

Biodiversity and Environment - UPSC
(17 December, 2021)

Biodiversity Explained

1. **E O Wilson** coined the term. Both wild and domesticated flora and fauna. Biodiversity can be studied at the **genetic, species & ecosystem diversity levels**.

2. **How to measure Biodiversity?**
 1. **Alpha Diversity** (diversity within a particular ecosystem) i.e. **species richness**.
 2. **Beta diversity** (comparison of diversity between ecosystems) and
 3. **Gamma diversity** (a measure of overall diversity for different ecosystems).

3. **Genetic Diversity is considered during Conservation-**
 1. It provides natural resistance/ strength against CC or vulnerability.
 2. **The mobility of animals describes Genetic diversity.** Ex. African & Asiatic Lion.
 3. Ex **Cheetah extinct** because of genetic diversity and desertification. A similar threat to **Gir Lion (Canine Distemper Virus)**.
 4. India has **4 Biodiversity Rich areas, 2 Biological Hotspots, 10 Biogeographical regions/ zones.**



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5. 4 Biodiversity Rich Areas

1. **Western Ghats** = Endemism because of monsoon, rainforest & geographic isolation.
2. **Andaman & Nicobar** = **transition zone**, isolated location, Oceanic influence & Rainforest.
3. **Eastern Himalayas** = High rainfall, **subtropical to temperate conditions**, altitude, **evergreen forests**.
4. **Western Himalayas** = Highest altitude. **Alpine. Conifer**. Geographic isolation.

6. 2 Biodiversity Hotspots in India out of 34 BH in World

1. **2 strict criteria** to qualify as a Biological Hotspot
 1. It must contain **at least 1500 species of vascular plants (>0.5% of the World's total) as endemics**.
 2. It has to **have lost at least 70% of its original habitat**.
2. India has 2 hotspots = **Western Ghats and Eastern Himalayas** because of **High endemism**.

7. 10 Biogeographical regions/ zones = Many ecosystems coexist in larger unit called Biogeographical regions. Classified by W D Rodgers -& H S Panwar. The deccan peninsula is the largest followed by Semi arid area and the lowest is of Coasts.

8. India is also 1 of the 17 Mega biodiverse countries of the World.

9. India has 2 Biogeographic realms -

1. **Oriental or Indo Malayan** (Indian subcontinent and Southern Asia) and
2. **Palaearctic (Himalayan)**.

10. India has 5 Biomes:

1. Tropical **Humid Forests**
2. Tropical **Dry or Deciduous Forests** (Monsoon).
3. **Warm Deserts** and semi-deserts.
4. **Coniferous** forests and
5. **Alpine meadows**.

11. Why biodiversity is rich in Tropics?

1. Over geological times the **tropics have had a more stable climate than temperate zones**.

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2. **Tropical communities are older than temperate ones** and hence, there has been **more time for them to evolve**. This has allowed them a **greater degree of specialization and local adaptation** to occur.
3. **Warm temperatures and high humidity in most tropical areas**. This does not allow any single species to dominate.
4. Among plants, the **rate of outcrossing appears to be higher in the tropics**, which lead to higher levels of genetic variability.
5. Tropical areas receive **more solar Energy** and hence are productive.
6. **Frequent glaciations in the past**, tropical latitudes have remained **relatively undisturbed** for millions of years.

Conservation Programmes

UN CBD (Convention on Conservation of Biological Diversity), 1992:

1. Biodiversity knows no political boundaries and hence its conservation is the responsibility of all.
2. It was **established in Rio Summit** and **entered into force in 1993**. **1st comprehensive global agreement with respect to all aspects of Biodiversity**. 192 countries except the USA has ratified. **USA has not ratified UN CBD awa Kyoto Protocol**.
3. It has **3 main goals**:
 1. Conservation of Biodiversity
 2. **Sustainable use** of its components
 3. **Fair & Equitable sharing benefits** arising from genetic resources.
4. **CBD = BD Act, 2002 and NBA (Chennai)**.
5. **Biopollution = Appraisal Committee (GEAC) & Cartagena Protocol**.
6. **Sharm El- Sheikh (Egypt) Declaration (COP 14 of CBD)**
 1. On Investing in Biodiversity for People & Planet.
 2. **New Deal for Nature**: For **post-2020 global biodiversity framework** to achieve **2050 Vision** for Biodiversity.
 3. **International Alliance of Nature and Culture**: to focus on Biological & cultural diversity in Collaboration with UNESCO & local people.
 4. It **wanted** UNGA to designate **2021 - 2030 as the UN Decade of Ecosystem Restoration**.

