



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : Biodiversity Conservation

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BIODIVERSITY CONSERVATION

BIO DIVERSITY CONSERVATION

The 1992 UN Earth Summit defined Biodiversity as the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part. This includes diversity within species, between species and ecosystems of a region. It reflects the number of different organisms and their relative frequencies in an ecological system and constitutes the most important functional component of a natural ecosystem. It helps to maintain ecological processes, create soil, recycle nutrients, influence climate, degrade waste and control diseases. It provides an index of health of an ecosystem. The survival of human race depends on the existence and wellbeing of all life forms (plants and animals) in the biosphere.

Concept of biodiversity

The term biodiversity was introduced by Walter Rosen (1986). Biodiversity is the assemblage of different life forms. Each species is adapted to live in its specific environments. The changes in climatic conditions are reflected in the distribution and pattern of biodiversity on our planet. The number of species per unit area declines as we move from tropics towards the poles. The Tundra and Taiga of northern Canada, Alaska, northern Europe and Russia possess less than 12 species of trees. The temperate forests of the United states have 20-35 species of trees, while the tropical forests of Panama have over 110 species of trees in a relatively small area.

Magnitude of biodiversity

Biodiversity is often quantified as the number of species in a region at a given time. The current estimate of different species on earth is around 8-9 million. However, we really don't know the exact magnitude of our natural wealth. This is called the 'The Taxonomic impediment'. So far about 1.5 million species of microorganisms, animals and plants have been described. Each year about 10-15 thousand new species are

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identified and published worldwide, of which 75% are invertebrates. The number of undescribed species is undoubtedly much higher. India is very rich in terms of biological diversity due to its unique bio-geographical location, diversified climatic conditions and enormous eco-diversity and geo-diversity. According to world biogeographic classification, India represents two of the major realms (The Palearctic and Indo-Malayan) and three biomes (Tropical humid forests, Tropical Dry/Deciduous forests and Warm Deserts/Semi deserts). With only about 2.4% of the world's total land surface, India is known to have over 8 % of the species of animals that the world holds and this percentage accounts for about 92,000 known species.

India is the seventh largest country in the world in terms of area. India has a variety of ecosystems, biomes with its varied habitats like, hills, valleys, plateaus, sea shores, mangroves, estuaries, glaciers, grasslands and river basins. It also reflects different kinds of climates, precipitation, temperature distribution, river flow and soil. India is one of the 17 mega biodiversity countries of the world and has ten biogeographic zones with characteristic habitat and biota.

TYPES OF BIODIVERSITY

The term 'Biodiversity' to describe diversity at all levels of biological organization from populations to biomes. There are three levels of biodiversity – Genetic diversity, Species diversity and Community/Ecosystem diversity

1.Genetic Diversity

Genetic diversity refers to the differences in genetic make-up (number and types of genes) between distinct species and to the genetic variation within a single species; also covers genetic variation between distinct populations of the same species. Genetic diversity can be measured using a variety of molecular techniques.

India has more than 50,000 genetic variants of Paddy and 1000 variants of Mango. Variation of genes of a species increases with diversity in size and habitat. It results in the formation of different races, varieties and subspecies. Rauvolfia vomitoria, a medicinal plant growing in different ranges of the Himalayas shows differences in the potency and concentration of the active ingredient reserpine due to genetic diversity.

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Genetic diversity helps in developing adaptations to changing environmental conditions.

2.Species Diversity

Species diversity refers to the variety in number of different species of plants and animals and richness of the species in any habitat. A community with more number of species enjoys species richness. Naturally undisturbed forests have greater species richness than reforested areas or plantations.

There are three types of Species:

a. Endemic species - is one whose habitat is restricted only to a particular area because of which it is often endangered. It differs from “indigenous,” or “native,” which although it occurs naturally in an area, is also found in other areas.

b. Exotic Species - is any species intentionally or accidentally transported and released by man into an environment outside its original range. These are often the most severe agents of habitat alteration and degradation, and a major cause of the continuing loss of biological diversity throughout the world.

c. Cosmopolitan Species – It is a species that is found to be distributed over most regions of the earth example: cats, dogs, human beings. The killer whale is considered as the most cosmopolitan species in the world.

Measurement of Biodiversity:

1.Species Richness:

The number of species per unit area at a specific time is called species richness, which denotes the measure of species diversity. The Western Ghats have greater amphibian species diversity than the Eastern Ghats. The more the number of species in an area the more is the species richness. The three indices of diversity are - Alpha, Beta and Gamma diversity

- i. Alpha diversity: It is measured by counting the number of taxa (usually species) within a particular area, community or ecosystem.

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- ii. Beta diversity: It is species diversity between two adjacent ecosystems and is obtained by comparing the number of species unique to each of the ecosystem.
 - iii. Gamma diversity refers to the diversity of the habitats over the total landscape or geographical area.

2.Species Evenness:

To make an ecosystem healthy and balanced ecosystem.

3.Community/Ecosystem Diversity

Species biodiversity is the variety of habitats, biotic communities, and ecological processes in the biosphere. It is the diversity at ecosystem level due to diversity of niches, trophic levels and ecological processes like nutrient cycles, food webs, energy flow and several biotic interactions. India with its alpine meadows, rain forests, mangroves, coral reefs, grass lands and deserts has one of the greatest ecosystem diversities on earth.

Patterns of Biodiversity Distribution

The distribution of plants and animals is not uniform around the world. Organisms require different sets of conditions for their optimum metabolism and growth. Within this optimal range (habitat) a large number and type of organisms are likely to occur, grow and multiply. The habitat conditions are determined by their latitudes and altitudes.

Latitudinal and Altitudinal Gradients:

Temperature, precipitation, distance from the equator (latitudinal gradient), altitude from sea level (altitudinal gradient) are some of the factors that determine biodiversity distribution patterns. The most important pattern of biodiversity is latitudinal gradient in diversity. This means that there is an increasing diversity from the poles to equator. Diversity increases as one moves towards the temperate zones and reaches the maximum at the tropics. Decrease in species diversity occurs as one ascends a high mountain due to drop in temperature (temperature decreases @ 6.5°C per Km above mean sea level)

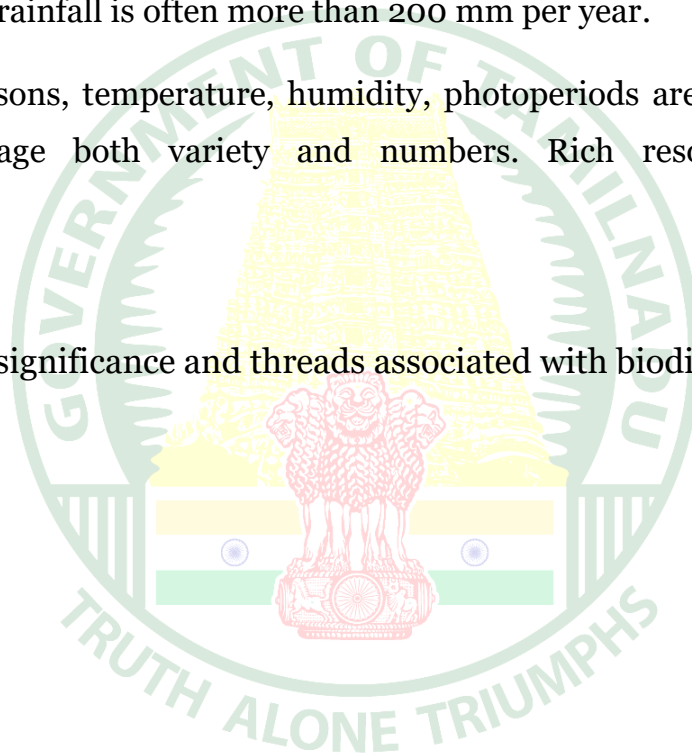


The Reasons for The Richness of Biodiversity In The Tropics Area:

1. Warm tropical regions between the tropic of Cancer and Capricorn on either side of equator possess congenial habitats for living organisms.
2. Environmental conditions of the tropics are favourable not only for speciation but also for supporting both variety and number of organisms.
3. The temperatures vary between 25°C to 35°C, a range in which most metabolic activities of living organisms occur with ease and efficiency.
4. The average rainfall is often more than 200 mm per year.
5. Climate, seasons, temperature, humidity, photoperiods are more or less stable and encourage both variety and numbers. Rich resource and nutrient availability.

Question:

1. Explain the significance and threads associated with biodiversity Conservation.





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BIODIVERSITY HOTSPOTS IN INDIA

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Hotspots are areas characterized with high concentration of endemic species experiencing unusual rapid rate of habitat modification loss. Norman Myers defined hot spots as “regions that harbour a great diversity of endemic species and at the same time, have been significantly impacted and altered by human activities.”

A hotspot is a region that supports at least 1500 endemic vascular plant species (0.5% of the global total) has lost more than 70% of its original vegetation.

To qualify as a hotspot, a region must meet two strict criteria:

- a. **Species endemism**- It must contain atleast 1500 species of vascular plants (>0.5% of the world's total) as endemics and
- b. **Degree of threat**- It has to have lost atleast 70% of its original habitat.

Factor responsible for forming hotspots:

1. Endemic plant
2. Endemic vertebrate
3. Endemic plant / area ratio
4. Endemic vertebrate / area ratio
5. Remaining primary vegetation as % of original context.

There are 35 biodiversity hotspots in the world. India is home to four biodiversity hotspots (as per ENVIS). They are

- a. Western Ghats
- b. Himalaya (the entire Indian Himalayan region)
- c. Indo-Burma: includes entire North-eastern India, except Assam and Andaman group of Islands (and Myanmar, Thailand, Vietnam, Laos, Cambodia and Southern China)

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d. Sundaland: includes Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei, Philippines)

1. The Western Ghats and Sri Lanka:

1. Western Ghats also known as the Sahyadri hills encompasses the mountain forests in the southwestern part of India and highlands of southwestern Sri Lanka.
2. The wide variation of rainfall patterns in the western Ghats coupled with the regions complex geography produce great variety of vegetation types. These regions have a moist deciduous forest and rainforest. The region shows high species diversity as well as high levels of endemism.
3. Nearly 77% of the amphibians and 62% of the reptile species found here are found nowhere else.
4. Sri Lanka, which lies to the south of India, is also a country rich in species diversity also dominated rainforests to tropical montane cloud forests.
5. It has been connected with India through several past glaciation events by a land bridge of almost 140km wide. The important population include Asian elephant, Nilgiri tahr, Indian Tigers, Lion Tailed Macaque, Giant Squirrel etc.

2. The Eastern Himalayas:

The Eastern Himalayas is the region encompassing Bhutan, North Eastern India, and southern, central, and eastern Nepal. The region is geologically young and shows high altitudinal variation.

1. The Eastern Himalayan hotspot has nearly 163 globally threatened species including the One-horned Rhinoceros, the Wild Asian Water buffalo and in all 45 Mammals, 50 Birds, 17 Reptiles, 12 Amphibians, 3 Invertebrate and 36 Plant species.
2. Mammals like the Golden langur, The Himalayan Tahr, The Pygmy Hog, Langurs, Asiatic Wild Dogs, Sloth Bears, Gaurs, Muntjac, Sambar, Snow Leopard, Black Bear, Blue Sheep, Takin, The Gangetic Dolphin, Wild Water Buffalo, Swamp Deer call the Himalayan ranged their home.

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3. The only endemic genus in the hotspot is the Namdapha flying squirrel which is critically endangered and is described only from a single specimen from Namdapha National Park.
 4. There are an estimated 10,000 species of plants in the Himalayas of which one third are endemic and found nowhere else in the world. Many plants species are found even in the highest reaches of the Himalayan mountains. For example, a plant species *Ermania Himalayensis* was found at an altitude of 6300 m in north western Himalayas.
 5. A few threatened endemic bird species such as the Himalayan Quail Western Tragopan are found here along with some of Asia's largest and most endangered birds such as the Himalayan vulture and white bellied heron.

3. Indo-Burma Region:

1. It is spread out from Eastern Bangladesh to Malaysia and includes North-Eastern India south of Brahmaputra river, Myanmar, the southern part of China's Yunnan province, Lao People's Democratic Republic, Cambodia, Vietnam and Thailand.
2. The Indo-Burma region is spread over 2 million sq. km of tropical Asia. Since this hotspot is spread over such a large area and across several major landforms, there is a wide diversity of climate and habitat patterns in this region.
3. Much of this region is still a wilderness but has been deteriorating rapidly in the past few decades. In recent time six species of large mammals have been discovered large antlered Muntjac, Annamite Muntjac, Grey Shankled Douc, etc.
4. This region is home to several primate species such as Monkeys, Langurs And Gibbons with populations numbering only in the hundreds. Many of the species, especially some freshwater turtle species, are endemic.
5. Almost 1300 bird species exhausts in this region including the threatened White Earned Night Heron, The Grey Crowned Crocias, and Orange Necked Partridge.
6. It is estimated that there are about 13,500 plants species in this hotspot with over half of them endemic. Ginger is example for native to this region.

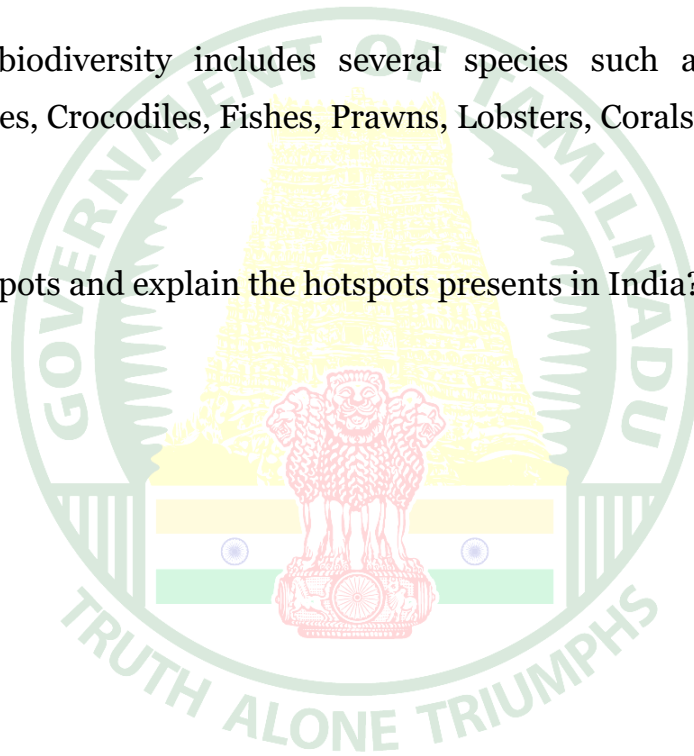


4.Sundaland:

1. Sundaland is a region in South-East Asia that covers the western part of the Indo-Malayan archipelago. It includes Thailand, Malaysia, Singapore, Brunei and Indonesia.
2. India is represented by the Nicobar Islands. The United Nations declared the islands a World Biosphere Reserve in 2013.
3. The islands have a rich terrestrial and marine ecosystem that includes Mangroves, Coral reefs and Seagrass beds.
4. The marine biodiversity includes several species such as Whales, Dolphins, Dugong, Turtles, Crocodiles, Fishes, Prawns, Lobsters, Corals and Seashells.

Question:

1. What are hotspots and explain the hotspots presents in India?





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BIODIVERSITY: SIGNIFICANCE AND THREATS

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Significance of Biodiversity – Global and India

Biodiversity is the variety of life on earth. That is, it is the number of different species of flora and fauna including microorganisms. These organisms can inhabit different ecosystems with varying conditions like the Rainforests, Coral reefs, Grasslands, Deserts, Tundra and the Polar ice caps. This variety (Biodiversity) is essential for the wellbeing of our planet and sustenance of life as a whole.

The importance of biodiversity can be viewed and measured as

- a) Ecosystem services
- b) Biological resources
- c) Social benefits of biodiversity

The organization and functioning of ecosystems world over are affected and dependent on biodiversity and its richness. The major functional attributes are:

1. Continuity of nutrient cycles or biogeochemical cycles (N_2 , C, H_2O , P, S cycles)
2. Soil formation, conditioning or maintenance of soil health (fertility) by soil microbial diversity along with the different trophic members
3. Increases ecosystem productivity and provide food resources
4. Act as water traps, filters, water flow regulators and water purifiers (forest cover and vegetation)
5. Climate stability (forests are essential for rainfall, temperature regulation, CO_2 absorption, which in turn regulate the density and type of vegetation)
6. Forest resource management and sustainable development
7. Maintaining balance between biotic components
8. Cleaning up of pollutants – microbes are the biggest degraders of molecules including many anthropogenic ones which are present in effluents, sewage, garbage and agro-chemicals.

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9. Ecological stability – the varieties and richness of species contribute to ecological stability and survival of species. Biodiverse regions are reservoirs of biological resources like food resources, gene pool, genetic resource, medicinal resources, bio-prospecting
 10. To provide unique aesthetic value and hot spots for Ecotourism. Along with forest resources and wildlife it has commercial significance
 11. An indicator of the health of the ecosystem. Endemism is a crucial indicator of richness.

Biogeographical Regions of India

As per the international 'biome' type of classification based upon climate, fauna and flora and the soil conditions, India can be divided into ten different biogeographic zones, namely:

1. Trans Himalayan Region:

An extension of the Tibetan plateau, high-altitude cold desert in Ladakh (J&K) and Lahaul Spiti (H.P) comprising 5.7% of the country's landmass. The mountains of this region have the richest wild sheep and goat community in the world, renowned for its quality wool and wool products. Other fauna includes Chiru and Black-rocked Crane.

2. Himalayas:

The entire mountain chain running from north-western to north-eastern India, comprising a diverse range of biotic provinces and biomes and covers 7.2% of the country's landmass. The common fauna of the Himalayan ranges, are the wild sheep, mountain goats, shrew, snow leopard and panda, many of which are endangered.

3. Indian Desert:

The extremely arid area west of the Aravalli hill range, comprising both the salty desert of Gujarat and the sand desert of Rajasthan. It comprises 6.9% of the country's land-mass. Wild ass is endemic to this region. It is also the habitat for the Indian Bustard, camel, foxes and snakes, many of which are endangered.



4. **Semi – Arid Zones:**

This zone is between the desert and the Deccan plateau, including the Aravalli hill range covering 15.6% of the country's landmass. Fauna found here are nilghai, blackbuck, four horned antelopes, sambhar, chital and spotted deer which are herbivores along with predators like Asiatic lion, tiger, leopard and jackal.

5. **Western Ghats:**

Western Ghats, are mountain ranges along the west coast of India, extending over almost 1,500 km from Sat Pena in south Gujarat to the southernmost tip of Kerala. The annual rainfall is about 2000 mm. This zone has large populations of Nilgiri tahr (State animal of Tamil Nadu), Nilgiri Langur, tiger, leopard, and Indian elephant. The grizzled squirrel and lion tailed macaque are endemic to this region.

6. **Deccan Peninsula:**

This covers much of the southern and south-central plateau with a predominantly deciduous vegetation and 4.3% of the country's landmass. It is known for deciduous forests, thorn forests and pockets of semi ever green forests. Fauna found here are Chital, Sambhar, Nilghai, Elephant, Sloth bear, Black buck and Barking deer. It is the catchment area of major Indian rivers like Godavari, Tapti, Narmada and Mahanadi.

7. **Gangetic Plains:**

These plains are relatively homogenously defined by the Ganges river system and occupy about 11% of the country's landmass. This region is very fertile and extends up to the Himalayan foothills. Fauna includes rhinoceros, elephant, buffalo, swamp deer, hog-deer.

8. **North-East India:**

The plains and non- Himalayan hill ranges of north eastern India are home to a wide variety of vegetation. With 5.2% of the country's landmass, this region represents the transition zone between the Indian, Indo-Malayan and Indo-Chinese biogeographical regions and is the meeting point of the Himalayan Mountains and peninsular India. The North-East is thus the biogeographical 'Gateway' for much of

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India's fauna and flora and also biodiversity hotspot (Eastern Himalaya), which includes the Indian rhinoceros, leopard and golden langur.

9. Coastal Region:

Coastal region of India with sandy beaches, mud flats, coral reefs, mangroves constitutes 2.5% of the total geographical area. The coastline from Gujarat to Sundarbans is estimated to be 5423 km long. Apart from this a total of 25 islets constitute the Lakshadweep, which are of coral origin and have a typical reef lagoon system, rich in biodiversity. The fauna includes native crabs, turtles and tunas

10. Andaman and Nicobar Islands:

The Andaman and Nicobar Islands in the Bay of Bengal have highly diverse set of biomes, constituting 0.3% of the total geographical area. They are centers of high endemism and contain some of India's finest evergreen forests and support a wide diversity of corals. Fauna includes Narcondam hornbills of the Andamans and the South Andaman Krait.

Threats To biodiversity

Even though India is one of the 17 identified mega diverse countries of the world, it faces lots of threats to its biodiversity.

The threats are:

1. Natural causes, human activities, both directly and indirectly are today's main reason for habitat loss and biodiversity loss.
2. Fragmentation and degradation due to agricultural practices,
3. Extraction of mining, fishing, logging, harvesting.
4. Development of settlements, industrial and associated infrastructures leads to habitat loss and fragmentation leads to formation of isolated, small and scattered populations and as endangered species.
5. Other threats includes specialized diet, specialized habitat requirement, large size, small population size, limited geographic distribution and high economic or commercial value.

Causes of Biodiversity Loss

The major causes for biodiversity decline are:

1. Habitat loss due to Industrialization, Urbanization, infrastructure development, Transport – Road and Shipping activity, communication towers, dam construction, unregulated tourism and monoculture are common area of specific threats
2. Fragmentation and destruction (affects about 73% of all species)
3. Pollution and pollutants (smog, pesticides, herbicides, oil slicks, GHGs)
4. Climate change
5. Introduction of alien/exotic species
6. Over exploitation of resources (poaching, indiscriminate cutting of trees, over fishing, hunting, mining)
7. Intensive agriculture and aqua cultural practices
8. Hybridization between native and non-native species and loss of native species
9. Natural disasters (Tsunami, Forest fire, Earth quake, Volcanoes)
10. Co-extinction

1. Habitat Loss

Development of human society is inevitable. Natural habitats are destroyed for the purpose of settlement, agriculture, mining, industries and construction of highways. As a result, species are forced to adapt to the changes in the environment or move to other places. If not, they become victim to predation, starvation, disease and eventually die or results in human animal conflict.

Over population, urbanization, industrialization and agricultural advancements require additional land, water and raw materials every year. This is made possible only through fragmentation or destruction of natural habitats by filling wetlands, ploughing grasslands, cutting down trees, forest, desilting rivers, constructing transport ways, caving mountains, extracting, ores, changing the course of rivers and filling of seashore. The most dramatic example of habitat loss comes from the tropical rainforests 14% of the earth's land surface once covered by these tropical forests, is not more than 6% now. The Amazon rainforest, a vast area, harbouring millions of species,

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also called “Lungs of the planet “is destroyed and being replaced for agriculture and human settlements. 90% of New Zealand’s wetlands have been destroyed and cleared for cultivating soya beans and raising grass for beef cattle. Kodaikanal and Nilgiri hills of Tamil Nadu have been destroyed rapidly for human occupancy. Loss of habitat results in annihilation of plants, microorganisms and forcing out animals from their habitats.

2.Habitat fragmentation

Habitat fragmentation is the process where a large, continuous area of habitat is both, reduced in area and divided into two or more fragments. Fragmentation of habitats like forest land into crop lands, orchard lands, plantations, urban areas, industrial estates, transport and transit systems has resulted in the destruction of complex interactions amongst species, (food chain and webs) destruction of species in the cleared regions, annihilation of species restricted to these habitats (endemic) and decreased biodiversity in the habitat fragments. Animals requiring large territories such as mammals and birds are severely affected. The elephant corridors and migratory routes are highly vulnerable. The dwindling of many well-known birds (sparrows) and animals can be attributed to this.

3.Over exploitation:

We depend on nature for our basic needs such as food and shelter. However, when the need becomes greed, it leads to over exploitation of natural resources. Excessive exploitation of a species, reduces the size of its population to such a level that it becomes vulnerable to extinction. Dodo, passenger pigeon and Steller’s sea cow have become extinct in the last 200-300 years due to over exploitation by humans. Overfishing due to population pressure leads to many marine fish (populations) declining around the world.

4.Exotic species invasion:

Exotic species (non-native; alien) are organisms often introduced unintentionally or deliberately for commercial purpose, as biological control agents and other uses. They often become invasive and drive away the local species and is considered as the second major cause for extinction of species. Exotic species have proved harmful to both aquatic and terrestrial ecosystems.

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Tilapia fish (*Jilabi kendai*) introduced from east coast of South Africa in 1952 for its high productivity into Kerala's inland waters, became invasive, due to which the native species such as *Puntius dubius* and *Labeo Kontius* face local extinction. Amazon sailfin catfish is responsible for destroying the fish population in the wetlands of Kolkata. The introduction of the Nile Perch, a predatory fish into Lake Victoria in East Africa led to the extinction of an ecologically unique assemblage of more than 200 nature species of cichlid fish in the lake. African apple snail (*Achatina fulica*) is the most invasive among all alien fauna in India. This mollusc was first reported in the Andaman and Nicobar Islands. It is now found across the country and threatens the habitat of several native species. Moreover, it is becoming a vicious pest in vegetable farms. Exotic earthworms compete for food with native varieties and deplete their population in soil. Papaya Mealy Bug (*Paracoccus marginatus*) is native of Mexico and Central America, is believed to have destroyed huge crops of papaya in Assam, West Bengal and Tamilnadu.

6.Climate changes

Industrialization is a major contributor to climate change and a major threat to biodiversity. Energy drives our industries, which is provided by burning of fossil fuels. This increases the emission of CO₂, a GHG, leading to climate change. Due to large scale deforestation, the emitted CO₂ cannot be absorbed fully, and its concentration in the air increases. Climate change increases land and ocean temperature, changes precipitation patterns and raises the sea level. This in turn results in melting of glaciers, water inundation, less predictability of weather patterns, extreme weather conditions, outbreak of squalor diseases, migration of animals and loss of trees in forest. Thus, climate change is an imminent danger to the existing biodiversity

7.Shifting or Jhum cultivation (Slash-and-burn agriculture)

In shifting cultivation, plots of natural tree vegetation are burnt away and the cleared patches are farmed for 2-3 seasons, after which their fertility reduces to a point where crop production is no longer profitable. The farmer then abandons this patch and cuts down a new patch of forest trees elsewhere for crop production. This system is practiced in north-eastern regions of India. When vast areas are cleared and burnt, it results in loss of forest cover, pollution and discharge of CO₂ which in turn attributes to

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loss of habitat and climate change which has an impact on the faunal diversity of that regions.

8.Coextinctions

Coextinction of a species is the loss of a species as a consequence of the extinction of another. (Eg. orchid bees and forest trees by cross pollination). Extinction of one will automatically cause extinction of the other. Another example for co-extinction is the connection between Calvaria tree and the extinct bird of Mauritius Island, the Dodo. The Calvaria tree is dependent on the Dodo bird for completion of its life cycle. The mutualistic association is that the tough horny endocarp of the seeds of Calvaria tree are made permeable by the actions of the large stones in birds gizzard and digestive juices thereby facilitating easier germination. The extinction of the Dodo bird led to the imminent danger of the Calvaria tree coextinction.

9.Pollution

Pollutants and pollution are a major cause for biodiversity loss. Excessive use of fertilizers, pesticides and heavy metals have polluted the land, ground and surface water bodies. There is a tendency of pesticide biomagnification which results in high concentrations at higher trophic levels which has resulted in drastic decline in the population of fish-eating birds and falcons. Run off from fertilizer rich fields causes nutrient enrichment of water bodies leading to eutrophication. Mercury, arsenic, cadmium, chromium poisoning has led to depletion of biotic resources in vulnerable ecosystems. Death of vulture population is attributed to the veterinary medicine Diclofenac, which is responsible for the thinning of the egg shells.

10.Intensive agriculture:

Spread of agriculture is sometimes at the cost of wetlands, grasslands and forests. Intensive agriculture is based on a few high yielding varieties. As a result, there is reduction in the genetic diversity. It also increases vulnerability of the crop plants to sudden attack by pathogens and pests. There are only few varieties of traditional paddy strains today due to use to hybrid varieties in Tamil Nadu.

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11.Forestry

There is a tendency to grow economically important and viable trees like Teak, Sandal, Oak, Sal in forests resulting in loss of other forest trees.

12.Natural threats

These include spontaneous jungle fires, tree fall, land slide, defoliation by insects or locust attack.

13.Loss of biodiversity

Species have been evolving and dying out (extinction) ever since the origin of life. However, species are now becoming extinct at a faster rate. This is destabilizing the ecological stability and the distribution of biological diversity on earth. Human activities greatly contribute to the loss of biodiversity. Natural resources such as land, water and organisms are indiscriminately exploited by human beings.

According to the Convention of Biological Diversity, direct and indirect human activities have a detrimental effect on biodiversity. Direct human activities like change in local land use, species introduction or removal, harvesting, pollution and climate change contribute a greater pressure on loss of biodiversity. Indirect human drivers include demographic, economic, technological, cultural and religious factors.

Even though new species are being discovered, there is little hope for adding new species through speciation into the biodiversity treasure. Monsoon failure, global warming, depletion in ozone layer, landslides in hilly states, pollution are a few indirect effects of human activities which results in the loss biodiversity. IUCN Red List (2004) documents the extinction of 784 species in the 500 years.

It is estimated that the current rate of biodiversity loss is 100 to 1000 times higher than the naturally occurring extinction rate and is still expected to grow in the future. This loss of biodiversity has an immense impact on plant animal and human life. The negative effects include dramatic influence on the food web. Even reduction in one species can adversely affect the entire food chain which further leads to an overall reduction in biodiversity. Reduced biodiversity leads to immediate danger for food security by reducing ecosystem services.

◆.....◆ **14. Extinction:**

Species is considered extinct when none of its members are alive anywhere in the world. If individuals of a species remain alive only in captivity or other human controlled conditions, the species is said to be extinct in the wild. In both of these situations, the species would be considered globally extinct. A species is considered to be locally extinct when it is no longer found in an area it once inhabited but is still found elsewhere in the wild. In the 450 million years of life on Earth, there had been 5 mass extinctions, which had eliminated at least 50% of the species of flora and fauna on the globe. The extinction of species is mainly due to drastic environmental changes and population characteristics.

There are three types of Extinctions

i. Natural extinction is a slow process of replacement of existing species with better adapted species due to changes in environmental conditions, evolutionary changes, predators and diseases. A small population can get extinct sooner than the large population due to inbreeding depression (less adaptivity and variation).

ii. Mass extinction: The earth has experienced quite a few mass extinctions due to environmental catastrophes. A mass extinction occurred about 225 million years ago during the Permian, where 90% of shallow water marine invertebrates disappeared.

iii. Anthropogenic extinctions These are abetted by human activities like hunting, habitat destruction, over exploitation, urbanization and industrialization.

Questions:

1. Explain the causes and threats of the biodiversity and its significance to the ecosystem.



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : Changes in monsoon pattern in Tamil Nadu and India

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CHANGES IN MONSOON PATTERN IN TAMILNADU AND INDIA

CHANGES IN MONSOON PATTERN IN TAMILNADU AND INDIA:

MONSOON

The word 'monsoon' has been derived from the Arabic word 'Mausim' which means 'season'. Originally, the word 'monsoon' was used by Arab navigators several centuries ago, to describe a system of seasonal reversal of winds along the shores of the Indian Ocean, especially over the Arabian Sea. It blows from the south-west to north-east during summer and from the north-east to south-west during winter.

According to the Dynamic concept, Monsoon wind originates due to the seasonal migration of planetary winds and pressure belts following the position of the sun. During summer solstice, the sun's rays fall vertically over the Tropic of cancer. Therefore, all the pressure and wind belts of the globe shift northwards. At this time, Inter -Tropical Convergence Zone (ITCZ) also moves northward, and a major part of Indian landmass comes under the influence of southeast trade winds. While crossing equator this wind gets deflected and takes the direction of southwest and becomes southwest monsoon. During the winter season, the pressure and wind belts shift southward, thereby establishing the north-east monsoon (trade winds) over this region. Such systematic change in the direction of planetary winds is known as monsoon.

The Factors Affecting the Climate

Climate of India is affected by the factors of latitude, distance from the seas, monsoon wind, relief features and jet stream.

1.Latitude

Latitudinally, India lies between 8°4'N and 37°6'N latitudes. The Tropic of cancer divides the country into two equal halves. The area located to the south of Tropic of cancer experiences high temperature and no severe cold season throughout the year

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whereas, the areas to the north of this parallel enjoys subtropical climate. Here, summer temperature may rise above 40°C and it is close to freezing point during winter.

2.Altitude

When the altitude increases, the temperatures Decreases. Temperature decreases at the rate of 6.5°C for every 1000 metres of ascent. It is called normal lapse rate. Hence, places in the mountains are cooler than the places on the plains. That is why the places located at higher altitudes even in south India have cool climate. Ooty and several other hill stations of south India and of the Himalayan ranges like Mussourie, Shimla etc., are much cooler than the places located on the Great Plains.

3.Distance from The Sea

Distance from the sea does not cause only temperature and pressure variations but also affects the amount of rainfall. A large area of India, especially the peninsular region, is not very far from the sea and this entire area has a clear maritime influence on climate. This part of the country does not have a very clearly marked winter and the temperature is equable almost throughout the year. Areas of central and north India experience much seasonal variation in temperature due to the absence of influence of seas. Here, summers are hot and winters are cold. The annual temperature at Kochi does not exceed 30°C as its location is on the coast while it is as high as 40°C at Delhi, since it is located in the interior part. Air near the coast has more moisture and greater potential to produce precipitation. Due to this fact, the amount of rainfall at Kolkata located near the coast is 119 cm and it decreases to just 24 cm at Bikaner which is located in the interior part.

4.Monsoon Wind

The most dominant factor which affects the climate of India is the monsoon winds. These are seasonal reversal winds and India remains in the influence of these winds for a considerable part of a year. Though, the sun's rays are vertical over the central part of India during the mid-June, the summer season ends in India by the end of May. It is because the onset of southwest monsoon brings down the temperature of the entire India and causes moderate to heavy rainfall in many parts of the country. Similarly, the climate of southeast India is also influenced by northeast monsoon.

5. Relief

Relief of India has a great bearing on major elements of climate such as temperature, atmospheric pressure, direction of winds and the amount of rainfall. The Himalayas acts as a barrier to the freezing cold wind blows from central Asia and keep the Indian subcontinent warm. As such the north India experiences tropical climate even during winter. During southwest monsoon, areas on the western slope of the Western Ghats receive heavy rainfall. On the contrary, vast areas of Maharashtra, Karnataka, Telangana, Andhra Pradesh and Tamilnadu lie in rain shadow or leeward side of the Western Ghats receive very little rainfall. During this season, Mangalore, located on the coast gets the rainfall of about 280 cm whereas the Bengaluru located on the leeward side receives only about 50 cm rainfall.

6. Jet Streams

Jet streams are the fastmoving winds blowing in a narrow zone in the upper atmosphere. According to the Jet stream theory, the onset of southwest monsoon is driven by the shift of the subtropical westerly jet from the plains of India towards the Tibetan plateau. The easterly jet streams cause tropical depressions both during southwest monsoon and retreating monsoon.

The onset of the monsoon has been delayed almost every year since 1976, when there was a regime shift in climate around the world - from a weak to a strong El Nino period. Since this time, monsoons have also been ending sooner- almost a week from the end of September; so, the length of the rainy season has been compressed.

In India, one of the nations most-highly affected by monsoons, as well as neighboring countries, 75% of annual rainfall is supplied during the monsoons. This means drinking water, bathing water, water for crops and food preparation, hydroelectric power, and the countless other necessary uses of water. The monsoon season is, for many regions and communities, a lifeline and a necessity for agriculture, livelihood, and basic survival. The deep dependence on monsoons means that even a slight shift in timing or amount of rainfall can be chaotic and lethal.

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CHANGES IN INDIA:

Monsoons are triggered by a contrast in temperature between land masses and oceans, which triggers a Reversal of wind patterns, causing an increase in precipitation, which we call a monsoon. As temperatures increase as a result of climate change, monsoons are altered, and levels of rainfall are skewed. Monsoons are becoming more unpredictable and irregular, entering periods of reduced rainfall in certain regions, specifically southern Asian regions, is projected to worsen in the future. The primary issue is the increasing irregularity of monsoons, with periods of intense dry spells, sometimes followed by an unpredictably intense monsoon season.

Measures:

To strongly promote water management and conservation measures such as

1. reusing treated wastewater,
2. rainwater harvesting,
3. monitoring water in-flow through real-time gauging, and
4. moving towards honest pricing.

Question:

1. Explain the factors that affect climate change and write about the causes of climate change in India and Tamilnadu.



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : CITES, IUCN & CBD

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CITES, IUNC & CBD

CITES

CONSERVATION OF INTERNATIONAL TRADE AND ENDANGERED SPECIES OF WILD FAUNA AND FLORA OR WASHINGTON CONVENTION

1. It is an International agreement and multilateral treaty to regulate worldwide commercial trade in wild animal and plant species.
2. It was signed on March 3, 1973 (Hence world wildlife day is celebrated on march 3) came in to force in 1975.
3. It is administered by the United Nations Environment Programme (UNEP).
4. Secretariat — Geneva (Switzerland) and 2018 secretary general of the CITES is IVANGO HIGUERO.
5. CITES is legally binding on state parties to the convention, which are obliged to adopt their own domestic legislation to implement its goals but participation is voluntary.
6. Although CITES is legally binding on the Parties, it does not take the place of national laws. Rather it provides a framework respected by each Party, which must adopt their own domestic legislation to implement CITES at the national level.
7. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species in the wild, and it accords varying degrees of protection to more than 35,000 species of animals and plants.

Classifications:

It classifies plants and animals according to three categories, or appendices, based on how threatened. They are.

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Appendix I species: It lists species that are in danger of extinction. It prohibits commercial trade of these plants and animals except in extraordinary situations for scientific or educational reasons.

Appendix II species: They are those that are not threatened with extinction but that might suffer a serious decline in number if trade is not restricted. Their trade is regulated by permit.

Appendix III species: They are protected in at least one country that is a CITES member states and that has petitioned others for help in controlling international trade in that species.

In addition, CITES also restricts trade in items made from such plants and animals, such as food, clothing, medicine, and souvenirs.

INTERNATIONAL UNION FOR CONSERVATION OF NATURE(IUCN):

The International Union for Conservation of Nature (IUCN) is an organization working in the field of nature conservation and sustainable use of natural resources. The International Union for Conservation of Nature is a membership Union uniquely composed of both government and civil society organizations. It provides public, private and non-governmental organizations with the knowledge and tools that enable human progress, economic development and nature conservation to take place together.

IUCN is the global authority on the status of the natural world and the measures needed to safeguard it.

It was established in 5th October 1948 and Head quarter in Gland VD, Switzerland.

Vision:

The vision of IUCN is 'A just world that values and conserves nature'. It is involved in data gathering and analysis research, field projects and education on conservation, sustainable development and biodiversity.

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Mission:

IUCN's mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. IUCN has widened its focus beyond conservation of ecology and now incorporates issues related to sustainable development in its projects. It influences governments and industries through partnerships by providing information and advice.

