High Arctic Plants and Methane

How do Arctic ecosystems absorb or release greenhouse

Key Messages

• Understanding how arctic ecosystems absorb and release greenhouse gases helps researchers predict the effects of climate change.

• Soil moisture and temperature influence how greenhouse gases are absorbed or released by arctic soils.

• Dry polar deserts are a **methane sink**, meaning they absorb more methane than they release. In contrast, wet soils are a source of methane. Drier sites released less carbon dioxide than wetter sites.

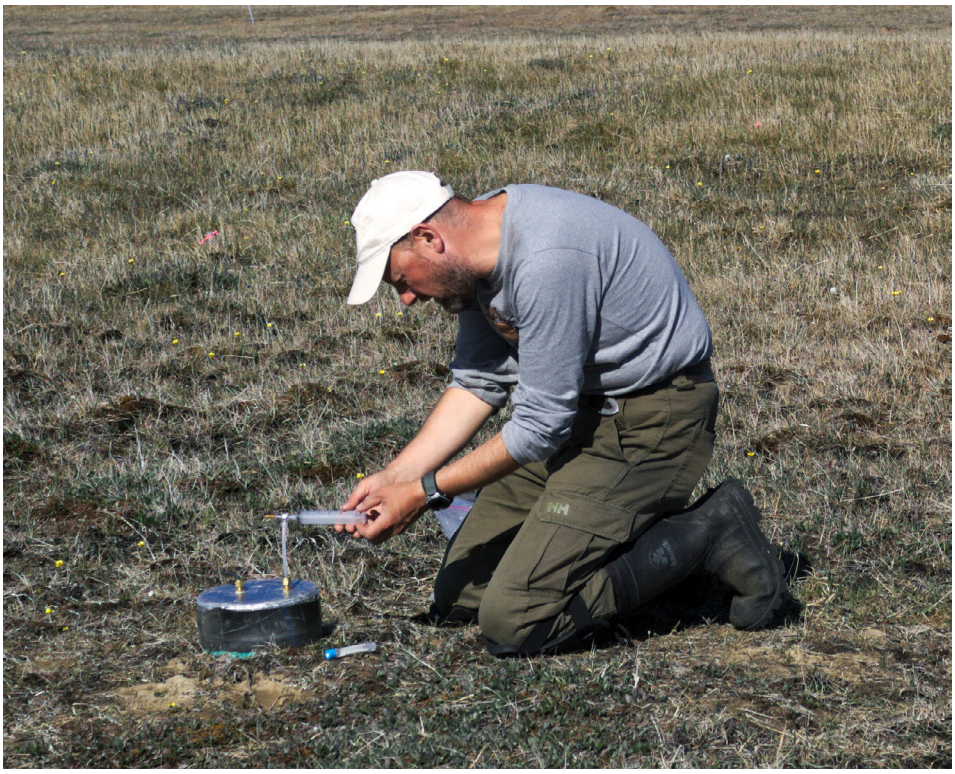
• Past studies likely underestimated how much methane is absorbed by Arctic soils because most studies take measurements in wetter ecosystems.

Research Summary

The research team studied the relationship between moisture, ecosystems, and greenhouse gases in Arctic environments.

At their study site at Cape Bounty on Melville Island, NU, the research team measured greenhouse gases in ecosystems across sites with differing levels of soil moisture. From driest to wettest, their sites included dry polar desert, mesic tundra, and wet sedge meadow (wetland) ecosystems.

The team measured three greenhouse gases: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Methane and nitrous oxide are less abundant than carbon dioxide, but they all have powerful warming effects.



POLAR scientist Johann Wagner measures the flows of greenhouse gases in the mesic tundra at Cape Bounty, Melville Island: Johann Wagner

Project leader*: Neal Scott, Queens University, Kingston ON

Read the full research results in the Arctic Journal
https://www.nrcresearchpress.com/doi/pdf/10.1139/ as-2018-0018

Based on two years of observations, the study found that drier sites absorbed methane (CH_4), while wetter sites released methane. Carbon dioxide (CO_2) emissions were lower in dry polar desert sites.

Arctic permafrost soils store a significant amount of the world's carbon. Plant communities, and the soil microbes (tiny organisms) they live with, play an important role in the exchange of gases between the soil and air.

Changes in Arctic ecosystems are important to global climate change. The Arctic is expected to become warmer and wetter with climate change. Since soil moisture and temperature affects Arctic plant communities, climate change will likely lead to changes in the types of plants and their coverage. Understanding how different plant ecosystems absorb and release greenhouse gases helps researchers make better predictions about how the climate might change.

Melville Island Ecosystems

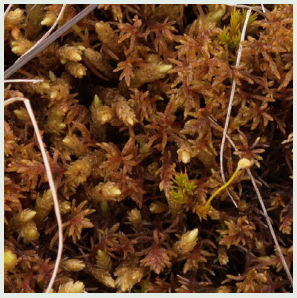
On Melville Island, the permafrost active layer is on average 50 to 90 cm deep, and scattered vegetation only grows at the edges of frost boils in most places. Three important terrestrial Arctic ecosystems are described by the soil moisture and the plants that grow there.

Polar Desert

- Dry soil
- Bare mineral soils cover 80% of the land
- Common plants include purple saxifrage, Arctic poppy, lichens, and mosses
- Most common ecosystem at Cape Bounty, Melville Islands

Mesic Tundra

- Moderate soil moisture
- Organic soils about 3 cm deep
- Common plants include mosses, lichens, grass-like plants, sedges, rushes, and herbaceous flowering plants
- Common ecosystem in other parts of the Arctic



Wet Sedge Meadow (Wetland)

- Wet soil
- Organic soils about 5 cm deep
- Completely covered by vegetation, including cottongrasses, aquatic sedge, Fisher's tundra grass, and alpine foxtail
- Often found downhill from melting icefields

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