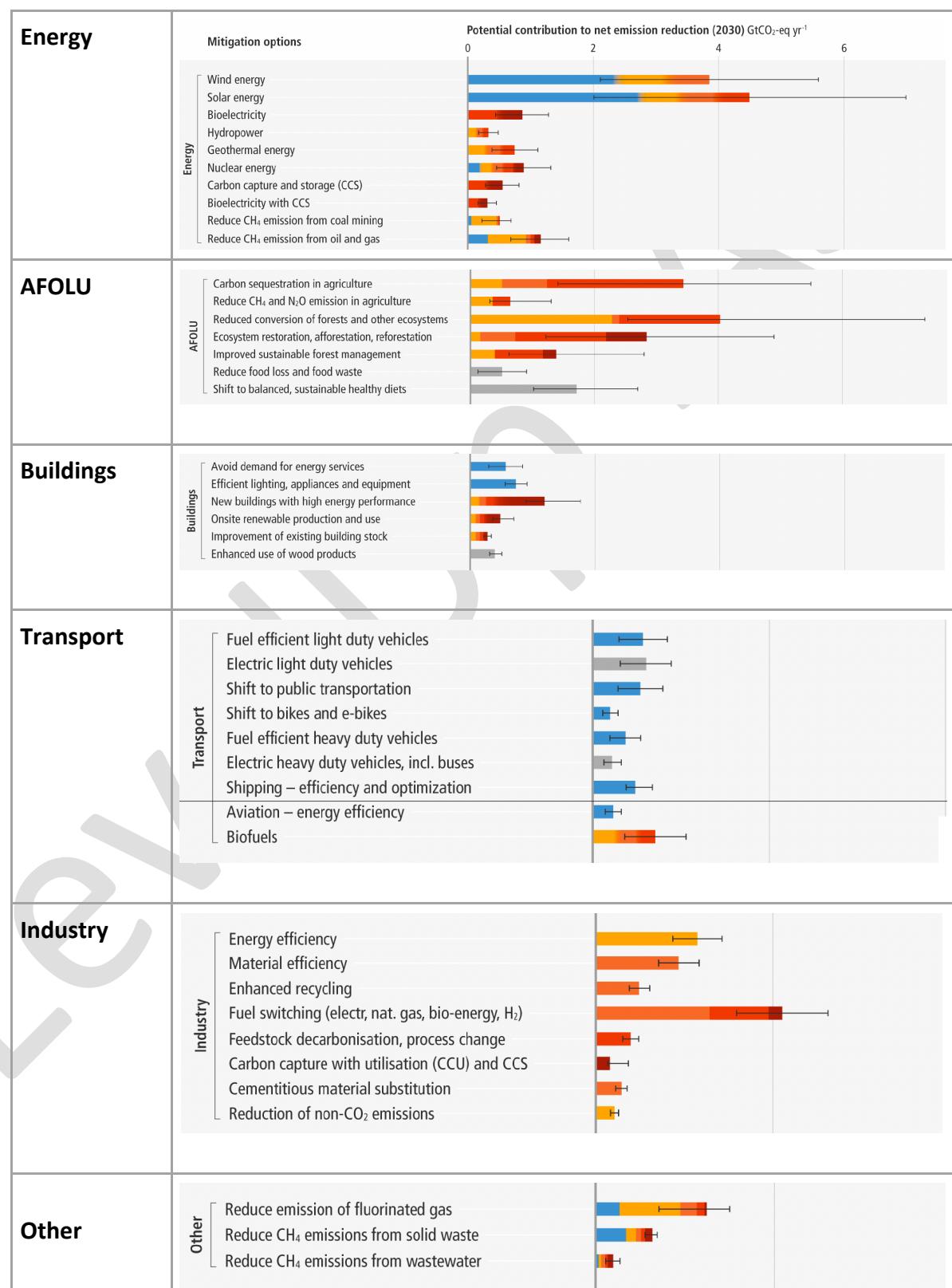


- Many options available now in all sectors are estimated to offer substantial potential to reduce net emissions by 2030. Relative potential and cost will vary across countries in the longer term compared to 2030.



- **Implementing these mitigation strategies** would come at a substantial cost. The report estimates that taking the actions to keep temperature below 2 degree C could **reduce global GDP by 1.3% to 2.7% by 2050**, but not doing so has its own costs.
- **Climate Finance:**
 - Tracked financial flows were still **falling short** of the levels needed to achieve mitigation goals across all sectors and regions.
 - The **gaps are the widest** for the agriculture, forestry, and other land use (AFOLU) sector and for developing countries.
 - But the **global financial system is large enough** and "sufficient global capital and liquidity" exist to close these gaps.
- **Implications of the report for India**
 - The report warns against opening new coal plants.
 - The report says that Coal-fired power plants, without the technology to capture and store carbon (CCS), would need to be shuttered by 2050 if the world aspired to limit global temperature rise to 1.5-degree C.

B) OTHER IPCC REPORT

IPCC Report, 2018: The Special Report on Global Warming (1.5C Report)

IPCC Report: Special Report on Climate Change and Land

IPCC Special Report on the Ocean and Cryosphere (SROCC)

4. REPORTS ABOUT CLIMATE CHANGE

A) REPORT BY WORLD METEOROLOGICAL ORGANIZATION (WMO)

- **About WMO**
 - **WMO** is a specialized body of UN which is an authoritative voice on behaviour of earth's atmosphere, its interaction with the oceans, the climate it produces and the resulting distribution of water resources.
 - **Headquarter:** Geneva
 - It originated from the International Meteorological Organization, which was founded in 1873. It was established in 1950, and became the specialized agency of UN in 1951 for Meteorology (weather and climate), operational hydrology and related geophysical sciences.

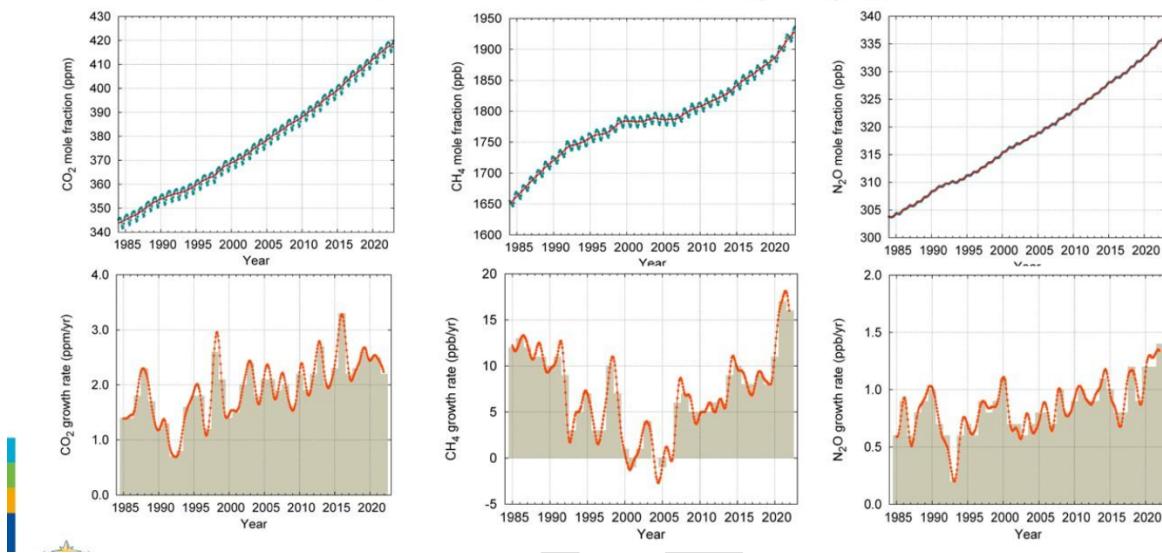
B) STATE OF GLOBAL CLIMATE REPORT, 2023

- Provisional data shows that 2023 is set to be the warmest year on record. Data until the end of Oct 2023 shows that the year was about 1.4 degree C (with a margin of uncertainty of +-0.12 degree C) above the pre-industrial levels.

C) GREENHOUSE GAS BULLETIN, 2023 BY WMO

The abundance of heat-trapping greenhouse gases in the atmosphere once again reached a new record last year (i.e. in 2022) and there is no end in sight to the rising trend, according to a new report from the World Meteorological Organization (WMO).

Main greenhouse gases (CO_2 , CH_4 , N_2O)



D) GLOBAL OCEAN OBSERVING SYSTEM (GOOS) REPORT CARD, 2022

It was prepared in collaboration with WMO, the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) and other GOOS partners and experts, and produced by its operational centre OceanOP.

E) OTHER REPORTS BY WMO

- State of Climate in Asia, 2021
- State of Climate Service Report

3) REPORTS BY UNEP

F) THE EMISSION GAP REPORT, 2023

- About the Report

- The report provides the latest assessment of scientific studies on current and estimated future Green House Gases (GHG) emissions and compares these with the emission levels permissible for the world to progress on a least-cost pathway to achieve the goals of Paris agreement. The

difference between "where we are likely to be and where we need to be" has become known as the "**emission gap**".

- **Key Highlights of the 2023 Report:**

- There has been progress since the Paris Agreement was signed in 2015.
- GHG emissions in 2030, based on policies in place, were projected to increase by 16 per cent at the time of the agreement's adoption.
- Today, the projected increase is 3 per cent.
- However, predicted 2030 greenhouse gas emissions still must fall by 28 per cent for the Paris Agreement 2°C pathway and 42 per cent for the 1.5°C pathway.

G) THE ADAPTATION GAP REPORT

- **Introduction:**

- The report by UNEP looks at the progress in planning for, financing and implementing adaptation - with a focus on nature-based adaptation.
- Adaptation action is critical to enable both public and private sectors to prepare for and respond to the impacts of climate change.
- **Adaptation Gap Report 2023: Underfinanced. Underprepared – Inadequate investment and planning on climate adaptation leaves world exposed**
 - The report finds that progress on climate adaptation is slowing when it should be accelerating to catch up with these rising climate change impacts.

H) OTHER REPORTS BY UNEP

- Global Environment outlook report

4) REPORTS BY GLOBAL CARBON PROJECT

- Global Carbon Budget 2022 Report
- Global Methane Budget (GMB)
- Global Nitrous (N₂O) Budget

I) ABOUT GLOBAL CARBON PROJECT (GCP)

- » GCP is a global research project of Future Earth and a research partner of the World Climate Research Program.
- » It was formed to work with international science community to establish a common and mutually agreed knowledge base to help fight climate change.
- » It was established in 2001 by a shared partnership between the International Geo-Sphere-Biosphere Program (IGBP), the International Human Dimension Program on Global Environmental Change (IHDP), the World Climate Research Program (WCRP) and Diversitas. This partnership constituted the **Earth Systems Science Partnership** which subsequently evolved into future Earth.
- Goals

- » Develop complete picture of the global carbon cycle, including both in biophysical and human dimensions together with the interactions and feedbacks between them.

5) OTHER REPORTS

J) CLIMATE CHANGE PERFORMANCE INDEX (CCPI)

- Published since 2005, CCPI is an independent monitoring tool of countries' climate protection performance. It aims to enhance transparency in international climate politics and enables the comparability of climate protection efforts and progress made by individual countries.
- The CCPI assesses each country's performance in **four categories**:
 - **GHG emissions** (40% of the overall ranking)
 - **Renewable Energy** (20%)
 - **Energy Use** (20%)
 - **Climate Policy** (20%)
- **59 countries** (which together are responsible for 92% of the global emissions) are assessed under the ranking.
- The report is **jointly presented** by: **GermanWatch**, NewClimate Institute and Climate Action Network (CAN).

K) GLOBAL CLIMATE RISK INDEX – BY GERMANWATCH

L) OTHER REPORTS

- Climate and Development: An Agenda for Action: By the World Bank
- NDC Synthesis Report, 2022: UNFCCC
 - It is the annual summary of climate commitments made by countries and their impact on GHG emissions.
- Investing in Carbon Neutrality: Utopia or the new green wave
- State of Climate Action Report 2022 – By Climate action tracker (an independent analytic group comprising Climate Analytics and New Climate Institute), the United Nations High Level Climate Change Champions, World Resource Institute and Others
- The World Heritage Glaciers Report – Jointly released by UNESCO and IUCN
 - 1/3rd of the World Heritage Glaciers will disappear by 2050.
 - Note: So far, around 50 UNESCO Heritage sites have glaciers in them.

5. OTHER MISCELLANEOUS TOPICS

A) WET BULB TEMPERATURE

- **What is wet bulb temperature?**
 - Wet bulb temperature is the lowest temperature to which air can be cooled by the evaporation of water into the air at a constant pressure.

- It is therefore measured by wrapping a wet wick around the bulb of a thermometer and the measured temperature corresponds to the wet bulb temperature.
- In simpler terms, wet bulb temperature is the lowest temperatures that our bodies can reach when we are in hotter environments, by sweating. It tells us at what level our bodies will not be able to cool themselves down by sweating. In this case the threat of heat stroke rises dramatically.
- The **dry bulb temperature** is the ambient temperature.
- **The difference between** the two temperatures (dry bulb and wet bulb) is a measure of humidity of the air. The higher the difference in these temperatures, lower the humidity of the air.
- **Why is wet bulb temperature important?**
 - Dry temperature, or the temperature that we see in daily weather forecast - doesn't tell us the full story. Wet bulb temperature, especially in times of heat waves, tells us how habitable a place is for human body.
 - **A wet bulb temperature of 32 degree C** is the maximum that a human can endure and carryout normal outdoor activities. This is equivalent to dry temperature of 55-degree C. The theoretical maximum wet bulb temperature is 35 degree C - most humans, even with unlimited water supply, are likely to suffer heat strokes at this level, likely leading to death.
- **Climate Change and Wet Bulb temperature:**
 - IPCC study shows that with climate change, the wet bulb temperature in India is going up.
 - If emissions continue to increase Lucknow and Patna would be the cities which would reach wet bulb temperature of 35 degree C. Parts of Central India, including Vidarbha are at risk of exceeding wet bulb temperature of 32-34 degree C

6. IMPACT OF GLOBAL WARMING

GWG emissions is breaching all the records: As per the AR6, **Emissions of Carbon dioxide, methane and nitrous oxide breached records in 2020**. CO₂ Concentration in the atmosphere - at around 419 parts per million - are the highest they have been in 2 million years.

- **Three factors** make carbon budgeting complex:
 1. **The pollutants** - primarily GHGs like CO₂ and methane - have an extraordinary long life. Thus, historic emissions continue to warm up the planet just like current emissions.
 2. GHG emissions are linked to economic growth.
 3. **Sharing of burden** becomes difficult as the emissions are associated with economic growth.

1. Rising Temperatures

- » As per the AR6 of IPCC, the global temperature has already risen by 1.1 degree C since preindustrial 19th century. This could increase upto 1.5 degree Celsius in less than 20 years (before 2040).
 - **Further, the 2 degree C warming** is likely to get exceeded by the end of this century unless immediate and deep reductions in greenhouse gas emissions are initiated immediately.
 - **In business-as-usual approach**, or in **worst case scenario**, the temperature rise by the end of this century would exceed even 4 degree Celsius'

- The report is also 'unequivocal' (i.e. there is almost no doubt) that most of the observed warming of the planet since the late 1800s is caused by human activities.
 - » As per the WMO, the decade 2010-20 and the five years (2015-20) were the hottest in the earth's history
- 2. Melting of Glaciers and Sea Level Rise -> Submergence of coastal region**
- » AR6: Sea level rise has tripled compared with 1901-1971. The Antarctic sea ice is the lowest in last 1,00 years.
 - » The temperature of Antarctica rose above 20 degree Celsius for the first time on record.
- 3. Heating up of Oceans -> marine heat waves, intense cyclones etc.**
- 4. Increasing variability in weather patterns**
- » **Heat waves and floods** which used to be once-in-a century event are becoming more regular occurrence.
 - » **Weather Disasters** have displaced millions of people this year and **affected rainfall patterns** from India to northern Russia and the Central United States.
 - » **For instance: India saw 13 Deficit Monsoons in 18 years between 2001-18.**
- 5. Compounding extremes** (several climate change drivers operating together) are maximizing disaster in India and elsewhere.
- » E.g., heavy rainfall, landslides, snow avalanches, and flooding occurring together is an example of compounding event.
- 6. Thawing of Permafrost and Arctic Lakes Bubbling Methane**
- » **Reasons: Permafrost Thawing producing methane gas**
 - Organic matter in Artic generally remain frozen. But, with climate change thawing is taking place. This thawing is leading to organic matter decaying into carbon di oxide and methane which is leading to methane getting emitted in atmosphere.
 - » **Warmer temperature increases the thawing of permafrost and release methane to the atmosphere**
 - But this also means that growing season increases, more plant growth takes place and thus more CO₂ getting absorbed. But overall, the increase in release of GHGs would be much higher.
 - » **Presently Arctic is a net carbon sink**
 - But soon arctic could become a carbon source, if the earth continues to warm, and a lot of permafrost thaws out. This would start a cycle of releasing more carbon from permafrost thawing and less absorption where the extra carbon in the atmosphere results in increasing warming.
- 7. Sea Water is 26% more acidic** than at the start of the industrial era. This is leading to degradation of marine ecosystem.
- 8. Biodiversity Loss**
- » **At least 1 million species were at risk** because of the rising CO₂ concentration in the atmosphere and global warming.

- For instance, a recent study shows that seal pups (IUCN: LC) are finding it tough to survive in the Baltics in the absence of ice. 100s of grey seal pups are dying on the shores of the Baltic Sea in Estonia and Latvia as the Nordic coastline faced winter without ice in decades.

9. Negative Impact on Food Security, Agriculture and Economy

- » Variability in rainfall
- » Increased temperature and evaporation of water sources
- » Increased chances of Locust attacks
- » Extreme weather events triggered by climate change costs India \$87 billion annually : State of Climate in Asia, 2020 (report by WMO)

10. Climate Change has adversely affected both physical and mental health of people.

- » Impacts on health is mediated by both through natural and human systems, including economic and social conditions and disruptions.
- » Extreme heat events -> Mortality and morbidity
- » Climate related food borne and water borne diseases has increased. The incidence of vector borne diseases have also increased due to range expansion and/or increased reproduction of disease vectors.
- » Some mental health challenges are associated with increasing temperatures, trauma from weather and climate extreme events, and loss of livelihood and culture. Exposure to wildfire smoke, atmospheric dust, and aeroallergens have been associated with climate sensitive cardiovascular and respiratory distress.

11. Achievements of SDG targets have been negatively hindered.

12. Shrinking of Stratosphere:

According to a study published by NASA, the earth's energy imbalance doubled over the 14 year period between 2005 - 2019, doubling the pace at which the Earth retains heat from 2005. As a result of this we are already on the brink of losing stratosphere

7. UNFCCC – PARIS AGREEMENT TO COP27

1) UNFCCC

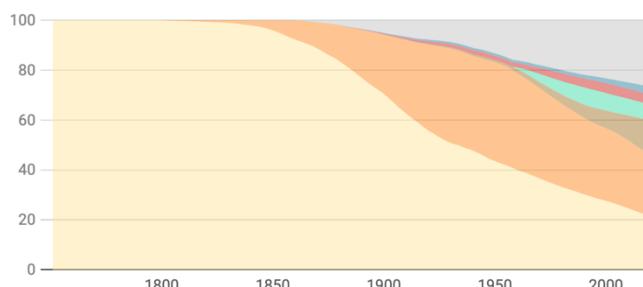
- It is one of the three conventions adopted at the Rio Earth Summit (UN summit Conference on Environment and Development (UNCED)) in 1992. Its sister Rio Conventions are the UN Convention on Biological Diversity and the Convention to Combat Desertification.
- This was the first multilateral legal instrument on climate change and came into force in 1994 after a sufficient number of countries had ratified it.
- **Ultimate Aim** of UNFCCC
 - Prevent dangerous human interference with the climate system by stabilizing greenhouse gas concentration in atmosphere.

- It sets on **non-binding limits** on greenhouse gas emission for individual countries and contain **no enforcement mechanism**.
- **Parties to Convention**
 - **197 parties**
 - All UN member states, Palestine (observer state), Niue and Cook Island (non-member states) and the European Union.
 - **Annex 1 Parties** -> Industrialized OECD countries, Economies in Transition (EIT), EU
 - **Annex 2 Parties** -> OECD members of Annex-1, NO EIT.
 - Provide financial and technical support to EITs and developing countries for mitigating Climate change.
 - **Non-Annex 1 Parties** -> Mostly developing
 - **Least Developed Countries (LDCs)**

Over the last 250 years, Europe and the US have contributed to most of the world's CO2 emissions

% share in cumulative global CO2 emissions

EU-28* United States China Russia Japan India ROW



*28 nations in the European Union

Source: Global Carbon Project; Our World in Data • [Get the data](#) • [Created with Datawrapper](#)

Key Significance of UNFCCC - 1) Recognition of the problem 2) Setting target of stabilizing GHGs 3) Onus on Developed countries 4) Funds and technology transfer to developing countries 5) Regular Reporting -> Keep a tap on the problem.

A) KYOTO PROTOCOL

- It was an international agreement to reduce greenhouse gas emissions. It was negotiated under the UNFCCC during a meeting held in Kyoto, Japan, in 1997 and came into force in 2005 (due to complex ratification process)
 - **The first commitment period** was 2008-2012
 - **The second commitment period** beginning 1 Jan 2013 to 2020.
 - Launched by Doha Amendment (2012)
- The **objectives of KP** included reducing greenhouse gas emissions through enforcement of compliance; promote sustainable development through tech-transfer and investment; and encourage developing countries and private sector to contribute to emission reduction.
- **Parties to Kyoto Protocol**
 - **Annex B:** Nearly identical to Annex - I of the UNFCCC; Agreed for emission reduction.
 - **Non-Annex B Parties:** Countries which are not listed in Annex B of KP.
- **Key Features**
 - The protocol 'operationalized' the UNFCCC. It commits industrialized countries to stabilize greenhouse gas emissions based on the principles of the Convention.
 - **Binding Emission targets for 38 industrialized countries and the European Community (Annex 1 Parties)** in its first commitment period.

▪ Only bound developed countries - **Common but Differentiated Responsibility**

- **Flexible Architecture of KP Regime to meet target**
 - **National Measures and Market Based Mechanisms**
 - This market based mechanism allows GHG abatement to start where it is most cost-effective - for e.g. in the developing world.
 - **3 Components - Carbon Trading, Clean Development Mechanisms and Joint Implementation**
- **Penalties for not meeting the targets**
- **What is the status of the Kyoto Protocol?**
 - The Protocol was ratified by 191 countries and EU. **Canada withdrew** from the Protocol in 2012.
 - The US was the only country that signed the protocol and never ratified it.
 - Internal country politics.
 - **Were targets met?**
 - Most countries didn't meet the targets for emission reduction assigned for the first period of commitment (2008-2012).
 - So protocols impact was very small.
- **Kyoto Beyond 2012**
 - At Doha in 2012, the amendments to Kyoto Protocol for the 2nd commitment period (the Doha Amendment) were successfully adopted for the period 2012-2020.
 - It entered into force on **31st Dec**, following an acceptance by the mandated minimum of at least 144 states, although the second commitment period ended on the same day.
 - **It entered into force in 2020** as the required number of countries didn't deposit their instrument of accession earlier.
 - But some developed countries started implementing their commitments under the '**opt-in**' provisions of the Doha Round.
 - **Note: India ratified** the second commitment period of Kyoto Protocol in Jan 2017

B) PARIS AGREEMENT

- The Paris Agreement and the accompanying COP decisions are focused on enhancing **efforts to mitigate and adapt to climate change beyond 2020.**
 - a. **Long Term Goal:**
 - » Reaffirm the goal of limiting global temperature increase well below 2 degree Celsius, while urging efforts to limit the increase to 1.5 degrees.
 - » **Two long term emission goals**
 - Peaking of emissions as soon as possible (with a recognition that it will take longer for developing countries)
 - A goal of Net Green House Gas Neutrality (expressed as "a balance between anthropogenic emissions by sources and removals by sinks") in the second half of this century.
 - b. **Ends the Strict Differentiation between developed and developing countries:** Provides for a framework that commits all countries to put forward their best efforts against climate change and keep strengthening these efforts.

- c. **Mitigation - Binding Procedural Commitments** -> Preparing, communicating and maintaining NDC; Communicate new progressive NDC every five years;
 - » The agreement commits parties to "pursue domestic measures with the aim of achieving the objectives" of its NDC.
 - » Doesn't make implementation or achievement of NDCs a binding obligation.
- d. **Carbon Markets** – the agreement recognized that the parties may use internationally transferred mitigation outcomes to implement its NDCs.
- e. **STOCKTAKE/SUCCESSIVE NDCs**
 - » To ensure successive improvement in efforts, the agreement provides for **two linked processes**, each on a five-year cycle.
 - **Global Stocktake** to assess collective progress towards the agreement's goals. The first global stocktake took place in 2023.
 - **New NDCs** every five years informed by the outcomes of the global stocktake. Signatories should ensure that the new NDCs are more ambitious than the previous ones.
- g. **Finance**
 - **Provisions for Support to poor developing countries by Developed countries.**
 - **Finance Mobilization goal.**
 - The COP decided to extend the \$100 billion-a-year goal through 2025, and beyond that, by 2025 COP will set a "new collective quantified goal from a floor of "\$100 billion a year".
- h. **Adaptation**

A major priority for many developing countries was strengthening adaptation efforts under the UNFCCC. The agreement does that by:

 - Establishing a global goal of "enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change"
 - Committing enhanced adaptation support for developing countries
 - Including a review of adaptation progress, and of the adequacy and effectiveness of adaptation support, in the global stocktake to be undertaken every five years.
- i. **Loss and Damage**
 - In a victory to small island countries and other countries highly vulnerable to climate impacts, the agreement includes a **free-standing provisions** extending the Warsaw International Mechanism for Loss and Damage
 - The mechanism, established at COP-19 is charged with developing approaches to help vulnerable countries cope with unavoidable impacts, including extreme weather events such as sea-level rise.
 - Potential approaches include early warning systems and Risk insurance.
 - Loss and Damage provision "did not involve or provide a basis for any liability or compensation.

C) WHEN DID PARIS AGREEMENT ENTER INTO FORCE?

- It required approval of atleast **55 countries accounting for atleast 55 percent of greenhouse gas emission.**
- It came into force on **Nov 4, 2016** (a month after required number of ratification)

D) INDIA'S UPDATED FIRST NDC UNDER PARIS AGREEMENT (AUG 2022)

- India submitted its INDC on 2nd Oct 2015.
- The NDC submitted in Aug 2022 is India's first NDC under the Paris Agreement. The Article 4, paragraph 9 of the Paris Agreement provides that each Party shall communicate a nationally determined contribution every five years in accordance with the decision of COP21.
- So, in Aug 2022, India communicated an update to its first NDC submitted earlier on Oct 2, 2015 for the period upto 2030, as under:
 - To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation, including through a mass movement for 'LIFE'–'Lifestyle for Environment' as a key to combating climate change [UPDATED].
 - To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
 - To reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level [UPDATED].
 - To achieve about **50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030**, with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF) [UPDATED].
 - To create an **additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent** through additional forest and tree cover by 2030.
 - To better **adapt to climate change by enhancing investments in development programmes** in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.
 - To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
 - To **build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology** in India and for joint collaborative R&D for such future technologies.

This update to India's existing NDC is a step towards our long term goal of reaching net-zero by 2070.

E) INDIA'S LONG TERM LOW EMISSION DEVELOPMENT STRATEGY (LT-LED STRATEGY) (NOV 2022)

- **Details**
 - LT-LED is a requirement emanating from the 2015 Paris Agreement whereby countries must explain how they will transition their economies beyond achieving near-term NDC targets, and work towards the larger climate objective of cutting emissions by 45% by 2030 and achieve net zero around 2050. This is what scientists say, offers the best chance of keeping temperature rise below 1.5 degree C. So far, no country is on track towards such a pathway.

- Very few countries (including India) have submitted their Long-Term Strategy. So far.
- **Highlight of India's Long-Term Strategy:**
 - i. **Nuclear Power Capacity** - It will be increased at least 3-fold in the next decade.
 - ii. India will focus on increasing the proportion of ethanol in petrol - with ethanol blending to reach 20% by 2025 and a strong shift to public transport for passenger and freight traffic.
 - iii. India would also become an international hub of producing green hydrogen.
 - iv. India will also focus on **energy efficiency** by the Perform, Achieve and Trade (PAT) scheme; increasing electrification; enhancing material efficiency; and recycling and ways to reduce emissions.
 - v. The country is also on track to achieve the NDC commitment of 2.5 to 3 billion tonnes of additional carbon sequestration in forest and tree cover by 2030.
 - vi. The emphasis is on ensuring energy security, energy access and employment, while keeping focus on our vision of Atmanirbhar Bharat.

2) THE CONTINUING UNFCCC NEGOTIATION

- **The Continuing UNFCC Negotiations:**
 - After the COP-21 - Paris Agreement, the negotiations have continued. COP-22 (Marrakech Summit, 2016), COP-23 (Bonn Summit, 2017), COP-24 (Katowice Summit, 2018), COP-25 (Madrid Summit, 2019), COP-26 (Glasgow, 2021);

B) COP 26 (GLASGOW PACT) - KEY OUTCOMES: 2021

- **Mitigation:**
 - » It asked countries to strengthen their 2030 climate action plan or NDCs by 2022.
 - » First clear recognition of the need to move away from fossil fuels -> it called for "phase down of coal" and "phase out of inefficient fossil fuel subsidies".
- **Adaptation:**
 - » Asked developed countries to atleast double the money being provided for adaption by 2025 from the 2019 levels.
 - » It created a two year work program to define a goal on adaptation.
- **Paris Rule Book has been finalized.**
 - » 'Transparency Framework' was completed - it included reporting rules and formats for emissions, progress on pledges and financial contributions.
 - » Carbon Market provisions have been finalized [a major achievement of COP26].
 - **Credit generated from earlier periods**, including through Clean Development Mechanism were transferred to the Paris Agreement but only since 2013. This will allow developing countries to meet its first NDC targets.
 - On the issue of double counting, it has been decided that a country that generates a credit will decide whether to authorize it for sale to other nations or

to count towards their climate targets. The emission cuts will be counted only once.

- **Various Positive "Parallel Outcomes"** (not part of the official COP26 negotiations)
 - » India's announcement of a Panchamitra
 - » Plurilateral Agreement on Methane Reduction among 100 countries is crucial. (Note: India is not a member)
 - » Plurilateral Agreement to reverse deforestation among another group of 100 countries. (Note: India didn't join the group due to concerns over a clause on possible trade measures related to forest products).
 - » COP26 Transport Declaration -> 100% transition to emission less (electric vehicles) cars by 2040.
 - This has also been signed by over 30 countries.
 - » Glasgow Financial Alliance for Net Zero (Gfanz): 450 of the world's banks and other financial institutions have pledged to report annually on the carbon emissions linked to the projects they lend to.
 - They also plan to lend trillions of dollars in green finance - while committing to net zero emission across the board by 2050.
- **Problems that remained:**
 - » Funding
 - » L&D
 - » Didn't specifically raise emission reduction targets.

C) COP-27 (SHARM EL SHEIKH, EGYPT)

- **Quotes:**
 - » The UN Secretary General had declared at the start of the conference, "We are on a highway to climate hell with foot still on the accelerator".
- **Key Highlights:**
 - » Nod for establishment of Loss and Damage Fund.
 - » Estimates of Financial Requirements -> COP27 agreement for the first time, quantified the financial needs for climate action. It said about US\$ 4 trillion had to be invested in the renewable energy sector every year till 2030 if the 2050 target of net zero was to be achieved.

D) COP28: DUBAI, UAE (30TH NOV 2023 – 12TH DEC 2023)

- The meeting reviewed the Progress of commitment made by 197 countries under the Paris Agreement to mitigate the razing global warming.
- **Outcome: Dubai Consensus:**
 - Negotiators adopt resolution titled "Dubai Consensus"; the text reflects a compromise between developed and developing countries on emissions.
- **Highlights of Global Stocktake (GST):**

- The GST text echoed the GST input findings that 1.5 degree target would require "deep, rapid and sustained" reduction in global emissions of 43% by 2030 and 60% by 2035 from the 2019 levels and eventually reaching net zero by 2050.
- **Fossil Fuel Phase-out:**
 - » Fossil fuels was the most hotly contested issue of the COP28; It was first time that fossil fuel was at the centre of discussion at UNFCCC COP.
 - » **Outcome:**
 - COP28 agreement has called upon countries to contribute towards "transitioning away" from fossil fuels and phase down of unabated coal power so as to achieve net zero by 2050.
 - » **Criticisms:**
 - No timelines
 - Not using the phrase "fossil fuel phase-out" and instead the use of "transitioning away".
 - While calling for phase down of "unabated coal power", the door was left open for "low-carbon fuels", "low emission" technologies, "low-carbon hydrogen" - all terms with very loose definitions.
- **Tripling global renewable energy capacity by 2030** (from 3400 GW today to 11000 GW) and doubling of global average rate of energy efficiency improvements by 2030.
 - COP28 calls the member countries to achieve these two targets which have the potential to avoid emissions of about 7 billion tonnes of carbondioxide equivalent between now and 2030.
 - **Tripling is a global target for renewables is not incumbent on every country** individually. It is not thus clear how this tripling will be achieved.
 - This is the only outcome that contribute to additional emission reduction between now and 2030.
- **Accelerating and substantially reducing non-carbon-dioxide emissions globally**, including in particular methane emissions by 2030.
 - **Criticisms:** No target mentioned
 - **Note:** A group of about 100 countries at Glasgow (in 2021) had made a voluntary commitment to reduce methane emissions by 30% by 2030.
- **Reduction of emission from road transport** on a range of pathways, including through development of infrastructure and rapid deployment of zero-and low-emission vehicles;
- **Phase down of inefficient fuel subsidies** that don't address energy poverty or just transition, as soon as possible.
- **Operationalization of L&D Fund:**
 - **Background:** A decision to set up a Loss and Damage Fund had been taken last year in Sharm el-Shaikh (COP27) but it had not been created, and no money had been promised.

- COP28 operationalized the fund and several countries have already made commitments worth around \$800 million by the end of the conference.
 - COP28 decided that the fund will be serviced by new, dedicated and independent secretariat. It will be supervised and governed by the Board.
 - The fund is accountable to and functions under the guidance of the CoP serving as the meeting of the Parties to Paris Agreement (CMA).
- This is the most significant outcome for vulnerable countries as L&D fund is meant to provide financial help to countries trying to recover from climate-induced disasters.
- Santiago network has also decided to avert, minimize, and address loss and damage to catalyze the technical assistance of relevant organizations, bodies, networks and experts for the implementation of relevant approaches associated with climate change impacts.

