YOJANA SUMMARY

OUR ECOSYSTEM

APRIL 2024

GEOLOGICAL ECOSYSTEM

- India is the **fifth largest country** in the world and has rich geographical and geological diversity.
- Its geological terrain has rocks, ranging from the Achaean age, formed billions of years ago, at the beginning of the formation of Earth, to riverine alluvium deposited just a few thousand years back.

Geographical Landscape Of India

A. The Himalayas

- It is the highest mountain range in the world which separates the Indian landmass from the Tibetan Plateau. It has been formed by the collision of the Indian plate with the Eurasian plate.
- It runs from west-northwest to east-southeast direction in the form of an arc for about 2,400 km. Its **width** varies from 350 km in the west to 150 km in the east.
- Physiographically, the Himalayas consist of four parallel mountain ranges namely, the **Shivalik** Hills, the **Lower Himalayan Range** or Himachal, the **Great Himalayan Range** or Himadri, and the **Tibetan Himalayas** from south to north.
- The Great Himalayas are home to some of the highest peaks in the world such as Mount Everest, Kanchenjunga, Nanga Parbat, etc.
- Several glaciers are present within the range, including **Gangotri Glacier and Satopanth Glacier**.
- The region is still geologically active, with potential for geothermal energy resources.

B. The Northern Plains

- It is also referred to as 'Great Plains of India'. It is one of the most extensive alluvial tracts in the world.
- It runs for roughly 2400 km from west to east and stretches 240 to 320 km from north to south. In some parts, the depth of the sediments is as much as 2000 to 3000 m.
- It has a low elevation with a general slope from northeast to southwest and south.
- As the rivers originating from the Himalayas descend the hills, their velocity decreases.
- As a result, they dump much of their denser and coarser sediment fraction along the foothills in a narrow, porous, thin **strip called Bhabar** which is around 8 to 16 km wide.
    - The streams go underground in the Bhabar belt because of its porosity.
- The **Terai belt** is located south of the Bhabar belt where streams go underground in the Bhabar belt resurfaces.
    - The densely forested Terai region has diverse flora and fauna and houses some of the famous national parks such as Jim Corbett National Park in Uttarakhand and Kaziranga National Park in Assam.
- Another relief feature of the Northern plains is **Bhangar**, which is an older alluvium that forms a terrace above the floodplain.
    - It is frequently covered in calcareous stone-like pebbles known as 'Kankar.
- The flood plains along the riverbanks are formed by **Khadar**, which is made up of newer alluvium, replenished every year.
- The sand deposits of the plains are excellent aquifers that provide water for drinking and agriculture.
- The rivers of northern plains are laden with sediment deposits, their sediment load at the mouth forms the largest delta in the world called **Sundarbans.**
    - Small islands of salt-tolerant mangrove forests are also present. The mangrove forest presents a natural barrier against tropical cyclones and tsunamis.

C. The Peninsular Plateau

- It is the largest physiographic entity of the Indian landmass. It has a **table-land type** of topography, marked by elevations of about 900-1200 m above mean sea level, dissected by numerous rivers, forming broad valleys.
- It presents a rugged terrain with residual hills, formed by weathering of mountain chains formed millions and billions of years ago.
- The plateau stretches from the Aravalli Range in the west to the Chota Nagpur Plateau in the east. It comprises important mountain ranges of Central India such as Vindhyans, Satpuras, Mahadeo, Maikal and Sarguja ranges as well as the Western and Eastern Ghats.
- It mainly **comprises hard crystalline rocks of igneous and metamorphic origin**.
- It is rich in mineral resources, which is critical for India's economic development.
    - It contains mineral deposits, such as iron, bauxite, mica, gold, copper, manganese, etc.
    - It is home to well-known mines like Kolar, Hutti, Bailadila, Singhbhum, Korba, Malanjkhand, etc.
    - Most of the **Gondwana coal deposits** of India are found in the Peninsular Plateau. The region has abundant **reserves of limestone** which is a key raw material used in the cement industry.
    - The Deccan basalts of the peninsular plateau are being quarried at many places to be used as road metal.
    - The plateau also has deposits of various other mineral commodities such as chromite, lead, zinc, gypsum, etc.
- A large part of the plateau is covered with fertile black soil which is extremely useful for growing cotton. Some low-hilly regions of peninsular India are suitable for the cultivation of crops like tea, coffee, rubber, etc.

D. Coastal plains

- The fertile coastal plains formed from alluvium brought by rivers, draining peninsular India support agriculture in coastal areas.
- The beach sands of coastal areas are rich in **thorium-bearing monazites** which have the potential to power India's nuclear projects.

E. The Thar Desert

- It is also known as the **'Great Indian Desert'**. It is a vast arid region, located primarily in the northwestern part of the Indian subcontinent.
- The sand dunes, known as **'bhakhar,** can reach heights of up to 150 m and constantly shift with the wind. The desert also features dry riverbeds called 'nullahs, which occasionally fill with water during the monsoon season.
- The region is rich is oil reserves and is home to one of the largest onshore oil fields in India in **Barmer Basin**.
- The region also has one of the largest salt marshes in the world called the 'Great Rann of Kutch. Kutch is one of the major salt-producing districts in India.

