

# TARGET PRELIMS 2024

## BOOKLET-19; EB&CC-9

### BIODIVERSITY-IMPORTANT SPECIES-3

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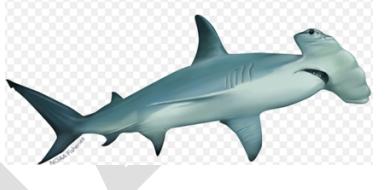
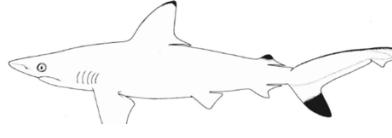
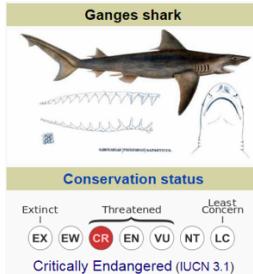
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## 2. FISH DIVERSITY

### 1) CRITICALLY ENDANGERED (CR) FISH SPECIES IN INDIA

<p><b>Indian Swellshark:</b> Small <u>deep-water catshark</u> known from the coast of Kollam, Kerala; A&amp;N; Sri Lanka.</p> <p><b>Threats:</b> Very <u>limited geographical range and population</u>; <u>accidental catch</u> by deep water trawling.</p>								
<p><b>Scalloped Hammerhead:</b> "Hammerheads" or "hammer shaped head" is the most distinguished characteristic.</p> <p><b>Distribution:</b> warm, temperate, and tropical coastal waters all around the globe.</p>								
<p><b>Oceanic White Tip Shark:</b> Large shark found in tropical and subtropical oceans throughout the world.</p>								
<p><b>Pondicherry Shark:</b> <u>Extremely rare species</u> found in <u>Indo-Pacific waters</u> from <u>Oman to New Guinea</u>. It has also been seen in <u>Godavari River Estuarine Ecosystem</u> in recent times. In <u>Andhra Pradesh</u> it is locally named as "<u>Pala Sora</u>".</p> <p><b>Threats:</b> Commercial fishery.</p>								
<p><b>The Ganges Shark (Glyphis gangeticus):</b> <b>Distribution:</b> Found in the <u>Ganges (Padma River)</u> and the <u>Brahmaputra River</u> in India and Bangladesh. It is <u>uniquely adapted (small eyes) fish eating (slender teeth) shark</u> that occur in the turbid waters of Ganga River and the Bay of Bengal.</p> <ul style="list-style-type: none"> <li>» These are <u>true river sharks</u> which <u>need not to migrate to salt water to reproduce</u>.</li> <li>» <b>Note:</b> Species in the genus <u>Glyphis</u> are <u>true river shark</u>.</li> </ul> <p><b>Threat:</b> Overfishing, pollution, dams, barrages etc.</p>	 <p><b>Ganges shark</b></p> <p><b>Conservation status</b></p> <table border="1"> <tr> <td>Extinct EX</td> <td>Threatened EW</td> <td>Critically Endangered CR</td> <td>EN</td> <td>VU</td> <td>NT</td> <td>Least Concern LC</td> </tr> </table> <p>Critically Endangered (IUCN 3.1)</p>	Extinct EX	Threatened EW	Critically Endangered CR	EN	VU	NT	Least Concern LC
Extinct EX	Threatened EW	Critically Endangered CR	EN	VU	NT	Least Concern LC		
<p><b>The Hump Backed Masheer (Tor Ramadevii)</b> The hump backed Mahseer - a <b>large freshwater fish</b> also called the <b>tiger of the water</b> is found <b>only in the Cauvery River basin</b> (including Kerala's Pambar, Kabini, and Bhavani rivers). Inclusion in the red list was possible only after getting the <u>scientific name</u> which it got in June 2018 - <u>Tor Ramadevii</u>.</p>								
<p><b>Other CR Fish:</b></p> <ol style="list-style-type: none"> <li>1. Large Tooth Sawfish (Freshwater sawfish)</li> <li>2. Green Sawfish or long combed sawfish or narrow snout sawfish</li> </ol>								

## 2) IMPORTANT ENDANGERED SPECIES

### Whale Shark (Rhincodon Typus)

Whale Shark is the largest known fish species and is the largest non-mammalian vertebrate. It has a lifespan of around 130 years and has a unique pattern of dots on its body. It can grow upto 10 meters in length and weigh around 20 tonnes.

**Food:** Whale shark are filter feeders and consume plankton, small fish, and squid. They are apex predators and rely on diet of animal-based protein to sustain their large size and energetic demands.

- » **Filter Feeders:** They swim slowly through the water with mouth open, using their large gill rakers to filter out plankton and other small organisms from the water.
- » <https://youtu.be/jPSgCWI5PrQ?si=QGirwD9wjRiOMWd>

#### Conservation status

- » IUCN: Endangered



**Habitat:** They inhibit all tropical and warm-temperate seas.

In India, they are found in Saurashtra and Gulf of Kutch coast of Gujarat, Gulf of Mannar and Lakshadweep.

#### Other endangered fish:

Speartooth shark; The knifetooth sawfish; Humphead Wrasse;

## 3) IMPORTANT VULNERABLE FISH SPECIES

### A) GREAT SEAHORSE (HIPPOCAMPUS KELLOGI)

#### - Why in news?

- » The (*Hippocampus Kellogi*), one of the 12 species of fish with a horse-like head found in the Indo-Pacific region, could be migrating towards coastal Odisha due to fishing pressure. (2023)

#### - Details about Hippocampus Kellogi

The Great Seahorse (*Hippocampus kellogi*), also known as Kellog's seahorse is a species of fish in the family Syngnathidae. It is one of the largest of the 54 species of seahorse.

**Distribution:** Indo-Pacific region (including sea of Japan, and around north and south Australia). They frequent areas rich in Coral so that they can latch to something.

#### Seahorses in India's coastal ecosystem:

Coastal ecosystem of India has 9 species out of 12 species found in indo-Pacific.

The population of the great seahorse, which is among the eight species tagged 'vulnerable', is declining due to its overexploitation for traditional Chinese medicines and as ornamental fish, combined with general destructive fishing and fisheries bycatch.

Great seahorse



There is a ban on fishing and trading activities on seahorses from 2002, but illegal, clandestine trade continues. This creates immense pressure on seahorse populations.

Extensive fishing off the coast of Coromandel coast could be forcing the great seahorse to migrate laboriously towards Odisha.

## B) OTHER IMPORTANT VULNERABLE FISH SPECIES

- Giant Guitarfish
- Ganges Stringray
- Porcupine Ray
- Giant Grouper

## 4) IMPORTANT FOOD FISH SPECIES IN NEWS

### Hilsa:

Hilsa fish has been ruling the hearts of Bengalis for generations. It is generally referred to as "**King of Fish**" for its soft texture and pleasant flavor. It is also national fish of BD and state fish of West Bengal and Tripura.

**Hilsa catch in West Bengal has decreased over the years.** For quite some time, the demand has outstripped the supply. Earlier, Hilsa imported from BD played a key role in fulfilling the gap.

### Hilsa's significance for BD's economy:

It contributes to 11% of total fish produced in BD and it also contributes to 1% of BD's GDP.

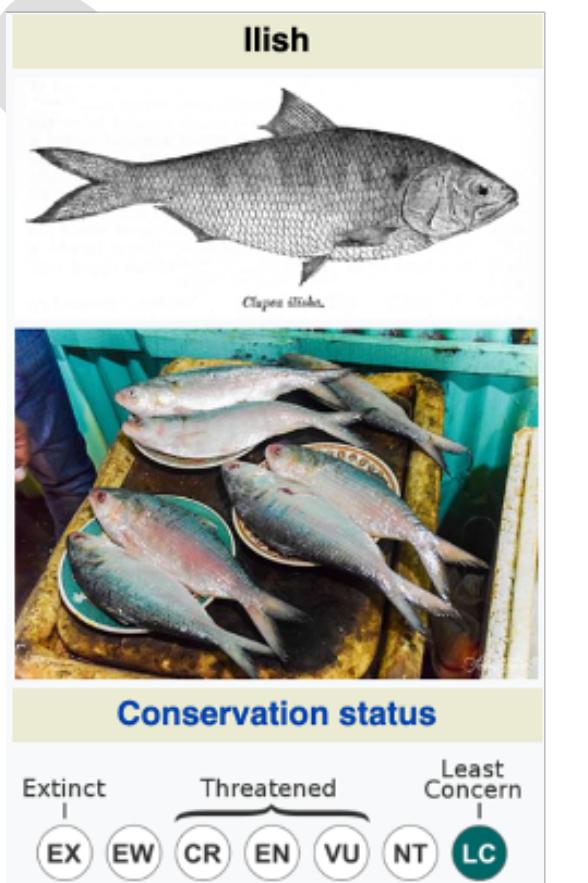
Nearly 75% of the World's HILSA production comes from BD.

**Hilsa Export** has been **banned from Bangladesh** since 2012.

**Reason:** Decreasing Hilsa population due to over-exploitation, pollution etc.

But, generally during Durga Puja festival in India, Bangladesh allows exports to India.

**Hilsa can't be farmed:** This is because of peculiar habitat requirements. The Adult Hilsa swim several kms upstream to fresh water from sea for spawning (laying eggs) and return back to sea. Therefore, the fish is generally found at the mouth of the rivers of Ganga, Brahmaputra, Godavari, Krishna etc.



<p><b>Sardine:</b> It is a species of ray-finned fish in the genus <u>Sardinella</u>.  <ul style="list-style-type: none"> <li>• It is one of the <u>two important commercial fishes in India (with the mackerel)</u>.</li> <li>• It is one of the <u>more regionally limited species of Sardinella</u> and can be found in the <u>northern regions of Indian Ocean</u>.</li> </ul> <p>It was showing <u>declining trend for the past few years</u> but seems to be on <u>revival path on Kerala Coast</u>. This was informed by <u>state-run Central Marine Fisheries Research Institute (CMFRI)</u>. <b>Warming of ocean water</b> has been the <u>major reason for decline in the past</u>.</p> </p>	 <p>CMFRI has raised concerns over <u>indiscriminate fishing of unmatured sardines</u>.</p>
<p><b>Trout in Kashmir:</b> A Scotsman named <u>J.S. Macdonall shipped 1,800 trout eggs into Kashmir in 1900</u> and introduced Kashmir to fishing culture. These fish which are <u>popular in Europe, found Kashmir suitable as its weather conditions match with that of Europe</u>.</p> <p>Now, <u>cold-water trout</u> is the most popular fish in the Kashmir plates and <u>growing number of farmers are looking at opportunities to export the fish to Europe</u>.</p> <p>The <u>last 10 years</u> have seen a tremendous increase in the production of trouts in Kashmir. In 2019-20, <u>J&amp;K had 534 farmers producing 650 tonnes of trouts</u>. In 2022-23, <u>1114 farmers produced 1,990 tonnes of trout</u>.</p>	 <p><b>Globally, Denmark</b> produces <u>more than 55,000 tonnes of trouts</u>. But <u>Kashmir has much more water and resources</u> and thus can compete with Denmark in European market with <u>trout produce</u>.</p>

## 5) INVASIVE FISH SPECIES IN NEWS IN INDIA

- As of 2018, of 3535 species in India's freshwater, brackish and marine waters, 14%, or 495, were found to be alien.
- **Factors for rise in alien species.**
  - **Extreme Climate Events** may aid the spread of alien species in biodiversity hotspots.
    - » E.g., 2018 and 2019 Kerala flood driven release of alien species like alligator gar from illegal aquaculture farms in Kerala to its natural water bodies.
  - **Degrading quality of natural water bodies and rivers**
  - **Ornamental Trade:** Most of the alien species that enter India are principally for ornamental trade. These fish are dumped into water bodies causing problems.

### Suckermouth Catfish

It is native to South America's Amazon River.

It is a hardy fish which can survive very hostile conditions. It is an omnivorous feeder and has ability to tolerate hypoxic conditions. They are highly resilient and have armored bodies. It can breed in stagnant water and has thick skin which reduces scope of predation.



They are only fit for aquarium. They don't have any food value - fisherman don't find buyers for these fish. They are popular in aquarium as they are preferred for cleaning inside walls of aquarium owing to its habit to feed on growing algae.

### African Catfish:

Its cultivation was banned in 2000 in India but the practice still thrives in many parts of the country.

They grow quickly and hence is preferred by fish-farmers. But during floods, they leak into rivers and lakes causing havoc there.



### Alligator Gar

It is a north American fish which is an invasive species in countries like China and India.

It reached India through Aquarium trade. Buyers don't initially know that the fish becomes very large. And once, it does, they have to release it in some large water body.

These fish are not of much use to humans and are apex predators. Their meat is not palatable, roe is poisonous, skin is like a hide which will cut human hands. The mouth is full of teeth. They kill anything that they can overpower including baby crocodiles.

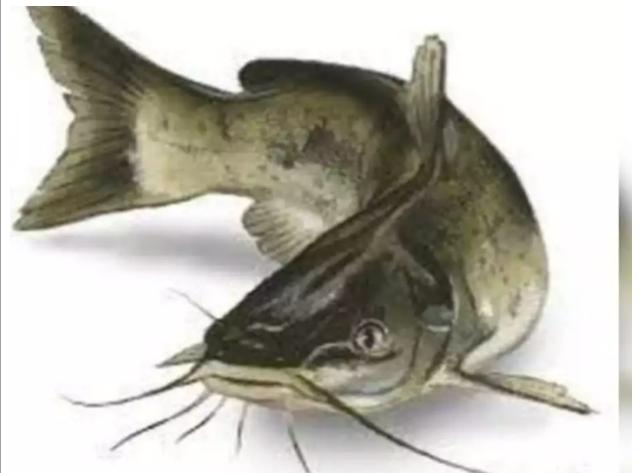


### Thai Magur

The fish is also known as African Mangur or Foreign Mangur.

Farming of the Thai Magur fish has been banned from 2000 only. But the fish farmers continue to cultivate it.

- Fish grows to 3 to 5 feet.
- They can survive in difficult circumstances for e.g. in mud waters between rains.
- It has an omnivorous diet, burrowing capability and ability to survive of land.



MHA fishery department has banned sale of Thai Magur fish in the fish markets, as it is a invasive species in India.

- A study in Mumbai shows that it is responsible for 70% decline in native fish species of the country.

- Further, it is cultivated in highly unhygienic conditions, which may lead to people falling sick after consuming it.

**Other invasive species** in India:

red-bellied Pacu, red bellied Piranha, Asian Carp

### C) MOSQUITOFISH BECOMING INVASIVE (NOV 2023)

#### What is Mosquito Fish?

Mosquitofish is a small fish of genus **Gambusia**. They are small in comparison to many freshwater fish, with females reaching a max length of 7 cm and males 4 cm.

- It is called "mosquitofish" because the fish eats mosquito larvae and has been used more than any other fish for mosquito control.

The two most important species are **G. affinis** and **G. holbrooki**. These fish originated in North America but are now a global inhabitant.



#### - Gambusia in India:

- » **Gambusia** was first introduced in India during British rule. Later, government organizations like ICMR, local bodies etc took over in an effort to combat malaria.
- » In 2023, several government and NGOs in Andhra, Odisha, and Punjab have released mosquitofish into local water bodies to deal with mosquito menace.

#### - Invasive:

- » **Mosquitofish** are among the hundred most detrimental invasive alien species. They have emerged as some of the most widespread freshwater fish.
  - They are resilient to fluctuating environmental conditions and have voracious feeding habits.
  - These fishes are notorious for their detrimental ecological impact, including displacing and preying on native fauna, leading to extinction of native fish, amphibians, and various other freshwater communities.
  - For these reasons, in 1982, WHO stopped recommending **Gambusia** as a mosquito control agent.
  - In 2018, the National Biodiversity Authority of Government of India, also designated **G. affinis** and **G. holbrooki** as invasive alien species.
- » A study has revealed that two species of mosquito fish have invaded various ecosystems across India.
  - **Gambusia affinis** and **G. holbrooki** are widely distributed specially in northeast India.
- » How can mosquitofish be controlled?
  - Stringent restriction on introduction of these fish in freshwater ecosystem; manage consequence of past introduction.

