Biodiversity as India’s Sustainable Edge

This editorial is based on “India’s biodiversity is a strategic advantage” which was published in Hindustan Times on 04/06/2025. The article highlights India's rich biodiversity as key to achieving self-reliance and economic resilience by 2047, stressing its protection as a national and global responsibility.

For Prelims: Biodiversity conservation, Western Ghats, Sundarbans, Ayurveda, Environment (Protection) Act, 1986, Biological Diversity Act, 2002, Kasturirangan Committee Recommendations,Nationally Determined Contributions (NDCs) under the Paris Agreement, India’s National Gene Bank, Sacred groves, Kunming-Montreal Global Biodiversity Framework , Prosopis juliflora, Great Indian Bustard.

For Mains: Significance of Biodiversity in Shaping India's National Growth and Resilience, Key Emerging Threats to India's Biodiversity.

India's rich biodiversity represents an untapped strategic asset that could serve as a cornerstone for the **nation's journey toward self-reliance and economic resilience by 2047**. India's natural capital offers immunity from trade wars while providing crucial ecosystem services worth billions annually. But, there is also an urgency: with **global forest loss accelerating and species facing extinction, protecting India's biodiversity is both a moral obligation under international commitments and a strategic imperative for long-term prosperity.** By viewing ourselves as trustees rather than shareholders of this ecological legacy, India can transform its **biodiversity from heritage asset to sustainable economic differentiator** in an increasingly resource-scarce world.

What is the Significance of Biodiversity in Shaping India's National Growth and Resilience?

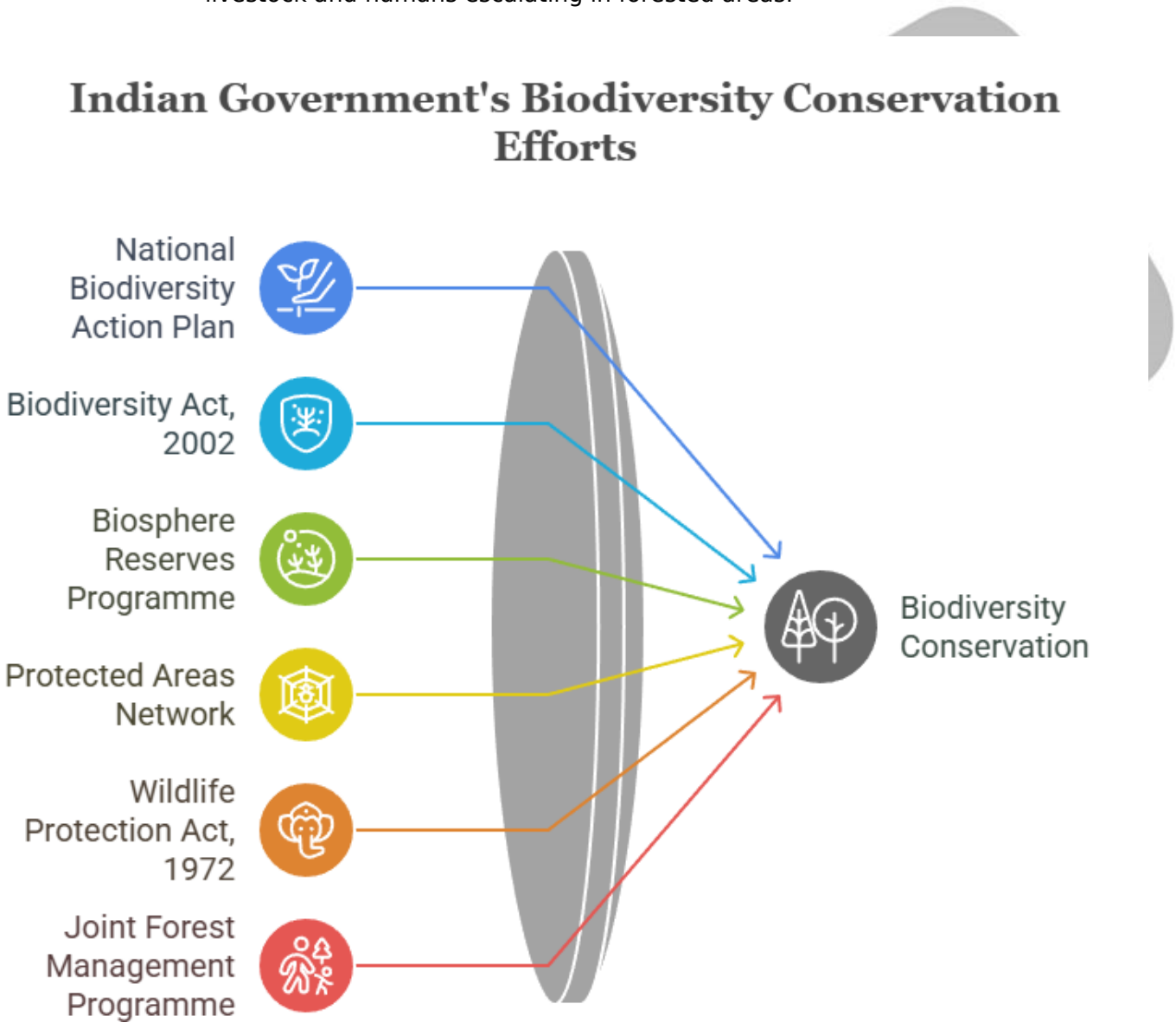
- **Direct Economic Contribution:** Biodiversity is a cornerstone of India’s economy, offering direct economic benefits through sectors like **agriculture, forestry, and fisheries.**
    - A vast pool of biological resources supports livelihoods and industries.
    - The **forestry and logging sectors contribute roughly 1% to India’s GDP**, and over **200 million people depend on forests.**
        - The **Indian fisheries sector not only supports the livelihoods of around 30 million people**, especially in coastal and rural communities, but it also holds immense potential for growth, job creation, and rural development.
- **Climate Change Mitigation and Carbon Sequestration:** Biodiversity plays a critical role in combating climate change by sequestering carbon, thus mitigating environmental risks.
    - India’s forests currently **neutralize nearly 11% of the country’s greenhouse gas emissions**, contributing to the **Nationally Determined Contributions (NDCs) under**