F. Islands

- The **Andaman and Nicobar Islands** form an archipelago, consisting of around 572 islands, out of which only about 37 are inhabited.
    - These island chains are mainly volcanic in origin. Barren Island in the Andaman Sea is the only active volcano in India.

- Another prominent group of islands from the west coast of India is **Lakshadweep,** which is an archipelago of 36 islands. These are mainly coral islands with unique marine flora and fauna.

FROM PEAKS TO VALLEYS: A HOLISTIC EXPLORATION OF THE WESTERN GHATS

- Nestled along the western coast of India, the **Western Ghats (WG)** spans over 1,600 Kms and covers an area of approx. 140,000 sq. Kms.
- Western Ghats are recognised as a global biodiversity hotspot and often referred to as the Great Escarpment of India. It also holds the designation of a **UNESCO World Heritage Site**.
- It is also known as the Sahyadri Mountain Range and stretches from the river Tapti in the north to Kanyakumari in the South.
- It encompasses regions in six states: Gujarat, Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu, and one UT (Dadra & Nagar Haveli).

Topography and Natural Resources

- One of its significant aspects is that its geomorphic value belongs to the Malabar Rainforest Biogeographic Province.
- The Western Ghats are older than the Himalayas and hold the distinction of being an **evolutionary ecotone**, providing evidence for both the 'Out of Africa' and 'Out of India' hypotheses.
- These mountains took shape millions of years ago during the collision of the Indian subcontinent with the Eurasian Plate.
    - As a result of this collision, the land was thrust upward, giving rise to the majestic mountains of the Western Ghats.
    - Anamudi, located in Kerala, is the highest peak in the Western Ghats.

Three Primary Parts Of The Western Ghats

- **The Northern Ghats:** The area extends from Gujarat to Maharashtra and represents the lowest and least rugged section of the Western Ghats.
- **The Central Ghats:** They extend from Karnataka to Kerala and represent the highest and most rugged section of the Western Ghats.
- **The Southern Ghats:** The area extends from Kerala to Tamil Nadu and represents the most dissected section of the Western Ghats.

Multiple Names Of The Western Ghats: Reflecting The Diverse Languages And Cultures Of The Region

- **Sahyadri:** This range stretches from Gujarat in the north to Maharashtra and Karnataka in the south.
- **Nilgiri Hills:** Signifying 'blue mountains, this name is attributed to the southernmost section of the Western Ghats, located at the junction of Karnataka, Kerala, and Tamil Nadu.
- **Sahya Parvatam:** In is commonly used in Kerala, particularly in the southern reaches of the range.
- **Cardamom Hills:** Located on the Kerala-Tamil Nadu border
- **Anaimalai Hills:** Situated in the southern reaches of the Western Ghats along the Kerala- Tamil Nadu border

Hydrological And Watershed Functions Of WG

- The Western Ghats are watershed for several major rivers, including the Godavari, Krishna, Kaveri, and Tungabhadra.
- These mountains play a pivotal role in modulating India's climate by intercepting monsoon winds, preventing them from reaching the Deccan Plateau, and thus maintaining its cool, dry conditions.

- The Ghats exert a significant influence on the ecological and biophysical processes throughout the entire Indian peninsula, shaping monsoon weather patterns across the country and exemplifying the tropical monsoon system.
- Acting as a **natural barrier against rain-laden southwest monsoon** winds during late summer, the Western Ghats perform crucial hydrological and watershed functions.
- The region is abundant in mineral resources such as iron ore, manganese, bauxite, limestone, and others.

Vegetation Types of WG

Vegetation type	Elevation	Rainfall	Dominant flora
Tropical evergreen forest (west slopes)	200-1,500m	2,500-5,000mm	Emergents up to 60m; *Acrocarpus, Aglaia, Artocarpus, Calophyllum, Canarium, Cullenia, Dipterocarpus, Holigarna, Knema, Myristica*
Moist deciduous forest (most on high east slopes)	500-900m	2,500-3,500mm	*Bridelia, Pterocarpus, Sterculia, Tectona, Pterospermum, Lagerstroemia, Terminalia*
Dry deciduous Buchanania (east slopes)	300-900m	1000-2000mm	*Albizia, Anogeissus, Bauhinia, Butea, Dillenia, Emblica*
Scrub	200-500m	300-600mm	*Acacia, Carissa, Capparis, Flacourtia, Gardenia*
Shola	Above 1,500m	Medium to high	Short trees 15-20m: *Actinodaphne, Elaeocarpus, Euonymus, Michelia, Rhodomyrtus, Schefflera, Symplocos*
Grassland	1,700-1900m	Medium to high	Grasses: *Chrysopogon, Arundinella, Eulalia, Heteropogon*
Montane grassland	Montane	Very high	Herbaceous to shrubby cover: *Ligustrum, Rhododendron, Anaphalis, Strobilanthes*
Peat bog	<2000m	High	Grasses, sedges and mosses: *Carex, Cyanotis, Cyperus, Eriocaulon*
Myristica swamp	0 m to 600m	Medium to high	*Myristica, Knema, Hydnocarpus, Lophopetalum*

Biodiversity of WG

- The Western Ghats, harbours one of the highest levels of endemism globally. Of the nearly 650 tree species identified in the Western Ghats, 352 (54%) are found nowhere else.
- Animal diversity is equally remarkable, with amphibians (up to 179 species, 65% endemic), reptiles (157 species, 62% endemic), and fishes (219 species, 53% endemic), highlighting high levels of endemism.
- Briefly, the Western Ghats have the following forest types:
    - dry scrub vegetation; dry deciduous forests; moist deciduous forests; semi evergreen forests; evergreen forests; shoals; and high-altitude grasslands.
- The Western Ghats stand out as one of India's key regions characterised by tropical evergreen forests, boasting immense plant diversity.

