TARGET PRELIMS 2024
BOOKLET-18; EB&CC-8
BIODIVERSITY-IMPORTANT SPECIES

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2. REPORT: THE STATE OF INDIA'S BIRDS 2023 (REPORT PUBLISHED IN AUG 2023)

- **About the report**:
  - » It is the **2nd iteration** (first released in 2020) of the report and is an **assessment** of the distribution range, trends in abundance and conservation and status of **942 of India's 12,00 bird species** and has been carried out by **13 partner organizations**, including the WII and Zoological Survey of India.
  - » The report is based on data from about 30,000 birdwatchers.

- **The assessment relies on 3 indices**:
  - » Two are related to change in abundance.
    - Long term trend (change over 30 years)
    - Current Annual Trend (change over past seven years)
  - » Third is a measure of distribution range size in India.

- **Key Highlights**:
  - » General decline in number of most bird species in the country.
    - **Raptors, migratory shore birds** and ducks have declined the most.
    - There were 338 species (out of 942 species studied) for which long term trend has been determined.
      - 60% (204) have declined in long term.
      - 98 species are stable.
      - 36 have increased.
    - For 359 species current annual trends could be determined
      - 142 species or 39% are declining.
        - 64 are in rapid decline.
      - 189 are stable.
      - 27 bird species are increasing.
    - **Specialists** (birds restricted to narrow habitats like wetlands, rainforests and grasslands), as opposed to species that can inhabit a wide range of habitats such as plantations and agricultural fields - are rapidly declining.
    - **Generalists** (birds that can live in multiple habitat types are doing well as a group)
    - **Migrants**: Abundance trend of migratory species show that long-distance migrants, such as migratory birds from Eurasia or the Arctic, have declined the most - by more than 50% - followed by short distance migrants.
    - **Birds which are endemic to the Western Ghats** and SriLanka biodiversity hotspots have rapidly declined in India over the past few decades.
      - The Great Grey Shrike has shown a long-term decline of more than 80%.
    - **Ducks** are also rapidly declining in India. India hosts eight resident and 35 migratory species.

- Baer's Pochard, Common Pochard, Andaman Teal have been found to be most vulnerable.

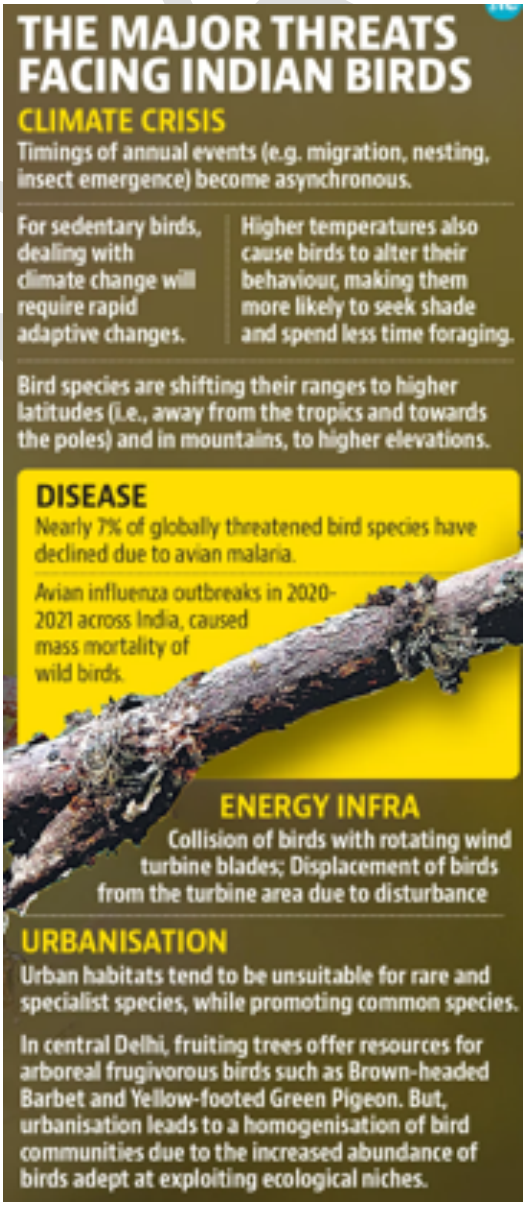
- **Riverine Sandbar-nesting birds** are also showing a decline due to widespread pressure on rivers from irrigation schemes, transportation, human disturbance, domestic use, and pollution from agriculture and industrial chemicals, variation in the water level and sand mining.
- **Spoonbill** has declined by more than 50% in the long term and by over 6% annually since 2015.
- **Sarus Crane** has rapidly declined over the long term and continues to do so.
- Of the 11 species of woodpeckers for which clear long-term trends could be obtained, seven appear stable, two are declining, and two are in rapid decline.
  - **Yellow crowned woodpecker**, inhabiting widespread thorn and scrub forest, has declined by more than 70% in the past three decades.
- **Bustards** (Great Indian Bustard, the Lesser Florican, and the Bengal Florican - have been found to be most vulnerable)

» Several Bird Species like **India Peafowl**, **Rock Pigeon, Asian Koel**, and House Crow are not only healthy in both abundance and distribution but showing an "increasing trend".

- **Peafowl,** which is the national bird of India, is one of the **most rapidly increasing species** in the country today. It is expanding into habitats where it has never occurred previously. In last 20 years it has expanded into High Himalayas and Western Ghats. It also appears to be expanding population density in areas where it occurred earlier.
- **Asian Koel** has shown a rapid increase in abundance of 75%, with an annual current increase of 2.7% per year.
- **House crow, Rock Pigeon, and Alexandrine Parakeet** has also established new populations in several cities.

» India is home to **232 endemic species** found nowhere in the world.

- **Major Threats: See Adjacent image.**

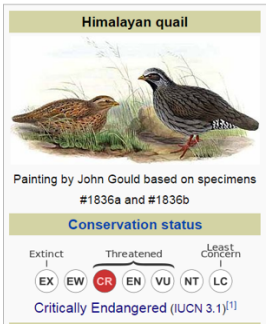


3. REPORT: 75 ENDEMIC BIRDS OF INDIA

- **Why in news?**
  - » Zoological Survey of India (ZSI) have published a title called ***75 Endemic Birds of India.*** (Aug 2023)

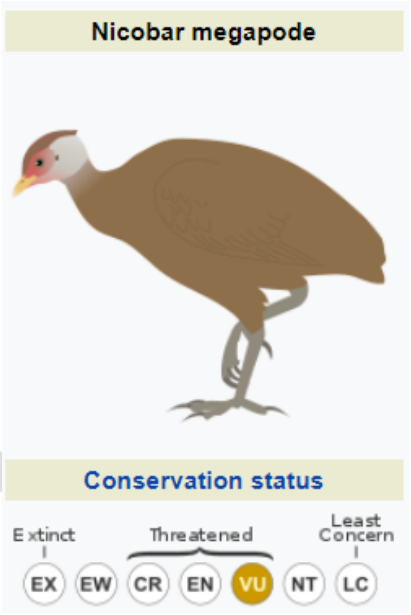
- **Key Highlights**
  - » India is home to 1,353 bird species, which represent approximately 12.4% of the global bird diversity. Of these, 5% i.e. **78 birds** are **endemic to India**.
    - Of these 3 are CR (Bugun Liocichla; Himalayan Quail; Jerdon's Courser)

- Of these, **3 species have not been recorded in last few decades**.

1	**Manipur Bush Quail** (*Perdicula manipurensis*) • Listed EN by IUCN • Last recording in 1907	
2	**Himalayan Quail** (Ophyrsia superciliosa) • Listed as CR by IUCN • Last sighting in 1876	
3	**Jerdon's Courser** (Rhinoptilus bitorquatus) • Listed as CR by IUCN • Last confirmed sighting in 2009	

- **75 Endemic Birds of India**
  - » They belong to 11 different orders: 31 families and 55 genera.
  - » **Highest number (28) of endemic birds** have been recorded in **Western Ghats**.
    - Interesting species include Malabar Grey Hornbill; Malabar Parakeet; Ashambu Laughing Thrush; and While Bellied Sholakili

» **Andaman and Nicobar Islands** (25 birds) have second highest number of endemic birds. Interesting species are:

1	**Nicobar Megapode:** It is a megapode found in some of the **Nicobar Islands only**. • Like other megapode relatives, it builds a large mound nest with soil and vegetation, with the **eggs produced by the heat produced by decomposition**. • **IUCN: VU**	
2	**Nicobar Serpent Eagle:** • It is probably smallest known eagle, with a weight of about 450 g. • IUCN: NT	
3	**Andaman Crake:** IUCN status: LC	
4	**Andaman Barn Owl:** Species endemic to southern Andaman Island.	

- **Eastern Himalayas** has 4 endemic species.
- South deccan plateau and central Indian Forest have one species each

4. CRITICALLY ENDANGERED BIRDS IN INDIA

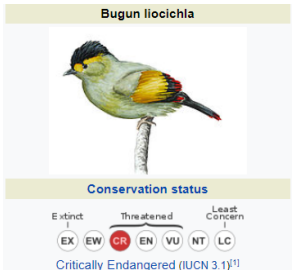
1) THE JERDON'S COURSER (RHINOPTILUS BITORQUATUS)

It is a **nocturnal bird** found only in the of state of Andhra Pradesh.
It is a flagship species for the extremely threatened scrub jungle.

Was considered extinct till 1986 when it was rediscovered and the area of rediscovery was subsequently declared as the Sri Lankamaleshwara Wildlife Sanctuary in Kadappa district Andhra Pradesh.
Habitat: Undisturbed scrub jungle with open areas.
Distribution: It is a restricted range endemic found locally in **Eastern Ghats of Andhra Pradesh**.
Threats: Clearing of scrub jungle, creation of new pastures, illegal trapping of birds, plantation of exotic trees, quarrying and construction of river canals (Telegu Ganga Canal).

2) BUGUN LIOCICHLA

It is a bird species that was first spotted in Arunachal Pradesh, India in 1995. It was described as a **new specie** after being discovered from in **Eaglenest Wildlife Sanctuary in Arunachal Pradesh**.



3) THE WHITE BELLIED HERON (ARDEA INSIGNIS) (IMPERIAL HERON) (GREAT WHITE-BELLIED HERON)

It is a large heron species. It is mostly dark grey with a white throat and underparts.

Distribution: Foothills of eastern Himalayas in northeastern India and Bhutan to Northern Myanmar. In India, they are found in 5-6 sites of Assam and Arunachal Pradesh.

Habitats: It inhabits undisturbed rivers and wetlands.

Other Characteristics: It is inherently rare, and population has never been known to be very high.

Threats: Habitat Degradation (lowland forests and wetlands are being exploited by humans)

4) THE BENGAL FLORICAN (HOUBAROPSIS BENGALENSIS) (BENGAL BUSTARD)

About Bengal Bustard:

- A very rare bustard specie that is very well known for its mating dance.
- **Habitat:** Grasslands occasionally interspersed with scrublands.
- **Distribution:** Native to only 3 countries in World: India, Nepal and Cambodia
  - **In India:** Uttar Pradesh, Assam and Arunachal Pradesh.
- **Threats:** Ongoing conversion of bird's grassland habitat for various purpose including agriculture.

5) LESSER FLORICAN (SYPHEOTIDES INDICUS)

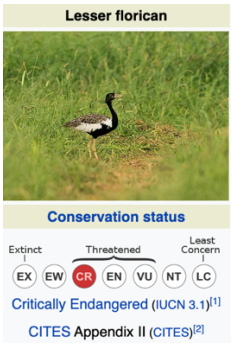
It is the smallest bustard in the world, weighing between 500 g to 700 g, and is found **only in India**.

It is endemic to Indian sub-continent. According to WII, less than 300 floricans remain in India. This is a sharp drop from 3,500 twenty years ago.

- Dehradun-based WII has also launched a recovery program for the bird.

Distribution

- Historically it was found throughout the country from Gujarat to Bengal and from Rajasthan to Kerala.



- **Now**, the bird is observed in Rajasthan, Madhya Pradesh, Gujarat and some other regions during the monsoon season, when it breeds and later disappear with its chicks to unknown places.
- It is generally found in grasslands and grassland-like habitat, including certain croplands.

Various local names:

- ***Kharmore*** (meaning grass peacock***) Kakatya*** *(referring to the sound the bird produces while courtship displays)***/ Phudakdya** (referring to jump during the courtship display)

Other features:

- It is best known for male's leaping breeding displays during the monsoons.

Current causes of decline

- **Habitat loss and degradation:** Destruction of grasslands due to excessive cattle grazing, plants of shrubs and trees etc.

6) THE GREAT INDIAN BUSTARD (GODAWAN - POPULAR NAME IN RAJASTHAN)

Physical features:

- A large bird with **horizontal body and long legs** giving it an ostrich like appearance. It is the largest of the four Bustard Species found in India. The other three are MacQueen's Bustard (VU), lesser Florican and Bengal Florican.
- Among the **heaviest of flying birds**. It is unmistakable with its **black cap contrasting with pale head and neck**.

Habitat and Distribution:

- **Historic range** included much of the Indian subcontinent, but it has now shrunken to just 10% of it.
- **Habitats:** GIBs prefer grasslands as their habitat and are considered the flagship bird species of **grassland**. They also act as barometer of the health of the grassland ecosystem. They are terrestrial birds and thus spend most of their time on ground with occasional flights to go from one part of their habitat to the other.
- Currently, they are found in **India (150 ~** decreasing**)** and adjoining region of **Pakistan.** Often found associated in the same habitat as black buck.
- **In Pakistan:** Critically endangered in Pakistan, few birds found in the Cholistan desert.
- **In India** the distribution is as follows:
  - **128** are found in Rajasthan.
  - **10** in Kutch region of Gujarat.
  - Very few in Maharashtra, Karnataka and Andhra Pradesh.

• **Today, the bustard are restricted to isolated pockets of Rajasthan, MP, Gujarat, MHA, Andhra, and Karnataka.** • **Desert National Park**, in Rajasthan has a good number of them. • In fact, Rajasthan has 95% of World's population.	

- **Protection Status**
  - IUCN: CR
  - WPA: Schedule 1
  - CITES: Appendix 1
  - CMS: Appendix 1

- **Key threats**
  - **Hunting** - Initially it was a major concern.
  - **Loss of Habitat** - wastelands are increasingly converted into agri-lands or are being used for renewable energy power projects.
  - **Accidents due to high tension electricity cables**: Scientists at WII consider it the biggest threat to the GIBs. WII research has concluded that 18 GIBs die every year after colliding with high tension wires.
    - **Why?**
      - Due to their poor frontal vision, the birds can't spot the power lines from a distance, and are too heavy to change the course.
      - In Kutch and Thar desert a lot of transmission lines have been set up as a number of solar and wind power plants have increased a lot.

- **Conservation Efforts**
  - It is identified as one of the species under **Integrated Development of Wildlife Habitat** under MoEF&CC.
  - In 2015, the GoI launched the **GIB Species recovery program**.
    - Under the program, the **WII and Rajasthan Forest department** have jointly set up c**onservation breeding center**s where GIB eggs harvested from the wild are incubated artificially and hatchlings raised in controlled environment.
    - In May 2017, Rajasthan government announced setting up of the **Great Bustard Breeding Centre** at **Sorsan** in Kota district.
  - **Project GIB**: Launched by government of Rajasthan with an aim of constructing breeding enclosures for the species and developing infrastructure to reduce human pressure on its habitats.
  - **Firefly Diverters:**

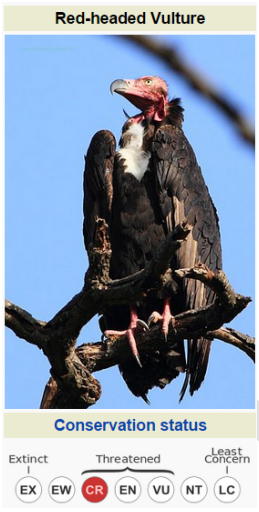
7) VULTURES

- **Significance of Vultures**
  - Vulture is nature's most efficient scavenger and halts the spread of bacteria and fungus from dead animals to environment.

  - **4 Species** of vultures in India are Critically Endangered.

» **White-backed Vulture / White rumped vulture (Gyps bengalensis), Slender Billed Vulture (Gyps tenuirostris),** and **Long - billed Vulture (also known as Indian vulture) (Gyps indicus**) have **declined by 99%**.

» **Red headed vulture** with a population crash of 91% has also suffered a rapid decline in recent past and is also critically endangered.

White Backed (CR)	**Slender Billed (CR)**	**Long Billed(CR)**
		
Red Headed Vulture (CR)	**Egyptian Vulture** (EN)	**Cinerous Vulture (NT), Himalayan (Griffon) Vulture (NT),** and **Bearded Vulture (NT)**, Eurasian Griffon (**LC**)
		

- **Habitat:** Forests, villages etc.
- **Distribution:** Across India
- **Why drastic crash in population:**

» The crash in vulture population came into light in 1990s and the reason was identified in 2004. The cause of **Diclofenac** - a veterinary nonsteroidal anti-inflammatory drug (NSAID) used to treat pain and inflammatory diseases such as gout - in carcasses that vultures would feed on.

- **Note1:** In 2006, the veterinary use of Diclofenac was banned.
- **Note2:** In 2015, after GoI placed restrictions on the size of Diclofenac vials for human consumption to just 3 ml, the prevalence of Diclofenac in cattle carcasses was reduced to less than 2% which is safe for vultures.
- However, unlawful use of Diclofenac is still reported. Similarly, the continued use of vulture toxic drugs, including **Aceclofenac, Ketoprofen, and Nimesulide** in livestock treatment, could pose a major impediment to the re-introduction program.

» Accumulation of diclofenac in vultures results in **gout like symptoms such as neck-dropping**, ultimately leading to death.

» **Just 0.4-0.7% of animals** carcasses contaminated with diclofenac was sufficient to decimate 99% of vulture populations.

- **Key Steps:**
  - » **Action Plan for Vulture Conservation 2006**
    - Released by MoEF&CC
    - In 2020, it was extended till 2025.
    - **Ban on the veterinary use of diclofenac** in 2006 by DCGI
    - **The Central Zoo Authority** and **BNHS** have also established the **Vulture Conservation Breeding Program**
      - It has been successful and had the three CR species (white backed, slender billed, long billed) bred in captivity for the first time.
      - As of Sep 2022, there are 800 odd vultures at eight centres located in **Pinjore, Rani (Assam)**, **Rajabhatkhawa (WB)**, **Hyderabad** (Telangana), **Bhopal** (MP), **Junagadh** (Gujarat), **Ranchi** (Jharkhand), and **Bhubaneswar (Odisha)**.
    - The **Vulture Safe Zone Program** is being implemented in eight different places in the country where there were extant population of vultures, including two in Uttar Pradesh.
      - An area is declared Vulture Safe Zone only when no toxic drugs are found in undercover pharmacy and cattle carcass surveys for two consecutive years and the vulture population is stable and not declining.
    - Conservation program for red-headed and Egyptian vultures would also be launched with breeding programs for both.

- **Other facts for Prelims**
  - **NSAIDS** like aceclofenac, ketoprofen, nimesulide etc. were meant to be alternative to diclofenac. But, detailed studies have found that they may also harm birds and thus BNHS have requested GoI to ban the veterinary use of these drugs.

- **Jatayu Conservation and Breeding Centre (JCBC)**
  - It is situated at Bir Shikargah WLS in Shivalik ranges of the Himalayan foothills in Haryana's Pinjore.
    - As many as 378 vultures of three species are housed at the Centre, of which 131 are oriental white-backed vultures, 195 are Long billed vultures, and 52 are slender billed vultures.
    - The founder stock of birds at the Centre were collected from various states, including Assam, Rajasthan, Gujarat, Madhya Pradesh and Maharashtra, to maintain genetic diversity.

8) THE HIMALAYAN QUAIL (OPHRYSIA SUPERCILIOSA) OR MOUNTAIN QUAIL

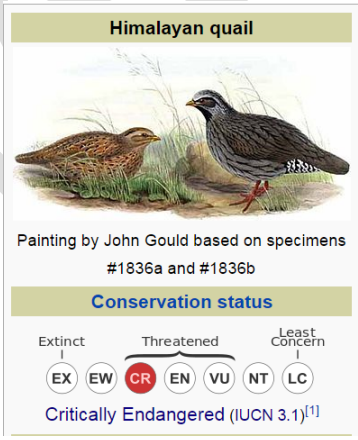
Medium size quail belonging to pheasant family.

Feared Extinct: Last reported in 1876 and is feared extinct. **Possible siting** of this specie was reported in Nainital in 2003.

Habitat: Tall grass and scrub on the steep hill side.

Distribution: Was known from 2 locations in western Himalayas in Uttarakhand.

Reasons for Extinction: Indiscriminate hunting during colonial period and habitat modification



9) PINK HEADED DUCK (RHODONESSA CARYOPHYLLACEA)

Feared Extinct: Not been conclusively reported since 1949.

Males have a deep pink head and neck from which it derives its name.

Habitat: Overgrown still-water pools, marshes and swamps in lowland forests and tall grasslands

Distribution: Once found in parts of **Gangetic plains of India/Bangladesh** and in the **riverine swamps of Myanmar**.

Reason for Extinction/Disappearance : Wetland degradation and loss of habitat.

10) SOCIABLE LAPWING (VANELLUS GREGARIOUS)

It's a **winter migrant** to India. it **breeds in Kazakhstan** and winters in West Asia, Indian Subcontinent, and Sudan.
Habitat: Fallow fields and scrub lands
In India: Habitat distribution is restricted to the north and north west of the country.
Threats: Conversion of **habitat to arable land**, illegal hunting and proximity to human settlements.
Decline: The species has witnessed a sudden and rapid population decline due to which it has been listed as critically endangered

11) SPOON BILLED SANDPIPER (EURYNORHYNCHUS PYGMEUS)

Its breeds on the coast of the **Berring** Sea and winters in South-East Asia.

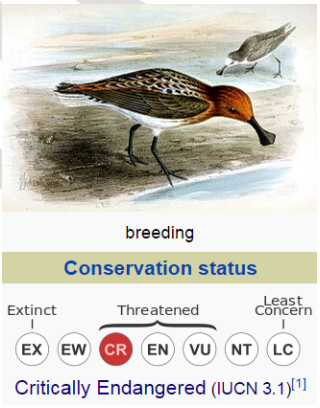
Habitat**:** It has a **very specialized breeding habita**t, using only lagoon spits with crow-berry lichen vegetation or dwarf birch and willow sedges, together with adjacent estuary or mud flat habitats that are used as feeding sites by adults during nesting. **This becomes a constrain and** has always kept its population scarce.

Distribution: Russia, South-East Asia, Indian, Sri Lanka.

In India: Distribution has been recorded in WB, Orissa, Kerala and Tamil Nadu.

Protected area in its breeding, staging and wintering areas include Point Calimere and Chilka Lake

Threats : Habitat degradation and land reclamation. Human disturbance also leads to high incidence of nest desertion.



12) SIBERIAN CRANE (GRUS LEUCOGERANUS) (ALSO KNOWN AS SIBERIAN WHITE CRANE OR SNOW CRANE)

Distribution: Two breeding population in Arctic Tundra of western and Eastern Russia.
Migration: The eastern population migrate during winter to China while the western population winters in Iran and formerly India and Nepal.
Habitat: Wetland areas.
In India: They are known to winter at Keoladeo National Park, Bharatpur, Rajasthan. However, **the last documented sighting of the bird was in 2002**.

Threats: Pesticide pollution, wetland drainage, development of prime habitat into agricultural fields, and to some extent, hunting

13) BAER'S POCHARD (AYTHYA BAERI)

Details

- It is a medium sized diving duck found in Eastern Asia.
- **It breeds in Southeastern Russia and north-east China. But in winters, it migrates to Southern China, Vietnam, Japan, and India.**
- **Habitats:** These pochards inhabit water with rich aquatic vegetation. They occur in freshwater bodies, rivers, freshwater lakes, reservoirs and coastal habitats surrounded by rich vegetation.
- **In India**, there peak population could be seen **in Tinsukia district of Assam**. They are also found from **Gir-Himachal-West Bengal**.

Why critically endangered?

- It is undergoing an extreme rapid population decline, as measured by numbers on both breeding and wintering grounds.
- **Habitat destruction** and overharvesting of both birds and eggs have become the key reason for this decline.

5. ENDANGERED BIRDS

1) WINGED WOOD DUCK (CALLED "DEO HANSH" IN ASSAM)

It is a bird which can be heard, but rarely seen. It has a dark body contrasting with a whitish head and neck. It is a crepuscular bird as it is most active at dusk and dawn. The adults are largely omnivorous.

Distribution: It mostly resides in dense tropical evergreen forests and is known to prefer inaccessible swampy areas formed by rivers, lakes etc.

- There was a time when the duck was extensively found in Assam and Arunachal Pradesh while also being sighted in Meghalaya, Manipur and Nagaland. Further it was also found in South East Asia.
- **Currently**, its population is limited only to **certain pockets of Assam and Arunachal Pradesh** and Myanmar and Bangladesh.

- **IUCN status: EN**
- In 2003, it was declared Assam's state bird.

- **Project Deo Hanh** -
  - Launched in 2018, it aims to develop a long-term conservation strategy to revive population of the bird.
    - It is also focused on initiating a conservation breeding program to supplement the wild population if suitable habitat of these birds are found.
  - It is being implemented by the Assam Forest Department (AFD) and Wildlife Trust of India (WTI) with support from Oil and Natural Gas Limited (ONGC).

▪ **Threats: Habitat loss**: Encroachment, deforestation and anthropogenic pressure. Reserve forests like Kakojan, Kukurmara, Kundil Kalia, Sadiya Station and Kotha in Eastern Assam, which were once suitable habitat for the ducks, are now heavily degraded.	

2) THE FOREST OWLET (HETEROGLAUX BLEWITTI)

- **Rediscovery:** After 113 years in 1997.
- **Habitat:** Dry deciduous forests
- **Distribution:** Southern MP, Northwest, and North Central Maharashtra.
  - Recently, the specie has been located in a number of new locations, so its status has changed from CR to EN.
- **Threat:** Logging operations, burning, and cutting of trees damage roosting and nesting trees of the forest owlets

6. HORNBILLS IN INDIA

- India has **9 Hornbill species**:
- Hornbills are known as **forest engineers or 'farmers of forests'**. As large fruit eating bird, they play a vital role in dispersing the seeds of about 80 rainforest trees.
- Hornbills indicate the prosperity and balance of the forest they build nest in.
- **Key threat:**
  - **Habitat losss**: A recent study using satellite imagery data flagged **high rate of deforestation** in **Papum forest reserve (RF) adjoining the Pakke Tiger Reserve** (which is a major hornbill habitat in Arunachal Pradesh) as well as the adjoining parts of Assam.
  - **In the past,** hornbills were hunted for **casques** - upper beak and **feathers** for adorning headgear despite being cultural symbols of some ethnic group in the northeast, specifically the **Nyishi** of Arunachal Pradesh. But a **20-year-old conservation program** entailing the use of **fiber-glass beaks d**efused the threat to the birds to a large extent.

A) VARIOUS HORNBILL SPECIES OF NORTHEAST INDIA

1. Great Indian **Hornbill (VU)**
2. Wreathed Hornbill (VU)
3. Oriental Pied Hornbill (VU)
4. Rufous Necked Hornbill (VU) [Arunachal Pradesh, Assam, WB]
5. Austen's Brown Hornbill (Brown Hornbill, or White throated Hornbill) *(Anorrhinus austeni)* (NT) [almost throughout India, except dry NW region and heavy rainfall area of south-western ghats

B) GREAT INDIAN HORNBILL

The great hornbill also known as the Indian hornbill or great pied hornbill. It is the largest hornbill species in India. It is long lived, living for nearly 50 years in captivity.
It's impressive size and color have made it important in many tribal cultures and rituals.

It is predominantly frugivorous but is an opportunist and will prey on small mammals, reptiles and birds.

Most prominent feature
Bright yellow and black casque on top of its massive bills.
The casque is hollow and serves no purpose.

Distribution and habitat
Great hornbills are found in forests of India, Bhutan, Nepal, Mainland SEA, Indonesian Island of Sumatra and North Eastern Region of India.

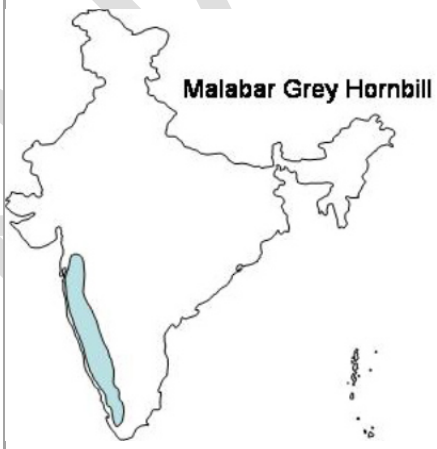
State birds of
Kerala and Arunachal Pradesh

Conservation Status
IUCN: VU
CITES: Listed in Appendix 1 of CITES
Key threats
Tribal peoples threaten the great Indian hornbill by hunting it for its various parts
The beaks and head are used in charms and the flesh is believed to be medicinal.
Tribes in North-eastern India and Borneo use the feathers for head-dresses, and the skulls often wore for decoration.
Habitat loss - deforestation

C) HORNBILLS IN WESTERN GHATS AND A&N

- Four Hornbill species are found in Western ghats: **Great Indian Hornbill (widely distributed), Indian Grey Hornbill, the Malabar Grey Hornbill** and **Malabar Pied Hornbill**;

Great Indian Hornbill (VU)	Discussed in detail above	

Indian Grey Hornbill (LC) (Endemic to India)	It is a common hornbill found on the **Indian subcontinent**. It is mostly arboreal and are commonly sighted in pairs. It has grey feathers all over the body with a light grey or dull light white belly. **Distribution: Plains** (From the foothills of Himalayas southwards; bounded in west by Indus system and bounded to the east by the Ganges Delta) Note: Not found in NE India, dry western regions and very wet western ghats southern part.	
Malabar Grey Hornbill (VU) (Endemic to Western Ghats)	It is a hornbill **endemic to Western Ghats** and is associated with the hills of South India. They have a large beak but lack the casque that is prominent in some hornbill species. They are found in dense forests and around rubber, arecanut and coffee plantation. It is known for its loud '**laugh**' that echoes in the Western Ghats	
Malabar Pied Hornbill (NT) (Endemic to India and Sri Lanka)	It is also known as lesser pied hornbill. **Distribution**: It is distributed across three main regions within the Indian sub-continent: Central and Eastern India, Western Ghats, and in Sri Lanka. It's habitat is evergreen and moist deciduous forests, often near human settlements.	

Naracondam Hornbill (VU) (Endemic to the Narcondam island of Andamans)	**Note:** India also has one species that has one of the smallest ranges of any hornbill: the Narcondam Hornbill, found only on the island of Narcondam (In the Andamans) **Distribution**: It is endemic to Indian island of **Narcondam** in the Andamans. It has the smallest home range of all the Asian hornbills.	

D) HELMETED HORNBILL

The helmeted hornbill is a very large bird of hornbill family.
It is found in Malaysian Peninsula, Sumatra, and Borneo. The casque (helmet like structure on the head) accounts for 11% of its 3 kg weight.

- The poachers are not interested in their brilliant plumage or large bills, but the helmet like block of **reddish-gold keratin** at the front of the skulls known casque.

In the past few years, a surge in the demand for hornbill ivory has pushed the avian species to the brink.

The product has become very popular in China and wealthy collectors are keen to show off their status by acquiring rare or unusual animals, that it is fetching up to five times the price of elephant tusk on black market.

The casque (soft, ivory-like substance that's carved by craftsmen in China into luxury ornaments, statues, and jewellery) has soared in value as so-called **red ivory**.

E) HORNBILL FESTIVAL

» The Hornbill festival is an annual festival celebrated from 1st - 10th December in the North-eastern Indian State of **Nagaland**.

» It represents all ethnic groups of Nagaland for which it is also called the ***Festival of Festivals***.

» **Reason behind the festival:**

- The state of Nagaland has several ethnic groups, which have their own distinct festivals. More than 60% of the population of Nagaland depends on agriculture and therefore most of their festivals revolve around agriculture.

- To encourage inter-ethnic interaction and to promote cultural heritage of Nagaland, the Government of Nagaland organizes the Hornbill Festival every year in the first week of December. The first was held in Dec 20220.

» **Who organizes the festival:**

- The festival is organized by Department of Tourism and Department of Art & Culture and showcases melange of cultural displays under one roof.

» **Venue:**

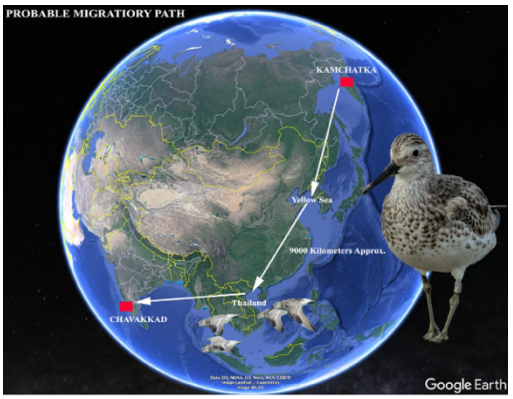
- The main venue of the hornbill festival is held at the **Kisama Heritage Village** located in the Southern Angami region of Kohima District which is about 12 km from Kohima.

7. OTHER BIRDS IN NEWS

1) THE GREAT KNOT

- **Details about Great Knot**
  - The great knot (*Calidris tenuirostris*) is a small wader.
  - Their breeding habitat is tundra in north-east Siberia (and in small numbers in Western Alaska).
  - They are **strongly migratory** wintering on coasts in **southern Asia through to Australia**.

- **Recent sighting in India**
  - Around 1000 birds were tagged with MOSKVA rings in the Kamchatka peninsula in eastern Russia.
    - One of them has been seen in **Kerala's coast on the Chavakkad beach in Thrissur district**. It came calling in a flock of 14 great knots and many other migratory birds.
    - The engraving on the bird's ring provided a vital clue of its Russian connections.



The migratory path of the Great Knot

  - This migratory bird traversed Central Asian Flyway and is only one of the two great knots (other has been sighted in Jamnagar Gujarat) to be re-sighted in India among the early thousand ones tagged with MOSKVA rings in Kamchatka peninsula.
  - These long-distance migrants stay at the Yellow Sea region and Thailand in southeast Asia before proceeding to their southerly winter grounds including Peninsular India along the CAF.
  - The migratory route suggested that the bird that flew to Thrissur travelled over 9,000 kms.
  - Another bird, that was tagged 6Z has been sighted at Jamnagar for the past consecutive years.

2) MANDARIN DUCK (*AIX GALERICULATA*)

- **Details:**
  - It is considered the most beautiful duck in the world. It has majestic colors and can be spotted from a distance. It is a **perching duck species native to East Asia** including Russia, China, Japan.
  - Over the years, population has also been established in Europe and USA.
- **IUCN** status: LC

Spotting in Assam (Feb 2021)

- In Feb 2021, the bird was seen in the **Maguri-Motapung beel** (or wetland) in Assam's Tinsukia. In Tinsukia it was last seen in Dibru River in 1902.
  - More recently it was sighted in Manipur's Loktak lake in 2013, and in Saatvoini Beel in Manas National Park and Tiger Reserve in Assam's Baksa district 2014.
- It's a **migratory bird** that breeds in Russia, Korea, Japan and north-eastern parts of China. But it rarely visits India as it doesn't fall in its usual migratory route.

8. BIRD MIGRATION

WORLD MIGRATORY BIRD DAY (WMBD)

- The day is celebrated **bi-annually** on the **second Saturday of May and October**.
- It is an awareness raising campaign highlighting the need for conservation of migratory birds and their habitats.
  - It aims to draw attention to the threats faced by migratory birds, their habitats etc.

1) SIBERIAN CRANE – DONE EARLIER

2) GREATER FLAMINGO (LC)

- It is the **most widespread and largest species of flamingo family** in the world. It is found in Africa, Southern Europe, Middle East, and Indian Subcontinent.
- They generally reside in mudflats and shallow coastal lagoons with saltwater.

- **Indian subcontinent** is the **largest breeding ground for Greater flamingo and lesser flamingo** coming to India in winter season.

- Greater Flamingoes migrate to freshwater and estuarine habitats across **Maharashtra, Andhra Pradesh, Telangana, Rajasthan and some other** states.
- **Around Mumbai it can** be seen in Sewri Mudflats, Thane Creek and the Talawe Wetlands.

3) LESSER FLAMINGO (NT)

- These are the smallest species of Flamingo.
- They occur in sub-Saharan Africa and north-western India.
- Most lesser Flamingoes in India feed in and around Mumbai's mudflats.

4) JACOBIN CUCKOO (PIED CUCKOO OR PIED CRESTED CUCKOO)

- **Details**
  - It is a member of the cuckoo order of birds that is found in **Africa and Asia**.
  - In **India**, they are **partially migratory**.
    - The pied cuckoos that come to Himalayan foothills are believed to migrate from Africa.
      - It is one of the few species of migratory birds in India that come in Summer. Most migratory species come in winter from colder places like Mangolia, Siberia, Northeastern China, Kazakhstan etc.
      - They are considered harbinger of Monsoon in India. Farmers in India have relied on the arrival of pied cuckoo as a signal to sow seeds, as they know that Monsoon will be soon upon them. This signal is never wrong as the pied cuckoo arrives in India r**iding the monsoon wind**.

    - The community of pied cuckoos in southern India are resident birds and not migratory.
  - The species is a **brood parasite** and in India the host is mainly species of **babblers** in the genus Turdoides. The color of the eggs matches those of the host, typically turquoise blue.
  - **IUCN: LC**

5) BAR HEADED GOOSE

- Bar headed geese are found in **Central China and Mongolia** and they breed there. They are generally found in high altitude lakes where the bird grazes on short grass.
- During winters, they **migrate to Indian Subcontinent** and stay here till the end of the season.
    - It can be clearly distinguished from any other grey geese because of the **black bars** on its head.

- **Known for High Altitude Fly:**
    - They are one of the birds which can fly even at high altitudes. They come to India and return to their homes by **crossing the Himalayan ranges**. This is **one of the most high-altitude migrations in the world**. Their ability to sustain the high oxygen demands of flight in air that is exceedingly oxygen-thin is exceptional. This ability of bar-headed geese differentiates them from other similar lowland waterfowl.
- **Large folks visit** the Koonthakulam Bird Sanctuary in TN. But they are rarely seen in Kerala.
- **IUCN Status:** LC

6) WARBLERS

- **Note: Warblers**
    - Various Passeriformes (perching birds) are commonly referred to as warblers.
    - They are not necessarily closely related to one another, but **share some characteristics,** such as being **fairly small, vocal, and insectivorous**.

Lesser White Throat:
It is a migratory bird which **comes from Europe to India around October-November ev**ery year.

It hunts insects while flitting from branch to branch. It's feeding behavior is slightly different from other Warblers: it also forages on the ground for insects and grubs.

In Delhi NCR, the bird is common throughout the city, especially in birding hotspots (Sultanpur Sanctuary outskirts, Okhla Bird Sanctuary) and areas with old dense forests.

Willow Warbler

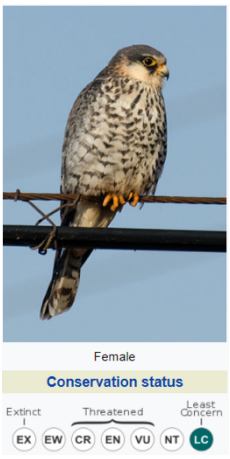
Willow Warbler (*Phylloscopus trochilus),* one of the longest migratory small birds that breeds throughout the northern and temperature Europe and the Palearctic, has been sighted for the first time in the country **at Punchakkari** in Thiruvananthapuram (Nov 2020)

Other Warbler birds which migrate to India

Greenish Warbler	
Hume's Warbler	

7) AMUR FALCON

- **About Amur Falcon**
  - » It is a small raptor (25 cm long) of falcon family which breeds in **Siberia** , Mongolia and North China. It winters several thousands of the bird migrates to India and across the Indian Ocean to **South Africa**. This bird has one of the longest migration routes of all birds, doing up to 22,000 km in a year.
  - » It is also known as **eastern red foot falcon**.
  - » In Manipur, the birds are locally known as **Akhuaipuina**.
  - » **Physical characteristics**
    - It shows dimorphism. Male has a sooty grey back while the female is paler and has scaly marks.



» They are **wholly insectivorous** thus helping agriculture of the region.

- **Conservation Efforts:**
  - » In 2012, thousands of Amur Falcons were killed in Nagaland.
  - » But efforts including nature education, conservation awareness and community engagement to connect with nature ensured not a single killing in 2013, 14, 15, and 16.
  - » With the hunters turning into protector, **Nagaland's Pangti Village has become the falcon capital of the world**.
    - In April 2018, '**The Pangti Story**' was adjudged the Best Environment Film at the 65th National Film festival.
  - » Thanks to Amur Falcon, Nagaland is also listed as among the 10 best birding destinations in the world by National Geographic.

