



Biodiversity

- Biodiversity at global, National and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity.
- Threats to biodiversity: habitat loss, Endangered and endemic species of India
- Conservation of biodiversity.



Biodiversity

Currently about 1.8 million species have been identified around the world.

The estimated number of species of plants and animals on earth vary from 5 to 50 million.

The biodiversity of the earth is can be described as different type of ecosystems, e.g. the tropical rainforests, tall grass prairies, savannas, desert, tundra etc.

Tropical rain forests have highest biodiversity which contain about 50 to 80% of total species in the world.

Temperate forest have much less diversity.



Biodiversity at Global Level

- Out of 1.8 million species which have been identified so far, there are about 120000 species of animals and 400000 plant species including micro-organisms. There are about 34 hot spots of biodiversity at the global level.
- Twelve megadiversity nations which are highly rich in biodiversity.
- These include Brazil, Columbia, Ecuador, China, Mexico, Australia, South Africa, Indonesia, Venezuela, Peru, India and Malaysia.
- About 70 per cent biodiversity of the world is present in these megadiversity centres.



Biodiversity at National level

- India is greatly rich in biodiversity.
- A variety of climatic and altitudinal conditions present in India.
- About 40 per cent land is under cultivation in India.
- There are 96 national parks, 572 wildlife sanctuaries, 14 biosphere reserves and 4 hot spots. About 81000 species of animals and 50000 species of plant and micro-organisms are found in India.



Biodiversity at Local level

- It includes various species found in a small region.
- It has three basic components like compositional aspects, structural aspects and functional aspects.
- Compositional aspects include the genetic constitution of a population in a particular area.
- Structural aspects govern the physical features and vegetation found in a habitat.
- Functional aspects refer to hydrological, geographical, ecological, climatic and evolutionary aspects that help maintain biodiversity.

Global species diversity

Group	No. of Described Species
Bacteria and blue-green algae	4,760
Fungi	46,983
Algae	26,900
Bryophytes (Mosses and Liverworts)	17,000 (WCMC, 1988)
Gymnosperms (Conifers)	750 (Reven et al., 1986)
Angiosperms (Flowering plants)	250,000 (Reven et al., 1986)
Protozoans	30,800
Sponges	5,000
Corals and Jellyfish	9,000
Roundworms and earthworms	24,000
Crustaceans	38,000
Insects	751,000
other arthropods and minor Invertebrates	132,461
Molluscs	50,000
Starfish	6,100
Fishes (Teleosts)	19,056
Amphibians	4,184
Reptiles	6,300
Birds	9,198 (Clements, 1981)
Mammals	4,170 (Honacki et al., 1982)
Total: 1,435,662 SPECIES	

From 'Conserving the World's Biological Diversity WRI, IUCN, CI, WWF-US, The World Bank.'



India as a mega-diversity nation

- India has a rich biodiversity, covering a wide variety of habitats from tropical rainforests to high-altitude vegetation and from temperate forests to coastal wetlands.
- India contains about 7 to 8% of the world's biodiversity on 2% of the Earth's surface.
- India is one of the 12 megadiversity countries in the world.
- India has regions of almost all kinds of climatic conditions from tropical to alpine and from desert to humid.



India as a mega-diversity nation

India is home to 33% of the plants and animals found in the world and is one among the 12 megadiverse countries of the world.

There are 33 botanical gardens, 89 national parks, 275 zoos, 504 sanctuaries and 18 biosphere reserves in India.

India's 60% bio-diversity can be found in the Western Ghats, which is one of the hotspots of diversity in India.



India as a mega-diversity nation

India is a signatory to the international conventions like Convention of International Trade on Endangered Species (CITES) and Convention of Migratory Species (CMS) which aim towards the conservation of biodiversity.

6 world heritage natural sites are found in India.

India has three major ecosystems, namely the tropical humid forests, the tropical dry/deciduous forests, and the warm desert/semi-deserts.



Hot-spots of biodiversity

The areas on earth which exhibit high species richness as well as high species endemism are termed as hot-spots of biodiversity. These hotspots cover only about 2.3% of the world's land area. Over 50% of the world's plant species and 42% of all terrestrial vertebrate species are endemic to the 35 biodiversity hotspots.

It must support 0.5% of the global plant species.

It must have lost more than 70% of its original habitat.