Other Aspects of WG

- **Western Ghats and the ancient landmass of Gondwana**
    - The floral species found in the Western Ghats shares a striking resemblance to the flora of Eastern Africa, Malaysia, and Sri Lanka.
    - This floral affinity suggests a connection between the Western Ghats and the ancient landmass of Gondwana, which comprised South America, Madagascar, India, and the islands of Malaysia, Sri Lanka, Australia, and Antarctica.
- **Biodiversity hotspot**
    - The Western Ghats boast an exceptional diversity of fauna, making them one of the world's biodiversity hotspots.

- The Western Ghats are home to a minimum of 325 species listed as globally threatened according to the IUCN Red List.
- The Western Ghats are home to several flagship mammal species, including significant populations of globally threatened species such as the Asian Elephant, Gaur, and Tiger. Additionally, the region hosts endangered species like the lion-tailed Macaque, Nilgiri Tahr, and Nilgiri Langur, which are unique to the area.
- The Western Ghats play a critical role in conserving various threatened habitats, such as distinctive seasonally mass- flowering wildflower meadows, Shola forests, and Myristica swamps.

WG& Indigenous Knowledge System

- Indigenous communities in the Western Ghats, like **the Kani tribe**, hold extensive knowledge of medicinal plants like Arogyapacha (Trichopuszeylanicus).
  - Used in their traditional remedy Jeevani, Arogyapacha has anti-stress and immune-boosting properties.
  - Through a pioneering benefit-sharing approach, the tribe benefits from royalties, facilitated by a patent application for an herbal sports medicine derived from the plant.
    - The patent was filed by the Jawaharlal Nehru Tropical Botanic Garden & Research Institute in Kerala.
    - The formula was developed into a commercial enterprise, and the tribe's Kerala Kani Welfare Trust receives licence fees and royalties.
- The **Soligas, dwelling in Karnataka's Biligiri Hills** alongside wildlife, possess deep ecological wisdom. They predict rain through bird behavior, understand tiger and elephant cues for safety, and maintain environmental harmony by venerating flora and fauna, ensuring balance and health.
  - Their peaceful coexistence with wildlife shows us the importance of including traditional knowledge from tribal communities in our conservation efforts.
- Several ancient dolmens, caves adorned with cave paintings, and megalithic burial sites can still be found in Chinnar.
- Ganga Moola in Kudremukh is revered as the source of three great rivers. Among the mountains, there are approximately 2,000 sacred groves.

Threats

- Habitat loss, driven by agricultural expansion for crops like coffee and rubber, alongside urbanization and industrial growth, threatens flora and fauna.
- Wildlife poaching, deforestation, and agrochemical use worsen the situation, while infrastructure projects like railways and mining disrupt natural balance in mountainous regions.

Conservation and Management

- Efforts to conserve the Western Ghats involve a comprehensive legal framework and initiatives like Eco-Sensitive Zones. Institutions such as the Ministry of Environment and Forests oversee conservation, with projects like Project Tiger and national missions.
- Challenges remain in policy implementation, balancing development, interstate coordination, and addressing climate change impacts.

SOIL ECOSYSTEM A COMPLEX WEB OF LIFE

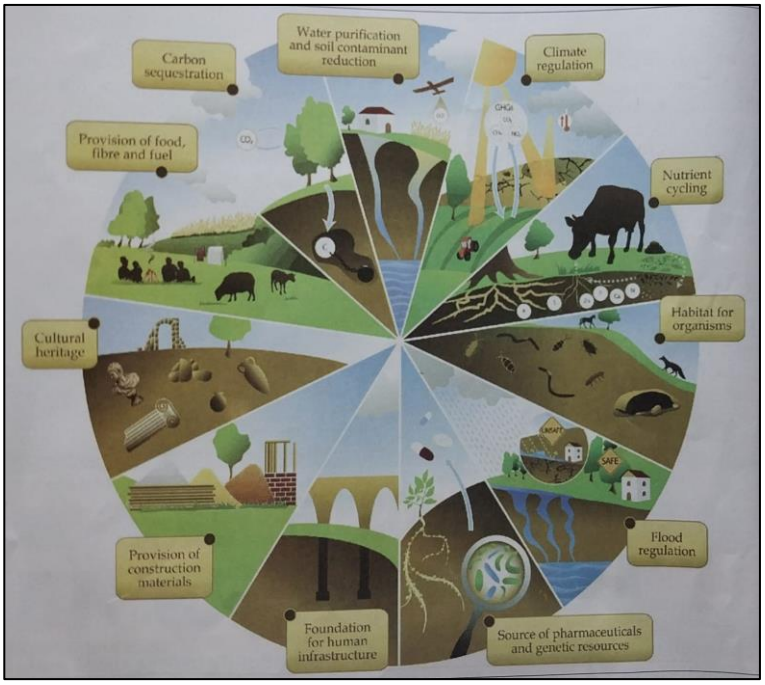
- The soil ecosystem is a dynamic and diverse community of organisms and abiotic factors that sustain life on Earth.
- From nutrient cycling to habitat support, soil plays a vital role in terrestrial ecosystems and human well-being.