8) OTHER MIGRATORY BIRDS

A. Common Teal/ Eurasian Teal (LC)
B. Yellow Wagtail
C. White Wagtail
D. Northern Shovler
E. Rosy Pelican
F. Wood Sandpiper
G. Spotted Sandpiper
H. Eurasian Wigeon
I. Black tailed goodwit
J. Spotted Redshank
K. Starling
L. Blue throat
M. Asian Koel
N. Black crowned Night Heron
O. Eurasian Golden Oriole
P. Comb Duck
Q. Blue Cheeked Bea Eater
R. Blue Tailed Bea Eater
S. Cuckoos

- **Reasons for Migration**
  1. To avoid adverse factors (extreme climatic condition)
  2. To manage food shortage
  3. To manage water shortage
  4. To have better breeding conditions
  5. Less competition for safe nesting places

9. REPTILES: CRITICALLY ENDANGERED

1) GHARIAL (GAVIALIS GANGETICUS)

- One of the longest of all living crocodilians, uniquely evolved as specialized, river dwelling, fish eater. With 110 sharp interdigitated teeth in its long thin snout, it is well adapted to catching fish, its main diet.

- **Habitat:** They inhabit foremost flowing rivers with high sand bank which they use for basking and building nests.

- **Distribution**
  - » **Past:** Once inhabited all the major river system from the Irrawaddy River in the east to the Indus river in the west.
  - » **Now**
    - **Only viable population** in National Chambal Sanctuary (also known as National Chambal Gharial Wildlife Sanctuary) , spread across three states of UP, Rajasthan and Madhya Pradesh.
    - **Recent Conservation** efforts have led to breeding of gharial after 45 years in Odisha in 2021 in Mahanadi River near Satkosia range.
      - » With the introduction of Gharial in 1975, Odisha has become the **only state with all the three species** - Freshwater Gharials, Muggers, and Saltwater Crocodile
    - **Small non-breeding population:** Exist in son, Gandak, Hoogly and Ghagra rivers.
    - **Extinct** in Myanmar, Pakistan, Bhutan and Bangladesh.

- **Threats**
  - » The combined effects of dams, barrages, artificial embankments, change in river course, pollution, sand mining, riparian agriculture and ingress of domestic and feral livestock.

A) ODISHA GETS ITS FIRST GHARIAL HATCHLING IN 45 YEARS (JUNE 2021)

- For the first time since they were introduced in the rivers back in 1975, **Odisha have seen natural nesting of Gharials**.
  - The journey for conservation of Indian Gharials (Gavialis gangeticus) started in 1975 at Gharial Research and Conservation Unit (GRACU), Tikarpada, and adjoining Satkosia Gorge Sanctuary along the Mahanadi river in Odisha.

- All the original Gharials introduced in Odisha over the years are dead now. In the past three years, Odisha had introduced 13 more gharials in the Mahanadi. Only eight survived.

- As many as 28 hatchlings were spotted towards the end of May in Mahanadi river, in the Baladamara area near Satkosia range.
- **Note:**
  - With the introduction of Gharial in 1975, Odisha has become the **only state with all the three species** - Freshwater Gharials, Muggers, and Saltwater Crocodile.
- Gharials are different from Muggers and don't harm humans. But, many people mistake them for crocodiles and consider them harmful.

A) REINTRODUCED GHARIALS THRIVING IN BEAS RIVER (DEC 2021)

- Since 2017, 94 gharials have been released in the Beas Conservation Reserve and there have been only two casualties.
- These Gharials are healthy and have adapted to the Beas Conservation Reserve as their home. They have dispersed both upstream and downstream of the release site and can be spotted any time depending on the water levels and season, indicating that the **first step of their rehabilitation has been successful**.
- **Experts believe that they may start breeding in the next few years** as the released gharials are healthy and have adapted to the Beas Conservation Reserve as their home.
  - » **Natural breeding** would be the real success. The eldest of the reintroduced gharials is 7 years old now and experts are hopeful that breeding would start in next three years (Gharial start breeding at the age of 10).

- **Background:**
  - » Gharials were commonly seen in Beas River till the 1960s after which it became extinct.
    - **Why?** Change in hydrology due to dam construction, rapid-land use change of flood plains and rampant overfishing led slowly into the extinction of the gharial from the Beas

2) OTHER CROCODILE SPECIES OF INDIA (NON-CRITICALLY ENDANGERED)

A) MUGGER CROCODILE: (CROCODYLUS PALUSTRIS) (VU)

- Mugger Crocodile, also called marsh crocodile, broad-snouted crocodile is a crocodilian native to **freshwater habitat** from Southern Iran, Pakistan, India and Sri Lanka. It is already extinct in Bhutan and Myanmar.
- Sex of the hatchlings depends on the temperature during incubation.
- In India it is **distributed throughout the country** From Rajasthan to Odisha and from Punjab to Tamil Nadu.

Mugger 'high'-walking in National Chambal Sanctuary, India

- **Protection Status**
  - **IUCN: VU**
  - **WPA: Schedule 1**

B) SALTWATER CROCODILE (CROCODYLUS POROSUS) (IUCN: LC)

- **Details**
  - It is a saltwater crocodile native to Saltwater habitats and brackish wetlands from India's East Coast across South East Asia and the Sundaic region to northern Australia and Micronesia.
  - These are the **largest living reptiles** and thus also the largest crocodilian species known.
    - **Males** can grow upto 6 meters with more than **1,000 kg** of weight.
    - **Females** are much smaller and rarely surpass 3 m.

  - It is an opportunistic hypercarnivores apex predator. It's also very **dangerous for humans** if they venture into its occupied areas.
    - Their population has been growing a lot in A&N islands and therefore the UT administration has been requesting Central government to delist it from WPA-Schedule-1

  - **Distribution in India:**
    - The saltwater crocodile is found in eastern states of WB, Odisha, AP and TN. It is also found in A&N Islands.

- **Protection:**
  - **IUNC: LC**
  - **WPA:** Schedule-1

3) TURTLES OF INDIA

- India has 29 species of turtles
  - **Freshwater Turtles** (25)
  - **Tortoises** (5)

- The main difference between **turtles and tortoises** is that **turtles are primarily aquatic** whereas tortoise are terrestrial and spend more time on land.

- More than half of the turtle species in India are threatened and half of them are protected under WPA-Schedule-1.

4) CR REPTILES

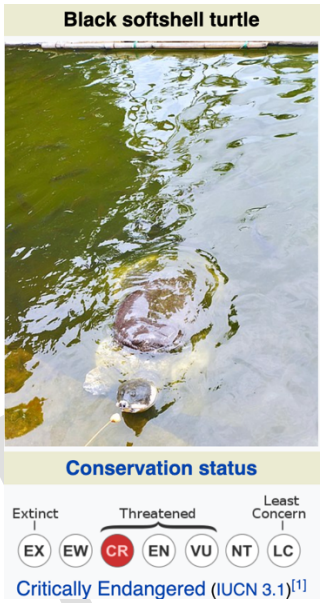
A) BLACK SOFTSHELL TURTLE (NILSSONIA NIGRICANS)

About Black Soft Shell Turtle

- It is rarest of India's turtle species.

Recent efforts for preservation

- Hayagriva Madhab Temple at Hajo (30 km from Guwahati) released 16 black soft shell turtle, in the Haduk Beel (wetland) of Pobitaro WLS. These turtles were bred in the temple's pond.
- Other softshell turtles species moved from the temple pond to the wild was Indian Softshell Turtle and peacock softshell Hatchlings



B) ASIAN FOREST TORTOISE (MANURIA EMYS)

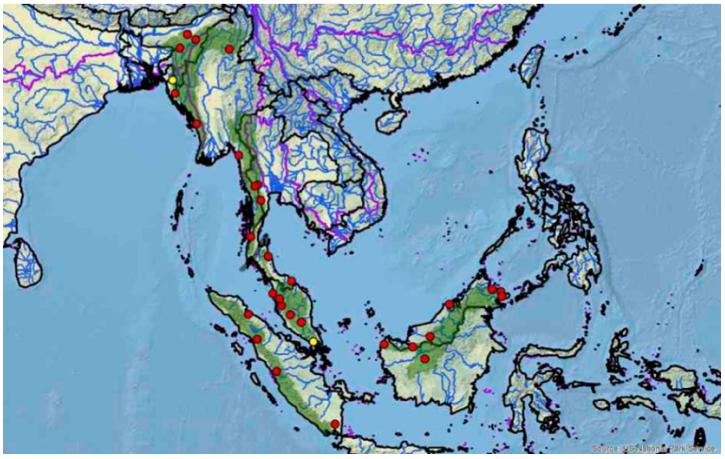
- **Why in news?**
  - » Ten captive bred **Asian Giant Tortoise** (*Manouria emys*) juveniles were released into a protected area of Nagaland (Dec 2022)

Asian Forest Tortoise (commonly known as the **Mountain Tortoise)** is the largest tortoise species in the mainland Asia. It is endemic to North-eastern India, Bangladesh and Southeast Asia.
Habitation: Hilly wet forests.
IUCN: CR

Other interesting features:

- » These are the only Tortoise which lay eggs above ground in a nest, which is constructed out of leaf litter by females.

Threats: Over-exploitation and unsustainable use for consumption by local communities resulted in species being pushed to the brink of extinction.



Soft Release in Nagaland Protected areas:

- » The Nagaland Forest Department and non-profits **Turtle Survival Alliance and Wildlife Conservation Society**, India conducted a soft release of juvenile tortoise with an objective to rewild the species and population recovery.

» The animals were **conserved and bred for five years** at the Nagaland Zoological Park, Dimapur before their release. » **Soft Release** is a process of gradually releasing captively bred species into the wild. This allows the species to develop comfort with the surrounding and other released individuals	**Distribution:** India, Bangladesh, Myanmar, Thailand, Singapore etc.

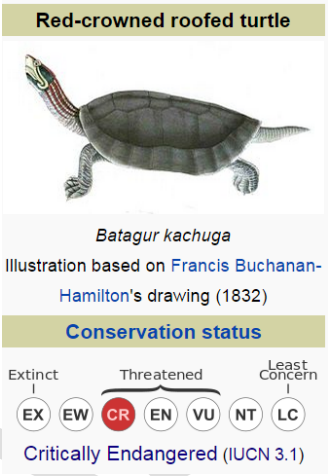
C) HAWKSBILL SEA TURTLE (ERETMOCHELYS IMBRICATA)

- **Distribution:** Have a side range, found predominantly in tropical reefs of the Indian, Pacific and Atlantic Oceans. Found in more than 70 countries.
  - **In India:** Andaman and Nicobar Islands, the coast of Orissa and Tamil Nadu**.**
- **Habitat: Nesting occurs in insular sandy beaches.**
- **Threats**
  - Turtle shell trade (for decorative purposes), egg collection, slaughter for meat, oil pollution and destruction of nesting and foraging habitats.

D) FOUR-TOED RIVER TERRAPIN OR RIVER TERRAPIN (BATAGUR BASKA)

- Specie of riverine turtle
- **Diet**: Omnivorous diet makes them an essential part of the efficient clean-up systems of aquatic habitats.
- **Habitat**: Fresh water rivers and lakes.
- **Distribution**: Found only in Bangladesh, Parts of India (WB and Orissa), Myanmar and Cambodia .
  - It is presumed extinct in several south-eastern Asian countries. Even in WB and Orissa, it is difficult to find in wild.
  - It is considered world's second most endangered turtle. The Yangtze giant soft shell turtle, *Rafetus swinhoei,* is considered the most endangered fresh water turtle.
- **Protection Status**
  - IUCN: CR
  - WPA: Scheduled 1
- **Threats**: Use of flesh for medicinal purposes, demand for eggs, which are considered a delicacy.
- **Note**
  - There are **six large fresh water turtle of the genus Batagur**, three are found in India.
    - » Batagur Kachuga (Red-crowned roofed turtle) and Batagur dhongoka (three-striped roofed turtle) are found in tributaries of the Ganga, such as Chambal.
    - » The **Northern river terrapin** is the most endangered of the three species.

E) RED-CROWNED ROOFED TURTLE OR THE BENGAL ROOF TURTLE (BATAGUR KACHUGA)



- Critically endangered turtle, endemic to South Asia.
- Males have bright red coloration during the breeding season.

- **Habitat**: Deep flowing rivers but with terrestrial nest sites.

- **Distribution**: Found in **India, Bangladesh, and Nepal**.
  - In India it resides basically in watersheds of Ganga. **The National Chambal Sanctuary** is believed to be one of the last viable habitats for the species.

- **Threats**: Water development projects, water pollution, human disturbance and poaching for illegal wildlife market.

F) LEITH'S SOFTSHELL TURLTE

IUCN: CR
CITES: Appendix-1

It mainly inhabits rivers and reservoirs mainly in southern peninsular India, in states like Odisha, Madhya Pradesh, Karnataka, Andhra Pradesh, Kerala, Maharashtra, and Tamil Nadu. Its presence is substantial in the Cauvery, Tungabhadra, Ghatprabha, Bhavani, Godavari, and Moyar Drainages.

The specific name, *leithii,* is in the honor of Andrew H. Leith, a physician with the Bombay Sanitary Commission.

Threats: Loss of habitat, pollution, and unchecked urbanization.

G) ASIAN GIANT SOFTSHELL TURTLE (CANTOR'S GIANT SOFTSHELL TURTLE)

IUCN: CR
CITES: Appendix-II

It's a freshwater turtle that is native to Southeast Asia. It is considered among the largest extant freshwater turtles.

Distribution: Cantor's giant softshell turtles occur in eastern and southern India, Bangladesh, and throughout southeast Asia and Papua New Guinea.

They spend most of their life buried and motionless with only their eyes and mouth protruding from the sand. They surface only twice a day to take a breath and capture their prey by sit-and-wait strategy. **Key threats**: Habitat destruction, harvesting for meat, and accidental killing by getting trapped infishing gears.	It Kerala they are also called **'Pala poovan'** - since its nose and white bony belly plate resemble the shape and color of the pala flower, a type of crape jasmine.

H) SAL FOREST TORTOISE (ELONGATED TORTOISE)

- **Details**
  - It is a species of tortoise found in Southeast Asia and parts of the Indian subcontinent.
    - In India, it is found in Assam, Bihar, Jharkhand, Meghalaya, Mizoram, Odisha, Sikkim, Tripura, Uttarakhand, UP and West Bengal.

  - It is called elongated as its shell is considerably depressed, more than twice as long as deep, with flat vertebrate region;
  - This species is **dimorphic**.

- **Protection Status**
  - **IUCN: CR**
  - **CITES:** Appendix-II
  - **WPA:** Schedule-IV

10. REPTILES: ENDANGERED TURTLES/TORTOISES IN INDIA

1) INDIAN PEAKCOCK SOFTSHELL TURTLE (NILSSONIA HURUM)

- **Distribution and Habitat**
  - **Distribution:** It is found throughout the Indus, Ganga and Brahmaputra basins of **Pakistan, India, Nepal and Bangladesh**.
  - **Habitat and Ecology:** Wetlands (inland), Artificial/Aquatic & Marine.
- **Major threats**
  - Habitat degradation
  - **Illegal trade** - It is in demand in both domestic and international (east Asian) food markets and can occasionally be found as individuals in domestic pet trade.
- **Conservation Status:**
  - IUCN: EN
  - WPA: Schedule-1
  - CITES: Appendix-1

2) GREEN SEA TURTLE (CHELONIA MYDAS) [ALSO KNOWN AS GREEN TURTLE, BLACK TURTLE, OR PACIFIC GREEN TURTLE]

- **Details**
  - Its common name refers to the green fat found beneath its carapace, not to the color of its carapace, which is **olive to black.**
  - They are herbivorous and consume sea grass, algae etc.
- **Habitat and Distribution**
  - They extend **throughout tropical and subtropical oceans** worldwide.
  - **In India**, it occurs in East coast, West Coast, Lakshadweep, and Andaman & Nicobar Islands.
    - » In MHA, they are often spotted by locals
- **Conservation Status**
  - IUCN: EN
  - CITES: Appendix-1
  - WPA: Schedule-1

3) ASSAM ROOFED TURTLE (PANGSHURA SYLHETENSIS)

- **Details**
  - It is a species of turtle found in Brahmaputra-Meghna draining in India (Assam) and parts of Eastern Bangladesh.

- **Habitat and Distribution**
  - **Habitat:** It has specialized habitat requirements for clear flowing streams
  - **Distribution:** It is known to be distributed in **north-east India**.

- **Conservation Status:**
  - IUCN Endangered
  - CITES: Appendix II
  - WPA: Schedule-1

11. REPTILES: VULNERABLE TURTLE/TORTOISE IN NEWS

1) LEATHERBACK SEA TURTLE (DERMOCHELYS CORIACEA)

IUCN: VU
WPA: Schedule-1
It is the largest of all living turtles and the heaviest non-crocodilian reptile.

- They can weigh as much as 900 kgs. '

It is the only species in the genus Dermochelys and family Dermochelyidae.

It can easily be differentiated from other modern sea turtles by its lack of a bony shell. Instead, its carapace, is covered by skin and oil flesh.

Diet: Jelly fish is their primary food. Important top predators in marine environment.
Habitat: tropical and subtropical oceans
Threats

- High sea fishing operations, harvesting of eggs, destruction of nests by wild predators and domesticated species such as cats, dogs and pigs.
- **Artificial lighting ,**disorient hatchlings and adults and cause them to migrate inland rather than towards the sea.

Distribution:
They are found in all oceans (tropical and temperate waters) **except the Arctic and Antarctic**.

- **In Asia**, they nest only in **Indonesia, Sri Lanka** and the **Andaman and Nicobar Islands**.
- **In India** the population is restricted to Great and Little Nicobar Islands.

▪ **Threats to habitats :** Construction, mining and plantation of exotics.	

2) OLIVE RIDLEY SEA TURTLES (*LEPIDOCHELYS OLIVACEA*)

- **Introduction**
  - Olive Ridley Sea turtle, also known as the Pacific Ridley Sea Turtle, is a medium sized species of turtle found in warm and tropical waters, primarily in the pacific and Indian Oceans. It is the **most abundant** of all sea turtles in the world.
  - **Conservation status**
    - The Olive Ridley turtle is classified as Vulnerable according to IUCN and listed in Appendix 1 of CITES.
    - The turtles are also protected under the Wildlife (Protection) Act (Schedule 1 - Part II).

- **Specialty**
  - These species along with their cousin the **Kemps Ridley turtl**e (CR) are known for their unique mass nesting called **Arribada**, where thousands of females come together on the same beach to lay eggs.

- **Where are they found in India?**
  - **i. Gahirmatha Beach** in the Kendrapada district of Odisha, which is also **part of Bhitarkanika Wildlife sanctuary,** is the largest breeding grounds for these turtles.
    - Gahirmatha Marine Wildlife Sanctuary, which bounds the Bhitarkanika WLS to the east, was created in 1997. it extends from Dhamra River mouth in the north to Brahamani river mouth in the south.
    - It is known as world's largest Olive Ridley rookery, the animals come here in lakhs for mating and laying eggs.
    - Mass nesting in the Gahirmatha marine sanctuary occurred from March 9-23, 2021 and over 3 lakh eggs were laid during this period.

  - ii. **Other mass nesting beaches in Odisha**
    - Beaches at the mouth of rivers Rushikulya and Devi.
      - The Rushikulya river mouth is considered the second-biggest rookery in India after Gahirmatha.
    - Oliver Ridley turtles stayed away from Rushikulya in Odisha in 2021. But experts said that it was a natural phenomenon and is not unusual.

- **Other parts of the world**
  - Coast of Orissa is the largest mass nesting site for Olive Ridley turtles followed by coast of Mexico and Coast of Costa Rica.

3) INDIAN STAR TORTOISE

- It is a threatened species of tortoise found in **dry and scrub forests in India, Pakistan and Sri Lanka**.

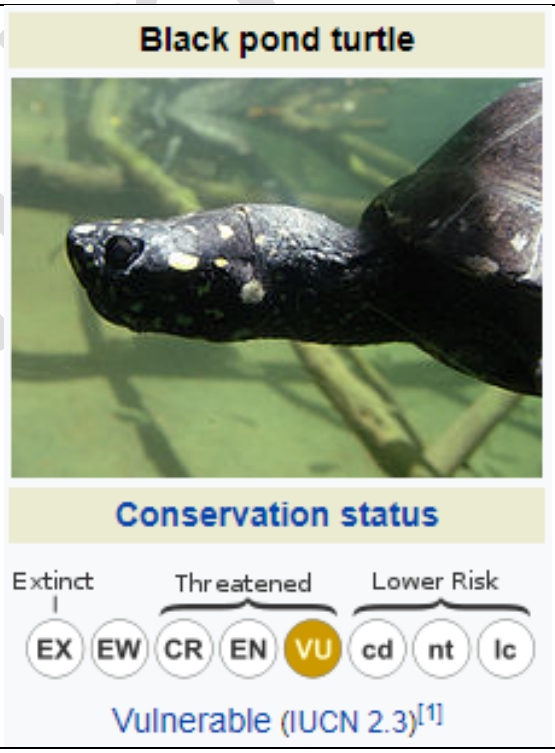
- They are distributed from India (except lower Bengal), extending west to Sindh Province and SriLanka.
- **Protection Status**
  - IUCN: VU
  - WPA: **Schedule IV**
  - CITES: Appendix 1 (updated in 2019 from appendix 2 to Appendix-1)

- **Key threats**
  - Species popularity in the **exotic pet trade** makes it vulnerable. It is one of the most trafficked tortoise species in the world owing to the unique star like radiating pattern on the shell.

4) OTHER VULNERABLE TURTLES

Black Spotted Turtle (Geoclemys hamiltonni)/ Spotted Pond Turtle/ Indian Pond Turtle

- It is a medium size freshwater turtle which is endemic to South Asia. It is mainly black with small yellowish spots and a much-elevated carapace.
- The species is distributed across the North, Northeast and a few parts of Central India in states of Meghalaya, Assam, West Bengal, Bihar, UP, UK, Haryana, Punjab, Rajasthan, MP etc.
- Earlier hunted for meat, is now more sought after as an exotic pet.



Aldabra Giant Tortoise

Why in news?

- Seychelles has gifted India a pair of giant Aldabra Tortoise in a good will gesture and as a symbol of ever-lasting friendship.

Intro

- The Aldabra giant tortoise, from the island of the Aldabra atoll in the Seychelles. It is one of the largest tortoise in the world.
- In past, it was found on many of the western Indian Ocean Islands, as well as Madagascar

Threat Status: VU in IUCN Red list

Protection Status: It is listed in CITES appendix II.

Indian Soft-Shell Turtle (Nilssonia gangetica), or **Ganges Soft Shell Turtle**

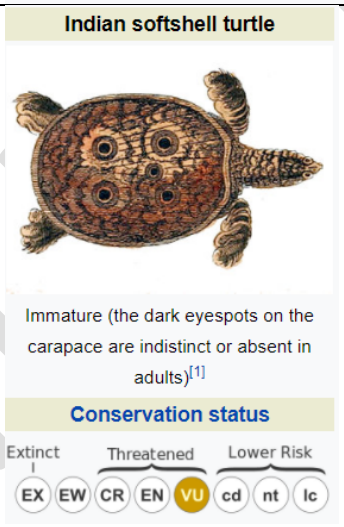
Intro: It is a species of soft-shell turtle found in South Asia in rivers such as the Ganges, Indus and Mahanadi.

Protection and Conservation Status

- IUCN Red List: Vulnerable
- Listed in Schedule 1 of the Wildlife Protection Act, 1972

Main Dangers

- Its meat is considered a delicacy in parts of TN and hence is traded illegally.



12. REPTILES: INVASIVE TURTLE IN NEWS

1) RED EARED SLIDER TURTLES

- It derives its name from the red stripes around the part where its ears would be and from its ability to slide quickly off any surface into the water.
- It is native to USA and northern Mexico and is an extremely popular pet due to its small size, easy maintenance, and relatively low cost.

- They **grow fast** and leave virtually nothing for the native species to eat. Thus, it is also an invasive species. In India it has already affected states such as Karnataka and Gujarat.

- It is threatening to invade the natural water bodies across the North-east, home to 21 of the 29 vulnerable native Indian species of freshwater turtles and tortoises.

- A recent study by a team of herpetologists have found red eared slider in the Deepor Beel Wildlife Sanctuary and the Ugratara temple pond - both in Guwhati. Another study has found red-eared slider from an unnamed stream, connected to Tlwang river, on a farm near Mizoram capital Aizwal.
- **Preventing its invasion of Brahmaputra** and other river systems of northeast is especially important because the north-east is home to 72% of the turtle and tortoise species in the country.

- **Note:** It is **traded legally**, but perhaps the time has come for the government to come up with regulations against keeping invasive as pets.

13. REPTILES:

1) WORLD SNAKE DAY: 16TH JULY 2023

- **History:**
- World Snake Day is an annual event celebrated on July 16th to raise awareness about the importance of snakes and to dispel some of the myths and fears that surround them.
- It was first celebrated in 2006 by the Snakebite Survivors Network (SSN) and the International Society of Herpetologists (ISU).
- **National Zoological Park, New Delhi** has celebrated World Snake Day on 16th July 2023.

2) SNAKES OF INDIA

- Snakes have been slithering on earth for more than a 100 **million** years. These creatures have evolved from lizards
- Globally, more than 34,00 species of snakes have been identified. India, is home to 350 species of snakes. **This** number is increasing constantly as a result of new discoveries. But only 15% of these are venomous.

A) THE BIG FOUR

- The four venomous snake species responsible for causing the greatest number of medically significant human snake bite cases on Indian subcontinent are sometimes collectively referred to as the **Big Four**.
- They Include the following snakes:

Russel's Viper: Daboia russelii:

It is native to Indian subcontinent. They are mainly nocturnal.

Their **hiss** is amongst the loudest hiss of the snakes in the country.

IUCN Status: LC

They are responsible for more than **40% of snake bites in** India.

Common Krait (Bungarus caeruleus):
It is a nocturnal snake and thus most of the human encounters happen at night.

IUCN: Not Evaluated

They are responsible for around 18% of snake bites in India.

Indian Cobra (Naja Naja):

Indian Cobra is a species of the genus Naja found in India, Pakistan, Bangladesh, Sri Lanka, Nepal and Bhutan. It is also known as the spectacled Cobra, Asian Cobra, or binocellate Cobra.

Conservation Status:

- It is not a threatened species and is not listed in IUCN Red List.
- It is listed under Appendix II of CITES because it closely resembles other species that are threatened and in need of protection.

About Genome Sequencing

A large international team of researchers affiliated with corporate and academic institutions has sequenced the genome of the Indian Cobra. They have published their paper in the journal *Nature*

	Genetics. The group describes their goal to develop an anti-venom. **Need:** Every year around 5 million people around the world are bitten by Venomous snake - around 1 lakh loose their lives. Four snakes - the common Krait, the Russell's Viper, the saw scaled Viper and the Indian Cobra do the most harm. Further, scientists have been unsuccessful in developing anti-venom against these snakes so far. **With gene sequencing** scientists are hoping that it would be lead to development of an **antivenom based on synthetic recombinant venom built from protein**.
Indian Saw Scaled Viper (Echis Carinatus): It is a venomous viper species found in West Asia, Central Asia and South Asia. It is the smallest member of the big four snake that are responsible for causing the most snakebite cases and deaths, due to various factors including their frequent occurrence in highly populated region, and their inconspicuous nature. **IUCN:** Note Evaluated	

4) KING COBRA (OPHIOPHAGUS HANNAH)

- It is one of the most venomous snakes in the world. They can reach upto 18 feet in length, making them l**ongest of all venomous snakes**.

- **Habitation and Distribution**
    - King Cobra lives mainly in the **rain forests and plains in India, southern China and South East Asia**. They are comfortable in a variety of habitats, including forests, bamboo thickets, mangrove swamps, high altitude grasslands, and in rivers.

- In India, they are known from **Odisha and Jharkhand.** Recently (Aug 2022), it has been confirmed that their habitat has expanded to Central India (Chhattisgarh) as well.

- **Food:**
  - They are carnivores and it other snakes, lizards, eggs, and small mammals.
- **Other special features**
  - They are the only snakes in the world that build nests for their eggs, which they guard ferociously until the hatchlings emerge.
  - It is best known as the species of choice for the snake charmers of South Asia. Though, they can hear, they are actually deaf to ambient noises, sensing ground vibrations instead.
  - **Snake charming** is "often a sad con game in which an exhausted cobra is put on the defensive, yet conditioned (with pain) not to strike the flutist," Smithsonian's National Zoo says
- **Protection Status:** They face a variety of threats stemming from human activities, these snakes are vulnerable to extinction.
  - **IUCN Status: VU**
  - **CITES: Appendix-II**
  - **WPA:** Schedule-II
- **Note:** It is different from **Indian Cobra (Naja naja)** which is not a threatened species.
- **Increase in sightings in Human Settlement** in Odisha
  - Disturbances caused by forest fires and other human activities may cause the king cobras to come to their natural habitats in the forests to human habitats.
  - The dwindling population of prey in forests could be other reason.

Sightings of King Cobra in Chhattisgarh for the first time (Aug 2022)

- **31 nesting spots of King Cobras** have been confirmed in the Korba forest range.
- **Note:** Earlier, there was no known evidence of the longest venomous snake in Chhattisgarh or all of central India before this.
- King Cobras require a continuous forest patch. Their presence indicates that the habitat is performing better in terms of ecosystem services.

5) RETICULATED PYTHON

It is the longest snake (third heaviest) in the world regularly reaching 6.25 m in length. The longest reticulated python ever recorded was 10 metres.

It is a non-venomous snake.

IUCN: LC (wide distribution)
Distribution: Native to South and South-east Asia

Habitat: Rainforests, woodlands, grasslands.

6) INDIAN RAT SNAKE (PTYAS MUCOSA)/ ORIENTAL RAT SNAKE / INDIAN RAT SNAKE

It is a common non-venomous species of Columbidae family found in south and Southeast Asia. In northern India they are also called **Dhamans.**

They are famous for their crawling speed and large size. They are a farmer's friend, as they help control the rodent population from destroying crops.

They are favorite meals of King Cobra.

7) INDIAN ROCK PYTHON

It is one of the heaviest and longest snakes found in India.

Despite being common in most part of the country it is difficult to see them in the wild as they are **nocturnal and arboreal snakes**. They have a thermal sensing pit on their jaws.

1) OTHER VULNERABLE SNAKES

Burmese Rock Python (*Python bivittatus)* - Note1: It is found in **SE Asia, Southern China, and North-Eastern Indian region**. - Note2: It is an invasive species in Southeastern United States and it reached there as a result of pet trade. - https://youtu.be/9CddEykqaKk	
Andaman Krait (Bungarus *andamanesis)* - It is a species of venomous snake found in Andaman Islands only.	
Walnut Kukri Snake (Oligodon juglandifer) - It is found in N-E India mostly in Darjeeling hills and Sikkim. It inhabits montane grasslands and lowland and montane moist forests.	

14. REPTILES: GECKOS, LIZARDS ETC.

A) GECKOS: CRITICALLY ENDANGERED

ANNAIKATTI GECKO

- **Distribution**
  - Anaikatti hills (near Coimbatore)

A) GECKOS: ENDANGERED: JEYPORE GROUND GECKO (ALSO CALLED JEYPORE INDIAN GECKO) (*CYRTODACTYLUS JEYPORENSIS*)

- **Why in news?**
  - Rare Jeypore Ground Gecko listed in Appendix 2 of CITES to stall its trafficking (Nov 2022)

IUCN: EN
CITES: Appendix-II
WPA: Not included yet.

It was first discovered in 1877, from Jeypore forests of resent day-Odisha.

It was considered extinct before its rediscovery in 2010 in eastern ghats of Odisha.

Distribution: the lizard inhabit semi-evergreen forests in high elevation areas of eastern ghats of Southern Odisha and northern Andhra Pradesh.

Illegal trade - Species look handsome and docile making it a good candidate for pet trade. It is popular among breeders in and outside India.

8) OTHER GECKO SPECIES

A) SISPARA DAY GECKO (CNEMASPIS SISPARENSIS) (NT)

- It's a large gecko which dwells usually in Forests, it is largely insectivorous and nocturnal.
- **Habitat / Distribution:** Endemic to western Ghats, and found in Sispara, Nilgiris, Kavalai near Cochin.
- **Threats:** Habitat conversion and modification.

B) TOKAY GECKO (GEKKO GECKO) (LC)

- **Introduction**
  - It is a nocturnal arboreal gecko in the genus Gekko, the true geckos. It is **native to Asia and some pacific island countries**.
  - **Distribution:** The species occur in northeast India, Bhutan, Nepal, and Bangladesh, throughout Southeast Asia, including Phillipines and Indonesia and to western New Guinea in Melanesia.

Tokay gecko

  - **Features**
    - Tokay geckos are the second largest geckos in the world today.
    - Distinctive in appearance, and known for its loud mating call, Tokay is about 11-20 inches in length weighing 150-400 gms.
  - **Conservation Status**
    - **IUCN: LC**
    - **Wildlife Protection Act of India:** Included in Scheduled III as highly endangered animal.
    - **CITES:** Appendix - 2
  - **Threats**
    - **Poaching for medicinal trades** in parts of Asia.
      - Ingredient in traditional Chinese medicine t
        - Dried up body part is reportedly used as aphrodisiac.
      - Highly sought after in China, Hong Kong, Taiwan, Vietnam, Malaysia, Singapore and other parts of Asia
    - **Kept as pet**

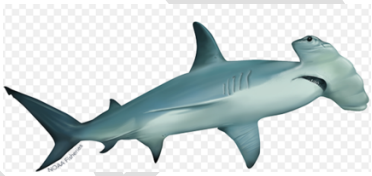
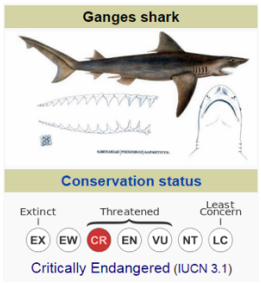
High profile advanced research

TARGET PRELIMS 2024
BOOKLET-19; EB&CC-9
BIODIVERSITY-IMPORTANT SPECIES-3

1. TABLE OF CONTENTS

2. FISH DIVERSITY

1) CRITICALLY ENDANGERED (CR) FISH SPECIES IN INDIA

Indian Swellshark: Small deep-water catshark known from the coast of Kollam, Kerala; A&N; Sri Lanka. **Threats**: Very limited geographical range and population; accidental catch by deep water trawling.	
Scalloped Hammerhead: "Hammerheads" or "hammer shaped head" is the most distinguished characteristic. **Distribution**: warm, temperate, and tropical coastal waters all around the globe.	
Oceanic White Tip Shark: Large shark found in tropical and subtropical oceans throughout the world.	
Pondicherry Shark: Extremely rare species found in Indo-Pacific waters from Oman to New Guinea. It has also been seen in Godavari River Estuarine Ecosystem in recent times. In Andhra Pradesh it is locally named as "**Pala Sora"**. **Threats**: Commercial fishery.	
The Ganges Shark (Glyphis gangeticus): **Distribution**: Found in the Ganges (Padma River) and the Brahmaputra River in India and Bangladesh. It is uniquely adapted (small eyes) fish eating (slender teeth) shark that occur in the turbid waters of Ganga River and the Bay of Bengal. » These are **true river sharks** which need not to migrate to salt water to reproduce. » **Note**: Species in the genus Glyphis are true river shark. **Threat**: Overfishing, pollution, dams, barrages etc.	
The Hump Backed Masheer (Tor Ramadevii) The hump backed Mahseer - a **large freshwater fish** also called the **tiger of the water** is found **only in the Cauvery River basin** (including Kerala's Pambar, Kabini, and Bhavani rivers). Inclusion in the red list was possible only after getting the scientific name which it got in June 2018 - Tor Ramadevii.	
Other CR Fish: 1. Large Tooth Sawfish (Freshwater sawfish) 2. Green Sawfish or long combed sawfish or narrow snout sawfish	

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/jPSgCWl5PrQ?si=QGirwD9wjaRiOMWd

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 rom 2002, but illegal, clandestine trade continues. This creates immense pressure one 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.

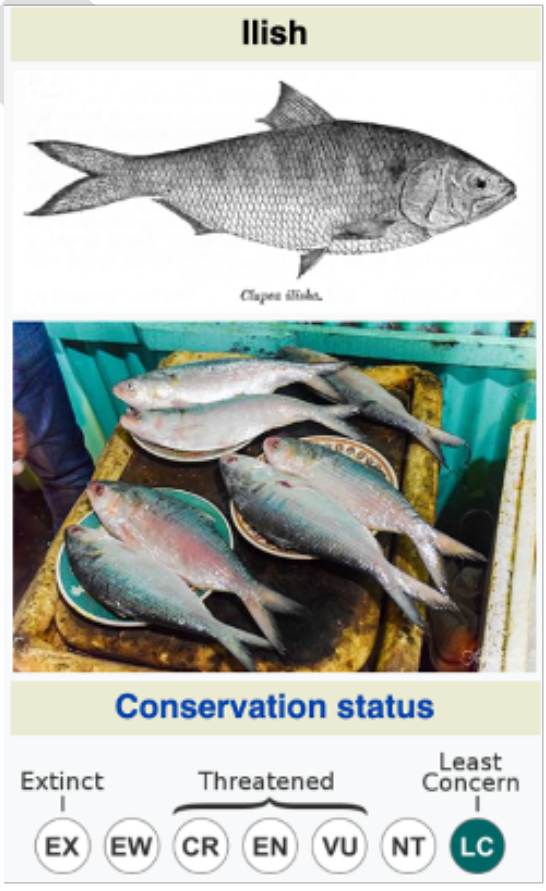
Hilsa catch in West Bengal has decreased over the years. For quite some time, the demand has outstripped the supply. Earlier, Hilsa imported from BD played a key role in fulfilling the gap.

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.



Sardine: It is a species of ray-finned fish in the genus Sardinella. • It is one of the two important commercial fishes in India (with the **mackerel**). • It is one of the more regionally limited species of Sardinella and can be found in the northern regions of Indian Ocean. It was showing declining trend for the past few years but seems to be on revival path on Kerala Coast. This was informed by state-run Central Marine Fisheries Research Institute (CMFRI). **Warming of ocean water** has been the major reason for decline in the past.	 CMFRI has raised concerns over indiscriminate fishing of unmatured sardines.
Trout in Kashmir: A Scotsman named J.S. Macdonall shipped 1,800 trout eggs into Kashmir in 1900 and introduced Kashmir to fishing culture. These fish which are popular in Europe, found Kashmir suitable as its weather conditions match with that of Europe. Now, cold-water trout is the most popular fish in the Kashmir plates and growing number of farmers are looking at opportunities to export the fish to Europe. The **last 10 years** have seen a tremendous increase in the production of trouts in Kashmir. In 2019-20, J&K had 534 farmers producing 650 tonnes of trouts. In 2022-23, 1114 farmers produced 1,990 tonnes of trout.	 **Globally**, **Denmark** produces more than 55,000 tonnes of trouts. But Kashmir has much more water and resources and thus can compete with Demark in European market with trout produce.

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:

It's 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 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.

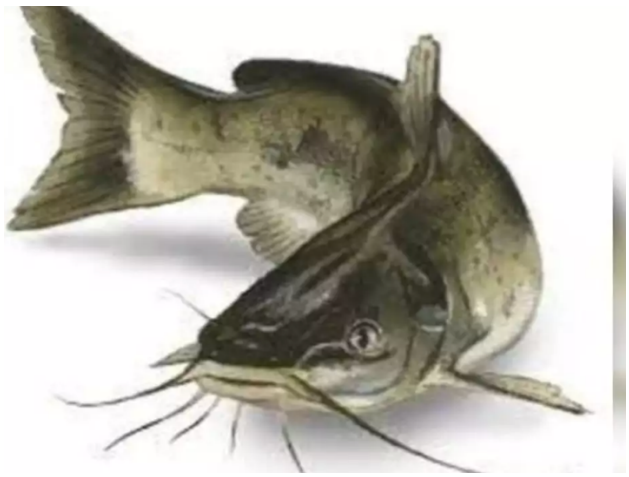
Thai Magur

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 deterimental 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 mosquitoe 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 INTERMEDICA (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. Gundiyan Indian Frog
c. The Kerala Indian Frog (Indirana 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 rog 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. The 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 s**mall 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.