Out of 35 hot spots of biodiversity on a global level, India has these four hot-spots:

Himalaya

Indo-Burma

Sundalands

Western Ghats



Hot-spots of biodiversity in India

Himalaya: Includes the entire Indian Himalayan region (and also the regions in Pakistan, Tibet, Nepal, Bhutan, China and Myanmar)

Indo-Burma: Includes entire North-eastern India, except Assam and Andaman group of Islands (and Myanmar, Thailand, Vietnam, Laos, Cambodia and southern China)

Sundalands: Includes Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei, Philippines)

Western Ghats and Sri Lanka: Includes entire Western Ghats (and also Sri Lanka)



Hot-spots of biodiversity

- **Eastern Himalayas:** Includes the Valleys in Sikkim which are extremely rich in endemic plant species. In an area of 7300 Km² of Sikkim about 4300 plant species are found of which 60% are endemic.
- **Western Ghats:** It extends along a 17,000 km² of forests in Maharashtra, Karnataka, Tamil Nadu and Kerala and has 40% of the total endemic plant species
- 62% amphibians and 50% lizards are endemic to Western Ghats.

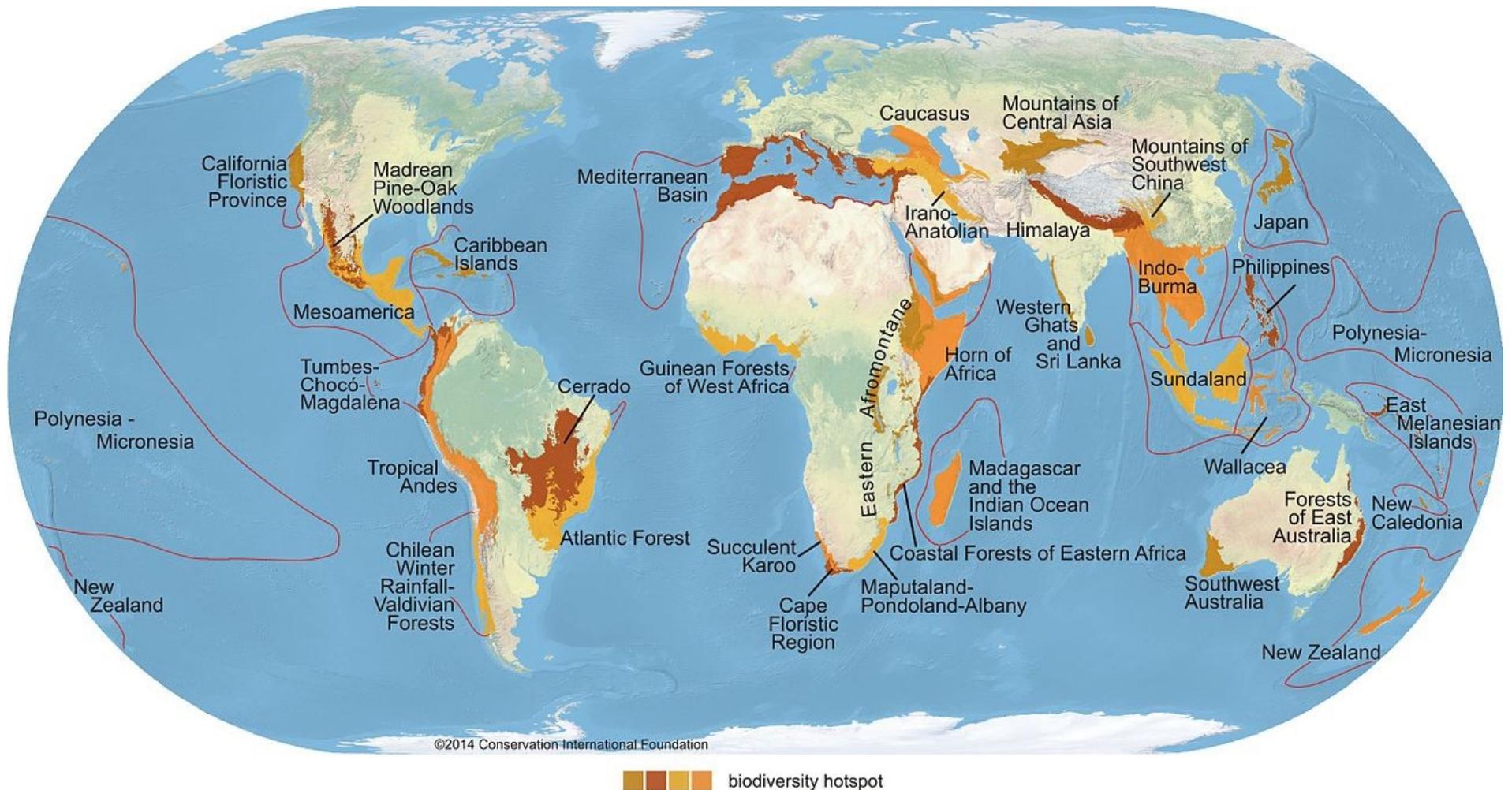


Hot-spots of biodiversity

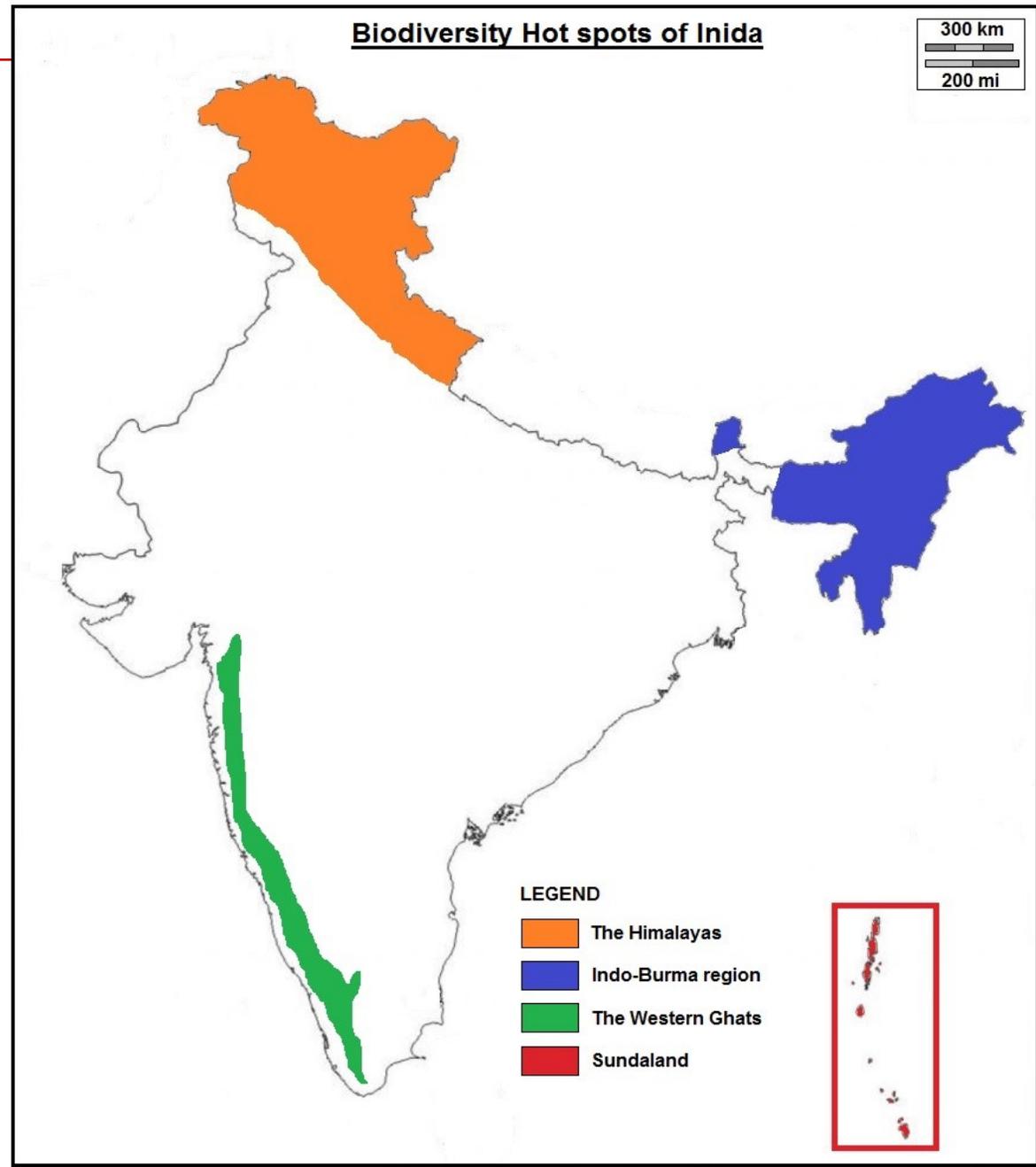
- About 40% of terrestrial plants and 25% of vertebrate species are endemic and found in these hotspots.
- After the tropical rain forests, the second highest number of endemic plant species are found in the Mediterranean.
- The hot spots are in Western Amazon, Madagascar, North and East Borneo, North Eastern Australia, West Africa and Brazilian Atlantic forests. These are the areas of high diversity, endemism and are also threatened by human activities. More than 1 billion people live in these areas.