Components of Soil Ecosystem

1. **Physical Environment:** The physical properties of soil, including texture, structure, and moisture content, create the foundation for the soil ecosystem. These factors influence the distribution and behaviour of organisms within the soil profile.
2. **Organic Matter:** Dead plant and animal material, along with living organisms such as microbes, fungi, and earthworms, comprise the organic component of soil. Organic matter provides nutrients and energy to support soil life and plays a crucial role in soil fertility and structure.
3. **Microorganisms:** Bacteria, fungi, protozoa, and other microorganisms are abundant in soil and are vital for nutrient cycling, decomposition, and soil health. They break down organic matter, fix nitrogen, and contribute to the formation of soil aggregates.
4. **Macroorganisms:** Larger organisms, including earthworms, insects, nematodes, and small mammals, inhabit the soil and play various roles in nutrient cycling, soil aeration, and soil structure formation. Their activities influence soil fertility and ecosystem functioning.
5. **Plant Roots:** Plant roots penetrate the soil, anchoring plants and absorbing water and nutrients. Root exudates fuel microbial activity and contribute to soil organic matter, shaping soil microbial communities and nutrient cycling processes.

Functions of the Soil Ecosystem

1. **Nutrient Cycling:** Soil organisms decompose organic matter, releasing nutrients such as nitrogen, phosphorus, and potassium into the soil. These nutrients are then taken up by plants, fuelling growth and productivity.
2. **Decomposition:** Decomposition processes contribute to soil fertility and organic matter accumulation.
3. **Soil Formation:** Through weathering and biological processes, soil develops over time from parent material.
4. **Water Regulation:** Soil acts as a reservoir for water, storing and releasing it slowly over time. Soil structure and organic matter content influence water infiltration, retention, etc.
5. **Habitat Support:** Soil provides a habitat for a vast array of organisms, ranging from microscopic bacteria to larger mammals.



Interconnections in the Soil Ecosystem

- The components and functions of the soil ecosystem are interconnected through intricate networks of relationships and feedback loops.
- For example, plant roots exude sugars and other compounds, fuelling the growth of soil microbes. In return, microbes aid in nutrient uptake by plants and contribute to soil aggregation and structure formation.

Conclusion

- From nutrient cycling to habitat support, soil plays a vital role in terrestrial ecosystems and human well- being.

- Understanding the complexity of the soil ecosystem is essential for sustainable land management and ecosystem conservation, ensuring the continued health and productivity of soils for future generations.

SACRED GROVES

"*Very little has been published regarding sacred groves in India, but they are, or rather were, very numerous...these...as a rule, are not touched by the axe, except when wood is wanted for the repair of religious buildings.*" - D Brandis (1887) , First Inspector General of Forest of India

- **Sacred groves** are small forest patches conserved by local people through religious beliefs, traditional sentiments, and taboos and are repositories of many threatened species; they are popularly called living biological heritage sites as they contain rich diversity.
- It is estimated that the total number of sacred groves in India is likely to be more than 1.5 lakh
- They have different vernacular names in rural and tribal areas. For example, in Sikkim popularly known as 'Gumpas'; Kave in kerala; Orans in Rajasthan. Andhra Pradesh and Telangana Popularly known as 'Pavitra Vanalu/Rakshita Vanalu/Devata Vanalu.

Types of Sacred Groves

1. **Temple Groves:** These groves are associated with temples due to their religious importance. Examples: Ficus, Neem, and Tamarind tree.
2. **Traditional Sacred Groves:** These are the places where the folk deities reside, i.e., Polamma, Maridimma in Andhra Pradesh, Sammakka-Sarakka Grama Devathalu in Telangana, Kavus in Kerala, Gumpa Groves in Sikkim, etc.
3. **Religious Groves:** Where they are associated with Hinduism, Buddhism, Jainism, Islamism, and Sikhism.
4. **Island Groves:** Island groves can be categorised based on the habitat type-specific ecological importance, for example, mangroves and coastal/reverie areas in Andhra Pradesh.