International Conventions on Biodiversity

1. Cartagena Protocol on Biosafety, LMO and GMO 2000

1. Because of biotech advancement & **Genetic Engineering**, the scientific introduction of new genes. But we don't know impact = **Biopollution**

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(irreversible). Hence Cartagena Protocol is for Biosafety, GMO & LMO.
To ensure safe transfer, safe handling & safe use of LMO.

2. It addresses technology development, benefit-sharing and biosafety issues.
3. **Legally binding. India is a party.**

2. Nagoya Protocol on ABS Access and Benefit Sharing, 2010

1. It is for Access (to Genetic resources) and (Fair and Equitable) Benefit-sharing.
2. It applies to achieve 1 of the 3 objectives of CBD i.e. Fair and Equitable Sharing of benefits.
3. It **applies to genetic resources covered by CBD and also covers Traditional Knowledge** associated with it.
4. **Strategic Plan (2011 - 2020) and Aichi declaration is a part of the Nagoya Protocol.**
5. **Aichi declaration:** was adopted in Nagoya conference. It is a **short-term plan** that provides a set of **20 ambitious yet achievable targets aka Aichi Targets.**
6. **Wealth Accounting and the Valuation of Ecosystem Services (WAVES) launched in Nagoya meet, 2010**
 1. It is a **World Bank-led global partnership** that aims to promote **sustainable development** by ensuring that natural resources are mainstreamed in development planning and national economic accounts.

3. International Treaty on Plant Genetic Resources for Food and Agri (ITPGRFA) aka Seed Treaty, 2001

1. **Under FAO. 2019 Summit = Rome, Italy.** It is a biennial session. **India is a signatory.** It is in harmony with CBD.
2. It aims at **guaranteeing food security thru conservation, exchange & sustainable use of the World's PGRFA and fair and equitable sharing arising from its use.**

3. 3 Objectives

1. **Farmers Contribution:** To recognise their contribution to the diversity of crops.
2. **ABS:** Establish a **global system** to provide farmers, plant breeders & scientists with **access to plant genetic material.**
3. **Sustainability:** conserve & sustainably use plant genetic resources for food & Agriculture + Fair & equitable sharing of benefits in line with CBD.

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4. Act says Farmers can save, use, sow, resow, access, share it sell his farm produce including seed under PPVFRA except for Brand Name.
5. PPVFRA is compliant with Art 9 of the Seed Treaty. It was awarded the plant genome saviour awards by the protection of PPVFRA.
4. Hyderabad Summit = Talked about Marine Protected Areas. Antarctica. No fishing, no development & MP zones.
5. India recently submitted its 6th National Report to CBD. It is among the 1st 5 in the World, 1st in Asia and 1st among Biodiversity rich megadiverse countries to submit it. The submission of national reports is a **mandatory obligation on parties to international treaties, including CBD.**

GEAC (Genetic Engineering Appraisal Committee) under EPA, 1986

1. Under EPA under 'Rules of Manuf, Use, EXIM & Storage of Hazardous micro org/ Genetically Engg org or Cells, 1989'. Aim of the rules is to protect Environment, Nature & Health with respect to the **application of Gene technology & microorganisms.**
2. 1989 rules empower 5 authorities to handle the rules = Institutional Biosafety Committees (IBSC), Review Committee of Genetic Manipulation (RCGM), **GEAC**, State Biotechnology Coordination Committee (SBCC) and Dist Level Committee (DLC).
3. Under 1989 rules which ensure that **R&D of products from LMO are conducted safely & scientifically.**
4. It mandates large scale use of **GMOs** in research, Environmental release of **GMO** & updates it on the website.

