Wildfire and Earth’s Carbon Balance

Mains Syllabus: GS I - Important Geophysical phenomena; changes in critical geographical features; GS III - Conservation, environmental pollution and degradation.

Why in news?

Multiple states in the U.S. were recently in the grip of tornadoes, wildfires, and dust storms.

What is the recent increase in wildfire events globally?

- **Global trends** - Forest fires are becoming more widespread, with the area burned increasing by about 5.4% annually since 2001.
- In 2023 alone, nearly 12 million hectares of tree cover were lost due to fires.
- **US inferno** – Forest fires have damaged homes, various natural ecosystems in Texas, Oklahoma, Los Angelos, California.
- **Japan’s biggest forest fire** - The country's biggest forest fire in three decades has torched more than 5,200 acres around the northern Japanese city of Ofunato.
- **Forest fire in India** - According to the latest India State of Forest Report published on December 21, 2024, Uttarakhand, Odisha and Chhattisgarh recorded the most fires in that year.
- Uttarakhand alone recorded 5,315 forest fires between November 2022 and June 2023.

What are the causes of wildfire events?

- **Increasing land temperature** - India has been experiencing some of its highest land temperatures in recent years.
- Indian Institute of Tropical Meteorology, Pune reported that in India’s northwest, northeast, and central regions, land temperature is rising
    - 0.1º-0.3º C per decade in the pre-monsoon season and
    - 0.2º–0.4º C per decade in the post-monsoon season.
- **Increasing heat waves** - Heat waves have also been found to be occurring earlier in the year, moving slower, and lasting longer.
- **Prolonged dry spells** – Heat waves together with prolonged dry spells create conditions ripe for wildfires.
- **Climate Change** - It is contributing to more frequent and intense wildfires by increasing the frequency and severity of droughts and heatwaves, which dry out vegetation and create conditions that are more conducive to wildfires.

- **Spontaneous combustion** - Organic materials like dry leaves or grass can ignite naturally under intense heat or conditions.
- **Agricultural practices** - Slash-and-burn farming methods can sometimes result in uncontrollable fires.
- **Lightning** - Lightning strikes are a major natural cause of wildfires, especially during dry periods, as they can ignite dry vegetation.

What are the impacts of wildfire on Earth's carbon balance?

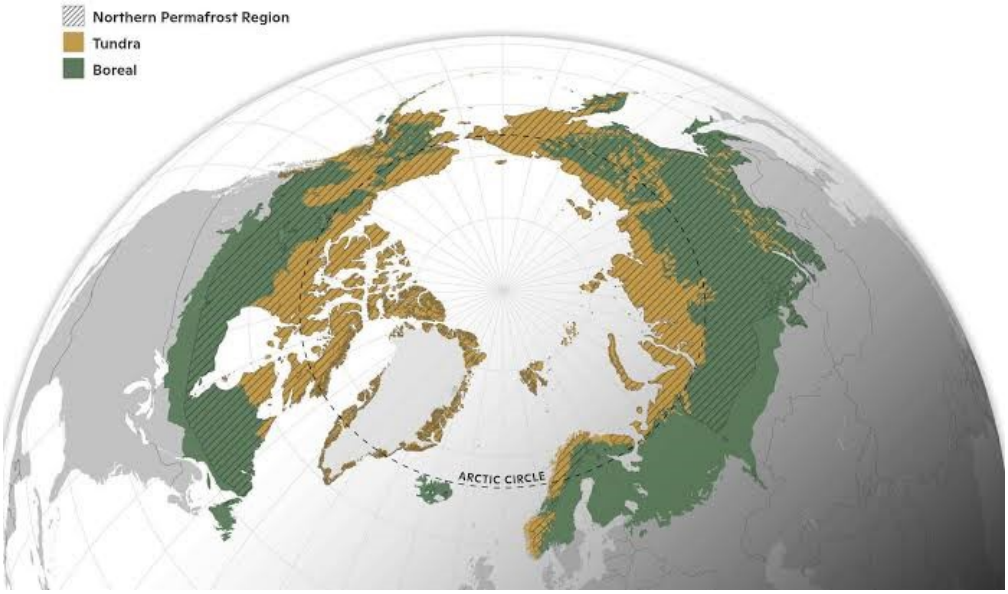
- **Radiation** - The radiative power of fire in recent wildfire incidents is 10 times higher than the average between 2003 and 2024.
- **Carbon emissions** - Wildfires release vast amounts of stored carbon into the atmosphere, contributing to climate change.
- According to the Copernicus Air Monitoring Service (CAMS) of the European Union, wildfires released 800,000 tonnes of carbon in January 2025 alone.
- Forest fires in India emit around 69 million tonnes of carbon dioxide every year.
- **Disruption of Carbon Sinks** - Forests, which act as natural carbon sinks, are damaged by wildfires and their ability to absorb carbon is reduced.

Carbon sinks absorbs more carbon than they release and helps in reducing its concentration in the air. Example - oceans, forests, and soil.

Carbon sources releases more carbon than they absorb.Example - burning of fossil fuels or volcanic eruptions.

- **Impact on Arctic Boreal Zone (ABZ)** – According to a recent study, due to wildfires, more than 30% of the ABZ has now stopped capturing carbon and is instead releasing it.
- The regions in ABZ , Alaska accounted for 44% of the 'new' emissions, northern Europe and Siberia accounted for 25% and 13%, respectively.

Arctic Boreal Zone (ABZ) coniferous forest is the world's largest land-based biome. Its tundra, coniferous forests, and wetlands around the Arctic Circle have absorbed carbon and sequestered it in the zone's permafrost.



- **Thawing of tundra permafrost** – Wild fires and the consequent global warming effects have been more pronounced in cooler regions.
- It dries out the soil, increases average temperature of the top soil the , changes the type of plants that grow and the organic materials in the soil decompose, releasing carbon dioxide into the atmosphere.

What lies ahead?

- **Plan better for the long term** – Cities and regions need smart, science-based plans to handle heatwaves and wildfires.
- **Protect carbon sinks** – Saving forests, wetlands, and permafrost areas that naturally store carbon.
- **Work together globally** – Since wildfires can spread across countries, international support and joint action are important.
- **Fix the root problem** – To break the wildfire-warming cycle, we need to reduce pollution, stop deforestation, and fight climate change.

Reference

The Hindu | Wild fire