Significance of Sacred Groves

1. **Protection of Ecosystems:** Sacred groves often serve as protected areas, safeguarding biodiversity by restricting human activities that can harm the environment.
2. **Traditional Knowledge:** Local communities that manage sacred groves often possess a deep understanding of the local ecology and traditional practices.
3. **Biodiversity Conservation:** Sacred groves can act as refuge for a wide range of plant and animal species, especially in areas where habitat loss is a major threat.
4. **Cultural Preservation:** Sacred groves are important repositories of cultural and religious practices of local communities.
5. **Community Empowerment:** Sacred groves are often managed by local communities.
6. **Environmental Benefits:** They play a vital role in maintaining the ecological balance of an area. The trees and other vegetation in sacred groves help to prevent soil erosion and provide clean air.
7. **Community Conservation:** The core principle of community conservation is protecting biodiversity, preserving natural resources, and managing natural resources sustainably for future preservation.

Biodiversity Heritage Site

- Biodiversity Heritage Site is a unique conservation approach recognised under **Section 37 (1) of the Biological Diversity Act, 2002**.
- The State Government may, from time to time, in consultation with the local bodies, notify in the official Gazette of areas of biodiversity importance as Biodiversity Heritage Sites.

- So far, 44 Biodiversity Heritage Sites have been notified by 16 states. The National Biodiversity Authority (NBA) issues guidelines for selection and management of the BHS.

Heritage Trees

- Heritage trees are special trees that are considered to be of cultural, ecological value, and biological significance.
- These trees are often the oldest living things in a community and providing habitat for wildlife.

Challenges

- Some of the challenges are - Habitat loss; Climatic change; Global warming; Invasive/ Alien species; Exploitation of resources.
- **Other challenges:** Anthropogenic pressure, encroachment, deforestation, cultural degradation, pollution, and no proper legislations, etc.

Management of Sacred Groves

- Some groves are under the custody and management of local communities or tribes. Some are owned and managed by the village communities through a system of hereditary trusteeship.
- **Legislations**
  - **Wildlife (Protection) Amendment Act, 2002:** This act introduced the concept of 'Community Reserves', which can be used to provide government protection to sacred groves on community-conserved lands.
- **Constitutional Protection**
  - There is no specific article directly mentioning sacred groves but there are a few articles that can be interpreted to some level of protection of sacred groves.
  - **Article 25(1):** guarantees the freedom of conscience and the right to practice and propagate religion.
  - **Article 48A:** Directs the state to protect and improve the environment and to safeguard the forests and wildlife of the country.
  - **Article 51A(g):** This article imposes a fundamental duty on every citizen to protect and improve the environment.
- **National Institutions**
  - **The Ministry of Environment, Forest and Climate Change (MOEFCC):**
  - **The National Biodiversity Authority (NBA):**
    - NBA was established in 2003 to implement India's Biological Diversity Act (2002). It is headquartered in Chennai, Tamil Nadu.
    - It is a statutory body and that performs facilitative, regulatory and advisory function on issue of conservation, sustainable use of biological resource, and the fair and equitable sharing of benefits of arising from their utilisation to the convention on Biological Diversity.
  - **State Biodiversity Boards:** Recognises that sacred groves are important for biodiversity conservation.
  - **Biodiversity Management Committees (BMCs) -** Every local body at the Gram Panchayat level in the rural areas and at the Nagar Panchayat or Municipal Committee at the Municipal Corporation level in the urban areas shall constitute a Biodiversity Management Committee.

International Organisations

1. **The United Nations Environment Programme (UNEP)** focuses on traditional knowledge and biodiversity conservation.
2. **The United Nations Educational, Scientific and Cultural Organisation (UNESCO)** has a programme on 'World Heritage Indigenous Peoples' that recognises the importance of sacred groves for cultural heritage and biodiversity conservation.

- For example, Osun- Osogbo Sacred Grove of Nigeria is UNESCO World Heritage Site.

3. **The World Wildlife Fund for Nature** has funded projects that support the conservation of sacred groves around
4. **The World Conservation Union** is an international organisation that brings together governments and NGOs to work on conservation issues.
5. **Conventional on Biological Diversity (CBD)** acknowledges the significance of sacred natural sites.

BLUE ECONOMY

What is Blue Economy?

- According to the World Bank, the blue economy is defined as the sustainable development of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of the ocean ecosystem.
- The blue economy emphasises the integration of the development of the ocean economy with social inclusion and environmental sustainability, combined with innovative business models.
- The blue economy encompasses a diverse range of activities – Renewable energy, Fisheries, Maritime Transport, Tourism, Climate Change, Waste Management.

Why Blue Economy?

- Oceans are considered future growth engines, even with the changing climate and other anthropogenic pressures.
- The ocean works as a huge reservoir of heat and plays an important role in moderating the weather and climate.
- The ocean is responsible for almost half of the oxygen that is inhaled and also plays a pivotal role in the carbon cycle.
- It is home to most of the earth's biodiversity and is the main source of protein for more than a billion people around the world.
- With at least 3-5% of global GDP derived from oceans, the blue economy, has great potential for boosting economic growth.
- The United Nations has promulgated the period 2021-2030 as the 'UN Decade of Ocean Science for Sustainable Development'.

India's Potential

- India has a coastline of more than 7500 km and an EEZ of more than 2.2 million sq km.
- Nine of India's states have access to the coastline.
- India comprises 200 ports, of which 12 are major ports that handled 541.76 million tonnes in FY21, the highest being Mormugao Port, located in Goa.
- The coastal economy sustains over 4 million fishermen and coastal towns. India is the second- largest fish-producing nation in the world and has a fleet of 2,50,000 fishing boats.
- India's blue economy accounts for roughly 4% of the GDP and is estimated to increase once the mechanism is improved.