Hotspots of Biodiversity

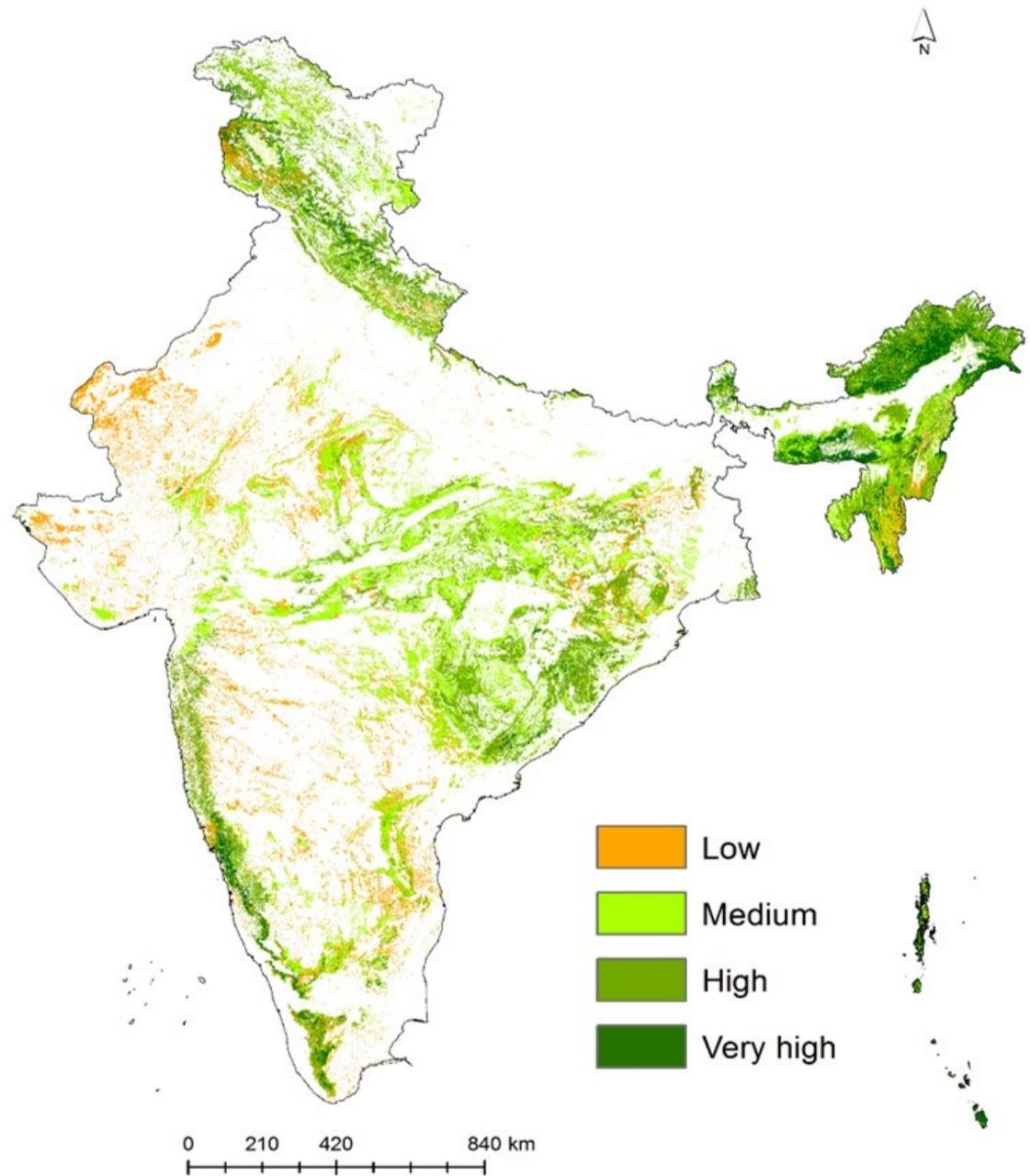


Conservation International (conservation.org) defines 35 biodiversity hotspots — extraordinary places that harbor vast numbers of plant and animal species found nowhere else. All are heavily threatened by habitat loss and degradation, making their conservation crucial to protecting nature for the benefit of all life on Earth.





