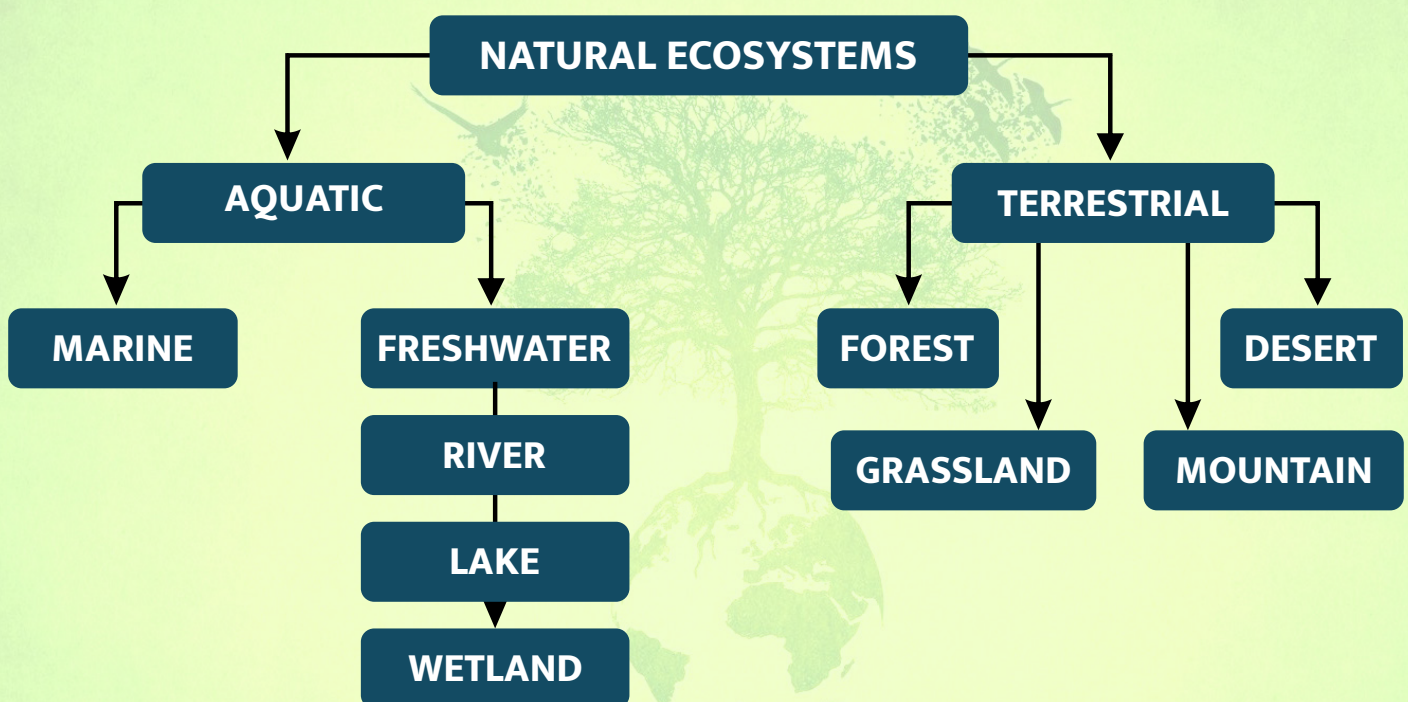




QUICK REVISION MODULE (UPSC PRELIMS 2024)