Santiago Network: At COP25, the parties to UNFCCC decided to set up a Santiago network as part of Warsaw International Mechanism (WIM) for loss and damages. It is aimed to organize the technical assistance of relevant organizations for the implementation of relevant approaches in developing countries that are particularly vulnerable to adverse impacts of climate change.
- Global Goal on Adaptation (GGA):
 - » Background: COP26 at Glasgow had decided to set up a two-year work program to define the contours of adaptation framework.
 - Adaptation hasn't received enough attention and the entire focus of various agreements have been on mitigation. But, developing countries have been arguing for a global framework for adaptation.
 - The two year work program resulted in identification of some common adaptation goals like reduction in climate-induced water scarcity, attaining climate-resilience in food and agricultural production, supplies and distribution and resilience against climate induced health impacts.
 - » The COP28 retains calls for a doubling in adaptation finance and plans for assessment and monitoring of adaptation needs in the coming year.
 - An explicit 2030 date has been integrated into the text for targets on water security, ecosystem restoration, health.
- Issue of Climate Finance Targets will be reviewed in next COP:
 - » Currently, the \$100 billion goal hasn't yet been met (although it appears on track this year) and is far short of what is needed.
 - » COP28 saw an agreement to draft a post 2025 finance target ahead of COP29. This is a step forward, but details will only be hammered next year.
- COP28 Declaration on Climate Change and Health
 - » This is the first ever move to commit action and finance to combat the health impact of climate change.
 - » The COP28 Presidency and the WHO together issued the 'COP28 UAE Declaration on Climate and Health'.

- It's signatories aim to accelerate action to protect public health and communities from negative and growing climate impacts and strengthen healthcare systems to cope with the effects of extreme heat, air pollution, infectious and zoonotic diseases and environmental risk factors.

- **Other Related Outcomes:**
 - » A group of **22 countries** signed a **declaration to triple nuclear energy capacity** between 2020 and 2050, in order to reduce dependence on oil, gas, and coal.
 - » **G7 countries** have announced to phase out coal by 2030 and have urged G20 countries to also agree on it.
 - » India and Sweden co-launched Phase II of the Leadership Group for Industry Transition (LeadIT 2.0) for the period 2024-26 at COP-28. They also launched the Industry Transition Platform, which will connect the governments, industries, technology providers, researchers, and think tanks of the two countries.
 - » **Green Industrialization Initiative**: African leaders came together on the third day of COP28 to launch the initiative. The GII is set to accelerate green growth of industries in Africa and attract finances and investment opportunities.

- **Limitations/Criticisms:**
 - » **Countries failed to adopt rules to set up global carbon market**: Civil society has hailed the move as parties didn't agree to adopt weak rules for carbon markets.
 - » **Climate Finance issue** is still pending and would be taken up in COP25.
 - » **No timelines for fossil fuel transitioning**: The text related to fossil fuel transitioning is weak, in-adequate and with loopholes.
 - » **NDCs** remain far away from achieving Net Zero by 2050.
 - » **Net Zero by 2050** target is expected to bring pressure on China and India whose net zero targets are for 2060 and 2070 respectively.
 - » **Major Decisions** have not been integrated with agendas like 'Common but differentiated responsibilities'.

3) NET ZERO

- **Details**
 - » Achieving a global balance between emissions and removal of greenhouse gases to and from the atmosphere is called **net zero** (or no net emissions). The Paris agreement targets this to be achieved somewhere in the second half of this century, but the earlier this happens, the greater the chances of keeping global warming below 2-degree C.
 - » Electricity and heat are responsible for 25% of global GHGs. The **International Energy Agency** envisages that in a net-zero world, almost 90% of electricity could come from renewable sources, mostly solar and wind, with nuclear power making up most of the rest.

- **Achieving Net Zero:**
 - » **Focus on 2030 goal first:**

- IPCC's AR6 emphasized that to keep temperature rise within 1.5 degree C, global emissions should be reduced by 45% from 2010 levels by 2030, on the way to net zero by 2050.
 - But the UN NDC report says that as per the current NDCs, the global emission is expected to increase by 16.3% in 2030 (compared to 2010 levels).
- » **Energy Conservation and Efficiency:** Global emissions show that energy is the biggest emitter (73.2%) including its use in transport, industry, and building. Therefore, energy efficiency can play a crucial role in achieving net zero.
 - Targeted consumer education and behavioral change would also be important here.
- » **Renewable Energy:** Gradually phasing out thermal energy (coal, petrol, gas etc.) and increase the capacity of renewables with improved grid infrastructure, smart grids, etc.
 - Insure against Renewable Droughts through other sources like **Nuclear Energy**.
- » **Transport Sector:** Accelerated transition to e-mobility and non-motorized transport is required.
- » **Create Offset:** Inspite of all the efforts, humans would still produce some billions of tonnes of emissions by mid-century. This will have to be balanced by removals to achieve net zero. Offset can be in the form of afforestation, increasing soil organic carbon, and advanced carbon sequestration techniques.
- » **Enhancement in Funding:** The Promised funding from developed to developing countries need to be delivered.
- » **More R&D in advanced technology** like low and zero emission technologies across all sectors. There is also a need of innovation for renewable integration, power to x-storage, and conversion and reconversion pathways. Moreover, carbon-removal technologies need to be focused upon.
- » **CBDR should not be ignored:** Developed countries should achieve net zero earlier and few extra decades should be available to developing countries.

4) INDIA'S DECISION TO ACHIEVE NET ZERO BY 2070: CRITICAL ANALYSIS

- At COP26, PM Modi has proposed a **fivefold strategy** for India to play its part in helping the world get closer to 1.5 degrees Celsius. India's 'Panchamrita' promises include:
 - » India will get its non-fossil energy capacity to **500 GW** by 2030.
 - This is a 50 GW increase from its existing target.
 - » India will meet 50% of its energy requirements till 2030 with renewable energy.
 - » India will reduce its projected carbon emission by one billion tonnes by 2030.
 - » India will reduce the carbon intensity of its economy by 45% by 2030.
 - » India will achieve net zero by **2070**.
- **India's demand from developed countries:**
 - » In the spirit of climate justice, the developed countries should be providing at least \$1 trillion in climate finance to assist the developing countries and those most vulnerable.
- **Analysis:**
 - This is a very positive move as India had resisted any net zero target in the run up to the COP26. This announcement is expected to put India on a firm path towards decarbonization.
 - This announcement also keeps in mind the Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC).

- India's net zero comes in 2070 and NDC is subject to funding from developed countries
- **India is contributing more than its share:** Despite a 2070 net zero year for India, India's cumulative emissions between 1900-2100 would be lower than the US, China or EU.
- **India continues to show international leadership** - It has launched the Infrastructure for Resilient Island States - an initiative under the coalition for Disaster Resilient Infrastructure to support vulnerable island countries. India has also launched Green Grids Initiative in partnership with UK to tap into renewable energy resources everywhere.

- **Critics of shifting to a Net Zero target**

- **Over-appropriation of global carbon budget** by a few.
 - Countries which have higher emissions presently are taking more advantages of the environment.
 - The campaign to achieve net zero by 2050 is designed to achieve Paris goals by the "lowest cost" methods, foregoing equity and climate justice.
- **Wasn't mandated by Paris Agreement.**
- **India is anyways a small contributor** - Our emissions are 4.37% of the world's share (with 18% population).

Critics of Sustainability of India's Net Zero Strategy

- India's plan to increase dependence on hydro projects and nuclear energy will create displacement, deforestation, hazardous radiation etc.
- Solar and Wind Energy is also focused on Mega energy parks which may cause displacements.

5) MECHANISMS AND ISSUES WITH CLIMATE FUNDING

- **Introduction**

- » Money has been central to many a fight at the Climate Change negotiations. UNFCCC as part of its CBDR principle requires developed countries to provide financial assistance to developing nations in their fight against the climate change.
- » **Globally**, there are two funding mechanisms - **The Green Climate Fund** and the **Global Environment Facility**.

- **Green Climate Fund (GCF)**

- » Established at COP-16 in 2010, it is the financial mechanism for UNFCCC under article 10. It is regarded as the chief instrument for the fulfillment of developed world's annual support of \$100 billion annually till 2025.
- » **COP-21 held at Paris** also decided that **GCF shall serve the Paris Agreement.**

- **Global Environment Facility (GEF)**

- » Created at Rio Earth Summit in 1992 to help tackle planet's most important environmental problems.

- **What has it done so far? / What does GEF do?**

- » GEF also serves as financial mechanism for the following conventions:
 - CBD
 - UNFCCC
 - UNCCD

- Stockholm Convention on Persistent Organic Pollutants (POPs)
- Minamata Convention on Mercury
- It also supports implementation of Montreal Protocol on substances that deplete the ozone layer in countries with economies in transition.

- **Current Funding Situation:**

- **Requirement:** As per COP27 (Sharm el-Sheikh agreement), the global transition to a low-carbon economy would likely require about US\$ 4-6 trillion every year till 2050. This is 5% of the global GDP.
 - The cumulative requirement of developing countries, just for implementing their climate action plans, was about US\$ 6 trillion between now and 2030.
- **Availability:**
 - The \$100 billion amount, that the developed countries have promised is the only money in play right now. And of this only around US\$50-80 billion per year is being mobilized. This indicates that the fund available in less than 10% of what is required.

- **Key Problems of current climate funding are:**

- **Requisite finance** hasn't been mobilized.
- **Funding bias in favour of climate change mitigation activities**. This bias is there because mitigation efforts are easily visible in short run and returns from adaptation efforts will be visible after long time.
 - For e.g., if we adapt by moving away from coasts, the benefit of this adaptation efforts would be visible much later.
- **Developing world** in itself cannot fight the climate crisis as they are still struggling for finance for their development needs.
- **A number of countries** are unable to access global finance. Present rules and regulations of global financial systems, make it difficult for many countries to access international finance, particularly those with political instabilities
- **Lack of transparency** is leading to problems of double counting and green washing.

- **Way Forward:**

- **Availability and Access** are two main dimensions to the problem of climate finance.
- **Increasing Availability:**
 - **Developed countries** need to increase their contribution.
 - But, even if this happens, this won't be able to fulfill the requirement of around \$6 trillion needed annually.
 - **Mobilize resources from private sector**: Businesses and Corporations need to invest money into green projects.
 - In climate finance thus far, private investment have lagged behind public money. Barely 30% of current financial flows are coming from private sources.
 - **Creation of right environment for investments in green project** -> Private sector will not invest unless they are reasonably sure of healthy returns.
 - Here, international financial institutions should engage with governments, central banks, commercial banks etc. to incentivize climate friendly investments and discouraging, or even penalizing, dirty investments.

- **Carbon Tax** - Common citizens will have to contribute to the bulk of the additional financial resources.
- **Increasing Access:** There is a need to simply lending mechanisms and overhaul credit rating systems.
- **Increased Transparency:**
 - Climate finance flows through a maze of channel - bilateral, regional, multilateral. It is in the form of grants, concessionary loans, debt, equity, carbon credit, and more. As a result, there are widely different opinion on the quantum of climate finance currently being mobilized. This needs to be addressed.

8. OTHER EFFORTS TO FIGHT CLIMATE CHANGE

1) REDD+

- **Need of REDD+**
 - Deforestation and forest degradation account for 17% of carbon emissions, more than the entire global transportation sector and second only to energy sector. Therefore, **conservation of forests can play a very crucial role in controlling climate change.**
- **Introduction to REDD+**
 - **REDD+** is a climate change mitigation solution developed by parties to UNFCCC. It **incentivizes developing countries to keep their forest standing** by offering results-based payments for actions to reduce or remove forest carbon emissions.
 - » The idea is that developing nations should be able to financially benefit from the ecosystem services that their forests provide, such as carbon storage and as reservoirs of biodiversity.
 - The payment is targeted at five activities:
 - » **Reducing Emissions** from Deforestation
 - » **Reducing Emissions** from forest degradation.
 - » Conservation of carbon stocks
 - » Sustainable management of forests
 - » Enhancement of Carbon stocks.
 - **REDD+ goes beyond simply deforestation and forest degradation and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.**
 - **In 2019, Brazil** became one of the first countries to receive results-based aid.
 - **In 2020, Uganda** has become the first African country to submit the results for Reducing Emissions from Deforestation and forest degradation (REDD+) to the UNFCCC.
 - Uganda has now become eligible for results based payments.
 - In 2020, **Uganda became eligible** for REDD+ payments, the first African country to do so.

A) REDD+ IN UNFCCC

- First negotiated in UNFCCC 2005 (COP-11).
- Adopted at COP-13 in 2007 in Bali.
- In 2013, **COP-19** produced at least seven decisions on REDD+, which are jointly known as the "**Warsaw Framework on REDD-Plus**".
- And finally, the remaining decisions on REDD+ was **completed at COP21** in 2015 and the UNFCCC rulebook on REDD+ was completed. **All countries were also encouraged to implement and support REDD+ in Article 5 of the Paris Agreement**. This was part of the broader article that specified that all countries should take action to protect and enhance their greenhouse gas sinks and reservoirs (stores of sequestered carbon).
- UNFCCC requests All developing countries aiming to undertake REDD+ to develop the following elements:
 1. A **national strategy or action plan**;
 2. A **national forest reference emission level** and/or forest reference level.
 3. A **national forest monitoring system** for monitoring and reporting on REDD+ with if possible subnational monitoring

Elements of UNFCCC Warsaw Framework for REDD+



B) REDD AND REDD+

- REDD originally referred to "reducing emissions from deforestation in developing countries" the title of the original document on REDD. It was superseded in the negotiation by REDD+.
- REDD+ refers to "reducing emissions from deforestation, and forest degradation in developing countries, and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries". This is the most recent elaborated terminology used by COP.

C) INDIA'S REDD+ STRATEGY (RELEASED IN AUG 2018)

- The strategy has been **prepared by Indian Council for Forestry Research & Education (ICFRE)**, Dehradun.
- The strategy builds upon existing national circumstances which have been updated in line with India's National Action Plan on Climate Change, Green India Mission, and India's NDC to UNFCCC.
- **Key focus**
 - Cooperation and involvement of the tribals, other forest dwelling communities and the society as a whole
- **Significance**
 - Reiterates India's commitment to Paris Agreement on CC
 - It will help in conservation of forests and enhance productivity of forest ecosystem.
 - REDD+ strategy will help India fulfill its NDC commitment and contribute to the livelihood of the forest dependent population.

2) THE UN REDD PROGRAM (THE UN COLLABORATIVE PROGRAM ON REDUCING EMISSIONS FROM DEFORESTATION AND DEGRADATION IN A DEVELOPING COUNTRIES)

- It is a multilateral body which partners with developing countries by assisting them to develop the capacities needed to meet the UNFCCC REDD+ requirements.
 - It does so through a country based approach that provides advisory and technical support services tailored to national circumstances and needs.
- It is a collaborative initiative of FAO, UNDP, and UNEP. It also harnesses technical expertise of other UN agencies.

3) CENTRAL AFRICAN FOREST INITIATIVE (CAFI)

- CAFI was founded in 2015 as a collaborative agreement between six Central African Countries - the Central African Republic, the Democratic Republic of Congo, the Republic of Congo, Gabon, Equatorial Guinea and Cameroon - and six financial partners: the European Union, France, Norway, Germany, South Korea and the Netherlands.
 - It is **based around the REDD+ mechanism** developed by the parties to the UNFCCC.

9. MITIGATION STRATEGIES

Key issues covered – Carbon Sequestration, Carbon Sink, Carbon Credit, Carbon Offset, Carbon Tax, and Geo-Engineering

1) CARBON SEQUESTRATION

- It is the process of capturing and storing atmospheric carbon dioxide. It is one of the methods of reducing the amount of carbon dioxide in the atmosphere with the aim of fighting climate change.
- **There can be two major types of carbon sequestration:**
 - » **Biological:**
 - Biological Carbon Sequestration is the storage of carbon dioxide in **vegetation** such as grasslands, or forests, as well as in **soils and oceans**.
 - **Plant rich landscapes** like forests, grasslands etc. capture 25% of the global carbon emissions.



- **Soil** can store carbon in the form of Soil Organic Carbon.
 - Soil can also store carbon as carbonates.
- **Colder and nutrient rich part of ocean** can absorb more carbon dioxide than warmer parts. Therefore, polar regions generally serve as carbon sink.

» **Geological Carbon Sequestration**

- It is the process of storing carbon dioxide in underground geologic formations, or rocks.
- **Naturally, Carbonates** are created over thousands of years when carbon dioxide dissolved in water and percolates in soil, combining with calcium and magnesium minerals, forming '**caliche**' in desert and arid soil.
- **Artificially**, CO₂ captured from industrial, or any other sources may be injected into porous rocks for long-term storage.
 - **Hydrodynamic Trapping**: It refers to a time-dependent hydrogeological process where injected CO₂ is effectively trapped by the existence of very long travel times to the surface.
 - **Solubility Trap**: CO₂ dissolved in liquid like water or oil.
 - **Mineral Carbonation**: CO₂ can be made to react to naturally occurring minerals to form stable compound which can stay like that for years (e.g. Calcium carbonate)

» **Technological Carbon Sequestration**

- These are the new ways being explored by scientists to capture and store carbon using innovative technologies and to make useful products out of it.
- **Graphene Production**
- **Direct Air Capture** - Capturing carbon directly from air using advanced technology plants.
 - For now the technology is highly expensive and energy intensive. But with more advancement in technologies, this may become a viable option.
- **Engineered Molecules** - These molecules can change shape by creating new kinds of compounds capable of singling out and capturing carbon dioxide from the air.

2) CARBON SINK (GREEN AND BLUE CARBON)

- **Green Carbon**: It is the carbon which is stored by vegetation (forests, grasslands, etc.). It is basically **biological carbon sequestration**. Reforestation and Afforestation are mechanisms to enhance Green Carbon
- **Blue Carbon**: Carbon stored by coastal, aquatic or marine ecosystems. These include mangroves, seagrasses etc.
 - Coastal ecosystems are more efficient carbon sinks when compared to tropical rain forests.

1) CARBON CREDIT AND CARBON OFFSETTING (ALREADY DISCUSSED WITH MARKET BASED MECHANISM)

2) CARBON PRICING INCLUDING CARBON TAX

- **Carbon Pricing** is a method which captures the external cost of green house emissions - i.e. the losses to different sectors like agriculture, health, property etc. due to addition of Greenhouse gas in atmosphere. There are **two major types** of Carbon Pricing - **Emission Trading System** (or Cap and Trade System) and **Carbon Tax**.
- **Advantages of Carbon Pricing:**
 - » Shifts the cost on polluters -> internalize the external cost of pollution
- **Carbon tax** is a potential alternative to the 'cap and trade' method currently used by the Kyoto protocol to reduce the carbon emission.
 - » A carbon tax aims to internalize the externality of climate change by setting a price on the carbon content of energy consumed or greenhouse gas emitted in the production of consumption of goods.
- **Advantages of carbon taxes over 'Quantitative limits' or 'Cap and trade' system**
 1. **Avoids the problem of choosing a baseline** : In a price approach, the natural baseline is a zero carbon tax.
 2. **Better adaptation to element of uncertainty** which pervades the science of climate change.
 - Quantitative limits are related to the stocks of greenhouse gas emissions, while the price limits are related to the flow of emissions.
 3. **Less volatility and more predictability** : From uncertainty (point 2) arises volatility. Carbon tax regime is likely to cause less volatility in the prices of carbon emission
 4. **Less administrative arbitrariness - easier implementation - lack of manipulation**
 - Quantity limiting policies are often accompanied by administrative arbitrariness and corruption through rent seeking. This sends of wrong signals to investors.
 - In a price based system, the investors has an assured long-term regulation to adapt to and can weigh in the costs involved.
 5. **Addresses the problem of equity**
 - Equity is the most contentious issue in any international negotiation on climate change mitigation either at the level of WTO or UNFCCC.
 - The price based approach in the form of carbon tax makes it easier to implement the equity based international adjustments than the quantity based approach.
 6. **Carbon tax will essentially be a Pigovian tax** which balances the marginal costs and benefits of additional emissions, thereby internalizing the cost of environmental damage.
 7. **Better understandability**: the carbon tax is simpler to understand and therefore may be braced by more people
- **Limitations of Global Carbon Tax**
 - **No CBDR**: It penalizes incremental carbon emissions rather than those who have **already spewed into the atmosphere** since the Industrial revolution.
 - **Taxes are part of national social contracts** that emerge out of very specific conditions that can't necessarily be replicated on a global scale.
- **Has India imposed any carbon tax yet?**
 - A carbon tax increases the price that consumers pay for energy. Increase in **fuel taxes** as well as **quadrupling of the coal cess** is sometimes interpreted as a variant of a carbon tax.

- Similarly, not decreasing the petrol/diesel prices according to the decrease in crude oil prices can also be seen as a method of imposition of carbon tax.

3) GEO-ENGINEERING

- Introduction:**
 - Definition:** Geo-engineering is a theoretical concept which aims to modify and cool environment to defeat the global warming. It may involve reduction of Sunlight reaching earth or absorption of CO₂ to reduce global warming (Carbon Capture Technologies).
 - Since the global community is looking for a Net Zero target by 2050, the Geo-engineering technologies are expected to play a key role in this.
- Reduction of sunlight reaching Earth:**
 - Stratospheric Aerosol Injection:** Injecting the atmosphere with Sulphur/ Hydrogen Sulphide (copies volcanic effect and scatters sunlight).
 - Putting Large Mirrors in Space** - reduce the amount of sunlight reaching earth.
 - Using Wind-Powered Motors to **whiten the cloud** -> by spraying water into the sky -> reflect solar radiation.
- Carbon Capture and Storage (CCS)** (Or Carbon Capture Utilization and Storage (CCUS)) refers to technologies that can capture CO₂, at a source of emissions before it is released into atmosphere.
 - The process starts with capture of CO₂ which undergoes a compression process to from a dense fluid. This eases the transport and storage of the captured CO₂.
 - This dense fluid is transported via pipelines and then injected into the underground storage facilities. It can also be used as a raw material in other industrial processes such as bicarbonates.
- CDR** takes the form of both natural means like afforestation or reforestation, and technologies like direct air capture where machines mimic trees by absorbing CO₂ from their surrounding and storing it underground.
 - E.g. Fake Trees containing compounds which can react with CO₂ to absorb it and store it in solid from.
- Other Carbon Capture Technologies**
 - Ocean Iron Fertilization:** Seeding the Sea with Iron
 - Phytoplankton prefer iron and flourish in its presence, thus absorbing a lot of CO₂.
- How significant is the role of CCS and CDR in achieving net-zero by 2050?**
 - In IPCC AR6, there is no pathway to 1.5 degrees C that doesn't use CDR.
- Limitations/Problems with these CCS and Geoengineering method:**
 - CCS and CDR** are still technologies under development without demonstrated feasibility at large scale despite decades of development.
 - It also suffers from other challenges like high energy requirements; high cost; challenges in the transport and long-term storage of carbon.
 - CDR** methods like afforestation, reforestation, Bioenergy with Carbon Capture and Storage (BECCS) are constrained by their need of land. It may also hamper food and water security.

- » **Ocean Iron Fertilization:** The Convention of Biological Diversity has already imposed a de facto moratorium based on precautionary principle. It could result in eutrophication, which may adversely affect the ocean ecosystem.
- » **Stratospheric Aerosol Injection** is also highly controversial as this could have unintended effects on global and regional climates.
- » Further, there are concerns related to **fairness, equity, and justice** in the adoption of geo-engineering technologies as most of the R&D is dominated by North American and Western Euro.

- So far, there has been very little progress on these technologies and most of the R&D is dominated by North American and Western European Nations. Emerging economies like China and India have also begun to look into these options more seriously.
 - CCS is **absent from INDCs of most of the countries**, indicating that most of the countries have not yet accepted it as promising technology.
 -
- **Why very little progress?** - Lack of policy support and spending on R&D.

4) OCEAN CARBON DIOXIDE REMOVAL

- **Introduction:**
 - » Ocean stores about 50 times more carbon than the atmosphere. So, for taking carbon out of atmosphere and storing it someplace where it won't continue to warm the planet, the ocean is the single biggest place it can go.
 - » **Ocean Carbon dioxide Removal (Ocean CDR)** uses the ocean's natural ability to take up carbon on a large scale and amplifies it.
 - **Carbon gets into ocean from atmosphere in two ways:**
 1. Air dissolves in the ocean surface. Because sea water is slightly alkaline, the CO₂ is absorbed into the ocean.
 2. The second involves **biologic pump**.
 - Ocean is a living medium and has algae, crustaceans, fish, whales etc. When organic material is eaten or dies, it gets recycled. It rains down through the ocean and makes its way to the ocean twilight zone, a level around 200 to 1,000 meters deep.
 - This twilight zone sustains the biological activities of the ocean. It is the soil of the ocean where organic carbon and nutrients accumulate and are recycled by microbes.
 - It is also home to the largest animal migration on the planet. Each day, trillions of fish and other organisms migrate from the depths to the surface to feed on the phytoplankton and one another and go back down, acting like a large carbon pump that captures carbon from the surface and shunts it down into the ocean where it is stored away from the atmosphere.
- **Why is OCEAN CDR drawing so much attention right now?**
 - » Some experts feel that because of its volume and carbon storage potential, the ocean is really the only arrow in our quiver that has the ability to take up and store at the scale and urgency required.

- » A 2022 report by the national academies outlined a research strategy for ocean carbon dioxide removal. The **three most promising methods** highlighted are:
 - **Ocean Alkalinity enhancement:** Oceans are naturally alkaline, with a pH of about **8.1**. Increasing alkalinity by dissolving certain powder rocks and minerals makes the ocean a chemical sponge for atmospheric CO₂.
 - **Add micro-nutrients to ocean surface**, particularly soluble iron.
 - Very small amount of soluble iron can stimulate great productivity (algal growth), which drives a more vigorous biological pump.
 - Over a dozen of these experiments have been done, so the scientists know that it works.
 - **Grow Kelp in the Ocean:** It captures carbon at the surface through photosynthesis, then bale it and sink it to the deep ocean.
- » But, **all these methods** have drawbacks for large scale use, including cost and unanticipated consequences

10. EFFORTS BY AVIATION AND SHIPPING SECTOR

1) ICAO – CORSIA

- **Introduction**
 - » The International Civil Aviation Organization (ICAO) is a specialized agency of UN which deals with administration and governance of the Convention on International Civil Aviation (Chicago Convention).
 - » It was established in **1944** and is headquartered at **Montreal Canada**.
 - » It works with 192 Member states of convention and other industry groups to come to a consensus on **International Civil Aviation Standards and Recommendation Practices (SARPs)** and **Policies** to ensure safe, efficient, secure, economically sustainable and environmentally responsible civil aviation.
 - » It also assists member states in capacity building towards various aviation development objectives.
- **Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)**
 - » In **2016**, ICAO finally (after years of negotiations) sealed the first deal for limiting green-house gases from international aviation. The decision was taken during 39th ICAO general assembly meeting attended by 191 countries.
 - » **Details of the Offsetting Scheme:** From **2021**, any increase in airline CO₂ emission will be offset by activities like tree planting, which soak up CO₂.
 - CO₂ will be allowed to grow to 2020 but after that, emissions will need to be offset.
 - Three Phases:
 - **Pilot Phase:** 2021-2023 (Voluntary)
 - **First Phase:** 2024-2026 (Voluntary)
 - **Second Phase:** 2027-2035 (Mandatory for all member states)
 - The deal will be voluntary till 2026 but most major nations are expected to take part.
 - Review period every three years and it rules out "double counting" of offsets to ensure that forest protection efforts elsewhere aren't used to negate aircraft emissions.

- » Applicable to Civilian passenger and cargo flights.
- » **Exceptions:** Humanitarian, Medical, Firefighting flights etc.
- **Developing countries** like India, China, Brazil etc had opposed the provisions. Why? ?
- **CORSIA** is part of the effort from ICAO to halve the carbon emissions by 2050 compared to 2005 levels.
 - » **Other efforts** include adoption of new technology - including deployment of sustainable alternative fuels, more efficient aircraft operations, infrastructure improvements including modernized air-traffic management systems.
- **DGCA Guidelines to airlines operators** (Oct 2018)
 - » Under these guidelines, all operators engaged in international operations have to capture their fuel consumptions and carbon emissions data annually, starting from Jan 1, 2019.
 - » Further, beginning 2021, the operators will have to meet offsetting requirements by purchasing and cancelling "emission units".

2) INTERNATIONAL MARITIME ORGANIZATION (IMO) REACHES A DEAL TO CUT EMISSIONS

- **Key Highlights of the deal:**
 - » More than 170 countries under the aegis of IMO have agreed to a target to reduce greenhouse gas emissions from shipping by at least 50% of 2008 levels by 2050. This is being called as "initial strategy".
 - » The strategy also proposes to reduce carbon intensity from shipping - the amount of CO₂ emitted from each unit of transport - by at least 40% by 2030, and 70% by 2050.
 - » The final IMO Plan is not expected by 2023.
 - » **Some possible medium term measures** discussed include:
 1. Low carbon and zero carbon fuels
 2. Improved energy efficiency of new and existing ships
 3. Possible market based mechanism to encourage shift to lower carbon fuels.
- **Analysis**
 - » Experts feel that IMO should and could have gone much further in their contribution. Opposition from some countries especially USA, Saudi Arabia and Panama had limited what could be achieved at the IMO session.
 1. To align with Paris goals, the reduction target should be 70-100%.
 - » **Developing countries** like India are worried that a target to reduce emission from shipping sector will negatively hamper their yet to fully develop sector.
- **Note:** Shipping and Aviation sector avoided specific emission-cutting targets in a global climate pact agreed in Paris in 2015.

11. EFFORTS BY INDIA TO FIGHT CLIMATE CHANGE

1) NATIONAL ACTION PLAN ON CLIMATE CHANGE (NAPCC)

- **Introduction**
 - » Challenges emerging from climate change are complex and multi-sectoral, and therefore these have to be dealt with a multi-dimensional approach.

- » Keeping this in mind, **GoI in 2008, adopted NAPCC** which is aimed at promoting development objectives and at the same time tackling climate change effectively.
 - » There are 8 missions which form the core of NAPCC. These missions represent the multipronged and integrated approach required to deal with climate change.
- **How NAPCC was supposed to deal with Climate Change**
- Development and use of **new technologies**.
 - **Involving multiple ministries** which will focus on different mission objectives
 - **Involving private sector** through PPP projects and civil society actions.
 - **Promoting awareness** about climate change, adaptation, energy efficiency etc.
- **Understanding Achievements and Limitations of Individual Missions**
- i. **National Solar Mission** is aimed at increasing the solar energy capacity in the country and thus reducing the emission of GHGs.
 - Governed by Ministry of New and Renewable energy.
 - The target of JNNSM was enhanced to 100 GW by 2022 which includes 60 GW through large and medium scale grid connected solar power projects and 40 GW through rooftop solar.
 - ii. **National Mission for Enhanced Energy Efficiency (NMEEE)** is aimed at improving energy efficiency and thus meeting energy demands of the country.
 - **Ministry:** Ministry of Power
 - The mission commenced in 2010 with a target to achieve the following:
 - GHG reduction of 98.55 million tonnes/ year at full implementation stage.
 - Annual fuel savings of 23 million tons.
 - iii. **National Mission for Sustainable Habitat**
 - **Ministry of Housing and Urban Affairs**
 - The mission commenced in 2010 with an aim to reduce emission in cities.
 - It focuses on GHG reduction opportunities by increasing energy efficiency of the building, improving municipal solid waste management, and encouraging people to use public transport.
 - Some specific initiatives to achieve these objectives are Adaptation of the existing Energy Conservation Building Code and promoting investments in development of high capacity public transport system.
 - iv. **National Water Mission**
 - Ministry of Jal Shakti.
 - The mission commenced in 2011 with an aim to ensure water security and improve access to water resources. It aims to achieve this by promoting water conservation and water use efficiency.
 - It covers the entire sweep of water management to fight climate change impacts: from water conservation to water use efficiency.
 - v. **National Mission for Sustaining Himalayan Ecosystem**

- Governed by **Department of Science and Technology**
 - Commencement in 2011
 - Aimed at developing capacity to assess the health status of Himalayan Ecosystem and helping Himalayan states in policy formulation and implementation.
- vi. **The National Mission on Strategic Knowledge for Climate Change**
- Governed by **Department of Science and Technology**
 - Commencement in 2014
 - Aimed at establishment of knowledge network among the existing knowledge institutions engaged in R&D related to climate change.
 - The two missions (NMSHE and NMSKCC) operated under **DST** and aims to generate new information, building scientific and technical capacity, and produce new channel of collaboration between scientists, policy makers and law makers to ensure that climate action is based on sound knowledge and science.
- vii. **National Mission for Green India**
- **MoEF&CC**
 - Commencement: 2014
 - Aims: To increase forest and tree cover.
 - Under this the focus is on reviving degraded forests with a focus on increasing forest cover & density and conserving biodiversity.
- viii. **National Mission for Sustainable Agriculture**
- Commenced in 2012 with aim to climate-proof agriculture and reduce emission from the sector.
 - There are **four components** under NMSA
 1. **Soil Health Management** aims at nutrient management through judicious use of chemical fertilizers for improving soil health and productivity.
 2. **Rainfed Area Development** to develop or bring agri-land under integrated farming system.
 3. **Sub-Mission on agro-forestry** to promote plantation along with crops.
 4. **Climate Change and Sustainable Agriculture: Monitoring Modeling and Networking** (CCSAMMN) for creating models on adaptation and dissemination of information about climate change.

3) MISSION LIFE

- **Why in news?**
 - » PM Modi launched Mission LiFE (Lifestyle for Environment), in the presence of UN Secretary General Antonio Guterres (Oct 2022)
- **Details about Mission LiFE**
 - » It was first proposed by PM Modi at COP 26 of UNFCCC in Nov 2021. It is envisioned as an India led global mass movement that will nudge individual and collective action to protect and preserve the environment.
 - PM Modi has underlined that Mission LiFE makes the fight against climate change democratic, in which everyone can contribute with their respective capacities.

- It emboldens the spirit of the P3 Model: Pro Planet People.
- It functions on the basic principles of 'Lifestyle of the planet, for the planet and by the planet'.
- » At the launch, PM Modi also highlighted that the concept of 'Reduce, Reuse and Recycle' and circular economy; and mentioned that it has been part of the Indian Lifestyle for thousands of years.
- » LIFE also resonates with **climate justice** -> it highlights enhanced obligations for those in developed countries and supports climate adaptation and mitigation for those most affected and yet least responsible.
- **NITI Aayog and MoEF&CC**, in collaboration with Government of Gujarat, organized the global launch of Mission Life.
 - » NITI aayog will curate and incubate Mission Life in the first year, and it will subsequently be implemented by MoEF&CC.
 - » It is a five year program.
- **Significance:**
 - » According to UNEP, more than 2/3rd of the GHG emissions can be attributed to household consumption and lifestyles -> therefore the urgent cuts to global emissions we need can only be achieved through widespread adoption of greener consumption habits.
 - » Life recognizes that small individual actions can tip the balance in the planet's favor.
 - Actions such as saving energy at home; cycling and using public transport instead of driving; eating more plant-based foods and wasting less; and leveraging our position as customers and employees to demand climate-based friendly choices.
 - » Many of the goals of LiFE can be achieved by deploying 'nudges', gentle persuasion technique to encourage positive Behaviour.
 - The UNEP employs proven nudging techniques:
 - Discouraging Food waste by offering smaller plates in cafeterias;
 - encouraging recycling by making bin lids eye-catching;
 - and encouraging cycling by creating cycle paths
- **Note: Other Recent global initiatives launched/initiated by India:**
 - Panchamrita Targets announced by Mr Modi at COP26
 - International Solar Alliance
 - The Coalition for Disaster Resilient Infrastructure

4) GREEN BONDS: MOBILIZING FUNDS

- Though the Paris Agreement provides for mobilization of resources from developed countries, the process has been very slow.
- Thus, India has scaled up its efforts towards greater mobilization of private capital to meet its ambitious climate action goals.
- Green Bonds are financial instruments that generate proceeds for investment in environmentally sustainable and climate suitable projects.
 - Developed countries such as UK, France, Germany etc have been using Green bonds to raise billions of dollars of sovereign green debts.