Biodiversity Act (BDA), 2002

1. To protect India's rich biodiversity & local growers, To check biopiracy and associated knowledge against their use by foreign individuals or organizations without sharing Benefits.
2. It has a 3 Tier structure:
 1. **NBA: National Biodiversity Authority** established in 2003 in Chennai
 1. It is an **autonomous, statutory, regulatory & corporate body** established under **Section 8 of BDA** to **monitor, manage databases, coordinate with SBBs** and **consult**

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BMCs with respect to the use of biological resources.

2. It has the **powers of a civil court.**
3. **Objectives** = Conservation of Biodiversity, Sustainable use of biological resources, Fair & Equitable sharing of benefits out of the use of biological resources (part of **Aichi declaration / Nagoya protocol = ABS**).
4. **All foreign individuals/ organizations require prior approval of NBA for obtaining biological resources + associated knowledge. Even Indian individuals/ organizations require approval for transferring the results of research.**
5. **Before applying for IPR in or outside India for an invention based on research on biological resources obtained from India, NBA approval is required.**
6. The **monetary benefits, fees, royalties** through NBA approvals will be **deposited in the National Biodiversity Fund** which will be used for conservation & development of areas of research (in **consultation with local self govt**).

7. Working areas

1. Regulating access to Biological resources + CBD + sustainable use.
 2. **Respect & protect the knowledge of local communities.**
 3. Secure **benefit sharing with locals** as conservers of biological resources + holder of knowledge.
 4. **Declares Biodiv Heritage sites (1st site in KN - Nalehar, Devanhalli for Tamarind).**
 5. **Protect + rehabilitation of Threatened species.**
 6. Involve institutions & state govt in implementing BD Act. Hence **constitution of Committees.**
2. **SBB (State Biodiversity Boards):** Consult BMC with respect to the use of biological resources.
 3. **BMC (Biodiversity Management Committees):** at the Local level
 1. Promote conservation, sustainable use & **documentation** of Biodiversity.
 2. **Maintains registers where locals update the inventory + record local flora & fauna.** Guided by Section 37.
 3. **Collaborative research projects** & exchange of knowledge & resources are exempted. **But Indian Citizens/ organizations/ local people (Vaid / Hakim) have free access to bio res.**
 4. **Notification of National Heritage Sites by States in consultation with Local self govt.**
 5. **Biosphere reserves under UNESCO MAB, conserve BD from genetic to species to Ecosystem level** including Cultural biodiversity. Ex Mankidia in Simlipal.

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6. UNEP - GEF and MoEF Project

1. On **strengthening and implementation of Biodiversity Act** and rules with a focus on **ABS provisions**.
2. It is **implemented by NBA in 5 states - AP, Gujarat, West Bengal, Himachal Pradesh and Sikkim**.
3. It is **funded by the Global Environment Facility and Govt of India**.

Botanical Survey of India (HQ - Kolkata)

1. It is the **apex research organization** under MoEF for **floristic studies on wild plant resources**. It also conducts **surveys**.
2. It explores plant resources, studies fragile ecosystems & Protected Areas, identifies species with ecological diversity, **inventory of RET plant species** (Rare, Endemic & Threatened).
3. Evolve conservation strategies, improve and maintain endemic plants, threatened plants, wild ornamental plants, Botanical gardens & orchids.
4. **Documents traditional knowledge of tribals & people; National database** of herbs, life collection, botanical painting.

Zoological Survey of India (HQ - Kolkata)

1. Studies **fauna** of States, conservation areas, important ecosystem, the status of endangered species, ecological studies & **EIA**.
2. **ZSI with the help of ENVIS is working with CITES** for faunal conservation & prevention of hunting & poaching.
3. **Primary objectives:**
 1. **Survey, exploration, inventorying and research** of fauna in India.
 2. **Preparation of Red data book**, the fauna of India and States.
4. **Secondary objectives: GIS, Remote sensing studies** on animal diversity, **chromosomal mapping and DNA Barcoding** and even **Antarctica expedition**.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