ECOSYSTEMS

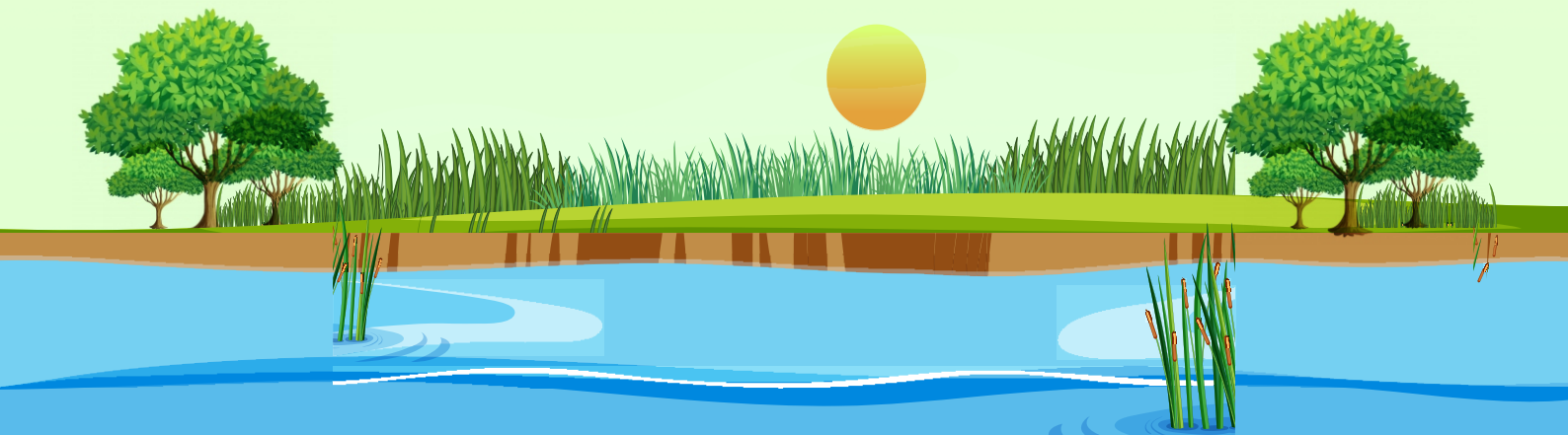
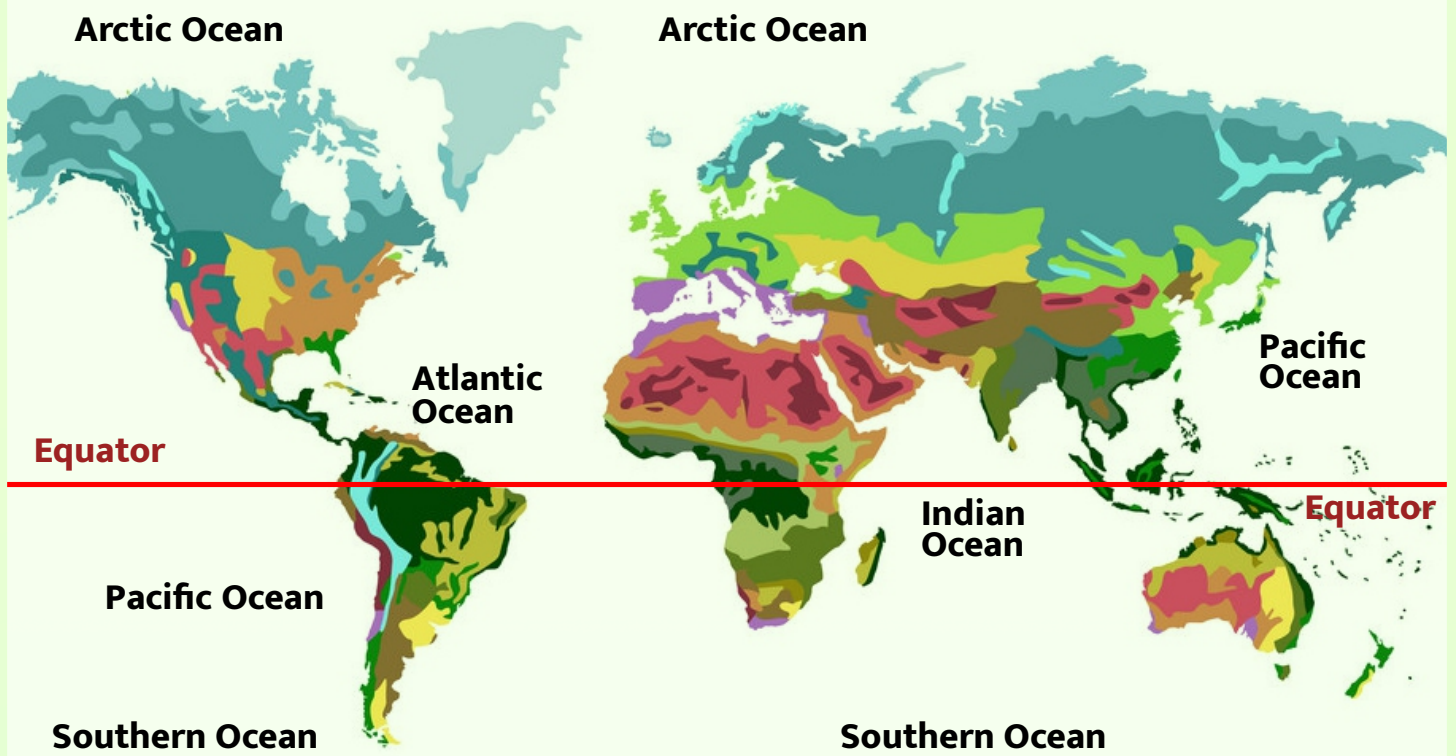
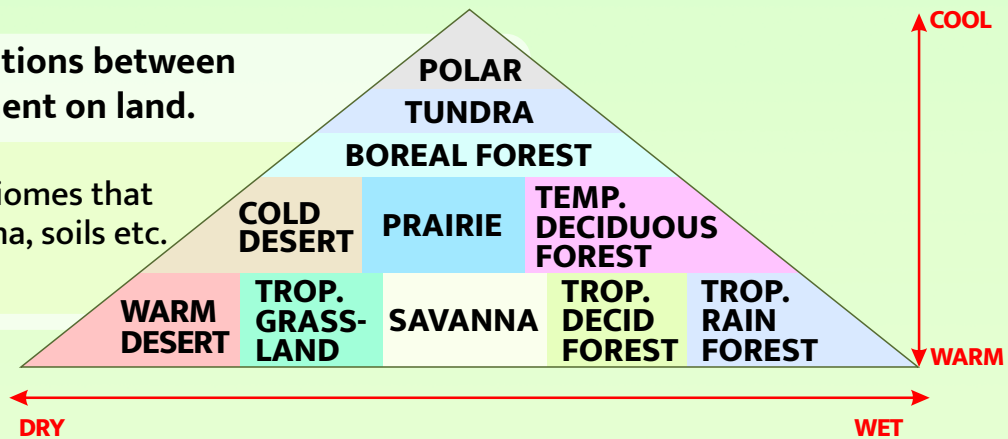
ECOSYSTEMS: They constitute the structural and functional units of the biosphere, consisting of living beings, their physical environment and the interaction among them.



