ENVIRONMENTAL SCIENCE

PRESENTATION BY AMIT SIR

EVIROMENT & ECOLOGY

BY AMIT

SYLLABUS IN UPSC

PRELIMS

- General issues on Environmental Ecology, Biodiversity and Climate Change
 - that do not require subject specialisation.

MAINS (GS PAPER III)

Conservation, environmental pollution and degradation, environmental impact assessment

SOURCES

- NIOS ENVIRONMENT BOOK
- SHANKAR IAS BOOK (6th EDITION)
- NCERT 11th & 12th CHAPTERS ON ENV.
- INDIA YEAR BOOK 2020 –CH. 12 ON ENV.
- MAJID HUSSAIN INDIAN GEOGRAPHY- for flora & fauna, parks & sanctuaries
- STATE OF FOREST REPORT –selective
- NEWSPAPER for current

80/20 rule

- This is a general rule which says that you can cover 80% of the syllabus by just reading 20% of the books, this is smart study.
- Problem arises when we want to complete everything, want to solve every questions and spend most of our time in outliers.

QUESTIONS ASKED

Prelims upsc

2013- 17

2014- 28

2015- 22

2016- 21

2017- 14

2018- 12

2019- 21

Shows importance of this

section in UPSC

TREND

- questions on summits or reports
- flora & fauna discoveries
- less utility of traditional sources
- international org & fund
- Wildlife Park and Sanctuary related questions

GLIMPSE OF SEVERAL CS PRE 2109 QUESTINS

- (Pre19-SetA) Q19. Which one of the following national parks lies completely in the Temperate alpine zone?
 - (a) Manas national park
 - (b) Namdapha national park
 - (c) Neora valley national park
 - (d) Valley of flower national park

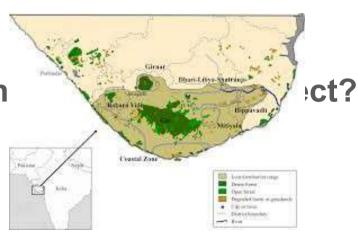


8. Consider the following statements:

- 1. Asiatic lion is naturally found in India only.
- 2. Double-humped camel is naturally found in India only.
- 3. One-horned rhinoceros is naturally found in India only.

Which of the statements given

- (a) 1 only
- (b) 2 only
- (c) 1 and 3 only



(Pre19-SetA) Q29. Consider the following pairs:

Wildlife: Naturally found in

Blue finned mahseer: Cauvery river

Irrawaddy dolphin : Chambal river

Rusty spotted cats: Eastern ghats

Which one of the pair given above are correctly matched?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3



QUESTIONS IN MAINS

IN 2019

 Coastal sand mining, whether legal or illegal, poses one of the biggest threats to our environment. Analyze the impact of sand mining along the Indians coasts, citing specific examples.

(Answer in 150 words) 10

 Define the concept of carrying capacity of an ecosystem as relevant to an environment. Explain how understanding this concept is vital while planning for sustainable development of a region.

(Answer in 250 words)15

• Environmental carrying capacity is an ecological concept about the sustaining of population of organism at a steady state with respect to resources available in the ecosystem in which they reside.

CONCEPT OF EARTH OVERSHOOT DAY

ENVIRONMENT

• "Environment is the sum of the components like water, air, land; inter-relationships among themselves and also



ECOLOGY

- "Ecology is a science in which study of organism is undertaken in relation to their environment."
- This science developed as response to increasing awareness of interrelationships between plants, animals and their physical habitat.



Why to study environment?

Humanity's entire life support system depends on the well -being of all the environment factors.

Historical

Background

BEGINNING

- Humanity's relationship and dependence on earth for their needs has existed since the beginning of time.
- Ecological awareness first appears in the human record at least 5,000 years ago. Vedic sages praised the wild forests in their hymns, Taoists urged that human life should reflect nature's patterns and the Buddha taught compassion for all sentient beings.
- earliest ideas in Jainism, are traced to efforts by Mahavira –whose core values associated with environmental activism, i.e., protection of life by nonviolence

Recent changes

 Beginning in the nineteenth century, the Industrial Revolution caused many changes;

 In the growing industrial cities of London, New York and Chicago, coal burning factories polluted the air and water

Compliments

while the need for lumber to caused mass deforestation of animal life.

 Western people realized their behavior had a negative impact on the environment.

- In the years proceeding World War II, America witnessed economic boom and emergence of New technologies introduced atomic energy, synthetic materials and chemicals, such as pesticides, which led to advancements in agriculture and consumer products.
- "pollution was the price of economic progress"
- In 1969, the Cuyahoga River in Ohio was so polluted with toxic chemicals and industrial waste that the river caught fire.
- For the WEST, this was **turning point** in acknowledgement of the need for drastic action to protect the environment.

Fire on Cuyahoga river



Watershed movement

- Stockholm Summit was held by United Nations
 Conference on the Human Environment in Stockholm, Sweden in 1972.
- This summit led to creation of UNEP.
- Report of Brundtland Commission wit title Our Common Future on sustainable development, is published.

•In 1992

The Earth Summit was held in Rio de Janeiro, which was an unprecedented event for a United Nations conference, in terms of both its size and the scope of its concerns.

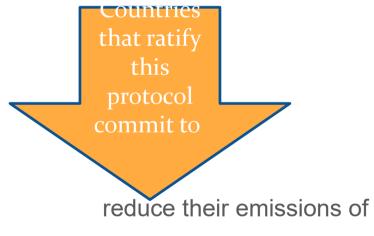
United Nations Framework Convention on Climate open for signature

Change was put

• term Ecological footprint was coined by William Rees.



- The Kyoto Protocol came into existence in Kyoto, Japan in 1997.
- as amendment to the United Nations Framework Convention on Climate Change (UNFCCC).



carbon dioxide and five other greenhouse gases

- In 2001, U.S. rejects the Kyoto Protocol
- In 2002,Second Earth Summit, held in Johannesburg as United Nations conference.
- The Kyoto Protocol came into force on in 2005, after Russia ratified the protocol, fulfilling all its provisions
- Finally, we have

Paris Agreement

is an international agreement to combat climate change.



Leaders of world committed to resolve climate woes in Paris

Thank you

BASICS OF ENVIRONMENT

DEFINITION

Inter-relationship between living organisms and their surroundings

Types of environment

- 1. Physical environment- it comprise of abiotic or physical component of environment which are non-living elements like soil, minerals, water, etc.
- **2. Biotic environment-** composed of living parts of Earth
- **3. Social or cultural environment-** which is created by man through his/her socio-cultural aspects

PHYSICAL ENVIRONMENT

ATMOSPHERE

3 COMPONENTS

HYDROSPHERE

COMPOSED OF LAYERS OF AIR, COMPRISING OF GASES LIKE:

- NITROGEN- 78.09%
- OXYGEN- 20.95%
- ARGON- 0.93%
- 0.03% CO2
- TINY AMOUNT OF OTHER GASES

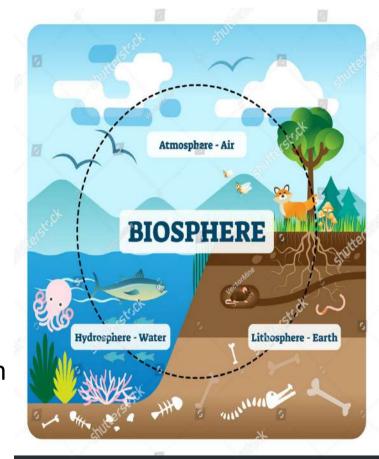
LITHOSPHERE

CRUSTAL COMPONENT OF EARTH WITH **SOIL** BEING MOST IMPORTANT CONSTITUENT RELATED TO
SURFACE WATER COMPOSED OF
BODIES LIKE
RIVERS, OCEANS,
LAKES, PONDS,
ETC
& CRYOSPHERE

BIOTIC COMPONENT

 BIOSPHERE forms the zone of life on Earth, it extends to any place on Earth where life can exist

 biosphere is the global <u>ecological</u> system integrating all <u>living beings</u> and their relationships, including their interaction with the elements of the <u>lithosphere</u>, <u>hydrosphere</u>, and <u>atmosphere</u>.



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SOME QUESTIONS:

Q1. Consider the following: (2011)

Carbon dioxide

Oxides of Nitrogen

Oxides of Sulphur

Which of the above is/are the emission/ emissions from coal combustion at thermal power plants?