Priority areas:

1. Bio diversity
2. Climate change
3. Sustainable energy
4. Human well being
5. Green economy

Red Data Book

Red Data book or Red list is a catalogue of taxa facing risk of extinction. IUCN – International Union of Conservation of Nature and Natural Resources, which is renamed as WCU – World Conservation Union (Morges Switzerland) maintains the Red Data book. The concept of Red list was mooted in 1963. The organization collects, compiles and publishes the IUCN red list of threatened species and their conservation status in the world. It plays a vital role in the implementation of several international conventions on nature conservation and biodiversity.

The purpose of preparation of Red List are:

1. To create awareness on the degree of threat to biodiversity
2. Identification and documentation of species at high risk of extinction
3. Provide global index on declining biodiversity
4. Preparing conservation priorities and help in conservation of action
5. Information on international agreements on conservation of biological diversity

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Red list has eight categories of species

- a. Extinct- The species has disappeared and no known individuals remaining
- b. Extinct in wild - Known only to survive in captivity, or as a naturalized population outside its historic range.
- c. Critically Endangered - Species that have drastically dwindled and are at extremely high risk of extinction in the wild
- d. Endangered - High risk of extinction in the wild
- e. Vulnerable – High risk of endangerment in the wild
- f. Near threatened – Likely to become endangered in the near future
- g. Least concern – Lowest risk widespread and abundant Conservation dependent. This group has now merged with near threatened.
- h. Data deficiency - Not enough data to assess the risk of extinction of the species.
- i. Not Evaluated-Species not yet been evaluated against the criteria.

In the context of the IUCN Red List, ‘threatened’ embraces the three categories of Critically Endangered, Endangered, and Vulnerable.

IUCN World Conservation Congress

1. Held once every four years
2. Brings together several thousand leaders and decision-makers from government, civil society, indigenous peoples, business, and academia, with the goal of conserving the environment and harnessing the solutions nature offers to global challenges.
3. Forum — hub of public debate, bringing together people from all walks of life to discuss the world’s most pressing conservation and sustainability challenges.
4. Members’ Assembly— IUCN’s highest decision-making body. A unique global environmental parliament, it involves governments and NGOs – large and small, national and international – taking joint decisions on conservation and sustainability.

CONVENTION ON BIOLOGICAL DIVERSITY

1. United Nation Conference on The Human Environment (1972)

The United Nations Conference on the Human Environment was first held in Stockholm, Sweden, in 1972. It marked the emergence of international environmental law.

Stockholm Declaration

It is also known as The Declaration on the Human Environment. It set out the principles for various international environmental issues, natural resource management, pollution prevention and the relationship between the environment and development.

2. United Nations Conference on Environment and Development:

Also known as RIO Earth summit, Rio conference, held in Rio de-janeiro in June 1992. Earth Summit 1992 succeeded in raising public awareness of the need to integrate environment and development. At 1992 Earth Summit in Rio de Janeiro, world leaders agreed on a comprehensive strategy for “sustainable development” — meeting our needs while ensuring that we leave a healthy and viable world for future generations.

The issues addressed by this Summits are:

1. Checking production of toxic components, such as lead in gasoline, or poisonous waste including radioactive chemicals,
2. Alternative sources of energy to replace the use of fossil fuels,
3. New reliance on public transportation systems in order to reduce vehicle emissions, congestion in cities,
4. The health problems caused by polluted air and smoke, and
5. The growing usage and limited supply of water.

The Earth Summit resulted in the following documents:

1. **Rio Declaration:** principles intended to guide countries in future sustainable development.
2. **Agenda 21:** non-binding action plan of the United Nations with regard to sustainable development.

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3. **Forest Principles:** Non-legally binding document on Conservation and Sustainable Development of All Types of Forests.

Landmark Agreements

Important legally binding agreements (Rio Convention) were opened for signature:

1. Convention on Biological Diversity (CBD)
2. United Nations Convention to Combat Desertification (UNCCD)
3. United nation framework on climate change (UNFCC).

CONVENTION ON BIOLOGICAL DIVERSITY:

The Convention on Biological Diversity is the international legal instrument that has been ratified by 196 nations. The Convention on Biological Diversity (a multilateral treaty) was opened for signature at the Earth Summit in Rio de Janeiro in 1992 and entered into effect in 1993. It is often seen as key document for Sustainable development.

Three main goals:

1. Conservation of Biodiversity
2. Sustainable use of the components of biodiversity
3. Sharing benefits arising from the commercial and other utilization of genetic resources in a fair and equitable way.

Nearly all countries have ratified it (notably, the US has signed but not ratified) The CBD Secretariat is based in Montreal, Canada and it operates under the United Nations Environment Programme. The Parties (Countries) under Convention of Biodiversity (CBD), meet at regular interval and these meetings are called Conference of Parties (COP).

There are two different protocols

1. Cartagena protocol:

On 29 January 2000, the Conference of the Parties to the Convention on Biological Diversity (COP5) adopted a supplementary agreement to the Convention known as the Cartagena Protocol on Biosafety. It came into force on 11 September 2003. The Protocol seeks to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology. There are two major

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components of Cartagena Protocol viz. Advanced Informed Agreement (AIA) Procedure and Biosafety Clearing House.

Advanced Informed Agreement (AIA)

AIA under the Cartagena Protocol ensures that the countries are provided with the information necessary to make informed decisions before agreeing to the import of Living Modified Organisms into their territory.

Biosafety Clearing House

Biosafety Clearing-House facilitates the exchange of information on living modified organisms and to assist countries in the implementation of the Protocol.

2.Nagoya Protocol:

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) to the Convention on Biological Diversity was adopted on 29 October 2010 in Nagoya, Japan at COP10. It entered into force on 12 October 2014. It provides a transparent legal framework for the effective implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources. It not only applies to genetic resources that are covered by the CBD, and to the benefits arising from their utilization but also covers traditional knowledge (TK) associated with genetic resources that are covered by the CBD and the benefits arising from its utilization.

Along with Nagoya Protocol on Genetic Resources, the COP-10 also adopted a ten-year framework for action by all countries to save biodiversity.

Aichi Targets:

Officially known as “Strategic Plan for Biodiversity 2011-2020”, provide a set of 20 ambitious yet achievable targets (divided into 5 sections: A to E), collectively known as the Aichi Targets for biodiversity.

The Aichi Biodiversity Targets are:

- 1. Strategic Goal A:** Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society.

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1. By 2020, at the latest, making the people aware of the values of biodiversity and the steps they can take to ensure conservation and sustainable use of the resources of biodiversity.
 2. By 2020, at the latest integrating the biodiversity values in the national and local level development and poverty reduction plans and strategies, and the planning process to be incorporated in the national accounting, as appropriate and reporting systems.
 3. By 2020, at the latest, the incentives including subsidies which are harmful to the biological diversity are eliminated, phased out or reformed to minimize or remove its negative impacts on biodiversity. Also, positive incentives to ensure the conservation and sustainable use of the resources of biological diversity are developed and applied which are consistent and in harmony with the CBD, and other international obligations and treaties, taking into account the national socio-economic conditions.
 4. By 2020, at the latest, the governments, businesses and other stakeholders at all the levels should have taken steps to achieve or have implemented plans and strategies to ensure sustainable production and consumption to keep the impacts of natural resources within the safe ecological limits.
2. **Strategic Goal B:** Reduce the direct pressures on biodiversity and promote sustainable use.
1. By 2020, the rate of loss of forests and all other natural habitats is at least halved and wherever possible brought close to zero, and the degradation and fragmentation of habitats are reduced significantly.
 2. By 2020 all the fish and invertebrates stocks and the aquatic plants are harvested and managed sustainably, legally and by applying ecosystem-based approach. This is to avoid overfishing, the recovery plans and measures are in place for all the depleted species, and the fisheries have no significant negative impacts on the threatened species. The vulnerable ecosystems and the impacts of fisheries on the stocks, species and the ecosystems are well within the safe ecological limits.
 3. By 2020, the areas under agriculture, forestry and aquaculture are managed sustainably to ensure the conservation of biodiversity.

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4. By 2020, the pollution levels, including from the excess of nutrients, are brought to the levels which are not detrimental to the functioning of ecosystem and biodiversity.
 5. By 2020, the invasive alien species and their pathways are identified and prioritized. The priority species are either controlled or eradicated, and measures are taken to manage the pathways to prevent their introduction and establishment.
 6. By 2015, the multiple sources of anthropogenic pressures on the coral reefs, and all other vulnerable ecosystems which are highly impacted by the climate change or by the ocean acidification are minimized to ensure their integrity and proper functioning.
3. **Strategic Goal C:** To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity
1. By 2020, at least 17% of the terrestrial and the inland water, and 10% of the coastal and marine areas, especially the areas which are important for biodiversity and ecosystem services are conserved. This is to be achieved through effectively and equitably managed, ecologically representative and well-connected ecosystems of the protected areas and other area-based conservation measures and strategies, and are integrated into the wider landscapes and the seascapes.
 2. By 2020, the extinction of the threatened species is to be prevented and their conservation and protection status, especially of those which are most in decline, has been improved and sustained.
 3. By 2020, genetic diversity of the cultivated plants and domestic animals and their wild relatives, including other socially, economically and culturally valuable species has been maintained. Also, strategies had been developed and implemented to reduce and minimize the genetic erosion and for safeguarding their genetic diversity.
4. **Strategic Goal D:** Enhance the benefits to all from biodiversity and ecosystem services
1. By 2020, ecosystems which provide essential services, including the services related to water, and contribute to the health, wellbeing, and livelihoods are to be

restored and safeguarded. It will also take into account the needs of women, local and Indigenous communities and that of the poor and vulnerable sections.

2. By 2020, the ecosystem resilience and contribution of biological diversity to the carbon stocks are to be enhanced and increased through conservation and restoration. It includes the restoration of at least 15% of the degraded ecosystems, thereby contributing to the mitigation and adaptation of climate change and to combat desertification.
3. By 2015, the Nagoya protocol and the access to genetic resources and fair and equitable sharing of benefits arising from its utilization are in force and operational, and it is also consistent with the national legislation.

5. **Strategic Goal E:** Enhance implementation through participatory planning, knowledge management and capacity building.

1. By 2015, each party has developed and adopted a policy instrument and has also commenced the implementation of an effective, updated and participatory national biological diversity strategy and action plan.
2. By 2020, the traditional knowledge, practices and innovations of the local indigenous communities which are relevant to the conservation and the sustainable use of biological diversity, and their customary use of biodiversity resources are respected subject to the national legislation and international treaties and applications. Also, it has to be fully integrated and reflected in the implementation of this convention with effective participation of the local and indigenous communities at all the relevant levels.
3. By 2020, the knowledge, scientific base and the technologies related to the biological diversity, its values, status, trends and the functioning and the consequences of its loss and degradation, are improved, widely shared and transferred, and are applied.
4. By 2020, the mobilization of financial resources for effective implementation of the strategic plans and measures for biodiversity 2011 - 2020 from all the different sources, in accordance with the consolidated and an agreed process for resource mobilization should increase to a significant extent from the current levels. The target will be subject to the different change's contingent on the

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resource needs assessments which are to be developed and reported by the parties.

In India Biodiversity:

1. The government passed the biodiversity act to conserve and promote sustainable use of biological diversity and to regulate the access to biological resources of the country with equitable share in benefits.
2. It sets up National Biodiversity Authority (NBA), State Biodiversity Board (SBB) and Biodiversity Management Committees.
3. Besides, it aims to respect and protect knowledge of local community's traditional knowledge related to biodiversity and secure sharing of benefits with local people as conservers of biological resources and holders of knowledge and information relating to the use of biological resources.
4. Besides, it also has provisions for notifying heritage sites by State Government in consultation with local body.

NATIONAL BIODIVERSITY AUTHORITY:

The National Biodiversity Authority (NBA) was established by the Central Government in 2003 to implement India's Biological Diversity Act (2002). The NBA is a Statutory Body and it performs facilitative, regulatory and advisory functions for the Government of India on issues of conservation, sustainable use of biological resources and fair and equitable sharing of benefits arising out of the use of biological resources. The NBA is headquartered in Chennai, Tamil Nadu.

International Biological Diversity Day is observed on 22nd May. United Nations General Assembly had declared the period 2011-2020 to be the "United Nations Decade on Biodiversity".

Questions:

1. Discuss the aims and working of the CITES.
2. Give the detailed notes of IUCN role in nature conservation and its Red data book.



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : Clean and Green Energy

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CLEAN AND GREEN ENERGY

CLEAN AND GREEN ENERGY:

In India recent past moving towards clean and green energy, more than 80% of India's electricity comes from fossil fuels, which produce greenhouse gases and hasten global warming. Reaching the renewables target is important because it will point India towards a route to achieve its 2030 goal of getting its 40% electricity from non-fossil sources, compared to 11% now. Renewables will also solve an important health issue back home: air pollution, responsible for one in every eight deaths and the loss of 1.24 million lives in India in 2017, India launched the world's largest renewable energy expansion programme and aims to achieve 175 GW capacity of renewable energy by 2022. The country is taking national actions plans to abide by its duty under the Paris Agreement. Projects like electrifying Rural India is also focused on using clean energy.

Need to promote Green Energy

1. Energy consumption results in 77 percent of India's greenhouse gas emissions.
2. Pollution in cities is already at critical levels.
3. Raising population out of poverty and the subsequent rural-urban migration will substantially increase India's carbon emissions in the years to come.
4. Volatility concerns regarding dependence on oil imports from West Asia
5. India's rapid growth is largely dependent on its energy supply.

Government Initiatives:

1. National Action Plan on Climate Change

8 govt missions under National Action Plan on Climate Change (NAPCC)

- 1) **National Solar Mission:** This initiative started in 2010 to promote the use of solar power. Recently, India achieved 20Gw (giga watt) cumulative solar capacity

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achieving the milestone four years ahead of the target for 2022 originally set in the National Solar Mission.

- 2) **National Mission for Enhanced Energy Efficiency:** The initiative was undertaken to promote the market for energy efficiency by fostering innovative policies and effective market instruments. In 2009, it was approved 'in principle' by the PM's Council on Climate Change.
- 3) **National Mission on Sustainable Habitat:** Approved by the PM in 2011, it aims to make cities sustainable through improvements in energy efficiency in buildings, management of solid waste and shift to public transport. The Ministry of Housing and Urban Affairs backs the mission.
- 4) **National Water Mission:** The mission was put in place to ensure integrated water resource management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within states.
- 5) **National Mission for Sustaining the Himalayan Ecosystem:** A multi-pronged, cross-cutting mission across various sectors, NMSHE got a nod from the Union Cabinet in 2014. Aimed at protecting the Himalayas, it has mapped institutes and civil society organizations working on the Himalayan ecology for ease of coordination between governmental and non-governmental agencies.
- 6) **National Mission for a Green India:** Also termed as the Green India Mission/Scheme, it aims at protecting; restoring and enhancing India's diminishing forest cover and responding to climate change by a combination of adaptation and mitigation measures. Driven by the Ministry of Environment and Forests, it received the nod of approval from the Cabinet in 2014.
- 7) **National Mission for Sustainable Agriculture:** Another one of the govt's most efficient missions, it has been formulated for enhancing agricultural productivity especially in rain-fed areas focusing on integrated farming, water use efficiency, soil health management and synergizing resource conservation. It got the nod back in 2010, and has recently got approval for one of its key missions National Bamboo Mission by the Cabinet.

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8) **National Mission on Strategic Knowledge for Climate Change:** The mission seeks to build a dynamic and vibrant knowledge system that informs and supports national policy and action for responding effectively to climate change challenges, while not compromising on the nation's growth goals.

2.State Action Plan on Climate Change (SAPCC):

State governments have drafted climate strategies aligned with the eight National Missions under the NAPCC. The strategies focus on issues ranging from climate mitigation, energy efficiency, and resource conservation to climate adaptation.

3.International Solar Alliance (ISA):

The International Solar Alliance (ISA) is an alliance of more than 122 countries initiated by India, most of them being sunshine countries, which lie either completely or partly between the Tropic of Cancer and the Tropic of Capricorn, now extended to all members of UN. The ISA Framework Agreement entered into force on December 6th , 2017, ISA formally became a de-jure treaty based International Intergovernmental Organization, headquartered at Gurugram, India. The Paris Declaration establishes ISA as an alliance dedicated to the promotion of solar energy among its member countries.

Objectives:

The ISA's major objectives include global deployment of over 1,000GW of solar generation capacity and mobilization of investment of over US\$ 1000 billion into solar energy by 2030.

As an action-oriented organization, the ISA brings together countries with rich solar potential to aggregate global demand, thereby reducing prices through bulk purchase, facilitating the deployment of existing solar technologies at scale, and promoting collaborative solar R&D and capacity building.

4.FAME Scheme for E-mobility:

Union Government in April 2015 launched Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME) – India Scheme with an aim to boost sales of eco-

friendly vehicles in the country. It is a part of the National Mission for Electric Mobility. The schemes under the ministry of heavy industries

Objectives:

1. Encourage Faster adoption of Electric and hybrid vehicle by way of offering upfront Incentive on purchase of Electric vehicles.
2. Establish a necessary charging Infrastructure for electric vehicles.
3. The scheme will help in addressing the issue of environmental pollution and fuel security.

Now Fame II

'Faster Adoption and Manufacturing of Electric Vehicles in India Phase II' scheme for promotion of Electric Mobility in the country. The scheme with total outlay of ₹ 10000 Crores over the period of three years (2019-20 to 2021-22) will be implemented with effect from 1st April 2019.

Salient Features

1. Emphasis on electrification of the public transportation that includes shared transport.
2. In 3-Wheel (W) and 4-Wheel (W) segment incentives will be applicable mainly to vehicles used for public transport or registered for commercial purposes.
3. In the 2-Wheel (W) segment, the focus will be on the private vehicles.
4. To encourage advance technologies, the benefits of incentives, will be extended to only those vehicles which are fitted with advance battery like a Lithium Ion battery and other new technology batteries.
5. The scheme proposes for establishment of charging infrastructure, whereby about 2700 charging stations will be established in metros, other million plus cities, smart cities and cities of Hilly states across the country so that there will be availability of at least one charging station in a grid of 3 km x 3 km.

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6. Establishment of Charging stations are also proposed on major highways connecting major city clusters. On such highways, charging stations will be established on both sides of the road at an interval of about 25 km each.

5.Pradhan Mantri Ujjwala Yojana:

Pradhan Mantri Ujjwala Yojana aims to provide LPG (liquefied petroleum gas) connections to poor households. Under the scheme, an adult woman member of a below poverty line family identified through the Socio-Economic Caste Census (SECC) is given a deposit-free LPG connection with financial assistance of ₹ 1,600 per connection by the Centre.

Identification of households:

Eligible households will be identified in consultation with state governments and Union territories. The scheme is being implemented by the Ministry of Petroleum and Natural Gas.

Key objectives of the scheme are:

1. Empowering women and protecting their health.
2. Reducing the serious health hazards associated with cooking based on fossil fuel.
3. Reducing the number of deaths in India due to unclean cooking fuel.
4. Preventing young children from significant number of acute respiratory illnesses caused due to indoor air pollution by burning the fossil fuel.

Question:

1. What is clean and green energy? And give some government initiatives associated with clean and green energy.



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material

Subject : Environment, Biodiversity and Disaster Management

Topic : Ecological succession

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ECOLOGY SUCCESSION

ECOLOGICAL SUCCESSION

Succession is a universal process of directional change in vegetation, on an ecological time scale. Succession occurs due to large scale changes or destruction (natural or manmade). The process involves a progressive series of changes with one community replacing another until a stable, mature, climax community develops. The process by which communities of plant and animal species in an area are replaced or changed into another over a period of time is known as ecological succession.

The first plant to colonize an area is called the pioneer community. The final stage of succession is called the climax community. A climax community is stable, mature, more complex and long-lasting. The stage leading to the climax community is called successional stages or seral. Each transitional community that is formed and replaced during succession is called a stage in succession or a seral community.

Succession is characterized by the following:

- i. increased productivity,
- ii. the shift of nutrients from the reservoirs,
- iii. increased diversity of organisms, and a
- iv. gradual increase in the complexity of food webs.

Succession would occur faster in area existing in the middle of the large continent. This is because here seeds of plants belonging to the different ser would reach much faster.

Primary succession:

1. Primary succession takes place on over bare or no community has existed previously. Such areas include rock outcrops, newly formed deltas and sand dunes, emerging volcano islands and lava flows, glacial moraines (muddy area exposed by a retreating glacier), etc. In primary succession on a terrestrial site, the new site is first colonized by a few hardy pioneer species that are

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often microbes, lichens and mosses. The pioneers over a few generations alter the habitat conditions by their growth and development. Lichen are plant-like organisms that consist of a symbiotic association of algae (usually green) or cyanobacteria and fungi. Fungi provide shelter, water and minerals to the algae and, in return, the alga provides food.

2. The pioneers through their death and decay leave patches of organic matter in which small animals can live. The organic matter produced by these pioneer species produces organic acids during decomposition that dissolve and etch the substratum releasing nutrients to the substratum. Organic debris accumulates in pockets and crevices, providing soil in which seeds can become lodged and grow. The new conditions may be conducive to the establishment of additional organisms that may subsequently arrive at the site. As the community of organisms continues to develop, it becomes more diverse, and competition increases, but at the same time, new niche opportunities develop. The pioneer species disappear as the habitat conditions change and invasion of new species progresses, leading to the replacement of the preceding community.

Secondary Succession:

Secondary succession is the sequential development of biotic communities after the complete or partial destruction of the existing community. A mature or intermediate community may be destroyed by natural events such as floods, droughts, fires, or storms or by human interventions such as deforestation, agriculture, overgrazing, etc. This abandoned land is first invaded by hardy species of grasses that can survive in bare, sun-baked soil. These grasses may be soon joined by tall grasses and herbaceous plants. These dominate the ecosystem for some years along with mice, rabbits, insects and seed-eating birds. Eventually, some trees come up in this area, seeds of which may be brought by wind or animals. And over the years, a forest community develops. Thus, an abandoned land over a period becomes dominated by trees and is transformed into a forest. Unlike in the primary succession, the secondary succession starts on a well-developed soil already formed at the site. Thus, secondary succession is **relatively faster**.



Autogenic and allogenic succession:

When succession is brought about by living inhabitants of that community itself, the process is called autogenic succession, Autogenic succession is driven by the biotic components of an ecosystem. While change brought about by outside forces is known as allogenic succession. Allogenic succession is driven by the abiotic components (fire, flood) of the ecosystem.

Autotrophic and heterotrophic:

Succession in which, initially the green plants are much greater in quantity is known as autotrophic succession; and the ones in which the heterotrophs are greater in quantity is known as heterotrophic succession.

Succession of Plants

Based on the nature of the habitat – whether it is water (or very wet areas) or it is on very dry areas – succession of plants is called hydrarch or xerarch, respectively.

1. **Hydrarch** succession takes place in moisture areas and the successional series progress from hydric to the mesic conditions.
2. **Xerarch** succession takes place in dry areas and the series progress from xeric to mesic conditions.

Hence, both hydrarch and xerarch successions lead to medium water conditions (mesic) – neither too dry (xeric) nor too wet (hydric).

Question:

1. Write short note on Ecological Succession and its Types.



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : Ecology: Structure and function of Ecosystem

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ECOLOGY – STRUCTURE & FUNCTION OF ECOSYSTEM

ECOLOGY:

Scientific study of the reciprocal relationship between organisms includes Microbes, Plants, Animals, Man with their environment.

STRUCTURE OF ECOSYSTEM

Level of Organization in ecology

Ecology encompasses the study of individual organisms (species), population, community, ecosystem, biome and biosphere which form the various levels of ecological organization.

1. Individual

Organism is an individual living being that has the ability to act or function independently. Species are a group of living organisms consisting of similar individuals capable of exchanging genes or of interbreeding. They are considered as the basic unit of taxonomy and are denoted by a Latin binomial, e.g. *Homo sapiens*.

2. Population

Population is a community of interbreeding organisms (same species), occupying a defined area during a specific time. Population growth rate can be positive due to birth and/or immigration or negative due to death and/or emigration.

3. Community

Communities in most instances are named after the dominant plant form. A Community is not fixed or rigid; community may be large or small. For example, a grassland community is dominated by grasses, though it may contain herbs, trees, etc.

Types of community

On the basis of size and degree of relative independence communities divided in two types:



Major Communities

These are large sized, well organized and relatively independent. They depend only on the sun's energy from outside. E.g. **Tropical evergreen forests.**

Minor Communities

These are dependent on neighboring communities and are often called **societies**. They are secondary aggregations within a major community. E.g. A mat of lichen on a cow dung pad.

4.Ecosystem:

An ecosystem is a structural and functional unit of biosphere consisting of community of living beings and the physical environment, both interacting and exchanging materials between them.

Major components of an ecosystem

The ecosystem is made up of two main components: A. Abiotic Component and B. Biotic Component

A. Abiotic Component: This component of the ecosystem includes the non-living substance of the environment. Example; light, air, soil, water, climate, minerals, etc. Sun is the main source of energy for the earth.

B. Biotic Component: This includes a variety of living organisms such as microorganisms, plants and animals. The biotic component of an ecosystem can be further divided into producers, consumers and decomposers based on their capacity to sustain themselves

a. Producers: Organisms that can produce or manufacture their own food are known as producers. They do not need to eat other organisms to do this. Producers are also called autotrophs. Plants that have green pigments or chlorophyll, produce their own food in the presence of CO₂ in the atmosphere, water from the soil and sunlight through a process called 'photosynthesis'. These green plants are called as 'autotrophs' (auto – self; trophs – nourishing) as they manufacture their own food.



b. Consumers: Consumers are organisms that cannot manufacture their own food and get their food and nutrients from producers directly or from other organisms. All animals are consumers as they cannot produce their own food. They are called as ‘heterotrophs’ (hetero – others; Trophs – nourishing). Consumers can be divided into primary, secondary and tertiary consumers.

1. Primary Consumers Organisms that feed on producers (green plants) are called primary consumers. They are also called as ‘herbivores’ or plant eating organisms. Examples of terrestrial herbivore are grasshopper, sheep, goats, cow, rabbit, deer, elephant etc. Examples of aquatic herbivores are zoo plankton, krill, squid, small fish, sea urchin, etc.

2. Secondary Consumers Animals that kill and eat the herbivores or plant eating animals are called secondary consumers. They are also called as ‘carnivores’, Example; lion, tiger, foxes, frogs, snakes, spider, crocodiles, etc.

3. Tertiary Consumers They are top predators in a food chain. They are carnivores at the topmost level in a food chain that feed on other carnivores or secondary consumers. Example: an owl eats a snake but an owl is eaten by a hawk, therefore a hawk is a tertiary consumer. Tertiary consumers that occupy the top trophic level, and are not predated by any other animals are called ‘apex predators’.

However, when they die their bodies will be consumed by scavengers besides the decomposers Example: alligator and hawk. Some organisms eat both plants and animals. These animals are called as omnivores. Example: cockroach, foxes, seagull and human.

Some omnivores are ‘scavengers’, which eat food that other animals have left behind Example: hyena and vultures. Plants and animals that live on or inside other plants or animals are called as Parasites. Example: mistletoe lives on other plants. Other examples are tapeworms, round worms, lice, ticks, flea etc.

‘Detritivores’ are consumers that feed on detritus. Detritus includes fallen leaves, parts of dead trees and faecal wastes of animals. Ants, termites, earthworms, millipedes, dung beetle, fiddler crabs and sea cucumbers are detritivores.



4. Decomposers: Decomposers are organisms that help decompose dead or decaying organisms. Decomposers are also heterotrophs. Decomposers are nature's built-in recycling system. By breaking down materials – decomposers return nutrients to the soil. They, in turn, create another food source for producers within the ecosystem. Mushrooms, yeast, mould, fungi and bacteria are common decomposers.

Types of Ecosystem:

Ecosystems can be either natural or artificial.

Natural ecosystem

Ecosystem originated without human intervention is called a natural ecosystem. This can be an aquatic ecosystem or a terrestrial ecosystem. The ecosystem in water is called aquatic ecosystem. Sea, river, lake, pond and puddle are some examples of natural aquatic ecosystem. Ecosystems outside the water body and on land are called terrestrial ecosystems. Forests, Mountain regions, Deserts etc., are examples of natural terrestrial ecosystems.

Artificial ecosystem

Artificial ecosystems are created and maintained by human. They have some of the characteristics of natural ecosystems. They are much simpler than the natural ecosystems. These can be the terrestrial ecosystems such as paddy fields, gardens etc. or the aquatic ecosystem such as fish tank.

Ecotone:

The zone of junction between two or more diverse ecosystems called ecotone.

Characteristics of ecotone:

1. It may be very narrow or quite wide.
2. It has the conditions intermediate to the adjacent ecosystems. Hence it is a zone of tension.
3. It is a linear as it shows progressive increase in species composition one in coming community and simultaneous decrease in species of the other outgoing adjoining community.

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4.Edge Effect:

The number of species and the population density of some the species is much greater in this zone than either community.

Niche:

A niche is the unique functional role or place of a species in an ecosystem. The physical, chemical and biological factors that a species needs to survive, stay healthy, and reproduce. A niche is unique for a species, which means no two species have exact identical niches. Niche plays important role conservation of organism.

Types of Niche:

1. Habitat niche-Where it lives
2. Food niche-what it eats or decomposes and what species it competes with.
3. Reproductive niche-how and when it reproduces
4. Physical and chemical niche-temperature, land, shape, land slope, humidity and other equipment.

Biomes:

A biome is a geographically extensive ecosystem where all flora and fauna are found collectively. It is the total assemblage of plant and animal life interacting within the biosphere. Biomes are defined by abiotic factors like, relief, climate, soils and vegetation. They are classified into two broad categories, terrestrial biomes and aquatic biomes.

Types of Biomes

World Biomes are mega ecosystems existing and operating over large areas. These divisions are based on climate pattern, soil types, and the animals and plants that inhabit an area. Basically, biomes are classified into two major groups such as Aquatic biomes and Terrestrial biomes. Wetlands are transition zones between aquatic and terrestrial biomes

To understand the earth biomes, it is necessary to understand the following:

1. The characteristics of regional climates.
2. Aspects of the physical environment.
3. The type of soil and the processes contributing to soil development.
4. The distribution of flora in the area.
5. The distribution of fauna in the area and their adaptation to the environment.



A. Aquatic Biomes

The aquatic biomes are the most important of all the biomes as, the water forms the vital resource and is essential for any life form. Since many types of species live in the water, it is one of the most important natural resources that need to be protected.

Aquatic Biome is further divided into:

- a. Fresh Water Biome
- b. Marine Biome
- c. Corals
- d. Wetlands
- e. Estuaries.
- f. Mangroves

a. Fresh Water Biome:

These biomes are spread over all parts of the earth and have different set of species depending on their location and climate. Fresh water Ecosystem are classified as lotic (moving water) includes streams, springs, rivulets, creeks, brooks, and rivers., and lentic (stagnant water) includes ponds, pools, ponds, some swamps. Lakes and ponds are stagnant water bodies and are smaller in their area. The diversity of life forms in river changes with increasing water volume. For example, Dolphins are found in the river Ganges, Brahmaputra and the Indus which carry huge volumes of water.

b. Marine Biome

The Marine biome is an aquatic biome which is salt water biome occupying seas and oceans of the world. Nearly three quarter of earth's surface is covered by ocean with an average depth of 3750 m and with salinity 35ppt, about 90 percent of which is sodium chloride. Marine biome plants have various roles, plants such as sea grasses and macro algae give shelter and nutrient for many animals.

c. Corals

Marine plants are sources of nutrients for the corals and help corals to build up reefs. The reefs are kept intact by plants like coralline algae. Corals are marine invertebrates which live in compact colonies. They inhabit tropical oceans and seas.



Corals cannot survive in waters below 20°C but grow optimally in temperatures between 23°–29° Celsius. Coral reefs are marine ecosystems which are held together by structures made of calcium carbonate secreted by the corals. Coral reefs are mainly classified into three types – Fringing reef, Barrier reef and Atoll.

Fringing reefs grow seaward from the shore along the coast forming a fringe. They are the common type of reefs.

Barrier reefs also border the shoreline but are separated from the coast by an expanse of water or lagoon.

Atolls are coral reefs that are circular in shape enclosing a lagoon with absence of an island in the center. Marine biome includes fishes, whales, crustaceans, molluscs, sea anemones, fungi and bacteria. Marine species are continuously impacted by change in climatic condition and the oceans are frequently disturbed by ocean waves and currents.

d. Wetlands

A wetland is an area of land which is permanently or periodically saturated with water and exists as a distinct ecosystem. Wetlands play many roles in the environment, such as water purification, flood control, carbon sink and shoreline stability. Wetlands are home to a wide range of aquatic plants and animal life. Wetlands can be freshwater, brackish, or saltwater. Examples of aquatic vegetation that thrive in wetlands are milkweed, bald cypress trees, mangroves and cattails.

e. Estuaries

Coastal bays, river mouths, and tidal marshes form the estuaries. In estuaries fresh water from rivers meet ocean water and the two are mixed by action of tides. Estuaries are highly productive as compared to the adjacent river or sea.

B. Terrestrial Biome

Terrestrial biomes are a group of living organisms that live and interact with one another on land. They are mainly determined by temperature and rainfall. Terrestrial biomes are very large ecosystems over land and they vary according to latitude and climate. They can be divided into numerous sub-types. In this lesson they are broadly divided into eight types.



i. Tropical Evergreen Rain Forest Biome

Tropical Evergreen Rain Forest Biome extends between 10° North and South of the equator.

Regions:

This biome is seen in the Amazon Basin of South America, Congo Basin of Africa and the Indo Malaysian Region of Southeast Asia (Java, Sumatra, Borneo, Malaysia and Guinea)

Characteristics:

This biome receives direct sunlight throughout the year and so temperatures are high year-round. The average annual temperature is 20°C to 30°C. The average annual rainfall of the tropical evergreen rain forest is 200 cm. The Tropical Evergreen Rain Forest Biome has the largest number of plant and animal species. Broad leaved, tall evergreen hard wood trees are found in this biome. Trees grow up to 20 to 35 meters high. The forest is characterized by thick undergrowth and creepers.

The main trees in this biome are mahogany, rose wood, ebony, cinchona, rubber, coconut palm, cane, bamboo etc. This forest biome has innumerable insects, birds, reptiles and furless animals. At the edge of the forest animals like gorilla, and monkey are found.

Tribes:

Important tribes inhabit this biome, for example the Pygmies in the jungles of Africa and the Yanomani and Tikuna tribes of the Amazon region. Traditionally they live by hunting and gathering food. In the recent years in South East Asia, the tropical evergreen rainforest has been slowly replaced by rubber and sugarcane plantations. The human settlements in this biome are small and scattered.

ii. Tropical deciduous Forest/Monsoon Forest Tropical Monsoon forest

Tropical deciduous forest is found in the regions experiencing monsoon climate. This biome is also called as the dry forest or monsoon forest biome.

Regions:

This is found in South and South East Asia in parts of India, Myanmar, Vietnam, Thailand, Cambodia and southern coastal China. It is also found in eastern Brazil and in



smaller areas in South and Central America, the West Indies, southeastern Africa, and northern Australia.

Characteristics:

In this biome, the temperature varies from one season to another season. In summer the maximum temperature ranges from 38°C to 48°C. Summer season is warm and humid. In the dry winter season temperature ranges between 10°C to 27°C. The total amount of precipitation is 75 to 150 cm/year and this affects the natural vegetation of the tropical deciduous forest biome. The plants shed their leaves during the dry season. Trees here have huge trunks with thick rough barks.

The plants grow at three different levels. The common trees are teak, sal, sandalwood, mahua (illupai), Mango, Wattle, Bamboo, semal (Illavamaram), sheesham (Karuvellamaram) and banyan. The animals of this biome are elephant, lion, tiger, leopards, bison, tapier, hippopotamus, wild boar, flying squirrel along with a wide variety of bird species. This biome faces rapid rate of deforestation and is, therefore, one of the most disturbed ecosystems in the world. Large tracts of forests have been destroyed for agriculture and urban development. Several species of precious animals have now become endangered Example: lions, tigers, leopards, etc.

iii. Temperate Deciduous Forest Biome

The temperate deciduous forest is a biome that is always changing. This biome lies in the mid- latitude areas of the earth, between the tropics and Arctic Circle i.e., between 30° and 50° north and south of the equator.

Regions:

The temperate deciduous forest biome can be seen in the eastern United States, most parts of Europe, China, Japan, North and South Korea. The average annual temperature is 10°C.

Characteristics:

These biomes have four seasons such as winter, spring, summer and fall. Winters are cold and summers are warm. As winter approaches, the duration of day light decreases. In this biome, deciduous trees shed their leaves in the fall. The production of chlorophyll in the leaves slows and eventually stops revealing leaves having bright red,

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yellow and orange colors. These forests are also known as broad leaved forest, because the trees have wide flat leaves.

Some important trees found here are oak, maple, beech, hickory, cedar and chestnut. On the forest floors that receive very little sunlight are found mosses, azaleas and mountain laurels. Inhabiting the temperate deciduous forest are ants, insects, flies, bees, wasps, cicadas, walking sticks, moths, butterfly, dragon flies, mosquitoes and praying mantises. Frogs, toads, snakes and salamanders are some of the reptiles in this biome.

Common birds found in this biome are woodpecker, robin, jays, cardinals, owls, turkeys, hawks and eagles. Small mammals like rabbits, otters, monkeys, beavers, squirrels and porcupine are also seen in this biome along with bears, grey fox, wolves, white tailed deer and moose. Animals that live in this biome adapt to the changing seasons. Some animals migrate or hibernate in winter. Most of these forests on the earth are cleared for agriculture. The soil here is very fertile. This is one of the most important agricultural regions of the world.

Grasslands

Grasslands are found bordering the deserts and make up for one fourth of the natural vegetation of the earth. Those that lie in the low latitudes are called tropical grasslands and the ones which lie in the mid latitudes are called temperate grasslands.

iv Tropical Grassland Biome or Savanna Biome

The tropical grass land biome is generally referred to as the Savanna biome. A savanna is a rolling topography that features vast open grasslands scattered with small shrubs and isolated trees.

Region:

It is found between the tropical rainforest and desert biome. Tropical grassland biomes are mainly found in Africa, South America and Australia. Tropical grasslands in Africa is known as the savannas. Tropical grasslands are called as llanos in Columbia and Venezuela and as Campos in Brazil of South America.



Characteristics:

Savanna biomes experience warm temperature year around. It has very long and dry winter season and a very wet summer season. The grass here is very tall often one or two metres tall scattered with small shrubs and isolated umbrella shaped trees like the acacia and the baobab trees which store water in their trunks.

Most of the animals in the savanna have long legs, like the giraffe and kangaroo. The carnivorous animals like lions, leopards, cheetahs, jackal and hyenas live in this biome. Zebras and elephants are also found in this biome. In many parts of the savannas of Africa people have started using the grassland for grazing their cattle and goats. Due to overgrazing in this region most of the tropical grasslands here are lost to the Sahara Desert year after year.

v. Temperate Grassland Biome or Steppe

Region

The temperate grassland biomes are generally found in the interior of the continents in the mid latitudes.

