

Arctic Tundra

Posted at: 20/12/2024

Arctic Tundra: From Carbon Sink to Source

Context:

The **Arctic tundra**, a region that has stored vast amounts of carbon for **thousands of years**, is now emitting **greenhouse gases (GHGs)** such as carbon dioxide (CO_2) and methane (CH_4). This finding is part of the **National Oceanic and Atmospheric Administration (NOAA)**'s recent analysis, the **Arctic Report Card**.

Background

The **Arctic Report Card**, published **annually by NOAA**, provides a comprehensive overview of **environmental changes** in the polar region, highlighting critical shifts in its ecosystems.

How Does the Arctic Tundra Store Carbon?

In typical ecosystems:

- **Plants** absorb CO_2 through **photosynthesis**.
- Carbon moves through the ecosystem as plants and animals **grow, die, and decompose**, with microorganisms releasing CO_2 back into the atmosphere, completing the **carbon cycle**.

In the **Arctic tundra**, however:

- The decomposition of organic matter is dramatically **slowed down** due to the **cold climate**.
 - **Permafrost** (frozen soil) traps plant and animal remains, preventing CO_2 from being released.
 - Arctic soils store over **1.6 trillion metric tonnes of carbon**, roughly **double the carbon present in the atmosphere**.
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Why Is the Arctic Tundra Emitting More Carbon Than Absorbing It?

In recent years, the Arctic tundra has transitioned from a **carbon sink** to a **carbon source** due to:

1. Rising Temperatures:

- The Arctic is warming **four times faster** than the global average.
- **Thawing permafrost** activates **microbes** that break down organic matter, releasing **CO₂** and **CH₄** into the atmosphere.

2. Increased Wildfires:

- The Arctic has experienced **frequent and intense wildfires** in recent years.
- **Wildfire smoke** adds to **GHG emissions** and accelerates **permafrost thaw**.
- **2020** marked the **worst wildfire season** in the Arctic's recorded history.

Together, these factors caused the **Arctic tundra to release more carbon** than its plants absorbed between **2001 and 2020**, potentially for the first time in **thousands of years**, according to NOAA's report.

This alarming shift underscores the need for **urgent global action** to mitigate **climate change** and its cascading impacts on sensitive ecosystems like the **Arctic tundra**.



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