Modern Technology for Sustainable Forest Management

For Prelims: 18th India State of Forest Report 2023, National Forest Policy 1988, RFID Tags, Geofencing, Invasive Plants, Carbon Sink, Greenhouse Gas, Carbon Border Adjustment Mechanism (CBAM), Agroforestry, Carbon Credits, Paris Agreement.

For Mains: Need and role of modern technology in sustainable forest management, Steps to improve sustainable forest management.

Source: BS

Why in News?

Madhya Pradesh has become the **first state** in India to implement an **AI-based Real-Time Forest Alert System (RTFAS)** on a pilot basis for **active forest management.**

- It underscores the **use of technology** in helping meet India's challenges in **sustainable forest management.**

Note: As per the **18th India State of Forest Report 2023**, **Madhya Pradesh** has the **largest forest cover in India (85,724 sq km)** but also reported the **highest deforestation (612.41 sq km lost in 2023).**

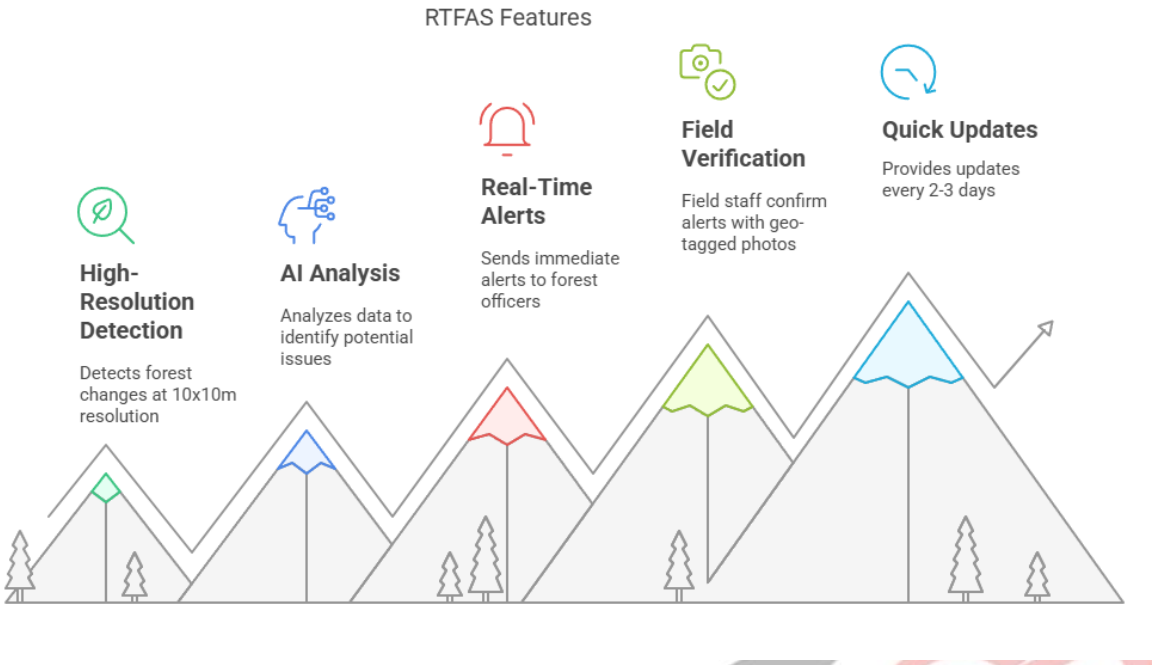
- **India's forest** and **tree cover is 25.17%**, significantly below the **33% target** set by the **National Forest Policy 1988**.

What is the Status of Forests in India?

Click Here to Read: 18th India State of Forest Report 2023

What is an AI-based Real-Time Forest Alert System?

- **About:** RTFAS is a **cloud-based AI system** that integrates **satellite technology, machine learning, and real-time monitoring** to combat **deforestation**.
  - It uses **Google Earth Engine** to analyze **multi-temporal satellite data** and **detect land use changes** through a **custom AI model**.
- **Key Features:**



What is the Role of Technology for Sustainable Forest Management?

