

THAWING PERMAFROST, THRIVING COPIOTROPHS

Who lives there?

- **Copiotrophs:** Fast-growing bacteria that thrive in nutrient-rich environments
- **Oligotrophs:** Resource-efficient and slow-growing bacteria, adapted to nutrient-poor environments
- **Methanogens:** Archaea that thrive in wet, anoxic soils

Did you know?

Permafrost soils account for 11% of the Earth's exposed land surface

Permafrost thaw is expected to:

1. Favor copiotrophs over oligotrophs
2. Lead to an increase in methanogens in the deep bog and in the fen

Main findings

Oligotrophs:

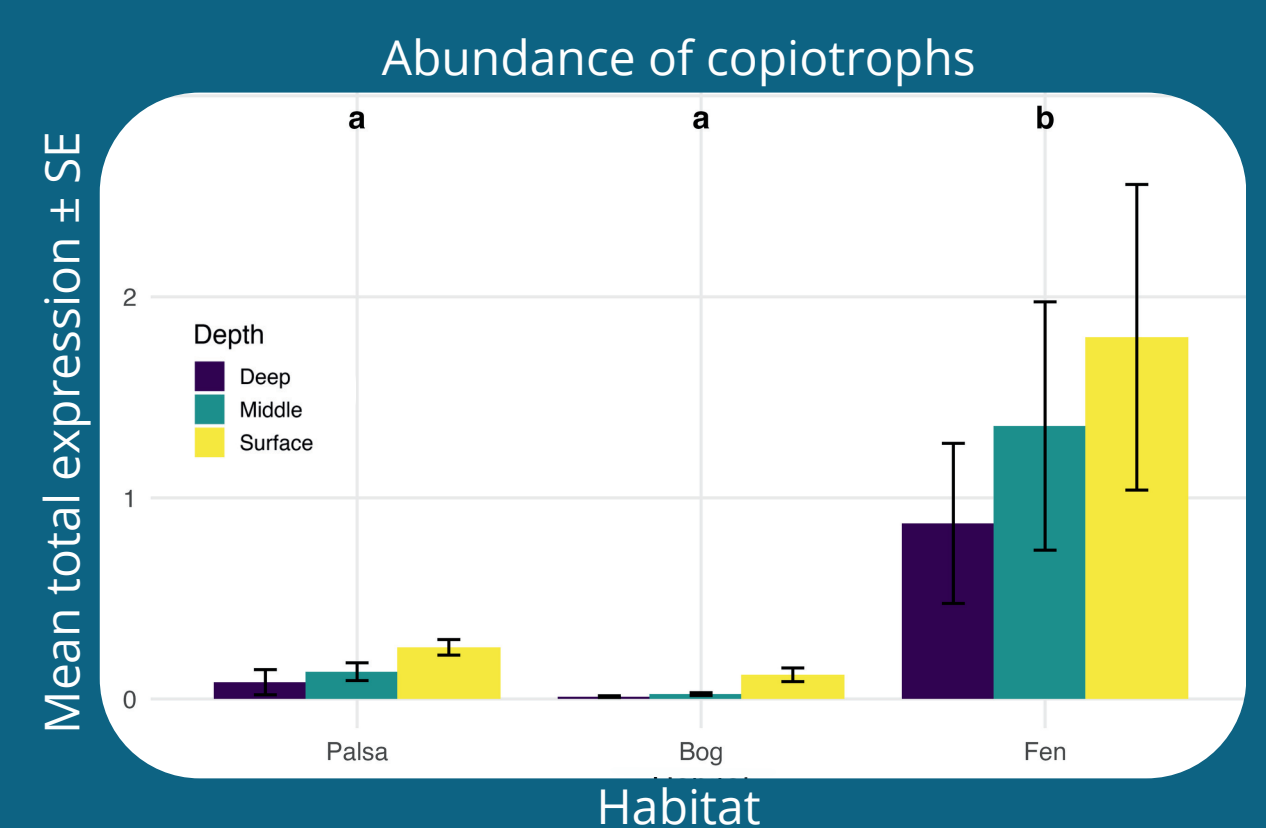
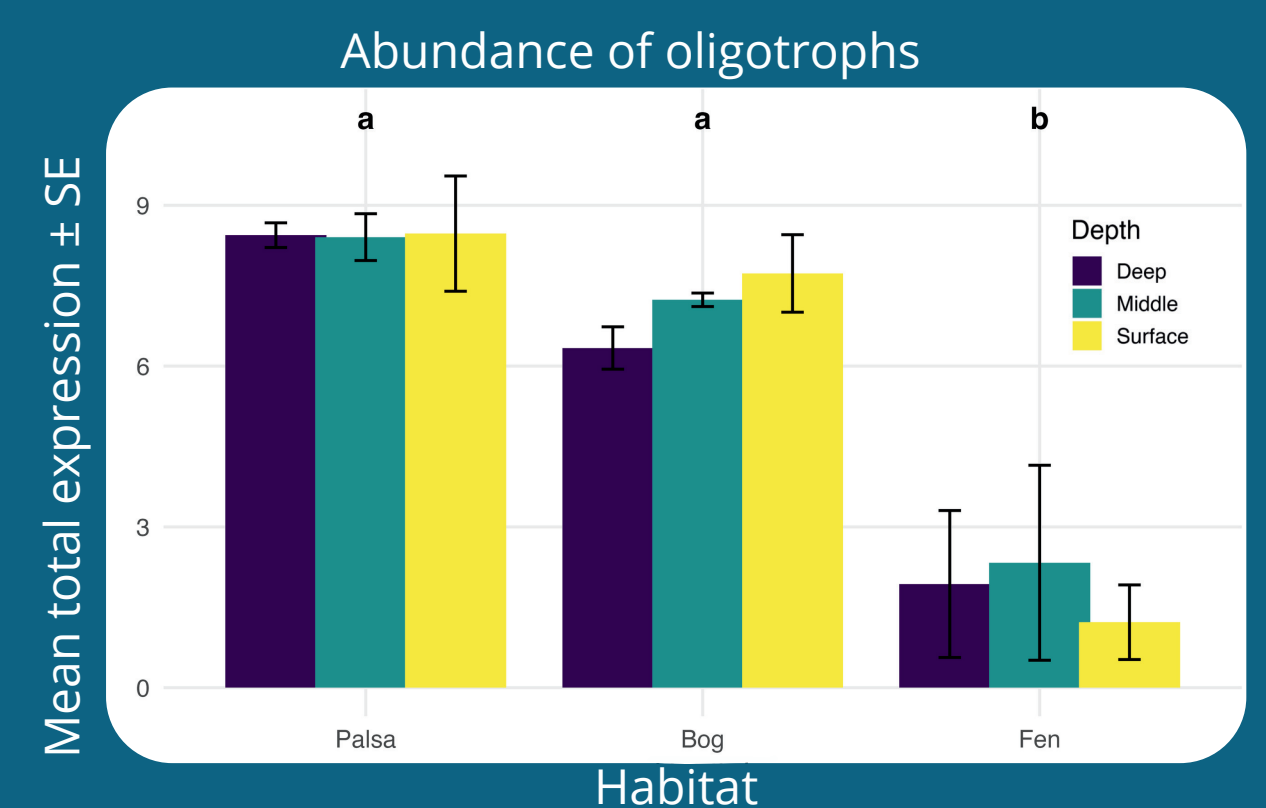
- Highest in palsa and bog habitats
- Significant decline in the fen, particularly in surface samples

