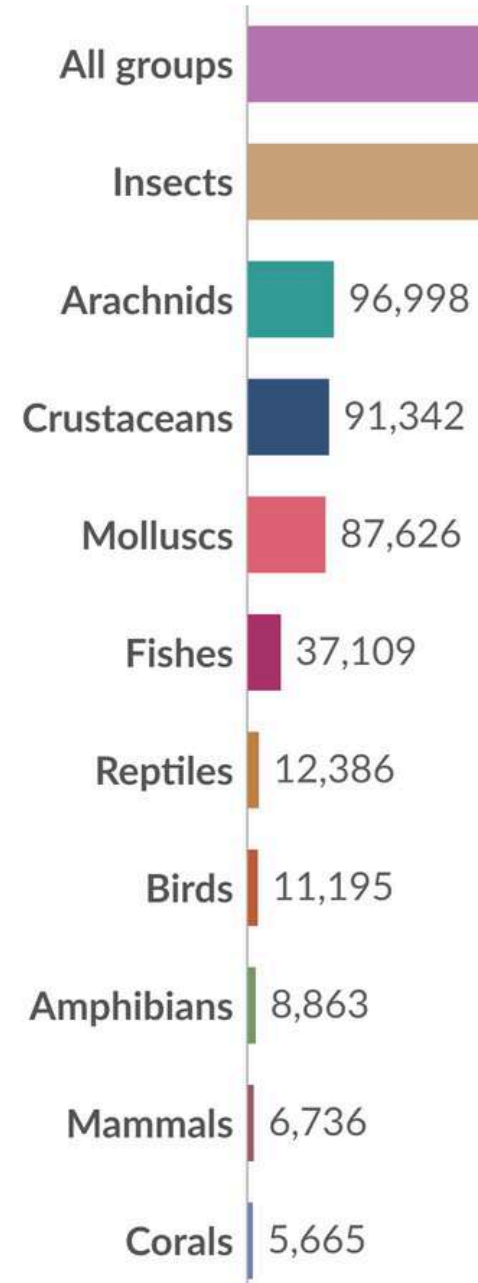
UPSC Biodiversity PRELIMS

Biodiversity is the variety of life on Earth, encompassing the diversity of species, genetic variations within those species, and the ecosystems they form. It is a term that includes all living organisms, from plants and animals to microorganisms, and the complex interactions between them and their habitats.

- **Species diversity:**
  The variety of different species in a given area, from the number of species to their relative abundance.
- **Genetic diversity:**
  The variation of genes within a single species, which is crucial for adaptation and survival.
- **Ecosystem diversity:**
  The variety of different ecosystems in a geographical area, such as forests, wetlands, and deserts.

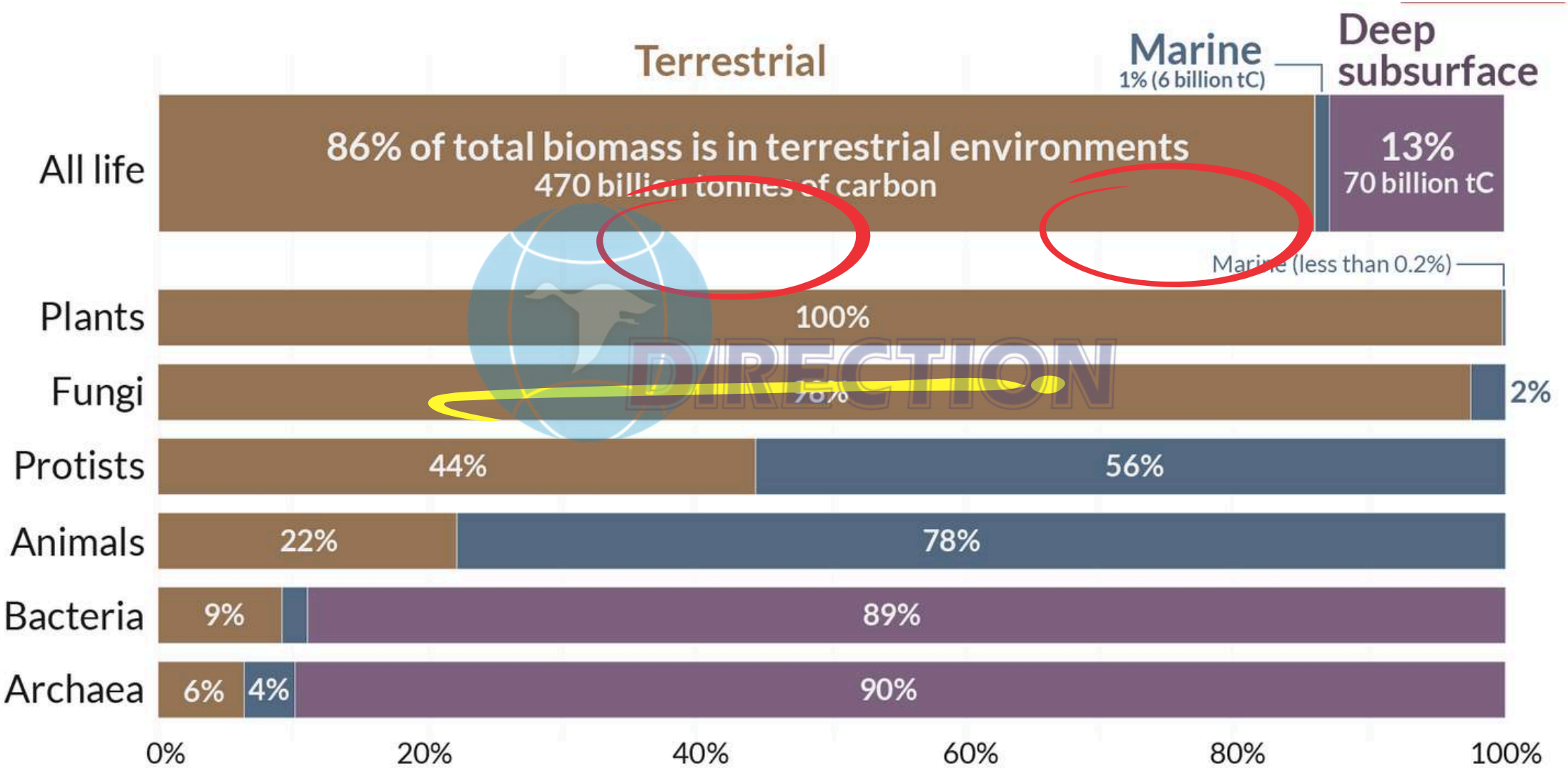
Number of described species

The number of identified and named species in each taxonomic group[1]. Since many species have not yet been described, this is a large underestimate of the total number of species in the world.



There are an estimated 8.7 million species on Earth

86 Percent of Earth's Species Still Unknown?


Terrestrial
Marine
1% (6 billion tC)
Deep subsurface
All life
86% of total biomass is in terrestrial environments
470 billion tonnes of carbon
13%
70 billion tC
Marine (less than 0.2%)
Plants
100%
Fungi
2%
Protists
44%
56%
Animals
22%
78%
Bacteria
9%
89%
Archaea
6%
4%
90%
0%
20%
40%
60%
80%
100%

Most of life exists on land 86% of biomass.

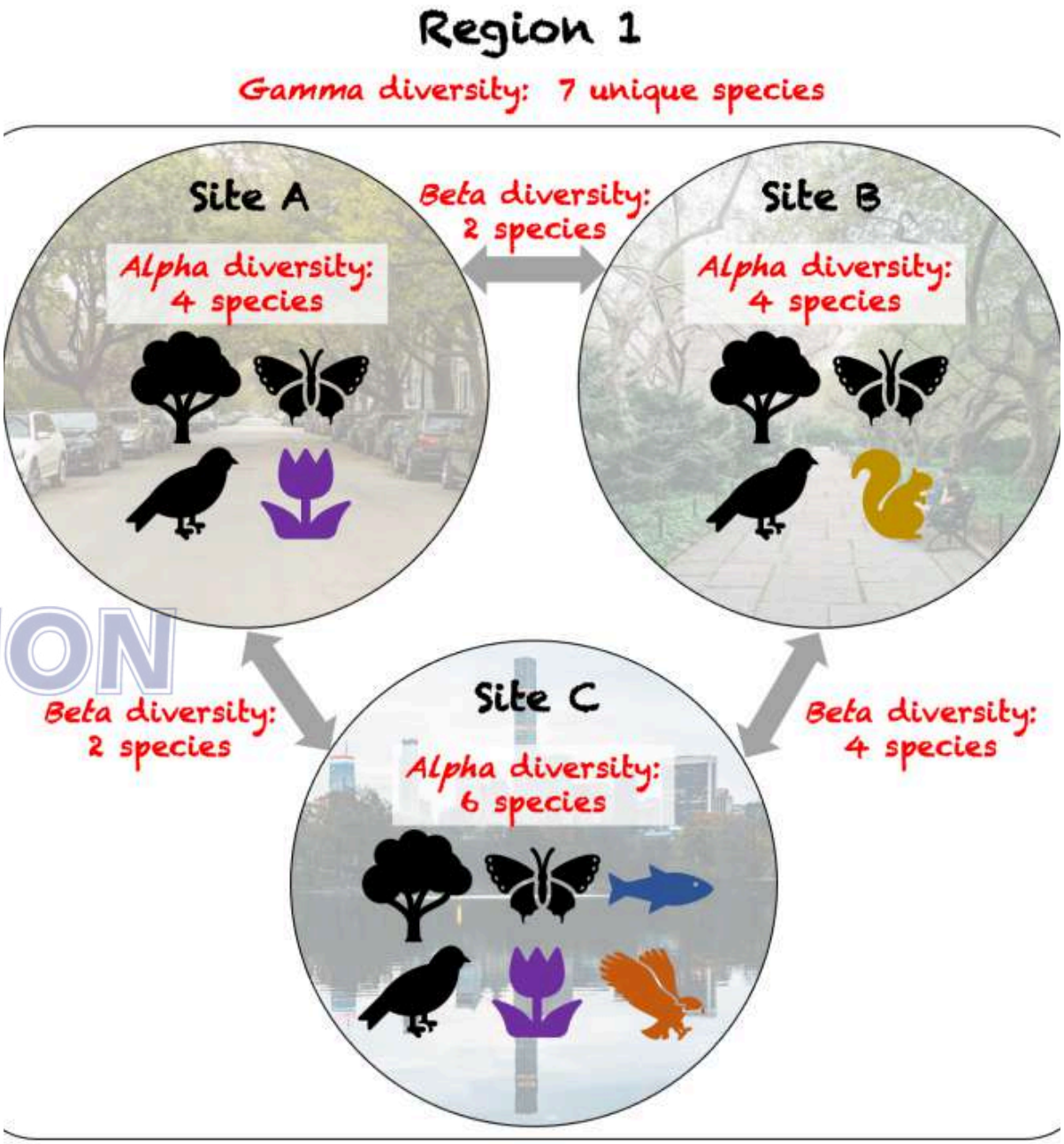
- This is because almost all plant life – mostly trees – is terrestrial. The marine plants, for example seaweed, make up less than 1 billion tonnes of carbon. This is less than 0.2% of total plant biomass.
- Most bacteria and archaea exists in the deep subsurface, meaning 13 percent of global biomass thrives in this environment.
- Despite dominating our planet in terms of area and volume – taking up more than 70% of global surface area – the oceans are home to just 1% of biomass.

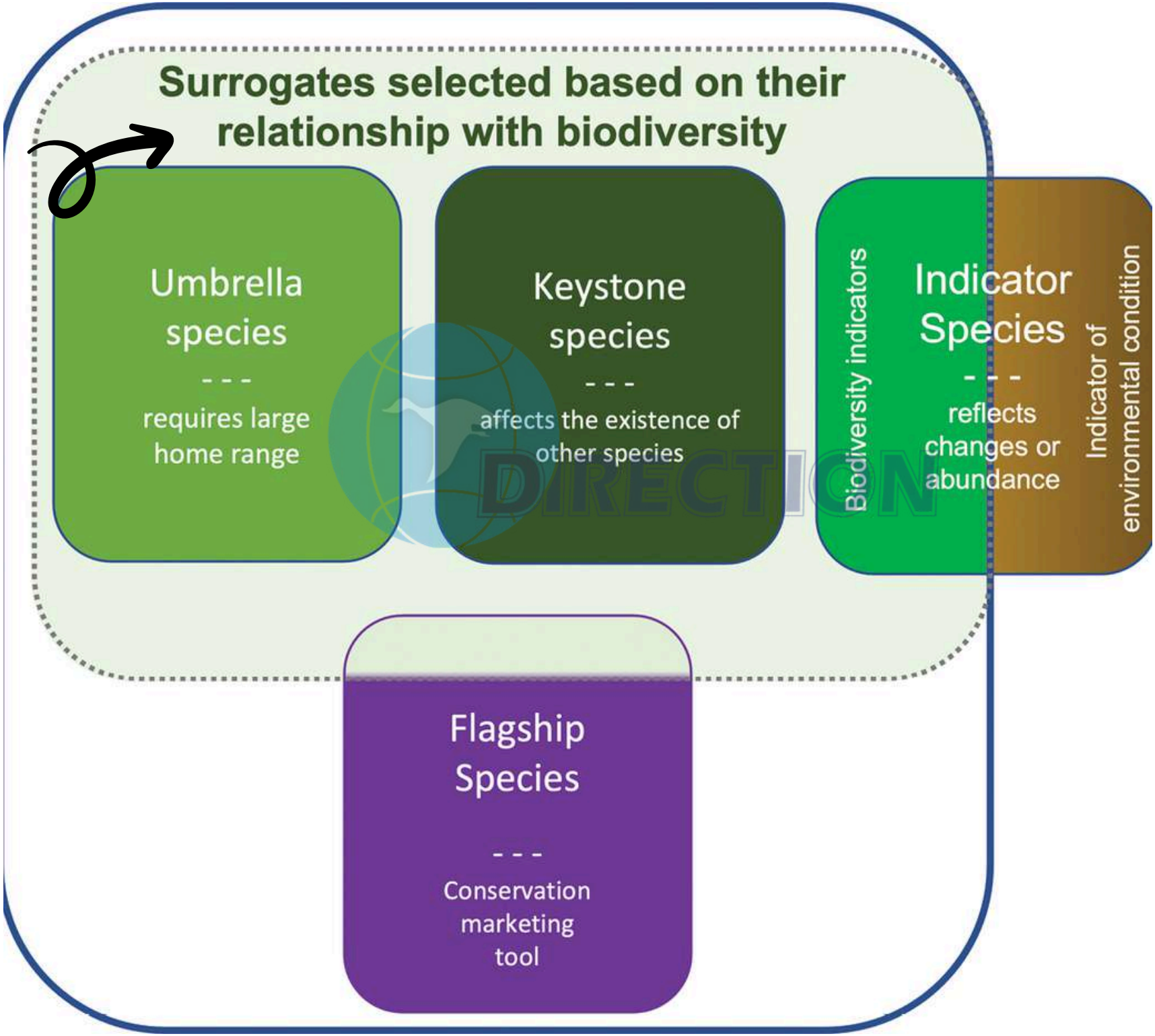
But they do dominate the animal kingdom: 78% of animal biomass lives in the marine environment.

Species diversity

Alpha, beta, and gamma diversity are measures of biodiversity across different scales:

alpha diversity is the species richness within a single habitat, **beta diversity** measures the change in species composition between different habitats, and **gamma diversity** is the total species richness across a larger region that includes multiple ecosystems




Surrogates selected based on their relationship with biodiversity
Umbrella species
- - -
requires large home range
Keystone species
- - -
affects the existence of other species
Biodiversity indicators
Indicator Species
- - -
reflects changes or abundance
Indicator of environmental condition
Flagship Species
- - -
Conservation marketing tool

A keystone species is a species that has a disproportionately large effect on its natural environment relative to its abundance. The concept was introduced in 1969 by the zoologist Robert T. Paine.

- **Predators** Wolves - Apex Predators
- **Modifiers** American Alligator
- **Prey** Pacific Salmon
- **Mutualists** Ruby throated humming bird
- **Hosts** Aspen stands are habitat for many insects.

Keystone Species Examples In India

- **Fiddler crabs** are detritivores, which means they eat dead organic stuff. The ecosystem cannot function without it. These crabs provide an important service by removing leaf litter and delivering nutrients to the soil.
- **Cullenia exarillata tree (local name Veipla)** is native to India's Western Ghats, is home to a diverse range of species. This life-giving stationery guardian attracts insects, birds, and mammals alike.
- **Sloth bears i**n the wild serve critical roles in the ecology they dwell in, excavating termite, mounds, and hills with their enormous claws and munching on the morsels buried within. These are keystone species because their food, which consists primarily of termites, fruits, and tubers, contributes to forest health. Ramdurga ecosystem protection in Karnataka has recovered to its former glory! Sloth bears, leopards, and the uncommon pangolin have all made a comeback.
- **Elephants** are a keystone Engineers in the southern part of India including Karnataka, kerala and Tamil nadu. Elephants consume small trees and shrubs that thrive in the area. Elephants can topple and uproot the acacia tree, even if it reaches a height of a yard or more. Because of their grazing habits, the area remains a grassland instead of a forest.
- The mutually beneficial relationships that **bees have with plants** make them an excellent example of keystone species of arch. They increase plant growth and fertilisation potential, for instance, when they gather nectar and pollen, which are their main food sources.

Indicators species An indicator species can be any organism that is abundant and sensitive to changes in the environment.

Around 50% of indicator species are animals, and 70% are invertebrates! These are creatures without a backbone such as starfish, earthworms, jellyfish, spiders, snails, etc.

- **Amphibians:** Freshwater frogs and toads have exceptionally permeable skin, which enables these amphibious species to provide an early warning of decreased water quality and changes in environmental conditions.
- **Crustaceans:** Ecologists test fish and shellfish for heavy metals, pesticides, and plastics to gauge the effects of agricultural runoff and other water pollution issues. Crustaceans can also provide researchers with indications of the alkalinity or acidity of large bodies of water.
- **Lichens:** Mosses and lichens in old-growth forests—for example, in the Pacific Northwest region of North America—can be some of the best ecological indicators of water and air pollution in temperate forest ecoregions.

- **Macroinvertebrates:** Very small animals like microorganisms and macroinvertebrates can provide researchers with a detailed picture of ecosystem health in waterways and sediment. These organisms can provide researchers with extensive data if several species cohabitate in a compact biosphere.
- **Wetland mammals:** Manatees, river otters, and beavers are examples of species that typically live in fragile wetland ecosystems, which have some of the best biodiversity on the planet. The population size, reproduction rates, and general health of bioindicator species in wetland areas can provide scientists with a clear picture of degenerating habitats.

Bioindicator vs. Biomonitor

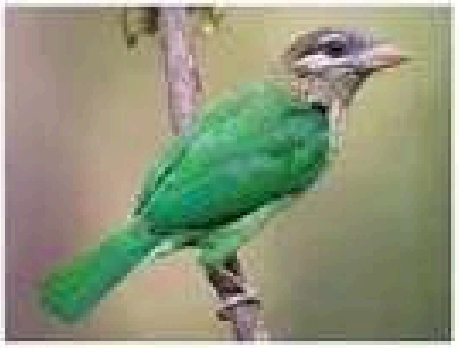
A bioindicator is an organism that is used to qualitatively assess an environmental change. A biomonitor, on the other hand, is used to quantitatively measure responses and changes in the environment that indicate pollution. For example, if the amount of chlorophyll in a lichen decreases, scientists know that air pollution is present.

An **endemic species** is native to and found only in a specific geographic area, while a **precinctive species** is a rarer, interchangeable term for this concept, referring to species restricted to a defined, exclusive area

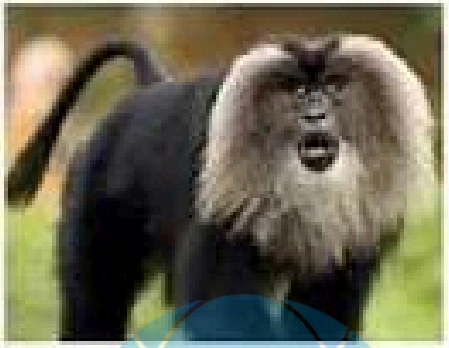
India has many endemic species, such as

- the Asiatic Lion in Gir Forest,
- the Lion-Tailed Macaque and
- Purple Frog in the Western Ghats,
- the Nilgiri Tahr in the Nilgiri Hills, and
- the Sangai Deer in Manipur.

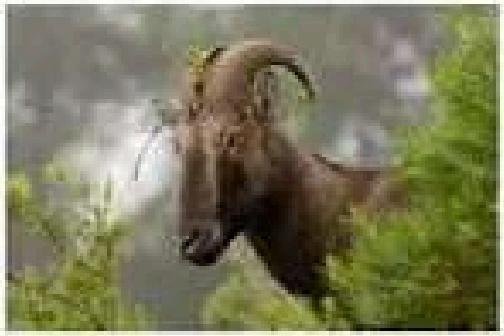
Other examples include the Kashmir Stag (Hangul) in the Kashmir Valley and the Pygmy Hog in Assam



White cheeked barbet



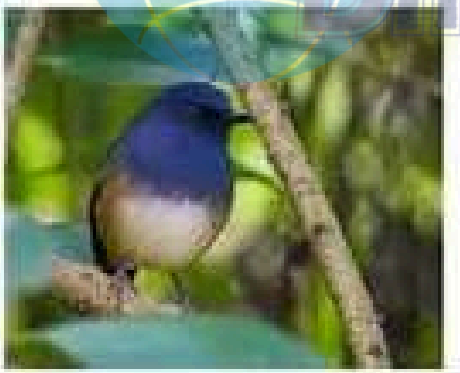
Lion tailed macaque



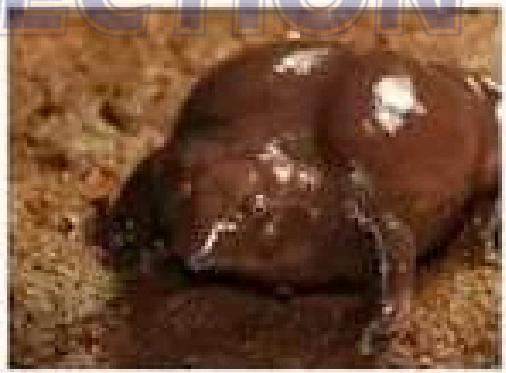
Nilgiri Tahr

Malabar large spotted civet

Pygmy hog

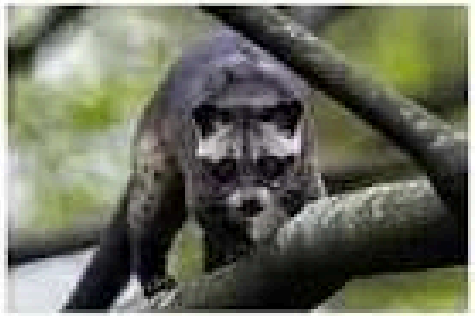


Nilgiri blue robin

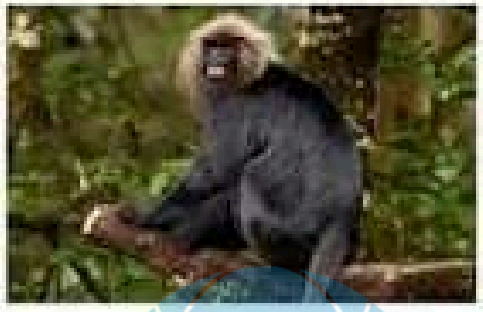


purple frog

malabar gliding frog



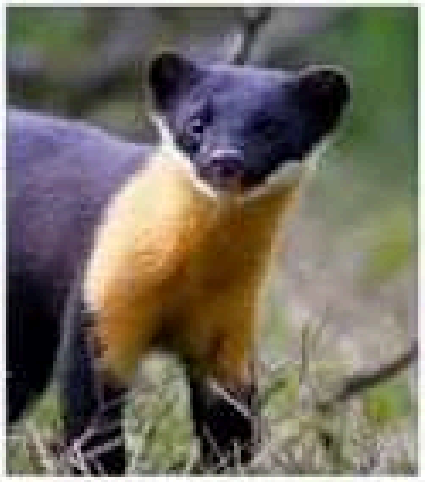
Brown palm civet



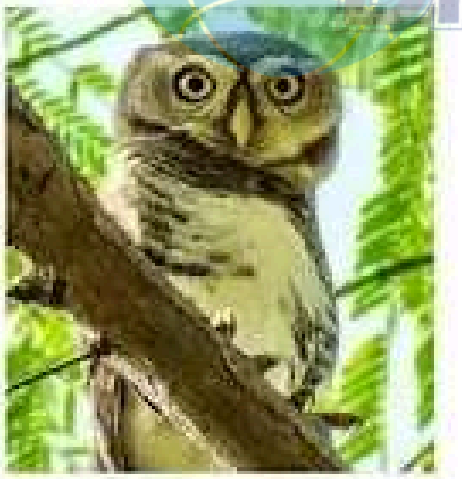
Nilgiri langur

Saara

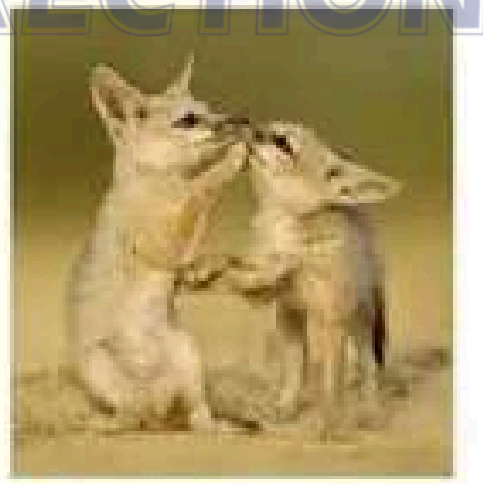
Nilgiri Flycatcher



nilgiri marten



Forest owlet



Bengal fox

Nilgiri wood pigeon

An invasive species is an organism that is not indigenous, or native, to a particular area. Invasive species can cause great economic and environmental harm to the new area.