Characteristics:

These grassland biomes are found in the transitional zone between the humid coastal areas and the mid latitude deserts. The temperate grasslands are known as Steppes in Europe and Asia, Prairies in North America (Canada and USA), Pampas in South America, Veldts in South Africa, Downs in Australia and Puszta in Hungary. The annual range of temperature is quite large with summer temperature reaching as high as 38°C and winter temperatures falling down to -40° C. The rainfall is moderate from 25 cm to 50 cm. Grasses form a major part of the vegetation in the temperate grasslands. The height of the grasses depends upon the amount and distribution of rainfall.

The animals in this area include the bison, wolves of the Prairies of North America. The other animals and birds are coyotes, prairie dog, foxes, mice, rabbits, badgers, rattle snakes, pocket gophers, weasel, grasshoppers, quails and hawks.



vi. Tropical Desert Biome

A tropical desert is the hottest and driest place on earth where rainfall is very scanty and irregular.

Regions:

This biome is typically found in the western parts of the continents within the tropics. In the northern hemisphere, the Afro – Asian deserts form the longest belt which includes the Sahara Desert, Arabian desert and the Thar deserts. In North America the tropical deserts cover, California, Arizona and New Mexico states of USA and it further extends to Mexico. The deserts in the southern hemisphere are, the Atacama Desert west of Andes mountains in South America, the Namibian and the Kalahari deserts in southern Africa and the Great Australian desert in the central and southern parts of Australia.

Characteristics:

The tropical deserts are not conducive for the growth of vegetation due to shortage of water. The plants found here are the xerophytes which have their own moisture conserving methods such as long roots, thick barks, waxy leaves, thorns and small leaves so as to avoid evaporation-transpiration. The main trees and bushes found in this region are acacia, cacti, date palm, kikar, babul etc. The animals in this biome are limited in number. They are able to bear the drought and the heat of the desert. Animals like the camel, antelopes, fox, spotted hyena, fallow deer, cape hare, hedgehog etc., live in the desert. The tropical desert biomes are agriculturally unproductive except in and near the oasis. In the oasis, cultivation is carried through irrigation either from streams or from underground sources. Date palms are widely grown here. The people in the deserts are generally nomads living in tents and moving from place to place. They are the Berbers of North Africa, the Bedouins of the Arabian deserts, the Damara in Namibia, the Bushman of the Kalahari Desert and the Aborigines of Australia. They practice food gathering and hunting while some herd cattle, goats and camel and some of them practice very simple subsistence farming.

vii. Taiga or Boreal Forest Biome

The taiga biome is the largest terrestrial biome and extends across Europe, North America and Asia. The taiga biome is also known as coniferous forest or boreal forest biome.



Regions:

It extends from about 50° to 55° North to 65 ° to 70° North latitudes. This region lies between the temperate grassland in the south and the polar tundra in the north. The taiga region is absent in the southern hemisphere mainly because of the narrowing of continents towards the South Pole.

Characteristics:

This biome has short wet summer and long cold winters. The taiga region has low mean annual precipitation ranging between 35 cm and 60 cm and the rainfall occurs mostly in summer. It receives plenty of snow during winter. The taiga or boreal forest biome consists mainly of evergreen coniferous forests. The important coniferous trees in this biome are pines, spruces, firs, maples and cedars. During the short summer season snow melts and this helps lichens, mosses and short grasses to grow and cover the ground. These are called meadows. Taiga is the home of some larger animals like moose, deer, and bears, while smaller animals like bobcats, squirrels, chipmunks, ermine, and moles are also found. Animals of the taiga have specialised adaptation including lot of thick fur or feathers and the ability to change colours during different seasons example ermine.

Lumbering is the main occupation of the people in areas which are easily accessible. The softwood from the coniferous forests is widely used in the manufacture of wood pulp and paper, newsprint, matches, furniture and building materials. The hunting of fur bearing animals like musk rats, ermine, and silver fox are important economic activities. The taiga forest is endangered due to logging and mining by humans. When trees are cut down in the taiga it takes a very long time to restore itself because of the very short growing season.

viii. Tundra Biome

Tundra is a Finnish word which means barren land.

Region:

The tundra region is a vast bowl lying beyond the Arctic Circle (66.5° North latitude) in the northern hemisphere along the shores of the Arctic Ocean. The Arctic tundra extends southwards from North Pole to the Taiga forest. Tundra is also found in the high altitudes especially in the Alpine region.



Characteristics:

Due to long and severe cold winters, this region is treeless and has very little vegetation. The growing season for plants is very short. Natural vegetation mainly consists of shrubs, sedges, grasses, mosses and lichens. The main features of this climate in the tundra region are the general absence of insolation and presence of very low temperature throughout the year. The average annual temperature is about -12°C . The ground surface is covered with snow for at least 8 to 9 months in a year.

In this biome, the sub soil remains permanently frozen and is known as permafrost. Permafrost tundra covers vast barren areas of northern Russia and Canada. Algae and fungi are found on the rocky cliffs and rosette plants grow in rock and gravel beds. Spongy turf and lichen develop in the drier inland tundra. Animals common to Arctic tundra are the polar bear, arctic wolf, arctic fox, arctic hare and arctic weasel.

Large herbivores such as musk oxen, caribou and reindeer are found. Lemmings are also found in this Biome. Insects like moths, butterflies, beetles, mosquitoes and black flies are common in the Arctic tundra. Migratory birds include tundra swans, harlequin ducks, sand pipers, plovers, geese and gulls. The Antarctic region is covered with ice sheets. It is too cold and dry to support vegetation. However, some portions of the continent have areas of rocky soil that support plant life. Vegetation comprises of mosses, lichens and liverworts. This area is referred to as Antarctic tundra. Seals and Penguins inhabit the shore areas of Antarctica.

Biosphere:

The word Biosphere originates from the Greek words bios = life and sphaira = sphere. Earth is the only planet in the solar system that supports life. There are many reasons that contribute to this and the most important being the earth's distance from the sun, the presence of oxygen in the atmosphere and the presence of water. The above factors, along with the existence and interaction of the three spheres of the earth (the lithosphere, hydrosphere and atmosphere) gives rise to the fourth sphere which is the life sphere or biosphere. The term Biosphere was coined by Eduard Suess in 1875. Later contributions to the study of biosphere were from, Charles Darwin and many other scientists. Thus, in the biosphere, life exists on land, water and air and life forms range from microorganisms

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to plants, animals, birds, amphibians, reptiles and mammals including human beings. The biosphere is formed of biotic components. It consists of organisms, population, community and ecosystem.

Organism – includes animals, plants and microorganisms.

Population – is a group of similar plants or animals living in an area.

Community – refers to all the plants and animals living in an area.

Ecosystem – all living and non living things and their interaction within an area.

FUNCTION OF ECOSYSTEM

The function of ecosystem is a broad, vast and complete dynamic system.

The functions are:

1. Energy flow
2. Pollutants and trophic level
3. Food chain
4. Food web
5. Energy pyramids
6. Nutrient cycling
7. Ecological succession

1. Energy Flow:

Energy is a path way along which the energy flows through the organisms from producers to top carnivores called energy flow which is Unidirectional. Energy is basic force responsibilities for all metabolic activities. The available energy in a food chain decreases with each step or trophic levels up in the food chain. As such, there is less energy available to support organisms at the top of the food chain. That is why the tertiary and quaternary consumers are far less in number in an ecosystem than organisms at lower trophic levels.

The food chain begins with the energy given by the Sun. Sunlight triggers photosynthesis in plants. The energy from the Sun is stored in the plant parts. When the grasshopper eats the grass, the energy flows from grass to grasshopper. Frog gets energy by eating grasshopper. This energy is transferred to a crow, when the frog is eaten by a

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crow. Thus, we conclude the primary energy production in the world of living things is made by plants; that is by photosynthesis.

The microorganism reduces the excreta and the dead bodies of animals into primary simple components and puts them back into soil. It is this material that help the plants to grow. Thus, we can see that there is a cycle of materials from primary producers to highest level predators, then back to soil.

2.Pollutants and Trophic level

Pollutants especially non degradable ones move through the various trophic levels in ecosystem. non degradable pollutants mean materials which cannot be metabolized by the living organism.

Movement of pollutants involves two main processes

1.Bio Accumulation: It refers to how pollutants enter a food chain, there is increase in concentration of a pollutants from the environment to the first organism in a food chain.

2.Biomagnification: It refers to the tendency of pollutants to concentrate as they move from one trophic level to another trophic level. It increases the concentration of a pollutant from one link in a food chain to another.

Trophic level: The study of trophic level interaction in an ecosystem gives an idea about energy flow through the ecosystems also deals with how the members of an ecosystem are connected based on nutritional needs.

Trophic levels:

1. Autotrophs-green plants(producers)
2. Heterotrophs
 - a. Herbivore (primary consumers)
 - b. Carnivore (secondary consumers)
 - c. Carnivores (tertiary consumers)
 - d. Top carnivores (quaternary consumers)

Energy flow through the trophic levels from producers to subsequent trophic levels. The energy always flows from lower to higher trophic level.



3.Food chain:

A food chain describes the flow of food in an ecosystem. This flow or feeding structure in an ecosystem is called 'trophic structure'. Each level in this structure is called a trophic level. In any ecosystem there is a chain like relationship between the organisms that live there. This sequence of who eats whom in an ecosystem is called as food chain. It describes how organisms get energy and nutrients by eating other organisms. A food chain shows the relationship between producers (e.g. grass) and consumers (e.g. deer, goats, cows and tiger).

Types of food chain:

Grazing food chain:

Consumer which start the food chain, utilizing the green plant or plant part as their food constitute the grazing food chain. Example: Plant (primary producer) is eaten by a rabbit (herbivores, primary consumer), rabbit is eaten by a snake (carnivores, consumer or primary carnivore) and the snake is eaten by a hawk (tertiary consumer).

Aquatic food chain:

In aquatic ecosystem phyto-planktons is eaten by zoo planktons which is eaten by fishes and fishes are eaten by pelicans. Eg - phytoplankton zooplankton fish pelican

Detritus food chain:

It starts from dead organic matter of decaying animals and plant bodies consumed by the microorganisms and then to detritus feeding organism called detritivores or decomposer.

Litter →earthworms → chicken→ hawk

Importance of food chain

1. Learning food chain help us to understand the feeding relationship and interaction between organisms in any ecosystem.
2. Understanding the food chain also helps us to appreciate the energy flow and nutrient circulation in an ecosystem. This is important because pollution impacts the ecosystem.
3. The food chain can be used to understand the movement of toxic substances and their impacts.



4.Food web

A Food Web is a complex network of interconnected food chains. Food chains show a direct transfer of energy between organisms. In a food web, the mouse might eat seeds, but it also might eat some grains, or maybe even some grass. The mouse might be eaten by a snake, or the eagle, or even a fox. The snake could be eaten by the eagle, but also might be eaten by a fox in the forest. Since each organism can eat multiple organisms and be eaten by multiple organisms, a food web is a much more realistic scheme of the transfer of energy within an ecosystem.

Food chains and food webs are found in both terrestrial and aquatic ecosystems. Organisms in a food chain or food web are linked and dependent on one another for survival. If organisms in one trophic level become threatened, it impacts the organisms in other trophic levels. Primary consumers get less food due to loss or destruction of habitat. This in turn means less primary consumers for secondary and tertiary consumers to feed.

The plant and animal species in such an environment could become endangered or even extinct. For this reason, it is vital that an ecosystem remains balanced containing an appropriate proportion of producers and consumers. Consumers have different sources of food in an ecosystem and do not rely on only one species for their food. If we put all the food chains within an ecosystem together, then we end up with many interconnected food chains. This is called a food web.

A food web is very useful to show the many different feeding relationships between different species within an ecosystem.

5.Ecological pyramids:

The steps of trophic levels expressed in a diagrammatic way referred as ecological pyramid. The pyramid consists of a number of horizontal bars depicting specific trophic levels which are arranged sequentially from primary producer level, through herbivore, carnivore onwards. The length of each bar represents the total number of individuals at each trophic level in an ecosystem.

The ecological pyramids are three categories:

1. Pyramid of numbers

Pyramids of numbers upright:

The number of individuals decreased from lower level to higher level. This type of pyramid can be seen in grassland ecosystem.



The number of individuals is increased from lower level to higher trophic level. This type of pyramid can be seen in parasites.

2. Pyramid of biomass

To overcome the shortcomings of pyramid of numbers, the pyramid of biomass is used in this method each trophic level weighed instead of being counted. pyramid of biomass means the total dry weight of all organism at each trophic level at particular time. Biomass is measured in g/m². The upward biomass is in terrestrial ecosystem, the inverted pyramid is in aquatic ecosystems.

3. Pyramid of energy

Energy pyramids are another tool that ecologists use to understand the role of organisms within an ecosystem. An energy pyramid reflects the laws of thermodynamics with conversion of solar energy to chemical energy and heat energy at each trophic level and with loss of energy being depicted at each transfer to another trophic level. Hence the pyramid is always upward, with a large energy base at the bottom.

The most of the energy in an ecosystem is available at the producer level. As you move up on the pyramid, the amount of available energy decreases significantly. It is estimated that only about 10% of the energy available at one trophic level gets transferred to the next level of the energy pyramid. The remaining 90 percent of energy is either utilized by the organisms within that level for respiration and other metabolic activities or lost to the environment as heat. The energy pyramid shows how ecosystems naturally limit the number of each type of organism it can sustain.

6. Bio Geochemical Cycles:

Nutrients move through the ecosystem in cycles is called 'biogeochemical cycles'. A biogeochemical cycle is a circuit or pathway by which a chemical element moves through the biotic and the abiotic components of an ecosystem. All life processes are associated with the atmosphere by important cycles such as the Carbon, Oxygen, Nitrogen cycles etc. Through these cycles energy and materials are transferred, stored and released into various ecosystems.

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Types of nutrient cycle:

Based on the replacement period a nutrient cycle is referred to as perfect or imperfect cycle.

A perfect nutrient cycle:

The nutrients are replaced as fast as they are utilized most gaseous cycles are considered as perfect cycles. The gaseous cycles where the reservoir is the atmosphere or the hydrosphere. The gaseous cycles are water, carbon, nitrogen.

Water Cycle

Water cycle or hydrological cycle is the continuous movement of water on earth. In this process, water moves from one reservoir to another, from river to ocean or from ocean to the atmosphere by processes such as evaporation, sublimation, transpiration, condensation, precipitation, surface runoff and infiltration, during which water converts itself to various forms like liquid, solid and vapour.

Evaporation

Evaporation is a type of vaporization, where liquid is converted to gas before reaching its boiling point. Water evaporates from the surface of the earth and water bodies such as the oceans, seas, lakes, ponds and rivers turn into water vapour.

Sublimation

Sublimation is conversion of solid to gas, without passing through the intermediate liquid phase. Ice sheets and ice caps from north and south poles, and icecaps on mountains, get converted into water vapour directly, without converting into liquid.

Transpiration

Transpiration is the process by which plants release water vapour to atmosphere through small pores in leaves and stems.

Condensation

Condensation is the changing of gas phase into liquid phase and is the reverse of vaporisation. At higher altitudes, the temperature is low. The water vapour present there condenses to form very tiny particles of water droplets. These particles come close together to form clouds and fog.

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Precipitation

Due to change in wind or temperature, clouds combine to make bigger droplets, and pour down as precipitation(rain). Precipitation includes drizzle, rain, snow and hail.

Run off

As the water pours down, it runs over the surface of earth. Runoff water combines to form channels, rivers, lakes and ends up into seas and oceans.

Infiltration

Some of the precipitated water moves deep into the soil. Then it moves down and increases the ground water level.

Percolation

Some of the precipitated water flows through soil and porous or fractured rock. Infiltration and percolation are two related but different processes describing the movement of water through soil.

Human impacts on water cycle

Major human activities affecting the water cycle on land are urbanization, dumping of plastic waste on land and into water, polluting water bodies and deforestation.

1. Nitrogen Cycle

Nitrogen is primary nutrient important for survival of all living organisms. It is an essential component of proteins, DNA and chlorophyll. Atmosphere is a rich source of nitrogen and contains about 78% nitrogen. Plants and animals cannot utilize atmospheric nitrogen. They can use it only if it is in the form of ammonia, amino acids or nitrates. Processes involved in nitrogen cycle are explained below.

Nitrogen fixation

Nitrogen fixation is the conversion of atmospheric nitrogen, which is in inert form into reactive compounds available to living organisms. This conversion is done by a number of bacteria and blue green algae (Cyanobacteria). Leguminous plants like pea and beans have a symbiotic relationship with nitrogen fixing bacteria Rhizobium. Rhizobia occur in the root nodules of leguminous plants and fixes nitrogenous compounds.

Nitrogen assimilation

Plants absorb nitrate ions and use them for making organic matter like proteins and nucleic acids. Herbivorous animals convert plant proteins into animal proteins. Carnivorous animals synthesize proteins from their food.

Ammonification

The process of decomposition of nitrogenous waste by putrefying bacteria and fungi into ammonium compounds is called ammonification. Animal proteins are excreted in the form of urea, uric acid or ammonia. The putrefying bacteria and fungi decompose these animal proteins, dead animals and plants into ammonium compounds.

Nitrification

The ammonium compounds formed by ammonification process are oxidized to soluble nitrates. This process of nitrate formation is known as nitrification. The bacteria responsible for nitrification are called as nitrifying bacteria.

Denitrification

Free living soil bacteria such as *Pseudomonas* reduce nitrate ions of soil into gaseous nitrogen which enters the atmosphere.

Human impacts on nitrogen cycle

Burning fossil fuels, application of nitrogen-based fertilizers and other activities can increase the amount of biologically available nitrogen in an ecosystem. Nitrogen applied to agricultural fields enters rivers and marine systems. It alters the biodiversity, changes the food web structure and destroys the general habitat.

Microorganisms involved in nitrogen cycle

Role played in nitrogen cycle

Nitrogen fixation

Ammonification

Name of the microorganisms

Azotobacter (in soil)

Rhizobium (in root nodules)

Blue green algae- *Nostoc*

Putrefying bacteria

	Fungi
	Nitrifying bacteria
Nitrification	Nitrosomonas
	Nitrobacter
Denitrification	Denitrifying bacteria
	Pseudomonas

2. Carbon cycle:

Carbon is exchanged, or cycled among all the spheres of the earth. All living organisms are built of carbon compounds. It is the fundamental building block of life and an important component of many chemical processes. Living things need carbon to live, grow and reproduce. Carbon is a finite resource that cycles through the earth in many forms.

Carbon is an essential element in all organic compounds and since there is only a limited amount available it must be recycled continuously. This takes place in the biosphere. Atmospheric carbon is fixed in green plants through photosynthesis. This carbon is passed on to other living organisms through the food chain. The carbon food compound is utilized and later released to the atmosphere through the process of respiration.

By-products of respiration are carbon- dioxide and water which are returned to the air. A carbon cycle is completed by decomposers like bacteria and fungi which break down dead plants and animal tissues there by releasing some carbon to the air, water and soil. All producers and consumers are not decomposed. The organic matter of some of them is preserved in fossil fuels such as coal and petroleum for millions of years.

In a carbon cycle, carbon moves between reservoirs. Carbon reservoirs include the atmosphere, the oceans, vegetation, rocks, and soil. Today, the carbon cycle is changing. Human activities have added more carbon into the atmosphere. More carbon is moving to the atmosphere when fossil fuels, like coal and oil, are burned. More carbon is moving to the atmosphere as humans destroy the forest. This increase in carbon in the atmosphere causes the earth to warm up more than the normal level, leading to climate change and many problems connected with it.

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An imperfect nutrient cycle:

The cycle also known as sedimentary cycle. Some nutrients are lost from the cycle and get locked into sediments and so became available for immediate cycling. In sedimentary cycle where the reservoir is the earth's crust. The sedimentary cycles are phosphorus and Sulphur cycle.

1. Phosphorous Cycle:

Phosphorous plays a central role in aquatic ecosystems and water quality. Unlike carbon and nitrogen, which come primarily from the atmosphere, phosphorous occurs in large amounts as a mineral in phosphate rocks and enters the cycle from erosion and mining activities. This is the nutrient considered to be the main cause of excessive growth of rooted and free-floating microscopic plants (phytoplankton) in lakes (leads to eutrophication). The main storage for phosphorus is in the earth's crust. On land, phosphorus is usually found in the form of phosphates. By the process of weathering and erosion, phosphates enter rivers, streams and finally oceans. In the ocean, phosphorus accumulates on continental shelves in the form of insoluble deposits. After millions of years, the crustal plates rise from the seafloor and expose the phosphates on land. After more time, weathering will release them from rock, and the cycle's geochemical phase begins again.

2. Sulphur Cycle

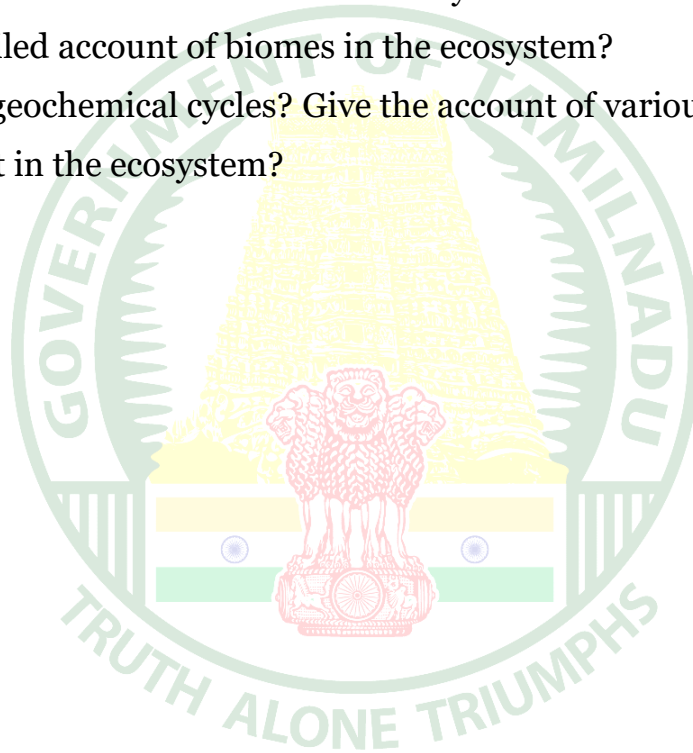
The sulphur reservoir is in the soil and sediments where it is locked in organic (coal, oil and peat) and inorganic deposits (pyrite rock and sulphur rock) in the form of sulphates, sulphides and organic sulphur. It is released by weathering of rocks, erosional runoff and decomposition of organic matter and is carried to terrestrial and aquatic ecosystems in salt solution. The sulphur cycle is mostly sedimentary except two of its compounds, hydrogen sulphide (H_2S) and sulphur dioxide (SO_2), which add a gaseous component. Sulphur enters the atmosphere from several sources like volcanic eruptions, combustion of fossil fuels (coal, diesel etc.), from the surface of the ocean and gases released by decomposition. Atmospheric hydrogen sulphide also gets oxidized into sulphur dioxide. Atmospheric sulphur dioxide is carried back to the earth after being dissolved in rainwater as weak sulphuric acid (acid rain). Whatever the source, sulphur in

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the form of sulphates is taken up by plants and incorporated through a series of metabolic processes into sulphur bearing amino acid which is incorporated in the proteins of autotroph tissues. It then passes through the grazing food chain. Sulphur bound in a living organism is carried back to the soil, to the bottom of ponds and lakes and seas through excretion and decomposition of dead organic material.

Questions:

1. What Is Ecology? Explain the Functions of Ecosystem?
2. Explain the Function and Structure of Ecosystem.
3. Give the detailed account of biomes in the ecosystem?
4. What are biogeochemical cycles? Give the account of various biogeochemical cycles present in the ecosystem?





Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : Environmental Clearance and Auditing

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ENVIRONMENTAL CLEARANCE

ENVIRONMENTAL CLEARANCE

Environmental clearance is the procedure for obtaining government clearance for certain projects to be 'installed' and 'modified'. For projects that can cause high environmental pollution, environmental clearance is mandatory.

Environmental Clearance on the basis of environmental impact assessment is mandatory for various development projects. A beginning in this direction was made in our country with the impact assessment of river valley projects in 1978-79 and the scope has subsequently been enhanced to cover other developmental sectors such as industries, thermal power projects, mining schemes, etc.

ENVIRONMENTAL AUDITING:

Environmental auditing is essentially an environmental management tool for measuring the effects of certain activities on the environment against set criteria or standards. Depending on the types of standards and the focus of the audit, there are different types of environmental audit. Organizations of all kinds now recognize the importance of environmental matters and accept that their environmental performance will be scrutinized by a wide range of interested parties. Environmental auditing is carried out when a development is already in place, and is used to check on existing practices, assessing the environmental effects of current activities (ex post). Environmental auditing therefore provides a 'snap-shot' of looking at what is happening at that point in time in an organization.

Environmental auditing is used to

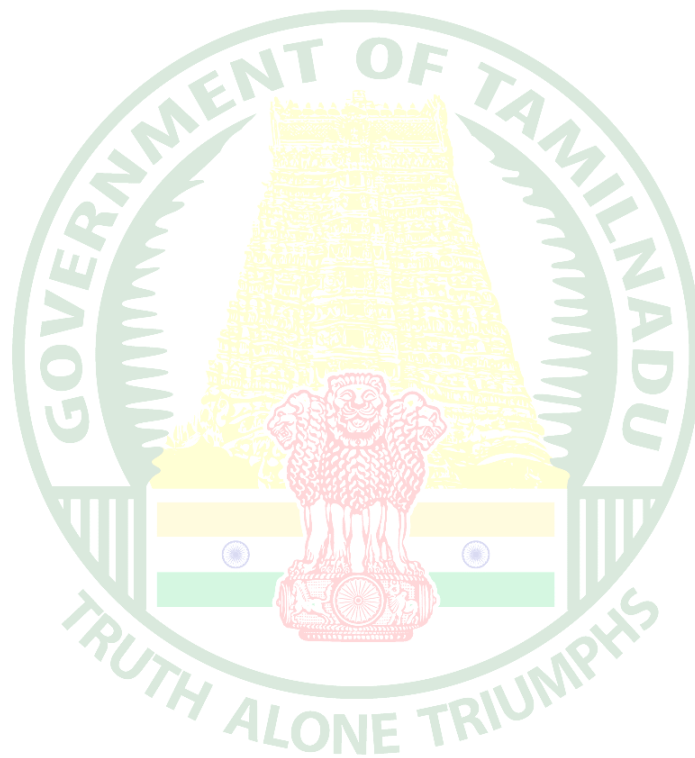
1. investigate
2. understand
3. identify

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These are used to help improve existing human activities, with the aim of reducing the adverse effects of these activities on the environment. An environmental auditor will study an organizations environmental effects in a systematic and documented manner and will produce an environmental audit report. There are many reasons for undertaking an environmental audit, which include issues such as environmental legislation and pressure from customers.

Question:

1. Give short notes on Environmental Auditing and Environmental clearance.





Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material

Subject : Environment, Biodiversity and Disaster Management

Topic : Environmental consequences of climate change and mitigation measures

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ENVIRONMENTAL CONSEQUENCES OF CLIMATE CHANGE AND MITIGATION MEASURES

ENVIRONMENTAL CONSEQUENCES OF CLIMATE CHANGE AND MITIGATION MEASURES:

Reasons for Climate Change

Burning fossil fuels emits gases into the atmosphere. Burning fossil fuel to provide energy, coupled with the effects of major transportation and deforestation causes a rapid increase in global temperatures. This can change the climate of a place.

Effects of climate change

Scientists had predicted in the past that the result from global climate change are now occurring, loss of sea ice, accelerated sea level rise and longer, more intense heat waves.

- 1. Temperatures will continue to rise** -Experts agree that greenhouse gases which trap heat and prevent it from leaving the earth's atmosphere are mostly responsible for the temperature spike.
- 2. Frost- free season (and growing season) will lengthen** -It could actually have detrimental effects on the crops we grow. Warmer weather helps pests survive longer which can destroy crops. Rising temperatures are also expected to contribute to a shift in areas which are agriculturally most productive and the crops that grow there.
- 3. Changes in precipitation patterns** - The contrast between wet and dry areas will increase globally. In other words, the wet areas will get wetter and the dry areas will get drier.
- 4. More droughts and heat waves** – With rising temperatures and shifting rainfall patterns, heat waves and droughts are increasing infrequency and intensity.

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5. Sea level rise – Scientists have determined that global sea level has been steadily rising since 1900 at a rate of at least 0.1 to 0.25 cm per year. Sea level can rise by two different mechanisms with respect to climate change.

6. Arctic likely to become ice-free - The Arctic Ocean is expected to become essentially ice free in summer before mid-century.

ENVIRONMENTAL CONSEQUENCES OF CLIMATE CHANGE:

1.Agriculture and Food Security

- i.** Climate Change can affect crop yield as well as the types of crops that can be grown in certain areas, by impacting agricultural inputs such as water for irrigation, amounts of solar radiation that affect plant growth, as well as the prevalence of pests.
- ii.** Rise in temperatures caused by increasing greenhouse gases is likely to affect crops differently from region to region. For example, moderate warming (increase of 1 to 3°C in mean temperature) is expected to benefit crop.
- iii.** Yields in temperate regions, while in lower latitudes especially seasonally dry tropics, even moderate temperature increases (1 to 2°C) are likely to have negative impacts for major cereal crops. Warming of more than 3°C is expected to have negative effect on production in all regions.
- iv.** As a result of thawing of snow, the amount of arable land in high-latitude region is likely to increase by reduction of the amount of frozen lands. At the same time arable land along the coast lines are bound to be reduced as a result of rising sea level.
- v.** Erosion, submergence of shorelines, salinity of the water table due to the increased sea levels, could mainly affect agriculture through inundation of low-lying lands.
- vi.** If agricultural production in the low-income developing countries of Asia and Africa is adversely affected by climate change, the livelihoods of large numbers of the rural poor will be put at risk and their vulnerability to food insecurity will be manifold.

●.....● **Impacts on Indian Agriculture**

1. A large part of the arable land in India is rain-fed, the productivity of agriculture depends on the rainfall and its pattern. Agriculture will be adversely affected not only by an increase or decrease in the overall amounts of rainfall but also by shifts in the timing of the rainfall.
2. Any change in rainfall patterns poses a serious threat to agriculture, and therefore to the economy and food security. Summer rainfall accounts for almost 70 per cent of the total annual rainfall over India and is crucial to Indian agriculture. Increased frequencies of droughts, floods, storms and cyclones are likely to increase agricultural production variability.
3. Semi-arid regions of western India are expected to receive higher than normal rainfall as temperatures soar, while central India will experience a decrease of between 10 and 20 per cent in winter rainfall by the 2050's.
4. Productivity of most crops may decrease due to increase in temperature and decrease in water availability, especially in Indo-Gangetic plains. There would be a decline in the productivity of Rabi as compared to kharif season crops. Rising temperature would increase fertilizer requirement for the same production targets and result in higher GHG emissions, ammonia volatilization and cost of crop production.

2. Water Stress and Water insecurity

- i. Lack of access to water is a perturbing issue, particularly in developing countries. Climate change is expected to exacerbate current stresses on water resources. By 2020, between 75 and 250 million people are projected to be exposed to increased water stress due to climate change. Spreading water scarcity is contributing to food insecurity and heightened competitions for water both within and between countries.
- ii. Warming has resulted in decline in mountain glaciers and snow cover in both hemispheres and this is projected to accelerate throughout the 21st century. This will in turn lead to reducing water availability, hydropower potential, and would

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change the seasonal flow of rivers in regions supplied by melt water from major mountain ranges (e.g. Hindu-Kush, Himalaya, Andes). By 2050 freshwater availability in Central, South, East and South-East Asia, particularly in large river basins is projected to decrease. The frequency of severe floods in large river basins has increased during the 20th century. Increasing floods poses challenges to society, physical infrastructure and water quality.

- iii.** Rising temperatures will further affect the physical, chemical and biological properties of fresh water lakes and rivers, with predominantly adverse impacts on many individual fresh water species, community composition and water quality. In coastal areas, sea level rise will exacerbate water resource constraints due to increased salinization of groundwater supplies.

Impacts on Water Situation in India

1. Water resources will come under increasing pressure in the Indian subcontinent due to the changing climate.
2. The Himalayan glaciers are a source of fresh water for perennial rivers, in particular the Indus, Ganga, and Brahmaputra river systems. In recent decades, the Himalayan region seems to have undergone substantial changes as a result of extensive land use (e.g. deforestation, agricultural practices and urbanization), leading to frequent hydrological disasters, enhanced sedimentation and pollution of lakes.
3. Glacial melt is expected to increase under changed climate conditions, which would lead to increased summer flows in some river systems for a few decades, followed by a reduction in flow as the glaciers disappear.
4. As a result of increase in temperature significant changes in rainfall pattern have been observed during the 20th century in India.
5. The food production has to be increased to the tune of 300 MT by 2020 in order to feed India's ever-growing population, which is likely to reach 1.30 billion by the year 2020. The total food-grain production has to be increased by 50 per cent by

2020 to meet the requirement. The falling groundwater levels in various parts of the country have threatened the sustainability of the groundwater resources.

3. Rise in Sea Levels

- i.** Sea level rise is both due to thermal expansion as well as melting of ice sheets.
- ii.** Satellite observations available since the early 1990s show that since 1993, sea level has been rising at a rate per year, significantly higher than the average during the previous half-century. IPCC predicts that sea levels could rise rapidly with accelerated ice sheet disintegration.
- iii.** Global temperature increases of 3–4°C could result in 330 million people being permanently or temporarily displaced through flooding. Warming seas will also fuel more intense tropical storms.

Impacts on Coastal States in India

1. The coastal states of Maharashtra, Goa and Gujarat face a grave risk from the sea level rise, which could flood land (including agricultural land) and cause damage to coastal infrastructure and other property.
2. Goa will be the worst hit, losing a large percentage of its total land area, including many of its famous beaches and tourist infrastructure.
3. Flooding will displace a large number of people from the coasts putting a greater pressure on the civic amenities and rapid urbanisation. Sea water percolation due to inundations can diminish freshwater supplies making water scarcer.
4. The states along the coasts like Orissa will experience worse cyclones. Many species living along the coastline are also threatened.
5. The coral reefs that India has in its biosphere reserves are also saline sensitive and thus the rising sea level threatens their existence too, not only the coral reefs but the phytoplankton, the fish stocks and the human lives that are dependent on it are also in grave danger.

4.Ecosystems and Bio-Diversity

- i. Climate Change has the potential to cause immense biodiversity loss, affecting both individual species and their ecosystems that support economic growth and human well-being. The projected extinctions of flora and fauna in the future will be human driven i.e. due to adverse impact of human activities.
- ii. Many species may be unable to move to new areas as quickly enough to survive changes that rising temperatures will bring to their historic habitats. WWF asserted that one-fifth of the world's most vulnerable natural areas may be facing a "catastrophic" loss of species.
- iii. It has catastrophic impact on the marine ecosystems. They will be affected not only by an increase in sea temperature and changes in ocean circulation, but also by ocean acidification, as the concentration of dissolved carbon dioxide (carbonic acid) rises.

Impacts on India's Biodiversity

1. India is a land of mega-biodiversity, encompassing features from glaciers to deserts. However, climate change is posing grave threat to its ecosystems. Temperature increases and human activities are causing fragmentation and degradation of mountain biodiversity.
2. The Himalayan Ecosystem is considered as the lifeline not only to India but also to our neighbouring countries such as China, Pakistan, Nepal, owing to the perennial rivers that arise out of the melting glaciers.
3. It is home to the largest number of glaciers after the North and the South Poles. However, climate change is threatening this life giver drastically.
4. It is also predicted that there will be an increase in the phenomenon of Glacial Lake Outburst Floods (GLOFs) in the eastern and the central Himalayas, causing catastrophic flooding downstream, with serious damage to 'life, property, forests, farms, and infrastructure'.

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5. The melting glaciers of the Himalayas have a serious impact given the fact that they give rise to the perennial rivers that further flourishes the agriculture.

5.Climate Change and Health

- i. Climate change poses a host of threats to the survival of mankind. A warmer and more variable climate would result in higher levels of some air pollutants, increased transmission of diseases through unclean water and through contaminated food.
- ii. Climate change has a direct impact on human health. It is anticipated that there will be an increase in the number of deaths due to greater frequency and severity of heat waves and other extreme weather events. Climate change and the resulting higher global temperatures are causing increasing frequency of floods and droughts leading to the risk of disease infections.
- iii. Lack of freshwater during droughts and contamination of freshwater supplies during floods compromise hygiene, thus increasing rates of diarrhoeal disease. Endemic morbidity and mortality due to diarrhoeal disease primarily associated with floods and droughts are expected to rise in East, South and South-East Asia due to projected changes in hydrological cycle. Flooding also creates opportunities for breeding of disease carrying insects such as mosquitoes.

Response to Climate Change

There are two main responses to climate change.

- 1. Mitigation** - Which addresses the root causes of climate change, by reducing greenhouse gas emissions.
- 2.Adaptation** - Seeks to lower the risks posed by the consequences of climatic changes. Both approaches will be necessary to deal with the global changes that have already been set in motion.

●.....● MITIGATION STRATEGIES

Mitigation measures:

It is important that we learn how to reduce climate change, and put them into practice now, before it is too late.

1. Cleaner alternative energy sources: One important way to fight climate change is to reduce our reliance on and usage of fossil fuels, and depend on alternative renewable and greener sources of energy such as wind energy, solar energy, water or hydropower, biomass, and geothermal energy.

2. Energy saving tips - we can adopt energy saving tips by investing in more expensive energy-saving appliances like the compact fluorescent light (CFL) bulbs, Air conditioners, refrigerators etc. Switching off our electrical appliances when not in use.

3. Green driving tips - The best strategy to reduce toxic gas emissions is definitely to reduce the use of automobiles. Use public transport, carpooling, use of electricity powered cars or two wheelers can be an alternative.

4. Reduce - Reuse - Recycle practices –Reducing, reusing and recycling helps us conserve resources and energy, and reduce pollution and greenhouse gas emissions produced thereby.

5. Re-forestation - The cleanest and most efficient remover of carbon dioxide from our atmosphere actually is nothing but green plants and trees. The rate at which we are cutting down our trees and forests to make way for human developments has greatly reduced the earth's ability to remove carbon dioxide from the atmosphere.

6. Organic farming - Soils are an important sink for atmospheric carbon dioxide. Nevertheless, deforestation making way for conventional agriculture is increasingly depleting this sink. Sustainable and organic agriculture helps to counteract climate change by restoring soil organic matter content as well as reduce soil erosion and improve soil physical structure. Organic farming uses natural fertilizers and helps maintain crop yields.

7. Carbon Sequestration:

Carbon capture and storage, also known as CCS or carbon sequestration, describes the technologies designed to tackle global warming by capturing CO₂ at power stations, industrial sites or even directly from the air and permanently storing it underground. Carbon sequestration describes long-term storage of carbon dioxide or other forms of carbon to either mitigate or defer global warming. It has been proposed as a way to slow the atmospheric and marine accumulation of greenhouse gases, which are released by burning fossil fuels.

Sinks

Carbon sequestration may be carried out by pumping carbon into 'carbon sinks'— an area that absorbs carbon.

1. Natural sinks - Oceans, forests, soil etc.
2. Artificial sinks - Depleted oil reserves, unmineable, mines, etc.

There are three main steps to carbon capture and storage (CCS) –

1. trapping and separating the CO₂ from other gases,
2. transporting this captured CO₂ to a storage location,
3. storing that CO₂ far away from the atmosphere (underground or deep in the ocean).

