Growing Menace of Forest Fires in India

This editorial is based on "[Addressing the growing threat of forest fires](#)" which was published in The Hindu on 12/02/2025. The article brings into picture the tenfold surge in forest fires over two decades, causing ₹1.74 lakh crore in annual losses, with conservation efforts hindered by implementation gaps and climate change.

For Prelims: [Forest fires](#), [Monsoon](#), [India State of Forest Report (ISFR) 2023](#), [Heat waves](#), [Slash-and-burn technique](#), [Forest Rights Act](#), [Desertification](#), [CAMPA](#), [Green India Mission](#), [Environmental impact assessments](#), [Non-Timber Forest Produce](#), [Aravalli Green Wall project](#).

For Mains: Forest Fires in India, Issues Related to Forests in India.

[Forest fires](#) have emerged as a critical environmental challenge, with **India witnessing a tenfold increase in incidents over the past two decades** despite merely a **1.12% growth in forest cover**. With over **36% of India's forest area prone to fires**, the devastation extends beyond environmental damage to significant economic losses, **estimated at ₹1.74 lakh crore annually.** Despite progressive policies and constitutional safeguards, the implementation gaps in forest management, coupled with climate change impacts, continue to undermine India's forest conservation efforts.

Why Do Forest Fires Frequently Occur in India?

- **Climate Change and Rising Temperatures:** India's rising temperatures, **prolonged dry spells, and [erratic monsoon patterns](#)** have increased forest fire susceptibility.
  - Warming trends have led to drier forests, reducing moisture levels in vegetation, making them highly flammable.
  - Unseasonal **[heat waves](#) in March-April**, especially in **Himalayan states,** have intensified fire risks.
  - **India recorded its hottest February in 2023 (IMD)**, impacting pre-monsoon soil moisture.
    - As a result, **[India State of Forest Report (ISFR) 2023](#)**, revealed that Uttarakhand alone experienced 5**,351 forest fires** between November 2022 and June 2023.
  - Also, climate change is making El Nino phenomena more common. **[El Niño](#) years bring below-average rainfall,** extending dry periods and intensifying fire risks.
    - Erratic monsoons leave forests drier for longer, creating ideal conditions for wildfires.
    - The 2023–2024 El Niño was regarded as one of the five strongest **[El Niño–Southern Oscillation](#)** event in recorded history
      - In 2024, the **IMD reported a pre-monsoon rainfall deficit** with shortages of **30% in the east and northeast and 68% in the south.**
- **Human-Induced Causes and Encroachments:** Expanding agricultural frontiers and illicit land

clearing contribute to frequent fires.

- **Slash-and-burn techniques,** rampant in Northeast India, worsen fire outbreaks, particularly during dry seasons.
- Infrastructure projects like roads and railways also escalate **accidental ignitions.**
  - WWF International in its 2020 report has estimated that humans are responsible for around **75% of all wildfires.**
- Increasing footfall in forested regions for tourism, **particularly in the Himalayas and Western Ghats,** has led to more accidental fires.
  - Pilgrimage routes like **Vaishno Devi** witness open fires due to improper waste disposal, escalating fire risks.