Ocean Resources

- **Fisheries and aquaculture:** Fisheries can be sub-categorised into two categories: marine fisheries and inland fisheries.
    - Fisheries have contributed Rs. 46,663 crore to the economy through exports in 2019-20. In 2019- 20, it was 14.2 MMT. Out of 14.2 MMT production, marine fish production was 3.7 MMT, and inland fish production was 10.4 MMT.

- **Minerals:** The continental margins of India contain heavy minerals like ilmenite, magnetite, monazite, zircon, and rutile.
    - **Biogenous sediments** are reported from shallow offshore areas of the Laccadive Islands, the Gulf of Kutch, the outer shelf of Mumbai, and the backwaters of Kerala.
    - **Homogenous deposits** like phosphorites are reported from the southwestern and western continental shelves manganese crust is found in the Andaman Islands.
    - Evidence has been found of reserves of Manganese, cobalt, and hydrothermal sulphides in the deep ocean in the Central Indian Ocean Basin (CIOB).
    - Also, marine gypsum is found in salt pans during the processing of common salt in the coastal regions of Gujarat and Tamil Nadu.
    - Ocean also contains huge rare earth minerals.
- **Hydrocarbons:**
    - India has 26 sedimentary basins, spread across a total area of 3.4 million square kilometres.
    - There are 16 inland basins, seven located both inland and offshore, and 3 completely offshore. India hosts about 34 MMT of oil and 33 BCM of gas production.
    - The current annual oil and natural gas consumption is about 1.3 billion barrels and 65 billion cubic metres.
- **Renewable Energy:**
    - The generation of oceanic renewable energy has tremendous scope. Commercialisation of tidal energy has gained momentum.
- **Ports, Shipping, and Marine Tourism**
    - Services India has a network of 12 major ports and 187 non-major ports.
    - Approximately 95% of the country's trade by volume and 68% by value is moved through maritime transport.
    - The Indian Maritime Sector comprises ports, shipping, marine biotechnology, shipbuilding and repair, and inland water transport systems.
    - Other riparian industries, namely fishing, aquaculture, tourism, net manufacturing, and aquaculture technology, contribute to the country's economy.
    - Other marine services include marine insurance.
    - India has one of the largest merchant shipping fleets among the developing countries and ranks 17th in the world. Marine tourism is the fastest growing globally.

Ocean Science and Services

- **Observations, data, and information services:**
    - Operational services such as Marine Fishery Advisories, Ocean State Forecasts, Tsunami and Storm Surge Early Warnings, etc. are key to enhancing the safety of lives and livelihoods of coastal communities.
    - The Indian National Centre for Ocean Information Services (NCOIS) provides flagship service advisories on the Potential Fishing Zones (PFZ) each day of the year except during the fishing ban period and adverse sea-state conditions.
- **Impact of climate change and disasters on the blue economy:**
    - The ocean holds vast natural capital (Ocean Asset Value), estimated at USD 24 trillion.
    - However, ocean warming, sea-level rise, ocean acidification, and marine pollution are damaging marine ecosystems, productivity.
    - Nearly 40 per cent of the SDGs depend on ocean sustainability, particularly **SDG 14** (life below water) and **SDG 13** (climate action).

- Oceans play a crucial role in mitigating global climate change by sequestering about 25% of global anthropogenic emissions of carbon dioxide.
  - Coastal ecosystems such as mangroves, seagrass beds, and saltmarshes that contribute to coastal protection and marine biodiversity are adversely affected by climate change.
  - Coastal hazards such as tsunamis, floods, sea level rise, and earthquakes undermine the resilience and sustainability of the blue economy.
  - Climate change is expected to increase the frequency and intensity of disasters such as floods, tropical cyclones, and droughts.
- Behind every warning lies the pivotal role of **observation and forecasting**.
- The **Early Warnings for All initiative** has been launched by the World Meteorological Organization and other UN bodies.
  - It is an effort to ensure everyone on Earth is protected from hazardous weather, water, or climate events through life-saving early warning systems by the end of 2027.
- A 'Community-Based Flood Early- Warning System' needs to be established.
- ICT enabled systems to monitor water levels, mapping of water bodies, desilting, and systematic data collection; geomorphological mapping of the floodplain combined with the analysis of flood management can be an efficient tool for flood hazard assessment and prediction of future flood scenarios.

- **Marine Biodiversity:**
  - Conservation and sustainable use of marine and coastal biodiversity, including the declaration of marine protected areas (MPA), is essential to ensuring that the world's oceans.
  - As per SDG 14.2, 20% of EEZs need to be declared MPAs by 2030.
  - The coastal economy sustains over 4 million fisherfolk and coastal communities. Better connectivity in the region will significantly cut transport costs and maritime waste.
  - The development of the Blue Economy can serve as a growth catalyst for realising the vision to become a $10 trillion economy by 2032.
- **Healthy Ocean:**
  - The United Nations has also called for the prevention and significant reduction of marine pollution of all kinds by 2025, particularly from land-based activities, which are the main source of plastics and microplastics.
  - The Sustainable Development Goals (SDG 14), Life Below Water, of the UN call for conservation and sustainable use of oceans and marine resources.
  - India's recent single-use plastics ban will help address the marine plastic litter challenge.
  - India has played a key role in the global negotiations on single-use plastics that led to a historic resolution at the 5th UNEA session in 2022 to forge an international legally binding agreement to end plastic pollution.