Types of Sequestration:

There are number of technologies under investigation for sequestering carbon from the atmosphere. These can be discussed under three main categories:

1. Ocean Sequestration: Carbon stored in oceans through direct injection or fertilization.
2. Geologic Sequestration: Natural pore spaces in geologic formations serve as reservoirs for long-term carbon dioxide storage.
3. Terrestrial Sequestration: A large amount of carbon is stored in soils and vegetation, which are our natural carbon sinks. Increasing carbon fixation through photo-synthesis, slowing down or reducing decomposition of organic

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matter, and changing land use practices can enhance carbon uptake in these natural sinks.

4. Geologic Sequestration is thought to have the largest potential for near-term application.

8. Carbon sink

Unlike black and brown carbon that contribute to atmospheric greenhouse gases, green and blue carbon sequester the atmospheric greenhouse gases

Green Carbon

Green carbon is carbon removed by photosynthesis and stored in the plants and soil of natural ecosystems and is a vital part of the global carbon cycle.

Many plants and most crops, have short lives and release much of their carbon at the end of each season, but forest biomass accumulates carbon over decades and centuries.

Afforestation and reforestation are measures that can be taken to enhance biological carbon sequestration.

Blue Carbon

Blue Carbon refers to coastal, aquatic and marine carbon sinks held by the indicative vegetation, marine organism and sediments. In particular, coastal ecosystems such as tidal marshes, mangroves, and seagrasses remove carbon from the atmosphere and ocean, storing it in plants and depositing it in the sediment below them by natural processes.

Why is Blue Carbon Ecosystem Important?

1. Preventing degradation and destruction and promoting restoration of coastal ecosystems is a significant tool to mitigate climate change.
2. The coastal ecosystems of mangroves, tidal marshes, and seagrasses are some of the most rapidly disappearing natural systems on Earth.

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3. When lost they not only stop sequestering carbon but also release their stores of carbon and become new sources of climate change causing carbon emissions which can last for centuries.

The Blue Carbon Initiative

The Blue Carbon Initiative is the first integrated program with a comprehensive and coordinated global agenda focused on mitigating climate change through the conservation and restoration of coastal marine ecosystems.

9.carbon credit:

A carbon credit is a tradeable certificate or permit representing the right to emit one tonnes of carbon or carbon-dioxide equivalent (tCO₂e). One carbon credit is equal to one ton of carbon dioxide, or in some markets, carbon dioxide equivalent gases.

How does one earn a carbon credit?

An organization which produces one tonnes less of carbon or carbon dioxide equivalent than the standard level of carbon emission allowed for its outfit or activity, earns a carbon credit.

How does it help?

Countries which are signatories to the Kyoto Protocol under the UNFCCC have laid down gas emission norms for their companies to be met by 2012. In such cases, a company has two ways to reduce emissions.

- (i) It can reduce the GHG (greenhouse gases) by adopting new technology or improving upon the existing technology to attain the new norms for emission of gases.
- (ii) It can tie up with developing nations and help them set up new technology that is eco-friendly, thereby helping developing country or its companies 'earn' credits.

This credit becomes a permit for the company to emit GHGs in its own country. However, only a portion of carbon credits of the company in developing country can be transferred to the company in developed country.

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10.carbon offsetting:

Carbon offsets are credits for reductions in greenhouse gas emissions made at another location, such as wind farms which create renewable energy and reduce the need for fossil-fuel powered energy. Carbon offsets are quantified and sold in metric tonnes of carbon dioxide equivalent (CO₂e). For a carbon offset to be credible it must meet essential quality criteria, including proof that it is additional (the reduction in emissions would not have occurred without the carbon finance), that it will be retired from the carbon market so it cannot be double counted, and that it addresses issues such as permanence (it delivers the reductions it stated) and leakage.

Example:

Business A1 is unable to reduce 100 tonnes of its CO₂ emissions in the short term. There is a project somewhere else in the world which could save 100 tonnes easily, but they need a cash injection. For example, a community in India could swap from carbon intensive kerosene as an energy source to solar panels – but they can't afford the solar panels. Through the purchase of carbon offsets, you provide the financial assistance to subsidize the cost of getting solar panels onto housing, and through that means you have enabled a saving of 100 tonnes of CO₂. Business A1 has therefore reduced global net CO₂ emissions by 100 tonnes. The added benefit is that Business A1 has helped facilitate a step change in local technology in a developing market.

11.carbon tax:

Carbon tax is the potential alternative to the 'cap and trade' method currently used by the protocol. This tax is based on the amount of carbon contained in a fuel such as coal, etc. The aim of this tax is to cause less fossil fuel use and hopefully cause an incentive to use other sources of energy. If the carbon tax was implemented it would be gradual and start at a low amount and increase over time to allow better industry and technology to be developed.

India's Position on carbon tax:

India will bring a WTO challenge against any "carbon taxes" that rich countries impose on Indian imports. "If they impose such a tax, we will take them to the WTO dispute

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settlement forum,” “We will deal through hard negotiations. Such barriers are not going to be WTO-compatible and we will fight it.” – the minister, MoEF. Both United States and European Union have discussed the possibility of imposing tariffs or other forms of “border carbon adjustment” on goods imported from countries with tax regulations on greenhouse gas emissions.

12.Geo-engineering:

Geo-engineering primarily aims at modifying and cooling Earth’s environment, defeating the environmental damage and ensuing climate changes to make the planet more inhabitable. Geoengineering, at this point, is still only a theoretical Concept. Hoisting parasols, placing mirrors in space, whitening the stratosphere with sulfate aerosols, whitewashing building roofs to reflect sunlight or flinging iron filings into the ocean to promote carbon-gulping algae are some of the modes.

How Geoengineering Works: Big Plans to Stop Global Warming

1. Copy a Volcano

A volcanic eruption can bellow many million tons of sulfur-dioxide gas into the atmosphere, creating a cloud that blocks some of the sun’s radiation. By injecting the atmosphere with sulfur, some scientists believe they could likewise block solar radiation and potentially cool the planet. Those droplets are particularly good at scattering the sun’s light back out into space. And because Sulphur doesn’t heat the stratosphere as much as other aerosols, it wouldn’t work against the cooling effect. Hydrogen sulfide is an even better candidate for atmospheric seeding than sulfur dioxide.

2. Shoot Mirrors into Space

In order to deflect enough sunlight to bring the Earth’s climate back to its pre-industrial level, geoengineers plan to launch a mirror, the size of Greenland and strategically position it between the planet and the sun.

3. Seed the Sea with Iron

Scientist suggests iron will be the key to turn things around. Phytoplankton, which dwell near the surface, prefer iron. They are also adapted at pulling carbon out of the

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atmosphere during photosynthesis. When they die after about 60 days, the carbon the organisms have consumed falls to the bottom of the ocean. By pumping iron into the sea and stimulating phytoplankton to grow like crazy, scientists believe, global warming could be reversed.

4. Whiten the Clouds with Wind-Powered Ships

Scientists hope, like the volcanic eruption, the tops of clouds also reflect solar radiation. Spraying a lot of seawater into the sky by wind-powered remotely activated ships to whiten the clouds and thus it will reflect solar radiation.

5. Build Fake Trees

“Artificial tree,” a scaled-down version of an earlier prototype capable of capturing a ton of carbon in the atmosphere per day. Panels covering the surface of the tree--which would need to be about 50 square meters--will be made of an absorbent resin that reacts with carbon dioxide in the air to form a solid. It can be compared to a furnace filter, capable of pulling particles out of the air. The panels, or “boxes,” can be removed and exposed to 113 F steam, which effectively cleans the filter. The chemical reaction with the steam causes the solid to release the carbon it has captured, which can then be seized as liquid CO₂. But pulling carbon dioxide from the atmosphere is only half the battle--afterwards it must be sequestered, or permanently trapped.

How sequestered CO₂ can be commercially used?

Horticulturists need CO₂ in greenhouses for plants to use during photosynthesis, for dry ice production, and for developing new kinds of plastic and concrete that can be made with CO₂.

Drawbacks

1. Scientists have no idea whether they could shut down some of these geoengineering projects once they start.
2. Geoengineering treats the symptoms of global warming, and could very well undermine efforts to address the root cause.

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3. people may feel as though they don't need to reduce their personal carbon emissions and companies may continue to conduct business as usual, expecting researchers to clean up the mess.
 4. The cost, maintenance for geoengineering projects are too high.

Question:

1. Explain environmental consequence and its mitigation strategies.





Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : Environmental Health and Sanitation

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ENVIRONMENTAL HEALTH AND SANITATION

ENVIRONMENTAL HEALTH AND SANITATION

Health:

Health refers to a state of complete emotional and physical well-being. Healthcare exists to help people maintain this optimal state of health.

As defined by World Health Organization (WHO), it is a "State of complete physical, mental, and social well being, and not merely the absence of disease or infirmity."

Health is a dynamic condition resulting from a body's constant adjustment and adaptation in response to stresses and changes in the environment for maintaining an inner equilibrium called homeostasis.

Hygiene is a science of the establishment and maintenance of health conditions or practices (as of cleanliness) conducive to health. Poor personal hygiene. Brushing your teeth regularly is an important part of good oral hygiene. Hygiene is the practice of keeping yourself and your surroundings clean, especially in order to prevent illness or the spread of diseases.

ENVIRONMENTAL HEALTH

Environmental health refers to aspects of human health (including quality of life) that are determined by physical, chemical, biological, social and psychosocial factors in the environment.

The Importance of Environmental Health:

The people who live in the earth need safe, healthy and supportive environments for good health. The environment in which we live is a major determinant of our health and wellbeing. We depend on the environment for energy and the materials needed to sustain life, such as:

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1. Clean air
 2. Safe drinking water
 3. Nutritious food
 4. Safe places to live.

Maintaining a healthy environment is central to increasing quality of life and years of healthy life. Environmental factors are diverse and far reaching. They include:

1. Exposure to hazardous substances in the air, water, soil, and food
2. Natural and technological disasters
3. Climate change leads temperature rising
4. Occupational hazards
5. The built environment Increased level of pollution
6. Lack of infrastructure
7. Sea level rising leads floods in some part of areas

Poor environmental quality has its greatest impact on people whose health status is already at risk. Therefore, environmental health must address the societal and environmental factors that increase the likelihood of exposure and disease.

Problems Associated with Environmental Health:

Air pollution causes respiratory problems, cardio-vascular disease and lung cancer.

1. Water pollution cause diarrhoeal illnesses, eye and ear and throat Infection.
2. The highest exposure of sunlight causes skin cancer, melanoma and Non melanoma related issues.
3. The bite of mosquitoes and other insects causes fever like dengue, malaria and etc.
4. Noise pollution cause sleeping disorder, hearing loss and cardiovascular problems.
5. Silicosis caused by deposit of silica in the lungs of workers working and silica industries or at the sand blasting sites.

- 6. Asbestosis caused due to settlement of asbestos in lungs.
- 7. Itai-Itai disease- due to cadmium
- 8. Sulphur oxide that caused severe smog which is released largely by burning petroleum and crude oil.

The Centre For Environmental Health:

The Centre for Environmental Health in New Delhi to assess the impact of environment-related problems on health. The centre will assess the impact of environment-related problems like climate change, air pollution, pesticide use and sanitation on health. It is a joint initiative of the Tata Institute of Social Science (TISS) and Public Health Foundation of India (PHFI). The centre will conduct research across wide range of environmental health issues, including water, chemical exposure and hygiene. It will also establish a policy engagement platform with regular meetings with the civil society, government, academia and private sector to develop strategies for better implementation of the eco-friendly policies.

SANITATION:

World Health Organization – Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces. The word 'sanitation' also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal."

A safe sanitation system is a system designed and used to separate human excreta from human contact at all steps of the sanitation service chain from toilet capture and containment through emptying, transport, treatment (in-situ or offsite) and final disposal or end use.

Inadequate sanitation is a major cause of disease world-wide and improving sanitation is known to have a significant beneficial impact on health both in households and across communities.

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The Government Goals:

1.The sustainable Development Goal:

The Sustainable Development Goals 2015-2030, a successor to Millennium Development Goals, include Goal 6 for clean water and sanitation for ensuring their availability and sustainable management.

Goal 6.1 specifically says that by 2030, countries including India should ‘achieve universal and equitable access to safe and affordable drinking water for all’, and

Goal 6.2 stipulates that by 2030, countries should also “achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.”

2.Ecosan Toilets

About 150 liters of wastewater at an average is generated by an Indian individual daily, and a large amount of it is generated from toilets. Ecological sanitation (Eco-San) is a sustainable system for handling human excreta by using dry composting toilets. Eco-San toilets not only reduce wastewater generation but also generate the natural fertilizer from recycled human excreta, which forms an excellent substitute for chemical fertilizers. This method is based on the principle of recovery and recycling of nutrients from excreta to create a valuable supply for agriculture. ‘Eco-San’ toilets are being used in several parts of India and Sri Lanka.

3.Swachh Bharat Mission:

To accelerate the efforts to achieve universal sanitation coverage and to put focus on sanitation, the Prime Minister of India launched the Swachh Bharat Mission on 2nd October, 2014.

The Mission Coordinator for SBM is Secretary, Ministry of Drinking Water and Sanitation (MDWS) with two Sub-Missions, the Swachh Bharat Mission (Gramin) and the Swachh Bharat Mission (Urban). Together, they aim to achieve Swachh Bharat by 2019, as a fitting tribute to Mahatma Gandhi on his 150th Birth Anniversary.

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The aim of Swachh Bharat Mission (Gramin) is to achieve a clean and Open Defecation Free (ODF) India by 2nd October, 2019.

Objectives:

1. To bring about an improvement in the general quality of life in the rural areas, by promoting cleanliness, hygiene and eliminating open defecation.
2. To motivate communities to adopt sustainable sanitation practices and facilities through awareness creation and health education.
3. To encourage cost effective and appropriate technologies for ecologically safe and sustainable sanitation.
4. To develop community managed sanitation systems focusing on scientific Solid & Liquid Waste Management systems for overall cleanliness in the rural areas.
5. To create significant positive impact on gender and promote social inclusion by improving sanitation especially in marginalized communities.

4.Bio-toilets

Indian railways aim to install human waste discharge free bio-toilets in all its coaches and the same would be completed by September 2019. It will help in proving cleanliness and hygiene also preventing corrosion of the tracks. It is part of the Swachh Bharat Mission.

The environment-friendly bio-toilets for passenger coaches were developed jointly by Indian Railways and Defence Research and Development Organization (DRDO).

In the bio-toilet fitted coaches, human waste is collected in bio digester tanks below the toilets and is decomposed by a consortium of anaerobic bacteria.

By the process of hydrolysis, acetogenesis, acidogenesis and methanogenesis, the anaerobic bacteria convert human faecal matter into water and small amount of gases (including methane).

5.SWAJAL Yojana:

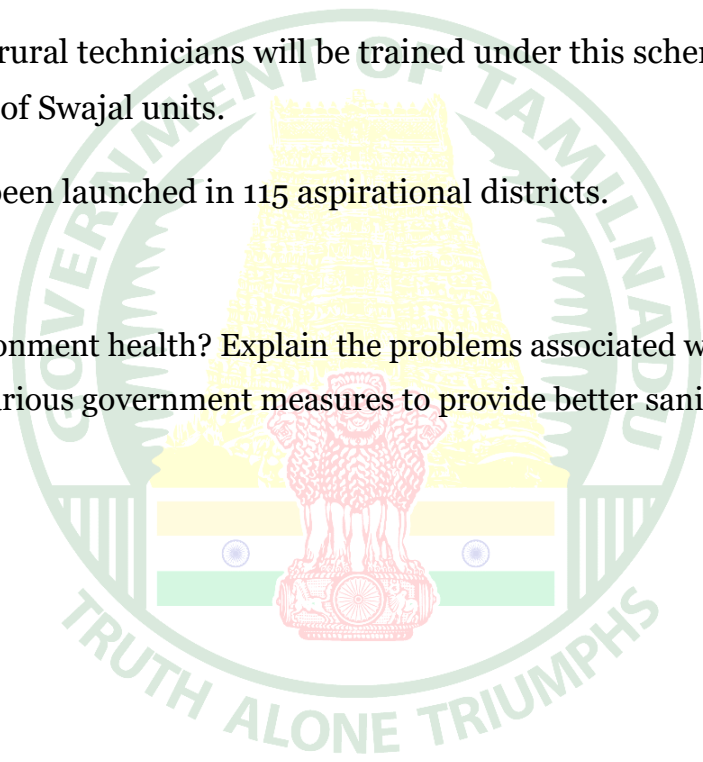
1. Swajal is community owned drinking water programme for sustained drinking water supply.

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2. The scheme aims at ensuring availability of clean drinking water to every household round year and also generate employment.
 3. Under it, 90% of the project cost is borne by Government and remaining 10% cost is contributed by the community.
 4. The Operations and management of the project will be taken care by the local villagers.
 5. Under this scheme, government aims to provide villages with piped water supply powered by harnessing solar energy.
 6. Hundreds of rural technicians will be trained under this scheme for operation and maintenance of Swajal units.

Fact: Schemes has been launched in 115 aspirational districts.

Question:

1. What is environment health? Explain the problems associated with environment.
2. Discuss the various government measures to provide better sanitation.





Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : Environmental Impact Assessment (EIA)

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ENVIRONMENTAL IMPACT ASSESSMENT

ENVIRONMENTAL IMPACT ASSESSMENT

Every country strives to progress ahead. One aspect of progress is economic development through manufacturing and trading. Every country build industry which provide employment, serve the consumers' needs and help to generate revenue. The dominant pattern of development that humankind has followed in recent decades has brought about large scale changes in the earth systems.

Environmental Impact Assessment (EIA)

EIA is a planning tool to achieve the goal of harmonizing development activities with the environmental concerns. Environment Impact Assessment in India is statutory backed by the Environment Protection Act in 1986, which contains various provisions on EIA methodology and process.

1. Serve as a primary environmental tool with clear provisions.
2. Apply consistently to all proposals with potential environmental impacts.
3. Use scientific practice and suggest strategies for mitigation.
4. Address all possible factors such as short term, long term, small scale and largescale effects.
5. Consider sustainable aspects such as capacity for assimilation, carrying capacity, biodiversity protection.
6. Lay down a flexible approach for public involvement.

The Objective of EIA

- (i) To identify, predict and evaluate the economic, environmental and social impact of development activities
- (ii) To provide information on the environmental consequences for decision making and

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(iii) To promote environmentally sound and sustainable development through the identification of appropriate alternatives and mitigation measures.

The important aspect of EIA

1. Risk Assessment
2. Environmental Management And
3. Post Product Monitoring

Rationale behind EIA:

EIA looks into various problems, conflicts and natural resource constraints which may not only affect the viability of a project but also predict if a project might harm to the people, their land, livelihoods and environment. Once these potential harmful impacts are predicted, the EIA process identifies the measures to minimize those impacts. Once the assessment is complete, the EIA findings are communicated to all stakeholders viz. developers, investors, regulators, planners, politicians, affected communities etc. On the basis of the conclusion of EIA process, the government can decide if a project should be given environment clearance or not. The developers and investors can also shape the project in such a way that its harms can be mitigated and benefits can be maximized.

Steps in the EIA Process

The eight steps of the EIA process:

- i. Screening:** First Stage of EIA, which determines whether the proposed project, requires an EIA and if it does, then the level of assessment required.
- ii. Scoping:** This stage identifies the key impacts that should be investigated. This stage also defines the time limit of the study.
- iii. Impact analysis:** This stage of EIA identifies and predicts the likely environmental and social impact of the proposed project and evaluates the significance.
- iv. Mitigation:** This step in EIA recommends the actions to reduce and avoid the potential adverse environmental consequences of development activities.

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- v. Reporting:** This stage presents the result of EIA in a form of a report to the decision-making body and other interested parties.
 - vi. Review of EIA:** It examines the adequacy and effectiveness of the EIA report and provides the information necessary for decision –making.
 - vii. Decision-making:** It decides whether the project is rejected, approved or needs further change.
 - viii. Post monitoring:** This stage comes into play once the project is commissioned. It checks to ensure that the impacts of the project do not exceed the legal standards and implementation of the mitigation measures are in the manner as described in the EIA report.

Benefits:

1. EIA provides a cost-effective method to eliminate or minimize the adverse impact of developmental projects.
2. EIA enables the decision makers to analyses the effect of developmental activities on the environment well before the developmental project is implemented.
3. EIA encourages the adaptation of mitigation strategies in the developmental plan.
4. EIA makes sure that the developmental plan is environmentally sound and within limits of the capacity of assimilation and regeneration of the ecosystem.
5. EIA links environment with development. The goal is to ensure environmentally safe and sustainable development.

Limitations of EIA

1. Time-consuming.
2. Little public participation in actual implementation.
3. Sometimes too focused on the scientific analysis.
4. Compliance monitoring after EIA is seldom carried out.

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5. Impact assessment processes are in place and applied in many countries, yet biodiversity is often inadequately addressed.
 6. There is a growing recognition of the need to better reflect biodiversity considerations in environmental impact assessments and strategic environmental assessments.

Environmental Impact Assessment in India

EIA was introduced in India in 1978, with respect to river valley projects. On 27 January 1994, the Union Ministry of Environment and Forests (MEF), Government of India, under the Environmental (Protection) Act 1986, made Environmental Clearance (EC) mandatory for expansion or modernization or for setting up new projects listed in Schedule 1 of the notification. Since then there have been 12 amendments made in the EIA notification of 1994. Both central and state authorities share the responsibility of EIA's development and management. EIA is now mandatory for 30 categories of projects, and these projects get Environmental Clearance (EC) only after the EIA requirements are fulfilled.

The MoEF&CC recently notified new EIA legislation in September 2006. The notification makes it mandatory for all projects to get environment clearance from the central government under the following categories:

1. Industries
2. Mining
3. Thermal power plants
4. River valley projects
5. Infrastructure and CRZ (Coastal Regulation Zone)
6. Nuclear power projects.

However, the new legislation has entrusted the decision of clearing projects on the state government depending on the size/ capacity of the project. EIA appraises the environmental health and social implications of planned developmental projects. It thus links environment with development. The goal of EIA is to ensure environmentally safe and sustainable development.

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Questions:

1. What is Environment impact assessment? Explain the procedural steps involved in EIA?





Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material

Subject : Environment, Biodiversity and Disaster Management

Topic : Environmental Laws, Policies & Treaties in India and Global scenario

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ENVIRONMENTAL LAWS, POLICIES AND TREATIES IN INDIA AND GLOBAL SCENARIO

ENVIRONMENTAL LAWS, POLICIES AND TREATIES IN INDIA AND GLOBAL SCENARIO:

Environmental laws:

“Environmental Law” as an instrument to protect and improve the environment and control or prevent any act or omission polluting or likely to pollute the environment. It is clearly stated that it is the duty of the State to “protect and improve the environment and to safeguard the forests and wildlife of the country”. It imposes a duty on every citizen “to protect and improve the natural environment including forests, lakes, rivers, and wildlife”. Reference to the environment has also been made in the Directive Principles of State Policy (Part IV) as well as the Fundamental Rights (Part III). The Department of Environment was established in India in 1980 to ensure a healthy environment for the country. This later became the Ministry of Environment and Forests in 1985.

Environmental Laws, Policies, And Treaties in India:

1.Ministry of Environment, Forest and Climate Change (MoEF&CC):

The Ministry of Environment, Forest and Climate Change (MoEF&CC) is the nodal agency in the administrative structure of the Central Government for the planning, promotion, co-ordination and overseeing the implementation of India’s environmental and forestry policies and programmes.

The primary concerns of the Ministry are implementation of policies and programmes relating to conservation of the country’s natural resources including its lakes and rivers, its biodiversity, forests and wildlife, ensuring the welfare of animals, and the prevention and abatement of pollution. While implementing these policies and programmes, the Ministry is guided by the principle of sustainable development and enhancement of human well-being.

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The ministry also serves as the nodal agency in the country for the united nations environment programme, south Asia co-operative environment programme, international centre for integrated mountain development and for the follow-up of the united nations conference on environment and development. The ministry is also entrusted with issues relating to multilateral bodies such as the commission on sustainable development, global environmental facility and of regional bodies like economic and social council for Asia and pacific and south Asian association for regional co-operation on matters pertaining to the environment.

The Broad Objectives Are:

Conservation and survey of flora, fauna, forests and wildlife

1. Prevention and control of pollution
2. Afforestation and regeneration of degraded areas
3. Protection of the environment and
4. Ensuring the welfare of plants and animals

The Constitution of India

1. The 'Right to Life' contained in Article-21 of the Constitution of India includes the right to clean and human environment. It means you have the right to live in a clean and healthy environment
2. Article-38 of our Constitution requires State to ensure a social order for the welfare of people, which can be obtained by an unpolluted and clean environment only.
3. Article-48A of the Constitution declares "The State shall endeavour to protect and improve the environment and safeguard forests and wildlife of the country."
4. Article-51A(g) of the Indian Constitution says: "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures."

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2.The Water (Prevention and Control of Pollution) Act, 1974

The Water (Prevention and Control of Pollution) Act was enacted in 1974 to provide for the prevention and control of water pollution, and for maintaining or restoring of wholesomeness of water in the country. This is the first law passed in India whose objective was to ensure that the domestic and industrial pollutants are not discharged into rivers, and lakes without adequate treatment. The reason is that such a discharge renders the water unsuitable as a source of drinking water as well as for the purposes of irrigation and support marine life. In order to achieve its objectives, the Pollution Control Boards at Central and State levels were created to establish and enforce standards for factories discharging pollutants into water bodies. The 1988 amendment act empowered SPCB and CPCB to close a defaulting industrial plant.

3.The Water Prevention and Control of Pollution Cess Act 1977:

The Water Cess Act was passed to generate financial resources to meet expenses of the Central and State Pollution Boards. The Act creates economic incentives for pollution control and requires local authorities and certain designated industries to pay a cess (tax) for water effluent discharge. The Central Government, after deducting the expenses of collection, pays the central board and the state's such sums, as it seems necessary. To encourage capital investment in pollution control, the Act gives a polluter a 70% rebate of the applicable cess upon installing effluent treatment equipment. This Act binds consumers who are carrying on an industry that falls within the provisions to affix meters for the purpose of assessing the quantity of water used in the act. Industries also have to include operations or processes or treatment and disposal systems which consume water or give rise to sewage effluent.

4.Forest conservation Act 1980:

1. First forest conservation Act 1927. Alarmed at India's rapid deforestation and resulting environmental degradation, central government enacted the Forest conservation act 1980.

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2. It is an Act of the Parliament of India that was enacted for providing a higher level of protection to forests and to regulate diversion of forest lands for Non forestry purposes.
 3. As per the Forest (Conservation) Act, 1980 Prior permission/approval of the Central Government is essential for De-reservation/ Diversion of forest land for non-forestry purposes. An advisory committee constituted under the act advises the centre on these approvals.
 4. The act deals with the four categories of the forests namely reserved forests, village forests, protected forests and private forests.
 5. This is given on the condition that user agency will deposit required amount to undertake compensatory afforestation for mitigate negative impact of forest land diversion. The act extends to whole of India except state of Jammu and Kashmir (J&K).

5.The Public Liability Insurance Act, 1981

1. This Act aims to provide immediate relief to the persons affected by accident occurring while handling any hazardous substance.
2. It provides that every owner shall take out, before he starts handling any hazardous substance, one or more insurance policies providing for contracts of insurance.
3. The objective of taking insurance is that the compensation resulting from the possible future accident is guaranteed.
4. The collector of the area has been empowered to verify the occurrence of any accident at any place within his jurisdiction and also cause publicity to be given for inviting applications from the victims for any compensation.
5. Apart from the insurance contract, the funding for the purpose of compensation is also generated by the Central Government by the establishment of “Environment Relief Fund.” This fund may be utilized by the collector for paying the compensation.

6.The Air (Prevention and Control of Pollution) Act, 1981

The Air (Prevention and Control of Pollution) Act, 1981 was enacted to provide for the prevention, control and abatement of air pollution in India.

It is a specialized piece of legislation which was enacted to take appropriate steps for the preservation of natural resources of the earth, which among other things include the preservation of the quality of air and control of air pollution.

The prime objectives of the Act are the following:

1. Prevention, control and abatement of air pollution;
2. Establishment of central and state pollution control boards to implement the aforesaid purpose; and
3. To maintain the quality of air

Powers and Functions of the Boards:

1.Central Pollution Board:

The main function of the Central Board is to implement legislation created to improve the quality of air and to prevent and control air pollution in the country. The-Board advises the Central Government on matters concerning the improvement of air quality and also coordinates activities, provides technical assistance and guidance to State Boards and lays down standards for the quality of air. It collects and disseminates information in respect of matters relating to air pollution and performs functions as prescribed in the Act.

2.State Pollution Control Boards:

The State Boards have the power to advise the State Government on any matter concerning the prevention and control of air pollution. They have the right to inspect at all reasonable times any control equipment, industrial plant, or manufacturing process and give orders to take the necessary steps to control pollution. They are expected to inspect air pollution control areas at intervals or whenever necessary. They are empowered to provide standards for emissions to be laid down for different industrial

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plants with regard to quantity and composition of emission of air pollutants into the atmosphere. A State Board may establish or recognize a laboratory to perform this function. The State Governments have been given powers to declare air pollution control areas after consulting with the State Board and also give instructions to ensure standards of emission from automobiles and restriction on use of certain industrial plants.

3. Penalties:

The persons managing industry are to be penalized if they produce emissions of air pollutants in excess of the standards laid down by the State Board. The Board also makes applications to the court for restraining persons causing air pollution.

Whoever contravenes any of the provision of the Act or any order or direction issued is punishable with imprisonment for a term which may extend to three months or with a fine of ₹10,000 or with both, and in case of continuing offence with an additional fine which may extend to ₹5,000 for every day during which such contravention continues after conviction for the first contravention.

7. The Environment Protection Act, 1986

It was the Bhopal Gas Tragedy which necessitated the Government of India to enact a comprehensive environmental legislation, including rules relating to storing, handling and use of hazardous waste.

On the basis of these rules, the Indian Parliament enacted the Environment Protection Act, 1986. This is an umbrella legislation that consolidated the provisions of the Water (Prevention and Control of Pollution) Act of 1974 and the Air (Prevention and Control of Pollution) Act of 1981.

Within this framework of the legislations, the government established Pollution Control Boards (PCBs) in order to prevent, control, and abate environmental pollution.

Environment Protection Act, 1986

The genesis of the Environment (Protection) Act, 1986 is in Article 48-A (Directive Principle of State Policy) and Article 51-A(g) (Fundamental Duty) of the Indian

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Constitution. Soon after the United Nations Conference on the Human Environment held in Stockholm in 1972, the Water (Prevention and Control of Pollution) Act, 1974 was enacted. Then came the Air (Prevention and Control of Pollution) Act 1981 and finally the Environment (Protection) Act, 1986.

The Environment (Protection) Act (EPA) contains 26 sections which are divided into four chapters relating to

1. Preliminary
2. General powers of the Central Government
3. Prevention, abatement, and control of environmental pollution and
4. Miscellaneous provisions

Objectives:

The objective of the Environment Protection Act is to protect and improve the environment in the country. It describes rules to regulate environmental pollution, laying down procedures and standards for industrial waste, emissions, hazardous waste etc. Besides, it deals with the prevention, control and abatement of environmental pollution.

Provisions of the Act

1. The Act consists of and deals with more stringent penal provisions. The minimum punishment for contravention or violation of any provision in the Act is imprisonment for a term which may extend up five years or a fine of up to one lakh rupees or both.
2. The Act also provides for further punishment if the contravention or violation continues after the date of conviction, which is ₹5000 per day. If the violation extends for a period beyond one year, the offender is punished with imprisonment for a term which may extend up to seven years.
3. The Act empowers the Central Government to take all appropriate measures to prevent and control pollution and to establish effective machinery for the purpose

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of protecting and improving the quality of the environment and preventing, abating and controlling environmental pollution.

4. The Central Government or any authorized person is empowered to collect samples of air, water, soil or any other substance as evidence for the offences under the Act. It prescribes the procedure for handling hazardous substances, and the concerned person has to handle such substances in accordance with the procedure established by the Act.
5. The Act has relaxed the provision of "Locus Standi" which has enabled even a common citizen to approach the Court provided he/she has given a notice of sixty days of the alleged offense and his/her intention to make a complaint to the Central Government or any other competent authority.
6. In case the offense under the Act has been committed by a government department, the head of the department is held responsible unless he/she provides evidence that the offense was committed without his/her knowledge or that he/she has exercised due diligence to prevent the commission of such offense.
7. The Act also empowers and authorizes the Central Government to issue directions for the operation or process, prohibition, closure, regulation of any industry. The Central Government is also authorized to stop or regulate the supply of electricity, water, or any other utility services directly, without obtaining a Court order for this purpose.
8. The Act grants immunity to officers of the Government for acts done under the provisions of this Act or under the powers vested in them or functions assigned to them under this Act. The Central Government is also empowered to enter and inspect any place through any person or through any agency authorized by the Central Government.
9. The Act debars a civil court from having any jurisdiction to entertain any suit or proceeding in respect of any action, order, or direction issued by the Central Government or any other statutory authority under this Act.
10. The Act contains a supremacy provision. This means that the provisions of this Act and the rules made thereunder, or the orders issued under this Act shall

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exercise supremacy over any provision under any enactment which is inconsistent with those under this Act.

8.National Forest Policy 1988:

The National Forest Policy of 1988 was launched with the principal aim of ensuring environmental stability and maintenance of ecological balance, including atmospheric equilibrium which is essential for the sustenance of all life forms - plant, animal, and human.

The objectives of the National Forest Policy 1988

1. Maintenance and restoration of the ecological balance which has been adversely disturbed by a serious depletion of the forests.
2. Conservation of the natural heritage and protection of remaining flora and fauna, representing the genetic diversity in the country.
3. Checking soil erosion and denudation in the catchment areas of rivers, lakes, reservoirs in the interest of soil and water conservation.
4. Checking the extension of sand-dunes in the desert areas of Rajasthan and along the coastal tracts.
5. Increasing substantially the forest/tree cover in the country through massive afforestation and social forestry programmes, especially on all denuded, degraded and unproductive lands.
6. Meeting the requirements of fuel-wood, fodder, minor forest produce, and small timber of rural and tribal populations.
7. Increasing the productivity of forests to meet the essential national needs.

Strategy to implement the provisions of the policy

1. About one-third of the total geographical area of the country to be brought under forest cover. In hills and mountainous regions, about two-thirds of the total area must be kept under forest cover to prevent soil erosion and land degradation and to preserve the stability of the fragile ecosystems.

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2. To encourage the planting of trees along roads, railway lines, canals and streams, and over the unutilized lands of State entities, lands under institutional or private ownership.
 3. Formation of Green belts in and urban areas, industrial zones etc., to check soil erosion and desertification as well as to improve the micro-climate of the region.
 4. Village and community lands must be encouraged to grow tree crops and fodder resources. The revenue generated from such resources must be shared with the panchayats and local communities.
 5. Land laws should be modified to encourage individuals and institutions to take up tree-fanning and grow fodder plants, legumes, etc., on their lands. Appropriate regulations must be put in place to oversee the felling of trees in private lands

The major achievements of the National Forest Policy, 1988 include

1. Increase in the forest and tree cover.
2. Involvement of local communities in the protection, conservation, and management of the forests through Joint Forest Management Programme.
3. Conservation of biological diversity and genetic resources of the country through in-situ and ex-situ conservation efforts.
4. A significant contribution towards the maintenance of ecological balance and environmental stability in the country.

Joint Forest Management Programme

1. Under JFM programme both the State forest department, as well as the local communities, are involved in the conservation, protection, and management of forest lands under their jurisdiction.
2. The local communities enter into a JFM agreement with the forest department under which they assist the forest department in the protection of forests from the illegal felling of trees, excessive grazing, fires, etc., in return for rights over the minor forest produce and a share of revenue generated from the sale of timber products.

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9.The National Environment Tribunal Act, 1995

This Act is aimed to provide for strict liability for damages arising out of any accident occurring while handling any hazardous substance and for the establishment of a National Environment Tribunal for effective and expedition disposal of cases arising from such accident, with a view to giving relief and compensation for damages to persons, property and the environment and for matters connected with it.

The Act lies in the fact that the liability of the owner of hazardous substance has been made strict in case of any accident and the resultant injury to public.

In any claim for the compensation, the claimant is not required to plead and establish that the death, injury or damage in respect of which the claim has been made was due to any wrongful act, neglect or default of any person. So, the burden of proof does not rest upon the claimant of compensation which is a big relief for the victims.

10.The National Environment Appellate Authority (NEAA) Act, 1997

The National Environment Appellate Authority (NEAA) was set up by the Ministry of Environment and Forests to address cases in which environment clearance is required in certain restricted areas.

It was established by the National Environment Appellate Authority Act 1997 to hear appeals with respect to restriction of areas in which any industries, operations, processes or class of industries, operations or processes shall or shall not be carried out, subject to certain safeguards under the Environment Protection Act, 1986.

11.The Noise Pollution (Regulation and Control) Rules, 2000

There was no direct provision for 'noise pollution' under the Environment Protection Act, 1986 or any other legislation.

The increasing ambient noise levels in public places from various sources like industrial activity, generator sets, loud speakers, vehicular horns etc. have harmful effects on human health.

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It was the need of the hour to come with a law which would regulate and control noise producing sounds with the objective of maintaining the ambient air quality standards in respect of noise.

Therefore, the Central Government framed 'The Noise Pollution (Regulation and Control) Rules, 2000'. These rules have been laid down by the government to reduce environmental noise pollution.

Certain standards, such as the ambient air quality standards, have been set by the government.

The permissible levels of noise are different for different areas, such as industrial, commercial, residential areas and silence zones (area within the vicinity of hospitals, educational institutions or courts).

12.The Ozone Depleting Substances (Regulation and Control) Rules, 2000

The Ozone Depleting Substances (Regulation and Control) Rules 2000 under the environmental protection act 1986 and have been laid down for the regulation of production, trade import and export and consumption of ozone depleting substances.

The main objective of this rule is protection of the Ozone layer. The rule restricts unauthorized sale, purchase, import, export and use of ozone depleting substance.

The rules prohibit the use of Cfc's in manufacturing various products beyond 1st Jan 2013 except meter dose inhaler and for other medical purposes.

Similarly use of halons is prohibited after 1st Jan 2001 except for essential use. Other ODS such as carbon tetrachloride and methyl chloroform and Cfc for metered dose inhalers can be use up-to 1st Jan 2010.

Further the use of methyl bromide has been allowed up to 1st Jan 2015. Since Hcfc's are used as interim substitute to replace CFC these are allowed as interim substitute to replace cfc these are allowed up to Jan 1 2040.

13.The National Green Tribunal :2010

The National Green Tribunal has been established on 18th Oct,2010 under the National Green Tribunal Act 2010 for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto. It is a specialized body equipped with the necessary expertise to handle environmental disputes involving multi-disciplinary issues.

The Tribunal's dedicated jurisdiction in environmental matters shall provide speedy environmental justice and help reduce the burden of litigation in the higher courts. The Tribunal is mandated to make and endeavor for disposal of applications or appeals finally within 6 months of filing of the same.