TERRESTRIAL ECOSYSTEMS:

They constitute the interrelations between organisms and the environment on land.

- They are divisible into many biomes that have varied climate, flora, fauna, soils etc.
- No two biomes are alike.



TYPES OF TERRESTRIAL ECOSYSTEMS:

TYPE OF TERRESTRIAL BIOME	VEGETATION	FAUNA	OTHERS
Tundra Biome: Two types of tundra – Arctic and Alpine (high mountains above the tree line)	• The lowest forms like mosses, lichens are sparsely found on bare rocks. • Insects emerge when snow thaws. • Insects have short life cycles which are completed during the favourable periods.	• Reindeer, arctic fox, wolves, musk-ox, polar bear, lemming, arctic hare, arctic willow. • Animals have long life hick cuticle and epidermal hair or fur- protectc from the cold. • Mammals- large body size and small tail and ear to avoid the loss of heat from the surface. • Reptiles and amphibians are almost absent.	• Tundra means barren land. • Soil is under permafrost.
Taiga or Boreal Biome: World's largest land biome-North America and Eurasia-southern margins of the tundra zone.	• Evergreen coniferous forest with-spruce, fir and pine. • The litter derived from conifer needle (leaf) is decomposed very slowly and is not rich in nutrients (humus content is low) giving thin podzols and are nutrient-poor soils.	• Siberian tiger, wolverine, lynx, wolf, bear, red fox, squirrel, and amphibians like Hyla, Rana, etc.	• The productivity is lower than those of any other forest ecosystem.
Temperate Deciduous Biome (North western Europe-British Type Climate)	• Deciduous and trees shed their leaves in cold season -an adaptation for protection against the winter snow and frost. • Species include Oak, Elm, Ash, Birch, Beech, and Poplar.	• Fauna are the familiar vertebrates and invertebrates.	• Precipitation • Uniform throughout the year . • Oil- podzolic and fairly deep soils.
Temperate Rainforest Biome: Northwestern coast of North America from northern California through southern Alaska and small areas around southern Chile, New Zealand, Australia	• Big coniferous trees dominate- Douglas fir, Western red cedar, Mountain hemlock, Western hemlock, Sitka spruce and Lodgepole pine. • Mosses and lichens are very common, often growing as epiphytes.	• Fauna are the familiar vertebrates and invertebrates.	• Grizzly bears- found in Alaska.
Temperate Deciduous Biome (Mediterranean Climate)	• Trees with small broad leaves,widely spaced and never very tall. • Regions with adequate rainfall are inhabited by low, broad-leafed evergreen trees-evergreen oaks. • Thus species here are drought tolerant.	• Most of the fauna are the familiar vertebrates and invertebrates.	• Fire is a hazardous factor • Adaptation of the plants enables them to regenerate quickly after being burnt.

Sub-Tropical Deciduous Biome: Eastern China, South Eastern USA	• Lowlands carry both ever-green broad-leaved forests and deciduous trees (hardwood). • On the highlands, various species of conifers such as pines and cypresses are important. • Perennial plant growth	_____	_____
Steppe or Temperate	• Practically treeless	• Not much animal diversity.	_____
Grassland Biome	• Grasses-shortes,fresh and nutritious. • Pole ward-increase in precipitation-transitional zone of wooded steppes where some conifers gradually appear.	_____	_____
Tropical Deciduous Biome (Monsoon Climate)	• Teak, neem, bamboos, sal, shisham, sandalwood, khair, mulberry.	• Drought-deciduous forest; dry forest; dry deciduous forest; tropical deciduous forest.	_____
Savannah or Tropical Wet and Dry Biome	• Tall grass and short trees. • Deciduous, shedding in cool, dry season to prevent excessive loss of water through transpiration. • Have broad trunks, with water-storing devices to survive through the prolonged drought. • Umbrella shaped, exposing only a narrow edge to the strong winds.	• Savannah biome is rich in mammal, bird and reptile diversity.	_____
Tropical Rain Forest Biome: High temperature and rainfall.	• Evergreen trees, plants struggle upwards (most epiphytes) for sunlight resulting in a peculiar layered arrangement (canopy). • Well-developed layering of understorey vegetation-dense that hardly any light reaches ground level	_____	• In the coastal areas and brackish swamps, mangrove forests thrive.
Desert Biome	• Xerophytic or drought-resistant- cacti, thorny bushes, long-rooted wiry grasses and scattered dwarf acacias. • Long roots, well spaced out to gather moisture, and search for ground water. • Seeds-have thick, tough skins to protect them while they lie dormant.	_____	_____

AQUATIC ECOSYSTEMS:

Ecosystems consisting of water as the main habitat. Types:



Freshwater ecosystems:
water on land- continuously cycling, has low salt content >5
lentic and lotic ecosystems.