- (a.) 1 only
- (b.) 2 and 3 only
- (c.) 1 and 3 only
- (d.) 1, 2 and 3

Q2 Regarding "carbon, credits", which one of the following statements is not correct? (2011)

- (a.) The carbon credit system was ratified in conjunction with the Kyoto Protocol
- (b.) Carbon credits are awarded to countries or groups that have reduced greenhouse gases below their emission quota
- (c.) The goal of the carbon credit system is to limit the increase of carbon dioxide emission
- (d.) Carbon credits are- traded at a price fixed from time to time by the United Nations Environment Programme

Q3. There is a concern: over the increase in harmful algal blooms in the seawaters of India. What could be the causative factors for this phenomenon? (2011)

- 1. Discharge of nutrients from the estuaries.
- 2. Run-off from the land during the monsoon.
- 3. Upwelling in the seas.

Select the correct answer from the codes given below:

- (a.) 1 only
- (b.) 1 and 2 only
- (c.) 2 and 3 only
- (d.) 1, 2 and 3

Q4. The scientific view is that the increase in global temperature should not exceed 2 °C above pre-industrial level. If the global temperature increases beyond 3°C above the pre-industrial level, what can be its possible impact/impacts on the world?

- 1. Terrestrial biosphere tends toward a net carbon source
- 2. Widespread coral mortality will occur.
- 3. All the global wetlands will permanently disappear.
- 4. Cultivation of cereals will not be possible anywhere in the world.

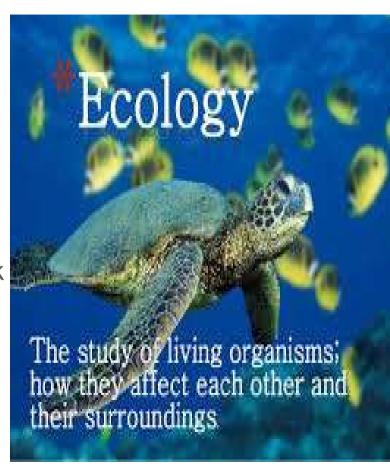
Select the correct answer using the code given below.

- 5. 1 only
- 6. 1 and 2 only
- 7. 2, 3 and 4 only
- 8. 1, 2, 3 and 4,

ECOLOGY

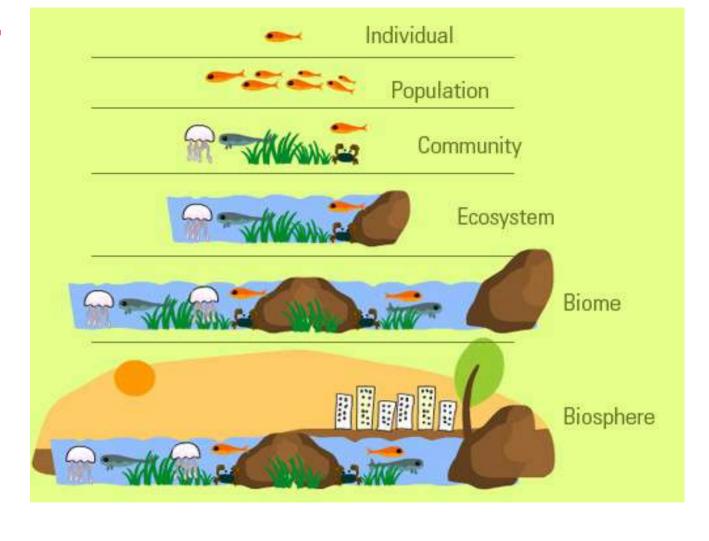
 Scientific study of relationship of living organisms among themselves and with their environment

 The term ecology is obtained from Greek words namely, 'oikos' meaning place to live and 'logos' meaning study



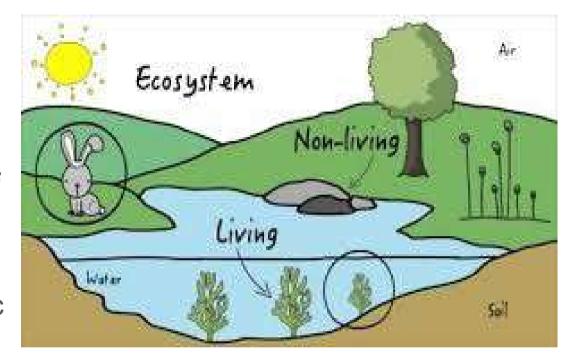
LEVELS OF ECOLOGY

There are six levels of ecology



ECOSYSTEM

- It is defined as selfsustained, structural and functional unit of biosphere
- consisting of living beings and their abiotic surroundings both interacting and exchanging materials between them



 A healthy ecosystem means that its elements are capable of reproducing themselves

COMPONENTS OF ECOSYSTEM

1) ABIOTIC COMPONENTS

ABIOTIC components includes **inorganic and nonliving parts** of the world, lke:

- Air
- soil
- Water
- Light
- Temperature
- Energy
- Minerals
- Also the physical processes like Earthquakes, forest fire,etc

2) **BIOTIC COMPONENTS**

They are living organisms like plant, animals and microbes, classified as per their functional roles, as:

- Primary producers or Autotrophs- plants-GPP & NPP
- Consumers or heterotrophs
 - Herbivores
 - Carnivores
 - Saprotrophs or decomposers

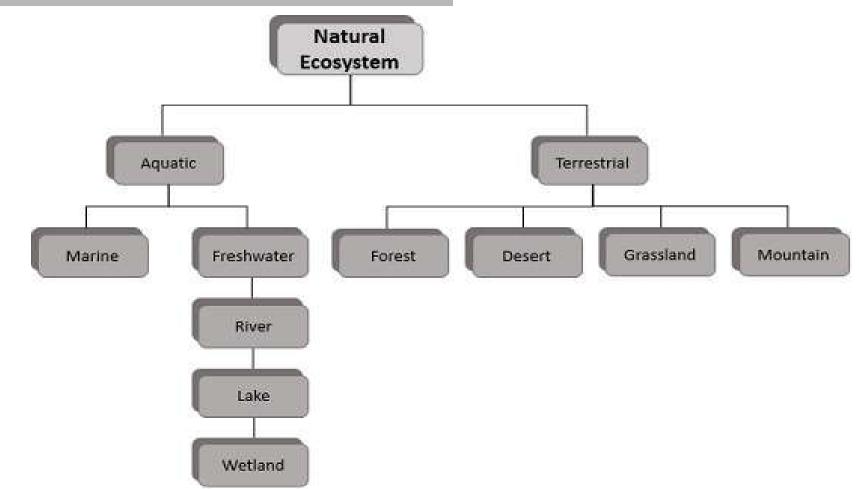
$$2NH_3 + 3O_2 \longrightarrow 2NO_2^- + 2H^+ + 2H_2O \qquad (i)$$

$$2NO_2^- + O_2 \longrightarrow 2NO_3^- \qquad (ii)$$

Ammonia is first oxidised to nitrite by the bacteria *Nitrosomonas* and/or *Nitrococcus*. The nitrite is further oxidised to nitrate with the help of the bacterium *Nitrobacter*. These steps are called **nitrification** (Figure 12.3). These nitrifying bacteria are **chemoautotrophs**.

The nitrate thus formed is absorbed by plants and is transported to the leaves. In leaves, it is reduced to form ammonia that finally forms the amine group of amino acids. Nitrate present in the soil is also reduced to nitrogen by the process of denitrification. Denitrification is carried by bacteria *Pseudomonas* and *Thiobacillus*.

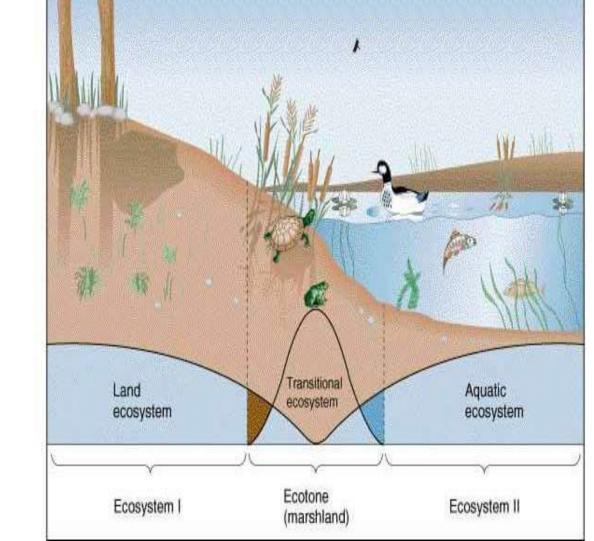
TYPES OF ECOSYSTEM



ECOTONE

 It is a zone of transition between two or more diverse ecosystem

For eg. Mangrove
 forests represent an
 ecotone between
 marine and terrestrial
 ecosystem



 Well developed ecotone contain species entirely different from adjoining community

• "EDGE EFFECT" is the phenomenon where number of species and population density of some species in transition zone is much greater than either community.

