

ARCTIC BOREAL ZONE: PLACES IN NEWS

The Arctic Boreal Zone plays a critical role in global carbon dynamics due to its large soil organic carbon reservoirs. However, new research highlights concerning changes in its carbon balance.

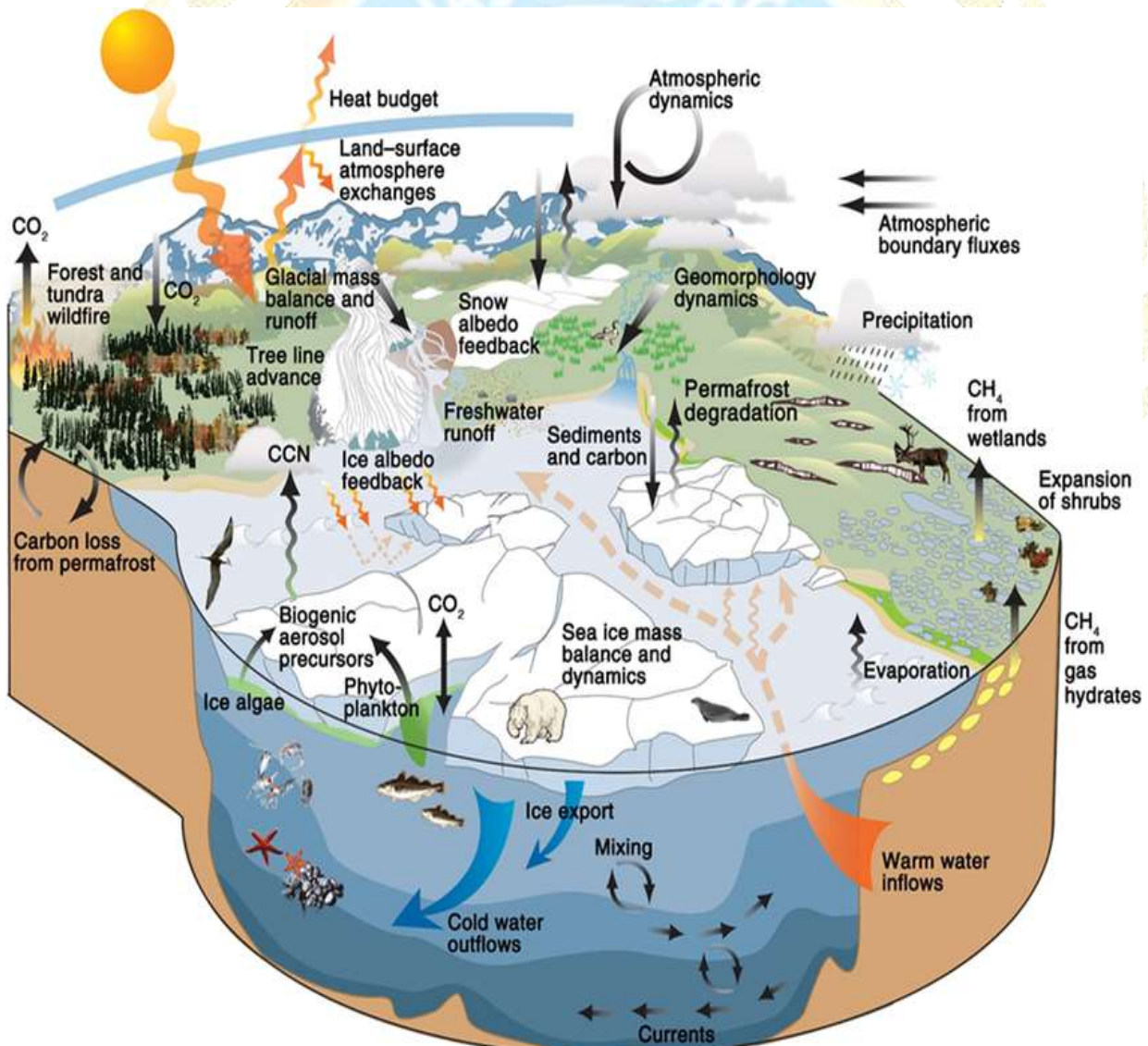
- **New Research Findings:**

Recent studies reveal that the **Arctic Boreal Zone** is now releasing more **carbon dioxide (CO₂)** into the atmosphere than it absorbs. This shift represents a troubling change in the region's role as a global carbon sink.