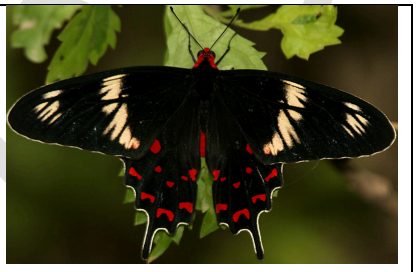
Krishna Peacock (Papilio Krishna)	**Indian Jazebel** (Delias eucharias)	**Orange Oakleaf** *(Kallima inachus)*
		
Krishna Peacock, a flagship species for biodiversity and conservation , is generally found in large numbers in the **Himalayas**. Possessing a peculiarly large swallowtail, its iridescent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

- 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 (PACHLIOPTA 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 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
Glorisa 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.

Problems caused by Moths:

- » Several moths are considered pests.

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.

- **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-eclamsia 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 n 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 (POECILOTHERIA 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 G**ooty (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 Uniondae.

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 calm 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.

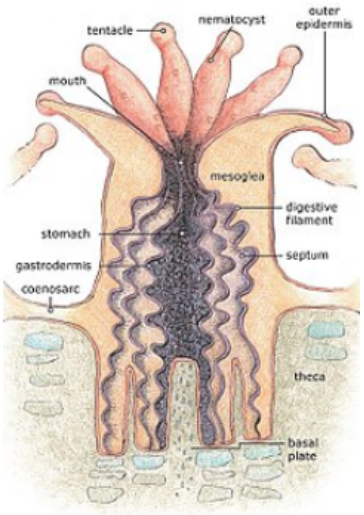
- **Illegal Trafficking:**
  - » A new study by Wildlife Conservation Society- India (WCS-India) has shown that Sea Cucumber were **the most frequently trafficked marine species** in India between 2015 - 2021.
    - The greatest number of seizures were observed in Tamil Nadu, Maharashtra, Lakshadweep, 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.



Anatomy of a stony coral polyp

  - **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?

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.

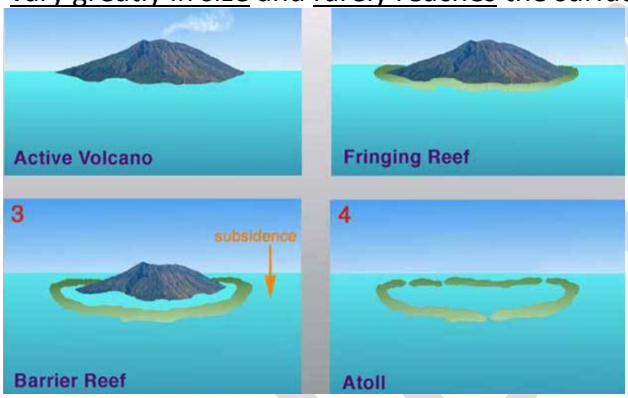
  - **Coral** reefs grow best in warm water and they prefer a shallow range with lots of sunlight for their symbiotic algae.

  - **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**.

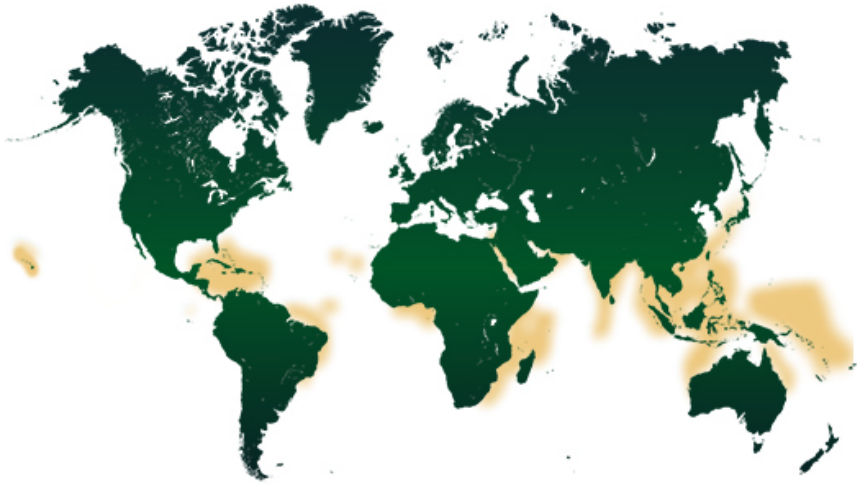
    b. **Barrier Reefs** are also parallel to coastline but are separated by **deeper, wider lagoons**. At their shallowest point, they can reach the water's surface forming a '**barrier**' to navigation. The **great barrier reef of Australia** is the largest and the most famous of the barrier reefs.
       - 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.

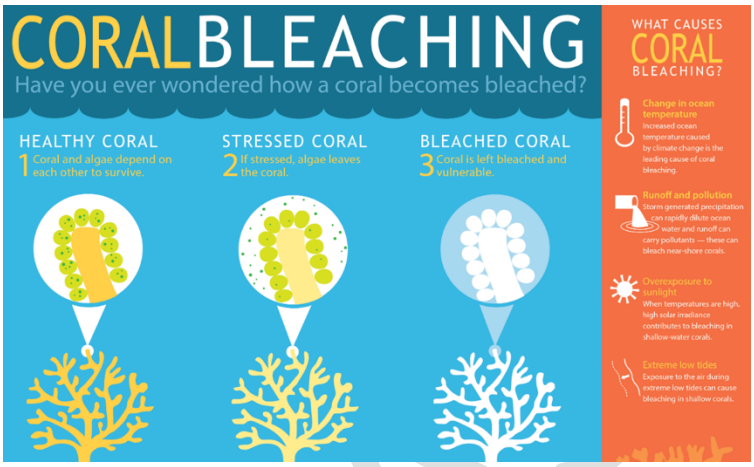
        - **Size:** It stretches more than 2,300 kms and has some 2,500 individual reefs of varying sizes and shapes, and over 9,00 islands. It is extremely rich in **biodiversity** - it has 400 types of corals, 15,00 species of fish, and 4,000 types of molluscs.
    - The **entire ecosystem** was inscribed 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 $CaCO_3$ 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 <u>temperature, light, or nutrients</u>, 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.



14) FIRE CORALS (MILLEPORA BOSCHMAI)

- Fire corals are <u>colonial marine organisms that look like a real coral</u>. **Technically they are not corals**. They are more closely associated with **Hydra and other hydrozoans**.
- **Millepora Boschmai:** It is a **<u>critically endangered species</u>** <u>of fire coral</u>. As per the IUCN's latest update the fire Coral (Millepora Boschmai) may be possibly extinct.
- The scientific name Millepora is <u>derived from several small pores on the surface of these corals</u>. They are usually yellow green or brown in color.
- **Habitat:** <u>Generally found in Murky inshore waters and display a tolerance for siltation</u>. 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 <u>decoration and jewellery trade</u>.
  - <u>Global warming and related bleaching effect</u>: 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
Total	**54733**	**100**

15) INTERNATIONAL DAY OF FORESTS

- **21st 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.

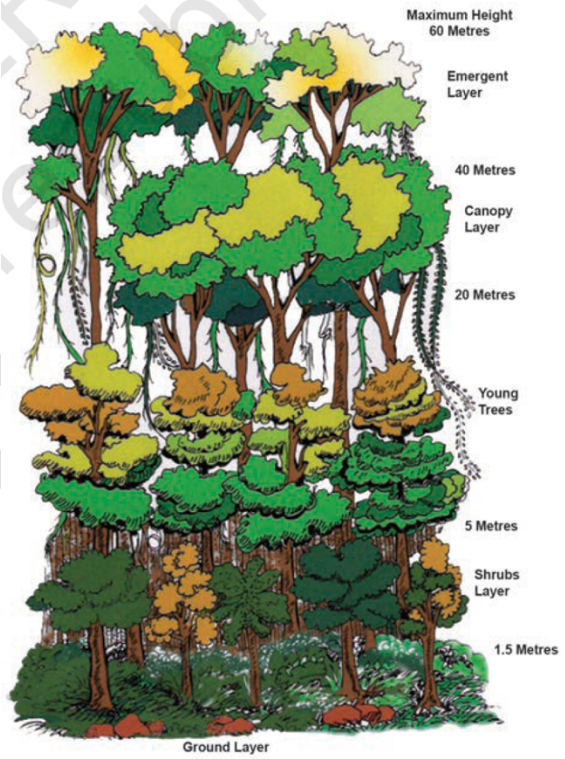
Distribution in India: Western Slopes of Western Ghats, Hills of North-eastern region, Andaman and Nicobar Islands.

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 spcies 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.

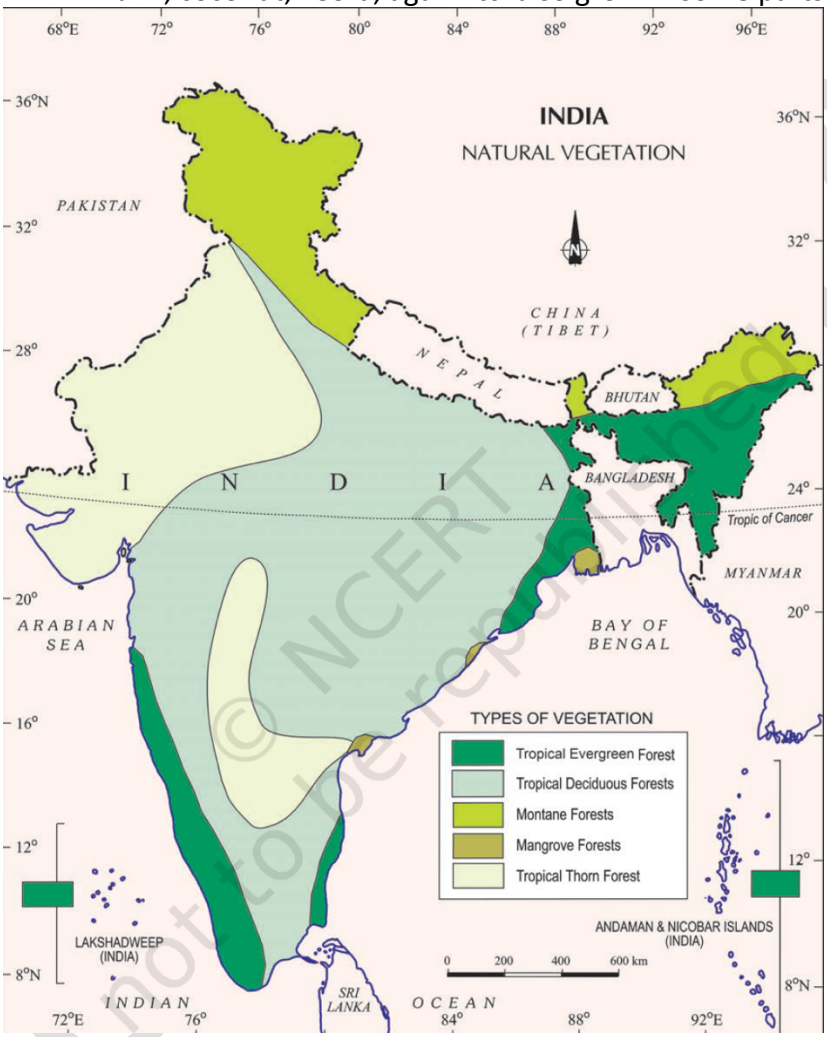
    - **At height above 3,600 metres** temperature forests and grasslands give way to Alpine vegetation. Silver fir, junipers, pines and birches are the common trees of these forests. However, they become progressively stunted as they approach the snowline.

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.



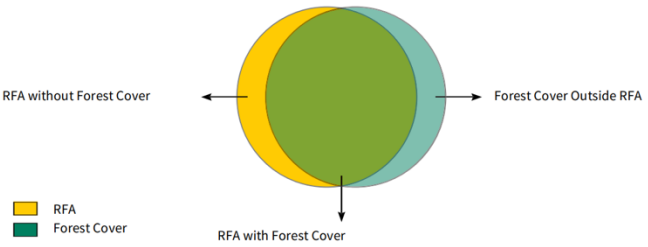
11. INDIA STATE OF FOREST REPORT, 2021

- **Introduction**
  - » Published by Forest Survey of India, MoEF&CC, GoI.
  - » 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.

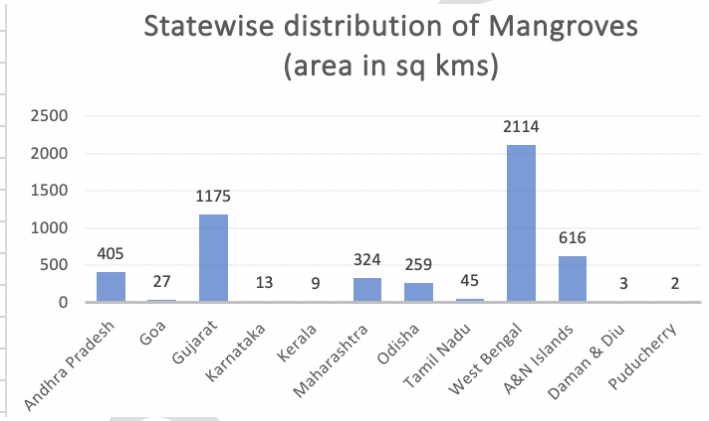


1) KEY HIGHLIGHTS OF THE 2021 SURVEY

- 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**.



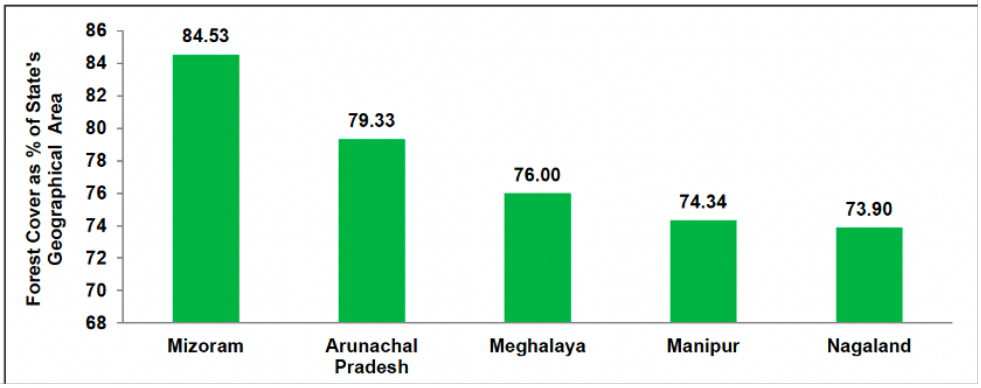
- **Bamboo Forests** have grown from 13,882 million culms (stems) in 2019 to 53,336 million culms in 2021.

- **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 Lakshadweep as they are UTs:

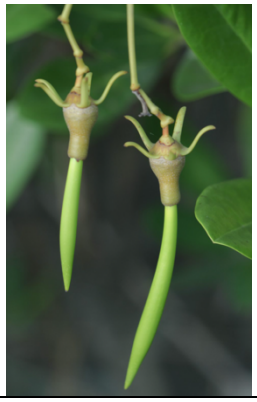
- Lakshadweep (90%) A&N Islands: 81.75%

- **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:
    i. **Tolerance to Salinity; Salt filtering or exuding system**
    ii. **Tolerance to oxygen deficient soil**
    iii. **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.
    iv. **Succulents (thick fleshy leaves)**
    v. **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.

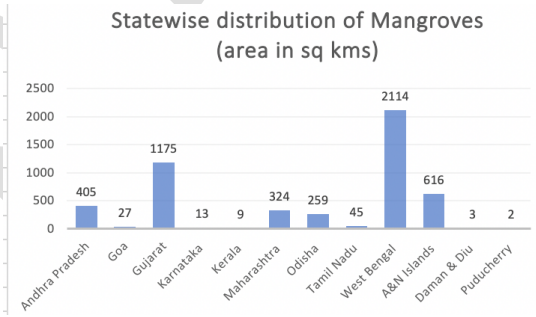
- **Global Distribution of Mangroves**:

» 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, Bruguira 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.
    - GoI, 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_2 from the atmosphere each year. This is roughly equal to half of UK's annual CO_2 emissions from fossil fuels.
    » They also store a substantial amount of carbon in addition to absorbing CO_2 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.

  » **Temperature grasslands** include the Eurasian steppes (in Ukraine and Russia), North American Prairies, Argentine Pampas, Down in Australia, and Veld in South Afria.
    - 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, temperature grasslands support prairies dog, badgers, coyotes and a variety or 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 repellant** (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,	

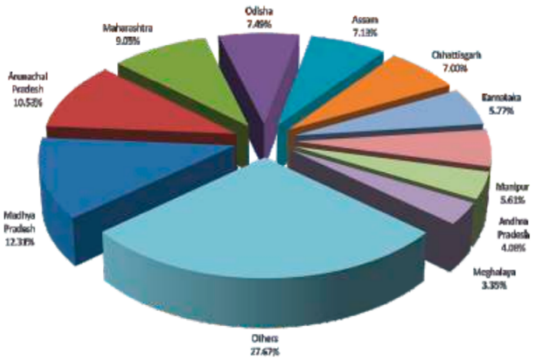
15. BAMBOOS

- **Introduction**:
  - » Bamboos, the **most diverse groups of plants in the grass family** belong to subfamily **Bambusoidae** 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, Dinochola, 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

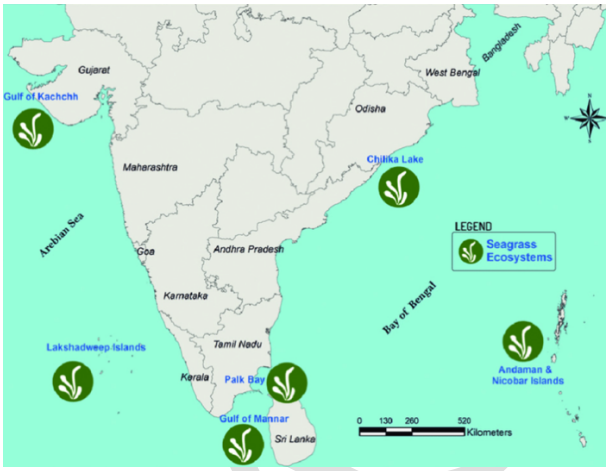
- **Why in news?**
  - In Baltic Sea, citizen drivers restore seagrass to fight climate change (July 2023)
    - » This is part of a new project that trains local citizens to restore seagrass meadows in the Baltic Sea. The hope is that this painstaking work can help tackle climate change. **Seastore 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 X 10^5 km^2**, which represent **about 0.1% - 0.2**% of the ocean floor.
  - » In India, total seagrass cover is estimated to be 517 km^2 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^2 respectively.
2. The Ramasar site of Chilika Lagoon in Odisha state also has seagrass meadows that have expanded from 20 km^2 to 80 km^2 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.



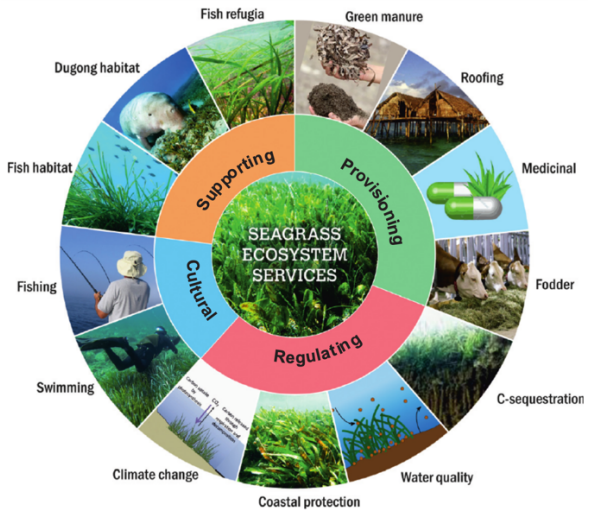
- **Significance of Seagrasses Ecosystem:**

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 CO2 per square mile than forests do on land, according to a 2012 study. They accumulate CO2 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 fragra**nt 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:
    - **Epiphyti**c: (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.

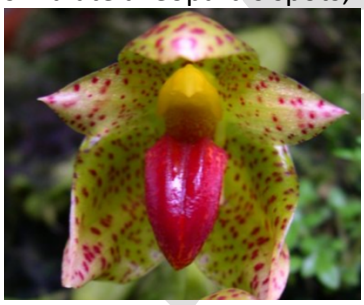
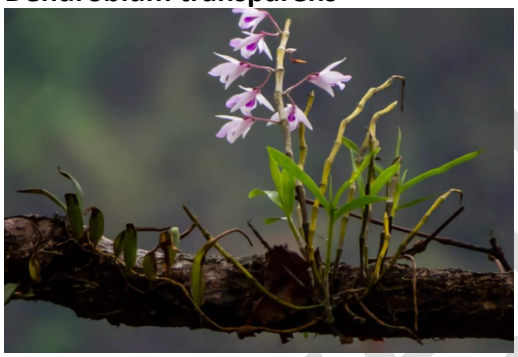
- **Orchids of North Bengal are facing threats** (June 2023)

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 Oroan 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 Bulbohyllum 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 vary 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 HYSTEROPHORUS (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, Pobitaro and Manas - are currently reeling under the attack of these invasive plants.

E) LANTANA CAMARA

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

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

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 *lacifolius*** 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. Gleadovia 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 s**tem 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

Nepenthes khasiana

- **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 **Nepenthese 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. **Niligiri 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 in 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:

Sarpagandha : Used to treat blood pressure; it is found only in India.
Jamun : 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.
Arjun : The fresh juice of leaves is a cure for earache. It is also used to regulate blood pressure.
Babool : Leaves are used as a cure for eye sores. Its gum is used as a tonic.
Neem : Has high antibiotic and antibacterial properties.
Tulsi : Is used to cure cough and cold.
Kachnar : 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. Fritilloria cirrhosa (VU)

Also known as Himalayan fritillary is a perennial bulbous herb.

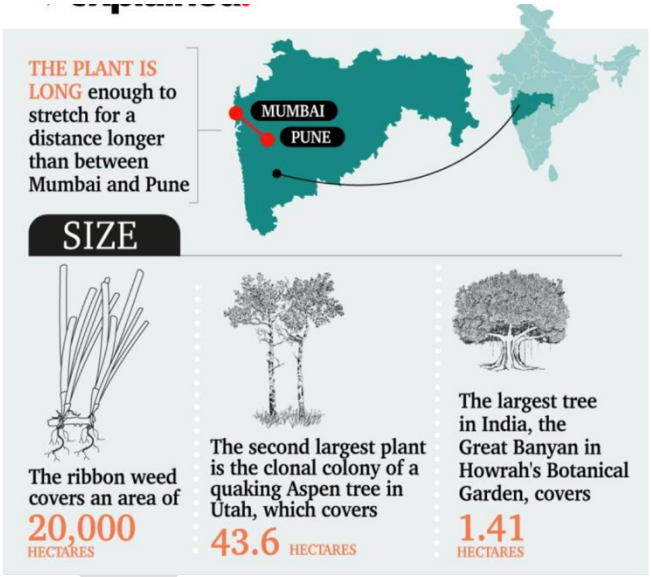
It's population is estimated to have declined by at least 30% in last 24 years. Considering the rate of decline, long generational length, poor germination potential, high trade value, extensive harvesting pressure and illegal trade, the species is listed as 'Vulnerable'.

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 **Polypoid** - 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. Polypoid 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 Cacoa 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 endomorphin, 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 below 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 come 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.

- **Dalbegia Sisoo** (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. It's 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**.

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.

TARGET PRELIMS 2024 BOOKLET-20; ECONOMY-1 BUDGET 2024-25; OTHER UPDATES RELATED TO FISCAL DEVELOPMENT

1. TABLE OF CONTENTS

2. KEY HIGHLIGHTS FROM THE SPEECH

1) SOCIAL JUSTICE:

- As our PM firmly believes, we need to focus on **four major castes**. They are, 'Garib' (Poor), 'Mahilayen' (women), 'Yuva' (Youth) and 'Annadata' (farmer). There needs, their aspirations, and their welfare are our highest priority.

- **Garib Kalyan, Desk Ka Kalyan**:
  - Government has assisted 25 crore people to get freedom from **multi-dimensional poverty**.
  - '**Direct Benefit Transfer'** of 34 lakh crore from the government using PM-Jan Dhan accounts has led to savings of Rs 2.7 lakh crores for the government. The savings have helped in providing more funds for Garib Kalyan.
  - '**PM SVANidhi'** has provided credit assistance to 78 lakh street vendors. From that a total of 2.3 lakh have received credit for the third time.
  - **'PM JANMAN'** Yojana reaches out to the PVTG groups.
  - '**PM Vishvakarma Yojna**' provides end to end support to artisan and craftspeople engaged in 18 trades.

- **Momentum to Nari Shakti**:
  - 30 crore Mudra Yojna loans have been given to women entrepreneurs.
  - Making Triple Talaq illegal.
  - Reservation of 1/3rd of the seats for women in the Lok Sabha and State legislative assembly.
  - Giving over 70% houses under PMAY in rural areas to women.

- **Welfare of Annadata**:
  - **PM-KISAN SAMMAN Yojna**: It provides direct financial assistance to **11.8 crore farmers** including marginal and small farmers.
  - **PM Fasal Bima Yojna** provides crop insurance for 4 crore farmers.
  - **E-NAM** mandis have integrated 1361 mandis and is providing services to 1.8 crore farmers with trading volume of Rs 3 lakh crores.

- **Empowering Amrit Peedhi, the Yuva**:
  - **PM ScHools for Rising India (PM SHRI)** are delivering quality teaching and nurturing holistic and well-rounded individuals.
  - **The Skill India Mission** has trained 1.4 crore youth, upskilled and reskilled 54 lakh youth, and established 3,000 new ITIs.
  - A large number of new Institutions of Higher Learning, namely 7 IITs, 16 IIITs, 7 IIMs, 15 AIIMs, and 390 universities have been set up.
  - **PM MUDRA Yojna** has sanctioned 43 crore loans aggregating 22.5 lakh crores for entrepreneurial aspiration of youth.

2) ECONOMIC MANAGEMENT

The multipronged economic management over the past ten years has complemented people-centric inclusive development. Following are some of the **major elements**.

(1) All forms of **infrastructure,** physical, digital or social, are being built in record time.

(2) All parts of the country are becoming active participants in economic growth.

(3) **Digital Public Infrastructure**, a new 'factor of production' in the 21st century, is instrumental in formalization of the economy.

(4) **GST** has enabled ***'One Nation, One Market, One Tax'***. Tax reforms have led to deepening and widening of tax base.

(5) **GIFT IFSC and the unified regulatory authority, IFSCA** are creating a robust gateway for global capital and financial services for the economy.

(6) **Proactive inflation management** has helped keep inflation within the policy band.

3) GLOBAL CONTEXT

- **Several achievements during G20 President of India**. The country showed the way forward and built consensus on solutions for those global problems.
- **India-Middle East Europe Economic Corridor** announced recently, is a strategic economic game changer for India and others.

4) VISION FOR VIKASIT BHARAT

- Our vision for Vikasit Bharat is that of "Prosperous Bharat in harmony with nature, with modern infrastructure, and providing opportunities for all citizens and all regions to reach their potential".
- The trinity of Democracy, Demography and Diversity backed by 'Sabka Prayas' has the potential to fulfill aspirations of every Indian.

5) STRATEGY FOR 'AMRIT KAAL'

- Government will adopt measures to foster and sustain growth, facilitate inclusive and sustainable development, improve productivity, create opportunities for all, help them enhance their capabilities, and contribute to generation of resources to power investments and fulfill aspirations.

- Government is guided by '**Reform, Perform and Transform**', the government will take up next generation reforms, and build consensus with the states and stakeholders for effective implementation.

- Government will facilitate sustaining high and more resource-efficient economic growth in line with '**Panchamrita' goals**. This will work towards energy security in terms of availability, accessibility, and affordability.

- **To facilitate** investment, government will prepare financial sector with size, capacity, skills and regulatory framework.

6) IMPORTANT INITIATIVES DISCUSSED IN THE BUDGET (WILL BE DISCUSSED IN DETAIL LATER IN THE CLASSES)

- **Aspirational District Program**

- **PMAY (Grameen):** Government is close to achieving the target of 3 crore houses. **Two crores more houses will be taken up in next five years** to meet the requirements arising from increase in the number of families.

- **Rooftop Solarization and Muft Bijli**: Through this program 1 crore households will be enabled to obtain upto 300 units free electricity every month. The scheme is expected to have following benefits:
  1) Financial saving of 15k-18K per year for households from free electricity and selling of surplus to the distribution companies.
  2) Charging of electric vehicles.
  3) Entrepreneurship opportunities for large number of vendors for supply and installation.
  4) Employment opportunities for the youth with technical skills in manufacturing, installation, and maintenance.

- **Housing for Middle Class**: Government will launch **a scheme to help deserving sections of middle class** "living in rented houses, of slums, or chawls, and unauthorized colonies" to buy or build their own houses.

- **Medical Colleges**: Government plans to set up more medical colleges by utilizing the existing hospital infrastructure under various department. A committee for this purpose will be set-up to examine the issues and make relevant recommendations.

- **Cervical Cancer vaccination**: Government will encourage vaccination for girls in age group of 9 to 14 years for prevention of cervical cancer.

- **Maternal and Child healthcare**:
  1) Various schemes for maternal and child health care will be **brought under one comprehensive program** for synergy in implementation.
  2) Upgradation of anganwadi centres under "**Saksham Anganwadi and Poshan 2.0"** will be expedited for improved nutrition delivery, early childhood care and development.
  3) The newly designed **U-WIN Platform** for managing immunization and intensified efforts of mission Indradhanush will be rolled out expeditiously throughout the country.

- **Ayushman Bharat**: Healthcare cover under AB Scheme will be extended to all ASHA workers, Anganwadi Workers and Helpers.

- **Agriculture and Food Processing**:
  1) **Pradhan Mantri Kisan Sampada Yojna** has already benefitted 38 lakh farmers and generated 10 lakh employment.

  2) **Pradhan Mantri Formalization of Micro Food Processing Enterprise Yojana** has assisted 2.4 lakh SHGs and 60,000 individuals with credit linkages.

  3) **NANO DAP**: After the successful adoption of Nano-UREA, application of Nano DAP on various crops will be expanded in all agro-climatic zones.

  4) **Atmanirbhar Soil Seeds Abhiyan**: Building on the initiative announced in 2022, a **strategy will be formulated to achieve *'atmanirbharta'* for oil seeds** such as mustard, groundnut, sesame, soybean, and sunflower. This will cover **research for high-yielding varieties**, widespread adoption of modern farming techniques, market linkages, procurement, value addition, and crop insurance.

  5) **Dairy Development**:
     - **Efforts to control foot and mouth disease (**a highly contagious viral disease**)** are on.
     - **India** is the world's largest milk producer, but Indian milch-animal has low productivity.
     - **A program will be built on the successes of existing schemes**, such as Rashtriya Gokul Mission, National Livestock Mission, and Infrastructure Development Funds, for daily processing and animal husbandry.

  6) **Matsya Sampada**:
     - Government has taken several steps like setting up of separate fishery department etc. for the fishery sector. All this has contributed to doubling of both inland and aquaculture production and exports since 2013-14.

     - **Implementation of Pradhan Mantri Matsya Sampada Yojna (PMMSY)** will be stepped up to:
       a) Enhance **aquaculture productivity** from existing 3 to 5 tons per hectare.
       b) Double exports to 1 lakh crore
       c) Generate 55 lakh employment opportunity.

     - **Five integrated aquaparks** will be set up.

- **Lakhpati Didi**:
  1) **What is Lakhpati Didi Initiative**: This initiative was announced in PM's Independence Day Speech in which he said that it was his dream to make 2 crores 'Lakhpati Didis' in the country's villages. In the Budget speech the **target has been enhanced to 3 crores**. The target is a 3-year timeline under the scheme that is being executed by Deendayal Antyodaya Yojna – National Rural Livelihood Mission.

  2) **83 lakh SHGs** with nine crore women are transforming rural socio-economic landscape with empowerment and self-reliance. Their success has assisted around 1 crore women to become Lakhpati Didi already. Their achievements will be recognized by honoring them.

- **Research and Innovation for Catalyzing growth, employment and development.**
  - PM Shashtri gave the slogan of "*Jai Jawan, Jai Kisan*". PM Vajpayee made that "*Jai Jawan, Jai Kisan, Jai Vigyan*". PM Modi has furthered that to "*Jai Jawan, Jai Kisan, Jai Vigyan, Jai Anusandhan*".

  - A corpus of **Rs 1 lakh crore** will be established with fifty-year interest free loan. This corpus will provide **long term financing or refinancing with long tenors and low or nil interest rates**. This will encourage private sector to scale up research and innovation significantly in sunrise domain.

  - A new scheme will be launched for strengthening deep-tech technologies for defence purposes and **expediting Atmanirbharta**.

7) INFRASTRUCTURE DEVELOPMENT RELATED INITIATIVES

- **Capital expenditure outlay** for FY25 is being increased by 11.1% to elevent lakh, eleven thousand, one hundred, eleven crore rupees (11,11,111 crores). This will be **3.4% of the GDP**.

- **Railways**:
  1) **Three major economic railway corridor programs** will be implemented. These are:
     - Energy, mineral and cement corridor
     - Port Connectivity corridors, and
     - High traffic density corridors

     The projects have been identified under PM Gatishakti for enabling multi-modal connectivity. This will improve logistics efficiency and reduce cost.

     Significance: Improved operation of passenger trains; accelerate logistic efficiency; promote GDP growth.

  2) Fourty thousand normal rail bogies will be converted to the Vande Bharat standards to enhance safety, convenience and comfort of passengers.

- **Aviation Sector**: In the past 10 years, number of airports have doubled to 149. Roll out of regional connectivity under UDAN scheme has been widespread. 570 new routes are carrying 1.3 crore passengers. Indian carriers have also placed orders for over 1,000 new aircrafts. This expansion of new airports and development of new airports will continue expeditiously.

- **Metro and NaMo Bharat:** India is seeing an expansion of middle class and increased urbanization. Metro Rail and Namo Bharat can be the catalyst for required urban transformation. Expansion of these systems will be supported in large cities focusing on transit-oriented development.
  1) **Note**: NaMo Bharat is an electric multiple unit (EMU) train built for RapidX (Regional Rapid Transit Services). The train was designed by the French rolling stock manufacturer **Alstom** at its engineering centre in Hyderabad, and was manufactured in Savli, Gujarat. The train has an aerodynamic design which reduces the drag when it travels. The train has a design speed of **180 km/h** and is operated at a speed of 160 km/h. Currently, it is operational on **Delhi Meerut RRTS** system.

- **Green Energy**: To meet the commitment of **Net Zero** by 2070 following steps will be taken:
    1) **Viability Gap Funding (VGF)** will be provided for harnessing offshore wind energy potential for initial capacity of one giga-watt.
    2) **Coal Gasification and Liquefaction capacity** of 100 MT will be set up by 2030. This will help in reducing the import of natural gas, methanol and ammonia.
    3) **Phased Mandatory Blending** of Compressed Biogas (CBG) in Compressed Natural Gas (CNG) for transport and Piped Natural Gas (PNG) for domestic purpose will be mandated.
    4) **Financial Assistance** will be provided for procurement of biomass aggregation machinery to support collection.

- **Electric Vehicle Ecosystem**: Government will expand and strengthen the E-vehicle ecosystem by supporting manufacturing and charging infrastructure. Greater adoption of e-buses for public transport networks will be encouraged through payment security mechanism.

- **Biomanufacturing and Bio-foundary**: A new scheme of biomanufacturing and bio-foundary will be launched to promote green growth. It will provide **environment friendly alternatives such as biodegradable polymers, bioplastics, biopharmaceuticals and bio-agri-input**s. This scheme will also help in transforming today's consumptive manufacturing paradigm to the one based on regenerative principles.

- **Blue Economy 2.0**: For promoting climate resilient activities for blue economy 2.0, a scheme for restoration and adaptation measures, and coastal aquaculture and mariculture with integrated and multi-sectoral approach will be included.

    1) **Note**: Mariculture has been defined as the cultivation, management, and harvesting of marine organisms in their natural environment (including estuarine, brackish, coastal, and offshore waters) or in enclosures such as pens, tanks, or channels.

- **Comprehensive Development of Tourism Sector**:
    1) **States will be encouraged** to take up comprehensive development of iconic tourist centres, branding and marketing them at global scale. A **framework for rating of the centres** based on quality of facilities and services will be established. **Long-term interest free loans will be provided to States** for financing such development on matching basis.
    2) To address the **emerging fervour for domestic tourism**, projects for port connectivity, tourism infrastructure, and amenities will be taken up on **our islands, including Lakshadweep**.

8) OTHER INITIATIVES DISCUSSED IN THE BUDGET

A) PROMOTING INVESTMENT

- During 2014-2023, FDI inflow in country was $596 billion (double of previous 10 years.
- For further promoting investments, government is negotiating **bilateral investment treaties** with foreign partners, in the spirit of '**First develop India**'.

B) REFORM IN THE STATE FOR VIKASIT BHARAT

- A provision of 75,000 crore rupees as fifty year interest free loan is proposed this year to support those milestone-linked reforms by the state governments.

C) DEALING WITH FAST POPULATION GROWTH AND DEMOGRAPHIC CHANGES

- Government will from a **high powered committee** for an extensive consideration of the challenges arising from fast population growth and demographic changes. The committee will be mandated to make recommendations for addressing these challenges comprehensively in relation to the goal of '**Vikasit Bharat'**.

3. VOTE ON ACCOUNT

Government sought a '**vote on account'** approval of the Parliament through appropriation Bill for a part of the financial year 2024-25.

Details about Vote on Account:

- **Article 116 of the Indian Constitution** defines Vote on Account as an advanced grant to the government from the Consolidated Fund of India to cover short-term expenditure requirement until the new financial year begins.

- A VOTE ON ACCOUNT, is the process of withdrawing money from CFI (for the period when the final appropriation bill is not passed), usually 2 months. A vote on account doesn't require debate. When elections are scheduled in the same year, government seeks a vote on account for four months. Vote on account is essentially Parliament's **interim approval of spending** by the government.
- Thus, in an election year, the government doesn't present a full-fledged budget for the whole year, instead the government prepares an interim budget or vote on account.

- **Reasons**:
    - It would be prerogative of the new government to signal its policy direction, which is often reflected in the budget.
    - There is little time to get approval from Parliament for various grants to ministries and departments, and to debate these as well as any provisions for changes in taxes.

- **Because of the above reasons**, starting 1948, when Finance Minister R K Shanmukham Chetty presented a vote on account and followed it up with Independent India's regular budget, **most governments have followed this convention**.
    - **Note**: Some governments have made policy announcements or tweaked tax rates in the vote on account.

- **Difference between Vote on Account and Interim Budget**:
    - **A vote on account** only includes government's expenditure, whereas the **interim budget** deals with both receipt and expenditure.
    - Vote on account is passed by LS without discussion. An interim budget is passed after discussion with LS.
    - Vote on account can't change the direct taxes, whereas interim budget may change the tax regime.

- Vote on account can be used by both regular and caretaker government, whereas interim budget is only used by caretaker (outgoing) government.

4. IMPORTANT DATA FROM BUDGET

i. Fiscal Deficit

= Total Expenditure - Total Receipts other than borrowings

= Revenue Expenditure + Capital Expenditure - (Revenue Receipt + Non-Debt Creating Capital Receipt)

- Targeted Fiscal Deficit to be below **4.5%** by 2025-26.

