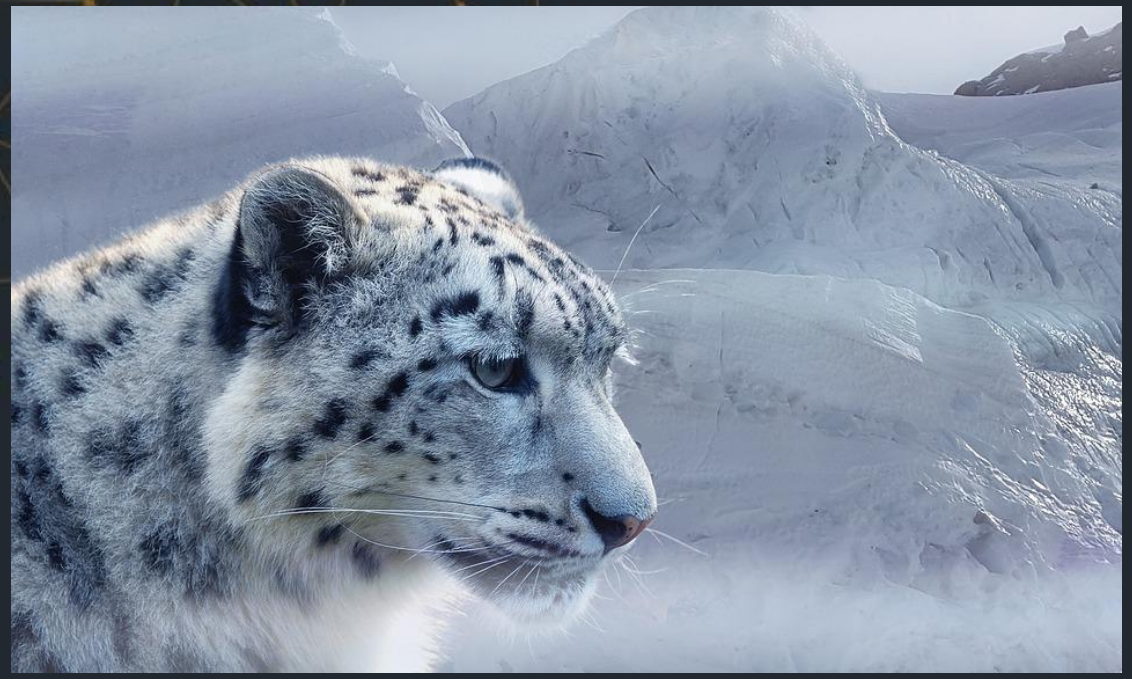

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Environment & Ecology

Biodiversity, Hotspots

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Environment & Ecology

Biodiversity and its importance

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Topics

- Biodiversity
- Types of Biodiversity
    - Genetic Biodiversity
    - Species Biodiversity
    - Ecosystem Diversity
  - Indian Biodiversity
    - Biogeographic Zones of India
    - Hotspots of Biodiversity

Topics

- IUCN
- Red List - IUCN
- Extinction of species
- Major Causes of Extinction
  - Habitat Loss
  - Illegal killing, hunting or poaching
  - Introduced/ Exotic Species
  - Pollution
  - Disease

Biodiversity

- ‘Biological diversity’
- The variety and abundance of living organisms living in a particular region
- Convention of Biological Diversity (CBD) 1992
- Biodiversity differs from place to place

Types of Biodiversity

- Genetic level to species diversity - as per different Biomes
- Based on these, three types of biodiversity are found:-
    1. Genetic Biodiversity
    2. Species Biodiversity
    3. Ecosystem Diversity

1. Genetic diversity

- Gene within the same species shows different versions due to new combination, it is called genetic diversity
- It is a basic source of biodiversity
- The genes of an organism can form an enormous number of combination each of which give rise to some variability
- Genes are the basic unit of hereditary information transmitted from one generation to the other
- All rice varieties belong to the specie *Oryza sativa*. But, there is difference at genetic level and we can see that variability in colour, aroma, size etc.