Copiotrophs:

- Highest in fen habitats
- Significant increase in the fen, particularly in surface samples

Methanogens

- Highest in the deep bog and in the fen

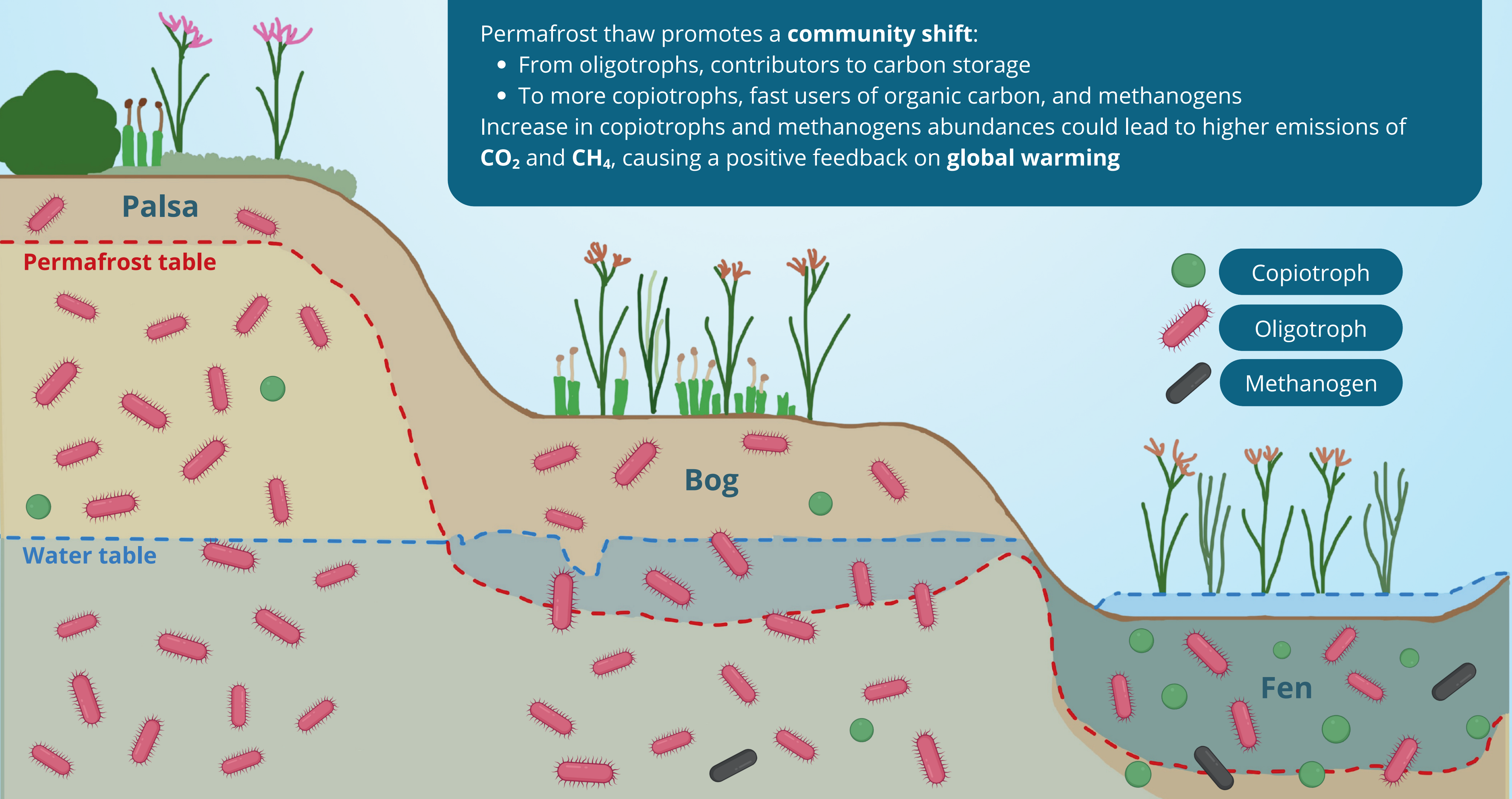


From carbon sink to carbon source?

Permafrost thaw promotes a **community shift**:

- From oligotrophs, contributors to carbon storage
- To more copiotrophs, fast users of organic carbon, and methanogens

Increase in copiotrophs and methanogens abundances could lead to higher emissions of **CO₂** and **CH₄**, causing a positive feedback on **global warming**



Authors:

Anna V. Robberstad

Luca Ieranò

Emilie C.S. Hole

References:

Drawing inspired by: Chang et al. (2019). Methane Production Pathway Regulated Proximally by Substrate Availability and Distally by Temperature in a High-Latitude Mire Complex. *Journal of Geophysical Research: Biogeosciences*, 124. <https://doi.org/10.1029/2019JG005355>
 McGivern et al. (2024). Microbial polyphenol metabolism is part of the thawing permafrost carbon cycle. *Nature Microbiology*, 9(6), 1454–1466. <https://doi.org/10.1038/s41564-024-01691-0>
 Fierer et al. (2007). Toward an ecological classification of soil bacteria. *Ecology*, 88(6), 1354–1364. <https://doi.org/10.1890/05-1839>