HABITAT

- Habitat is the physical environment in which an organism lives. It is simply the address of species, which can be same for many species. For eg. pond, ocean, forest, etc.
- Four major habitats-(1) **Terrestrial** (2) **Freshwater** (3) **Estuarine** and (4) **Ocean**.

niche

- It's unique functional role played by a species in an ecosystem. No two species can have identical niches.
- About physical, chemical and biological factors that a species need to survive, stay healthy and reproduce.

Ecological Niche

The ecological niche describes the functional position of an organism in its environment.

- A niche comprises:
 - the habitat in which the organism lives.
 - the organism's activity pattern: the periods of time during which it is active.
 - the resources it obtains from the habitat.

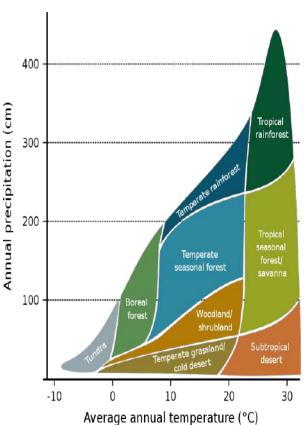


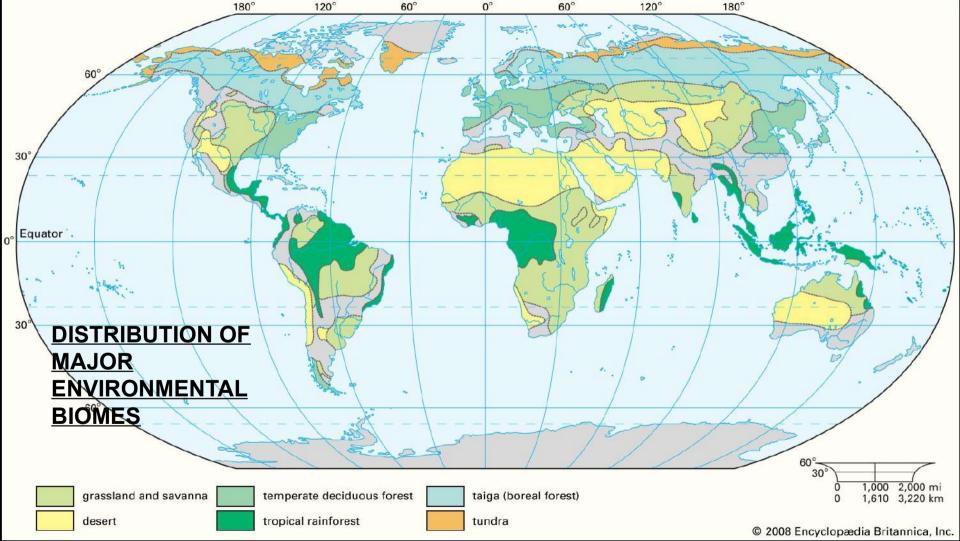
BIOME

- Community of plants and animals with common characteristics, formed in response to shared physical climate
- The terrestrial part of biosphere can be divided into several large regions called biomes.
- Characterised by their climate, vegetation, animal life and soil type

Climatic factors like temperature and precipitation

determine the boundary of a biome and distribution of plants and animals in a biome





THANK YOU

Some previous year questions

- Q. Consider the following pairs about parks and rivers passing through them:
 - 1. Corbett National Park: Ganga
 - 2. Kaziranga National Park: Manas
 - 3. Silent Valley National Park: Kaveri

Which of the above pairs is/are correctly matched? (2013)

- a. 1 and 2
- b. 3 only
- c. 1 and 3
- d. None



Q. The term 'Intended Nationally Determined Contributions' is sometimes seen in the news in the context of

- (a) pledges made by the European countries to rehabilitate refugees from the war-affected Middle East
- (b) plan of action outlined by the countries of the world to combat climate change
- (c) capital contributed by the member countries in the establishment of Asian Infrastructure Investment Bank
- (d) plan of action outlined by the countries of the world regarding Sustainable Development Goals

INDIA'S TARGETS UNDER PARIS AGREEMENT FOR 2030

- Reducing greenhouse gas emission intensity of its GDP by 33–35% below 2005 levels by 2030
- Forty percent of its power capacity to be based on non-fossil fuels
- Create an additional 'carbon sink' of 2.5-3 billion tonnes of Co2 equivalent through additional forest and tree cover by 2030

RECORDED ACHIEVEMENT

- Emission intensity of GDP reduced by 21 per cent below 2005 levels by 2014.
- 35% of power capacity based on non-fossil fuels achieved by March 2018.
- Emissions avoided by forest cover fall by more than half between 2010–14. Those by tree cover double in the same period.

Q. Recently there was a proposal to translocate some of the lions from their natural habitat in Gujarat to which one of the following sites?

- (a) Corbett National Park
- (b) Kuno Palpur Wildlife Sanctuary
- (c) Mudumalai Wildlife Sanctuary
- (d) Sariska National Park

Q. Which one of the following terms describes not only the physical space occupied by an organism, but also its functional role in the community of organisms? (2013)

- a. Ecotone
- b. Ecological niche
- c. Habitat
- d. Home range

Q. Which of the following National Parks is unique in being a swamp with floating vegetation that supports a rich biodiversity?

- (a) Bhitarkanika National Park
- (b) Keibul Lamjao National Park
- (c) Keoladeo Ghana National Park
- (d) Sultanpur National Park



DID YOU KNOW?

Keibul Lamjao - The only floating park in the world, located in Manipur.

This National park is a swamp made of biomass vegetation called *phumdis*, floating on the surface of Loktak Lake.

ECOSYSTEM

DEFINITION

Ecosystem is a community of living organisms coexisting with nonliving components of their environment, interacting whole as a **self sustainable system.**

The term 'ecosystem' was coined by **A.G. Tansley** in 1935.



- In ecosystem, each species or population interacts with one another in a complex web of relationships.
- These relationships can be oppositional (negative), symbiotic (positive) or neutral in nature.

Types of interaction

- Predator: in this relationship, predator eats, captures or kills another organism called prey.
 Eg cat eating a mice.
- 2. Parasitism: here, one organism, usually a small size organism, lives in or on organism of another species, called the host, from which the parasite gets its food and often shelter. The parasite is benefited at the expense of its host. Eg. worm, virus, bacteria in human body.

- **3. Amensalism-** a negative association between two species, where one species harms the other species without itself getting affected or harmed. Eg small trees growing
- **4. Commensalism-** relationship, where one of the species benefits while the other is neither harmed nor benefited. For eg. cow dung provides food and shelter to dung beetles.
- **5. Mutualism-** association between two species, where both gets benefit from each other. When this association is so intimate, that both cannot survive without each other, it is called symbiosis. Eg. termite and their intestinal flagellates.
- **6. Competition-** interaction between two populations in which both species are harmed to some extent. It occurs when both compete for the same limited resources.
- **7. Neutralism-** the relationship between two species which do interact but do not affect each other. There is no relationship with true neutralism in nature.

Q. Lichens, which are capable of initiating ecological succession even on a bare rock, are actually a symbiotic association of

- 1. algae and bacteria
- 2. algae and fungi
- 3. bacteria and fungi
- 4. fungi and mosses

FUNCTIONS OF AN ECOSYSTEM

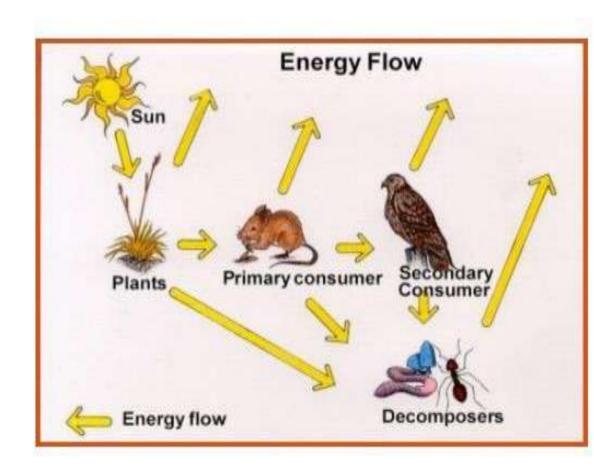
They can be studied under three broad categories

- 1. Energy flow
- 2. Nutrient cycling
- 3. Ecological Succession
- 4. homeostasis

Energy flow

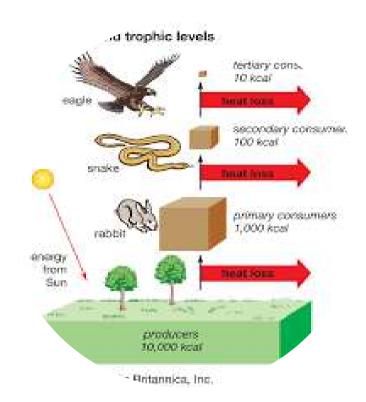
- It governs metabolic functions of all living organisms
- Its flow is unidirectional,
 i.e., from producers to top
 consumers
- Flow of energy follows
 10% law or Lindeman's

 law which says that only
 10% energy will be
 transferred from one
 trophic level to the next
 higher trophic level.