2. Species diversity

- Diversity at species level
- The variability found within the population of a species or between different species as community
- Examples of species diversity are - the big cats for example Tiger (*Panthera tigris*), lion (*Panthera leo*) and Snow Leopard (*Panthera uncia*) all belong to the same genus Panthera but they all differ at species level
- The two indices for measuring species diversity are
    - Shannon-wiener index
    - Simpson index

3. Ecosystem Diversity

- Ecological complexity showing variation in physical character, ecological niches, trophic structure, food webs, nutrient cycles etc.
- The ecosystem vary with respect to physical parameter like - moisture, temperature, altitude, precipitation etc. thus, the occurs tremendous diversity within the ecosystems, along these gradients
- An example of ecological diversity on a global scale would be the variation in ecosystems, such as deserts, forests, grasslands, wetlands and oceans

IUCN

- International Union for Conservation of Nature and Natural Resource is a membership Union uniquely composed of both government and civil society organisations.
- Public, private and non-governmental organisations with the knowledge and tools that enable human progress, economic development and nature conservation to take place together.
- Created in 1948, IUCN has evolved into the world's largest and most diverse environmental network.
- IUCN is the global authority on the status of the natural world and the measures needed to safeguard it.
- The IUCN enjoys "observer status" at the United Nations General Assembly.

Red List - IUCN

- It is a system of classifying plants, animals etc on basis of their likelihood of extinction.
- This classification contains total 9 groups.

All Species

- NE: Not Evaluated
- DD: Data Deficient
- LC: Least Concern
- NT: Near Threatened
- VU: Vulnerable
- EN: Endangered
- CR: Critically Endangered
- EW: Extinct In Wild
- EX: Extinct

Evaluated

Adequate Data

Threatened Categories

NE DD LC NT VU EN CR EW EX

Increasing Risk of Extinction

- Extinct (EX) – No known individuals remaining.
- Extinct in the wild (EW) – Known only to survive in captivity, or as a naturalized population outside its historic range.
- Critically endangered (CR) – Extremely high risk of extinction in the wild.
- Endangered (EN) – High risk of extinction in the wild.
- Vulnerable (VU) – High risk of endangerment in the wild.
- Near threatened (NT) – Likely to become endangered in the near future.
- Least concern (LC) – Lowest risk. Does not qualify for a more at-risk category. Widespread and abundant taxa are included in this category.
- Data deficient (DD) – Not enough data to make an assessment of its risk of extinction.
- Not evaluated (NE) – Has not yet been evaluated against the criteria.

- The pink pages in this publication include the critically endangered species.
- As the status of the species changes, new pages are sent to the subscribers.
- Green pages are used for those species that were formerly endangered, but have now recovered to a point where they are no longer threatened.
- With passing time, the number of pink pages continue to increase with decreasing green pages.

Extinction of species

- Extinction is the end of a group of organisms (taxon), normally a species.
- The moment of extinction is generally considered to be the death of the last individual of the group (although the capacity to breed and recover may have been lost before this point).
- Because a species' potential range may be very large, determining this moment is difficult, and is usually done retrospectively.
- Many factors are driving an unprecedented rate of extinction of plant and animal species world wide.
- Although extinction is a natural process, the rate at which current extinction is taking place is clearly not, and all scientific evidence indicates that the activities of mankind are the primary engine behind most recent and present extinction events.

Major Causes of Extinction

1. Habitat loss
2. Unregulated or Illegal Killing, Hunting or Poaching
3. Introduced Exotic Species
4. Pollution
5. Disease
6. Competition

Importance of Biodiversity

- Biodiversity boosts ecosystem productivity where each species, no matter how small, all have an important role to play.
- For example,
  - A large number of plant species means a greater variety of crops
  - Greater species diversity ensures natural sustainability for all life forms
  - Healthy ecosystems can better withstand and recover from a variety of disasters

Importance of Biodiversity

- Consumptive use value : Direct use of biodiversity product for example fuel, food, drugs, pulp etc. can be harvested and consumed directly.
- Productive use value : commercial use of the products which can be marketed and sold. These may include silk industry, textile industry etc.
- Social Value : Values associated with the social life, customs, religion and psycho spiritual aspects of people. Many plants like Tulsi, peepal etc. are considered sacred in our country.
- Ethical Value or Moral Value : Ethical issues based on the concept of live and let live

Importance of Biodiversity

- Aesthetic Value : Rich biodiversity gives us pleasure, peace of mind, excitement and hence holds a great aesthetic value.
  - Ecotourism
- Option Values : Potential of diversity that are presently unknown and need to be explored.
- Ecosystem Service Value : Service provided by the ecosystem. Recently, non-consumptive use value related to self maintenance of the ecosystem and various important ecosystem service has been recognised.