- **Deficient Early Warning and Fire Management Systems:** Inadequate fire surveillance, outdated response mechanisms, and weak enforcement of fire prevention laws exacerbate the crisis.
  - **Most state forest departments lack real-time monitoring** and rapid response teams.
  - As of 2019, the country had **just 3,377 fire stations as against the 8,559 required with only minimal progress since then.**
    - This is a pressing concern when **more than 60% of Indian states** are highly prone to forest fire events.
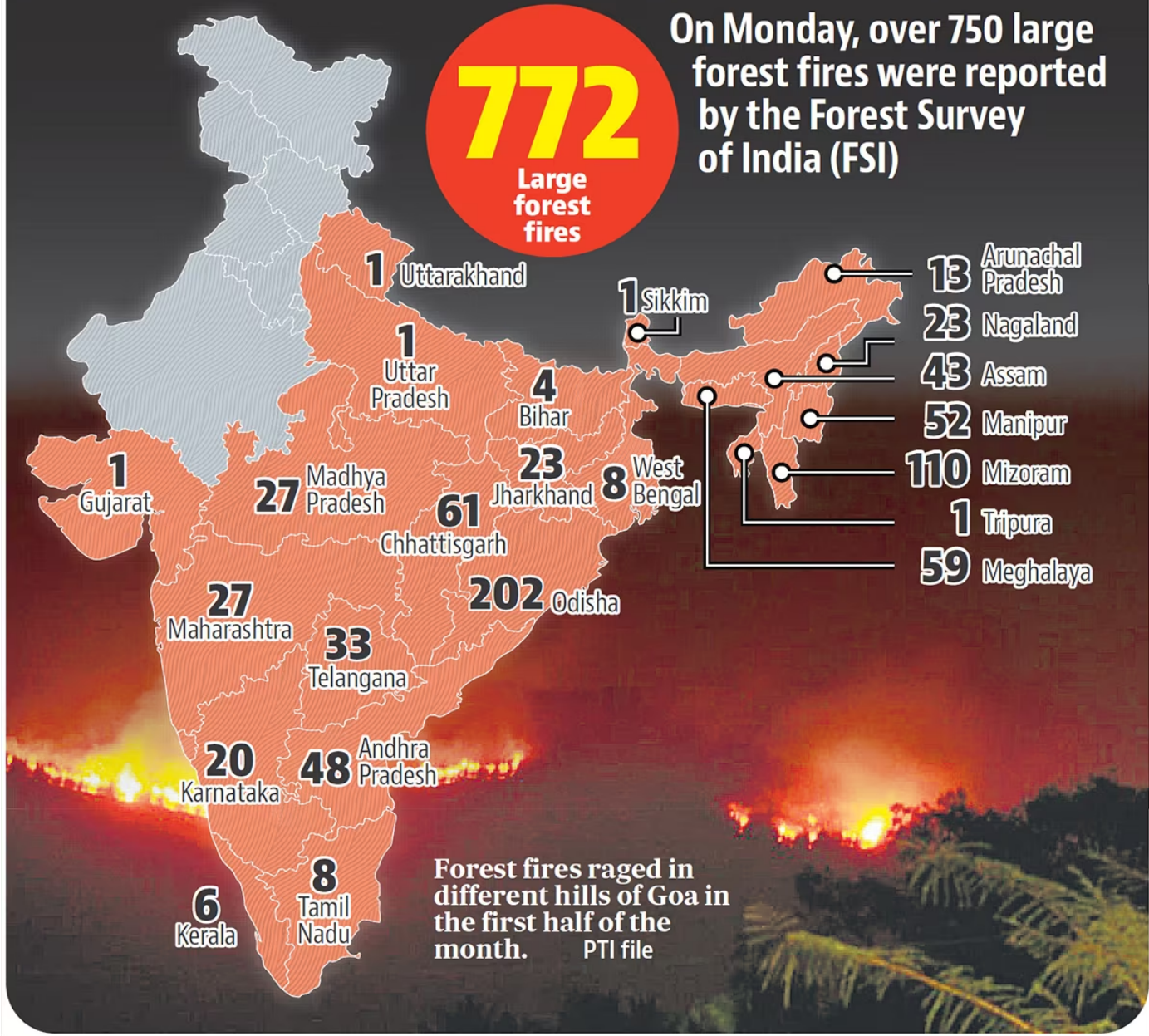
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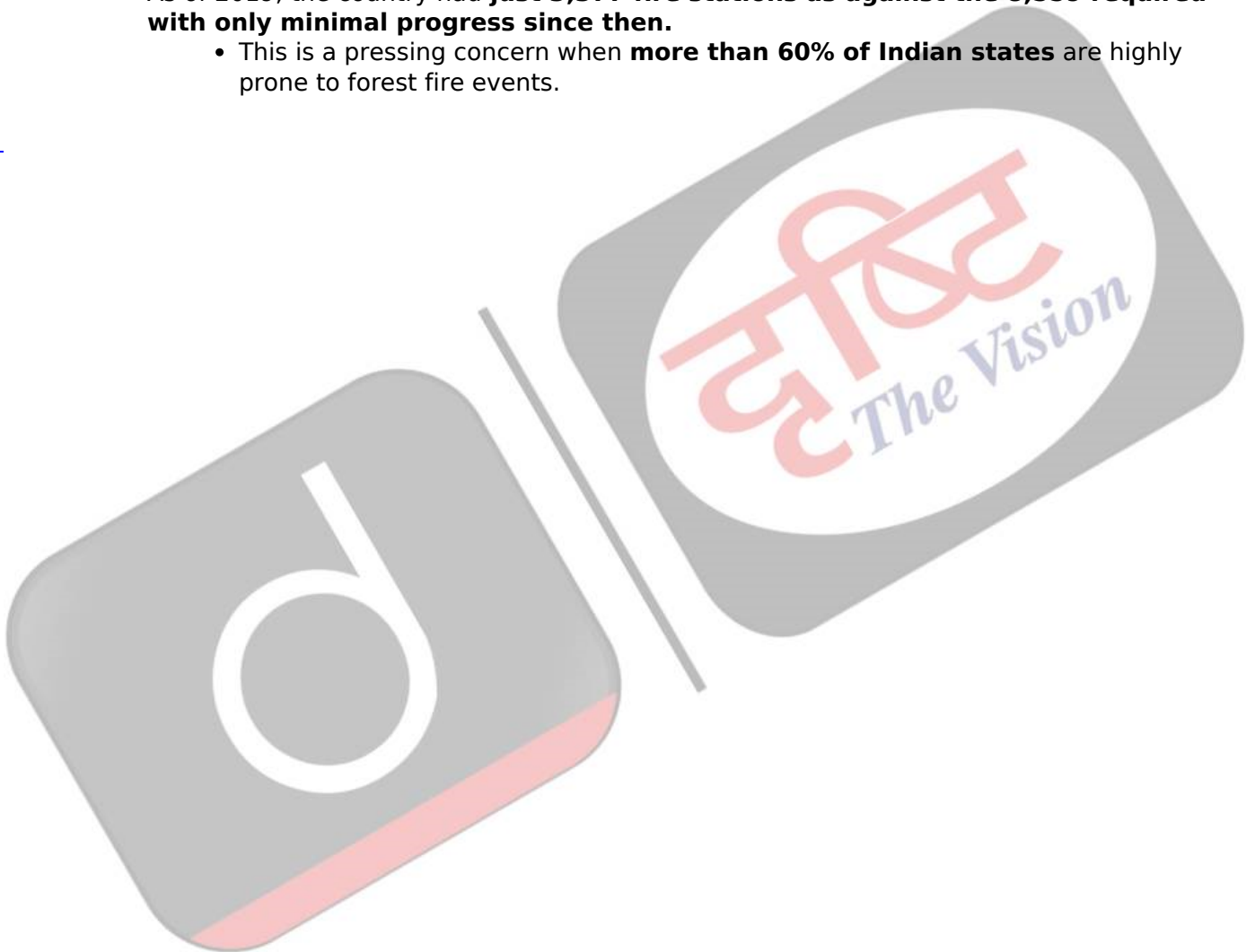
Active large fires across country
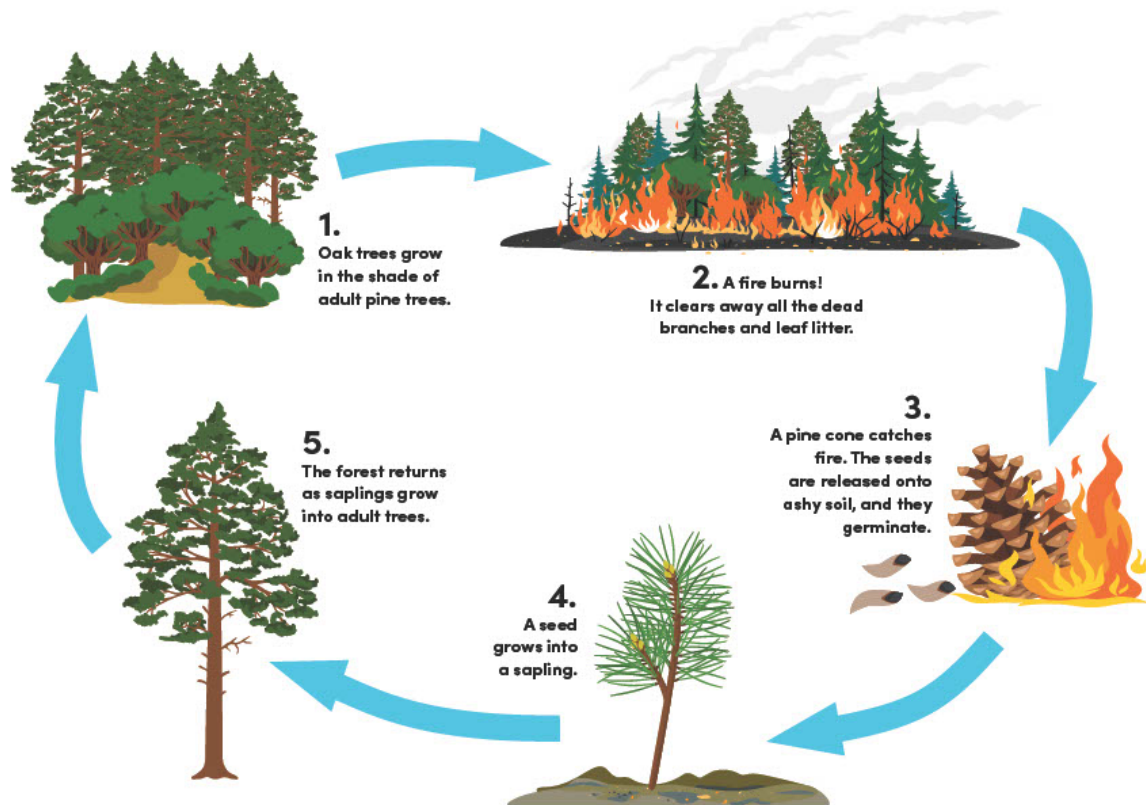
772 Large forest fires

