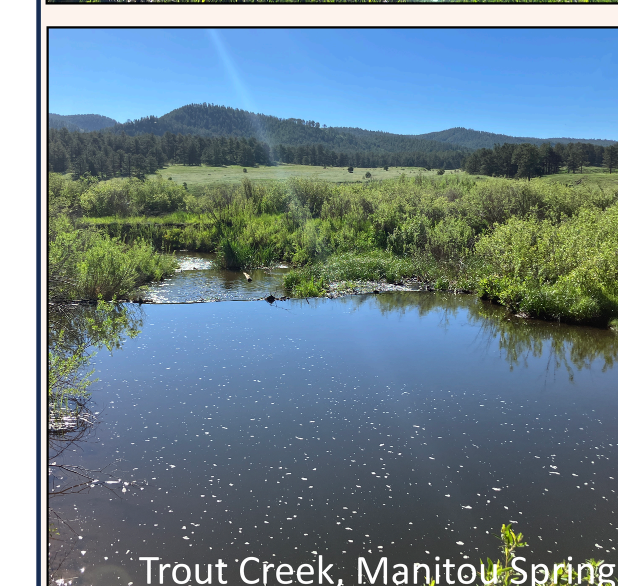


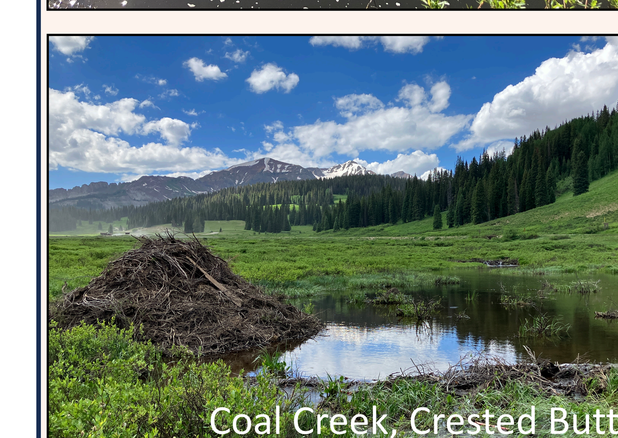
Figure 4: Water MeHg (ng/L) (**a**) and sediment MeHg (ng/g) (**b**) for the inlet, pond, and outlet by site (colored).

Future Work

- Samples will be analyzed for sulfate reduction rates.
- To investigate the mechanisms that drive MeHg production in beaver ponds.
  - **Porewater** samples.
  - Methylation **incubations** using ambient Hg concentrations and sulfate amendments.
  - Pair **sulfate reduction** and methylation rates.







Acknowledgments

A special thank you to everybody at the **USGS Mercury Research Lab** for hosting and mentoring me. Thank you to Hannah Miller for her constant support and input.

Funding

- Critical Zone Dynamic water: EAR-2012669
- NSF GRFP: DGE 2040434

NSF

References:
(1) Roy et al., 2009
(2) Levanoni et al., 2015
(3) Sinclair et al., 2012
(4) Peterson et al., 2022