Not all non-native species are invasive.

To be invasive-

- a species must adapt to the new area easily.
- It must reproduce quickly.
- It must harm property, the economy, or the native plants and animals of the region.

Invasive animals

African catfish : Introduced for aquaculture, it has spread to many river systems and lakes, threatening native fish populations.

Red-eared slider: This North American turtle is popular as a pet but is often abandoned in local water bodies, where it outcompetes native freshwater species for food and habitat.

Invasive plants

- **Lantana camara:** Introduced as an ornamental plant, it now clogs forests and protected areas.
- **Water hyacinth** (\(Eichhorniacrassipes\)): Originally introduced in the early 1900s, it forms dense mats on water bodies, disrupting aquatic ecosystems.
- **Parthenium hysterophorus:** Also known as Congress grass, this weed spreads quickly in disturbed land and agricultural fields, potentially causing health issues and reducing crop yields.
- **Prosopis juliflora:** Also called the kiker tree, it was introduced for afforestation and now dominates arid regions, degrading native ecosystems.
- **Chromolaena odorata:** Commonly known as Siam weed, it can outcompete native vegetation.

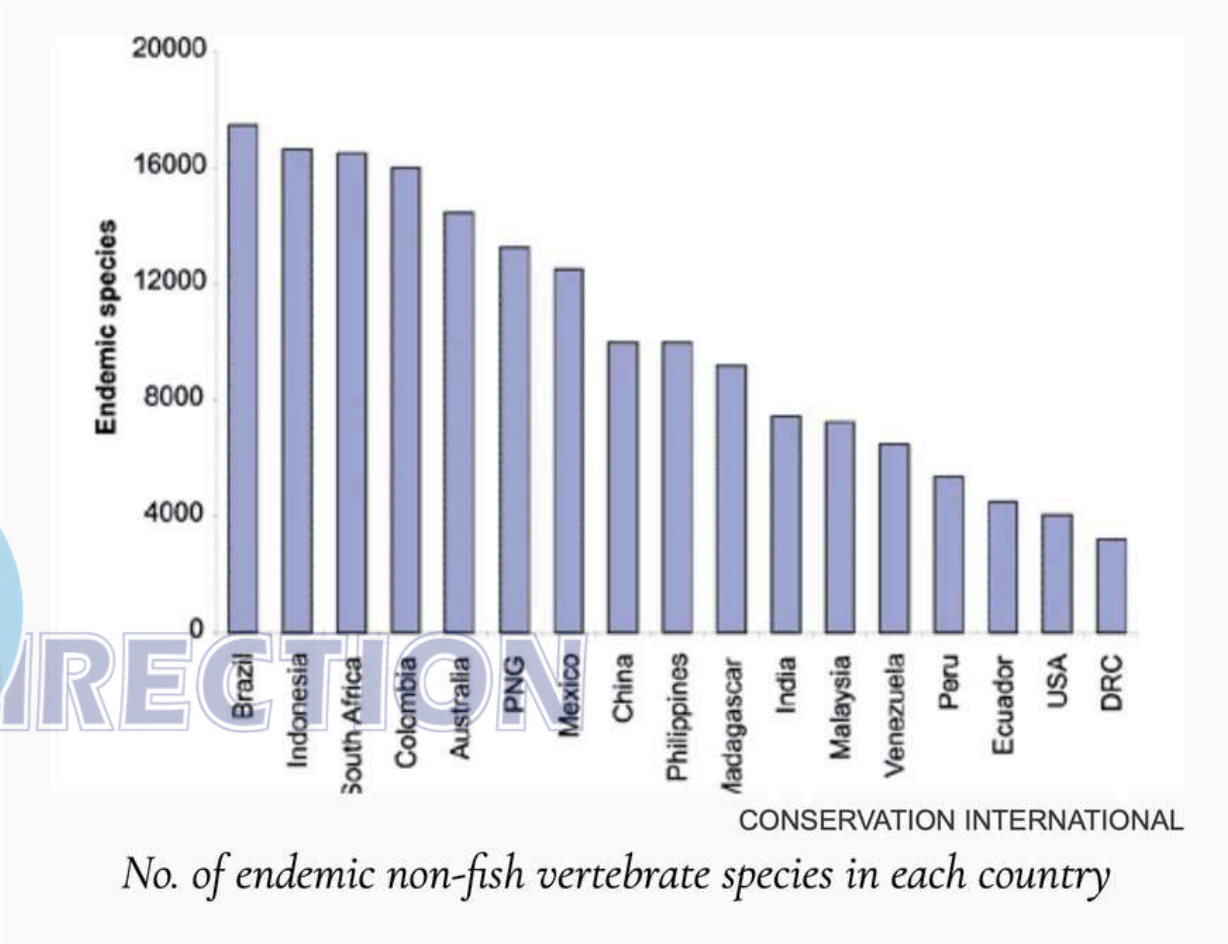
A flagship species/ Umbrella species is an organism, often charismatic or iconic, chosen to represent and raise public attention and support for conservation efforts, habitat preservation, and broader environmental causes.

Examples include the Giant Panda, a symbol for conservation in China
India's main flagship species include the Bengal tiger, Indian elephant, and one-horned rhinoceros, which represent major conservation efforts like Project Tiger and Project Elephant.
Other key flagship species include the snow leopard, Asiatic lion, and Ganges river dolphin.

What is megadiversity

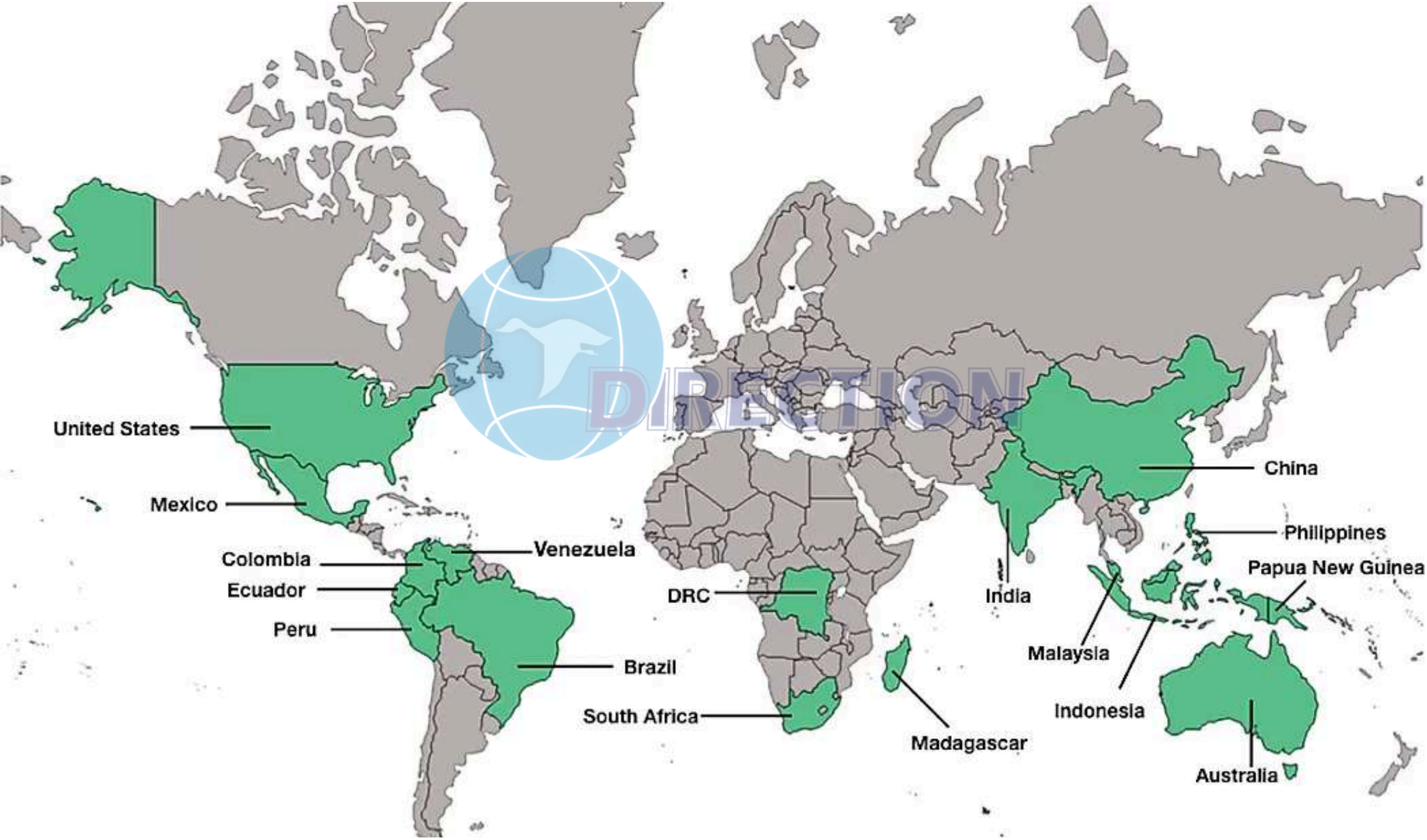
The identification of "megadiverse" countries comes from organizations like the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and Conservation International. It's a term for a country or region with a high level of biodiversity or different species, including a significant percentage of endemic species.

To be classified as megadiverse, a nation must have at least 5,000 plants that occur naturally only within its borders, as well as a marine ecosystem.



No. of endemic non-fish vertebrate species in each country

The 17 megadiverse countries comprise approximately 70% of the world's biodiversity and have their own organization, the Like-Minded Megadiverse Countries.

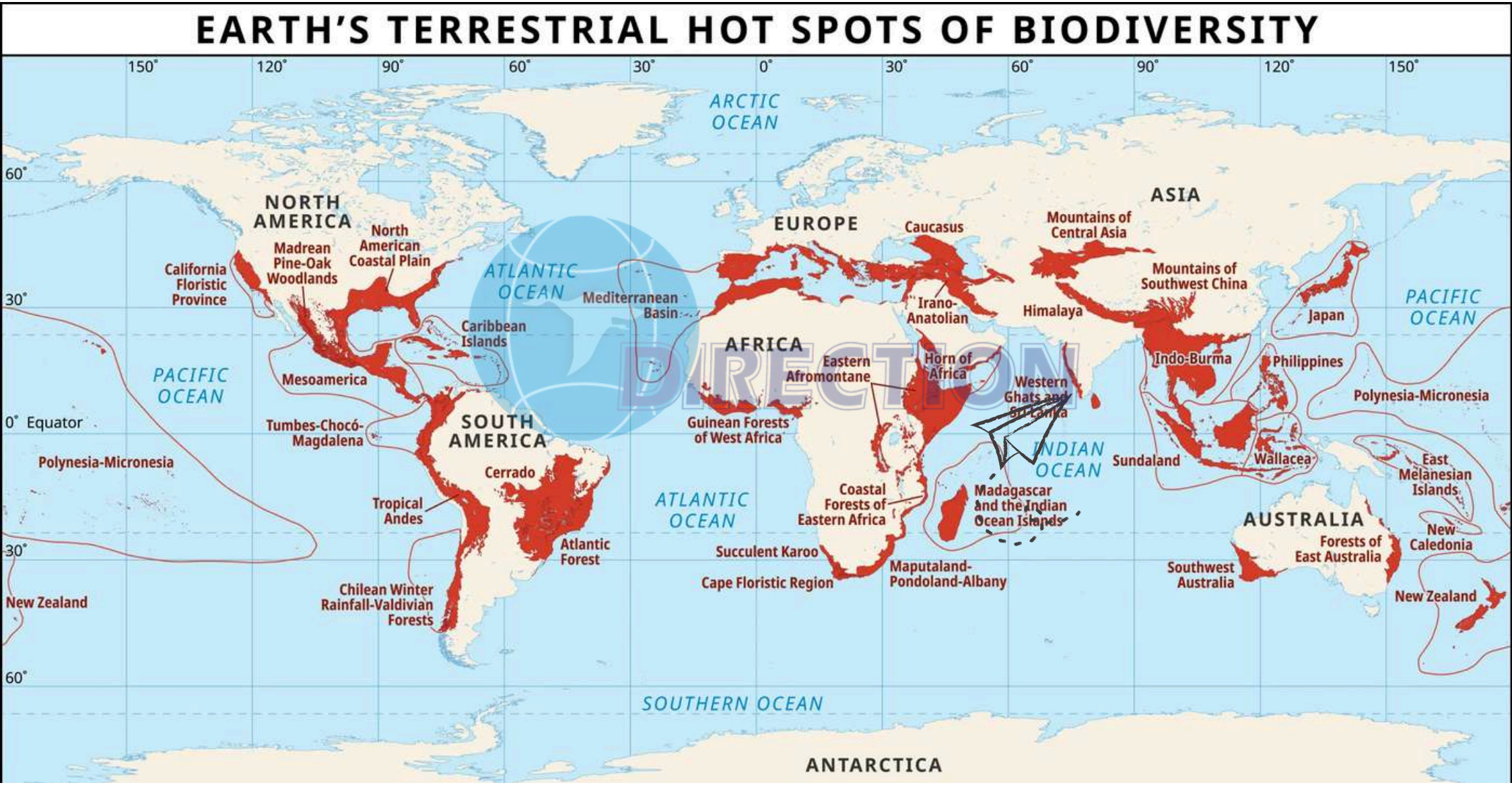

United States
Mexico
Colombia
Ecuador
Peru
Venezuela
Brazil
DRC
South Africa
Madagascar
India
China
Philippines
Papua New Guinea
Malaysia
Indonesia
Australia

To qualify as a **biodiversity hotspot,** a region must meet two strict criteria:

- It must have at least 1,500 vascular plants as endemics — which is to say, it must have a high percentage of plant life found nowhere else on the planet. A hotspot, in other words, is irreplaceable.
- It must have 30% or less of its original natural vegetation. In other words, it must be threatened.

Around the world, 36 areas qualify as hotspots. Their intact habitats represent just 2.5% of Earth's land surface, but they support more than half of the world's plant species as endemics — i.e., species found no place else — and nearly 43% of bird, mammal, reptile and amphibian species as endemics.

EARTH'S TERRESTRIAL HOT SPOTS OF BIODIVERSITY



The Himalaya is a global biodiversity hotspot covering parts of Nepal, Bhutan, China, and India's Northeast, renowned for its incredible plant and animal diversity, especially endemic species. This region features extreme elevation changes, creating diverse ecosystems from subtropical forests to alpine meadows and is home to threatened species like tigers, snow leopards, and the **Red Panda**.

- Mammals: Home to iconic and endangered species such as Asian Elephants, Tigers, Snow Leopards, and the Red Panda.
- Birds: Includes the vulnerable Great Hornbill and White-bellied Heron.
- Plants: Hosts an estimated 9,000 plant species, with about 3,500 being endemic and holding medicinal properties.

The Western Ghats form a part of Western Ghats-Sri Lanka global biodiversity hotspot.

They run parallel to the west coast of India and run across the states of Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala. Locally they are also known as the Sahyadris.

They harbour 7388 species of flowering plants. Out of these 7388 species, 5584 species are indigenous.

Out of the 5584 indigenous species of plants, 2242 species are endemic to India and 1261 are endemic to the Western Ghats endemics.

The Western Ghats is also rich among the invertebrate groups.

- About 350 ant species, 20% of which are endemic to this region.
- 330 butterfly species, 11% of which are endemic to this region.
- 174 odonate species that includes dragonflies and damselflies, 40% of which are endemic to this region.
- 269 mollusc species that includes land snails, 76% of which are endemic to this region.
- The fish fauna of the Western Ghats spans around 288 species, 41% of which are endemic to this region.
- The amphibian fauna of this region consists of 220 species, of which 78% are endemic.
- 62% of the 225 described species of reptiles found here, are endemic to this region.

Over 500 species of birds and 120 species of mammals are also known from this region.

- Key species: Home to endangered species like the Nilgiri Tahr and Lion-tailed Macaque.

The Western Ghats region harbours the largest global populations of the Asian elephants and possibly of other mammals such as the tiger, dhole and gaur.

Wild relatives of cultivated plants are also found here, including pepper, cardamom, mango, jackfruit and sandal.

The North-East forms a part of Indo-Burma global biodiversity hotspot.

Some parts of the north-eastern region of India, excluding the Himalayan region, form a part of the Indo-Burma biodiversity hotspot.

- It is centred on the Indo-Chinese Peninsula, and comprises of Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand, Vietnam and parts of Southern China.
- More than 60% of the bird species found in India have been recorded in the North-East.
- It harbours 35 endemic reptilian species including two genera of lizards and two turtle species.
- Out of 341 Indian amphibian species, at least 68 species are known to occur in the North-East. 20 out of the 68 are endemic.
- It is enriched with 13,500 vascular plant species, of which about 7000 (52%) are endemic to North-East.
- 74 out of the 1277 bird species found in Indo-Burma are endemic to North-East.
- 71 of the 430 mammal species in the hotspot are endemic to this region.
- 189 of the 519 non-marine reptile species are endemic to this region.
- 139 of the 323 amphibian species are endemic to the hotspot.
- It also supports a high diversity of freshwater turtles.
- It also accounts for about 10% of the fish fauna in the world. 566 out of the 1262 documented fish fauna species are endemic to this region.

Nicobar Islands are a part of the Sundaland global biodiversity hotspot.

- Mangrove forests are found in these islands.
- 3500 plant species are found in the Andaman and Nicobar group of islands.
- Out of these 3500 species, 422 of floral genera and 648 species are endemic to the Nicobar Island.
- Out of the 120 pteridophyte species of the Andaman and Nicobar Islands, 50% are from Great Nicobar Island alone.
- A total of 110 wild orchids are reported from these islands, of which 19 genera, with 25 species, are endemic.
-

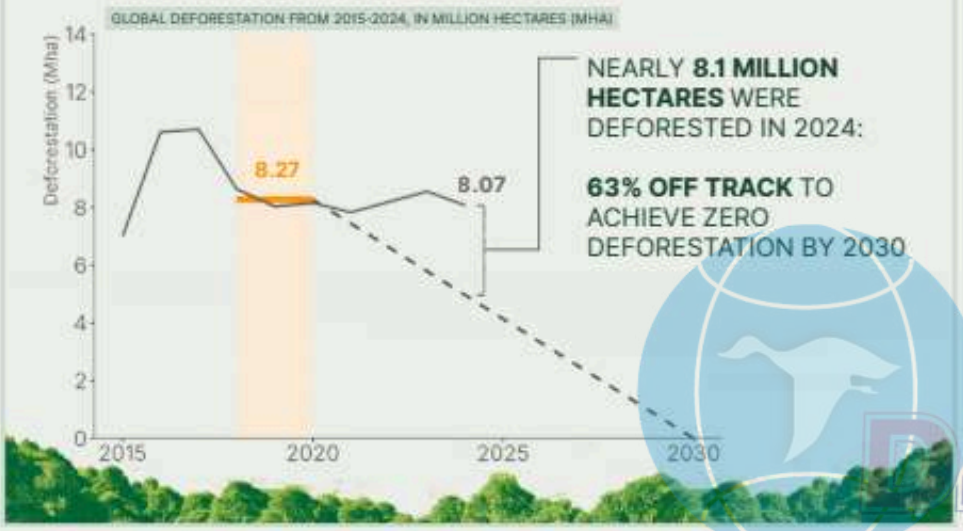
The Malayan box turtle, the Sunbeam snake, the Saltwater crocodile and the Reticulated python are found in the Southern Nicobar group, besides several species of Pit viper in the central Nicobars.

15 reptile species are reported to be endemic to the Nicobars.

Four species of marine turtle, the Leatherback turtle, Hawksbill turtle, Green sea turtle and the Olive ridley turtle feed and nest around the Andaman and Nicobars. The nesting population of Leatherbacks in the Nicobars is one of the last four colonies that exceed 1000 individuals in the Indo-Pacific and hence has global significance.

The Forest Declaration Assessment

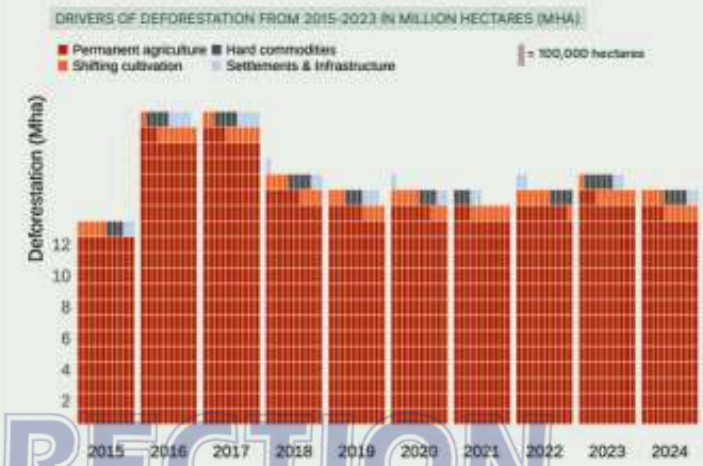
THE WORLD REMAINS OFF TRACK TO ELIMINATE DEFORESTATION BY 2030.



NEARLY **8.1 MILLION HECTARES** WERE DEFORESTED IN 2024:

63% OFF TRACK TO ACHIEVE ZERO DEFORESTATION BY 2030

IN THE PAST DECADE, 86% OF GLOBAL DEFORESTATION HAS BEEN CAUSED BY PERMANENT AGRICULTURE.



Agricultural expansion the dominant direct driver of deforestation worldwide, with mining projected to increase pressures on forest ecosystems.

Corruption, weak law enforcement, land speculation, and market forces - both from domestic and international consumers - form a complex web of indirect drivers that must be addressed.

FIRES IN THE AMAZON EMITTED MORE THAN MANY INDIVIDUAL COUNTRIES IN 2024

8.8 million hectares of tropical moist forests were degraded in 2024. A major driver of this was forest fires in tropical moist forests in the Amazon basin, which emitted:

791 MILLION METRIC TONS OF CO2eq IN 2024

– exceeding the GHG emissions of an industrialized country like Germany.

FORESTED KEY BIODIVERSITY AREAS ARE STILL UNDER THREAT

Protecting forest habitats is crucial for the forest dependent species and making progress toward global biodiversity targets.