- In India, as per SEBI's data between 2017 and Sep 2022, 15 Indian corporates have issued green bonds of value of Rs 4,539 crores. Most of this is related to renewable energy generation.
- Union Budget 2022-23 announced the issuance of Sovereign Green Bonds.
 - The final sovereign Green bond framework of India has been issued.
 - The Green Financing working committee has also been set up to oversee and validate key decisions on the issuance of Sovereign green bonds.
 - The committee has the mandate to select the projects for allocation of proceeds, do a time-bound review of the allocation and carry out annual reporting along with an impact assessment of the proceeds from sovereign green bonds issued

A) REGULATORY FRAMEWORK FOR ISSUANCE OF GREEN DEBT SECURITIES

- Reserve Bank of India:
 - In Nov 2021, the RBI published its 'Statement of Commitment to Support Greening India's Financial System' - **NGFS**. Here, the Reserve Bank of India (RBI) laid out, keeping in view its national commitments, priorities, and complexity of our financial system, committed to, among others, exploring how climate scenario exercises can be used to identify vulnerabilities in RBI-supervised entities' balance sheets, business models and gaps in their capabilities for measuring and managing climate-related financial risks.
 - **Also, in 2007, the RB advised banks to put in place an appropriate action plan for making a meaningful contribution** to sustainable development.
 - Over time, RBI has incentivised bank lending towards greener industries and projects.
 - For example, renewable energy projects have been included under Priority Sector Lending (PSL).

B) SECURITIES AND EXCHANGE BOARD OF INDIA (SEBI)

- SEBI introduced the regulatory framework for issuance of green debt securities as a mode of sustainable finance under the erstwhile SEBI (Issue and Listing of Debt Securities) Regulations, 2008, (ILDS Regulations), in 2017.
- At the time of review of the ILDS Regulations, the provisions of the erstwhile circular were subsumed, and the definition of "green debt security" was incorporated as Regulation 2(1)(q) in the SEBI (Issue and Listing of Non-Convertible Securities) Regulations, 2021 ('NCS Regulations'). The disclosure requirements were prescribed vide Operational Circular dated August 10, 2021.
- In Nov 2022, SEBI has allowed an issuer under the SEBI (Issue and Listing of Municipal Debt Securities) Regulations, 2015 ('ILMDS Regulations') to issue a green debt security if it falls within the definition of "green debt security" as per Regulation 2(1)(q) of the NCS Regulations. Such an issuer has to comply with both ILMDS Regulation and NCS Regulation
- In the backdrop of increasing interest in sustainable finance in India as well as around the globe, and with a view to aligning the extant framework for green debt securities with the updated Green Bond Principles recognised by International Organisation of Securities Commission (IOSCO), SEBI undertook a review of the regulatory framework for green debt securities. Based on the review, it has been decided in the SEBI board meeting dated December 20, 2022, to:

- Enhance the scope of the definition of green debt security by including new modes of sustainable finance in relation to pollution prevention and control, eco-efficient products, etc.;
- Introduce the concept of blue bonds (related to water management and marine sector), yellow bonds (related to solar energy) and transition bonds as subcategories of green debt securities.

12. DESERTIFICATION AND LAND DEGRADATION

- **Introduction**
 - Desertification is a type of land degradation in which relatively dry land region becomes increasingly arid, typically losing its bodies of water as well as vegetation and wildlife.
 - Currently, 41% of the landmass worldwide is prone to desertification and more than 2 billion people are affected by desertification and land degradation.
- **Key causes**
 - i. **Deforestation**
 - ii. **Overgrazing and unsustainable agri practices** are other major factors leading to desertification.
 - iii. **Increasing Pollution** also negatively hampers biodiversity (including biodiversity), causes infertility of soil and promotes desertification
 - iv. **Climate Change and higher probability of droughts** have made more areas vulnerable to desertification
 - v. **Salination** caused by overuse of water, degrades soil and promotes desertification.
 - vi. **Unsustainable Mining practices** also degrades the geographic region and promotes desertification.
 - vii. **Invasive species** of plants such as **Proposis Juliflora** have also resulted in the decline of natural vegetation and expansion of deserts.
 - This can be specifically seen in case of **Banni Grassland**, of Kutch Gujarat.
 - viii. **Forest fires** are the other major drivers of desertification.
 - ix. **Lack of Resources** to fight desertification
 - The issue was also raised recently in the 14th COP on UNCCD. Only \$6.4 billion have been spent in last 2 years to combat desertification, the real cost should be as much as \$450 billion annually.
- **Impact**
 - i. **Threatens socio-economic development** by threatening food security, increasing poverty and unemployment due to land degradation.
 - ii. **Increases vulnerability of already vulnerable groups**
 - iii. **Promotes the vicious cycle of degradation**
 - Poverty force people to go for unsustainable agri practices, further promoting desertification.
 - iv. **Desertification adds to and worsens the impact of climate change**
 - It reduces forest cover and thus reduces the sinks for CO₂.

1) UNITED NATION CONVENTION ON COMBATING DESERTIFICATION (UNCCD)

- UNCCD is one of three important conventions finalized in 1992 Earth Summit (the other being CBD and UNFCCC)

- It was **established in 1994** and is the **sole legally binding international agreement linking environment and development to sustainable land management**.
 - The convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as drylands, where some of the most vulnerable ecosystems and peoples can be found.
- The convention has **197 members** who work together to:
 - Improve the living condition of people** in drylands
 - Maintain and restore soil productivity**
 - Mitigate the effect of drought**

2) THE NEW UNCCD 2018-30 STRATEGIC FRAMEWORK

- It is the most comprehensive global commitment to achieve **Land Degradation Neutrality (LDN)** to achieve a land degradation-neutral world consistent with the 2030 Agenda for Sustainable Development.
- **Land Degradation Neutrality**
 - A state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems.
- **The LDN Target Setting Program**
 - Through this, the Global Mechanism (GM) and Secretariat on UNCCD, in collaboration with multiple international partners, are supporting interested countries in their national LDN target setting process.
- **The LDN Fund**
 - It is an impact investment fund, blending resources from the public, private and philanthropic sectors to support achieving LDN through sustainable land management and land restoration **projects implemented in private sector**.
 - It is the first of its kind investment vehicle leveraging public money to raise private capital for sustainable land projects.
 - It was officially launched at COP 13 in Ordos, China.

3) WORLD DAY TO COMBAT DESERTIFICATION AND DROUGHT: 17TH JUNE

- **Background**

- In 1994, General Assembly established the United Nations Convention to Combat Desertification (UNCCD), the sole legally binding international agreement linking environment and development to sustainable land management, and declared 17th June "World Day to Combat Desertification and Drought".
- Later, in 2007, UNGA declared the decade 2010-2020 as the **UN Decade for Deserts and Fight Against Desertification to mobilize global action to fight land degradation.**
- The 2021 Desertification and Drought day focused on turning degraded land into healthy land.

Desertification & Drought Day

17 JUNE
2021



Restoration. Land. Recovery.

We build back better with healthy land

4) THE BONN CHALLENGE

- It is a global goal to bring 150 million hectares of degraded and deforested landscapes into restoration by 2020 and 350 million hectares by 2030.

5) GREAT GREEN WALL INITIATIVE

- This initiative was launched in 2007 by African Union and is aimed at restoring Africa's degraded landscapes and transform millions of lives in one of the world's poorest regions, the Sahel.
- It will be covering the Sahel region, from Senegal in the west to Djibouti in the East of Africa.
- Once, complete the wall will be the largest living structure on the planet - an 8,000 km natural wonder of the world stretching across the entire width of the continent.
- The initiative has brought together African Countries and International Partners, under the leadership of African Union Commission and Pan-African Agency of the Great Green Wall.
- **Objectives:**
 - By 2030, restore 100 million ha of currently degraded land; sequester 250 million tons of carbon; and create 10 million green jobs.



6) UN HIGH LEVEL DIALOGUE ON DESERTIFICATION, LAND DEGRADATION, AND DROUGHT

- **Why in news?**
 - PM Modi gave a keynote address at the UN 'High-Level Dialogue on Desertification, Land Degradation and Drought' (June 2021)
- **Details**

- The President of General Assembly convened a High-Level Dialogue to assess the progress made in the fight against DLDD during the UN Decade for Deserts and the Fight Against Desertification (2011-2020) and map the way forward. This dialogue took place in May 2021.

- **Key Purpose**

- Bring attention to how COVID-19 recovery process can be aligned to address DLDD through job creation project in land restoration, regenerative agriculture, renewable energy and energy efficiency, and investments in sustainable land management.
- Elevate the discourse on DLDD issues' global significance for the entire SDG agenda and for climate, biodiversity and disaster risk reduction.
- Build upon the commitments made by member states during CBD summit, UNFCCC summit and so on.
- Encourage all UN members to adopt and implement Land degradation Neutrality targets and National Drought Plans as part of their NDCs to Paris Agreement.
- Call member countries to support the Land Degradation Neutrality Fund and other funding mechanisms to scale up land restoration by all sectors of society
- Share experiences, best practices, cutting edge technologies and innovative business models that advance green, resilient and inclusive recovery strategy.

- **Key Highlights of PM Modi's Address**

- In India, we have **always given importance to land and considered the sacred Earth as our mother.**
- **Key steps by India:**
 - » **Afforestation:** Over last 10 years, India has added 3 million hectares of forest cover.
 - » India is on track to achieve our national commitment of Land Degradation Neutrality [SDG target 15.3].
 - » India is also working towards restoring 26 million hectares of degraded land by 2030.
 - This would also contribute to India's NDC commitment of an additional 2.5 to 3 billion tonnes of carbon dioxide equivalent.
 - » In the spirit of south-south cooperation, India is also helping fellow developing countries to develop land restoration strategies.
 - » A centre of excellence is being set up in India to promote scientific approach towards land degradation strategy.
- **Restoration of land** can start the virtuous cycle of good soil health, increased land productivity, food security and improved livelihood.

7) DESERTIFICATION AND LAND DEGRADATION ATLAS OF INDIA

- It has been published by Space Application Centre, ISRO Ahmedabad (June 2021)
- The Atlas provides state wise area of degraded lands for the time frame 2018-19. It also provides change analysis for the duration of 15 years, from 2003-05 to 2018-19.
- **Key Highlights**
 - 29.7% of India's land is degraded.
 - i.e. 97.8 million hectares of India's total geographical area (TGA) of 328.72 mha underwent land degradation

- Area under **desertification** have also increased to 83.69 million hectares in 2018-19 from 82.64 mha in 2011-13.
 - Note: Land degradation within dry land regions (arid, semi-arid, and dry sub-humid regions) is termed as desertification.
- **Statewise breakup**
 - **Increase in level of desertification** have been seen in 28 out of 31 states and UTs between 2011-13 and 2018-19.
 - Even in **Goa and Odisha** where desertification had earlier declined (between 2003-05 and 2011-13), it has increased now.
 - Land degradation and desertification was **declining** in UP, Rajasthan and Telangana in 2018-19.

Around 23.79% of the area undergoing desertification with respect to the TGA of the country was contributed by Rajasthan, Maharashtra, Gujarat, Karnataka, Ladakh, Jharkhand, Odisha, Madhya Pradesh, and Telangana.

13. OZONE LAYER

- Ozone is a natural gas, it is an allotrope of oxygen consisting of three atoms of oxygen bound together in a non-linear fashion. The chemical symbol for ozone is O₃.
- It's a pale blue gas with distinctive pungent smell.
- **Pollutant at ground level** - discussed with air pollution
- **Ozone Layer**
 - » The ozone layer or ozone shield is a region of Earth's stratosphere that absorbs most of the sun's ultraviolet (UV) radiation. It contains high concentration of Ozone (O₃) in relation to other parts of the atmosphere, although still small in relation to other gases in the stratosphere.
 - » Ozone layer is mainly found in lower stratosphere (approx. 20-30 km above earth)
- **Usefulness of ozone layer:** Prevents damaging Ultraviolet from reaching earth thus benefitting both plants and animals; Protects oxygen of lower layer which would break up by the action of ultraviolet rays otherwise.

1) OZONE LAYER DEPLETION

- **What caused Ozone Layer depletion?**
 - » In 1970s scientists discovered that Chlorofluorocarbons (CFCs), broke apart in the atmosphere and released **chlorine atoms**. This caused the ozone depletion. The same effect resulted when bromine atoms were released by halons. Thus, **CFCs and halons** are examples of Ozone depleting substances.
- **What are the uses of Ozone depleting substances/ when and why they are produced?**
 - » **Chlorofluorocarbons (CFCs):** Used as refrigerants and aerosol propellants, for making plastic foam, cleaning of electronic equipment.

- Lifetime and removal of CFCs: Unlike other chemicals, CFCs cannot be eliminated from atmosphere by the usual scavenging processes like photo dissociation, rain-out and oxidation.
 - Escape of CFCs: The CFC enter into atmosphere by gradual evaporation from their source (discarded refrigerators etc.) Since the CFCs are thermally stable, they can survive in the troposphere. But in the stratosphere, they are exposed to UV radiation.
- **Bromine containing compounds:** Bromine containing compounds called halons and HBFCs, i.e., hydro Bromo fluorocarbons [both used in fire extinguishers] and methyl bromide (a widely used pesticide).
- **Carbon Tetrachloride:** It is a cheap, highly toxic solvent. Used in manufacture of synthetic rubber, the production of pesticides and pharmaceuticals.
- **Methyl Chloroform:** Used as cleaning solvent for clothes and metals, and a propellant in a wide range of consumer products, such as correction fluid, dry cleaning sprays, spray adhesives) and other aerosols.
- **Trichloroethane:** A versatile, all-purpose solvent.
- **Hydrochlorofluorocarbons (HCFCs):** Developed as an interim replacement for CFCs. Much less harmful than CFCs. But have high global warming potentials.
- **Nitrous Oxide (N₂O):** It can gradually reach the middle of the stratosphere, where it is photolytically destroyed to yield nitric oxide which in turn destroys ozone.
- **Sulphuric Acid Particles:**
 - The most prominent acid used in various industries
 - These particles free chlorine from the molecular reservoirs, and convert reactive nitrogen into inert forms thus preventing the formation of chlorine reservoirs.

2) SCIENCE OF OZONE DESTRUCTION

- **Through Chlorine atoms**
 - The molecules of CFCs when exposed to UV radiation break up, thus freeing chlorine atoms. A free chlorine atom reacts with an ozone molecule to form chlorine monoxide (ClO).
 - The depletion of ozone is catalytic ((ClO) further combine with an atom of oxygen to form O₂ and Cl. This Cl can further react with O₃ and the cycle continues. Thus, a single chlorine atom can destroy thousands of ozone molecules)
- **Bromine atoms**
 - Each bromine atom destroys hundred times of more ozone molecules than what a chlorine atom does.
 - » Bromine + Ozone ---> Bromine monoxide + Oxygen
 - » Bromine monoxide + Chlorine Monoxide ---> Oxygen + Bromine + Chlorine
- **Nitric Oxide (NO)**
 - Nitric oxide also catalytically destroys ozone
 - » Nitric Oxide (NO) + Ozone (O₃) -> Nitrogen dioxide (NO₂) + Oxygen (O₂)

» Nitrogen dioxide (NO_2) + monoxide (O) \rightarrow Nitric Oxide (NO) + oxygen (O_2)

3) EXTENT OF MAXIMUM DAMAGE OF OZONE LAYER

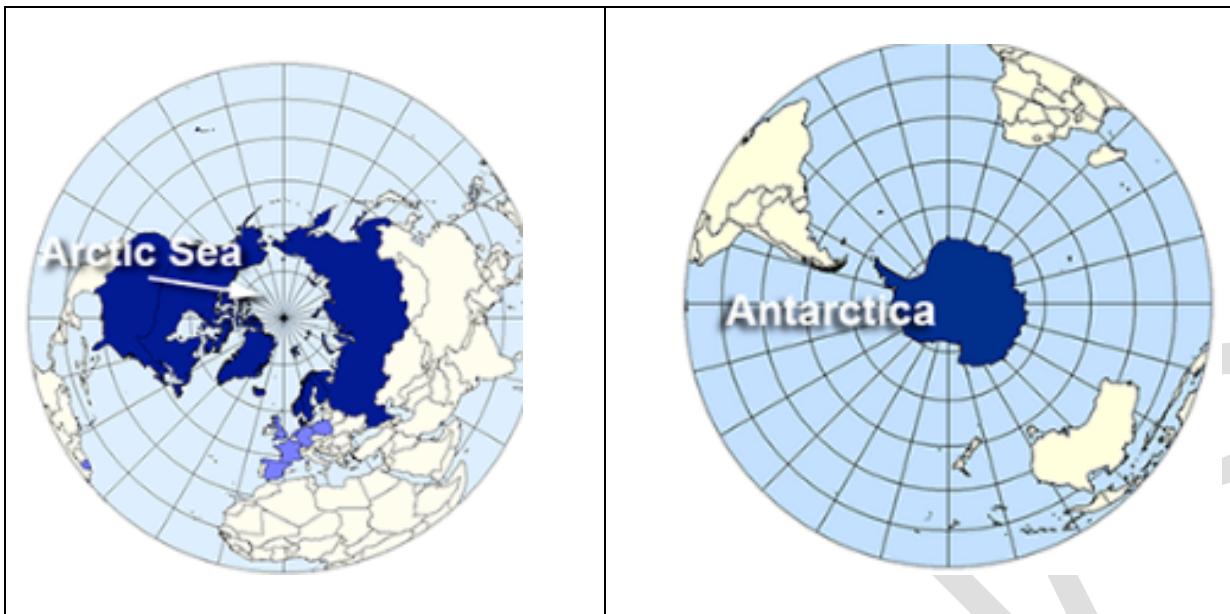
In 2000, the areas of Antarctic Ozone hole reached a record **of 29 million sq km**

4) POLAR STRATOSPHERIC CLOUDS AND OZONE DEPLETION

- What is Polar Stratospheric Cloud?
 - PSCs, also known as nacreous clouds (or mother of pearl, due to its iridescence), are clouds in the winter polar stratosphere at altitude of 15 - 25 kms. They contain water, nitric acid and/or sulfuric acid.
- Role in ozone depletion
 - Situation without PSCs
 - » **Chlorine** released by the breakdown of CFCs exists initially as pure chlorine or as chlorine monoxide but these two react further to form compounds Chlorine nitrate and HCl that are stable (inactive chlorine)
 - » The stable compounds HCl and ClONO_2 reservoirs of chlorine, and therefore for chlorine to take part in reactions of any sort, it has to be freed.
- Role of PSCs: Activating chlorine and absorbing nitrogen
 - Ice particles of the PSC provides substrates for chemical reaction which frees chlorine from its reservoirs. Usually, the reaction between HCl and ClONO_2 (Chlorine Nitrate) is very slow, but this reaction occurs at a faster rate in the presence of suitable substrate which is provided by the stratospheric clouds at the poles.
 - $\text{HCl} + \text{Chlorine Nitrate} \rightarrow \text{Cl}_2$ (Molecular chlorine) + HNO_3 (Nitric Acid)
 - PSCs not only activate chlorine, but they also absorb reactive nitrogen. If nitrogen oxides were present they would combine with chlorine monoxides to form a reservoir of chlorine nitrate (ClONO_2).

5) WHY IS OZONE DEPLETION PREDOMINANT OVER ANTARCTIC (AND NOT ARCTIC) AND OTHER AREAS WHICH PRODUCE MORE OZONE?

1. Antarctic is more cold than arctic: The Antarctic stratosphere is **much colder**. The low temperature enables the formation of PSCs, below 20 km.
 - Why Antarctic is colder than Arctic?



2. Stability of Vortex is longer here

- The vortex is a ring of rapidly circulating air that confines the ozone depletion in the Antarctic region.
- The longevity of the Antarctic vortex is another factor, enhancing favorable conditions for the depletion of ozone.
- The vortex in Antarctic remains, in fact, throughout the polar winter, well into midspring whereas the vortex in the Arctic disintegrate by the time of polar spring (March-April)

6) ENVIRONMENTAL IMPACT OF OZONE DEPLETION: IMPACT OF UV-B RADIATION ON LIVING AND NON-LIVING THINGS ON EARTH

- Decrease in the quantity of total-column ozone tend to cause increased penetration of solar UV-B radiation (290-315 nm) to the earth's surface. It has profound effect on human health, animal plants, microorganisms, material, and air quality.
 - i. **Effect on Human and Animal Health**
 - Eye disease, skin cancer and infectious morbidity
 - In susceptible (light skinned colored) population UV-B radiations is the key risk factor for development of non-melanoma skin cancer (NMSC).
 - ii. **Effects on terrestrial plants and Aquatic Ecosystem**
 - Physiological and developmental process are affected
 - iii. **Effects on biogeochemical cycles**
 - Alternates both source and sinks of greenhouse and chemically important trace gases
 - iv. **Effects on air quality**
 - **Higher photo dissociation rates of key trace gases** that controls the chemical reactivity of the troposphere.
 - Increase both production and destruction of ozone (O_3) and related oxidants such as hydrogen peroxide (H_2O_2), which are known to have adverse effect on human health, terrestrial plants, and outdoor materials.

- Can lead to increased production of particulates such as cloud condensation nuclei.
- v. **Effects on Materials**
- Synthetically occurring polymers and naturally occurring bio-polymers as well as other materials are adversely affected by solar UV radiation.
 - It increases photodegradation of these materials, limiting their life outdoors.

7) VARIOUS INITIATIVES TO CONTAIN OZONE DEPLETION

A) VIENNA CONVENTION

- **Background:** Signed in 1985 and came into force in 1988
- **Convention**
 - The objective of the convention was for countries to promote cooperation by means of systematic observations, research and information exchange on the effects of human activities on the ozone layer and to adopt legislative and administrative measures.
 - Did not contain legally binding controls and targets.
 - However, it set an important precedent. For the first time, nations agreed in principle to tackle a global environmental problem before its effects were felt or conclusively proven by science.
 - In 2009, the Vienna Convention became the first convention of any kind to achieve universal ratification.

B) MONTREAL PROTOCOL

- Once the scientific observation confirmed the ozone hole, governments recognized the need for stronger measures to reduce production and consumption of several CFCs and halons.
- Thus the Montreal protocol was signed in Sep 1987. It is an international treaty designed to protect the ozone layer through reduction of production and consumption of ODS. It came into force in 1989.
- **Key features**
 1. It required all parties to eliminate the production and import of nearly 100 substances that deplete the ozone layer, in accordance with agreed timelines.
 2. Special provisions for developing countries -> grace period of 10-15 years.
 3. Multilateral funds - a financial mechanism to help qualifying developing countries to phase out their consumption of ozone depleting substances.
 4. It required parties to report annually on production, import and export of ODSS.
 5. Precludes parties from trading ozone-depleting substances with non-parties.
 6. Requires regular assessments to enable parties to make informed decisions with the most up to date information.
- **Chemicals covered**
 - The Montreal protocol controls nearly 100 chemicals, grouped in the following categories:
 - CFCs
 - Halons
 - Carbon tetrachloride (CTC)
 - HCFC
 - Methyl Chloroform
 - Methyl Bromide

- It has been ratified by 197 parties making it first and only universally ratified protocol in UN history.
- **Impact of Montreal Protocol**
 - It has also been a highly successful international arrangement, as it has phased-out more than 98% of the ODS which was part of its main mandate by 2021. The remaining ODS are HCFCs which are in the process of being phased out.
- **What has India done under the Montreal Protocol**
 - India has already phased out CFCs, and CTC.
 - In Jan 2020, India also achieved complete phaseout of Hydrochlorofluorocarbon (HCFC)-141 b, which is a chemical used by foam manufacturing enterprise and is one of the most potent ODS after CFCs.
 - It is mainly used as a blowing agent in the production of rigid polyurethane (PU) foams.
 - Currently India is engaged in the phase-out of production and consumption of other Hydrochlorofluorocarbons (HCFCs) with an accelerated phase out schedule as per the Montreal Protocol.
 - India's current plan will result in 60 percent phase out of HCFCs by Jan 1, 2023.

C) KIGALI AMENDMENT TO MONTREAL PROTOCOL

- **About Kigali Agreement to Montreal Protocol.**
 - During the 28th Meeting of Parties (MoP) of the Montreal Protocol in 2016, Kigali Agreement was finalized.
 - Kigali agreement refers to an amendment to the 1989 Montreal Protocol to eliminate planet-warming HFC gases.
 - » It calls for phasing-out of HFCs, a set of 19 gases in Hydrofluorocarbon family that are used extensively in air-conditioning and refrigerant industry.
 - These gases are not ozone depleting but are thousands of times more dangerous than carbon dioxide in causing global warming.
 - Currently, they may have a small contribution in global warming, but with increase in the use of Air-Conditioning and Refrigeration, its contribution will be huge. Some estimates show that if the growth in the use of HFCs continue at the current rate, their contribution to global warming may reach 19% by 2050.
 - » **Why put the target in Montreal Protocol and not UNFCCC?**
 - Montreal Protocol is much more successful than the UNFCCC and have fairly good track record in controlling various kinds of emissions.
 - **Legally binding commitments**
 - » Rich and industrialized countries bring down their HFC production and consumption by at least 85 percent by 2036 compared to their annual average values in the period 2011-13 starting from 2019.
 - » A group of developing countries (more than 100) including China, Brazil and South Africa are mandated to reduce their HFC use by 80 percent of their average value in 2020-22 by the year 2045 starting from 2024.

- » India and some other developing countries - Iran, Iraq, Pakistan, and some oil economies like Saudi Arabia and Kuwait - will cut down their HFCs by 85 percent of their values in 2024-26 by the year 2047 starting from 2028.

- **The Parties to the amendment agreed to provide financing for HFCs reduction**
- **Significance:**
 - Fight Climate Change; CBDR to ensure developmental needs of countries like India; Target approach to better monitor progress
- **India's decision to ratify the Kigali Amendment (Aug 2021)**
 - Union Cabinet has decided to ratify the Kigali agreement. It comes close on the heels of similar decisions by the USA, and China - the world's largest producers and consumers of HFCs.
 - India has also announced that it will draw up a national strategy for phase-down of HFCs by the year 2023 in "consultation with all industry stakeholders". India will also amend the existing domestic laws that govern the implementation of the Montreal Protocol by the middle of 2024 to facilitate the HFC phase-down.
 - **Note-1:** India's reductions have to begin only after 2028
 - **Note-2:** By July 2021, **122 countries have ratified** the Kigali Agreement.



TARGET PRELIMS 2024

BOOKLET-17; EB&CC-7

BIODIVERSITY-BASICS; IMPORTANT MAMMALS

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2. BIODIVERSITY-BASICS

1) DEFINITION

- Biodiversity is the term popularized by the socio-biologist **Edward Wilson** to describe the **combined diversity at all levels of biological organization**.
- Biodiversity is defined as '**the variability among living organisms from all sources**, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; **this include diversity within species, between species and of ecosystems**'. (UN Earth Summit).

2) HOW IS BIODIVERSITY DISTRIBUTED ON EARTH?

- The **vast majority** of all species are found in the **tropics, and subtropics**, where most of the developing countries are also located. Infact, **50-75%** of all species are found in **tropical rainforests** that account for **just 6% of the land areas**.
 - The **genetic diversity needed to maintain the world's agricultural system** is found **mainly in tropics, and sub-tropics**. These areas also contain **most of the important medicinal plants from which new pharmaceutical products are extracted**.
 - In the **northern regions, the recurrent ice ages did not permit the flowering of many life forms**.
- **Variation with altitude:** In general biodiversity **increases with altitude until a certain threshold** and **then decreases**. This is due to environmental factors such as temperature, air pressure, and precipitation.
 - **Many mountain ecosystems show greater biodiversity and higher levels of endemism than adjacent lowlands.**
 - **Mountain at lower altitudes can support exceptional biodiversity, due to compression of a wide range of ecosystems into a relatively short distance.** Mountains also often provide **islands of suitable habitat**, isolated from unfavourable surrounding lowlands.
 - **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.

3) MEGA DIVERSE COUNTRIES

- The megadiverse country is a term used to refer to the world's top biodiversity-rich countries. These were identified in 1988 by **Conservation International (CI)**, to promote the awareness for biodiversity conservation among world nations. According to CI, there are 17 of these nations, which are mostly located in the tropical and subtropical region.
- **Criteria**
 - The principle criterion is **endemism**, first at the species level and then at higher taxonomic levels such as genus and family. To qualify as a Megadiverse Country, a country must:
 - i. Have at least 5,000 of the world's plants as endemics (native restricted to a certain place)
 - ii. Have marine ecosystem within its border.

- Purpose of this classification [Raises awareness about biodiversity conservation; complements biodiversity hotspots and HBWA in protection of biodiversity; Demonstrates how a few countries hold a large portion of global biodiversity and therefore have disproportionate political responsibility]

List of 17 megadiverse countries according the conservation international:

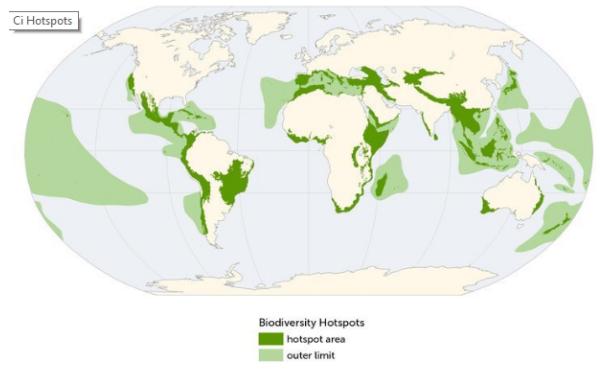
- USA
- Mexico
- Brazil
- Venezuela
- Colombia
- Ecuador
- Peru
- Democratic Republic of Congo
- South Africa
- Madagascar
- India
- China
- Malaysia
- Indonesia
- Philippines
- Papua New Guinea
- Australia



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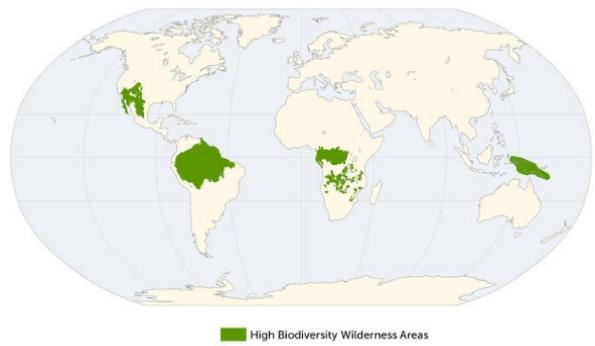
4) BIODIVERSITY HOTSPOTS

- Biodiversity hotspots are **regions containing exceptional concentrations of plant endemism and experiencing high rates of habitat loss.**
- Of the total 35/36 globally identified biodiversity hotspots India has 4 of them i.e. **Eastern Himalayas**, Nepal, India; **Indo-Burma**, India and Myanmar, **Western Ghats**, India; **Sundaland**s: include Nicobar group of islands (and Indonesia, Malaysia, Singapore, Brunei and Philippines)
- Norman Meyers wrote about the concept in two articles in "The Environmentalist" (1988) & (1990)
- **Description:** Biodiversity hotspots are a method to identify those regions of the world where attention is needed to address biodiversity loss and to guide investment in conservation.
- To qualify as a biodiversity hotspot on Meyers 2000 edition of the hotspot-map, a region must meet **two strict criteria**
 - i. **Plant Endemism:** It must contain at least 0.5% of the world's total or 1500 species of vascular plants as endemics.
 - ii. **Serious Habitat Loss :** It has to have lost at least 70% of its primary vegetation.
- Around the world 36 areas qualify under this definition, with some other possible candidates.
- Supported by Conservation International



5) HIGH BIODIVERSITY WILDERNESS AREA

- The large intact ecosystems of the world that hold significant levels of global biodiversity.
- Approach developed by **Conservation International**.
- HBWAs consist of 5 of the 24 major wilderness areas that hold globally significant levels of biodiversity.
- The 5 HBWAs are Amazonia, the Congo forest of Central Africa, New Guinea, the Miombo-Mopane woodlands of Southern Africa (including the Okvango delta), Northern American desert complex of northern Mexico and South Western part of USA.
- In the **past**, the HBWAs were mostly considered to have '**low vulnerability**' because of their low level of past habitat loss. However, recent analysis suggests that the high cultivation potential of many HBWAs makes them a target for future agri-expansion.



6) THREE LEVELS OF BIODIVERSITY

a. Genetic diversity

- Genetic diversity refers to variety at the level of genes. It consists of variation of genes in a particular species.
- Significance of genetic diversity
 - High Genetic Diversity -> Higher Adaptability -> Higher chance of survival
- **E.g.**
 - India has more than 50,000 genetically different strains of rice, and 1,000 varieties of mangoes.
- **E.g. of low genetic diversity :**
 - Only one species of Asiatic Cheetah survives in the world today and due to **inbreeding**, this species has lost genetic diversity.
 - Hence Cheetahs are prone to genetic disorders and low reproductive success.
 - Koalas in Europe

b. Species diversity

- Diversity at the species level.
- Species diversity refers to variety of plants and animals' species present in a community or ecosystem.
- Species differ from one another, markedly in their **genetic makeup, do-not interbreed in nature**.
- Closely-related species however have in common much of their hereditary characteristics. For instance, about 98.4% of the genes of humans and chimpanzees are the same.
- It is the **ratio of one species population over total number of organisms across all species in the given biome**.
 - 'Zero' would be infinite diversity, and 'one' represents only one species present.
- For e.g.
 - Western Ghats have greater amphibian species diversity than the Eastern Ghats.

- **Species diversity is high in:**
 - Tropical rain forests
 - Coastal zones

- **Species diversity is low in:**
 - Small isolated islands
 - Polar regions

c. Ecosystem Community Diversity (Ecological Diversity)

- Ecosystem diversity refers to **variety of ecosystems** found in a given area or region.
- This refers to the **different type of habitats**. A habitat is the cumulative factor of the climate, vegetation and geography of a region.
- There are several kinds of habitats around the world. **Corals, grasslands, wetlands, desert, mangrove and tropical rain forests are example of ecosystems.**
- As the environment changes, species best adapted to that environment becomes predominant. **Thus, the variety of diversity of species in the ecosystem is influenced by the nature of the ecosystem.**
- E.g.
 - **India** with its deserts, rain forests, mangroves, coral reefs, wetlands, estuaries, and alpine meadows has **a greater ecosystem diversity than a Scandinavian country like Norway.**

7) FACTORS WHICH DETERMINE THE DEGREE OF DIVERSITY

- **Habitat stress:** Diversity is low in habitats under any stress like **harsh climate or pollution**
- **Geographical isolation:** Diversity is **less in isolated regions** like an island. If a species in an island disappears, it can't be easily replaced.
- **Dominance by one species:** The dominant species **consumes a disproportionate share of the resources**. This does not allow many species to evolve and flourish.
- **Availability of ecological niches:** A **complex community offers a greater variety of niches** than a simple community and promotes greater diversity.
- **Edge Effect:** Always **greater diversity at ecotones** or transition areas between ecosystem.
- **Geological history:** **Old and stable ecosystems like rain forests** that have not experienced many changes have high diversity. **An ecosystem like the Arctic has undergone many changes and this does not allow species to establish themselves.**

8) SIGNIFICANCE OF BIODIVERSITY

A) BIODIVERSITY AND FOOD SECURITY

- Biodiversity is the **cornerstone of healthy and sustainable food system**.
 - » It plays a role in **protecting pollinators; improving soil fertility; and building resilience of food system to the effects of climate change**. It is thus **crucial for fighting global hunger**.