Ecosystem Services

The Millennium Ecosystem Assessment (MA) report 2005 defines Ecosystem services as benefits people obtain from ecosystems and distinguishes four categories of ecosystem services, supporting services are regarded as the basis for the services of the other three categories.

1. Supporting services

- nutrient recycling
- primary production
- soil formation
- habitat provision
- pollination

These services make it possible for the ecosystems to continue providing services such as food supply, flood regulation, and water purification.

Ecosystem Services

2. Provisioning services

- food, crops, wild foods, and spices
- raw materials (including lumber, skins, fuel wood, organic matter, fodder, and fertilizer)
- genetic resources (including crop improvement genes, and health care)
- water
- biogenic minerals
- medicinal resources (including pharmaceuticals, chemical models, and test and assay organisms)
- energy (hydropower, biomass fuels)
- ornamental resources (including fashion, handicraft, jewelry, pets, worship, decoration and souvenirs like furs, feathers, ivory, orchids, butterflies, aquarium fish, shells, etc.)

Ecosystem Services

3. Regulating services

- Carbon sequestration and climate regulation
- Predation regulates prey populations
- Waste decomposition and detoxification
- Purification of water and air
- pest and disease control

Ecosystem Services

4. Cultural services

- cultural (including use of nature as motif in books, film, painting, folklore, national symbols, architect, advertising, etc.)
- spiritual and historical (including use of nature for religious or heritage value or natural)
- recreational experiences (including ecotourism, outdoor sports, and recreation)
- science and education (including use of natural systems for school excursions, and scientific discovery)
- Therapeutic (including Ecotherapy, social forestry and animal assisted therapy)

Indian Biodiversity

- 2.4% of the World's land with 8.1 % of Species Diversity share
- A rich biological diversity of flora and fauna, diverse climate - forests, deserts, mountains
- It lies within the Indomalaya ecozone and houses four of the 35 biodiversity hotspot in the world
- Total number of living species identified in India are around 1,50,000 (Plants, Animals)
- India is also one of the 17 mega biodiversity countries in the world