TROPHIC LEVEL

For their nutritional needs, organisms in an ecosystem can be arranged into various hierarchical levels, called as trophic levels.



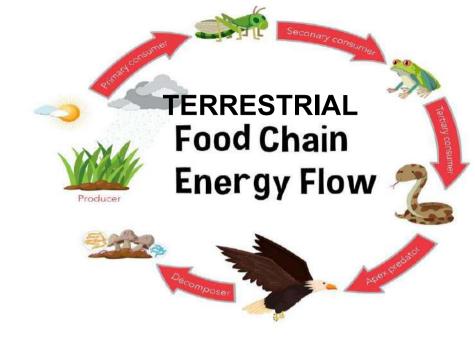
Energy Interaction among trophic levels

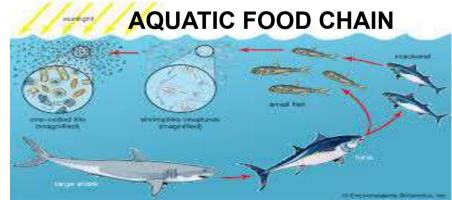
There can be 3 ways of such interaction:

- 1. Food chain
- 2. Food web
- 3. Ecological pyramids

FOOD CHAIN

- Its a linear network or chain depicting transfer of matter and energy in the form of food, from one trophic level to next trophic level.
- It begins with producers and ends with top consumers.

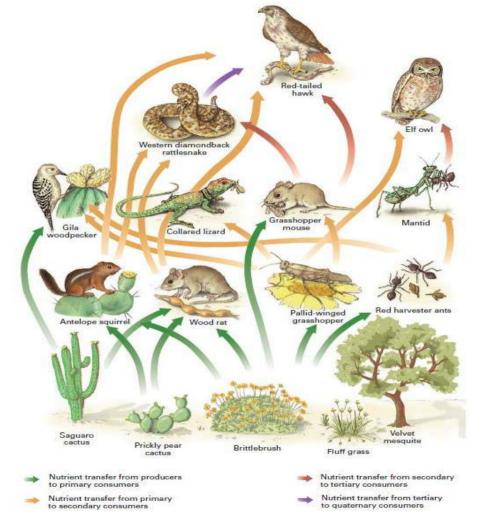






It is a network of several inter- related food chains, showing nutrition transfer in actual conditions in nature, as most organisms consume more than one type of animal or plant.

It is a complex web of several interlinked food chains, **providing alternative routes of nutrition transfer**, which improves chances of survival of organisms involved.



Q. With reference to food chains in ecosystems, consider the following statements : (2013)

- 1. A food chain illustrates the order in which a chain of organisms feed upon each other.
- 2. Food chains are found within the populations of a species.
- 3. A food chain illustrates the numbers of each organism which are eaten by others.

Which of the statements given above is / are correct?

- (a) 1 only
- (b) 1 and 2 only
- (c) 1, 2 and 3
- (d) None

Q. With reference to the food chains in ecosystems, which of the following kinds of organism is / are known as decomposer organism/organisms?

- 1. Virus
- 2. Fungi
- 3. Bacteria

Select the correct answer using the codes given below.

- a. 1 only
- b. 2 and 3 only
- c. 1 and 3 only
- d. 1, 2 and 3

What would happen if phytoplankton of an ocean is completely destroyed for some reason? (2012)

- 1. The ocean as a carbon sink would be adversely affected.
- 2. The food chains in the ocean would be adversely affected.
- 3. The density of ocean water would drastically decrease.

Select the correct answer using the codes given below:

- (a) 1 and 2 only
- (b) 2 only
- (c) 3 only
- (d) 1, 2 and 3

BIOMAGNIFICATION and BIOACCUMULATION

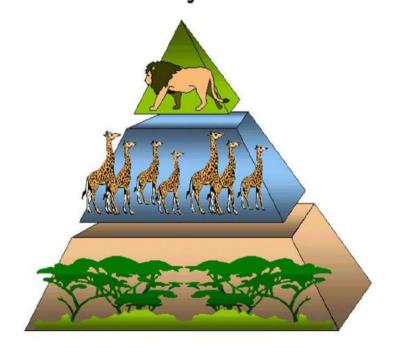
- Biomagnification is the increase in toxin concentration, as we move up across the trophic levels in a food chain.
- Bioaccumulation occurs at a trophic level, where toxic substances gets absorbed from food or environment.

ECOLOGICAL PYRAMIDS

- Ecological pyramids are the graphic representations of trophic levels in an ecosystem
- They represent sequential arrangement of trophic levels with primary producers, herbivore, carnivore and so on.

- They are of 3 types:
 - 1. PYRAMIDS OF NUMBER
 - 2. PYRAMIDS OF BIOMASS
 - 3. ENERGY PYRAMID

Ecological pyramids of Ecosystem

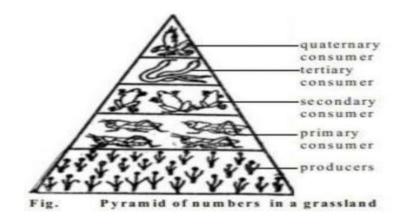


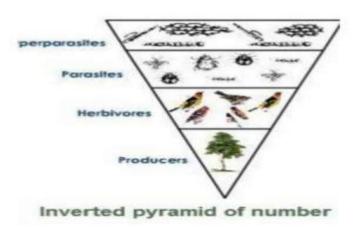
PYRAMID OF NUMBERS

- This pyramid shows **abundance of organisms** in terms of their number at different trophic levels, without considering the size of organisms.
- It can be upright or inverted in presentation, based on ecosystem considered.
- Length of bar represents the number of organisms at a trophic level.

Upright pyramid

Inverted pyramid

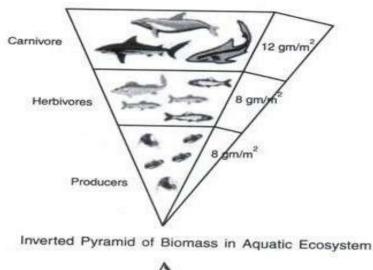


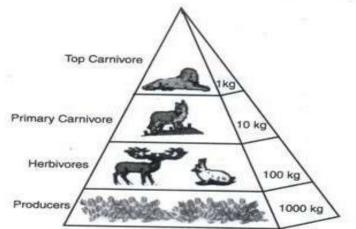


BIOMASS PYRAMID

It represents total standing crop biomass at each level, which is the amount of the living matter at any given time. It is expressed as gm per unit area or kilo cal per unit area.

This pyramid can also be upright or inverted.

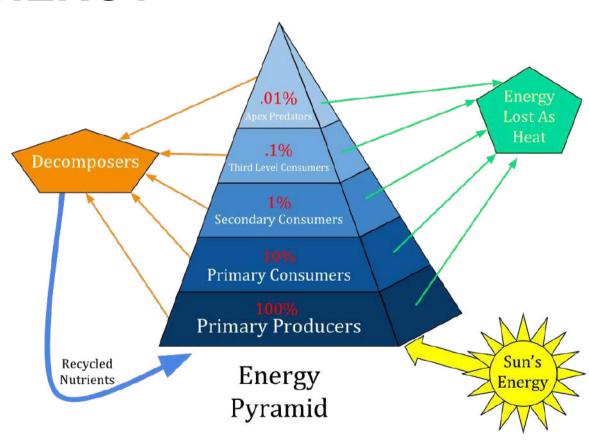




Upright Pyramid of Biomass for Grassland Ecosystem

PYRAMID OF ENERGY

- This pyramid graphically shows the amount of energy present at each trophic level
- Pyramid of energy is always unidirectional, i.e., the energy always flow from producers to consumers and follows 10% principle
- Seldom we witness more than 4 or 5 trophic levels, because of very low energy reaching there.