- **NCVBDC** (of MoH&FW) on its website recommends use of these mosquitoes. This needs to be removed on priority.
- **R&D to identify alternative local fish species** for mosquito control.

#### D) GOLDFISH: A CUTE PET IN BOWL, GIANT THREAT WHEN FREE IN A LAKE (NOV 2023)

**The goldfish** is a freshwater fish. It is commonly kept as pet in indoor aquariums and is one of the most popular aquarium fish. It is native to China and relatively small member of carp family.

**Goldfish** released in wild can grow to very large size and have become invasive pest in North America. They eat pretty much everything, roots up plants and reproduce and grow so quickly that almost no predator can stop it.

**Nov 2023:** A goldfish weighing more than 30 kg was caught from Bluewater Lakes in Champagne, France.



#### 6) RECENTLY DISCOVERED FISH SPECIES

##### A) BADIS LIMAAKUMI (OCT 2023: SOURCE-DTE)

Scientists have recently discovered a new fish species from Milak River, Nagaland. It has been named *Badis limaakumi*, after Limaakun, assistant professor and head of the zoology department at Fazl Ali College, nagaland.

It belongs to family Badidae, a small freshwater fish found in streams with slow or moderate water flow. These are edible fish and are also found in ponds and stagnant water.

The new species differs from other members of the genus due to its larger size and other physical characteristics.



Fish from the Badis family are also known as chameleon fish for their ability to change color. This helps them blend with the surrounding when under stress.

##### B) PTERYGOTRIGLA INTERMEDIA (SEP 2023)

The scientists of Zoological Survey of India (ZSI) have discovered this new fish species. It is the fourth species of Pterygotrigla genus reported in India so far.

It is commonly known as gurnards or sea-robins and belong to the family Trigidae.

**Discovered where:** It's a marine water fish discovered from Digha Mohana in WB.



### 3. AMPHIBIANS: CRITICALLY ENDANGERED

#### 1) DORIA'S FOAM NESTING TREE FROG (CHIRIXALUS DORIAE)

- This tree frog resurfaced in India after 108 years (May 2021).
- Recently, it was discovered in the buffer area of Mizoram's Pualreng Wildlife Sanctuary in June 2020.
- The only previous record of this tree frog in India was South of Arunachal Pradesh's Tenga Valley in 1912.
- It has known traits like changing skin shade and whipping up foam to protect its eggs.



#### 2) OTHER CR AMPHIBIANS

- a. Anaimalai Flying Frogs
- b. Gundiyam Indian Frog
- c. The Kerala Indian Frog (*Indiranana phrynoderma*)
- d. The Charles Darwin Frog (*Ingerana charlesdarwini*)
- e. The Kottigehar Bubble-nest Frog (*Micrixalus kottigeharensis*)
- f. Amboli Bush Frog
- g. Chalazodes Bubble-nest frogs (*Raorchestes Chalazodes*) / White spotted Bush Frog
- h. Green Eyed Bush Frog (*Raorchestes chlorosomma*)
- i. The Griet Bush Frog
- j. The Kaikatta's Bush Frog
- k. The Mark's Bush Frog
- l. The Munnar Bush Frog
- m. The Sacred Grove fush frogs
- n. Etc.

### 4. OTHER AMPHIBIANS IN NEWS

#### 7) PURPLE FROG (NASIKABATRACHUS SAHYADRENSIS)

- A proposal to declare a species of purple frog found in Idukki district of Kerala as state's official amphibian has been kept in abeyance by the Kerala Wildlife Advisory Board (Feb 2023)
- It was discovered in Kerala's Idukki district in 2003 for the first time.
- This frog is found only in Western Ghats and spends most of its time underground. After the tadpole stage, they go underground and return to the earth's surface only to breed once in a year. It feeds mostly on soil mites, ants and termites. It is also known as pig-nosed frog and Maveli Frog.
- It is believed to be closely related to family of frogs found in Seychelles and thus gives hint that continent of Africa and Asia were once part of the same landmass.



- If it is chosen, Kerala will be the first state to have a state frog.
- IUCN Status: NT

## 5. INVERTEBRATES: PORIFERA

- Phylum Porifera is the lowest multicellular animal of the Animal Kingdom. This Phylum includes more than 5,000 species. They are pore-bearing first multi-cellular animals. They have spongy appearance and therefore are also called **sponges**. They are attached to the substratum and don't move.
- They were earlier regarded as plants due to green color and their symbiotic relation with algae. But, after detailed study of their lifecycle, they were included in the category of animals.
- Key features:
  - Loosely organized cells
  - Mostly marine (few freshwater)
  - Either radially symmetrical or asymmetrical
  - No specialized organs
  - Reproduce asexually by budding.

- **Impact of Climate Change and Pollution:**

Marine sponges were earlier thought to be more resilient to ocean warming than other organisms. But, in 2022, New Zealand recorded the largest ever sponge bleaching event off its southern coast. While only one species, the cup sponge *Cymbastella lamellata*, was affected, a prolonged marine heatwave turned millions of normally dark brown sponges bright yellow. Subsequently other sponge species across the northern coastline of New Zealand also faced decay and death



- **Why should we care about sponges?**

- » They are among the most ancient and abundant animals on rocky reefs across the world. They serve a number of ecological functions:
  - They filter large quantities of water.
  - **Important role in Food chain:** They capture small particles and moving carbon from the water column to the seafloor where it can be eaten by bottom dwelling invertebrates. These invertebrates in turn are consumed by organisms further up the chain, including commercially and culturally important fish.
  - They also add three-dimensional complexity to the sea floor, which provides habitat for a range of other species such as crabs, shrimps, and starfish.

- **Sponge Bleaching:**

- » Sponges are in symbiotic relations with algae (diatoms). These diatoms live within the sponge tissues, exchanging food for protection.
- » **When sponge bleach**, it expels diatoms, leaving the sponge skeleton exposed.
- » **Tissue loss occurs** when sponges are stressed and either have to invest more energy into cell repair or when their food source is depleted, and they reabsorb their own tissues.

- » **Tissue decay** or necrosis on the other hand is generally associated with changes in the microbial communities living within sponges and growth of pathogenic bacteria.

## 6. INVERTEBRATES: ARTHROPODS

### 8) INSECTS: BUTTERFLIES

#### A) 3 CONTENDERS FOR NATIONAL BUTTERFLY STATUS

- A citizen poll to identify the national butterfly concluded with three species garnering the highest number of votes.
  - The nationwide poll organized by the National Butterfly Campaign Consortium, a collective of 50 butterfly experts and enthusiasts, yielded 59,754 votes.

Krishna Peacock (Papilio Krishna)	Indian Jazebel (Delias eucharias)	Orange Oakleaf ( <i>Kallima inachus</i> )
		
<p>Krishna Peacock, a <u>flagship species for biodiversity and conservation</u>, is generally found in large numbers in the <b>Himalayas</b>. Possessing a peculiarly large swallowtail, its <u>iridescent green scales diffract light to coat itself in radiance</u></p>	<p>Blessed with a vibrant colour pattern, including vermillion (haldi – kumkum), the <u>Indian Jezebel (or Common Jezebel)</u> is <u>known to deter its predators with its flashy wing colours</u>. Regarded as <u>soldiers of farmers</u>, they also <u>prey on parasites</u> that infest fruit-bearing plants. <u>Widely distributed</u>, the species can be spotted in gardens and other lightly wooded areas</p>	<p>Orange Oakleaf is commonly known as '<u>dead leaf</u>' for its ability to camouflage as a dry autumn leaf while striking a stationary pose with its wings closed. The <u>masquerade enables the species to prevent it from being devoured by birds in the moist forests of northern Western Ghats, central, northern and north-eastern parts of India</u> where they are generally found. Besides, the Oakleaf is also known to exhibit <b>polyphenism</b> as it assumes specific colour and size during dry and wet seasons</p>

- Union Ministry of Environment Forest and Climate Change (MoEF&CC) will choose one among them.
  - One among them will join the ranks of the Bengal Tiger, Indian Peacock, Indian Lotus, banyan tree, and mango as yet another national symbol.

## B) GOLDEN BIRDWING: INDIA'S LARGEST BUTTERFLY

- A Himalayan Butterfly named Golden Birdwing has **regained the status of India's largest butterfly**, after dethroning an unknown specimen which had held this record for **88 years**.
- **Unknown Specimen of The Southern Birdwing** held the record.
- Brigadier William Harry Evans, a British military officer and lepidopterist, had in 1932 recorded a wingspan of 190 mm of Southern Birdwing.
- **But recently, a female Golden Birdwing was found to have marginally higher wingspan of 194 mm.**



## C) CRIMSON ROSE (PACHLOPTA HECTOR)

Crimson Rose is a large butterfly with a mix of black, white and crimson colors on its wings and body. It is known for crossing the sea to migrate to Sri Lanka.

**IUCN: LC**

**Distribution:** It is found in India, Sri Lanka, Maldives, and possibly the coast of Myanmar.

In India, it is distributed in Western Ghats (MHA, Karnataka, Tamil Nadu and Kerala), Eastern India (WB, Odisha, Andhra), and Andaman & Nicobar Islands.

- In Andamans, it is a straggler.



**Migration:** This is the most striking aspect of the butterfly's behaviour. During the peak of its season, several thousand crimson roses can be found congregating and then migrating to other areas.

## D) BLUE DUKE (BASSARONA DURGA)

**Distribution:** It is found in Sikkim, Abor Hills and Nagaland.



**State Butterfly of Sikkim:** In 2022, it was declared the state butterfly of Sikkim. It represents Sikkim with its two unique colors - Blue represents sky while the white represents mountains of Himalayas.

## E) KAISER-E-HIND (TEINOPALpus IMPERIALIS)

**Physical features:** The rare butterfly is a visual delight. It has shimmering green, bright yellows, and delicate blacks. It has a 90-120 mm wingspan.



**Distribution:**

The butterfly is found along the Eastern Himalayas (WB, Assam, Meghalaya, Sikkim, Manipur and Arunachal Pradesh) in India.

- The butterfly also flutters in Nepal, Bhutan, Myanmar, Laos, Vietnam and Southern China.
- The butterfly usually flies at tree top level and descends to sit on low vegetation when there is strong morning sunlight.

**State Butterfly of Arunachal Pradesh:** In 2021, Arunachal Pradesh government announced it as the state butterfly of Arunachal.

#### F) TAMIL YEOMEN: STATE BUTTERFLY OF TN

It is locally known as **Tamil Marvan** meaning "Tamil Warrior". It is a canopy butterfly and is sized between 60-75 mm. It belongs to the family of brush-footed butterflies or the Nymphaid.

In 2019, TN has declared Tamil Yeomen (*Cirrochroa thais*) as its state butterfly to symbolize its rich natural and cultural heritage, in a move aimed at boosting the conservation efforts of the attractive insect.

#### Other State biodiversity of TN

Palmyra: State Tree

Gloriosa Lily: State Flower

Emarald Dove: State Bird

Jackfruit: State Fruit

Nilgiri Tahr: State Animal



#### G) OTHER BUTTERFLIES IN NEWS

##### MONARCH BUTTERFLY

- Why in news?
  - IUCN has added the Monarch butterfly in the list of EN species.

Monarchs are large, beautifully colored butterflies that are easy to recognize by their striking orange, black, and white marking.

**Distribution:** They live in North, Central and South America as well as Australia, some pacific islands and India.

#### Special Characteristics:

- Poisonous:** A monarch's brilliant coloring tells predators: "Don't eat me. I am poisonous." The butterflies get their toxins from a plant called milkweed.
- Migratory:** North American Monarch butterflies undertake enormous migration each year. In winters they migrate from



**IUCN Status:** EN

**Threats:** Deforestation habitat degradation.

Canada and Northern USA towards California and Mexico (around 2,500 miles).

- **Return to same forests** and sometimes same trees as that of their ancestors: Scientists don't know how migrating monarchs know way to go, since they only live a few months, and none makes the journey more than once.

**Useful Video:** [Endangered Migration: A Monarch Butterfly Story](#)

Useful Video-2: Monarch Migration and Metamorphosis: [Monarch Migration and Metamorphosis | Incredible Animal Journeys | National Geographic](#)

## BLACK VEINED BUTTERFLY

### - Why in news?

- » Re-emergence of 'extinct' black veined butterfly in England likely due to unscientific release (June 2023: Source - DTE)

### About the Black Veined White (*Aporia crataegi*):

It is a large butterfly that became extinct from British Isles in 1925. It was always considered a rarity in the British Isles but on the continent, it is often very common.



In June 2022, the butterfly was spotted in London. These sightings are the result of unofficial release and is unlikely that the butterfly will survive in the wild to breed. It is not known who did this or why.

## 9) ARTHROPODS: INSECTS: MOTHS

### - Why in news?

- » Study identifies 37 rare moth species in Kerala, three first times in India: ZSI (Nov 2023)

### About Moths:

Moths are group of insects that include all members of the order Lepidoptera that are not butterflies.

- **Kingdom: Animalia; Phylum: Arthropoda; Class: Insecta; Order: Lepidoptera**

**Note:** Lepidoptera is an order of insects that includes butterflies and moths.

- » While butterflies are pollinators, moths are largely considered crop pests. Though some moths pollinate the flowers that bloom at night.



### Significance of Moths:

- » They perform some essential ecosystem services, including pollination, nutrient cycling and providing prey to birds and bats.
- » Moths are nocturnal and potential indicators of ecosystem health and changes. Therefore, in agro-ecosystem, moth abundance is positively related to abundance of crops.

### Important Moths:

**Silkworm moth**, (*Bombyx mori*) in its caterpillar stage is used for silk production (sericulture) for thousands of years. The species has undergone complete domestication with the species no longer being found in the wild.

### Problems caused by Moths:

- » Several moths are considered pests.

- About the Zoological Survey of India's study on Moths in Kerala:
  - The study was conducted through a two - year long survey from 2018.
  - **Key Findings:**
    - » The study identified 37 new moth species including **3 new species discovered first time in India**. These were Aeolarcha eaphthalma, Pharambara micacealis, and Tirathaba leucotehars.
    - » There has been a decline in the diversity due to excessive use of pesticides, radiation and air pollution.

## 10) ARTHROPODS: INSECTS: DRAGONFLY

Dragonflies belong to the order Odonata, characterized by large multifaceted eyes, two pairs of strong transparent wings and an elongated body.

They are mostly found in Wetlands – in areas like lakes, ponds, streams – because their **larva called nymphs** are aquatic.

They spend a larger part of their life under water and as an aquatic predator feed on fish, tadpoles, and other aquatic insects.

They were among the very first winged insects to have evolved over 300 million years ago.

Grasshoppers also act as **bio-indicators** and studying their life-cycle gives us an idea about our wetlands and ecology as a whole.

They also act as important bio-control agent as adult Odantes feed on mosquitoes, blackflies and other blood sucking flies. They eat a large number of mosquitoes in their larval stage.



**Key threats faced by Dragonflies:**  
Degrading wetlands

### A) NATIONAL DRAGONFLY FESTIVAL

The National Dragonfly Festival, being conducted across 11 states in India by the WWF-India in collaboration with several other organizations like BNHS, aims to create awareness for the conservation of these insects. This festival was first observed in 2018. It is citizen science movement that has been running for the past five years. This festival will continue till December (Oct 2023)

### B) NEW SPECIES OF DRAGONFLIES: RED RUMPED HAWKLET

**Red rumped hawklet** (*Epithemis wayanadensis*): It is a new species of dragonfly that was discovered by naturalist David Raju at Wayanad in Kerala. A paper related to this was published in 2023.



## 11) ARTHROPODS: CRUSTACEANS (CRABS, LOBSTERS, BARNACLES)

### A) CRABS

- Crabs are decapod crustaceans, which means they have 10 legs and a hard outer shell called an **exoskeleton**.
- The Coconut crab, found on islands in the Indian and Pacific Oceans, is the largest land-living arthropod in the world, with a leg-span of upto 3 feet.