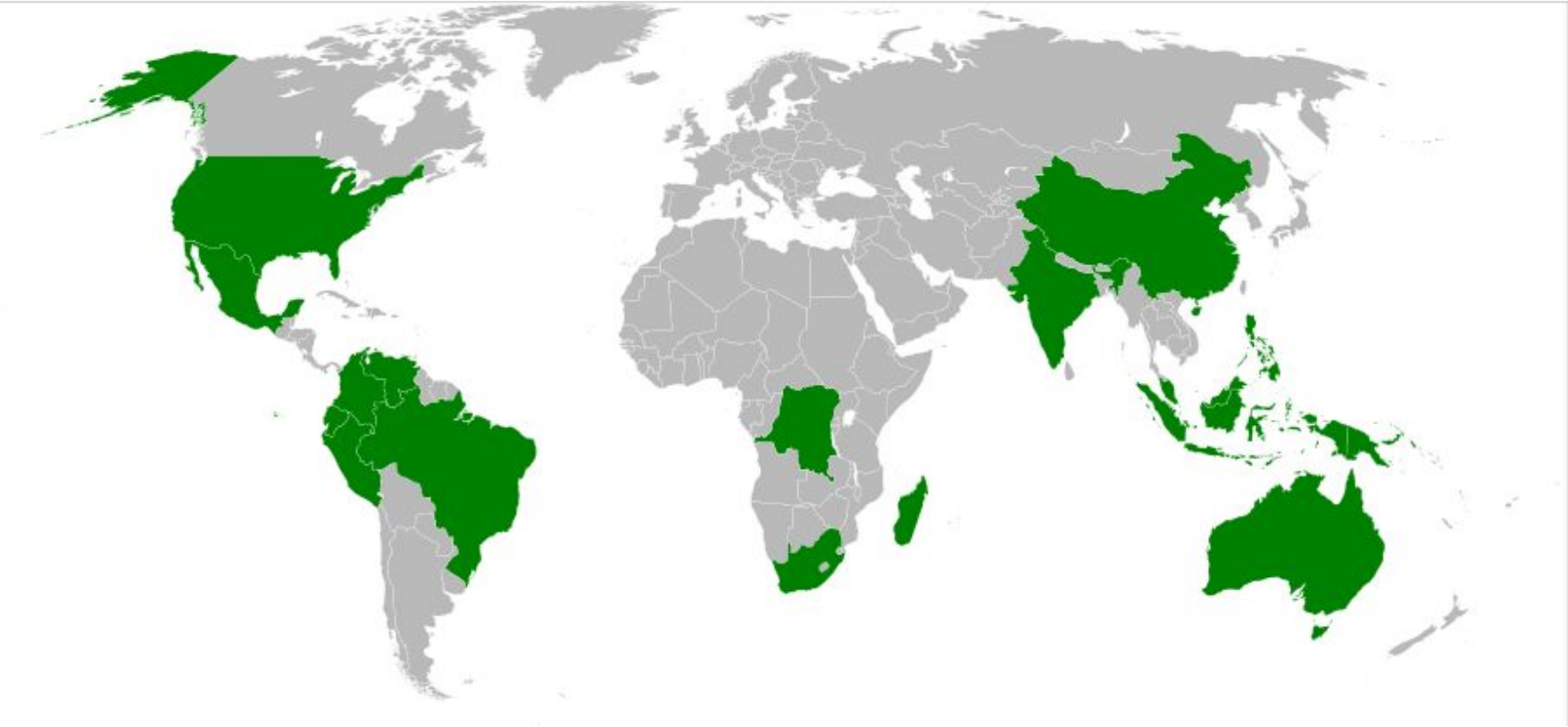
Endemism :

- This is described as the phenomena in which species are restricted only to a particular area
- India shows a good number of endemic species
- 62% of them are amphibians and 50% of them are lizards
- Western Ghats exhibits maximum endemism

Megadiverse Countries

- The term megadiverse country refers to any one of a group of nations that harbor the majority of Earth's species and high numbers of endemic species.
- Conservation International identified megadiverse countries in 1998.
- Many of them are located in, or partially in, tropical or subtropical regions.
- Megadiversity means exhibiting great biodiversity.
- The main criteria for megadiverse countries is endemism at the level of species, genera and families.
- Eligibility - A megadiverse country must have at least 5,000 species of endemic plants and must border marine ecosystems.
- These 17 countries harbour more than 70% of the earth's species.

Megadiverse Countries



1. Australia
2. Brazil
3. China
4. Colombia
5. Democratic Republic of the Congo
6. Ecuador
7. India
8. Indonesia
9. Madagascar
10. Malaysia
11. Mexico
12. Papua New Guinea
13. Peru
14. Philippines
15. South Africa
16. United States
17. Venezuela

Biogeographic Zones of India

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On the basis of natural vegetation and wildlife India has been divided into ten biogeographic zones

- Trans- himalayan
- Himalayan
- Deserts
- Semi arid
- Western Ghats
- Deccan peninsula
- Gangetic Plain
- N.E. India
- Islands
- Coasts

Hotspot of Biodiversity

- By Norman Myers
- Regions of high conservation priority with their biodiversity richness and high endemism and a high threat
- CI - Conservation International
- Biodiversity hotspots are the areas with the large percentage of endemic species
- The hotspots cover less than 2% of the world's land and are found to have about 50% of the terrestrial biodiversity
- There are 35 such hot spots of biodiversity on a global level.
- To qualify as biodiversity hotspot, region must meet two strict criteria :
  - The region should contain at least 0.5% or 1500 endemic species of world's total species of plants.
  - The region should have lost at least 70% of its primary vegetation.