- **CURRENT SCENARIO**: **FISCAL DEFICIT**
  i. **FY23: (ACTUAL)**: 6.32%
  ii. **FY24: (BE):** 5.9%
  iii. **FY24**: (RE): 5.8%
  iv. FY25: (BE): 5.1%

- **Implications of High fiscal deficit**:
  - **Inflationary Spiral**
  - **Increased national debt**: This will impact future economic growth as a large part of the expenditure will go in paying interest for the debt rather than for capital investment.
  - **Vicious Cycle of high Fiscal Deficit and Low GDP Growth**
  - **Crowding out Effect**: This is the situation when high borrowing by the government (due to high fiscal deficit) leads to reduction in availability of funds for private investors. Accordingly overall investment in the economy reduces.
  - **Erosion of government credibility** and credit ratings

  - **Therefore**, fiscal deficit shouldn't be allowed to go beyond manageable limits (about 3% of the GDP is considered manageable).
    - **High deficit** also signifies fiscal indiscipline. It points to a situation when GDP growth is low, and unemployment is high. The economy slips into stagnation and revival becomes difficult with FDI.

ii. Revenue Deficit: It refers to excess of revenue expenditure over revenue deficit.
- **FY24(RE): 2.8%**
- **FY25(BE): 2.0%**

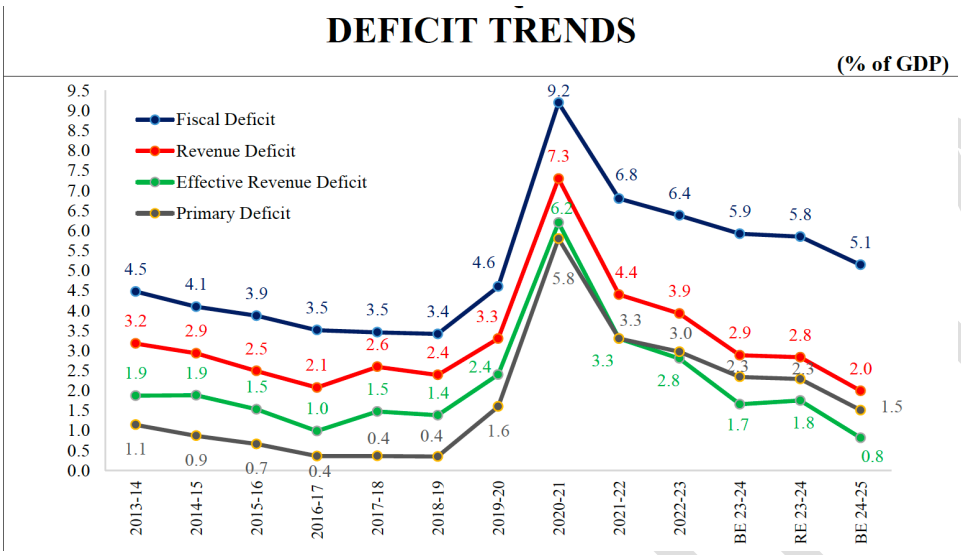
iii. Effective Revenue Deficit is the difference between Revenue Deficit and Grants for Creation of Capital Assets.
- **The calculation of effective revenue deficit was introduced from 2010-11 budget.**
- **FY24(RE): 1.8**
- **FY25(BE): 0.8**

iv. Primary Deficit is measured as Fiscal Deficit less interest payments.
- **Primary Deficit** = Fiscal Deficit - Interest Payment
- **FY24** (RE): 2.3%

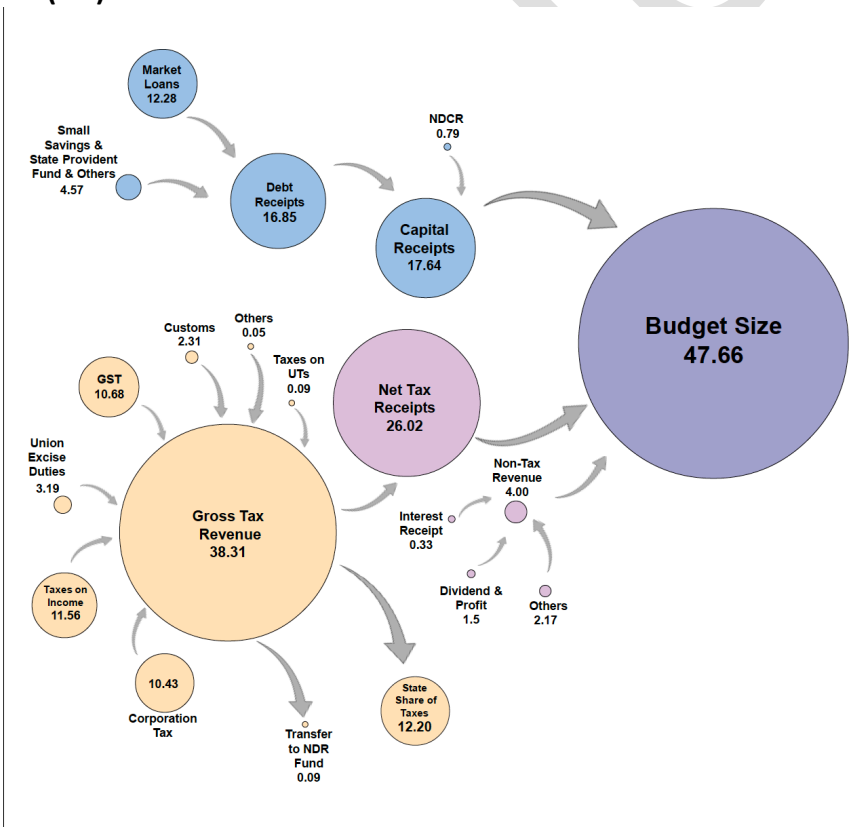
- **FY25 (BE):** 1.5%

v. **Monetized Deficit**: It goes beyond the government's budgetary operations. It represents increase in the net RBI credit to the Union government which is the sum of increase in RBI's holding of government debt and any draw down by the government of its cash balance with RBI.

vi. **Fiscal Slippage**: If the actual fiscal deficit is more than what was expected it is called fiscal slippage.

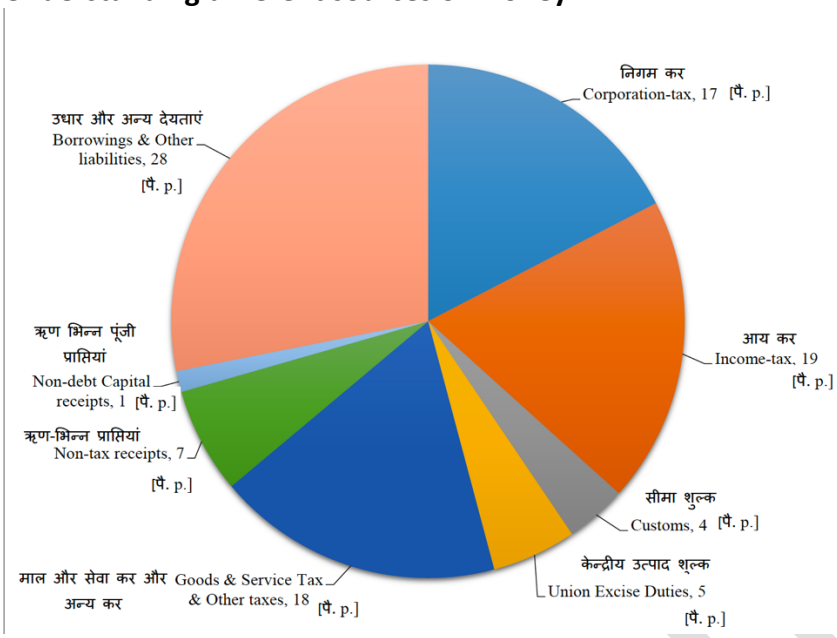


D) FY25 (BE): RECEIPT

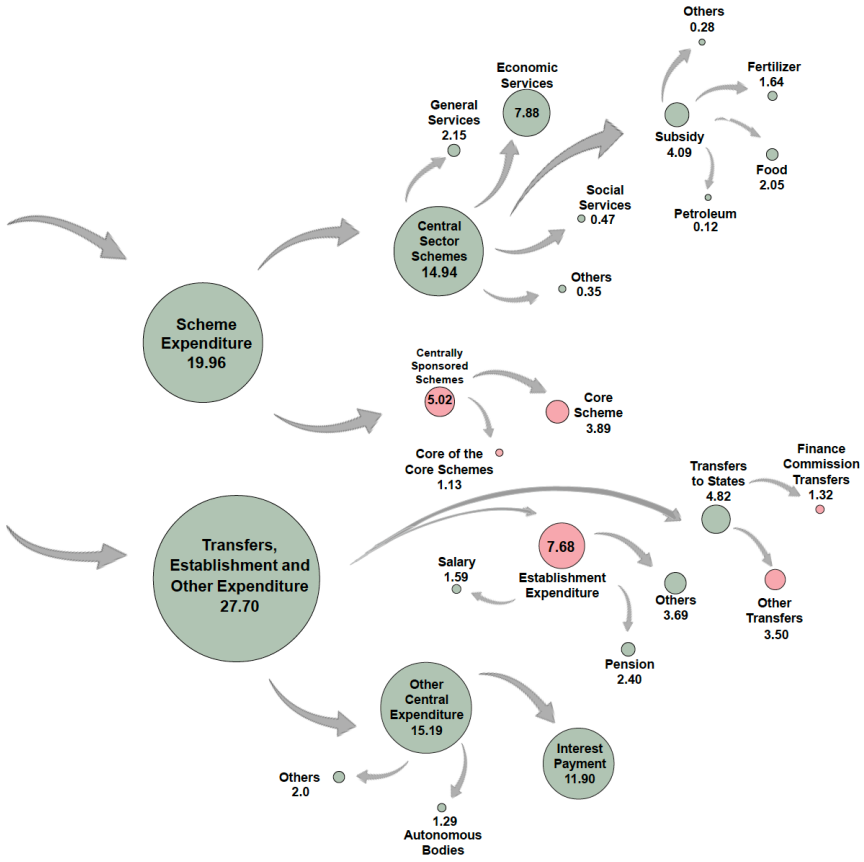


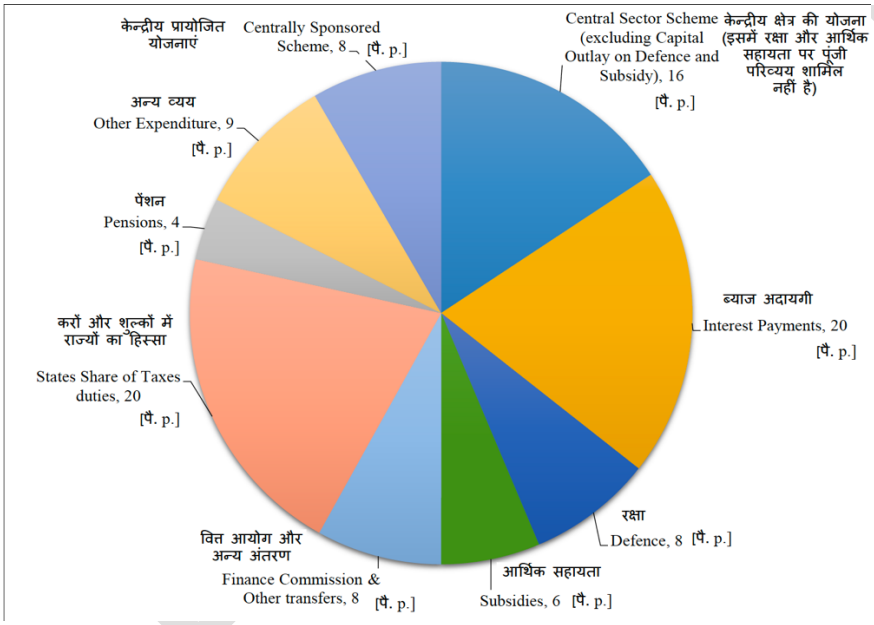
Total Receipt (other than borrowing) is estimated at 30.80 lakh crores. **Total Expenditure:** 47.66 lakh crores.

Understanding different sources of Money:

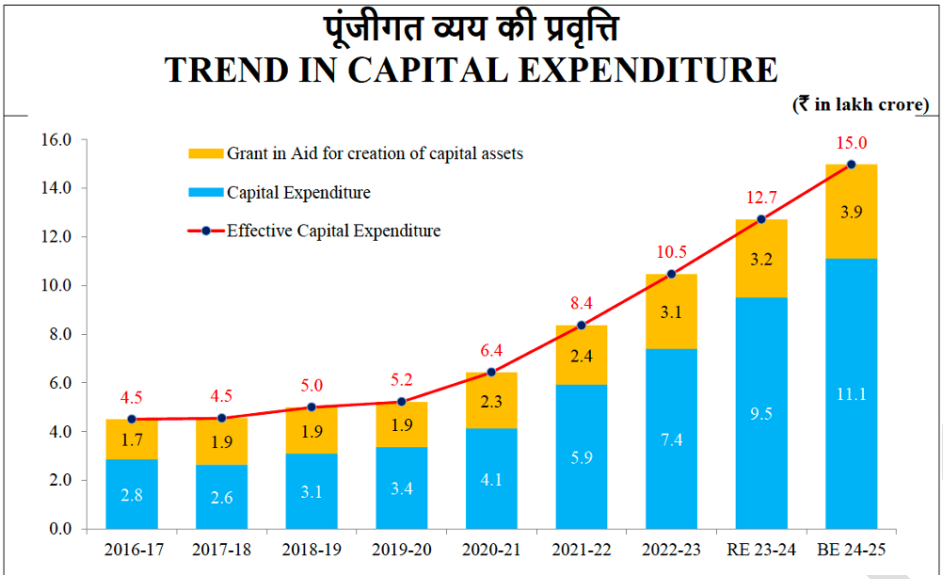


E) EXPENDITURE:





5. TREND IN CAPITAL EXPENDITURE



- Capital Expenditure has rose substantially in last **5 years**.
    - The government's thrust on capital expenditure, particularly in the infrastructure intensive sectors like roads and highways, railways, and housing and urban affairs, has longer term implications for growth.
    - **Advantages of Higher Capital Expenditure:**
        - Strengthens aggregate demand.
        - Crowds in private spending
        - Enhances longer term supply chain productivity.
    - Centre has also worked towards enhancing capex from state governments by providing long-term interest free loans and capex-linked additional borrowings.

- In the **Budget FY25**, government has announced that the scheme of fifty-year interest free loan for capital expenditure to states will be continued this year with total outlay of 1.3 lakh crores.

6. ANY CHANGES IN THE TAX REGIME IN THE INTERIM BUDGET (NO)

- **Direct Taxes**:
    - FM proposes to retain **same tax rates for direct taxes**
    - Direct tax collection tripled, return filers increased to 2.4 times, in the last 10 years
    - Government to improve tax payer services
        - Outstanding direct tax demands upto Rs 25000 pertaining to the period upto FY 2009-10 withdrawn
        - Outstanding direct tax demands upto Rs 10000 for financial years 2010-11 to 2014-15 withdrawn
        - This will benefit one crore tax payers
    - **Tax benefits to Start-Ups, investments made by Sovereign wealth funds or pension funds** extended to 31.03.2025
    - **Tax exemption on certain income of IFSC units** extended by a year to 31.03.2025 from 31.03.2024

- **Indirect Taxes**

- FM proposes to **retain same tax rates for indirect taxes and import duties**
- **GST unified the highly fragmented indirect tax regime in India**
  - Average monthly gross GST collection doubled to Rs 1.66 lakh crore.
  - GST tax base has doubled
  - State SGST revenue buoyancy (including compensation released to states) increased to 1.22 in post-GST period(2017-18 to 2022-23) from 0.72 in the pre-GST period (2012-13 to 2015-16)
  - 94% of industry leaders view transition to GST as largely positive
  - GST led to supply chain optimization
  - GST reduced the compliance burden on trade and industry
  - Lower logistics cost and taxes helped reduce prices of goods and services, benefiting the consumers

7. FISCAL CONSOLIDATION

- **Fiscal consolidation** refers to long term permanent strategies to reduce deficit by increase the revenue and reducing expenditure.

- **Why is Fiscal Consolidation** (i.e. reduction of fiscal deficit) **needed / Negative Impacts of High Fiscal Deficit**:
  - **Inflationary Spiral**: Borrowing from RBI leads to increased money supply in economy which leads to higher inflation.
  - **Increased national debt**: This will impact future economic growth as a large part of the expenditure will go in paying interest for the debt rather than for capital investment.
  - **Vicious Cycle of high Fiscal Deficit and Low GDP Growth**
  - **Crowding out Effect**: This is the situation when high borrowing by the government (due to high fiscal deficit) leads to reduction in availability of funds for private investors. Accordingly overall investment in the economy reduces.
  - **Erosion of government credibility**: High fiscal deficit (thus high debt of government) erodes credibility of the government in domestic as well as international money market. It may also lead to reduction in the 'Credit Rating' of the government (and the economy). Lower credit rating may lead to global investors withdrawing their investment from the domestic economy.
  - **High Burden on Future Generation** as they are the ones who have to bear the brunt of higher interest rates.

- **Therefore**, fiscal deficit shouldn't be allowed to go beyond manageable limits (about 3% of the GDP is considered manageable).

- **However**, some amount of fiscal deficit may be crucial for developing economies like India.
  - Promote capital expenditure (fiscal deficit with high capex)
  - Revitalize the business cycle (Counter-cycle fiscal policies)
  - Promote crowding in investment (if better infrastructure is created -> fall in cost of production)
  - Spending has higher fiscal multipliers during slowdown.

- **Thus, fiscal deficit may be ok, if following things are kept in mind:**
  - Loan interest shouldn't become very high. Rate of growth of interest shouldn't be higher than the rate of growth of the GDP.
  - Loans shouldn't be used to fund revenue deficit. It should go on **capital expenditure**.

- **Current Situation of India**:
  - Structural reforms in FY20 (reduction in corporate taxes) and COVID-19 lockdowns in FY21 and FY22, diverted India from the track of fiscal consolidation.
  - But currently India is back on track with target of fiscal deficit to be **4.5% by FY26**. In FY 25 (BE) fiscal deficit will reduce **to 5.1% of the GDP**.

8. MONETIZATION OF DEFICIT

– **What is Monetization of Deficit?**
  » In simple terms, monetization of deficit means **printing more money i.e. RBI buys government securities from the primary market to fund the government's expenses**. It thus means increase in RBI credit to government.
  » **Note:** Monetization of deficit doesn't mean that government is getting free money, rather it is highly subsidized money.

– **Monetization of Deficit in India**
  » Till 1997, monetization of deficit was a **common practice in India** and RBI used to automatically monetize government's deficit through the issue of ad-hoc treasury bills.
    ▪ But, through **agreements in 1994 and 1997 t**he funding through ad-hoc treasury bills was completely phased out. Later, **FRBM act** completely prohibited RBI from subscribing to the primary issuance of the government from 1st April 2006.
    ▪ **Now**, RBI only buys government bonds in secondary market through open market operations. Here RBI is indirectly monetizing the deficit.
    ▪ **Note:** FRBM Act has an escape clause which permits monetization of the deficit under special circumstances.

– **Advantages of the above decision to prohibit/phase out monetization of deficit** i.e. of prohibiting RBI from subscribing to the primary issuance of the government.
  » Since the government started borrowing in the open market, **interest rates went up** which **incentivised saving and thereby spurred investment** and growth
  » Also, the **interest rate that the government commanded** in the open market acted as a critical **market signal of fiscal sustainability**.
  » Importantly, the agreement shifted **control over money supply, and hence over inflation, from the government's fiscal policy to the RBI's monetary policy.**
  » The **India growth story** that unfolded in the years before the global financial crisis in 2008 when the economy clocked growth rates in the range of 9 per cent was at least in part a consequence of the high savings rate and low inflation which in turn were a consequence of this agreement

– **Advantages/ Need of Monetization during recessionary face**
  » **Fiscal Stimulus**
  » **Reducing cost of borrowing**

– **Limitations**

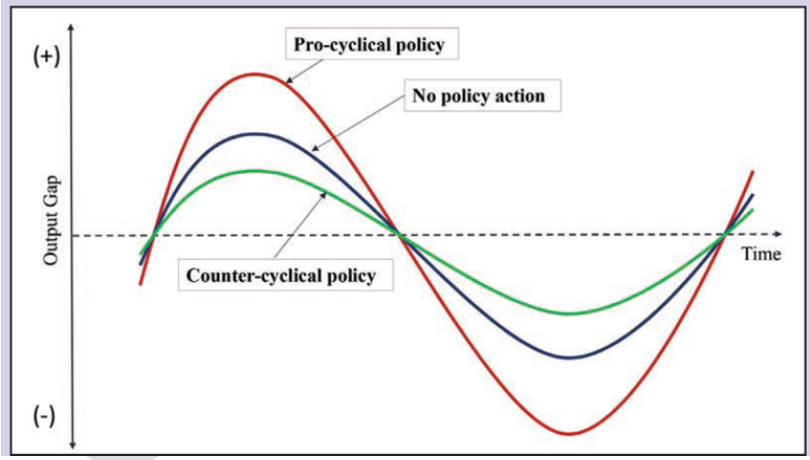
- » It triggers **inflation**. In long run, the increased money supply would definitely add to the inflationary pressure.
- » **Increased supply of Rupee** may also lead to **depreciation of the value of Rupee**. This makes imports expensive and exports cheap.
- » It gives rise to **unproductive spending**.
- » **Impacts credibility of government ->** portrays government as unable to meet its own financial needs.
- » Finally, it also **erodes RBI's control over monetary policy** (and thus its independence). If RBI agrees to monetize the deficit, it is effectively agreeing to subordinate monetary policy to the financing policy of the government.

9. COUNTERCYCLICAL FISCAL POLICY

- **What is Countercyclical Fiscal Policy?**
  - » **During slow-down or recession**, government should allow slippage of fiscal target and reduce taxes and increase expenditure. This creates more demand and brings economic upswing.
  - » **During Boom Period**, government should perform fiscal discipline, increase taxes and reduce government expenses. Otherwise, the growth would not be sustainable, high inflation may result and the amplification of boom can be disastrous in long run.

- **Pro Cyclic Fiscal Policy**
  - » It is opposite of counter cyclic policy. During Boom, government may further increase the expenditure to allow further growth of the boom.

- **Why counter-Cyclic Fiscal Policy is crucial?**



- At the time of recession, **private consumption (C) reduces, and private investment (I) also go down.** In such scenario, **increasing government expenditure** – both consumption and expenditure – **will support GDP and minimize the output gap**. This happens primarily through the **following mechanism**:
  - i. Increased government expenditure **cushions the contraction in output by contributing to the GDP growth** and offsetting the decline in consumption and investment.
  - ii. During recession **spending multiplier is higher** which leads to boosting of private investment and consumption.
  - iii. Higher spending by government **compensates for 'risk aversion' by private sector** and brings back 'animal spirits'.

iv. It also **enhances expectation multiplier** by building confidence in tough times. Since government is able to exhibit their commitment to sound fiscal management, the *rational players in the economy would not expect the economy* to fluctuate as much and therefore private players will further increase the investments and reinforce this expectation multiplier.

10. FRBM ACT

- **Background: Need to institutionalize a new fiscal discipline framework:**
  - » In 1980s, India saw a sharp deterioration in fiscal situation, which ultimately culminated in the balance of payment crisis of 1991. Within a decade of economic liberalization, the fiscal deficit and debt situation again seemed to head towards unsustainable level around 2000. At that time, a need to **institutionalize a new fiscal discipline framework**.

- **FRBM Act** was passed in 2003 and became effective from July 5, 2004. It enjoins government to conform to a pre-set fiscal target, and in the event of failure to do so, to explain the reasons for deviation.
  - » The **aims** of the act are to:
    - Introduce **transparency in India's fiscal management** systems.
    - Achieve **inter-generational equity** by ensuring equitable distribution of debt over the years.
    - Ensure **long term macro-economic stability** through fiscal stability

  - » **To promote transparency** in fiscal management, **section 3 of the act** provides that Union government will place **three more documents on fiscal policy** along with the budget:
    1. Macroeconomic framework Statement
    2. Medium Term Fiscal Policy Statement
    3. Fiscal Policy Strategy Statement

  - » Later, through an amendment a fourth statement, **Medium Term Expenditure Framework (MTEF)** needs to be presented.

  - » At the end of the second quarter, the finance minister would make a statement on the trend of fiscal indicators and corrective measures taken thereof.

  - » The Act requires the central government to progressively reduce outstanding debt, revenue deficit, and fiscal deficit.
    - The central government gives three year rolling targets for these indicators when it presents the Union Budget each year.

  - » It says that the **Central Government shall not borrow from the RBI** except by way of advances to meet temporary excess of cash disbursements over cash receipts.
    - Further, **RBI shall not subscribe to the primary issue of the Central government securities** from the year 2006-2007.

- **Originally, the following targets were set under the act and FRBM rules.**
  - Revenue Deficit -> 0 by 2007-08; Fiscal Deficit -> 3% by 2007-08.

- **Total liabilities of** central government should **not rise by more than 9% a year**.
- Union government will not give guarantee to loans raised by PSUs and state governments for more than **0.5%** of the GDP aggregate.

- **2008 Financial crisis and its aftermath**
  - Deadlines for the implementation of the targets in the act was initially postponed and subsequently suspended in 2009. In the next few years, the act was largely neglected.

- **NK Singh Committee to review FRBM Act (Report submitted in 2017): Key Recommendations:**
  - The committee said that **debt should be considered primary targe**t. It suggests Public Debt to GDP ratio as a medium-term anchor for fiscal policy in India.
  - It also gave targets of (Fiscal Deficit, Revenue Deficit and debt) to be achieved by 2022-23.
  - Creation of a **Fiscal Council**: It is a proposed 3 member body which will have functions like preparing multi-year fiscal forecast; preparing fiscal sustainability analysis; providing independent assessment of the central government's fiscal performance; and improving quality of data.
  - **Escape Clause and Buoyance Clause**

- **In 2018, the FRBM Act was amended to specify three conditions upon which the escape clause can be invoked**.
  - **First**, over-riding considerations of **national security, acts of war, and calamities of national proportion** and **collapse of agriculture severely affecting farm output and incomes**.
  - Second, far-reaching **structural reforms in the economy** with unanticipated fiscal implications.
  - Three, a **sharp decline in real output growth of at least 3 percentage points** below the average for the previous four quarters.
  - The FRBM amendments also mentioned that the **deviation from the stipulated fiscal deficit target must not exceed 0.5 percentage** points in a year.

  - **Note:** the term "escape clause" hasn't been used in the act. It was used by the FRBM review committee chaired by NK Singh.

  - In Budget 2020-21, the finance minister Nirmala Sitharaman has used the escape clause provided under the act to relax the fiscal deficit target. It was done on the grounds of reduction in corporate tax (structural reform)
    - The fiscal deficit of FY19-20 was 3.8% (BE was 3.3%, therefore the 0.5% relaxation)

- **Recommendations of the 15th Finance Commission**
  - The 15th Finance Commission for 2021-26 suggested a path for fiscal consolidation for the centre by reducing **fiscal deficit to 4%** of GDP and **outstanding debt liabilities** to 56.6% of the GDP by 2025-26**.**

- **Current Scenario:**
  - Due to **COVID-19 scenarios**, the **targets were against missed**. Therefore, FRBM Act should have been amended to set new targets.

» But the revisions to the FRBM Act Medium Term Fiscal Policy Statement for 2021-22 and 2022-23 omitted the rolling targets for budget deficits.
    - **Government wants a fiscal flexibility to respond to emerging contingencies** till the pandemic induced uncertainties ease.

» However, government has said that it would pursue **a broad path of fiscal consolidation** reaching the target **of 4.5% of Fiscal Deficit by 2025-26**.

In Aug 2023, the Finance Ministry conveyed its inability to release **Medium Term Expenditure Framework (MTEF)**, mandated by FRBM Act, 2003. It said that since the presentation of Union Budget for FY24 in Feb, there hasn't been any significant and favourable change in global headwinds and associated risks. Therefore, the **medium-term projections are not feasible**. Further, effective management of exogenous shocks and global uncertainties **necessitated additional flexibility** for the Government in terms of expenditure management and fiscal consolidation.

TARGET PRELIMS 2024
BOOKLET-21; ECONOMY-2
AGRICULTURE AND RELATED ISSUES

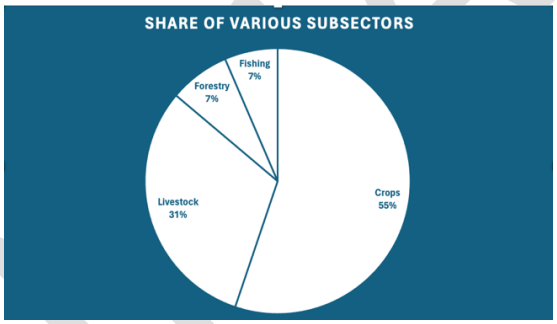
1. TABLE OF CONTENTS

2. AGRICULTURE AND ALLIED SECTOR: SHARE IN ECONOMY

- **Declining share of Agriculture** in India's economy:
  - It is estimated that at the time of independence Agriculture contributed to more than 50% of India's GDP and employed 2/3rd of the population.
  - Today, agriculture contributes to around 18% of India's GDP and employs more than 50% of India's population.
- **GVA Share:** According to Ministry of Statistics & Program Implementation (MoSPI), the GVA of agriculture and allied sectors in 2020-21 was 20.1%, it was 19% in 2021-22 and it again came down to **18.3% in 2022-23**.

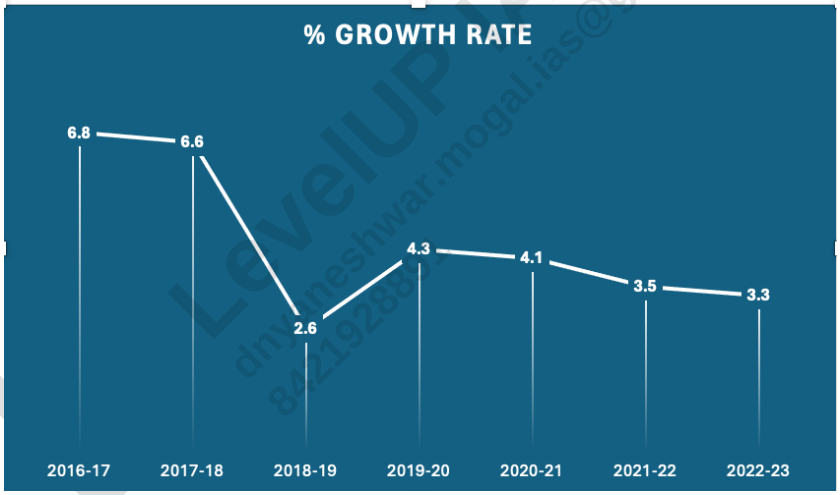
- **Distribution of various sub sectors**:

FY22:
- Crops: 55%
- Livestock: 30.87%
- Forestry: 7.36%
- Fishing 6.44%



  - **Note**: Share of Livestock and fishery has been going up and share of Crops and forestry has been going down

- **Growth rate of Agriculture and allied sector** (percentage)



3. AGRI-CENSUS (2015-16) (RELEASED IN 2018)

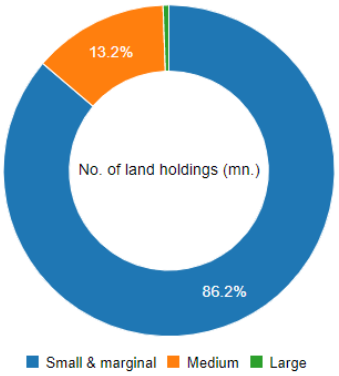
- **Intro**
  - Department of Agriculture, Cooperation and Farmers Welfare, MoA&FW conducts a **quinquennial Agriculture Census** (every five years) in the country to collect **key information about the structure and agriculture holdings in the country** and **monitor changes that take place over time**.

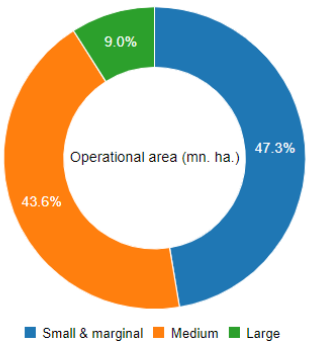
- **2015-16** census was the **10th Agri census** conducted in the country. (the first census was done in 1970-71)
  - **Note**: As of Jan 2024, 11th Agi-Census is going on. It was launched in July 2022.
- In the census, the unit of enumeration is defined by the term '**Operational Holding**' and it corresponds to the person who actually cultivates the land rather than its ownership. The concepts followed are broadly in conformity with the World Census of Agriculture, FAO of the UN.

- **Some other terms to understand**
  - **Operational Holding**
    - All land which is used wholly or partly for agricultural production **and** is operated as one technical unit by one person alone.
  - **Operated Area**
    - Include both cultivated and uncultivated area, provided part of it is put to agricultural production during the reference period.
  - **Size Classes**

S.No.	Group	S.No.	Classes (in ha.)
I.	Marginal	1. 2.	Below 0.5 ha. 0.5 – 1.0 ha.
II.	Small	3.	1.0 – 2.0 ha.
III.	Semi-medium	4. 5.	2.0 – 3.0 ha. 3.0 – 4.0 ha.
IV.	Medium	6. 7. 8.	4.0 – 5.0 ha. 5.0 – 7.5 ha. 7.5 – 10.0 ha.
V.	Large	9. 10.	10.0 – 20.0 ha. 20.0 and above.

- **Key Highlights**
  - **Decline in total operated area by 1.53%**
    - From 159.59 million hectares to 157.14 million hectares.
  - **State wise total operated area is highest in:**
    - **Rajasthan**, followed by Maharashtra, UP, MP and Karnataka.
  - **Total Number of Land Units (Operational holdings)**
    - **Increase of 5%** (from 138 million 2010-11 to 146 million in 2015-16)
    - **Uttar Pradesh** is the state with highest number of landholders, constituting 16% of the total number. UP is followed by **Bihar** and **Maharashtra**.
  - **Small and marginal landholdings** (<2 hectare area) constituted **86.21%** of the total landholding, an **increase of 1.2%** points compared to 2010-11.
    - Farmers holding 10 hectares and more account for just **0.57%**.
    - Semi-Medium and Medium: 13.2%
  - **Decline in average size of landholding** from 1.15 hectare to 1.08 hectare.
  - Average size of farm holding was the **highest in Nagaland** at 5.06 hectares and **lowest in Kerala** at 0.18 hectares.
  - It is noteworthy that **small, marginal and medium landholdings** constitute the lion's share of operated area - **large landholding** account for only 9% of the total operated area.





- **Marginal Increase in number of Small and Marginal agricultural land holdings** in the country
  - This means that there are more people now who own smaller parcel of land.
- **Percentage of women landholders have increased**
  - From 12.79% in 2010-11 to **13.87%** in 2015-16
  - There is also a corresponding increase of **1.2%** () in operated area.

4. INPUT MANAGEMENT

1) SEEDS

- **Introduction**
  - » **Good seeds** are catalysts for change in agriculture. The **Green Revolution** was ushered in by the import of 18,000 tonnes of high-yielding varieties of **wheat seeds, Lerma Rojo and Sonaro-64,** and **IR-8 rice seeds**.
  - » Today, India is AtmaNirbhar in staple crops and exports seeds to its neighbouring countries. This is thanks to these seeds and research conducted by ICAR.

- **Recognizing the significance of seeds government has taken several steps:**
  - » **Seed Production in Agricultural Crops:** This is a seed project to promote Seed Replace Rate (SRR) and Varietal Replacement Rate (VRR)

  - » **Sub-Mission on Seeds & Planting Materials**
    - The submission is focused on production and supply of quality seeds to farmers through its various components:
      - **Seed Village Program**
        - The program is aimed at upgrading the quality of farm saved seeds.
        - Under this by 2020-21, 4.29 lakh seed villages have been created wherein 38.01 lakh qtls. of foundation/certified seeds were distributed at concessional rates to 170 lakh farmers.
      - **Establishment of Seed Processing-cum-Seed Storage Godowns at Gram Panchayat Level**
        - Centre provides financial assistance to states to establish Seed processing-cum-storage godowns units each of 500 Mt capacity at Gram Panchayat Level.
      - **National Seed Reserve**
        - Under this seed of short and medium duration crops varieties are kept to meet the requirement of farmers for re-sowing during natural calamities and unforeseen conditions i.e. drought, cyclone and floods etc.
      - **Boosting Seed Production in Private Sector**
      - **Strengthening of Quality Control Infrastructure Facilities**

A) REGULATION OF SEED SECTOR IN INDIA

- » Currently, the **Seeds Act, 1966** regulates the quality of seeds in India.
  - This was introduced right after the ushering of the 'Green Revolution' in India.

- The Act along with the **Seed Rules**, 1968**, Seed** (Control) Order (1983**), New Policy on Seed Development (1988**), Plants Fruits & Seeds (Regulation of Import into India) Order (1989) has served well in making the Indian Seed Industry vibrant and competitive to serve the interest of farmers.
- **Protection of Plant Varieties and Farmers' Right Act (2001)** and the **Essential Commodities**, **Act 1955** have also served a role in the regulation of seed sector in India.

» **Key highlights of the Seeds Act, 1966**
- It only covers "notified kinds of varieties of seeds".
- **Labelling of seeds** with notified quality parameters has been made **mandatory** under the 1966 Act with p**unitive measures against seed sellers** in case of any deficiency in seed quality parameters mentioned on the label.
  - Essentially, the **seed label is treated as a guarantee card** and it is given a unique ID number to ensure traceability of seeds.
- **Central Seed Committee** notifies any seed variety found suitable as per the act.

» **Some limitations of Seeds Act, 1966**
- It only covers notified kinds or varieties of seeds. Thus, seed varieties which are not officially notified are not covered.
- **Seed variety registration** has been left to the discretion of the developers.

» **The Draft Seeds Bill, 2019:** Hasn't progressed ahead because of various criticisms.

B) OPEN SOURCE SEED MOVEMENT

- **Background:**
  » The advent of hybrid seeds, GM seeds etc have conferred plant breeders and developers of new varieties with the so-called plant breeder's rights (PBR). In this regime, farmer's rights were limited while right-holders could demand royalty on seeds and legally enforce PBRs.

- **Need of Open-Source Seed Movement:**
  » Decline in public sector breeding and increasing domination of private sector in seed breeding
  » High prices of private sector owned seeds.

- **What are Open-Source Seeds?**
  » Open-Source Seeds are those seeds which have been freed from IPR restrictions to allow open use of these seeds.
  » In 1999, a Canadian plant breeder named **T.E. Michaels suggested an approach** to seeds based on the principles of open-source software.
  » In 2012, Jack Kloppenburg, whose 1988 book ***First the Seed*** **altered the world** to trends in the seeds sector and the use of IP to control farmers' right, launched the '**Open Source Seed Initiative'** (OSSI) in Wisconsin. **OSSI simply asks for a pledge, that an individual won't restrict others use of these seeds or their derivatives by patents or other means, and to include these pledges with any transfer of these seeds or their derivatives.**
    - Since then several programs have come up around the world.

» **In India**, the Hyderabad based **Centre for Sustainable Agriculture (CSA)**, part of the **Apna Beej Network**, developed a model incorporated into an agreement between CSA and th recipient of the seed/germplasm.

2) IRRIGATION

- **Introduction**
  - » Irrigation is crucial to ensure that farmers reap full benefit of better-quality seeds and fertilizers. But, as per ESI 2021-22, only **49% of India's total cropped area is irrigated**. Rest depends on Monsoon rainfall for agriculture. This is the most important factor which makes farming a vulnerable profession.

- **Importance of Irrigation:**
  1. **Insufficient, Uncertain and Irregular Rains**
  2. **Higher Productivity of Irrigated Fields**
  3. **Multiple Cropping Possible**
  4. **Brining More Land Under Cultivation**
  5. **High Yielding Varities Program's** success depends to a large extent on the timely availability of ample supply of water.
  6. **Reduces Instability in output levels**
  7. **Other Indirect Benefits of Irrigation**: employment potential of irrigated land increases. It also helps in developing allied activities, means of water transport etc.
     - **For e.g. it has been estimated that for every Rs 100 of direct benefits from Bhakra Nangal Dam, there was a generation of Rs 90 of indirect benefits.**

A) DIFFERENT TYPES OF IRRIGATION IN INDIA:

» Sources of Irrigation in India can be divided into the following: **(i) Wells/Tube Wells (ii) Canals (iii) Tanks,** and **Others**

» **Wells and Tube-wells** are the most important source of irrigation in India.
  - They are spread over large areas of Punjab, Haryana, Uttar Pradesh, Bihar, Rajasthan, and Tamil Nadu.
  - **Advantages of Well and Tube well Irrigation**: Simplest and cost-effective way, easily affordable by poor Indian farmers (wells). It is an independent source of irrigation and can thus be used whenever the necessity arises. Certain chemicals from ground water such as nitrate, chloride, sulfate etc. are generally found mixed in well water. This can be good for agriculture.
  - **Disadvantages**:
    - Only limited area can be irrigated (upto 1 to 8 hectare of land per day)
    - Excessive extraction has caused ground water depletion in several parts of the country.

» **Canals** contribute to irrigation of around 24% of the irrigated area. This includes large area of Punjab, Rajasthan, Haryana, Uttar Pradesh, Bihar and some parts of southern states.

- Digging of Canals in stony and uneven areas is difficult and unprofitable. Thus the canals are practically absent from the Peninsular plateau. However, the coastal and delta region of south India do have some canal system.
- **Advantages of Canal Irrigation**:
  - Canals can convert dry regions into fertile territory (e.g. Rajasthan impacted by Indira Gandhi Canal)
  - They carry a lot of sediments carried by rivers -> this when deposited in agri field contributes to soil fertility.
  - It's quite cheap in long run (initially it can be expensive due to the cost of multipurpose projects etc.)
- **Drawbacks**:
  - **Water logging** along the canal route: It is caused by soaking on canal water into the ground.
  - **Land Degradation**: Capillary action brings alkaline salts to the surface and makes large areas unfit for agriculture.
  - **Overflow of canals during rainy season** also becomes a reason for floods.
- Taken together, **Canals and wells** accounted for 86% of the irrigated area in 2012-13.