### B) HORSESHOE CRAB

Horseshoe crabs are marine and brackish water arthropods. They are the only living member of the order Xiphosura.

- Despite their name, they are not true crabs or crustaceans; they are chelicerates, most closely related to arachnids (spider, ticks, scorpions etc.)

They live in and around shallow coastal waters.

They are medicinally priceless and one of the oldest creatures on earth.

**News (March 2023)**

**Horseshoe crab disappearing off Odisha has scientists alarmed (March 2023: Source - TH)**

- India has two species of Horseshoe crabs and major concentration of the animals is found in Odisha.
- They are disappearing from their familiar spawning grounds along Chandipur and Balaramgadi coast in Odisha's Balasore district.
- **Medicinal Value:**
  - Horseshoe crab has blue, copper-based blood which is used in the biomedical industry to test for bacterial contamination in medical equipment and vaccines.
  - All injectable and medicines are tested with the help of Horseshoe crabs.
  - A molecule has been developed from reagent of Horseshoe crab that would help treat pre-eclampsia and lives of many babies can be saved in womb itself.
- **Key threats to Horseshoe crabs:**
  - Damaging of eggs by local people.
- **Living Fossil:** They are referred to as "living fossil" as they have been around for over 450 million years and have changed very little over time. Scientists are surprised to find strong immune system in animal that helped them survive millions of years.



Like Olive Ridley Sea turtles, these crabs are basically deep sea animals. They come to the coast of Balasore in Odisha and Digha and Sundarban in West Bengal for breeding purposes. They select suitable site for laying eggs.

## 12) ARTHROPODS: ARACHNIDS: SPIDERS (CR)

### A) RAMESHWARAM ORNAMENTAL (OR RAMESHWARAM PARACHUTE SPIDER)

It is a tree dwelling species endemic to TN's Ramanathapuram district.

It was first discovered in Rameshwaram Island in 2004 and has been named after the island.

IUCN: CR

**Physical Features:** The Spider has light and dark brown stripes across its body and legs, characteristic of all spiders in the genus Poecilotheria, which give it excellent camouflage in trees.



**Distribution and threat:** This species face extinction mainly due to loss of its natural habitat to development activities. The habitat is restricted to a few tamarinds, casuarina and mixed dry deciduous tree and palm plantations on the Remshwaram Island. The occupancy of the population is only 6 sq km.

## B) GOOTY TARANTULA, METALLIC TARANTULA OR PEACOCK TARANTULA (POECILOOTHERIA METALLICA)

**Physical Characteristics:** Steel blue color with patches of intense orange yellow, black and white. It is the only blue species of the genus Poeciltheria.



**Discovery:** First discovered in a railway timber yard in Gooty (Ooty/Udhagamandalam) in south India in a burn pile during railway construction.

**Distribution / Habitat:** Endemic to South India, wooden mountain system.

**Ornamental Pet:** Great demand world over in illegal pet trade.

### Threats:

- Illegal trade: One of the most expensive spiders in the illegal pet trade.
- Deforestation and habitat destruction

## 7. MOLLUSCA: MUSSELS

Mussels refer to numerous bivalve mollusks belonging to the marine family Mytilidae and to freshwater family of Unionidae.

**Distributed:** They are distributed worldwide and are most common in cool seas.

**Important Food Species:** Some species like the blue mussel are important as food in Europe and other parts of the world and have been cultivated since 13th century.



**Invasive Mussels:** The two species of tiny zebra mussel (genus Dreissena) are prominent freshwater pests. They proliferate readily, and adhere in great numbers virtually to any surface.

## A) CHARRU MUSSEL

- **About Charru Mussel (*Mytella strigata*)**
  - Charru Mussel is native to the South and the Central American Coast. But in Indian waters it is invasive.
  - It is spreading quickly through the backwaters of Kerala and is elbowing out other mussel and clam species and threatening the livelihood of fishermen involved in molluscan fisheries.
    - Vembanad, Ponnai, Ashtamudi, Paravur etc. are some wetlands which have been affected.
    - Ashtamudi (which is also a Ramsar site), is among the worst affected water bodies. With a population as high as 11,384 per sq. meter in Ashtamudi, it has replaced Asian Green Mussel (*Perna viridis*) and the edible oyster *Magallana bilineata*.
  - **How did it come to India?**
    - Most probably, the mussel reached Indian shores attached to ship hulls or larval form in ballast water discharge.
    - The rapid spread may have been caused by cyclone Ockhi which struck the region in 2017.
- **Way forward**
  - Urgent need to study the spread of Charru Mussel throughout Indian water bodies, understand the pathways of introduction and thus take steps to control it.
  - There is also a need to **promote studies on invasion biology** and strengthen awareness on marine invasive species.

## 8. ECHINODERMS

- **Exclusively free living marine animals.**
  - » They are triploblastic and have a coelomic cavity.
  - » Most have arms that radiate from the centre of their body. Centre body contains organs and mouth for feeding



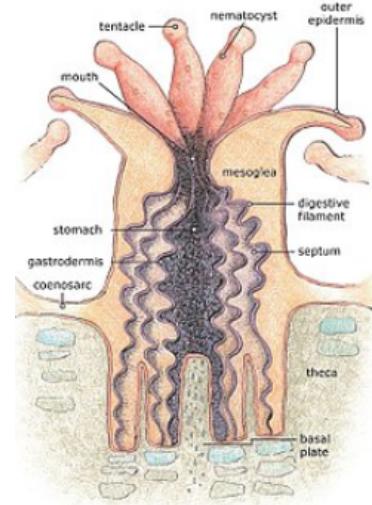
## 13) SEA CUCUMBERS

- **Details**
  - » Sea cucumbers are marine animals with a leathery skin and an elongated body containing a single, branched gonad.
  - » They are found in seafloor worldwide.
  - » They play a significant role in marine ecosystem. They help recycle nutrients. They break down detritus and other organic matter, after which bacteria can continue decomposition process. Thus, they play a role similar to what earthworms play on land.

- » They are named for their resemblance to the fruit of cucumber plant.
- Threats:
  - » Many of the sea cucumbers are gathered for human consumption and some are even cultivated in aquaculture system.
- Illegal Trafficking:
  - » A new study by Wildlife Conservation Society- India (WCS-India) has shown that Sea Cucumber were the most frequently trafficked marine species in India between 2015 - 2021.
    - The greatest number of seizures were observed in Tamil Nadu, Maharashtra, Lakshadweep, and Karnataka.
  - » WPA currently protects all species of sea cucumbers.
- CITES COP-19 (Nov 2022)
  - » Sea cucumbers are included in CITES Appendix-II. Cites has decided to include the genus *Thelenota* in the category.

## 9. CNIDARIA: CORALS

- Why in news?
  - Largest deep-sea coral reef to date is mapped by scientists off the US Atlantic Coast (Jan 2024)
- What is Coral?
  - Corals are colonial organisms made up of individual polyps. Coral 'Polyps' are tiny animals related to anemones and jellyfish.
  - They fall under phylum **Cnidaria** and the Class Anthozoa. They have a sac like body and an opening, or mouth, encircled by stinging tentacles. They use calcium and carbonate ions from water to form a hard-cup shaped skeleton of calcium carbonate. This skeleton protects the soft, delicate body of Polyp. Most skeletons have clear bodies i.e. their skeletons are white like human bones.
  - Understanding Symbiotic Relationship between Coral (Polyp) and Algae
    - Algae zooxanthellae provide nutrients through photosynthesis activities.
    - Corals provide protected environment, steady supply of carbon dioxide, for photosynthesis and phosphorus to algae.
  - Other Source of Nutrition for Corals
    - In addition to the symbiotic relation with algae, most corals capture and consume live prey ranging from microscopic zoo-planktons to small fish, depending on the Coral size.
  - Useful Video: What is Coral: [Coral: What is it?](#)



Anatomy of a stony coral polyp

## Types of Corals

### - Hard Coral and Soft Corals

- **Only hard corals form reef:** They produce rock-like skeleton made up of calcium carbonate. These skeletons contribute towards making reefs. They rely on algae (zooxanthellae) living within their tissues for nutrition and energy to build their skeleton. They therefore live in shallow clear water to allow sunlight to reach the algae.
- **Soft Corals**, such as sea fans and sea whips, look like colorful plants or graceful trees and are not reef building as they don't form hard calcified skeleton of many reef-building corals. They only produce small amount of calcium carbonate which help them remain in shape. They may or may not be in symbiotic relations with zooxanthellae.

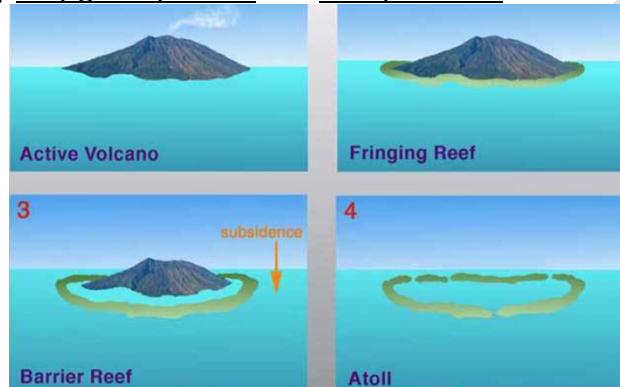
### - Cold Water Corals/Deep water Corals

- Though majority of coral reefs are found in tropical and sub-tropical waters, there are also deep-water corals in colder regions.
  - » They are mostly stony (hard) corals but can also include soft corals like sea fans.
  - » They are not dependent on Zooxanthellae for energy. They filter out food particles out of water for energy.
  - » They provide habitat for sharks, swordfish, sea stars, octopus, shrimp, various types of fish etc.
- **Largest Deep-Sea Coral Reef to date** is mapped by Scientists off the US Atlantic Coast (Jan 2024)
  - » It extends for about 499 kms from Florida to South Carolina and at some point is upto 109 kms wide.
- **Scientists** predict that deep reef cover more of the ocean floor than tropical reefs. 75% of world's ocean floor is still unmapped in high resolution.

### - Coral Reefs

- These are larger underwater structure composed of the skeletons of Corals. Reefs are built by coral polyps as they secrete layers of Calcium carbonate from under their skin. These skeletons made from calcium carbonate, protect the coral animals from predators and also offer a substrate on which new Coral Polyps can attach themselves.
- **Coral** reefs grow best in warm water and they prefer a shallow range with lots of sunlight for their symbiotic algae.
- **Classification of Coral Reefs based on their location: Fringing, Barrier, Atolls and Patches**
  - a. **Fringing Reefs** grow near the coastline around islands and continents. They are separated from the shore by narrow, shallow lagoons. They are the **most common types** of reefs that we see.
    - E.g. reefs of Andamans.
  - b. **Barrier Reefs** are also parallel to coastline but are separated by deeper, wider lagoons. At their shallowest point, they can reach the water's surface forming a '**barrier**' to navigation. The **great barrier reef of Australia** is the largest and the most famous of the barrier reefs.
    - E.g. in reefs in Nicobar and Lakshadweep.

- c. **Atolls** are rings of corals that create protected lagoons and are usually located in the middle of the sea. They are generally formed when islands surrounded by fringing reefs sink into the sea or the sea level rises around them. The fringing reefs continue to grow and eventually form circles with lagoons inside. **Atolls are like circular barrier reefs but without their central land mass.**
  - E.g. Atolls of Lakshadweep and Nicobar.
- d. **Patch reefs** are small, isolated reefs, that grow up from the open bottom of the island platform or continental shelf. They usually occur between fringing reefs and barrier reefs. They vary greatly in size and rarely reaches the surface of the water.



- **Where are Coral Reefs located globally?**
  - » Coral reefs are found in more than 100 countries of the world. Most of these reefs are located between the Tropic of Cancer and Tropic of Capricorn.
  - » **Great Barrier Reef**, located off Australia's East Coast is the largest coral reef in the world.
  - » **Important Coral Reef Areas of India** include Andaman and Nicobar Islands, Lakshadweep Islands, the Gulf of Mannar and finally the Gulf of Kutch in the order of their species diversity.



- **Great Barrier Reefs**
  - » It contains the world's largest collection of Coral Reefs and is world's most extensive coral reef ecosystem. It is a site of remarkable variety and beauty on north-eastern Coast of Australia.

- **Size:** It stretches more than 2,300 kms and has some 2,500 individual reefs of varying sizes and shapes, and over 9,00 islands. It is extremely rich in **biodiversity** - it has 400 types of corals, 15,00 species of fish, and 4,000 types of molluscs.
  - » The **entire ecosystem** was inscribed as **World Heritage Site** in 1981, covering an area of 348,000 sq. km and a length of 2,300 km.
  - » **But the Reef system is facing severe environmental threats.**
    - Recently, World Heritage Committee have tried to downgrade the reef's World Heritage Status to "in danger" because of the damage caused by climate change. But, Australia has prevented this by garnering enough international support.
    - **Factors threatening Reef:**
      - Rising sea temperature
      - Thermal extremes
    - The state of the ecosystem has become very poor here due to rising sea temperatures and thermal extremes. This is negatively impacting abundance and health of many species groups, including corals, invertebrates, some bony fishes, marine turtles and seabirds.
- **Significance of Coral Reefs**
- » **Biodiversity Protection:** Coral reefs are believed to have highest biodiversity of any ecosystem on the planet - even more than the tropical rain forests. They occupy less than 1% of the ocean floor but is home to 25% of marine life. They are sometimes also known as '**The tropical rainforest of the Oceans**'.
    - They also provide substrate for mangroves.
  - » **Economic Benefits:** The value of goods and services provided by Coral reefs is estimated to be \$2.7 trillion per year.
  - » Coral reef provide millions of people with food, medicine, protection from storms, and revenue from fishing and tourism.
  - » They are also the largest biogenic CaCO<sub>3</sub> producer.
- **Threats:** As per Global Coral Reef Monitoring Network (CCRMN), in the last decade, world has lost 14% of its Coral.
- **Key Factors:**
- i. **Man-Made Causes**
    1. **Pollution, Ocean Acidification, etc.**
      - Eutrophication -> Deoxygenation -> Dead zones. As per a recent study, deoxygenation has emerged as the biggest threats in recent years.
    2. **Overfishing, Unsustainable Tourism, and Poor Coastal Management**
    3. **Mechanical Damages**
    4. **Thermal Pollution**
    5. **Climate Change**
      - As per the GCRMN report, the reefs all over the world are under relentless stress due to warming caused by climate change.
      - Higher sea surface temperatures have also become a factor for coral bleaching.
  - ii. **Natural disturbance** such as violent storms, El Nino Southern Oscillation, epizootics etc.

- **Coral Bleaching**

- » When Corals are stressed by **changes in conditions** such as **temperature, light, or nutrients**, they **expel the symbiotic algae** living on their tissues, causing them to turn **completely white**.
- » It has emerged as one of the major reasons for coral reef destruction. For e.g. in 1998, it caused the loss of 8% of the world's corals.

# CORAL BLEACHING

Have you ever wondered how a coral becomes bleached?

## HEALTHY CORAL

- 1 Coral and algae depend on each other to survive.



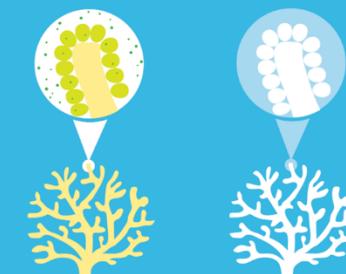
## STRESSED CORAL

- 2 If stressed, algae leaves the coral.



## BLEACHED CORAL

- 3 Coral is left bleached and vulnerable.



### WHAT CAUSES CORAL BLEACHING?

**Change in ocean temperature**  
Temperature caused by climate change is the leading cause of coral bleaching.

**Rainfall and pollution**  
Storm generated precipitation can rapidly dilute ocean water and runoff can carry pollutants — these can contribute to bleaching in shallow water corals.

**Overexposure to sunlight**  
When temperatures are high, high solar irradiance contributes to bleaching in shallow water corals.