Hotspots of India

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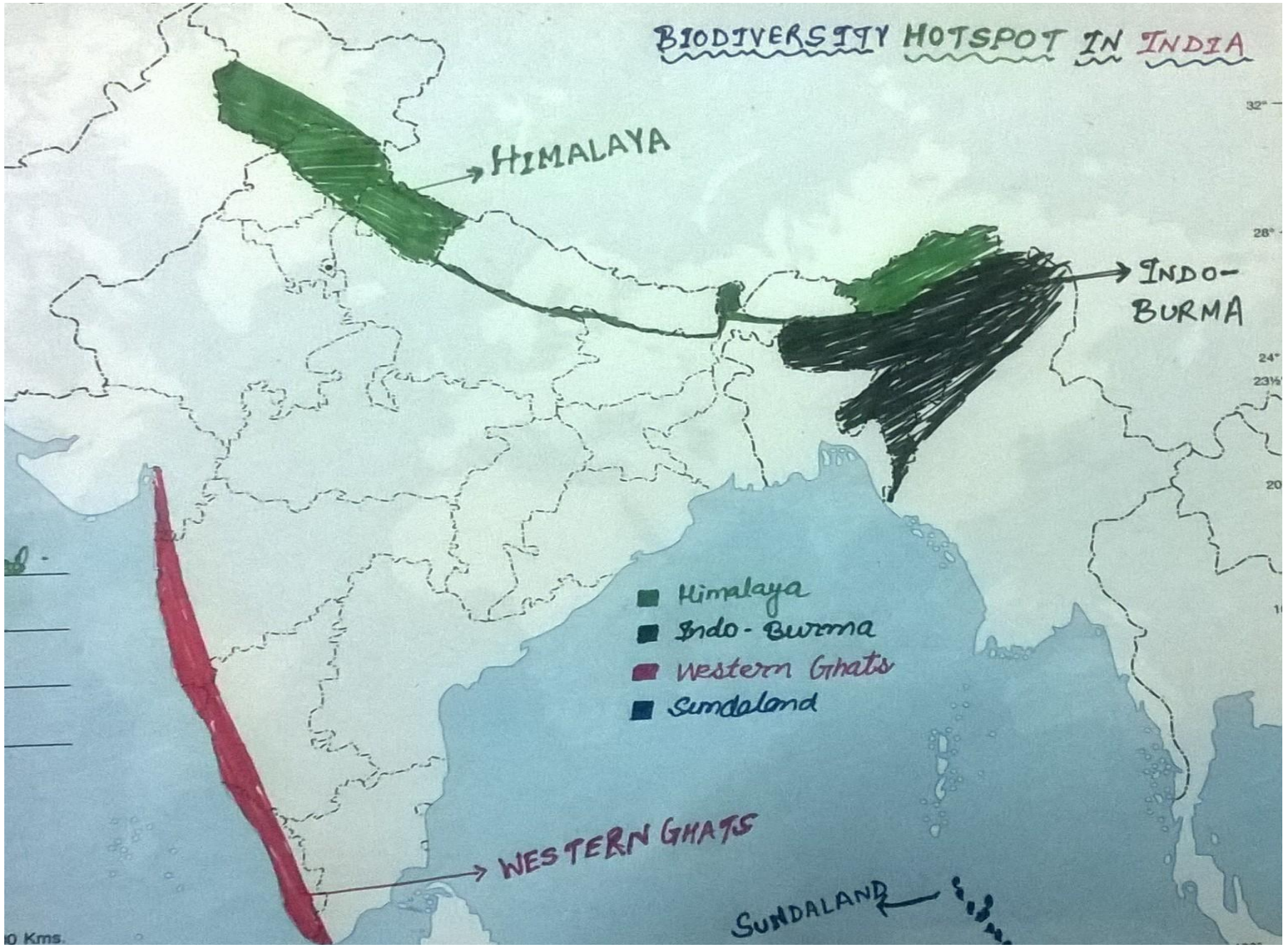
1. Himalaya : Includes the entire Indian Himalayan region (and that falling in Pakistan, Tibet, Nepal, Bhutan, China and Myanmar)
2. Indo-Burma : Includes entire North-eastern India, except Assam and Andaman group of Islands (and Myanmar, Thailand, Vietnam, Laos, Cambodia and southern China)
3. Sundalands : Includes Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei, Philippines)
4. Western Ghats and Sri Lanka : Includes entire Western Ghats (and Sri Lanka)


