

Forest Fires and Carbon Balance

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Forest Fires and Carbon Balance: A Climate Emergency

Context:

In recent months, multiple states in the United States have simultaneously experienced tornadoes, wildfires, and dust storms. These are not isolated weather events but are part of a larger global pattern of increasing climate-related disasters. Among them, **wildfires have emerged as a critical concern**, affecting ecosystems, human health, and the planet's carbon balance.

Global Trends in Wildfire Incidents

- Forest fires are becoming increasingly widespread across continents.
- The area affected by wildfires has **increased by about 5.4% annually since 2001**.
- In **2023**, nearly **12 million hectares** of tree cover were lost due to wildfires.

Country-specific data:

- **United States:** Forest fires have severely impacted homes and ecosystems in **Texas, Oklahoma, Los Angeles, and California**.
- **Japan:** Witnessed its **largest forest fire in three decades**, burning over **5,200 acres** near **Ofunato** in the north.
- **India:** As per the **India State of Forest Report 2024**, **Uttarakhand, Odisha, and Chhattisgarh** recorded the most wildfire incidents.
 - **Uttarakhand alone** experienced **5,315 forest fires** between **November 2022 and June 2023**.

Causes Behind the Rise in Wildfires

1. Rising Land Temperatures

- According to the Indian Institute of Tropical Meteorology, India's land surface temperature is rising steadily:

- **0.1°C-0.3°C per decade** during the **pre-monsoon season**

- **0.2°C-0.4°C per decade** during the **post-monsoon season**

2. Increased Heatwaves

- Heatwaves are occurring earlier in the year, lasting longer, and moving more slowly.
- Combined with prolonged dry spells, they make forests more vulnerable to fires.

3. Climate Change

- Contributes to drier and hotter conditions, increasing the frequency and severity of wildfires globally.

4. Spontaneous Combustion

- Under extreme heat, organic materials like dry leaves or grass may ignite naturally.

5. Agricultural Practices

- Slash-and-burn methods used in farming can unintentionally spark large-scale fires.

6. Lightning Strikes

- Natural cause of wildfires during dry seasons when vegetation is highly flammable.
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Impact of Wildfires on Earth's Carbon Balance

1. Radiative Power

- The radiative intensity of recent wildfires has been **ten times higher** than the average recorded between **2003 and 2024**.

2. Carbon Emissions

- According to the **Copernicus Air Monitoring Service**, wildfires released **800,000 tonnes of carbon** in **January 2025 alone**.
- **India's forest fires** emit approximately **69 million tonnes of carbon dioxide every year**.

3. Destruction of Carbon Sinks

- Forests, wetlands, and permafrost that once acted as **carbon sinks** are being destroyed, reducing their ability to absorb CO₂ and increasing atmospheric carbon levels.

Definitions:

- **Carbon Sink:** A natural system that absorbs more carbon than it releases. Examples include forests, oceans, and soil.
- **Carbon Source:** A system or activity that releases more carbon than it absorbs. Examples include wildfires and fossil fuel combustion.

Arctic Boreal Zone (ABZ): A Region of Concern

- The **Arctic Boreal Zone**, the world's **largest land-based biome**, includes tundra, wetlands, and coniferous forests.
- Wildfires have transformed **more than 30% of the ABZ** from a carbon sink into a carbon source.

Regional contributions to new carbon emissions in ABZ:

- **Alaska:** 44 percent
- **Northern Europe:** 25 percent
- **Siberia:** 13 percent

Thawing of Permafrost:

- Wildfires are accelerating the thawing of permafrost.
- This process:
 - Dries the soil
 - Raises the temperature of the topsoil
 - Alters vegetation cover
 - Releases trapped organic carbon into the atmosphere

What Lies Ahead: Strategy and Recommendations

1. Long-Term Urban and Regional Planning

- Cities and regions must adopt scientific, climate-resilient strategies to reduce wildfire vulnerability.

2. Protection of Carbon Sinks

- Prioritise the conservation of forests, wetlands, and permafrost zones to maintain Earth's natural carbon balance.

3. Global Collaboration

- International cooperation is essential to address the transboundary impacts of wildfires and climate change.

4. Addressing the Root Causes

- Urgent efforts are needed to reduce greenhouse gas emissions, prevent deforestation, and promote sustainable land use practices.

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