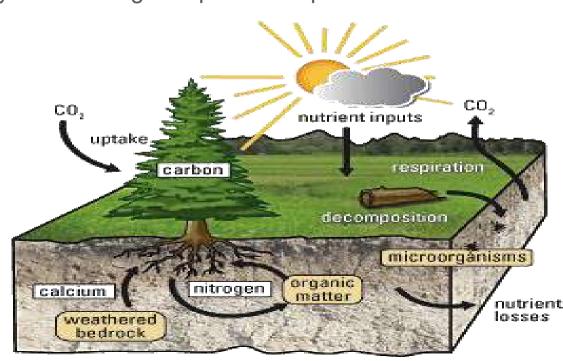


NUTRIENT CYCLING

Flow of energy is linear but flow of nutrients is cyclical.

 Nutrients flow from dead remains of organisms released into the soil and then again get absorbed from soil by the root of green plants are passed on to others.

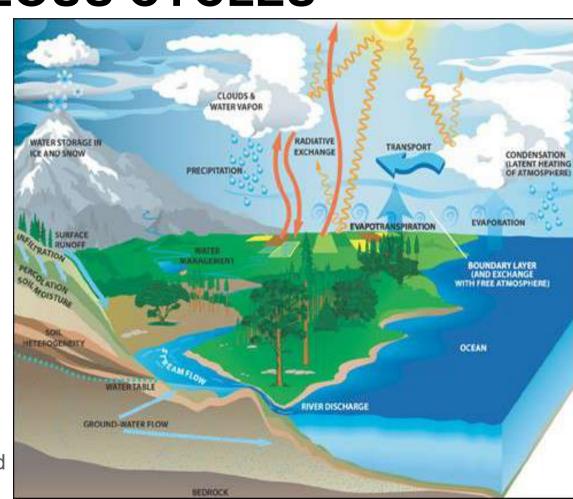
- This recycling of the nutrients is called biogeochemical or nutrient cycle.
- They can be classified as gaseous (or perfect cycle of short duration) and sedimentary cycle (or imperfect cycle of long duration).



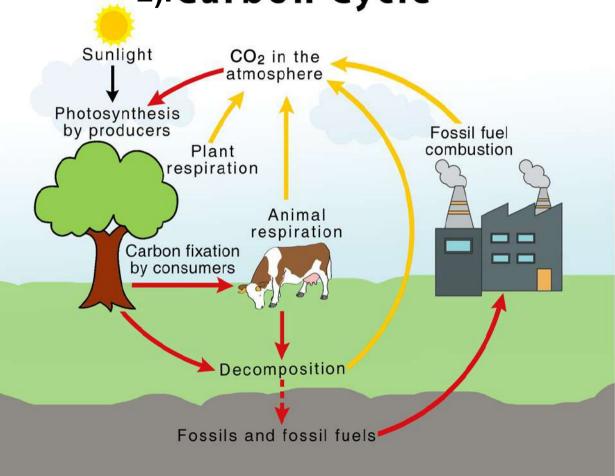
GASEOUS CYCLES

1). HYDROLOGICAL CYCLE

- It is the circulation of water in earth's atmosphere, driven by heat energy of Sun.
- It is a cyclical process of evaporation, transpiration, condensation, cloud formation, precipitation, runoff and groundwater flow.
- impact generating
 hydroelectricity, irrigation,
 deforestation and the greenhouse
 effect, use of motor vehicle use and
 animal husbandry.



2). Carbon Cycle



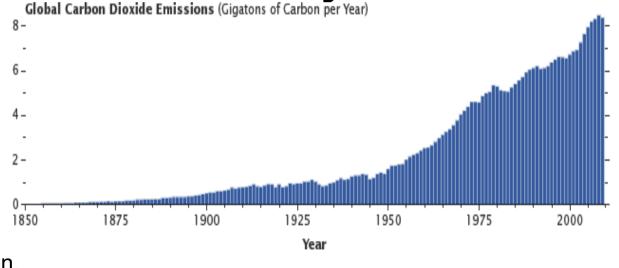
 It is the movement of carbon and its compound between atmosphere and organisms on earth.

- CO2 is the minor constituent gas in air, which is absorbed under process of photosynthesis and
- released in processes like respiration, decomposition, combustion and other anthropogenic activities.

 Carbon cycle can be a short term cycle or it can become a long term cycle when carbon enters as sediments in geological cycles to get transformed into fossils

Impact of humans on carbon cycle

Over the past million years, CO2 levels never 6 exceeded 280-300 ppm. But a recent report claimed the presence of 407 ppm of CO2 in atmosphere, this significant rise is largely due to human intervention.



Which of the following adds/add carbon dioxide to the carbon cycle on the planet Earth?

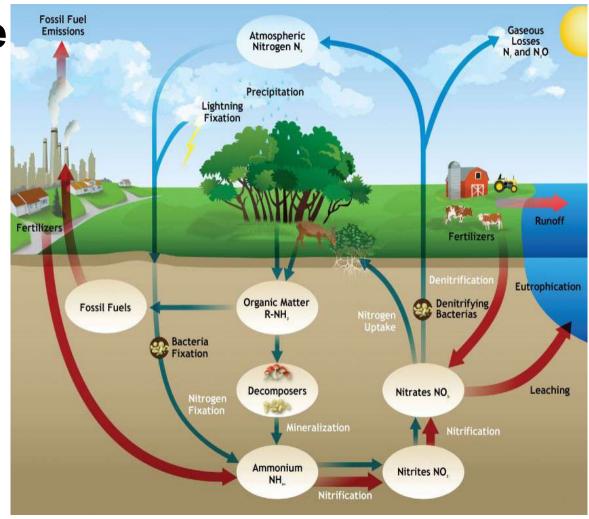
- 1. Volcanic action
- 2. Respiration
- 3. Photosynthesis
- 4. Decay of organic matter

Select the correct answer using the code given below.

- A. 1 and 3 only
- B. 2 only
- C. 1, 2 and 4 only
- D. 1, 2, 3 and 4

3). Nitrogen cycle

- It is the circulation of nitrogen (and its converted compounds) between terrestrial, atmospheric and marine ecosystems, through various physical and biological processes.
- Nitrogen is essential constituent of protein, and thus basic building block of tissues.
- Nitrogen forms 79% of the air, but it cannot be utilised by plants in this from.



ESSENTIAL PROCESSES INVOLVED IN CYCLE:

denitrification.

Nitrogen fixation : conversion of atmospheric nitrogen gas into ammonia, thus
to be utilised by plants. It is done by human (by industrial processes), by nature
(to some extent by lightning) and by microorganisms like rhizobium (living in root
nodules of leguminous plants) or by free living bacteria (like nostoc, azotobacter).
Nitrification: process under which nitrates or nitrites are formed after
conversion from ammonia by Nitrosomonas and Nitrococcus bacteria
respectively.
Assimilation : here the already fixed nitrogen is turned into organic molecules
like proteins (DNA and RNA), by plants.
Ammonification: conversion of living waste and dead and decaying matter back
into inorganic ammonia, is called ammonification (by ammonifying bacteria).
Denitrification: conversion of nitrates back into gaseous nitrogen is called

Acid rain is caused by the pollution of environment by (2013)

- (a) carbon dioxide and nitrogen
- (b) carbon monoxide and carbon dioxide
- (c) ozone and carbon dioxide
- (d) nitrous oxide and sulphur dioxide

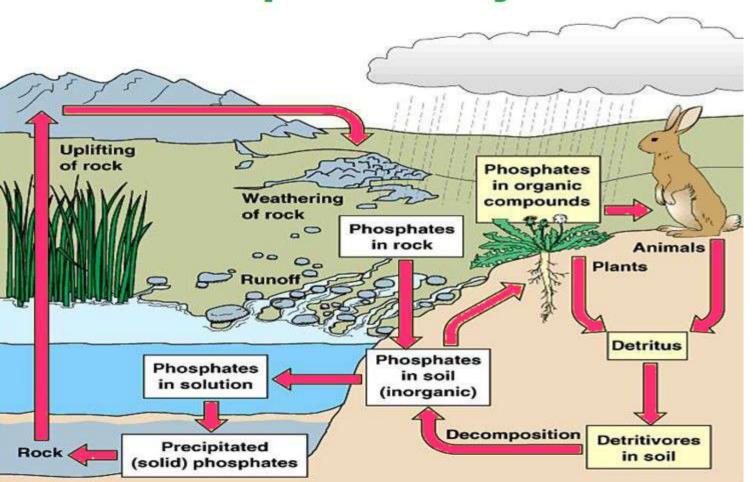
SEDIMENTARY CYCLES

Elements like calcium, magnesium, phosphorous, sulphur, etc get recycled in long term in lithosphere, hydrosphere and biosphere under processes like erosion, sedimentation, mountain building, volcanic eruption, transportation and deposition.