the Paris Agreement. Forests' role in carbon sequestration directly supports climate change goals and national resilience.
        - The **Green India Mission** aims for protecting, restoring, and enhancing India's forest cover and **responding to climate change by undertaking eco-restoration activities.**
- **Healthcare and Medicinal Resources:** Biodiversity is integral to healthcare, providing medicinal resources for indigenous and modern medicine.
    - Over **45,000 plant species, including those with medicinal properties,** form the backbone of India's traditional medicine systems like **Ayurveda**.
    - **India's National Gene Bank holds 0.47 million accessions (plant material stored and used for breeding)**, ensures the preservation of plant genetic resources.
        - This rich biodiversity base supports the discovery of **novel pharmaceutical solutions,** boosting healthcare innovation.
- **Enhancing Agricultural Productivity and Food Security:** Biodiversity enriches agriculture by **enhancing crop resilience and productivity**, vital for India's food security.
    - India is a center for crop diversity, with **over 50,000 rice varieties and 5,000 types of sorghum.**
    - This **genetic diversity ensures crop resilience against climate change and pests,** improving food security.
        - The role of biodiversity in agriculture is pivotal, with India being the **world's second-largest producer of rice,** relying heavily on its agricultural biodiversity.
- **Ecosystem Services and Livelihoods:** Biodiversity directly supports ecosystem services such as **pollination, soil fertility, and water regulation,** essential for human well-being and economic stability.
    - **Wetlands, for instance, support fisheries, water purification, and flood mitigation**, while forests maintain water cycles.
    - **India's 4,991.68 km2 of mangroves protect coastal communities** from storm surges, contributing to resilience.
        - With **250 million people living within 50 km of India's coastline,** these ecosystem services are essential for economic stability.
- **Strengthening Tourism and Conservation Initiatives:** India's rich biodiversity is a cornerstone of its growing eco-tourism sector, contributing to sustainable national development.
    - **Eco-tourism generates income for local communities** and fosters conservation awareness.
    - The **Western Ghats and Sundarbans are prime eco-tourism destinations,** with the Sundarbans hosts more than one lakh local and foreign tourists annually, generating substantial revenue.
        - Such initiatives also drive local conservation, as seen with the **Amur Falcon conservation project in Nagaland,particularly in areas like Pangti and Doyang.**
- **Socio-Cultural and Spiritual Value:** Biodiversity is woven into India's cultural fabric, influencing traditions, rituals, and spiritual practices.
    - **Sacred groves (like Sarna in Bihar, Dev Van in Himachal Pradesh, Devarakadu in Karnataka),** often preserved by local communities, contribute to biodiversity conservation while fostering cultural values.
    - An estimated 1,00,000 to 1,50,000 sacred groves across India help conserve diverse flora and fauna.
        - **Such areas are not only vital for maintaining biodiversity** but also hold cultural significance, supporting community-driven conservation efforts.
- **International Collaboration and Global Responsibility:** India's biodiversity places it at the **heart of international environmental governance,** as seen in its active role in global agreements like the **Convention on Biological Diversity (CBD).**
    - India has set ambitious biodiversity targets, aligned with the global **Kunming-Montreal Global Biodiversity Framework**, aiming to protect **30% of its land, inland water, and marine areas by 2030.**
        - This global responsibility fosters both national and international partnerships, strengthening India's role in global biodiversity conservation efforts.