**Extreme low tides**  
Exposure to the air during extreme low tides can cause bleaching in shallow corals.

## 14) FIRE CORALS (MILLEPORA BOSCHMAI)

- Fire corals are colonial marine organisms that look like a real coral. **Technically they are not corals**. They are more closely associated with **Hydra** and other **hydrozoans**.
- **Millepora Boschmai:** It is a critically endangered species of fire coral. As per the IUCN's latest update the fire Coral (Millepora Boschmai) may be possibly extinct.
- The scientific name Millepora is derived from several small pores on the surface of these corals. They are usually yellow green or brown in color.
- **Habitat:** Generally found in Murky inshore waters and display a tolerance for siltation. Often found in clear offshore sites.
- **Distribution:** Indonesia, Gulf of Chiriqui in Panama Pacific Province.
- **Possibly extinct from:** Australia, India, Indonesia, Malaysia etc.
- **Threats**
  - Illegal Trade: Collected for decoration and jewellery trade.
  - Global warming and related bleaching effect: though to have completely disappeared from the majority of marine.



## 10. PLANT BIODIVERSITY SITUATION IN INDIA

- The latest estimate of plant diversity in India stands at 54,733 taxa including 21849 angiosperms, 82 gymnosperms, 1310 pteridophytes, 2791 bryophytes, 2961 lichens, 15504 fungi, 8979 algae, and 1257 microbes. These represent around 14% of total recorded plant species in the world.

Group	No. of taxa in India	Percentage of plant diversity in India
Virus/Bacteria	1257	2.29
Algae	8979	16.4
Fungi	15504	28.33
Lichens	2961	5.41
Bryophytes	2791	5.11
Pteridophytes	1310	2.39
Gymnosperms	82	0.15
Angiosperms	21849	39.92
<b>Total</b>	<b>54733</b>	<b>100</b>

## 15) INTERNATIONAL DAY OF FORESTS

- **21<sup>st</sup> March** is observed as the **International Day of Forests** (IDF) by the United Nations.
- The year 2022 marked a decade of IDF.
  - The UN had proclaimed **21st March as the International Day of Forests in 2012**.
- The day celebrates and raises awareness about the importance of all types of forests.
- The **theme** for 2023 was 'Forests and Health', which calls for giving, and not just taking, recognizing that healthy forests will bring healthy people.
- **Organizers** are the UN Forum on Forests and the Food and Agriculture Organizations (FAO) of the UN, in collaboration with Governments, the collaborative partnerships on forests and other relevant organizations.

## 16) NATURAL VEGETATION IN INDIA (SOURCE – GEOGRAPHY NCERT)

- Natural vegetation is the **plant cover that grows without any human intervention and is adapted to the local climate and soil conditions**. It plays an important role in maintaining ecological balance and supports a wide range of flora and fauna. It is also known as **virgin vegetation**.
  - Thus, cultivated crops and fruits, orchards from part of vegetation but not natural vegetation.
- Based on certain common features such as pre-dominant vegetation type and climatic regions, Indian forests can be divided into following types:
  - Tropical Evergreen and Semi Evergreen Forests
  - Tropical Deciduous Forests

- Tropical Thorn Forests
- Montane Forests
- Littoral and Swamp Forests

- Details about each forest types:

#### A) TROPICAL EVERGREEN AND SEMI EVERGREEN FORESTS:

They are found in warm and humid areas with an annual precipitation over 200 cm and a mean annual temperature above 22 degree C.

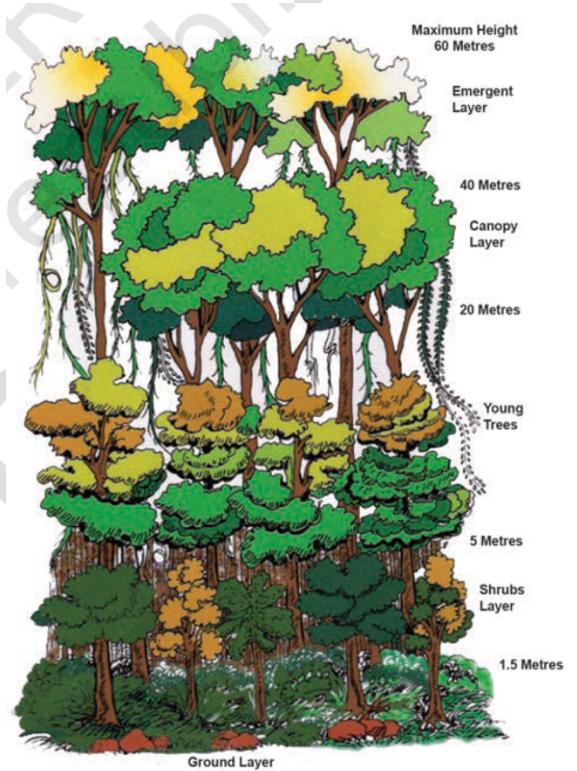
**Distribution in India:** Western Slopes of Western Ghats, Hills of North-eastern region, Andaman and Nicobar Islands.

**Tropical Evergreen Forests** are well stratified with layers closer to the ground.

- They are covered with shrubs and creepers, with short structured trees followed by tall variety of trees.
- No definite time for trees to shed their leaves. Therefore, these forests appear green all the year round.
- Some commercially important trees are ebony, mahogany, rosewood, rubber, cinchona.

**Semi Evergreen Forests** are found in the less rainy part of this region. They have a mixture of evergreen and moist deciduous trees.

- The undergrowing climbers provide an evergreen character to these forests.
- Main species are white Cedar, hollock and kail



#### B) TROPICAL DECIDUOUS FORESTS

- Most widespread forests in India. They are also called monsoon forests and are spread over regions receiving rainfall between 70-200 cm. **Trees shed leaves** once a year four six to eight weeks in dry summer.
- The tropical deciduous forests are found in central and southern India .
- The deciduous forests can be further classified into moist deciduous forests and dry deciduous forests based on the amount of rainfall received.

- **Moist Deciduous Forests** are more pronounced in the region which record rainfall between 100-200 cm. They are found in NE states along the foothills of Himalayas, eastern slopes of western ghats, and Odisha.
  - **Mains species** - Teak, Sal, Bamboos, Shisham, sandalwood, kair, kusum, arjun, semul, mulberry, Mahua etc.
  
- **Dry Deciduous** are found in areas where rainfall range from 70-100 cm. It acts as transition between moist deciduous and thorn forests. They are found in rainier area of Peninsula and plains of UP and Bihar.
  - In the higher rainfall area of the peninsular India and northern plains, these forests have a parkland landscape with open stretches in which teak and other trees interspersed with patches of grass are common. As the dry season begin, the trees shed their leaves and forest appears like vast grassland with naked trees all around.
  - **Main Vegetation:** Tak, Sal, Peepal, Neem, Tendu, etc.

### C) TROPICAL THORN FORESTS

- Areas with rainfall less than 50 cm.
- Consist of variety of grasses and shrubs
  
- It includes semi-arid areas of south west Punjab, Haryana, Rajasthan, Gujarat, MP and UP. In these areas plants remain leafless for most part of the year and give an expression of scrub vegetation.
  
- **Important Plant Species:**
  - Acacia, palms, euphorbias, and cacti are the main plant species.
  - Babool, Ber, date palm, khair, neem, palas etc are also common.
  - **Tussocky grass** grows upto a height of 2m as the undergrowth.

### D) MONTANE FORESTS

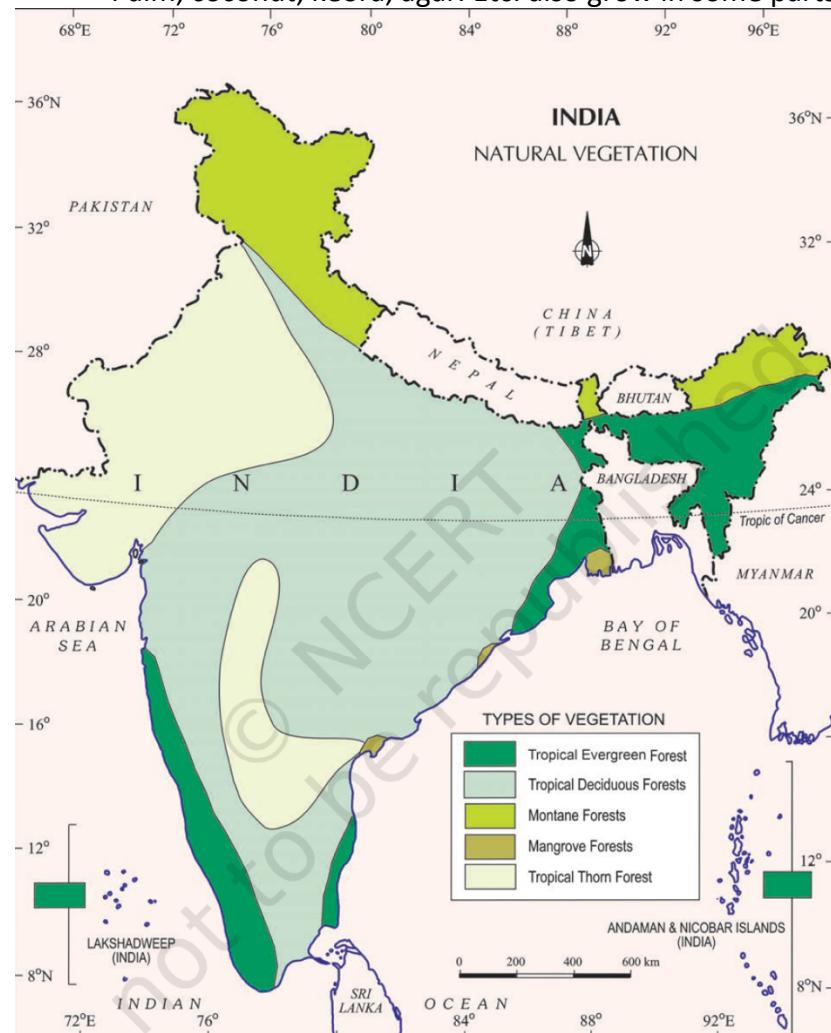
- In Mountainous region, the decrease in temperature with increasing altitude leads to corresponding change in natural vegetation. We see a succession of vegetation from tropical to tundra region.
  - **The Wet Temperate** type of forests is found between 1,000 m to 2000 m height. Here, Evergreen broad leaf trees, such as oaks, chestnuts dominate.
  - **The Temperate forests containing coniferous trees** are found between 15,00 and 3,000 metres. It include pine deodar, silver firs, spruce and cedar. These forests are generally found in southern slope of Himalayas, places having high altitudes in southern and northeastern India.
    - **Temperate grasslands** are common at higher altitudes.
  - **At height above 3,600 metres** temperature forests and grasslands give way to Alpine vegetation. Silver fir, junipers, pines and birches are the common trees of these forests. However, they become progressively stunted as they approach the snowline.

Ultimately through shrubs and scrubs, they merge into **Alpine grasslands**. These are used extensively for grazing by nomadic tribes, like Gujjars, and Bakarwals.

- At higher altitudes Mosses and Lichens are part of the **tundra vegetation**.

#### E) LITTORAL AND SWAMP FORESTS:

- Mangrove Forests are found in areas of coasts influenced by tides.
  - Sundari trees provide durable hard timber.
  - Palm, coconut, keora, agar. Etc. also grow in some parts of the delta.



#### 11. INDIA STATE OF FOREST REPORT, 2021

- **Introduction**
  - » Published by Forest Survey of India, MoEF&CC, Gol.
  - » Biennial report
  - » Provides state/district wise forest cover of the country and changes thereon wrt previous assessment.
  - » The forest cover assessment is a wall-to-wall mapping exercise based on remote sensing supported by intensive ground verification and field data from National Forest Inventory.

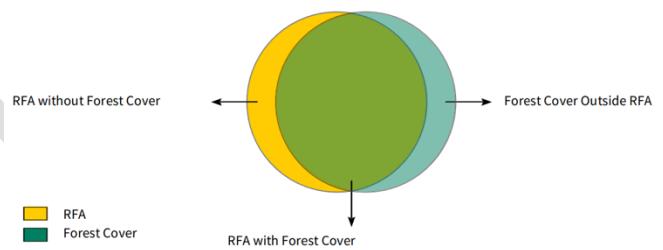
- **About Forest Survey of India**
  - » It was **founded in 1976** as a key National Survey Organization under Ministry of Environment Forest and Climate Change. It is headquartered in Dehradun.
  - » It conducts forest surveys, conducts research to monitor changing land and forest resources, implements social forestry.
  - » **Reports**
    - ISFR
    - 'The Reports on Inventory of Wood Consumption'.

- **Some other Basic Information**

- » **Forest cover classified into three density classes.**
  1. **Very Dense Forest** (canopy density > 70%)
  2. **Moderately Dense Forest** (40-70% of canopy density)
  3. **Open Forest** (10-40% of canopy density)
- » **Scrub** (degraded forest lands with density less than 10%) -> not counted in forest cover
- » **Non-Forest** (land not included in any of the above 4 categories (includes water bodies))

- **Forest Cover and Recorded Forest Area**

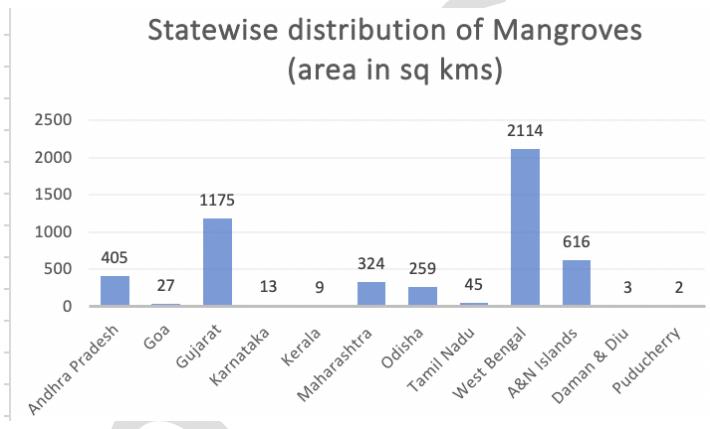
- » **Forest Cover:** All land more than 1 hectare in area with a tree canopy of more than 10%, irrespective of land use, ownership, and legal status. It may include even orchards, bamboo, palm etc. and is assessed through remote sensing.
- » **Recorded Forest Area/Forest Area:** Refers to all geographical areas recorded as 'Forests' in government record.
- » **Note:** There may be areas under Forest Area which will not be covered under definition of Forest cover. Similarly, there will be areas outside Forest Area which may be included in forest cover.



## 1) KEY HIGHLIGHTS OF THE 2021 SURVEY

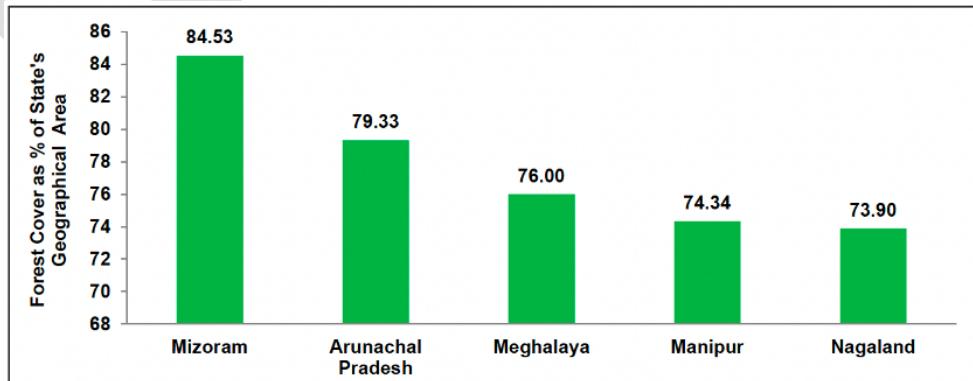
- India's **total forest cover**: 7.13 lakh sq km (**21.71%** of India's total area)
  - » In 2011, the total area under forest cover was **21.05%**. So, there has been an increase of 3.14 percent in the forest cover over 2011.
  - » This increase in total forest cover is mainly attributed to increase in very dense forest, which rose by 19.54 per cent between 2011 and 2021. Open forest also improved by 6.71 per cent, while moderately dense forest declined by 4.32 per cent between 2011 and 2021.
    - **Causes of Concern?**
      - **Decline in Natural Forests:**
      - **Decline in North-East India**
        - **Importance of NE:** It accounts for 7.98% of total geographical area but 23.75% of total forest cover.
  - » The Forest cover has increased by 1,540 sq km since 2019.

