ARTIC BOREAL ZONE: GEOGRAPHY

NEWS: As the world burns more, the Arctic biome is refusing more carbon

WHAT'S IN THE NEWS?

The 2024 Arctic Report Card highlights that rising temperatures and wildfires have turned the Arctic Boreal Zone from a carbon sink into a carbon source. This shift threatens global climate stability by releasing large amounts of carbon previously stored in permafrost and forests.

Context

- The 2024 *Arctic Report Card* released by the **U.S. National Oceanic and Atmospheric Administration (NOAA)** reported alarming changes in the Arctic Boreal Zone (ABZ), including the shift of this region from a carbon sink to a carbon source.
- This shift is primarily due to increasing wildfires and rising land temperatures, which are intensifying carbon emissions and accelerating global climate change.

Findings of NOAA's 2024 Arctic Report Card

- The report confirms that both the **Arctic tundra** and the **Arctic Boreal Zone (ABZ)** are now becoming **net carbon sources**.
- The transition is attributed to **warming temperatures**, **escalating wildfire activity**, and **permafrost thaw**, which together release stored carbon into the atmosphere.
- These developments contradict the long-standing role of Arctic ecosystems as stable, natural carbon sinks.

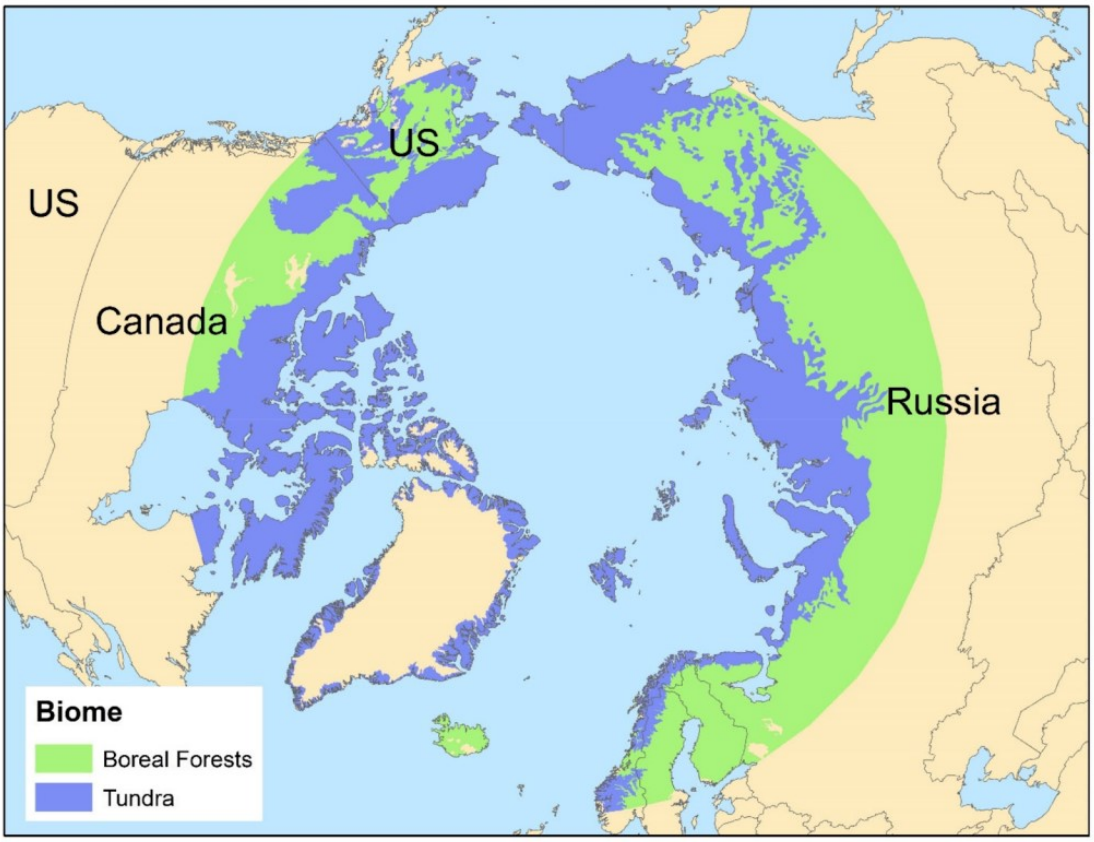
About the Arctic Boreal Zone (ABZ)

- The ABZ is a **vast ecological belt** located in the Northern Hemisphere, encompassing **high-latitude forests, wetlands, tundra, and permafrost regions**.
- It spans across countries such as the **United States (Alaska), Canada, parts of Northern Europe**, and **Siberia in Russia**.
- The zone is one of the **largest biomes** in the world and plays a **critical role in regulating Earth's carbon cycles** and climate stability.

Importance of the ABZ as a Carbon Sink

- Historically, the ABZ has **absorbed more carbon than it emits**, making it a **natural carbon sink**.
- The **coniferous forests**, **wetlands**, and especially the **permafrost soils** in this zone store vast amounts of **organic carbon** frozen for centuries.

- This sequestration of carbon has helped **mitigate the effects of global warming**, acting as a buffer against rising greenhouse gas concentrations.