B) BIODIVERSITY PROVIDES A NUMBER OF NATURAL SERVICES FOR HUMANS

- a. **Ecosystem Services**
 - Protection of water resources

- Soil formation and protection
- Nutrient storage and recycling
- Pollution breakdown and absorption
- Contribution to climate stability
- Maintenance of ecosystem
- Recovery from Unpredictable events

b. Biodiversity Services

- Food
- Wood Products
- Ornamental Plants
- Medicinal resources and pharmaceutical drugs
- Breeding stocks, population reservoirs
- Future resources
- Diversity in genes, species and ecosystems

c. Social Services

- Research, education and monitoring
- Recreation and tourism
- Cultural values

9) ENDEMIC SPECIES

- An endemic species is found only in a specific geographical location, and not found anywhere else. A species may be native to an area, but is not endemic to that area, if it is found elsewhere too.
 - For e.g., the **Lion-tailed macaque** (*Macaca silenus*), and the **Nilgiri Langur** are endemic to the **western Ghats of India**.

10) KEYSTONE SPECIES

- Keystone species are those species which have disproportionately large effect on the communities in which it occurs. It plays an essential role in the structure, functioning in fact, it determines the ability of a large number of species in the community to survive.
- When a keystone species disappears, it could result in a series of extinction of other species.
 - **E.g. 1:** An example is the **wild durian**, a tree endemic to the western Ghats.
 - Its fruits attract insects and birds come in to eat insects. Reptiles consume both insects and birds. The tree is also the habitat of monkeys, which eat the fruits, leaves and insects. Even tigers may come to eat the animals that are attracted by all the food in the tree ecosystem.
 - **If the wild durian tree is removed from the ecosystem, many of the species will be adversely affected and some may disappear.**
 - **E.g. 2: Wolves**

- If wolves go extinct in an ecosystem, the population of deer and other herbivores will increase exponentially. Due to excessive grazing by the herbivores, many plants may go extinct. Then, the small animals and insects that feed on the plants may disappear.

11) INDICATOR SPECIES

- Indicator species is one whose presence, absence, or abundance reflects a specific environmental condition. They are very **sensitive indicators of environmental problems**. They give early warning of problems that could potentially affect other species. They are also called sentinel species.
 - E.g. **Lichen**, which is sensitive to the presence of heavy metals or acids in rain. Its behaviour may indicate that acid rain is falling in the area.
 - Lichens are mutualistic association of fungus and algae or cyanobacterium and occurs as a crusty patch or bushy growths on trees, rocks and bare grounds.
 - Lichens are very sensitive to SO₂ pollution and since industrial revolution a number of their population have become extinct. **So, if air is badly polluted by SO₂, no lichens may be present.**
- Top predators like tigers and snow leopards** are also indicator species. Their presence indicates that entire ecosystem is healthy.
- Frogs and other amphibians** may also be indicator species

12) FLAGSHIP SPECIES

- A flagship species is a species selected to act as an ambassador, icon or symbol for a defined habitat, issue, campaign or environmental cause. It is chosen to raise support for biodiversity conservation in a chosen place or context. These species have the ability to capture the imagination of public and induce people to support conservation action and/or to donate funds.
- By focusing on, and achieving conservation of that species, the status of many other species which share its habitat - or are vulnerable to the same threats - may be improved.
- They are usually relatively large and considered to be **charismatic** in western countries.
- They may or may not be keystone species and may or may not be good indicators of biological process.
- E.g.
 - Bengal Tiger**
 - Jerdon's Courser (a CR bird found only in Andhra Pradesh)
- Some limitations**
 - May skew the management and conservation priorities in their favour and to detriment of more threatened species.
 - The disappearance of the flagship can have negative impact on the attitude of conservation stakeholders.

13) PRIORITY SPECIES

- It is a **WWF** term which is solely for the purpose of planning and simple communication.

- For WWF, a priority species may be either a **flagship specie** or a **keystone specie** and is chosen to represent an ecoregion or region.
- A priority species is **reflective of a key threat** across that eco-region - such that **conservation of the species will contribute significantly to a broader threat mitigation outcome**. It is often crucial to the economic and/or spiritual well-being of people within that eco-region.
 - **Note:** **World Wide Fund for Nature** was originally called World Wildlife Fund (WWF), a term which is still used in Canada and USA. It is **an international NGO founded in 1961** working in the field of **biodiversity preservation** and the reduction of human impact on environment.
- **WWF Priority species of India**
 - Asian Elephant (EN)
 - Bengal Tiger (EN)
 - One-horned Rhino (VU)
 - Ganges River Dolphin
 - Snow Leopard
 - Red Panda

14) INVASIVE SPECIES

- **Introduction:**
 - **An alien** plant/animal also referred to as **exotic, introduced, foreign etc.** is one that has been **introduced by humans intentionally or otherwise through human agency or accidentally from one region to another.**
 - An alien plant/animal that has escaped from its original ecosystem and is **reproducing at its own in the regional flora** is considered a **naturalized species**.
 - Those naturalized aliens that become **so successful as to spread in the flora/fauna and displace native biota or threaten valued environmental, agricultural or personal resources** by the damage it causes are considered **invasive**.
 - **To be called invasive, it should also be a threat** to the native species of the area by rapidly growing in population. This happens when the **invasive species has no predator in the area**.

A) ASSESSMENT REPORT ON INVASIVE ALIEN SPECIES AND THEIR CONTROL: BY INTERGOVERNMENTAL PLATFORM ON BIODIVERSITY AND ECOSYSTEM SERVICES (IPBES)

- Human beings have **introduced 37,000 alien species**, including plants and animals. Of these **3,500 are invasive alien species** that have played a **key role in 60% of global plant and animal extinction recorded**.
- The report has noted that the **number of alien species** (**species introduced to new regions through human activities**) has been rising continuously for centuries. But now, they are rising at **unprecedented rate**, with increased human travel, trade and expansion of global economy.
- **E.g.:**
 - » **Water Hyacinth** is the **world's most widespread invasive alien species on land**.
 - » **Lantana**, a flowering shrub, and the **black rat** are the second and third most widespread globally.
- Invasive alien species are **one of the five major direct drivers of biodiversity loss globally**, alongside land and sea use change, direct exploitation of organisms, climate change, and pollution.

B) EXAMPLE OF INVASIVE SPECIES

DOMESTICATED CATS (*FELIS CATUS*):

- The State of Indian Birds, 2023 have highlighted that cats are a silent bird killer lurking in India's urban areas. SO along with other threats like industrialization, forest degradation, and climate change, climate change is also a threat for birds in India.
- **But**, detailed studies are lacking in India. In the USA, where detailed studies have been done, it is estimated that free ranging domestic cats kill billions of birds every year.
 - One study says that cats may be the single greatest source of anthropogenic mortality for the birds and mammals in the USA.
- **Worldwide**, free ranging domestic cats have caused or contributed to dozens of extinctions of birds species recorded in the IUCN red list.
- **Cats are more dangerous than free ranging dogs:**
 - As they can climb easily and thus reach the bird habitat.
 - Cat saliva is also more likely to contain bacteria (*Pasteurella multocida*) that are lethal to birds. So, if the cat attack doesn't kill the bird, the bacteria does.
 - Cats also maintain a landscape of fear making birds avoid or nesting in these regions.
- **Origin of Domestic Cats:**
 - **Domestic Cats (*Felis catus*)** are the only domesticated species in the family **Felidae**.
 - Studies show that Wild Cats (*Felis sylvestris*) were probably first domesticated in West Asia around 10,000 years ago and since then they have spread to different parts of the world.
 - Today, they are one of the world's 100 worst invasive alien species.
- **Handling Domestic Cats:**
 - A popular method in the West has been **Trap-Neuter-Return (TNR) policy**, whereby stray dogs and cats are trapped, sterilized and returned in the hope that this will reduce their population. But this hasn't been very successful.

RABBITS IN AUSTRALIA

AFRICAN CATFISH:

- The fish species is not native to India and is originally found in Africa and the middle east.
- It is known to be aggressive feeder, eating even the chicks of waterfowl. It poses a **major threat to native fauna**.
- The female matures in about 3 years and can bear 10s of thousands of eggs.
- The species has now spread to subcontinent and is found in Cauvery, Ganga, Yamuna and even the streams of western Ghats.
- This was introduced by businessmen for commercial fish cultivation in the National Park as it could adapt to poor quality of water, raised in high densities, and reproduce well in captivity, making it ideal for those looking to sell the fish for food. Though, **the cultivation of this specie was banned by Agriculture Ministry in 2000 itself**.

RED EARED SLIDER TURTLE IN NORTH-EAST INDIA

» This is a cute American turtle popular as a pet. But it is threatening to invade the natural water bodies across the northeast, home to 21 of the 29 vulnerable native Indian species of freshwater turtles and tortoises.

CARIBBEAN FALSE MUSSEL (*MYTILOPSIS SALlei*):

Origin: The Caribbean false mussel is originally from the Atlantic and Pacific coast of South and Central America. They may have travelled to Indian subcontinent via ships (ballast water) and then using small vessels spread to estuaries.

Damage: It is damaging locally important fishery in Kerala, by wiping out native clams and oysters.



ACHATINA FULICA (AFRICAN APPLE SNAIL)

The snail (a mollusk) is native to coastal areas and islands of east Africa.

It is invasive species across the world. It has a broad diet preference and cause heavy loss to farmers.

In India, it is **most invasive of all faunas**.

Most invasive of all fauna

It was first reported in A&N island but today it is found all across the country and is threatening habitats of several native species.



C) IN 2017, ZOOLOGICAL SURVEY OF INDIA (ZSI) HAS FOR THE FIRST TIME COME UP WITH LIST OF 157 ALIEN INVASIVE SPECIES IN INDIA

- While invasive plant species have been studied in the past, the **animal species was analysed in detail for the first time**. Invasive animal species like the plant species pose threat to biodiversity.
- **Key Highlights**
 - i. Of the **157 species** 58 are found on land and the remaining 99 in Marine ecosystem.
 - ii. Of the 58 invasive species on land, 38 are arthropods, 19 of fish, three of Mollusks and birds, one reptile and two mammals.
- **Examples of Alien species found on Land** (including rivers)
 - i. **Paracoccus Marginatus (Papaya Mealy Bug)**
 - Destroyed crops of Papaya in Assam, WB and TN.

- Originally from Mexico and Central America
- ii. **Phenacoccus Solenopsis (Cotton Mealybug)**
 - Severely affected cotton crops of deccan
 - Native to North America.
- iii. **Invasive Fish Species**
 - **Pterygoplichthys pardalis** (Amaxon sailfin Catfish)
 - Destroying fish population in wetlands of Kolkata.
- **Examples of Alien Species found in Marine Ecosystem**
 - i. **Tubastrea Coccinea** (Orange Cup- Coral)
 - Originated in Indo-east-pacific but has now been reported in the A&N Islands, the Gulf of Kutch, Kerala, and Lakshadweep.

15) SPECIATION

- Speciation refers to formation of new species due to genetic changes in an existing species. Speciation occurs when a group within a species separates from other members of its species and develops its own characteristics. In the process of a species adapting itself to changing environmental conditions, a new species may emerge.
- **There are five types of speciation:**
 - **Allopatric Speciation:** It occurs when a species separates into two separate groups which are isolated from one another. A Physical barrier, such as mountain ranges or a waterway, makes it impossible to breed with one another. Each species develops differently, based on the demand of their unique habitat or the genetic characteristics of the group that are passed to the offsprings.
 - **For e.g.:**
 - Four distinct sub-species of the Asian elephant probably emerged due to allopatric speciation.
 - Squirrels and other small mammals on the two sides of Grand Canyons
 - **Peripatric Speciation:** When small group of individuals break off from the larger group and form a new species. This is called peripatric speciation. Like allopatric speciation, here also, physical barriers make it impossible for members of the group to interbreed with one another.
 - **Main difference** between Allopatric Speciation and peripatric Speciation is that in peripatric speciation, one group is much smaller than the other.
 - **Parapatric Speciation:** In this method, a species is spread over large geographical area. Although, it is possible for any member of the species to mate with another member, individual only mate with those in their own geographical region. Like allopatric and peripatric speciation, different habitats influence the development of different species in parapatric speciation. **Instead of being separated by a physical barrier**, the species are **separated by differences in the same environment**.
 - **Sympatric Speciation:** It is controversial. Some scientists don't believe that it exists. It occurs when there are no physical barriers preventing any members of species from mating with

another, and all the members are in close proximity to one another. A new species, perhaps based on a different food source or characteristic, seems to develop spontaneously. The theory is that some individuals become dependent on certain aspects of environment - such as shelter or food source, while others don't.

- For e.g., the parasitic great spotted cuckoo, and its magpie host, both native to southern Europe, are considered to be sympatric species.
- **Artificial Speciation:** It is creation of new species by people. This is achieved through lab experiments, where scientists mostly research insects like fruit flies.

16) MEASUREMENT OF BIODIVERSITY

- **Diversity is a single statistic** in which the number of species richness and evenness are compounded. Biodiversity is measured in two components:
 - Species Richness
 - Species Evenness
- **Species Richness**
 - It is the measure of number of species found in a community
 - **Alpha Diversity**
 - The diversity within a particular area or ecosystem and is usually expressed by the number of species (i.e., species richness) in that system.
 - **Beta Diversity**
 - It represents **differences in species composition among sites (ecosystem)**.
 - It is something of a bridge from local (alpha) to the regional (gamma) scale.
 - It can be considered a metric of dissimilarities between sites.
 - It can also be interpreted as rate of accumulation of diversity with an increasing number of sites sampled.
 - In simple terms it is ratio between gamma (regional) and alpha(local) diversities.
 - **Gamma Diversity**
 - It is the measure of **diversity of the entire landscape** (regional species pool).
- **Species Evenness**
 - It measures the proportion of species at a given site, e.g. low evenness indicates that only few species dominate the site.

17) CLASSIFICATION OF LIFE FORMS

- **Kingdom** (Monera, Protista, Fungi, Plantae, Animalia)
- **Phylum** (For animals) / **Division** (for plants)
 - **Class**
 - **Order**
 - **Family**
 - **Genus**
 - **Species**

E.g. For tiger

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Carnivora
Family: Felidae
Genus: Panthera
Species: P. Tigris

E.g. For Humans

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Primates
Family: Hominidae

- Members of this family are known as great apes or hominids. Currently it consist of four genera.
 - **Pongo** (Bornean, Sumtran, and Tapanuli Orangutan); **Gorilla** (the eastern and western Gorilla); **Pan** (the Chimpanzee and the bonobo); and **Homo** (of which only Homo Sapiens remain)

Genus: Homo

Species: H. sapiens

3. IUCN CLASSIFICATION

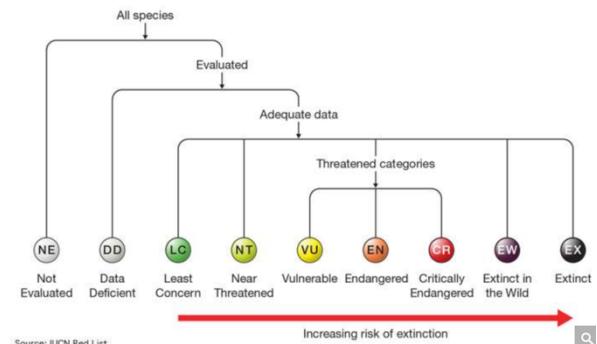
1) THE RED DATA BOOK

- Species judged as threatened are listed by various agencies as well as by some private organizations. The most cited of these lists is the Red Data Book.
- It's a loose-leaf volume of information on the status of many kinds of species. This volume is continuously updated and is issued by International Union for Conservation of Nature (IUCN) located in Merges, Switzerland.
- The red data book was **first issued in 1966** by the IUCN's special Survival Commission as a guide for information, preservation and management of species listed. In this book, information for endangered mammals and birds are more extensive than for other groups of animals and plants, coverage is also given to less prominent organisms facing extinction.
- "Red" of course is symbolic of danger that species both plants and animals presently experience throughout the globe.
 - **The Pink page** in this publication include the critically endangered species. As the status of the species change, new pages are sent to the subscribers.

- **Green pages** are used for those species that were formerly endangered, but have now recovered to a point where they are no longer threatened. With passing time the number of pink pages continue to increase. There are pitifully few green pages.

2) DETAILS ABOUT IUCN

- IUCN is a membership union composed of both government and civil society organizations.
- It harnesses the experience, resources, and reach of its more than 1,400 member organizations.
- It is a **democratic union** that brings together the world's most influential organizations and top experts in a combined effort to conserve nature and accelerate the transition to sustainable development.
- The **Red Databook** of IUCN is the most cited list of threatened species.
- It classifies the **conservation status** of individual species based on their probability of extinction.



3) IUCN DATABASE OF CONSERVATION PRIORITY

1. **Extinct (EX):** A taxon is extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual.
2. **Extinct in Wild (EW):** A taxon is extinct in wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed extinct in wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual.
3. **Critically Endangered (CR):** A taxon is critically endangered when the best available evidence indicates that it meets any of the criteria for critically endangered.
 - **Criteria**
 - A. **Reduction in population size**
 - ($\geq 90\%$ over the **last 10 years** or three generations, whichever is longer), where the causes of reduction is clearly reversible AND understood AND ceased.
 - ($\geq 80\%$ over the **last 10 years** of three generations, whichever is longer), where the causes of reduction may not have ceased to exist OR may not be understood OR may not be reversible
 - ($\geq 80\%$, projected or suspected to be met within the next 10 years or three generations, whichever is longer (upto a maximum of 100 years)
 - An observed **estimated inferred**, projected or suspected population size reduction of $\geq 80\%$ over any 10 year or three generation period, whichever is longer (upto a maximum of 100 years in future), where the time period must include **both the past and the future**, and where the reduction and its causes may not have ceased OR may not be understood OR may not be reversible.

B. Geographical Range in the form of either B1 (**extent of occurrence**) OR B2 (**area of occupancy**) OR both:

- **Extent of occurrence** estimated to be less than 100 Km², and estimate indicating atleast two of the following
 - Severely fragmented or known to exist only at a single location
 - Continuing decline
 - Extent of occurrence
 - Area of occupancy
 - Area, extent and/or quality of habitat
 - Number of locations and subpopulations
 - Number of mature individuals
 - Extreme fluctuation in any of the following
 - Extent of occurrence
 - Area of occupancy
 - Number of locations or subpopulations
 - Number of mature individuals
- **Area of Occupancy** estimated to be less than 10 Km², and at least 2 of the following
 - Same three criteria as above (extent of occurrence)

C. Population size estimated to number fewer than 250 mature individuals and either

- An estimated continuing decline of 25% within three years or one generation, whichever is longer,(upto a maximum of 100 years in future)
- A continuing decline, of mature individuals AND atleast one of the following
 - Population structure in the form of one of the following
 - No subpopulation estimated to contain more than 50 mature individuals, OR
 - Atleast 90% of mature individuals in one subpopulation
 - Extreme fluctuation in number of mature individuals

D. Population size (number less than 50 mature individuals)

E. Quantitative analysis showing the **probability of extinction** in wild at least 50% in their 10 years or three generations, whichever is longer(upto maximum 100 years)

4. **Endangered**

5. **Vulnerable (VU)**

6. **Near Threatened (NT)**

- A taxon is near threatened when it has been evaluated against the criteria but does not qualify for CR, EN, VU now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

7. **Least Concern (LC)**

- A taxon is least concern when it has been evaluated against the criteria and does not qualify for CR, EN, VU, or NT. Widespread and abundant taxa are included in this category.

8. **Data Deficient (DD)**

- A taxon is DD when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution or population status. Appropriate data on abundance and/or distribution is lacking. Not a category of threat.
- Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.

9. Not Evaluated (NE)

- When it has not yet been evaluated against the criteria.

4) IUCN HAS RELEASED THEIR NEW RED LIST OF THREATENED SPECIES DURING UNFCCC COP28 IN DEC 2023

- Over 44,000 species are threatened with extinction (around 2,000 more than last year) of the total 157,190 species in the IUCN Red List.
- The update includes the First Broad Assessment of the health of freshwater fish species. Around 25% of the species (around 3,000) are facing risk of extinction.
 - » Climate change, pollution, overfishing and invasive species are the major challenge.
- Atlantic Salmon (a ray-finned species) found in northern Atlantic Ocean Basin has declined by 23% (2006-2020) thus moving it to Near Threatened (from LC)
- Green Turtles (of Central South Pacific and East Pacific) populations are respectively Endangered and Vulnerable.
- Mahogany Tree (*Swietenia macrophylla*), also known as Honduran Mahogany or big leaf mahogany, has become Endangered.
 - » It is one of the species that yields genuine mahogany timber.
 - » It is native to South America, Central America and Mexico. It is also naturalized in Phillipines, Singapore, Malaysia and Hawaii and is cultivated in plantations and windbreak elsewhere.
 - » Note: *Swietenia mahogani*, is another species which is also found in India and is NT
- Some Success Stories:

Scimitar-horned oryx: It has moved from EW to EN showcasing the reintroduction efforts the republic of Chad.



Saiga Antelope improves from CR to NT due to conservation measures. In past it inhabited a vast area of Eurasian Steppe. Today, it is only found in Russia, Mongolia, Kazakhstan, Turkmenistan, Uzbekistan etc. **Key Feature:** Unusual hanging nose.



A male at the Steppnoi Nature Sanctuary of Astrakhan Oblast, Russia



A female at the Askania-Nova Biosphere Reserve of Kakhovka Raion, Ukraine

5) NATIONAL ENDANGERED SPECIES DAY

- The National Endangered Species Day is celebrated on the **third Friday of May every year** across the USA. It was established by the US Senate, in 2006.
- **2023 Theme:** "Celebrating 50th anniversary of endangered species act".
Note: In USA, the Endangered Species Act was enacted in 1973.

4. MAMMALS – EXTINCT

1) ASIATIC CHEETAH (EXTINCT IN INDIA)

- **IUCN Status of Asiatic Cheetah**
 - **CR** in Iran (Iran has a subspecies of Asiatic Cheetah, but has refused to share it with India)
 - **EX** in India.
 - It is the only large carnivore that got wiped out of India, mainly due to over-hunting and habitat loss.
 - The last **physical evidence** of Asiatic Cheetah in India was from Madhya Pradesh in 1947 when it was hunted by Maharaja Ramanuja Pratap Deo of Surguja State. A female is also said to have been sighted in **Koriya District** of Chhattisgarh, in 1951.
- **Why extinct?**
 - » Hunting (excessive from Mughal Era to British Period)
 - » Two key characteristics:
 - The Cat was very easy to tame. Therefore, it was regularly caught for sports.
 - It was nearly impossible to breed in captivity.
 - There is only 1 formally recorded instance of captive breeding in Emperor Jahangir's Tuzuk-i-Jahangiri.
 - » **Classification as Vermin** by Britishers in 19th century was the last nail in the coffin.

A) ACTION PLAN FOR INTRODUCTION OF CHEETAH IN INDIA: PROJECT CHEETAH

- Project Cheetah is the world's first inter-continental large wild carnivore translocation project. Under this there is a plan to introduce 50 African Cheetahs in various protected areas of India under 'Action Plan for Introduction of Cheetah in India'.
- **Goals of Reintroduction:**
 - » **Establish viable Cheetah metapopulation** in India that allows the Cheetahs to perform its functional role as a top predator and provide space for the expansion of the Cheetah within its historical range thereby contributing to its conservation efforts.
- **Reintroduction:**

- » **20 African Cheetah** have been imported so far.
 - **The first batch** of 8 Cheetah arrived in Sep 2022 from **Namibia**.
 - **Another batch** of 12 Cheetah arrived in Feb 2023 from South Africa.

- Now, Cheetah is the **sixth in the list of Big cats found in India** after **Royal Bengal Tiger (Panthera Tigris tigris)**, **Asiatic Lion (Panthera leo leo)**, **Indian Leopard (Panthera pardus fusca)**, **Snow Leopard (Panthera uncia)**, and **Clouded Leopard (Neofelis nebulosa)**.

- **Cheetahs were not directly released into wild:**
 - They were first kept in **quarantine for a month**. Then they are released into **large electronically fenced area** to get acclimatized. Finally, they were released into wild.

- **One Year of Project Cheetah (Sep 2023)**
 - **The Project** has achieved success on **four fronts**:
 - » **50% survival** of the introduced Cheetahs
 - » **Establishment of home ranges**
 - » **Birth of cubs in Kuno**
 - » **Increased tourism and revenue for local communities.**
 - **Yet**, as of Jan 2024, the **project lost 45% of its functional adult population**. Of the 20 Cheetahs that arrived in India, **7 died** (Dhatri, Shasha and Shaurya from Namibia and Suraj, Uday, Daksha, and Tejas from South Africa); 2 (Jwala and Nabha from Namibia) were deemed unfit for wild.
 - **Four cubs** were born in India March 2023, **three of which died** due to heatwaves, and the fourth is being raised in captivity.
 - **3 more cubs** were born in Jan 2024 to Namibian Cheetah **Aasha**. This was also born in captivity.
 - **3 more cubs were born** in Jan 2024 to **Namibian Cheetah Jwala**.
 - As of **16th Feb 2024**, there are **20 Cheetahs at Kuno Palpur** (13 adults (7 females, 6 males), 7 cubs)

- **Why so many deaths?**
 - **Different weather pattern** between home and host countries.
 - » The cheetahs introduced to India, were from **countries in southern hemisphere**, where the weather cycle is opposite.
 - » **Namibia and South Africa had much drier conditions** when compared to India. Namibian and south African Cheetah had **never experienced heavy rains** which they had to face in Kuno.
 - » **Collars** also became a problem. The Cheetahs were **unable to lick and clean their wounds** as the collars posed an obstruction which then gave rise to bacteria and maggots.
 - » For e.g. Dhatri died on 12th Aug 2023, because of **infection due to maggot infestation due to humidity**. Earlier, two male cheetahs had died of the same cause.
 - **Negligence** by authorities.

- **Steps being taken:**
 - Cheetahs **were brought back to enclosures** and were properly being monitored. Their collar has also been removed.
 - Experts suggest that **India may need to bring Cheetah from northern hemisphere** from countries like Somalia.
 - There is a **suggestion for developing much bigger habitats before bringing in more Cheetahs.**

- **Where are Cheetahs being reintroduced?**
 - They are being brought to Kuno Palpur National Park (KNP) in MP. This site was rated the highest among the 10 surveyed sites.
 - KNP is 748 sq km in area, devoid of human settlements.
 - It is probably the only wildlife site in the country where there has been a complete relocation of villages from inside the park. It forms part of Sheopur-Shivpuri deciduous open forest landscape and is estimated to have a capacity to sustain 21 cheetahs.
 - It also has good population of Chinkara, spotted deer, and blackbuck, on which Cheetahs can prey and grow in the wild.
 - Here facilities for the big cats have been developed, staff have been trained, and larger predators, such as leopards, have been moved away.
 - The **Other Sites** recommended for holding and conservation breeding of Cheetahs in India, in controlled conditions are:
 - i. Nauradehi Wildlife Sanctuary (1,197 sq. km, habitat 5,500 sq.km), Madhya Pradesh
 - ii. Gandhi Sagar Wildlife Sanctuary – Bhainsrorgarh Wildlife Sanctuary complex (~2500 sq.km), Madhya Pradesh
 - iii. Shahgarh bulge in Jaisalmer, Rajasthan (4,220 sq.km)
 - iv. Mukundara Tiger Reserve as fenced enclosure (~80 sq.km), Rajasthan
- **Where are Cheetahs coming from?**
 - Since, it is not possible to source the CR Asiatic Cheetah from IRAN without affecting this subspecies, India has sourced Cheetahs from Namibia and South Africa.
 - **African Cheetahs have other advantages** (why they are suitable for introduction in India)
 - They have maximum observed genetic diversity among extant cheetahs, an important attribute for a founding population stock.
 - They are also ancestral to all the other cheetah lineage including those found in Iran.
 - **Note:** Cheetahs being introduced are African Cheetah and Cheetahs which had gone extinct from India were Asiatic Cheetah and they are today found in small numbers only in Iran.
- **Background: Genesis of the Plan**
 - Cheetah reintroduction project was first conceived in 2009 and an expert panel formed in 2010 recommended KunoPalpur (MP), Velvadar National Park (Gujarat) and Tal Chappar Sanctuary (Rajasthan) for reintroducing Cheetah.
 - But the plans were quashed by the SC as it may have conflicted with reintroduction of Lions here.
 - After many hurdles, in Jan 2020, the SC had given the green signal to introduction of African Cheetah on pilot basis to a suitable habitat in India.

5. BIODIVERSITY IN INDIA: MAMMALS – CRITICALLY ENDANGERED

1) ANDAMAN WHITE TOOTHED SHREW (CROCIDURA ANDAMANENSIS), JENKIN'S ANDAMAN SPINY SHREW (CROCIDURA JENKINSI) AND NICOBAR WHITE TAILED SHREW

- Distribution

- Andaman White toothed shrew is found on Mount Harriet in the South Andaman Islands. It is endemic to South Andaman Island.
- Jenkin's Andaman Spiny Shrew is found on Wright Myo and Mount Harriet in the South Andaman Islands
- Nicobar White Tailed Shrew is found in the southern tip of Greater Nicobar Island and is also recorded in the area extending from the Campbell Bay National Park to the Galathea River in the Andaman and Nicobar Islands.



- All three of them are endemic to India.

- They are usually active by twilight or in the night and have specialized habitat requirements.

- Habitat: Leaf litter and rock crevices

- Threats : Habitat loss due to selective logging, natural disasters such as the tsunami and drastic weather changes.

- WPA: Schedule-2 (as amended in 2022)

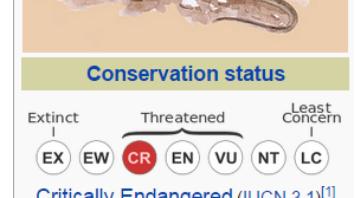
2) THE LARGE ROCK RAT (ELVIRA RAT) (CREMNOMYS ELVIRA)

- It is a medium size, nocturnal and burrowing rodent, endemic to India.

- Habitat: Tropical dry deciduous shrubland forest, seen in rocky areas.

Distribution: Known only from eastern Ghats of Tamil Nadu, India.

- Threats: Major threats are habitat loss, conversion of forests and fuel wood collection.



3) THE NAMDAPHA FLYING SQUIRREL (BISWAMOYOPTERUS BISWASI)

The Namdapha flying squirrel is an arboreal, nocturnal flying squirrel endemic to India.

It was sole in the genus Biswamoyopterus until the description of the Laotian giant flying squirrel (*Biswamoyopterus laoensis*) in 2013.

It was first recorded in 1981 where a single individual was found in Namdapha Tiger Reserve. After that it wasn't seen till 2022.

Updates: Missing for 42 years, Namdapha flying squirrel resurfaces in Arunachal (Dec 2023)

IUCN: CR

WPA: Schedule-1 (after 2022 amendment)



Habitat: Tropical forests

Distribution : It is now restricted to as single valley in the Namdapha N.P. (or) W.L.S. in Arunachal Pradesh.

Namdapha National park is the **largest protected area in the Eastern Himalayan Biodiversity hotspot** and is located in Arunachal Pradesh. It is also **one of the largest National Park in India in terms of area** (after hemis, desert, Simlipal and Gangotri)

Threats: It is CR due to habitat loss. In addition it is **hunted for food, and skins/fur.**



Note: Namdapha is home to another flying squirrel (Red Giant Flying Squirrel) (*Petaurista petaurista*), whose IUCN status is LC. Like other flying squirrels, Red Giant Flying Squirrel is also mostly nocturnal and is able to glide long distance between trees.

4) MALABAR CIVET (VIVERRA CIVETTINA) ALSO KNOWN AS MALABAR LARGE SPOTTED CIVET

- It is considered one of the world's rarest mammals. It is endemic to India and was first reported from Travancore, Kerala.
- Nocturnal in nature
- **Distribution:** Found exclusively in western Ghats.
- **Habitat :** Wooded plains and hill slopes of evergreen forests.
- **Threats :** Deforestation and commercial plantations are major threats.
- WPA (as amended in 2022): Schedule-1



5) HIMALYAN BROWN BEAR/ RED BEAR (URSUS ARCTOS ISABELLINUS)

- **Why in news?**
 - » A Himalayan brown bear (*Ursus arctos isabellinus*) as captured by J&K Wildlife Department on May 13, 2023, at Rajwara in the North Kashmir district of Handwara, days after it was found wrecking graveyards, reportedly in search of human cadavers to eat (June 2023: Source - DTE)

It is the largest animal in Himalayas and is usually reddish brown in color. They inhabit altitudes ranging from 2,000 to 2,500 metres, predominantly above the tree line.

It also shows sexual dimorphism (Males (1.5 - 2.2m), Females (1.37 - 1.83m)).

Distribution: Nepal, Pakistan, and Northern India. In Hemis National Park, Great Himalayan National Park, Nanda Devi Park -> this may be seen as the giant mammal walking upright.

IUCN Status: CR

Please note that IUCN status of Brown bear is LC (due to its wide distribution). But the Himalayan subspecies is CR.

Updates:

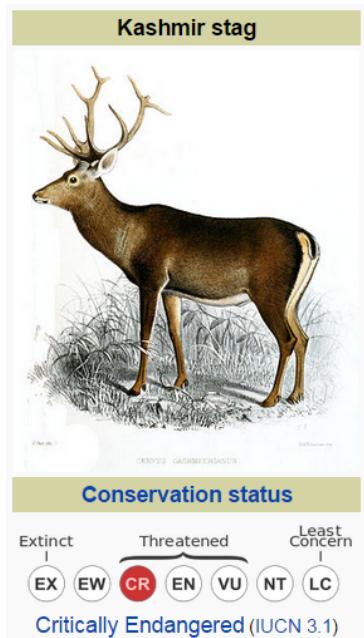
Human encroachment in wildlife has led to bears straying more often into human-dominated areas. Several incidents from various villages of J&K such as Behnipora, Budshungi, and Shatiam have been reported, where more than one bear may have entered.