What are the Key Emerging Threats to India's Biodiversity?

- **Climate Change and Its Impact on Ecosystems:** Climate change is intensifying stress on India's ecosystems, altering rainfall patterns, temperatures, and causing extreme weather events.
    - **Rising temperatures are shifting the natural range of species,** with the Himalayan ecosystem being particularly vulnerable.
    - For example, the **rare dancing frog of the Western Ghats is now at risk due to changing micro-climates**.
        - The IPCC's report warned that Indian biodiversity hotspots, especially the **Western Ghats** regions, **could lose up to 33% biodiversity by 2050 due to climate change.**
- **Invasive Alien Species: Invasive species** are emerging as one of the most pressing threats to India's biodiversity, outcompeting native species for resources and spreading diseases.
    - For instance, the **spread of Prosopis juliflora, an invasive tree species in Rajasthan**, is disrupting native plant communities and reducing grazing land for wildlife.
        - It is estimated that **40% of species of Indian flora are alien, of which 25% are invasive,** leading to reduced agricultural productivity and habitat degradation.
        - Invasive species like the **African apple snail** also threaten freshwater ecosystems.
- **Habitat Fragmentation and Loss:** The rapid expansion of **urbanization, industrialization, and agriculture** is fragmenting India's critical ecosystems, isolating species and impeding their movement.
    - Fragmentation disrupts ecological connectivity, exacerbating species vulnerability to extinction.
    - For instance, the **Brahmaputra floodplains have seen forest loss and fragmentation** in the past due to large-scale tea expansion and agriculture.
- **Pollution and Contaminants:** Pollution, including chemical runoff from agriculture, industrial effluents, and plastic waste, is severely impacting India's biodiversity.
    - **Aquatic life, particularly in the Ganga and Yamuna rivers,** faces rising toxicity levels, affecting species like the **Ganga dolphin.**
    - **Less than one-third of India's urban wastewater and sewage are treated**, leaving over **70% of untreated wastewater flowing into rivers, lakes and land** (Centre for Science and Environment).
        - This pollution disrupts breeding patterns, reduces species populations, and introduces toxins into the food chain.
- **Overexploitation of Natural Resources:** Unsustainable extraction of resources, such as **deforestation for timber, overfishing, and illegal wildlife trade**, continues to threaten India's biodiversity.
    - For example, the **illegal poaching of elephants for ivory and tigers for their pelts** remains a serious issue.
        - Between 2021 and 2023, **poaching claimed the lives of 32 tigers across India**, with Madhya Pradesh's forests bearing the brunt.
        - Additionally, India's 7500-km coastline is threatened by illegal light fishing, **despite a 2017 ban**, impacting both biodiversity and local economies dependent on fisheries.
- **Unsustainable Developmental Projects and Unregulated Infrastructure Expansion:** Infrastructure projects like **dams, highways, and mining operations** are encroaching upon ecologically sensitive areas, causing permanent damage to ecosystems.
    - More than **500,000 acres of wildlife habitat are reportedly lost each year** due to urban expansion and infrastructure development.
    - The proposed **INR 80,000 crore infrastructure project in the Great Nicobar Island threatens** to destroy tropical rainforests that harbor rare species like the **Nicobar scrubfowl and leatherback turtles.**
- **Agricultural Intensification and Land Use Change:** The intensification of agriculture, driven by the need to feed a growing population, is putting immense pressure on India's biodiversity.
    - Practices like **monocropping, excessive use of pesticides, and land conversion for farming** destroy natural habitats.
    - The decline in species such as the **Great Indian Bustard and Lesser Florican,** which rely on grasslands, is linked to agricultural expansion.
- **Lack of Effective Enforcement and Legal Frameworks:** Although India has a strong legal

