The Fate of Redox-Active Organic Matter in High-Elevation Wetlands of the Colorado Rocky Mountains U.S.

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Introduction

- High-Elevation wetlands are subjected to extreme environmental stressors which is amplified by global climate change.
- **Redox-Active Organic Matter (RAOM)** is an organic compound that can serve as a terminal electron acceptor in microbial redox reactions (Fig. 1).
- RAOM reduction plays an important role in the global carbon (C) cycle as it releases carbon dioxide (CO_2) and suppresses methane (CH_4).

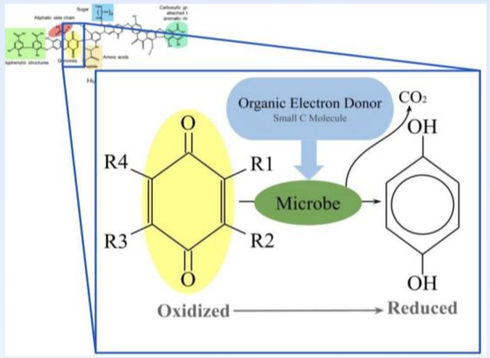

Figure 1: Redox-active organic matter contains quinones (yellow) that serve as TEAs in microbial redox reactions (Adapted from Sutradhar et al., 2023).

Research Question

How does RAOM reduction protentional vary across three different wetland types at Niwot Ridge Long Term Ecological Research (LTER) Site and how might this impact CO_2 and CH_4 production at these sites?

Methods

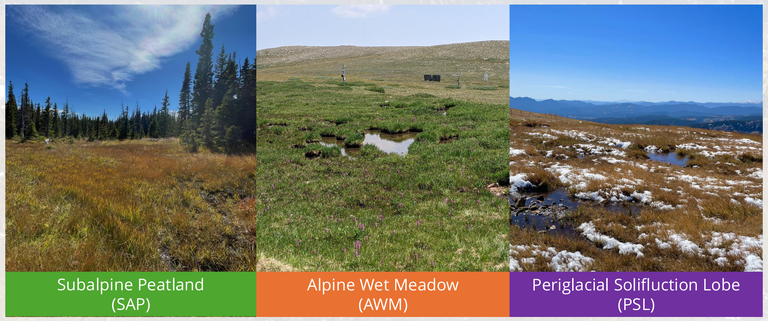

Figure. 2: Three different wetland types sampled at the Niwot LTER site.

Anaerobic Incubation (63 days)

Measured: Electron shuttling capacity (ESC), CO_2, and CH_4

Results

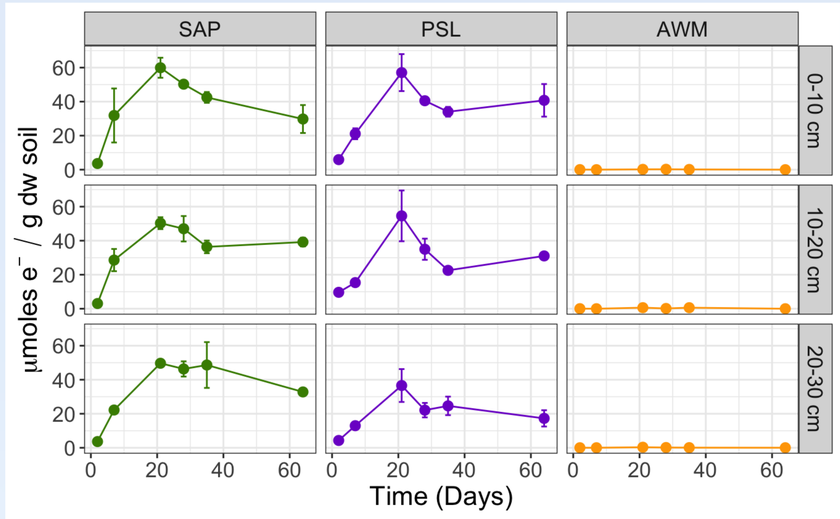

Figure 3: Average potential RAOM reduction at the subalpine peatland and periglacial solifluction lobe, depicted as ESC (µmoles e- g^{-1}dw soil) in three replicate samples per depth (+/- SE).