Initially, the NGT is proposed to be set up at five places of sittings and will follow circuit procedure for making itself more accessible. New Delhi is the Principal Place of Sitting of the Tribunal and Bhopal, Pune, Kolkata and Chennai shall be the other four places of sitting of the Tribunal.

Composition of National Green Tribunal (NGT)

NGT comprises of both judicial and expert members as adjudicators. The Chairman of NGT is a judicial member and must be or has been a judge of the Supreme Court of India or Chief Justice of a High Court. The Chairman is appointed by the Central Government in consultation with the Chief Justice of India. Other judicial members of the NGT must be or has been a judge of the High Court. For an expert member a person must have a doctorate degree in life sciences or physical sciences with fifteen years experience in the relevant field including five years practical experience in the field of environment and forest in a reputed national level institution or an administrative experience of fifteen years including experience of five years in dealing with environmental matters in the Central or State Governments or in a reputed National or State level institution. The Judicial and expert members are appointed by the Central Government on the recommendation of a Selection Committee.

●.....● **Jurisdiction and Powers of NGT**

Jurisdiction means authority of any Court or Tribunal to accept a matter for hearing and decision. NGT has the jurisdiction over all civil cases where a substantial question relating to environment (including enforcement of any legal right relating to environment), is involved and such question arises out of the implementation of the enactments specified in Schedule I of the National Green Tribunal Act, 2010.

Schedule I of the Act lists following legislations:

1. The Water (Prevention and Control of Pollution) Act, 1974.
2. The Water (Prevention and Control of Pollution) Cess Act, 1977.
3. The Forest (Conservation) Act, 1980.
4. The Air (Prevention and Control of Pollution) Act, 1981.
5. The Environment (Protection) Act, 1986.
6. The Public Liability Insurance Act, 1981.
7. The Biological Diversity Act, 2002.

NGT is empowered to provide by an order:

Relief and compensation to the victims of pollution and other environmental damage arising under the enactments specified in Schedule I (including accident occurring while handling any hazardous substance) of the Act.

The Act mandates that in case of accident, the Tribunal shall, apply the principle of 'no fault'. 'No fault principle' stipulates that in case of accident the owner or the employer cannot take the defense of him/her having committed no fault. If accident occurs and as a consequence of it damage is caused to any person or environment, the owner or the employer is liable, only because of the fact that accident occurred in his/her enterprise. Apart from this principle, NGT has to also apply the principles of 'Sustainable Development', 'precautionary principle' and 'polluter pays principle', while giving an order or decision or award.

Procedure NGT is not bound to follow the procedures laid down in the Code of Civil Procedure, 1908; or the Indian Evidence Act, 1872; rather it has to be guided by the principles of natural justice. It has for the purposes of discharge of its functions all the

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powers of the Civil Court for trying a suit as given under the Code of Civil Procedure, 1908. Any decision, order or 'award' of the Tribunal is executable by the Tribunal as a 'decree' of the Civil Court and, therefore, for this purpose the 'Tribunal' will have all the powers of a Civil Court. The Tribunal can also if it deems fit transmit its order or award for execution to a Civil Court having local jurisdiction as if it were the 'decree' of that Civil Court.

Minimum number of members who must together hear and decide a case is two, out of which one must be a judicial member and other an expert member. The decision of Tribunal by majority is binding. In case the opinion of the bench is equally divided then the matter is to be heard and decided by the Chairman of NGT if he/she was not part of the equally divided bench. In cases, where the Chairman himself/herself is part of the equally divided bench then he/she shall refer the matter to other member of the Tribunal not part of that equally divided bench to hear the case and decide.

Penalty

Whoever fails to comply with any order, decision or award of the NGT under the National Green Tribunal Act, 2010, commits a cognizable offence and shall be punishable with an imprisonment for a term which may extend to three years or with fine which may extend to 10 Crore rupees (25 Crore in case of a company) or with both and in case the failure or contravention continues, with additional fine which may extend to 25,000 Crore (1 Lakh Crore in case of a company) for every day during which such failure or contravention continues after conviction for first such failure or contravention.

Appeal

In an appeal the person who has lost the case can again challenge the decision made by the NGT before the Supreme Court. Any person aggrieved by any decision, order or award of the Tribunal, may file an appeal before the Supreme Court within 90 days from the date of communication of such decision, order or award. Though, the Supreme Court may allow a person to file such appeal even after 90 days if the Court is satisfied that the person appealing was prevented to do so for sufficient cause.

●.....● **14.National Biodiversity Authority 2003:**

The National Biodiversity Authority (NBA) was established by the Central Government in 2003 to implement India's Biological Diversity Act (2002).

The NBA is a Statutory Body and it performs facilitative, regulatory and advisory functions for the Government of India on issues of conservation, sustainable use of biological resources and fair and equitable sharing of benefits arising out of the use of biological resources.

Objectives:

The Biological Diversity Act (2002) mandates implementation of the provisions of the Act through decentralized system with the NBA focusing on

1. Advising the Central Government on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of benefits arising out of the utilization of biological resources;
2. Advising the State Governments in the selection of areas of biodiversity importance to be notified under Sub-Section 1 of Section 37 as heritage sites and measures for the management of such heritage sites. The NBA considers requests by granting approval or otherwise for undertaking any activity referred to in Sections 3,4 and 6 of the Act.

The State Biodiversity Boards (SBBs)

The state biodiversity boards focus on advising the State Governments, subject to any guidelines issued by the Central Government, on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of the benefits arising out of the utilization of biological resources;

The SSBs also regulate, by granting of approvals or otherwise upon requests for commercial utilization or bio-survey and bio-utilization of any biological resource by the Indians.

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The local level Biodiversity Management Committees (BMCs)

The local level biodiversity management committee are responsible for promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and microorganisms and chronicling of knowledge relating to biological diversity.

The NBA with its headquarters in Chennai, Tamil Nadu, India delivers its mandate through a structure that comprises of the Authority, Secretariat, SBBs, BMCs and Expert Committees. Since its establishment, NBA has supported creation of SBBs in 29 States and facilitated establishment of around 1,55,868 BMCs.

15. Wildlife institute of India:

Established in 1982, Wildlife Institute of India (WII) at Dehradun and it is an internationally acclaimed Institution, which offers training program, academic courses and advisory in wildlife research and management. The Institute is actively engaged in research across the breadth of the country on biodiversity related issues. WII is an autonomous institution under the Union Ministry of Environment Forest and Climate Change. It is based in Chandra Bani, Dehradun.

Functions:

It conducts specialized research in areas of study like Endangered Species, Biodiversity, Wildlife Management, Wildlife Policy, Wildlife Forensics, Habitat Ecology, Spatial Modelling, Ecodevelopment, and Climate Change.

16. Wild Life Crime Control Bureau:

Wildlife Crime Control Bureau is a statutory multi-disciplinary body Under Section 38 (Z) of the Wild Life (Protection) Act, 1972, established by the Government of India under the Ministry of Environment and Forests, to combat organized wildlife crime in the country.

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The Bureau has its headquarter in New Delhi and five regional offices at Delhi, Kolkata, Mumbai, Chennai and Jabalpur; three sub-regional offices at Guwahati, Amritsar and Cochin; and five border units at Ramanathapuram, Gorakhpur, Motihari, Nathula and Moreh.

Functions:

1. It is mandated to collect and collate intelligence related to organized wildlife crime activities and to disseminate the same to State and other enforcement agencies for immediate action so as to apprehend the criminals; to establish a centralized wildlife crime data bank.
2. Co-ordinate actions by various agencies in connection with the enforcement of the provisions of the Act.
3. Assist foreign authorities and international organization concerned to facilitate co-ordination and universal action for wildlife crime control.
4. Capacity building of the wildlife crime enforcement agencies for scientific and professional investigation into wildlife crimes and assist State Governments to ensure success in prosecutions related to wildlife crimes.
5. Advise the Government of India on issues relating to wildlife crimes having national and international ramifications, relevant policy and laws.
6. It also assists and advises the Customs authorities in inspection of the consignments of flora & fauna as per the provisions of Wild Life Protection Act, CITES and EXIM Policy governing such an item.

17. Animal Welfare Board of India:

The Animal Welfare Board of India is a statutory advisory body on Animal Welfare Laws and promotes animal welfare in the country. Established in 1962 under the Prevention of Cruelty to Animals Act, 1960, the Animal Welfare Board of India was started under the stewardship of Late Smt. Rukmini Devi Arundale, well known humanitarian. From ensuring that animal welfare laws in the country are diligently followed, to provide grants to Animal Welfare Organizations and advising the Government of India on animal welfare issues, the Board has been the face of the animal welfare movement in the country for the last 50 years. The Board consists of 28 Members. The term of office

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of Members is for a period of 3 years. Headquarters of this was located in ballabgarh, Haryana.

Mandate

To prevent the infliction of unnecessary pain or suffering on animals, in terms of the provision of the Prevention of Cruelty to Animals (PCA) Act, 1960.

Functions

1. To keep the law in force in India for the Prevention of Cruelty to Animals under constant study and to advise the government on the amendments to be undertaken in any such law from time to time.
2. To advise the Central Government on the making of rules under the Act with a view to preventing unnecessary pain or suffering to animals generally, and more particularly when they are being transported from one place to another or when they are used as performing animals or when they are kept in captivity or confinement.
3. To advise the Government or any local authority or other person on improvements in the design of vehicles so as to lessen the burden on draught animals.
4. To take all such steps as the Board may think fit for *(amelioration of animals) by encouraging or providing for, the construction of sheds, water troughs and the like and by providing for veterinary assistance to animals.
5. To advise the Government or any local authority or other person in the design of slaughter houses or the maintenance of slaughter houses or in connection with slaughter of animals so that unnecessary pain or suffering, whether physical or mental, is eliminated in the preslaughter stages as far as possible, and animals are killed; wherever necessary, in as humane a manner as possible.
6. To take all such steps as the Board may think fit to ensure that unwanted animals are destroyed by local authorities, whenever it is necessary to do so, either instantaneously or after being rendered insensible to pain or suffering.
7. To encourage by the grant of financial assistance or otherwise, (the formation or establishment of Pinjarapoles, rescue homes, animals shelters, sanctuaries and the like), where animals and birds may find a shelter when they have become old and useless or when they need protection.

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8. To co-operate with, and co-ordinate the work of, associations or bodies established for the purpose of preventing unnecessary pain or suffering to animals or for the protection of animals and birds.

18.The Wildlife (Protection) Act, 1972 (Last amended in 2006)

The Wildlife (Protection) Act (WLPA), 1972 is an important statute that provides a powerful legal framework for:

1. Prohibition of hunting
2. Protection and management of wildlife habitats
3. Establishment of protected areas
4. Regulation and control of trade in parts and products derived from wildlife
5. Management of zoos.

The act provides for the protection of wild animals, birds and plants and matters connected with them, with a view to ensure the ecological and environmental security of India.

Extends to the whole of India, except the State of Jammu and Kashmir which has its own wildlife act.

It provides for prohibition on use of animal traps except under certain circumstances. It provides for protection of hunting rights of the Scheduled Tribes in Andaman and Nicobar Islands.

Has provisions for the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

It has six schedules which give varying degrees of protection the poaching, smuggling and illegal trade of animals listed in the schedule 1 to schedule 4 are prohibited.

1. Species listed in Schedule I and part II of Schedule II get absolute protection — offences under these are prescribed the highest penalties. For Example: lion tailed macaque, great Indian bustard, Narcondam hornbill.

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2. Species listed in Schedule III and Schedule IV are also protected, but the penalties are much lower compared to schedule 1 and part of schedule 2. Nilgai, Mongoose, vultures.
 3. Schedule V includes the animals are called vermin so which may be hunted. For Example: Mice, rat, common crow and flying fox are the list of animals.
 4. The plants in Schedule VI are prohibited from cultivation and planting for example red vanda, blue vanda, kuth, pitcher plant, beddomes cycad and ladies sliper orchid.

The WLPA provides for several categories of Protected Areas/Reserves:

Sanctuaries: The State or Central Government may by notification declare its intention to constitute any area as a sanctuary for protecting wildlife and the environment. The government determines the nature and extent of rights of persons in or over the land within the sanctuary.

National Parks:

The State or Central Government may declare an area, whether inside a sanctuary or not, as a national park for the purpose of protecting and developing wildlife and its environment. The State Government cannot alter the boundaries of a national park except on the recommendation of the National Board for Wildlife. No grazing is allowed inside a national park. All provisions applicable to a sanctuary are also applicable to a national park.

Conservation Reserves: The State Government after consultations with local communities can declare any area owned by the Government, particularly areas adjacent to national parks or sanctuaries, as conservation reserves. The government constitutes a Conservation Reserve Management Committee to manage and conserve the conservation reserve.

Community Reserves: The State Government can, in consultation with the community or an individual who have volunteered to conserve wildlife, declare any private or community land as community reserve. A Community Reserve Management

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Committee shall be constituted by State Government for conserving and managing the reserve.

Tiger Reserve: These areas were reserved for protection tiger in the country. The State Government on the recommendation of the Tiger Conservation Authority may notify an area as a tiger reserve, for which it has to prepare a Tiger Conservation Plan.

The Wildlife Crime Control Bureau (WCCB), National board on wildlife and National tiger conservation authority was constituted under this act.

The acts set up various provisions related to trade and penalties for hunting the animals in wild.

Global Environmental Laws and Policies and Treaties

1.UN Conference on Human Environment, Stockholm, Sweden

The United Nations Conference on the Human Environment (also known as the Stockholm Conference) was an international conference convened under United Nations auspices held in Stockholm, Sweden from June 5-16, 1972.

It was the UN's first major conference on international environmental issues, and marked a turning point in the development of international environmental politics.

The United Nations Environment Programme has been established by the United Nations General Assembly in pursuance of the Stockholm Conference.

Nairobi declaration:

1. Declaration adopted in 1982 (10th anniversary of Stockholm)
2. The Declaration envisaged the creation of a special commission to frame long term environment strategies for achieving sustainable developments upto the year 2000 and beyond.
3. The Declaration was endorsed by the governing Council of United Nations Environment Programme (UNEP) in 1987

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2.UN environment programme (UNEP), Stockholm, Sweden

1. Established in 1972 — result of the United Nations Conference on the Human Environment (Stockholm Conference) Headquarter — Nairobi, Kenya.
2. Its Activities cover a wide range of issues regarding the atmosphere, marine and terrestrial ecosystems, environmental governance and green economy.
3. Agency of United Nations that coordinates its environmental activities, assisting developing countries in implementing environmentally sound policies and practices
4. Publishes Global environment outlook
5. seven thematic areas of work:
 1. Climate Change
 2. Disasters and Conflicts
 3. Ecosystem Management
 4. Environmental Governance
 5. Chemicals and Waste
 6. Resource Efficiency
 7. Environment Under Review

UNEP is also one of several Implementing Agencies for the Global Environment Facility (GEF) and the Multilateral Fund for the Implementation of the Montreal Protocol. UNEP has also been active in funding and implementing environment related development projects. UNEP has aided in the formulation of guidelines and treaties on issues such as the international trade in potentially harmful chemicals, transboundary air pollution, and contamination of international waterways

3.Ramsar Convention

The Convention on Wetlands, called the Ramsar Convention is also known as waterfowl convention the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. The Convention was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975. Since then, almost 90% of UN member states, from all the world's geographic regions, have acceded to

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become “Contracting Parties”. India has 27 Ramsar Sites which are the Wetlands of International importance.

Wetlands:

The Convention uses a broad definition of wetlands. It includes all lakes and rivers, underground aquifers, swamps and marshes, wet grasslands, peatland, oases, estuaries, deltas and tidal flats, mangroves and other coastal areas, coral reefs, and all human-made sites such as fish ponds, rice paddies, reservoirs and salt pans.

World wetlands day, 2nd February every year.

Mission:

the conservation and wise use of all wetlands through local, regional, and national action and international cooperation as a contribution towards achieving sustainable development throughout the world.

Three pillars:

1. Work towards wise use of all their wetlands through national land use planning, appropriate policies and legislation and management actions and public education.
2. Designate suitable wetlands for the list of wetlands of international importance and ensure their effective management
3. Cooperate internationally concerning transboundary wetlands, shared wetlands systems, shared species, and development project that may affect wetlands.

Transboundary Ramsar sites:

Contracting Parties are designating their new and existing Ramsar Sites as Transboundary Ramsar Sites. These are ecologically coherent, shared wetlands extending across national borders, which are managed collaboratively.

Montreux Record

Montreux Record under the Ramsar Convention is a register of wetland sites on the List of Wetlands of International Importance where changes in ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or other human interference. It is maintained as part of the Ramsar List.

Currently, two wetlands of India are in Montreux record : Keoladeo National Park (Rajasthan) and Loktak Lake (Manipur).

Note: Chilika lake (Odisha) was placed in the record but was later removed from it.

International organizational partners:

The Ramsar Convention works closely with six organisations known as International Organization Partners (IOPs). These are:

1. Birdlife International
2. International Union for Conservation of Nature (IUCN)
3. International Water Management Institute (IWMI)
4. Wetlands International
5. WWF
6. International Wildfowl & Wetlands Trust (WWT)

Ramsar sites in India: Sl. No.	Name of Site	State Location	Date of Declaration	Area (in Sq. km.)
1	Asthamudi Wetland	Kerala	19.8.2002	614
2	Bhitarkanika Mangroves	Orissa	19.8.2002	650
3	Bhoj Wetlands	Madhya Pradesh	19.8.2002	32.01
4	Chandertal Wetland	Himachal Pradesh	8.11.2005	0.49
5	Chilka Lake	Orissa	1.10.1981	1165
6	DeeporBeel	Assam	19.8.2002	40
7	East Calcutta Wetlands	West Bengal	19.8.2002	125

8	Harike Lake	Punjab	23.3.1990	41
9	Hokera Wetland	Jammu and Kashmir	8.11.2005	13.75
10	Kanjli Lake	Punjab	22.1.2002	1.83
11	Keoladeo Ghana NP	Rajasthan	1.10.1981	28.73
12	Kolleru Lake	Andhra Pradesh	19.8.2002	901
13	Loktak Lake	Manipur	23.3.1990	266
14	Nalsarovar Bird Sanctuary	Gujarat	24/09/12	120
15	Point Calimere	Tamil Nadu	19.8.2002	385
16	Pong Dam Lake	Himachal Pradesh	19.8.2002	156.62
17	Renuka Wetland	Himachal Pradesh	8.11.2005	0.2
18	Ropar Lake	Punjab	22.1.2002	13.65
19	Rudrasagar Lake	Tripura	8.11.2005	2.4
20	Sambhar Lake	Rajasthan	23.3.1990	240
21	Sasthamkotta Lake	Kerala	19.8.2002	3.73
22	Sunderbans Wetland	West Bengal	30.1.2019	4230
23	Surinsar-Mansar Lakes	Jammu and Kashmir	8.11.2005	3.5
24	Tsomoriri Lake	Jammu and Kashmir	19.8.2002	120

25	Upper Ganga River (Brijghat to Narora Stretch)	Uttar Pradesh	8.11.2005	265.9
26	VembanadKol Wetland	Kerala	19.8.2002	1512.5
27	Wular Lake	Jammu & Kashmir	23.3.1990	189
		Total Area (in Sq. km.)		11121.31

4. Convention on the conservation of migratory species of wild animals:(1979)

1. It is an intergovernmental environmental treaty under the aegis of the United Nations Environment Programme, CMS (also referred to as the Bonn Convention)
2. It provides a global platform for the conservation and sustainable use of migratory animals like terrestrial aquatic and avian and their habitats.
3. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.
4. It is the only global convention specializing in the conservation of migratory species, their habitats and migration routes.
5. **Appendix I-** Migratory species threatened with extinction are listed on appendix I of the convention. CMS parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them.

Appendix II- Migratory species that need or would significantly benefit from international cooperation are listed in appendix II of the convention.

6. India has been a Party to the CMS since 1983. The Conference of Parties (COP) is the decision-making organ of this convention.

●.....● **5.Global Tiger Forum: 1994**

The Global Tiger Forum (GTF) is the only inter- governmental international body established with members from willing countries to embark on a global campaign to protect the Tiger.

Utilizing co-operative policies, common approaches, technical expertise, scientific modules and other appropriate programmes and controls the GTF is focused on saving the remaining 5 sub-species of Tigers distributed over 13 Tiger Range countries of the world.

Functioning

The GTF has a General Assembly meeting every 3 years and Standing committee meetings at least once a year.

A Chairperson, usually a Minister from one of the Tiger Range countries heads GTF for a fixed tenure of 3 Years. The Secretariat of GTF is headed by a Secretary General and is located in New Delhi, India.

Goal:

To highlight the rationale for tiger preservation and provide leadership and common approach throughout the world in order to safeguard the survival of the tiger, its prey and its habitat.

Objectives:

1. To promote a worldwide campaign to save the tiger its prey and its habitat.
2. To promote a legal framework in the countries involved for biodiversity conservation
3. To increase the protected area network of habitats of the tiger and facilitate their inter passages in the range countries.
4. To urge countries to enter into relevant conventions for conservation of tiger and elimination of illegal tiger.

6. Intergovernmental Panel on Climate Change

This is a scientific intergovernmental body under the UN. Formed in 1988 by WMO and UNEP. The secretariat of the IPCC is located in Geneva Switzerland. It is open to all member countries of the United Nations and WMO.

It produces report based on scientific developments across the world. The IPCC does not carry out its own original research, nor does it do the work of monitoring climate or related phenomena itself. Thousands of scientists from all over the world contribute to the work of the IPCC on a voluntary basis.

The IPCC bases its assessment on the published literature. IPCC has so far produced five assessment reports, the latest one was published in 2014.

It said that India's high vulnerability and exposure to climate change will slow its economic growth, impact health and development, make poverty reduction more difficult and erode food security. It was awarded the Nobel peace prize in 2007. IPCC functions under UNFCCC.

The aims of the IPCC are to assess scientific information relevant to :

1. Human-induced climate change,
2. The impacts of human-induced climate change,
3. Options for adaptation and mitigation

7. United Nations Conference on Environment and Development:

Earth Summit 1992 is also known as The United Nations Conference on Environment and Development (UNCED), Rio summit, Rio conference. Earth Summit 1992 succeeded in raising public awareness of the need to integrate environment and development. 190 countries pledged their commitment to achieve by 2010, a significant reduction in the current rate of biodiversity loss at global, regional and local levels.

The issues touched included:

1. Checking production of toxic components, such as lead in gasoline, or poisonous waste including radioactive chemicals,

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2. Alternative sources of energy to replace the use of fossil fuels,
 3. New reliance on public transportation systems in order to reduce vehicle emissions, congestion in cities,
 4. The health problems caused by polluted air and smoke, and
 5. The growing usage and limited supply of water.

Landmark Agreements

Important legally binding agreements (Rio Convention) were opened for signature:

1. Convention on Biological Diversity.
2. United Nations Convention to Combat Desertification.
3. United nations framework on climate change.

The Earth Summit resulted in the following documents:

1. Rio Declaration: principles intended to guide countries in future sustainable development.

2. Agenda 21:

Agenda 21 is a non-binding action plan of the United Nations (UN) related to sustainable development. It was an outcome of the Earth Summit 1992. The number 21 refers to an agenda for the 21st century. Its aim is achieving global sustainable development. Since 2015, Sustainable Development Goals are included in the Agenda 2030.

3. Forest Principles: Non-legally binding document on Conservation and Sustainable Development of All Types of Forests.

Rio+5

In 1997, the UN General Assembly held a special session to appraise the status of Agenda 21 (Rio +5). The Assembly recognized progress as “uneven” and identified key trends, including increasing globalization, widening inequalities in income, and continued deterioration of the global environment.

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The Johannesburg summit:

Rio+10 (2002) or Earth Summit 2002 or World Summit on Sustainable Development. Took place in Johannesburg, South Africa in 2002. Rio+10 affirmed UN commitment to Agenda 21, alongside the Millennium Development Goals. Johannesburg Declaration: committing the nations of the world to sustainable development.

Rio+20

Twenty years after the landmark 1992 earth summit in Rio. At the Rio+20 conference world leaders along with thousands of participants from the private sector, NGO's and other groups, came together to shape how we can reduce poverty, advance social equity and ensure environmental protection on ever more crowded planet.

The official discussions focused on two main reasons:

- 1.How to build a green economy to achieve sustainable development and lift of people out of poverty.
- 2.How to improve international coordination for sustainable development.

United Nations Framework Convention on Climate Change:

It is international environmental treaty negotiated at Earth Summit in Rio de Janeiro in 1992 and entered into force in 1994. It has near universal membership as it has 196 countries and European Union (EU) as its members. It is parent treaty of the 1997 Kyoto Protocol which was ratified by 192 of the UNFCCC Parties. The ultimate objective of both treaties is to stabilize greenhouse gas (GHGs) concentrations in atmosphere at a level that will prevent dangerous human interference with the climate system.

Conference of Parties (COP)

COP is the supreme decision-making body of United Nations Framework Convention on Climate Change (UNFCCC). All States that are Parties to UNFCCC are represented at COP. At COP, all parties review implementation of Convention and take decisions necessary to promote the effective implementation of Convention.

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Kyoto Protocol:

1. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets.
2. Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities."
3. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. The detailed rules for the implementation of the Protocol were adopted at COP 7 in Marrakesh, Morocco, in 2001, and are referred to as the "Marrakesh Accords." Its first commitment period started in 2008 and ended in 2012.
4. In Doha, Qatar, on 8 December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted:
5. New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;
6. A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
7. Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

Paris agreement:

Parties to UNFCCC agreed to strive to limit the rise in global warming to well under 2 degrees Celsius, over pre-industrial levels by 2100, under Paris Agreement 2015.

1. Nationally determined contributions (NDCs) were conceived at Paris summit which require each Party to prepare, communicate and maintain successive nationally determined contributions (NDCs) that it intends to achieve.

- 2. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.
- 3. Paris Agreement replaced earlier agreement to deal with climate change, Kyoto Protocol.
- 4. USA recently pulled out from the agreement seriously damaging the global effort to reverse climate change, as USA is one of the largest Greenhouse Gas emitter.

8. Hazardous Material:

1. Stockholm Convention:

Aim — to eliminate or restrict the production and use of persistent organic pollutants United Nations treaty Signed — 2001 and Effective — 2004. The POPs are classified into Annexure A, Annexure B, Annexure C

Persistent organic pollutants (POPs)

1. POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms and are toxic to humans and wildlife
2. POP can lead to serious health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and damages to the central and peripheral nervous systems.
3. Given their long-range transport, no one government acting alone can protect its citizens or its environment from POPs Global Environmental Facility (GEF) is the designated interim financial mechanism for the Stockholm Convention.
4. It distributed throughout the environment as a result of natural process involving soil, water, and most notably air.
5. Accumulates in the fatty tissue of living organism including humans, and or found at higher concentrations at higher levels in the food chain and toxic to both humans and wildlife.

The initial 12 POPs

Initially, 12 POPs have been recognized as causing adverse effects on humans and the ecosystem. They were placed in 3 categories as:

- Pesticides: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene.
- Industrial chemicals: hexachlorobenzene, polychlorinated biphenyls (PCBs).
- By-products: hexachlorobenzene, polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans (PCDD/PCDF), and PCBs.

List of New POPs

Nine new POPs have been added to the list of POPs under Stockholm Convention at the CoP held in 2009. Annexures A, B, and C were amended to include the following chemicals as POPs.

1. Pesticides: chlordecone, Alpha Hexachlorocyclohexane, Beta Hexachlorocyclohexane, lindane, Pentachlorobenzene.
2. Industrial chemicals: Hexabromobiphenyl, Hexabromodiphenyl Ether and Heptabromodiphenyl Ether, Pentachlorobenzene, Perfluorooctane Sulphonic Acid, its salts and Perfluorooctane Sulphonyl Fluoride, Tetrabromodiphenyl Ether and Pentabromodiphenyl ether.
3. By-products: Alpha Hexachlorocyclohexane, Beta hexachlorocyclo hexane, and Pentachlorobenzene.

2. Basel Convention:

It is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries (LDCs). opened for signature on 22 March 1989 and entered into force on 5 May 1992. Parties – 187.

Objectives:

To protect the human health and environment against adverse effects of hazardous wastes. The hazardous wastes based covers based on their origin and/or composition and their characteristics as well as two types of wastes defined as “other wastes”- household wastes and incinerator waste.

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Principal aim:

The reduction of hazardous waste generation and promotion of environmentally sound management of hazardous wastes, wherever the place of disposal;

The restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management.

A regulatory system applying to cases where transboundary movements are permissible.

Waste under the Basel convention:

Waste are substances or objects which are disposed of or are intended to be disposed of by the provisions of national law.

Annex:**Annex I:**

Annex I of the convention as further clarified in annexes VIII and IX lists those wastes that are classified as hazardous and subject to the control procedures under the convention.

Annex II:

Annex II of the convention identifies those wastes that require special consideration.

Examples of wastes regulated by the Basel Convention:

1. Biomedical and healthcare wastes.
2. Used oils
3. Persistent organic pollutants wastes
4. Polychlorinated biphenyls
5. Thousands of chemical wastes generated by industries and other consumers.

It does not address the movement of radioactive waste. The Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate.

3. Rotterdam convention:

The Rotterdam Convention (formally, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade) is a multilateral treaty to promote shared responsibilities in relation to importation of hazardous chemicals. It was adopted in September 1998 and entered into force on 24 February 2004. It's jointly administered by the United Nations Food and Agriculture Organization (FAO) and UN Environment (UNEP). It creates legally-binding obligations for the implementation of the Prior Informed Consent (PIC) procedure.

Objectives:

To promote shared responsibility and cooperative efforts among parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm.

To contribute to the environmentally sound use of those hazardous chemicals by:-

1. Facilitating information exchange about their characteristics;
2. Providing for a national decision-making process on their import and export;
3. and disseminating these decisions to parties.

Annex III chemicals:

The chemicals listed Annex III include pesticides and industrial chemicals that have been severely restricted for health or environmental reasons by two or more parties and which the conference to subject to the PIC procedure.

There are total of 43 chemicals listed in Annex III 32 are pesticides (including 4 severely hazardous pesticides formulations) and 11 industrial chemicals.

9. Land:

1. United Nations Conventions to Combat Desertification:

1. It was established in 1994, the sole legally binding international agreement linking environment and development to sustainable land management.

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2. The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the drylands, where some of the most vulnerable ecosystems and peoples can be found.
 3. UNCCD 2018-2030 Strategic Framework: It is the most comprehensive global commitment to achieve Land Degradation Neutrality (LDN) in order to restore the productivity of vast expanses of degraded land, improve the livelihoods of more than 1.3 billion people, and reduce the impacts of drought on vulnerable populations to build.
 4. The Convention's 197 parties work together to improve the living conditions for people in drylands, to maintain and restore land and soil productivity, and to mitigate the effects of drought.
 5. The UNCCD is particularly committed to a bottom-up approach, encouraging the participation of local people in combating desertification and land degradation.
 6. The UNCCD secretariat facilitates cooperation between developed and developing countries, particularly around knowledge and technology transfer for sustainable land management.
 7. As the dynamics of land, climate and biodiversity are intimately connected, to meet these complex challenges with an integrated approach and the best possible use of natural resources.
 8. The convention promotes sustainable land management as solution to global challenges. Land degradation is long term loss of ecosystem functions and productivity caused by disturbances from which the land cannot recover unaided.

While the sustainable land management is focused on changes in land cover/land use in order to maintain and enhance eco systems functions and services.

2.REED:

The United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries was launched in 2008 and builds on the convening role and technical expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP). The UN-REDD

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Programme supports nationally led REDD+ processes and promotes the informed and meaningful involvement of all stakeholders, including indigenous peoples and other forest-dependent communities, in national and international REDD+ implementation.

3.REED+

REDD+ means “Reducing Emissions from Deforestation and forest Degradation”, conservation of forest carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks in developing countries.

1. REDD+ is a mechanism developed by Parties to the United Nations Framework Convention on Climate Change (UNFCCC).
2. It creates a financial value for the carbon stored in forests by offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development.
3. Developing countries would receive results-based payments for results-based actions. REDD+ goes beyond simply deforestation and forest degradation and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.

10.Marine:

1.International Whaling Commission:

It is an international body set up under International Convention for the Regulation of Whaling (ICRW). ICRW governs the commercial, scientific, and aboriginal subsistence whaling practices of fifty-nine member nations. It was signed in Washington, D.C., United States, in 1946. Headquarters — Impington, near Cambridge, England. In 1986, it adopted a moratorium on commercial whaling. This ban still continues. India is member of international whaling commission. The IWC currently has 88 member governments from countries all over the world.

The commission is pre-eminent global body responsible for the conservation and management of whales and leads international efforts to tackle the growing range of threats to whales globally including by catch, ship strikes, entanglement, noise and whaling.

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Objectives:

1. To provide for the proper conservation of whale stocks.
2. For orderly development of the whaling industry.

Whale sanctuary:

In 1994, it created the Southern Ocean Whale Sanctuary surrounding the continent of Antarctica. Here, the IWC has banned all types of commercial whaling.

Only two such sanctuaries have been designated by IWC till date. Another is Indian Ocean Whale Sanctuary by the tiny island nation of the Seychelles.

In December 2018 Japan announced its decision to withdraw from IWC.

2.Antarctic treaty system:

Antarctic Treaty and related agreements are collectively known as the Antarctic Treaty System (ATS). It regulate international relations with respect to Antarctica. Antarctica is defined as all of the land and ice shelves south of 60°S latitude. Antarctic Treaty Secretariat Headquarters — Buenos Aires, Argentina.

Antarctic treaty

First arms control agreement established during the Cold War Signed in Washington on 1959(1 December) by the twelve countries whose scientists had been active in and around Antarctica during the International Geophysical Year (IGY) of 1957-58. Entered into force in 1961. Currently has 53 parties. Sets aside Antarctica as a scientific preserve

Provisions

1. Antarctica shall be used for peaceful purposes only (Art. I)
2. Freedom of scientific investigation in Antarctica and cooperation toward that end ... shall continue (Art. II).
3. Scientific observations and results from Antarctica shall be exchanged and made freely available (Art. III).

●.....● **Protocol on Environmental Protection to the Antarctic Treaty**

Signed in Madrid on October 4, 1991. In 1998 — entered into force. It designates Antarctica as a “natural reserve, devoted to peace and science”. It sets forth basic principles applicable to human activities in Antarctica. Article 7 — prohibits all activities relating to Antarctic mineral resources, except for scientific research.

Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), 1982

The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) was established by international convention in 1982 with the objective of conserving Antarctic marine life. This was in response to increasing commercial interest in Antarctic krill resources, a keystone component of the Antarctic ecosystem and a history of over-exploitation of several other marine resources in the Southern Ocean.

Ecosystem-based management

Being responsible for the conservation of Antarctic marine ecosystems, CCAMLR practices an ecosystem-based management approach. This does not exclude harvesting as long as such harvesting is carried out in a sustainable manner and takes account of the effects of fishing on other components of the ecosystem.

International commission

CCAMLR is an international commission with 25 Members, and a further 11 countries have acceded to the Convention. Based on the best available scientific information, the Commission agrees a set of conservation measures that determine the use of marine living resources in the Antarctic.

The key institutional components of CCAMLR are:

The CAMLR Convention which entered into force on 7 April 1982. A decision-making body, the Commission a Scientific Committee which advises the Commission using the best available science Conservation measures and resolutions CCAMLR's Membership and provisions for international cooperation and collaboration Secretariat based in Hobart, Tasmania, that supports the work of the

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Commission. CCAMLR's programs of research, monitoring and the application of conservation measures in the Convention Area make a valuable contribution to global food security.

India's research centres in Antarctic

a) Dakshin Gangotri — established during the third Indian expedition to Antarctica in 1983/84. Abandoned as it was buried in 1990. India's first committed research facility, Dakshin Gangotri, is being used as a supply base.

b) Maitri (1989) – second permanent research station. situated on the rocky mountainous region called Schirmacher Oasis. India also built a freshwater lake around Maitri known as Lake Priyadarshini.

c) Bharti, 2012- Bharati is an Antarctic research station commissioned by India. It is India's third Antarctic research facility and one of two active Indian research stations, alongside Maitri India has demarcated an area beside Larsemann Hills at 69°S, 76°E for construction. The research station has been operational since 18 March 2012, though it is still being run on trial basis and formal launch is awaited. Since its completion, India has become one of nine nations to have multiple stations within the Antarctic Circle. Bharati's research mandate focuses on oceanographic studies and the phenomenon of continental breakup.

3.Arctic council:

1996 – Ottawa declaration, The Arctic Council is an intergovernmental forum for discussing and addressing issues concerning the Arctic region. These include scientific research, and peaceful and sustainable use of resources in the region. Not a treaty-based international organization but rather than. All decision-making happens through consensus between the eight members, and in consultation with the permanent participants. The decisions, recommendations or guidelines of the Arctic Council are non-enforceable and strictly the prerogative of the individual state. Its mandate explicitly excludes military security.

Origin

September 1989 – Initiative of Finland — 8 Arctic countries met in Rovaniemi, Finland to discuss cooperative measures to protect the Arctic environment. As a result, numerous technical and scientific reports being prepared. 1991 — Arctic Environmental Protection Strategy (AEPS) signed by 8 arctic members — declaration on the protection of Arctic environment

Focus areas

1. The Environment and climate change.
2. Bio-diversity.
3. Oceans
4. The indigenous Arctic peoples.

Organization structure

a) **Chairmanship Rotated** every two years once

b) **Secretariat**

1. Rotated biennially with the Chairmanship of the Arctic Council
2. It supports the Chair of the Arctic Council
3. It manages logistics related to the biennial member states' meetings and the more frequent SAO meetings

c) **SAO (Senior Arctic Official)**

1. A government representative, usually from a member states' Ministry of Foreign Affairs
2. Guides and monitors Arctic Council activities in accordance with the decisions and instructions of the Arctic Council Foreign Ministers.

Members :8 countries with territory above the Arctic Circle (Canada, Denmark, Finland, Iceland, Norway, Sweden, the Russian Federation, and the United States)

Observer status in the Arctic Councils open to Non-arctic states, inter-governmental and inter-parliamentary organizations, global and regional, non-governmental organizations. observer country is invited to the meetings of the council. India granted the observer status in 2013 at Kiruna Ministerial Meeting

India and arctic:

The Himadri research station, located in Ny Alesund, Svalbard in Norway, was started in 2008.

The Goa-based National Centre for Antarctic and Ocean Research (NCOAR) is the nodal organization coordinating the research activities at this station.

Why is it significant to India?

1. The Arctic Council does not prohibit the commercial exploitation of resources in the Arctic.
2. It only seeks to ensure that it is done in a sustainable manner.
3. So, countries with ongoing activities in the Arctic hope to have a stake in the commercial exploitation of natural resources there.
4. India could derive some commercial and strategic benefits, given the fact that the Arctic region is rich in some minerals, and oil and gas,
5. With some parts of the Arctic melting due to global warming, the region also opens up the possibility of new shipping routes.

11.Nature:

1.International tropical timber organization:

The International Tropical Timber Organization (ITTO) is an intergovernmental organization promoting the sustainable management and conservation of tropical forests and the expansion and diversification of international trade in tropical timber from sustainably managed and legally harvested forests. ITTO:

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1. Develops internationally agreed policy guidelines and norms to encourage sustainable forest management (SFM) and sustainable tropical timber industries and trade.
 2. Assists tropical member countries to adapt such guidelines and norms to local circumstances and to implement them in the field through projects and other activities.
 3. Collects, analyzes and disseminates data on the production and trade of tropical timber.
 4. Promotes sustainable tropical timber supply chains.
 5. Helps develop capacity in tropical forestry.