» **Tank Irrigation** is resorted to mostly in **Telangana, Andhra Pradesh, Tamil Nadu, and** parts of **West Bengal** and **Bihar**.
- A **tank** act as an irrigation storage system that is developed by constructing a small bund of earth or stones built across a stream.
- Rivers of south don't flow all the year around. Therefore, tanks are constructed for storing water in rainy season which is subsequently used for irrigation purposes.
- **Andhra** Pradesh (including Telangana) is the largest state of tank irrigation which has about 29% of tank irrigated area of India. The drainage system of Godavari and its tributaries have a large number of tanks.
- **Advantages:**
  - Most of the tanks are natural and not expensive for their construction. Even an individual farmer has his own tank.
  - They are generally constructed on a rocky bed and has long life.
  - Fishing activities in some tanks adds to the food resources and income of the farmers.
- **Limitations:**
  - **They dry up during dry season** and fail to provide the irrigation when it is needed the most.
  - **Silting** of the tank bed is a serious problem and it requires desilting of the tank at regular interval.

» **Micro Irrigation** (including Sprinklers, Drip Irrigation Etc.) have emerged as the new efficient way of irrigation.

- **Various Initiatives** to promote increase irrigation cover in India:
  1. **Accelerated Irrigation Benefit Program (AIBP)** was launched in 1996-97 to provide Central Loan Assistance to states for completion of large and medium irrigation project which have been stuck for long due to fund crunch. It has been now subsumed under PMKSY (PMKSY-AIBP)

2. **Pradhan Mantri Krishi Sinchai Yojana** (PMKSY)is operational since 2015 with the vision of extending the coverage of irrigation "Har Khet ko Pani" and Improving water use efficiency "More Crop Per Drop".

3. **Promoting water use efficiency:**
    - To promote **micro-irrigation a Micro Irrigation Fund (MIF)** with corpus of Rs 5,000 crore was created with NABARD during 2018-19. As of 1st Dec 2021, loans under MIF amounting to Rs 3,970.17 crores have been approved for 12.81 lakh ha of Micro Irrigation area.
    - Micro irrigation is also being promoted through the Per Drop More Crop component of PMKSY (PMKSY-PDMC) from 2015-16.
4. **Watershed Development Program** (now part of PMKSY) also focuses on improving irrigation situation in rain-fed area.

B) PRADHAN MANTRI KRISHI SICHAYI YOJNA

- **Introduction**:
    - » Pradhan Mantri Krishi Sinchayi Yojna (PMKSY) is a flagship scheme launched by Government of India in 2015. the main objective of the PMKSY is to:
        i. Achieve convergence of **investments** in irrigation at the field level.
        ii. Expand cultivable **area** under irrigation ("Har Khet ko Pani")
        iii. Improve on-farm water use **efficiency** ("More Crop Per Drop")to reduce wastage of water, Enhance the adoption of precision irrigation and other water saving technologies (Per Drop More Crop)
        iv. Enhance recharge of aquifers and introduce **sustainable water conservation** practices by exploring the feasibility of reusing treated municipal waste water for peri-urban agriculture and attract greater private investment in precision irrigation.

- **Key Features of the Scheme**:
    - » **Amalgamation of Ongoing Schemes:**
        - Accelerated Irrigation Benefit Program (AIBP) of Ministry of Water Resource, River Development & Ganga Rejuvenation (MoWR, RD&GR) (Now Ministry of Jal Shakti)
        - Integrated Watershed Management Program (IWMP) of Department of Land Resources (DoLR) - MoRD
        - On Farm Water Management (OFWM) of Department of Agriculture and Cooperation - Ministry of Agriculture and Farmer Welfare
    - » **Decentralized State-Level Planning and Execution**: States will draw their own irrigation development plan based on district irrigation plans and state irrigation plans.
    - » It serves as a **convergence platform** for all water sector activities including drinking water and sanitation, MGNREGA, application and S&T through comprehensive plan.
    - » **Focused on "Protective Irrigation"** by sustainably water conservation by harnessing rain water at micro level through 'Jal Sanchay' and 'Jal Sinchan'
    - » **Special Focus on Micro-Irrigation** to increase water use efficiency.
    - » **Other objectives** include enhancing recharge of acquifers and introducing sustainable water conservation practice by exploring the feasibility of reusing municipal waste water and peri-urban agriculture and attract greater private investment in precision agriculture.

- The program has now been **extended for another five years till Dec 2026**. Three components AIBP, Har Khet ko Pani and Watershed development has been extended.

C) ACCELERATED IRRIGATION BENEFIT PROGRAM

- **Need of AIBP**
  - » Irrigation a state subject -> states develop irrigation projects -> several **major and medium projects** were stuck due to inadequate provisions of funds locking the fund spent on these projects too.
  - » Keeping the above in view, Central government **in 1996-97**, launched an Accelerated Irrigation Benefit Program (AIBP) to provide **Central Loan Assistance (CLA**) to these projects so that development could be accelerated.
  - » Central assistance is released in the form of **block loans and grants** not tied to any sector of development or project.

- **Types of Projects chosen**
  - » Special emphasis was to be given to Pre-fifth and Fifth Plan Project.
  - » Priorities were also to be given to those projects which were benefitting Tribal and Drought Prone Areas.
  - » After the revision in 1999-2000 onwards, AIBP could also be extended to **minor** surface irrigation projects of special category states (N.E Stats & Hilly state of HP, Sikkim, J&K and Uttarakhand)

- **State's contribution (after relaxation in Dec 2006) [25%** (10% in special category states, projects benefitting draught prone areas, tribal areas, and flood prone areas)]
- **Progress as of Dec 2021**
  - » Out of 99 projects, 44 projects have been reported to be completed/almost completed.

D) LONG TERM IRRIGATION FUND (LTIF)

- It was established by NABARD in 2016 to fund central and state share of 99 prioritized irrigation projects under the PMKSY.
- It gives **loans to NWDA and State governments** for the irrigation projects and thus funds and fast tracks implementation of incomplete major and medium irrigation projects during 2016-2020.
- **99 Projects of AIBP** which have been identified:
  - » 23 Projects for completion in 2016-17 (Priority-1)
  - » 31 Projects for completion in 2017-18 (Priority-2)
  - » 45 projects for completion by Dec 2019. (Priority-3)
- It had an initial corpus of about Rs. 20,000 crore (which was later extended to **40,000 crores)**
  - » The corpus will come from budgetary allocation from GoI, extra-budgetary allocation through GoI fully serviced bonds to be raised by NABARD.

E) INSTITUTIONS: NATIONAL WATER DEVELOPMENT AGENCY (NWDA)

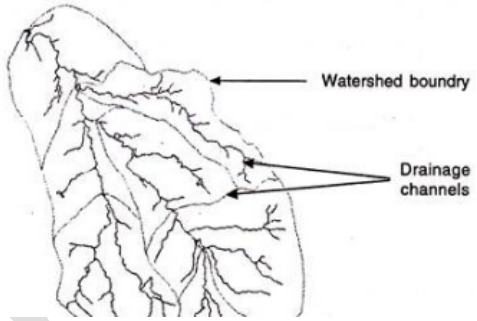
- NWDA was set up in 1982 as Autonomous society under the Societies Registration Act of 1860, to carry out the water balance and other studies on a scientific and realistic basis for optimum utilization of water resources of the **Peninsular river** system for preparation of feasibility report and thus to give concrete shape to **Peninsular River Development component of National Perspective Plan prepared by Central Water Commission**.

- Government subsequently modified the functions of NWDA to include the Himalayan Component of National Perspective for Water Resource Development.

- In 2006, it was also decided that NWDA will explore the feasibility of **linking sub-basins of rivers** in state like Bihar.
- It has also been tasked to prepare **feasibility** reports of **intra-state links** as proposed by the States

3) WATERSHED DEVELOPMENT PROGRAM

- **Introduction**
  - » **Watershed** is an area of land where surface water drains down to a single point (stream, lake or ocean).



  - » **Watershed development/management** is the treatment of the entire catchment area around the village to ensure conservation and regeneration of natural resources, especially water and its judicious use.
  - » Watershed development is all about making running water stop and standing water to sink inside. It is the only option for rainfed areas for water conservation and recharge and to prevent soil degradation.

- **How is watershed development done?**
  - » It is done from ridge to valley basis. Watershed development starts from the top-most point (ridge) and progresses downwards towards the valley.
    - Structures such as Water absorption trenches (WAT), Continuous contour trenches (CCT), stone bunds, check dams, percolation dams, ponds, and channels are built from the ridge to the valley.
  - » **Main objective is to slow the movement of water**
  - » **Note:** Earlier method of focusing only on water storage structures had limitations like washing away of top soil and silting of the water storage structure (reduction in the capacity to store water).

- **Watershed Development Programs in India: Key Programs**
  a. Integrated Watershed Management Program (now a component of PMKSY)
  b. National Watershed Development Project for Rainfed Areas (NWDPRA)
  c. Watershed Development Project in Shifting Cultivation Area (WDPSCA)
  d. Watershed Development Fund (WDF)
     - With the help of NABARD
     - Unified fund to help various watershed development programs in India.

- **How has watershed management programs contributed/ What are the objectives of these program?**

» Water Conservation, Soil Conservation, Flood Control, Rehabilitation of Degraded Land, Better agri practices, better integration of non-agri activities, Increased farmer income, capacity building of farmers.

4) MICRO-IRRIGATION

- **Introduction**
  - » Water is a scarce natural resource and faces a huge demand supply gap all over the world. Situation is worse in India which accommodates 17% of the world's population with 4% of the water resources.
  - » In India, more than 80% of water is used for **irrigation purposes**. Therefore, optimal utilization of water in irrigation can play crucial role in ending the water scarcity that exists. Here, micro-irrigation can play a crucial role.

- **Micro Irrigation** is an innovative water saving technology in which water is directly supplied to crops with very less conveyance and evaporation losses. Main types of micro-irrigation system include:
  i. **Drip Irrigation:** It allows water to drip slowly to the roots of plants, either from above the soil surface or buried below the surface.
     - In India, major crops cultivated under drip irrigation includes sugarcane, banana, cotton, lemon, grapes, oranges, mangoes, vegetables etc.
  ii. **Sprinkler Irrigation:** It uses water sprinklers to irrigate agri-crops. The water is applied in a controlled manner in a method that is similar to rainfall.
     - In India, major crops cultivated under sprinkler irrigation include, wheat, mustard, millet, sorghum etc.
  iii. **Micro-Sprinkler Irrigation** provide irrigation with very fine droplets. They are suitable for low volume irrigation in horticulture crops, fruit flowers, greenhouses, nurseries etc.
  iv. **Porous Pipe System:** It is a system of sub-surface irrigation which can work on low pressure that can be provided by gravity (overhead tanks).
     - Water is dispensed gradually near the roots of the plant/tree.
  v. **Rain Gun**
     - Pressurized water through rain-guns are used to irrigate the crop.

- Drip Irrigation and Sprinkler Irrigation is the most common type of micro-irrigation system used in India.

- **Benefits of Micro Irrigation**
  - Better water use efficiency, better fertilizer use efficiency, energy efficiency, increased productivity, crop diversification, better quality of produce, more income for farmers etc.

- **Efforts towards promoting Micro-Irrigation in India**
  i. **National Mission on Micro Irrigation Program** which was later subsumed under **National Mission on Sustainable Agriculture**.
     - It is now being implemented as "**Per Drop More Crop**" component under Pradhan Mantri Krishi Sinchai Yojana (PMKSY) from 2015-16.
     - Under it various **Training and Awareness Programs**, **workshops, seminars** and **interactive meets** are conducted.

- **50% subsidy** is provided to farmers for installing micro-irrigation system (MIS). (40% Centre, 10% state)

ii. **Micro-Irrigation Fund with NABARD** under PMKSY
- It was set up in 2018 with the major objective of funding the states to facilitate them to mobilize resources which can be used to incentivize farmers towards micro-irrigation beyond the provisions available under PMKSY-PDMC.
- Its initial corpus was Rs 5,000 crore which was increased to 10,000 crore in Budge 2020-21.

5) AGRI-INPUT: MECHANIZATION

- **Introduction**
  - Farm/Agri mechanization is the process of replacing human and animal labour with machines in agriculture sector. The use of tractors, threshers, harvesters, pump sets etc. are all steps towards farm mechanization.

- **Advantages of Farm Mechanization-**
  - Increased Productivity - Reduced time and labor - Reduced Cost - Increased soil fertility - reduced water use - Reduced post-harvest losses - no labor bottlenecks - create skilled jobs - Overall increased income for farmers.

A) INITIATIVES FOR AGRI-MECHANIZATION

1. Sub-Mission on Agriculture Mechanization (SMAM)
- Launched in 2014-15
- Ministry: MoA&FW
- Objective
  - » To promote agricultural mechanization among small and marginal farmers.
- Under the scheme, assistance is provided to state governments to:
  - » Impart training and demonstration of agriculture machinery;
  - » Provide assistance to farmers for procurement of various agri-machineries and equipment and;
  - » For setting up of Custom Hiring Centers.
- Progress:
  - » As of Dec 2022, 21628 CHCs and 467 Hi-tech hubs and 18306 farm machinery banks have been established.

2. **The Scheme for CRM (Crop Residue Management): 'Promotion of Agriculture Mechanization for In-situ management of Crop Residue in the State of Punjab, Haryana, Uttar Pradesh and NCT of Delhi'**
- Initiated in 2018
- **Ministry:** MoA&FW, Central Sector
- Farmers are provided machinery for in-situ management of crop residue through establishments of **Custom Hiring Centers**. **80% subsidy** is provided for establishment of CHCs.
- **Individual farmers** are provided subsidy (50%) for procurement of machinery.

- **In Budget 2020-21** a total allocation of Rs 600 crore has been provided of which Rs 548.20 crore has already been released.

3. **Multilingual Mobile App - "CHC - Farm Machinery"**
   - It connects farmers with CHCs situated in the locality.
   - It facilitates agri-mechanization in the country by encouraging small and marginal farmers to take machines on rental basis for agri-practices.
   - The app has been further modified and now has been given the acronym of "**FARMS-App**" (Farm Machinery Solutions - App). This version is more user friendly, and the scope of the app has been enhanced.

4. **Other** Schemes of the ministry such as RKVY, NFSM, NHM, NMOOP etc also promote farm mechanization.

5. **Other steps**
   - Government has decided to enhance **farm power availability** from 2.02 KW per ha (2016-17) to 4.0 kW per ha by th end of 2030.

B) REPORT: THE STANDING COMMITTEE ON AGRICULTURE, ANIMAL HUSBANDRY, AND FOOD PROCESSING (CHAIR: MR. P.C. GADDIGOUDAR) PRESENTED ITS REPORT ON "RESEARCH AND DEVELOPMENT IN FARM MECHANIZATION FOR SMALL AND MARGINAL FARMERS IN THE COUNTRY" ON JULY 21, 2023

- **Status of Farm Mechanization**: As of Aug 2022, 47% of agricultural activities are mechanized in India. This is lower than other developing countries like Brazil (75%) and China (60%).
- **Mechanization level** in different crops:

Crop	Rice	Wheat	Pulses	Sugarcane	Overall
Level	53%	69%	41%	35%	47%

- **Small Holdings**: Unless machines appropriate for small holdings are made available or substantial farm land consolidation takes place, **small farmers will find it difficult to purchase their own machinery**.
- It will take country 25 years to achieve 75-80% mechanization. It recommended that government should take steps to do it in less than 25 years.
- **Key recommendations**:
  - » **Government should publicize** initiatives like Custom Hiring Centres etc.
  - » **Design Standardization** should be achieved to ensure interchangeability.
  - » **Under Sub-Mission on Agri Mechanization** - Government should promote low cost equipment - to increase the reach to small and marginal farmers.
  - » **Increase the availability of farm power** to 4 KW per hectare (from current 2 Kw per hectare)
  - » **Study to assess farm mechanization** - The committee has recommended that Department of Agriculture and Farmers' Welfare prepare a plan for such study

6) AGRI-INPUT: CROP INSURANCE

- **Background: Why didn't Farmers participate in agri-insurance Schemes?**

» NSSO report 573 (2012-13) identified following as the main reason for farmers not insuring their crops - **Non awareness**, **not interested, non-availability, lack of resources**, **complex process** and **Delays** in claim payments

- **Problems with Crop Insurance Scheme before PMFBY ->** Partial Risk Coverage; Available only for notified crops; High Premium Rates; Complex system -> lack of uniformity; Delays in claims settlement; very less focus on awareness generation.

A) PRADHAN MANTRI FASAL BEEMA YOJANA (PMFBY)

- **Introduction**
  - » In a bid to protect farmers against losses incurred because of frequent changes in weather patterns, the PMFBY was launched in Feb 2016 and was implemented from Kharif 2016 (June 2016). It replaced the NAIS and MNAIS. However, WBCIS and Coconut Palm Insurance Scheme have continued to operate. Premium paid under WBCIS has been brought on par with PMFBY.

- **Key Improvements:**
  - » **Higher losses coverage** (pre harvest to post harvest losses)
    - ▫ Provision of claims upto 25% of sum insured for **prevented sowing**.
    - ▫ It covers post-harvest losses also.
    - ▫ It expands the definition of disaster to include aspects like flooding of crops and damage after harvest.
      - Provision of individual farm level assessment for Post-harvest losses against the cyclonic & unseasonal rains for the crops kept in the field for drying upto a period of 14 days, throughout the country.
  - » **Full Coverage:** No upper limit on government subsidy -> Doesn't cap premium rates**,** so that farmers can get full sum assured.
  - » **Uniform low premium rates for farmers**

Crop	Premium charged
Kharif	2.0% of sum assured
Rabi	1.5% of sum assured
Annual Commercial and horticulture crops	5% of sum assured

  - » **Uniformity in implementation**: Districts are allotted to insurance companies on cluster basis for a longer duration to ensure uniformity in implementation of the scheme.
  - » **'Area Approach Basis'** and **'Individual Insured farm**
    - ▫ The scheme is implemented on an 'Area approach basis'.
      - Admissible claims are worked out and paid directly to the insured farmer's account by the insurance companies on the yield data based on the requisite number of CCE's per unit area furnished to the concerned insurance company.
    - ▫ **Individual Insured Farm approach:**
      - Losses due to **localized calamities** like hailstorms, landslides, inundations etc. are calculated on an individual-insured farm basis.
  - » **Subsidy shared between center and state**

» **Provisions for quick settlement of claims**
  - **Note**: Operational guidelines under PMFBY require state governments to carry out **at least four CCEs in every village panchayat for every notified crop** and submitted the **yield data to insurance companies within a month of the date of harvest**. The companies have to **settle the claims within three weeks of receiving CCE data**.
» **Increased Use of Technology:** The use of technology will be promoted to greatest extent possible. Remote sensing, smart phones and drones will be used for quick estimation of the crop losses and early settlement of claims.
» The scheme is implemented through **empaneled general insurance companies**.
» The Scheme covers all Food & Oilseed crops and Annual/Horticulture Crops for which past yield data is available and for which requisite number of CCEs are being conducted under the General Crop Estimation Survey.

- **The scheme PMFBY and Restructured Weather Based Crop Insurance Scheme were made voluntary for all farmers**, post its revamp in Feb 2020.
  - Further, the states have been provided flexibility to rationalize the sum insured so that adequate benefits can be availed by farmers.

- **Other steps to improve the implementation of schemes**:
  - **National Crop Insurance Portal** has been developed to handle all grievances from end to end. This portal is equipped with the necessary features, such as complaint/Query capturing through multiple modes, farmer authentication etc.
  - A provision of Stratified Redressal Mechanism, viz., District Level Grievance Redressal Committee (DGRC), State Level Redressal Committee (SGRC) has been made.

- **The scheme wants to support sustainable production of Agriculture sector by way of** financial support; stabilizing income; promoting adoption of innovative and modern practices; ensuring flow of credit to agri-sector.

- **Progress So far:**
  - As per ESI 2022-23, PMFBY is the **largest crop insurance scheme** in the world in terms of farmer enrolments, averaging 5.5 crore applications every year and the third largest in terms of premium received.
  - During the last six years of its implementation, farmers paid a premium of **Rs 25,186 crore** and received claim accounting to Rs 1.2 lakh crore (as of Oct 2022)
  - The acceptability of the scheme among farmers can be ascertained from the fact that the share of non-loanee, marginalized, and small farmers have increased by 282% since the scheme's inception in 2016.

7) AGRI-INPUT: AGRI-CREDIT

- Agriculture credit as a percentage of Agriculture GDP increased form **2% percent in 1970s to 47% by 2019-20**, portraying significant progress made in lending to agriculture.

- In the Union Budget for FY24, the Union government has set the Agri Credit Target to 20 lakh crore. This indicates an increased focus of government on agri-credit sector as there is an one-one-one correspondence between growth of agri-credit and agri-production

- **Key steps to promote Agri-Credit:**
  i. **Nationalization of Commercial Banks** in 1969, Establishment of **Regional Rural Banks** in 1976 and setting up of **NABARD in 1982** have been some of the biggest steps towards increasing farm credit.
  ii. **Priority Sector Lending (PSL)** norms initiated in 1974, mandates all domestic commercial banks (and foreign banks with 20 or more branches) to earmark 18% of loans for farm credit.
  iii. **Kisan Credit Card (KCC)** introduced in 1998 are aimed at providing adequate and timely short term credit needs for farmers and has now been extended to fishery and animal husbandry sector also.

  > **Kisan Credit Card (KCC) scheme** was introduced by NDA government in Aug **1998** with an aim to provide adequate and **timely short term credit needs** for farmers during the cropping season.
  > » NABARD has prepared a Model Kisan Credit Card Scheme in consultation with major banks on the basis of **R V Gupta Committee** recommendations.
  > » **Objective and Rationale ->** adequate, timely and cost effective credit; simple process; protect from usurious money lenders.

  iv. **Modified Interest Subvention Scheme**, operational since 2006-07, provides short term agri credit of upto Rs 3 lakh at a subsidized interest rate of 7% per annum to farmers engaged in agriculture and allied activities.
    - An **additional 3% subvention** (Prompt repayment incentive) is also given to farmers for prompt and timely repayment of loans.

8) AGRI-INPUT: FERTILIZERS

- **Why in news?**
  » CACP recommends Centre to bring urea under NBS regime to check overuse (June 2023)

- **Introduction**:
  » A fertilizer is any organic or inorganic, natural or synthetic material added to soil to supply one or more plant nutrients essentially to the growth of plants.
  » These fertilizers provide **six macro nutrients** and **8 micro-nutrients** to plants for well balanced growth:
    i. **6 macronutrients:** nitrogen(N), phosphorus(P), potassium(K), Calcium (Ca), magnesium (Mg), and sulphur(S). They are consumed by plants in larger quantities and make the bulk of fertilizers.
    ii. **8 Micronutrients:** Boron (B), Chlorine (Cl), Copper (Cu), iron (Fe), manganese (Mn), Molybdenum(Mo), Zinc (Zn) and Nickel (Ni).

  » Fertilizer are an important input for agriculture and have played a major role in increasing farm productivity since green revolution.

  » But Indian farmers have often faced difficulties due to **shortage of fertilizers** in past. So, the government, giving high priority to farmer's welfare, has taken a number of initiatives to ensure supply of fertilizers around the year.

» **Scale of Fertilizer Subsidy**:
  » 2021-22: Rs 1.62 lakh crore
  » 2022-23: Rs 2.55 lakh crore
  » 2023-24: Rs 1.75 lakh crores (Budgetary Allocation)

» The two main important fertilizer subsidy schemes are Nutrient Based Subsidy Scheme and Urea Subsidy Scheme

A) NUTRIENT BASED SUBSIDY (NBS) SCHEME

- **Key provisions of NBS**
  - » **Fixed subsidy based on nutrient:**
    - ▫ Government provides a fixed amount of subsidy based on the nutrient content (both macro and micro (boron, zinc etc.)) (per kg) of fertilizers (unlike the earlier product-based subsidy scheme) to the fertilizer companies.
    - ▫ For e.g. for RABI 2022 (from 01/10/2022 to 31/03/2023) - Subsidy rate was decided as follows:
      - **N** (Rs 98.02/kg) **P** (Rs 66.93/Kg), K **(Rs 23.65/Kg)** and **S** (Rs 6.12/kg)
  - » **MRP to be fixed by fertilizer companies** on the basis of demand and supply but after incorporating the subsidy element.
  - » Rate of subsidy is determined by various factors such as international prices, exchange rate, inventory levels etc.
  - » The NBS scheme currently covers 21 grades of different phosphatic and potassic (P&K) fertilizers including DAP (diammonium phosphate), MOP (Murate of Potash) and other NPK complex fertilizers.
  - » **UREA has been kept outside the coverage of the NBS** scheme.

- **Key Aim ->** Reduced Subsidy Burden; New specialized variety of fertilizers; Balanced application; Improved farm output; promote indigenous fertilizer industry.
- **Hasn't been as affective** -> Government's subsidy burden still very high -> UREA kept out of NBS, so farmers shifted to UREA -> Balanced Nutrient Goal also missed.
- Subsidy burden remained very high.

B) UREA SUBSIDY SCHEME

- **Introduction:**
  - ▫ To ensure affordable access to fertilizers to farmers, UREA is made available at **statutorily controlled price**, which at present is Rs **5378 per MT** (exclusive of Central/State Tax and other charges towards neem coating).
  - ▫ The difference between the delivered cost of fertilizers at farm gate and MRP payable by farmers is **given as subsidy to the fertilizer manufacturer/importer by GoI**.
  - ▫ **Urea Subsidy Scheme** is a part of Central Sector Scheme of Department of Fertilizers
  - ▫ It also includes imported urea subsidy which is directed towards import to bridge the gap between assessed demand and indigenous production of Urea in the country. It also includes freight subsidy for movement of across the country.

- **Issue of Diversion**
    - Being super-subsidized, urea is always **prone to diversion for non-agricultural use** - as a binder by plywood/particle board makers, cheap protein source for animal feed manufacturers or adulterant by milk vendors - apart from being smuggled to Nepal and Bangladesh.

    - From 2018, the government announced the **implementation of DBT** for disbursement of fertilizer subsidy.
        - Now the subsidy transfer only happens after the actual sales to farmers by retailers. Retailers have a point of sale (PoS) machine linked to **e-Urvarak DBT Portal**. Fertilizer buyers (farmers) are required to furnish Aadhar or KCC number.
        - **Advantages**
            - **Prevents diversion and plug the leakages** (because Aadhar is used)
            - Timely payment of Urea subsidy to urea manufacturing companies.
            - Adequate availability of UREA to farmers at adequate prices.

    - **But** the **diversion still continues at the retail level**.
    - **Various steps being proposed to deal with this problem:**
        - **Plans for Direct Cash Transfer to Farmers:**
        - **Plans to cap the total number of subsidized fertilizer bags that any person can buy during an entire Kharif and Rabi Cropping season:**
            - This is expected to end even retail-level diversion and purchases by large buyers masquerading as farmers.

C) SOME STEP WHICH HAVE BEEN TAKEN TO MAKE UREA SECTOR EFFICIENT

i. **GAS Price Pooling**
- Earlier, different urea plants got gas at different prices, so their cost of production differed.
- Therefore, in 2015 government has approved a major policy intervention. Under this policy the **domestic gas is pooled with imported LNG gas** to provide uniform natural gas to all the Urea manufacturing plants for the production of Urea.
    - **Cost of UREA at pooled price will be less** that the price of imported urea. This will help in increasing the production. This will augment indigenous production capacity.

ii. Neem Coating of UREA
- Reduces rate of dissolution in soil -> slowly absorbed by plants
- Reduces diversion to industry
- Neem has other advantages for crops -> insecticidal and pesticidal properties
- UREA can't be used in synthetic milk now

iii. New Urea Policy to increase the productivity, efficiency and indigenous production

iv. **Introduction of 45 kg Urea Bag** (from earlier 50 kg) -> aimed at cutting demand

vi. **Nano Urea**
- Government has notified the **specification of Nano nitrogen** under Fertilizer Control Order, 1985.

vii. One Nation One Fertilizer Scheme

- It aims to ensure timely supply of fertilizers as well as eliminate the dilemma of farmers in choosing one of the many brands available in the market.
- **By** Ministry of Chemicals and Fertilizers
- It aims at marketing fertilizers in India under **'Bharat'** brand name.
    i. Under this scheme, all subsidized fertilizers - including UREA, Di-ammonium Phosphate (DAP), Muriate of Potash (MoP), and NPK will be marketed under Single Band Name.
    ii. It aims to ensure timely supply of fertilizers as well as eliminate the dilemma of farmers in choosing one of the many brands available in the market.
- The scheme has also outlined the specifications of the new packaging for companies:
    i. 2/3rd of the front will be covered by 'Bharat' brand and PMBJP Logo. 1/3rd of the space will be left for manufacturing brands.
- It will reduce the **logistic cost** involved in the transportation of fertilizers. It will stop crisscross movement of fertilizers for longer distance.

viii. **Pradhan Mantri Krishi Samriddhi Kendra** (PMKSK)

- It has been decided to convert the existing village/block/sub-district/taluk and district level fertilizer retail shop into **Model Fertilizer Retail Shops**. These shops will act as **"One Stop Shop"** for all the agriculture related inputs and services.

ix. **PM PRANAM** (Proposed)

- Aimed at reducing the use of chemical fertilizers and thus reducing the subsidy burden.
- **What is the need of this scheme? Drastic increase in overall expenditure of government on fertilizer subsidy**.
- The scheme will not have a separate budget and will be financed by the "savings of existing fertilizer subsidy" under the schemes run by the Department of fertilizers. Further, 50% subsidy savings will be passed on to the states that save the money as Grant. 70% of the grant provided under the scheme can be used for asset creation related to technological adoption of alternative fertilizers and alternate fertilizer production units at village, block and district levels.

D) SOIL HEALTH CARDS (SHCS)

- **About the scheme**
    - » The international year of soils was celebrated in 2015 the same year India's unique program of soil health card was launched on 19th Feb to assess the nutrient status of every farm holding in the country.
    - » It is a scheme administered by **Department of Agriculture & Cooperation** under the MoA&FW. It is being implemented through the Department of Agriculture of all the states and UT governments.
    - » **The objective** of the scheme is to issue soil health cards to farmers every 2 years so as to provide a basis to address nutritional deficiencies in fertilization practices.
    - » The SHCs carry crop-wise recommendations of nutrients and fertilizers required for the individual farms to help farmers improve the productivity through judicious use of input.
    - » All Soil samples are to be tested in soil testing labs across the country.

- **Other Unique Features of SHC**

- Collecting soil samples at a grid of 2.5 ha in irrigated area and 10 ha in un-irrigated areas.
- Uniform approach in soil testing adopted for **12 parameters** viz. primary nutrients (NPK); secondary nutrient (S); micronutrients (B, Zn, Mn. Fe & Cu); and other (pH, Electrical Conductivity & Organic Carbon) for comprehensiveness.
- **GPS enabled soil sampling** to create a systematic database and allow monitoring of changes in the soil health over the years.

5. CHEMICAL FREE AND NATURAL FARMING

1) ZERO BUDGET NATURAL FARMING

- **Definition: What is ZBNF?**
  - ZBNF is a method of **chemical-free agriculture drawing from traditional Indian practices**. It is a set of agricultural methods which doesn't involve any credit, doesn't spend any money on purchased inputs (**zero budget**), uses very less water (10%), doesn't use any synthetic chemical fertilizer or pesticide (thus **natural**) and believes in natural growth of crops using inputs which are locally available.
- **Subhash Palekar**, the original promoter of ZBNF, **identifies four important Pillars of ZBNF**.

a. **Beejamrita/beejamrutha** is the **seed treatment using local cow dung, cow urine, lime and soil**. This protests young roots from fungus and soil borne or seed borne diseases.

b. **Jivamrita/Jivamrutha** is a fermented microbial culture which is used as a **base fertilizer**. It is a fermented mixture of water, cow dung, cow urine, jaggery, pulse flour and a handful of soil from the bund of the farm. It provides basic nutrient, acts as catalytic agent to promote the activity of micro-organisms, and reduces fungal and bacterial infections.

c. **Acchadana - Mulching** activities to ensure favourable microclimate in the soil. Three kinds of mulching has been suggested: **Soil Mulch,** Straw Mulch and Live Mulch (symbiotic intercrops and mixed crops)

d. **Whapasa - Moisture:**
   - Palekar questions the idea that plant roots need a lot of water and therefore criticizes over reliance on irrigation in green revolution. According to Palekar, root needs water vapours.
   - **Whapasa is a condition where there is both air molecule and water molecule present in the soi**l and thus Palekar encourages reducing irrigation, irrigating only at noon, and in alternate furrows.

- **In addition**, ZBNF includes three methods of insect and pest management: Agniastra, Brahmastra, and Neemastra (all different preparation using cow urine, cow dung, tobacco, fruits, green chilli, garlic and neem).
- **ZBNF - a movement at grassroot level**
  - It has emerged as a grassroot peasant movement and has spread to various states in India, especially becoming very successful in southern states. This movement could be running among millions of farmers according to ZBNF leaders. This success have been achieved without any

formal movement organization, paid staff or even bank accounts. ZBNF has inspired a spirit of volunteerism among its peasant, who are the main protagonist of the movement.

- **Benefits of ZBNF**
  - ZBNF has not only worked in agronomic terms. But, it has brought about a variety of social and economic benefits.
    - **Reduced Cost: Reduces Resource Utilization -> Higher income for farmers**
    - **Sustainability**:
      - **Seed Diversity:** Rather than standard GM crops, it promotes local variety of seeds, their conservation and reuse.
      - **Water Conservation**
      - **Biodiversity Conservation**: ZBNF encourages the planting of diverse crops, inter cropping, and maintaining natural habitats on the farm. This promotes biodiversity, preserves native species, and supports the ecosystem balance.
      - **Reduced Pollution and GHG emissions**: By avoiding synthetic chemicals in agriculture, ZBNF promotes soil conservation, reduces water pollution and also controls global warming.
    - **Food Safety** due to less chemical use
    - **Household Food Autonomy**, not dependent on MNCs for seeds and fertilizers
    - **Reduced Import Dependence** as India is a net importer of fertilizers
    - **Reduced Subsidy burden for government** -> More spending on other socio-economic sectors
- **Some Limitations:** Unscientific – fertility reducing in long run

2) ORGANIC FARMING SITUATION IN INDIA

- As per **ESI 2022-23**, India has **44.3 lakh organic farmers,** the highest in the world, and about **59.1 lakh ha** area was brought under organic farming by 2021-22.
- **Area wise** Madhya Pradesh has the highest area under organic farming in India, followed by MHA and RAJ.
- **Sikkim** voluntarily adopted going organic, and the process of getting total cultivable land of 58,168 hectares under organic farming commenced at ground level in 2010.
  - It has become the **first state in the world** to be become fully organic.
- **States** like Tripura and Uttarakhand have also set up similar targets.

3) PARAMPARAGAT KRISHI VIKAS YOJANA (PKVY)

- **Introduction**
  - PKVY has been launched by GoI to support and promote organic farming and thereby improving soil health.
  - Encourage farmers to adopt eco-friendly concept of cultivation and reduce their dependence on fertilizers and agricultural chemicals to improve yield.

- **Clustered Approach:** The PKVY supports organic farming via cluster approach.
  - 50 or more farmers form a cluster having 50 acre land to take organic farming.

- Each farmer would be provided 20,000 Rs per acre in three years for seed to harvesting crops and to transport them to market.
  - Out of this 61% is provided directly through DBT for inputs bio fertilizers, bio-pesticides, organic manure, compost, vermi-compost, botanical extracts etc.

A) BHARTIYA PRAKRITIK KRISHI PADHATI (BPKP)

- BPKP is introduced as a sub-scheme of Paramparagat Krishi Vikas Yojna (PKVY) since 2020-21 for the promotion of **traditional indigenous practices** for encouraging all forms of ecological farming, including zero-budget natural farming.
  - The scheme focuses upon capacity building, training, handholding, and on-field demonstration of natural farming through champion farmers.
- The scheme mostly emphasizes on exclusion of all synthetic chemical inputs and promotes on-farm biomass recycling with major stress on Biomass mulching; use of cow-dung formulations; plant-based preparations and time to time working of soil for aeration.
- Under BPKP, financial assistance of Rs 12,200/ha is provided for 3 years for cluster formation, capacity building and continuous handholding by trained personnel, certification and residue analysis.
- So far, **4.09 lakh ha** of land have been brought under natural farming in 8 states.

4) MISSION ORGANIC VALUE CHAIN DEVELOPMENT FOR NORTHEASTERN REGION (MOVCD – NER)

- It is a central sector scheme and a submission under National Mission for Sustainable Agriculture. It was launched by MoA&FW in the north-eastern states (including Sikkim) in 2015.

- Farmers are given assistance of Rs 25,000/ha/3 years for, organic inputs including organic manure and bio-fertilizers etc.
- The scheme also provides an end-to-end support to the farmers from farm to fork including quality production, effective postharvest management, value addition through processing and direct marketing linkages to national and international markets.
- It is also aimed at developing certified organic products.
- **Impact:**
  - During last five years, the scheme has covered 74,880 ha area.
  - Government now targets 1.0 lakh ha area under 200 new FPOs over a period of 3-year period. (2021-2024)

Note: North-eastern region is not part of PKVY, since a dedicated scheme, MOVCD-NER was launched.

5) ALLELOPATHY

- **Introduction**
  - » Allelopathy is a biological phenomenon by which an **organism produces one or more biochemicals** that influence germination, growth, survival, and reproduction of other organisms. These biochemicals are known as **allelochemicals** and can be released in air, water or soil. These may have **beneficial or detrimental effects** on target organisms and the community.

- **It can play significant role in major cropping systems of irrigated agriculture**:
  - » **Increase nutrient availability** which can improve crop yield.
    - For e.g. wheatgrass can produce allelochemicals that can improve the quality of crops.
  - » **Sustainable Agriculture**: Allelopathy can contribute to sustainable agriculture by reducing the need for chemical inputs (like herbicides) and enhancing biodiversity.
    - **Controlling Weeds**: For e.g. crop residue of rye when used as a cover crop in a no-till system, it releases allelochemicals and prevent growth of weeds.
    - **Pest and Disease Control**: For e.g. Marigolds produce several allelochemicals in their roots and leaves. Hey are often planted in gardens and agricultural fields to deter various pests.
  - » **Making Crop Rotation and Intercropping better:** Better understanding of allelopathy can help us understand which crops will benefits each other in case of crop rotation or inter-cropping.
  - » **Soil Health**: Allelochemicals can influence the soil microbial community, affecting nutrient cycling, and soil fertility. They may either enhance or reduce soil health, depending on the type of allelochemicals involved.

- **However**, it has to be understood that lack of understanding of allelopathy can lead to several negative impacts. For e.g. Negative allelopathy can reduce crop yield if crops are grown in sequence or in combination with plants that produce inhibitory chemicals. They may inhibit germination, growth or reproduction.
  - » For e.g.
    - Mustard produces a chemical called allyl isothiocyanate, which can inhibit the growth of some plants, such as tomatoes.
    - Peanuts produce a chemical called gossypol, which can inhibit the growth of plants like corn.

6. IMPORTANT FOOD CROPS AND PLANTATION CROPS

1) TEA

- **Introduction**
  - » Tea is the **dried leaf of a bush**. It contains **theine (caffeine)** and when added to boiling water along with sugar and milk, gives a stimulating drink. It is the most important beverage crop of India.

- **Institutional Arrangements**
  - » **Tea Board of India**
    - The Tea Board of India is a state agency of GoI established to promote cultivation, processing, and domestic trade as well as export of tea from India. It was established by the enactment of the Tea Act, 1953 with its headquarters in Kolkata.
    - **Functions**
      - Responsible for assignment of certification numbers to exports of certain tea merchants. This certification is intended to ensure the teas origin, which in turn

would reduce the amount of fraudulent labelling of rare tea such as ones harvested in Darjeeling.

- Endorsement of diverse production and productivity of Tea
- Financial support to research organizations
- Monitoring of advances in Tea packaging as it relates to health beneficial aspects
- Ensuring technical support for tea trade in global industry by coordinating with research institutes, tea trade and government bodies.

- **Tea Cultivation**
  - **Requirements for Tea Cultivation**
    - **Climate:**
      - Tropical and subtropical climate endowed with deep and fertile well drained soil, rich in humus an organic matter.
        - A moderately hot and humid climate, which is preferred for better yield, crop distribution and quality.
      - Frequent showers evenly distributed over the years ensure continuous growth of tender leaves.
    - **Temperature:** An ambient temperature within 13 degree Celsius and 28-32 degree C is conducive for growth of tea. Maximum ambient temperature above 32 degree C is unfavorable for optimum photosynthesis. Heat is synergically disastrous for the crop if it is accompanied by low humidity.
    - **Winter Dormancy:** At temperature below 12 degree C, there is hardly any growth during this period. Flushing in the tea plant starts from March, with the rise in temperature.
    - **Soil**
      - Acidic soil with around 4.5-5.5 pH. Suitable soil for tea cultivation is well drained, deep, friable loamy soil. **The best soil for tea cultivation is forest soils rich in humus and iron content.**
    - **Other Requirements**
      - Cheap and efficient labour as tea is almost exclusively hand picked.
      - Tea grows better when planted along the shady tree.