1). PHOSPHORUS CYCLE

- It is a biogeochemical cycle where phosphorus moves between different spheres of earth (except atmosphere).
- Phosphorus exists as a mineral in phosphate rocks, from where it erodes to enter the cycle.
- It has significant role in aquatic ecosystem and for growth rooted and free floating microscopic plants in lakes.

Phosphorus Cycle

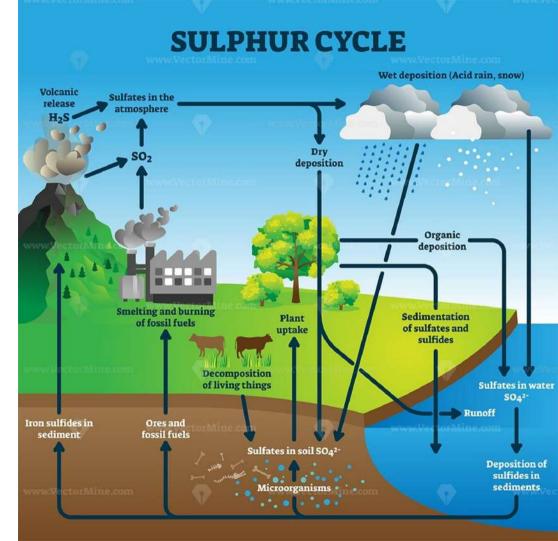


Impact of humans:

Activities like large scale mining, excessive use of fertilisers and eutrophication, like processes ,grea tly alter the amount of phosphorus in nature.

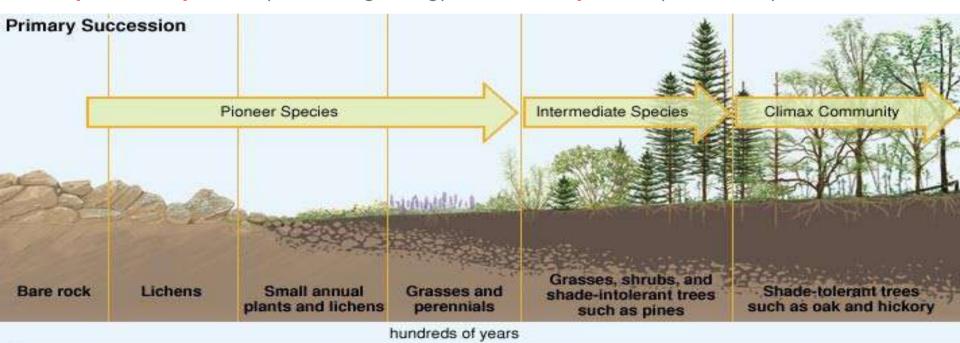
2). SULPHUR CYCLE

- This cycle involves movement of sulphur in lithosphere, hydrosphere, biosphere and atmosphere.
- Sulphur is locked in organic reservoirs of coal, oil, peat and in inorganic deposits such as pyrite and sulphur rock.
- This erodes to be later absorbed by plants as sulphates, and thus enters food chain.
- It goes back to the soilthrough excretion and decomposition processes.



ECOLOGICAL SUCCESSION

It is the process of **progressive change in structure of species** in an ecosystem, over the period of time. Here the composition an ecological community changes from **pioneer species** (in the beginning) to **climax species** (in the end).



Related terminologies

- Pioneer species- is the species which first colonise an ecosystem (barren or disrupted). Example of some lichens can be taken which can grow on rocks and aid in soil formation processes.
- Intermediate species- species which succeeds the pioneer species and form an array of species between pioneer and climax species, passing through seral stages.
- Climax species- is the ecological community in final stage of succession, where changes in populations of plants and animals present reaches a steady state, and remain stable until disrupted due to changes in climate.
- **SERE**: changes from initial to final community takes place in successional stages, and these transitional stages are called sere.

General Process of Succession



NUDATION

Colonisation of bare area (formed due to factors like topographic, climatic, biotic)

INVASION

It is successful establishment of species and Includes process of migration, ecesis and aggregation

CO-ACTION & COMPETITION

Aggregated species compete for light, space and nutrients.

REACTION

Autogenic changes takes place that affects habitat of organisms, like development of humus layer in soil

STABILISATION

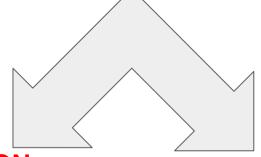
Formation of climax community which is in equilibrium with its surrounding environment.

In the grasslands, trees do not replace the grasses as a part of an ecological succession because of : (2013)

- (a) insects and fungi
- (b) limited sunlight and paucity of nutrients
- (c) water limits and fire
- (d) None of the above

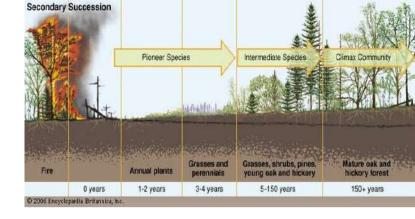


Types of succession



PRIMARY SUCCESSION

- Ecological succession in which an area is colonised for the first time by a species or ecological community
- Usually these are hardy pioneer species that alter the habitat condition by their growth and development, thus establishing conducive conditions for arrival of subsequent species
- consisting of microbes, lichens and mosses which can colonise even barren rocky areas.



SECONDARY SUCCESSION

- It occurs on pre-colonised habitat, where most of life ended due to some disturbance like fire, flood or human intervention.
- It occurs when initial succession gets disrupted and is usually faster than primary succession.

Other classifications of ecological succession

1. Based on energy generation

- i. Autotrophic that generates energy from its own internal processes, or
- **ii. Heterotrophic** that depends on already available energy, having initial dominance of heterotrophs, like those beginning with decomposers.

2. Based on changes in system

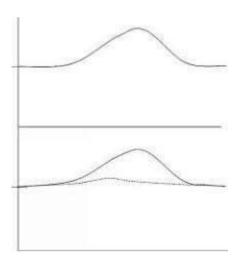
- i. Autogenic changes brought due to interaction within the system
- ii. allogenic changes that occur as response to interaction with external system

3. Based on direction

- i. **Progressive** changes in direction of increasing biomass productivity, increasing biodiversity, niche development and increasing structural complexity of ecosystem.
- ii. retrogressive when above variables are on degrading or declining trend

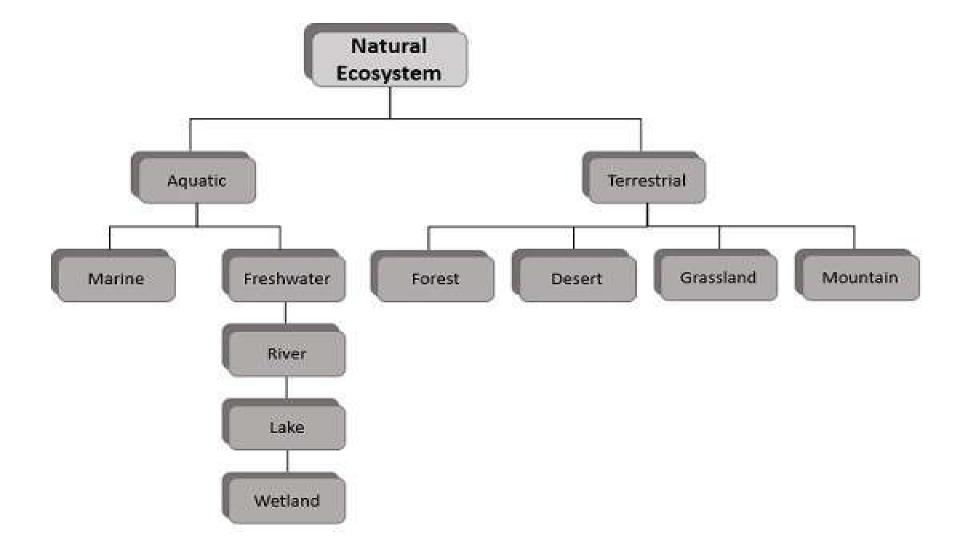
HOMEOSTASIS

- It is the **ability of an ecosystem to maintain its condition of equilibrium.** It is self-regulation of structure of species and functional processes of ecosystem, so as remain in stable & balanced state.
- In simple terms, it is tendency of biological systems to resist changes and remain stable.
- Example of an aquatic ecosystem can be taken- suppose their is increase in population of fishes, they would consume phytoplanktons on larger scale causing decline in their population, which would result in competition and lesser food availability for fishes and thus population of fishes would also decline on account of starvation. Then, over the period of time, phytoplanktons would be able to revive their numbers and so the population of fishes, leading to attaining of balance in ecosystem.