- **Total Forest and Tree Cover:** 8.09 lakh sq km (**24.62% of India's total area**).
  - » There has been a 1,540 sq km increase in forest cover and 721 sq km increase in tree cover since the last report in 2019.
- **Total Mangrove cover** in the country is 4,992 sq km which is 0.15% of the country's total geographical area.
  - » As per the ISFR 2021, there has been a net increase of 17 sq km in the mangrove cover of the country compared to 2019 assessment.
  - » Very Dense (29.55%), Moderately Dense (29.67%), and Open Mangroves (40.78%).
    - **Odisha** (8 sq km), **Maharashtra** (4 sq km) and **Karnataka** (3 sq km) have shown **most increase**.



- **Bamboo Forests** have grown from 13,882 million culms (stems) in 2019 to 53,336 million culms in 2021.
- **The total carbon stock in forests** was estimated to be 7,204 million tonnes, an increase of 79.4 million tonnes from 2019.
- **States with more than 33% of area under forest cover:** 17 states
  - » 5 States/Uts: Lakshadweep, Mizoram, Andaman & Nicobar Islands, Arunachal Pradesh and Meghalaya have more than 75% forest cover.
  - » 12 States/Uts: Manipur, Nagaland, Tripura, Goa, Kerala, Sikkim, Uttarakhand, Chhattisgarh, Dadra & Nagar Haveli and Daman & Diu, Assam, and Odisha have forest cover between 33% and 75%.
- **Top 5 States in terms of Forest Cover**
  - » Madhya Pradesh (11% of the total forest cover), Arunachal Pradesh (9%), Chhattisgarh (8%), Odisha (7%), and Maharashtra (7%).

- **Top 5 States by % of Geographical Area under Forest Cover**



- **Note:** The above data has not included islands of A&N and Lakshadwee as they are UTs:

- Lakshadweep (90%) A&N Islands: 81.75%
- **Assessment of Forest Cover in tiger reserves, tiger corridors and Gir Forest** which house the Asiatic Lion.
  - » In Tiger Corridors the forest cover has increased by 37.15 sq km (0.32%) between 2011 - 2021.
  - » In Tiger Reserves the forest cover has decreased by 22.6 sq km (0.04%) between 2011-2021.
  - » Forest cover has increased in 20 tiger reserves in these 10 years and decreased in 32.
    - **Pakke Tiger Reserve** (in Arunachal Pradesh) has the highest forest cover at 97%.

## 12. MANGROVES

### - Introduction

- » Mangroves are salt tolerant plant communities found in tropical and sub-tropical intertidal regions of the world. They are a group of 70 species of trees, shrubs and ferns. Mangrove areas are characterized by high rainfall (100 - 300 cm) and high temperature (26 degree C - 35 degree C).
- » Mangrove species exhibit a variety of adaptation in morphology, anatomy, and physiology to survive in water logged, highly saline soils and cyclone and tide prone environment.
- » They show convergent adaptations to saline, oxygen deficient, habitats. The 'true mangroves' exhibit all or few of the typical mangrove adaptations:
  - Tolerance to Salinity; Salt filtering or exuding system**
  - Tolerance to oxygen deficient soil**
  - Stilt or knee roots, Aerial Roots (pneumatophores)**
    - **Note:** Aerial roots project above the mud and have small openings (lenticles) through which air enters, passing through the soft spongy tissues to the roots beneath the mud. This acts as site of oxygen intake for the submerged roots.
  - Succulents (thick fleshy leaves)**
  - Viviparous Seedlings**

Vivipary is a phenomenon that involves seeds germinating prematurely while they are still inside or attached to the parent plant or fruits. Many mangrove species show vivipary. The ovum is fertilized while still on the parent tree and grows by a combination of photosynthesis and acquisition of nutrients from the parent until it may reach a length of 50 cm



- » These features allow these species, belonging to different families and genus survive along the coasts. Some prominent mangrove genera are Avicennia, Rhizophora, Sonneratia, Brugueira, etc.
- **Global Distribution of Mangroves:**

- » The distribution and diversity of mangroves is higher in the tropical Indo-West Pacific region and goes on reducing the subtropical, Atlantic, Caribbean, and Eastern Pacific regions.



#### » **Continental Distribution:**

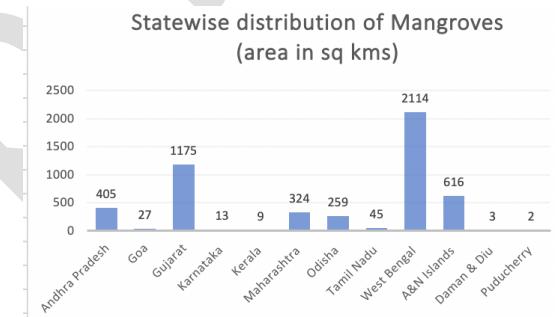
- As per the India State of Forest Report (ISFR), 2021, globally around 113 countries have mangrove forests with highest continental distribution in Asia, followed by Africa, North and Central America, South America and Oceania.

#### » **Country wise distribution:**

- More than 40% of the total area of Mangroves was reported to be in just four countries: Indonesia (19%), Brazil (9%), Nigeria (7%), and Mexico (6%).

### - **Mangroves in India:**

- » India has 3.3% of the world's mangroves. Important species of Mangrove ecosystem in India include *Avicennia officinalis*, *Rhizophora mucronata*, *Sonneratia Alba*, *Avicennia Alba*, *Bruguiera cylindrica*, *Heritiera littoralis*, *Phoenix paludosa*, *Morinda citrifolia* & *Ceriops tagal*.
- » **Sundarban**, located in the northern Bay of Bengal is the world's largest single patch of Mangrove forests. It is spread over approx. 10,000 sq km, in BD and India. It was the first mangrove forest to be brought under scientific management as early as in 1892.
  - Gol, had set up a National Mangroves Committee in 1976 to advise the government on issues related to conservation and development of mangroves in the country.



### - **Importance:**

- » **Protection against Tsunamis, Storm Surges and Soil Erosion**
- » **Enhance Sediment deposition:** Act as a zone of land accretion
- » **Reduces sea water pollution**
- » **Biodiversity:** They act as fertile breeding ground for many fish species and other marine fauna.
- » **Economy:** They act as important source of livelihood for the coastal communities dependent on collection of honey, tannins, wax and fishing
- » **Fight Climate Change:** Important carbon sink

### - **Factors harming Mangrove Ecosystem:**

- » Land Reclamation for agriculture.
- » Industrialization along the coastlines
- » Discharge of untreated domestic sewage and industrial effluents

## 1) MISHTI

- **MISHTI (Mangrove Initiative for Shoreline Habitats & Tangible Incomes):**
  - » It is a centrally sponsored scheme launched by MoEF&CC in 2023-24.

- » It aims to:
  - **Increase the mangrove cover** in India by 540 sq km along the coastline and on saltpan lands in 9 coastal states and 4 Union territories during five years commencing FY 2023-24 onwards.
  - **Conserve and restore mangrove ecosystem.**
  - **Promote ecotourism and Livelihood generation** activities in mangrove areas.
- » **Components:**
  - Mangrove Plantation
  - Awareness Generation
  - Capacity Building
  - Research and Development

## 2) MANGROVES ALLIANCE FOR CLIMATE (MAC)

- **Mangrove Alliance for Climate (MAC)** (Nov 2022)
  - » **Why in news?**
    - Launch of Mangrove Alliance for Climate (MAC) on the sidelines of COP 27 (Nov 2022)
- **Details**
  - » Mangrove Alliance for Climate (MAC) is an initiative led by UAE and Indonesia. It also includes India, Sri Lanka, Australia, and Spain.
  - » It seeks to educate and spread awareness worldwide on the role of mangroves in curbing global warming and its potential as a solution for climate change.
  - » The intergovernmental alliance works on a voluntary basis meaning that there are no real checks and balances to hold the members accountable. Instead, the parties will design their own commitments and deadlines regarding planting and restoring mangroves.
- **Suggestions: Integration of Mangroves** into the national REDD+ programs need of the hour

## 3) UNESCO WORLD HERITAGE FORESTS: INDIA'S SUNDARBANS AMONG 5 SITES WITH HIGHEST 'BLUE CARBON' GLOBALLY

- Researchers at UNESCO, the World Resource Institute and the IUCN estimated the **gross and net carbon absorbed and emitted by the UNESCO World Heritage Forests between 2001 and 2020**
- **Key highlights of the study:**
  - » **UNESCO World Heritage Forests in 257 sites** absorbed approx. 190 million tonnes of CO<sub>2</sub> from the atmosphere each year. This is roughly equal to half of UK's annual CO<sub>2</sub> emissions from fossil fuels.
  - » They also store a substantial amount of carbon in addition to absorbing CO<sub>2</sub> from the atmosphere. The total carbon stored by these forests is approx. 13 billion tonnes.
- UNESCO lists 50 sites across the globe for their unique marine values. This represents just 1% of the global ocean area. But they comprise at least 15% of the global carbon assets.

- » The top five sites include Great Barrier Reefs (502 million tonnes of Carbon), Everglades National Park in USA (400 Mt C), Banc d'Arguin National Park in Mauritania (110 Mt C), Bangladeshi Portion of Sundarbans (110 Mt C) and Sundarban National Park in India (60 Mt C).

- **Worrying trend:**

- » 10 of the 257 forests emitted more carbon than they captured between 2001 and 2020 due to different anthropogenic disturbance and pressures.

## 13. GRASSLANDS

- Grasslands are types of vegetation mainly comprised of grasses belonging to the families **Poaceae** that include plants like **millets, rice, wheat, bluegrass, ryegrass, bamboos, sugarcane and many more.**
  - » In India various famous grasses are doab (durva), lemongrass, kans, sewan, congress grass etc.

- **Global Distribution of Grasslands:**

- » Grasslands go by different names in different parts of the world.

Region	Name
US Midwest	Prairies
South America	Pampas, Llanos, and cerrados
Central Eurasia	Steppes
West African	Savannas
Australia	Rangelands

- » **Climatic Conditions:**

- Grasslands would be found in places where there is not enough regular rainfall to support the growth of forest, but not so little that deserts form.

- **Types of Grasslands:** Tropical and Temperate

- » **Tropical Grasslands** are also called Savannahs. They are found in warm and hot climates where the annual rainfall is between 50.8 to 127 cms per year.

- They have scattered trees and some shrubs.

- **Distribution:**

- The largest savannahs are found in Africa (Savanna). It covers more than 50% of the entire continent.
- They are also found in Australia, South America (campos in Brazil, Llanos in Venezuela) and India.

- » **Temperate grasslands** include the Eurasian steppes (in Ukraine and Russia), North American Prairies, Argentine Pampas, Down in Australia, and Veld in South Africa.

- They are found in wide plains which are drier than Savannahs with but much colder.
- They are flat, treeless, covered with grass, and have rich soil.

- What they have in common is that grasses are their naturally dominant vegetation.

- Depending on how they are defined, they account for 20-40% of the global land area.
- They are generally open and fairly flat. Also, grasslands are **generally very fertile** as there is no heavy rain to wash away the nutrients.
  - This makes them vulnerable to human encroachment. For e.g., the much of the prairies have been encroached upon for agriculture purpose. This threatens biodiversity which depends on the grassland ecosystem.
- **Key threats:** Farming, overgrazing, invasive species, illegal hunting, climate change etc.
- **Grasslands and Biodiversity:**
  - **Grassland support variety of species.** Vegetations on the African Savannah, for example, feeds animals including zebras, wildebeest, gazelles, and giraffes. Similarly, temperate grasslands support prairies dog, badgers, coyotes and a variety of birds.

## 14. FAMOUS GRASSES IN INDIA

### Doab Grass or Durba grass (*Cynodon dactylon*):

These are common type of grass seen across India. They also have cultural significance and is used in deity worship. They are also used in Ayurveda system of India and in ancient medicines.



### Lemon Grass:

*Cymbopogon* genus, also known as lemongrass, barbed wire grass, silky heads, Malabar grass.

- Some species, particularly *Cymbopogon citratus* are commonly cultivated as culinary and medicinal herbs because of their scents, resembling that of lemon.
- Lemongrass and its oil is also believed to produce therapeutic properties.
- They may be used for producing citronella oil, which is used in soaps, as an insect repellent (especially mosquitoes and houseflies)



**Kans Grass** is a grass native to Indian subcontinent. It is a perennial grass, growing upto three meters in height, with spreading rhizomatous roots.

They form important habitat for the Indian Rhino in Assam.



**Revenna Grass** (elephant grass): It is a big, tall and large kind of grass that grows in moist and wet habitat types in India.

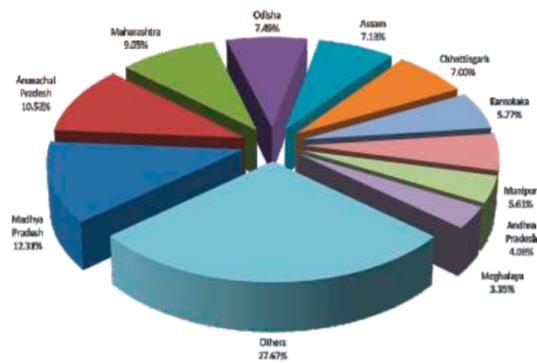


**Other important grasses** are Sewan grass, Carpet grass, Manila Grass (Korean grass), Napier Grass, Desho Grass, Foxtail Bristle grass, Big Leaf Grass, Congress grass,

## 15. BAMBOOS

- **Introduction:**
  - » Bamboos, the most diverse groups of plants in the grass family belong to subfamily Bambusoideae of the family Poaceae (Gramineae).
  - » They are fast growing perennial plants and are found in tropical, sub-tropical and mild temperature regions of the world.
  - » **Factors for geographical distribution:** Precipitation, temperature, altitude, and soil conditions.
    - As per FAO, globally there are 1,200 species of Bamboo in 90 genera across the world.
    - Large tracts of natural bamboo forests are found in tropical Asian countries between 15 degree N - 25 degree N latitudes.
- **In India**, bamboo is found naturally almost throughout the country except in Kashmir region.
  - » There are 125 indigenous and 11 exotic species of bamboo from 23 genera.
  - » Bamboos are found in abundance in the deciduous and semi-evergreen forests of the NE India and tropical moist deciduous forests of Northern and Southern India.
    - NE states and WB account for more than 50% of the bamboo resource of the country.
    - Other Bamboo rich areas are A&N, Chhattisgarh, MP, and the Western Ghats.
  - » **Major bamboo genera of India** are Arundinaria, Bambusa, Chimonobambusa, Dendrocalamus, Dinnochla, Gigantochloa etc. Different climatic conditions have different species in abundance.
- **Various properties of Bamboo:**
  - » The various properties of bamboos are availability in different sizes, light weight yet strong, hard, flexible, straight, fast growing, abundant, and hence having many uses.
- **Significance of Bamboo:**
  - » **Economic Significance:** Bamboo contributes to subsistence needs of about 2.5 billion people around the world, a majority of whom are tribal, forest dwellers, or communities dependent on forest resources.
  - » **Other uses** of bamboo include making normal and final quality paper, fishing poles, furniture, flooring, handicrafts, walking sticks etc.
  - » **Environmental benefits:** Bamboo plays a very important role in bio-diversity conservation, carbon sequestration and soil moisture conservation.
  - » **Food:** Young Bamboo shoots are used as food in some cuisines.

- **Protection Status in India:**
  - » **Indian Forest Act** was amended in 2017 to exempt Bamboo grown in non-forest areas from **definition of tree**. This did away with the requirement of felling/ transit permit of its transport and economic use.
- **Total Bamboo bearing area of the country** has been estimated to be 15.0 million ha.
  - » **Madhya Pradesh** (1.84 million ha) has the largest area followed by Arunachal Pradesh (1.57 million ha), Maharashtra (1.35 million ha) and Odisha (1.12 ha).