- **India's major Tea producing areas**
  - The main tea growing regions are in Northeast India (including Assam) and in North Bengal (Darjeeling district and the Dooar region). Tea is also grown on large scale in Nilgiris in South India.
  - **Assam:** Darrang, Goalpara, Kamrup, Lakhimpur, Dibrugarh, Nowgong, Sibsagar, Cachar, Karbi Anlong, North Cachar.
  - **West Bengal:** Darjeeling, Terai (west Dinajpur), Doors (cooch bihar)
  - **Tamil Nadu:** Kanyakumari, Tirunelveli, Madurai, Coimbatore, Nilgiris.
  - **Kerala:** Cannanore, Palghat, Kozhikode, Malappuram, Trichur, Trivandrum, Quilon, Kottayam, Ernakulam, Idukki, Wayanad.
  - **Karnataka:** Chikkamagaluru, Coorg, Hassan.
  - **Himachal, Uttarakhand, Meghalaya, Andhra Pradesh, and Tripura** are also tea producing states in the country.

- **Tea Consumption in the country**

- India is also one of the largest tea consumers in the world, without about 3/4th of the total production consumed in the country itself.

- **Exports**
  - India exports CTC (crush-tear-curl) grade mainly to Egypt, Pakistan and the UK, and the orthodox variety to Iraq, Iran and Russia.

- **Key problems faced by the Organized Tea Industry in the country**
  - **Scarcity of labor and its cost** (65% of the cost) in the organized industry
  - **Prices** have not increased in tandem with inflation.
  - **Emergence of the small tea growers** as a dominant force in the industry
    - Lately, the organized sector's production has shown a declining trend and small tea growers now have a larger share of the pie.
  - **Deteriorating quality due to aging tea bushes** in this centuries-old industry.
    - Till Sep 2019, around 3,325.7 hectares have been uprooted and replanted during the government's medium term framework (MTF-2017-20)

2) COFFEE

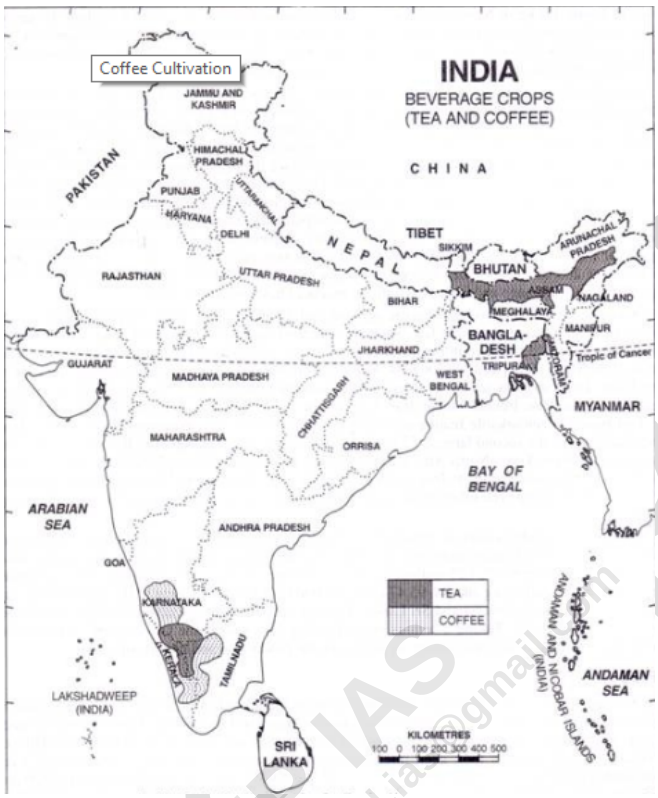
- **Introduction**
  - Coffee is a tropical plantation crop. Its seeds are roasted, ground and are used for preparing beverage. In India, it is the second most important beverage crop, next only to tea.
  - It is indigenous to Ethiopia. In India, Coffee plantations started in 18th century. Over the years, we have earned a distinct identity for our coffee. India is the only country in the world where coffees are grown under a '**well-defined two-tier shade canopy**' of evergreen leguminous trees.
  - There are three varieties of coffee i.e. **arabica**, **Robusta** and **liberica**. India mostly grows the superior quality coffee, arabica, which is also in great demand in the international market.
  - India is one of the top 10 coffee producers in the world (generally ranked 5th or 6th) -> After Brazil, Vietnam, Columbia and Indonesia. We produce around 5% of the world coffee.

- **Total Production and Exports**
  - India's coffee production is estimated in 2022-23 at 393,400 tonnes.
  - India exports 80% of its production to more than 40 countries.
    - The exports reversed a COVID-induced slide to record a **42% year on year jump** in 2021-22, exceed the $1 billion mark for the first time.

- **State wise production.**
  - Coffee plant was grown for the first time on **Baba Budan Hills (Karnataka)** in India.
  - The **three southern states** account for almost all of the coffee production in the country with **Karnataka (71%)** being the largest producer followed by Kerala (21%) and Tamil Nadu (5%).
  - In Karnataka, the **Kodagu and Chikkamagaluru** district account for over 80% of the state's total output.

- **Climatic Condition Requirements**
  - Since coffee is a **tropical plantation**, it requires **hot and humid** climate with temperature varying between 15 degrees Celsius to 28 degree Celsius and a rainfall between 150-250 cm.

» It grows on the hilly slopes at the height of 900-1800 m. These conditions are prevalent in the hill areas of Nilgiris where the coffee plantations are mostly confined.
» **Dry weather** is necessary at the **time of ripening of the berries.**
» It **doesn't tolerate** frost, snowfall, high temperature above 30 degree Celsius and strong sun shine and is generally grown under shady trees.
» **Cheap and skilled labor force** is another requirement for coffee cultivation which is required in sowing, transplanting, pruning, drying, grading and packing of coffee.



3) PULSES

- **Intro**
  » Pulses are the important source of proteins, vitamins and minerals and are popularly known as "**Poor man's meat**".

- **Advantages Positives about Pulses**
  » Nutritional Security
  » Suitable for Marginal Environment
  » Increase fertility of Land
  » Low food wastage footprint

- **Various pulses and production in India**.
  ▪ India is the **largest producer** (25% of global production), **consumer** (27% of world consumption) and **importer (14%)** of pulses in the world.

    - They account for 20% of India's total area under cultivation and provide 7-10% of the total food grains in the country.

- **The overall pulse production in India** has gone up from **8.4 million tonnes** in 1950-51 to **27 million tonnes** in 2022-23.
    - » In fact, in the last decade, India's production has increased by **50%** (from 18 million tonnes to 27 million tonnes)
    - » But pulse production has not increased in step with the population growth, per capita availability of pulses have **declined from 22.1 kg per person in 1951 to 16.4 kg per person in 2022**.
    - » Though there is surplus production of Chana, the imperfect substitution among pulses and limited international availability put pressure on the prices of some pulses.

- **Main Crops:**
    - » **Bengal Gram** (Desi Chick Pea/ Desi Channa), **Pigeon Peas** (Arhar/ Toor/ Red Gram), **Green Beans** (Moong Beans), **Chick Peas** (Kabuli Chana), **Black Matpe** (Urad / Mah / Black Gram), **Red Kidney Beans** (Rajma), **Black eyed Peas** (Lobiya), **Lentils** (Masoor), **White Peas** (Matar) are major pulses grown and consumed in India.

    - » **Rabi Crops (60% Production Share)**: Gram, Peas, lentil (masur), and black gram
    - » **Kharif Crops (40% Production Share)**: Arhar(tur), Moong and Urad etc.

    - » **Gram** (with 50% share) is the most dominant pulse produced and consumed in India. it is followed by **Tur/Arhar (15-20%**) and **Urad & Moong (8-10%).**
        - **Note:** Experts say that Tur's consumption in meals as dal is much more than that of Chana. Chana is used more on account of its use in packaged food.
    - » **Gram** is the crop of subtropical areas. It is a rainfed crop.

    - **Major Pulse Producing States**:
        - Madhya Pradesh, Maharashtra, Rajasthan, UP, and Karnataka.

- **Primary reasons for domestic shortage of pulses and reduction in per capita availability of Pulses in India** are:
    A. **The increase in area under cultivation, production and productivity of pulses has been extremely slow.**
    B. **Low Yield, increased irrigation facilities and Blue Bulls trouble**
    C. **Open ended procurement of wheat and rice under MSP -> Lack of assured price for pulse**
    D. **Very less R&D on pulses globally** (due to very less consumption in advanced western countries)

- **Steps which have been taken to increase pulse production.**
    A. **Measures to incentivize Pulse Production** under **National Food Security Mission (NFSM)**, **Minimum Support Price Programs and by Increase production.**
        - For e.g. PM AASHA's prize support scheme specifically focused on increasing the procurement of pulses on MSP.
    B. **Crop Diversification Program** (a sub scheme of RKVY) is being implemented in original green revolution states viz. Punjab, Haryana, and in Western Uttar Pradesh to diversify paddy areas towards less water requiring crops like oil seeds, pulses, coarse cereals, agro forestry etc.

4) MILLETS

- **International Year of Millet (IYM):** The United Nations General Assembly has declared the year 2023 'International Year of Millets'. It will help in creating awareness throughout the world about the significant role of millets in sustainable agriculture and its benefits as a smart food and superfood.

- IYM 2023 aims to contribute to the UN 2030 Agenda for Sustainable Development, particularly SDG 2 (Zero Hunger), SDG 3 (Good health and well-being), SDG 8 (Decent work and economic growth), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate action) and SDG 15 (Life on Land)

- **Definitions:**
  - Millets include Jowar, Bajra, Ragi, little millets including Kutki, Kodo, Sawa, Kangni and Cheena.

- **Cropping:**
  - They are generally cultivated in low-fertile land, mountains, tribal and rain-fed areas.
    - These areas include Andhra, Chhattisgarh, Gujarat, Haryana, MP, Rajasthan, MHA, KAR, UP, TN and Telangana.
  - India is the **largest producer and second largest exporter of millet** and in 2022 India produced around 50.9 million tonnes. This accounts for 80% of Asia's and 20% of global production. India is followed by African countries like Nigeria and Niger in production.

- **Decreased Production over the years:**
  - In pre green revolution era (1965-66), millets were cultivated in 36.90 million hectares of the country. In 2016-17, the area reduced to **14.72 million hectares**.
    - **Why?**
      - **Green Revolution** increased the productivity of wheat and rice.
      - Expansion in irrigation.
      - MSP Policy
      - **Changes in consumption pattern, dietary habits etc**: Socio-economic dynamics resulting from the hardy nature of the crop, relegated them to be the grain of the poor.

- **But recent studies** have highlighted **various significance of millets** for healthy life and sustainable economic development:
  - **Agri-Sustainability**:

- **Climate Resilience**: Millets are tolerant to droughts, intensive to excess sunlight etc.
- **Water Efficient**: Millets can survive in less water conditions and can solve the problem of over-extraction of water resources.
    - A new study published in the journal ***Nature Water*** in Oct 2023 highlights that shifting to millets increases groundwater recharge more than drip irrigation in India's northern plains.

» **Better Health:**

- **Food Security**: In arid areas, millets are often the only crops that can be harvested in the dry regions and are a crucial part of household food basket.
- **Nutrition:** Millets are smart food which are rich in nutrients like protein, vitamin-A, iron, calcium, iodine etc.
    - For e.g., just 100 gm of daily cereals (rice) intake with finger millets (ragi) will increase the daily iron intake by 50% and calcium by 350%.

- **Government Initiatives to promote Nutri-Cereals:**

» **Union Budget for FY24** announced an initiative focused on '**Making India a Global Hub for Millets**' (Shree Anna).

- The Indian Institute of Millet Research, Hyderabad, will be supported as the Centre of Excellence for sharing the best practices, research and technologies at the international level.

» **MAHARISHI Initiative** i.e. Millets and OtHer Ancient Grains International ReSearcH initiative. This international initiative will focus on research and awareness via agro-biodiversity, food security and nutrition aligning with the International Year of Millets.

» **India had declared year 2018** as the **Year of Millets**:

- Spreading **awareness** about nutritional benefits of nutrients which will help in increasing the demand resulting in remunerative prices for poor and marginal farmers.

» Under the **Sub Mission on National Food Security Mission (NFSM)** - **Nutri Cereals** is creating awareness among farmers for Nutri Cereals (Millets).

- NFSM - Coarse Cereals are divided into two components
    - NFSM (Makka and Jau)
    - Sub Mission on Nutri-Cereals covering Jowar, Bajra, Ragi and little millets like Kutki, Kodo, Sawa, Kangni and Cheena

5) OILSEEDS – NEXT CLASS

TARGET PRELIMS 2024
BOOKLET-22; ECONOMY-3
AGRICULTURE AND RELATED ISSUES-2

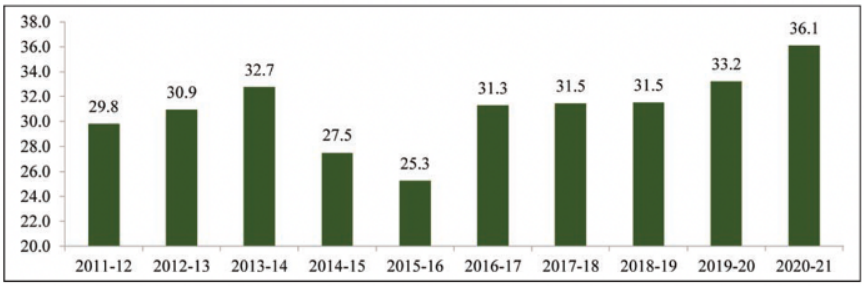
1. TABLE OF CONTENTS

2. OILSEEDS

- Area under Oilseeds cultivation has increased from 10.7 million hectares in 1950-51 to **28.8 million hectares in 2020-21. The production of Oilseeds** has also increased to 36.1 million tonnes **in 2020-21**. But, even now, **India imports majority of its edible oil consumption**.

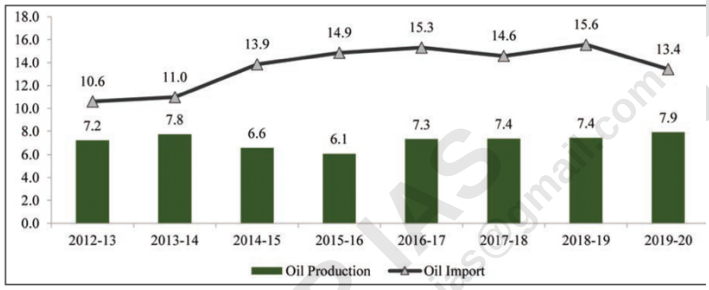
  - » As of 2019-20, India produced 7.9 million tonnes of oil and imported 13.4 million tonnes of oil. This makes India the **largest importer and second largest consumer of edible oil** in the world.
    - India is one of the major oilseeds growing country in the world. The production was fluctuating earlier, but since 2016-17 it has continuously grown. The production has increased to **36.1 million tonnes in 2020-21** which is 43% higher than the 2015-16 production.

Figure 7: Trend in Production of Oilseeds (Million Tonnes)



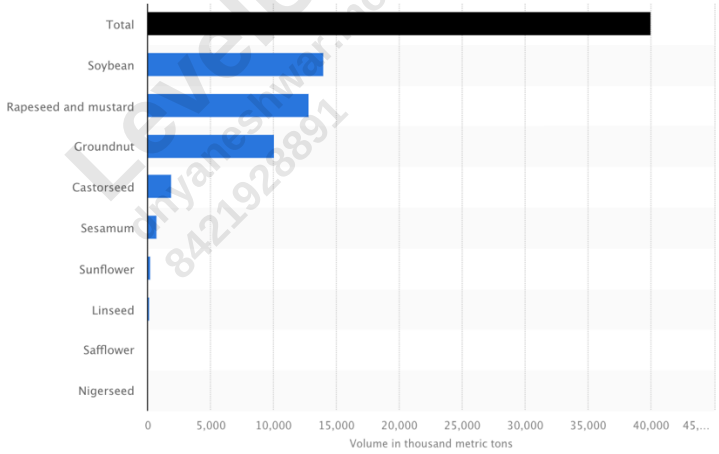
Source: Based on data of 4th Advanced Estimates as on Directorate of Economics & Statistics Website.

Figure 8: Production & Import of Oil (Million Tonnes).



Source: Based on data of Agricultural Statistics at Glance, 2020.

- **Production of oilseeds in India in 2023** (in 1,000 tones)



- **Reasons for Low Oil Seeds Production in India**:
  - » **More Focus on Wheat and Rice:** Green Revolution, MSP Regime, High Yielding Varieties etc.
  - » **Productivity and yield of oilseeds crop** is low.

- **Palm** oil which has high productivity hasn't grown in India
- Lack of access to **improved variety of seeds** (for e.g. GM varieties like DMH-11 are still not allowed to be grown commercially.
- Specialized inputs like specific fertilizers, pesticides etc. are not easily available.

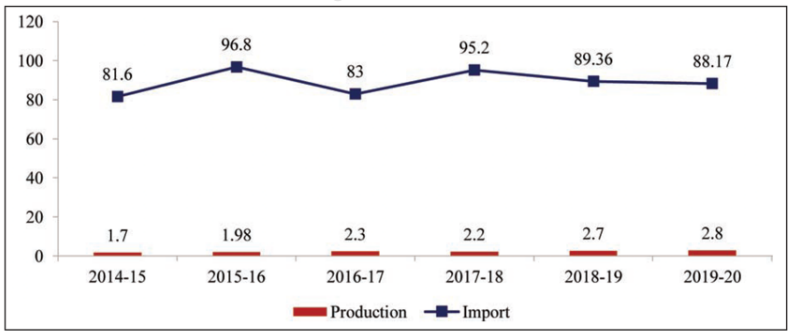
» **Poor Infrastructure:** Inadequate irrigation facilities

- **Government Initiatives** to reduce the import dependency has been focused on increasing the production and productivity of oilseeds:

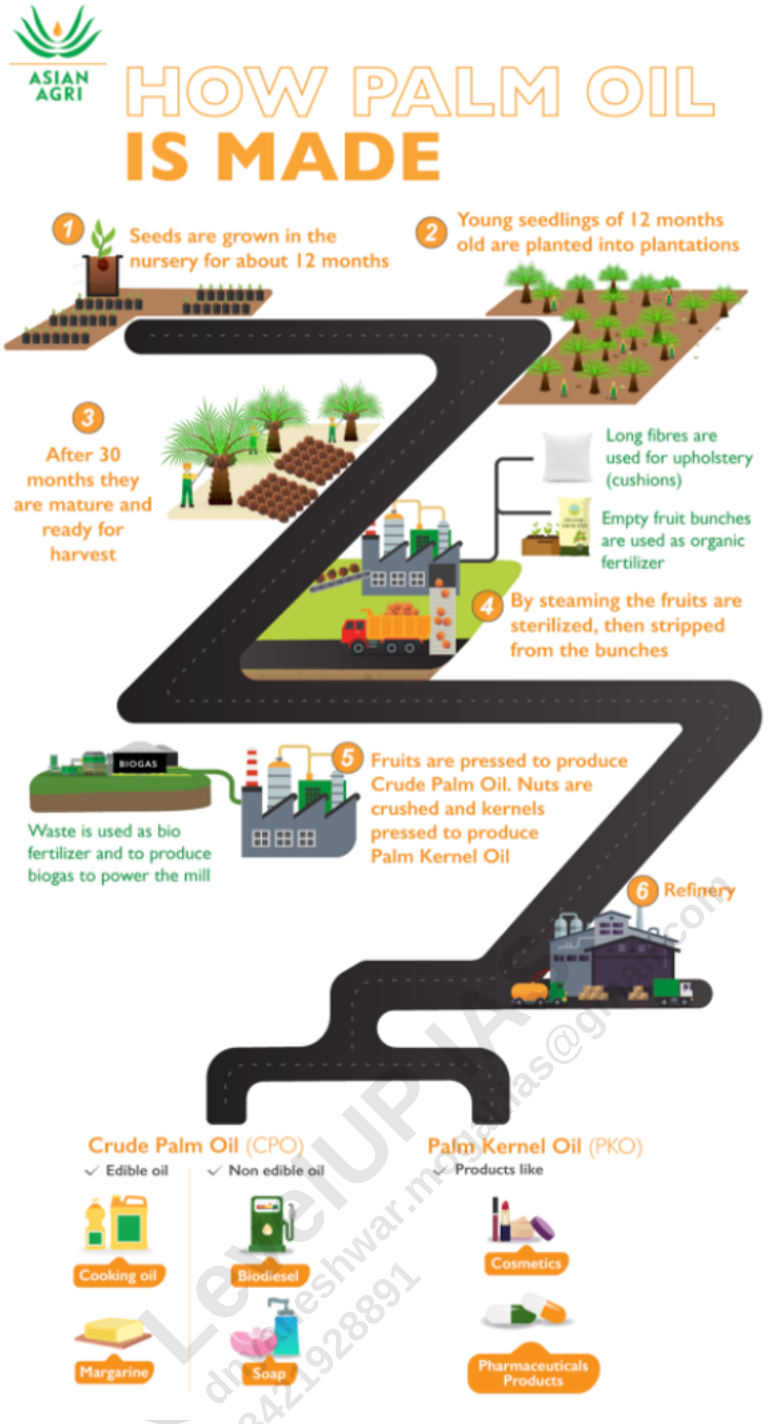
1. **Improving the Seed Varieties: National Food Security Mission – Oil Seeds** (NFSM-Oilseeds)
   - » A centrally sponsored scheme
   - » Focused on **production** of **foundation and certified seeds** and **distribution** of certified seeds and seeds mini kits of latest high yielding varieties.
   - » Under NFSM-Oilseeds, government of India has set up **36 oilseeds seed hubs** during 2018-19 and 2019-20 with **an objective to increase the availability of high yielding quality seed**.
2. **Incentivization of oilseeds** through **MSP regime**.
3. **National Mission on Edible Oils – Oil Palm (NMEO-OP)** aimed at increasing availability of edible oil in the country by **harnessing area expansion** and through price incentives.
4. **Asian Palm Oil Alliance (APOA): 5 Major Palm Oil Importers from Asia form alliance (Sep 2022)**
   - » The **apex edible oil industry associations** from five major palm oil importing countries of Asia - **India, Pakistan, Sri Lanka, BD, and Nepal** - have come together to form the Asian Palm Oil Alliance (APOA), at the instance of Solidaridad Network, a specialist in sustainable agriculture. The purpose is to safeguard the economic and business interests of the palm-oil consuming countries.
5. **Atmanirbhar Oil Seed Abhiyan** (announced in Budget 2024-25)
   - » Under this a strategy will be formulated to achieve 'Atmanirbharta' for oil seeds such as mustard, groundnut, sesame, soybean, and sunflower. The initiative will focus on research for high-yielding varieties, widespread adoption of modern farming techniques, market linkages, procurement, value addition, and crop insurance.
6. Other steps like Pradhan Mantri Krishi Sinchayi Yojna, MSP for Oil seeds, subsidies for inputs such as fertilizers and pesticides, Training and extension programs for farmers etc. also help oil seed sector.

1) ABOUT PALM OIL

Figure 9: Production and Import of Palm Oil (Lakh Ton)



Source: Based on data of Agriculture Statistics at Glance, 2020 and DAFW.



- **Oil Palm Cultivation in India has significant potential due to following reasons**:
    1. **Increasing Demand of vegetable Oil**
    2. **Agro-Climatic Conditions**: Oil Palm can be grown in tropical and subtropical climates of India. Regions like Tamil Nadu, Kerala, Karnataka, and North-eastern India are well suited for palm oil cultivation.
    3. **Potential to reduce India's import dependency**: Of all the vegetable oils imported in India, Palm oil constitute around 60%.

4. **High Yield of palm oil**: It produces 10 to 46 times more oil per hectare compared to other oilseed crops.
5. **Other value-added products** - Other than cooking oil, Palm Kernel oil is used in cosmetics and pharmaceutical products.
6. **Increased economic opportunities and Jobs**

- **However**, introduction of largescale oil palm cultivation has also been associated with some challenges:
    1. **Deforestation and biodiversity loss**: Indonesia has seen large scale deforestation and biodiversity loss to expand oil-palm cultivation.
    2. **High Initial Cost**: The oil palm tree takes 3-4 years to mature and start producing oil palm. This can be barrier for most Indian farmers.
    3. **Price Fluctuation** is also a major concern which limits the scope of
    4. **High Irrigation requirement** is another challenge
    5. **Shortage of planting material**.

2) NATIONAL MISON ON EDIBLE OIL - OIL PALM (NMEO-OP) AIMS TO REDUCE SOME OF THE ABOVE CHALLENGES.

» Launched as part of Atmanirbhar Bharat Scheme, **it aims to expand India's oil palm** cultivation from around 3.5 lakh hectares **to 10 lakh hectares** in a phased manner. It also targets to increase crude oil production **to 11.2 lakh tones by 2025-**26 and **upto 28 lakh tonnes by 2029-30**.

» **Budgetary allocation** - Rs 11,040 crores (of which Rs 21,96 crore will come from states)

» **To tackle High Initial cost**, a substantial increase in assistance for **inputs/interventions has been made**: :

- For Planting Materials for oil palms, a substantial increase from Rs 12,000/ha to Rs 29,000/ha has been made.
- Substantial increase has been made for maintenance and intercropping interventions -> A special assistance @Rs 250 per plant is being given to replant old gardens for rejuvenation of old gardens.

» **To tackle price fluctuation**, government is also providing **price assurance to palm oil farmers** for the fresh fruit bunches. This is called **viability price**. It will protect farmers from price fluctuations in international market.

- The VP will be annual average CPO price of the last five years adjusted to WPI Index, multiplied by 14.3%.
- There is a sunset clause for the scheme which is 1st Nov 2037.
- The Scheme will have special focus on north-east region and the **Andaman and Nicobar Islands**.
    - To give impetus to the NE region and Andaman, the government will additionally bear a cost of 2% of the CPO price to ensure that the farmers are paid at par with the rest of India.

» To address the issue of shortage of Planting Material in the country, **seed gardens will be provided assistance upto Rs 80 lakhs for 15 ha** in rest of India and Rs 100 lakhs per ha in NE India and Andaman region.

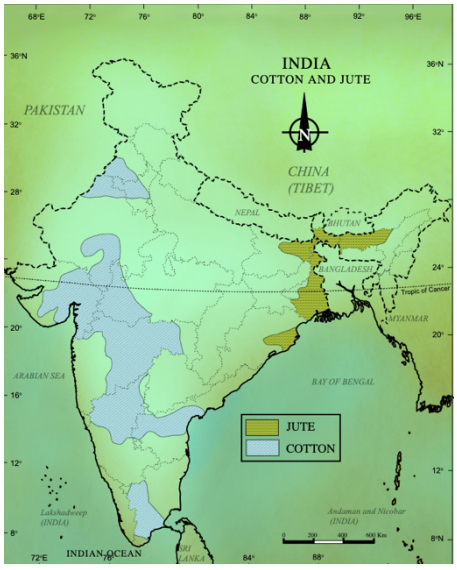
» **For Environment sustainability** NMEO advocates responsible cultivation practices that align with India's **National Biodiversity Action Plan**. It also has provisions for investment in R&D for the development of drought resistance varieties.

3. COTTON PRODUCTION

- Cotton is one of the principal commercial crops of India and India accounts for around 25% of the total global cotton production. It plays a major role in sustaining the livelihood of an estimated **6 million cotton farmers** and **40-50 million** people engaged in related activity such as cotton processing & trade.
  - » Due to its economic significance, in India, it is also termed as "**White Gold**".
  - » **India is the largest producer and consumer of Cotton** in the world. Adoption of Bt Cotton in 2000s enabled significant increase in cotton production from **10 million bales in 2001-02** to **34.3 million bales** in 2022-23.
  - » It is an indigenous crop which is sown as Kharif Crop in semi-arid region of the country. It takes 6-8 months to mature.

- **Suitable Climate Condition for Cotton**
  - » Cotton is a crop of tropical and subtropical areas and requires **uniformly high temperatures** between **21 degrees and 30 degrees C**. The growth is negatively impacted if the temperature falls below 20-degree C. **Frost** is harmful for the crop.
  - » The crop has **modest water requirement** (average annual rainfall of **50-100 cm**) and can be grown in areas with lower rainfall with the help of irrigation.
  - » **Good sunshine** is a must at the time of flowering and moist weather or heavy rainfall at the time of ball opening and picking are detrimental to the crop.

- **Other requirements**
  - » Cheap and skilled labor force at the time of picking of cotton. Normally the picking season is spread over a period of 3 month.
- **Traditionally**, it is cultivated on the **lava plateau of Deccan** and therefore the soil here is called the **Black Cotton soil**.
- **In Tamil Nadu**, it can be grown both in Kharif and Rabi season as there is **no threat of frost** which is dangerous for the cotton production.
- **Total Production and Distribution of Cotton Cultivation in India:**
  - » India has the **world's highest area** under cotton cultivation which accounts for around **6% of the net sown area**.
  - » India also produces 51% of the total organic cotton production of the world, which demonstrates India's effort towards sustainability
  - » There are **three major cotton producing regions** in India:
    - i. **Northern Zone:** Southeast Punjab, Western Haryana, and Northern Rajasthan
    - ii. **Central Zone**: Gujarat, Maharashtra, Western Madhya Pradesh and neighboring Southern Rajasthan in Western India
    - iii. **Southern Zone:** Telangana, Andhra Pradesh, North Karnataka and Tamil Nadu



- **Initiatives:**
  - » **Budget 2023-24:**
    - To enhance productivity of extra-long staple cotton, we will adopt **a cluster based and value chain approach through Public Private Partnerships (PPP).**

      This will mean collaboration between farmers, state and industry for input supplies, extension services, and market linkages

- **Various types of cotton grown in India:** Three broad types of cotton are generally recognized on the basis of length, strength, and structure of the fiber.
  a. **Long Staple Cotton**
     - Cotton with longest fiber (24 to 27 mm)
     - Fine and shining quality, used for superior quality of clothes.
     - About 50% of the cotton produced in the country is long stable type.
  b. **Medium Staple Cotton**
     - Length of the fiber (20 to 24 mm)
  c. **Short staple cotton**
     - Inferior cotton with less than 20 mm length. Used for making inferior cloth and fetches less price.

1) PROBLEM OF DEVELOPMENT OF RESISTANCE IN PESTS SUCH AS PINK BOLL WORM (PBW)

- **Background:** Indian farmers have faced consistent loss of Bt Cotton crops due to pink bollworm attacks since the mid-2000s, when scientists found that the insect had became resistant to the genetically modified variety of cotton.
  - » **About PBW**:
    - PBW is a worm that **destroys parts of the developing cotton fruit**, such as the square (flower bud) and the boll (rounded sac of seeds with cotton fibres).
    - Adult worms are thin grey moths that lay eggs on buds, flowers, and bolls. The larvae hatch from the eggs and burrow into the bolls to feed on the seeds. It cuts through the lint and stains it in the process, resulting in a loss of quality
  - » Bt Cotton was encoded with Cry1Ac toxin which protected it from all three species of bollworms (American, spotted, and pink bollworm)
    - Later, Cry2Ab gene was also added in Bt Cotton to improve protection against the **American Bollworm**.
  - » But, in 2008, scientists in India found unusual survival of Pink bollworm in Amreli district of Gujarat, indicating of Pest's resistant to Bt cotton.
    - By 2014, it was clear that Pink Bollworm had become resistant to both Cry1Ac toxin as well as Cry2Ab toxin.
    - **PBW** is more dangerous than American Bollworm as it feeds from inside the bolls and thus remains elusive in the initial stages and is seen in harvest stages when the damage is already done. As it feeds from inside, no amount of pesticide help control it.

- **How was resistance developed by PBW: Key Factors:**

» **Early Sowing and Late Sowing**: The ideal time for sowing cotton is April 15 to May 15. But many farmers in the northern belt of Haryana, Rajasthan and Punjab have started sowing from March end or the first week of April and extend it up to June end, which is an increase from 45 days to 80 days.
    - The early sowing season coincide with the time the PBW comes out of hibernation or the diapause stage in the winter months. The pest survives in this stage between two cotton seeds or cotton crop residue.
    - The cotton plants are at bud or flowering stage, during which the PBW searches for food and begins feeding on bolls during the larval stage, which continues for 14-17 days. It eventually starts laying eggs.
    - The issue worsens for farmers who sow late. The process enables worms to access food for longer periods and increasing generations.
» The **longer duration of cotton varieties** in the south and central India, which lasted upto 150-160 days, helped the pest develop resistance to the genetically modified varieties.
» **Not Planting other varieties against Advice**: Farmers were repeatedly advised to plant indigenous, hybrid varieties of cotton alongside Bt to prevent developing resistant. "The crossbreeding of pests from different varieties of plants would have prevented developing tolerance for longer years". But farmers haven't followed the advice.

- **Cotton Crops across the North-Indian States,** Punjab, Haryana, and Rajasthan, are reporting a severe pink bollworm attack and even Bt-Cotton is falling prey to the pest it was created to resist. (Oct 2023)
- **Impact:**
    - **Damage to crops**: Damage in 2023, is the highest since 2001 - both according to government and farmers.
        - **Note:** Before 2001, the American bollworm created havoc and ruined lives of farmers.
    - **Difficult to find laborers**: As laborers refuse to pick leftover crop as yield is too low
    - **Difficult to find buyers** as traders refuse to buy citing poor quality.
    - **Farmer Suicide:** In Sep 2023, Sri Ganganagar district saw first farmer suicide in over a decade. It was due to the fact that farmer had a lot of debt accumulated due to loss of cotton crop consecutively for 3 years.
    - **Farmers giving up cotton cultivation** in the northern belt (for e.g. the production of cotton in Punjab has almost halved in the past decade).

4. HORTICULTURE

1) TOTAL PRODUCTION

- Horticulture sectors comprise a wide array of crops from fruits and vegetables to nuts, spices, medicinal plants, flowers, and plantation crops, provides many opportunities for income generation.

Total Horticulture	2021-22 (Final)	2022-23 (First Adv. Est.)	2022-23 (Second Adv. Est.)
Area (in million hectares)	28.04	28.28	28.12
Production (in million tonnes)	347.18	350.87	351.92

- **Globally**

» India is the **2nd largest producer of fruits and vegetables.** China is the largest vegetable producer, but it produces four times that of India. It shows that India has a long way to go in terms of vegetable production.
» India is the **largest producer of mango, banana, coconut, cashew, papaya and Pomegranate.**
» India is also **largest producer and exporter of spices.**

A) SCHEME: HORTICULTURE CLUSTER DEVELOPMENT PROGRAM (CDP)

- It is a central sector program implemented by the **National Horticulture Board (NHB)** of the Ministry of Agriculture and Farmers' Welfare.

- It aims at **growing and developing horticulture clusters** to make them globally competitive.
  - Total **53 clusters** have been identified for the program, but initially in pilot phase, the CDP would be implemented in **12 clusters**. Later, based on learning from the pilot phase, the program would be extended to all 53 clusters.

- The program is designed to leverage the geographical specialization and promote integrated and market led development of horticulture clusters.

- It will address all major issues related to Indian horticulture sector including pre-production; production; post-harvest management; logistics; marketing and branding.

- **Expected benefits:**
  » Benefit 10 lakh farmers; improve exports of targeted crops by at least 20%; create a cluster specific brand for better recognition and competitiveness of cluster crops; attract investment of around 10,000 crores when implemented in all 53 clusters.
  » The **Clusters of the pilot phase** include Shopian (J&K) and Kinnaur (H.P) for Apple; Lucknow (UP), Kutch (Gujarat) and Mahbubnagar (Telangana) for Mango; Anantapur (A.P.) and Theni (T.N.) for Banana, Nasik (Maharashtra) for Grapes, Siphahijala (Tripura) for Pineapples, Solapur (Maharashtra) and Chitradurga (Karnataka) for Pomegranate and West Jaintia Hills (Meghalaya) for Turmeric.
  » These clusters will be implemented through Cluster Development Agencies (CDAs) which are appointed on the recommendations of the respective State/UT Government.
- The program will **converge with other initiative of the Government** such as the Agriculture Infrastructure Fund (AIF) which is a medium - long term financing facility for investment in projects for post-harvest management of infrastructure and community farming assets and will leverage the central sector schemes of the Ministry for **Formation and Promotion of 10,000 Farmers Producer Organizations (FPOs)**.

B) MISSION FOR INTEGRATED DEVELOPMENT OF HORTICULTURE (MIDH)

- All erstwhile schemes (National Horticulture Mission (NHM), Horticulture Mission for North East and Himalayas (HMNEH), National Horticulture Board [NHB], Coconut Development Board [CDB], Central Institute for Horticulture, and National Bamboo Mission [NBM] have been **subsumed under MIDH during the 12th Plan**.
- MIDH was introduced in 2014-15.
  » The interventions include introducing improved varieties and quality seeds, incentives for plantation crops, cluster development, and post-harvest management.

» According to third advance estimates (2021-22), a record production of 342.3 million tonnes in an area of 28.0 million hectares was achieved.
» The government has identified **55 horticulture clusters**, of which 12 have been selected for the Cluster Development Programme (CDP) pilot phase. This programme is designed to leverage the geographical specialisation of horticulture clusters and promote integrated and market-led development of pre-production, production and post-harvest activities, including the entire supply chain.

- **Capacity Building of Farmers** by organizing them in **farmer producer Organization [FPO]/ Farmer Producer Companies [FPC]** is an added feature of MIDH.

C) PROJECT CHAMAN (COORDINATED HORTICULTURE ASSESSMENT AND MANAGEMENT USING GEO-INFORMATICS)

- Launched in 2014 under MIDH.
- Here remote sensing technology is used for generating action plan and strategic development of horticulture sector as also to increase the farmer's income.
- It is being implemented by the Delhi based **Mahalanobis National Crop Forecast Centre** (MNCFC).
  » It helps in identifying right crop for right weather conditions; methods for calculating reliable estimates; creating digital inventory; identifying areas of high post harvest losses etc.
  » It helps in **managing inflation by giving correct estimates** of agri-products.

D) ATMANIRBHAR HORTICULTURE CLEAN PLANT PROGRAM

In order to promote the availability of disease free, quality planting material of high value horticultural crops, Government has initiated "Atma Nirbhar Clean Plant Programme" at an **estimated cost of Rs.2200 crore for a period of 7 years (2024-30)** with 50% assistance from Asian Development Bank (ADB).

The objectives of Atma Nirbhar Clean Plant Programme are:

i. To enhance yield of horticulture crops by providing disease free planting material, dissemination and adoption of climate resilient varieties.
ii. To protect ecosystem through proactive virus and disease control measures by establishing Clean Plant Centres (CPCs).
iii. To enhance stakeholder capacities for the adoption and operation of clean plant production, maintenance, and distribution.
iv. To improve the knowledge network among research institutes, universities, knowledge centers, national and state agencies for sustainable operation of clean plant centers and nursery certification programs.

2) SOME INDIVIDUAL CROPS

A) ONION

- India is the second largest producer of onion (19.9% of world production) after China.
- In India, Maharashtra(around 32%) is the largest producer of onion followed by Karnataka, Madhya Pradesh and Gujarat.

- The district of Nasik (around 40% of MHA production) of Maharashtra is famous for production of onion.

- India has three onion crops a year
  - Early kharif: (onion comes to market between October and December)
  - Late Kharif (rangda): Crop arrive between Jan and March
  - Rabi Crop: available for sale from April to May

B) TOMATO

- **Introduction**
  - » Among the vegetables consumed in India, Tomato ranks 3 after potato and Onion, but globally it is the 2nd most consumed vegetable after Potato.
    - Note: Botanically, tomatoes fit the definition of fruit as they form from a flower and contain seeds.
  - » In terms of **area under tomato cultivation** and in terms of total production, India ranks 2nd in the world.
    - The major tomato producing countries in the world are China, India, USA, Turkey and Egypt.

- **About Tomato production in India**
  - » **India's total tomato production** is around 20 million tonnes. It peaked in 2019-20 at 21.187 million tonnes and has been **declining since**. The production in 2021-22 dropped to 20.69 MT and 20.62 MT in 2022-23.
  - » It is typically a 90-100 day crop that starts yielding fruits 60-70 days after transplantation.
    - The seeds are first sown in nursery beds to raise seedlings that are transplanted in fields after around 25 days.
    - Production happen in flushes.

  - » There are two major crops of tomato annually - **Kharif and Rabi**.
  - » There are two main crops of tomato grown in the country.
    1. The first one transplanted from around **mid-June in Central and South India (**places such as Shivpuri, Sagar in **MP**, Nasik In **MHA**, Madanapalle in **AP**, Kolar and Mysore in **Karnataka** and Dindigul in **TN**) and mid-July to Aug in North India (Jhalawar and Jaipur-chomu belt in Rajasthan; Sonabhadra, Varanasi, Lucknow, Bareilly and Agra in Uttar Pradesh) and stretching to end of Sep in Eastern India (Purulia in West Bengal, Buxar in Bihar and Ranchi in Jharkhand)
       - **The autumn to late kharif crop supplies the market from Sep onwards**. This along with a smaller rabi crop transplanted during October-November, contributes to the familiar low tomato prices through the winter.