47% INCREASE IN FOREST LOSS IN fKBAs FROM 2023-2024

FOREST RESTORATION EFFORTS PROGRESS, BUT MONITORING REMAINS A CHALLENGE

An estimated 10.6 million hectares of global restoration activities (as of Sept. 2025) represents a small fraction of the global restoration potential. Fragmented data hinders complete estimates.

AREA COVERED BY RESTORATION PROJECTS TARGETING DEFORESTED LAND & DEGRADED FORESTS, VIA RESTOR & BRRO

The Forest Declaration Assessment 2025 finds that:

- **8.1 million hectares of forest were lost in 2024, a level of destruction 63% higher than the trajectory needed to halt deforestation by 2030.**
- **Loss of humid primary tropical forests—the irreplaceable stores of carbon and biodiversity—spiked In 2024, largely due to climate change-induced increase of forest fires.**
- **Forest degradation affected 8.8 million hectares affected in 2024—eroding ecosystem integrity and climate resilience.**
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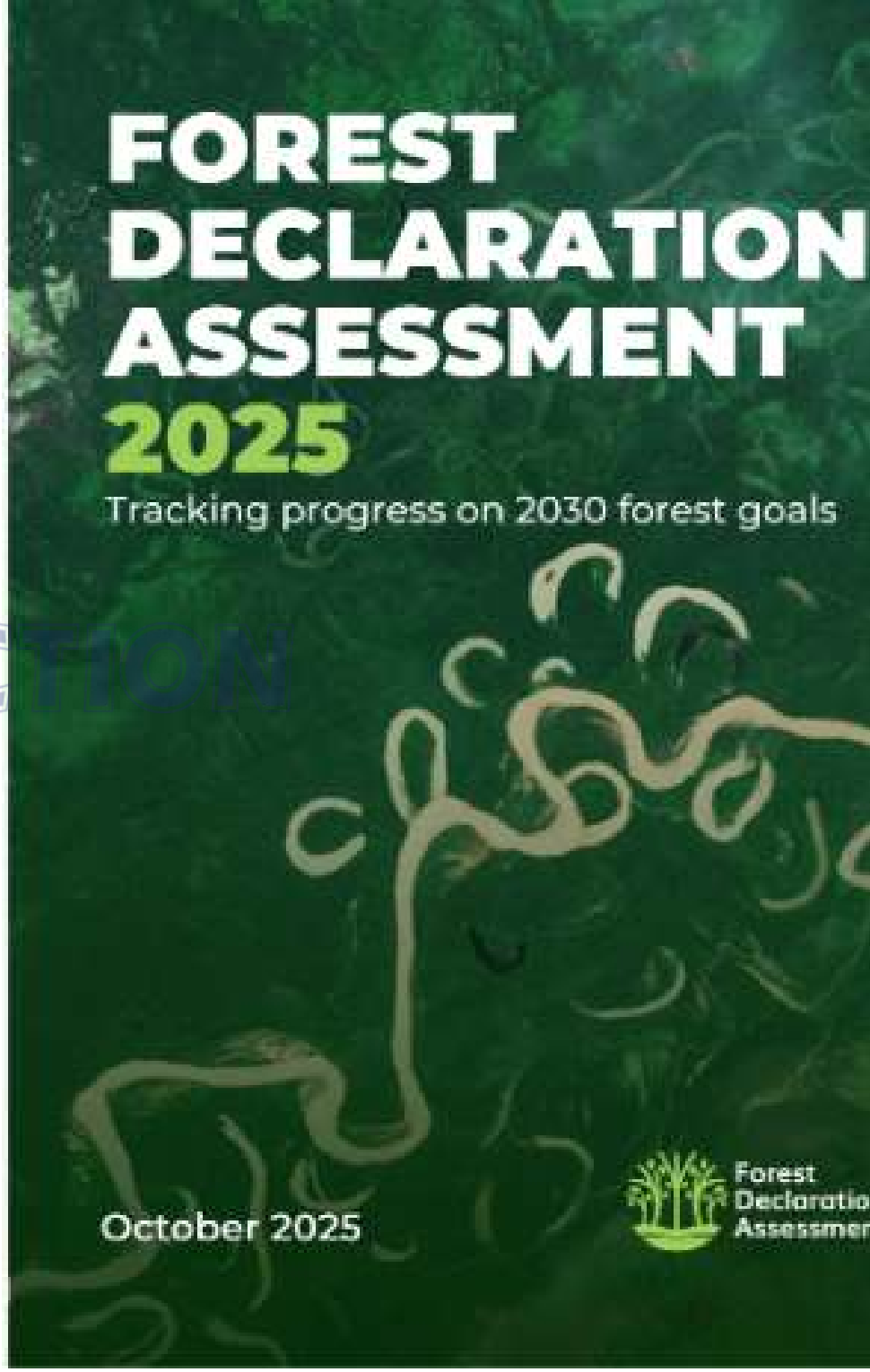


Restoration efforts are expanding, with at least 10.6 million hectares hosting forest restoration projects worldwide. But global data remain too fragmented to determine whether the world is recovering forests at the scale required.

Financial flows are still grossly misaligned with forest goals, with harmful subsidies outweighing green subsidies by over 200:1. Despite new pledges, the flow of funds to forest countries and local actors remains far below what's necessary to deliver on 2030 goals.

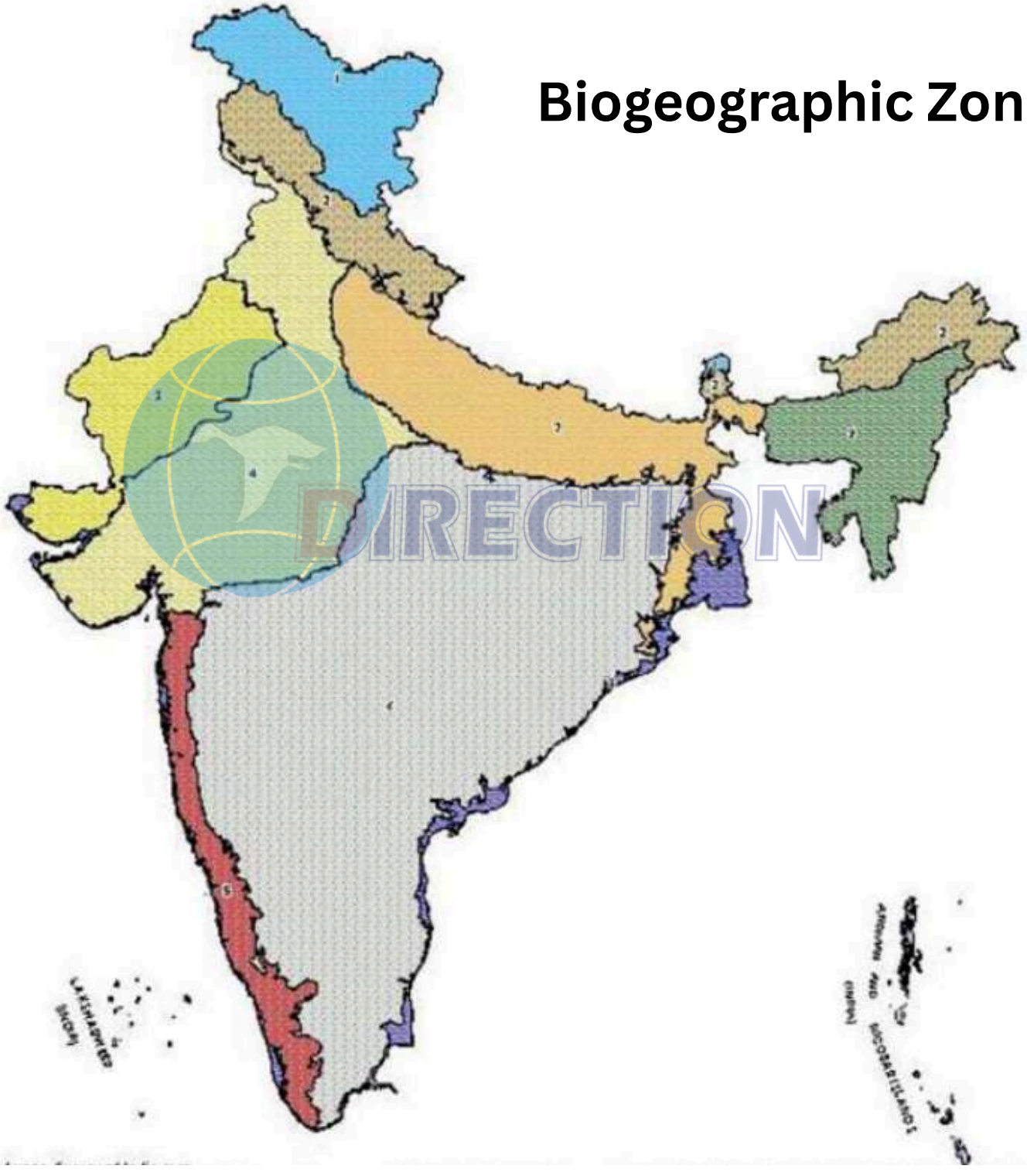
Delivery on corporate and financial sector commitments is lagging, and transparency remains inconsistent.

At the halfway point to 2030, the world should be seeing a steep decline in deforestation. Instead, the global deforestation curve has not begun to bend.

India is considered a megadiverse country because it has a high level of biodiversity, with 8.1% of the world's recorded species despite occupying only 2.4% of the world's land area. This is supported by diverse ecosystems like forests, wetlands, and grasslands, along with various climatic conditions and geographical features.

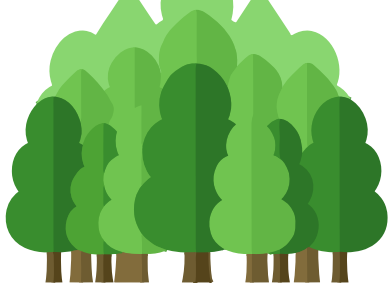
India is home to a significant portion of global species and contains four major biodiversity hotspots: the Himalayas, Western Ghats, North-East, and Nicobar Islands

Biogeographic Zones



- Asiatic Lion: Gir, Gujarat
- Asian Elephant (Indian Elephant): Eastern Arunachal Pradesh, the Plains of Upper Assam, and the foothills of Nagaland
- Bengal Florican: Uttar Pradesh, Assam, and Arunachal Pradesh
- Bengal Tiger: Mangroves of the Sundarbans, West Bengal
- Blackbuck: Maharashtra, Odisha, Punjab, Rajasthan, Haryana, Gujarat, Andhra Pradesh, Tamil Nadu, and Karnataka
- Great Indian Bustard: Rajasthan, Gujarat, and Maharashtra
- Himalayan Monal (Pheasant): Himachal Pradesh, Uttarakhand, Sikkim, and Arunachal Pradesh
- Hoolock Gibbon: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura
- Jerdon's Courser: Eastern Ghats of Andhra Pradesh
- Leopard Cat: Foothills of the Himalayas
- Lion Tailed Macaque: Western Ghats of South India
- Malabar Civet: Western Ghats of South India
- Nilgiri Langur: Nilgiri Hills of the Western Ghats in South India
- Olive Ridley Sea Turtle: Gahirmatha, Odisha
- Pygmy Hog: Assam
- Sarus Crane: Haryana, Rajasthan, Uttar Pradesh, and Madhya Pradesh
  Wild Ass: Rann of Kutchchh, Gujarat

Forest in India



Forest and Tree cover is 8,27,357sq km,

Forests are vital ecosystems that support environmental stability, economic growth, food security, and the well-being of people at all levels. They deliver tangible and non-tangible benefits such as storing carbon, protecting soil and water, regulating climate, and conserving biodiversity while supporting the livelihoods of millions, including Indigenous and forest-dependent communities.

Forests ecosystem and related activities are directly or indirectly linked to Sustainable Development Goals (SDGs), making them central to the global development agenda adopted by 196 countries, including India. International agreements, such as the United Nations Strategic Plan for Forests 2017-2030, highlight the importance of reversing forest loss, restoring degraded forests, and boosting cooperation and resources for long-term sustainability.

India is ranked third in the world for the highest net annual gain in forest area (2010-2020), due to large-scale restoration projects, strong community participation, and progressive agroforestry efforts, demonstrating the country's on-going commitment to forest conservation.

India supports a diverse range of forest types 16 broad groups spanning tropical, sub-tropical, temperate, alpine, and scrubby/evergreen forests found across various regions and climatic zones, reflecting the country's ecological richness and complexity. Forests and tree cover in I**ndia together account for 8.27 lakh sq. km, (25.17%) of the country's geographical area, according to the India State of Forest Report 2023. Forest cover alone is 7.15 lakh sq. km (21.76%), and tree cover is 1.12 lakh sq. km (3.41%). India is a signatory to the United Nations Strategic Plan for Forests 2017-2030**, which sets six Global Forest Goals and 26 voluntary targets, including reversing the loss of forest cover, enhancing forest benefits, expanding sustainable management, mobilizing increased financial resources and strengthening governance and cooperation.

India’s forests are classified into four major groups

Top four states showing maximum increase in forest and tree cover are Chhattisgarh (684 sq km) followed by Uttar Pradesh (559 sq km), Odisha (559 sq km) and Rajasthan (394 sq km).

namely- tropical, sub-tropical, temperate and alpine. These four groups are further classified into 16 type groups . The landscape of Indian forests ranges from Tropical Wet Evergreen Forests in the Andaman & Nicobar Islands, the Western Ghats, and the north-eastern States, to Dry Alpine Scrub high in the Himalayas in the north. The country has Semi-Evergreen Forests, Deciduous Forests, Thorn Forests, and Subtropical Pine Forests in the lower montane zone and Temperate Montane Forests in the higher zones. At the other extreme, tropical dry deciduous and thorn forests predominate in the semi-arid areas of Rajasthan and Gujarat.

According to the FAO's State of the World's Forests 2024 report, India ranked third globally in terms of average annual net gain in forest area between 2010 and 2020. During this period, India recorded an average annual increase of 266,000 hectares of forest area. Only China and Australia reported higher gains. The report also highlighted India's initiatives in restoring degraded lands and promoting agroforestry as key contributors to this positive trend.

Ranking	Country	Forest area	
		1000 ha / yr	Percentage
1	China	1937	0.93
2	Australia	446	0.34
3	India	266	0.38
4	Chile	149	0.85
5	Vietnam	126	0.90
6	Turkey	114	0.53
7	United States of America	108	0.03
8	France	83	0.50
9	Italy	54	0.58
10	Romania	41	0.62

Source: *Global Forest resource assessment, 2020, FAO*

Forest cover classes-

Very Dense Forest (VDF)

All lands with tree canopy density of 70% and above

Moderately Dense Forest (MDF)

All lands with tree canopy density of 40% and more but less than 70%

Open Forest (OF)

All lands with tree canopy density of 10% and more but less than 40%

Scrub

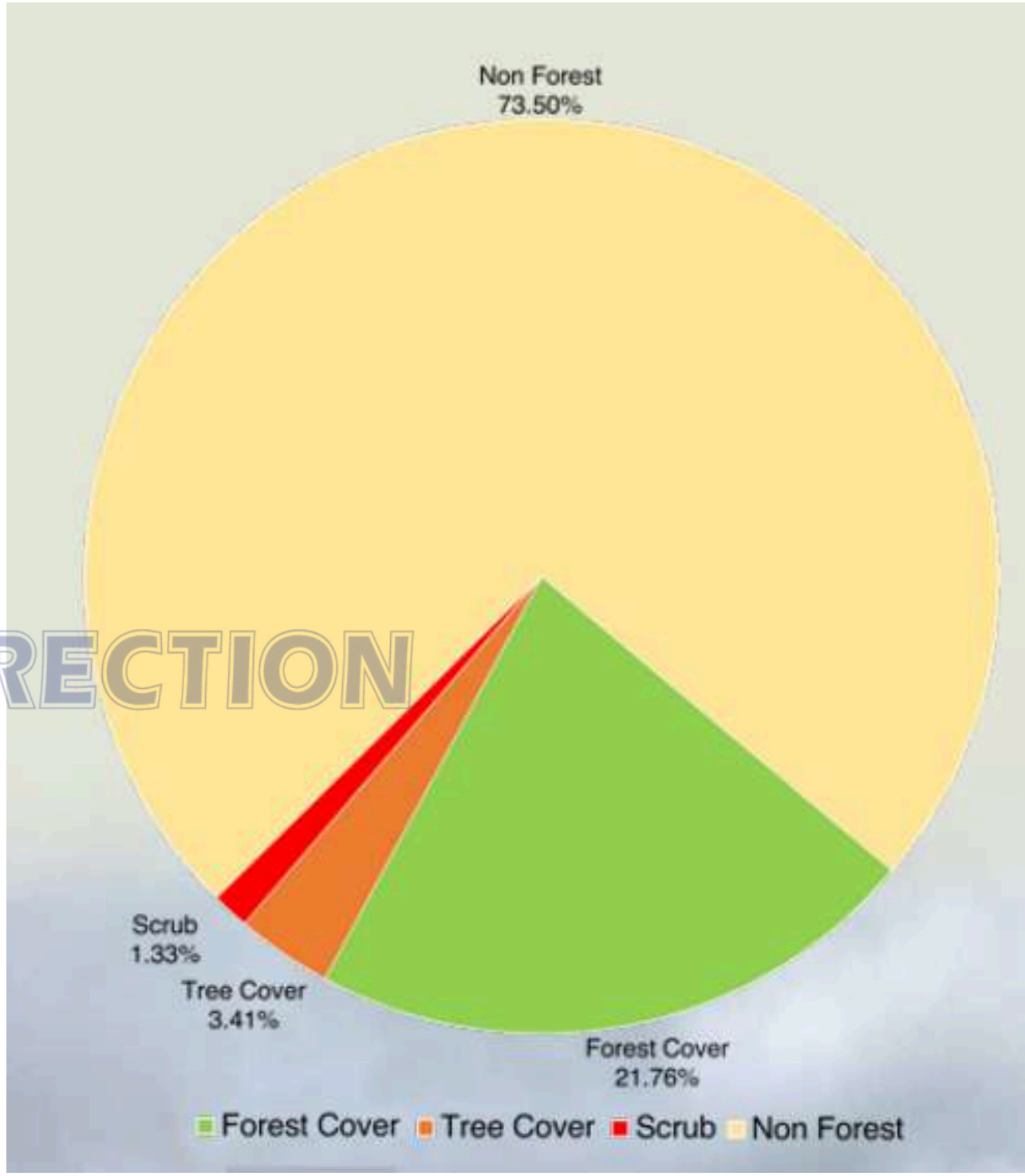
Forest lands with canopy density less than 10%

Non-Forest

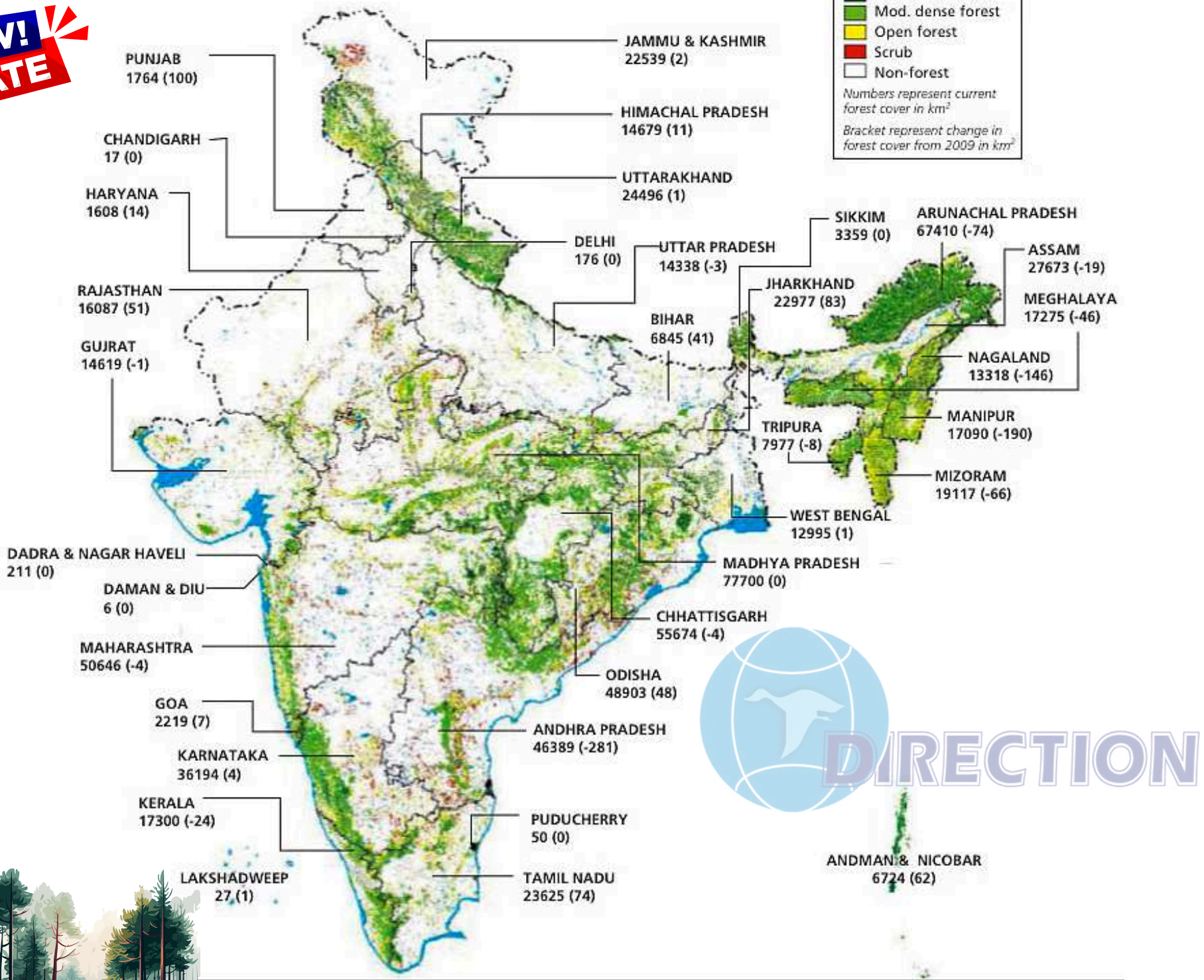
Lands not included in any of the above classes (includes water)

Forest Cover is defined as follows: “All areas with tree cover having canopy density of greater than or equal to 10% and having an area greater or equal to 1 hectare.” It may be situated in recorded forest, or on other Government, private or Institutional lands.

Tree Cover is defined as follows: “Tree Cover includes Woody vegetation Resources in patches and individual trees outside the RFA on blocks of less than one hectare.”