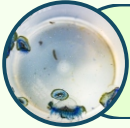


Marine ecosystems:
Salt concentration equal to or above that of seawater ≥ 35 ppt.



Brackish water ecosystems:
Salt-5 to 35 ppt. e.g. estuaries, salt marshes, mangrove swamps and forests.

AQUATIC ORGANISMS: CLASSIFIED BASED ON ZONE OF OCCURRENCE.



Neuston:
live at the air-water interface, e.g. floating plants.



Periphyton:
Attached to stems and leaves of rooted plants or substances emerging above the bottom mud.



Plankton:
Microscopic floating organisms- both microscopic plants and animals



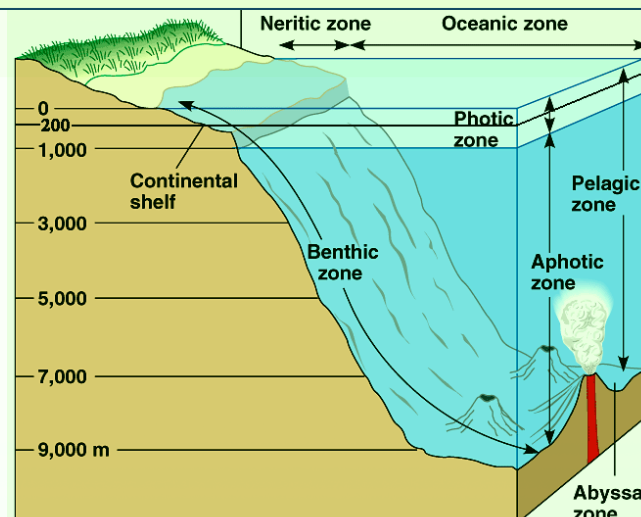
Nekton:
Powerful swimmers that can overcome the water currents.



Benthos:
Living at the bottom of the water mass

FACTORS LIMITING THE PRODUCTIVITY OF AQUATIC HABITATS:

Sunlight, dissolved oxygen, temperature





BRACKISH WATER ECOSYSTEMS:

ESTUARINE ECOSYSTEM: Where a river or a stream opens into the sea (mouth of the river). They are transition zone (Ecotone) between river and maritime environments. They are enclosed coastal area of brackish water (salinity varies between 0-35 ppt) with one or more rivers or streams flowing into it, and with a free connection to the open sea. Freshwater carrying fertile silt and runoff from the land mixes with the salty seawater. They support habitats, such as mangroves, salt marshes, sea-grass, mudflats etc.

OSMOREGULATION: Plants and animals in the estuaries are subjected to variations in salinity to which they are adapted.

IMPORTANCE OF ESTUARIES:

- They are transition zones
- More productive than wetlands
- Experience very little wave action
- Precipitation of clay and alluvium particles in the estuarine region is high
- Store and recycle nutrients, traps sediment and form a buffer between coastal catchments and the marine environment.
- They also absorb, trap and detoxify pollutants, acting as a natural water filter.
- Estuaries with their wetlands, creeks, lagoons, mangroves and sea-grass beds are rich in natural resources including fisheries.

ESTUARINE VEGETATION:

- Capable of surviving in brackish waters.
- Phytoplanktons of estuaries are diatoms, dinoflagellates, green algae, bluegreen algae.
- Towards the sea coast, there are large algae and seagrasses.
- Near the mouth of the rivers and deltas, there are mangrove forests.

There are all kinds of terrestrial or land-based plants and animals, such as wood storks, pelicans, coniferous and deciduous trees and butterflies. Estuaries are also home to unique aquatic plants and animals, such as sea turtles, sea lions, sea catfish, saltworts, eelgrass, salt grasses, cordgrasses, seagrass, sedge, bulrush etc.

INDIA ESTUARINE ECOSYSTEM:

The Country has 14 major, 44 medium and 162 minor rivers drains into the sea through various estuaries. Most of India's major estuaries occur on the east coast. In contrast, the estuaries on the west coast are smaller.