THANK YOU

TYPES OF ECOSYSTEM



TERRESTRIAL ECOSYSTEM

These are the ecosystem having communities of organisms and their surrounding environment, found on land asses of - continents or islands, which includes:

- Forests
- Grasslands
- Deserts

Most important factor which differentiates terrestrial ecosystem are temperature and precipitation.



FORESTS

- They are complex ecosystem comprising groups of stands of trees, animals and micro-organisms (biotic component) interacting and functioning with abiotic factors in their environment
- Distribution of forests depends on factors like soil, topography, biota and climate (specifically temperature and precipitation).



Major Forest Types of the World

- (i) Tropical forests
- (ii) Temperate forests
- (iii) Boreal or north coniferous forests

Figure 1. Ecosystem Services Provided by Forests









conservation



values





and cultural benefits for communities

Conservation Values

Source: Forest Trends



Tropical forests

☐ Tropical rainforest

- Low latitude -10o N to 10o S, i.e., the equatorial and tropical zones.
- Continuously warm and humid, abundant rainfall (>180 cm annually).
- found in the Amazon lowland, central lowlands of Africa, and a belt from Sumatra, Indonesia to the islands of the western Pacific. Some extensions found poleward along the monsoon and trade wind coasts.
- Biodiversity: richest of all terrestrial ecosystems.

deciduous forest
(including moist
tropical, dry tropical,
and monsoon forest)

- Hot lowlands outside the equatorial zone 10o to 30o latitude
- Rainfall more seasonal, dry season more pronounced, especially in dry tropical forests.
- Monsoon forest found in southern Asia, Myanmar, Thailand, and Cambodia; also south-central Africa and South America bordering the equatorial rainforest.
- Biodiversity: less diverse than low-latitude rainforest

☐ Subtropical evergreen forest

TEMPERATE FOREST

Temperate needleleaf forest

- Moist, subtropical zones, with mild winters and ample rainfall.
- Often at intermediate elevation (montane forest).
- Broadleaf once covered extensive areas of southern China and southern Japan. Needleleaf occurs only in southeastern United States.

- Temperate zones- 30 to 60 N & S.
- Mostly Western Hemisphere. In western North America and in upland and mountainous regions of Europe and Asia.

almost entirely in Northern Hemisphere, though a small area is located in Patagonia. Associated with moist continental climate, rainfall in all months and a strong annual temperature cycle. many hardwood species valued for high quality end Sclerophyll forest uses - eg. oak, beech, birch, walnut, maple, elm, and and woodland ash. Native vegetation of the Mediterranean climate, found in narrow coastal belt around the Mediterranean Sea. Central and southern California coast, central Chile, Cape Region of South Africa and southern Australia.

condition summers

Temperate

deciduous forest

Native vegetation of eastern North America and

Moderate winter rainfall, but long, hot, drought

Western Europe. Also found in eastern Asia. Found

Temperate rainforest
Boreal
Forest
(or North

Coniferous Forest)

- Vegetation type limited to the west coasts of continents and large islands in the midlatitudes, where precipitation exceeds 150 cm/year and falls during at least 10 months. Temperatures are cool year round, but always above freezing.
- Frequent fogs and high humidity permit the growth of large evergreen trees.
- contain some of the world's oldest and largest trees.

- High latitude forests, found in two broad continental belts in North America and Europe and Siberia. They require cold climate and adequate moisture.
- Boreal forests extend into lower latitudes where mountain ranges and high plateaux exist, such as the cordilleras of western North America, extending to southern Mexico.
- no counterpart of these forests in southern hemisphere as there is no land at this latitude. e.g. spruce, fir and pine trees.

FOREST TYPES OF INDIA

	Champion and Seth (1968)	
I. Moist Tropical Forests	II. Dry Tropical	
01. Tropical wet evergreen	Forests	
forests	05. Tropical dry	
02. Tropical semi-evergreen	deciduous forests	

forests 03. Tropical moist deciduous forests 04. Littoral and swamp forests

06. Tropical thorn forests 07. Tropical dry

09. Sub-tropical pine forests 10. Sub-tropical dry

III. Montane Sub-

Tropical Forests

08. Sub-tropical broad

leaved hill forests

evergreen forests

IV. Montane Temperate Forests

V. Sub-Alpine Forests

VI. Alpine Scrub

- 11. Montane Wet temperate forests 12. Himalayan moist temperate forests

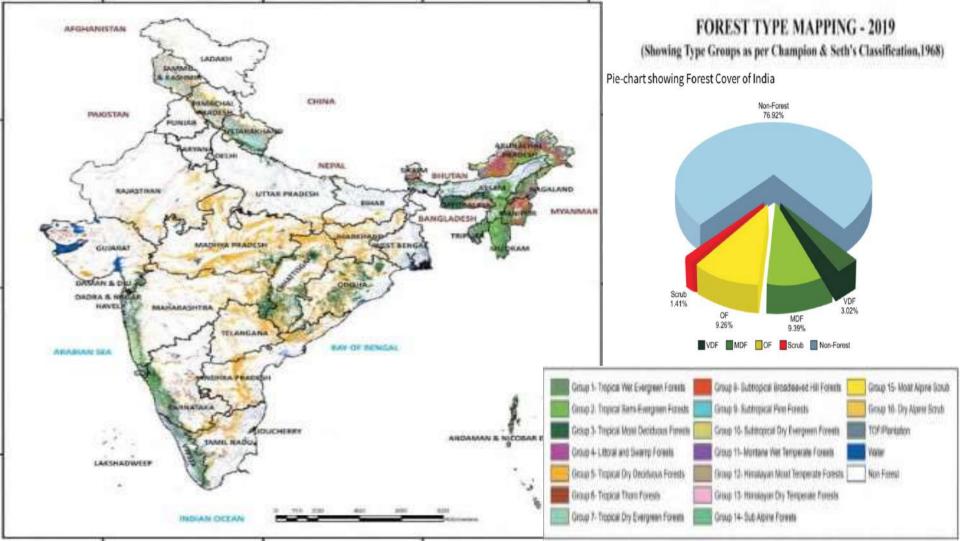
13. Himalayan dry temperate forests

evergreen forests

14. Sub alpine forests

15. Moist alpine scrub

16. Dry alpine scrub



ISFR Report 2019

- It is a biennial report published by the Forest Survey of India (FSI), under MoEFCC.
- The organisation has been mandated to assess the forest and tree resources of the country including wall-to-wall forest cover mapping in two year cycle.
- Started in 1987, ISFR 2019 is the 16th assessment report in the series.
- National forest policy 1988, has target to increase our forest cover to 33%.



Key findings of report:

- Forest Cover of India is 21.67% & Tree Cover of India is 2.89%, leading to total forest cover of 24.56%, i.e., 80.73 million hectares of country's total geographical area.
- An increase of 5,188 sq. km in total forest cover is observed, compared to the assessment of 2017.
 Highest increase in forest cover is seen in: Karnataka (1,025 sq km), Andhra Pradesh (990 sq km), Kerala (823 sq km),
- In the North-Eastern region, the forest cover is 65.05%, where Except for Assam and Tripura, all the States in the region show a decline in forest cover. While in tribal districts, the forest cover is 37.54%.
- Mangrove cover in the country has increased by 54 sq km ,i.e., 1.10% as compared to the last assessment.
- Total Carbon Stock in the forest is 7124.6 million tonnes, as per present assessment.
- Wetlands cover 3.83% of Recorded Forest Area with Gujarat having the largest area under wetlands.
- The analysis reveals that 21.40% of the forest cover of the country is highly to

Threats to forest

- Deforestation & Land use transformation
- Forest fires
- Disease, pests and invasive species
- like hurricane, droughts, storms, etc.