BIODIVERSITY HOTSPOT IN INDIA
HIMALAYA
INDO-BURMA
WESTERN GHATS
SUNDALAND
Himalaya
Indo-Burma
Western Ghats
Sundaland
32°
28°
24°
23½
20
0 Kms.

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1. Himalayas

- Stretching in an arc over 3,000 kilometers of northern Pakistan, Nepal, Bhutan and the northwestern and northeastern states of India.
- This immense mountain range has been divided into two regions: the Eastern Himalaya and Western Himalaya.
- It has world's highest mountains, including Mt. Everest.
- Vascular plants have even been recorded at more than 6,000 m.
- It has populations of numerous large birds and mammals, including vultures, tigers, elephants, rhinos and wild water buffalo.

2. Indo-Burma

- It covers more than 2 million km^2 of tropical Asia, Indo-Burma is still revealing its biological treasures.
- Six large mammal species have been discovered in the last 12 years: the large-antlered muntjac, the Annamite muntjac, the grey-shanked douc, the Annamite striped rabbit, the leaf deer, and the saola.
- It holds remarkable endemism in freshwater turtle species, most of which are threatened with extinction, due to overharvesting and extensive habitat loss.
- Bird life in Indo Burma is also incredibly diverse, holding almost 1,300 different bird species, including the threatened white-eared night-heron, the grey-crowned crocias, and the orange-necked partridge.

The Saola

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The Saola

- IUCN Status - CR
- Evolutionarily Distinct & Globally Endangered (EDGE) species
- The Saola (*Pseudoryx nghetinhensis*) is one of the rarest large animals on earth.
- It is the sole species of a genus of bovids, and has been known to science only since 1992.
- Both females and males are characterized by long, gently curving horns, and a striking pattern of white markings on the head. I
- Saola's closely living relatives are wild cattle and buffaloes.
- Found only in Laos and Vietnam, in the Annamite Mountains
- Saola means 'spinning wheel posts'
- Saola is by far the largest terrestrial animal in the world (of certain existence) that has never been seen in the wild by a biologist. It remains an enigma into the 21st century.

3. Sundaland

- It covers the western half of the Indo-Malayan archipelago and is dominated by two of the largest islands in the world: Borneo and Sumatra.
- Orangutan found only in this hotspot and declining rapidly.
- Some of the last refuges of two Southeast Asia rhino species are also found on the islands of Java and Sumatra.
- Rubber, oil palm, and pulp production are three of the most detrimental forces facing biodiversity in the Sundaland Hotspot.
- Notable plants in the hotspot include members of the genus Rafflesia, represented by 16 species with very large flowers.
- One of these, *Rafflesia arnoldii*, has the largest flowers in the world, measuring up to one meter in diameter.

Orangutan

- IUCN Status - CR
- The orangutans are three extant species of great apes native to Indonesia and Malaysia. Orangutans are currently only found in the rainforests of Borneo and Sumatra.
- Classified in the genus Pongo, orangutans were originally considered to be one species.
- From 1996, they were divided into two species: the Bornean orangutan and the Sumatran orangutan
- In November 2017 it was reported that a third species had been identified, the Tapanuli orangutan

4. Western Ghats

- Known as the Sahyadri Hills, are formed by the Malabar Plains and the chain of mountains running parallel to India's western coast.
- The region has important populations of Asian Elephants, Indian Tigers, the Endangered Lion-tailed Macaque, Nilgiri Langur, Nilgiri Tahr, Flying Squirrel, and Malabar Gray Hornbill.
- Freshwater fish endemism is extremely high as well, with over 140 native species.

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