Key reasons: Insufficient food in their habitats;



6) HANGUL/KASHMIR RED STAG (CERVUS ELAPHUS HANGUL)

- A sub species of red deer which is native to India.
- Hangul has red-brownish coat bringing them in the fold of red deer. The **color, however, changes with season and age**.
- **Note:** Earlier it was believed to be a subspecies of red deer. But Mitochondria DNA genetic studies have revealed that is part of the Asian Clade of elk.
- It is native to Jammu and Kashmir, where it is the **state animal**.
- Known for its giant antlers bearing 11 to 16 points. Hangul has been hunted over centuries and its habitat destroyed.
- **Habitat/Distribution:** In dense riverine forests, high valleys, and mountains of the Kashmir valley and northern Chamba in Himachal Pradesh.
- **Threat:**
 1. habitat destruction
 2. Over-grazing by domestic livestock
 3. Poaching.
- **In 2016, Hangul was classified as CR by IUCN**



- Once found in thousands in the mountains of Kashmir Valley, the population of the famed Kashmir red deer, has dwindled to less than 150, according to senior wildlife scientists.
- Its **last bastion** is **Dachigam National Park** located on foothills of **Zabarwan range** on the outskirts of Srinagar, J&K.

7) CHINESE PANGOLIN

The Chinese Pangolin is a pangolin found in Northern India, Nepal, Bhutan, Bangladesh and Myanmar, northern Indo China, through most of Taiwan, and Southern China.



7) SUMATRAN RHINO AND JAVAN RHINO – EXTINCT IN INDIA

More About Sumatran Rhino

- It is the smallest hairiest and most endangered of the five rhinoceros species.
- It is now thought to be regionally extinct in India, though its ones occurred in foothills of Himalayas and north east India.
- They are now critically endangered, with only five substantial populations in the wild: four on Sumatra, and one in Borneo (Indonesian Borneo).
- In total **only 80 Sumatran Rhino** are thought to exist in the wild now. All are found in Indonesia.

Key threats

- Isolation** is the biggest threat this species face. This is because the females of this species can develop cysts and fibroids in their reproductive tracts if they go too long without mating.
 - It is because of this, in 2018, the world's leading conservation non-profits, including the National Geographic society, announced an unprecedented collaboration called the Sumatran Rhino Rescue. The aim was to find and safely capture as many Sumatran Rhino as possible so that they can be brought together for captive breeding.
- Habitat destruction** have remained a major concern for long.

Sumatran rhinoceros^[1]



Sumatran rhinos

Conservation status



Critically Endangered (IUCN 3.1)^[2]

The Javan Rhinoceros (*Rhinoceros sondaicus*) is also believed to be extinct in India and only a small number survive in Java and Vietnam

Other Important Rhino species (not found in India)

1. Northern White Rhino (*Ceratotherium simum cottoni*)

Introduction:

- The northern white rhinoceros, or northern square-lipped rhinoceros, was one of the two subspecies of the white rhinoceros.
- Formerly, found in several countries in East and Central Africa of the Sahara, it is listed as **Critically Endangered**.
- Other subspecies of white Rhino, the Southern White Rhino has the conservation status of **Least Concerned**.

Northern white rhinoceros



Angalifu, a male northern white rhinoceros at the San Diego Zoo Safari Park. Angalifu died 14 December 2014^[1]

Conservation status



Main Reasons for decreased population

- **Poaching:** Demand for northern white Rhino Horns which can be sold at \$50,000 per kg making them more valuable than gold. The demand was fueled by belief in Asia of it treating various ailments.
- **Habitat Loss**

There are only **2 rhinos of this subspecies** left.

- Both belong to the Dvur Kralove Zoo in the Czech Republic but live in the **Ol Pejeta Conservancy in Kenya** and are protected round the clock with armed guards.
- These two rhinos are
 - Two females (mother-daughter) Najin and Fatu.
- Existence of no males makes the species **functionally extinct**.
 - It is "possibly extinct in the wild".

In March 2018, Sudan the last male white Rhino Died

Future Prospects

- Developing **in-vitro-fertilization techniques** using eggs from the last two remaining females, stored northern-white rhino semen from males and surrogate southern white rhino females.
- There is a chance that females of Northern white rhino can mate with males of Southern white Rhino a subspecies. Offspring will not be a 100% northern white Rhino; it would be better than nothing.

Note: there are **five Rhino species in the world**: White Rhino (Southern White Rhino (LC) and Northern White Rhino (EW) are two subspecies of this); Black Rhino (CR); Greater One Horned Rhino (VU); Sumatran Rhino (CR); and Javan Rhino (CR).

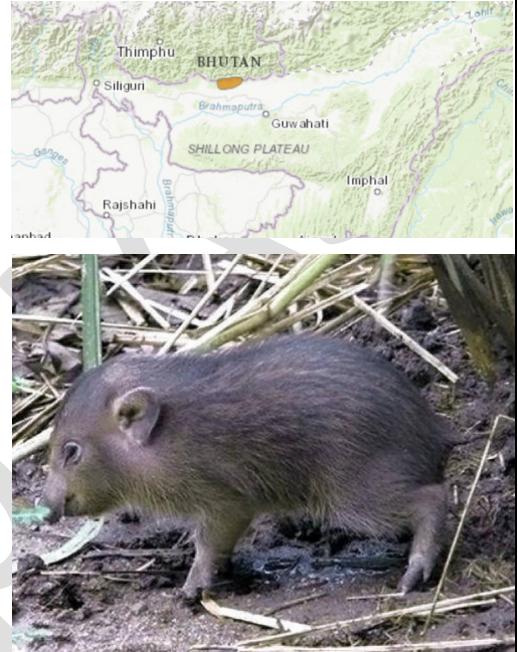
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6. BIODIVERSITY IN INDIA: MAMMALS – ENDANGERED

1) TIGER – COVERED

2) PIGMY HOG

- **Geographical Range**
 - » It is only known from India.
 - » Its presence is uncertain in Bhutan and is extinct from Nepal and Bangladesh.
- **More Details about Pigmy Hog**
 - » World's smallest wild pig, with adults weighing only 8 kg.
 - » **Habitat:** Grassland - Found in relatively undistributed tall Tarai grasslands
 - » **Distribution:** Formerly, the species was more widely distributed along the southern Himalayan foothills but now is restricted to only a single remnant population in Manas wildlife sanctuary and its **buffer reserves**.
 - » **Threats:** The main threats are the loss and degradation of grasslands, dry season burning, livestock grazing and afforestation of grasslands. Hunting is also a threat to the remnant population.
 - » It is one of the most useful indicators of the management status of the grass land habitats. The grassland where the pigmy hog resides are crucial for the survival of another endangered species such as Indian Rhinoceros, Swamp Deer, Wild Buffalo, Hispid Hare, Bengal Florican and Swamp Francolin.
 - » In 1996, a captive breeding program was initiated in Assam, and some hogs were reintroduced in Sonai Rupai area in 2009.
- **Conservation Status**
 - » IUCN - EN
 - » WPA (as amended in 2022) - Schedule-1
- **Pygmy Hog Sucking Louse**, a parasite that feeds only on Pygmy Hogs will also fall in the same risk category of EN as its survival is linked to that of the host species.



3) ASIATIC LION

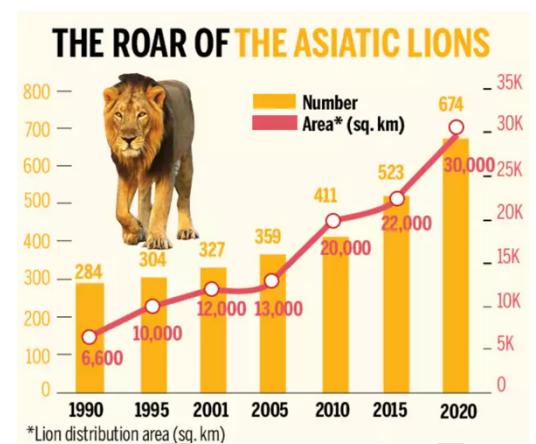
- Asiatic lions once ranged from Persia to Eastern India, but were almost drawn to extinction by indiscriminate hunting and habitat loss.
- **By 1890s, a single population of about 50 Lions** remained in the Gir Forests of Gujarat.
- **With timely and stringent protection offered** by the state government and the central government, they have increased to over 674 now.
 - » Of this around 50% are found outside protected areas.

- » Note: The Gir Protected Area Network includes **Gir National Park, Gir Sanctuary, Pania Sanctuary, Mitiyala Sanctuary adjoining forest reserves, protected forests and unclassed forests.**
- » Lions has been recorded in a total area of about 30,000 sq kms of which, only about 1,650 sq km is in five Protected areas. The protected areas carrying capacity seems to be exceeded.

- Over last several years, the lion population in Gujarat has been steadily rising.
- Male female ratio: 161:260

- **Asiatic Lions and African Lions**

- » They are both distinct subspecies of Lion. They are the second largest cats in the world after tigers. Male Lions are characterized by thick mane of hairs around their head which is absent in females.



Characteristics	Asiatic Lion	African Lion
Distribution:	Only in Gujarat, India	Several countries across Africa, from the Savannah in east Africa to dry grasslands of South Africa
Physical Appearance	Slightly smaller than African Lion, with <u>a shorter mane and fold of skin on their bellies</u>	African Lions have <u>larger manes</u> .
Genetics	The two subspecies have <u>distinct genetic profile</u> . They diverged from the same ancestor around 1,00,000 years ago	
Behaviour	Asiatic Lions are <u>more solitary</u> and <u>live in pairs or small groups</u> of related females and their cubs.	The African Lions are known for their social behaviour and live in large groups called Prides , consisting of <u>several females, their cubs, and one or more males</u> .
IUCN Status	EN	VU

B) WORLD LION DAY: AUG 10

- » Celebrated on Aug 10 of every year to raise awareness about lions and to mobilize support for their protection and conservation.
- » World Lion Day is the brainchild of co-founders Dereck and Beverly Joubert, a husband-and-wife team with a passion for big cats. They began the initiative in 2013, bringing together both **National Geographic** and the **Big Cat Initiative under a single banner** to protect the remaining big cats living in the wild.

C) CONSERVATION STATUS:

- » IUCN: Endangered
- » WPA (as amended in 2022): Scheduled 1
- » CITES: Appendix 1

D) 8 ASIATIC LIONS TESTING POSITIVE FOR COVID-19 (MAY 2021)

- » Where? Nehru Zoological Park, Hyderabad
- » This was the first case of the human infecting the feline and making them sick in India.

E) PROJECT LION

- » It was announced by PM on Aug 15, 2020. It will be on the lines of Project Tiger and Project Elephant.
- » The project has been launched for the conservation of Asiatic Lion and will focus on habitat development by engaging modern technologies in management as well as in addressing the issue of disease in lion.
- » The **Wildlife Institute of India** with the Gujarat Forest Department have created a Project Lion Proposal and set it to the Union MoEF&CC.
- » **Six new sites** apart from the Kuno-Palpur WLS have been identified under Project Lion for possible lion relocation.
 - Madhav National Park, Madhya Pradesh
 - Sitamata Wildlife Sanctuary, Rajasthan
 - Mukundra Hills Tiger Reserve, Rajasthan
 - Gandhi Sagar WLS, Madhya Pradesh
 - Kumbhalgarh WLS, Rajasthan
 - Jessor-Belaram Ambaji WLS and adjoining landscape, Gujarat.
- » In Dec 2022, Minister of State for EF&CC, Shri Ashwini Choubey, informed that the Project Lion document titled "Lion@ 47: Vision for Amrit Kal" has been prepared with the following objectives to secure and restore lions' habitats for managing and growing population; scale up livelihood generation, and participation of local communities; become global hub of knowledge on big cat disease diagnostics and treatment and create inclusive biodiversity conservation through project lion initiative.

F) ISSUE OF RELOCATION OF LIONS

- IUCN has raised concerns here "The Asiatic Lion currently exists as a single subpopulation, and is thus vulnerable to extinction from unpredictable events, such as an endemic or large forest fire."
- **Other Reasons to support translocation:** A large number of lions are outside the PA. These places are human dominated and have very little prey population. Thus, they depend on livestock which they kill or livestock carcass which are dumped outside the villages.
- **The Project Lion document of 2020** have also mentioned that babesiosis and CDV in Gir and that it has resulted the death of at least more than 60 lions in 2018-19.
 - It cautions that "the CDV can also spread very fast within the entire lion population of Gir, especially when containment is not possible due to feral animal vectors in a landscape that remains connected for disease transmission.

- Therefore, IUCN has recommended "establishment of at least one other wild population for population safety, for maximizing genetic diversity and in terms of ecology (re-establishing of the lion as a component of the fauna in its former range).
- **Wildlife activists** have been demanding transfer of lion to a second home **since 1990s**.
- **Studies** of three potential sites with the historical range of the Asiatic Lion **identified Kuno-Palpur sanctuary** in MP to be the most suitable for introducing the species.
 - In 2004, the Center had written to Gujarat for the first time for this relocation, but Gujarat kept dragging the issue and the matter reached Supreme Court.
- **Supreme Court of India** in April 2013, after several recommendations by various expert groups had ordered translocation of Gujarat Lions to Madhya Pradesh. This was done to ensure a second home for the endangered species and to save it from extinction, due to catastrophe like extinction.
 - The review and curative petitions by Gujarat were rejected by the court in 2014.
- **But the transfer hasn't happened yet**. In 2022, government officials have stated that there are no plans to translocate lions outside Gujarat and they will facilitate natural dispersal of lions within Gujarat.
 - These statements completely disregard 2013 SC verdicts and doesn't make any ecological sense.
- **Reason for non-removal** - it has more to do with **politics** than the effectiveness of translocation.

G) ISSUE OF DEATHS OF LION - CANINE DISTEMPER VIRUS (CDV)

- **More than two dozen** lions died in 2018 due to outbreak of canine distemper virus (CDV) and babesiosis.
 - **Canine Distemper Virus**
 - » Canine distemper is a contagious and serious disease caused by virus that attacks the respiratory, gastrointestinal, and nervous system of puppies and dogs. The virus has also been reported in Lions, tigers and other wild animals.
 - **Babesiosis:**
 - » It is caused by microscopic parasites that infect red blood cells and are spread by certain ticks.
- **Incidence of death due to disease in past**
 - In 2007, there were evidence of the Peste Des Petits Ruminants virus (PPRV) which had caused some death. PPRV (also known as Goat Plague) is highly contagious and can be deadlier than even CDV that wiped out a third of Africa's lion.

4) ELEPHANT

- **Introduction**
 - Elephant (Elephas maximum) is the **largest terrestrial mammal of India**.
 - **In past centuries**, forests of India literally teemed with elephants. Mughal emperors are known to have more than 1,00,000 elephants in their services giving us an idea about huge population of elephant in our country then.

- Today's population is obviously a fraction of the population of that time, but large numbers of sustainable herd exist - particularly in south and northeast.
- India has also declared elephant as 'National Heritage Animal'.

- **Conservation Status:**

- IUCN: Endangered
- WPA: Schedule 1
- CITES: Appendix 1

A) POPULATION OF ELEPHANTS (ELEPHANT CENSUS, 2017 REPORT ("SYNCHRONIZED ELEPHANT POPULATION ESTIMATION INDIA, 2017"))

- The census pegs India's total Asian Elephant population at 27312 across 23 states (a decrease over 2012 numbers of around 30,000 - but previous counts were not synchronized and may have had duplications. Therefore, experts say that comparisons should not be drawn). This was the first all India synchronized census which avoided many errors in estimation due to movement of elephants across different states.
- State wise:** Karnataka has the highest number of elephants, followed by Assam and Kerala
 - » Karnataka (6,049)
 - » Assam (5,719)
 - » Kerala (3,054)
- Region wise:** Highest in Southern (11, 960), followed by northeast (10,139), east central (3,128) and northern region (2,085)
 - » Further another survey in 2000 found that there are around 3,400 domesticated animal in the country.

B) INITIATIVES: PROJECT ELEPHANT

- Launched by GoI in 1992 as a centrally sponsored scheme.
- Objectives**
 - » To assist states having free ranging population of wild elephants.
 - » To protect elephants, their habitat & corridors.
 - » Addressing the human-elephant conflict issues
 - » Improving the welfare of captive animals.
- 16 states/UT in focus**
 - » The projected is being mainly implemented in 16 states
 - » Andhra, Arunachal, Assam, Chhattisgarh, Jharkhand, Karnataka, Kerala, Maharashtra, Meghalaya, Nagaland, Orissa, TN, Tripura, Uttaranchal, UP and WB.
- Steps taken**
 - » **Elephant Reserves:**
 - » Establishment of 33 elephant reserves throughout the elephant's traditional range and covering a total area of more than 30,000 km².
 - » Tamil Nadu and Assam have the highest number of elephant reserves (five each), followed by Kerala (4), Odisha (3), UP (2), Arunachal (2), Chhattisgarh (2), Karnataka (2), Nagaland (2), and West Bengal (2), Andhra (1), Jharkhand (1), Meghalaya (1), and Uttarakhand (1).

- In 2022, on the 30th anniversary of Project Elephant, government announced formation of three Elephant Reserves (LEMRU ER (Chhattisgarh), Agasthyamalai ER (TN) and Terai ER (UP)).

TERAI ELEPHANT RESERVE: INDIA'S 33RD ELEPHANT RESERVE IN UTTAR PRADESH (OCT 2022)

- The Centre has approved setting up of Terai Elephant Reserve (TER) at Dudhwa-Pilibhit in Uttar Pradesh.
 - The TER will be developed in joint forest area of Pilibhit tiger reserves and Dudhwa TR, covering conservation of four wild species such as Tiger, Asian Elephant, Swamp Deer, and One-horned Rhinoceros in the entire landscape that also includes Kishanpur and Katarnighat WLS.
 - It is situated on India-Nepal border.
- The TER will also implement human-elephant conflict mitigation strategy and protect villagers living in the Indo-Nepal border areas of Uttar Pradesh.

LEMRU ELEPHANT RESERVE – CHHATTISGARH

AGASTHYAMALAI ELEPHANT RESERVE

- Central government has accepted the proposal of the TN government to establish one more elephant reserve in the state in Agasthyamalai.
- Its total area would by 1,197 sq km.
- It is TN's 5th Elephant Reserve

C) INITIATIVE: MIKE

- MIKE (Monitoring of Illegal killing of Elephants) program of CITES.
- Discovered a significant increase in the poaching of bull tuskers, which has damaged population dynamics by disturbing the sex ratio.
 - In some areas the normal level of 1:12 ratio has been so distorted that 1:100 has been known.
 - This abnormality seriously affects the genetic viability of what on the surface can look like healthy sustainable population.

D) ODISHA TURNS TO SEED BOMBS TO FIGHT ELEPHANT PROBLEM

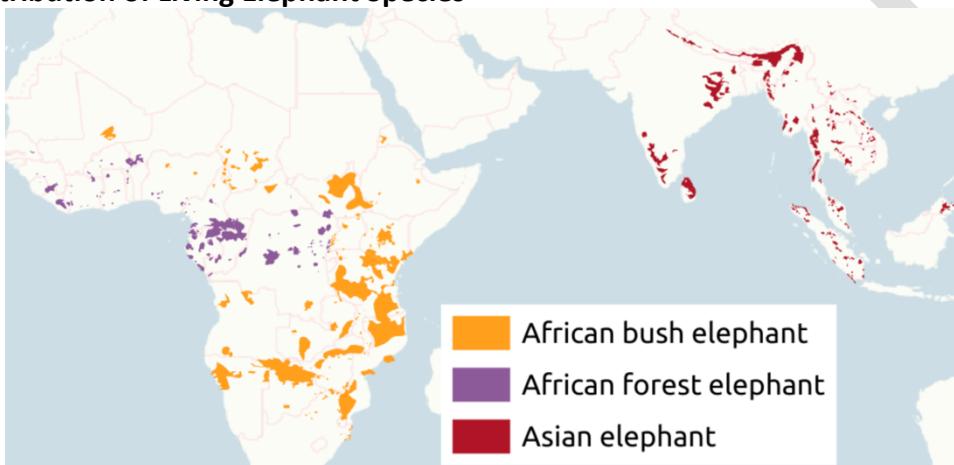
E) WORLD ELEPHANT DAY: 12TH AUG

- It was launched on 12th of August 2012 globally to mobilize attention and support for conservation of Asian and African Elephants.
- As per the available population estimates there are 4,00,000 African Elephants and 40,000 Asian elephants on earth.
- **India adopted the World Elephant Day in Aug 2016** to conserve and protect elephant in India and improve their welfare.
- **Nationwide Campaign "Gaj Yatra"**
 - Was first launched on Aug 12, 2017, by WTI (Wildlife Trust of India).

- **Aims to** protect elephant population.
- **Runs campaign** in 12 elephant range states

F) SOME GYAN ABOUT AFRICAN ELEPHANT

- African elephants are the largest elephant walking the earth. Their herd wander through 37 countries.
 - There are **two species of African Elephants**.
 - » The Savanna (or bush) elephant
 - » The Forest Elephant
 - **Savanna elephant** are larger than the forest elephants and their tusk curve outwards. They are the largest species of elephants and the biggest terrestrial animal on earth.
 - » IUCN: EN
- **Forest elephants** are smaller and darker; their tusks are straighter and point downwards. There are also difference in the size and the shape of the skull and skeleton between the two species.
 - » IUCN: CR
- **Distribution of Living Elephant Species**

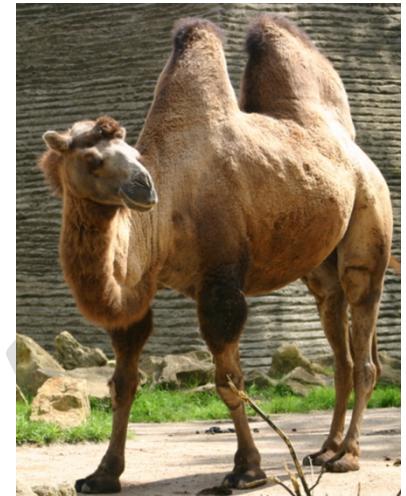


5) CAMELS IN RAJASTHAN

- **Different Types of Camels in India:**
 - The National Bureau of Animal Genetic Resources (NBAGR) lists **nine dromedary (*Camelus dromedarius*) breeds** of camel in India.
 - » **Five** (Bikaneri, Jaisalmeri, Jalori, Marwari, and Mewari) originated in Rajasthan
 - » **One - Mewati** can be seen in both Rajasthan and Haryana.
 - » **Two** (Kutchi and Khrai) are Gujarati
 - » **One** (Malvi) belongs to Madhya Pradesh.



- India also has **a small population of the double-humped Bactrian Camel (*Camelus bactrianus*), found mostly in the Nubra valley in Ladakh.**
- India's total camel population - all of them **descendants of wild dromedary, or Arabian, Camels** - decreased by 37% between 2012 and 2019.
 - Current estimates suggest that **there are fewer than 200,000 camels left among the nine breeds**, and **80% of these animals live in Rajasthan**, where they are bred to provide **transport, wool, and milk**, as well as plough field.
 - **Why decrease in Camel population?**
 - **Development in Western India** -> new roads, vehicles etc. -> reduces the need of camel transportation.
 - **Irrigation projects; Solar and Wind Farms** etc. have **reduced the land available for grazing of camels**.
 - **Collapsing tourism** (COVID-19 pandemic)
 - **Ban on export and sale of male camels** including blanket ban on the sale of camel meat.



- **Can Camel milk bring a solution?**
 - Camel milk is **touted as the next superfood**. It has **low amounts of sugar**, is **rich in vitamins and minerals**, such as **Vitamin C and potassium**, and is **alternative for lactose intolerance**.
 - Some studies have also shown that **Camel milk may reduce a person's need for Insulin (in case of Type-1 diabetes)**.
 - **Hurdles in promotion of use of Camel Milk?**
 - Supply and **potential demand centres** are very far away.
 - To transport raw camel milk to cities, it must be **pasteurized and refrigerated**, a **costly process**.
 - Learn from Gujarat model where **camel milk dairies have proven profitable**. Camel herders from Kutch region have **partnered with Amul**, which launched camel milk in 2019.

A) KHARAI CAMEL

- **Details**
 - » Kharai Camel are a **unique breed of camels** found **only in Kutch**. They are known for their **ability to swim in water**. They have **webbed feet** like that of a frog.
 - » The name is **derived from the local word Kharai** which means Saline. They are also known as **dariyataru** (meaning sea-swimmer).
 - » During the rainy season, they **swim along the Gulf Of Kutch**, an inlet of the Arabian sea, to **small forest islands and graze on mangroves and other saline-loving plants**.
 - » **IUCN: EN**
 - » **WPA: Schedule-1**
 - » **Key threats:**
 - **Habitat destruction** (mangrove forests they feed on are being destroyed)

- Salt pans have increased in the area, and they have destroyed habitat and blocked to path of travel for the camels.
- **Recognition as separate Breed:**
 - » The Kharai camels were recognized as a separate breed only in 2015.
- **Declining numbers**
 - » In 2010, there were about 10,000 camels in the region, which has now (2020) declined to around 5,000.
- **Key recent efforts**
 - » Amul have started making camel milk products to support camel herders.
- **Altercations between Kharai Camel Owners (Of Jamnagar and Devbhumi Dwarka) and Forest Department (Sep 2021) -> Grazing in Marine National Park**

6) KONDANA SOFT FURRED RAT (ALSO KNOWN AS KONDANA RAT OR LARGE METAD)

- Nocturnal burrowing rodent that is found only in India. It is sometimes known to build nests.
- **Habitat:** Its natural habitat are subtropical and tropical dry forests, subtropical or tropical dry lowland grassland, and urban areas.
- **Distribution:** Known only from the small Sinhagharh Plateau (about 1 km²), near Pune in Maharashtra.
- **Threats:** Major threats are habitat loss, overgrazing of vegetation, and disturbance from tourism.

7) Dhole/ ASIATIC WILD DOG OR INDIAN WILD DOG (CUON ALPINUS)

- **Other Names:** Indian wild dog, whistling dog, Chennai dog, Asiatic Wild Dog, red wolf etc.
- **Distribution:** Native to central Asia, South-East Asia.
 - » In India there are few remaining adults in the wild. They can be seen in protected areas of Karnataka, Maharashtra, and Kerala.
- **Population:** With less than 2,500 individuals surviving in the wild globally, the dhole is already extinct in about 10 Asian countries.
- **Very efficient predators:** They are so efficient as predators that there have been reports of them even attacking tigers.
- **Threat**
 - » Habitat loss
 - » Loss of prey



- » Competition with other species
- » Persecution
- » Possibly diseases transfer from other dogs (domestic and feral dogs).

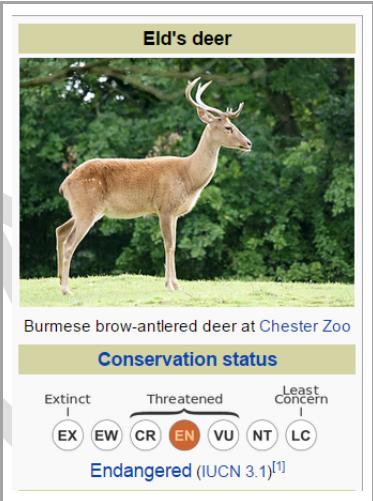
8) BROW-ANTLERED DEER/SANGAI DEER (PANOLIA ELDII)

Specific Habitat requirements: They inhabit the floating biomass in Loktak Lake Manipur.

Key threats: Hunted for their bow-shaped antlers.

Note: Sangai Deer (EN) is an endemic and endangered subspecies of brow-antlered deer found only in Manipur, India.

- It's original habitat is the floating marshy grasslands of the Keibul Lamjao National Park, located in the southern part of the Loktak lake, which is the largest freshwater lake in eastern India.
- State animal of Manipur.
- They are also known as **dancing deer**. This is because while walking on the floating island it often balances itself and appear to be dancing.



A) SANGAI FESTIVAL

- It is a **10-day annual cultural festival** organized by Manipur Tourism department every year from Nov 21 to 30.
- It was first celebrated in 2010. It was earlier called tourism festival which has been renamed to Sangai festival to promote the uniqueness of brow-antler deer.
- The festival also promotes Manipur's unique art, handicraft, sports, cuisine.
- Some **folk dances** of Manipur like **Kabui Naga Dance, Bamboo Dance, Maibi Dance, Lai Haraoba Dance, Khamba Thoibi Dance** etc could be seen here.
- **Manipur's martial art** form **Thang Ta** can also be seen here.
- **Some games** include:
 - **Yubi-Lakpi**, which is a game played like a rugby with greased coconut;
 - **Mukna Kangjei**, a game combining hockey and wrestling.
 - **Sangol Kangjei**, or Polo - It is believed that modern polo came from Manipur Polo, Sagol Kangjei.
- **Manipur cuisines** such as **Nga-thongba** (fish curry), and the popular **Eromba** (a mixture of boiled veggies with fermented fish) are also available at the festival.

B) LOKTAK LAKE

About the Lake

- It is one of the largest freshwater lakes in India. It is pulsating lake with surface area varying from 250 sq km to 500 sq km during the rainy season with a typical area of 287 sq km.
- It is lake in Manipur, which is located 40 kms south of Imphal.
- The town of Moirang, on its bank, was the headquarter of the Indian National Army where they established a provisional independent government after defeating the British.
- The lake covers 61% of the total identified wetlands of the state. It plays a significant role in socio-economic and cultural life of Manipuris.
- It is famous for Phumdis (soil and organic matter at various stages of decomposition) floating over it. The largest of all the phumdis covers an area of 40 km² and is situated on the southeastern shore of the lake. Located, on this Phumdi, Keibul Lamjao National Park is the only floating national park in the world. The park is the last natural refuge of the endangered Sangai (state animal).
- Once considered extinct, the population of brow-antlered deer found only on Keibul Lamjao National Park.
- Loktak lake is also one of the Ramsar sites in India.
 - It is also in Montreux Record and government is taking a lot of steps to get it delisted.



Key threats:

- Human Pressure - Floating houses and fishing structures.
- Ithai Barrage - brought about drastic changes in the characteristics of the wetlands.
- Pollution: Moreover, River Nambul that flows from Imphal into the lake, dumps in the untreated sewage of the entire city.

About Ithai Barrage

In 1983, NHPC constructed a barrage at the confluence of the Manipur and Khuga river - two of the five major rivers that drain into Loktak lake. This barrage has provided electricity and irrigation water to the region, but has created a number of problems for Loktak lake.

- Now even during dry season water level is high in Loktak lake and the Phumdis are not able to reach ground and absorb nutrition from there.
- Further, the dead biomass remains in the Lake only as the outflow has been blocked due to the barrage.
- The barrage has also blocked the route of migratory fish coming into the lake from Myanmar and so Loktak can no longer meet the demand of the entire state.

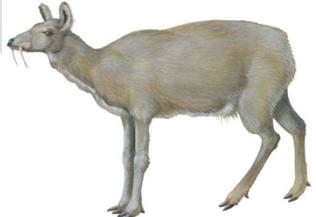
9) GEE'S GOLDEN LANGUR (TRACHYPITHECUS GEEI)

- **Distribution:** Golden langur is an old-world monkey, found in small regions of **western Assam, India and neighboring foothills of the Black Mountains of Bhutan.**
 - Manas National Park provides good sighting of this animal.
- **Status:** Endangered. One of the most endangered primate species of India.
- They have been named for their luscious coats and are considered sacred by Himalayan people.



10) HIMALAYAN WHITE BELLIED MUSK DEER

- **Habitat/Distribution:** Kashmir, Kumaon, Sikkim in India. Himalayas of Nepal and China.
- **Threats**
 - **Poaching and illegal trade for its musk**
 - **Musk:** is a substance with a persistent odor obtained from a gland of the male musk deer (only male produces the musk). The substance has been used as perfume fixative, incense material and medicine.



11) ALPINE MUSK DEER (MOSCHUS CHRYOSOGASTER)

- Alpine musk deer is a musk deer species native to the eastern Himalayas in Nepal, Bhutan and India to the highlands of Tibet.
 - It is now considered a separate species, to Himalayan Musk Deer. It is the state Animal of Uttarakhand.
 - IUCN Status: EN



12) KASHMIR MUSK DEER (MOSCHUS CUPREUS)

- It is an endangered species of musk deer native to Afghanistan, India, Pakistan and Nepal.
- In the past, the species was described as a subspecies to the alpine musk deer, but is now classified as a separate species.
- **IUCN:** EN

13) HISPID HARE

- **Details:** The Hispid hare, also called Assam rabbit, is a leporid, native to South Asia.
- **Habitat/Distribution:**
 - Historically it had wider range in southern Himalayan foothills, now distributed only patchily in India, Bangladesh, Nepal and Possibly Bhutan.
 - A significant population is found in Shuklaphanta National Park in Nepal, elsewhere it only occurs sporadically.
 - Habitat is highly fragmented due to increasing agriculture, flood control, and human development.



14) HOG DEER

Habitat/Distribution: Habitat ranges from Pakistan, through northern India, to mainland southeast Asia.

- But it has lost ground in most of its range.
- **Two sub species** of hog deer have been reported from its range
 - The western race is distributed from Pakistan and Terai Grassland (along the Himalayan foothills), from Punjab to Arunachal Pradesh.
 - The Eastern Race of hog deer is found in Thailand, Indo-China, Laos, Cambodia, and Vietnam.

Name: The hog deer runs through the forests with its head hung low (hog-like manner) so that it ducks under obstacles instead of leaping over them like most other deer do.



Eastern Hog Deer (*Axis Porcinus annamiticus*) - A rare subspecies of hog deer found in Keibul Lamjao National Park (2018)

- The sub-species was earlier believed to be confined to the eastern part of Thailand.
- **Genetic Study** by researchers at WII, Dehradun have reported presence of small population of Hog Deer at Keibul Lamjao National Park in Manipur.

15) LION TAILED MACAQUE / WANDEROO (MACACA SILENUS)

- **Details:** It's an old-world monkey, endemic to the Western Ghats of South India. They avoid human presence and they do not live, feed or travel through plantations.
- **Habitat:**
 - They live in Southwest India in pockets of evergreen forests, called **Sholas**, in the Western Ghats range. Today, they only live in mountain forests scattered across three Indian states: Karnataka, Kerala and Tamil Nadu.
- **Threat**
 - **Habit Fragmentation:** Due to spread of agriculture and tea, coffee, teak, and Cinchona, construction of water reservoirs and human settlements to support such activities.
- **Conservation Efforts**



- **Captive Breeding:** Aringnar Anna Zoological Park, Chennai and in Mysore Zoo.

16) NILGIRI TAHR

It is the only mountain ungulate in southern India amongst the 12 species present in India. It is also the state animal of Tamil Nadu. It is a sure-footed ungulate that inhabits the open montane grasslands habitats at elevations from 1200 m to 2600 m of the Southwestern ghats.

Distribution:

- Earlier, it was found throughout western ghats.
- But, today, it is distributed along a narrow stretch of 400 km between Nilgiris in the north and Kanyakumari in South. It has become locally extinct in around 14% of its traditional shola forests -grassland habitats.
- There are smaller populations found in the Palani Hills, Srivilliputtur, and the Meghamalai and Agasthiyar ranges, only two well protected large population is documented - one from the Nilgiris and the other from the Anamalais, including the high range of Kerala.
 - The Eravikulam National Park in Anamalai hills, Kerala, is home to the largest population of Nilgiri Tahr, with more than 700 individuals.
 - **Mukurthi National Park (TN)**, was created to protect this endangered species

Conservation Status

- IUCN/WPA/CITES: EN/Schedule-1/Appendix 1

Threats

- Habitat loss, overgrazing, illegal hunting.