INDIA

FOREST VEGETATION IN INDIA:

NAME	RAINFALL	REGION	CHARACTERISTICS
Tropical Evergreen Forests	> 200 cm, 15 to 30 degree Celsius.	- Near the equator, warm and wet throughout the year. - Occupy about 7% of the earth's land surface. - Has more than half of the world's plants and animals.	Trees- rosewood, mahogany, ebony, Bamboos and reeds- Reach heights $\geq$ 60 m. - Evergreen forests-western slopes of the Western Ghats in States, hills of Jaintia and Khasi. Animals-elephants, monkey, lemur and deer. One horned rhinoceros are found in the jungles of Assam and West Bengal.
Tropical Deciduous Forests	200 -70 cm.	- Most widespread forests of India. - Also called the monsoon forests and spread over the region receiving.	- Trees of this forest type shed their leaves for about six to eight weeks in dry summer. - Further divided into moist and dry deciduous.
Moist Deciduous Forests	200 -70 cm.	- Mostly in the eastern part of the country. - North-eastern states, along the foothills of the Himalayas, Jharkhand, West Orissa and Chhattisgarh, eastern slopes of the Western Ghats.	Teak is the most dominant species of this forest. -Bamboos, sal, shisham, sandalwood, khair, kusum, arjun, mulberry are other commercially important species.
Dry Deciduous Forests	100-70 cm	Rainier parts of the peninsular plateau and the plains of Bihar and Uttar Pradesh.	Trees- Teak, Sal, Peepal, Neem . -Large parts-cleared for cultivation and some parts are used for grazing. Animals- Lion, tiger, pig, deer and elephant. Birds, lizards, snakes, and tortoises etc.
Thorn Forests and Scrubs	<70 cm	North western part of the country including semiarid areas of Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Uttar Pradesh and Haryana.	Vegetation- thorny trees and bushes. Acacias, palms, euphorbias and cacti are the main plant species. Trees- scattered, have long roots penetrating deep into the soil in order to get moisture. - The stems are succulent to conserve water. - Leaves are mostly thick and small to minimize evaporation

Montane Forests		Mosses & Lichens Alpine Grassland Beyond 3600 mt- Shrubs, Scrubs 3000- 3600 mt- Temperature forests, Grassland- Silver fir, Juniper, Pine, Briches 1500-3000 mt - Temperature forests with conifers Pine, Decodar, Silver Fir, Spruce, Cedar (southern slopes of Himalayas) 1000-2000 mt- Wet temperate, ever-green broad leaf forest Oak & Chestnut	 TUNDRA  ALPINE FOREST  MONTANE FOREST  WOODLAND  ARID GRASSLAND  DESERT SHRUB • Animals-Kashmir stag, spotted deer , wild sheep, jackrabbit, Tibetan antelope, yak, snow leopard, squirrels, Shaggy horn wild ibex, bear and rare red panda, sheep and goats with thick hair.
Mangrove Forests	<70 cm	• Areas of coasts influenced by tides. • Mud and silt get accumulated on coasts. • Dense mangroves are the common varieties with roots of the plants submerged underwater. • Deltas of the Ganga, the Mahanadi, the Krishana, the Godavari and the Kaveri.	• Ganga Brahmaputra delta, sundari trees are found, which provide durable hard timber. Palm, coconut, keora, agar, also grow in some parts of the delta. Royal Bengal Tiger is the famous animal in these forests. Turtles, crocodiles, gharials and snakes are also found in these forests.

THE INDIA STATE OF FOREST REPORT (ISFR): Biennial report by the Forest Survey of India (FSI). Starting 1987, 16 assessments completed.

FSI: Estb-June 1,1981,under MoEFCC, for assessment and monitoring of the forest resources.

'FOREST AREA' (or recorded forest area) all the geographic areas recorded as forest in government records.

'FOREST COVER' all lands more than one hectare in area, having a tree canopy density of more than 10%.