On Monday, over 750 large forest fires were reported by the Forest Survey of India (FSI)

- **1** Uttarakhand
- **1** Sikkim
- **1** Uttar Pradesh
- **4** Bihar
- **1** Gujarat
- **27** Madhya Pradesh
- **23** Jharkhand
- **8** West Bengal
- **61** Chhattisgarh
- **27** Maharashtra
- **202** Odisha
- **33** Telangana
- **20** Karnataka
- **48** Andhra Pradesh
- **6** Kerala
- **8** Tamil Nadu
- **13** Arunachal Pradesh
- **23** Nagaland
- **43** Assam
- **52** Manipur
- **110** Mizoram
- **1** Tripura
- **59** Meghalaya

Forest fires raged in different hills of Goa in the first half of the month. PTI file

- **Biodiversity Hotspots and Flammable Vegetation:** India's vast biodiversity, especially in **dry deciduous and pine forests,** is highly fire-prone.
  - **Pine forests** in Uttarakhand and Himachal Pradesh shed resin-rich dry needles, acting as natural fuel.
    - For instance, forest fire in Himachal and in mid-Himalaya and lower belts may directly be correlated with **chir pine forests.**
  - **Grasslands and bamboo** groves in Central India also ignite easily during dry spells.

Pitch Pine Fire Cycle Diagram

1. Oak trees grow in the shade of adult pine trees.

2. A fire burns! It clears away all the dead branches and leaf litter.

3. A pine cone catches fire. The seeds are released onto ashy soil, and they germinate.

4. A seed grows into a sapling.

5. The forest returns as saplings grow into adult trees.

- **Weak Community Participation and Awareness:** Many rural communities depend on forests for livelihoods but **lack awareness about fire risks and mitigation.**
    - Traditional fire control practices have declined, and incentives for fire prevention are weak.
        - **Lack of coordination between panchayats, forest officials, and local residents** worsens the situation.
- **Lack of Technological Integration in Fire Prevention:** Despite advances in satellite monitoring, India lacks AI-driven predictive fire models and real-time drone surveillance.
    - Current forest fire alerts are often delayed, preventing timely action.
    - The absence of weather-based fire forecasting further hampers preparedness.
    - **AI-based fire prediction models** are yet to be widely implemented beyond pilot projects (MoEFCC).

What are the Other Issues Related to Forests in India?

- **Deforestation Due to Infrastructure and Industrial Projects:** Large-scale infrastructure projects like **highways, railways, and mining** have led to massive forest loss.
    - Increasing **urbanization and industrial expansion** are causing fragmentation of forest ecosystems, **reducing wildlife corridors.**
    - Despite compensatory afforestation laws, forest land diversion continues unchecked.
    - According to **Global Forest Watch (GFW),** India has lost 2.33 million hectares of tree cover since 2000, marking a 6% decline between 2001 and 2023.
        - Projects like the **Great Nicobar Project** involving diverting **130 square kilometres of forest,** to construct several developmental projects including a

transshipment, have also come into the spotlight.

- **Depleting Forest Cover in Tribal and Scheduled Areas:** Tribal communities rely on forests for sustenance, but aggressive commercial plantations and encroachments are displacing them.
    - The **Forest Rights Act (FRA) implementation remains weak**, with many rightful claims rejected.
    - Government afforestation programs often prioritize commercial species over native biodiversity.
        - Over 38% of all claims over land made under the Forest Rights Act (FRA), 2006 till **November 2022**, have been rejected.
- **Monoculture Plantations Impacting Natural Biodiversity:** Afforestation efforts are often focused on commercial monocultures like **eucalyptus, teak, or acacia**, which deplete groundwater and fail to support native biodiversity.
    - Such plantations do not compensate for the ecological value of lost natural forests, leading to biodiversity imbalances.
    - For instance, **Eucalyptus Plantations** have reduced groundwater levels by 20-30% in affected regions.
- **Human-Wildlife Conflict Due to Shrinking Habitats:** Rapid deforestation is forcing **wildlife into human settlements,** leading to an increase in conflicts, particularly with elephants, leopards, and tigers.
    - Expanding agricultural fields and highways through forests further escalates encounters, endangering both humans and animals.
    - For instance, between **2019 and 2024**, elephant attacks claimed **2,727 lives,** while tiger attacks resulted in 349 fatalities in India.
- **Forest Degradation Due to Unregulated Grazing:** **Overgrazing** by **livestock**, especially in fragile ecosystems, reduces regeneration capacity, compacts soil, and accelerates erosion.
    - **Traditional pastoral systems are collapsing,** leading to unsustainable grazing patterns that deplete forest biomass. Government policies often overlook sustainable grazing management.
    - As much as **77% of the country's livestock are herded or left to range on their own on common land by pastoralists**, per the September 2020 'Accounting for pastoralists in India' report.
- **Climate-Induced Shifts in Forest Ecosystems: Rising temperatures and erratic monsoon patterns** are altering **India's forest composition**, leading to species migration and ecosystem imbalances.
    - **Alpine and tropical forests are witnessing shifts in flora and fauna,** impacting biodiversity and local livelihoods.
        - For instance, **oak forests** in the Himalayas are being replaced by **chir pine.**
    - Also, West Bengal has lost **110 square kilometres of mangroves in the Sundarbans** in the past two decades due to climate change and global warming
- **Weak Implementation of Conservation Policies and Laws:** Despite strong legal frameworks, poor enforcement, bureaucratic delays, and political interference weaken conservation efforts.
    - Policies like **CAMPA** and **Green India Mission** have been criticized for inefficiency and fund misallocation.
        - Local communities often remain excluded from decision-making.
    - About **45% of funds allotted by the Centre for compulsory afforestation** between **2017 and 2022** have not been utilized by the state.