Historical references:

- Referred in Tamil Sangam literature 2,000 years back.
- Late Mesolithic paintings (10000-4000 BCE) also highlight significance of Tahr in the folklore, culture and life.



A) NILGIRI TAHR CONSERVATION PROJECT (DEC 2022)

- It is an initiative launched by TN government, at a cost of Rs 24.14 crores.
- Under this, the government wants to:
 - » Develop a better understanding of the Nilgiri Tahr Population through surveys and radio telemetry studies.
 - » Reintroduce the Tahrs to their historical habitats
 - » Address Proximate threats
 - » Increase public awareness of species.
- The funds, for the project is provided by the TN Pollution Control Board (TNPCB).
- Further, Oct 7, will be celebrated as 'Nilgiri Tahr Day' in honour of E.R.C. Davidar, who was responsible for pioneering one of the first studies of the species in 1975.

17) INDIAN PANGOLIN

- About Indian Pangolin

- The Indian Pangolin, thick tailed pangolin, or scaly pangolin is a pangolin found in the **plains and hills of India, Sri Lanka, Nepal, and Bhutan.**
- It is an **insectivore** that feeds on ants and termites, digging them out of mounds and logs using its long claws, which are as long as its fore limbs. It is a **solitary, shy, slow moving, nocturnal mammal.**



- Main Threats

- **Hunting for its meat and scale**
- Various body parts used in traditional medicines

- Conservation Status

- IUCN: Endangered
- WPA: Scheduled 1
- CITES: Appendix 1 (reclassified in 2016 from Appendix 2 to Appendix 1)

- Pangolins and India

- Among **8 species of Pangolin** found globally, four each are found in Asia and Africa. **India is home to two species - the Chinese Pangolin and the Indian Pangolin.**

- Recently, CITES COP19 has urged member countries to **remove references to Pangolins from Pharmacopoeia** – an official collection of approved pharmaceutical standards.

18) RED PANDA (AILURUS FULGENS) (LESSER PANDA, RED BEAR-CAT, AND RED CAT-BEAR

It is a **small arboreal mammal** native to **eastern Himalayas and south-western China.**

Habitat/ Distribution: **Sikkim, Assam, Meghalaya, Northern Arunachal Pradesh and Darjeeling.** Almost **50% of the Red Pandas** inhabit eastern Himalayas.



Physical features: It has **reddish brown fur** and a long shaggy tail.

Diet: Omnivorous (mainly on bamboo)

Conservation Status

- IUCN/WPA/CITES: EN/Schedule 1/ Appendix 1

Threats: Habitat loss and fragmentation; Poaching for Furs; Inbreeding Individuals;



A) THE PADMAJA NAIDU HIMALAYAN ZOOLOGICAL PARK (PNHZP) (DARJEELING ZOO) HAS STARTED AN INITIATIVE TO **RELEASE 20 RED PANDAS** IN FORESTS IN THE NEXT FIVE YEARS.

- **About the Zoo:**

- It is a zoological park located in Darjeeling. It is named after Padmaja Naidu, the former Governor of West Bengal, India. She is also the daughter of Indian Independence leader Sarojini Naidu.
 - It is a park situated 2,000 meters above the sea level. It was established in 1958 and is the largest high-altitude zoo in India.
 - It has been quite successful in captive breeding of the Red Panda. As of July 2022, there are 27 Red Pandas in the zoo.
- **Release of Red Pandas in Wild:**
- In the first re-wilding program of red Pandas in India, the PNHZP has started an ambitious program to release 20 of these mammals in about five years to the forests. They will be released in Singalila National Park.
 - In the past, two pairs of Red Pandas were released in 2021. Two animals managed to survive.

B) A RECENT PUBLICATION BY SCIENTISTS OF ZOOLOGICAL SURVEY OF INDIA (ZSI) HAVE RESOLVED THE MYSTERY AROUND DEMOGRAPHY AND SPECIATION OF RED PANDA.

- India is home to both the (sub) species - Himalayan Red Panda (*Ailurus fulgens*) and the Chinese red Panda (*Ailurus Styani*) and the Sang River in Arunachal Pradesh splits the two phylogenetic species.

19) ASIAN WILD BUFFALOE

- It is the large bovine native to the Indian subcontinent and Southeast Asia.
- It has been listed as endangered since 1986 and remaining population totals less than 4,000. More than 90% of its population is found in India, mostly in Assam.



7. TIGER (IUCN: EN, WPA – SCHEDULE-1; CITES – APPENDIX-1)

- **Introduction**
- The tiger can be called a keystone species because it has a strong influence on other animals and plants in the ecosystem, especially deer and boar. From the conservation perspective it is also called Umbrella Species because when its ecological needs are met, so are those of myriad other living things that share its landscapes.
 - It is estimated that India had 40,000 tigers in 1900, and the number declined to 1800 in 1972. Similarly, world had around 1,00,000 tigers in 1900's, to less than 4,000 in the 1970's.
 - Tigers have the species name **Panthera Tigris**. There are nine sub-species of tigers, three of which are extinct.

- Tiger Sub-Species

Species (non-extinct)	Other details
Bengal (Panthera tigris tigris)	India, Nepal, Bhutan and Bangladesh; most numerous, about 4,000
Indo-Chinese	Thailand, Cambodia, Vietnam, Laos, Myanmar, China etc fewer than 300 remain
Malayan	Malay peninsula and in the southern tip of Thailand; 500
Siberian or Amur	Russian Far East; 300
South China	China; probably extinct in the wild
Sumatran	Sumatra, Indonesia; 500-600
Species (Extinct)	
Bali	
Caspian	
Javan	



- IUCN has recently (2022) confirmed that tigers have gone extinct in Cambodia, Laos, and Vietnam. Poaching and habitat loss are the key reasons.

- Major Threats faced by Tigers.

1. **Poaching** driven by illegal international demand for tiger parts and products.
 - For e.g. Bangladesh has also emerged as a major hub in the illicit poaching and trafficking of tigers.
2. **Depletion of prey** caused by illegal bush meat consumption
3. **Habitat loss** due to ever increasing demand of forest lands
4. **Inbreeding**
5. **Human-Animal Conflicts**

1) INTERNATIONAL TIGER CONSERVATION EFFORTS

A) GLOBAL TIGER INITIATIVE, 2008

Global Tiger Initiative (GTI), 2008 is a global alliance of governments, international organizations, civil society, the conservation and scientific community, and the private sector committed to working together towards a common agenda to save wild tigers from extinction.

- » It was launched in 2008 by founding partners the World Bank, Global Environmental Facility, Smithsonian Institution, Save the Tiger Fund and International Tiger Coalition (representing more than 40 NGOs).
- » It is led by 13 tiger range countries (TRCs).
 - Russia, China, India, Nepal, Bhutan, Bangladesh, Myanmar, Thailand, Laos, Cambodia, Vietnam, Indonesia and Malaysia.
- » GTI secretariat, based at the World Bank in Washington, DC, assists 13 tiger range countries to carry out their conservation strategies and drive the global tiger conservation agenda, through planning, coordination and continuous communication.
- » The TRCs came together in an unprecedented pledge to double the world's tiger population by 2022 (which is the year of the Tiger on the Asian lunar Calendar), with a goal of achieving at least 6,000 tigers.
- » GTI is contributing through protection of habitat, fighting wildlife crime, building capacity, reducing demand, engaging community, and innovation.

B) GLOBAL TIGER RECOVERY PROGRAM 2.0 (GTRP 2.0)

- » Why in news?
 - Countries submit population numbers from 2010-2022 to Global Tiger Recovery Program, CITES (Jan 2024)
- » About GTRP:
 - GTRP (2010-22) was launched in 2010 under the GTI by the World Bank to save wild tigers. Tiger Range countries committed to doubling the tiger population by 2022.
 - How effective was it?
 - Successes in South Asia and Russia.
 - Failures (decline) in Southeast Asia.
- » GTRP 2.0:
 - On 29th July 2023, marking Global Tiger Day, the Global Tiger Initiative (GTI) introduced the latest iteration of the **Global Tiger Recovery Program (GTRP 2.0) For the Year 2022 to 2034**. It aligns with Post-2020 Global Biodiversity Framework (GBF), providing an opportunity for TRCs to integrate tiger conservation with global goals.
 - The following outcomes are expected from the GTRP 2.0:
 - Cross Sectoral Conservation
 - Increased Investment
 - Habitat protection
 - Conflict Management
 - Reduced Wildlife Trade
- » Submission of Numbers by Countries:
 - The submissions were made under GTRP 2.0 and CITES.
 - There has been overall increase in tiger population by 60%, taking the number to 5,870.
 - However, Bhutan, Myanmar, Cambodia, Lao-PDR, and Vietnam showed decline in tiger population. It makes the situation grim in the Tiger Range Countries (TRC) of southeast Asia.

C) TX2

GTI adopted St Petersburg declaration on Tiger Conservation and endorsed TX2 in 2010.

- Goal of TX2 is to double the number of tigers across their geographical areas.

D) TX2 TIGER CONSERVATION AWARD (TTCA)

- The Awards celebrate the 10-year anniversary of all 13 Tiger Range countries committing to double the global population of wild tigers by 2022 - a goal called TX2.
- It is given in two categories.
 - » **TX2 Conservation Excellence Award**
 - The award recognizes a site that has achieved excellence in two or more of five themes:
 - » Tiger and prey population monitoring and research (tiger translocation/prey augmentation);
 - » Effective site management.
 - » Enhanced law enforcement, protection and ranger welfare improvement;
 - » Community-based conservation, benefits and human-wildlife conflict mitigation and.
 - » Habitat and prey management.
 - » **TX2 Award** - It is given for efforts to increase tiger population and includes a financial grant to assist the ongoing conservation efforts.
 - These awards are supported by Conservation Assured | Tiger Standards (CA|TS), Fauna & Flora International, Global Tiger Forum (GTF), IUCN Panthera, UNDP, WildLife Conservation Society (WCS), and WWF.
- In 2023, Pench Tiger Reserve (PTR), Maharashtra, is among the three tiger reserves to win the TX2 Award for a fivefold increase in its tiger population from 9 individual in 2006 to 44 in 2021.
 - » The other two tiger reserves include Pench (Madhya Pradesh) and Satpura Tiger Reserve. While Pench (MP) increased its tiger population from 33 (2006) to 87 (2018), STR increased its numbers from 13 in 2010 to 48 in 2021.

E) INTEGRATED TIGER HABITATION CONSERVATION PROGRAM (ITHCP)

- **Why in news?**
 - IUCN Tiger Program launches phase-IV (Aug 2023)
- It is a strategic funding mechanism which aims to save tiger in the wild, their habitats and to support human populations in key locations throughout Asia. It was launched in 2014.
- **IUCN** is the program implementing agency.
 - » It is supported by German Government and the German Development Bank (KfW) and was launched in late 2014.
 - » The program contributed to the international goal set up during the 2010 St Petersburg Summit to double wild tiger population by 2022.
- **In India**, it was launched in Karnataka in 2016.
 - » In 2018, it was extended for further five years.

- **Updates:** Launch of Phase IV (Aug 2023)
 - » ITHCP has launched a call for Concept Notes for Phase IV of the Tiger Program.
 - It aims to allocate a total of Euro 10.7 million and, for the first time, the program will extend eligibility to other species that significantly contribute to the intricate tapestry of tiger conservation.
 - Projects can target one of the following species: Tigers (Panthera tigris), leopard (Panthera Pardus), and Clouded leopards (both mainland and Sunda)
 - Countries eligible under this call for concept notes include Nepal, Bhutan, India, Bangladesh, Myanmar, Thailand, Cambodia and Indonesia.
 - It should be noted that funding will exclusively be channeled towards specific Designated Program Areas, ensuring a focused and targeted approach to conservation efforts.
 - » By embracing a comprehensive and diversified strategy that encompasses a wider array of species, the program will continue to secure a viable future for these Species, their Habitats and the people that live in and around them.

F) CONSERVATION ASSURED TIGER STANDARDS (CATS)

- **CATS** is a conservation tool that specifies best practices and standards to manage target species and encourages assessments to benchmark progress.
 - It is a partnership of 13 Tiger range governments, inter-government agencies, NGOs, and conservation organizations.
 - WWF is helping the Tiger range countries to implement CATS.
 - It was launched in 2013 and Tigers are the first species selected for the initiative.
- **In July 2020:**
 - NTCA has decided to adopt the Conservation Assured Tiger Standards (CATS) across all fifty tiger reserve across the country.
 - » The Global Tiger Forum (GTF) and World Wildlife Fund India are the two implementing partners of the NTCA for CATS assessment.
 - This makes India the first among 13 Tiger range countries to nationally adopt CATS, which are a set of minimum standard setting benchmark for managing conservation sites.
 - » This will bring India's total number of registered sites to 94 including sites outside tiger reserves.

G) WORLD TIGER DAY/ INTERNATIONAL TIGER DAY: 29TH JULY

- **Why 29th July?**
 - It was a reminder of agreement signed by countries at St Petersburg Tiger Summit in Russia, 2010, to raise awareness about decline of global tiger population.
 - It was established in 2010 to raise awareness about the decline of wild tiger numbers.
- Tadoba Tiger Reserve, Maharashtra plays host for National Global Tiger Day Celebrations 2022

2) NATIONAL EFFORTS FOR TIGER CONSERVATION

A) PROJECT TIGER

- **News:** Project Tiger completes 50 years in 2023.
- It is a centrally sponsored tiger conservation programme launched in 1973 by the MoEF&CC, GoI.
- **Objectives / Aims**
 - » Ensuring a viable population of Bengal Tigers in their natural habitats and also to protect them from extinction.
 - » Preserving areas of biological importance as a national heritage for the benefit education and enjoyment of people.
 - » Harmonizing the rights of tribal people living in and around tiger reserves.
- **Tiger Reserves**
 - Tiger reserves are the areas that are notified for the protection of the tiger and its prey, and are governed by Project Tiger and administered by the National Tiger Conservation Authority.
- Tiger reserves are constituted on a **core/buffer strategy**:
 - The **Core Area** have the legal status of a national park or a sanctuary with an **exclusive tiger agenda**.
 - These areas are required to be kept inviolate for the purposes of tiger conservation, without affecting the rights of Scheduled Tribes or such other forest dwellers.
- The **Buffer or peripheral areas** are a mix of forest and non-forest land, managed as a multiple use area with an inclusive people-oriented agenda.
 - » It aims to promote coexistence between wildlife and human activity with due recognition of the livelihood, developmental, social and cultural rights of the local people.
 - » Limits of such area are determined on the basis of scientific and objective criteria in consultation with the concerned Gram Sabha and an Expert Committee constituted for the purpose.
- **Corridor Habitat**
 - » 2010 tiger census showed a decline in tiger occupied area. This decline in tiger occupancy area was recorded in areas outside the tiger reserves, indicating loss of habitat quality and extent - a crucial element essential for maintaining genetic connectivity between individual tiger population.
 - » To address this vital conservation concern, the **NTCA in collaboration with the WII delineated the minimal tiger habitat corridors connecting tiger reserves** for implementing landscape scale tiger conservation.
 - » Now all tiger reserves manage their tiger populations based on a Tiger Conservation Plan (TCP), which addresses specific prescriptions for core, buffer, and corridor habitats.
- Currently, there are 54 tiger reserves spread across 75,796 km², effectively covering 2.3% of India's total land area.

B) NATIONAL TIGER CONSERVATION AUTHORITY (NTCA)

- Wildlife Protection Act of 1972 was amended in 2006 to provide for the formation of National Tiger Conservation Authority to aid in the implementation of measures for the conservation of tiger. It comes under MoEFCC.
- **What does it do?**
 - » Providing central assistance to states under the ongoing Project Tiger, for activities based on Tiger Conservation Plan.
 - » **Conducting countrywide tiger census every four years.** It does assessment of the status of tiger, co-predators, prey, and habitat using the refined methodology approved by the Tiger Task Force.
 - » Taking steps for protection and act against poaching
 - Alert states as and when required; Transmit backward/forward linkages of information relating to poachers.
 - Use IT for improved surveillance (e-Eye system) using thermal cameras.
 - Launch tiger reserve level monitoring using camera trap to keep a photo ID database of individual tigers.
 - Prepare a national database (Tiger Net) of individual tiger photo captures to establish linkage with body parts seized or dead tigers.
 - Assist states to refine protection oriented monitoring through Monitoring System for tiger's intensive protection and ecological status (M-STIPES).
 - It is an android app which was launched in 2010.
 - Support states for raising, arming and deploying the Special Tiger Protection Force.
 - Address issues such as the movement of tigers out of their habitats into human settlements.

C) MANAGEMENT EFFECTIVE EVALUATION (MEE) OF TIGER RESERVES IN INDIA

- MEE is a globally accepted framework for measuring the conservation efforts of tiger reserves. It has been adopted from the framework of the IUCN World Commission on Protected Areas and has emerged as the most important tool to assist and improve management perspectives of Tiger Reserves and their associated landscape connectivity.
- In India MEE is being jointly conducted by the NTCA and WII and has paved the way for a successful evaluation of national tiger conservation effort.
- **India is the only country in the world to have institutionalized and effectively completed five cycles of MEE of Tiger Reserves in the country.**
- **Key Highlights of the fifth cycle of Evaluation:**
 - A total of 51/53 tiger reserves have been independently evaluated through the MEE process in the fifth cycle in 2022.
 - 10 independent regional expert committees (RECs) were constituted and deputed in 10 different clusters of five tiger landscapes to evaluate the 51 tiger reserves of the country.
 - Each team consisted of a chairperson and 2-3 members (retired IFS officers having experience in wildlife management, especially in the field of tiger reserves).

- **33 criteria/Indicators** were used for evaluation of six elements of MEE framework.
- **The results** were classified in four categories based on the percentage of maximum possible score: (50-59% rated as '**Fair**'; 60-74% rated as '**Good**'; 75-89% rated as '**very good**' and >=90% rated as **excellent**).

- **Results:**

- Overall average score of 78.01% for 51 Tiger Reserves.
- **12 tiger reserves got excellent category (score >=90%).**
 - These include - Periyar (KER), Satpura (MP), Bandipur, Nagarhole, Kanha, Biligiri Ranganatha Swamy Temple (KAR), Annamalai (TN), Pench (MHA), Bhadra (KAR), Kali (Dandeli-Anshi) (KAR), Simlipal (Odisha), Mudumalai (TN).
- **21 tiger reserves got very good category; 13 'Good' category and 5 Tiger Reserves in 'Fair Category;**
 - "**Very Good**" tiger reserves include - Pench (MP), Tadoba-Andhari (MHA), Manas (Assam), Melghat (MHA), Sathyamangalam (TN), Parambikulam (Kerala), Kaziranga (Assam), Navegaon-Nagzira (MHA), Bandhavgarh (MP), Panna (MP), Kalakad-Mundanthurai (TN), NSTR (AP), Dudhwa (UP), Corbett (UK), Sahyadri (MHA), Amrabad (Telangana), Bor (MHA), Pakke (Arunachal), Valimiki (Bihar), Sundarbans (WB) and Satkosia Odisha)
 - "**Good**" tiger reserve includes Kawal (Telangana), Ranthambore (Raj), Kamlang (Arunachal), Sanjay-Dubri (MP), Pilibhit (UP), Achanakmar (Chhattisgarh), Rajaji (UK), Orang (Assam), Palamu (Jharkhand), Sariska (Raj), Buxa (WB), Srivilluputhur Megamalai (TN), Mukundra (Raj)
 - "**Fair**" tiger reserves include Namdapha (Arunahcal), Udanti-Sitanadi (Chhattisgarh), Nameri (Assam), Indravati (Chhattisgarh) and Dampa (Mizoram).

D) CENTER MERGES PROJECT TIGER AND PROJECT ELEPHANT (JULY 2023)

- **The MoEF&CC** announced the merger in April and notified Project Tiger (PT) as Project Tiger and Elephant (PTE).
 - » **The Project Tiger Division** has been merged with **Project Elephant** and a new division with the name 'Project Tiger and Elephant Division' has been created under the MoEF&CC.
 - » After the merger, the staff and divisional heads of Project Elephant (PE) will now report to the additional director general of forests (ADGF), Project Tiger (PT), who has now been designated as ADGF (PT&E).
- **Criticism:**
 - » **Decision without any discussion:**
 - » **May hamper Project Tiger** as it may get bogged down in the bureaucratic quagmire of MoEF&CC.
 - NTCA has a single-minded focused attention on conserving tiger and is disconnected from the tentacles of the vast bureaucracy.
 - » A similar proposal of planning commission was rejected by NBWL in the past.

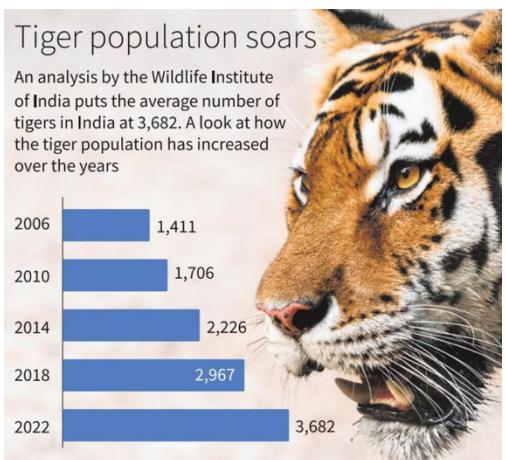
E) TIGER REVIVAL PROGRAM OF NTCA: TRANSLOCATION OF BIG CATS TO MADHAV NATIONAL PARK IN MP TO BEGIN ON MARCH 10, 2023

- In March 2023, the Madhya Pradesh Forest department has released tigers in Madhav National Park as part of the tiger reintroduction project.
 - » It will be first time in two decades that the park will have tigers.
- This is the **third time** the MP forest department has reintroduced a tiger in a wildlife sanctuary, which is devoid of majestic beasts.
 - » Earlier, the tigers have been successfully rehabilitated in the Panna Tiger Reserve and the Nauradehi WLS in Sagar

F) INTER-STATE TIGER TRANSLOCATION PROJECT – CLASS DISCUSSION

3) TIGER ESTIMATES IN THE COUNTRY

- NTCA has been conducting a survey of tiger population every four years since 2006.
- NTCA's census of tigers conducted in 2006, 2010, 2014, 2018 and 2022 show an increasing trend.
- India currently harbors 75% of the world's wild tiger population.
- **Key Highlights of All India Tiger Estimates - 2022:** Release of detailed report (July 2023)
 - » **Total Tiger Population** - 3682 (as per detailed report released in 2023)
 - Note: In April 2022, PM Modi declared the minimum tiger population of 3167, which is the population estimate from the camera trapped area.
 - Now (2023), further analysis of data done by Wildlife Institute of India (WII), from both camera-trapped and non-camera trapped tiger presence areas, the upper limit of tiger population is estimated to be 3925 and the average number is 3682 tigers, reflecting a commendable annual growth rate of 6.1% per annum.
 - » **States with Highest Tiger Population:** MP (785); Karnataka (563); Uttarakhand (560) and Maharashtra (444)
 - **Some states**, including Mizoram (0), Nagaland (0), Jharkhand (1), Goa (5), Chhattisgarh, and Arunachal Pradesh (9), have reported disquieting trends with smaller tiger population.
 - » **Tiger reserves with highest number of tigers:** Corbett (260), Bandipur (150), Nagarhole (141), Bandhavgarh (135), Dudhwa (135) etc.
 - **Corbett** also has the highest density of wild tigers in the world.



- » **Reserves with no tigers** (Dampa (Mizoram); Kamlang (Arunachal Pradesh); Kawal (Telangana), Satkosia (Odisha), Sahyadri (MHA);
- » **Tiger Reserves with less than 10 big cats:** These are Ranipur in Uttar Pradesh; Achanakmar, Indravati and Udanti Sitanadi in Chhattisgarh; Palamau in Jharkhand; Bor in Maharashtra; Mukundara and Ramgarh Vishdhari in Rajasthan; Kalakad Mundanthurai in Tamil Nadu; Nameri in Assam; Pakke and Namdapha in Arunachal Pradesh and Buxa in West Bengal.
- » **Landscape wide distribution:**
 - i. **Central India landscape** has seen an increase in tiger population to **1161** (from 1033 in 2018).
 - ii. **Western Ghats** showed a decline of tiger population (**824**)
 - iii. **Shivalik Hills and Gangetic Plains** landscape had **804** tigers and have witnessed an increase from 648 population in 2018.
 - iv. **Northeastern Hills and Brahmaputra Plains landscape** - have shown evidence of **194 tigers**.
 - v. **Sundarbans** (100) also saw an increase from 88 in 2018.
- » **Techniques used for estimation:**
 - **M-STrIPES** (Monitoring System for Tiger-Intensive Protection and Ecological Status): It uses a GPS and remote sensing to collect information from the field.
 - **Camera-Trap based capture**
 - **Extracting DNA from SCATs** in area where camera traps were not possible.

G) ODISHA WANTS ITS OWN CENSUS (SEP 2023)

- **Why?**
 - » It disagrees with NTCA findings.
 - All India Tiger Estimate (AITE) had said that more than half the tigers of Odisha had in 2016, have vanished, with one of its two notified tiger reserves Satkosia has none.
 - Odisha says that this is an inaccurate representation as the sampling intensity was very low.
 - They said though the AITE protocol mandates that the phase-I survey be carried out in all forest beats (in tiger reserves, protected areas, reserve forests, protected forests, revenue forests in all wildlife and territorial divisions) and phase-III in all potential tiger-bearing forest blocks, in Odisha, it was carried out only in limited areas. The state claimed a total of 733 camera traps were deployed in Odisha, as against 6,894 and 4,872 in Madhya Pradesh and Maharashtra respectively.
- **How will Odisha do Census?**
 - » While the AITE since 2006 has replaced the pugmark method with new technologies, Odisha's survey will rely on the camera trap method along with pugmark and other approaches.
 - » **Where?**
 - All districts (except coastal districts)

H) INAUGURATION OF INTERNATIONAL BIG CAT ALLIANCE

- PM Modi inaugurated the International Big Cat Alliance (IBCA) in Karnataka's Mysuru (April 2023)
 - » India has proposed to launch a mega global alliance to protect big cats and assured support over five years with guaranteed funding of \$100 million (over Rs 800 crores).
 - » The IBCA will focus upon conserving 7 major big cats of the world - Tiger, Lion, Leopard, Snow Leopard, Puma, Jaguar, and Cheetah
 - » The alliance aims to reach out to 97 range countries covering the natural habitats of Tiger, Lions, Snow Leopard, Leopard, Puma, Jaguar, and Cheetah.
 - » It will further strengthen global cooperation and efforts to conserve wild denizens, especially big cats.
 - » **Governance:** General Assembly, Council and Secretariat

I) PROTECTION OF BLACK TIGER (MELANISTIC TIGER)

- **Melanistic tigers** have been recorded only in Similipal Tiger Reserve in Odisha. As per the 2022 census, there are total 16 individual tigers in Similipal out of which **10 are melanistic**.
- **A standard operating Procedure (SOP)** has been issued by the NTCA for active management towards rehabilitation of tigers from source areas at the landscape level.
 - Based on genetic composition, the Similipal Tiger Reserve has been identified as a distinct genetic cluster for conservation. **Funding assistance is provided** under the ongoing Centrally sponsored scheme of Integrated Development of Wildlife Habitats (CSS-IDWH) to the Similipal Tiger Reserve for conservation of tigers, raising awareness on tiger & other wildlife conservation, habitat management, protection, eco-development, human resource and infrastructure development, voluntary village relocation, as per the sanctioned Annual Plan of Operation of the Tiger Reserve which emanates from a statutory Tiger Conservation Plan (TCP).

8. VULNERABLE MAMMALS OF INDIA

4) GREAT INDIAN ONE HORNED RHINO

Details: Fifth largest land animal.

Threats:

- Poaching - rhino horn great demand in China and other Asian countries for traditional medicines.
- Habitat loss
- Fragmentation of Habitat

Habitat and Distribution

- **Past:** Once ranged throughout the entire stretch of Indo-Gangetic Plain.
 - Population went down to a mere 200 in the early 1990s, and was declared to be endangered.
- **Present:** Found only in the tall grasslands and forests in the foothills of the Himalayas. Today more than 3,000 Rhino live in wild, most of them confined in Assam (2500+). They range from few pockets in Southern Nepal, northern Bengal, and Brahmaputra Valley.
 - Today, they are mostly found in 7 protected areas:
 - In Assam: Kaziranga National Park, Pobitora WLS, Orang NP, Manas NP
 - In WB: Jaldapara NP and Gorumara NP
 - In UP: Dudhwa NP
 - Protected Areas for Rhino (all three in Assam)
 - Kaziranga National Park
 - Pabitora Wildlife Sanctuary
 - Manas National Park



Indian rhinoceros (^[1]*Rhinoceros unicornis*)

in the Kaziranga National Park



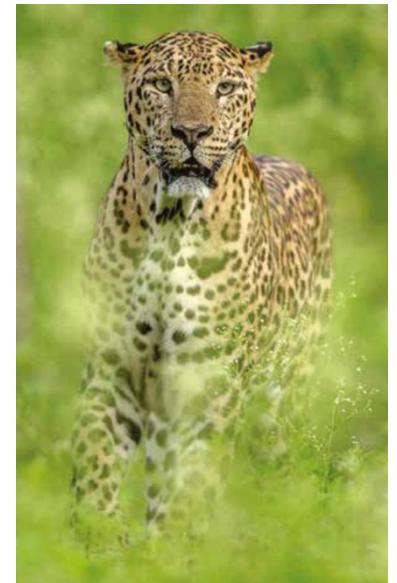
A) INDIAN RHINO VISION 2020 COMES TO AN END

- It was a partnership among the government of Assam, the International Rhino foundation, WWF, the Bodoland Territorial Council, and the US Fish and Wildlife Service that aims to increase the number of Rhino population and provide long term viability in seven of Assam's protected areas by 2020.
- Need of such mission
 - Rhino population had been confined to 2-3 protected areas of Assam.
- The main feature of the vision was the translocation of rhinos from Kaziranga, Orang and Pobitora to other protected areas.
 - Other activities involved anti-poaching, monitoring, community conservation efforts etc.

- The ambitious program came to a **close in April 2021** with the release of two Rhinos in Assam's Manas National Park transported from Pobitora WLS about 185 km to the east.
 - There were total eight rounds of rhino translocation under IRV2020.
 - Manas NP has received a total of 22 Rhinos from other protected areas.
- **Has the target been achieved:**
 - It is believed to have achieved its target of attaining a population of 3,000 Rhinos in Assam. (2018 Census had 2650 Rhinos)
 - But, the plan to spread the Rhinoceros unicornis across 7 Protected Areas of Assam didn't materialize completely.

2) INDIAN LEOPARD (PANTHERA PARDUS FUSCA)

- **Details about Leopard**
 - They are found in **widely distributed and adaptable habitats**. It is absent only in arid deserts and above timber line in the Himalayas and are found throughout the country. In Himalayas, they are sympatric with snow leopard (Panthera uncia).
 - Among all sub-species, the Indian leopard retains the largest population size and range outside Africa.
 - In areas devoid of any other large carnivore, the leopards can act as an **umbrella species for biodiversity conservation**.
- **Protection Status**
 - IUCN: VU
 - WPA: Schedule - 1
 - CITES: Appendix-1
- **Status of Leopard in India, 2018** (published in 2020)
 - During the **All-India tiger estimation** of 2018, leopard population was also estimated within the forested habitats in tiger occupied states.
 - » Note: Non-forested areas like coffee and tea plantation, higher reaches of Himalayas, arid landscape and majority of north-eastern landscapes were not sampled, and therefore this population estimate should be considered as minimum number of leopards in each of the landscapes.
- **Key highlights**
 - **Total Population:** 12,852
 - **60% increase in population** in 2018 when compared to 2014.
 - » **But North-eastern region** see the population facing major threat due to land use changes triggered by agriculture, tea gardens and linear infrastructure projects.
 - **Regional Distribution** (MP > KAR > MHA > TN > Chhattisgarh > UK)



- » **Shivalik Hills and Gangetic Plains:** 1,253 leopards
 - Uttarakhand > UP > Bihar
- » **North-eastern Landscape:** 141 leopards
 - WB > Assam > Arunachal
- » **Central India and Eastern Ghats:** 8071 leopards
 - MP > MHA > Chhattisgarh
- » **Western Ghats:** 3,386 leopards
 - Karnataka > TN > Kerala

3) SNOW LEOPARD

Distribution:

- Native to mountain ranges of central and South Asia, it is found along the upper reaches of Himalayas at elevations between 3000-4000 m.
 - It is known as the "**ghost of mountain**" and is the top predator of the region. It is a flagship species for high altitude Himalayas. It is also an indicator species and its presence gives an indication about the whole mountain ecosystem.
 - Reclusive nature of Snow Leopard and difficult terrain have made population estimation difficult.
- In India it is found in **Ladakh, Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh**.
 - **Hemis** (Ladakh) is also known as the snow leopard capital of the world.
 - India has identified **three landscapes** namely:
 1. **Hemis-Spiti** across Ladakh and Himachal Pradesh;
 2. **Nanda Devi - Gangotri** in Uttarakhand
 3. **Khangchendzonga - Tawang** across Sikkim and Arunachal Pradesh.
- Globally, it is found in **12 countries** of South Asia and Central Asia - India, Nepal, Bhutan, China, Mongolia, Russia, Pakistan, Afghanistan, Kyrgyzstan, Kazakhstan, Tajikistan, and Uzbekistan.

Conservation Status

- IUCN: VU
 - Note: IUCN moved it from endangered to vulnerable in 2017
- WPA: Schedule 1 (Part 1)
- CITES: Appendix 1
- Convention on Migratory Species (Appendix - 1)

Snow leopard



Snow leopard in Wakhan District, Afghanistan



At Hemis National Park, India

Conservation status



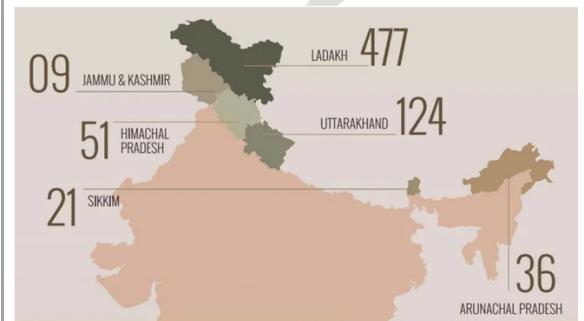
National Heritage Animal: Snow leopard is national heritage animal of Afghanistan and Pakistan.

Key threats

- Habitat loss, fragmentation, human-animal conflict, hostile habitat -> traditionally lower population

Status Report of Snow leopard in India (Jan 2024)

- The report was released by the Union Minister of EF&CC during the National Board of Wildlife Meeting in Delhi.
- The Snow Leopard Population Assessment in India (SPA) Program is the first ever scientific exercise** about snow leopard population in India.
- The Wildlife Institute of India (WII)** is the National Coordinator for this exercise that was carried out with the support of all snow leopard range states and two conservation partners, the Nature Conservation Foundation, Mysuru and WWF-India.
- The SPAI systematically covered over 70% of the potential snow leopard range in the country of around 1,20,000 sq km. It covered the UT of Ladakh, UT of J&K, and states such as Himachal Pradesh, Uttarakhand, Sikkim, and Arunachal Pradesh.
- The exercise was carried out between 2019-2023 using a meticulous two step framework:
 - The first step** involved evaluating snow leopard spatial distribution.
 - The second step** snow leopard abundance was estimated using the camera traps in each identified stratified region.