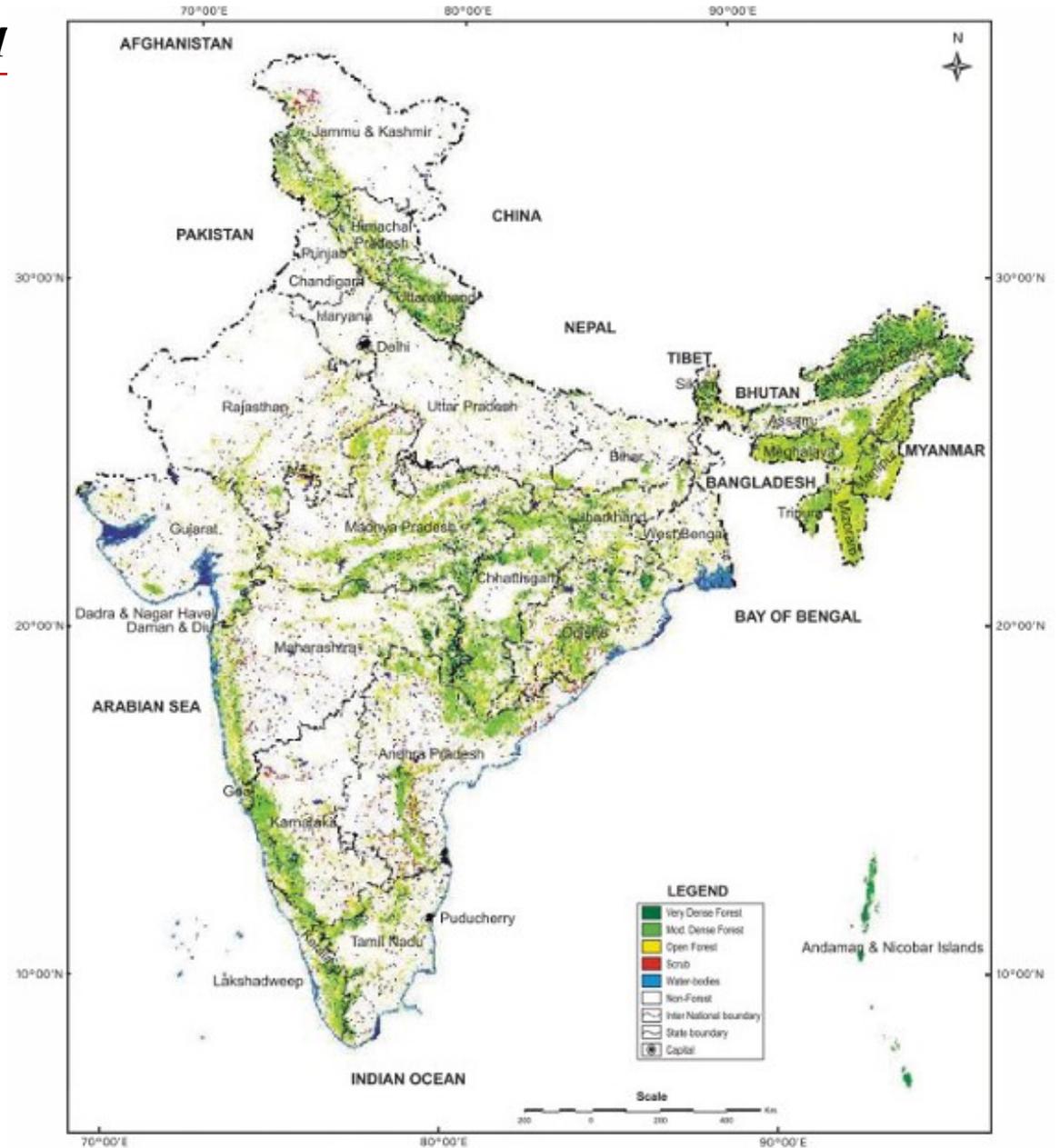
Biodiversity Map of India





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Forest Cover in India



Forest Cover Map of India



Threats to biodiversity

- Human activities in a natural ecosystem tends to reduce its biodiversity. Pollution generated due to increasing human population and industrialization destroys the environment and leads to reduction in biodiversity. The changes induced by human activities in the ecosystem threatens the normal ecological cycle. Causes for loss of biodiversity are:
 - Habitat loss
 - Poaching of wildlife and
 - Man-wildlife conflicts



Threats to biodiversity

Habitat loss

- The loss of populations of interbreeding organisms is caused by habitat loss. Factors influencing habitat loss are:
- Deforestation: Loss of habitat is mainly caused by deforestation activities. Forests and grasslands are cleared for conversion into agriculture lands or settlement areas or developmental projects. Forests and grasslands are natural home to thousands of species which disintegrate due to loss of their natural habitat.



Threats to biodiversity

- Destruction of wetlands: Wetlands, estuaries and mangroves are destroyed due to farming, filling and pollution that cause loss of biodiversity
- Habitat fragmentation: The division of habitat into small and scattered patches is called habitat fragmentation. This leads to the loss of most wildlife
- Raw material: Wild plants are used as raw materials, leading to extinction of many wild plant species.
- Production of drugs: Drug companies utilize wild plants for the production of drugs leading to extinction of several medicinal plant species.



Threats to biodiversity

Illegal trade: Illegal trade of wildlife reduces biodiversity leading to habitat loss

Developmental activities: Construction of dams in forest areas coupled with the discharge of industrial effluents kills birds and other aquatic life.

Poaching of wildlife:

- Poaching means killing of animals or commercial hunting. It contributes to loss of biodiversity. Poaching can be of two types :
- Subsistence poaching: This refers to killing animals for food.
- Commercial poaching: This refers to hunting animals in order to sell their products.