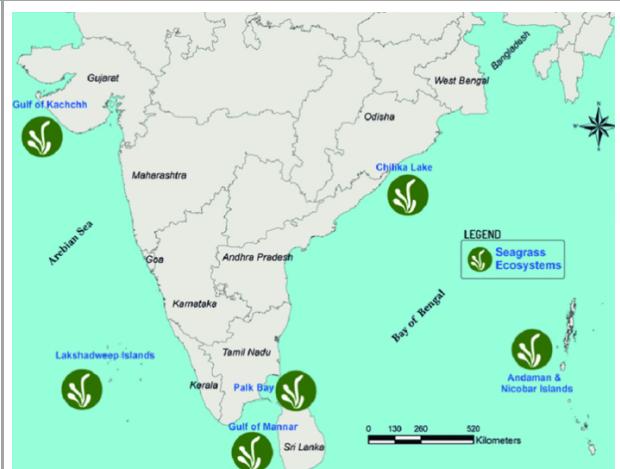
## 16. SEAGRASSES

- **Why in news?**
  - » In Baltic Sea, citizen drivers restore seagrass to fight climate change (July 2023)
  - » This is part of a new project that trains local citizens to restore seagrass meadows in the Baltic Sea. The hope is that this painstaking work can help tackle climate change. **Seastore Seagrass Restoration Project**, run by the GEOMAR Helmholtz Centre for Ocean Research in Keil, Germany, is one of the first that aims to enable citizens to restore seagrass autonomously.
- **Introduction:**
  - » Seagrasses are marine flowering plants that thrive fully submerged in shallow oceanic and estuarine habitats. They are one of the most important coastal habitats.
  - » **Global coverage** of seagrass is estimated to be  **$3.45 \times 10^5 \text{ km}^2$** , which represent about **0.1% - 0.2%** of the ocean floor.
  - » In India, total seagrass cover is estimated to be 517 km<sup>2</sup> with 14 reported species and six genera.
    - ***Halophila beccarii* (IUCN: VU)**, is the most commonly distributed species reported from all the coastal states except islands, acts as a pioneer species in the succession process of mangrove formation.
  - » **Distribution of seagrasses in India:**

The overall distribution of seagrass meadows in India occurs from the intertidal zone to a maximum depth of 15 m with varying species diversity.

The Major seagrass ecosystem along the coast of India are found in:

1. Gulf of Mannar and Palk Bay regions on the east coast comprise the largest seagrass meadows in India, covering 80 and 320 km<sup>2</sup> respectively.
2. The Ramasar site of Chilika Lagoon in Odisha state also has seagrass meadows that have expanded from 20 km<sup>2</sup> to 80 km<sup>2</sup> after the opening of the new bar mouth.
3. Gulf of Kuchchh on the west coast;
4. The lagoons of islands in the Lakshadweep in the Arabian Sea and;
5. Andaman and Nicobar Islands in Bay of Bengal.



#### - Significance of Seagrasses Ecosystem:

##### Provisioning Services:

- **Medicine** (treatment of heart conditions, sea sickness etc.)
- **Food** (Nutritious seeds)
  - Recently, a study has shown the presence of various biological metabolites in some India seagrass that can be used effectively in the food and pharmacological industries.
- **Fertilizer** (Nutrient rich biomass)
- **Livestock feed** (food for goats' sheep etc.)
- **Building Material** (Such as roofing for houses)

##### Supporting Services:

- **Key Fishing Grounds** as they offer a complex habitat for a variety of fish and other marine organisms like Dugongs.
- Seagrass based fisheries are globally important and are present wherever seagrass exists, supporting subsistence, commercial and recreational activities.
- Their high rates of primary production result in well-oxygenated waters that support complex food webs.



##### Regulating Services:

- **Coastal Protection**: Seagrass reduce the energy of waves and thus protect the seashore.
- **Carbon Sequestration**: Seagrass store more than twice as much carbon from planet warming CO<sub>2</sub> per square mile than forests do on land, according to a 2012 study. They accumulate CO<sub>2</sub> from both in-situ production and sedimentation of particulate carbon from the water column.

- **Water Purification:** They trap fine sediments and suspended particles in the water column and increase water clarity.

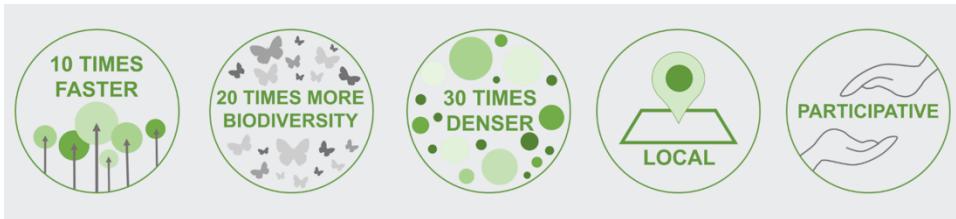
- **Threats to Seagrass Ecosystems:** Globally, seagrass habitations have declined in area and several species are threatened due to several natural and anthropogenic stressors:
  - **Natural Stressor:** Cyclones, heavy rainfall, coastal uplift and subsidence, grazing herbivores, and diseases
  - **Anthropogenic Stressors:**
    - i. **Commercial Fishing and trawling activities:** this is the most important threat to seagrass in India.
    - ii. **Boat activities** for recreational purposes
    - iii. **Runoff (Pollution)** from coastal aquaculture and agriculture
    - iv. **Shell Harvesting and Seaweed cultivation**
    - v. **Accidents like Oil Spills.**

- **Key Steps** which protect Seagrasses:

- » **CRZ Notification** 2011, issued under Environmental (Protection) Act, 1986, has classified seagrass meadows as CRZ1-A (Ecologically sensitive area). It prohibits developmental activities in its vicinity.

## 17. RECENT INITIATIVES TOWARDS ENHANCING GREEN COVER: MIYAWAKI FORESTS

- These forests are developed using Miyawaki method to create urban forests. **Dr Akira Miyawaki**, botanist and professor, is the inventor of the technic since 1980. He is a recipient of the 2006 Blue Planet Prize, which is the equivalent of a Nobel prize in ecology.
- Using the method, native urban forest ecosystems can be created much quicker.
  - The method take its inspiration directly from process and diversity in nature: 15 to 30 different species of trees and shrubs are planted together. This plant community works very well together and is perfectly adapted to local weather conditions.
  - The habitat thus created get more complex over time and attract much more biodiversity. Vegetation becomes much denser than conventional plantations, and it has the structure of a mature natural forest.
  - It is a multistorey structure, where different levels of vegetation appear. The forest thus structured delivers many benefits in the form of ecosystem services.
  - **Faster Recovery:** It would take 200 years to let a forest recover on its own. But with the Miyawaki method a similar result is achieved in 20 years.



- The technique works worldwide irrespective of soil and climatic conditions.
- **Miyawaki Forest at Ektanagar Gujarat:**
  - » At Ektanagar, the Miyawaki Forest will include following divisions: A native Floral Garden, a timber garden, a fruit garden, a medicinal garden, a Miyawaki section of mixed species and a Digital Orientation Centre.

## 18. ORCHIDS IN INDIA

- **What are orchids?**
    - They are a diverse and widespread group of flowering plants, with blooms that are often colorful and often fragrant commonly known as the Orchid family. They belong to the family Orchidaceae, which is one of the largest family of flowering plants with possibly over 27,000 species and more than 800 genera.
    - **Habitats:** Orchids can be found in nearly every habitat, but most orchid species are tropical.
  - As per Botanical Survey of India, there are 1256 species of Orchids in India.
    - **Orchids can be classified** in three types:
      - **Epiphytic:** (Plants growing on another plants including those growing on rock boulders and often termed lithophyte).
      - **Terrestrial:** (Plants growing on land and climbers)
      - **Mycoheterotrophy:** (Plants that derive nutrients from mycorrhizal fungi that are attached to the roots of a vascular plants).
    - In India, of all orchids 757 are epiphytic, 447 are terrestrial, and 43 are mycoheterotrophy.
  - **State wise distribution:**
    - **Arunachal Pradesh** (612 species); Sikkim (560 species) and West Bengal (with Darjeeling Himalayas having high species concentration) with 479 species.
- **Orchids of North Bengal are facing threats** (June 2023)

The wild orchids of Darjeeling Hills and Dooars are facing threats due to habitat loss (mostly due to deforestation).

**The most endangered** are the epiphytic orchids - the type that grows on another plant/tree merely for physical support.

Orchids are also natural gauges of air quality because they don't grow in polluted air



**Applications:**

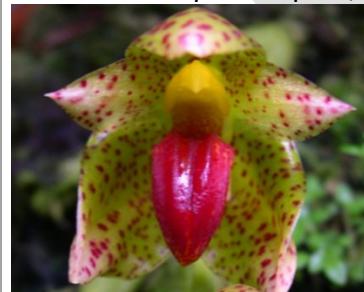
- The Oraon and Kharia tribal communities use wild orchids to treat range of diseases - cut and fractures, skin diseases, aches and pains.

**- Some Important species of Orchids:**

**The Dendrobium aphyllum** carries pinkish violet, fragrant flowers;



**The Bulbophyllum leopardinum**, with its pale green and spotted red flowers simulate a leopard's spots;



**Dendrobium transparens**



**Aerides Maculosa - Foxrush Orchid**



**Vanda Tessellate** is greenish with a striking blue purple lip



- The Vanda's scent is fusion of grape and lavender and the blooms are long lasting.

## 19. EXOTIC ALIEN PLANT SPECIES

### 1) EXOTIC ALIEN PLANT SPECIES

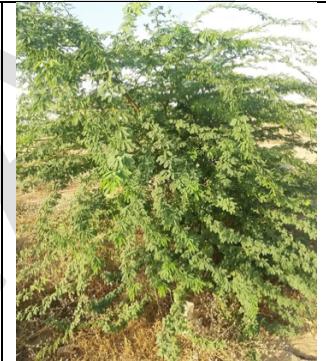
- A study published in ***Biological Invasions*** in 2018 showed that **as many as 471 plant species** that are alien or exotic - not native to India - are '**naturalized**' for they can thrive in the country's wilderness by forming stable populations.
- **Naturalized species** reproduce naturally in the environments they colonize.
- **Invasive species** are naturalized species which reproduce naturally but so prolifically that they alter the workings of the natural ecosystem they colonize and invade.
- **The list of 471 Exotic – Naturalized Plant Species include:**
  - **Common Guava** (*Psidium guajava*)
    - Not invasive
    - Exotic species in India. Native to Mexico and Central Asia.
  - **Lantana Camara**
    - Invasive
    - It replaces undergrowth and prevents native undershrub and plants from surviving.
  - **Siam Weed** (*Chromolaena odorata*) (native to South America and central America)
    - Invasive
  - **Tridax daisy**
    - Invasive
  - **Mimosa Pudica**
    - Invasive
  - **Proposis Juliflora**
    - Invasive
  - **Parthenium Hysterophorus** (Carrot grass, Gajar Ghans)
    - Invasive
- **Tamil Nadu (331)** leads the states having highest number of naturalized plants, followed by **Kerala (290)**.
- **Lakshadweep (17)** has the least number of exotic naturalized plant species.
- **110 alien plants** now occur in more than 31 states in India.
- **Cause of Worry?**
  - We have to worry about invasive species among these. The government needs to strengthen quarantine measures adopted before a plant is brought to the country.
  - In 2017, a study identified India as one of the 'hot-spots' of naturalized plant species and among the seven regions in the world that have the highest number of invasive species.

### 2) INVASIVE PLANT SPECIES IN INDIA

- **Invasive Plant Species** threaten 66% of India's natural systems: report published in *the Journal of Applied Ecology*.
  - The finding is based on National level survey conducted in India.
  - The 11 high concern invasive plant species that showed presence in 20 states of the country included Lantana Camara, Prosopis juliflora and Chromolaena odorata.
  - **Economic loss:** The study estimates that loss due to these biological invasions will cost the Indian economy upto **\$182.6 billion**

#### A) PROSOPIS JULIFLORA / MESQUITE (ANGREJI BABOOL OR VILAYATI BABOOL IN HINDI) (SEEMAI KARUVELAM IN TAMIL)

- It is a shrub of small tree in the family Fabaceae.
- It is native to Mexico, South America and the Caribbean.
- It has become an invasive weed in Africa, Asia and Australia.
- **Distribution in India**
  - They are distributed throughout the country and are aggressive colonizer.
  - They are common weed of waste lands, scrub lands and degraded lands.
- **Considered a threat to biodiversity**
  - It has survived where other tree species have failed, and in many cases, becomes a major nuisance.
  - It is a water-greedy plant that depletes ground water and nullifies the growth of native trees.
  - In 2004, it was rated one of the world's top 100 least wanted species (Invasive species specialist group of the IUCN, 2004)
- **Was considered a boon in 1960s**
  - In the light of severe firewood shortage
    - In 1960s, TN government had made provisions for aerial seeding of the plant from helicopter
  - The tree was also used to erect fences, making it difficult for animals to invade agriculture fields.
- **Other news about it**
  - It is affecting the wild ass population in Kutch Gujarat.



#### B) PROPOSIS CHILENSIS

- **Why in news?**
  - An invasive plant from South America (Prosopis Chilensis) is threatening to pulverise indigenous plants across the 21 islands where 96 species of birds have been recorded. (April 2023: Source - TH)
- **About Prosopis Chilensis**
  - It is a drought resistant plant native to arid regions of four South American countries - Argentina, Bolivia, Chile, Peru.
  - **Invasive in India:**
    - » It has become a cause of trouble in Gulf of Mannar Biosphere Reserve.
  - There is very less or no study on the invasiveness of this species on how it came to India unlike the equally invasive Prosopis juliflora.

### C) BLACK MIMOSA (MIMOSA PIGRA)

Genus Mimosa contains 400-500 species, which are mostly native to South America.

It is a **woody invasive shrub** that originates from tropical America and has now become widespread throughout the tropics.

- It has been listed as one of the world's 100 worst invasive species and forms dense, thorny, impenetrable thickets in wet areas.



#### Distribution in India

- Throughout
- Abundant in still or slow floating waters. Nuisance for aquatic ecosystem.

### D) PARTHENIUM HYSTEROPOHORUS (CARROT GRASS)

- It is an annual herb which is native to the American Tropics.
- It is an invasive species in India and several other countries. In India it is also known as **Carrot grass, Congress grass or Gajar Ghans**.
- It invades disturbed land, including roadsides, infests pastures and farmlands, leading to disastrous loss of yield.
- The plant produces allelopathic chemicals that suppress crop and pasture plants, and allergens that affect humans and livestock. It also frequently cause pollen allergies.
  - **All four of Assam's Rhino reserves** - The national park of Kaziranga, Orang, Pobitora and Manas - are currently reeling under the attack of these invasive plants.



### E) LANTANA CAMARA

It is also known as big-sage, wild sage, red sage and tickberry. It is a species of flowering plant within the verbena family, Verbenaceae, that is native to American tropics.

#### How was it introduced in India?

Lantana arrived in India as a decorative shrub in the British colonial period but quickly took over several ecosystems as an invasive species.

**Current Spread:** The plant currently covers 40-50% of India's area and have also invaded national parks and pasture lands.

It has spread from its native Central and South America to 50 different countries, where it has become invasive species.

- **Reduces biodiversity:** It often outcompetes more desirable species, leading to reduction in biodiversity.
- **Impacts Agriculture:** It can also cause problems if it invades agricultural areas as a result of its toxicity to livestock as well



Flowers and leaves of the Lantana camara. (Via Wikimedia Commons)

as **ability to form dense thickets** which if left unchecked can greatly reduce the productivity of farm land.