Key Highlights of the report:

Total Population: 718

Ladakh (477), UK (124), Himachal (51), Arunachal (36), Sikkim (21), and Jammu and Kashmir (9)

The report also mentions the need for establishing a dedicated Snow Leopard Cell at WII under MoEF&CC with primary focus on long-term population monitoring, supported by well-structured study designs and consistent field surveys.

Programs by GoI to protect Snow Leopard

A) SECURE HIMALAYAS

- It is a GEF-UNDP funded project which is focused on conservation of high altitude biodiversity and reducing the dependence on local communities on the natural ecosystem.
 - It is currently operational in four snow leopard ranges - J&K, Himachal, UK and Sikkim.

B) PROJECT SNOW LEOPARD (LAUNCHED BY GOI IN 2009)

- It is an initiative for strengthening wildlife conservation in the Himalayan High altitudes, covering Jammu and Kashmir, Himachal Pradesh, UK, Sikkim and Arunachal Pradesh.
- It aims at promoting knowledge-based and adaptive conservation framework that fully involves local communities, who share snow-leopard's range, in conservation efforts.

- » The project facilitates a landscape level approach to wildlife conservation by developing scientific frameworks for comprehensive surveys, rationalizing the existing protected area network and improving protected area management.

C) "HIMAL SANRAKSHAK" - COMMUNITY VOLUNTEER PROGRAM

- Launched in Oct 2020

D) THE UT OF LADAKH HAS ADOPTED SNOW LEOPARD AND BLACK NECKED CRANE, AS THE STATE ANIMAL AND STATE BIRD (SEP 2021)

E) SNOW LEOPARD CONSERVATION BREEDING PROGRAM

- It is being carried out at Padmaja Naidu Himalayan Zoological Park.

International Efforts

A) INTERNATIONAL SNOW LEOPARD DAY: 23RD OCTOBER

- It marks the adoption of Bishkek Declaration by 12 countries on the conservation of snow leopard in 2013.
- The Global Snow Leopard & Ecosystem Protection Program (GSLEP) was also launched on the same day.

B) GLOBAL SNOW LEOPARD & ECOSYSTEM PROTECTION PROGRAM (GSLEP)

- The GSLEP is a first-of-its kind intergovernmental alliance for the conservation of the snow leopard and its unique system. It was created in 2013 when officials, and conservationists arrived at a common conservation strategy enshrined in the Bishkek Declaration (2013) to cooperate in the conservation of this species and its habitat.
- It is a range wide effort and unites range country government, NGOs, local communities, and private sector to conserve snow leopard and their ecosystem.
- It is led by environment ministers of 12 countries in Asia which form the home range of snow leopards.
- The GSLEP secretariat is in Bishkek.
- India is a member of GSLEP since 2013.
 - Gol also hosted 4th Steering Committee of the GSLEP in 2019 which also resulted in the "New Delhi Statement" of strengthening the resolve of the snow leopard range countries towards conservation of the mountain ecosystem of Central and South Asia.

4) CLOUDED LEOPARD (NEOFELIS NEBULOSA)

- Why in news?
 - » A new study reveal that clouded leopard doesn't follow any specific pattern of operating in a certain space, unlike other carnivores (Aug 2023)
- About Clouded Leopard

The clouded leopard has been named so after the cloud-shaped pattern on its skin. They are considered evolutionary link between big cats and small cats.

Habitations

They are typically rainforest dwellers, but can also be found in drier forest of South East Asia.

Distribution: Himalayan foot hills to Southeast Asia and China. In India, they are distributed in Northern West Bengal, Sikkim, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura.



IUCN Status: VU

It is also the **state animal of Meghalaya**

Study: A new study revealed that clouded leopard doesn't follow any specific pattern of operating in a certain space, unlike other carnivores. They seemed to go wherever they pleased without worrying about other predators, primarily because of their ability to climb trees, even hang upside down from large branches.

5) BLACK PANTHERS

- It is a melanistic color variant of any big cat species.
 - o In Asia and Africa, they are leopards.
 - o In Americas they are jaguars.
- **Conservation Status**
 - o IUCN/WPA/CITES: VU/Schedule 1/ Appendix 1
- **Distribution in India**
 - o Odisha to Kerala



6) FISHING CAT

Fishing cats are generally twice the size of the household cats. They are generally found on the Marshy wetlands of northern and eastern India, and on the mangroves of the east coast.

- They are found in Sundarbans of India and Bangladesh, Chilika Lake and surrounding wetlands in Odisha, Coringa and Krishna Mangroves in Andhra Pradesh.
- The fishing cat has also been document in Ranthambore Tiger Reserve, Pilibhit, Dudhwa, Valmiki Tiger Reserve, and Sur Sarovar Bird Sanctuary.



Protection Status

» IUCN: VU

- They are generally observed while hunting along the edges of water bodies grabbing prey from the water or diving in to catch prey farther from the banks.

» **CITES:** APPENDIX-II

» **WPA:** Schedule-1

Other features

- They are mostly active at night and adults are solitary in nature

World's First Fishing Cat Census done in Chilika (June 2022)

- » The Chilika Lake, Asia's largest brackish water lagoon, has 176 fishing cats: As per the census done by Chilika Development Authority in collaboration with the Fishing Cat Conservation Alliance (FCCA), a non-profit.
- » **About Fishing Cat Conservation Alliance (FCCA)**
 - It is an NGO which consists of team of conservationists, researchers, and enthusiasts across the world working to achieve a single dream - a world with functioning floodplains and coastal ecosystems that ensure survival of the fishing cat and all species with which it shares a home.
- **Fishing Cat Project** launched by Chilika Development Authority in collaboration with FCCA in 2010
 - » As part of the project awareness will be created among local people and fishermen for the animal's conservation.

- In 2012, **WB government** declared fishing cat as the **state animal** and the Calcutta Zoo has two big enclosures dedicated to them.

Major threats

- » **Habitat Loss** (wetland degradation, and conversion of aquaculture, and other commercial projects), **Sandmining along riverbanks, agriculture intensification** etc.
- » Killed by people under assumption that it is a juvenile tiger and thus dangerous.

7) BINTURONG (ARCTICTIS BINTURONG) (BEARCAT)

It is also known as **bearcat** and is an arboreal mammal. It is native to south and Southeast Asia.



Distribution: It is found in India, Nepal, Bangladesh, Bhutan, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines and Yunnan in China.

In India, it is confined in tall forests of the foothills and hills with good tree cover. It is known from Manas National Park, Karbi Anglong and other regions.

IUCN: VU

WPA: Schedule-1

Recent Development (Jan 2024): Kaziranga National Park adds two new Mammal Species - Binturong (Arctictis binturong), and the Small Clawed otter (Aonyx cinera).

8) HIMALAYAN SEROW (**CAPRICORNIS SUMATRAENSIS THAR**)

- There are several species of serows, and all are found in Asia. The **Himalayan serow is restricted to Himalayan region** and are typically found at altitudes between 2,000 meters and 4,000 meters. They are found in eastern, central and Western Himalayas but not in trans-Himalayan region.
- Taxonomically it is a subspecies of the mainland serow (*Capricornis Sumatrensis*).



9) GAUR/ INDIAN BISON (BAUS GAURUS)

It is also known as Indian Bison and is a bovine native to South Asia and Southeast Asia. It is the biggest among wild cattles.

IUCN: VU

Habitat: Largely confined to evergreen forests or semi-evergreen and moist deciduous forests.

Historical Distribution: It occurred throughout mainland south and southeast Asia.

Present Distribution:

- But today the population is fragmented, with it being extinct from Sri Lanka and Malaysian Peninsula.
- They are largely confined to evergreen forests or semi-evergreen and moist deciduous forests, but also inhabits deciduous forest areas at the periphery.

Note: The domesticated form of the gaur is called gayal (*Bos frontalis*) or mithun.



Distribution in India:

- Western Ghats** in particular Wayanad - Nagarhole - Mudumalai - Bandipur complex constitute one of the most extensive extant strongholds of gaur. Nilgiri forest division is estimated to have a population of more than 2,000.
- Eastern Ghats** also has some population of gaurs in Odisha and Andhra Pradesh.

Interesting Fact: The famous drink "Red Bull" is based on a Thai drink 'Gratin Daang', meaning "red gaur".

Bos frontalis (Mithun) - Domesticated form of Gaur:

Recent News: The Food Safety and Standards Authority of India (FSSAI) has recognized the mithun as a '**food animal**' with effect from 1st Sep. With this, the mithun can be commercially farmed and its meat processed for pickles, soups, wafers nd biryani.

Work is on to help farmers and tribal village communities benefit commercially from the sale and processing of Mithun.

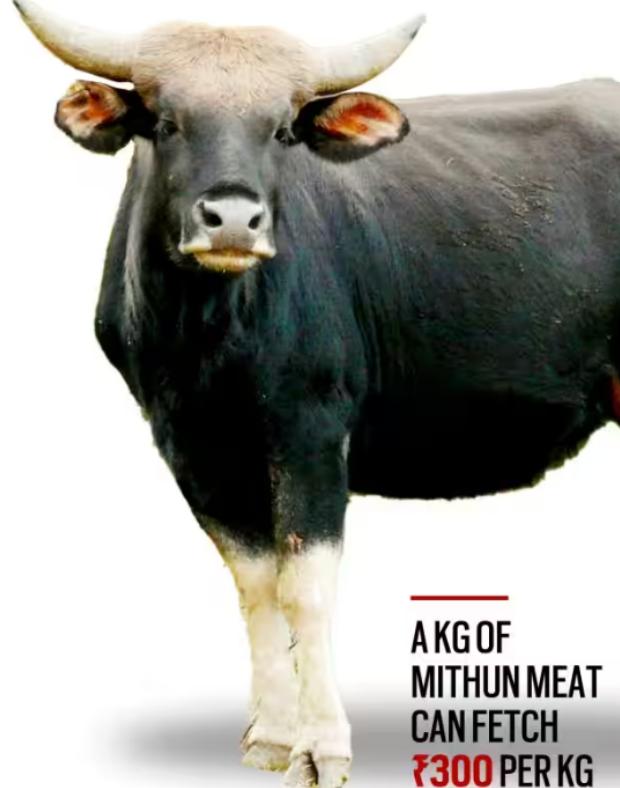
The **Animal** is endemic to Arunachal Pradesh, Nagaland, Manipur and Mizoram. It is semi-domesticated and is reared in free range forest ecosystem. The only **supplementary feed** that it needs is salt.

It is the **state animal** of both Arunachal Pradesh, and Nagaland.

The slaughter of the mithun is traditionally reserved for special occasions such as festivals or weddings (and now a days - elections)

Biodiversity Significance: The "food animal" status can increase the commercial value and may increase the population of Mithun.

Mithuns: From farms to the table



A KG OF
MITHUN MEAT
CAN FETCH
₹300 PER KG

10) FOUR HORNED ANTELOPES (*TETRACERUS QUADRICORNIS*)

Details: Species of small antelope found in **open forests of India and Nepal**.

It is the only species currently classified in genus Tetracerus. It is the smallest of Asian bovids.

Males are unique among extant animals as they possess four permanent horns.

Threats: Loss of natural habitat to agriculture land.

It should drink water regularly to survive.



Conservation status					
Extinct	EW	CR	EN	VU	Least Concern
EX	EW	CR	EN	VU	NT LC

11) NILGIRI MARTEN

Details: The Nilgiri Marten is the only species of Marten found in South India. Only species of marten which is considered Vulnerable to extinction.



Habitat: Hills of Nilgiris and parts of Western Ghats. Endemic to western Ghats, inhibit areas that are far from human disturbance.

Threat: Habitat loss and fragmentation; Hunting for fur

12) NILGIRI LANGUR / NILGIRI LEAF MONKEY (TRACHYPITHECUS JOHNII)

- **Endemic to** Southern India. Distributed in southern western ghats - Karnataka, TN and Kerala.
 - It prefers higher altitude and is a canopy dweller. It forages on fruits and vegetables.
- **Threats**
 - **Habitat Destruction:** Deforestation
 - **Poaching:** For fur and Flesh (which is believed to have aphrodisiac properties)



13) BARASINGHA OR SWAMP DEER

- **Habitat/Distribution**
 - » It has a very patchy distribution.
 - » There are **three subspecies of the swamp deer**:
 - **Southern Swamp Deer/Hard Ground Barasingha** are found in Central and North India. They have hard hooves and is adapted to the flooded tall grassland habitat in the Indo-Gangetic plain.
 - They are restricted to Kanha National Park and Satpura Tiger Reserve.
 - **Eastern Swamp Deer** are found in Kaziranga (Assam).
 - **Western Swamp Deer** has splayed hooves and is adapted to the flooded tall grassland habitat in the Indo-Gangetic plains.
 - » **IUCN:** VU



14) ORIENTAL SMALL CLAWED OTTER AND SMOOTH COATED OTTER

A) ORIENTAL SMALL CLAWED OTTER / ASIAN SMALL CLAWED OTTER

Smallest otter species in the world, weighing less than 5 Kg. It posses partially webbed feet with short claws, enhancing their hunting skills in aquatic environments. They predominantly inhabit freshwater habitats, sustaining themselves on a fish, crustaceans and mollusk diet.



Habitat: Live on mangrove swamp or fresh water wetlands of Bangladesh, Burma, India, South China and South East Asia.

In India, its presence is noted in WB, Assam, Arunachal, Karnataka, TN and some parts of Kerala.

Threat : Habitat loss, pollution, trade and hunting.

- Trade is rampant as the pups of both these otters are high in demand in Asian market and can fetch upto \$10,000.

IUCN: VU

CITES: Appendix-1

WPA: Schedule-1 (2022 amendment)

Recent Development (Jan 2024): Kaziranga National Park adds two new Mammal Species - Binturong (*Arctictis binturong*), and the Small Clawed otter (*Aonyx cinera*).

B) SMOOTH COATED OTTER (LUTROGALE PERSPICILLATE)

- It is a species of otter, the only extant representative of the genus Lutrogale.
- The species is found in **most of the subcontinent and eastward in South East Asia**, with a disjunct population in Iraq.
- As its name suggest the fur of the species is smoother and shorter than that of other otters.
- The otter lives in rivers, lakes, peat swamp forests, mangroves and estuaries.
 - It uses swamps as natal den sites and nursery during the breeding season in early winter.
- CITES:** Appendix-1
- WPA:** Schdeule-1



THE EURASIAN OTTER (IUCN: NT)

Other than oriental small, clawed otter and smooth coated otter, India also has Eurasian Otter.

About Eurasian Otter: It is classified as NT on the IUCN red list. It is regarded as a flagship species and indicators of high-quality aquatic habitat.



Distribution: it has one of the widest distributions of all palaearctic mammals. Its range covers parts of Europe, Africa and Asia.

In India, it occurs in northern, northeastern and southern India.

Recently, a team of scientists have camera trapped **three Eurasian Otters** - two adults and one sub-adult in the NEERU stream of the Chenab catchment (March 2023)

Neeru river is a tributary of the **Chenab river** and the finding shows that upper stretch of its remain unpolluted.



15) ASIAN BLACK BEAR/ MOON BEAR OR WHITE CHESTED BEAR

- **Details:** Medium size bear, largely adapted for arboreal life.
- **Habitat:** Asian Black Bear has wide distribution in the higher elevation of N and NE India and other Southeast Asia.
 - > Out of the **7 subspecies**, 'Himalayan Black Bear, Indo Chinese Black Bear, and Tibetan Black Bear are distributed within the Indian boundaries of its global distribution.
 - > **Himalayan subspecies** is found in Kashmir Himalayan and Sikkim.
 - > **Indochinese subspecies** is distributed in Himalayas along the China Border
 - > **Tibetan subspecies** is found in Nepal and Assam.
 - > Threats: Deforestation and hunting for its body parts.
- **Threats:** Deforestation and hunting for its body parts.
- **WPA:** Schedule-1 (2022 amendment)



16) INDIAN SLOTH BEAR (MELURSUS UR SINUS UR SINUS) – SUBSPECIES OF SLOTH BEAR

- It is one of the eight bear species found in India. It is endemic to Indian sub-continent. They have evolved from ancestor brown bear during the Pleistocene and shares features found in insect-eating mammals.
- **They are unique bears** -> they carry their young on their backs for six-nine months and 50% of their diet is made up of termites and ants. They also feed on honeybee colony and fruits.
- **Population Decline:** In last 3 decades, the population has fallen by 40%-50%.

- **Key threats:**
 - Habitat loss and Fragmentation
 - Poaching
 - Increasing Human Animal conflict:
 - The sloth bear is more inclined to attack man unprovoked than almost any other animal, and casualties inflicted by it are unfortunately very common.
 - In the past, the ethnic group of Kalandars captured these bears and tortured them to perform.
- **Conservation Status**
 - **IUCN:** Vulnerable
 - **WPA:** Schedule 1
 - **CITES:** Appendix II
- **Where are they found in India?**
 - It is the most widespread bear species in India, where it mostly occurs in areas with forest cover, low hills bordering outer ranges of Himalayas from Punjab to Arunachal Pradesh.
 - It is absent in high mountains of Himachal and Jammu and Kashmir, the northwestern deserts of Rajasthan, and a broad unforested swath in south, where Mount Abu WLS is located.
- **Global Distribution:** Sloth bear's geographical range includes **India**, the **Southern lowlands of Nepal**, and **Sri Lanka**. It is regionally extinct in Bangladesh.
 - In Nepal, only a tiny scattering of this species is found.
 - In Sri Lanka a subspecies is found.
 - Thus, **India is the main home** of this species and 90% of the global sloth bear population is found in India.
 - It occurs in wide range of habitats including wet and dry tropical forests, Savannahs, Scrublands, and grassland below 1500 m on the Indian sub-continent

17) HIMALAYAN YAK

Categorization as Food Animal:

- **Background:** The request was submitted by National Research Centre on Yak (NRC-Y) based in Arunachal Pradesh's Dirang in 2021.

FSSAI's Approval came in Nov 2022.

Significance:

- The categorization is expected to help check the decline in the population by making it part of the conventional milk and meat industry.
- It will also contribute to development of local entrepreneurship.
- Yak Milk and Meat are nutrient loaded:



Yaks are traditionally reared under a transhumance system which is primitive, unorganized and full of hardship. But the Yak Population in the country had been decreasing at alarming rate (It has dropped by 25% to 58,000 in 2019 from the 2012 numbers).

The mains reason is the less remuneration from the bovid. It is mainly because Yak milk and meat are not a part of

- Yak Milk has 78-82% of water; 7.5-8.5% of fat; 4.9 - 5.3% protein, 4.5-5.0% lactose and 12-13% of solids-not fat.
- Yak Meat is also lean with 21.7% protein and 1.5% crude fat.

the conventional dairy and meat industry. Thus, there sale is limited to local consumers.

IUCN: VU

CITES: Appendix-1

WPA: Schedule-1

9. NEAR THREATENED MAMMALS

1) ASIAN WILD ASS / KHUR (EQUUS HEMIONUS KHUR)

- Locally known as **GHUDKHAR**
- **Past Distribution:** Once extended from western India, southern Pakistan, Afghanistan, Southeastern Iran etc.
- **Today, Distribution:**
 - Last refuge lies in the **Indian Wild Ass Sanctuary, Little Rann of Kutch.**
- **Conservation Status**
 - IUCN: NT (was moved from EN to NT in 2016)
 - WPA: Schedule 1 (2022 amendment)
- **Threat**
 - **Diseases**
 - In 1958-60, surra disease, caused by Trypanosoma evansi (a Protozoa) and transmitted by horse flies.
 - In 1961, outbreak of south African horse sickness.
 - **Other Threats**
 - Habitat degradation due to salt activities
 - Invasion of Prosopis juliflora shrub
 - Encroachment and grazing by the **Maldhari**
 - Uninformed release of water from Sardar Sarovar dam impacting short grasslands on which it depends.
 - **Human wild-life conflict increasing** (now 1/3rd of the Wild Ass Population lives outside the protected area)



A) BANNI GRASSLAND

- The grassland consists of an area of 2,500 sq km in the Kutch district. It is the largest natural grassland in the Indian subcontinent.
- **In the past** it was among Asia's finest grasslands, with nearly 200 varieties of vegetation.
- The grassland has degraded over the years, owing largely to an invasion of an alien woody species - **Prosopis Juliflora**, known locally as **Gando baval**.

B) CHARI DHAND WETLAND CONSERVATION

This is a seasonal reserve wetland and only gets swampy during a good monsoon, receiving water from north flowing rivers as well as the huge catchment areas of many surrounding hills.

2) CHIRU/ TIBETAN ANTELOPE

- **Details:** The Tibetan antelope is a medium sized bovid native to the Tibetan Plateau.
- **Habitat:** Tibet Cold desert.
 - In India, it is found in the Ladakh region besides some places in Himachal Pradesh bordering Tibet, Sikkim and Nepal.
- **Threat**
 - Hunting
 - » Soft and warm wool known as **shahtoosh** (usually obtained after death).
 - » Magnificent horns
 - » Meat
- **Protection**
 - Included under Schedule-I of Wildlife (Protection) Act, 1972.
 - It gets highest degree of protection.
 - Hunting of these species, and trade of its parts and products, including shawls made of Chiru wool are prohibited under the Act.
 - CITES
 - Selling or owning Shahtoosh was made illegal in all countries that signed the CITES in 1975.
- **In 2017, Parliamentary Panel on Environment and Climate Change headed by Congress leader Renuka Chowdhury has recommended lifting ban, allowing weaving and trading in the world's most expensive fabric, shahtoosh, made from the fine fur undercoat of the endangered Tibetan Antelope known as "Chiru".**
 - It recommended that MoEF&CC should conserve and breed the Chiru goat and vast tract of land should be utilized for conserving the Chiru goat.
 - These goats can be given to shawl makers for collecting hair. This would not only increase the number of goats but would also help in sustainable livelihood opportunities of the people of Jammu and Kashmir.
 - China and Mongolia are already doing captive breeding of these animals.
 - **Currently, Shawl's sale or possession is banned in India and in many countries**
- **But in 2018, MoEF&CC refused to allow captive breeding** as this species have poor survival rate in captivity.



3) MARKHOR

- **Distribution:** Northeastern Afghanistan, Northern Khyber Pakhtunkhwa, Jammu and Kashmir, South Tajikistan, and Uzbekistan.
- **National Animal:** The markhor is also **national animal of Pakistan.**
- **Status:** Till 2015, IUCN classified it as endangered, but now it has been down listed to Near Threatened, as their numbers have increased in recent years by an estimated 20% for last decade.
- **Threats**
 - **Hunting:** For meat and for its twisted horns.
 - **Armed Conflict**
 - **Habitat loss**



4) SLENDER LORIS (GREY SLENDER LORIS)

- **Details**
 - » Slender Loris are small nocturnal animals. They are arboreal in nature as they spend most of their lives on trees.
 - » **IUCN status:** NT
 - » WPA: Schedule-1
- **Benefits for farmers:**
 - The species act as a biological predator of pests (insects) in agricultural crops and benefits farmers.
- **Least Known behaviour:** The behavior of the gray slender loris is amongst the least known of the primates, despite the relatively large number of studies undertaken since 2000s.
- **Four Subspecies:**
 - Malabar Slender Loris
 - Mysore Slender Loris
 - Northern Ceylonese Slender Loris
 - Highland Slender Loris
- **TN notifies India's first slender loris sanctuary (Oct 2022)**
 - The state government notified 'Kadavur Slender Loris Sanctuary' under section 26(A)(1)(b) of Wildlife (Protection) Act, 1972.
 - **The Kadavur Slender Loris Sanctuary** is to cover 11,086 hectares in Karur and Dindigul districts.
- **Note:** Red Slender Loris are native to Sri Lankan rain forests and are EN in the IUCN red list.
- **Note:** In recent times, TN government has also notified India's first Dugong Conservation Reserve in Palk Bay, the Kazhuvedi Bird Sanctuary in Villupuram, the Nanjarayan Tank Bird Sanctuary in Tiruppur, and a fifth elephant reserve at Agasthyamalai in the Tirunelveli district.



10. OTHER MAMMALS IN NEWS

1) NILGAI (BOSELAPHUS TRAGOCAMELUS)

Nilgai is the largest Asian Antelope. It is the sole member of genus Boselaphus.

It shows sexual diamorphism - Females and juveniles are orange to tawny, adult males have a bluish grey coat. Only males possess horn.

It is a diurnal animal (i.e., it is active mainly during daytime).

Distribution and habitat: Nilgai prefer areas with short bushes and scattered trees in scrub forests and grassy plains. Major population occur in the Indian and Nepali Terai. Pakistan and Bangladesh also have some population.

Other than **Terai region of India**, it is also found in Haryana, Rajasthan, Madhya Pradesh, Chhattisgarh, Maharashtra, Andhra Pradesh etc.

It is also common in agricultural land, but rarely in dense forests. It is a **herbivore** and prefers grasses and herbs; woody plants are commonly eaten in the dry tropical forests of India.

The nilgai can survive for long periods without water and doesn't drink regularly even in summers.



IUCN: LC

WPA: Schedule-II (2022 amendment)

2) BLACK BUCK (ANTILOPE CERVICAPRA)

- Details:

- Black Buck, also known as Indian Antelope, is an antelope found only on Indian subcontinent in Nepal, Pakistan and India.
- In India it is found in Punjab Haryana in North to TN in south, and Rajasthan-Gujarat in the west to Odisha in the east. But it is **not found in very vast herds** anywhere.
- **Details:** Only living species of genus antelope. It shows sexual dimorphism.
- **Protection**
 - IUCN: LC
 - WPA: Schedule -1 (i.e., highest protection)
- **Habitat:** Grassland
- **Distribution:** Today, Black buck population is confined to area of MHA, Orissa, Punjab, Rajasthan, Haryana, Gujarat, Andhra Pradesh, Karnataka, and Tamil Nadu.
 - They occur in protected areas of India.



- **Blackbuck National Park, Velavadar** in Bhavnagar, Gujarat.
 - Highest numbers here
 - **Point Calimere Wildlife and Bird Sanctuary**, Nagapattinam TN.
 - **Tal Chhappar Sanctuary**, Churu District, Rajasthan.
 - **National Chambal Sanctuary**, near the Tripoint of Rajasthan, MP and Uttar Pradesh.
 - **Keoladeo National Park**, Bharatpur, Rajasthan. Formerly known as the Bharatpur Bird Sanctuary.
 - **Rehekuri Blackbuck Sanctuary** in Ahmednagar district Maharashtra.
 - **Ranibennur Blackbuck Sanctuary**, Haveri District Karnataka.
 - **Guindy National Park**, Chennai, TN
- In Rajasthan, there are many areas such as Guda Vishnoiyan, Dhawa Doli and Kankania (where actor Salman Khan allegedly hunted in 1998), that are **protected by the Bishnoi Community** who consider blackbuck sacred. Similarly in parts of Haryana and Punjab a few thousand black bucks are surviving in Bishnoi dominated areas.
- **Threat:**
- Poaching, habitat destruction, habitat fragmentation, urbanization, and neglect are the major causes for disappearance of Blackbuck.
 - A new menace is the free ranging village dogs which now roam all over India killing Blackbuck, Chinkara, Nilgai etc.
 - Excessive hunting for meat and sporting trophies, as well as habitat loss.

3) PASHMINA GOAT/ CHANGTHANGI GOAT

Changthangi or Pashmina Goat is a special breed of goat indigenous to the high altitude regions of Ladakh. They are raised for ultra-fine Kashmere wool, known as Pashmina, once woven. The textile is home spun and were first woven in Kashmir.

These goats are generally domesticated and reared by nomadic communities called the Changpa in the Changthang region of Great Ladakh. They live in tough and hostile terrain of **Changthang** and are solely dependent on Pashmina for livelihood. At present there are around 2,400 families rearing around 2.5 lakh goats.

Ladakh produces around 50 MT of the finest grade Pashmina in the world (12-15 microns).

IUCN: LC

In 2019, PASHMINA products have received BIS Certifications.

BIS has published an Indian standard for identification, marking and labelling of Pashmina products to certify its purity.



Significance of BIS Certification

- It will discourage counterfeit or substandard products presently mislabeled and sold as genuine Pashmina in the market.
- It will also ensure better prices for the goat herding community in Ladakh as well as Local handloom artisans producing genuine Pashmina products. They are till now disadvantaged due to rampant marketing malpractices.

11. MARINE MAMMALS

1) FRESH WATER DOLPHINS

- Fresh Water Dolphins of India: Ganga River Dolphin ('Susu')
 - » Habitat/ Distribution: India, Bangladesh, Nepal.
- At present World has 7 Fresh Water Dolphins
 - » Amazon River Dolphin (*Inia geoffrensis*) (VU)
 - » Bolivian River Dolphin (*Inia boliviensis*) (VU)
 - » Ganges River Dolphin (*Platanista gangetica*) (EN)
 - » Indus River Dolphin (*Platanista gangetica minor*) (EN)
 - » Irrawaddy River Dolphin (*Orcaella brevirostris*) (EN) (not a true freshwater dolphin can be found in brackish water also)
 - It traverses three rivers in South and Southeast Asia: the Irrawaddy, the Mahakam, and the Mekong.
 - » The Yangtze Finless Porpoise (*Neophocaena asiaeorientalis*) (CR)
 - Note: The difference between a dolphin and a porpoise has to do with their appearance: dolphins have longer snouts, bigger mouths, more curved dorsal fins, and longer, leaner bodies than porpoises
 - » Tucuxi from Amazon and Orinco river basin (*Sotalia fluviatilis*) (EN)
 - With the latest update it was moved from DD to EN, which has effectively led to all the world's freshwater dolphin species being listed as threatened.
- Species in the subcontinent: Species in Indian Subcontinent are divided into two subspecies. (Recent studies have shown that they are two separate species)
 - » Ganges River Dolphin (*Platanista gangetica gangetica*) ~ 3000 individuals
 - Assam: 962 (based on the Jan-March 2018 assessment)
 - UP: 1,272 (assessment in 201
 - » Indus River Dolphin (*Platanista gangetica minor*) ~ 1500 individuals.
- Note: Both sub-species are effectively blind.

2) PROJECT DOLPHIN

- Details

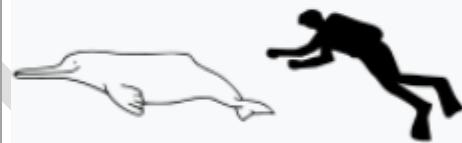
- The plans about the project were announced by PM Modi during his Independence Day speech in Aug 2020.
- It will be aimed at saving both river and ocean dolphins.
- The project will be on lines of Project Tiger which has helped in increasing tiger population. Such an initiative got in-principal approval in December 2019 itself, at the first meet of the National Ganga Council headed by the PM.
- The proposed project is aimed at saving both river and marine dolphin.

A) GANGES RIVER DOLPHIN

- **Conservation Status:**
 - » IUCN: Endangered
 - » WPA: Scheduled 1 (even after the 2022 amendment)
 - » CITES: Appendix 1
 - » CMS: Appendix 1
- **Habitat/Distribution:** Ganges and Brahmaputra River, and their tributaries in India, Bangladesh and Nepal.
 - » In India, distributed in Uttar Pradesh, Bihar, Jharkhand, WB, Rajasthan, Madhya Pradesh and Assam.
 - » Note: Various examples of the dolphin found in rivers of Odisha.
- **National Aquatic Animal of India.**
- **WB** got India's first river dolphin reserve on Hoogly river.
- **Key threats**
 - » Loss of habitat due to increased development work on the river.
 - National Waterway Project is threatening Gangetic Dolphins: Conservationist
 - » Rising salinity in Sundarbans is also causing a decrease in population of Gangetic Dolphin.
 - » **Biological Resource Use**
 - Fishing & harvesting aquatic resources.
 - Depletion of prey base
 - Accidental mortality in fishing net



Ganges river dolphin leaping out of the water



Size compared to an average human



Important Steps for Protection:

- » **Project Dolphin:** In his Independence Day speech on 15th Aug 2020, PM Modi announced Project Dolphin on lines of the Project Tiger and Project Elephant. It was officially launched in 2021.
 - The project will focus on both river dolphins and sea dolphins and strengthen biodiversity, create employment, and attract tourism.
- » **National Ganga River Dolphin Day** - 5th Oct

<ul style="list-style-type: none"> » Accidental deaths due to vessel propellers » Invasive & other problematic species » Pollution <ul style="list-style-type: none"> ▪ Domestic, industrial and agricultural pollution <p>- Other features: Essentially Blind - Hunt by ultrasonic sound</p> <p>- Why its crucial to save Gangetic Dolphin?</p> <ul style="list-style-type: none"> » Aquatic life is an <u>indicator</u> of the <u>health of the river ecosystems</u>. Since the Gangetic Dolphin is at the <u>top of the food chain</u>, protecting the species and its habitat will ensure <u>conservation of aquatic lives of the river</u>. 	<ul style="list-style-type: none"> • It was on this day, the then PM Dr. Manmohan Singh, while presiding over the meeting of NGRBA, <u>declared Ganga Dolphin as the National Aquatic Animal</u>. <p>» Declared National Aquatic Animal</p> <p>» Protected Areas:</p> <ul style="list-style-type: none"> • Vikramshila Sanctuary (Bihar) - 1991 • Hastinapur Sanctuary (UP) - Proposed
--	---

RESCUE OF GANGETIC RIVER DOLPHIN FROM ODISHA (JAN 2024)

- A fisherman in Odisha's Balasore district captured a rare and endangered Gangetic dolphin in the Jalaka river on 18th Jan 2024. Forest authorities then rescued the dolphin from a pond locals put it in and are planning to release it into Budhabalang river soon.

REPORT: 'RESCUING GANGES RIVER DOLPHINS FROM IRRIGATION CANALS IN UTTAR PRADESH, NORTH INDIA, 2013-2020 (OCT 2023)

- The publication says that dams and barrages have severely affected river habitat and dolphins have moved into irrigation canals where they were at risk of injury or death due to multiple factors, such as rapidly receding waters, heat stroke and human interference.

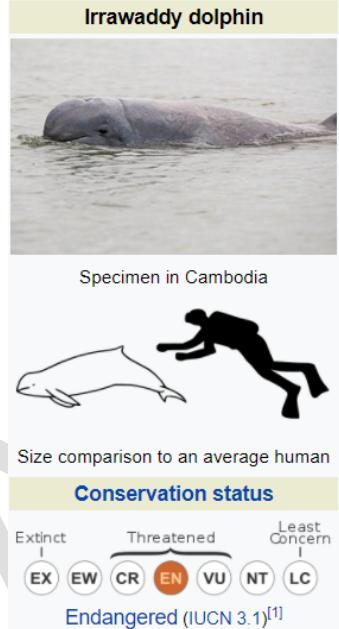
B) INDUS RIVER DOLPHIN (EN)

- Habitat/Distribution: Indus River in Pakistan and its Beas and Sutlej tributaries.
- Also called **Bhulan**

3) OCEANIC DOLPHINS

A) IRRAWADY RIVER DOLPHIN

- It is an eutrophic species of oceanic dolphin found in discontinuous sub-populations near sea coasts and estuaries and rivers in parts of Bay of Bengal. It is also found in South-east Asia.
- **Protection Status**
 - IUCN: EN
 - WPA: Schedule 1
 - CITES: Appendix 2



B) VAQUITA PORPOISE

- **Why in news?**
 - » The plight of the vaquita forces International Whaling Commission to issue first extinction alert (Aug 2023)

Drastic Decline in Population: The Species global population is down to only 10. The species has seen a 98% decline in population in 2 decades.