Threats to biodiversity

Factors influencing poaching

- Human population: Increased human population in India has led to pressure on forest resources, leading to degradation of wildlife habitats
- Commercial activities: There is a continuous smuggling of wildlife products because trading of such products is highly profitable. Poachers continue to hunt endangered animals and smuggle their fur, skin and tusks to other countries.
- Wildlife products include furs, horns, tusks, live specimens and herbal products. Richest source of biodiversity lies in developing nations in Asia, Africa and Latin America. Advanced countries like Europe, North America, Japan, Taiwan, Hong Kong are the major importers of wildlife products.



Man-wildlife conflicts

- Man-wildlife conflicts arise, when wildlife starts causing damage and danger to man. Under such conditions it is very difficult for the forest department officials to convince the affected villagers for wildlife conservation.
- People get killed by wild animals like elephants, or tigers. In retaliation, the villagers kill or injure the animals.
- In Mysore, elephants were killed by farmers in retaliation to the damage done by elephants to their cotton and sugarcane fields.
- Villagers sometimes hide explosives in their fields to ward-off animals which explode when the animals enter the fields



Factors influencing Man-wildlife conflicts

- Shrinking forest cover compels wildlife to move outside the forest
- Human encroachment into forest area induces a man-wildlife conflict
- Injured animals have a tendency to attack man
- Wild animals venture out of the forest area in search of food
- Villagers set-up electric wiring around their fields. This injures animals (Elephants) who suffer pain and get violent.
- Cash compensation paid by the government is not enough.
- Garbage near human settlements or food crops attracts wild animals.



Endangered and Endemic species of India

Endangered Species Of India

- A plant, animal or microorganism that is in immediate risk of biological extinction is called endangered species or threatened species.
- In India, 450 plant species have been identified as endangered species. 100 mammals and 150 birds are estimated to be endangered.

India's biodiversity is threatened primarily due to:

- Habitat destruction
- Degradation and
- Over exploitation of resources



Endangered species of India

- The International Union for Conservation of Nature and Natural Resources (IUCN) publishes the Red Data Book which include list of endangered species of plants and animals.
- In India, nearly 450 plant species have been identified in the category of endangered, threatened or rare. Existence of about 150 mammals and 150 species of birds is estimated to be Threatened while an unknown number of species of insects are endangered.



Endangered species of India

The RED-data book contains a list of endangered species of plants and animals. It contains a list of species of that are endangered but might become extinct in the near future if not protected.

Some of the rarest animals found in India are:

- Asiatic cheetah
- Asiatic Lion
- Asiatic Wild Ass
- Bengal Fox
- Gaur
- Indian Elephant
- Indian Rhinoceros
- Marbled Cat
- Markhor



Endangered species of India

- Endangered or threatened species is one whose number has been reduced to a critical number. Unless it is protected and conserved, it is in immediate danger of extinction.
- Vulnerable species is one whose population is facing continuous decline due to habitat destruction or over exploitation. However, it is still abundant.
- Rare species is localized within a restricted area or is thinly scattered over an extensive area. Such species are not endangered or vulnerable.



Endangered species in the world

- West Virginia Spring Salamander (U.S.A)
- Giant Panda (China)
- Golden Lion Tamarin (Brazil)
- Siberian Tiger (Siberia)
- Mountain Gorilla (Africa)
- Pine Barrens Tree Frog (Male)
- Arabian Oryx (Middle East)
- African Elephant (Africa)



Endangered species in the world

- Other important endangered species are:
- Tortoise, Green sea Turtle , Gharial, Python (Reptiles)
- Peacock, Siberian White Crane, Pelican, Indian Bustard (Birds)
- Hoolock gibbon, Lion-tailed Macaque, Capped mokey, Golden monkey (Primates)
- Rauvolfia serpentina (medicinal plant), Sandal wood tree, etc



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Endemic species of India

- Species that are found only in a particular region are known as endemic species. Almost 60% the endemic species in India are found in Himalayas and the Western Ghats. Endemic species are mainly concentrated in:
- India shows a good number of endemic species. About 62% of amphibians and 50% of lizards are endemic to India. Western ghats are the site of maximum endemism.
- A large number of species are known to have originated in India. Nearly 5000 species of flowering plants had their origin in India.
- North-East India
- North-West Himalayas
- Western Ghats and
- Andaman & Nicobar Islands.



Endemic species of India

Endemic Plant species

- Sapria Himalayana
- Ovaria Lurida
- Nepenthis khasiana etc

Endemic animals in the western ghats

- Lion tailed macaque
- Nilgiri langur
- Brown palm civet and
- Nilgiri tahr



Factors affecting endemic species

- Habitat loss and fragmentation due to draining and filling of inland wetlands.
- Pollution also plays an important role.
- Frog eggs, tadpoles and adults are extremely sensitive to pollutants especially pesticides.
- Over-hunting Populations can be adversely affected by introduction of non active predators and competitors. Disease producing organisms also play an important adversary in reducing populations of endemic species.