India's forest cover



Regional Distribution of Forest Type as per Champion and Seth (1968) Classification-

S.no	Forest Type Group	General Composition	Regional Occurrence (States of India)
1	Tropical Wet Evergreen Forest (TWEF)	Dense tall forests, entirely evergreen or nearly so	NER excluding Meghalaya , Karnataka, Kerala, Tamil Nadu, Andaman & Nicobar Islands and Goa. Arunachal Pradesh, Assam, Nagaland
2	Tropical Semi-Evergreen Forests (TSEF)	Dominants includes deciduous species but evergreens predominant	Assam, Karnataka, Kerala, Maharashtra, Nagaland, Odisha, Tamil Nadu, Andaman & Nicobar Islands and Goa. Arunachal Pradesh, Bihar, Manipur, Meghalaya, Mizoram, Tripura, Uttar Pradesh, West Bengal
3	Tropical Moist Deciduous Forests (TMDF)	Dominants are mainly deciduous but sub-dominants and lower story largely evergreen top canopy even and dense but 25m high	Andhra Pradesh, NER excluding Arunachal Pradesh & Sikkim, Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu, Uttar Pradesh, West Bengal, Andaman & Nicobar Islands, Goa , Himachal Pradesh, Assam, Chhattisgarh, Jharkhand, Manipur, Meghalaya, Mizoram, Nagaland, Telangana, Tripura, Uttarakhand, Dadar & Nagar Haveli and Daman & diu

4	Littoral and Swamp Forests (L&SF)	Mainly evergreens of varying density and height but always associated predominantly with wetness	Andhra Pradesh, Gujarat, Maharashtra, Odisha, Tamil Nadu, West Bengal and Andaman & Nicobar Islands. Assam, Bihar, Goa, Karnataka, Kerala, Madhya Pradesh, Uttar Pradesh, Uttarakhand, Dadar & Nagar Haveli and Daman & diu, Puducherry
5	Tropical Dry Deciduous Forests (TDDF)	Entirely deciduous or nearly so top canopy uneven rarely over 25 m high	Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Jammu & Kashmir, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal, Chhattisgarh, Delhi, Goa, Jharkhand, Kerala, Telangana, Uttarakhand, Chandigarh, Dadar & Nagar Haveli and Daman & diu
6	Tropical Thorn Forests (TTF)	Deciduous with low thorny trees and xerophytes predominant top canopy more or less broken, less than 10 m high	Andhra Pradesh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh, Delhi, Kerala, Telangana, Dadar & Nagar Haveli and Daman & diu

7	Tropical Dry Evergreen Forests (TDEF)	Hard leaved evergreen trees predominate with some deciduous emergent often dense but usually under 20 m high	Andhra Pradesh and Tamil Nadu
8	Sub-Tropical Broad-Leaved Hill Forests (STBLHF)	Broad-leaved largely evergreen high forests	Assam and Meghalaya Arunachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Mizoram, Nagaland, Sikkim, Tamil Nadu, West Bengal
9	Sub-Tropical Pine Forests (STPF)	Pine associated predominates	Arunachal Pradesh, Haryana, Himachal Pradesh, Jammu & Kashmir, Manipur, Meghalaya, Nagaland, Punjab, Assam, Mizoram, Uttarakhand
10	Sub-Tropical Dry Evergreen Forests (STDEF)	Low xerophytic forest and scrubs	Jammu & Kashmir
11	Montane Wet Temperate Forests (MWTF)	Evergreen without coniferous species	Arunachal Pradesh, Manipur and Nagaland, Kerala, Sikkim, Tamil Nadu, West Bengal

12	Himalayan Moist Temperate Forest (HMTF)	Evergreen forests mainly sclerophyllous oak and coniferous species	Himachal Pradesh. Jammu & Kashmir, Arunachal Pradesh, Manipur, Nagaland, Sikkim, Uttarakhand, west Bengal, Ladakh
13	Himalayan Dry Temperate Forests (HDTF)	Coniferous forests with sparse xerophytic under-growth	Jammu & Kashmir and Himachal Pradesh Arunachal Pradesh, Uttarakhand, Ladakh
14	Sub-Alpine	Stunted deciduous or evergreen forests, usually close formation with or without conifers	Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand, West Bengal, Ladakh
15	Moist Alpine Scrub	Low but often dense scrub of evergreen species	Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand
16	Dry Alpine Scrub	Xerophytic scrub in open formation mostly of deciduous in nature	Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Uttarakhand, Ladakh

India State of Forest Report 2023 (ISFR 2023)

The ISFR is brought out by the Forest Survey of India (FSI) on a biennial basis since 1987.

- FSI carries out in-depth assessment of the forest and tree resources of the country based on interpretation of Remote Sensing satellite data and field based National Forest Inventory (NFI), and the results are published in the ISFR. The India State of Forest Report 2023 is 18th such report in the series.
- As per the present assessment, the total Forest and Tree cover is 8,27,357sq km, which is 25.17 percent of the geographical area of the country. The Forest Cover has an area of about 7,15,343sq km (21.76%) whereas the Tree Cover has an area of 1,12,014 sq km (3.41%)

India State of Forest Report 2023

The total area covered is **8,27,357 sq km**, which constitutes **25.17% of India's geographical area**

This includes **7,15,343 sq km** of forest cover **(21.76%)** and **112,014 sq km** of tree cover **(3.41%)**

Increase of **1,445 sq km** in total forest and tree cover since last assessment in 2021

India State of Forest Report 2023

- Mangrove Cover: **4,992 sq km**
- Bamboo Bearing Area: **1,54,670 sq km** *(an increase of **5,227 sq km** in bamboo area from previous assessment)*
- Carbon Stock in Forests: **7,285.5 million tonnes** *(an increase of **81.5 million tonnes** in carbon stock from previous assessment)*

Top States with Maximum Increase : Chhattisgarh had the highest additional forest area of 684 sq km adding to the list is Uttar Pradesh with 559 sq km Odisha with 559 sq km and Rajasthan with 394 sq km.

- **States with Largest Forest and Tree Cover:** Among the states, Madhya Pradesh has the largest area under forests and trees 85,724 sq km, Arunachal Pradesh(67,083 sq km), Maharashtra (65,383 sq km only).
- **States with Largest Forest Cover:** The highest forest cover in the country is reported by the Madhya Pradesh at 77,073 Sq km, second largest in Arunachal Pradesh at 65,882 Sq km and the third largest in Chhattisgarh at 55,812 sq km.
- **Forest Cover as Percentage of Geographical Area:** Among the states, Lakshadweep has the highest percentage of forest cover with 91.33%, second by Mizoram at 85.34% and third by Andaman & Nicobar Islands at 81.62%.

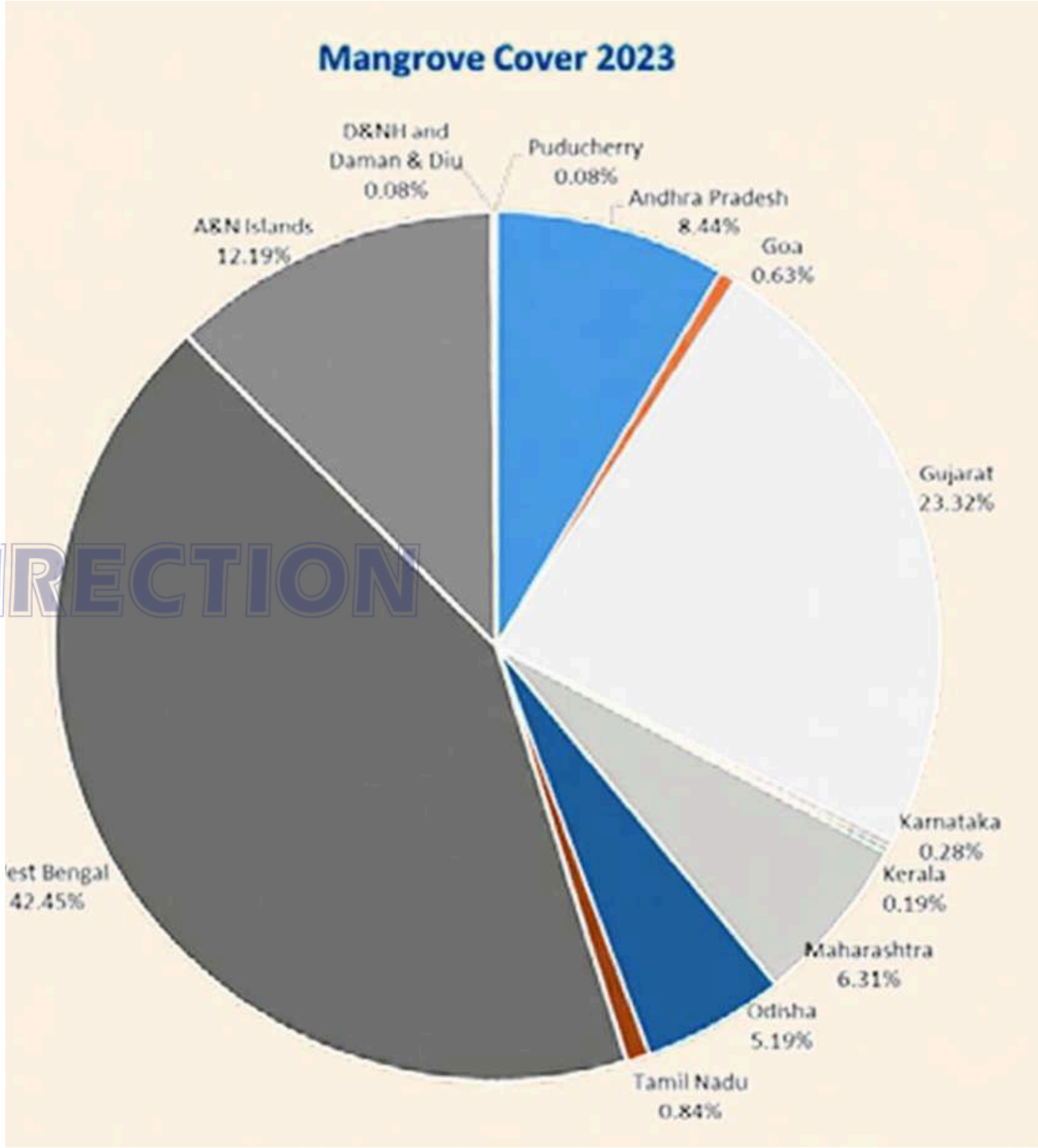
Mangrove Cover: Total Mangrove cover in India: 4,991.68 sq km or 0.15% of the geographical size of the country.

Breakdown of Mangrove cover: Very Dense Mangroves: 1,463.97km² of the total area with 29.33% of cover.

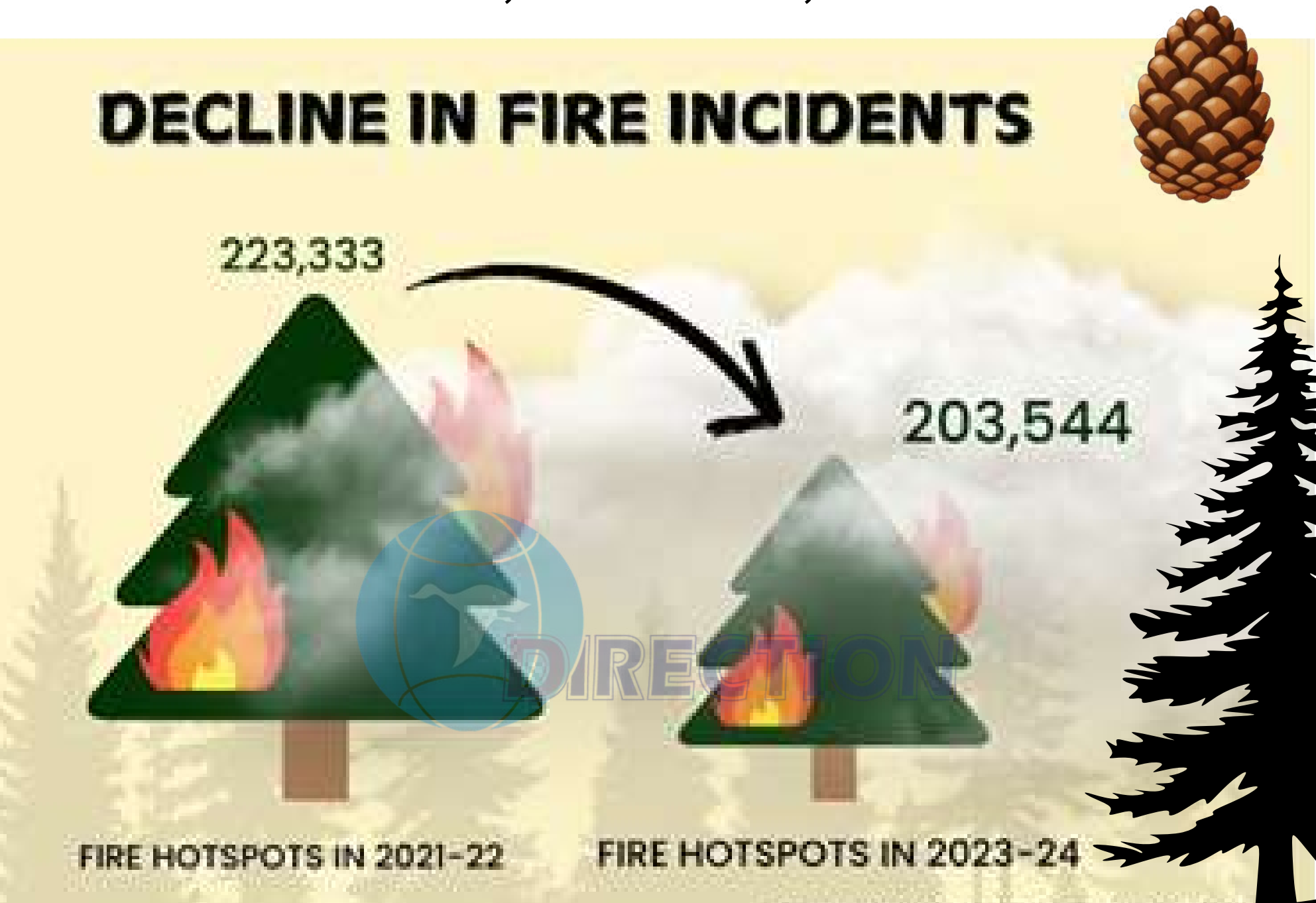
Moderately Dense Mangroves: 1,500.84 km² (30.07%).

Open Mangroves: 2,026.87 km² (40.60%).

Change in Mangrove cover: It is still lower by 7.43 KM² from the total area assessed in 2021.



Fire incidents have also decreased, with 203,544 fire hotspots recorded in 2023-24, down from 223,333 in 2021-22.



Forest and SDGs

Forests are important since they help in maintaining and upgrading the environment quality which is beyond quantification. But with more and more fragmentation in the forests, there is deterioration in the quality of the services provided by the forests. Owing to the importance of the forestry sector, the agreement on the first-ever United Nations Strategic Plan for Forests (2017-2030) was forged at a special session of the UN Forum on Forests in January 2017 and the Plan was adopted by the UN General Assembly on 27 April 2017. The Strategic Plan features a set of six Global Forest Goals and 26 associated targets to be archive by 2030, which are voluntary and universal.

Carbon Stock: The total carbon stocked in the forests is divided into five pools by Good Practice Guidance (GPG) of the Intergovernmental Panel for Climate Change (IPCC). The living portion of biomass carbon is classified as 'above ground biomass (AGB)' and 'below ground biomass (BGB)' and stores significant amount of carbon. The 'dead organic matter (DOM)' is classified as 'dead wood' and 'litter'. The fifth pool is 'soil organic matter' which contains substantial amount of organic carbon.

1. • **Global Forest Goal 1:** Reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation and contribute to the global effort of addressing climate change.

2. • **Global Forest Goal 2:** Enhance forest-based economic, social and environmental benefits, including by improving the livelihoods of forest-dependent people.

3. • **Global Forest Goal 3:** Increase significantly the area of protected forests worldwide and other areas of sustainably managed forests, as well as the proportion of forest products from sustainably managed forests.

4. • **Global Forest Goal 4:** Mobilize significantly increased, new and additional financial resources from all sources for the implementation of sustainable forest management and strengthen scientific and technical cooperation and partnerships.

5. • **Global Forest Goal 5:** Promote governance frameworks to implement sustainable forest management, including through the UN Forest Instrument, and enhance the contribution of forests to the 2030 Agenda.

6. • **Global Forest Goal 6:** Enhance cooperation, coordination, coherence and synergies on forest-related issues at all levels, including within the UN System and across Collaborative Partnership on Forests member organizations, as well as across sectors and relevant stakeholders.

Indicators under Condition account of Forest Ecosystems

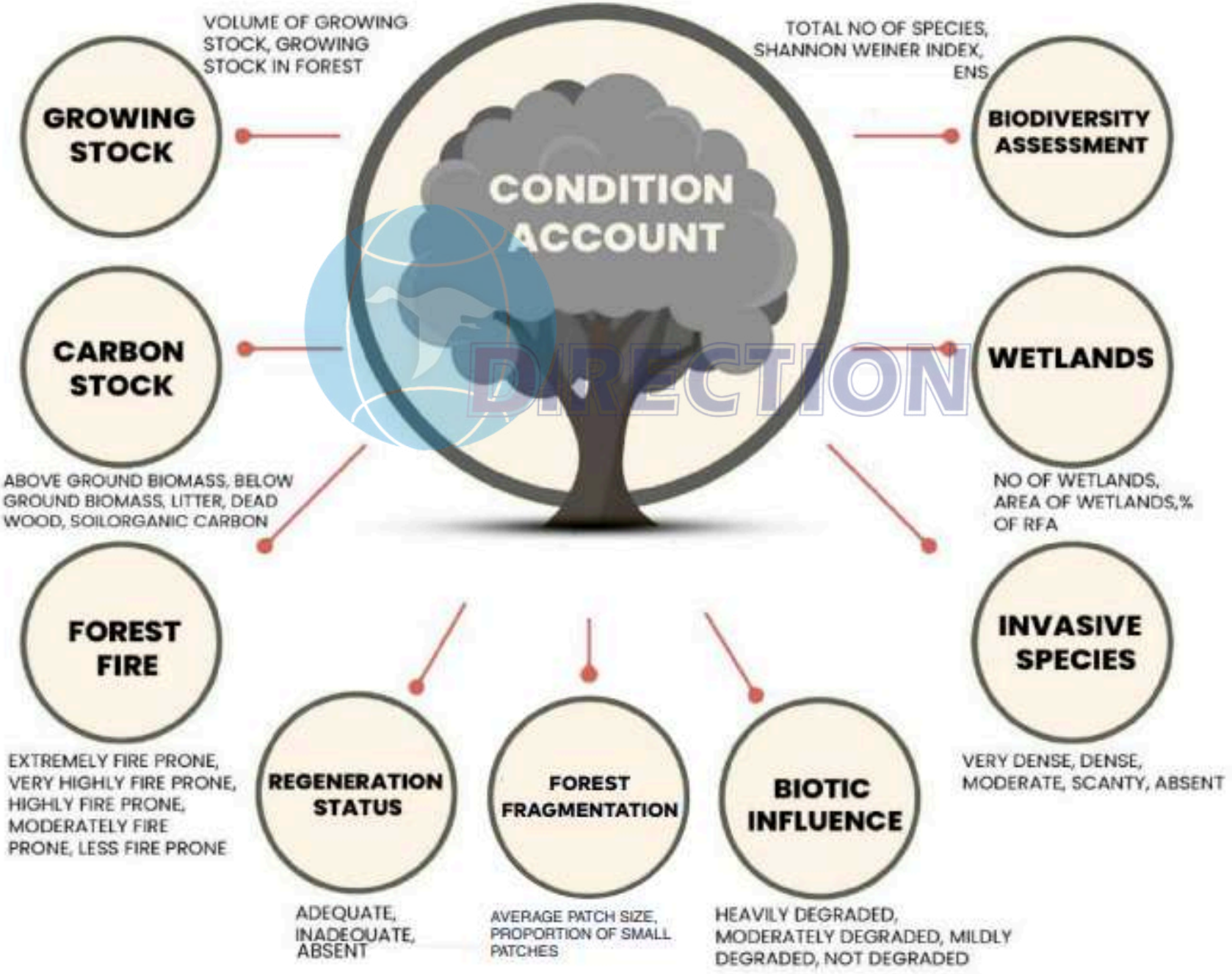


Table ***Classification of carbon stock in forests under different carbon pools***

Pools		Description
Living Biomass	Above ground biomass (AGB)	All living biomass above the soil including stem, stump, branches, bark, seeds and foliage.
	Below ground biomass (BGB)	All living biomass of live roots. Fine roots of less than 2mm diameter (country specific) are often excluded because these often cannot be distinguished empirically from soil organic matter or litter.
Dead Organic Matter	Dead wood	Includes all non-living woody biomass not contained in the litter, either standing or lying on the ground. Dead wood also includes dead roots and stumps larger than or equal to 10cm in diameter or any other diameter used by the country.
	Litter	Includes all non-living biomass with a diameter less than a minimum diameter chosen by the country (for FSI 5 cm), lying dead, in various states of decomposition above the mineral or organic soil.
Soil	Soil organic matter	Includes organic carbon in mineral and organic soils (including peat) to a specific depth chosen by the country (for FSI 30 cm) and applied consistently through the time series.

India's Integrated Vision for Forests, Food, and Sustainability

National Agroforestry Policy

Agroforestry is a sustainable land-use system that integrates trees and crops to enhance agricultural productivity, improve soil fertility, and provide an additional income source for farmers. Recognizing its potential, the Government of India introduced the National Agroforestry Policy in 2014 to promote tree plantation in farmland.

It is a combination of practicing agriculture and forestry together on same land

What are the components of agroforestry?

There are three main components of agroforestry — crops, trees and livestock.

What are the major agroforestry systems based on the type of component?

Agroforestry systems are classified into three categories based on the types of components: Agrisilviculture (crops + trees), silvopastoral (pasture/livestock + trees); and Agrosilvopastoral (crops + pasture + trees).

What are the major attributes that agroforestry systems should possess?

There are three attributes of agroforestry systems:

Productivity: Production of preferred goods and increasing productivity of land

Sustainability: Conserving the production potential

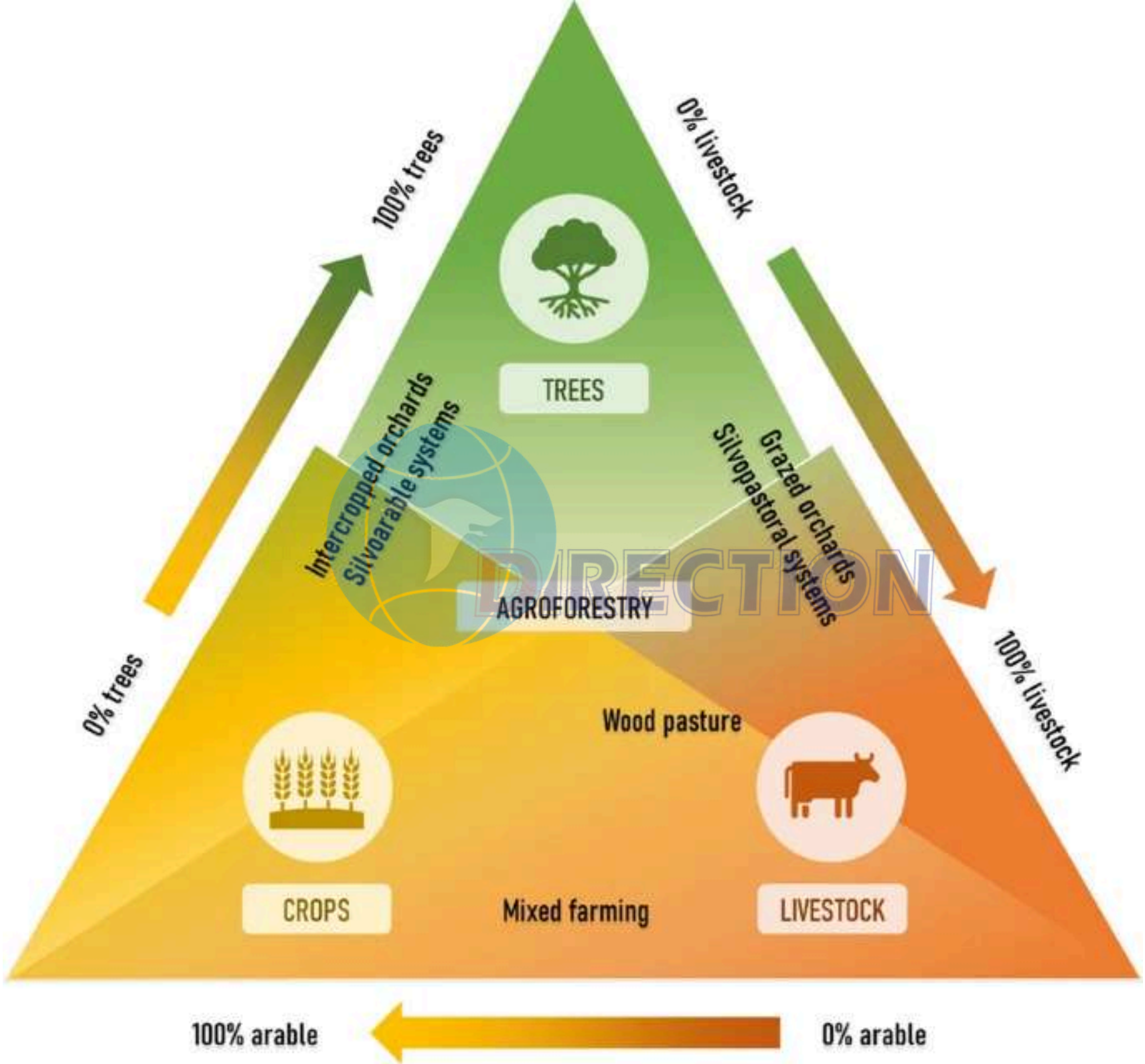
Adoptability: Acceptance of the prescribed practice

What are the trees suitable for rainfed areas?