- » It is the world's smallest cetacean and the most endangered marine mammal.
- » IUCN: CR

Where is it found?

- » They are all found in northern part of the Gulf of California or Sea of Cortez.
- » It has smallest range of any whale, dolphin or porpoise and live in small 1500 square mile area in Mexico's upper Gulf of California, near the town of San Felipe.



Extinction Alert: The first extinction alert by IWC was released on 7th Aug 2023. it is to encourage wider recognition of the warning signs of impending extinctions, and to generate support and encouragement at every level for the actions needed now to save the vaquita.

The vaquita is caught as bycatch in gillnets meant for totoaba, a fish the swimbladders of which are priced in Chinese cuisines.

4) HERBIVOROUS MARINE MAMMALS

F) DUGONG (DUGONG DUGON)

- **Why in news?**

- World Dugong Day - 28th May

- **About Dugong**

- Dugong is commonly known as **sea-cow** as it is a herbivorous marine mammal. It is a medium sized marine mammal which is fighting for its survival in Indian waters.
- **IUCN: VU, WPA (Schedule - 1), CITES (Appendix - 1)**
- **Habitat:** Swamps, rivers, estuaries, marine wetlands, and coastal marine waters.
- **Threats:** Hunting (meat and oil), habitat degradation, and fishing related fatalities.
- **Distribution in India** - According to a study by Zoological Survey of India (ZSI), there are only 250 Dugongs left in India.
 - Marine National Park in Gulf of Kutch, Jamnagar, Gujarat.
 - First Marine National Park of India.
 - Only remaining population of Dugong in Western India.
 - Gulf of Mannar Marine National Park and Palk Strait
 - Here population is seriously depleted.
 - Andaman and Nicobar Islands
 - **State Animal** of the territory.



G) MANATEES (VU) - ALSO KNOWN AS SEA COWS

- **Habitat/Distribution:** Caribbean Sea, Gulf of Mexico, the Amazon Basin, and West Africa
- **Threat:** Coastal development, red tide, hunting.
- Also known as **West Indian Manatees** (referring to West Indies)



5) NOTE: WHALES, DOLPHINS, AND PROPOISES ARE ALL MAMMALS

- In fact Whales, Dolphins and Porpoises belong to the Cetacean family and share several physiological traits with one another including blowholes, breathing oxygen, maintaining constant awareness of their breathing and being able to dispose of additional salt that are taken in by their body when they consume food.
- As marine mammals they are also warm-blooded animals that give birth to their young and produce milk to feed their babies.

12. FEW UNIQUE MAMMALS

1) FLYING MAMMAL

- **Note:** Bats are the only flying mammal.
- **Bats in India**
 - i. India is home to 130 known bat species
- **Important Species:**

Indian Flying Fox (Pteropus medius)

It is one of the world's largest bat species. It is also known as the fruit bat or great Indian Fruit Bat.

The bat is named so due to its fox like appearance, distinguishable long snout, and large eyes.

Important Disease vector: It is capable of transmitting several viruses to humans.

IUCN: LC



2) EGG LAYING MAMMALS (MONOTREMES)

- The unique feature of monotremes a subdivision of mammal, is that monotremes lay eggs rather than giving birth to the young ones.
- **Only 5 living monotremes**
 - Duck Billed Platypus
 - 4 species of Spiny Anteaters (also known as echidna)
- **Habitat**
 - Australia and New Guinea Region

A) PLATYPUS

- A semi aquatic animal - endemic to **eastern Australia including Tasmania**.
- The female retires to a burrow in the bank of a river or pond. The burrow is lined with dry vegetation, and there the eggs are laid.
- The male is poisonous - its venom can kill a small dog or cause excruciating pain among humans.



Conservation status



Least Concern (IUCN 3.1)^[2]

B) ECHIDNAS (SPINY ANT EATERS)

- **Habitat / Distribution:** Australia and New Guinea
- In Echidnas eggs are carried in a pouch on the female's belly until the young hatches, at which point the barely developed young must find a mammary gland and latch onto it for nourishment.



Western long-beaked echidna

Note: Organisms which roll up to protect vulnerable parts

- Hedgehog
- Pangolin

OTHER SPINY MAMMALS

Hedgehog - they are small, spiny mammals that roll themselves up into a tight ball when threatened



Armadillos - they are small armored mammals that can roll themselves up into a ball to protect themselves



- Echidnas
- Pangolins

6) MARSUPIALS

- Group of mammals commonly thought of as pouched mammals (like the **wallaby and Kangaroo**). They give live birth, but they don't have long gestation times like placental mammals. Instead, they give birth very early and the young animal, essentially a helpless embryo, climbs from the mother's birth canal to the nipples. There it grabs on with its mouth and continues to develop, often for weeks or months depending on the species.
- Like other mammals, the marsupials are covered with hair. Mother nurse their young - a young Kangaroo may nurse even when it has grown almost to the mother's size.
- **E.g. of Marsupials**

A) KANGAROO (LC)

B) KOALAS

- The Koala is an arboreal, herbivorous marsupial native to Australia.
- It is found in coastal areas of mainland's eastern and southern regions, inhabiting Queensland, New South Wales, Victoria, and South Australia. It is a major attraction for tourists in Australia.
- **Physical features:** It is easily recognizable by its stout, tailless body, and large head with round, fluffy ears and large spoon - shaped nose.
- **Conservation Status:**
 - IUCN: VU
- **Key threats faced:**
 - Habitat destruction due to agriculture, urbanization and forest fires.



C) THYLACINE (TASMANIAN TIGER, TASMANIAN WOLF)

- Tasmanian government has recently released a document, reporting eight sightings of a Tasmanian tiger from across the continent in past three years (Nov 2019)



D) TASMANIAN DEVIL

- Details

▫ Current distribution:

- Till recently, it was only found in Island state of Tasmania, but it has now been reintroduced to New South Wales in mainland Australia, with a small breeding population.
- They had become extinct from Australian mainland thousands of years ago most probably by Wild Australian Dogs known as dingoes.
- The birth of these babies is a baby step towards bringing Tasmanian devil back in Australia's wilderness.
- It remains unclear how the animals would fare outside the fenced 1,000 acre wildlife preserve where they were born.

Other Examples of Marsupials: Wallabies, possums, opossums, wombats etc.



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.

THE MAJOR THREATS FACING INDIAN BIRDS

CLIMATE CRISIS

Timings of annual events (e.g. migration, nesting, insect emergence) become asynchronous.

For sedentary birds, dealing with climate change will require rapid adaptive changes.	Higher temperatures also cause birds to alter their behaviour, making them more likely to seek shade and spend less time foraging.
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Bird species are shifting their ranges to higher latitudes (i.e., away from the tropics and towards the poles) and in mountains, to higher elevations.

DISEASE

Nearly 7% of globally threatened bird species have declined due to avian malaria.

Avian influenza outbreaks in 2020–2021 across India, caused mass mortality of wild birds.



ENERGY INFRA

Collision of birds with rotating wind turbine blades; Displacement of birds from the turbine area due to disturbance

URBANISATION

Urban habitats tend to be unsuitable for rare and specialist species, while promoting common species.

In central Delhi, fruiting trees offer resources for arboreal frugivorous birds such as Brown-headed Barbet and Yellow-footed Green Pigeon. But, urbanisation leads to a homogenisation of bird communities due to the increased abundance of birds adept at exploiting ecological niches.

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.**

<p>1 Manipur Bush Quail (<i>Perdicula manipurensis</i>)</p> <ul style="list-style-type: none"> • Listed EN by IUCN • Last recording in 1907 																									
<p>2 Himalayan Quail (<i>Ophrysia superciliosa</i>)</p> <ul style="list-style-type: none"> • Listed as CR by IUCN • Last sighting in 1876 	 <p>Himalayan quail</p> <p>Painting by John Gould based on specimens #1836a and #1836b</p> <table style="margin-top: 10px; border-collapse: collapse;"> <tr> <td colspan="6" style="background-color: #c0e0c0; text-align: center; padding: 2px;">Conservation status</td> </tr> <tr> <td style="text-align: center; padding: 2px;">Extinct</td> <td style="text-align: center; padding: 2px;">Threatened</td> <td style="text-align: center; padding: 2px;">Least Concern</td> <td style="text-align: center; padding: 2px;">CR</td> <td style="text-align: center; padding: 2px;">EN</td> <td style="text-align: center; padding: 2px;">VU</td> </tr> <tr> <td style="text-align: center; padding: 2px;">EX</td> <td style="text-align: center; padding: 2px;">EW</td> <td style="text-align: center; padding: 2px;">NT</td> <td style="text-align: center; padding: 2px;">LC</td> <td colspan="2"></td> </tr> <tr> <td colspan="6" style="text-align: center; padding: 2px;">Critically Endangered (IUCN 3.1)^[1]</td> </tr> </table>	Conservation status						Extinct	Threatened	Least Concern	CR	EN	VU	EX	EW	NT	LC			Critically Endangered (IUCN 3.1) ^[1]					
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Critically Endangered (IUCN 3.1) ^[1]																									
<p>3 Jerdon's Courser (<i>Rhinoptilus bitorquatus</i>)</p> <ul style="list-style-type: none"> • 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 White Bellied Sholakili

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

1	<p>Nicobar Megapode: It is a megapode found in some of the Nicobar Islands only.</p> <ul style="list-style-type: none"> Like other megapode relatives, it builds a <u>large mound nest with soil and vegetation</u>, with the eggs produced by the heat produced by decomposition. IUCN: VU 	 <p>Nicobar megapode</p> <p>Conservation status</p> <table border="0"> <tr> <td>Extinct</td> <td>Threatened</td> <td>Least Concern</td> </tr> <tr> <td>EX</td> <td>EW CR EN VU NT LC</td> <td></td> </tr> </table>	Extinct	Threatened	Least Concern	EX	EW CR EN VU NT LC	
Extinct	Threatened	Least Concern						
EX	EW CR EN VU NT LC							
2	<p>Nicobar Serpent Eagle:</p> <ul style="list-style-type: none"> It is <u>probably smallest known eagle</u>, with a weight of about 450 g. IUCN: NT 	 <p>Great Nicobar serpent eagle</p>						
3	<p>Andaman Crake: IUCN status: LC</p>							
4	<p>Andaman Barn Owl: Species endemic to <u>southern Andaman Island</u>.</p>							

- » 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 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.

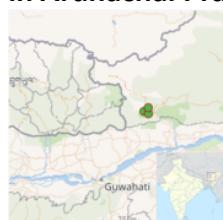
Distribution: It is a restricted range endemic found locally in **Eastern Ghats of Andhra Pradesh**.

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 species 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.



A male Bengal florican

Conservation status



Critically Endangered (IUCN 3.1)^[1]

CITES Appendix I (CITES)^[2]

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.



Lesser florican

Conservation status



Critically Endangered (IUCN 3.1)^[1]

CITES Appendix II (CITES)^[2]

- 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:

- **Khamore** (meaning grass peacock) **Kakatyā** (referring to the sound the bird produces while courtship displays)/ **Phudakdyā** (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.



At Naliya grasslands, Kutch, India

Conservation status



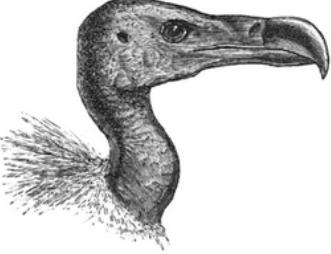
- Today, the bustard are restricted to isolated pockets of Rajasthan, MP, Gujarat, MHA, Andhra, and Karnataka.
- Desert National Park, in Rajasthan has a good number of them.
- In fact, Rajasthan has 95% of World's population.

- 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 conservation breeding centers 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)										
	<p>Slender-billed vulture</p>  <p>Head of <i>Gyps tenuirostris</i></p> <p>Conservation status</p>  <table border="1"> <tr> <td>Extinct</td> <td>Threatened</td> <td>Least Concern</td> </tr> <tr> <td>EX</td> <td>EW</td> <td>CR</td> <td>EN</td> <td>VU</td> <td>NT</td> <td>LC</td> </tr> </table>	Extinct	Threatened	Least Concern	EX	EW	CR	EN	VU	NT	LC	
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EX	EW	CR	EN	VU	NT	LC						
Red Headed Vulture (CR)	Egyptian Vulture (EN)	Cinerous Vulture (NT), Himalayan (Griffon) Vulture (NT), and Bearded Vulture (NT), Eurasian Griffon (LC)										
<p>Red-headed Vulture</p>  <p>Conservation status</p>  <table border="1"> <tr> <td>Extinct</td> <td>Threatened</td> <td>Least Concern</td> </tr> <tr> <td>EX</td> <td>EW</td> <td>CR</td> <td>EN</td> <td>VU</td> <td>NT</td> <td>LC</td> </tr> </table>	Extinct	Threatened	Least Concern	EX	EW	CR	EN	VU	NT	LC		
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EX	EW	CR	EN	VU	NT	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 (OPHRYSSIA SUPERCILIOSA) OR MOUNTAIN QUAIL

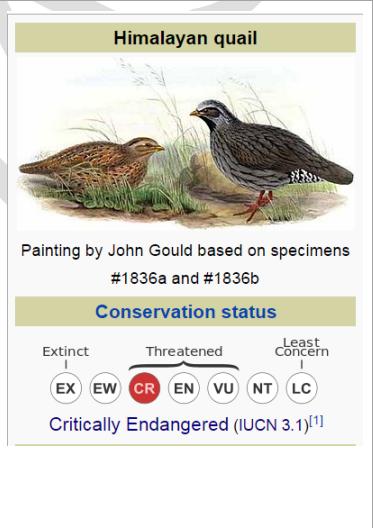
Medium size quail belonging to pheasant family.

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) SOCIALE 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 **Bering Sea** and winters in South-East Asia.

Habitat: It has a **very specialized breeding habitat**, 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)

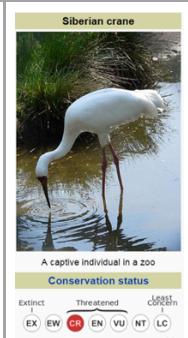
Distribution: Two breeding population in Arctic Tundra of western and Eastern Russia.

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**.



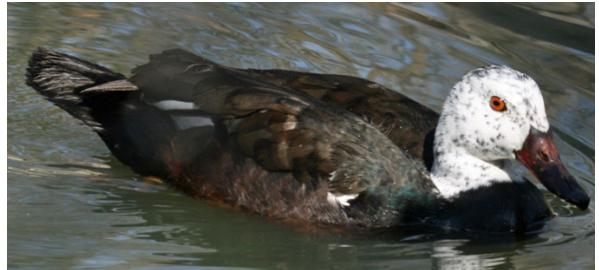
Why critically endangered?

- 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

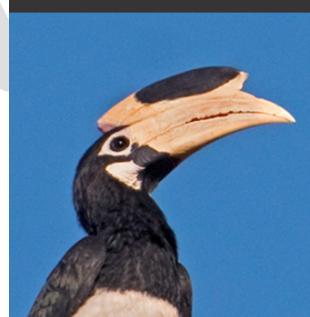


6. HORNBILLS IN INDIA

- 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 loss**: 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 defused 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 heads 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 wear for decoration.

Habitat loss - deforestation

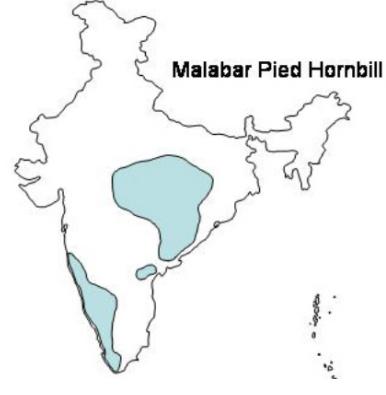
C) HORNBILLS IN WESTERN GHATS AND A&N

- 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



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

Narcondam 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 2020.

» **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.
- 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.



The migratory path of the Great Knot

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 Dibrugarh River in 1902.
 - More recently it was sighted in Manipur's Loktak lake in 2013, and in Saatvojni 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 Mongolia, 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 **riding 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 Koothanakulam 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** every year.

It hunts insects while flitting from branch to branch. Its 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 temperate Europe and the Palearctic, has been sighted for the first time in the country **at Punchakkari** in Thiruvananthapuram (Nov 2020)

Willow warbler



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 Akhuaiyuina.

» Physical characteristics

- It shows dimorphism. Male has a sooty grey back while the female is paler and has scaly marks.



Female

Conservation status

Extinct	Threatened	Least Concern
EX	EW	CR
EN	VU	NT
LC		

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



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

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 Pobitora 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

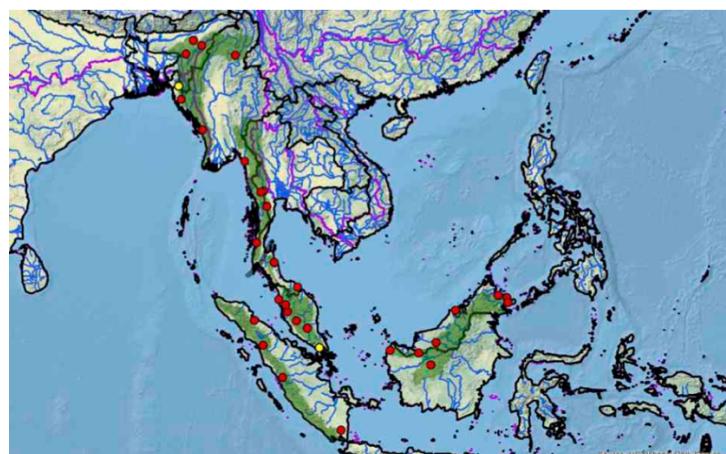
Other interesting features:

- 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 wide 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.



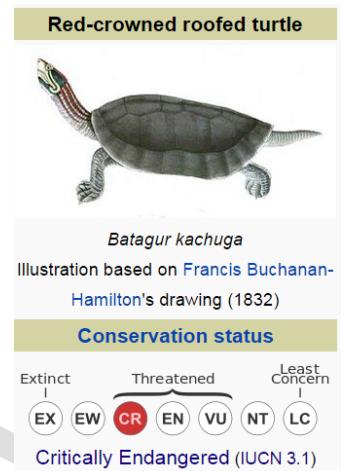
D) FOUR-TOED RIVER TERRAPIN OR RIVER TERRAPIN (BATAGUR BASKA)

- Species 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 TURTLE

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 in fishing gears.

In 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

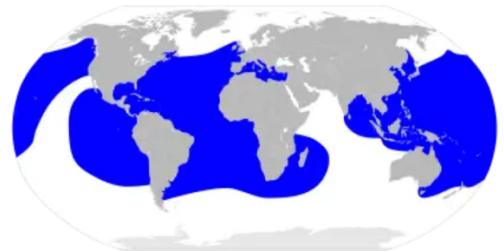
- High sea fishing operations, harvesting of eggs, destruction of nests by wild predators and domesticated species such as cats, dogs and pigs.
- Artificial lighting, disorient hatchlings and adults and cause them to migrate inland rather than towards the sea.



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 turtle (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 Brahmani 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.

Black pond turtle



Conservation status



Vulnerable (IUCN 2.3)^[1]

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.

Aldabra giant tortoise



Conservation status



Vulnerable (IUCN 3.1)^[1]

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.

Indian softshell turtle



Immature (the dark eyespots on the carapace are indistinct or absent in adults)^[1]

Conservation status



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 Guwahati. Another study has found [red-eared slider from an unnamed stream](#), connected to Tlwang river, on a farm near Mizoram capital Aizawl.
- 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 lose 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 longest 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/9CddEyqqaKk>

**Andaman Krait (*Bungarus andamanensis*)**

- 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

ANAIKATTI 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 recent 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) SISPORA 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.



▫ 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

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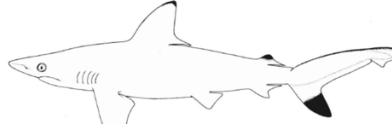
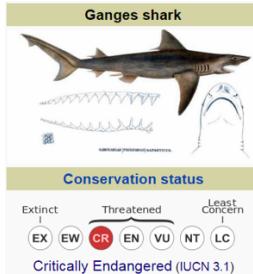
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2. FISH DIVERSITY

1) CRITICALLY ENDANGERED (CR) FISH SPECIES IN INDIA

<p>Indian Swellshark: Small <u>deep-water catshark</u> known from the coast of Kollam, Kerala; A&N; Sri Lanka.</p> <p>Threats: Very <u>limited geographical range and population</u>; <u>accidental catch</u> by deep water trawling.</p>											
<p>Scalloped Hammerhead: "Hammerheads" or "hammer shaped head" is the most distinguished characteristic.</p> <p>Distribution: warm, temperate, and tropical coastal waters all around the globe.</p>											
<p>Oceanic White Tip Shark: Large shark found in tropical and subtropical oceans throughout the world.</p>											
<p>Pondicherry Shark: <u>Extremely rare species</u> found in <u>Indo-Pacific waters</u> from <u>Oman to New Guinea</u>. It has also been seen in <u>Godavari River Estuarine Ecosystem</u> in recent times. In <u>Andhra Pradesh</u> it is locally named as "<u>Pala Sora</u>".</p> <p>Threats: Commercial fishery.</p>											
<p>The Ganges Shark (Glyphis gangeticus): Distribution: Found in the <u>Ganges (Padma River)</u> and the <u>Brahmaputra River</u> in India and Bangladesh. It is <u>uniquely adapted (small eyes) fish eating (slender teeth) shark</u> that occur in the turbid waters of Ganga River and the Bay of Bengal.</p> <ul style="list-style-type: none"> » These are <u>true river sharks</u> which <u>need not to migrate to salt water to reproduce</u>. » Note: Species in the genus <u>Glyphis</u> are <u>true river shark</u>. <p>Threat: Overfishing, pollution, dams, barrages etc.</p>	 <p>Ganges shark</p> <p>Conservation status</p> <table border="1"> <tr> <td>Extinct</td> <td>Threatened</td> <td>Least Concern</td> </tr> <tr> <td>EX</td> <td>EW</td> <td>CR</td> <td>EN</td> <td>VU</td> <td>NT</td> <td>LC</td> </tr> </table> <p>Critically Endangered (IUCN 3.1)</p>	Extinct	Threatened	Least Concern	EX	EW	CR	EN	VU	NT	LC
Extinct	Threatened	Least Concern									
EX	EW	CR	EN	VU	NT	LC					
<p>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 <u>scientific name</u> which it got in June 2018 - <u>Tor Ramadevii</u>.</p>											
<p>Other CR Fish:</p> <ol style="list-style-type: none"> 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/jPSgCWI5PrQ?si=QGirwD9wjRiOMWd>

Conservation status

- » IUCN: Endangered



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

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

Other endangered fish:

Speartooth shark; The knifetooth sawfish; Humphead Wrasse;

3) IMPORTANT VULNERABLE FISH SPECIES

A) GREAT SEAHORSE (HIPPOCAMPUS KELLOGI)

- Why in news?

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

- Details about Hippocampus Kellogi

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

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

Seahorses in India's coastal ecosystem:

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

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

Great seahorse



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

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

B) OTHER IMPORTANT VULNERABLE FISH SPECIES

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

4) IMPORTANT FOOD FISH SPECIES IN NEWS

Hilsa:

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

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

Hilsa's significance for BD's economy:

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

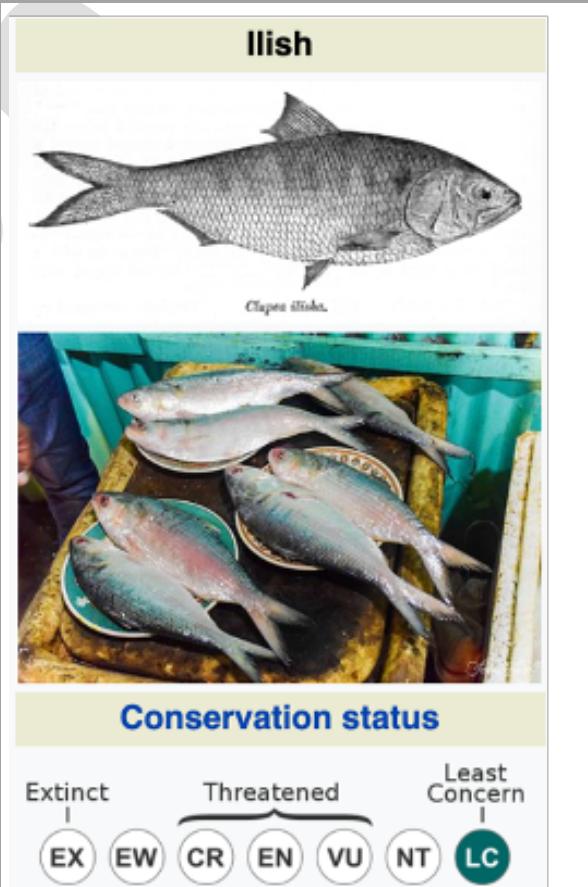
Nearly 75% of the World's HILSA production comes from BD.

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

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

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

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



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

5) INVASIVE FISH SPECIES IN NEWS IN INDIA

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

Suckermouth Catfish

It is native to South America's Amazon River.

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



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

African Catfish:

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

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



Alligator Gar

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

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

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



Thai Magur

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

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

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



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

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

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

Other invasive species in India:

red-bellied Pacu, red bellied Piranha, Asian Carp

C) MOSQUITOFISH BECOMING INVASIVE (NOV 2023)

What is Mosquito Fish?

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

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

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



- Gambusia in India:

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

- Invasive:

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

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

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

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

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

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



6) RECENTLY DISCOVERED FISH SPECIES

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

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

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

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



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

B) PTERYGOTRIGLA INTERMEDIA (SEP 2023)

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

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

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



3. AMPHIBIANS: CRITICALLY ENDANGERED

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

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



2) OTHER CR AMPHIBIANS

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

4. OTHER AMPHIBIANS IN NEWS

7) PURPLE FROG (NASIKABATRACHUS SAHYADRENSIS)

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



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

5. INVERTEBRATES: PORIFERA

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

- Impact of Climate Change and Pollution:

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



- Why should we care about sponges?

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

- Sponge Bleaching:

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

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

6. INVERTEBRATES: ARTHROPODS

8) INSECTS: BUTTERFLIES

A) 3 CONTENDERS FOR NATIONAL BUTTERFLY STATUS

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

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

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

B) GOLDEN BIRDWING: INDIA'S LARGEST BUTTERFLY

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



C) CRIMSON ROSE (PACHLOPTA HECTOR)

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

IUCN: LC

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

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

- In Andamans, it is a straggler.



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

D) BLUE DUKE (BASSARONA DURGA)

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



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

E) KAISER-E-HIND (TEINOPALpus IMPERIALIS)

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



Distribution:

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

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

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

F) TAMIL YEOMEN: STATE BUTTERFLY OF TN

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

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

Other State biodiversity of TN

Palmyra: State Tree

Gloriosa Lily: State Flower

Emarald Dove: State Bird

Jackfruit: State Fruit

Nilgiri Tahr: State Animal



G) OTHER BUTTERFLIES IN NEWS

MONARCH BUTTERFLY

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

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

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

Special Characteristics:

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



IUCN Status: EN

Threats: Deforestation habitat degradation.

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

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

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

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

BLACK VEINED BUTTERFLY

- Why in news?

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

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

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



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

9) ARTHROPODS: INSECTS: MOTHS

- Why in news?

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

About Moths:

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

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

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

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



Significance of Moths:

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

Important Moths:

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

Problems caused by Moths:

- » Several moths are considered pests.

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

10) ARTHROPODS: INSECTS: DRAGONFLY

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

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

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

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

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

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



Key threats faced by Dragonflies:
Degrading wetlands

A) NATIONAL DRAGONFLY FESTIVAL

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

B) NEW SPECIES OF DRAGONFLIES: RED RUMPED HAWKLET

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



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

A) CRABS

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

B) HORSESHOE CRAB

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

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

They live in and around shallow coastal waters.

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

News (March 2023)

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

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



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

12) ARTHROPODS: ARACHNIDS: SPIDERS (CR)

A) RAMESHWARAM ORNAMENTAL (OR RAMESHWARAM PARACHUTE SPIDER)

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

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

IUCN: CR

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



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

B) GOOTY TARANTULA, METALLIC TARANTULA OR PEACOCK TARANTULA (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 Gooty (Ooty/Udhagamandalam) in south India in a burn pile during railway construction.

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

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

Threats:

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

7. MOLLUSCA: MUSSELS

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

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

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



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

A) CHARRU MUSSEL

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

8. ECHINODERMS

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



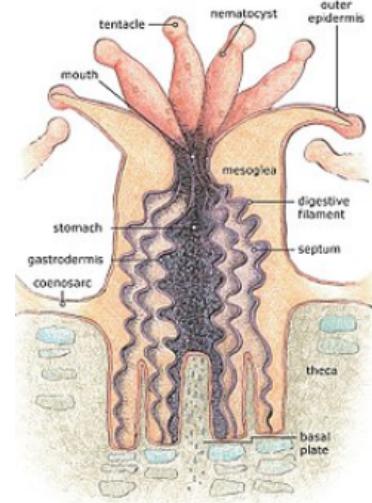
13) SEA CUCUMBERS

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

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

9. CNIDARIA: CORALS

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



Anatomy of a stony coral polyp

Types of Corals

- Hard Coral and Soft Corals

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

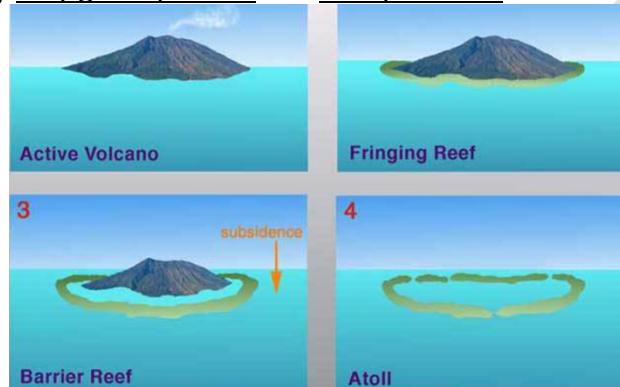
- Cold Water Corals/Deep water Corals

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

- Coral Reefs

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

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



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



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

- **Size:** It stretches more than 2,300 kms and has some 2,500 individual reefs of varying sizes and shapes, and over 9,00 islands. It is extremely rich in **biodiversity** - it has 400 types of corals, 15,00 species of fish, and 4,000 types of molluscs.
 - » The **entire ecosystem** was inscribed as **World Heritage Site** in 1981, covering an area of 348,000 sq. km and a length of 2,300 km.
 - » **But the Reef system is facing severe environmental threats.**
 - Recently, World Heritage Committee have tried to downgrade the reef's World Heritage Status to "in danger" because of the damage caused by climate change. But, Australia has prevented this by garnering enough international support.
 - **Factors threatening Reef:**
 - Rising sea temperature
 - Thermal extremes
 - The state of the ecosystem has become very poor here due to rising sea temperatures and thermal extremes. This is negatively impacting abundance and health of many species groups, including corals, invertebrates, some bony fishes, marine turtles and seabirds.
- **Significance of Coral Reefs**
- » **Biodiversity Protection:** Coral reefs are believed to have highest biodiversity of any ecosystem on the planet - even more than the tropical rain forests. They occupy less than 1% of the ocean floor but is home to 25% of marine life. They are sometimes also known as '**The tropical rainforest of the Oceans**'.
 - They also provide substrate for mangroves.
 - » **Economic Benefits:** The value of goods and services provided by Coral reefs is estimated to be \$2.7 trillion per year.
 - » Coral reef provide millions of people with food, medicine, protection from storms, and revenue from fishing and tourism.
 - » They are also the largest biogenic CaCO₃ producer.
- **Threats:** As per Global Coral Reef Monitoring Network (CCRMN), in the last decade, world has lost 14% of its Coral.
- **Key Factors:**
- i. **Man-Made Causes**
 1. **Pollution, Ocean Acidification, etc.**
 - Eutrophication -> Deoxygenation -> Dead zones. As per a recent study, deoxygenation has emerged as the biggest threats in recent years.
 2. **Overfishing, Unsustainable Tourism, and Poor Coastal Management**
 3. **Mechanical Damages**
 4. **Thermal Pollution**
 5. **Climate Change**
 - As per the GCRMN report, the reefs all over the world are under relentless stress due to warming caused by climate change.
 - Higher sea surface temperatures have also become a factor for coral bleaching.
 - ii. **Natural disturbance** such as violent storms, El Nino Southern Oscillation, epizootics etc.

- **Coral Bleaching**

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

CORAL BLEACHING

Have you ever wondered how a coral becomes bleached?

HEALTHY CORAL

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



STRESSED CORAL

- 2 If stressed, algae leaves the coral.



BLEACHED CORAL

- 3 Coral is left bleached and vulnerable.



WHAT CAUSES CORAL BLEACHING?

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

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

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

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

14) FIRE CORALS (MILLEPORA BOSCHMAI)

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



10. PLANT BIODIVERSITY SITUATION IN INDIA

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

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

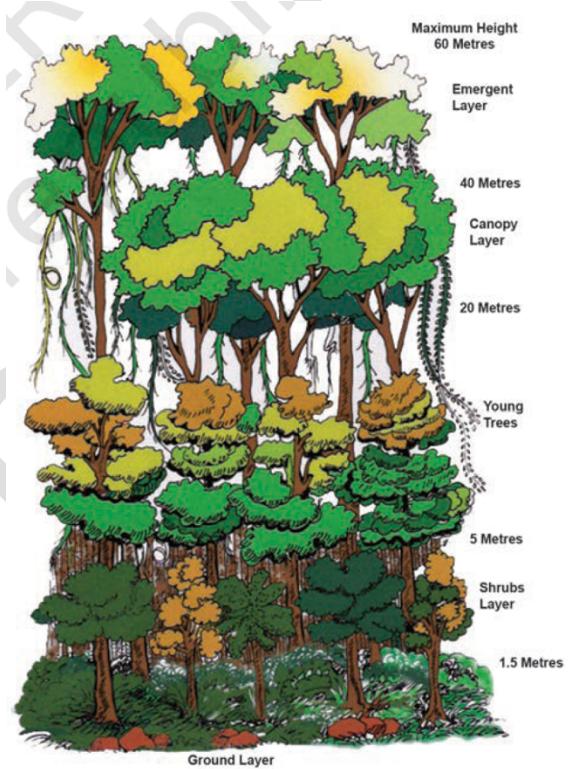
Distribution in India: Western Slopes of Western Ghats, Hills of North-eastern region, Andaman and Nicobar Islands.

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 species are white Cedar, hollock and kail



B) TROPICAL DECIDUOUS FORESTS

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