framework, including the **Wildlife Protection Act,** enforcement remains weak, leading to continued illegal activities.
    - The lack of adequate monitoring and penalties for biodiversity crimes often allow**s illegal logging, mining, and poaching to thrive.**
    - According to the **National Crime Records Bureau, there was a 20% increase in wildlife crimes in 2022 from 2021,** highlighting the inadequacies in law enforcement.
        - This weak governance undermines conservation efforts, leaving many species at risk.
- **Over-tourism and Human-Wildlife Conflict: Over-tourism in India's wildlife sanctuaries** and national parks is leading to environmental degradation and increased human-wildlife conflict.
    - The influx of tourists into tiger reserves like **Ranthambhore** has caused habitat disturbance, affecting animal behavior and breeding.
        - **Human-wildlife conflicts have also risen sharply (Uttarakhand alone reported 700 cases in the year 2022)**, with incidents of tigers attacking livestock and humans escalating in forested areas.



How can India Harness Biodiversity as an Economic Differentiator while Ensuring its Sustainable Conservation?

- **Green Economy Integration into National Policy:** India can embed biodiversity into its economic framework by **integrating natural capital accounting into national and state GDP**

calculations.
    - This would assign a **value to ecosystem services**, recognizing their contributions to sectors like **agriculture, forestry, and tourism.**
    - By incorporating biodiversity into economic models, the government can incentivize industries to invest in conservation while promoting sustainability as an economic asset.
        - Such integration **would create a more inclusive green economy**, where biodiversity acts as a key differentiator in the global marketplace.
- **Promoting Nature-based Solutions for Infrastructure Development:** Instead of relying on conventional infrastructure projects that harm ecosystems, India can adopt **nature-based solutions that harness biodiversity for resilient development.**
    - This could involve creating green infrastructure such as **urban forests, wetland restoration for flood management, and mangrove ecosystems** for coastal protection building upon the **recommendations of the Kasturirangan Committee.**
    - These projects can provide multiple co-benefits such as **carbon sequestration, water purification, and erosion control,** all while enhancing biodiversity.
- **Biodiversity-Driven Eco-Tourism Models:** India can develop and promote **biodiversity-driven eco-tourism** that emphasizes the conservation of lesser-known but ecologically critical species and habitats.
    - This **involves shifting the focus from traditional wildlife tourism centered on flagship species** to including biodiversity hotspots like wetlands, grasslands, and coastal ecosystems.
    - Such a model would generate income through sustainable tourism activities, reduce the pressure on high-profile areas, and encourage conservation across diverse ecosystems.
        - It would also **create decentralized employment opportunities,** directly linking rural development to biodiversity conservation.
- **Incentivizing Biodiversity-Friendly Agricultural Practices:** India can encourage **farmers to adopt biodiversity-friendly agricultural practices** by providing incentives such as **subsidies for organic farming, payment for ecosystem services, and access to biodiversity-certified markets.**
    - By promoting **agroecology**, sustainable land-use practices, and the conservation of traditional crop varieties, India can enhance food security while reducing biodiversity loss.
    - These practices can be incorporated into government schemes like the **National Mission on Sustainable Agriculture,** aligning food production with biodiversity conservation for long-term agricultural productivity.