Conservation of biodiversity

- Illegal hunting and trade of animals and animal products should be stopped immediately
- People-at-large should boycott purchasing coats, purse or bags made of animal skin
- Bio-diversity laws should be strengthened.
- Adequate crop and cattle compensation schemes must be started
- Solar powered fencing must be provided with electric current proof trenches to prevent animals from entering fields.



Conservation of biodiversity

- Cropping pattern should be changed near the forest borders
- Adequate food and water should be made available for wild animals within forest zones.
- Development and construction work in and around forest region must be stopped.
- Biodiversity is one of the important tools for sustainable development. The commercial, medical, genetic, aesthetic, and ecological importance of biodiversity emphasizes the need for its conservation.



Factors affecting biodiversity

- Biodiversity is disturbed by human activity
- Poaching of animals, over-exploitation of natural sources and degradation of habitats affect biodiversity.
- Marine ecosystems are disturbed due to oil spills and discharge of effluents
- Climatic factors like global warming, ozone depletion and acid rain also affect biodiversity



Need For Biodiversity

- It provides recreation and tourism
- Drugs, herbs, food and other important raw materials are derived from plants and animals
- It preserves the genetic diversity of plants and animals
- It ensures sustainable utilization of life supporting systems on earth.
- It needs to conservation of essential ecological diversity and life supporting systems
- Loss of biodiversity leads to ecological and environmental deterioration



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Conservation of biodiversity

There are two types of biodiversity conservation:

- In-situ conservation and
- Ex-situ conservation
- In-situ conservation involves protection of flora and fauna within its natural habitat. The natural habitats or ecosystems under in-situ conservation are called "protected areas".
- Biosphere reserves
- National parks
- Wildlife sanctuaries
- Gene sanctuaries



Biosphere reserves

- Biosphere reserves cover large areas (>5000 sq.km.) They are normally used to protect species for a long time. The roles of biosphere reserves are listed below:
- Long-term survival of evolving ecosystem
- Protect endangered species
- Protect maximum number of species and communities
- Serve as site of recreation and tourism
- May also be used for educational and research purposes
- Biosphere reserves function as an open system and changes in land use are not allowed. No tourism and explosive activities are allowed in biosphere reserves.



National Parks in India

- A national park is an area dedicated for the conservation of wildlife along with its environment. It covers an area ranging from 100 to 500 sq.km. One or more national parks may exist within a biosphere reserve.
- A national park is used for enjoyment through tourism, without affecting the environment.
- It is used to protect, propagate and develop wildlife.
- Grazing domestic animals inside national parks is prohibited
- All private rights and forestry activities are prohibited inside a national park