Neem, Pongamia, Sandalwood and Anjan tree among others

What are the tree crops suited for saline / sodic lands?

Eucalyptus, Casuarina, Pongamia, Neem and Flame of Forest among others


100% trees
0% livestock
TREES
Intercropped orchards
Silvoarable systems
Grazed orchards
Silvopastoral systems
AGROFORESTRY
0% trees
100% livestock
Wood pasture
CROPS
Mixed farming
LIVESTOCK
100% arable
0% arable

Key objectives

- **Enhance farmer livelihoods:**
- **Improve productivity, employment, and income for rural households, especially smallholder farmers, by integrating trees with crops and livestock.**
- **Increase forest/tree cover:**
- **Boost the overall tree cover in the country by promoting plantation on agricultural lands**
- **Promote environmental security:**
- **Protect ecosystems, increase carbon sinks, and make farming systems more resilient to climate change.**
- **Meet industrial demand:**
- **Supply timber and other products to wood-based industries, reducing the need for imports.**
- **Implementation and support**

Sub-Mission on Agroforestry (SMAF):

Launched in 2016-17 under the National Mission for Sustainable Agriculture to promote tree plantations on farmland with the motto "Har Medh Par Ped" (A tree on every bund).

- **Support for quality planting material: The program emphasizes the production and distribution of high-quality seedlings.**
- **Financial incentives: The SMAF scheme provides financial assistance for seedlings, planting, and protection.**
- **Coordination: The policy aims to coordinate efforts among various government departments related to agriculture, forestry, environment, and rural development.**

Green India Mission

The Green India Mission (GIM) also known as National Mission for a Green India, is a key part of India's National Action Plan on Climate Change (NAPCC). It is one of the eight missions under NAPCC. The mission aims to protect, restore, and enhance India’s forest cover while tackling climate change. GIM focuses on improving biodiversity, water resources, and ecosystems like mangroves and wetlands, all while helping absorb carbon. The activities under GIM were started in the FY 2015-16.

Mission Goals:

Expand forest/tree cover by 5 million hectares (mha) and improve the quality of another 5 mha of forest and non-forest land.

Boost ecosystem services like carbon storage, water management, and biodiversity.

Improve livelihoods for 3 million households by increasing income from forest-based activities.

Sub-Missions:

GIM has five sub-missions, each focused on a different aspect of greening:

- Enhancing Forest Cover – Improving Forest quality and ecosystem services.
- Ecosystem Restoration – Reforesting and increasing forest cover.
- Urban Greening – Adding more trees in cities and nearby areas.
- Agro-Forestry & Social Forestry – Boosting biomass and creating carbon sinks.
- Wetland Restoration – Reviving critical wetlands.

National Action Plan on Forest Fire

The primary forest fire prevention and management scheme is a Centrally Sponsored Scheme (CSS) of the Ministry of Environment, Forest and Climate Change (MoEFCC) in India that provides financial and technical assistance to states and Union Territories. It is complemented by the National Action Plan on Forest Fires (2018), which provides a framework for states to develop their own action plans. Key elements include early warning systems, community participation, prevention measures like fire line creation, modern firefighting equipment, and capacity building for staff and communities.

Key components of the scheme

Financial assistance:

The MoEFCC provides funding to states, with a cost-sharing ratio of 90:10 for the Northeast and Western Himalayan regions and 60:40 for other states.

National Action Plan on Forest Fires:

This plan provides a comprehensive strategy, guiding states to create their own plans based on local needs.

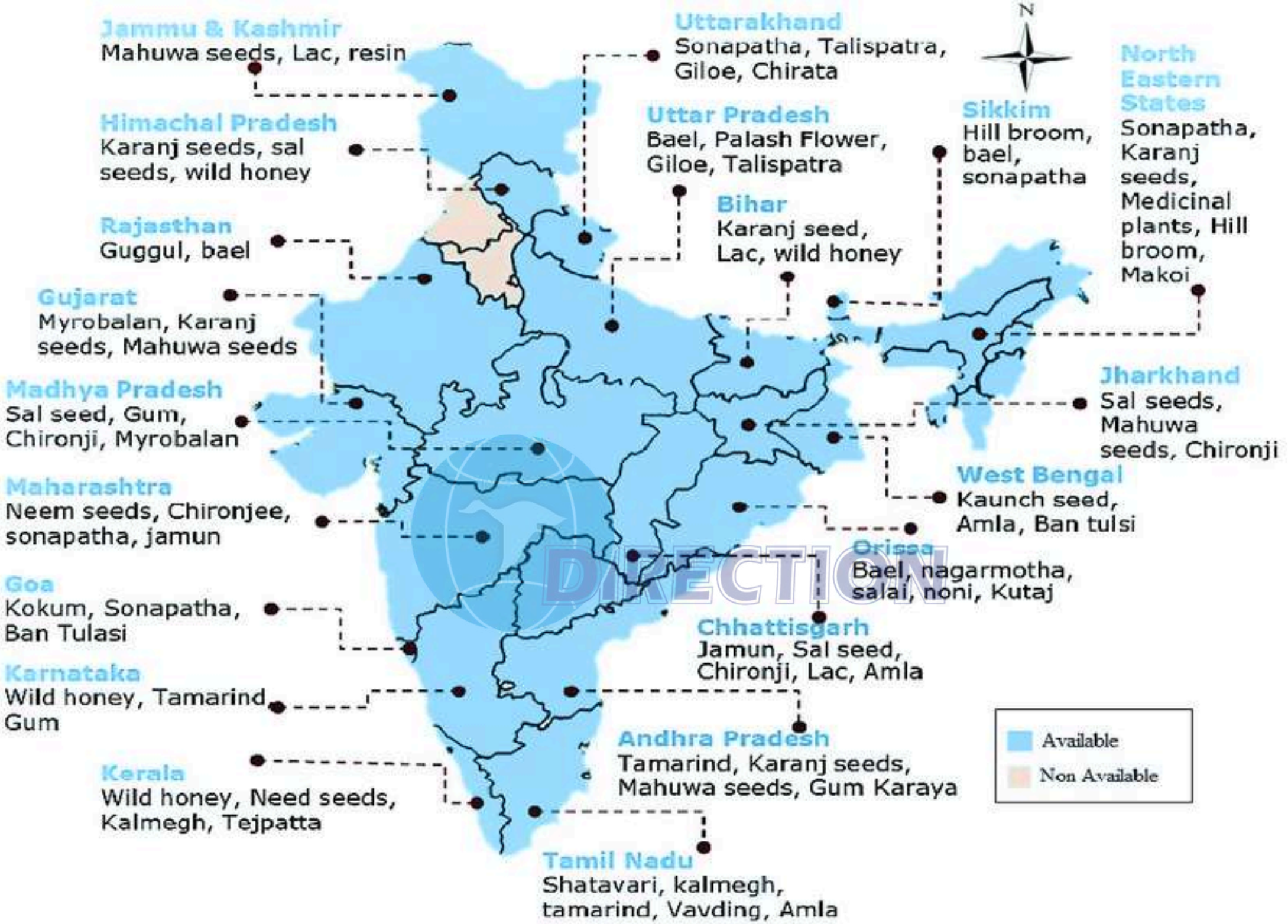
Early warning systems:

The Forest Survey of India (FSI) provides one-week advance and near real-time alerts through a satellite-based system via SMS and email.

Community participation:

The scheme emphasizes involving and empowering forest fringe communities and incentivizing their participation in prevention and control efforts.

Pradhan Mantri Van Dhan Yojana (PMVDY) or Van Dhan Vikas Yojana (VDVY) is a scheme launched by the Ministry of Tribal Affairs, Government of India, with the aim of improving the livelihood of tribal communities in India. The scheme focuses on developing value chains for forest-based products and enhancing the income of tribal communities by providing them with skill training and capacity building. The Van Dhan Vikas Yojana has the potential to transform the lives of tribal communities in India by providing them with alternative livelihood opportunities and improving their socio-economic status. The scheme not only promotes entrepreneurship but also helps in the conservation of forests and the protection of biodiversity.


Jammu & Kashmir
Mahuwa seeds, Lac, resin
Himachal Pradesh
Karanj seeds, sal seeds, wild honey
Rajasthan
Guggul, bael
Gujarat
Myrobalan, Karanj seeds, Mahuwa seeds
Madhya Pradesh
Sal seed, Gum, Chironji, Myrobalan
Maharashtra
Neem seeds, Chironjee, sonapatha, jamun
Goa
Kokum, Sonapatha, Ban Tulasi
Karnataka
Wild honey, Tamarind Gum
Kerala
Wild honey, Need seeds, Kalmegh, Tejpatta
Uttarakhand
Sonapatha, Talispatra, Giloe, Chirata
Uttar Pradesh
Bael, Palash Flower, Giloe, Talispatra
Bihar
Karanj seed, Lac, wild honey
Sikkim
Hill broom, bael, sonapatha
North Eastern States
Sonapatha, Karanj seeds, Medicinal plants, Hill broom, Makoi
Jharkhand
Sal seeds, Mahuwa seeds, Chironji
West Bengal
Kaunch seed, Amla, Ban tulsi
Orissa
Bael, nagarmotha, salai, noni, Kutaj
Chhattisgarh
Jamun, Sal seed, Chironji, Lac, Amla
Andhra Pradesh
Tamarind, Karanj seeds, Mahuwa seeds, Gum Karaya
Tamil Nadu
Shatavari, kalmegh, tamarind, Vavding, Amla
N
Available
Non Available

The scheme, **Nagar Van Yojana (NVY)** has been launched during the year 2020, for creation of Nagar Vans in urban areas, which promotes urban forestry by involving local communities, NGOs, educational institutions, local bodies, etc.

Nagar Van Yojana envisages creating 1000 Nagar Van / Nagar Vatika in Cities having Municipal Corporation/Municipal council/Municipality/Urban Local Bodies (ULBs) for providing wholesome healthy living environment for the residents and thus contributing to growth of clean, green, healthy and sustainable cities. **The salient features of Nagar Van Yojana are:**

- Creating green space and aesthetic environment in an urban set up.
- Creating awareness about plants and biodiversity and developing environment stewardship.
- Facilitating in-situ conservation of important flora of the region.
- Contributing to environmental improvement of cities by pollution mitigation, providing cleaner air, noise reduction, water harvesting and reduction of heat islands effect.
- Extending health benefits to residents of the city and
- Helping cities become climate resilient.

MISHTI (Mangrove Initiative for Shoreline Habitats & Tangible Incomes)

The "Conservation and Management of Mangroves and Coral Reefs" program under **the National Coastal Mission** provides financial and technical assistance to coastal states and union territories for protecting and managing these ecosystems. It involves developing and implementing annual Management Action Plans (MAPs) for activities like survey, demarcation, and restoration, with a 60:40 cost-sharing model between the central and state governments.

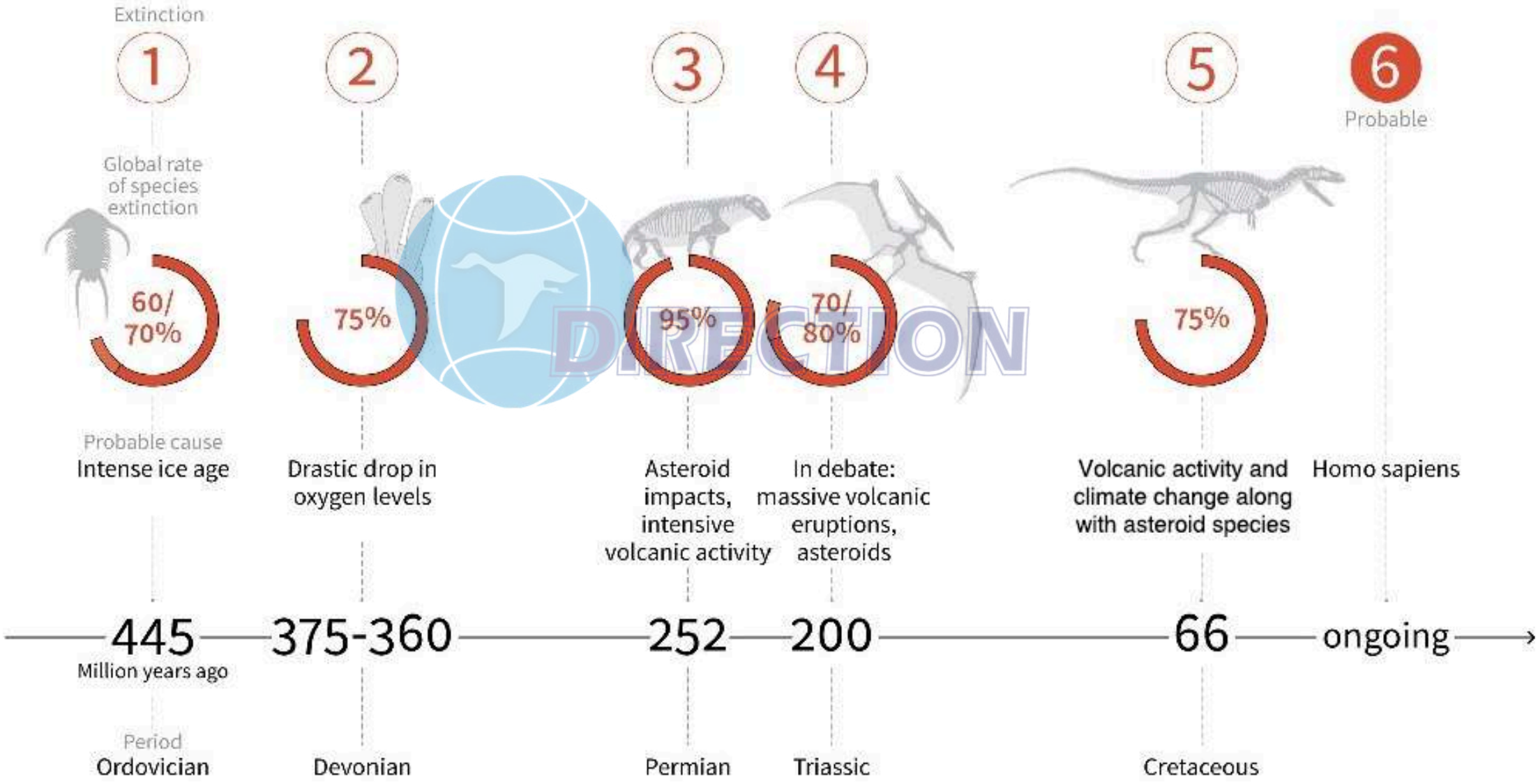
It includes subset - **MISHTI India's main scheme for mangrove restoration**

- Objective: To restore and afforest mangrove forests along India's coast.
- Scope: To restore approximately 540 sq. km of mangroves over a five-year period starting in 2023-24, across nine coastal states and three Union Territories.
- Funding: It is funded through a convergence of schemes, including the National Compensatory Afforestation Fund Management and Planning Authority (CAMPA) and the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS).

Compensatory Afforestation Fund Management and Planning Authority (CAMPA): This scheme compensates for the loss of forest cover and ecosystem services caused by the diversion of forest land for non-forestry purposes, in line with the Van Sanrakshan Evam Samvardhan Adhiniyam, 1980.

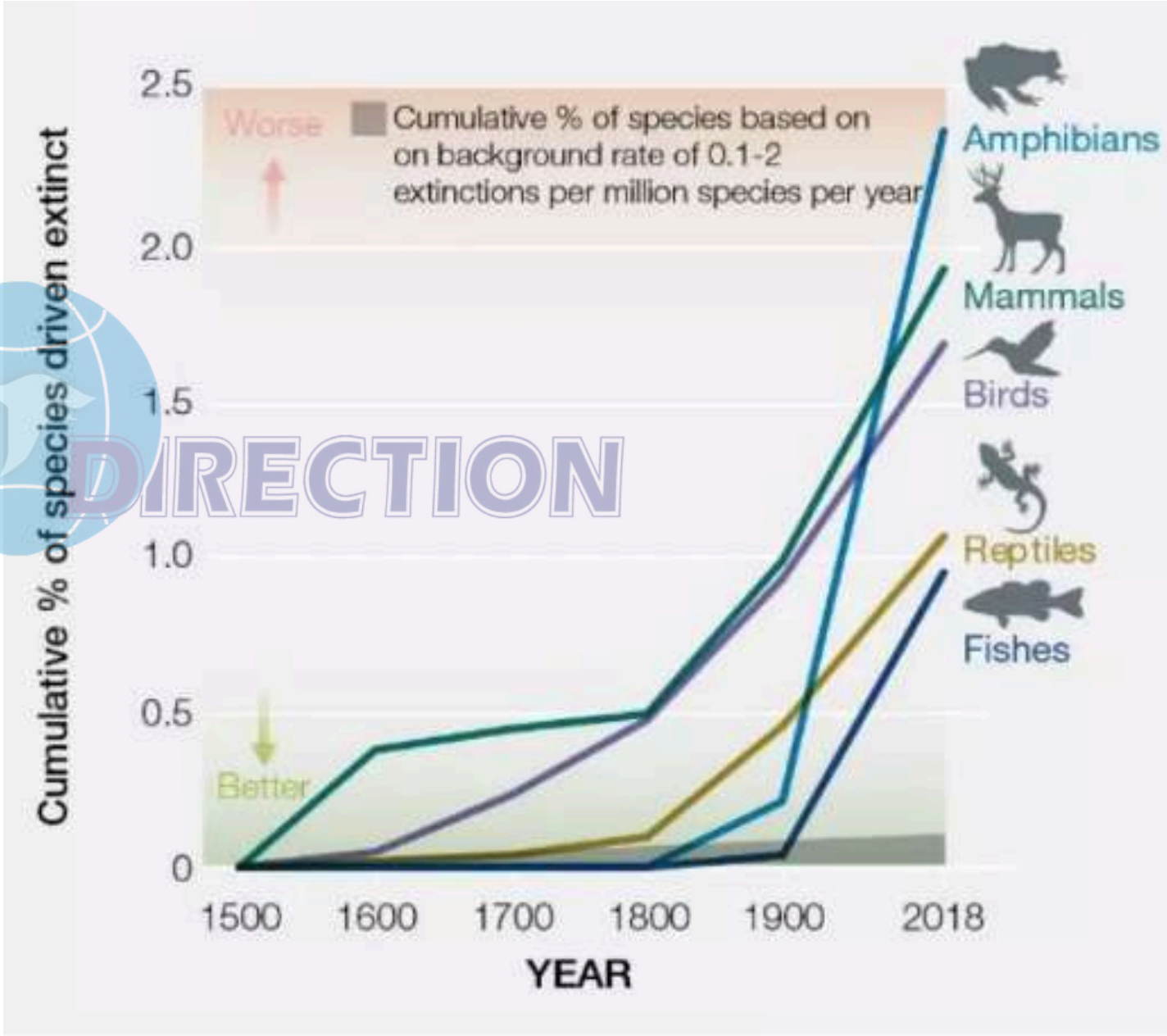
Joint Forest Management and Eco Development Committees: In line with the National Forest Policy of 1988, the Ministry has promoted community involvement through Joint Forest Management Committees (JFMCs) for better forest and wildlife protection, ensuring local participation in management and conservation activities.

Biodiversity Loss



Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

Often described as the 'IPCC for Biodiversity', the IPBES is the independent international body which inform policy on biodiversity and ecosystems. provides decision-makers with the most comprehensive scientific information on nature-related issues.

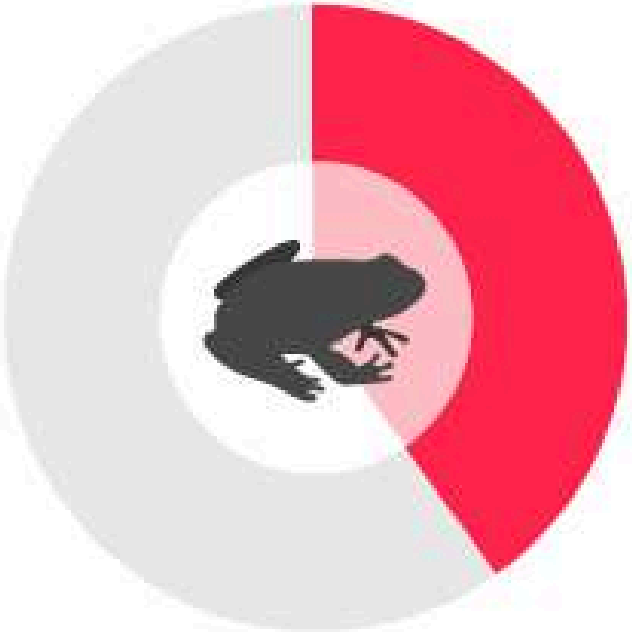


RISKS

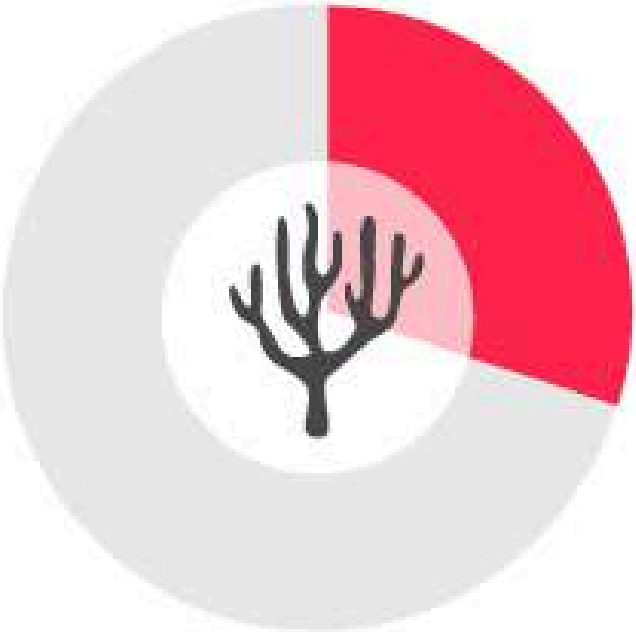
The report lists a number of key global threats, from humans' use of land and sea resources to challenges posed by climate change, pollution and invasive species.

- Loss of the natural world affects human societies.
- Disappearance of insects vital for pollinating food crops.
- Destruction of coral reefs that support fish populations that sustain coastal communities.
- Loss of medicinal plants.
- 40 per cent of the amphibian species are threatened with extinction.
- Almost 33 per cent of reef-forming corals and more than a third of all marine mammals are threatened.
- The average abundance of native species in most major land-based habitats has fallen by at least 20%, mostly since 1900.