About the Arctic Boreal Zone

1. Research Alignment with NOAA's 2024 Arctic Report Card:

- The findings align with the **National Oceanic and Atmospheric Administration's (NOAA) 2024 Arctic Report Card**, which monitors the Arctic's changing climate.
- This report emphasizes the **Arctic tundra's transition from a carbon sink to a carbon source**, primarily due to rising temperatures and increased wildfire activity.



2. Characteristics of the Arctic Boreal Zone:



- The Arctic Boreal Zone spans **26 million square kilometers** and includes:
 - **Treeless Tundra:** Cold, treeless regions with permafrost.
 - **Boreal Forests:** Cold-climate forests dominated by coniferous trees.
 - **Wetlands:** Water-saturated areas contributing to carbon storage.
- These ecosystems have historically served as **natural carbon sinks**, but warming trends threaten this balance.

Key Findings

1. Distribution of Carbon Source Areas:

- Carbon emissions in the Arctic Boreal Zone are unevenly distributed:
 - **Alaska:** Contributes the largest share of emissions at **44%**.
 - **Northern Europe:** Accounts for **25%**.
 - **Canada:** Adds **19%** to the emissions.
 - **Siberia:** Contributes **13%**, reflecting its smaller share in the carbon source areas.

2. Seasonal Carbon Emissions:

- During the prolonged **non-summer season (September to May)**, the **carbon dioxide released** exceeds the amount absorbed during the **short summer months (June to August)**.
- This imbalance indicates that longer winters, combined with warming conditions, are intensifying emissions.

3. Carbon Source Expansion:

- Alarmingly, **40% of the Arctic Boreal Zone** has transitioned into a **carbon source**.
- This shift marks a significant disruption, as these areas traditionally absorbed more carbon than they emitted.

Definitions

1. Carbon Sink:

- An ecosystem or region that **absorbs more carbon** from the atmosphere than it releases. Examples include forests, oceans, and tundra ecosystems under normal conditions.

2. Carbon Source:

- An ecosystem or region that **releases more carbon** into the atmosphere than it absorbs. This contributes to the greenhouse effect and accelerates climate change.

Reasons for Increased Carbon Emissions

1. Longer Growing Seasons:

- Warming temperatures have extended the growing season in the Arctic, resulting in:
 - **More plant decay** that releases carbon.
 - Increased microbial activity in the soil.

2. Increased Microbial Activity:



- Warmer conditions stimulate soil microbes, which break down organic matter, releasing **carbon dioxide** into the atmosphere.

3. Wildfires:

- The frequency and intensity of wildfires have risen, burning organic matter and directly releasing vast quantities of carbon into the air.

Concerns

1. Soil Organic Carbon Reservoirs:

- The Arctic Boreal Zone stores massive amounts of carbon in its soil.
- As warming accelerates, there is concern that a significant portion of this **carbon stock** will be released, amplifying global warming.

2. Limited Carbon Absorption:

- The region's limited ability to absorb carbon is hastening the **thawing of permafrost**, which further releases stored carbon, creating a **positive feedback loop** that exacerbates climate change.

Conclusion

The Arctic Boreal Zone, once a crucial **carbon sink**, is now a growing **carbon source** due to warming temperatures, prolonged winters, and increased wildfire activity. This shift poses significant environmental concerns, including accelerated **permafrost thawing** and increased greenhouse gas emissions. Urgent action is required to address these changes and mitigate their global impact on climate.