    2. The second main crop is **transplanted during January-Februar**y. This is a longer duration crop typically taking 130-150 days, yielding an average of 25 tonnes per acres.
       - This is the **summer tomato** as it is **harvested during May-July** is grown mostly in regions where maximum temperature don't go beyond the mid-to-late thirties range during the flowering and fruiting season.

» Such conditions are mostly found in relatively cool or hilly areas such as Madanapalle, Mysore, Kolar in Karnatka; Sangamner and Narayangaon in Maharashtra, or Solan and Mandi in Himachal Pradesh.

- **Why increase in Prices:**
  - » **Dip in overall tomato production due to**:
    - **i. Lower acreage of tomato**
    - **ii. Extreme Weather Conditions**
      - **i. Heatwaves and High temperatures** in April and May along with delayed Monsoon showers in southern India and Maharashtra led to attack on tomato crops.
        - Farmers in Maharashtra have said their tomato crop was impacted by attacks of the **Cucumber Mosaic Virus (CMV)** and growers in Karnataka ad other South Indian States have blamed the Tomato Mosaic virus (ToMV) for crop loss.
      - **ii.** Later, incessant rains in tomato-growing regions further affected the new crop and also made transportation to non-growing regions difficult.
    - **iii. Low commercial realization of the crop for farmers** in the months of June as well as the last year.
    - **iv. Seasonal Fluctuation**: July and August are the lean tomato production.

- **Other general challenges:**
  - » **Perishability of tomato** is much higher than Onion and Potato.
  - » **Supply chain issues** in transporting the vegetable from areas where it is grown to regions where it is not compounds the problem.

C) CUCUMBER MOSAIC VIRUSE AND TOMATO MOSAIC VIRUS (JULY 2023)

- Farmers in Maharashtra have said their tomato crop was impacted by attacks of the **Cucumber Mosaic Virus (CMV)** and growers in Karnataka ad other South Indian States have blamed the **Tomato Mosaic virus (ToMV)** for crop loss.

- The two plan pathogens have similar names and cause similar damage to crops, but they belong to different viral families, and spread differently.

- **About Tomato Mosaic Virus (ToMV):**
  - » It belongs to **the Virgaviridae** family and is closely related to **the Tobacco Mosaic** Virus (TMV).
  - » **Hosts:** ToMV hosts include tomato, tobacco, peppers, and certain ornamental plants.
  - » **Spread**ing mechanism: It mainly spreads through infected seeds, saplings, agricultural tools and often, through the hands of nursery workers who have failed to sanitize themselves before entering the field. It would require only few infected saplings for virus to take over an entire field in matter of days.
  - » **In the present case**, farmers have blamed seed manufacturers and nurseries.

- **About Cucumber Mosaic Virus (CMV)**
  - » It was first identified in cucumber in 1934, which gave the virus its name.

» **Hosts**: It has much larger host pool that include cucumber, melon, eggplant, tomato, carrot, lettuce, celery, cucurbits (member of gourd family, including squash, pumpkin, zucchini, some gourds, etc.) and some ornamentals.
» **Spreading mechanism**: They spread by aphids, which are sap-sucking insects. CMV too can spread through human touch, but the chances of that are extremely low.

- **Impact of these viruses**:
  - Both viruses can cause almost 100% crop loss unless properly treated on time.
    - The foliage of **plants infected by ToMV** shows alternating yellowish and dark green areas, which often appears as blisters on the leaves**.** Distortion of leaves and twisting of younger leaves are also symptoms. The fruit develops necrotic spots, which leads to overripening. Younger plants are dwarfed, and fruit setting is affected.
    - **CMV** too causes distortion of leaves, but the pattern is different. Often leaves at the top and bottom are distorted while those in the middle remain blemish free. Overall, it causes stunting and lower production.

- **Controlling these viruses:**
  - Following biosafety standards in nurseries, and compulsory seed treatment to stop spread of ToMV.
  - Awareness among farmers**:** Farmers who buy trays of saplings should check before planting and discard any visible infected material. They should also look for signs of infection during cropping cycle and remove any infected plants without allowing it to touch the healthy ones.
  - Any eye must be kept on aphid migration so that measures can be taken while planting the crop.

3) SPICES

A) SPICE BOARD OF INDIA

- Spices Board (**Ministry of Commerce and Industry, Government of India**) is the flagship organization for the development and worldwide promotion of Indian spices.
  » The Board is an international link between the Indian exporters and the importers abroad.
  » The Board has been spearheading activities for excellence of Indian spices, involving every segment of the industry.
  » The Board has made quality and hygiene the corner stones for its development and promotional strategies.
- It was established in 1987 under Spices Board Act, 1986 with the responsibility of production/development of cardamom and export promotion of 52 spices.
- **Key activities**:
  » Spice export promotion.
  » Quality control
  » Guiding farmers to get better yield.
  » Provisions for financial and material support to farmers.

- **Headquarter: Kochi**
  » Regional laboratories in Mumbai, Chennai, Delhi, Tuticorin etc.

B) TURMERIC AND TURMERIC BOARD

- **Turmeric** (Curcuma longa) is used as condiment, dye, drug and cosmetic in addition to its use in religious purpose.

- **India** is not only the leading producer and consumer but also the largest exporter of turmeric in the world.
  - » In the year 2022-23, a total of 3.24 lakh hectare was under turmeric cultivation with a production of 11.61 lakh tonnes (over 75% of the global production)
  - » **More than 30 varieties** of the turmeric are grown in India in more than 20 states.
  - » **Telangana (+Andhra Pradesh)** alone has 35.0% of the turmeric area and 47.0% of production.
    - **Telangana** (28.09%)
    - Andhra Pradesh (6%)
  - » **Maharashtra** (22.04%) of production comes second. I
  - » **Odisha, Karnataka, WB, Gujarat, Meghalaya, Assam**, etc. are some other major turmeric producing states.

- **Climate and Soil**:
  - » Turmeric can be grown in **diverse tropical conditions from sea level to 1500 m above sea level**, at a temperature range of 20-35oC with an annual rainfall of 1500 mm or more, under rainfed or irrigated conditions. Though it can be grown on different types of soils, it thrives best in well-drained **sandy or clay loam soils with a pH range of 4.5-7.5 with good organic status**.

NATIONAL TURMERIC BOARD (NOTIFIED IN OCT 2023)

- **GoI** notifies establishment of National Turmeric Board.
  - » The board will work towards development and growth of turmeric and turmeric products in the country.
  - » It will provide leadership in turmeric related matters, augment the efforts, and facilitate greater coordination with Spice Board, and other government agencies in the development and growth of turmeric sector.
  - » The board will also work towards usefully extracting turmeric's full potential for humanity.
- **Under Ministry of Commerce and Industry**

4) LOTUS – NAMOH 108

- **News:** Science Minister Jitender Singh unveiled a variety of lotus called '**Namoh 108'** at a function in the CSIR-National Botanical Research Institute, Lucknow. He described it as a "grand gift to the relentless zeal and innate beauty of Shri Narendra Modi, coming as it does in the 10th year of his tenure as the Prime Minister."

- **About the lotus**:
  - » It has 108 petals and was discovered several years ago in Manipur. It was kept at the National Botanical Research Institute (NBRI) as part of its collection of flowers and plants, on which the institute conducts research. However, it wasn't until four years ago that one of the scientists discovered that it had 108 petals. This number has religious significance in Hinduism.

» Other features of the flower on initial inspection was ordinary. It's fibre quality was less and it bloomed only in one season.
» Recently, it has become the first (and only) lotus variety whose gene has been sequenced. The only other lotus variety to be sequenced in the world was from China and it was completely different.

- **Scientists have also worked on its germplasm** and modified its characteristics in a way that it could be cultivated relatively easily outside the Manipur.
- **Note:** At the launch of Namoh 108, minister also launched several fibres and perfumes made from NAMOH 108.
- **CSIR: NBRI** would be soon initiating a '**Lotus Mission**' as part of larger ongoing horticulture mission to have more of the 108 Namoh flowers grown in other part of India.

5. FARMER PRODUCER ORGANIZATION (FPOS)

- **Introduction:**
  - » FPOs are collectivization of primary producers (farmers, dairy farmers, fishermen, weavers etc.), especially small and marginal farmers, to collectively address their key challenges and ensure economies of scale viz improved access to investment, technology, input and markets.
  - » While FPOs work under the **principle of cooperative societies**, their **registrations under Company's Act** provides more accountability and professionalism.
  - » Small Farmers Agri-business consortium (SFAC) has been mandated by Ministry of Agriculture, to support state governments in the formation of FPOs.

- **Aims behind FPOs/ Advantages of FPOs**
  - » **Enhance bargaining power** of farmers.
  - » **Increase farmers competitiveness** and their profits in emerging market economies.
  - » FPOs enable farmers to **enhance productivity** through efficient cost-effective and sustainable resource use and realize higher returns of their produce.
  - » FPO's also enable **integration of small farmers to the value chain**, **generating higher incomes** and **employments.**
- **Steps taken to promote FPOs/FPCs**
  - » **Central Sector Scheme** titled '**Formation and Promotion of 10,000 FPOs'**
    - Launched in Feb 2020 at Chitrakooot (Uttar Pradesh) with a budgetary provision of Rs 6865 crores.
    - Under the scheme, formation of 10,000 FPOs across the country is targeted in five years till 2023-24, while providing adequate handholding to each FPO for five years from the formation, for which the support will continue till 2027-28.
  - » **Budget 2018-19: Exemption from Income Tax** for FPOs with a turnover of upto Rs 100 crore.

6. SPECIAL AGRICULTURE PRACTICES AND ADVANTAGES

1) CROP DIVERSIFICATION

- **Introduction**
  - Crops diversification refers to **shift in cropping pattern from one or a few crops to other crops** which are more profitable, sustainable or less resource intensive.

- **Advantages**:
  - **Risk Mitigation**: Farmers growing multiple crops are less vulnerable to adverse weather conditions, pests, diseases, or **market fluctuations** affecting a particular crop.
  - **Sustainability**:
    - **Improved Soil Health**
    - **Reduce use of water and chemical fertilizers**.
    - **Planting diverse crops disrupts pest, weed and disease cycle**.
      - For e.g. Certain crops have allelopathic properties or growth habits that suppress weeds. By including such crops in a diversified cropping system, weed growth can be effectively controlled without heavy reliance on herbicide.
    - Improves the availability of fodder for livestock animals.
    - **Fighting the challenges of Monoculture**:
    - **Supports biodiversity**: By providing habitats for beneficial insects, birds, and pollinators.
    - **Resilience to climate change** as different crops will have varying level of tolerance to changing climatic conditions.
  - **Food Security and Nutrition** - Crop diversification will promote healthier diets and reduce risk of nutritional deficiency.
  - **Increased income for farmers** - By diversifying to high value horticulture crops.

- **Steps taken to promote diversification.**
  - **Crops Diversification Program (**a sub scheme under RKVY) is being implemented by government in **original green revolution states** viz. Punjab, Haryana, and in Western Uttar Pradesh to diversify paddy areas towards less water requiring crops like oil seeds, pulses, coarse cereals, agro-forestry, and **shifting of tobacco farmers to alternative cropping system** in tobacco growing states viz. Andhra Pradesh, Bihar, Gujarat, Karnataka, Maharashtra, Odisha, TN, Telangana, Uttar Pradesh and West Bengal wef from 2015-16.
    - Under CDP, assistance if provided to states for conducting cluster demonstration on alternate crops, promotion of water saving technologies, distribution of farm machineries, setting up of value addition facilities, awareness through training etc.
  - **Crop Diversification through Price Policy** -> Increasing MSP for crops which need to be promoted.
- **Status in India**
  - India has tremendous potential for crop diversification and to make farming a sustainable and profitable economic activity.

  - **The Index of Crop Diversification** (used by ESI 2017-18) analysis shows:
    i. **Declining inter-temporal behaviour** in crop diversification for the states like Chattisgarh, Haryana, MP, Odisha, Punjab and Uttar Pradesh. The decline has been sharp in Odisha (from 0.74 in 1994-1995 to 0.34 in 2014-15).
    ii. **Two states - Himachal and Jharkhand** have seen increasing crop diversification.
    iii. **For India as a whole** the crop diversification scenario appears to be stable throughout the period.

- **Factors behind decreasing crop diversification in some states**
  - **Minimum Support Price**
  - **Lack of awareness among farmers**.
  - **Limited Input Availability**:
  - **Risk Perception and Market Volatility**

2) INTEGRATED FARMING SYSTEM

- **Introduction**
  - » Integrated Farming System (IFS) is a comprehensive farming approach that c**ombines multiple agricultural activities and components within farming system** to optimize resource utilization, increase productivity, and improve sustainability. It involves the integration of crops, livestock, fisheries, agroforestry, and other allied enterprises (renewable energy - biogas generation) in a synergistic manner.
- **IFS** is helpful in sustaining agricultural production in the following ways:
  - i. **Resource Optimization and Enhanced Productivity**: Integration of various components like crops and livestocks can make efficient use of resources and minimize waste.
    - **For example**, crop residues and agricultural by-products can be utilized as livestock feed, while animal waste can be recycled as organic fertilizer for crops.
  - ii. **Nutrient Cycling and Soil health**:
    - Livestock manure and crop residues serve as organic fertilizers, improving soil fertility and nutrient availability.
    - The integration of leguminous crops in crop rotations adds nitrogen to the soil through biological nitrogen fixation.
    - Soil Conservation Practices like contour ploughing and agroforestry, help prevent erosion and maintain soil health.
  - iii. **Pest and Disease management**:
    - i. Diversity of crops and livestock reduces the risk of pest and disease outbreaks.
    - ii. Crop rotation, inter-cropping, and mixed cropping help disrupt pest life cycles and reduce pest pressure.
  - iv. **Climate Resilience**:
    - The integration of trees and agro-forestry practices help mitigate climate risks by providing shade, reducing wind speed, improving water filtration, and sequestering carbon.
    - Diverse Crop pattern is also more adaptable to climate variability.
  - v. **Economic security through income diversification**: IFS offers multiple income stream (crops, livestock, etc.) which reduces income risk associated with single crop.
  - vi. **Environmental Sustainability**:
    - **Reduced Pollution and land degradation:** IFS reduces the need for synthetic fertilizers, mitigates nutrient runoff and pollution, and enhances soil health and long-term sustainability.
    - **Biodiversity Protection**: The integration of diverse components helps conserve biodiversity, protect natural habitats, and provide ecological niche for beneficial organisms.

3) PRECISION AGRICULTURE

- **About Precision Agriculture**
  - » Precision Agriculture is a technique of agriculture which uses technology to determine the exact amount of input (water, fertilizers, pesticides etc.) required to ensure crops and soil receive exactly what they need for optimum health and productivity.

» This kind of agriculture is highly dependent on technology - Specialized equipment, software and IT.
    - It requires accessing real time data about the conditions of crops, soil and ambient air. It also needs hyper local weather predictions, labor costs, and equipment availability.
    - **Sensors** in the field measure the moisture content and temperature of the soil and surrounding air.
    - **Satellites** and **Robotic drones** provide real time images of individual farmers.

- **Advantages**
    - » **Economic Benefits**
        - Increase agri-productivity.
        - Improve the quality and reduce the cost of production
        - Improved socio-economic condition of farmers
    - » **Improve Sustainability of Agriculture**
        - Prevent Soil Degradation
        - Reduce Chemical application.
        - Efficient resource use (water, fertilizers etc.)
            - E.g. Drip Irrigation used with PA technology can reduce the amount of water used in crops.
    - » **PA** enables **Climate-Smart Agriculture**

4) MULTILAYERED FARMING

- It comprises of growing compatible plants of different heights on the same field at the same time. It is mostly practiced in orchards and plantation crops for maximum use of solar energy even under high planting density.

- **Advantages**
    - » **Efficient Land Use**
    - » **Diversification and Risk Reduction**
        - By growing variety of crops, farmers can diversify their produce, accessing different markets, and reducing price risks.
        - **Better Income**: The sale of high value crops, such as fruits, vegetables, herbs, and spices can generate higher returns compared to traditional mono-croppng.
    - » **Resource Efficiency:**
        - For e.g. different layers of crops create micro-climates that reduce water evaporation and help retain soil moisture.
        - The **crops complement each other** - for e.g. by providing shade canopy, litter, increasing moisture holding capacity of soil while nurturing microflora.
    - » **Nutrient Cycling and Soil Health**: it promotes the recycling of nutrients within the system, enhancing soil fertility and reducing the need of synthetic fertilizers
    - » **Biodiversity Conservation**: MLF creates diverse and complex habitats, supporting a range of beneficial organisms, including pollinators, beneficial insects and natural predators. Multiple crops and flowering plants provide food and shelter for a variety of beneficial organisms.
    - » **Income generation and livelihood improvement**:

- **E.g.**
  - **Coconut based multilayered farming** (Coconut, pepper, nutmeg, banana, cinnamon, turmeric, ginger) is more remunerative than traditional systems.

- **Steps being taken in India to promote Multi-Layered Farming**
  - » The Indian Institute of Farming Systems Research, Modipuram, Meerut, is **undertaking research (on-station) and technology validation** through farmer's participatory research (on-farm research) on Integrated Farming Systems and Cropping systems in 24 states.
  - » **Multi-layer Farming Models on high-value vegetable cultivation** under a three-tier system was introduced in the backward districts of Bihar by ICAR and farmers were able to grow three different vegetables on the same piece of land at a time**.**

7. NEXT CA BOOKLET

- Storage Issues
- MSP and Subsidy Issues
- Income Support: PM-KISAN
- Food Security
- FCI and its function
- PDS System
- Agri-market Reforms
- E-Technology
- Agri-Exports
- Animal Husbandry, Fishery etc.

TARGET PRELIMS 2024
BOOKLET-23; ECONOMY-4
AGRICULTURE AND RELATED ISSUES-3

1. TABLE OF CONTENTS

2. FOOD GRAIN STORAGE ISSUES

- The Food Corporation of India is the main agency for procurement, storage and distribution of food grains.

- **The requirement of Storage Capacity** in Food Corporation of India (FCI) depends upon the level of procurement, requirement of buffer norms, and Public Distribution System (PDS) operations for rice and wheat mainly.

- **Objectives**:
  - » **Feed TPDS** and other welfare schemes.
  - » **Ensure food security** during production shortfalls.
  - » **Stabilize prize.**

- **FCI** continuously assesses and monitors the storage capacity and based on the storage gap assessment, storage capacity is created/hired through following schemes:
  - **i.** **Hiring of godowns** from Central Warehousing Corporation (CWC)/ State Warehousing Corporation (SWCs)/ State agencies.
  - **ii.** **Hiring of godowns** through Private Warehousing Scheme (PWS)
  - **iii.** **Central Sector Scheme** (CSS):
    - ▫ Government is implementing a central sector scheme for construction of godowns with focus on augmenting storage capacity in the States of the NE region and a few other states.
  - **iv.** **Construction of SILOs** under PPP mode
  - **v.** **Private Entrepreneurship Guarantee (PEG)** Scheme

- This is used for storage of food grains procured for central pool by the government agencies.

- **Current Storage Capacity** (Feb 2024)
  - » As per the latest data (Feb 2024), the total storage capacity with **FCI** is **361.62 lakh tonnes**. Of this 146.86 lakh tones is owned by FCI and remaining 214.76 lakh tonnes is hired.
  - » The storage capacity with state government agencies is another **400.74 lakh tonnes**.
  - » Together it adds up to **762.36** lakh tonnes. (76 million tonnes)
  - » In addition, a capacity of around 15 million tonnes have been created by Private Entrepreneurs Guarantee Scheme.

1) IMPORTANT SCHEMES

B) WORLD'S LARGEST AGRI-STORAGE PLAN (FEB 2024)

- **Need** of such initiative:
  - » **Low food grain storage capacity in India**: Currently India has a storage capacity of **47% of its total food grains production**. In states like UP and Bihar this storage capacity is below 50%. But other countries like **China, USA, Brazil, Russia, Argentina, Ukraine, France** etc have storage capacity higher than the food grain production.

» **Multiple agencies involved in food grain management i**ncluding the Food Corporation of India (FCI), Central Warehouse Corporation, Warehouse Development Regulatory Authority, Railways, and the civil supply departments of states.

- In Feb 2024, PM Modi has announced a plan to set up the "World's largest grain storage plan **in the cooperative sector**".
  - » **Pilot project** is being undertaken in 11 Primary Agriculture Credit Societies (PACS) in 11 states.
    - ▫ **What will an integrated facility look like?**
      - The facility built at a cost of Rs 2.25 crore. The integrated modular PACs will have a custom hiring centre, a multi-purpose hall - procurement centers, primary processing units for cleaning and winnowing - a storage shed, and container storage and silos.
  - » Eventually the aim is to cover more PACs.

What are PACS?

Primary Agricultural Credit Societies (PACS) are grassroots-level institutions and their membership encompasses individual farmers, artisans, and members of other weaker sections of the society as shareholders. They form the **lowest tier of the federated short-term cooperative credit structure** with District Cooperative Banks (DCCBs) and/or State Cooperative Banks (StCBs) in their upper tiers.

They are involved in short term lending - or what is known as crop loans.

- **What is the plan expected to do?**
  - » **Set up storage infrastructure of 70 million tonnes** over the next five years at a cost of Rs 1.25 lakh crore.
    - ▫ The scheme will work on Hub and Spoke model.
      - Of the 63,000 PACS across the country, **55,767 will function as spoke** and will have a grain storage capacity of 1,000 metric tonnes each, while the remaining 7,233 PACS, which will function as hubs, will have a storage capacity of 2,000 metric tonnes each. Thus, all the 63,000 PACs will have a combined grain storage capacity of 70 million tonnes.
  - » This will enable farmers to store their produce and sell it at the right time and right price. These efforts should reduce post harvest losses; bring down food grain handling and transportation costs;
  - » This will also enable farmers to get loan from banks.
  - » The scheme will also enable PACS to undertake various other activities like Functioning as Procurement centres for State Agencies/ Food Corporation of India (FCI); Serving as Fair Price Shops (FPS); Setting up custom hiring centers; Setting up common processing units, including assaying, sorting, grading units for agricultural produce, etc.

- **Note**: Earlier in June 2023, the Union Cabinet has approved he constitution of an Inter-Ministerial Committee (IMC) to facilitate the world's largest grain storage plan in the cooperative sector. It was

chaired by Amit Shah. The IMC modified guidelines/ implementation methodologies of the schemes of respective ministries.

- **Budgetary Allocation**: The plan doesn't have a separate allocation; it will be implemented by the convergence of **8 Schemes**:
  - » **4 schemes under MoA&FW:** Agriculture Infrastructure Fund (AIF), Agricultural Marketing Infrastructure Scheme (AMI), Mission for Integrated Development of Horticulture (MIDH), and Sub Mission on Agricultural Mechanisation (SMAM)
  - » **2 Schemes under Ministry of Food Processing Industries**: Pradhan Mantri Formalisation of Micro Food Processing Enterprises Scheme (PMFME), and Pradhan Mantri Kisan Sampada Yojana (PMKSY).
  - » **2 Schemes under Ministry of Consumer Affairs, Food and Public Distribution**: Allocation of food grains under the National Food Security Act, and Procurement operations at MSP.

C) PRIVATE ENTREPRENEURSHIP GUARANTEE (PEG) SCHEME

- Launched in 2008
- **Aims**: Augmenting the covered storage capacity in the country.
- **Details:**
  - » Under the scheme godowns are constructed in PPP mode and the land and construction cost is borne by selected partners.
  - » FCI on its part **guarantees 10 year usage of storage capacities to the private investor**s and 9 years to CWC and SWCs.
  - » Locations for construction of godowns are identified by FCI on the basis of recommendations of state level committees to cover the gaps in the storage.

3. MSP, SUBSIDY AND RELATED ISSUES

1) MINIMUM SUPPORT PRICE (MSP)

- **Introduction**
  - » **What is MSP:** It is the minimum price set by the Government at which farmers can expect to sell their produce for the season. When market prices fall below the announced MSPs, procurement agencies step in to procure the crop and 'support' the prices.
  - » **Beginning:** The Minimum Support Prices (MSP) were announced by the Government of India for the first time in **1966-67 for Wheat** in the wake of the Green Revolution and extended harvest, to save the farmers from depleting profits.

- **How is MSP decided and Who takes final decision.**
  - » The Cabinet Committee of Economic Affairs (**CCEA**) announces MSP for various crops at the beginning of each sowing season based on the recommendations of the Commission for Agricultural Costs and Prices (**CACP**).
  - » The CACP takes into account demand and supply, the **cost of production (A2 + FL method)** and price trends in the market, inter-crop parity, implication for MSP on consumers, a minimum of 50% as the margin over cost of production; etc.

» The CACP calculates **three types of costs — A2, A2+FL and C2** — for each mandated crop for different states. The lowest of these costs is A2, which is the actual paid-out cost incurred by a farmer. Next is A2+FL, the actual paid-out cost plus imputed value of family labour. The highest of the three costs is **C2, defined as 'Comprehensive Cost including Rental Value of Own Land** (net of land revenue and interest on value of own fixed capital assets (excluding land))

- MSP is announced for 22 mandated crops and FRP is announced for sugarcane (**total 23 crops**)
  - » **Crops Covered under MSP:**
    - MSP is announced for **22 mandated crops** and **FRP** for Sugarcane. (**Total 23 crops)**
      - **Mandated Crops are:** 14 crops for Kharif season, 6 Rabi crops (except Toria) and 2 crash crops (Copra and Raw Jute).
      - In addition MSP for **Toria** and **De husked coconut** are fixed on the basis of MSP for rapeseed/mustard and Copra.
    - **Note:** Coffee, tea etc are not covered under MSP.
    - **7 Cereals**, **8 oilseeds**, 5 pulses, 5 cash crops - Copra, Raw cotton, Raw Jute, Virginia Flu cured (VFC) tobacco, Sugarcane.
    - **Note:** For Sugarcane Fair and Remunerative Prices (FRP) is announced that has to be paid by sugar mill owners.

Kharif Crops	**Rabi Crops**
1. Paddy	15. Wheat
2. Jowar	16. Barley
3. Bajra	17. Gram
4. Maize	18. Masur/lentil
5. Ragi	19. Rapeseed/mustard
6. Arhar (Tur)	20. Safflower
7. Moong	21. Toria (an oilseed similar to rapeseed)
8. Urad	**Other Crops**
9. Cotton	22. Copra / Dehusked Cotton
10. Groundnut	23. **VFC Tobacco**
11. Sunflower seed	24. Raw Jute
12. Soyabean black	25. Sugarcane(FRP)
13. Sesamum	
14. Nigerseed	

- **Need of MSP/ Rationale Behind MSP**
  - Protecting farmers from price volatility

- Incentivizing farmers to grow crops in short supply
- MSP also ensures easy procurement for food security schemes

- **From FY19** the MSP has been **pegged at more than 50% of cost of production for most of the Kharif and Rabi crops**. This is another step towards ensuring **income inclusiveness**.
  - » Accordingly, the Government has been increasing the MSP for all 22 Kharif, Rabi and Commercial crops with a margin of at least 50% over the all-India weighted average cost of production since the agricultural year 2018-19.
  - » Swaminathan Commission had recommended this way back in 2006.

- **Various Mechanisms under MSP to procure crops and ensure remunerative prices for farmers (Before PM-AASHA)**
  1. **For wheat and paddy -> Open Ended Procurement by FCI**
  2. **Coarse Grains -> Purchased by state government** with permission of central government, **upto the extent it is required** in their Target Public Distribution System (TPDS).
  3. **Price Support Scheme (PSS) - for oil seeds, pulses and cotton** - at the request of concerned states
  4. **Market Intervention Scheme (MIS)** for perishable horticulture commodities - at the request of states - when there is excess supply or low prices.

- **Some shortcomings in MSP Procurement Program**
  - » **Procurement is limited to few crops, few geographies and few farmers ->** only wheat and rice under open procurement -> Punjab, Haryana, Coastal Andhra benefitted a lot -> mostly big farmer benefitted
  - » There has been delays in establishment of procurement centre.
  - » Lack of awareness about MSP among large section of farmers. This leads to they getting exploited at the hands of commisison agent.
  - » **Inadequate MSP** (MSP calculation is not based on A2 + FL + C2 which was recommended by MS Swaminathan committee). It uses **A2 + FL** method.

- **Pradhan Mantri Annadata Aay Sanrakshan Abhiyan (PM-AASHA):**
  - » The scheme is aimed at increasing the MSP procurement of pulses, oilseeds, COPRA etc. This is expected to ensure remunerative price to farmers.
  - » **Three components of PM AASHA - Price Support Scheme; Price Deficiency and Payment Scheme; and Private Procurement & Stockist Scheme**
    - Note: For Oilseeds, the states will be allowed to choose between the PSS or two other schemes.
- **Note: AASHA is complementing (not replacing) complementing other schemes**
  - » Other existing schemes of Department of Food and Public Distribution (DFPD) for procurement of paddy, wheat and nutri-cereals/coarse grains and of Ministry of Textile for Cotton and Jute will be continued for providing MSP to farmers to these crops.

- **What was expected out of PM-AASHA:**
  - » Better remuneration for farmers; reduced storage and procurement requirement for government; increased private participation -> more investment in storage etc; improved food security

- **But, PM-AASHA has also not been able to increase MSP procurement a lot due to following reasons:**
  - » **Budgetary support for PM-AASHA** has been too minimal (around Rs 15,000 crore in the first year)
  - » **A number of factors preventing PM-AASHA to be inclusive:**
    - ▫ **Agri-Marketing reforms** are incomplete
    - ▫ **Poor infrastructure**: This has led to farmers remaining out of MSP regime, remaining out of MSP regime.
    - ▫ Further**, ineffective supply chain management**, has rendered the whole scheme trivial.
      - For e.g. NAFED has a stock of 4 million tonnes of pulse and oilseeds, but their distribution policy is non-existent.
  - » **State Financial condition** may not be strong enough for the program.

- **Other Criticism of MSP mechanism in general**
  - » **MSPs causes market distortion**
  - » **Cropping pattern** is affected and farmers tend to grow high MSP crops rather than the most suitable crop for the region.
    - ▪ **Excess fertilizer and water guzzling crops** makes agriculture unsustainable.
  - » **Higher inflation**
  - » **Cost Plus Pricing** is risky as it ignores the demand side, i.e. demand-supply, domestic and international price trends, terms of trade, inter-crop price parity etc.
  - » **Leads to less focus on non-price factors** like technology, inputs, services, institutions and infrastructure
    - ▪ High fiscal burden on government
  - » **Bigger stock exceeds the stock holding norms of FCI**
  - » **WTO' AOA issues** (discussed with WTO issues separately)

2) FARMER'S PROTEST: A LAW GUARANTEEING PROCUREMENT AT MSP: IS IT VIABLE

- **Background**:
  - » According to Shanta Kumar Committee report, **only 6% of the farm households sell wheat and rice to the government at MSP rates**.

- **What are the different ways in which MSP guarantee can be ensured?**
  - » **Force traders to buy at MSP:** Any buying of agri-produce (be it by private traders), would be on MSP (something similar happens in case of sugarcane).
    - » Something like this happens in case of sugarcane farmers.
    - » But there are **implementation hurdles** - delay and arrear in price payment; distortion of market;
  - » Government can make MSP procurement itself.
    - » **Criticism:** If government buys all produce this will be **unsustainable** - both physically and fiscally.
  - » Government can go for price deficiency payment mechanism.
    - » Something similar was implemented in Madhya Pradesh (Bhavantar Bhugtan Yojna) during the 2017-18 Kharif season for eight crops: urad (black gram), soyabean, maize,

Arhar (pigeon pea), Moong (green gram), groundnut, sesame, and nigerseed. But **scheme couldn't be continued** due to lack of support from central government.

» **Haryana** is implementing **Bhavantar Bharpai Yojna (BBY)** mainly for Bajra (pearl millet), mustard, and sunflower seeds. Technically it also covers groundnut, chana, moong, and 16 vegetables and 3 fruit crop.
  - The scheme operates on the Haryana Government's '**Meri Fasal, Mera Byaura portal**' in which farmers have to register themselves along with details of their land (village name, khasra plot no, holding size tc) and area sown under different crop.

» and Haryana (Bhavantar Bharpai Yojna).

- **Need of guaranteeing MSP:**
  - » It would **improve opportunities of fair prices** by farmers. It would encourage farmers to invest more in agriculture and increase productivity.
    - **Note:** As per census and National accounts data, the percentage of farmers benefitting from MSP is **5.6%** and the value of agri-produce benefitting from the MSP regime is a **paltry 2.2%**.
  - » **Promote crop diversity** as under guaranteed MSP, other crops would also fetch the MSP.
  - » **Other advantages of MSP**

- **Is it feasible?**
  - » Various estimates show that government will have to bear an additional **5 lakh crore** rupee of fiscal burden. This will be a logistical nightmare at best, and fiscal disaster at worst.
  - » **FCI stocking operations** is full of flaws and losses -> Wastage, corruption,
  - » **Discourage market forces**
  - » **Other problems associated with MSP** (discussed in the above topics)

A) DEMANDS FOR WHICH FARMERS ARE PROTESTING

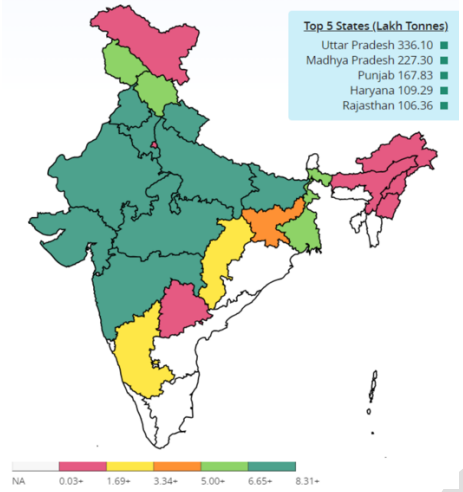
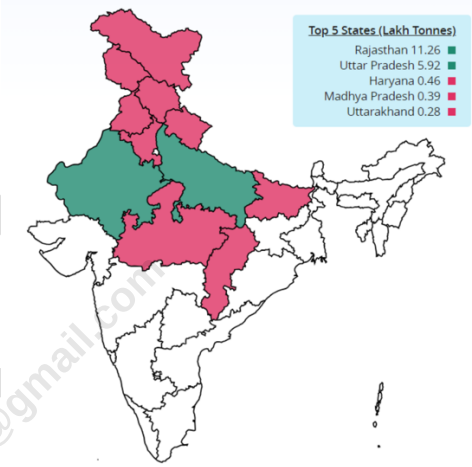
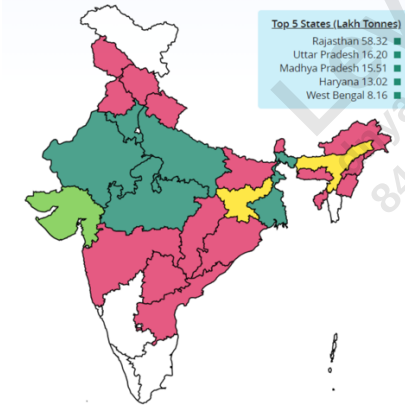
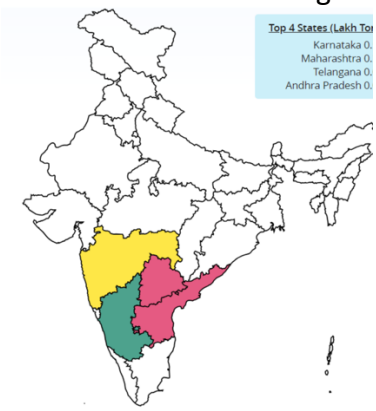
1. Full debt waiver for farmers and labourers;
2. Implementation of the Land Acquisition Act of 2013, with provisions for written consent from farmers before acquisition, and compensation at four times the collector rate;
3. Punishment for the perpetrators of the October 2021 Lakhimpur Kheri killings;
4. India should withdraw from the World Trade Organization (WTO) and freeze all free trade agreements;
5. Pensions for farmers and farm labourers;
6. Compensation for farmers who died during the Delhi protest, including a job for one family member;
7. Electricity Amendment Bill 2020 should be scrapped;
8. 200 (instead of 100) days' employment under MGNREGA per year, daily wage of Rs 700, and scheme should be linked with farming;
9. Strict penalties and fines on companies producing fake seeds, pesticides, fertilisers; improvements in seed quality;
10. National commission for spices such as chili and turmeric;
11. Ensure rights of indigenous peoples over water, forests, and land

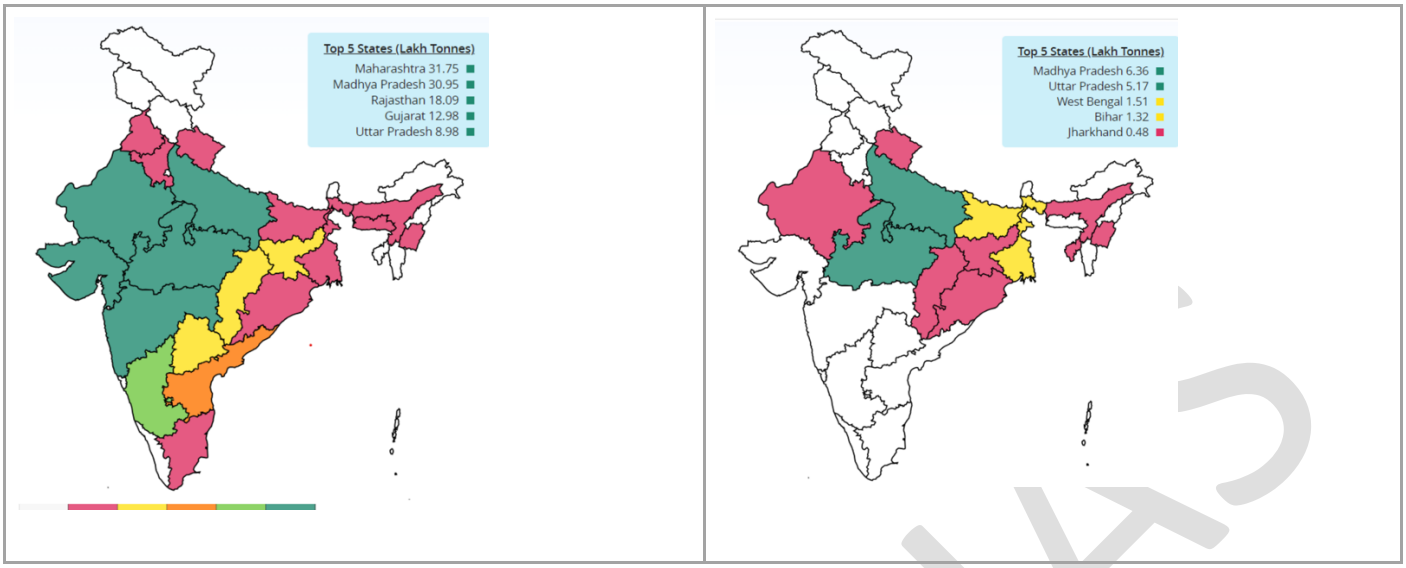
1) FOOD SUBSIDY BURDEN OF GOVERNMENT

- **FY25 (BE)** Food subsidy bill 2.05 lakh crore (less than Rs 2.12 lakh crore in FY24)
- For FY23, government had spent Rs 5,32,446 crore on subsidy.
  - » This includes Food Subsidy (Rs 2.8 lakh crores), Fertilizer Subsidy (Rs 2.1 lakh crores), and Petroleum subsidy (Rs 30,756 crore).
  - » It was the 2nd highest ever after the 7.06 lakh crores of FY 2021.

2) MSP ANNOUNCED FOR VARIOUS RABI CROPS (OCT 2023)

- **Crop (MSP per quintal, Increase from last year):** Wheat (2275, 150), Barley (1850, 115), Mustard & Rapeseed (5440, 105), Safflower (5,800; 150); Gram (5,440; 105) and Lentil (masur) (6,425; 425)

Wheat Production, 2022-23 (Final Estimate)**: UP> MP> Punjab> Haryana>Rajasthan** 	**Barley Production, Final Estimate, 2022-23**: Final Estimate 2022-23: Raj> UP> Haryana> Madhya Pradesh> Uttarakhand 
Mustard & Rapeseed Production Final Estimate (2022-23): RAJ> UP > MP> Haryana > WB 	**Safflower Production** 2022-23 (Final Estimate): Karnataka> MHA> Telangana> Andhra Pradesh 
Gram Production Final Estimate (2022-23): MHA> MP > Rajasthan> Gujarat > Uttar Pradesh	**Lentil Production** 2022-23 (Final Estimate): MP> UP> WB > Bihar> Jharkhand



3) COMMISSION FOR AGRICULTURE COST AND PRICES (CACP)

- The commission for Agricultural Cost & Prices (CACP since 1985, earlier named as Agricultural Prices Commission) was formed in 1965 and is an attached office to Ministry of Agriculture and Farmers Welfare, GoI. It is also a **statutory body**.