RANGE OF RISKS



More than **40%** of
amphibian species



Almost **33%** of
reef-forming corals

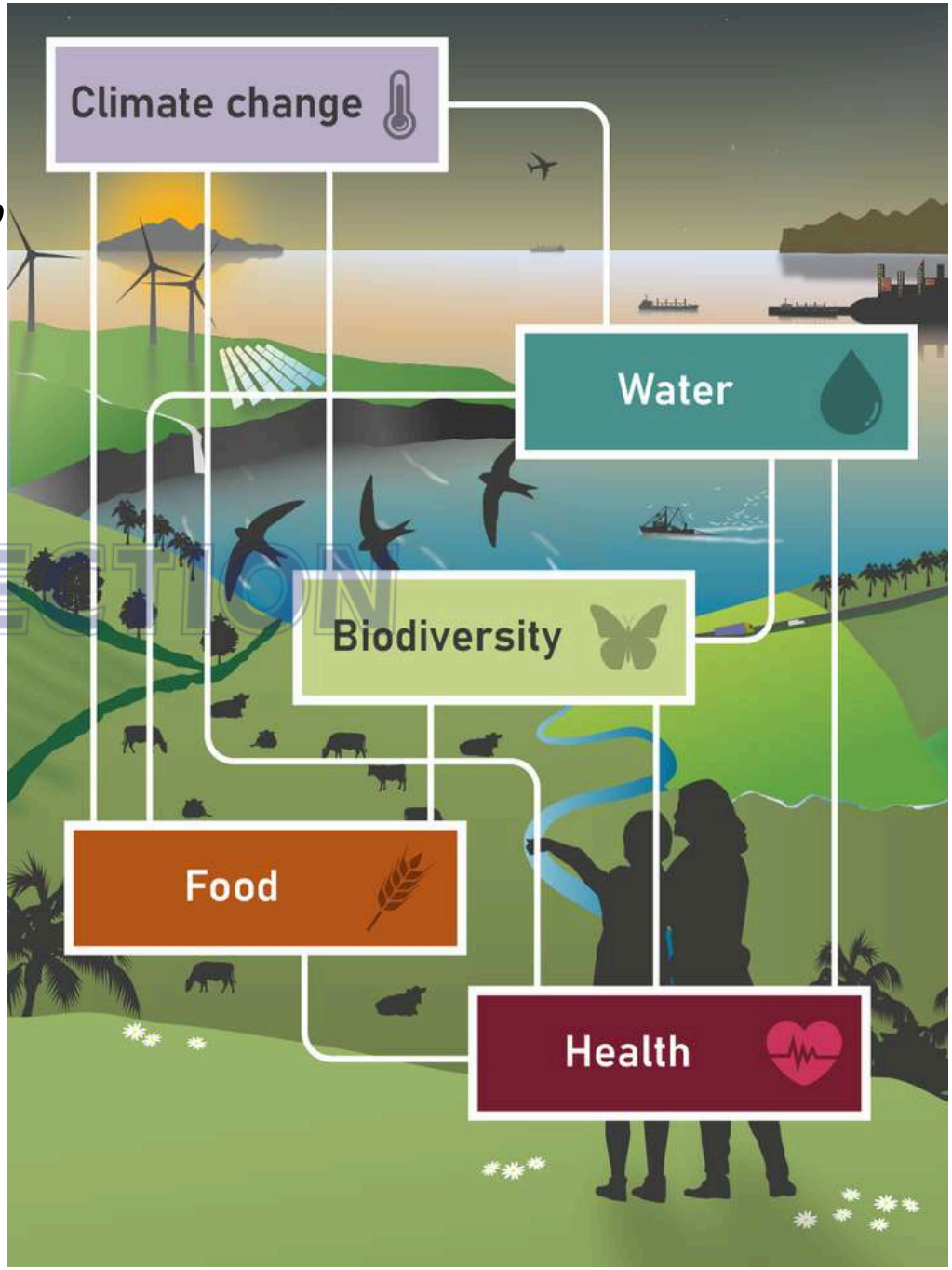
More than a **1/3** of all
marine mammals

REPORT'S NOTABLE FINDINGS

- 75% of land environment and some 66% of the marine environment "have been significantly altered by human actions."
- "More than a third of the world's land surface and nearly 75% of freshwater resources" are used for crops or livestock.
- "Up to $577 billion in annual global crops are at risk from pollinator loss."
- Between 100 million and 300 million people now face "increased risk of floods and hurricanes because of loss of coastal habitats and protection."
- Since 1992, the world's urban areas have more than doubled.
- "Plastic pollution has increased tenfold since 1980," and from "300-400 million tons of heavy metals, solvents, toxic sludge" and other industrial waste are dumped into the world's water systems.

The Nexus Report-2024

Biodiversity loss, water scarcity, food security, human health, and climate change are not isolated issues. They are indivisible, interrelated and interdependent. As they are intricately linked when one falters, the others follow. The IPBES Nexus Assessment is the first comprehensive global assessment that looks at the interlinkages between these crises and identifies solutions



According to IPBES assessments, the five main direct drivers of biodiversity loss are: land/sea-use change, direct exploitation of organisms, climate change, pollution, and invasive alien species. These direct drivers are exacerbated by indirect socioeconomic drivers like population growth, consumption patterns, and economic systems

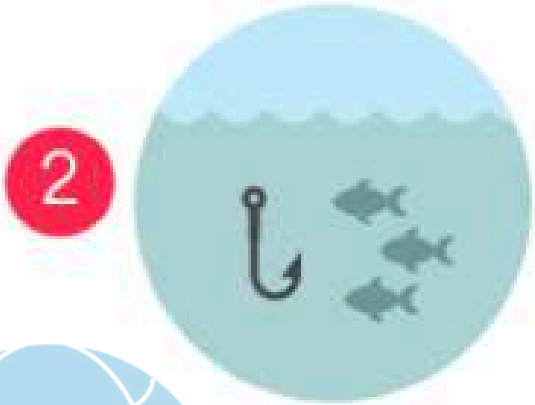
The assessment emphasized that traditional, siloed approaches to these issues are insufficient and often worsen other problems. Integrated actions, on the other hand, can achieve mutually supportive benefits and offer significant cost savings.
Taken together, support the achievement of all 17 SDGs, all 23 targets of the Kunming-Montreal Global Biodiversity Framework and the long-term goals for climate change mitigation and adaptation of the Paris Agreement. Twenty-four of the response options advance more than five SDGs and over five of the Global Biodiversity Framework targets.

Main Causes of Loss

1

Changes in land and sea use

Humans have altered **75%** of land and **66%** of marine environments since pre-industrial times.



2

Direct exploitation of organisms

In 2015, a **third** of marine stocks were being fished at unsustainable levels.

3

Climate change

Global warming has already impacted almost **half** of threatened mammals and **one quarter** of birds.

4

Pollution

Marine plastic pollution has increased tenfold since 1980, with an average **300-400M** tons of waste dumped annually into the world's waters.

5

Invasive alien species

The numbers of invasive alien species per country have risen by about **70%** since 1970.

The more than 70 response options presented in the report, these options are designed to maximize co-benefits across sectors and are organized into 10 broad categories of action.

Ten categories of action

Sustainable production and consumption: Reducing waste, promoting resource efficiency, and shifting to consumption patterns that have a lower environmental impact.
Integrated landscape and seascape management: Coordinated management of ecosystems across different land and sea uses to balance conservation with human needs. This includes restoring carbon-rich ecosystems like forests, soils, and mangroves.
Governance, institutions, and policies: Implementing legal and policy reforms that promote inclusivity and strengthen the links between sectors.

Addressing drivers of change: Tackling the underlying indirect drivers, such as overconsumption and population growth, that intensify biodiversity loss.
Economic and financial reforms: Reforming subsidies that harm nature and exploring new financing mechanisms that support biodiversity-positive activities.
Inclusive decision-making: Actively involving Indigenous Peoples, local communities, and vulnerable groups in developing and implementing solutions.
Nature-based solutions: Protecting, sustainably managing, and restoring natural or modified ecosystems to address societal challenges effectively.
Education and awareness: Promoting learning and raising awareness to shift societal values and behaviors towards sustainability.
Technology and innovation: Utilizing new technologies and traditional knowledge to create and improve sustainable practices.
Monitoring and adaptive management: Continuously monitoring the impacts of response options and adapting strategies based on new information.

The IPBES Transformative Change Assessment-2024

The IPBES Transformative Change Assessment identifies five key actions for achieving fundamental, system-wide shifts to address the drivers of biodiversity loss. These are: conserving and regenerating nature, driving systemic change in major sectors, transforming economic systems, improving governance systems, and shifting societal values.

Key actions for transformative change

- **Conserve, restore, and regenerate nature: This includes protecting and restoring places that are valuable to both nature and people, using approaches based on stewardship.**
- **Drive systemic change in key sectors: Focus on sectors most responsible for biodiversity loss, such as agriculture, fisheries, forestry, and fossil fuels, by changing their practices and operations.**
- **Transform economic systems: Shift away from current economic models to ones that prioritize both nature and social equity.**
- **Transform governance systems: Make governance systems more inclusive, accountable, and adaptive by involving a diverse range of stakeholders in decision-making.**
- **Shift views and values: Move toward a societal recognition of the deep inter connected ness between humans and nature, and prioritize this relationship.**

Living Planet Report 2024

Every two years WWF, in collaboration with the Zoological Society of London (ZSL), publishes an updated Living Planet Report.

The WWF's 2024 Living Planet Report found a 73% average decline in monitored wildlife populations between 1970 and 2020, with the steepest declines in Latin America and the Caribbean (95%), Africa (76%), and Asia-Pacific (60%). The report highlights habitat loss, degradation, and overexploitation as the primary threats, and warns that the planet is nearing dangerous tipping points for ecosystems like tropical forests and coral reefs

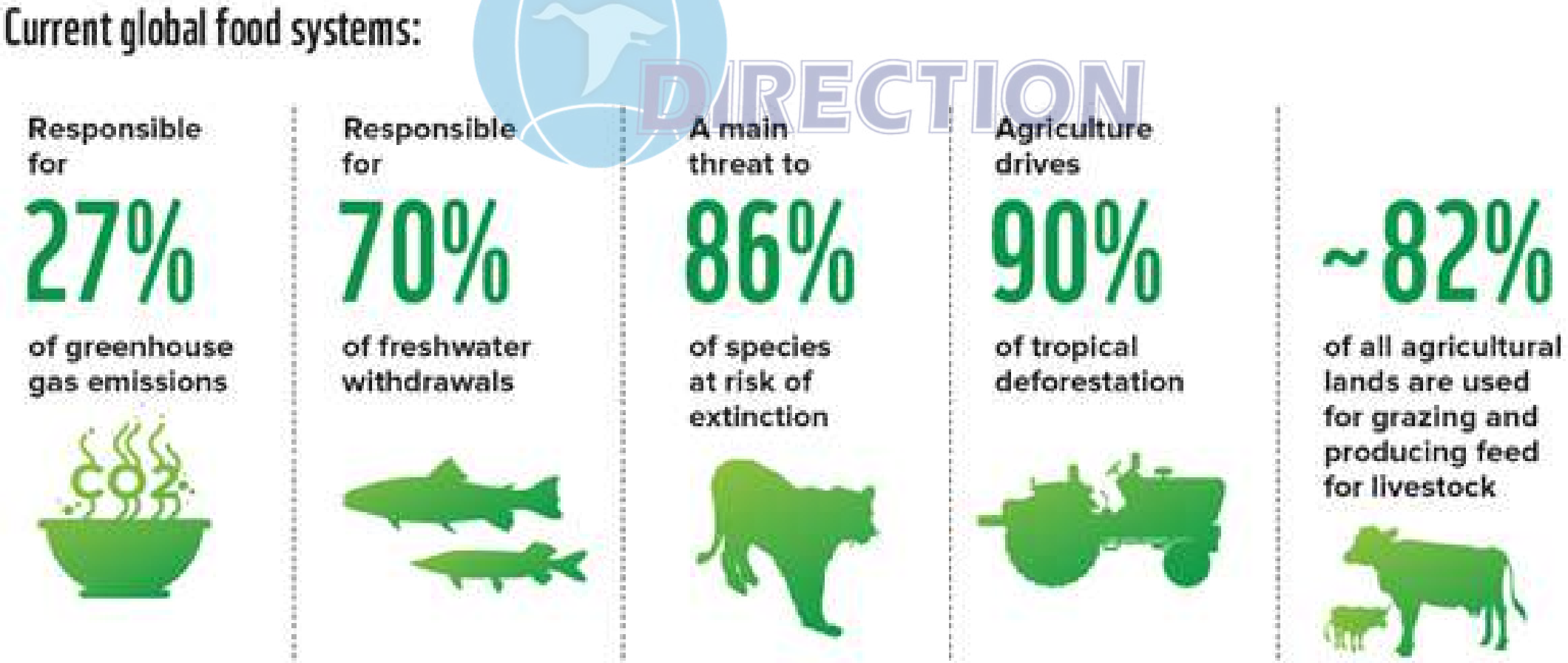
Key findings

- **Global decline: The average size of monitored vertebrate populations has dropped by 73% since 1970.**
- **Freshwater species hit hardest: Freshwater species experienced an 85% decline, followed by terrestrial (69%) and marine populations (56%).**
- **Regional disparities: Latin America and the Caribbean saw a 95% decline, while Africa had a 76% drop and Asia-Pacific experienced a 60% decline. North America and Europe saw lower but still significant declines of 39% and 35%, respectively.**
- **Primary threats: Habitat loss and degradation, driven mainly by the food system, are the most reported threats worldwide. Other major threats include overexploitation, invasive species, disease, and climate change.**
- **Tipping points: The report warns that ecosystems like tropical forests and coral reefs are approaching critical tipping points that could have irreversible and catastrophic consequences.**

UNSUSTAINABLE FOOD SYSTEMS

Experts identify food production as one of the main drivers of nature decline. It's the leading cause of habitat loss – with forests, wetlands, and other biodiversity hotspots cleared for agriculture.

Humans use over 40% of habitable land for food production. Crop production accounts for 70% of freshwater use. And the entire food sector is responsible for over a quarter of greenhouse gas emissions.

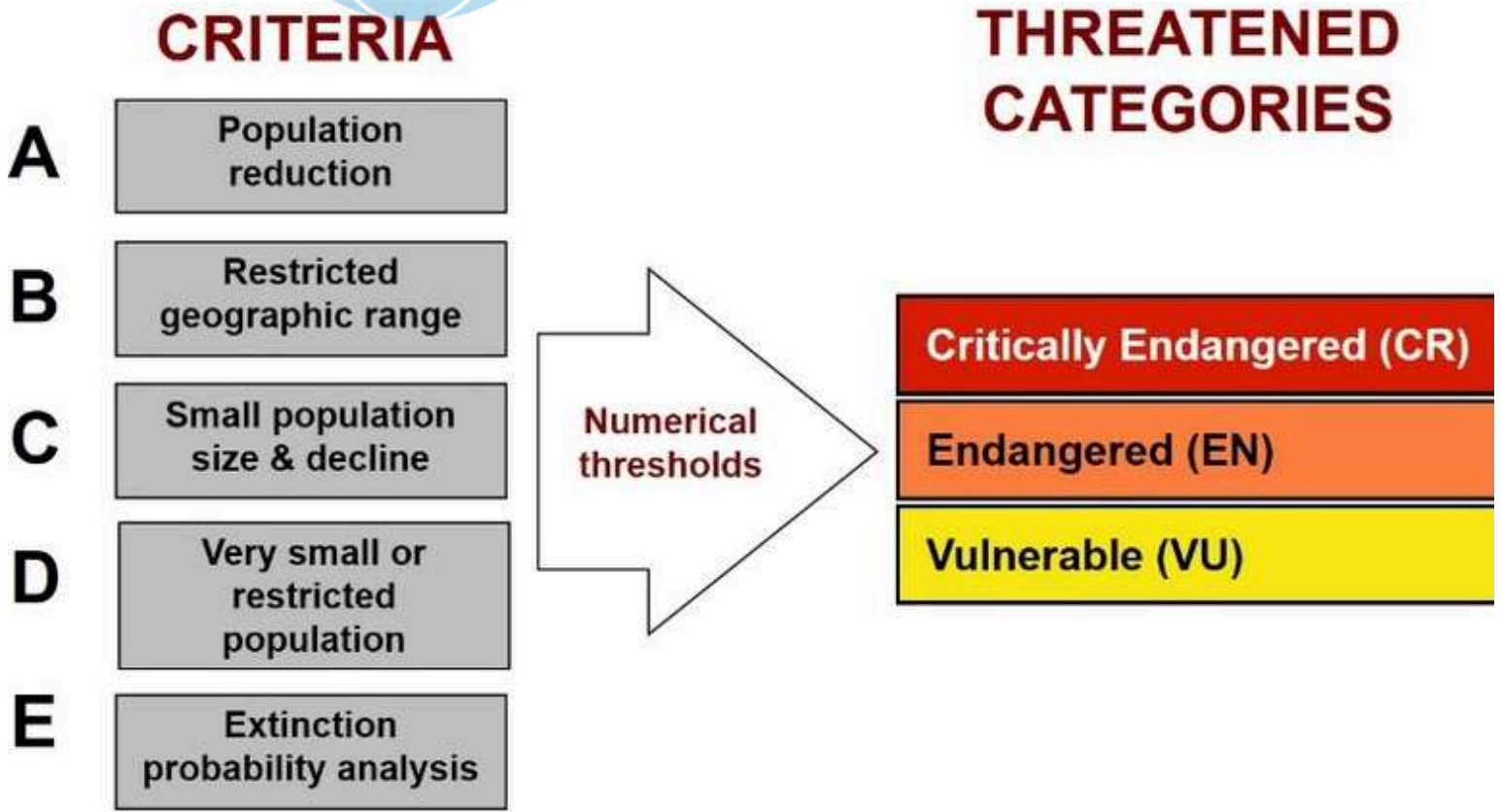


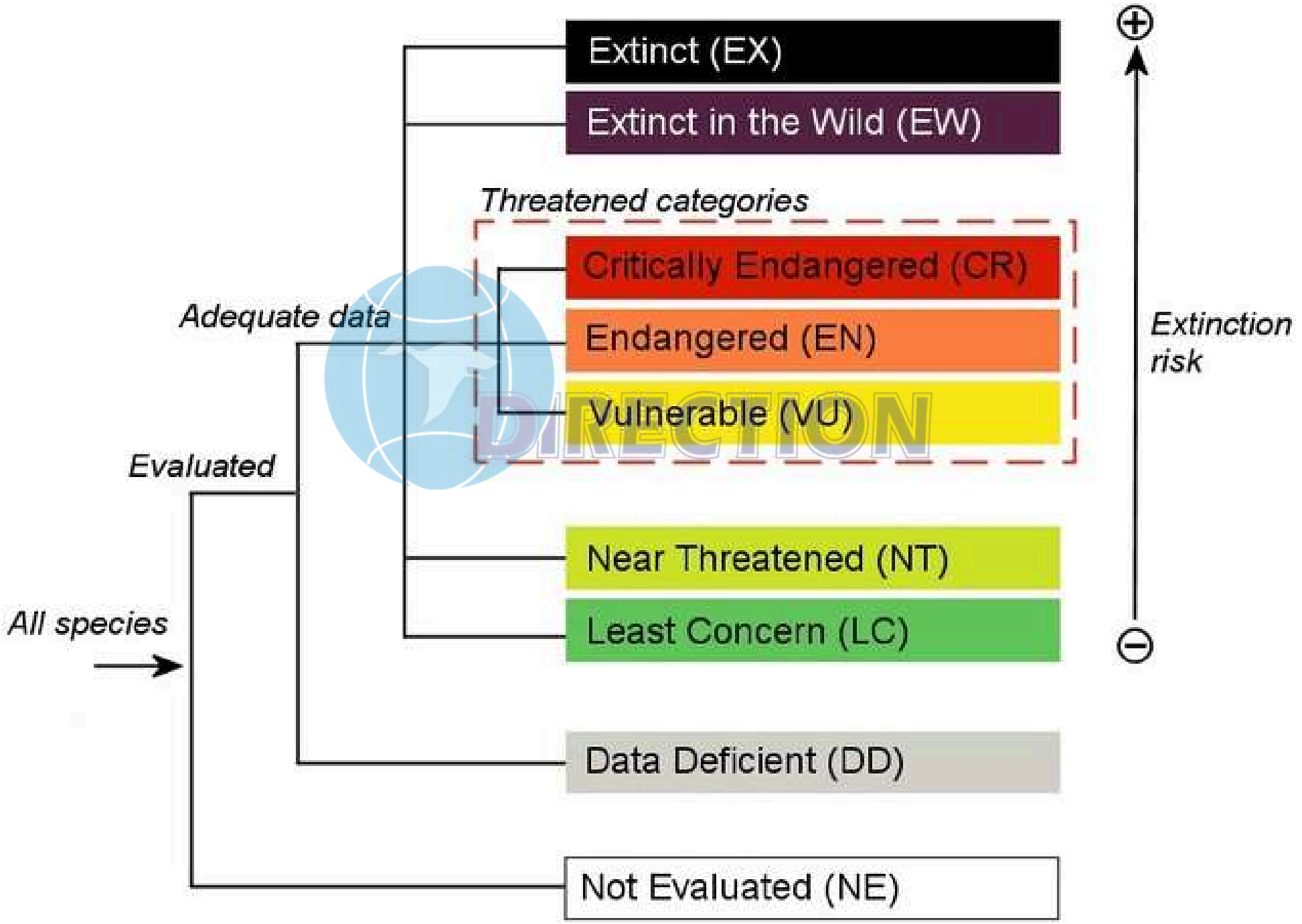
State of the World's Birds 2024

BirdLife International is the official Red List Authority for birds, responsible for assessing and documenting the global extinction risk of all 11,000+ species for the IUCN Red List. The "State of the Birds 2024" reports highlight global threats to bird populations from climate change and habitat loss, with a significant portion of species declining.

Species threat:

- **Climate change and human activities are impacting bird populations worldwide. In the 2024 Red List update, five species were reclassified as extinct, and several others moved to higher threat categories, though some species show recovery due to conservation efforts.**




Extinct (EX)
Extinct in the Wild (EW)
Threatened categories
Critically Endangered (CR)
Endangered (EN)
Vulnerable (VU)
Adequate data
Evaluated
All species
Near Threatened (NT)
Least Concern (LC)
Data Deficient (DD)
Not Evaluated (NE)
Extinction risk

Among the species moved to higher threat categories were several island endemics suffering the impacts of invasive species.

Two of Hawaii's honeycreepers—Anianiau Magumma parva and Kauai Amakihi Chlorodrepanis stejnegeri—moved from Vulnerable to Endangered following estimated population declines of more than 60% during 2008–2018, largely as a result of avian malaria carried by introduced mosquitos.

Anianiau
Number of mature individuals
3,000 - 5,000

Kauai Amakihi
Number of mature individuals
2,200 - 4,400

Elsewhere, Juan Fernandez Tit-tyrant , endemic to Robinson Crusoe Island off the coast of Chile, was uplisted from Near Threatened to Endangered after invasive plants and introduced predators drove rapid population declines.

Forest loss also continues to drive population declines worldwide. Citron-throated Toucan was moved from Least Concern to Near Threatened due to the ongoing effects of forest loss in South America, while in South-East Asia, Cinnamon-rumped Trogon Harpactes orrhophaeus was uplisted from Near Threatened to Vulnerable due to loss and fragmentation of its lowland forest habitat.

Juan Fernandez Tit-tyrant

Number of mature individuals

250 - 1,550

Citron-throated Toucan

Number of mature individuals

Unknown

Regional findings

India:

A report noted that of 942 species studied, 142 were in decline, with the Great Indian Bustard, White-bellied Heron, and Bengal Florican among the most threatened. The report also noted that 28 species, including the Indian Peafowl and Rock Pigeon, were thriving.

North America:

Habitat loss and degradation are identified as the biggest threats to Canada's bird populations, particularly to grassland and wetland ecosystems.

Migratory birds:

A global report from BirdLife International highlights a severe decline in migratory shorebird populations and a 15% decline in the abundance of all migratory species in general

State of India's Birds 2023

The "State of India's Birds 2023" report, based on citizen science data, reveals a significant decline in many bird species, with 60% of species showing long-term declines and 39% currently declining. The report highlights that habitat specialists, particularly in grasslands, open habitats, and wetlands, are most affected, though a few common species like the Indian peafowl and Asian koel have increased in numbers.

Key findings

Widespread decline:

A significant percentage of species are declining, with 60% of species assessed for long-term trends and 39% for current trends showing a downward trend.

Habitat loss:

Birds that depend on specific habitats like grasslands, open areas, and wetlands are experiencing particularly steep declines.

High-priority species:

The report identifies 178 bird species as "High Priority" for conservation efforts, including many common and widespread species whose populations have dropped substantially.

Migratory bird declines:

Long-distance migratory birds have seen a major decline, with those wintering in India experiencing an 80% drop in numbers.