- **Forest Carbon Management:** High-resolution satellites like ISRO's **Resourcesat** monitor **forest health and deforestation**, while **hyperspectral imaging** helps assess **carbon stock** and **biodiversity**.
    - **AI algorithms** analyze historical and real-time data to **predict deforestation trends.**
- **Preventing Forest Fires: AI Cameras & Thermal Sensors** detect **smoke and heat** to trigger **early fire alerts**. E.g., **FireSat** is a constellation of satellites **dedicated entirely to detecting and tracking wildfires**.
    - **Drones** provide live feeds to **aid firefighting** and monitor **fire hazards like pine needle buildup**.
- **Combating Encroachment:** Satellite-based systems like **RTFAS** send notifications to forest officers **within 2-3 days** when **unauthorized activities** (logging, farming, construction) are **detected**.
- **Mitigating Human-Wildlife Conflict: AI-Enabled Camera Traps & GPS Tracking** monitor **animal movement**s near village borders, reducing conflicts.
    - E.g., **PoacherCam** is an **advanced camera** equipped with a **specialized human-detection algorithm** that can remotely notify **anti-poaching teams** of **nearby intruders.**
    - **RFID tags** and **geofencing** alert officials when **elephants or tigers stray** into human settlements.
- **Forest Restoration and Afforestation**: **Green bots** can be deployed during the afforestation process to **track tree growth, soil health, and environmental changes**, creating a comprehensive database of **forest health.**
- **Biodiversity Monitoring**: **Acoustic sensors** like **Rainforest Connection** use AI to **recognize bird and frog sounds** and **track endangered species** in the Amazon.
    - **Environmental DNA (eDNA)** from water or soil samples **detects genetic traces of species** like fish and amphibians, helping **monitor invasive or rare aquatic life**.

What is the Need of Sustainable Forest Management?

- **Climate Change Mitigation**: Afforestation acts as a **carbon sink**, **absorbing CO_2 and**

reducing greenhouse gas emissions while promoting environmental sustainability alongside industrial growth.

- **Industrial & Trade Necessity:** The EU's **Carbon Border Adjustment Mechanism (CBAM)**, effective from **2026**, will impose **tariffs on carbon-intensive imports** (steel, cement, aluminium) from India and other countries.
    - Afforestation becomes **vital** for reducing the **carbon intensity of exports**, **helping lower CBAM tariffs** and sustain **trade competitiveness**.
- **Ecosystem Health**: Expanding tree cover enhances **soil health**, prevents **soil erosion**, recharges **groundwater**, retains **water**, and strengthens resilience to **extreme weather events.**
- **Economic and Social Benefits**: It supports industries like **timber**, **fuelwood**, and **agroforestry**, providing additional **income sources** for rural communities.

What are Initiatives Taken by India for Sustainable Forest Management?

- **Government-Led Programs:**
    - **Green India Mission (GIM):** Increased forest cover by **0.56%** between **2017 and 2021.**
    - **National Agroforestry Policy (2014):** Encourages **tree planting on private farmland** to reduce pressure on natural forests.
    - **Trees Outside Forests in India Program:** Encourages **tree planting on non-forest lands** by involving private stakeholders to boost green cover.
    - **Compensatory Afforestation Fund (CAMPA):** Funds reforestation where forests are **diverted for industrial use**.
- **Corporate & Community Efforts:**
    - **CSR-Driven Plantations:** Companies in **automobile, cement, and energy sectors** undertake afforestation to **offset emissions.**
    - **Agroforestry for Livelihoods:** Farmers integrate **timber, fruit, and medicinal plants with crops** for additional income.
- **Carbon Credit Strategies:** Industries invest in afforestation to earn **carbon credits**.

How India Can Improve Sustainable Forest Management?

- **Strengthen Carbon Markets:** Establish a **national carbon credit registry** and regulatory framework under **Article 6 of the Paris Agreement** to fully leverage its **forest stored carbon** in the **global carbon market** and incentivise both **public and private afforestation efforts.**
- **Enhance Industry Participation:** Mandate **carbon-offset plantations** for high-emission industries (steel, cement).
    - Offer **tax benefits** for companies investing in sustainable forestry.
- **Support Rural Communities:** Expand **Joint Forest Management (JFM)** programs and provide **training and market access** for forest-based products.
- **Improve Monitoring & Compliance:** Use satellite technology to monitor **afforestation progress** and enforce **strict penalties** for violating forest conservation laws.

Conclusion

India's integration of **AI** and **satellite technologies** in **forest management** marks a significant step toward **sustainability**. With proactive **policies**, **industry participation**, and **community engagement**, India can strengthen its **forest ecosystems**, **mitigate climate change**, and remain **globally competitive**. Continued **innovation** and **robust implementation** are key to long-term **environmental** and **economic goals.**

Drishti Mains Question:

"Sustainable forest management is essential for balancing ecological preservation with industrial growth." Evaluate.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. At the national level, which ministry is the nodal agency to ensure effective implementation of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006? (2021)

(a) Ministry of Environment, Forest and Climate Change

(b) Ministry of Panchayati Raj

(c) Ministry of Rural Development

(d) Ministry of Tribal Affairs

Ans: (d)

Mains

Q. “The most significant achievement of modern law in India is the constitutionalization of environmental problems by the Supreme Court.” Discuss this statement with the help of relevant case laws. (2022)