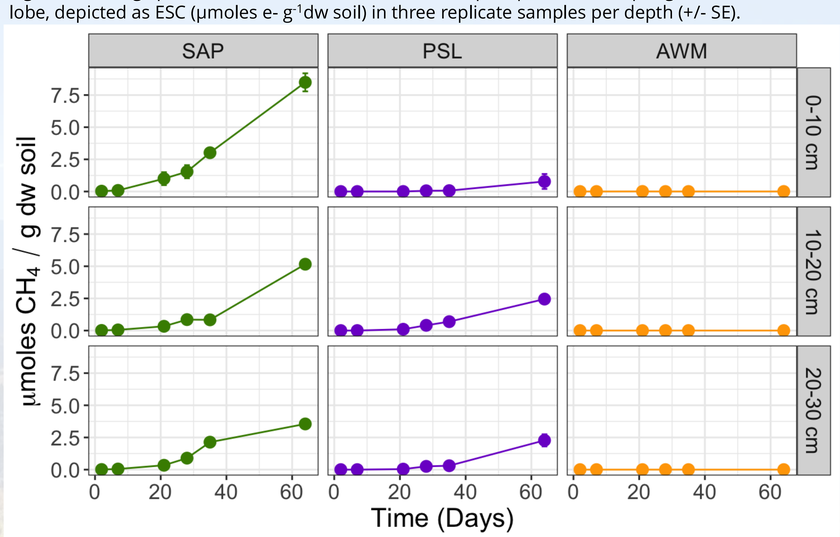

Figure 4: Average CO_2 production at the subalpine peatland and periglacial solifluction lobe (µmoles CO_2 g^{-1} dw soil), in three replicate samples per depth (+/- SE).

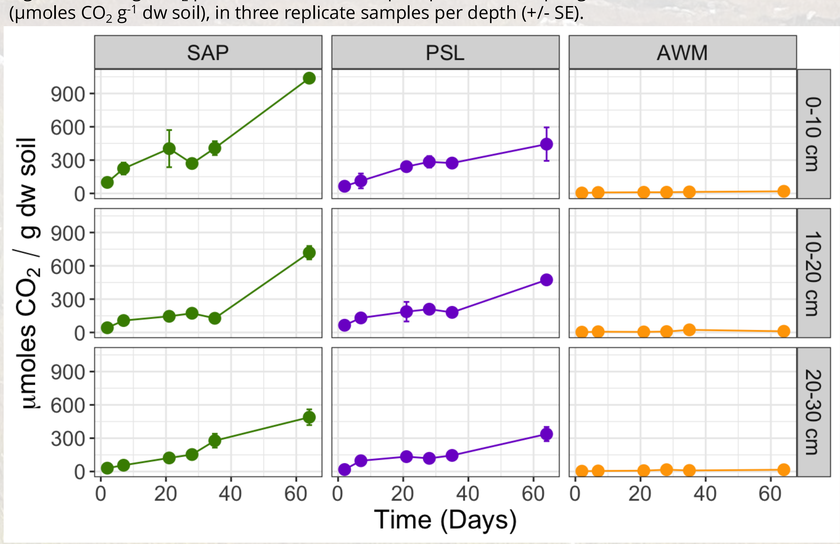

Figure 5: Average CH_4 production at subalpine peatland and periglacial solifluction lobe (µmoles CH4 g^{-1}dw soil), in three replicate samples per depth (+/- SE).

Conclusions

- RAOM is an important terminal electron acceptor in microbial respiration in the subalpine peatlands and periglacial solifluction lobes, but not the alpine wet meadows, at least at the end of the growing season.
- RAOM serves as a control on CO_2 and CH_4 production at these sites, suppressing CH_4 production when used as a TEA.

Acknowledgements

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CIRES

References

Sutradhar, S., & Fatehi, P. (2023). Latest development in the fabrication and use of lignin-derived humic acid. Biotechnology for Biofuels and Bioproducts, 16(1), 38.