THREATS TO INDIA'S BIRDS

LOSS OF HABITAT: Forest degradation, change in geography of open habitats, loss of wetlands, riverine nesting places and coastal habitats, owing to urbanisation, infrastructural developments and change in land use patterns. Then there's the rise of monoculture plantations—such as commercial teak, oil palm, tea and coffee plantations—which support fewer bird species than natural forests

CLIMATE CHANGE: Global temperature has risen by 0.8°C in the past 150 years, causing dehydration and exhaustion in birds. Erratic climate patterns also impact avian nesting and breeding behaviour

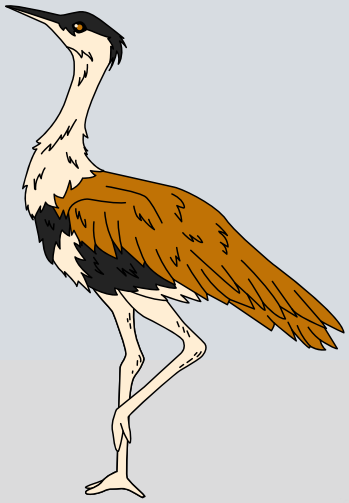
AVIAN DISEASE: The impact of avian disease on the shrinking bird population in India has not been well researched or documented. In 2020-21, outbreaks of avian influenza across many Indian states resulted in heavy mortality among wild birds

URBAN INFRA: Sound pollution and bright lights of cities may cause disorientation in birds, pushing them to alter their behaviour: urban noise may cause them to sing louder, or at different frequencies. Collisions with glass facades of buildings, wind turbines and power lines are other threats

ILLEGAL HUNTING AND TRADE: Birds continue to be removed from the wild and sold for meat or for entertainment. Thirty-seven seizures of poached birds reported in India in 2020 showed parakeets, owls and vultures to be among species at threat

LACK OF FOOD: Availability of food resources greatly affects bird populations. In India, the most visible decline in numbers has been witnessed among birds that feed on vertebrates and carrion. This implies the presence of contaminants in food

POLLUTION: Exposure to toxic chemicals—heavy metal pollutants, plastics and organophosphates in insecticides—causes hormone disruption in birds, alterations in feeding behaviour and compromised immune system



Conservation Priority for 942 bird species assessed by State of Indian Birds 2023

HIGH	MOD	LOW
179	323	441

HIGH

LESSER FLORICAN

Sypheotides indicus

Habitat: Grasslands in Gujarat, Rajasthan and Maharashtra

Reason for decline: Invasive species in open habitats, collisions with power lines

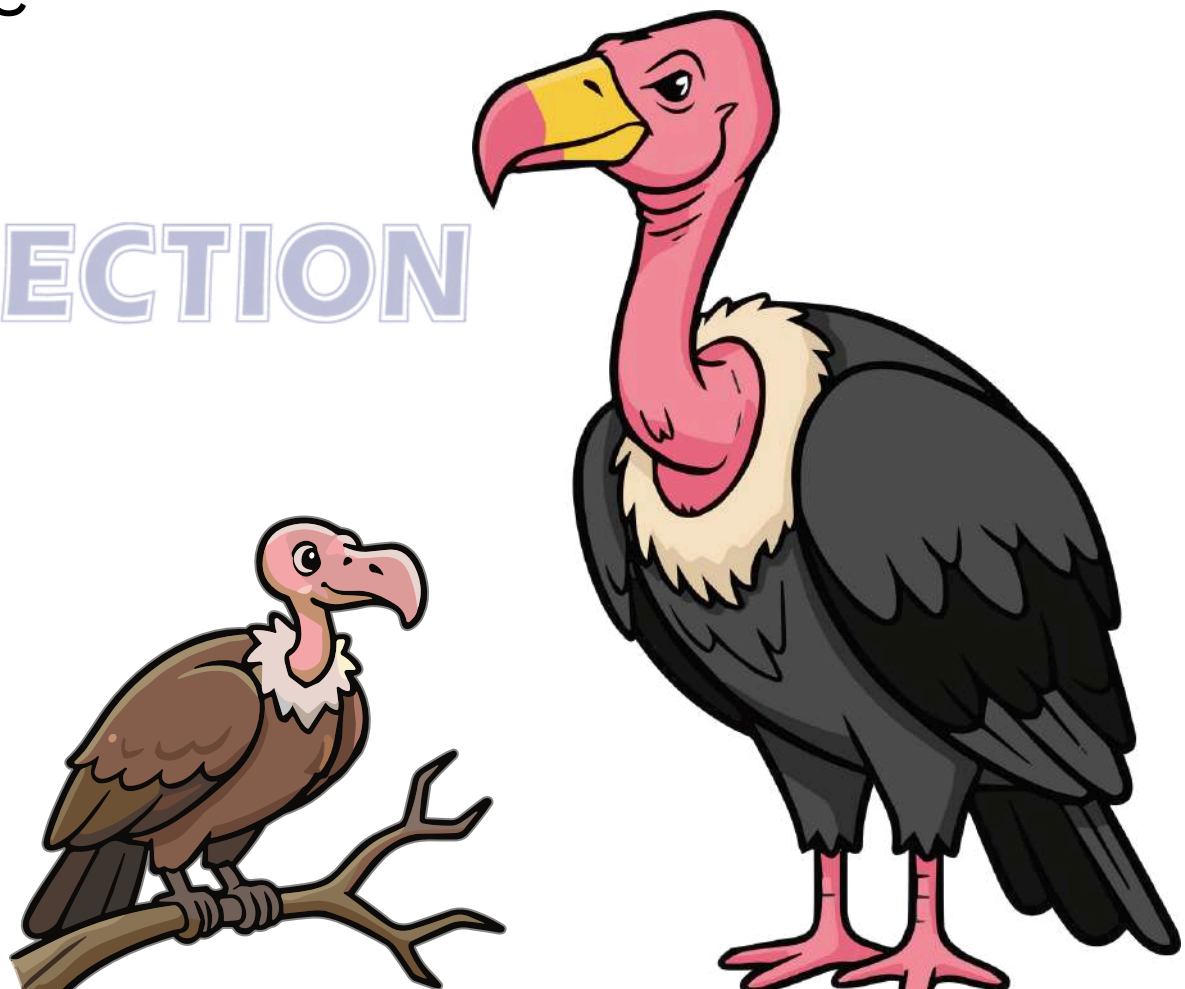
India is home to nine vulture species:

Resident species

- Indian Vulture (or Long-billed Vulture)
- White-backed Vulture
- Slender-billed Vulture
- Red-headed Vulture
- Bearded Vulture
- Egyptian Vulture

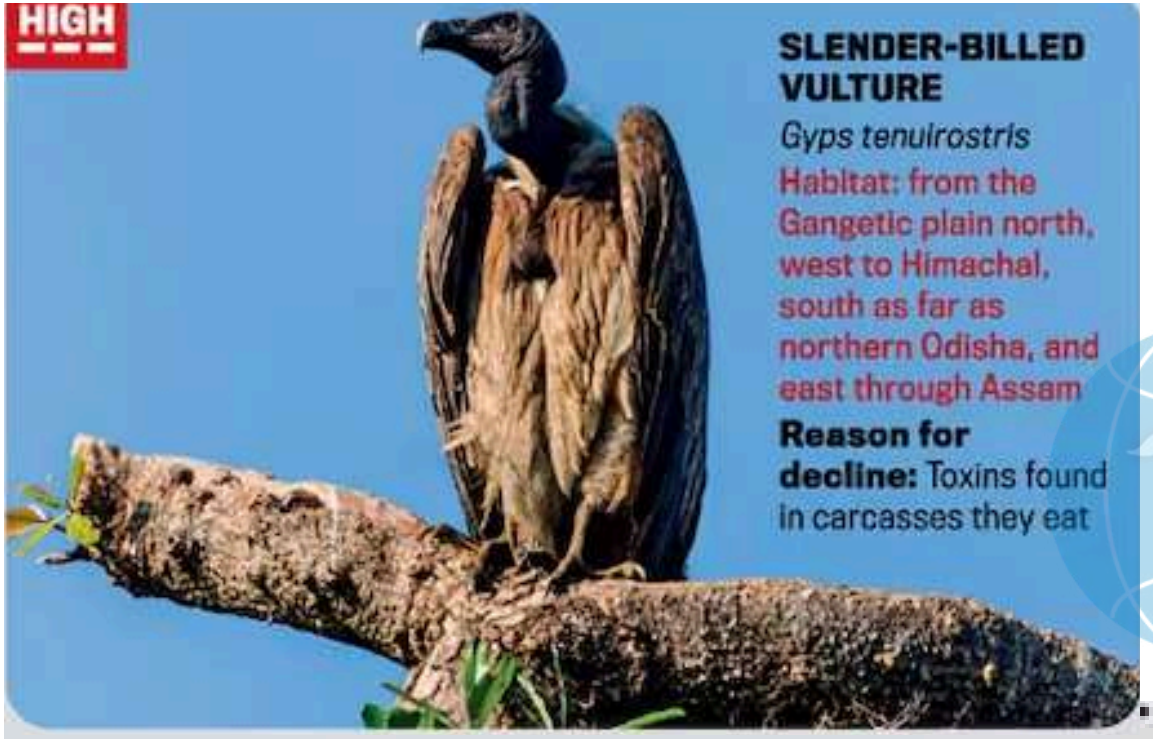
Migratory species

- Cinereous Vulture,
- Griffon Vulture, and
- Himalayan Vulture.



In a country with over 307.5 million cattle, obligate scavengers like vultures have a crucial role both in the ecosystem and economy.

India's first vulture conservation portal launched in Assam



SLENDER-BILLED VULTURE

Gyps tenuirostris

Habitat: from the Gangetic plain north, west to Himachal, south as far as northern Odisha, and east through Assam

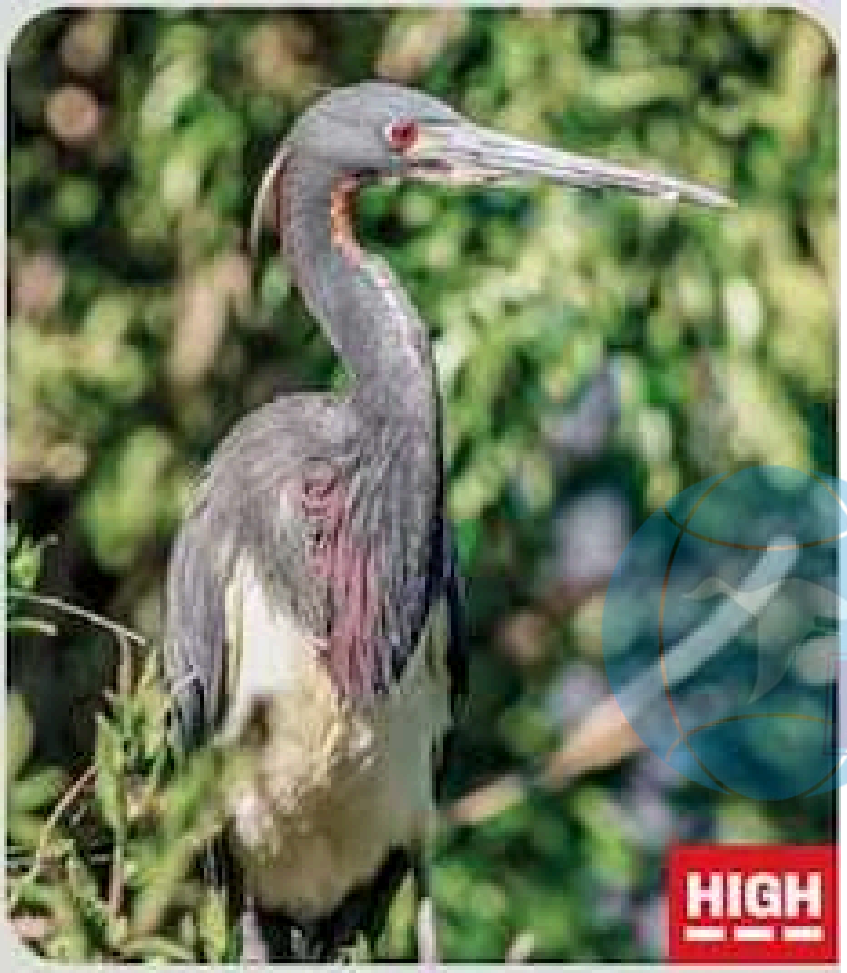
Reason for decline: Toxins found in carcasses they eat

MANIPUR BUSH QUAIL

Perdicula manipurensis

Habitat: Damp grasslands of northeast India

Reason for decline: Drainage and destruction of tall grasslands; illegal trade



WHITE-BELLIED HERON

Ardea insignis

Habitat: Wetlands of tropical/ sub-tropical forests in the foothills of the eastern Himalayas of northeast India

Reason for decline: Loss of breeding and feeding grounds

GREAT INDIAN BUSTARD

Ardeotis nigriceps

Habitat: Flat open landscapes in Rajasthan and Gujarat

Reason for decline: Loss and degradation of habitat, hunting

BUGUN LIOCICHLA

Liocichla bugunorum

Habitat: Montane forest and dense undergrowth in Arunachal Pradesh

Reason for decline:
Loss of habitat

THE FOREST OWLET

Heteroglaux blewitti

Habitat: Dry deciduous teak forests in central India

Reason for decline:
Deforestation, timber logging

BLACK-BELLIED TERN

Sterna acuticauda

Habitat: Wetlands of Andhra Pradesh, Delhi, MP, Odisha, Punjab, Telangana, UP

Reason for decline:
Loss of breeding sites, predation by animals

GREATER ADJUTANT

Leptoptilos dubius

Habitat: Open areas in Assam, Bihar

Reason for decline:
Loss of nesting and feeding sites

WHITE-WINGED WOOD DUCK

Asarcornis scutulata

Habitat: Assam and Arunachal Pradesh

Reason for decline: Habitat loss, hunting

SAKER FALCON

Falco cherrug

Habitat: Open areas in Rajasthan, Ladakh

Reason for decline: Habitat loss, scarcity of food, illegal trade

GREATER ADJUTANT

Leptoptilos dubius

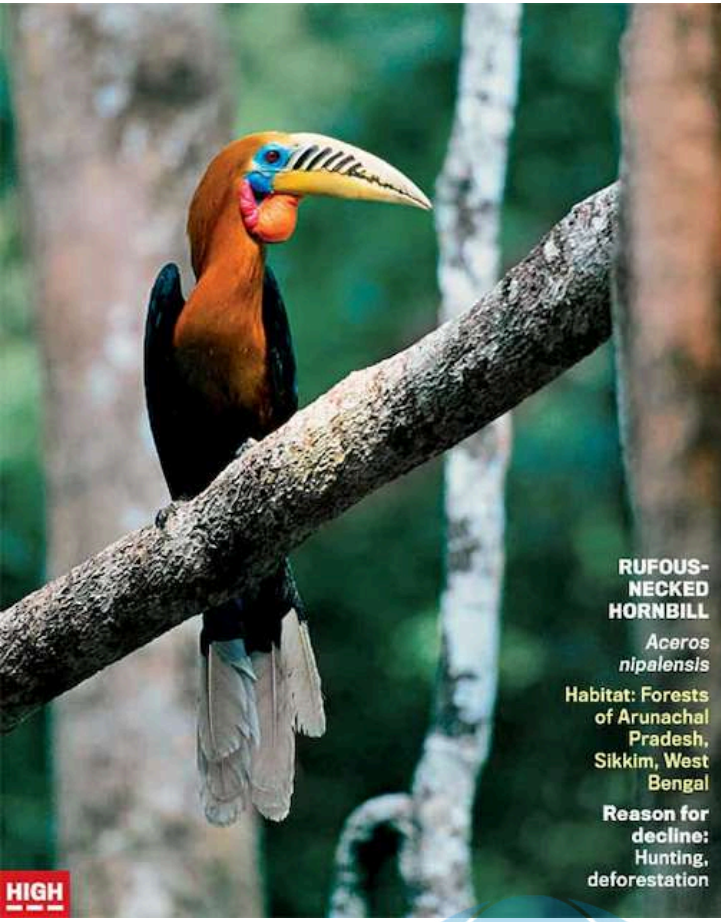
Habitat: Open areas in Assam, Bihar

Reason for decline: Loss of nesting and feeding sites

RAPTORS' FALL

TREND: Birds of prey, particularly those in open habitat or forests/ plantations, have showed an annual declining trend of around 50 per cent between 2014 and 2022. While the Pallid harrier has declined by nearly 70 per cent, the Short-toed snake eagle and Western marsh harrier also show decline between 50 and 70 per cent.

WHY: Open-habitat raptors typically feed in farming landscapes, where pesticide is used. Carrion-feeding vultures, specifically, succumbed to livestock drug diclofenac, which gave them kidney issues. Its ban may have improved things, but vultures continue to decline in the country—the Indian vulture by over 8 per cent a year, the Red-headed and White-rumped vultures by over 5 and 4 per cent, respectively. The Egyptian vulture fares only slightly better.



SILENCE OF THE HORNBILL

TREND: India is home to 9 species of hornbills. Of these, the Malabar grey hornbill, found in the Valparai plateau of the Western Ghats, declined by 56 per cent between 2004 and 2018. The Rufous-necked hornbill and Wreathed hornbill are declining.

WHY: Hornbills use the same nest year after year. Their peculiar nesting behaviour makes them particularly susceptible to disruption. Hunting poses another threat to the Great hornbill, the Rufous-necked hornbill and the Wreathed hornbill in parts of the eastern Himalaya. Forests are being lost to illegal logging, land use is changing and monoculture plantations are thriving. In northeast India, only 5 per cent landscape is suitable for these birds.

LOST IN MIGRATION

TREND: India is a key non-breeding destination for many Eurasian bird species. The decline in the number of long-distance migrants has been significant, over 50 per cent. Shorebirds that breed in the Arctic have been particularly affected, declining by close to 80 per cent as a group. By comparison, resident species as a group have remained much more stable.

WHY: Conservation of long-distance migrants requires identifying and maintaining the health of critical habitats, including intertidal mudflats, mangroves, grasslands, open wetlands, paddy fields and reedbeds. This ensures they are able to feed and build up resources for their arduous migration journeys.

DECLINING DUCKS

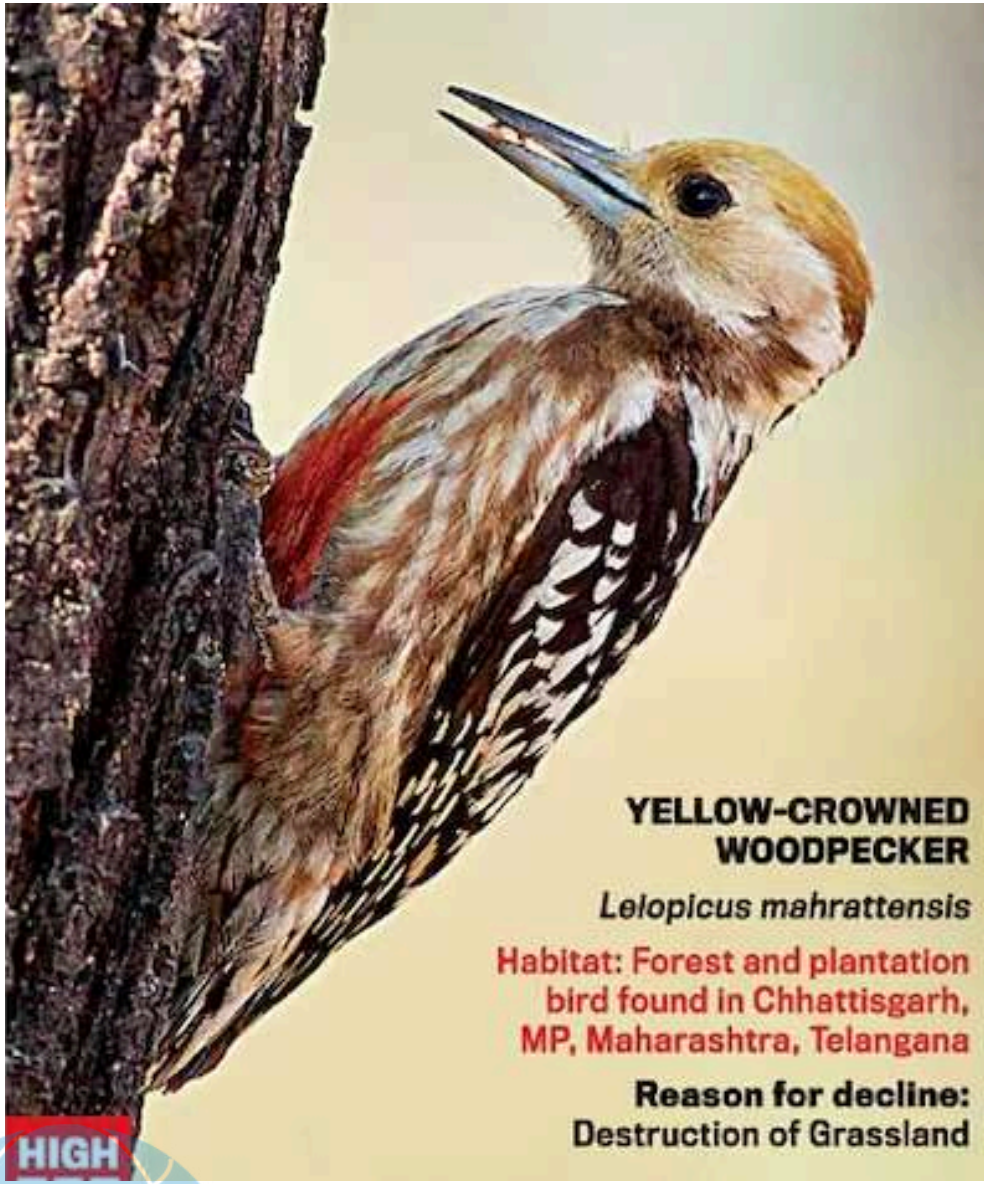
TREND: India hosts eight resident and 35 migratory species of the bird in a range of habitats, including inland lakes and tanks, submerged paddyfields, rivers, forest pools and coastal lagoons. Both kinds are experiencing long-term and continued decline. The Common pochard is declining by 2.5 per cent annually; at Chilika Lake, the counts went from 90,000 in 2001 to 2,000 by 2014. The Andaman teal has a population under 1,000; Baer's pochard has a global population of less than 1,700 and very few migrate to India now. The Tufted duck has declined by nearly 80 per cent between 2014 and 2022.

WHY: Though there are no studies to pinpoint exactly why the duck population is threatened, hunting, loss of wetlands and avian disease could be among some of the reasons.

WOODPECKER'S LAST KNOCK

TREND: Clear long-term trends are available for 11 species of woodpeckers, of which seven appear stable, two are declining, and two others are in rapid decline. The White-bellied woodpecker has dropped to less than 50 per cent of its historic baseline in the past three decades; the Yellow-crowned woodpecker has declined by more than 70 per cent in the past 30 years; and the Brown-capped pygmy woodpecker by 50 per cent in the long term.

WHY: Loss of large, old forest trees that woodpeckers prefer to make cavities in for nesting and fewer insects to feed on are the primary reasons for their decline.



YELLOW-CROWNED WOODPECKER

Lelopicus mahrattensis

Habitat: Forest and plantation bird found in Chhattisgarh, MP, Maharashtra, Telangana

Reason for decline: Destruction of Grassland

BUSTARDS GO BUST

TREND: Four species of bustards, a group of iconic grassland birds, are found in India. All four are specialised to open natural ecosystems (ONEs). Of these, the population of the Lesser florican, which breeds in fragments of grasslands, is less than 900 individuals. The Great Indian bustard has only 100–150 individuals, most of which survive in the Desert National Park of Rajasthan, where captive breeding has been started. The Bengal florican is restricted to the Himalayan Terai and the grasslands of northeastern India, with a South Asian population of under 400 individuals.

WHY: Bustard habitations have faced tremendous loss and change since the 1980s owing to infrastructural and developmental activities by humans.

THE HARDY BIRDS

Healthy both in abundance and in distribution, a few endemic bird species are exhibiting a rising trend in the past three decades

SHUTTERSTOCK

INDIAN PEAFOWL

Pavo cristalus

A rapidly increasing species, it is expanding into new areas such as the rainforests in the Western Ghats and the high Himalayas. It is now found in every district of Kerala where once it was extremely rare. The exact reasons are unclear, but their proliferation owes to protection by law and through religious-cultural beliefs. However, rising uncontrolled numbers can have a negative impact on snakes and crops.

ASIAN KOEL

Eudynamys scolopaceus

It has increased by almost 75 per cent compared to its pre-2000 baseline. No one knows why, but fruit-eating birds in general are doing well

ROCK PIGEON

Columba livia

It has successfully adapted to humans and can nest and feed on whatever humans provide. Since wild populations have been interbreeding with domestic pigeons for years, a large majority of Rock Pigeons seen around us are 'feral'.