ITTO is an action and field-oriented organization with more than 30 years of experience. It has funded and assisted in the implementation of more than 1000 projects and other activities addressing the many aspects of SFM, such as forest restoration; wood-use efficiency; the competitiveness of wood products; market intelligence and transparency in the tropical timber trade and tropical timber supply chains; forest law enforcement and governance; illegal logging; biodiversity conservation; climate-change mitigation and adaptation; the contributions of non-timber forest products and environmental services; and the livelihoods of forest-dependent communities.

ITTO's membership represents about 90% of the global tropical timber trade and more than 80% of the world's tropical forests.

12.Ozone:

1.Vienna Convention

The Vienna Convention for the Protection of the Ozone Layer was adopted in 1985 and entered into force on 22 Sep 1988. In 2009, the Vienna Convention became the first Convention of any kind to achieve universal ratification.

The objectives of the Convention were for Parties 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 or administrative measures against activities likely to have adverse effects on the ozone layer.

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The Vienna Convention did not require countries to take concrete actions to control ozone-depleting substances. Instead, in accordance with the provisions of the Convention, the countries of the world agreed the Montreal Protocol on Substances that Deplete the Ozone Layer under the Convention to advance that goal. The Parties to the Vienna Convention meet once every three years, back to back with the Parties to the Montreal Protocol, in order to take decisions designed to administer the Convention.

2.Montreal protocol:

The Montreal Protocol on Substances that Deplete the Ozone Layer was designed to reduce the production and consumption of ozone depleting substances in order to reduce their abundance in the atmosphere, and thereby protect the earth's fragile ozone Layer. The original Montreal Protocol was agreed on 16 September 1987 and entered into force on 1 January 1989.

The Montreal Protocol includes a unique adjustment provision that enables the Parties to the Protocol to respond quickly to new scientific information and agree to accelerate the reductions required on chemicals already covered by the Protocol. These adjustments are then automatically applicable to all countries that ratified the Protocol.

Since its initial adoption, the Montreal Protocol has been adjusted six times. Specifically, the Second, Fourth, Seventh, Ninth, Eleventh and Nineteenth Meetings of the Parties to the Montreal Protocol adopted, in accordance with the procedure laid down in paragraph 9 of Article 2 of the Montreal Protocol, certain adjustments and reductions of production and consumption of the controlled substances listed in the Annexes of the Protocol. These adjustments entered into force, for all the Parties, on 7 March 1991, 23 September 1993, 5 August 1996, 4 June 1998, 28 July 2000 and 14 May 2008, respectively.

The Parties to the Montreal Protocol have amended the Protocol to enable, among other things, the control of new chemicals and the creation of a financial mechanism to enable developing countries to comply.

India and Montreal Protocol

India became a party to the Montreal Protocol in 1992.

Kigali Amendment

The Kigali Amendment aims for the phase-down of hydrofluorocarbons (HFCs) by cutting their production and consumption. In 2016, more than 170 countries agreed to amend the Montreal protocol on Substances that Deplete the Ozone Layer in Kigali/Rwanda.

Given their zero impact on the depletion of the ozone layer, HFCs are currently used as replacements of hydro chlorofluorocarbons (HCFCs) and chlorofluorocarbons (CFCs), however they are powerful greenhouse gases.

The amendment has entered into force on 1 January 2019 with a goal to achieve over 80% reduction in HFC consumption by 2047.

The impact of the amendment will avoid up to 0.5 °C increase in global temperature by the end of the century.

It is a legally binding agreement between the signatory parties with non-compliance measures.

The amendment has divided the signatory parties into three groups-

Group I -consists of rich and developed economies like USA, UK and EU countries who will start to phase down HFCs by 2019 and reduce it to 15% of 2012 levels by 2036.

Group II -consists of emerging economies like China, Brazil as well as some African countries who will start phase down by 2024 and reduce it to 20% of 2021 levels by 2045.

Group III -consists of developing economies and some of the hottest climatic countries like India, Pakistan, Iran, Saudi Arabia who will start phasing down HFCs by 2028 and reduce it to 15% of 2024-2026 levels till 2047.

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The Technology and Energy Assessment Panel (TEAP) will take a periodic review of the alternative technologies and products for their energy efficiency and safety standards.

Questions:

1. Give detailed account of Environment Protection Act of 1986.
2. Explain the role and functions of national green tribunal.
3. Give short notes on:
 1. WCCB
 2. Ramsar convention
 3. Basel convention
 4. International Maritime Organization





Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : Environmental Sustainability

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ENVIRONMENTAL SUSTAINABILITY

ENVIRONMENTAL SUSTAINABILITY

Environmental sustainability is the ability of the environment to support a defined level of environmental quality and natural resource extraction rates forever to mankind. Unnecessary disturbances to the environment should be avoided whenever possible.

Why is sustainability important?

The excessive usage of natural and manmade resources deplete its availability for the future generation. We need to look after our planet, our resources and our people to ensure that we can hand over our planet to our children to live in true sustainability. Hence conservation and awareness are the two important terms that can bring sustainability to our living. When we use the word sustainability to mean maintain, it means to maintain it forever. This is because our actions have a lasting effect on the environment and we should protect it for our future generations.

United Nations and Sustainable Development

Sustainability was first featured in the principles adopted by the United Nations Conference on the Human Environment held at Stockholm on 16 June 1972. It was now realized that development needed to be sustainable – it should not only focus on economic and social matters, but also on matters related to the use of natural resources. The United Nations commissioned a group of 22 people from both developed and developing countries to identify long-term environmental strategies for the international community. This World Commission on Environment and Development (WCED), was headed by Gro Harlem Brundtland, then the Prime Minister of Norway. This commission came to be known as the Brundtland Commission, which submitted its report, entitled Our common future, to the UN in 1987.

The Brundtland Report focused on the needs and interests of humans. It was concerned with securing a global equity for future generations by redistributing resources towards

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poorer nations to encourage their economic growth in order to enable all human beings to achieve their basic needs.

The report highlighted the three fundamental components of sustainable development, the environment, the economy, and society, which later became known as the triple bottom line.

The 1992 and 2002 Earth Summits held at Rio de Janeiro and Johannesburg were the United Nations Conference on Environment and Development (UNCED), a direct result of the Brundtland Commission. An important achievement of the Rio summit was an agreement on the Climate Change Convention which led to the Kyoto Protocol.

The United Nations Conference on Sustainable Development (UNCSD), also known as Rio 2012, Rio+20 or Earth Summit 2012 was the third and recent International conference on sustainable development. It was hosted by Brazil in Rio de Janeiro from 13 to 22 June 2012.

Concept and Goals of Sustainable Development

In 1980 the International Union for the Conservation of Nature introduced the term "sustainable development". Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. A primary goal of sustainable development is to achieve a reasonable and equitably distributed level of economic wellbeing that can be continued for many human generations.

Sustainable Development Goals (SDGs)

In 1992, the UN Conference on Environment and Development published the Earth Charter, which outlined the building of a just, sustainable, and peaceful global society in the 21st century. The action plan was known as 'Agenda 21' for sustainable development. In September 2015, the United Nations General Assembly formally adopted the "Universal, integrated and transformative"

2030 Agenda for Sustainable Development, a set of 17 Sustainable Development Goals (SDGs). The goals are to be implemented and achieved in every country from the year

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2016 to 2030. Countries adopted a set of goals to end poverty, protect the planet and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years. For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and people.

Goal 1: End poverty in all its forms everywhere One in five people in developing countries still live on less than \$1.90 a day, many people risk slipping back into poverty. Economic growth must be inclusive to provide sustainable jobs and promote equality.

Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture, forestry and fisheries can provide nutritious food for all and generate decent incomes, while supporting people centered rural development and protecting the environment. A profound change of the global food and agriculture system is needed if we are to nourish today's 815 million hungry and the additional 2 billion people expected by 2050.

Goal 3: Ensure healthy lives and promote well-being for all at all ages Significant strides have been made in increasing life expectancy and reducing some of the common killers associated with child and maternal mortality. Major progress has been made on increasing access to clean water and sanitation, reducing malaria, tuberculosis, polio and the spread of HIV/AIDS.

Goal 4: Ensure inclusive and quality education for all and promote lifelong learning Major progress has been made towards increasing access to education at all levels and increasing enrolment rates in schools particularly for women and girls. For example, the world has achieved equality in primary education between girls and boys, but few countries have achieved that target at all levels of education.

Goal 5: Achieve gender equality and empower all women and girls Gender equality is not only a fundamental human right, but a necessary foundation for a peaceful, prosperous and sustainable world.

Goal 6: Ensure access to water and sanitation for all Clean, accessible water for all is an essential part of the world we want to live in. There is sufficient fresh water on the planet

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to achieve this. But due to bad economics or poor infrastructure, every year millions of people, most of them children, die from diseases associated with inadequate water supply, sanitation and hygiene. By 2050, at least one in four people is likely to live in a country affected by chronic or recurring shortages of fresh water.

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all
Energy is central to nearly every major challenge and opportunity the world faces today. Sustainable energy is opportunity – it transforms lives, economies and the planet.

Goal 8: Promote inclusive and sustainable economic growth, employment and decent work for all
Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs that stimulate the economy while not harming the environment. Job opportunities and decent working conditions are also required for the whole working age population.

Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation
Inclusive and sustainable industrial development is the primary source of income generation, allows for rapid and sustained increases in living standards for all people, and provides the technological solutions to environmentally sound industrialization.

Goal 10: Reduce inequality within and among countries to reduce inequality, policies should be universal in principle paying attention to the needs of disadvantaged and marginalized populations.

Goal 11: Make cities inclusive, safe, resilient and sustainable
Cities are hubs for ideas, commerce, culture, science, productivity, social development and much more. At their best, cities have enabled people to advance socially and economically. Common urban challenges include congestion, lack of funds to provide basic services, a shortage of adequate housing and declining infrastructure.

Goal 12: Ensure sustainable consumption and production patterns
Sustainable consumption and production is about promoting resource and energy efficiency, sustainable infrastructure, and providing access to basic services, green and decent jobs and a better quality of life for all. Its implementation helps to achieve overall

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development plans, reduce future economic, environmental and social costs, strengthen economic competitiveness and reduce poverty.

Goal 13: Take urgent action to combat climate change and its impacts Climate change is now affecting every country on every continent. It is disrupting national economies and affecting lives, costing people, communities and countries dearly today and may be even more tomorrow.

Goal 14: Conserve and sustainably use the oceans, seas and marine resources. The world's oceans – their temperature, currents and life – drive global systems that make the earth habitable for humankind. Careful management of this essential global resource is a key feature of a sustainable future.

Goal 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss Forests cover 30 per cent of the Earth's surface and in addition to providing food security and shelter, forests are key to combating climate change, protecting biodiversity and the homes of the indigenous population. Thirteen million hectares of forests are being lost every year while the persistent degradation of dry lands has led to the desertification of 3.6 billion hectares.

Goal 16: Promote just, peaceful and inclusive societies. This Goal is dedicated to the promotion of peaceful and inclusive societies for sustainable development, the provision of access to justice for all, and building effective, accountable institutions at all levels.

Goal 17: Revitalize the global partnership for sustainable development. A successful sustainable development agenda requires partnerships between governments, the private sector and civil society. These inclusive partnerships built upon principles and values, a shared vision, and shared goals that place people and the planet at the centre, are needed at the global, regional, national and local level.

Question:

1. What is environment sustainability and why it is very important to the environment and give short notes on SDG goals?



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : Global Environmental Issues and Management

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GLOBAL ENVIRONMENTAL ISSUES AND MANAGEMENT

CLIMATE CHANGE: GLOBAL ENVIRONMENTAL ISSUES

GLOBAL ENVIRONMENTAL ISSUES:

1. Climate Change:

Climate change is a change in usual weather found in place. This could be a change in how much rain in a place usually gets in a year or it could be a change in a place usual temperature for a month or season. Climate change is also a change in earth climate. This could be a change in where rain and snow usually fall on earth.

Changes in climate on earth:

Earth climate is always changing. There have been times when earth climate has been warmer than it is now. There have been times when it has been cooler. These times can last thousands or millions of years. People who study earth see that earth's climate is getting warmer. Earth's temperature has gone up about one Degree Fahrenheit in the last 100 years. This may not see much like much. But small changes in Earth's temperature can have big effects. The warming earth climate has caused some snow and ice to melt. The warming also has caused oceans to rise and it has changed the timing of when certain plants grow.

Causes of climate change:

Climate change caused may be human activities or nature of its own.

2. Global Warming:

Earth has warmed at an unprecedented rate over the last 100 years and particularly last two decades. An upsurge in the amount of extreme weather events, such as wildfires, heatwaves, and tropical storms. This is particularly because of the global warming.

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Global warming is increase in the earth average surface temperature due to effect of greenhouse gases, such as carbon dioxide emissions from burning of fossil fuels or from deforestation which trap heat that would otherwise escape from earth. This is a type of greenhouse effect.

Global warming impacts:

1. Rise in sea level
2. Changed in rainfall pattern
3. Increased likelihood of extreme events such as heatwave, flooding, hurricane etc.
4. Melting of ice caps, glaciers,
5. Widespread Vanishing of animal populations due to habitat loss.
6. Spread of disease like malaria etc.,
7. Bleaching of coral reefs
8. Loss of plankton due to warming of seas.

3.Greenhouse Effect

The greenhouse effect is a process (similar to green house) caused by greenhouse gases, which occur naturally in the atmosphere. This process plays a crucial role in warming the Earth's surface, making it habitable. However, human-generated greenhouse gas emissions upset the natural balance and lead to increased warmth.

Incoming energy:

The Sun emits energy that is transmitted to Earth. Because the Sun is very hot, the energy is emitted in high energy short wavelengths that penetrate the Earth's atmosphere.

Absorption

About 30% of the Sun's energy is reflected directly back into space by the atmosphere, clouds, and surface of the Earth. The rest of the Sun's energy is absorbed into the Earth's system.

Emission

The Earth re-emits energy back into the atmosphere Because the Earth is cooler than the Sun, the energy is emitted in the form of infrared radiation, at wavelengths longer than the incoming solar energy.

Role of Greenhouse Gases

Greenhouse gases in the atmosphere absorb much of the long-wave energy (infrared radiation) emitted from the Earth's surface, preventing it from escaping from the Earth's system. The greenhouse gases then re-emit this energy in all directions, warming the Earth's surface and lower atmosphere.

Human Role

The atmospheric concentration of greenhouse gases has increased significantly over the past two centuries, largely due to human-generated carbon dioxide emissions from burning fossil fuels, deforestation. This increase has amplified the natural greenhouse effect by trapping more of the energy emitted by the Earth. This change causes Earth's surface temperature to increase.

Greenhouse gases

Greenhouse gases means those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorbs and re-emit infrared radiation.

1. Water Vapour
2. Carbon Dioxide
3. Methane
4. Nitrous Oxide
5. Fluorinated Gases
6. Black Carbon
7. Brown Carbon

4. Deforestation

Deforestation is the destruction of forests in order to clear the land and make it available for other uses. Forests cover about 30 percent of the world's landmass. But due to deforestation it is estimated that the earth loses 18.7 million acres of forests per year. In 2016, global tree cover loss reached a record of 29.7 million hectares. Common methods of deforestation are burning trees and clear cutting.

People's Participation in Conservation of Forests People's participation is vital in forest conservation, especially those living in the or close to the forest. This is referred to as Community forestry, which varies widely in legal, political and cultural settings and the term covers a wide range of experiences and practices.

The Bishnois, who are known conservators of their forest, were inspiration to many people's participatory movements for Environmental protection in India. The Chipko movement resisted the destruction of forests of India in the 1970s. Sunderlal Bahuguna was the leader of this movement. People in the movement hugged the trees, and prevented felling of trees by contractors. The 'Forest man of India', Jadav Payeng who created 1,360 acres of dense and defiant forest was born in Aruna sapor (a river island on Brahmaputra).

5. Ocean acidification

The uptake of atmospheric carbon dioxide by the ocean increases, the concentration of hydrogen ions in the ocean increases, the concentration of carbonate ions decreases, the pH of the oceans decreases and the oceans become less alkaline – this process is known as ocean acidification.

Effect of ocean acidification

Seawater absorbs CO_2 to produce carbonic acid (H_2CO_3), bicarbonate (HCO_3^-) and carbonate ions (CO_3^{2-}). These carbonate ions are essential to the calcification process that allows certain marine organisms to build their calcium carbonate shells and skeletons (e.g. hard tropical corals, cold water corals, molluscs, crustaceans, sea urchins, certain types of plankton, lobsters, etc). However, increases in atmospheric CO_2 levels lead to decrease in pH level, increase in the concentration of carbonic acid and

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bicarbonate ions, causing a decrease in the concentration of carbonate ions. Thus carbonate ions are less available and calcification is therefore harder to achieve, and may be prevented altogether.

Mitigation

1. Reducing CO₂
2. Promoting government policies to cap CO₂ emissions,
3. Eliminate offshore drilling,
4. By advocating for energy efficiency and
5. Alternative energy sources such as wind power, solar, etc.

6.Ozone Depletion

At about 15 and 30 kilometers from the ground level, the earth's atmosphere has a thin layer of ozone, which absorbs ultraviolet sunlight. Ozone is found in the layer of the atmosphere called the Stratosphere. It acts as a protective covering that absorbs ultraviolet (UV) radiation from the sun. The ozone molecule (O₃) consists of three oxygen atoms. It is formed when atmospheric oxygen (O₂) on exposure to solar radiation breaks into two oxygen atoms; each atom then joins up with a single oxygen atom. The ozone molecule is unstable. It soon decays again to form molecular oxygen. This cycle is a continuous process in the upper reaches of the stratosphere.

Change in equilibrium

The equilibrium between the formation and destruction of ozone, has been upset by the influx of several substances in to the atmosphere which react with ozone and destroy it.

The rate at which ozone is being destroyed is much faster than the rate at which it is being formed.

It implies that there is a significant decrease in the concentration of the atmosphere hence the name 'ozone depletion'.

Causes and effects of ozone layer depletion

Causes:

Ozone layer depletion mainly occurs by anthropogenic actions.

The excessive release of chlorine and bromine from man-made compounds such as chlorofluorocarbons (CFCs) causes ozone layer depletion. CFCs, methyl chloroform, carbon tetrachloride, hydrochlorofluorocarbons, hydro bromo fluorocarbons and methyl bromide are found to have direct impact on the depletion of the ozone layer. These are categorized as ozone-depleting substances (ODS).

Effects:

1. UV rays may penetrate deep into the skin and can lead to premature skin aging and wrinkling of skin;
2. suppression of the immune system, skin cancer (melanoma) and chronic effects leading to eye damage.
3. DNA damage can result from free radicals and reactive oxygen and photons can damage the DNA itself.

Control:

Ozone layer depletion can be controlled by

- (1) Phase down or ban the use of CFCs (CFC free refrigerants).
- (2) Minimizing the use of chemicals such as halons and halocarbons.
- (3) Creating awareness about ozone depleting agents.

Monitoring the Ozone Layer

Some organizations that help in monitoring the atmosphere and form a network of information communication about the atmosphere, including ozone layer monitoring are:

1. World Meteorological Organization (WMO)
2. World Weather Watch (WWW)
3. Integrated Global Ocean Services Systems (IGOSS)
4. Global Climate Observing System (GCOS)

●.....● **Role of polar stratospheric clouds in ozone depletion.**

There are three types of stratospheric clouds. They are:

1. Nacreous clouds extend from 10 to 100km in length and several kilometers in thickness. They are also called 'mother-of-pearl' clouds due to their glow with a seashell like iridescence.
2. The second type of clouds contain nitric acid instead of pure water.
3. The third type of clouds have the same chemical composition as nacreous clouds, but form at a slower rate, which results in a larger cloud with no iridescence. The chlorine released by the breakdown of CFCs exists initially as pure chlorine or as chlorine monoxide (active chlorine / instable) but these two forms react further to form compounds Chlorine nitrate and HCL that are stable(inactive chlorine).

Why is the Ozone Depletion pre-dominant at the Antarctic?

The Antarctic stratosphere is much colder. The low temperature enables the formation of Polar stratospheric Clouds (PSCs), below 20 km.

Ozone absorbs sunlight, causing the characteristic increase in temperature with increase in altitude in the stratosphere. If ozone is being depleted, the air becomes cooler, further adding to the favorable conditions for the formation of PSCs and stabilization of the vortex.

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 remains, in fact, throughout the polar winter, well into midspring whereas the vortex in the Arctic disintegrates by the time the polar spring (March-April) arrives.

Typical happenings in the winter months leading to the Ozone Depletion over the Antarctic. In June Antarctic winter begins, the vortex develops and the temperature falls enough for the clouds to form.

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During July and August PSCs denitrify and dehydrate the stratosphere through precipitation, hydrochloric acid and chlorine nitrate react on cloud surfaces to free chlorine and winter temperatures drops to their lowest point.

In September sunlight returns to the centre of the vortex as the austral spring begins and PSCs disappear because of increasing temperature. ClO-ClO and ClOBrO catalytic cycles destroy ozone. During October lowest levels of ozone are reached. In November, Polar vortex breaks down, ozone-rich air from the mid-latitudes replenishes the Antarctic stratosphere and ozone-poor air spreads over the southern hemisphere.

Effect of Ozone depletion:

1.Environmental Effects of Ozone Depletion

1. Decrease in the quantity of total-column ozone; tend to cause increased penetration of solar UV-B radiation(290-315nm) to the earth's surface.
2. UV-B radiation is the most energetic component of sunlight reaching the earth's surface.
3. It has profound effects on human health, animals, plants, micro-organisms, materials and on-air quality.

2.Effects of human and animal health

1. Potential risks include an increase in the incidence of and morbidity from eye diseases, skin cancer and infectious diseases.
2. UV radiation has been shown in experimental systems to damage the cornea and lens of the eye. Experiments in animals show that UV exposure decreases the immune response to skin cancers, infectious agents and other antigens and can lead to unresponsiveness upon repeated challenges.
3. In susceptible (light-skin coloured) populations, UV-B radiations is the key risk factor for development of non-melanoma skin cancer (NMSC).

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Effects on terrestrial plants

1. Psychological and developmental processes of plants are affected by UV-B radiation.
2. Response to UV-B also varies considerably among species and also cultivars of the same species. In agriculture, this will necessitate using more UV-B tolerant cultivars and breeding new ones.
3. In forests and grasslands, this is likely to result in changes in the composition of species; therefore, there are implications for the biodiversity in different ecosystems.
4. Indirect changes caused by UV-B such as changes in plant form, biomass allocation to parts of the plant, timing of developmental phases and second metabolism may be equally or sometimes more important than the damaging effects of UV-B.

Effects on aquatic ecosystems

1. Exposure to solar UV-B radiation has been shown to affect both orientation mechanisms and motility in phytoplankton, resulting in reduced survival rates for these organisms.
2. Solar UV-B radiation has been found to cause damage in the early developmental stages of fish, shrimp, crab, amphibians and other animals.
3. The most severe effects are decreased reproductive capacity and impaired larval development.

Effects on bio-geochemical cycles

1. Increases in solar UV radiation could affect terrestrial and aquatic biogeochemical cycles, thus, altering both sources and sinks of greenhouse and chemically important trace gases.
2. These potential changes would contribute to bio-sphere atmosphere feedbacks that reinforce the atmospheric build-up of these gases.

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Effects on air quality

1. Reduction in stratospheric ozone and the concomitant increase in UV-B radiation penetrating to the lower atmosphere result in higher photo dissociation rates of key trace gases that control the chemical reactivity of the troposphere.
2. This can increase both production and destruction of ozone (O₃) and related oxidants such as hydrogen peroxide(H₂O₂), which are known to have adverse effects on human health, terrestrial plants, and outdoor materials.
3. Changes in the atmospheric concentrations of the hydroxyl radical (OH) may change the atmospheric lifetimes of climatically important gases such as methane (CH₄) and the CFC substitutes.)
4. Increased tropospheric reactivity could also lead to increased production of particulates such as cloud condensation nuclei, from the oxidation and subsequent nucleation of sulphur, of both anthropogenic and natural origin (e.g. carbonyl sulphide and dimethyl sulphide.

Effects on materials

1. Synthetic polymers, naturally occurring bio-polymers, as well as some other materials of commercial interest are adversely affected by solar UV radiation.
2. The application of these materials, particularly, plastics, in situations which demand routine exposure to sunlight is only possible through the use of light-stabilizers and / or surface treatment to protect them from sunlight.
3. Any increase in solar UV-B content due to partial ozone depletion will therefore accelerate the photo-gradation rates of these materials, limiting their life outdoors.

Question:

1. Discuss the Global environmental issues and its management briefly.



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material

Subject : Environment, Biodiversity and Disaster Management

Topic : In situ and Ex situ conservation measures

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IN SITU AND EX SITU CONSERVATION

IN SITU AND EX SITU CONSERVATION

Biodiversity and Its Conservation

The natural resources of the Earth, including air, water, land, flora and fauna of natural ecosystems must be safeguarded for the benefit of the present and future generations through careful planning and management, as appropriate – Principle of the Stockholm Declaration, 1972.

The large-scale loss of biodiversity and its global impact makes conservation the need of the hour. Conservation of biodiversity is protection and scientific management of biodiversity so as to maintain it at its optimum level and derive sustainable benefits for the present as well as future generations. It aims to protect species from extinction and their habitats and ecosystems from degradation.

General strategies in conservation

1. Identify and protect all threatened species
2. Identify and conserve in protected areas the wild relatives of all the economically important organisms
3. Identify and protect critical habitats for feeding, breeding, nursing, resting of each species resting, feeding and breeding places of the organisms should be identified and protected Air, water and soil should be conserved on priority basis Wildlife Protection Act should be implemented

Benefits of Biodiversity conservation

1. Conservation of biological diversity leads to conservation of essential ecological diversity to preserve the continuity of food chains.
2. The genetic diversity of plants and animals is preserved.

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3. It ensures the sustainable utilization of life support systems on earth.
 4. It provides a vast knowledge of potential use to the community.
 5. A reservoir of wild animals and plants is preserved, thus enabling them to be introduced, if need be, in the surrounding areas.
 6. Biodiversity conservation assures sustainable utilization of potential resources.

There are two aspects of conservation strategies

- i. In-situ conservation
- ii. Ex-situ conservation

i. In-situ Conservation:

This is the conservation of genetic resources through their protection within a natural or manmade ecosystem in which they occur. It is conservation and protection of the whole ecosystem and its biodiversity at all levels in order to protect the threatened species. Maximum protection of biodiversity hotspots regions with very high levels of species richness. Although all the biodiversity hotspots together cover less than 2 percent of the earth land area, the number of species they harbor is extremely high and protection of these hotspots could reduce the ongoing mass.

In-situ conservation includes:

1. National park
2. Wildlife sanctuaries and bird sanctuaries
3. Protected forests or Reserved forests
4. Biosphere reserves
5. Nature reserves like sacred groves, community reserves, conservation reserves.

Protected Area:

These are biogeographical areas where biological diversity along with natural and cultural resources is protected, maintained and managed through legal measures. protected areas include national parks, wild life sanctuaries, community reserves and biosphere reserves. World Conservation monitoring centre has recognized 37,000 protected areas world-wide. India has about 771 protected areas covering 162099 km²

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comprising of National Parks (104), Wild Life Sanctuaries (544), biosphere reserves (18) and several sacred groves.

National Parks (NP):

It is a natural habitat that is notified by the state government to be constituted as a National Park due to its ecological, faunal, floral, geomorphological, or zoological association of importance. No human activity is permitted inside the national park except the activities permitted by the Chief Wildlife Warden of the state.

National Park is an area which is strictly reserved for the betterment of wildlife and biodiversity and where activities like development, forestry, poaching, hunting, grazing and cultivation are not permitted.

National Parks in Tamil Nadu	Year of establishment	District(s)
Guindy NP	1976	Chennai
Gulf of Mannar Marine NP	1980	Ramanathpuram and Tuticorin
Indira Gandhi (Annamalai) NP	1989	Coimbatore
Mudumalai NP	1990	Nilgiris
Mukurthi NP	1990	Nilgiris

Wild Life Sanctuaries (WLS):

Any area other than the area comprised with any reserve forest or the territorial waters can be notified by the State Government to constitute as a sanctuary if such area is of adequate ecological, faunal, floral, geomorphological, natural or zoological significance. This is for the purpose of protecting, endangered factual species. Some restricted human activities are allowed inside the Sanctuary area. Ecotourism is permitted, as long as animal life is undisturbed.

There are 544 existing wildlife sanctuaries in India covering an area of 118,918 km², which is 3.62 % of the geographical area of the country (National Wildlife Database, 2017).

Sanctuaries are tracts of land where wild animals and fauna can take refuge without being hunted or poached. Other activities like collection of forest products, regulated

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 harvesting of timber, private ownership of land is permitted. Periyar wild life sanctuary in Kerala is famous for the Indian Tiger and Asiatic Elephant. Wildlife sanctuaries in India are IUCN category IV protected areas.

Prominent WLS in Tamil Nadu	Year of establishment	Districts
Vedanthangal Lake Birds WLS	1936	Chengalpet
Mudumalai WLS	1942	Nilgiris
Point Calimere WLS	1967	Nagapattinam
Indira Gandhi (Annamalai) WLS	1976	Coimbatore
Mundanthurai WLS	1977	Tirunelveli

Eco sensitive zones:

The National Wildlife Action Plan (2002–2016) of MoEFCC stipulated that state governments should declare land falling within 10 km of the boundaries of national parks and wildlife sanctuaries as eco-fragile zones or ESZs under the Environmental (Protection) Act, 1986. The purpose of the ESZ was to provide more protection to the parks by acting as a shock absorber or transition zone. Eco-Sensitive Zones would minimize forest depletion and man-animal conflict. The protected areas are based on the core and buffer model of management. The core area has the legal status of being a national park. The buffer area, however, does not have legal status of being a national park and could be a reserved forest, wildlife sanctuary or tiger reserve.

Biosphere Reserve (BR):

Biosphere Reserve (BR) is an international designation by UNESCO for representative parts of natural and cultural landscapes extending over large area of terrestrial or coastal/ marine ecosystems or a combination thereof. BRs are designated to deal with the conservation of biodiversity, economic and social development and maintenance of associated cultural values. Biosphere Reserves are thus special environments for both people and nature and are living examples of how human beings and nature can co-exist while respecting each other's needs. The Biosphere Reserve Programme is guided

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by UNESCO's Man and Biosphere (MAB) programme, as India is a signatory to the landscape approach supported by MAB programme. The scheme called Biosphere Reserve was implemented by the Government of

India in 1986. There are 18 Biosphere Reserves in the country. Agasthyamalai (Karnataka - Tamil Nadu - Kerala), Nilgiri (Tamil Nadu - Kerala), Gulf of Mannar (Tamil Nadu) are the BRs notified in Tamil Nadu.

The biosphere reserve consists of core, buffer, transition zones:

1.Core zone:

Fully protected and natural area of the biosphere reserve least disturbed by human activities. It is legally protected (under EPA Act 1986) ecosystem in which entry is not allowed except with permission of some special purpose. Destructive sampling for scientific investigations is prohibited. The core zone is to be kept free from all human pressure external to the system.

2.Buffer zone:

The buffer zones surround the core zone and is managed to accommodate a greater variety of resource use strategies, and research and educational activities. Limited recreation, tourism, fishing and grazing are permitted to reduce its effect on core zone.

3.Transition zone:

The outer most part of biosphere reserve, is an area of active cooperation between the reserve management and local people, wherein activities like settlements, cropping, forestry, recreation and other economic that are in harmony with the conservation goals. The transition zone is the experimental research areas used for understanding the patterns and processes in the ecosystem.

The main functions of biosphere reserves are:

- i. Conservation
- ii. Development
- iii. Scientific research, monitoring and education.



Community reserves:

Community reserves can be declared by the state governments in any private or community land not comprised within the national park, sanctuary, or conservation reserve, where an individual or community has volunteered to conserve wild life and its habitat. Community reserves are declared for the purpose of protecting fauna, flora and traditional or cultural conservation values and practices. The declaration of such areas is aimed at improving the socio-economic conditions of the people living in such areas as well as conserving wildlife. No change in land use pattern shall be made within the community reserve, except accordance with a resolution passed by management committee and approval of the same by the state government.

Conservation reserves:

Conservation Reserves can be declared by the State Governments in any area owned by the Government, particularly the areas adjacent to National Parks and Sanctuaries and those areas which link one Protected Area with another. Such a declaration should be made after having consultations with the local communities. The rights of people living inside a Conservation Reserve are not affected.

Sacred Groves

India is also a history of religious and cultural traditions that emphasized protection of nature. A sacred grove or sacred woods are any grove of trees that are of special religious importance to a particular culture. Sacred groves feature in various cultures throughout the world. These spaces are protected by local communities because of their religious beliefs and traditional rituals that run through several generations. The degree of holiness of the sacred groves varies from one grove to another. In some forests even the dry foliage and fallen fruits are not touched.

Such sacred groves are found in Khasi and Jaintia hills in Meghalaya, Aravalli hills of Rajasthan, Western ghat regions of Karnataka and Maharashtra and the Surguja, Chanda and Bastar areas of Madhya Pradesh and Chhattisgarh.



2.Ex-situ conservation

Ex-situ conservation involves maintenance and breeding of endangered plants and animals under partially or wholly controlled conditions in specific areas like zoo, gardens, nurseries etc. It includes offsite collections and gene banks.

Other examples of ex-situ conservation include:

1. Botanical gardens
2. Zoological park
3. Gene Banks
4. Seed Banks
5. Cryo-preservation
6. Conservation at molecular level

Botanical gardens

Botanical garden refers to the scientifically planned collection of living trees, shrubs, herbs, climbers and other plants from various parts of the earth.

Purpose of botanical gardens

1. Ex-situ conservation and propagation of important threatened plant species.
2. To build public awareness through education on plant diversity and need for conservation.
3. To study the taxonomy as well as growth of plants.
4. To study the introduction and acclimatisation process of exotic species of plants.
5. It acts as germplasm collection centre and helps development of new hybrids.
6. It serves as a Centre of Excellence for conservation, research and training.
7. It augments conserving rare and threatened species.
8. It acts as a source of recreation.

Botanical Survey of India (BSI)

BSI is the apex research organization under Ministry of Environment and Forests (MoEFCC) for carrying out taxonomic and floristic studies on wild plant resources of country. It was established in 1890 with objective to explore plant resources of country and to identify plants species with economic virtues. It has nine regional circles situated at different regions of the country.

Primary functions of BSI

1. Exploration, inventorying and documentation of Phyto-diversity in general and protected areas, hotspots and fragile ecosystems in particular.
2. Publication of National, State and District Floras.
3. Identification of threatened and red list species and species rich areas needing conservation.
4. Ex-situ conservation of critically threatened species in botanical gardens. Survey and documentation of traditional knowledge (ethno-botany) associated with plants.
5. Develop National database of Indian plants, including herbarium and live specimens, botanical paintings and illustrations, etc.

Zoological park

Zoo is an establishment, whether stationary or mobile, where captive animals are kept for exhibition to the public and includes a circus and rescue centres but does not include an establishment of a licensed dealer in captive animals. The initial purpose of zoos was entertainment, over the decades, zoos have got transformed into centres for wildlife conservation and environmental education. Apart from saving individual animals, zoos have a role to play in species conservation too (through captive breeding). Zoos provide an opportunity to open up a whole new world, and this could be used in sensitizing visitors regarding the value and need for conservation of wildlife.

Zoological survey of India:

1. It is India's apex organization on animal taxonomy.
2. Its objective is to promote survey, exploration, research and documentation on various aspects of animal taxonomy in Indian subcontinent.
3. It also seeks advancement of knowledge on animal taxonomy.
4. It was established in 1916 and headquartered in Kolkata.
5. It has been declared as designated repository for National Zoological Collection as per section 39 of the National Biodiversity Act, 2002.

Gene Banks

Ex-situ collection and preservation of genetic resources is done through gene banks. Gene banks are a type of bio repository which preserves genetic material. Seed bank, Tissue bank, CryoBank and Pollen bank are some of the types of gene banks. Tura Range in Garo Hills of Meghalaya is a gene sanctuary for preserving the rich native diversity of wild citrus and musa species.

Seed Banks

Seed Banks store seeds at extremely low temperature and humidity. Seed banks can save large variety of plant species in a very small space. A seed bank stores seeds as a source for planting in case seed reserves elsewhere are destroyed. The seeds stored may be of food crops, or those of rare species to protect biodiversity. Depending on the species, seeds are dried to suitably low moisture content. Typically, this will be less than 5%. The seeds then are stored at -18°C or below. Because seed RNA (like animal DNA) degrades with time, the seeds need to be periodically replanted and fresh seeds collected for another round of long-term storage.

Cryopreservation (preservation under freezing conditions)

Cryopreservation is particularly useful for conserving vegetative propagated crops. Cryopreservation is the storage of material at ultra-low temperature of liquid nitrogen (-196°C) and essentially involves suspension of all metabolic processes and activities and samples can be preserved in such state for extended periods. Cryopreservation has

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been successfully applied to meristems, zygotic and somatic embryos, pollen, protoplasts cells and suspension cultures of a number of plant species.

Conservation at molecular level (DNA level)

In addition to cryopreservation, germplasm conservation at molecular level is now feasible and attracting attention. Cloned DNA and material having DNA in its native state can all be used for genetic conservation.

Conservation of Biodiversity

Conservation of bio-diversity is the proper management of the biosphere by human beings in such a way that it gives maximum benefits for the present generation and also develops its potential to meet the needs of the future generations.

The three basic objectives of biodiversity conservation are:

- (a) To maintain essential ecological processes and life supporting systems.
- (b) To preserve the diversity of species.
- (c) To make sustainable utilization of species and ecosystems.

There are two types of conservation methods namely in-situ and ex-situ conservations.

In-situ Conservation	Ex-situ Conservation
It is the on-site conservation or the conservation of genetic resources in natural populations of plant or animal species.	This is a conservation strategy which involves placing of threatened animals and plants in special care locations for their protection.
It is the process of protecting an endangered plant or animal species in its natural habitat, either by protecting or restoring the habitat itself, or by defending the species from predators.	It helps in recovering populations or preventing their extinction under simulated conditions that closely resemble their natural habitats.
National Parks, Biosphere Reserve, Wild Life Sanctuaries form in-situ conservation strategies.	Zoological parks and Botanical gardens are common ex-situ conservation programs.



Conservation Programmes For Species Oriented:

Certain species have been identified as needing a concerted and specifically directed protection effort to save the ecological balance and biodiversity of the region. The projects are enacted to save the mentioned species, which are threatened or in the brim of extinction with their prey and habitat.

These species play significant role in ecosystem functions and also acts as indicator species to showcase the quality of their habitat.

The projects are:

1. Project Tiger:

The Government of India launched the 'Project Tiger' in 1973 to protect our national animal. From 9 tiger reserves since its inception, the Project Tiger coverage has increased to 50 at present and spread out 18 ranges. Project Tiger is an ongoing Centrally Sponsored Scheme of the Ministry of Environment and Forests, providing central assistance to the states for tiger conservation in designated tiger reserves. Project Tiger was launched in the Jim Corbett National Park, Uttarakhand in 1973. The project ensures a viable population of Bengal tigers in their natural habitats, protecting them from extinction and preserving areas of biological importance as a natural heritage. The state government shall on recommendation of the NTCA notify an area as a tiger reserve.