- **Strengthening the Bio-based Economy through Biotechnology and Pharmaceuticals:** India can leverage its rich biodiversity to boost its bio-based economy, particularly in biotechnology and pharmaceuticals, by **promoting sustainable bioprospecting.**
    - Focusing on the conservation of genetic resources for medicinal plants, marine organisms, and agricultural biodiversity can **position India as a leader in sustainable biomanufacturing.**
    - The **establishment of biotechnological research hubs,** integrated with biodiversity conservation efforts, would enhance India’s position in the global biopharmaceutical market.
- **Enhancing Legal Frameworks for Biodiversity-Based Intellectual Property:** India can **reform the current legal framework to protect its biodiversity-related intellectual property,** particularly traditional knowledge systems.
    - By aligning the protection of genetic resources and traditional knowledge with the global **Convention on Biological Diversity’s Access and Benefit-Sharing (ABS)** provisions, India can generate revenue through the licensing of genetic resources for research and development.
    - This framework would not only protect indigenous communities' rights but also create a new revenue stream from the **global biotrade sector,** enhancing the country’s economic position on the global stage.
- **Integrating Biodiversity into Corporate Social Responsibility (CSR):** India can encourage the corporate sector to invest in biodiversity conservation through CSR initiatives, by incentivizing companies to **integrate biodiversity into their environmental, social, and governance (ESG) strategies.**
    - Corporates can be provided tax benefits or recognition for investing in biodiversity conservation projects, such as habitat restoration or the promotion of sustainable supply

chains**.**

- **Implementing a Circular Economy Based on Biodiversity:** India can adopt a circular economy approach that not only minimizes waste but also fosters biodiversity conservation.
    - By focusing on **sustainable production and consumption patterns,** reducing resource extraction, and recycling biological materials**, India can reduce its ecological footprint.**
    - Such an economy would prioritize products and processes that regenerate ecosystems, promoting sustainable industries like **organic textiles, biodegradable packaging, and eco-friendly construction materials,** all of which would depend on healthy, functioning biodiversity.

Conclusion:

India's biodiversity represents both a **moral responsibility and a strategic opportunity for economic growth and resilience.** By aligning its policies with international frameworks like the **Convention on Biological Diversity (CBD)**, India can transform its natural assets into sustainable economic drivers. A holistic approach that integrates biodiversity into national development, eco-tourism, and agriculture will ensure long-term prosperity.

Drishti Mains Question:

Biodiversity is not just a natural heritage but an economic asset for sustainable development. Examine the role of biodiversity in India’s economic growth and resilience, while highlighting the emerging threats to its conservation.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q1. Which of the following can be threats to the biodiversity of a geographical area? (2012)

1. Global warming
2. Fragmentation of habitat
3. Invasion of alien species
4. Promotion of vegetarianism

Select the correct answer using the codes given below:

(a) 1, 2 and 3 only

(b) 2 and 3 only

(c) 1 and 4 only

(d) 1, 2, 3 and 4

Ans: (a)

Q2. Biodiversity forms the basis for human existence in the following ways: (2011)

1. Soil formation
2. Prevention of soil erosion
3. Recycling of waste
4. Pollination of crops

Select the correct answer using the codes given below:

(a) 1, 2 and 3 only

(b) 2, 3 and 4 only

(c) 1 and 4 only

(d) 1, 2, 3 and 4

Ans: (d)

Mains

Q. How does biodiversity vary in India? How is the Biological Diversity Act,2002 helpful in the conservation of flora and fauna? (2018)