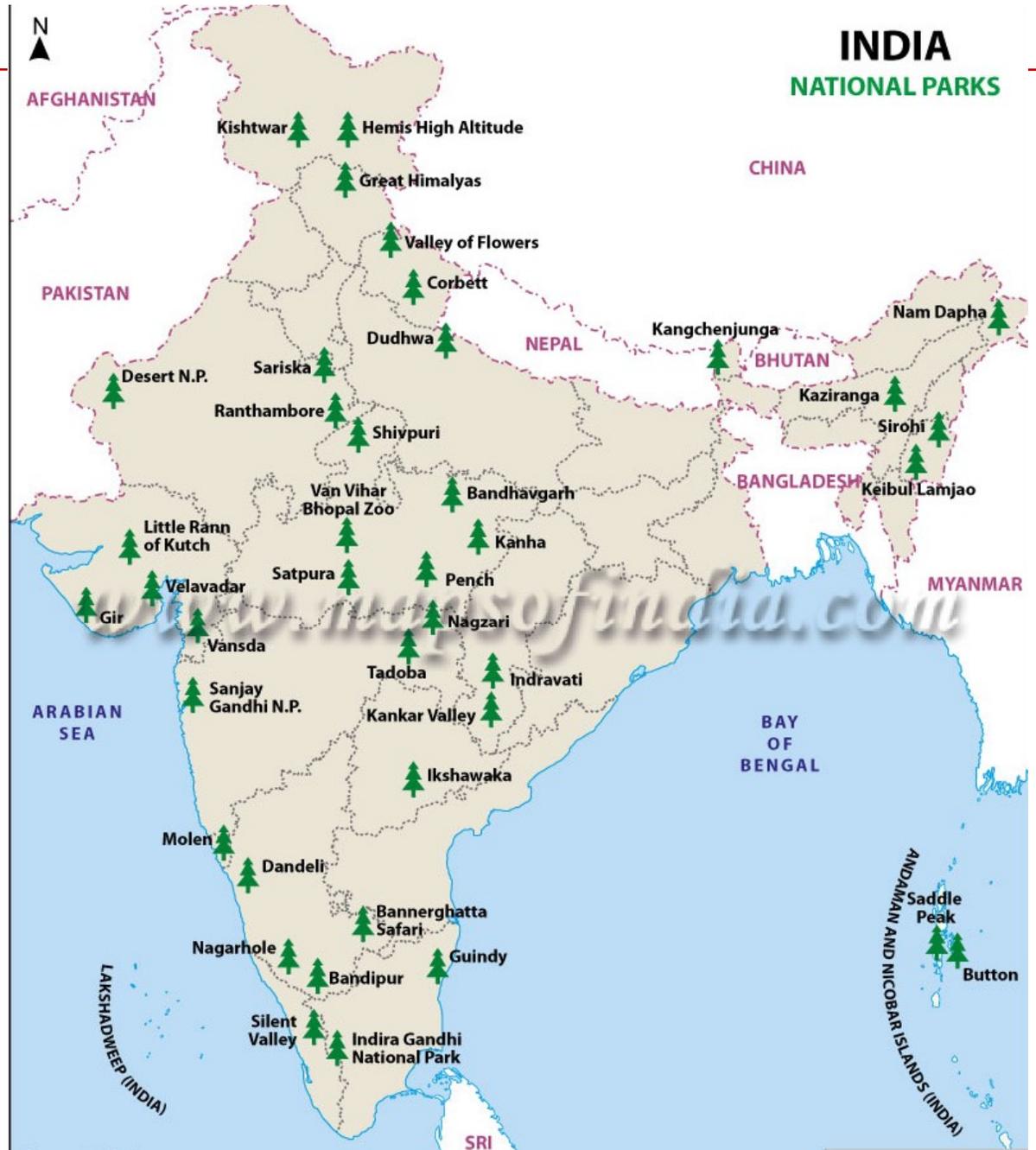


National Parks in India

Name	State	Wild life
Kaziranga	Assam	One-horned Rhino
Gir National park	Gujarat	Indian Lion
Bandipur	Karnataka	Elephant
Periyar	Kerala	Elephant, Tiger
Kanha	M.P	Tiger
Corbett	Uttarakhand	Tiger
Dudwa	U.P	Tiger
Ranthambore	Rajasthan	Tiger
Sariska	Rajasthan	Tiger



National Parks





National Parks





Conservation of biodiversity

- Wildlife sanctuary is an area that is reserved for the conservation of animals only.
- It protects animals only
- It allows operations such as harvesting of timber, collection of forest products, private ownership rights and forestry operations, provided it does not affect animals adversely
- Gene sanctuary is an area where plants are conserved.
- Other projects for the conservation of animals are Project Tiger, Gir Lion Project, Crocodile breeding project, project elephant etc



Wild life Sanctuaries in India

Name of Sanctuary	State	Major Wildlife
Ghana Bird Sanctuary	Rajasthan	300 species of bird (migratory also)
Hazaribagh	Bihar	Tiger, Leopard
Sultanpur Bird Sanctuary	Haryana	Migratory birds
Nal Sarovar Bird Sanctuary	Gujarat	Water birds
Abohar	Punjab	Black buck
Mudamalai	Tamil nadu	Tiger, elephant
Vedanthangal	Tamil Nadu	Water birds
Jaldapara	W.Bengal	Rhinoceros, elephant, Tiger
Wild Ass	Gujarat	Wild ass, wolf, nilgai



Conservation of biodiversity

Advantages of in-situ conservation

- It is cheap and convenient
- Species get adjusted to natural disasters like drought, floods, forest fires etc.

Disadvantages of in-situ conservation

- A large surface area of earth is required to preserve biodiversity
- Maintenance is not proper due to shortage of staff and pollution



Ex-situ conservation

- Ex-situ conservation involves protection of flora and fauna outside their natural habitats. This type of conservation is mainly done for conservation of crop varieties and wild relatives of crops.
- Ex-situ conservation involves maintenance and breeding of endangered plant and animal species under controlled conditions
- It identifies those species that are at a high risk of extinction
- It prefers species that are important for man in the near future among the endangered species.



Ex-situ conservation

- Important centers of ex-situ conservation:
- Botanical gardens
- Seed banks
- Microbial culture collections
- Tissue and cell cultures
- Museums and
- Zoological gardens



Ex-situ conservation

Advantages of Ex-situ conservation

- Survival of endangered species is increasing due to special care and attention
- In captive breeding the animals are assured of food, water, shelter and security thereby have a longer life span
- It is carried-out in cases of endangered species that do not have any chance of survival in the wild

Disadvantages of Ex-situ conservation

- It is an expensive method
- Freedom of wildlife is lost
- Animals cannot survive in the natural environment