A tiger reserves includes:

a) Core zone:

Critical tiger habit areas established on the basis of scientific and objective criteria. These areas are required to be kept as inviolate for the purposes of tiger conversation, without affecting the right of the scheduled tribes or such other forest dwellers. These areas are notified by the state government in consultation with an expert committee.

b) Buffer zone:

The Act defines buffer zone as the area peripheral to the critical tiger habitat or core area providing supplementary habitat for dispersing tigers, besides offering scope

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for co-existence of human activity (tribes). It aims at promoting co-existence between wildlife and human activity with due recognition of the livelihood, developmental, social and an Expert committee constituted for the purpose. The limits of such areas are determined with the concerned Gram Sabha and an Expert Committee constituted for the purpose. No alteration in the boundaries of a tiger reserve shall be made except on a recommendation of National Tiger Conservation Authority and National Board for Wildlife. No state government shall de-notify a tiger reserve except in public interest with the approval of National Tiger Conservation Authority and National Board for Wildlife.

National Tiger Conservation Authority:

The National Tiger Conservation Authority (NTCA) is a statutory body of the Ministry, created under the Wildlife (Protection) Act, 1972. India holds over half the world's tiger population. There are 50 tiger reserves in the country. The Authority will have eight experts or professionals having qualifications and experience in wildlife conservation and welfare of people including tribes, apart from three Members of Parliament of whom two will be elected by the House of the People and one by the Council of States. The Inspector General of Forests, in charge of project Tiger, will be ex-officio Member Secretary. The NTCA set up under the chairmanships of MOEFCC.

Objectives:

The objectives of NTCA are:

1. Providing statutory authority to Project Tiger so that compliance of its directives become legal.
2. Fostering accountability of Center-State in management of Tiger Reserves, by providing a basis for MoU with States within our federal structure.
3. Providing for an oversight by Parliament.
4. Addressing livelihood interests of local people in areas surrounding Tiger Reserves.

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Power and Functions:

Powers and functions of the National Tiger Conservation Authority as prescribed under section 380 of the Wildlife (Protection) Act, 1972, as amended in 2006 are as under:-

1. To approve the tiger conservation plan prepared by the State Government.
2. Evaluate and assess various aspects of sustainable ecology and disallow any ecologically unsustainable land use such as, mining, industry and other projects within the tiger reserves
3. To Lay down normative standards for tourism activities and guidelines for project tiger from time to time for tiger conservation in the buffer and core area of tiger reserves and ensure their due compliance
4. Provide for management focus and measures for addressing conflicts of men and wild animal and to emphasize on co-existence in forest areas outside the National Parks, sanctuaries or tiger reserve, in the working plan code.
5. Provide information on protection measures including future conservation plan, estimation of population of tiger and its natural prey species, status of habitats, disease surveillance, mortality survey, patrolling, reports on untoward happenings and such other management aspects as it may deem fit including future plan conservation
6. Approve, co-ordinate research and monitoring on tiger, co-predators, prey habitat, related ecological and socio-economic parameters and their evaluation
7. Ensure that the tiger reserves and areas linking one protected area or tiger reserve with another protected area or tiger reserve are not diverted for ecologically unsustainable uses, except in public interest and with the approval of the National Board for Wild Life and on the advice of the Tiger Conservation Authority
8. Facilitate and support the tiger reserve management in the State for biodiversity conservation initiatives through eco-development and people's participation as per approved management plans and to support similar initiatives in adjoining areas consistent with the Central and State laws

Tiger protection and antipoaching operations:

The illegal demand for body parts and derivatives of tiger outside the country continues to be a serious threat to wild tigers. Therefore, protection is accorded topmost priority in Project Tiger / NTCA. The States are engaged in an ongoing manner through the NTCA Headquarters as well as its Regional Offices, while issuing alerts, besides closely working with the CBI, Wildlife Crime Control Bureau and the Police Departments. The following actions are taken in this context:

1. Alerting the States as and when required
2. Transmitting backward / forward linkages of information relating to poachers
3. Advising the States for combing forest floor to check snares / traps
4. Performing supervisory field visits through the National Tiger Conservation Authority and its regional offices
5. Providing assistance to States for antipoaching operations
6. Using information technology for improved surveillance (e-Eye system) using thermal cameras launched in Corbett
7. Launching tiger reserve level monitoring using camera trap to keep a photo ID database of individual tigers
8. Preparing a national database of individual tiger photo captures to establish linkage with body parts seized or dead tigers

Due to concerted efforts under Project Tiger, at present India has the distinction of having the maximum number of tigers in the world at 2,967 (SE range 2,603 to 3,346) as per 2018 assessment, when compared to other tiger range countries. Tigers were observed to be increasing at a rate of 6% per annum in India when consistently sampled areas were compared from 2006 to 2018.

Estimation of tiger population:

The process of estimating the number of tigers in a given area is called 'Tiger census'. It is conducted at regular intervals to know the current tiger populations and population trends. Besides estimating the number of tigers the method also helps to gather information on the density of the tiger populations and associated prey. The most commonly used technique in the past was 'Pugmark Census Technique'. In this method

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the imprints of the pugmark of the tiger were recorded and used as a basis for identification of individuals. Now it is largely used as one of the indices of tiger occurrence and relative abundance. Recent methods used to estimate the numbers of tigers are camera trapping and DNA finger printing. In camera trapping, the photograph of the tiger is taken and individuals are differentiated on the basis of the stripes on the body. In the latest technique of DNA finger printing, tigers can be identified from their scats.

2.Project Elephant:

Project Elephant Launched in – 1992 to assist states having free ranging populations of wild elephants to ensure long term survival of identified viable populations of elephants in their natural habitats. Mainly implemented in 13 States/UTs – Andhra Pradesh, Arunachal Pradesh, Assam, Jharkhand, Karnataka, Kerala, Meghalaya, Nagaland, Orissa, Tamil Nadu, Uttaranchal, UP and WB. Small support to Maharashtra and Chhattisgarh. States were provided both financial and technical assistance.

Objectives

1. To protect elephants, their habitat & corridors
2. To address issues of man, animal conflict
3. Welfare of domesticated elephants

Aim

1. Restoring the natural habitats of elephants.
2. Addressing man and elephant conflict
3. Developing scientific and planned management measures for conservation of elephants.
4. Protecting the elephants from poachers and other unnatural causes of death
5. Preventing illegal ivory trade.
6. Researching on issues related to elephant
7. Crating public awareness and education programs for it.
8. Eco-development and Veterinary care for the elephants.
9. Maintaining health care and breeding of tamed elephants.

◆.....◆ **Elephant Corridor**

Stretch/narrow strips of forested land that connects larger habitats with elephant populations and forms a conduit for animal movement between the habitats. This movement helps in enhancing the species survival and birth rate. In India – 88 identified elephant corridors. Of total only 70% used by elephants. 1/3rd – ecologically high priority and 2/3rd –medium priority. Fragmentation of elephant habitat severity in following order – Northern WB → NW India → NE India → central India. South India – least fragmented because 65% corridors in south are protected areas or in reserved forests.

Threats to elephant corridors

1. Primary threat – Habitat loss.
2. Fragmentation and destruction of habitat due to developmental activities like construction of buildings, roads, railways, holiday resorts and the fixing solar energized electric fencing, etc.
3. “single biggest threats” in central India – Coal mining and iron ore mining
4. Mineral-rich states Orissa, Jharkhand and Chhattisgarh also have the highest number of elephant corridors in the country, which makes them known for elephant-man conflicts.
5. Poaching for extremely valuable elephant ivory
6. Non-accommodation of grazing grounds results in searching for food elsewhere which lead to them to crop fields and resulting in man animal conflict.

Mitigation

1. Fusion of the corridors with nearby protected areas wherever feasible.
2. In other cases, declaration as Ecologically Sensitive Areas or conservation reserves to grant protection.
3. Securing a corridor and Habitat restoration if needed.
4. Sensitizing local communities to the option of voluntarily relocation outside the conflict zones to safer areas.



Monitoring of illegal Killing of Elephants (MIKE) Programme

Project Elephant has been formally implementing MIKE (Monitoring of Illegal Killing of Elephants) programme of CITES in 10 Elephant reserves since January 2004. It is mandated by COP resolution of CITES. It was started in South Asia in 2003 with the following purpose –

1. To measure levels and trends in illegal hunting of elephants.
2. To determine changes in these trends overtime.
3. To determine the factors causing or associated with these changes and to try and assess in particular to what extent observed trends are a result of any decisions taken by the Conference of the Parties to CITES.
4. Data are collected from all sites on monthly basis in specified MIKE patrol form and submitted to Sub-Regional Support Office for South Asia Programme in Delhi who are assisting Ministry in implementation of the programme.

Haathi mere Saathi

No-no not the above movie. We are talking about campaign which was launched by the Ministry of environment and forests (MoEF) in partnership with the, wildlife trust of India (WTI).

Why launched?

To improve conservation and welfare prospects of the elephant –India's National Heritage Animal launched at – “Elephant- 8” Ministerial meeting, Delhi in 2011. E-8 countries are India, Botswana, Republic of Congo, Indonesia, Kenya, Sri Lanka, Tanzania and Thailand.

Aim – Increasing awareness among people and developing friendship, companionship between people and elephants.

The campaign Mascot “Gaju”

1. Focuses on – target audience groups including locals near elephant habitats, youth, policy makers etc.
2. It envisions of setting up of Gajah (Elephant) centre to spread awareness on their plight and invoke people's participation in addressing the threats to them.

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3. It also plans to build capacity of [protection and law enforcement agencies at the ground level, and advocate for policies favouring the elephants.
 4. Elephant task force (ETF) campaign to "Take Gajah (elephant) to the Prajah (people)" aims to spread awareness and encourage people's participation in elephant conservation and welfare.

Elephant – 8 Ministerial Meeting

The E-8 ministerial meeting represented regions with all 3 species of elephants –

1. *Elphas maximus* (Asian elephant)
2. *Loxodonta Africana* (African Bush elephant)
3. *Loxodonta Cyclotis* (African forest elephant)
4. Participants include – policy makers, conservationist, scientists, historians, art and culture experts among the participating countries.

Discussions were under 3 basic themes

1. Science and conservation
2. Management and conservation
3. Cultural and ethical perspectives of conservation

E-8 countries resolved to –

1. Take necessary steps in the direction of elephant conservation.
2. To actively pursue a common agenda to ensure a long-term welfare and survival of all species of elephants in all range countries.
3. To realize this goal meeting has called all range countries to join hands under umbrella of elephant 50:50 forum.

E-50:50 forum

It is the share vision of 50 states to promote conservation, management and welfare of elephants in next 50 years. 1st international congress – New Delhi (2013) – for adopting a common global vision of conservation, management and welfare of elephants across all range countries

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Gaj Yatra:

‘Gaj Yatra’, a nationwide campaign to protect elephants, was launched on the occasion of World Elephant Day in 2017. The campaign is planned to cover 12 elephant range states. The elephant is part of India’s animal heritage and the Government celebrates this day to spread awareness about the conservation of the species. The 15 months campaign will be led by the Wildlife Trust of India (WTI). The campaign aims to create awareness about elephant corridors to encourage free movement in their habitat.

3.PROJECT RHINO

Launched in 2005, Indian Rhino Vision 2020 is an ambitious effort to attain a wild population of at least 3,000 greater one-horned rhinos spread over seven protected areas in the Indian state of Assam by the year 2020. Seven protected areas are Kaziranga, Pobitora, Orang National Park, Manas National Park, Laokhowa wildlife sanctuary, Bura chapori wildlife sanctuary and Dibru Saikhowa wildlife sanctuary. The greater one-horned rhinoceros (*Rhinoceros unicornis*) is listed as Vulnerable on the IUCN Red List of Threatened Species. Rhinoceros unicorn is has been listed in CITES Appendix I since 1975. Close to 85% of the total population occurs in India, with about 75% in the state of Assam. The Indian and Nepalese governments have taken major steps towards Indian Rhinoceros conservation, especially with the help of the World Wide Fund for Nature (WWF) and other non-governmental organizations

Indian Rhino Vision (IRV) 2020 is a partnership between:

1. The Assam Forest Department,
2. The Bodoland Territorial Council,
3. The World Wide Fund for Nature (WWF),
4. The International Rhino Foundation (IRF), and
5. The US Fish and Wildlife Service.

Translocations are the backbone of the IRV 2020 program. Manas National Park was selected as the first site for translocation of rhinos. Ten Rhinos have been released into Manas since 2008. Ten more rhinos will be moved from Kaziranga National Park

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before the end of the year. Translocating rhinos will help to create a viable population of this threatened species.

Facts on threats

1. The extent and quality of the rhino's most important habitat, alluvial grassland and riverine forest, is considered to be in decline due to human and livestock encroachment
2. The Indian rhinoceros once ranged throughout the entire stretch of the Indo-Gangetic Plain, but excessive hunting and agricultural development reduced their range drastically to 11 sites in northern India and southern Nepal
3. As a result of habitat destruction and climatic changes their range has gradually been reduced so that by the 19th century, they only survived in the Terai grasslands of southern Nepal, northern Uttar Pradesh, northern Bihar, northern Bengal, and in the Brahmaputra Valley of Assam.

National Rhino Conservation Strategy

1. Recently, the government of India has also launched the National Rhino Conservation Strategy for India.
2. It called for active engagement between India and Nepal to protect the species.
3. The plan said the single population of rhinos in Sukla-Phanta (Nepal), Valmiki Tiger Reserve (India) and Chitwan National Park (Nepal) and Dudhwa (India) is separated by the political boundary between the two countries.
4. Instead of managing the two populations separately in the two countries, it needs to be managed with the same protocol.
5. The strategy would pave the path for long-term conservation of rhinos.

4.Project Snow Leopard: Jan 2009

Snow Leopard is globally endangered species as well as the most important flagship species of the mountain region. Project aims to conserve biodiversity with community participation. The project will be operational in five Himalayan States viz. Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, and Arunachal Pradesh with active

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support from wildlife institute of India and the Mysore based Nature Conservation Foundation.

The project stresses on a landscape approach to conservation wherein smaller core zones with relatively conservation values will be identified and conserved with support and the larger landscape will be managed in such a way that it allows necessary development benefits to the local communities. The project thus places greater importance to careful and knowledge-based management planning of the landscapes.

Threats: It is threatened by poaching for their fur, habitat destruction by infrastructure developments and climate change competition on livestock degradation and even facing local extinction.

Why to conserve the high-altitude ecosystem?

1. The high altitudes of India (> 3000 m) (including the Himalaya and Trans-Himalaya biogeographic zones) support a unique wildlife assemblage of global conservation importance.
2. This includes highly endangered populations of species such as the snow leopard, two species of bears, wolf, red panda, mountain ungulates such as the wild yak, chiru, Tibetan gazelle, Tibetan argali, Ladakh urial, two species of musk deer, the hangul, three species of goral, serow, and takin, etc. High altitude lakes and bogs provide breeding grounds for a variety of avifauna including the black-necked crane, bar headed Geese, Brahminy ducks, and brown-headed gulls, etc.
3. India has ratified international agreements promoting the conservation of high-altitude wildlife species such as the snow leopard.
4. In 2003, the Convention on Migratory Species included the snow leopard as a Concerted Action Species under its Appendix I.
5. Similarly, in 2003, the Convention on International Trade in Endangered Species (CITES) expanded the scope of the CITES Tiger Enforcement Task Force to include all Asian big cat species including the snow leopard.

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Initiatives:

Snow Leopard is found in 11 countries such as Afghanistan, Bhutan, China, India, Kazakhstan, Kyrgyz Republic, Mongolia, Pakistan, Russia, Tajikistan, and Uzbekistan. These countries formed the Global Snow Leopard Forum (GSLF) and signed the Bishkek Declaration to acknowledge its importance as the indicator of the health and sustainability of mountain ecosystems. It is the State animal of Himachal Pradesh.

Protection Status:

It has been listed in Schedule I under Wildlife (Protection) Act 1972, Appendix I of Convention on International Trade of Endangered Species (CITES) and Appendix I Convention on Migratory Species (CMS). In September 2017, International Union for Conservation of Nature (IUCN) had downgraded conservation status of snow leopard to “vulnerable” from “endangered”. It is National Heritage Animal of Pakistan and Afghanistan.

5.Project Sea Turtle:

A significant proportion of world's Olive Ridley Turtle population migrates every winter to Indian coastal waters for nesting mainly at eastern coast. Implementation by – MoEFCC & UNDP in 1999 with wildlife institute of India Dehradun as implementing agency.

Objective – Conservation of Olive Ridley turtles and other endangered marine turtles. The project being Implemented in 10 coastal states of the country with special emphasis in State of Orissa.

The project has helped in –

1. Preparation of inventory map of breeding sites of Sea Turtle.
1. Identification of nesting and breeding habitats along the shore line.
2. Migratory routes taken by Sea Turtles.
3. Development of guidelines to safeguard and minimize turtle mortality.
4. Development of national and international cooperative.
5. Collaborative action for Sea Turtle Conservation.

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Indian crocodile conservation project:

Implemented by – Government of India and UNDP. Launched in – 1975. This project had saved crocodiles from extinction and placed them on good path of recovery.

Objectives

1. Protect the remaining population of crocodilians in their natural habitat.
2. To rebuild natural, population quickly through 'grow and release' or 'rear and release technique'.
3. To promote captive breeding.
4. To take-up research to improve management.
5. To build up a level of trained personnel for better continuity of the project.
6. To involve the local people in the project intimately.

6.PROJECT VULTURE:

Vulture in India

India has 9 species of vultures in the wild. They are the –

1. Oriental White-backed Vulture (*gyps bengalensis*)
2. Slender billed Vulture (*gyps tenuirostris*)
3. Long billed Vulture (*gyps indicus*)
4. Egyptian Vulture (*Neophron percnopterus*)
5. Red Headed Vulture (*Sarcogyps calvus*)
6. Indian Griffon Vulture (*Gyps fulvus*)
7. Himalayan Griffon
8. Cinereous Vulture (*Aegypius monachus*) and
9. Bearded Vulture or Lammergeier (*Gypaetus barbatus*).

Decline of vulture populations 1st recorded at – Keoladeo Ghana National Park, Rajasthan. *Gyps* genus – 97% decline by 2005. Nepal and Pakistan also faced declines.

In India – White-backed Vulture (endangered), Slender billed Vulture and Long Billed Vulture declined. Red-headed vulture or king vulture, Slender billed Vulture and Long

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billed Vulture –critically endangered. Reason for decline was considered as decline in food availability or viral epidemic disease but it was due to drug Diclofenac.

Diclofenac Sodium as the Probable Cause

A non-steroidal anti-inflammatory drug (NSAID) administered to reduce inflammation and to reduce pain in certain conditions. Diclofenac was given to cattle's for reducing pain. The carcass of these cattle was eaten by Vultures. Vultures were unable to break down the chemical diclofenac and suffer from kidney failure (NSAIDs are associated with adverse kidney (renal) failure which is caused due to the reduction in synthesis of renal prostaglandins)“Neck drooping” – this behavior of vultures just weeks before collapsing from trees is sign or indication that birds are ill. Neck drooping is also reported in healthy birds under hot conditions.

Alternative of Diclofenac – Meloxicam

Meloxicam is a second generation NSAID. And rated Better than Diclofenac for the treatment of livestock, with reduced risk of side effects. Also approved for human use in more than 70 countries included in India and USA.

Diclofenac is banned but it is still in use. How's that's possible?

Indian government had banned it for use on cattle's. But it is not banned for human use and so same is used for cattle's. Human form of diclofenac is cheaper than Meloxicam

Significance of vultures in India

1. Keeps environment clean – by scavenging animal carcass.
2. Parsi community's religious practice of disposing dead bodies
3. Primary removers of carrion in India and Africa.

Without vultures:

Equilibrium between populations of other scavenging species will be affected. Result in increase in putrefying carcasses. Increasing risk of spread of Rabies and Anthrax – Movement of Feral dogs into carcass dumps. Traditional custom of the Parsis of placing their dead in the “Towers of Silence” for vultures to feed upon will be affected.



Life will be much harder for local hide and bone-collectors, who rely, on cleaned carcasses in order to earn living. Cattle owners will have to pay to have livestock carcasses buried or burnt.

Conservation of vultures

Vulture safety zones (VSZ)

Aim – To establish targeted awareness activities surroundings 150 km radius of vultures’ colonies so that no diclofenac or the veterinary toxic drugs are found in cattle carcasses, the main food of vultures (to provide safe food).

Zones

- Corbett to Katriya Ghat Slender-billed vulture and white-backed vulture. Marshy grassland, Savannas and forests.
- Dibrugarh (Assam) to North Lakhimpur (Arunachal Pradesh) Slender billed and white backed species of vulture
- Central India covering Chhattisgarh, where white-backed and long-billed vultures are found.

How VSZ can be helpful?

Safe source of food that is free of contamination from veterinary drugs, poisons and other agricultural chemicals. A place where vultures can feed free from human disturbances. Supplement the ever-decreasing food base for vultures. Increase their breeding success because of food availability. An economical and practical way of disposing of old and unproductive cattle. Help to reduce the risk of spreading diseases. A place for scientists to study the biology and ecology of these threatened species. An opportunity to raise public awareness on vulture conservation and to raise funds. An excellent opportunity for eco-tourists to observe these magnificent birds.

Vulture restaurants

At this restaurant, tables are reserved only for the unique and rare vultures by Maharashtra and Punjab forest departments.

Aim

1. Conserve the fast dwindling vulture population
2. Diclofenac free carcasses of cattle.
3. Involvement of local communities in in-situ conservation.
4. People inform the forest department in case of the death of an animal in their village and the department tests the dead animal for presence of diclofenac.
5. In their absence the department pays monetary benefits to the owner of the animal and informer, transports it to the vulture restaurant.
6. Whenever a vulture nesting is found, conservation measures like providing safe food near nesting trees, constant protection ... from all sorts of disturbances, etc., are put in place without delay.

Benefits

1. Conservation of vulture from extinction
2. Community participation in conservation
3. Economic incentive to local cattle breeders
4. Phasing out the use of diclofenac
5. Awareness
6. Dining spots
7. Punjab – Kathlore, Chandola and Chamraur
8. Maharashtra – Gadchiroli, Thane, Nagpur, Nashik, Raigad districts

Breeding Centers in India

Vulture Breeding and Conservation Centre had already been established at – Pinjore, Haryana in Rani, Guwahati (Assam) Buxa, West Bengal, Junagadh Bhopal, Hyderabad, Bhubhaneshwar

India's Role in Conservation

India moved a motion in IUCN in,2004 for vulture conservation, which was accepted in the form of the IUCN resolution.

This resolution called upon Gyps Vulture Range countries to begin action to –

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1. Prevent all uses of diclofenac in veterinary applications.
 2. Establishment of IUCN South Asian Task Force under the auspices of the IUCN and range countries to develop and implement national vulture recovery plans, including conservation breeding and release.

7. Project Hangul

1. The Kashmir stag also called Hangul is a subspecies of Central Asian Red Deer native to northern India.
2. Implemented by WWF, IUCN, Jammu and Kashmir government.
3. It is the state animal of Jammu & Kashmir.
4. In Kashmir, it's found in Dachigam National Park at elevations of 3,035 meters.
5. These deer once numbered from about 5,000 animals in the beginning of the 20th century.
6. Unfortunately, they were threatened, due to habitat destruction, over-grazing by domestic livestock and poaching.

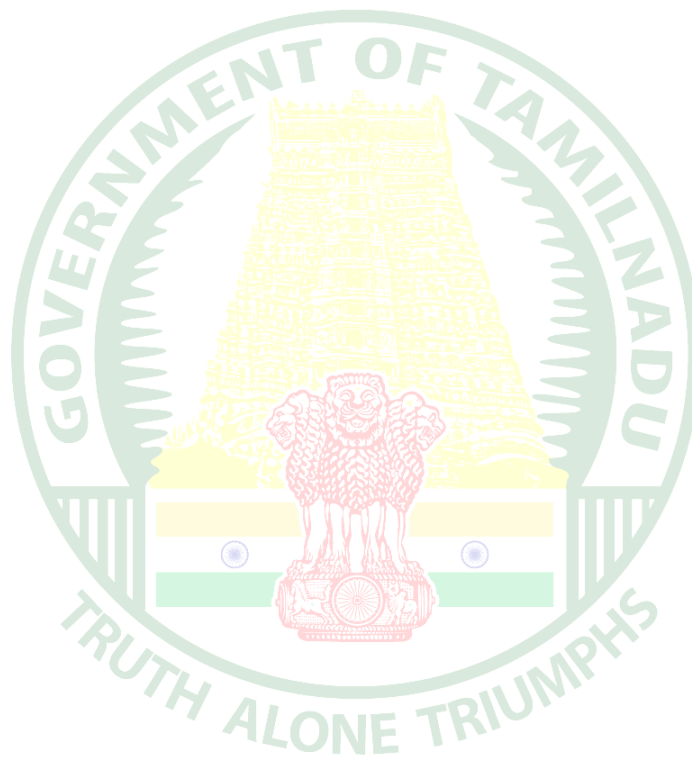
8. Gangetic Dolphins:

1. The Ministry of Environment and Forests notified the Ganges River Dolphin as the National Aquatic Animal.
2. The River Dolphin inhabits the Ganges-Brahmaputra-Meghna and Karnaphuli-Sangu river systems of Nepal, India, and Bangladesh.
3. It is estimated that their total population is around 2,000 and they are listed in Schedule I of the Wildlife Protection Act (1972).
4. The Ganges Dolphin is among the four “obligate” freshwater dolphins found in the world — the other three are the ‘baiji’ found in the Yangtze River (China), the ‘bhulan’ of the Indus (Pakistan) and the ‘boto’ of the Amazon River (Latin America).
5. Although there are several species of marine dolphins whose ranges include some freshwater habitats, these four species live only in rivers and lakes.

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Questions:

1. What is biodiversity conservation? Explain the insitu conservation briefly.
2. Explain the methods to conserve the species outside the natural host.





Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : Natural Calamities and Disaster Management

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NATURAL CALAMITIES AND DISASTER MANAGEMENT

NATURAL CALAMITIES AND DISASTER MANAGEMENT:

Disaster is a very common phenomenon in the human society. It has been experienced by people since time immemorial. Though its form may be varied, it has been a challenge for society. The latest development which has been discovered in the World Disaster Reports recently is that, the disasters have increased in frequency and intensity. India is one of the most disaster-prone countries in the world. It has some of the world's most severe droughts, famines, cyclones, earthquakes, chemical disasters, rail accidents and road accidents. The high density of population in the developing countries, especially in the high risk coastal areas, results in millions of people getting affected by natural disasters, especially in recurring disasters like floods, cyclones, storm surges, etc.

Disaster

'A disaster is a serious disruption of the functioning of a society involving human and material loss. Disaster is broadly classified into natural and manmade disasters.

1. Earthquake

An earthquake is sudden, rapid shaking of the ground caused by the shifting of rocks beneath the earth's surface. The duration of the earthquake may be a few seconds to some minutes. The point where an earthquake originates is called its 'focus'. The vertical point at the surface from the focus is called 'epicenter' and the damage caused by the earthquake is the highest near the epicenter. Earthquakes strike suddenly without warning and can occur at any time. The impacts of the earthquakes include deaths, injuries and damage of property. The earthquake is measured by an instrument called a Seismograph. It is recorded in Richter scale.

What to do during an earthquake?

Be aware that some earthquakes are actually foreshocks and a larger earthquake might occur later. Minimize your movements to a few steps that reach a safe place nearby and stay indoors until the shaking has stopped and you are sure exiting is safe.

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Rules of actions during an earthquake:

1. Stay calm, do not panic.
2. If you are in a building, sit down on the floor under a table or any other furniture and firmly hold on to it until the earthquake has stopped.
3. If there is no table nearby, cover your face and head with your hands and sit on the floor in a corner of the room.
4. Keep away from glass windows, glass doors and things that can fall down.
5. Do not try to leave the building quickly; during earthquakes people mostly die because they try to run out of the building and become trapped under ruins if the building is destroyed.
6. Do not go to the staircase, a balcony or an elevator.
7. If you are in the street, keep away from buildings; try to get into an open space and avoid power transmission lines.
8. If you are at home, turn off electrical equipment and gas quickly.
9. If you are in chemistry class or a laboratory where chemicals are stored, try to leave the room because chemicals may cause injuries;
10. Stop as quickly as safety permits. Avoid stopping near or under buildings, trees, overpasses and utility wires.
11. Proceed cautiously once the earthquake has stopped. Avoid roads, bridges or ramps that might have been damaged by the earthquake.
12. Move away from buildings, trees, streetlights and utility wires.
13. If you are in open space, stay there until the shaking stops. The greatest danger exists directly outside buildings at exits and alongside exterior walls. Most earthquake-related casualties result due to collapsing walls, flying glass and falling objects.

After earthquake:

1. First check if you have any injuries, and then check the condition of the surrounding people. If you cannot do this, wait for the rescue team;
2. After the earthquake when you leave the shelter, do not return for 2-3 hours because the quakes may repeat (an aftershock).
3. Check if there is fire; in case of a mild one try to extinguish it.

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4. Be cautious about the possibility of gas leakage and damage caused to electrical wiring.
 5. Be careful while opening wardrobe doors to take necessary items;
 6. Use only lanterns; do not use an oil lamp or a candle.
 7. Listen to the radio to receive information about the earthquake.

2.Tsunami

Tsunami are waves generated by earthquake, volcanic eruptions and underwater landslides. A tsunami can kill or injure people and damage or destroy buildings and infrastructure as waves come forth and recede. A tsunami is a series of enormous ocean waves caused by earthquakes, underwater landslides, volcanic eruptions or asteroids. Tsunamis can travel 700-800 km per hour, with waves 10-30 meter high. It causes flooding and disrupts transportation, power, communications, and water supply.

How to respond to Tsunami?

1. You should find out if your home, school, workplace or other frequently visited locations are in tsunami hazard areas along the sea-shore. Know the height of your street above sea level.
2. Plan evacuation routes from your home, school, workplace, or any other place you could be, where tsunamis pose a risk.
3. Discuss tsunamis with your family. Review safety and preparedness measures with your family. Be aware facts about tsunami.
4. Use a weather radio or stay tuned to a local radio or television station to keep informed of local watches and warnings.
5. Discuss tsunamis with your family. Everyone should be aware of what to do when tsunami strikes. Discussing tsunamis ahead of time will help reduce fear and save precious time in an emergency. Review flood safety and precautionary measures with your family.
6. You should find out if your home, school etc., are in vulnerable areas along sea shore.
7. Don't go to the coast to watch the Tsunami. Don't try to surf the tsunami waves.

What to do after a Tsunami?

1. You should continue using a weather radio or staying tuned to a Coast Guard emergency frequency station or a local radio or television station for updated emergency information.
2. Check yourself for injuries and get first aid if necessary, before helping injured or trapped persons.
3. If someone needs to be rescued, call professionals with the right equipment to help.
4. Help people who require special assistance, like Infants, elderly people, those without transportation, large families who may need additional help in an emergency situation, people with disabilities, and the people who care for them.
5. Stay out of a building if water remains around it. Tsunami water, like floodwater, can undermine foundations, causing buildings to sink, floors to crack, or walls to collapse.
6. Check for gas leaks. If you smell gas or hear a blowing or hissing noise, open a window and get everyone outside quickly.

Tsunami and floods

A killer Tsunami hit the south east Asian countries on the 26th of December, 2004. A massive earthquake with a magnitude of 9.1 -9.3 in the Richter scale epicentre in the Indonesian island of Sumatra. It triggered one of the biggest Tsunamis the world had ever witnessed. The massive waves measuring up to 30metres that killed more than 2,00,000 people of Asia. In India, over 10,000 people were killed by this disaster. Tamil Nadu alone accounted for 1,705 deaths. All the coastal districts were affected, Nagapattinam was the worst hit in the state of Tamil Nadu. Fishermen, tourists, morning walkers, children playing in beach and people living on the coast were unprepared for the waves. So, they lost their life and the most of the loss of lives and damage to property was within 500 metres of the shore. After that the Indian government set up a Tsunami Early Warning System at Indian National Centre for Ocean Information Services (INCOIS), Hyderabad in 2007.

3.Cyclones:

A low-pressure area which is encircled by high-pressure wind is called a cyclone. The major natural disaster that affects the coastal regions of India is cyclone and as India has a coastline of about 7516 km; it is exposed to nearly 10 percent of the world's tropical cyclones. About 71 percent of flood prone areas are in ten states (Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Pondicherry, Andhra Pradesh, Orissa and West Bengal). The islands of Andaman, Nicobar and Lakshadweep are also prone to cyclones.

Rules of action before a cyclone

1. Go to high-lying places from low-lying areas
2. Those residing in old buildings should temporarily relocate to safer buildings; Jewels and documents should be kept in safe custody.
3. Battery-operated radio, plastic torch- light, lamp, kerosene, match-box should be kept safely for future use.
4. Keep in ready all the first-aid kit and material available with you.
5. Keep in stock foodstuffs, material, fuel, drinking water and life-saving drugs needed for the next week.
6. It is also important to take cattle and other pets to safer places.
7. It is important to know that if we see quickly approaching storm clouds it is possible to predict strong winds several minutes in advance.

During a cyclone

1. If you are in a building during a strong gust, it is necessary to close and fasten windows and doors. It is better to stay in the rooms.
2. Turn off all electrical devices.
3. Protect yourself with your hands or a scarf. Protect the eyes, nose and mouth from dust.
4. If you are in a wildlife area, try to find a place protected from the wind. If there is no such place nearby, lie down on the ground.
5. If you are in a car it is better to stay there and close the windows. Do not park the car under unstable objects that can break down and fall on the car.

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After cyclone

1. Turn off electricity, gas and water and unplug all electric appliances.
2. Beware of snakes and other animals immediately after the cyclone.
3. Do not go for sightseeing.
4. Stay away from damaged power lines, falling trees and flood water.
5. Boil and purify water before drinking.

Districts in Tamil Nadu which are frequently affected by cyclones:

All the 13 coastal Districts of Tamil Nadu are affected by cyclonic storms which occur during May- June and in October-November months. These Districts are: Tiruvallur, Chennai, Kancheepuram, Villupuram, Cuddalore, Nagapattinam, Tiruvarur, Thanjavur, Pudukkottai, Ramanathapuram, Tuticorin, Tirunelveli and Kanyakumari. On an average, about five or six tropical cyclones form in the Bay of Bengal and Arabian sea and hit the coast every year. Out of these, two or three are severe. When a cyclone approaches to the coast, a risk of serious loss or damage occurs from severe winds, heavy rainfall, storm surges and river floods. The effect of a storm surge is most pronounced in wide and shallow bays exposed to cyclones such as in the northern part of Bay of Bengal. Most cyclones occur in the Bay of Bengal followed by those in the Arabian Sea and the ratio is approximately 4:1. During the cyclonic of cyclonic storms, wind speed is between 65 km/h and 117 km/h.

4.Flood

Floods are high stream flows, which overlap natural or artificial banks of a river or a stream and are markedly higher than the usual flow as well as inundation of low land. Flood destructions have always brought miseries to numerous people, especially in rural areas. Flood results in the outbreak of serious epidemics, specially malaria and cholera. Simultaneously, scarcity of water also arises. It has a drastic effect on agricultural produce. Sometimes, water remains standing over large areas for long span of time hampering the Rabi crops. India is one of the most flood prone countries in the world. The principal reasons for flood lie in the very nature of natural ecological systems in this country, namely, the monsoon, the highly silted river systems and the steep highly erodible mountains, particularly those of the Himalayan ranges.

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The average rainfall in India is 1,150 mm with significant variation across the country. The annual rainfall along the western coast and the Western Ghats, Khasi hills and over most of the Brahmaputra valley amounts to more than 2,500 mm. Twenty-three of the states (29) and union territories (6) in the country are subject to floods and 40 million hectares of land, roughly one- eighth of the country's geographical area, is prone to floods. The National Flood Control Program was launched in the country in 1954.

Types of floods

Flash floods: Such floods that occur within six hours during heavy rainfall.

River floods: Such floods are caused by Precipitation over large catchment areas or by melting of snow or sometimes both.

Coastal floods: Sometimes floods are associated with cyclone high tides and tsunami.

Causes of floods

1. Torrential Rainfall.
2. Encroachment of rivers bank.
3. Excessive rainfall in catchment.
4. Inefficient engineering design in the construction of embankments, dams and canals.

Effects of floods

1. Destruction of drainage system
2. Water pollution
3. Soil erosion
4. Stagnation of water
5. Loss of agricultural land and cattle
6. Loss of life and spread of contagious diseases.

During floods

1. Cut off gas connection and electricity.
2. Keep sand bags on drainage holes and bathroom holes.
3. Leave immediately through the known passage or prescribed passage
4. Drink hot water.

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5. Use bleaching powder to keep your environment hygienic.
 6. Before using match sticks and candles, ensure that there is no gas leakage.
 7. Don't eat more food when you are affected by diarrhoea.
 8. Don't try to take anything that floats in flood.

Do's before flood

1. Keep furniture and electrical appliances on beds and tables, to find out if the settlement area is to be affected by flood or not.
2. Put sandbags in the toilet bowl and cover all drain holes to prevent sewage back flow. Keeping radio, torch and additional batteries, storing drinking water, dry foods items, salt and sugar. Safeguarding materials like kerosene, candle, match box, clothes and valuable things.
3. Keep your mobile charged
4. Listen to radio or watch television for the latest weather bulletin and flood warnings.
5. Keep strong ropes, a lantern, battery operated torches, extra batteries ready.
6. Keep umbrellas and bamboo sticks with you for protection from snakes.
7. Keeping umbrella and bamboo poles, ³/₄ Keeping first aid box and strong ropes to bind things, ³/₄ to dig canals from the farm land, to drain the excessive water keeping sand bags etc.,

Don'ts

1. Try to connect electricity once it is cut.
2. Operate vehicles
3. Swim against floods
4. Avoid going on excursions. Neglect flood warning messages

5.Landslide

The movement of a mass of rocks, debris, soil etc., downslope is called a landslide. A landslide is defined as the movement of a mass of rock debris down a slope. Landslides are caused by the direct influence of gravity. Landslides can be caused by rainfall, snowmelt, stream erosion, and flood, earthquakes, volcanic activity, disturbance by human activities, or any combination of these factors.

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Landslides causes:

Landslides cause property damage, injury and death and adversely affect a variety of resources. For example, water supplies, fisheries, sewage disposal systems, forests, dams and roadways can be affected.

During a Landslide

1. Listen for any unusual sounds that might indicate moving debris, such as trees cracking or boulders knocking together.
2. If you are near a river, be alert for any sudden increase or decrease in water flow and for a change from clear to muddy water. Such changes may indicate landslide activity upstream, so be prepared to move quickly.
3. Be alert especially when driving. Embankments along roadsides are particularly susceptible to landslides.
4. Disconnect the power supply in the areas of landslide.

After the Landslide

1. Stay away from the slide area. There may be danger of additional slides
2. Check for injured and trapped persons near the slide, without entering the direct slide area.
3. Direct rescuers to their locations.
4. Listen to local radio or television for the latest emergency information
5. Watch for flooding, which may occur after a landslide or debris flow.