**Recent Updates:** A decade long initiative in MP to reclaim land overrun by Lantana helps residents restart agriculture and restore natural biodiversity. (Dec 2023: Source: DTE)



#### F) SIAM WEED (COMMUNIST PACHA)

- It is a common invasive species of Kerala, and is locally known as **Communist Pacha** (green) as it spread all over the state within a short span of time just like Communism did during the same time in 1950s.
- Siam weed is native to South America. Researchers have regularly pointed out this plant being responsible for harming many native plant species.
- **Why in news?**
  - After flood, there were reports of Siam weed becoming more common in Kerala.

#### G) SENNA SPECTABILIS (CALCEOLARIA SHOWER)

- **Details about Senna Spectabilis**
  - It is a plant species of the legume family and is native to South and Central America.
    - Here, they are often grown as an ornamental in front yards, parks, gardens, buildings, etc. due to their **bright yellow flowers** that bloom during the summer months.



- The species has become an invasive alien species in Africa and South-India, after it was introduced for resources such as firewood as well as to fight deforestation and desertification.
- Along with Lantana Camara and Wattle, it is among five major invasive weeds that had taken over vast swathes of the Nilgiris.
- In Madumalai Tiger Reserve, policy level decisions are being considered that will allow Tamil Nadu Newsprint and Papers Limited (TNPL) to remove the species from the landscape for paper making.

#### H) WATER HYACINTH

- **Why in news?**

- » MP's newest Ramsar wetland covered in invasive water hyacinth which is threatening biodiversity (2023)
- **About Water Hyacinth (*Pontederia crassipes*)**
  - » It is an aquatic plant native to South America. It is naturalized throughout the world and often invasive outside the native range.
  - » It is also known as "Terror of Bengal" as it competes strongly with native species. They have caused shortage of fish in Bengal.
    - It flourishes in Bengal's hot and humid climate and can live well and kill nearby plankton and water-borne species.
    - They double their biomass in six days and is one of the fastest growing plant known.
    - They take over local aquatic species. Additionally, these plants can produce thousands of seeds every year and these seeds can remain viable for over 28 years.
  - » It reduces the dissolved oxygen in the water and increases the biochemical oxygen demand causing the death of aquatic species.
- **Other problems caused by Hyacinth:** Economic loss, negatively impact hydel power project, pisciculture etc.
- **Note:** In small quantities water hyacinth can be good for ecosystem as they can remove heavy metal from water and can thus act as a water purifier.
- **News:** Sankhya Sagar in Madhya Pradesh (which was declared a Ramsar site) has virtually disappeared under a thick layer of water hyacinth.

## I) CANOCARPUS TREES

- **Concerns** over the management of invasive Conocarpus species of trees have recently led to Gujarat (2023) and Telangana (2022) banning their use. Several other states may follow suit - which is likely to discourage horticulturalists and nurseries from multiplying the species and using lakhs of its saplings in afforestation and landscaping projects across the country over the next year.
- **About Canocarpus Trees:**
  - There are two species of Canocarpus (buttonwood) trees, with several varieties of hybrids - *Canocarpus erectus*, which is widely used in India (and is native to South America) and *Canocarpus lacistema* is native to East Africa.
  - They are easily propagated and multiplied in nurseries through stem cuttings.
  - They have also been known to cause pollen allergies and respiratory problems in the vicinity of plantation.
- **Why do urban green initiatives end up deploying them in the first place?**
  - Since they are non-native species - they face very few or no pests or pathogens in new habitats, which makes their proliferation easy. They often require very little aftercare.
  - Some species like Canocarpus are not browsed by livestock and are thus favored for horticultural and landscaping projects.

## 20. PARASITIC PLANTS

### 1. Glechoma Konyakianorum

- A Parasitic plant discovered in Nagaland recently. It is a **holoparasite** (i.e. complete parasite) as it derives all its food from the host.

- It has no chlorophyll of its own and survives by feeding on another species of plant that has chlorophyll.
- It has been named in the honour of Konyak tribe of Nagaland.
- Conservation Status: Data deficient.

## 2. **Orabanche Cernua (Broomrape or Broom-rape): A parasitic weed that is affecting tobacco cultivation**

- **Introduction :**
  - Orobanche is a genus of over 200 species of parasitic herbaceous plants in the family Orobanchaceae, mostly native to the temperate Northern Hemisphere.
  - These plants completely lack chlorophyll, bearing yellow, white or blue snapdragon like flower.
  - As they have no chlorophyll, they are totally dependent on other plants for nutrients.
    - Broomrape seeds remain dormant in the soil, often for many years, until stimulated to germinate by certain compounds produced by living plant roots.
  - In India, it is recorded as a 'principal weed'. And adversely affects tobacco crops.
  - Globally it affects tomato, eggplant, potato, cabbage, coleus, bell pepper, sunflower, celery and beans.

## 3. **Some other details about Parasitic Plants**

- Plant parasites are differentiated as **stem and root parasites**.
  - **Common stem parasites found in India are**
    - Loranthus sp, on Mango trees, and Cuscuta reflexa, a climber.
  - Among the **root parasites** are
    - **Sapria himalayana**, a rare holoparasitic flowering plant found in Arunachal Pradesh and Meghalaya

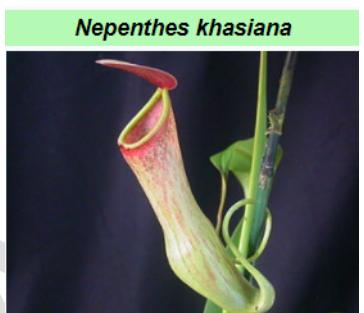
## 21. CARNIVOROUS/ INSECTIVOROUS PLANTS

- **Introduction**
  - Carnivorous plants are those plants which derive some or most of their nutrients (but not energy) from trapping and consuming animals or protozoans, typically insects and other arthropods. Insects are the most common prey for these plants and therefore they are also sometimes called insectivorous plants.
  - These plants have adapted to grow in areas which lack nutrients like swamps and rocky areas. The plants receive these nutrients, especially nitrogen from their preys.
  - They extract water and some minerals from soils too.
  - **Remember:** They have chlorophyll and they do photosynthesis to convert sun's energy into carbohydrate.
- **Types**
  - The plants are divided into active and passive types based on their trapping mechanism.
    - **Active** insectivorous use movements to trap the insect (ex. Venus fly-trap, Utricularia)
      - They use trapping mechanism like leaf traps etc
    - **Passive** insectivorous depend on long tubes with hairs that trap prey.
      - They use pitfall mechanism having some kind of jar or pitcher-like structure.

- **Insectivorous Plants in India**
  - Insectivorous plants in India are naturally found in Sikkim, Arunachal Pradesh, West Bengal and the Garhwal Himalayas.
  - The important genus of carnivorous plants in India are:

- **Nepenthes**

- These are the most glorious and spectacular genus of carnivorous plants in India.
- These plants form **wonderful pitchers** and their carnivorous traps are hungry looking maws that look every bit dangerous.
- It relies on pool of water to trap its prey by a combination of decaying odours and sometimes a red coloration. Once inside the picture, the prey fails to get a grip on the interior walls of this carnivorous plant because of the flaky wax on them, falls into water and hence is digested.
- Unlike other carnivorous plants, besides insects, gnaws and flies they feed on mice and frogs too.
- E.g.
  - **Nepenthes Khasiana** (Indian Pitcher Plant)
  - <https://youtu.be/1CP1i0UKvb8?t=144>



- **Pinguicula**

- Also known as Butterworts, and are mostly grown for their pretty orchid like flowers.
- The leaves of these plants emit a faintly fungal scent that attracts prey which gets stuck to the glandular surface of the leaves which then drowns in the moist pool of slime and is indeed digested.
- They are **absent** in India.
- <https://youtu.be/teLkmlaDSVU>



- **Drosera**

- Drosera is a sticky flypaper Carnivorous plant that bears long tentacles on its leaves. These stalks are tipped with brightly **colored glands**.
- As soon as an insect lands on these leaves, it sticks to them and these leaves coil around their prey to slowly digest it.
- There are around 180 species of these plants found globally. They are mostly found in region which are poor in organic nitrogen and phosphorus. (e.g. bogs on sandy banks or other mineral soils that are poor in organic nitrogen and phosphorus)
- <https://www.youtube.com/watch?v=h9NnctZVrvk>



## Utricularia

- largest genus of carnivorous plant that one can find, with more than 200 species occurring globally. It is a plant festooned with utricles or little bag like bladders and thus is named Utricularia. The little bladders in these plants are actually the carnivorous traps or the suction traps.
- The **flowers** of these plants are very small with a wild & varied display of Colors and form.

They mostly prey on worms, frogs, mosquitoes, scuds, flies, fleas and even amoeba.



### - Conservation Status

- The endangered species of carnivorous plants in India are Drosera Peltata, Aldrovenda vesiculosa and Nepenthes Khasiana have been included in the Red Book as endangered plants.

### - Main threats faced

- Gardening trading for medicinal properties
- Habitat destruction
- Pollution

## 22. OTHER SPECIAL PLANTS

### 1) NEELKURINJI (STROBILANTHES KUNTHIANUS) -> MONOCARPIC PLANTS

#### - About Neelakurinji

- It is a shrub found in Shola forests of Western Ghats in South India. Nilgiri Hills, which literally means the blue mountains, got their names from the purplish blue flowers of Neelkurinji that blossoms every 12 years.
- The shrub has been documented to bloom in 1838, 1850, 1862, 1874, 1886, 1898, 1910, 1922, 1934, 1946, 1958, 1970, 1982, 1994, 2006, and **2018**.



#### - Why Neelakurinji flowers only once in 12 years?

- Some perennial flower only once in lifetime, set seeds and die. The next generation of plants is established from these seeds and the cycle is repeated. Such plants are known as **monocarpic**, opposed to polycarpic plants that flower and set seeds many times during its lifetime. They flower only after attaining maturity. The time taken for attaining maturity may differ for different species. This is 12 years for Neelakurinji.
- Another characteristic shown by monocarpic plants is that it flowers gregariously in a single season. The term "Plietesials" is used to refer to such plants.

#### - Other example of Monocarpic Plants

Bamboos are monocarpic plants which take around 40 years to mature and flower

### 2) THE LIVING ROOT BRIDGE (THE JING KIENG JRI)

- More details about the living root bridges.
  - » The **Jing kieng jri or living root bridges** are aerial bridges built by weaving and manipulating the roots of Indian rubber tree (*Ficus Elastica*). They have been serving as connectors for generations in Meghalaya for Khasi and Jaintia people. Some root bridges have also been observed in Nagaland.
  - » These bridges have been built over many centuries and are a primary means to cross streams and rivers. The span distances between 15-250 feet and have also become a source of tourist attraction.



- » The root bridge uses **traditional tribal knowledge** to train the roots of Indian Rubber Fig Tree, found in abundance in the area, to grow laterally across the stream bed, resulting in a living bridge of roots.
- » The **process** begins with placing of young pliable aerial roots growing from Ficus Elastica trees in hollowed out areca catechu or bamboo trunks. These provide the essential nutrition and protection from weather, and also perform as aerial root guidance system. Over time, the aerial roots increase in strength and thickness, and the support bamboo trunks are no longer needed.
- » **The nature of Ficus Elastica** makes its conducive to the growth of bridges because of its very nature. They are elastic, the roots easily combine, and plants grow in rough, rocky soils. Further, they become stronger with time and are self-repairing in nature.
- » Experts consider these living root bridges as an example of indigenous climate resilience.

- **Research in its application in modern architecture (2019)**

- » Researchers from Germany studied 77 bridges in 2015, 2016 and 2017. This study has been published in the journal Scientific Report and suggest that bridges can be considered a reference point for future botanical architecture projects in urban contexts.

- **Attempt to get World Heritage Tag for living root bridges (Jan 2022)**

## 23. IMPORTANT MEDICINAL PLANTS IN NEWS

### 4) COMMONLY USED MEDICINAL PLANTS (AS DETAILED IN NCERT)

### MEDICINAL PLANTS

India is known for its herbs and spices from ancient times. Some 2,000 plants have been described in Ayurveda and at least 500 are in regular use. The World Conservation Union's Red List has named 352 medicinal plants of which 52 are critically threatened and 49 endangered. The commonly used plants in India are:

<b>Sarpagandha</b>	: Used to treat blood pressure; it is found only in India.
<b>Jamun</b>	: The juice from ripe fruit is used to prepare vinegar, which is carminative and diuretic, and has digestive properties. The powder of the seed is used for controlling diabetes.
<b>Arjun</b>	: The fresh juice of leaves is a cure for earache. It is also used to regulate blood pressure.
<b>Babool</b>	: Leaves are used as a cure for eye sores. Its gum is used as a tonic.
<b>Neem</b>	: Has high antibiotic and antibacterial properties.
<b>Tulsi</b>	: Is used to cure cough and cold.
<b>Kachnar</b>	: Is used to cure asthma and ulcers. The buds and roots are good for digestive problems.

Identify more medicinal plants in your area. Which plants are used as medicines by local people to cure some diseases?

Source : Medicinal Plants by Dr. S.K. Jain, 5th edition 1994, National Book Trust of India

## 5) THREE HIMALAYAN MEDICINAL PLANT ENTER IUCN RED LIST (DEC 2022)

### A. *Meizotropis Pellita* (CR)

Commonly known as Patwa, it is a perennial shrub with restricted distribution in Uttarakhand. The Species has been listed CR based on its limited area of occupancy (less than 10 sq km).



**Threats:** Deforestation, habitat fragmentation and forest fires.

**Medicinal Properties:** The essential oil extracted from the leaves of the species possesses strong anti-oxidants and can be promising natural substitute for synthetic anti-oxidants in pharmaceutical industries.

### B. *Dactylorhiza hatagirea* (EN)

It is commonly known as Salampanja.



It is perennial tuberous species endemic to the Hindu Kush and Himalayan ranges of Af, India, Nepal, Bhutan and China.

**Threats:** Habitat loss, livestock grazing, deforestation, and climate change. It is extensively used in Ayurveda, Siddha, Unani and other alternative systems of medicine to cure dysentery, gatritis, chronic fever, cough and stomach ache.

### C. *Fritillaria cirrhosa* (VU)

Also known as Himalayan fritillary is a perennial bulbous herb.



It's population is estimated to have declined by at least 30% in last 24 years. Considering the rate of decline, long generational length, poor germination potential, high trade value, extensive harvesting pressure and illegal trade, the species is listed as 'Vulnerable'.

**Medicinal Properties:** In China, it is used for treating bronchial disorders and pneumonia. It is also a strong cough suppressant and source of expectorant drugs in traditional Chinese medicine.

The Himalayan region is a biodiversity hotspot but there is a lack of data on many species here. The assessment of these plants will set our conservation priorities and help protect the species.

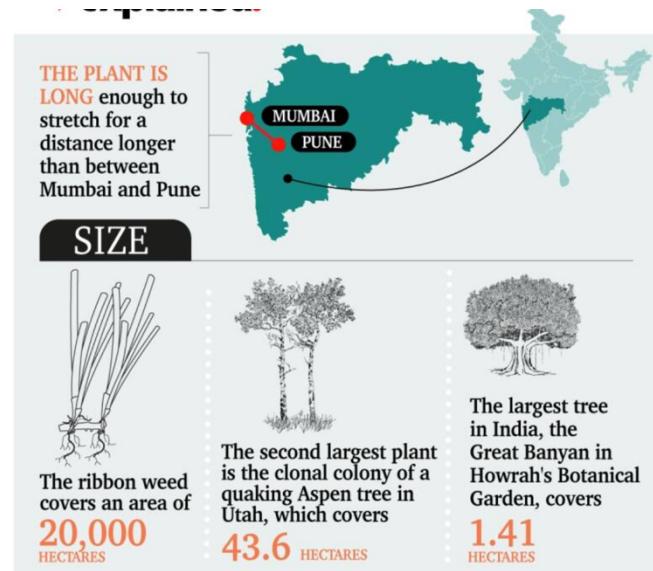
## 6) AROGYAPACHA (TRICHOPUS ZEYLANICUS)

### - More About Arogyapacha

- Trichopus zeylanicus (Arogyapacha) is a **highly potent medicinal plant endemic to the Agasthya hills**. It is traditionally used by the **Kani Tribal community** to combat fatigue.
- Studies have also proved its **varied spectrum of pharmacological properties** such as anti-oxidant, aphrodisiac, anti-microbial, anti-inflammatory, immunomodulatory, anti-tumor, anti-ulcer, anti-hyperlipidemic, hepatoprotective, and anti-diabetic.