FSI REPORT HIGHLIGHTS:

- Total forest and tree cover - 80.73 million ha,
- 24.56% of the geographical area of the country.
- The Total Forest cover- 7,12,249 sq km which is 21.67% of the geographical area of the country.
- Target is to achieve 33% of area under forest cover.
- Tree cover is 2.89% of the geographical area of the country.
- There is an increase of 5,188 sq. km in the total forest and tree cover of the country.
- Range increase in forest cover has been observed in open forest followed by very dense forest and moderately dense forest.
- Top three states showing increase in forest cover are Karnataka, Andhra Pradesh and Kerala.
- Area-wise Madhya Pradesh has the largest forest cover, followed by Arunachal Pradesh, Chhattisgarh, Odisha and Maharashtra.
- In terms of forest cover as percentage of total geographical area, the top five- Mizoram, Arunachal Pradesh, Meghalaya, Manipur and Nagaland.

Mangrove cover has been separately reported in the ISFR 2019. Total mangrove cover- 4,975 sq km. An increase of 54 sq Kms compared to 2017. Top three states showing increase are Gujarat followed by Maharashtra and Odisha

Bamboo- Bamboo bearing area-16.00 million hectare. Increase of 0.32 million hectare as compared to ISFR 2017.

Wetlands- FSI did a national level to identification of wetlands of more than 1 ha within RFA- 62,466 wetlands covering 3.8% of the area within the Recorded Forest Area/ Green Wash (RFA/GW) of the country.

Carbon Stock- Total carbon stock in country's forest-7,124.6 million tonnes. An increase of 42.6 million tonnes in the carbon stock of country as compared to 2017. Annual increase- 21.3 million tonnes, which is 78.2 million tonnes CO₂ eq.

CONSERVATION AND MANAGEMENT OF FOREST:

- **National Forest Policy, 1988:** To Ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium.
Derivation of direct economic benefit must be subordinate to this aim.
- Since its inception, forest and tree cover has increased 19.7 % to 24.6 % of the geographical area (SFI, 2019).
- Involvement of local communities through Joint Forest Management Programme.
- Meeting the requirement of fuel wood, fodder minor forest produce and small timber of the rural and tribal populations.
- Conservation of Biological Diversity and Genetic Resources of the country through ex-situ and in-situ conservation measures.

SOCIAL FORESTRY:

Management and protection of forests and afforestation on barren lands with the purpose of helping in the environmental, social and rural development.

NATIONAL AGROFORESTRY POLICY 2014 OBJECTIVES

Promote agroforestry to increase farm income and livelihoods of rural households, especially the small and marginal farmers.

- Protect and stabilise ecosystems, and promote resilient cropping and farming systems to minimise the risk during extreme climatic events.
- Provide raw material to wood-based industries, creating new avenues for rural employment, and reduce pressure on the forests.
- To develop capacity and strengthen research in agroforestry and create a massive people's movement for achieving these objectives.

NAGAR VAN SCHEME (MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE)

It aims at developing 200 Nagar Van (Urban Forests) across the country in next five years in cities having Municipal Corporation or Municipalities by involving local communities, educational institutions, local bodies, NGOs etc.

- Minimum of 20 ha of forests will be created in the city-either on existing forest land or on any other vacant land offered by urban local bodies.
- Van Udyan once established will be maintained by the State Government.
- Cities authorities will be encouraged to have a city forest comprising area up to 100 ha in forest area within their jurisdiction.
- In part, paid for by the CAMPA funds.
- Also linked to the Schools Nursery Yojana that aims to build lasting bond between students and nature.
- Warje Urban Forest in Pune (Maharashtra) - role model for the Scheme.

NATIONAL AFFORESTATION PROGRAMME:

Formulated by the merger of four 9th Plan centrally sponsored afforestation schemes of the MoEFCC.

- Objective is ecological restoration of degraded forests and to develop the forest resources with peoples' participation, with focus on improvement in livelihoods of the forest-fringe communities, especially the poor.