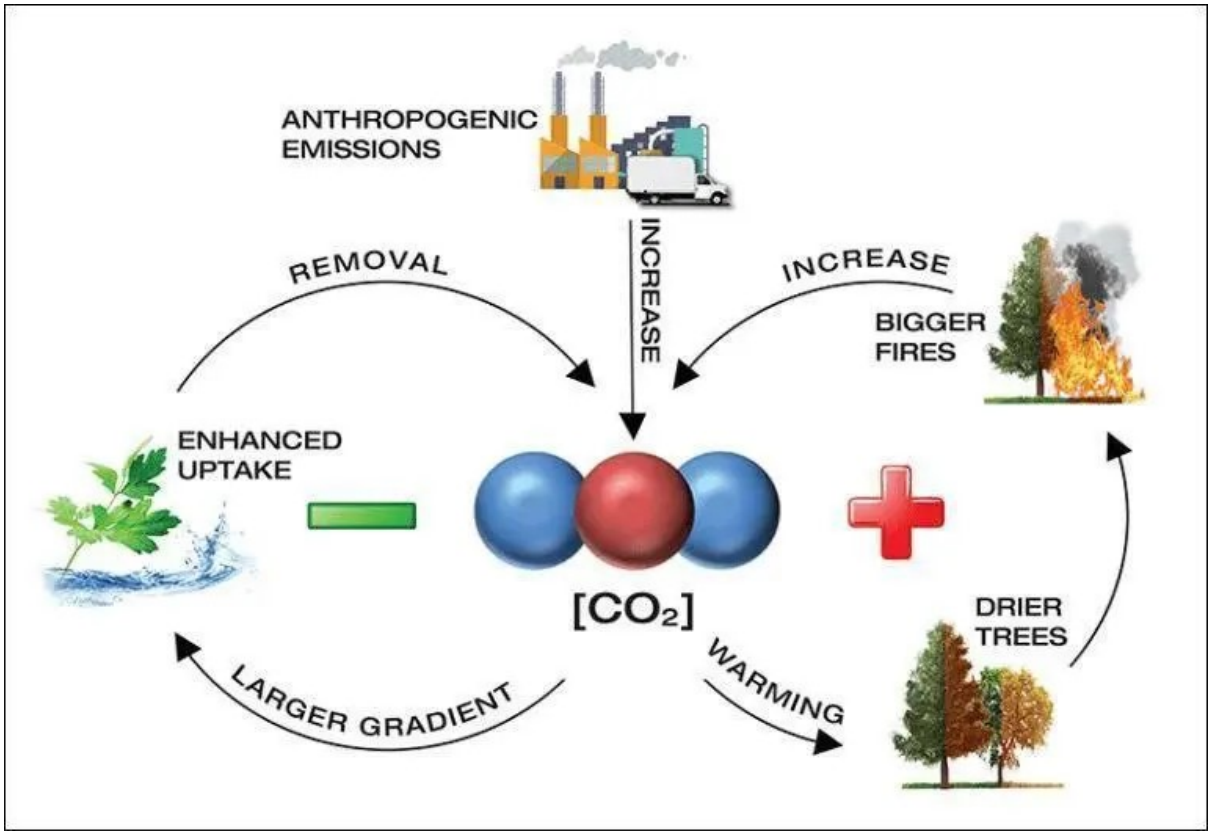
Impact of Recent Wildfires

- In early 2025, major wildfire events occurred not only in the ABZ but also in places like **Texas, Oklahoma, California (U.S.)** and **Ofunato (Japan)**.
- India saw a decline in forest fire hotspots, yet the number of fire incidents remains significantly high in **Uttarakhand, Odisha**, and **Chhattisgarh**.
- Factors such as **rising land surface temperatures**, **prolonged heat waves**, and **dry vegetation** have contributed to the spread and intensity of wildfires in both temperate and Arctic regions.

Rising Carbon Emissions from Wildfires

- Wildfires in **January 2025 alone released approximately 800,000 tonnes of carbon**, which is **four times more than the levels recorded a decade ago**.
- Global wildfires contribute massively to carbon emissions, with **India accounting for 69 million tonnes** of carbon emissions annually due to forest fires.

- Wildfires not only destroy vegetation but also release carbon stored in **biomass and soil**, adding significantly to **atmospheric greenhouse gases**.



Decline in Global Carbon Sink Efficiency

- Natural carbon sinks like **oceans, forests, and soils** are increasingly losing their ability to absorb carbon due to **climate-induced stress** and **human activities**.
- The **Arctic Boreal Zone**, once a reliable carbon sink, has been especially vulnerable due to:
    - Thawing of permafrost that releases **methane and CO_2**.
    - Repeated wildfires that burn forest cover and release stored carbon.
    - Reduced regrowth of vegetation due to shortened growing seasons and heat stress.
- Current estimates show that **more than 30% of the ABZ** now emits **more carbon than it captures**, signaling a dangerous reversal of its ecological function.

Broader Implications for Climate Change

- The transformation of the ABZ into a carbon source could trigger **climate feedback loops**, where increased emissions lead to further warming and more wildfires.
- Loss of carbon sinks globally would make it harder to **meet international climate targets** such as those outlined in the **Paris Agreement**.
- There is a heightened urgency to protect remaining carbon sinks, promote afforestation, and reduce anthropogenic emissions to stabilize global carbon balance.

Source: **https://www.thehindu.com/sci-tech/energy-and-environment/wildfires-arctic-boreal-zone-carbon-sink-emissions/article69360974.ece**