### - Significance of Genome mapping of the plant

- It will help us get deeper knowledge of plant's molecular secret. The genetic data will expedite research on Arogyapacha, particularly its secondary metabolism, genetic breeding, and comparative studies.



## 7) INDIAN BIRTHWORT (ARISTOLOCHIA INDICA L.) - A THREATENED MEDICINAL PLANT IN ASSAM

The population stock of the species has been depleting fast in its natural habitats as a consequence of certain factors such as **habitat fragmentation**, **over-exploitation** due to its high medicinal properties, and **other anthropogenic activities**.

## 24. PLANTS/ HYBRIDS/ VARIETIES IN NEWS RECENTLY

### 8) LARGEST PLANT THE WORLD

#### - Details

- » This plant is Ribbon Weed (or **Posidonia australis**) and has been discovered in Shark Bay off the West Coast of Australia.
  - The researchers have found that it is 180 km in length and covers 20,000 hectares of area. Its age has been estimated to be 4,500 years.
  - It has double the number of chromosomes than other plants.
- » Over the years, it has managed to survive the volatile atmosphere of the shallow shark Bay.

#### - Why has been discovered so late when it is so large?

- » The existence of the sea grass was known, but it wasn't known that it was a single plant.

- **How do we know that it's a single plant?**
  - » Researchers sampled seagrass shoots from across Shark Bay's variable environments and generated a 'fingerprint' using 18,000 genetic markers. This fingerprint was found to be the same.
- **How did it grow and survive for, so long?**
  - » Around 4,500 years ago, the plant took root in the Shark Bay. Then it kept spreading through its rhizomes overcoming everything in its way.
  - » Ribbon week rhizomes can usually grow to around 35 cm per year, which is how the scientists arrived at its lifespan of 4,500 year.
  - » One reason that it has survived for so long is that it is **Polyploid** - instead of taking half-half genome from both parents, it took 100%, something not unheard of in plants. Therefore, this ribbon weed has twice the number of chromosomes other plants of the same variety has. Polyploid plants often reside in places with extreme environmental conditions, are often sterile, but can continue to grow if left undisturbed, and this giant seagrass has done just that.

- **Note:**

- The second largest plant known on earth is the clonal colony of a quaking Aspen tree in Utah, which covers 43.6 hectares.
- The largest tree in India is the Great Banyan in Howrah's Botanical Garden. It covers 1.41 hectares.

### 3) THEOBROMA CACAO



- It is also called the Cacao tree and the Cocoa tree. It is a small evergreen tree in the family Malvaceae.
- It's **seeds**, the Cocoa beans, are used for making chocolate liquor, cocoa solids, cocoa butter, and chocolate.
  - Cocoa beans are fermented, dried, roasted, and ground to form the chocolate powder. Most chocolate sold today are made from the species **Theobroma cacao**. But, indigenous people in South America, Central America and Mexico make food, drink and medicine with many other Theobroma species.
- **History of Chocolates:**
  - The history of chocolates has a compelling and rich story.
  - **Cacao** was domesticated at least 4,000 years ago, first in Amazon basin and then in Central America.
  - Four thousands of years, Mesoamericans have used Cacao for many purposes: as a ritual offering, a medicine, and a key ingredient in both special occasion and everyday food and drink - each of which had different name. One of these special, local cacao concoctions was called "chocolat".
- In **16th century**, it was brought to Europe and Africa. Drinking chocolate soon became a way to socialize.
- **Advantages:**

- Cacao is one of the most anti-oxidant rich fruit and eating it increases endorphin, a hormone which makes you calm and happy.

#### 4) DRAGONFRUIT (KAMALAM)

- Scientific name: *Hylocereusundatus*.
- It is grown in countries such as Malaysia, Thailand, the Phillipines, the USA and Vietnam.
- It is very rich in fiber, vitamins, minerals and anti-oxidants.
- In India, the beginning of Dragon fruit cultivation started in 1990s. In recent years it has become very popular since farmers have taken up the cultivation across various states. It's cultivation requires less water and can be grown in various kinds of soil.
- There are three main varieties of dragon fruit: white flesh with pink skin, red flesh with pink skin, and white flesh with yellow skin.
- In July 2020, PM Modi in 'Mann Ki Baat' had mentioned about Dragon fruit farming in the arid Kutch region of Gujarat.



#### 5) ROSEWOOD

- Rosewood refers to any number of richly hued timber, often brownish with darker veining, but found in many different hues. All genuine rosewood belong to genus *Dalbergia*.
- Pre-eminent rosewood appreciated in the Western World is the wood of *Dalbergia nigra*. It is best known as 'Brazilian Rosewood' or 'Bahia Rosewood'. The wood has a strong, sweet smell, which persists for many years, explaining the name rosewood.
- Another classical rosewood comes from *Dalbergia latifolia* (VU), known as (East) Indian rosewood. It is native to India and is also grown in plantations elsewhere in Pakistan.
- Other species**
  - Dalbergia sissoo* (LC) is a rosewood species from India and Bangladesh, usually known as Sheesham or North-Indian Rosewood.
    - Its timber is extremely dense and has mild rot resistance. It is used for making cabinets and flooring, and for carving. Due to its after work quality when sealed and dyed, it is often sold as genuine rosewood and teak.
- Properties and uses**
  - All rosewoods are strong and heavy, taking an excellent polish, being suitable for guitars, marimbas, recorders, handles, furnitures, luxury floorings etc.
- Uses**
  - Steep demand in international market for musical instruments and furniture.
- Dalbergia Sissoo** (LC)
  - Its timber is extremely dense and has mild rot resistance. It is used for making cabinets and flooring, and for carving. Due to its after work quality when sealed and dyed, it is often sold as genuine rosewood and teak.

## 6) INDIAN ROSEWOOD (*DALBERGIA LATIFOLIA*)

- *D latifolia* is native to India and Indonesia, but is also grown in Nigeria, Kenya, Vietnam, the Phillipines, and other tropical Africa and Asia as an ornamental plant.
- It is very well known for producing very hard and durable wood with a long straight bore, which makes it highly valued on international markets. Its bark is also used for medicinal purpose in natural ranges.



- IUCN: EN
- CITES: Appendix-II

## 7) RED SANDERS (*PTEROCARPUS SANTALINUS*)

- Why in news?
  - » Red Sanders falls back in IUCN's 'endangered' category (Jan 2022)
    - Why?
      - IUCN assessment stated that "over the last three generations, the species has experienced a population decline of 50-80%. It is assessed as Endangered."
      - The overharvesting of the species has left the population structure skewed, with trees of harvestable size and maturity being scarce and making up less than 5% of the trees remaining in the wild.
      - Illegal international trade has continued - Large volume of Red Sanders timber and products are seized regularly by authorities at all stages of the illegal supply.
    - In 2018, IUCN moved it to Near Threatened Category from Endangered earlier.
  - About Red Sanders:
    - » Red Sander (*Pterocarpus Santalinus*) or Red Sandalwood or Rakt Chandan, and Saunderwood, are endemic to Southern Eastern Ghat Mountain Ranges of South India (Seshachalam Forests of Andhra). They are found in districts of Chittoor, Kadapa, Nandhyal, Nellore, Prakasam of Andhra Pradesh.
      - These are known for its rich hues and therapeutic properties and are high in demand across Asia, particularly in China and Japan, for use in cosmetics and medicinal products as well as for making furniture, woodcrafts and musical instruments.
        - The rare wavy grain variant is highly valued in Japan for its acoustic properties and is used to make musical instruments.
        - In addition, the timber is also exploited for the extraction of Santalin (a red pigment used as dye and colorant in food), medicine and cosmetics.
      - Its popularity can be gauged from the fact that a tonne of Red Sanders costs anything between Rs 50 lakh to Rs. Crore in international market.

- Note: this is **not aromatic**. (it should not be confused with the aromatic **Santalum Album (Indian Sandalwood) (VU)** tree that grow natively in South India.
  - IUCN: Endangered
  - WPA: Schedule-II
  - CITES: Appendix-II

## 8) SANDALWOOD

- It is also known as Chandan, Cendana, East Indian Sandalwood, Sandal, Sandal tree, White Indian sandalwood, chandal and Peetchandan.
- **Where is it found?**
  - S Album, commonly known as Indian Sandalwood, is a dry deciduous forest species native to India, China, Indonesia, Australia and Phillipines. It is also grown in plantation in Australia.
- The small tropical tree grows to 20m in height with red wood and a variety of dark colors of bark (dark brown, reddish and dark grey).
- **Applications:**
  - Because it is strong and durable - it is mostly harvested for its timber. Sandalwood heartwood, which is close grained, is used for fine furniture and carving.
  - The heartwood and roots also contain 'Sandal oil' which is used in perfumes, incenses, cosmetics, soaps, and medicines.
  - The bark contains tannin, which is used for dye.
- **Protection:**
  - Sandalwood is highly valued in India. Over the years, uncontrolled harvesting have caused populations to dwindle in recent years.
  - To Conserve Sandalwood, India has imposed an export ban on Sandalwood and instated conservation measures to protect the species in the country.
  - **IUCN: VU**
  - **CITES: Not listed**

## 9) MAHUA (MADHUCA INDICA)

- It is an Indian tropical tree found largely in Central, southern and north Indian plains and forests. They are also found in Nepal, Myanmar, and Sri Lanka.
- **Uses:**
  - i. Mahua flowers, fruits, and leaves are edible and used as vegetables in India and other Southern Asian Countries.
 

The **sweet, fleshy flower** are eaten fresh or dried, powdered and cooked with flour, used as a sweetener or fermented to make alcohol.
  - ii. It is also an oil plant, whose seeds yield between 35 and 47% oil. This oil is used for making soaps and candles. It also has a potential use in bio diesel production. Though, it is used as edible oil by tribals, WHO recommends against it as it contains **aflatoxin**, a toxin component. The processing of oil can get rid of aflatoxin and makes it edible.

- iii. **Cocoa Butter Extender:** It is prepared from Mahua seed oil and is a prized product. It can be used for making chocolate and other confectionaries. Experts feel that **this product has the scope of altering socio-economic conditions of tribals in India.**
- iv. **Timber:** The tree is also used for its hard, strong, dense and reddish timber.
- v. **Traditional Medicines** also use some mahua components.

## 10) SEABUCKTHORN

### - Details

- Seabuckthorn is a shrub where an orange-yellow coloured edible berry grows. This plant is found in upper tree line of Himalayan region in India including in the wild in Lahaul, Spiti, and parts of Kinnaur. There are many medicinal, ecological and economic benefits of growing the seabuckthorn plant.
- **Importance of the plant:**
  - As **folk medicine** it is used for the treatment of stomach, heart and skin problems. Some modern scientific research also back these uses.
    - The leaves and fruits of this shrub is rich in carotenoids, omega fatty acids and vitamins. It also help troops in getting accustomed to high altitude.
  - The plant is also a crucial source of fodder and fuelwood. It is also a soil binding plant which means it is capable of preventing soil-erosion.
  - It can also help to preserve floral biodiversity.
    - Due to pest attacks, many willow trees in the Lahaul valley are dying and this small plant can turn out to be a good alternative in order to protect the local ecology.
    - The plant also has commercial value and is utilized for production of jams, juices, as well as nutritional capsules.
- So, seabuckthorn needs to be cultivated on large scale for it to be a raw material for the industry. This can be done on arid and marginal lands with the help of CAMPA funds.
- MoEF&CC has asked these states to come up with a proposal where they can take up such plantations.
  - This will also reduce water flow from Himalayan glaciers.
  - Following this, the Himachal Pradesh CM has announced that the government will be planting seabuckthorn on 250 hectares of land in the state. This will be done over the next five years.



## 11) MADHUCA DIPLOSTEMON (FAMILY SAPOTACEAE)

### - Why in news?

- Madhuca Diplostemon, a tree species, long believed to be extinct, has been discovered in Western Ghats after a gap of more than 180 years. (Oct 2020)

- Details

- This species was last spotted in 1835, when its specimen was first collected. Since its original collection, specimens of **Madhuca Diplostemon** was never collected again, neither from its locality nor elsewhere, and botanical exploration both in Western and Eastern Ghats failed to locate the species.
- Recently, it was again discovered from a sacred grove in **Kollam district** in Western Ghats.
  - This sacred grove is **Koonayil Ayiravilli Siva Temple at Paravur, Kollam**.
- Scientists at the **Jawaharlal Nehru Tropical Botanical Garden and Research Institute (JNTBGRI)** at Palode have identified this species.
- Only 1 mature species has been found so far, meaning that this rediscovery was extremely valuable from a scientific, environmental and conservation point of view.
- The species should also be eligible to be categorized as **Critically endangered**.



Madhuca diplostemon

## 12) SONNERATIA ALBA (MANGROVE APPLE)

- Why in news?

- Sonneratia Alba species declared the state Mangrove tree of Maharashtra.

- Details

- It is an evergreen mangroves species that grows upto five feet. It has white flowers with pink base and bears distinctive green apples as fruits. The fruit is used for making pickles.
  - They often grow on newly-formed mud flats playing an important role in combating land erosion.



- Maharashtra is the first coastal state in India to declare a state mangrove tree species to enhance conservation of the salt-tolerant vegetation.
  - Globally, there are around 60 mangrove species. Maharashtra is home to 20 of them.

## 25. SOME RECENT CURRENT AFFAIRS UPDATE

### 9) HUMBOLDT'S ENIGMA

- **Background:** Conventionally, it was understood that biodiversity will be highest around the equator, in tropics, as this region has higher primary productivity as it receives the highest sunlight (energy). As one moves away from equator biodiversity decreases. Tropical rainforests thus hold the crown for species richness.
- **Humboldt's Observation:** Alexander von Humboldt, a German naturalist, during his extensive travels through South America in the early 19th century, noticed something intriguing. Mountain ranges, despite occupying relatively small areas compared to vast tropical forests, displayed exceptionally diverse plants and animal life. This stood in stark contrast to the predicted decrease in higher latitudes.
  - » Two centuries later, group of bio-geographers - scientists who explore the relationship of diversity with geography - used modern tools to take another look at the drivers of biodiversity. Based on their findings, they proposed their own version of the link between biodiversity and mountains and called it **Humboldt's enigma**.
  - » Examples of Humboldt's enigma in India:
    - **Eastern Himalayas:** These are the second-most diverse area of perching birds in the world. For river birds, the eastern Himalayas may be the most diverse.
- **Reasons for the Enigma:**
  - » **Compression of a wide range of ecosystem into relative short distance:** Mountains boast diverse landscapes with varied terrain, elevation, and microclimates. This creates a mosaic of distinct habitats, fostering speciation and niche adaptation among organisms.
  - » **Geological Process like Uplifts,** result in new habitats where new species arise, so the habitats are 'cradles'.
  - » **Climatic Stability:** Some climatologically stable mountains persist there for a long time, so these spots are 'museum' that accumulate many such species over time.
    - This provides refuge and protection to species during changing environment and thus aids biodiversity.
  - » **Unique Resources:** Mountains have resources like nutrient rich volcanic soils and unique water regimes which gives sustenance for specialized species.
- **E.g.:**
  - » **Coastal Tropical Sky Islands** (mountain surrounded by lowlands), like the Shola Sky Islands in the Western Ghats, are good examples of 'museum'. Here old lineage has persisted on the mountains tops as climates and habitats fluctuated around them in lower elevations. This is the reason, some of the oldest bird species in the western ghats, such as the **Sholicola**, and the **Montecincla**, are housed on the Shola Skey Islands.
  - » The **Northern Andes Range** - including Chimborazo - is considered the most biodiverse place in the world. If we start from the foothills of the Andes and climb, we're going to counter different temperature and rainfall levels that support everything from **tropical evergreen biomes in the lower elevation to the alpine and tundra biomes near the top**. Such a large variation over short distances supports the immense biodiversity found in mountain regions - and worldwide.