THE RAMSAR CONVENTION ON WETLANDS

- **About**
  - The signing of the Convention on Wetlands took place in 1971 at the small Iranian town of Ramsar. Since then, the Convention on Wetlands has been known as the Ramsar Convention.
  - Its aims are to halt the worldwide loss of wetlands and to conserve, through wise use and management, those that remain.

- Under the Ramsar Convention, a wide variety of natural and human-made habitat types ranging from rivers to coral reefs can be classified as wetlands.
- Wetlands include swamps, marshes, billabongs, lakes, salt marshes, mudflats, or bodies of water - whether natural or artificial, permanent or temporary. There are even underground wetlands.

- **Obligations**
  - The Ramsar Convention encourages the designation of sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity.
  - Once designated, these sites are added to the Convention's List of Wetlands of International Importance and become known as Ramsar sites.
  - In designating a wetland as a Ramsar site, countries agree to establish and oversee a management framework aimed at conserving the wetland and ensuring its wise use.

Ramsar Wetlands Sites in India (As in January 2024)

- **Jammu and Kashmir**
  - **Hokera Wetland:** A natural perennial wetland contiguous to the Jhelum basin.
  - **Hygam Wetland Conservation Reserve:** The wetland is located within the Jhelum river basin.
  - **Shallbugh Wetland Conservation Reserve:** It lies west of Anchar Lake in the Sindh river delta.
  - Other Sites include Surinsar-Mansar Lakes and Wular Lake.
- **Ladakh**
  - Tso Kar Wetland Complex lies in Changthang region of Ladakh. The complex includes two connected lakes, the freshwater Startsapuk Tso and the larger hypersaline Tso Kar;
  - Tsomoriri Lake: It is a freshwater to brackish lake. The site is said to represent the only breeding ground outside of China for one of the most endangered cranes, the Black necked crane and the only breeding ground for Bar- headed geese in India.
- **Himachal Pradesh**
  - **Chandertal Wetland:** A high altitude lake on the upper Chandra valley flowing to the Chandra River of the Western Himalayas near the Kunzam pass. It supports CITES and **IUCN Redlisted Snow Leopard** and is a refuge for many.
  - **Pong Dam Lake** on the Beas River
  - **Renuka Wetland:** A natural wetland with freshwater springs and inland subterranean karst formations, fed by a small stream flowing from the lower Himalayan out to the Giri River.
- **Punjab**
  - **Beas Conservation Reserve:** of the Beas River
  - **Keshopur-Miani Community Reserve:**
  - **Nangal Wildlife Sanctuary:** Located in the Shiwalik foothills of Punjab is the highly eco- sensitive Nangal Wildlife Sanctuary,
  - It occupies a human-made reservoir constructed as part of the Bhakra- Nangal Project in 1961. Other Sites include Ropar Lake, Harike Lake, and Kanjli Lake.
- **Rajasthan**
  - **Keoladeo Ghana NP:**
  - **Sambhar Lake:** A large saline lake, the site is important for a variety of wintering waterbirds, including large numbers of flamingos.
- **Haryana**
  - **Bhindawas Wildlife Sanctuary** is the largest wetland in Haryana State.

- **Sultanpur National Park**

- **Uttar Pradesh**
  - **Bakhira Wildlife Sanctuary** in the Sant Kabir Nagar district
  - **Haiderpur Wetland:** This human-made wetland is located within the boundaries of Hastinapur Wildlife Sanctuary.
  - **Nawabganj Bird Sanctuary**: A shallow marshland 45 kilometres from Lucknow in Uttar Pradesh.
  - Other Sites include Parvati Agra Bird Sanctuary, Saman Bird Samaspur Bird Sanctuary, Sandi Bird Sanctuary, Sarsai Nawar Jheel, Sur Sarovar, and Upper Ganga River.
- **Uttarakhand**
  - **Asan Conservation Reserve:** of the Asan River running down to its confluence with the Yamuna River in Dehradun district of Uttarakhand.
- **Madhya Pradesh**
  - **Bhoj Wetlands**
  - **Sakhya Sagar -** within the Madhav National Park.
- **Bihar**
  - **Kabartal Wetland:** Kabartal Wetland, also known as Kanwar Jheel,
- **Gujarat**
  - **Khijadia Wildlife Sanctuary:**
  - **Nalsarovar Bird Sanctuary:** A natural freshwater lake that is the largest natural wetland in the Thar Desert.
  - Other Sites include Thol Lake Wildlife Sanctuary and Wadhvana Wetland.
- **Maharashtra**
  - **Lonar Lake:** This wetland on the Deccan Plateau is an endorheic or closed basin, almost circular in shape, formed by a meteorite impact onto the basalt bedrock.
  - **Nandur Madhameshwar**
  - **Thane Creek:** The Site is one of the largest creeks of Asia and hosts many birds migrating on the Central Asian Flyway.
    - As a sanctuary for flamingos and other important bird species, it is in the list of Important Bird and Biodiversity Areas (IBAs).
- **Odisha**
  - **Ansupa Lake:** A small freshwater oxbow lake formed by the Mahanadi river.
  - **Bhitarkanika Mangroves:** One of the finest remaining patches of mangrove forests along the Indian coast
  - **Chilka Lake:** Brackish lake separated from the Bay of Bengal by a long sandy ridge.
  - Other Sites include Hirakud Reservoir, Satkosia Gorge, and Tampara Lake.
- **West Bengal**
  - **East Kolkata Wetlands:**
  - **Sunderbans Wetland:** It is located within the largest mangrove forest in the world,
- **Karnataka**
  - **Aghanashini Estuary:** The Site is an estuary where the Aghanashini River flows into the Arabian Sea in Karnataka State.
  - **Ankasamudra Bird Conservation Reserve:** The Site is a human-made wetland built for storing monsoon run-off water coming from the Tungabhadra River.
  - Other Sites include Magadi Kere Conservation Reserve and Ranganathittu Bird Sanctuary.

