



Humboldt's Enigma

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Why in News?

In recent years, **Humboldt's enigma** has garnered increased attention in the field of ecology as researchers seek to understand the **unexpected biodiversity found in mountain ecosystems**, challenging traditional beliefs.

What is Biodiversity?

- **About:** Biodiversity underpins **all life on earth** and refers to the variety of **plant, animal, and microbial species** plus all the related genetic variations in the world.
- **Measurement of Biodiversity:** It is measured by two major components: **species richness and species evenness**.
 - **Species Richness measures the number of species** found in a community.
 - Tropical rainforests in the terrestrial ecosystem and coral reefs in the marine ecosystem have the highest degree of species richness.
 - **Species evenness** is a measure of the **relative abundance of the different species** making up the richness of an area.
 - **Low evenness means a few species dominate** the site.
- **Biodiversity in India:** India is one of the recognized mega-diverse countries of the world, harbouring nearly **7-8% of the recorded species of the world**.
 - India represents **4 out of 36 globally recognised biodiversity hotspots** (Himalaya, Indo-Burma, Western Ghats and Sri Lanka, Sundaland).
 - So far, **over 91,200 species of animals and 45,500 species** of plants have been documented in the 10 **biogeographic regions** of the country.

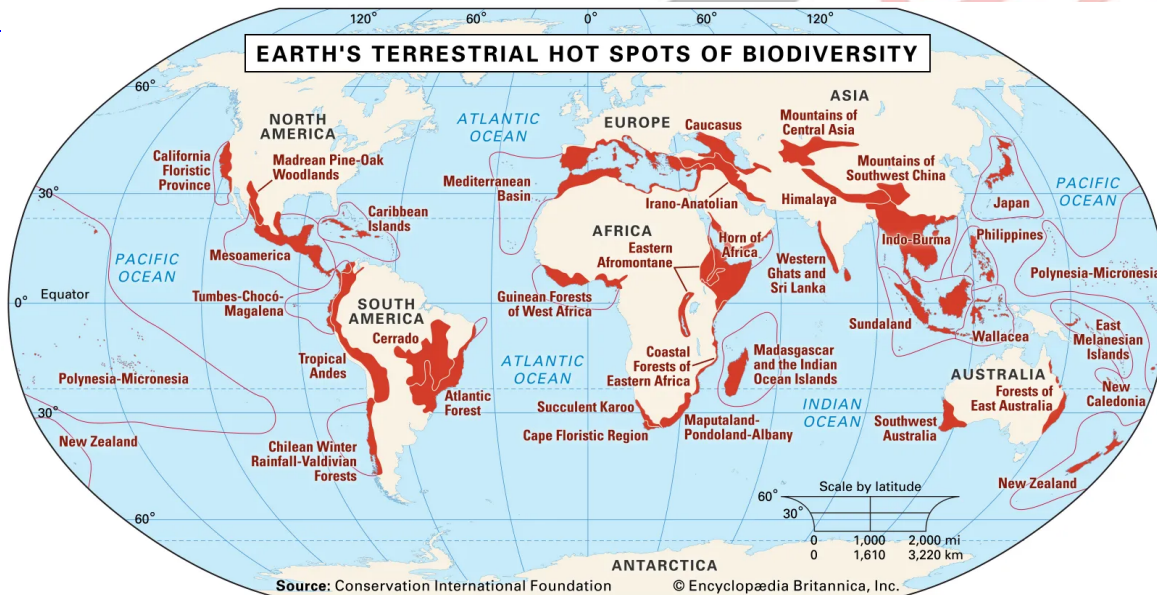
What is Humboldt's enigma?

- **Humboldt's enigma:** Sparked by **Alexander von Humboldt's observations**, it questions the conventional notion that tropical regions, **fueled by ample sunlight**, are the primary centres of biodiversity on Earth.
 - It contends that **despite receiving less sunlight and enduring colder temperatures, mountain ecosystems defy this notion by showcasing exceptional biodiversity**, thereby challenging traditional ecological theories and prompting investigation into this anomaly.
- **Humboldt's Observations:** Humboldt suggested there was a relationship between **temperature, altitude, and humidity** on one hand and the **occurrence patterns of species or their biodiversity** on the other.
 - His example of choice was the **Chimborazo mountain in Ecuador**, which has today become an important illustration of mountain diversity.
- **Factors Contributing to Mountain Biodiversity:**
 - **Varied Topography:** Mountains offer a mosaic of **microclimates**, ranging from snow-

capped peaks to sheltered valleys.

- This diversity creates distinct ecological niches, suitable for a wider range of species.
- **Isolation:** Mountains act as **isolated "islands" in the sky**, promoting unique evolutionary pathways and endemic species, found nowhere else.
 - For example, the **Hawaiian Islands are home to many endemic species of plants and animals**, which evolved in isolation from the mainland.
- **Dynamic landscapes:** Geological processes like **landslides and glacial retreats** constantly reshape mountain landscapes, creating opportunities for new species to colonize and evolve.
- **India's Enigmatic Mountains:** India's diverse mountain ranges, including the **Himalayas especially Eastern Himalayas**, serve as ideal settings to probe Humboldt's enigma.
 - According to the World Wildlife Fund, the Eastern Himalayas harbours thousands of different species, including over **10,000 plants, 900 species of bird, and 300 species of mammal**. Many of which are endangered or critically endangered.
 - Its grasslands are home to the densest populations of **Bengal tigers, Asian elephants, and one-horned rhino**.
 - Its mountains offer refuge to **snow leopards, red pandas, takins, Himalayan black bears, and golden langurs**, and its rivers contain the world's rarest dolphins (**Gangetic**).
- **Related Indian Government Initiatives:**
 - [National Mission on Sustaining Himalayan Ecosystem](#)
 - [National Mission on Biodiversity and Human Wellbeing](#)

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Note

The world's tropical areas receive more energy from the Sun because of the **earth's angle of inclination**. Therefore, the tropics have greater primary productivity, which then facilitates greater diversity: **more ecological niches become available**, creating more complex ecosystems and greater biological diversity.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims:

Q. If you travel through the Himalayas, you are likely to see which of the following plants are naturally growing there? (2014)

1. Oak
2. Rhododendron
3. Sandalwood

Select the correct answer using the code given below:

- (a) 1 and 2 only
(b) 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: (a)

Q. When you travel in Himalayas, you will see the following: (2012)

1. Deep gorges
2. U-turn river courses
3. Parallel mountain ranges
4. Steep gradients causing landsliding

Which of the above can be said to be the evidence for Himalayas being young fold mountains?

- (a) 1 and 2 only
(b) 1, 2 and 4 only
(c) 3 and 4 only
(d) 1, 2, 3 and 4

Ans: (d)

Mains:

Q. Differentiate the causes of landslides in the Himalayan region and Western Ghats. (2021)

Q. How will the melting of Himalayan glaciers have a far-reaching impact on the water resources of India? (2020)

Q. "The Himalayas are highly prone to landslides." Discuss the causes and suggest suitable measures of mitigation. (2016)