What Measures can India adopt to Ensure Sustainable Forest Management?

- **Community-Led Fire Prevention and Control Mechanisms:** Empowering local communities through **Van Panchayats and Joint Forest Management Committees (JFMCs)** can enhance forest fire preparedness.
    - Training villagers in early detection, controlled burning techniques, and rapid response mechanisms will ensure timely action.
        - Incentivizing **local participation through ecotourism** revenue sharing can sustain these initiatives.
        Example: Uttarakhand's Van Panchayats have successfully reduced fire

incidents in select areas through community patrols and firebreaks.

- **Use of AI and Satellite-Based Early Warning Systems:** Deploying artificial intelligence **(AI)-driven predictive models** and real-time satellite monitoring can help detect fire-prone zones.
  - Drones equipped with thermal imaging can help assess fire risks and direct firefighting efforts.
  - Forest Survey of India (FSI) utilizes fire detection data from two satellite sensors: **MODIS (Moderate Resolution Imaging Spectroradiometer) a**nd **SNPP-VIIRS (Suomi National Polar-orbiting Partnership - Visible Infrared Imaging Radiometer Suite)** to monitor forest fires across India, that can be further enhanced.
- **Fire-Resistant Afforestation and Green Firebreaks:** Shifting from **monoculture plantations to fire-resistant native species** can reduce forest fire susceptibility at prone areas.
  - Creating **green firebreaks—zones** with fire-resistant species like **sal, mahua, and jamun—**can prevent the spread of wildfires.
    - Also, broad-leaved trees like **oak and rhododendron** can help reduce the risk of forest fires.
  - Also, using **fungi-based mycelium barriers and bio-bricks** made from forest waste can create natural, fire-resistant zones.
    - These barriers decompose naturally while preventing fire spread in vulnerable regions. Integrating them with green firebreaks will enhance fire mitigation efforts.
- **Strengthening Forest Rights and Tribal Participation:** Recognizing and expediting **Forest Rights Act (FRA) claims** will empower tribal communities to sustainably manage forests.
  - Promoting **traditional knowledge-based conservation practices,** such as seed ball dispersal and water harvesting, will enhance forest resilience.
  - Direct benefit-sharing models from forest produce collection can create economic incentives for conservation.
    - **Odisha's Similipal Biosphere** has integrated tribal honey collectors into conservation efforts through cooperatives.
- **Transitioning to Climate-Resilient Forestry:** Integrating climate adaptation strategies, such as **selecting drought-tolerant native species** and restoring wetlands within forest landscapes, can enhance ecological resilience.
  - India's Carbon Credit Mechanism needs to be further refined to develop **forest-based carbon credit programs that can** attract investments for afforestation and conservation.
  - Aligning forest policies with **India's Net Zero targets** will ensure long-term sustainability.
    - **Meghalaya's Living Root Bridges ecosystem** is a brilliant example that aligns with natural climate resilience principles.
- **Banning Destructive Mining and Infrastructure in Eco-Sensitive Zones:** Strictly regulating **mining, road expansion, and hydroelectric projects** in fragile forest ecosystems will prevent irreversible damage.
  - Implementing **No-Go Zones for mining and enforcing stricter [environmental impact assessments (EIAs)](#)** will safeguard biodiversity.
    - Promoting eco-friendly alternatives, such as underground cabling instead of deforestation-heavy transmission lines, can mitigate damage.
  - In 2013, the Supreme Court asked the forest dwellers to decide if mining in **Niyamgiri hills** will affect their religious and cultural rights, **a significant step in involving forest communities.**
- **Integrating Agroforestry and Sustainable Forest-Based Livelihoods:** Promoting agroforestry models where **farmers grow trees alongside crops** can enhance tree cover without impacting food security.
  - Strengthening **[Non-Timber Forest Produce (NTFP)](#) value chains,** like medicinal plants and bamboo, can provide sustainable livelihoods.
  - Market linkages through initiatives like **Van Dhan Yojana** will ensure fair pricing and economic viability.
- **Enhancing Water Conservation in Forest Ecosystems:** Restoring f**orest-based water bodies, reviving traditional rainwater harvesting structures**, and protecting riparian forests can strengthen hydrological cycles.
  - Encouraging catchment area treatment in deforested river basins will improve groundwater recharge.