1. IPBES is an **independent intergovernmental body, established in 2012**.
2. The **objective** of IPBES is to **strengthen the science-policy interface for biodiversity and ecosystem services** for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development.
3. The work of IPBES can be broadly grouped into **4 complementary areas:**
 1. **Assessments: on specific themes** (e.g. "Pollinators, Pollination and

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- Food Production”); **methodological issues** (e.g. “Scenarios and Modelling); and at **both the regional and global levels** (e.g. “Global Assessment of Biodiversity and Ecosystem Services”).
- 2. Policy Support, Building Capacity & Knowledge.**
 - 4. UN report of IPBES says Pollinators (bees, butterflies, insects) are on the decline towards extinction.** Why? Changing nature of Agri, Pesticide use, Habitat loss, disease, parasites, pathogens, Global warming, vegetables and cash crops.
 - 5. Global Coalition of the Willing on Pollinators:** based on the **IPBES Assessment on Pollinators.**
 - Thus at **COP-CBD held in Mexico in 2016, the Netherlands launched** this Coalition. **Members:** The coalition now has 28 signatories including 17 European countries, 5 from Latin America and the Caribbean and 4 from Africa. **Not India.**
 - Nigeria becomes the 4th African nation to join it** after Ethiopia, Burundi and then Morocco.
 - 3. What is the importance of pollinators?**
 - About 16.5 % of vertebrate pollinators are threatened with global extinction, says IUCN.
 - 75 % of food crops in the world and nearly 90 % of wild flowering plants depend on animal pollination.
 - Pollinator-dependent species include several fruits, vegetables, seeds, nuts and oil crops, which are major sources of micronutrients, vitamins and minerals to humans.
 - 6. The 1st ever comprehensive Global Ecosystem Assessment Report on Biodiversity and Ecosystem Services by IPBES:** that primarily analysed the impact of economic development on nature and ecosystems.

The Economy of Ecosystem and Biodiversity (TEEB)

- It focuses **attention on the economic benefits of biodiversity** including the **growing cost of biodiversity loss and ecosystem degradation.**
- The TEEB study was launched by **Germany and EU Commission in response to G8 + 5 MoEF** in Potsdam, Germany.
- The **2nd phase of the TEEB study is hosted by UNEP.** It was led by **Pavan Sukhdev.**
- Estimates establish the cost of biodiversity and ecosystem damage expected to cost 18% of Global Economic Outlook by 2050.

India's first-ever Payment for Ecosystem Services (PES) agreement

- The PES Agreement involves **payments to the managers of land or other**

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natural resources in exchange for the provision of specified ecosystem services more than what would otherwise be provided in the absence of payment. The novelty of PES arises from its focus on the 'beneficiary pays principle', as opposed to the 'polluter pays principle'.

- Formalised in October 2010, it is a **rural-urban engagement model** for the sustainable supply of water and protection of the catchment area.
- Stakeholders enter into PES agreements on a **voluntary basis**.
- The first-ever PES agreement was signed between the Village Forest Development Society (VFDS) and the **Palampur Municipal Council (PMC), HP**.

Prelims Pointers on Biodiversity

1. **India Biodiversity Awards are given by MoEF, NBA and UNDP: In 4 categories:**

1. Conservation of threatened species;
2. Sustainable use of biological resources,
3. Successful models for access and benefit-sharing and
4. Biodiversity management committee.

2. **Biodiversity Finance Initiative (BIOFIN)**

1. It is a **new global partnership seeking to increase investment in the management of ecosystems and biodiversity**.
2. **BIOFIN is managed by UNDP Ecosystems and Biodiversity Programme**, in partnership with the **EU, Germany and Switzerland**. **GEF is a partner financing** parallel in-country projects.
3. **Kudremukh NP** is located in the Western Ghats and is part of the **World's 38 hottest hotspots of biodiversity**. It is named after Kudremukh Mountain in Karnataka.
4. The **1st International Agrobiodiversity Congress (IAC) held in New Delhi** adopted **New Delhi Declaration on Agrobiodiversity** to conserve and use agrobiodiversity.
5. **Productivity of Estuaries > Swamp, Marshes, Wetlands > Coral Reefs > EQ & Trop rainforests > Savannah.**