6.Drought

Drought is a period of time (months or years) during which a part of the land has shortage of rain, causing severe damage to the soil, crops, animals, and people. It sometimes causes even death. During drought high temperature is experienced. Such conditions may affect our health. The primary cause of drought is deficiency of rainfall and in particular, the timing, distribution and intensity.

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In India around 68 percent of the country is prone to drought. Of the entire area 35 percent receives rain falls between 750 mm and 1,125 mm which is considered drought prone.

Rules of action before, during and after Drought

- Before drought:**
1. Rainwater harvesting should be followed.
 2. Sewage water should be recycled and used for domestic purpose.
 3. Building canals or redirecting rivers for irrigation.
 4. Utilize water economically.

During drought:

1. Wear cotton clothing and a hat.
2. In case of overheating, immediately move to a shady area.
3. Consume adequate amounts of water stay.

After drought:

1. If anyone faints after sunstroke, emergency medical measures should be taken.
2. Contact local government agencies to receive information about disaster and assistance for the population.

7.Thunder and lightning

Thunder is a series of sudden electrical discharge resulting from atmospheric conditions. This discharge results in sudden flashes of light and trembling sound waves which are commonly known as thunder and lightning.

Lightning

Lightning is an atmospheric electrostatic discharge (spark) accompanied by thunder, which typically occurs during thunderstorms, and sometimes during volcanic eruptions or dust storms. Lightning generates 10-20 ampere current and it is therefore fatal. It is especially dangerous for people in an open area. Lightning strikes often have fatal consequences. On an average, 2000 people die from lightning in the world every year.

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Lightning mostly strikes tall things, such as trees that break down and catch fire or it may strike power transmission lines and antennas fastened on roofs and buildings which causing fire. The air temperature, when lightning occurs, is as hot as 9982.2 °C. Thunder is the sound caused by lightning. A charged, superheated lightning bolt creates a “resonating tube” as it travels.

The air in the tube rapidly expands and contracts causing vibrations that we hear as the rumble of thunder. Lightning strikes can explode a tree. Imagine 15 million volts of electricity hitting a tree branch. The heat travels through the tree, vaporizing its sap and creating steam that causes the trunk to explode.

Before lightning

1. If you are planning to go to the countryside, check the weather forecast.
2. If a thunderstorm is expected it is better to postpone the trip.
3. It is good if you can estimate the distance to the front line of a thunderstorm.

In order to do this, you must check the time interval from the moment you see the lightning until you hear thunder. Lightning always precedes thunder. We know that the sound speed travels on average about 1km every 3 seconds. Reduction of the time interval between the sight of lightning and the resulting thunder means that the danger is approaching and protective measures must be taken. If there is no interval between lightning and thunder means, it means that the cloud is already over your head.

During Lightning:

1. If you are in a building it is necessary to close windows, doors, ventilation pipes and chimneys.
2. It is necessary to turn off the telephone, TV set, and other electrical equipment because lightning may strike electrical cables and pass through wiring.
3. Do not take a shower because both water and metal conduct electricity.
4. Do not light the fireplace because the heat coming from the chimney may attract lightning.
5. It is better to stay away from electric wires, lightning rods, water pipes, antennas and windows.

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6. If you are in an open area during a thunderstorm, do not stand under a tall tree. Lighting is most damaging for tall trees. It is better to stay 30-40 meters away from them. Avoid trees that are standing separately. Remember that lightning does not strike bushes.
 7. If the area is open, it is better to find a lower place or a cavity and squat there. It is dangerous to stand or lie down on the ground, because this increases the exposure area.
 8. It is necessary to get rid of metal items such as a bicycle, coins etc.

Disaster Risk Reduction (DRR)

Disaster Risk Reduction: The practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters. There are four key approaches to public awareness for disaster risk reduction.

1. Campaigns,
2. Participatory learning,
3. Informal education, and
4. Formal school-based interventions.

Forecasting and Early Warning

Weather forecasting, Tsunami early warning system, cyclonic forecasting and warning provide necessary information which help in reducing risks during disasters. School Disaster Management Committee, Village Disaster Management Committee, State and Central government institutions take mitigation measures together during disaster. Newspaper, Radio, Television and social media bring updated information and give alerts on the vulnerable area, risk, preparatory measures and relief measures including medicine.

Questions:

1. Disaster played major role in recent past in our earth. In this statement what is meant by disaster explain the do's and don'ts of various types of disaster.



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ENVIRONMENTAL POLLUTION AND MANAGEMENT

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ENVIRONMENTAL POLLUTION:

Environmental pollution occurs when pollutants contaminate the natural surroundings. Pollution disturbs the balance of our eco system affecting our normal life styles and gives rise to human illnesses and global warming. The word 'pollute' means to degrade or to make dirty. Pollution is thus, an unfavorable modification of the natural world, caused entirely or partly due to direct or indirect actions of human beings also Pollution is an unwanted change in the physical, chemical and biological characteristics of our land, air and water. Pollution occurs when the environment gets contaminated by waste, chemicals and harmful substances.

In terms of eco-system, pollutants can be classified into two basic groups – Non-degradable and degradable. Based on the time taken to breakdown into their ingredients, degradable pollutants are classified as rapidly degradable (non-persistent) and slowly degradable (persistent).

a) Rapidly degradable or non-persistent pollutants: These can be broken down by natural processes. Domestic sewage and vegetable waste are examples of such pollutants.

b) Slowly degradable or persistent pollutants: These are pollutants that remain in the environment for many years in an unchanged condition and take decades or longer to degrade, as in the case of DDT.

c) Non-degradable pollutants: These cannot be degraded by natural processes. Once they are released into the environment, they are difficult to be eliminated and continue to accumulate (biomagnification). Toxic elements like lead, mercury, cadmium, chromium and nickel are such common pollutants.

Types of pollution

1. Air pollution
2. Water pollution
3. Soil pollution or land pollution
4. Thermal pollution
5. Noise pollution

1.AIR POLLUTION:

Air pollution is the presence of any solid, liquid, or gaseous substance in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

Types of Air pollution

Indoor Air Pollution: It refers to toxic contaminants that we encounter in our daily lives in our homes, schools and workplaces. For example, cooking and heating with solid fuels on open fires or traditional stoves results in high levels of indoor air pollution.

Outdoor Air Pollution: It refers to ambient air. The common sources of outdoor air pollution are caused by combustion processes from motor vehicles, solid fuel burning and industry.

Types of pollutants:

The natural pollutants are volcanic eruptions, wind erosion, pollen disposal, evaporation of organic compounds and radioactive elements etc., Natural air pollution does not occur in abundance and also creates a little impact on the environment.

Manmade pollutants like vehicular emission, industrial wastes, smoke from thermal power plants and refineries badly affect the environment. The main pathological effects caused by air pollutants, particularly oxides of Sulphur, nitrogen and carbon-di-oxide, include respiratory disorders, jaundice, irritation of eyes and throat, headache, cancer and even death.

Causes of Air Pollution

Vehicle exhaust smoke: Vehicles smoke happens to release high amounts of Carbon monoxide. Millions of vehicles are operated every day in cities, each one leaving behind its own carbon footprint on the environment. The vehicles are cars, buses, airplanes, trucks, trains.

Fossil Fuel based power plants: Fossil fuels also present a wider scale problem when they are burned for energy in power plants. Chemicals like sulfur dioxide are released during the burning process, which travel straight into the atmosphere. These types of pollutants react with water molecules to yield something known as acid rain. For example: power plants, incinerator, oil refineries.

Exhaust from Industrial Plants and Factories: Heavy machineries located inside big factories and industrial plants also emit pollutants into the air.

Construction and Agricultural activities: Potential impacts arising from the construction debris would include dust particles and gaseous emissions from the construction sites. Likewise, using of ammonia for agriculture is a frequent by product that happens to be one of the most dangerous gases affecting air. The agricultural sources are wood, stubble burning, fire places.

Natural Causes: Earth is one of the biggest polluters itself, through volcanoes, forest fires, and dust storms. They are nature-borne events that dump massive amounts of air pollution into the atmosphere. The sources are windblown dust, wildfires, volcanoes.

Household activities: Household activities like cooking, heating and lighting, use of various forms of mosquito repellents, pesticides and chemicals for cleaning at home and use of artificial fragrances are some of the sources that contribute to air pollution.

Effects of Air Pollution

Respiratory and heart problems: It creates several respiratory and heart ailments along with cancer. Children are highly vulnerable and exposed to air pollutants and commonly suffer from pneumonia and asthma.

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Global warming: Increasing temperature in the atmosphere leads to global warming and thereby to increase sea level rise and melting of polar icebergs, displacement and loss of habitat. Green House gases such as carbon dioxide, methane, water vapour and Chloro-Fluro Carbons (CFC), carbon monoxide, photo chemical oxidants and hydrocarbons, which are responsible for the heat retention ability of the atmosphere.

Acid rain: Harmful gases like nitrogen oxides and sulfur oxides are released into the atmosphere during the burning of fossil fuels. Acid rain causes great damage to human beings, animals and crops.

Eutrophication: Eutrophication is a condition where high amount of nitrogen present in some pollutants which adversely affects fish, plants and animal species.

Effect on Wildlife: Toxic chemical present in the air can force wildlife species to move to new place and change their habitat.

Depletion of Ozone layer: Ozone exists in earth's atmosphere and is responsible for protecting humans from harmful ultraviolet (UV) rays. Earth's ozone layer is depleting due to presence of chlorofluorocarbons and hydro chlorofluorocarbons in the atmosphere.

Human Health: Outdoor air pollution is a major cause of death and disease globally. The health effects range from increased hospital admissions and emergency room visits, to increased risk of premature death. An estimated 4.2 billion premature deaths globally are linked to ambient air pollution.

Gas leaks can be lethal or affect the quality of air in the affected area.

CO in the atmosphere interferes with O₂ transport since hemoglobin has greater affinity for carbon monoxide. At low concentration it causes headache and blurred vision. In higher concentration, it can lead to coma and death.

Smog:

Smog is a type of air pollution caused by tiny particles in the air. Smog generally refers to photochemical smog, which is created when sunlight reacts with nitrogen oxides and volatile organic compounds found in fossil fuel emissions from automobiles, factories,

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and power plants. These reactions create ground-level ozone and particulate matter, reducing visibility. Smog can make breathing more difficult, especially for people with asthma. Smog also affects plants and animals. It damages crops as well as causes health problems in pets, farm animals and human beings. Smog has also been known to cause corrosive damage to buildings and vehicles.

Peroxyacetyl nitrate (PAN) is a secondary pollutant present in photochemical smog. It is thermally unstable and decomposes into peroxy-Ethanol radicals and nitrogen dioxide gas causing eye irritation.

Remedial measures to control Air Pollution

- 1) Establishment of industries away from the towns and cities
- 2) Increasing the length of the Chimneys in industries
- 3) Growing more plants and trees
- 4) Use of non-conventional fuels like Biogas, CNG and LPG.
- 5) Use of Mass Transit System (Public Transport)
- 6) Cycle or walk short distances instead of using a motor vehicle.
- 7) Do not burn solid waste.
- 8) Avoid fireworks.
- 9) Trees are the best remedy for urban particulate and gaseous pollution
- 10) Forests act as carbon sinks and lungs of the planet

Legal Protection

1. The Air (Prevention and Control of Pollution) Act was enacted in 1981 and amended in 1987 for the prevention, control and abatement of Air pollution in India.
2. Traffic Emissions Standards: The Government has decided to enforce Bharat Stage VI norms from 2020.
3. The Green Bench and the National Green Tribunal (NGT) give judicial safeguard to environmental protection. Taj trapezium zone under environmental protection act 1986.

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Steps taken by the Central and the State governments in India:

1. Road traffic rationing, encourage public transport, carpooling.
2. Increase green cover alongside roads (planting avenue trees).
3. Promoting Swachh Bharat Abhiyan
4. Enactment and Enforcement of stricter environmental laws.
5. Maintenance of air standards by proper enforcement and monitoring Reducing carbon emissions.
6. Encourage use of renewable energy.
7. Limiting the sale of firecrackers and developing eco-friendly crackers.
8. Make Environmental Impact Assessment mandatory
9. Air Quality Index (AQI) is a number used by government agencies to communicate to the public how polluted the air is at a given time.

2.WATER POLLUTION

The introduction (directly or indirectly) of substances or energy into the marine environment (including estuaries) results in deleterious effects to living resources, hazards to human health, hindrance to marine activities.

Sources of Water Pollution

Even though water bodies or sources can be polluted by natural causes, water pollution is usually caused by human activities. There are three main types of sources: point sources, non-point sources, leaks and spills.

Point sources: Discharge of pollutants at specific locations through pipelines or sewers into the water body. Factory effluents, sewage, underground mines, oil wells, oil tankers and agriculture are common point sources.

Non-point sources: Sources that cannot be traced to a single site of discharge like acid rain, dumping of the plastics in water bodies, agriculture chemical run off are common examples.

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Leaks and Spills: This occurs mostly due to ship collision, off shore oil rigs, oil leakages and discharges into sea Sources of water pollution can also be classified in three ways. They are municipal wastes, industrial wastes, and agricultural wastes.

1. Municipal waste water is from homes and commercial establishments.
2. Industrial discharge (effluents) may contain varieties of compounds such as heavy metals (cadmium, chromium, lead), and organic / inorganic chemicals
3. Containing waste water, sometimes in toxic concentrations. These discharges can affect temperatures of the water bodies as well as dissolved oxygen level.
4. Agricultural wastes include fertiliser and pesticide runoff from agricultural fields, food processing waste, tree and saw dust from logging operations and bacteria from sewage or livestock operations. Water pollutants reach water bodies like rivers, streams and the marine system by precipitation, run-off and the groundwater by seepage or percolation.

Types of Water Pollution

1. **Surface water pollution:** Surface water includes natural water found on the earth's surface, like rivers, lakes, lagoons and oceans. Hazardous substances coming into contact with this surface water, dissolving or mixing physically with the water can be called surface water pollution.
2. **Groundwater pollution:** Groundwater contamination occurs when man- made products such as gasoline, oil and chemicals get into the ground water. In addition, untreated waste from septic tanks, toxic chemicals from underground storage tanks and leaky landfills contaminate groundwater.
3. **Microbiological pollution:** In many communities around the world, people drink untreated water (straight from a pond, river or stream). Sometimes there is natural pollution caused by micro-organism like viruses and bacteria. This natural pollution causes both aquatic and human illness.
4. **Oxygen depletion pollution:** When oxygen levels in the water are depleted, relatively harmless aerobic micro-organisms die and anaerobic micro-organisms begin to thrive. Some anaerobic micro-organisms are harmful to people, animals

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and the environment as they produce harmful toxins such as ammonia and sulfides.

Major water pollutants:

- a) The disease – Causing agents; bacteria, viruses, protozoa and parasitic worms that enter sewage – systems and untreated waste.
- b) Oxygen demanding bacteria: Wastes that can be decomposed by oxygen requiring bacteria.
- c) Water soluble inorganic pollutants: Acids, Salt and toxic metals.
- d) Organic compounds: Oil, plastics and pesticides in the water.

Causes of Water Pollution

Water pollution is caused due to several reasons. Here are the few major causes of water pollution:

1. **Discharge of sewage and waste water:** Sewage, garbage and liquid waste of households, agricultural runoff and effluents from factories are discharged into lakes and rivers. These wastes contain harmful chemicals and toxins which make the water poisonous for aquatic animals and plants.
2. **Dumping of solid wastes:** The dumping of solid wastes and litters in water bodies cause huge problems.
3. **Discharge of industrial wastes:** Industrial waste contains pollutants like asbestos, lead, mercury, grease oil and petrochemicals, which are extremely harmful to both people and environment.
4. **Oil Spill:** Sea water gets polluted due to oil spilled from ships and tankers while travelling. The spilled oil does not dissolve in water and forms a thick sludge polluting the water.
5. **Acid rain:** Acid rain is pollution of water caused by air pollution. When the acidic particles caused by air pollution in the atmosphere mix with water vapor, it results in acid rain.

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6. **Global warming:** Due to global warming, there is an increase in water temperature as a result aquatic plants and animals are affected.
 7. **Eutrophication:** Eutrophication is an increased level of nutrients in water bodies. This results in bloom of algae in water. It also depletes the oxygen in water which negatively affects fish and Other aquatic animal population.

Effects of Water Pollution

Water pollution adversely affects the health and life of man, animals and plants alike. Polluted water is also harmful for agriculture as it adversely affects the crops and the soil fertility. Pollution of sea water damages the oceanic life. The effects can be catastrophic, depending on the kind of chemicals, concentrations of the pollutants. The effects of water pollution are varied and depend on what chemicals are dumped and in which locations. Many water bodies near urban areas are highly polluted. This is the result of both garbage dumped by individuals and dangerous chemicals legally or illegally dumped by manufacturing industries, health centers and markets.

1. **Death of aquatic animals:** The main problem caused by water pollution is that it kills organisms that depend on these water bodies. Dead fish, crabs, birds and sea gulls, dolphins, and many other animals often wind up on beaches, killed by pollutants in their habitat.
2. **Disruption of food-chains:** Pollution disrupts the natural food chain as well. Pollutants such as lead and cadmium are eaten by tiny animals. Later, these animals are consumed by fish and the food chain continues disrupted at all higher levels.
3. **Diseases:** The discharge of untreated and under-treated effluent contributes to severe ecological degradation. The indiscriminate human activities such as open defecation, solid waste dumping, discharge of drainage water is responsible for the pathogenic bacteria water-borne diseases like Hepatitis-A, Typhoid, Malaria, Dysentery, Jaundice, Dengue fever, Viral fever and Worm infections.
4. **Destruction of Ecosystems:** Ecosystems can be severely destroyed by water pollution. Many areas are now being affected by careless human pollution, and this pollution is coming back to hurt humans in many ways.

Remedial measures to control Water Pollution

Legal measure:

- 1) Right to clean water is a fundamental right under the Indian Constitution.
- 2) Water (Prevention and Control of Pollution) Act, 1974, sections 17 to 40 prohibit the pollution of a stream or well by disposal of polluting matter.
- 3) The Central/State Pollution Control Boards have the power to advise the central/state government on various matters concerned with the prevention and control of pollution of water.
- 4) The Ministry of Environment, Forest and Climate Change (MoEFCC) is the nodal agency of the Central Government for the planning, promotion, co-ordination and for overseeing the implementation of India's environmental and forestry policies and programmes.

Prevention

- 1) Regulate or control of pollutant(s) discharge at the point of generation.
- 2) Wastewater can be pre-treated by scientific methods before discharge to municipal treatment sources.
- 3) Setting up of Sewage Treatment Plants (STP) and Effluent Treatment Plants (ETP).
- 4) Regulate or restrict the use of synthetic fertilisers and pesticides.
- 5) Public awareness and people's involvement is essential.

Others:

- 1) Comprehensive water management plan.
- 2) Construction of proper storm drains and settling ponds.
- 3) Maintenance of drain line.
- 4) Effluent and sewage treatment plant.
- 5) Regular monitoring of water and waste water.
- 6) Stringent actions towards illegal dumping of waste into the water bodies.

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Case study

Namami Gange (National Mission for Clean Ganga) Programme is an Integrated Conservation Mission approved as the 'Flagship Programme' of the Union Government in June 2014 with a budget outlay of 20,000 crores to accomplish the twin objectives of effective abatement of pollution, conservation and rejuvenation of River Ganga.

3.SOIL POLLUTION:

Soil pollution is another form of land pollution, where the upper layer of the soil is damaged. This is caused by the overuse of chemical fertilizers, and pesticides. This leads to loss of fertile land. Pesticides kill not only pests and also human beings.

1.Types of Soil Pollution

1. Agricultural soil pollution
2. pollution due to industrial effluents
3. pollution due to urban activities

2.Causes:

Improper agricultural practices like overuse of land in-terms of grazing, Agriculture etc.

1. Nuclear wastes
2. biological wastes
3. Disposal of coal ash
4. Electronic waste
5. Industrial activity
6. Agricultural chemicals like pesticides, weedicides, insecticides
7. Improper disposal of waste.
8. Pollution due to urbanization
9. Deforestation and soil erosion.

3.Sources:

- 1) **Industrial waste:** It includes chemicals such as mercury, lead, copper, cadmium, cyanides fly ash, metallic residues, zinc, cyanides, chromates, acids,

alkalis, organic substances, nuclear wastes. A large number of industrial chemicals, dyes, acids, etc. find their way into the soil.

- 2) Pesticides and fertilizers:** Pesticides are chemicals that includes insecticides, fungicides, algicides, rodenticides, weedicides sprayed in order to improve productivity of agriculture, forestry, and horticulture. Chloro hydrocarbons (CHCs) like DDT, endo-sulfan, heptachlor accumulate in soil and cause biomagnification. Some of these pesticides like DDT and endosulfan are banned by most of the countries. Excessive use of chemical fertilizer's reduces the population of soil-borne organisms and the crumb structure of the soil, productivity of the soil and increases salt content of the soil.
- 3) Discarded material:** It includes concrete, asphalt, rungs, leather, food, paper etc.
- 4) Radioactive material:** Radioactive elements from mining, nuclear power plants, find their way in to water and then soil.
- 5) Plastic bags:** They accumulate in soil and prevents germination of seeds. They stay in the soil for centuries without decomposing (non-biodegradable). Burning of plastic in garbage dumps release highly toxic and poisonous gases like carbon monoxide, carbon dioxide, phosgene, dioxins and other poisonous chlorinated compounds. Toxic solid residue left after burning remains in the soil. The harmful gases enter soils through chemical cycles.
- 6) Others:** Many air pollutants like acid rain and water pollutants ultimately become part of soil and soil also receives some toxic chemicals during weathering of certain rocks.

4. Effects:

1. Reduction in the fertility of soil due to increase in alkalinity, salinity or ph.
2. Soil erosion.
3. Emission of toxic gases.
4. Poisoning of the Ecosystem.
5. Contamination of underground and surface drinking water.
6. Reduced nitrogen fixation due to the reduced number of nitrogen fixers.

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7. Increased erosion due to loss of forests and other vegetation.

5.Control measures:

1. Reducing chemical fertilizer and pesticide use.
2. Use of bio-pesticides, bio fertilizers
3. Organic farming
4. Afforestation and Deforestation
5. Solid waste treatment
6. Reduction of waste from construction areas.

4. THERMAL POLLUTION

Thermal pollution is defined as sudden increase or decrease in temperature of a natural body of water which may be ocean, lake, river or pond by human influence. This normally occurs when a plant or facility takes in water from a natural resource and puts it back with an altered temperature. Usually, these facilities use it as a cooling method for their machinery or to help better produce their products.

The sources of Thermal Pollution

1. Nuclear Power Plant
2. Coal-fired power Plant
3. Industrial Effluents
4. Domestic Sewage
5. Hydro-electric power
6. Thermal Power Plant

Ecological Impacts of Thermal Pollution of Water

Other than man made sources of aquatic thermal pollution, changes in vegetation cover along the banks of the water body or increase in turbidity has been reported to cause increasing in temperature.

There are several effects of thermal pollution:

1. Sudden and periodic increase in temperature producing a thermal effect.
2. Changed dissolved oxygen.

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3. Distribution of organisms among major and minor communities.
 4. Death of stenothermic animals.
 5. Changes to reproductive powers and increased susceptibility to disease.
 6. Production of heat shock proteins for thermo tolerance.
 7. Changes in migration time and pattern may be affected.
 8. Bio indicators are the first to show the effects.
 9. Decrease in productivity of the water body.
 10. Economic and environmental damage.

The Harmful Effects of the Thermal Pollution

1. Reduction in dissolved Oxygen

The pollutant from various industrial plants are heated decreases the concentration of oxygen with an increase in the temperature of water.

2. Change in water properties

The decrease in density, viscosity and solubility of gases in water increases the setting speed of suspended particles which seriously affect the food supplies of aquatic organism.

3. Increase in toxicity

The concentrated pollutant causes the rise in the temperature of water which increases the toxicity of the poison present in water. The toxicity in water will increase the death rate in marine life.

4. Disruption of Biological activities

Temperature changes disrupt the entire marine ecosystem because changes in temperature causes change in physiology, metabolism and biological process like respiration rate, digestion, excretion and development of an aquatic organism.

5. Damage of biotic organism

Aquatic organisms like juvenile fish, plankton, fish, eggs, larva, algae and protozoa which pass through screens and condenser cooling system are extremely sensitive to abrupt temperature changes. They are habitual of warmer water may suddenly face

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increase or decrease in temperature of water bodies and thus die because of sudden changes in the temperature of water.

Prevention of thermal pollution

The following measures can be taken to prevent or control high temperature caused by thermal pollution:

1. Heated water from the industries can be treated before discharging directly to the water bodies.
2. Heated water from the industries can be treated by the installation of cooling ponds and cooling towers.
3. Industrial treated water can be recycled for domestic use or industrial heating.
4. Through artificial lakes: In this lake Industries can discharge their used or heated water at one end and water for cooling purposes may be withdrawn from the other end. The heat is eventually dissipated through evaporation.

Hence, we can say any kind of pollution may directly or indirectly affect humans because the loss of biodiversity causes changes that affect all the aspects of the environment.

5.NOISE POLLUTION

Noise pollution is unwanted or excessive sound that can have deleterious effects on human health and environmental quality. Noise pollution is commonly generated by many factories. It also comes from highway, railway and airplane traffic and from outdoor construction activities.

Types of Noise Pollution

1. **Atmospheric Noise:** Atmospheric noise or static is caused by lightning discharges in thunderstorms and other natural electrical disturbances occurring in the atmosphere.
2. **Industrial Noise:** Industrial noise refers to noise that is created in the factories. Sound becomes noise it becomes unwanted. Heavy industries like ship building, iron and steel have long been associated with Noise Induced Hearing Loss (NIHL).

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3. **Manmade Noise:** The main sources of man-made noise pollution are ships, aircraft, seismic exploration, marine construction, drilling and motor boats.

Causes of Noise Pollution

1. **Poor urban planning:** Improper urban planning will cause more nuisances among the city travelers.
2. **Sounds from motor vehicles:** Sounds from motor vehicles can cause temporary hearing loss.
3. **Crackers:** Enormous Crackers are used during some occasions. Such activities create a very louder noise to the level of harming the public. Sometimes, they may even cause deafness to children and aged.
4. **Factory machinery:** The industrial noise caused by continuous operation of mills, machines and pneumatic drills, is unbearable nuisance to the workers.

Effects of Noise Pollution

1. **Hearing Loss:** Chronic exposure to noise may cause noise-induced hearing loss. Older people are exposed to significant occupational noise and thereby reduced hearing sensitivity.
2. **Damage Physiological and Psychological health:** Unwanted noise can damage physiological and psychological health. For example, annoyance and aggression, hypertension, and high stress levels.
3. **Cardiovascular effects:** High noise levels can contribute to cardiovascular problems and exposure to blood pressure.
4. **Detrimental effect on animals and aquatic life:** Noise can have a detrimental effect on animals, increasing the risk of death.
5. **Effects on wildlife and aquatic animals:** It creates hormone imbalance, chronic stress, panic and escape behaviour and injury.

Remedial measures to control Noise Pollution

Legal Protection

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- 1) Article 48-A and Article 51-A of the Constitution of India, Noise Pollution (Regulation and Control) Rules 2000, and Tamil Nadu State Environment Policy 2017 are some of the legal relief from noise pollution.
 - 2) According to Noise Pollution (Regulation and Control) Rules, 2000, the permissible limit of noise in areas categorized as commercial is 65 decibels (dB) during day and 55 dB during night.

Others:

- 1) Use of noise barriers
- 2) Newer roadway for surface transport
- 3) Traffic control
- 4) Regulating times for heavy vehicles
- 5) Installations of noise barriers in the work place
- 6) Regulation of Loudspeakers
- 7) Turn off your electronics when you do not use them.
- 8) Lower the volume when you watch TV or listen to music.
- 9) Remind drivers not to use the horn too much.
- 10) Avoid fireworks.

Questions:

1. Discuss the air pollution causes and effects also mention the measure taken by government.
2. Give the detailed account of noise pollution.



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : Environment, Biodiversity and Disaster Management
Topic : Solid and Hazardous waste management

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SOLID AND HAZARDOUS WASTE MANAGEMENT

SOLID AND HAZARDOUS WASTE MANAGEMENT:

It is our duty to reduce creating waste and protect environment. 3R's are important in protecting environment. The first R is Reduce and the second R is Reuse and the last R is Recycle.

Solid waste:

Solid waste is discarded (abandoned or considered waste like) materials. solid waste means any garbage, refuse, sludge from a wastewater treatment plant or air pollution control facility and other discarded materials including solid, liquid, semi solid, or contained gaseous material resulting from industrial, commercial, mining, and agriculture operation and from community activities.

The solid waste does not include solid or dissolved materials in domestic sewage or solid or dissolved materials in irrigation return flows or industrial discharges.

Solid Waste Management

Solid Waste management includes the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process. It is all about how solid waste can be changed and used as a valuable resource.

Every day, tones of solid wastes are disposed off at landfill sites. This waste comes from homes, offices, industries and various other agricultural related activities. These landfill sites produce foul smell if waste is not stored and treated properly. When hazardous wastes like pesticides, batteries containing lead, cadmium, mercury or zinc, cleaning solvents, radioactive materials, e-waste and plastics are mixed up with paper and other scraps and burnt, they produce gases such as dioxins. These gases are toxic and carcinogenic. These pollute the surrounding air, ground water and can seriously affect

the health of humans, wildlife and our environment. The following are major sources of solid waste.

Case Study: The Corporation of Chennai looks after clearance and management of solid waste in Chennai. Every day around 5400 Metric Tonnes (MT) of garbage is collected from the city. Door to door collection of garbage is done in most zones apart from sweeping, collecting, and storing the waste in the specified bins. At present garbage generated in Chennai is dumped at two sites. Proposals are there for remediation of the existing landfill or scientific closure and to have integrated waste processing facilities with waste to energy plants as one of the components at the existing Kodungaiyur and Perungudi sites.

Waste management practices

- a) Source segregation
- b) Composting
 - 1. Aerobic
 - 2. Anaerobic
- c) Vermicomposting
- d) Biogas generation
- e) Incineration

Waste category	Source
Residential	Food wastes, plastics, paper, glass, leather, cardboard, metals, yard wastes, ashes, tires, batteries, old mattresses
Industrial	Packaging wastes, ashes, chemicals, cans, plastics, metal parts
Commercial	Thin and thick plastics, food wastes, metals, paper, glass, wood, cardboard materials
Institutional	Wood, paper, metals, cardboard materials, electronics
Construction and Demolition	Steel materials, concrete, wood, plastics, rubber, copper wires, dirt and glass.

Agriculture	Agricultural wastes, spoiled food, pesticide containers
Biomedical	Syringes, bandages, used gloves, catheter, urine bags, drugs, paper, plastics, food wastes, sanitary napkins and diapers, chemicals.
E-waste	Electronic items like used TVs, transistors, tape recorders, computer cabinets, mother boards, CDs, cassettes, mouse, wires, cords, switches., chargers.

Radioactive waste

Radioactive wastes are generated during various operations of the nuclear power plant. Radioactive waste can be in gas, liquid or solid form, and its level of radioactivity can vary. The waste can remain radioactive for a few hours or several months or even hundreds of thousands of years. Depending on the level and nature of radioactivity, radioactive wastes can be classified as exempt waste, Low and Intermediate level waste and High-Level Waste.

Radioactive waste management

Radioactive waste management involves the treatment, storage, and disposal of liquid, airborne, and solid effluents from the nuclear industry.

Methods of disposal of radioactive wastes are

1. **Limit generation** - Limiting the generation of waste is the first and most important consideration in managing radioactive wastes.
2. **Dilute and disperse** - For wastes having low radioactivity, dilution and dispersion are adopted.
3. **Delay and decay** - Delay and decay is frequently an important strategy because much of the radioactivity in nuclear reactors and accelerators is very short lived.

Concentrate and confine process - Concentrating and containing is the objective of treatment activities for longer-lived radioactivity. The waste is contained in corrosion resistant containers and transported to disposal sites. Leaching of heavy metals and radionuclides from these sites is a problem of growing concern.

Control and Management

Three ways are employed to manage nuclear wastes

Spent Fuel Pools - The spent fuel discharged from the reactors is temporarily stored in the reactor pool. The Spent fuel rods are used in stored cooling ponds. They protect the surroundings from radiation and absorb the heat generated during radioactive decay.

Vitrification method – This prevents reaction or degradation of nuclear waste for extended periods of time and encased in dry cement caskets.

Geological Repositories - A deep geological repository is a nuclear waste repository excavated deep within a stable geologic environment. It is suited to provide a high level of long-term isolation and containment without future maintenance. In India at Tarapur and Kalpakkam, a wet storage facility of Spent Fuel is the main mode of storage.

Medical waste

Any kind of waste that contains infectious material generated by hospitals, laboratories, medical research centers, Pharmaceutical companies and Veterinary clinics are called medical wastes. Medical wastes contain body fluids like blood, urine, body parts and other contaminants, culture dishes, glassware, bandages, gloves, discarded needles, scalpels, swabs and tissues.

If it is not managed properly it can cause serious threat to the humans.

Management: The safe and sustainable management of biomedical waste is the social and legal responsibilities of people working in healthcare centers.

Waste disposal: Involved by incineration, chemical disinfection, autoclaving, encapsulation, microwave irradiation are methods of waste disposals. Final disposal includes landfill and burying as per norms inside premises.

Solid Waste Management Rules 2016:

1. These rules replace the Municipal Solid Wastes (Management and Handling) Rules, 2000, are now applicable beyond municipal areas and have included urban agglomerations, census towns, notified industrial townships etc.
2. They focus on segregation of waste at source, responsibility on the manufacturer to dispose of sanitary and packaging wastes, user fees for collection, disposal and processing from the bulk generator.
3. It has also been advised that the bio-degradable waste should be processed, treated and disposed of through composting or bio-methanation within the premises as far as possible and the residual waste shall be given to the waste collectors or agency as directed by the local authority.
4. The rules promote the use of compost, conversion of waste into energy, revision of parameters for landfills location and capacity.
5. The government has also constituted a Central Monitoring Committee under the chairmanship of Secretary, MoEF&CC to monitor the overall implementation of the rules.
6. The Rules for the Safe Treatment of Legacy Waste prescribe bio-remediation and bio-mining in all open dumpsites and existing operational dumpsites in India.

Apart from this, Article 51 A (g) of the Constitution of India makes it a fundamental duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers, and wildlife, and to have compassion for living creatures.

Hazardous Waste

Hazardous waste is the waste that poses substantial or potential threats to public health or the environment. Industrial and hospital waste is considered hazardous as they contain toxic substances hazardous wastes can be highly toxic to humans, animals, and plants and are corrosive highly inflammable or explosive.

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Rapidly growing industries in the country have contributed in the production of large part of hazardous waste material. The sources of hazardous waste are basically agricultural and agro-industries, medical facilities, commercial centres, household and the informal sectors. Households waste that can be categorized as hazardous waste include old batteries, shoe polish, paint tins, old medicines and medicine bottles.

In the industrial sector the major generators of hazardous waste are the metal, chemical, paper, pesticides, dye, refining, and rubber goods industries. Direct exposure to chemicals in hazardous waste such as mercury and cyanide can be fatal. Therefore, to reduce environmental hazardous proper attention is required during disposal of such waste, because it cannot be disposed of by common means like other by products of our daily lives.

The Hazardous and Other Wastes (Management & Transboundary Movement) Amendment Rules, 2019 are as follows:

1. Solid plastic waste has been prohibited from import into the country including in Special Economic Zones (SEZ) and by Export Oriented Units (EOU).
2. Exporters of silk waste have now been given exemption from requiring permission from the Ministry of Environment, Forest and Climate Change.
3. Electrical and electronic assemblies and components manufactured in and exported from India, if found defective can now be imported back into the country, within a year of export, without obtaining permission from the Ministry of Environment, Forest and Climate Change.
4. Industries which do not require consent under Water (Prevention and Control of Pollution) Act 1974 and Air (Prevention and Control of Pollution) Act 1981, are now exempted from requiring authorization also under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016, provided that hazardous and other wastes generated by such industries are handed over to the authorized actual users, waste collectors or disposal facilities.

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Treatment and disposal of solid waste management:

1. Avoid

Avoid the usage of unwanted materials which create more debris. Before you buy anything, think that “Do I really need it?” (e.g) Avoid buying packaged foods. Refuse to buy use and throw plastic products.

2. Reduce

Reduce the waste by using durable goods that last longer instead of things that are used once and thrown away. (e.g) Write on both sides of papers. Instead of unnecessary printing, use electronic facilities. Share newspapers, magazines and other things with others.

3. Reuse

Reusing means using a thing again and again, rather than using and throwing after a single use. (e.g) Instead of using plastic bags, use and throw pens and batteries, use cloth bags, fountain pens and rechargeable batteries. Reuse glass bottles for other purposes. Repair foot wears and use them.

4. Recycle

The process by which waste materials are used to make new products is called recycling. (e.g) Using old clothes to make paper and melting some plastics to make floor mats, plastic boards and hose pipes.

5. Compost

The process of degradation of organic wastes into manure by the action of microorganism mainly fungi and bacteria are called composting. The manure thus obtained becomes natural fertilizer for the plants as well as increases the soil fertility.

6. Incineration plants:

The burning of solid waste in large furnaces at high temperature is called incineration. In these plants the recyclable material segregated and the rest of the material is burnt and ash is produced. Human anatomical wastes (discarded medicines, toxic drugs,

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blood, pus) are disposed by means of incineration. During incineration, the enormous heat kills all contagious disease-causing germs. We can also produce electricity with the help of this heat. So, the incineration is kept as the last resort and is used mainly for treating the infectious waste.

7. Landfill

Landfilling is a method in which wastes are dumped into naturally occurring or man-made pits and covered with soil. Mostly prevailed in urban areas. Garbage buried inside landfills remain here for a long time as they decompose very slowly and become manure. These places can be converted into parks, gardens, etc.,

8.Sanitary landfills:

Sanitary landfill is more hygienic and built in a methodical manner to solve the problem of leaching. These are lined with materials that are impermeable such as plastics and clay, and also built over impermeable soil. But constructing sanitary land fill is very costly.

9.Pyrolysis:

It is alternative to incineration. It is a process of combustion in absence of oxygen or material burnt under controlled atmosphere of oxygen the gas and liquid thus obtained can be used as fuels.

10.Vermiculture:

It is also known as earthworm farming. In this method the earth worms are added to the compost. These worms break the waste and the added excreta of the worms makes the compost very rich in nutrients.

Waste separation exercise

The Solid Waste Management (SWM) rules, 2016 say that,

1. Every Household should segregate and store the waste generated by them in three separate streams – namely bio-degradable, non-bio-degradable and domestic hazardous waste in suitable bins and handover segregated wastes to authorized

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waste pickers or waste collector as per the direction or notification by the local authorities from time to time.

2. No body shall throw, burn, or bury the solid waste on streets, open public spaces outside his premises or in the drain or water bodies.

Domestic hazardous waste means discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicines, broken mercury thermometers, used batteries, used needles and syringes and contaminated gauge, etc., generated at the household level.

Question:

1. Enumerate the measures taken by the government to reduce the solid and hazardous waste management wastes through policy.