GREEN INDIA MISSION (GIM):

Under the umbrella of National Action Plan for Climate Change, launched in 2014.

- The primary aim is to protect, restore and enhance India's diminishing forest cover.
- **Objectives:** Growth in forest or tree cover to 5 million hectares (mha) and increase the quality of forest cover in another 5 million hectares of forest or non-forest lands.

SUB-TARGETS

- Increase the quality of degrading moderately dense forests – 1.5 million hectares (ha).
- Ecologically restore open forests which are being degraded – 3 million hectares (ha)
- Grasslands revival – 0.4 million hectares
- Wetlands revival – 0.10 million hectares
- Ecological restoration of shifting cultivation areas, mangroves, scrub, ravines, cold deserts, & abandoned mining areas – 1.8 million hectares with different sub-targets.
- Increase in forest cover in urban areas and its outskirts – 0.20 million hectares.
- Increase forest and tree cover on marginal agricultural lands/fallows and other non-forest lands which comes under agroforestry – 3 million ha.
- Increase forest-based livelihood income for about 3 million households in and around these forest areas.
- Increase Carbon Dioxide sequestration to a range of 50 to 60 million tonnes by 2020.

ACT	OBJECTIVES	PROVISIONS
Compensatory Afforestation Fund Act 2016	• It refers to the afforestation and regeneration activities carried out as a way of compensating for forest land which is diverted to non-forest purposes.	• National Compensatory Afforestation Fund (NCAF) under the Public account of India • State Compensatory Afforestation Funds under public accounts of states. -Centre:state - 10:90. • For compensatory afforestation, additional compensatory afforestation, penal compensatory afforestation, net present value, catchment area treatment plan or any money for compliance of conditions stipulated by the Central Government while according approval under the provisions of the Forest (Conservation) Act, 1980. • Statutory status-National Compensatory Afforestation Fund Management and Planning. • Authority (NCAFMPA), State Compensatory Afforestation Fund Management and Planning • Authority for utilisation of State Compensatory Afforestation Fund. • Constitution of a multidisciplinary monitoring group to monitor activities undertaken from these funds. • Annual audit of the accounts by the Comptroller and Auditor General.
Forest Conservation Act, 1980	• To check further deforestation and conserve forests	• Restricts use of forest for non-forest purpose Restricts de- reservation of reserve forests. • Regulates diversion of forest land by way of lease to private industries and individuals. • Restricts clear felling of trees. • Constitution of Advisory Committee for grant of approval for any of the activities above.

Indian Forest Act, 1927

- To consolidate laws relating to forests, transit of forest produce and duty leviable on timber and forest produce
- Establishes three classes of forests-Reserve Forest , Protected Forest and Village Forest.
- Detailed process of settlement of rights through the FSO.
- Deals with control over forests not being the property of the Government.
- Deals with duty on timber and other forest produce and in transit.
- Regulate the rights of the owners in drift and stranded timber.
- Power to reserve specific tree species in reserve forest.

The Biological Diversity Act 2002

- Conservation of Biological Diversity, sustainable use of its components and equitable sharing of the benefits of biological resources.
- Estb National Biodiversity Authority, State Biodiversity Board.
- Requires the Central Government to develop National Strategies, plans, programmes for the objectives of the Act.
- Requires the Central Govt. to notify threatened species and the State Govt. to notify biodiversity heritage sites.
- Mandates every local body to constitute Biodiversity Management Committee.
- Provides for establishment of Local Biodiversity Funds

NATIONAL BAMBOO MISSION (NBM):

Centrally Sponsored Scheme in 2006-07 and was subsumed under Mission for Integrated Development of Horticulture (MIDH) during 2014-15 and continued till 2015-16.

- Restructured in 2018-19 for holistic development of complete value chain of sector.
- In 2017, Indian Forest Act 1927 was amended to remove bamboo from the category of trees. This allows cultivation and felling of bamboo and its products without any felling and transit permissions outside forests.