- **Structure:**
  - » Chairperson
  - » Member Secretary
  - » One Member (official)
  - » Two Members (non-official) - representatives of farming community

- It is mandated to recommend minimum support prices (MSPs) to incentivize the cultivators to adopt modern technology, and raise productivity and overall grain production in line with the emerging demand patterns in the country.
- As of now CACP recommends MSP for 22 crops and FRP for Sugarcane:

- **Note:** the final decision for MSP of a crop is taken by Cabinet Committee on Economic Affairs (CCEA).

4) FAIR AND REMUNERATIVE PRICES (FRP)

- **FRP** is the minimum price sugar mills have to pay to farmers for sugarcane.
  - » In 2009, Sugarcane (Control) Order, 1966 was amended to replace statutory minimum price (SMP) of sugarcane with FRP.
  - » FRP is decided by Cabinet Committee on Economic Affairs on the recommendations of Commission for Agriculture Costs and Prices (CACP) and in consultation with state governments and industry.
  - » There is also a threat of action by cane commissioners, in case of failure to clear FRP dues within 14 days of the cane being sold to farmers. Non-clearance can also lead to attachment of mill properties as arrears of land revenue.

- **State Advised Price (SAP)**: Some states like Haryana, Uttar Pradesh, and Punjab offer higher prices for sugarcane under state advised price (SAP), which mills in those states must abide by.

- **Why FRP for sugars** (and MSP for other 22 crops)
  - » **Sugarcane** has very small shelf life and thus farmers are forced to sell immediately, which may bring prices very low.
  - » Further, **other crops can be sold at prices higher than MSP**, but this is very less likely for sugar as all the sugarcane is sold right after harvesting and thus market prices would be very low.

- Cabinet approves 'Fair and Remunerative Price' (FRP) of sugarcane payable by sugar factories for sugar season 2024-25 (Oct-Sep) **[Feb 2024:** Source PIB**]**
  - » FRP = Rs 340/ Quintal at sugar recovery rate of **10.25%**.
  - » This is about 8% higher than FRP of sugarcane in current season (2023-24). The revised FRP will be applicable w.e.f. 1st Oct 2024.
  - » It is also 107% higher than A2 + FL cost.
  - » **Note**: India is already paying highest price to sugarcane farmers in the world and at the same time ensuring cheapest sugar for Indians.
  - » Note: The new FRP will kick in from 1st Oct 2024.

- **Minimum Selling Price (MSP) for Sugar**:
  - » The central government had in**troduced Minimum Selling Price (MSP) for sugar in 2018**.
    - ▫ It was fixed at Rs 2,850 per quintal which was subsequently raised to Rs 3,100 per quintal. This was part of the measures announced to arrest the constant slide of sugar and to keep the demand and supply ratio to a safe limit.
    - ▫ The Centre had also fixed **mill-wise sales quota**. Mills which breached either of the conditions were liable for action under the Essential Commodities Act, 1955 which would include a fine as well as a jail term (ranging from 3 months to 7 years) or both.

5) PM KISAN (PRADHAN MANTRI KISAN SAMMAN NIDHI)

- **Why in news?**
  - » Interim Budget 2024-24 Speech: 11.8 crore farmers receive financial assistance

- **PM KISAN** is a central sector scheme to supplement the financial needs of landholding farmers. It was announced in the Budget 2019-20.
- **Purpose**
  - » Income Support to help declining income of farmers, supplement financial needs for input procurement etc;
- **Provisions of the Scheme**
  - » Under the scheme financial benefit of Rs 6,000 per year is transferred into the bank accounts of farmer families through **DBT** in three equal instalments of Rs 2,000 each.
  - » The scheme covers **all 14.5 crore landholder farmer families** in the country.
  - » **Exclusions**
    - All institutional landholders
    - Farmer families where one or more of its members belong to following categories

- Constitutional post holders, ministers, Member of Parliament, MLAs, MLCs, Mayor of Municipal Corporation, Chairpersons of District Panchayats (in past or presently)
- Serving or retired officers of Central/State governments (excluding Multi-Tasking staff/ Class IV/ Group D employees)
- All superannuated retired personnel whose monthly pension is Rs 10,000 or more (excluding Multi-Tasking staff/ Class IV/ Group D employees)
- Professionals like Doctors, Engineers, Lawyers, CAs, and Architects registered with professional bodies and carrying out profession by undertaking practices.

- **State/UT government** will be responsible for **identifying the eligible families**. List is published at village level to ensure transparency.

- **Progress So far:** Around 11.8 crore farmers were covered under the scheme in Jan 2024.

- **Analysis: Positives**
  1. **Reduce Agri-Distress**
  2. **Boost Productivity**
- **Key Concerns/ Limitations**
  1. **Funds -** Fiscal burden.
  2. **Small impact on farmer's income**
  3. **Withdrawing the scheme will be challenging** considering the political economy that comes into play

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A) PM KISAN MOBILE APP WITH FACE AUTHENTICATION FEATURE (JUNE 2023: SOURCE - PIB)

- The PM-KISAN mobile app was launched in Feb 2020. The provision for e-KYC through face authentication introduced in June 2023.
- It will enable farmers to complete their e-KYCs effortlessly from their mobile devices. Farmer can also assist upto 100 other farmers in their vicinity with their e-KYCs. Additionally, state government officials, including district, block, and village level-nodal officers, can perform e-KYC for 500 farmers using their registered mobile number.
  - It will also resolve difficulties related to Aadhar verification and updating bank account details on PM KISAN portal through effective use of digital public goods.
- Note: The PM KISAN Scheme's services are also accessible through more than 4.0 lakh CSCs across the country.

1) INCOME SUPPORT TO FARMERS: STATE LEVEL SCHEMES

1. **Rajiv Gandhi Kisan Nyaya Yojna**
   - It is a **income support** scheme for farmers, Launched by Chhattisgarh government in May 2020.

2. **YSR Rythu Bharosa Scheme: Rs 13,500 for Farmers** (launched in 2019)
   - **Details about Rythu Bharosa**
     - The program is available for five years.
       - Every year, before the start of the Kharif season, an input assistance of Rs 7,500 will be provided to each farmer. Another Rs 4,000 will be provided at the time of

harvesting, just before the start of Rabi season. And the last instalment of Rs 2,000 would be provided at the time of farmers' festival of Sankranti.

- 54 lakh farmers have been identified for the scheme (including tenant farmers).
- Note: Rs 6,000 per head in the scheme comes from PM-Kisaan Samman yojna

3. **Ryuthu Bandhu** scheme of the neighbouring Telangana.
   - In Telangana the support was based on the size of land ownership (**Rs 4,000 per acre**). However, in AP every beneficiary will be given same amount, whereas in

4. **KALIA** (Krushak Assistance for Livelihood and Income Augmentation) of **Odisha government**
   - Covers 75 lakh farmers, including 25 lakh landless agricultural households.
     - It entitles each one of them Rs 10,000 per year payment for two crops (Kharif and Rabi**)**

5. **Krishak Bandhu Yojana** of **West Bengal**
   - Provides Rs 5,000 in two instalments to the state's estimated 72 lakh farmers and sharecroppers cultivating one acre or less.
6. **Mukhyamantri Krishi Ashirwad Yojna** of Jharkhand provides Rs 5,000 per acre (maximum Rs 25,000) annually to estimated 22.76 farmers owning up to five acres in land.
7. **Mukhyamantri Parivara Samman Nidhi Yojna** of Haryana limits the annual financial assistance at flat Rs 5,000 for agricultural families (including landless labourers) with less than five acres and also monthly income below Rs 15,000.

4. PM KISAN MANDHAN – PENSION SCHEME FOR FARMERS

- It is a government scheme meant for old age protection and social security of **Small and Marginal Farmers** (SMF).
  - » **Eligibility:**
    - All SMF in the age group of 18-40 years, and whose name appears in the land records of the state as of 1st Aug 2019.
  - » **Benefits:**
    - Minimum assured pension of Rs 3,000/- pm after attaining the age of 60 and 50% of the pension amount to spouse after the death of the farmer. (Family pension is applicable only to spouse)
  - » **Other features to note:**
    - It is a voluntary and contributory pension scheme (monthly contribution between Rs 55 to Rs 200 per month till the age of 60)
    - Matching contribution will be made by the government.
    - **LIC** will be the pension fund manager of the scheme.
  - » **Synergy with PM-KISAAN ->** Farmer can ask for withdrawal form PM-KISAAN for this scheme
  - » **Exceptions**
    - SMFs already covered under any other social security schemes like NPS, ESIC, EPFO etc.
    - Who opted for Shram Yogi Maandhan Yojana or Vyapari Maandhan administered by Ministry of Labour and Employment.
    - Other exceptions similar to PM-KISAN
  - » **Should Possess**
    - Aadhaar
    - Saving Account/PM-KISAAN Account
- **Need:**

» 90% of Indian workforce not covered under old age pension initiative

5. FOOD SECURITY

- **What is Food Security?**
  - As per the Committee on World Food Security, the food security exists when all people, at all times, have **physical, social and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences** for an active and healthy life.
  - The **Four Pillars** of food security are availability, access, utilization, and stability (both price and supply).

- **Key Initiatives to Promote Food Security in India**:
  - » **National Food Security Act, 2013:** It seeks to provide subsidized food grains to approximately 2/3rd of India's population.
    - Other than this, Mid-Day Meal Scheme, Integrated Child Development Program, and the PDS system are focused on ensuring nutritional security.
  - » **Various initiatives at state level include:**
    - '**Indira Canteen**' initiative by the state of Karnataka, which serves breakfast, lunch and dinner at very low prices.
    - **'Amma Unavagam'** (Mother's Canteen) is an initiative by TN.
  - » **Government also takes** several initiatives to control food inflation:
    - **Maintaining Buffer stocks**
    - **Controlling** Exports in case of scarcity
    - **Using MSP** mechanism to encourage farmers to grow crops which are in shortage.

2) NATIONAL FOOD SECURITY ACT, 2013

- **Introduction:**
  - The NFSA, 2013 seeks to provide for food and nutritional security in human lifecycle approach, by ensuring adequate quantity and quality of food at affordable prices to people to live a life with dignity and for matters connected therewith and incidental thereto.

- **Salient Features of the Act are:**
  - It gives legal entitlement to **75% rural and 50% of the urban population** (which come to 2/3rd of country's population) for subsidized grains under TPDS.
  - It moves from **'household food entitlement' to 'individual food entitlement'**. Every individual is entitled to 5 kg of rice, wheat, or coarse cereals a month at Rs 3, Rs 2 and Rs 1 per kg. The beneficiary is identified by the state government based on the parameters decided by centre.
  - The entitlement for Antyodaya Anna Yojna (AAY) will remain at Rs 35 kg per household.
  - **For pregnant and lactating mothers**, the act provides for free meal at the local anganwadi (during pregnancy and upto six months after child birth) as well as maternity benefits of Rs 6,000 in instalments.
  - **For Children:**
    - Below 6 months: 'Exclusive breast feeding shall be promoted)

        - **Six month to six years**: The age guarantees an age appropriate meal, free of charge, through the local anganwadis.
        - **Six years to 14 years:** One free mid-day meal, shall be provided everyday (except on school holidays) in all school run by local bodies, government and government aided schools, upto Class VIII.
    - The act also provides for the Creation of State Food Commissions which will monitor and evaluate the implementation of the act, give advice to state governments and will enquire into violations of entitlement.
    - **Food Security Allowance** in case of non-supply of the entitled quantities of foodgrains or meals to entitled persons under the act.
    - **Schedule 3 of the act** also lists various provisions for advancing food security, under three broad categories:
        - Revitalization of Agriculture; reforming procurement, storage and movement; other provisions like drinking water, sanitation, health care, adequate pensions for senior citizens, persons with disability and single women.

- **Progress:**
    - NFSA has been implemented in all 36 states/Uts covering more than 80 crore persons.
    - Direct Benefit Transfer: In Chandigarh, Puducherry, and Urban areas of Dadra and Nagar Haveli, the act is being implemented in the cash transfer mode.

- **How has it contributed in reducing Hunger:**
    - Increased food availability for weaker section. It is visible in increased government food subsidy burden.
    - By taking a lifecycle approach, it has ensured the right from the time women get pregnant to the death of a person, if the person is vulnerable, she would get food security support.
    - With improved used of technology, like Aadhar based authentication, leakage has reduced.
    - **One Nation One Ration Card (ONORC)** will also ensure that migrants are able to enjoy the benefits of NFSA.

- **Challenges:**
    - Fiscal Burden; Leakages and Siphoning; Identification of Beneficiaries issues; Infrastructural issues; Aadhar Related Issues; Social and Cultural Factors;

6. PUBLIC DISTRIBUTION SYSTEM AND ASSOCIATED ISSUES

- **Introduction**
    - The Public distribution system (PDS) evolved as a system of management of scarcity and for distribution of food grains at affordable prices. Over the years, PDS has become an important part of Government's policy for management of food economy in the country.
    - **Note**: PDS is supplemental in nature
    - **Responsibility:** PDS is operated under the **joint responsibility of the Central and the State Government**.
        - **Central Government**, through Food Corporation of India (FCI), has assumed the responsibility of procurement, storage, transportation and bulk allocation of food grains to the state governments.

- » **State government** own the operational responsibilities including allocation within state, identification of eligible families, issue of Ration Cards and supervision of the functioning of the fair price shops (FPSs).

- **Commodities:**
  - » Under the PDS, presently the commodities namely **wheat, rice, sugar and Kerosene** are being allocated to the States and UTs for distribution.
  - » **State governments** also distribute additional items of mass consumption through the PDS outlets such as pulses, edible oils, iodized salts, spices etc.

- **Evolution of PDS**
  - » Emanated in critical food shortages of 1960s. Initially began with focus on **urban scarcity area**. It contributed to containment of price rise and ensured access to food grain to urban consumers.

  - » With increase in food production, primarily due to green revolution, the outreach of PDS was extended to **tribal blocks and high poverty incidence areas** in 1970s and 1980s.
  - » Till 1992, it remained a general entitlement.

  - » In 1992**, Revamped PDS** was launched in 1775 blocks throughout the country - where a substantial number of poor lived.

  - » **Targeted PDS (TPDS)** was started in 1997 with focus on the poor.
    - **Three core TPDS categories:** Under the TPDS, households are classified in accordance with a set of socio-economic parameters and provided with a ration card on this basis. Across India, the three core PDS card categories are above poverty line (APL), below poverty line (BPL) and Antyodaya (poorest of the poor) (**AAY** was started in 2000).

  - » **Antyodaya Anna Yojana (AAY)**
    - In order to take TPDS more focused and targeted this category of population, the AAY was launched in December 2000 for 1 crore poorest of the poor families among the number of BPL families covered under TPDS within the states and providing them food grains at **highly subsidized rate of Rs 2 per Kg for wheat, Rs 3 per Kg for rice**. The states/UTs are required to bear the distribution cost, including margin to dealers and retailers as well as the transportation cost.
    - **The scale of issue** was initially **25 Kg per family per month** and was increased to **35 Kg per family per month with effect from April 1 2002**.

  - » **TPDS under National Food Security Act, 2013**
    - NFSA, 2013 was notified on 10th Sep 2013.
    - It covers 2/3rd of the entire population (75% of rural population and 50% of the urban population) under two categories of beneficiaries: 1) **Antyodaya Anna Yojana** (AAY) and 2) **Priority Households (PHH)**. .

- Under the NFSA, 2013, the **priority households** are entitled to receive food grains **@5 Kg per person per month** at the issue price of Rs. 3.00, Rs. 2.00 and Rs. 1.00 per Kg for rice, wheat and coarse grains respectively. **The existing AAY households**, however, continue to receive 35 Kg of food grains per household per month.

- **Pradhan Mantri Garib Kalyan Anna Yojna**
  - A Part of Atmanirbhar Bharat Abhiyan.
  - It was launched to provide additional allocation of foodgrains from the Central Pool at the rate of 5 kg per person per month **free of cost** for all the beneficiaries covered under TPDS (AYY & PHH) including those covered under DBT for a period of 3 months i.e. April - June 2020.
  - It has continued to be extended since then.
  - In **Nov 2023**, the government has declared the extension of PMGKAY for an additional **five years till 2028**. The implementation of this extension began from 1st Jan 2024.

- **Key Challenges faced by the PDS system**
  1. **Corruption and Leakage**; **Inaccurate targeting of beneficiaries**; **Heavy losses in storage and transportation**; **Later and Irregular arrival of grains in fair price shops**; **WTO's Agreement on Agriculture**; **Nutritional challenges due to lack of focus on food diversity**; **Digitization of PDS**

- **REVAMPING PDS**
  - » **Steps being Taken.**
    a. **Decentralization of Procurement Process**
    b. **Integrated Management of Public Distribution System -** (IM-PDS): Integrate PDS system/portals of states/UTs with Central Systems/portals with and aim to introduction of national portability, and de-duplication of ration cards/beneficiary etc.
    c. **One Nation One Ration Card (ONORC) -** To ensure that even migrant workers are able to enjoy the benefit of Public Distribution system.

3) ONE NATION ONE RATION CARD (ONORC)

- **What is a Ration Card?**
  - » PDS families are **issued Ration Cards** to access this benefit. Currently, around 23 crore ration cards have been issued in all states and UTs.
  - » **Before the ONORC system,** a ration card could be used to access subsidized grains from the fair price shop assigned in the **locality**. A migrant was not able to access subsidized grains in new locality.

- **One Nation, One Ration Card (ONORC)**
  - ONORC is being implemented under NFSA, 2013. it allows beneficiary to buy subsidized food grains from any FPS shop in the country, by using the same ration card after biometric/Aadhar authentication on electronic Point of Sale (ePOS) devices.

- **How does ONORC work?**
  - » Integrated Management of Public Distribution System (IM-PDS) portal, provide the technical platform for the inter-state portability of ration cards.
  - » **Biometric authentication** on ePOS devices enable beneficiary to purchase the entitled food grains under the NFSA.
  - » **Annavitran.nic.in** hosts the data of distribution of foodgrains through E-PoS devices within a state.
    - It allows availing of PDS benefit outside the district but within the home state.
  - » **Standard Format of ration cards** which ensures an unique ID of each customer.

- **How much foodgrains cane be procured?**
  - Only the migrants' entitlement, the rest of the grains would be procured by the family back home.

- **Steps being taken**
  - **Seeding of Ration Cards** with Aadhaar numbers, **Installation of ePOS devices** at all FPS
  - Once 100% target of both these are reached, the all-India portability of ration cards will become a reality.

- **Needs/Advantages of One Ration Card**
  - **Right to Food:** Enable **migrant families to access PDS benefits** from any Fair Price Shop in the country.
  - **End Discrimination and Improve the quality of service**
  - **Aadhaar seeding** would also **weed out duplicate ration cards**
  - It could be highly crucial for emergencies like the COVID-19 crisis.

7. AGRI-MARKETING REFORM

- **Efficient Agri-marketing is crucial for:**
  1. **Ensuring proper prices for farmers; Lower prices for consumers**; Stimulating **agro-based and food processing industrial growth.**
  2. **Reduced subsidy burden for government.**

- However, the Agri development in India has ignored the potential of marketing and has continued to follow its old trajectory. Since, agri-marketing is a state subject, it is stuck in a tussle between Centre and states.

- **How has the system functioned so far? -> The APMC System and its issues**
  - The Agri markets in India are mainly regulated by the state Agriculture Produce Marketing Committee (APMC) laws. These laws enable state governments to regulated wholesale markets and marketing practices. APMC Acts make in mandatory for farmers to sell their produce only to licensed merchants (can also be called government approved merchants) at Mandis set up by State Agriculture Market Boards.

- **What was the need of APMC Laws / Regulated Markets (Mandis)**

- In the absence of any market regulations, the farmers were being exploited by traders and intermediaries.
- The regulated Mandis prevented the exploitation by ensuring **fair prices through bidding process** at these regulated markets.

- **Current Situation**
  - India currently has around 2500 principle regulated primary agricultural markets in the country which are governed by state APMC Acts and administered by a separate Agricultural Produce Marketing Committee.
  - APMCs regulate the trade of farmers by
    - Providing **licenses** to buyers, commission agents, and private markets.
    - Levy **market fees** or any other charges on such trade.
    - Provide **necessary infrastructure** within their market to facilitate trade.
  - Trade is allowed withing the APMC mandis or between two APMC mandis situated in the same state.

- **How these Mandis have served farmers**: These APMCs have ensured that fruits of Green Revolution reach farmers.
  - **Reduction in exploitation by intermediaries** - not allowed to sell products outside the mandi
  - **Good Price: Sale through auction** -> best possible prices available.

- **But, present APMC structure has led to many challenges/limitations**
  - **Price Fixing, Cartelization** by licensed traders;
  - **Information asymmetry** and opaque process for price discovery.
  - **Undue deduction** in the form of commission charges and market fees.
  - **Fragmentation of agri-market**
  - **Hindered private investment in agri-marketing -> Poor Infrastructure and low use of technology**
    - As according to APMC acts, only state governments could set up these Mandis.

- **To remove the above limitations, the central government has taken many steps:**
  1. **Model APMC Acts**
  2. **Bihar** has completely done away with APMC act and **Kerala** had never implemented it. **Maharashtra** is also trying to liberalize the state APMC law.
  3. Promotion of **e-NAM** by central government for promotion of unification of markets both at state and national level.
  4. Development primary markets / submarkets as **GrAMs** (Gramin Agriculture Markets) with improved infrastructure
  5. Creation of **Agri Market Infrastructure Fund (AMIF)** for development and upgradation of Gramin Agriculture Markets.

- **The three farm laws and their repeal** [2020 and 2021]
  1. **The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020 [FPTC]**
     - It sought to create an ecosystem where farmers and traders enjoy the freedom of choice to sale and purchase of farmer's produce. The law granted freedom to farmers and buyers to transact in agriculture commodities even outside APMC mandis ensuring

competitive alternative trading channels to promote efficient, transparent, and barrier free inter-state and intra-state trade.

- It also allowed electronic trading and abolished market fees, cess or levy.
- It allowed electronic trading and e-trading platform could be set up by companies, partnership firms, or registered companies.

2. **The Farmers' (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act [FAPAFS], 2020**
    - The act provided for national framework for contract farming which protects and empowers the farmers in their engagement with agri-business firms, whole sellers, processors etc.
    - The act regulated the farming agreement and ensured a guaranteed price and mechanism for determining the guaranteed price.
    - It had also established a well-defined, fast tracked, dispute settlement system with SDM as adjudication authority and DM as the appellate authority.

3. **the Essential Commodities (Amendment) Act, 2020 [ECA]**
    - It sought to remove commodities like cereals, pulses, oilseeds, edible oils, onion and potatoes from the list of essential commodities. The amendment was aimed at ending the era of frequent imposition of stock-holding limits except under extraordinary circumstances.
        - As per this law stock limit could be imposed only if there was huge prize fluctuations (100% price rise for horticulture crops or 50% increase in retail price on non-perishable agri-good).

- **Some committees/reports which had recommended similar changes in the APMC** system.
    - Expert Committee on Strengthening and Development of Agriculture Marketing - Chairman: **Shri Shakerlal Guru (**June 2011)
    - Report on Task Force on Employment Opportunities - Chairman: Shri **Montek Singh Ahluwalia** (2001)
    - Model Act on Agriculture Marketing Reforms - Chairman: Shri R.C.A Jain (July 2001)
    - Model Act on Agriculture Marketing (Sep 2003)
    - Serving Farmers and Saving Farmers - First Report - **National Commission on Farmers - Chairman: Dr. M.S. Swaminathan (2004)**
    - Final Report of Committee of State Ministers, in-charge of Agriculture Marketing to Promote Reforms
    - Budget 2017-18
    - **Standing Committee on Agriculture,** Ministry of Agriculture and Farmers Welfare : Agriculture Marketing and Role of Weekly Graamin Haats (2018-19)
    - **Several Economic Surveys**

- **Why farmers protested?**
    - **Doubts about MSP regime weakening** due to private markets and players
    - **Unregulated markets may be problematic for farmers.**

- **Lack of Focus on Marketing Infrastructure -> APMC Mandi infra may deteriorate** -> the changes may have resulted in gradual erosion of the quality of trading infrastructure as was seen in case of Bihar after APMC Act was repealed in 2006.
- **In Contract Farming** it had been seen that small and marginal farmers are generally on the losing side with highly one-sided contracts, delayed payments, undue rejections and outright cheating besides poor enforcement of contracts. Further, the adjudication of dispute was left in the hands of executive.

- There was a **gross communication failure** on the part of the Central government to explain to farmers what these laws are, and how they are intended to benefit them.

4) E-NAM

- **Introduction: e-NAM**
  - » e-NAM is a pan India **electronic trading portal** for farm produce which creates a **unified national market** for agricultural commodities by i**ntegrating existing APMC markets** and other market yards. It was launched in **April 2016**.

  - » The **Small Farmers' Agribusiness Consortium (SFAC)** acts as the leading implementing agency of e-NAM. It operates and mantains the platform with the help of a strategic partner, NFCL
  - » This portal provides a **single window service** for all APMC related services and information, such as commodity arrivals and prices, provision of responding to trade offers, buy and sell trade offers, among other services.

  - » Under e-NAM, the Government provides free software and one time assistance of Rs 75 lakh per mandi for computer hardware and IT infrastructure.
    - The hardware includes quality assaying equipment and creation of infrastructure for cleaning, grading, sorting, packaging and compost unit, etc.

- **Salient Features**
  - » It provides for a **national e-market** platform for transparent sale transaction.
  - » It **enables farmers to showcase their produce** through their nearby markets and **facilitate traders from anywhere to quote price**.
  - » **Liberal licensing** of traders / buyers and commission agents by state authorities.
  - » There are **no preconditions for physical presence** or possession of shop/premises in the market yard.
  - » **One license** for the trader would be valid all across the country.
  - » **Single point levy of the market fee**, i.e. on the first wholesale purchase from the farmer
  - » **Harmonizing the quality standards of agricultural produce** and infrastructure for quality testing is made available in every market to enable informed bidding by buyers. At present, Common tradeable parameters have been developed in 25 commodities.
  - » **States desirous to join** has to accordingly **enact suitable provisions in their APMC Act**.
    - The amendments include a single point levy of mandi fee, unified trade license valid across all mandis of the state, and provision for e-auction facilities.

» States can have their own electronic platform and can decide to link them to NAM.

Budget 2024-25: About E-NAM: There has been an integration of 1,361 mandis under e-nam, supporting trading volume of around 3 lakh crores.

5) GRAMIN AGRICULTURE MARKETS (GRAMS)

- **About GrAMs (According to Budget 2018-19)**
  - » Existing 22,000 rural haats will be upgraded to **Gramin Agriculture Markets (GrAMs)**.
    - ▫ In these GrAMs physical infrastructure will be strengthened using MGNREGA and other government schemes.
    - ▫ These GrAMs will be electronically linked to e-NAM and exempted from regulations of APMCs. This will provide farmers with facilities to make direct sale to consumers and bulk purchasers.
    - ▫ An **Agri-Infrastructure Fund** with a corpus of Rs 2000 crore will be set up for developing and upgrading the agricultural market infrastructure in the 22000 Grameen Agricultural Markets (GrAMs) and 585 APMCs.
    - ▫ Prime Minister Gram Sadak Yojana Phase - III will ensure these GrAMs are connected to major link roads.

- **How will it benefit farmers?**
  - » GrAMs will serve as multi-purpose platforms for assembly, aggregation and local retail; It will enable flow of market intelligence and thus better price realization for farmers; even small and marginal farmers will benefit from E-NAM; improved infrastructure;
  - » Thus, GrAMs will provide systematic linkage access points to realize the vision of **Unified National Market** by bringing primary post production activities to farmers at village level.

6) AGRI-INFRASTRUCTURE FUND

- It is a central sector scheme which provide a medium to long term loans for investment in viable projects for **post-harvest management infrastructure and community farming assets**.
  - » Loans to be disbursed for only 6 years (2020-21 to 2025-26)
  - » Interest subvention and credit guarantee assistance will be given until 2032-33.

- **Intended beneficiaries:** Rs 1 lakh crore to be provided by banks and financial institutions to:
  - » Primary Agriculture Credit Societies (PACS), Marketing Cooperatives Societies, FPOs, SHGs, Farmers, Joint Liability Groups, Agri-entrepreneurs, Startups, Central/State Agency or Local Body Sponsored PPP Projects.

- **Benefits**
  - » **Interest subvention** of 3% per annum upto a limit of 2 crore. This subvention will be available for a max period of 7 years.
  - » Further, **Credit Guarantee Coverage** will be available for eligible borrowers from this financing facility under Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE) scheme for a loan of **upto Rs 2 crore**.

    - FPOs created under FPO promotion scheme of Department of Agriculture, Cooperation, & Farmer Welfare (DACFW) will also get Credit Guarantee
  - The Fee for this coverage will be paid by the government.
  - **Moratorium** for repayment under this financing facility may vary subject to minimum of 6 months and a maximum of 2 years.

- **The implication** of government will not be of more than Rs 5,000 crore in the form of Interest Subvention subsidies.

  Budget 2021-22 have announced that APMCs can get access to Agriculture Infrastructure Funds for augmenting Infrastructure Facilities.

7) KRISHI UDAN 2.0

- **Introduction**:
  - The **integration of Agriculture and aviation** is possible **in three ways**:
    - Evolutionary possible use of biofuel for aircraft in future
    - Use of drones in agriculture sector
    - Greater integration and value realization of agricultural products through schemes like Krishi UDAN. Krishi UDAN 2.0 is focused on this third way.

- **Agri-UDAN 2.0:**
  - Krishi UDAN 2.0 lays out a **vision** of **improving value realization** by optimizing and integrating agri-harvesting and **air transportation**. This would contribute to agri-value chain sustainability and resilience under different and dynamic conditions.
  - It is focused on facilitating and incentivizing movement of Agri-produce by air transportation.
  - It would be **implemented at 53 airports** across the country mostly focusing on NE, tribal regions and Hilly region and is likely to benefit farmers, agri forwarders and Airlines.
  - **A pilot version** would run for 6 months and later changes would be implemented as per the learning.
  - **Key Highlights:**
    - **Promoting movement of agri-produce by air transportation** -> Waiver of landing, parking and some other charges on selected airports of AAI.
    - **Strengthening Cargo related infrastructure** at airports and off airports: Focus is on developing a hub and spoke model and a freight grid. Airside transit and trans-shipment infrastructure will be created at Bagdogra and Guwahati airports, and at Leh, Srinagar, Nagpur, Nashik, Ranchi and Raipur as part of the focus on NER, Tribal and Hilly districts.
    - **Other Concessions** have been sought: States have been requested to reduce Sales Tax to 1% on ATF for freighters/ P2C aircraft as extended in UDAN flights.
    - **Resources-Pooling** have been planned. It includes collaboration with other government departments and regulatory bodies to provide incentives and concessions to enhance air-transportation of Agri-Produce.
    - **Technological Convergence:** Development of **E-KUSHAL** (Krishi UDAN for Sustainable Holistic Agri-Logistics) platform to promote information dissemination to all stakeholders. This will also help in coordination, evaluation and monitoring of the scheme. Furthermore, integration of E-Kaushal with e-NAM has also been proposed.
    - **The strategic selection of airports** is primarily focused on northeast region.

- Airports have been selected keeping in mind the whole country.

8. FOOD PROCESSING SECTOR – THE SUNRISE SECTOR

1. **Infrastructure Improvement**
    a. **Pradhan Mantri Kisan SAMPADA Yojana** (Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters) - a central sector scheme with an allocation of Rs 6,000 crore for the period 2016-20 for creation of modern infrastructure with efficient supply chain in the food processing sector.
        - It has **incorporated other schemes** related to food processing under it including Mega Food Parks, Integrated Cold Chain and Value Addition Infrastructure, Creation/Expansion of Food Processing/Preservation Capacities, Infrastructure for Agro-Processing Clusters, Creation of Backward and Forward Linkages, Food Safety and Quality Assurance Infrastructure, and Human Resource and Institutions.

    b. Mega Food Park Scheme, 2008
        - It focuses on establishing mega food clusters for creating major infrastructure facilities in India to add value and reduce wastage at each stage of the supply chain (from farm to market). MoFPI provides a assistance of 50% of the project cost (excluding land), subject to a maximum of Rs 50 crore.

    c. Modernization of Abattoirs Scheme:
        - Enhance processing and preservation capacities to improve quality and reduce wastage.

2. **Production Linked Incentive Scheme for Food Processing Sector** (PLISFPS)
    - A central sector scheme for implementation during 2021-22 to 2026-27 with an outlay of Rs 10,900 crore.
    - Aimed at increasing the production capacity and improved international branding for the Food Processing Sector in India.

3. **One of the priority sector** under **Make in India initiatives**

4. **Steps to ensure Credit Availability**
    a. The government has set up a **Special Fund of Rs 2,000 crore in NABARD to** make available affordable credit at concessional rate of interest to designated food parks and agro-processing units.
    b. Food and Agro Processing Units and Cold Chain infra have been brought under the ambit of **Priority Sector Lending**
    c. **Subsidized credit through** PM FME

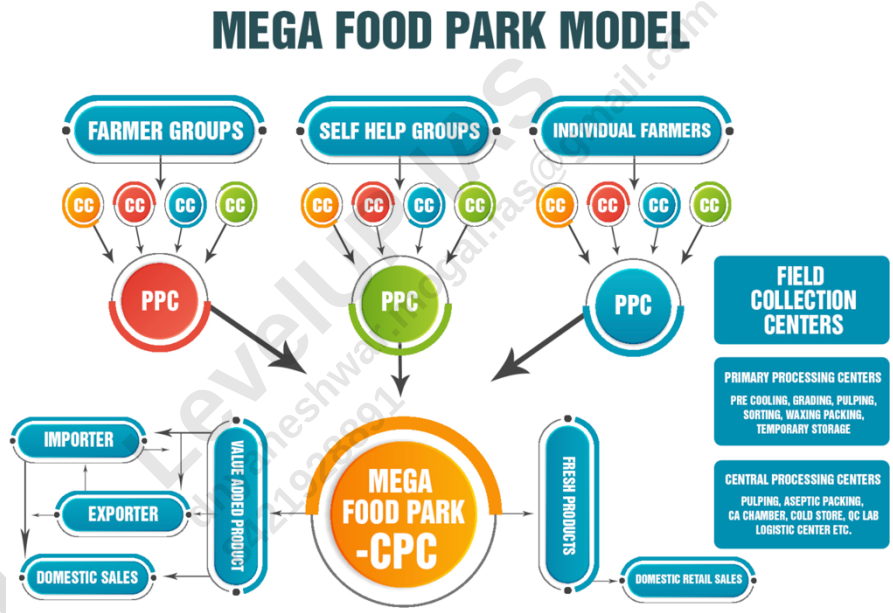
5. **Pradhan Mantri Formalization of Micro Food Processing Enterprise (PM FME)** provides **credit linked subsidies** to individuals/SHGs/FPOs etc. for food processing infra development. It also helps in development of common infrastructure like labs, warehouses etc.; support for marketing and branding; training; product development; packaging etc. it is based on **One District One Product (ODOP)** approach.

6. **Other steps for Attracting Investment in the sector:**
    - **100% FDI** is permitted under the automatic route for food processing sector.
        - **For e-commerce** in respect of food products manufactured and/or produced in India, 100% FDI through approval route is allowed.
    - **MoFPI**, GoI have signed MoU with Japan, Italy, Vietnam and Taiwan for promotion of investment in the Food Processing Sector. (July 2022)

8) MEGA FOOD PARK SCHEME

- **Ministry:** MoFPI
- This scheme is now a component of Pradhan Mantri Kisan Sampada Yojana (PMKSY).
- It focuses on **establishing mega food clusters** for creating major infrastructure facilities in India to add value and reduce wastage at each stage of the supply chain (from farm to market). MoFPI **provides a assistance of 50% [75% in NE and Hilly states] of the project cost** (excluding land), subject to a maximum of Rs 50 crore.

- The park is developed on **Hub and Spoke Model,** where Central Processing Centre acts as Hub and **PPCs** and **CCs** act as Spokes.
    - Facilities for **primary processing and storage** is created near the farm in the form of **Primary Processing Centre (PPC)** and **Collection Centre** (CC).
    - Common facilities and enabling infrastructure for providing **secondary and tertiary infrastructure and processing** services is created and **Central Processing Centre** (CPC).



- Under the scheme government has sanctioned setting up of **42 Mega Food Parks** in the country.
    - Of this final approval to 38 MFP have been given. Out of these, as of Aug 2021, 22 Mega Food Parks are operational.

- **Advantages**
    - Contributes to reduction of food wastage, increased income of farmers, better value addition etc.

- Gives boost to food processing sector (hence to export and employment opportunities) by creation of high quality infrastructure.
- Capacity building of producers and processors and creation of efficient supply chain along with significant direct and indirect employment generations.

9) PLISFPI (PRODUCTION LINKED INCENTIVE SCHEME FOR FOOD PROCESSING INDUSTRY)

- PLISFPI has been formulated based on the PLI Scheme for NITI Aayog under '**Aatmanirbhar Bharat Abhiyan for Enhancing India's Manufacturing Capabilities and Enhancing Exports**".
- It is a Central Sector Scheme for implementation during **2021-22 to 2026-27** with an outlay of Rs **10,900 crore**.
- **Objectives of the scheme:**
  - **Support FPIs** with stipulated minimum sales and willing to make minimum stipulated investments for expansion of processing capacity and branding abroad to incentivize emergence of strong Indian brands:
    - Support creation of Global Manufacturing Champions.
    - Strengthen select Indian Brand of food products for global visibility and wider acceptance in the international markets
    - Increase employment opportunities in off-farm jobs.
    - Ensuring remunerative prices of farm produce and higher income to farmers.

- MoFPI invited applications for availing sales based incentives and grants for undertaking Branding & Marketing activities abroad under the scheme from three categories of applicants:
  - **Category 1:** Applicants are large entities who apply for Incentives based on Sales and Investment Criteria. Applicant under this category could undertake branding & marketing activities abroad also and apply for grant under the scheme with a common application.
  - **Category 2**: SMEs applicants manufacturing innovative/ organic products who apply for PLI incentive based on sales.
  - **Category 3**: Applicants applying solely for grant for un**dertaking Branding & Marketing activities abroad**.

10) PM FORMALIZATION OF MICRO FOOD PROCESSING ENTERPRISES (PM FME)

- **Ministry**: MoFPI
- Launched in June 2020 as part of "AtmaNirbhar Bharat Abhiyan".
- It is a **centrally sponsored [60:40** (90:10 for SCS)**]** scheme which will be implemented over a period of five years 2020-21 to 2024-25 with an outlay of **Rs 10,000 crores**.

- The scheme is expected to benefit 2 lakh micro food processing units through credit linked subsidy.
- **Key Steps Planned:**
  - **Credit Linked Subsidy @35%** of the eligible project cost with a maximum ceiling of Rs. 10 lakh per unit would be provided **existing individual micro-food processing enterprises**.

- **Seed capital @Rs 40,000 per SHG** member would be provided for working capital and purchase of small tools.
- **FPOs/SHGs/ Producer Cooperatives** would be provided credit linked grant of 35% for capital investment along the value chain.
- **Support for development of Common infrastructure** - through **credit linked grant @35%** for development of common infrastructure including common processing facility, lab, warehouse, cold storage, packaging and incubation centre through FPOs/SHGs/ cooperatives or state owned agencies or private enterprises to use by micro units in the cluster.
- **Support for marketing and branding** would be provided to develop brands for micro units and groups with 50% grant at State or regional level which could benefit large number of micro units in clusters.
- **Special focus on Capacity Building and Research**
  - **NIFTEM** and **IIFPT**, the two academic institutions under MoFPI along with state level technical institutions selected by state would be provided support for training of units, product development, appropriate packaging and machinery for micro units.

- The scheme adopts **one district one product approach** (ODOP) to reap **benefit of scale** in terms of procurement of inputs, availing common services, and marketing of products.
  - The state will identify the food product for a district keeping in view the existing clusters and availability of raw material.
  - ODOP product could be cereal based, perishable or a food product widely produced in a district and their allied sector. E.g. mango, potato, litchi, bhujia, petha, papad, fisheries, poultry, meat, animal feed etc.
  - Preference would be given to ODOP product but other units would also be supported.
  - But support of common infrastructure, branding, marketing etc. would be available for ODOP only.
  - The scheme also places focus on **waste to wealth products**, **minor forest products** and **Aspirational districts**

9. PENDING TOPICS

- Agri-Exports
- Animal Husbandry, Fishery etc.