- Policies should integrate watershed management with afforestation projects for holistic forest health.
  - The **Aravalli Green Wall project** **in Haryana** is reviving **35,000 hectares of land** and restoring water bodies to combat desertification, can serve as a model.
- **Leveraging Sustainable Tourism for Conservation:** Regulating ecotourism through responsible tourism guidelines can generate revenue while protecting forests.
  - **Developing low-impact tourism infrastructure** and enforcing carrying capacity limits will reduce human disturbances.
  - Involving local communities in homestays and nature guide programs will ensure inclusive conservation efforts.
    - *Example:* **Kaziranga National Park** has successfully linked community-based ecotourism with conservation incentives.
- **Seed Bombing with Native and Climate-Resilient Species:** Drones can be used for aerial seed dispersal over degraded forests, improving afforestation efficiency.
  - Using indigenous seed varieties that require minimal water and are pest-resistant ensures better survival.
    - This technique is ideal for inaccessible or conflict-prone forest zones.
- **Forest-Based Blockchain for Transparent Conservation Funding:** Using blockchain to track afforestation and conservation funding can ensure accountability in tree plantation programs.
  - It will help **verify if afforestation commitments under CAMPA and CSR initiatives are actually implemented** on the ground.
    - Smart contracts can link funding to measurable outcomes like tree survival rates.
- **Artificial Fog Harvesting in Dry Forests:** Using fog nets to capture atmospheric moisture can provide water for forest regeneration in arid and semi-arid zones.
  - This is **particularly useful in regions where conventional water conservation methods are difficult.** Fog harvesting can be integrated with tree nurseries for improved seedling survival.
  - Tamil Nadu's coastal forests are experimenting with fog harvesting for afforestation efforts.

Conclusion:

India's escalating forest fire crisis underscores the urgent need for holistic and sustainable forest management. While climate change, human encroachments, and weak enforcement exacerbate fire risks, **solutions lie in community-driven conservation, AI-based early warning systems, fire-resistant afforestation, and stronger legal implementation.** Integrating traditional knowledge with modern technology, promoting eco-sensitive infrastructure, and aligning forest policies with India's climate goals will be crucial.

Drishti Mains Question:

Forest fires in India have increased significantly over the past two decades, posing serious environmental, economic, and social challenges. Discuss the key factors contributing to the rising frequency of forest fires in India.

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. Consider the following: (2019)

1. Carbon monoxide
2. Methane
3. Ozone
4. Sulphur dioxide

Which of the above are released into atmosphere due to the burning of crop/biomass residue?

(a) 1 and 2 only

(b) 2, 3 and 4 only

(c) 1 and 4 only

(d) 1, 2, 3 and 4

Ans: (d)

Mains:

Q. Most of the unusual climatic happenings are explained as an outcome of the El-Nino effect. Do you agree? (2014)