RETURN OF THE SPARROW

Once a fairly common sight, the urban house sparrow is slowly hopping back into our backyards

IN the early 2000s, the sparrow population began to decline alarmingly in India, by almost 70 per cent in certain areas. Among the reasons for decline was the lack of nesting sites in concrete buildings, disappearing kitchen gardens, competition for food from pigeons, electromagnetic radiation from mobile towers and disturbances from traffic noise and pollution.

However, the State of India's Birds 2020 report noticed the sparrow population becoming stable in the past 25 years. The revival of the bird owes a lot to the several micro-conservation efforts. In Delhi, for example, the Eco Roots Foundation has put out 700,000 nests for the birds. The bird was adopted as the state bird in 2012 and March 20 is celebrated as World Sparrow Day. Many people are also returning to feeding the birds with affordable bird feeders online.

TIME FOR BIRDERS TO REJOICE

Photo courtesy: Pankaj Gupta and Arvind Yadav

SONGBIRDS

Features

Arrive by late Sept

Leave by March-end

Generally small hill birds

Belong to forests

Examples: Warblers, flycatchers, larks and pipits, finches

Bar-headed goose

CRANES

Features

Very tall birds

Generally passage migrants for Delhi

Come from Palearctic

Examples: Sarus crane, common crane and demoiselle cranes

Steppe gull

Eurasian hobby

WADERS

Features: Reach region by early Oct

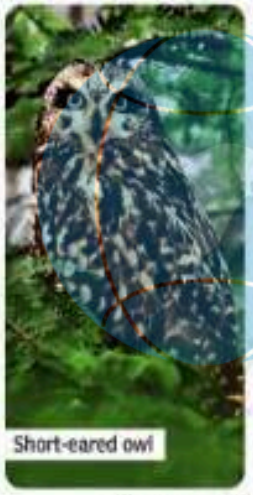
Stay in shallow water and marshes; come from Central Asia and Palearctic

Examples: Curlew, sandpipers, plovers

PELICANS

Features: Fish eating birds up to 3-4 feet tall

Examples: Rosy, great white pelican and spot-billed pelican



Short-eared owl

GEESE

Big birds, often seen around fields; Seen feeding on grasses and insects; Two major geese that come here are bar-headed goose and greylag

DUCKS

Features: Smaller than goose; Feeds on vegetation and insects or fish inside the water; Arrive by Nov from Palearctic, central Asia

Examples: Dabbling duck, diving duck

FLAMINGOS

Greater flamingos live permanently at Najafgarh and Okhla Bird sanctuaries

STORKS

Tall and large birds with long bil, neck and legs and baggy body

Examples: Painted stork, open billed stork and black necked are local

RAPTORS

Bird of prey

Come along the waterbirds to hunt

Examples: Greater spotted eagle, imperial eagle, hobby, peregrine falcons

SUGGESTIONS FOR BIRDING

1. Wetlands are best places to watch migratory waterbirds. Sultanpur, Najafgarh, Okhla and Surajpur are good places
2. A good binocular or spotting scope is must
3. Bird activity is at its peak in morning & evening
4. A bird guidebook or online guide will help
5. Photography helps in identifying later
6. Wear drab colour clothes
7. Do not go too close to birds
8. A notebook to make a sketch or scribble other details will be a good idea
9. A local birder or guide can be of immense help
10. Try to be at a vantage point with sun behind and birds in front
11. Watching and clicking from inside the vehicle is always advantageous
12. Read about what all kinds of birds you are likely to encounter

PREVIOUS SEASON

Last year Dec, 257 species of migratory, passage migratory and resident birds were recorded. Two of them spotted for the first time in the region

The species spotted are spread over 70 groups of birds like duck, geese and waterfowls; hawk eagles and kites; sandpipers; old world flycatchers; wagtails and pipits; herons, egrets and bitterns; gulls, terns and skimmers; larks; starlings; osprey; rollers

File Photo

India is a major destination for migratory birds, with numerous species arriving from regions like Europe, Siberia, and the Arctic to escape harsh winters and find food. Some of the most notable migratory birds include the Siberian Crane, Bar-headed Goose, Greater Flamingo, Bluethroat, and Amur Falcon

Yttrium, Cerium... Rare earths in plain English, and why China leads

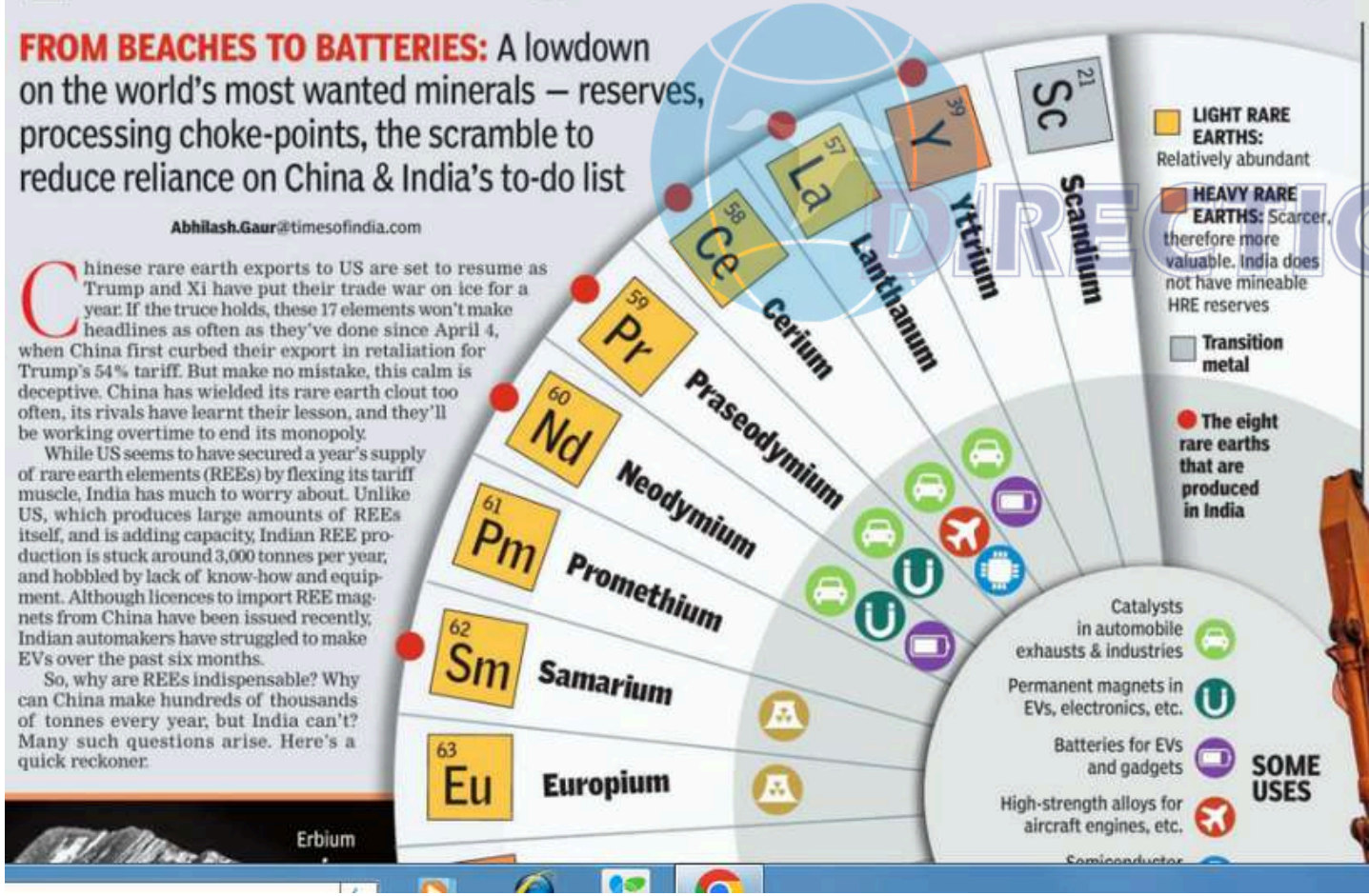
FROM BEACHES TO BATTERIES: A lowdown on the world's most wanted minerals — reserves, processing choke-points, the scramble to reduce reliance on China & India's to-do list

Abhilash.Gaur@timesofindia.com

Chinese rare earth exports to US are set to resume as Trump and Xi have put their trade war on ice for a year. If the truce holds, these 17 elements won't make headlines as often as they've done since April 4, when China first curbed their export in retaliation for Trump's 54% tariff. But make no mistake, this calm is deceptive. China has wielded its rare earth clout too often, its rivals have learnt their lesson, and they'll be working overtime to end its monopoly.

While US seems to have secured a year's supply of rare earth elements (REEs) by flexing its tariff muscle, India has much to worry about. Unlike US, which produces large amounts of REEs itself, and is adding capacity, Indian REE production is stuck around 3,000 tonnes per year, and hobbled by lack of know-how and equipment. Although licences to import REE magnets from China have been issued recently, Indian automakers have struggled to make EVs over the past six months.

So, why are REEs indispensable? Why can China make hundreds of thousands of tonnes every year, but India can't? Many such questions arise. Here's a quick reckoner.



How India squandered a 75-year head start

India set up IREL in 1950 to secure strategic minerals. In 2025 — amid an EV and defence boom — it's still stuck in permits, outdated technology and board vacancies

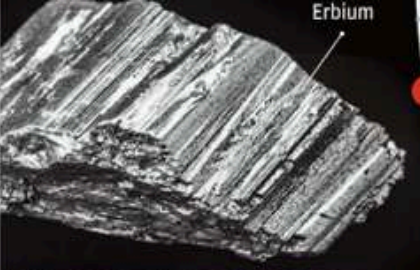
Surojit.Gupta@timesofindia.com

In 1950 — decades before the world woke up to rare earths — India set up Indian Rare Earths Ltd (IREL) to mine and process these strategic minerals. Seventy-five years on, with rare earths at the heart of EVs, electronics and defence supply chains, IREL should have been India's spearhead. Instead, this taxpayer-funded PSU — one many readers may be hearing about for the first time — is a laggard, hobbled by stalled mines, dated technology and a half-vacant board.

IREL (now under the Department of Atomic Energy) To be sure, China has also outpaced the US and Japan—how that happened, who holds the reserves, and what it means is explained in 'How China cornered the rare earths and India fell behind'.

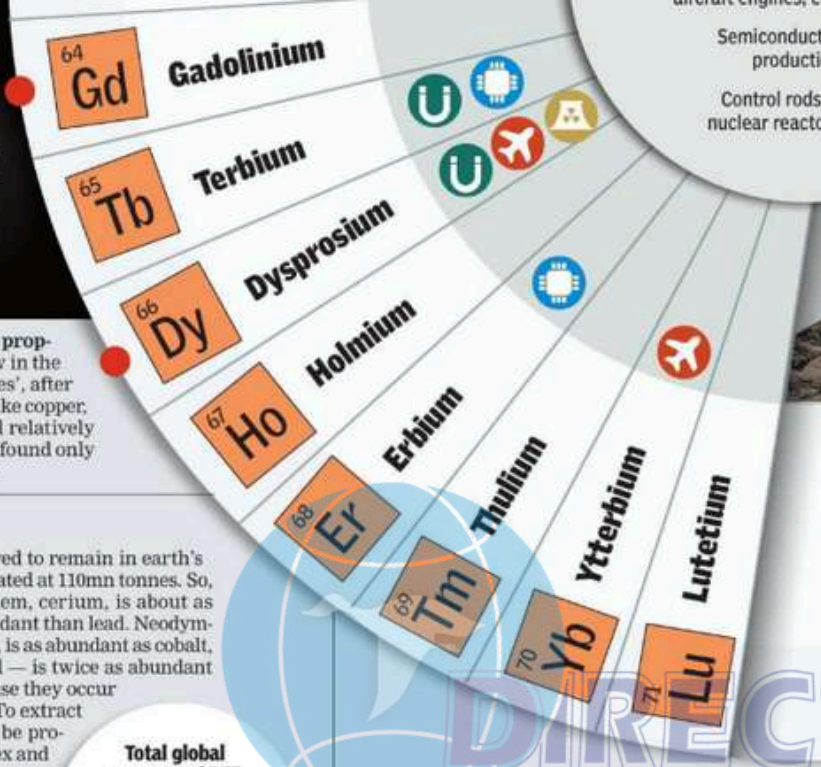
Governance & Capability Gaps

Even as global rivals scale up, IREL is hobbled by basic management gaps. Since Nov 2024, there has been no full-time CMD; the director (finance) holds additional charge. All four independent director seats are vacant; board strength is half the sanctioned 12, the parliamentary committee noted in March. The PSU also cites technology and manpower constraints. Being removed from the US En-



WHAT ARE RARE EARTHS?

They are a group of 17 metals with special properties. Fifteen of them occupy their own row in the periodic table, and are known as 'lanthanides', after lanthanum, the first element in that row. Unlike copper, iron and gold, these metals were discovered relatively recently. The first rare earth ore, yttria, was found only in 1794; the last metal, promethium, in 1945.



HOW RARE ARE THEY?

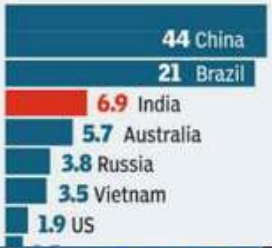
Only 50,000 tonnes of unmined gold is believed to remain in earth's crust now, but global REE reserves are estimated at 110mn tonnes. So, REEs aren't rare. The most abundant of them, cerium, is about as abundant as copper, and six times more abundant than lead. Neodymium, which is crucial for making EV magnets, is as abundant as cobalt, and dysprosium — another magnet essential — is twice as abundant as bromine. They are called 'rare' only because they occur in very low concentrations in earth's crust. To extract a small quantity, mountains of clay have to be processed. And the processing tends to be complex and highly polluting.

RELATIVE ABUNDANCE IN EARTH'S CRUST

Cerium	0.006%
Lanthanum	0.0034%
Praseodymium	0.00086%
Dysprosium	0.00062%
Gadolinium	0.00052%
Ytterbium	0.00028%
Gold	0.00000031%

Total global reserves of REE
110MT
Total mine production in 2024
0.4MT

Countries with biggest rare earth reserves
(million tonnes)



HOW DID CHINA MONOPOLISE REE PRODUCTION?

With luck, hard work and some cunning. It got lucky when geological movements over billions of years concentrated REEs in its territory. Current estimates — these are revised when new deposits are found — put its reserves at 44mn tonnes, far ahead of India (6.9MT) and US (1.9MT). Then, starting in the

THE EQUIPMENT HURDLE

Rare earth metals have almost identical physical and chemical properties, and tend to occur together in minerals like monazite. That's why refining them is, to use a metaphor, like finding a needle in a haystack. You need multistage processes, such as solvent extraction and ion exchange, to separate lanthanum from, say, neodymium. But as industry expert Jack Lifton, co-chair of Critical Minerals Institute, points out, this is easier in theory than practice. He's witnessed two solvent-extraction plants fail because "Western designers underestimated the corrosive nature of rare earth chemistry". Their pipes corroded and [illegible] costing "hundreds of millions of dollars and years of lost production".

US and Japan gave up their technology leadership in rare earths to China, and now don't have "a critical mass of engineers who know how to build rare earth process equipment".

Those who worked in the field in the 1970s and '80s have retired. Lifton says learning to make "corrosion-resistant metals and alloys, fluoropolymer-lined alloys, ceramic crucibles, graphite reaction chambers" for extracting specific rare earths could easily take a decade because China — which borrowed a lot of Western know-how in the 1990s — is now firmly guarding its tech

WHAT'S THE PROBLEM WITH CHINESE DOMINANCE?

Atomic number
Chemical symbol

Design: Sajeev Kumarapuram
Photos: Getty Images, AFP, iStock

runs plants in Kerala, Tamil Nadu and Odisha and supplies materials to nuclear, defence, space and a largely MSE (medium and small enterprise) customer base at home. It has stayed profitable, but insiders admit its competitiveness has eroded. Bureaucratic delays and a tight, state-controlled operating space have slowed expansion just as global demand took off.

"In our Tamil Nadu unit, from 1998 onwards, not a single mine has been allotted. The plant is running at 50% capacity because the mine is not allotted," an official said, underlining how permitting

KABIL—HOPE FOR NEW CAPABILITIES

The govt set up the Khanij Bidesh Nigam Ltd (Kabil) with three state-run companies — National Aluminium Company, Hindustan Copper, and Mineral Exploration and Consultancy — to ensure supply of critical and strategic minerals and also step up mineral security.

"Mandate of Kabil is to identify, explore, acquire, develop, mine, process, procure strategic minerals outside India for supplying primarily to India to meet domestic requirements due to its non- or meagre availability in the country and giving a big push to Make in India,"

tity List earlier this year should ease access to equipment, a senior official said, adding that upgrades are now "on a fast track."

Profits & Production

While revenue and profit after tax have risen in recent years (see chart), tight market conditions have started to bite now. Production went up from 445 kilo tonnes per annum in FY20 to 532 KTPA in FY24 — a steady, but modest growth for a firm with a seven-decade headstart and a once-in-a-generation demand boom. An IREL official explained the steady rise in revenues and profits till 2023-24 on the addition of several value-added products, largely driven by the expansion of their Odisha unit. But the annual report of the company for FY25 is still unavailable on the website. Officials said that it is under printing and would be uploaded soon. While the PSU has remained profitable, tight market conditions have hurt profits and sources say that provisional estimates show that profits could be down nearly 20% in FY25 compared with the previous year.

India produces about 8 of the 17 rare earths (lanthanum, cerium, praseodymi-

CRUST		
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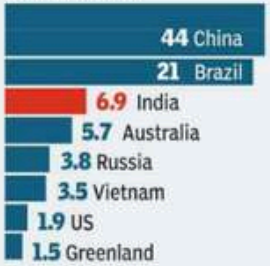
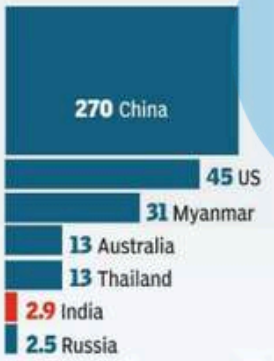
Chinese low prices undercut companies in US and elsewhere, forcing them to close. So, by 2002, the Chinese had a monopoly on REEs. Today, they control 61% of REE mining — which is the easy part — and 92% of processing, which is the real challenge. They also have a technological lead in the field, which extends to machinery used in various extraction stages. As for end products, like advanced magnets, they sometimes bought their way to pole position. For instance, GM's Magnequench arm had expertise in high-powered neodymium magnets used in airbags, mechanical sensors, precision-guided munitions, data storage devices, etc. When GM divested Magnequench in 1995 as a non-core business, the Chinese lapped it up and its technologies for all of $70mn.

Countries with biggest rare earth reserves
(million tonnes)



Top rare earth producers in 2024
(tonnes)



With the world's third largest reserves of ore — primarily LREs like lanthanum, cerium, neodymium, praseodymium and samarium — and cheap labour, India should be able to do better

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WHAT'S THE PROBLEM WITH CHINESE DOMINANCE?

REEs are needed to make everything from strong steel to EV motors, jet engines, phones, computer chips, etc. So, China can cripple manufacturing in any country that disagrees with it. For example, it curbed supplies to Japan in 2010, threatened to curb US supplies in 2019, and imposed global curbs this year. Besides, with its focus on remaining the world's factory, China sometimes doesn't have enough REE quotas to supply others.

BREAKING CHINESE STRANGLEHOLD

US used to be the leader in REE production till the mid-1990s, when stricter environmental norms made REE production uncompetitive cost-wise, but it's getting back in the game. Starting new mines and processing units takes years, but US and its allies are working on it. For example, Australian firm Lynas has been processing heavy rare earths in Malaysia, and Belgian firm Solvay is expanding its REE operations in France. Besides extracting these metals from clay, countries are looking at alternatives, such as fly ash — residue of burnt coal — stored in ponds around thermal power plants.

Coal naturally has some amount of REEs, and when it's burnt, the REEs get concentrated 6-10 times. Studies in India have found REE concentrations of 400 parts per million (PPM) in fly ash. US has over 2 billion tonnes of fly ash lying around that it could use to extract REEs for years. There's also a move to recycle REEs from old devices.

logjams — CRZ, mangroves, forest clearances and dense habitation — have clipped production for years.

China Sets The Pace

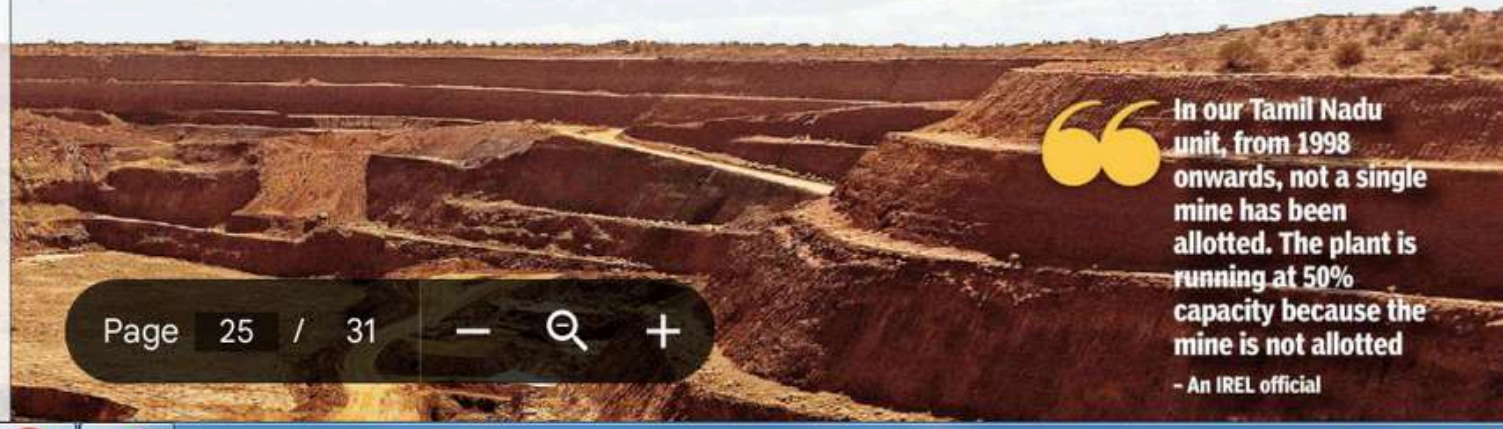
The market IREL operates in is overwhelmingly China-dominated: roughly 60-70% of global mining and 85-90% of processing, according to IREL's submission to a parliamentary panel in March this year. China's reserves (44 million tonnes) are about 6.4 times India's, and ore grades are far richer. Prices, supply and demand are effectively set in China, leaving India a price-taker.

a once-in-a-generation demand boom. An IREL official explained the steady rise in revenues and profits till 2023-24 on the addition of several value-added products, largely driven by the expansion of their Odisha unit. But the annual report of the company for FY25 is still unavailable on the website. Officials said that it is under printing and would be uploaded soon. While the PSU has remained profitable, tight market conditions have hurt profits and sources say that provisional estimates show that profits could be down nearly 20% in FY25 compared with the previous year.

India produces about 8 of the 17 rare earths (lanthanum, cerium, praseodymium, neodymium, samarium, gadolinium, dysprosium and yttrium/samarium), mainly from beach-sand minerals such as monazite. But high-value steps — separation at scale, advanced alloys, magnets — remain thin. Result: value leaks abroad, and supply chains stay fragile.

Way Forward

IREL says it has tied up with Oil India, Coal India and NLC to chase critical mineral assets and is exploring overseas collaborations. Internally, it wants to triple capacity and claims that by 2031-32 it can meet much of domestic demand. That will require: (1) time-bound mine allotments; (2) board and leadership fixes; (3) fast-tracked procurement of corrosion-resistant, solvent-extraction gear; (4) clear targets for separations and magnet-grade output, not just ore. As one official put it: "The country requires IREL to fast-track all its activities. Now, IREL has to live up to the expectations."



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