- **Tamil Nadu**
  - **Chitrangudi Bird Sanctuary:** The wetland is also classed as an Important Bird and Biodiversity Area (IBA).
  - **Gulf of Mannar Marine Biosphere Reserve:** Located at the south-eastern tip of India, it is the first Marine Biosphere Reserve in South and South-East Asia.
  - **Kanjirankulam Bird Sanctuary:** It is a nationally protected area and a notable nesting site for several migratory heron species.
  - Other Sites include Karaivetti Bird sanctuary, Karikili Bird Sanctuary, Koonthankulam Bird Sanctuary, Longwood Shola Reserve Forest, Pallikaranai Marsh Reserve Forest, Pichavaram Mangrove, Point Calimere Wildlife and Bird Sanctuary, Suchindram Theroor Wetland Complex, Udhayamarthandapuram Bird Sanctuary, Vaduvur Bird Sanctuary Vedanthangal Bird Sanctuary, Vellode Bird Sanctuary, and Vembannur Wetland Complex.
- **Goa**
  - **Nanda Lake:** It comprises intermittent freshwater marshes that lie adjacent to one of the major tributaries of the Zuari River.
- **Kerala**
  - **Asthamudi Wetland:** An extensive estuarine system, the second largest in Kerala State.
  - **Sasthamkotta Lake:** The largest freshwater lake in Kerala state
  - **Vembanad-Kol Wetland:** The largest brackish, humid tropical wetland ecosystem on the southwest coast of India, fed by 10 rivers.
- **Andhra Pradesh**
  - **Kolleru Lake:** A natural eutrophic lake, situated between the two major river basins of the Godavari and the Krishna.
- **Assam**
  - **Deepor Beel:** A permanent freshwater lake in a former channel of the Brahmaputra river.
- **Manipur**
  - **Loktak Lake:** A large, but shrinking freshwater lake and associated swamplands supplied by several streams.
    - Thick, floating mats of weeds covered with soil are a characteristic feature.
- **Mizoram**
  - **Pala Wetland:** is the largest natural wetland in the state of Mizoram.
- **Tripura**
  - **Rudrasagar Lake:** A lowland sedimentation reservoir in the northeast hills, fed by three perennial streams discharging to the River Gomti.

SUNDARBAN BIOSPHERE

- **About**
  - Sundarban is the largest delts in the world. It is spread over India and Bangladesh and is also the largest mangrove forest in the world.
- **Rivers**
  - The Indian Sundaban is bound on the west by the river Muriganga and on the east by the rivers Harinbhanga and Raimangal. Other major rivers flowing through this ecosystem are Saptomukhi, Thakuran, Matla and Goasaba.

- **National/International recognition**
  - The entire 9630 sq km of Sundarban was declared as Sundarban Biosphere Reserve in 1989.
  - It has also been included as the Second Biosphere Reserve from India, other than Nilgiri Biosphere Reserves, in the global network of Biosphere Reserves since November 2001.
  - The Sundarbans were declared a World Heritage site in 1989.
  - It has been nominated by the GoI as Ramsar site.
  - Sundarban Tiger Reserve was constituted by the GoI under the Project Tiger scheme in 1973.
    - Sudarban Tiger reserve is the only mangrove forest in the world that is the home of tigers.
    - Sundarban Tiger Reserve has the highest tiger population in the world.
    - It is also the only mangrove forest in the world, with the tiger as its indigenous population.
- **Geologic features**
  - Geologically, the Sundarban delta is the largest prograding delta on the globe. The region is covered solely by quaternary sediments carried and deposited by the rivers Ganges, Matla and Bidyadhari.
- **Climatic condition**
  - The temperature is equable due to its proximity to the sea. The avg. annual maximum temperature is around 35^0 C.
  - The avg. annual rainfall is 1920 mm and avg. humidity is about 82%, which is more or less uniform throughout the year.