Natural disasters and disturbances

- Degradation due to climate change
- Overexploitation of forest
- resourcesReplacement by mono-crop plantations
- Activities like mining

SOLUTIONS

- 0020110110
- Public-private participation models for afforestation and reforestation activities
- harmonization between policies and laws like the
 Forest Rights Act (FRA) 2006
 strengthening of the participatory forest
- strengthening of the participatory forest management approach by Community Forest Management (CFM)
- Use of compensatory afforestation fund for afforestation and rehabilitation works in both degraded & new areas under forest
 Setting up national bodies as envisaged in dr
- Setting up national bodies as envisaged in draft national forest policy 2018
- sustainable management of the forests
- promotion of trees outside forests and urban greens
- integrating climate change concerns into forest management and managing man-animal conflict



□ GRASSLAND

- These are areas where perennial grasses are the dominant plant community. It is the intermediate stage in ecological succession, where growth of trees is hindered due to climatic and soil conditions.
- They cover around 40% of the Earth's land surface.
- They are **rich in faunal biodiversity** & support a large number of herbivores from minute insects to very large mammals. Eg. Rats, mice, rodents, deer, elephant, dog, buffalo, tiger and lion.
- They are classified as:
 - **Temperate grassland**
 - **Tropical grassland**





Disha Daga



- floating 24% of sees it occupied by total and the first of the sees it occupied by
- Eg. Baguris, Bermi grandlands (Suport) and Shoke grandlands (Kernetaka)

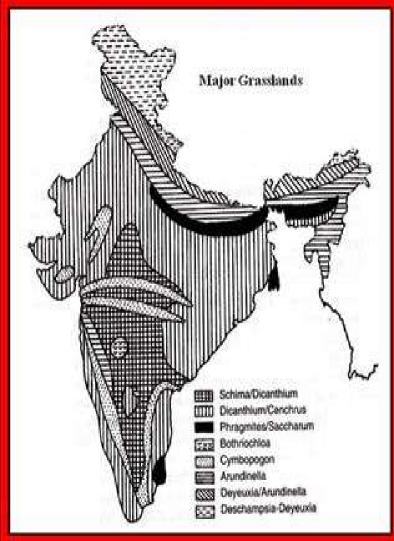


Here the under lined words " the plains of Punjab " instead it should be the plains of ganga, I think ... 1.36 PM

Please just check it 1:37 PM

Ok 1:39 PM V

Will check it 1:39 PM V



- Nearly 24% of area is occupied by grasslands in India.
- Eg.- Bugyals, Banni grasslands (Gujrat) and Shola grasslands (Karnataka)

	Type of grass cover	Area in sq kmt	Climate	Region
1	Sehima- Dichanthium	17,40,000	Semi arid	Central Indian Chota Nagpur plateau, Aravallis
2	Dichanthium - Cenchrus - Lasiurus	4,36,000	Arid, Semi arid	Northern parts of Gujarat, Rajasthan, Aravalli ranges, South Western Uttar Pradesh, Delhi and Punjab
3	Phragmites - Saccharum - Imperata	28,00,000	Dry- subhumid, Semi-arid	Gangetic plains, Brahmaputra Valley and the plains of Punjab in the states of Assam, Meghalaya, Tripura, West Bengal, Bihar, Uttar Pradesh, Punjab and Haryana
4	Themeda- Arundinella	2,30,400	Humid, Moist -sub humid	Manipur, Assam, West Bengal, Uttar Pradesh, Himachal Pradesh and Jammu and Kashmir
5	Temperate Alpine	data not available	Temperate cold arid	Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, West Bengal and North Eastern states

Source: Mohan et al (2015) Ecology and Management of grassland habitats in India. ENVIS Bulletin, Volume 17.

Threats to grassland

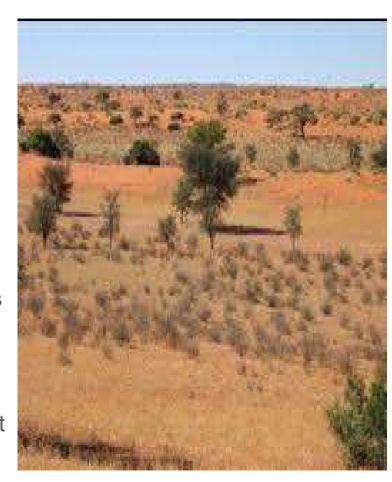
- Lack of national policy on grasslands
- Overgrazing and soil erosion
- habitat destruction and loss, by activities like agriculture and overuse of pesticides.
- Plantation and spread of invasive species like prosopis juliflora
- Considered as wasteland, thus land use transformation to developmental activities

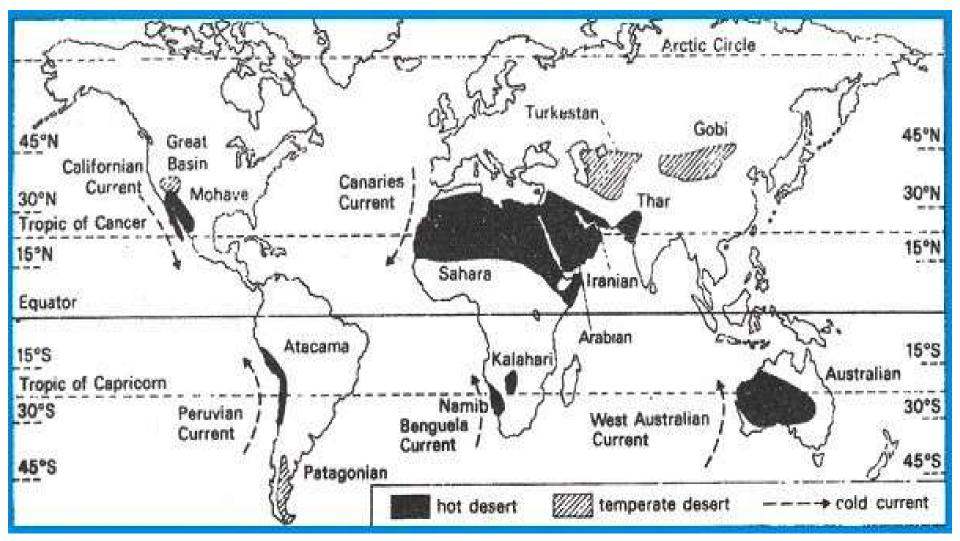
SOLUTION

- National policy on grassland management
- Restoration of degraded grassland with the help of local communities
- Control & management of invasive species
- Regulated grazing and prevention of uncontrolled fire.
- Conversion of barren and arid regions into grasslands.

DESERT

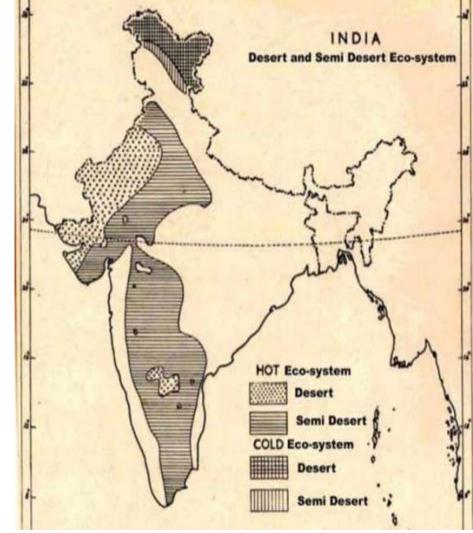
- Deserts are dry and arid region, generally characterised by high temperatures and scanty rainfall, however cold deserts also exist.
- These are region of fragile ecosystem and usually have annual rainfall less than 25 cm.
- They are widely found near subtropical high pressure zone in rain shadow areas of temperate region.
- Adaptation among flora and fauna is found, for less water and energy consumption and to sustain high temperatures.
- Plants contain mostly thorny shrubs, while rodents are common among animals. Camels are important species found here.
- They can be hot desert or cold desert.





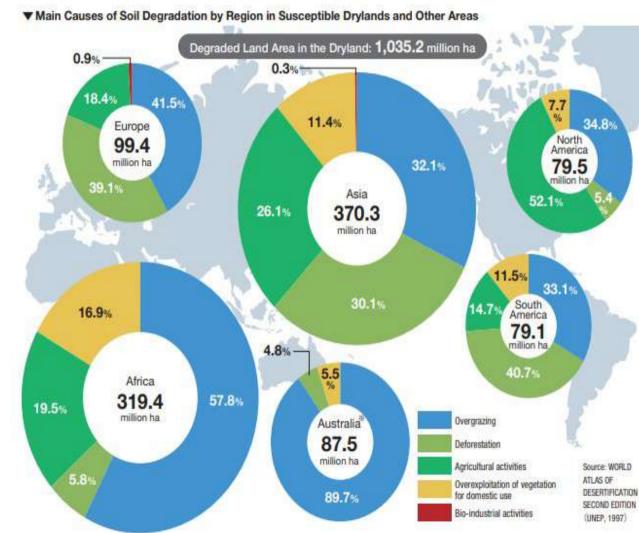
Desert in India

- Thar Desert covers some 77,000 square miles
 (200,000 square km) of territory.
- It is bordered by the Indus River plain to the west, the Punjab Plain to the north and northeast, the Aravalli Range to the southeast, and the Rann of Kachchh to the south.
- The subtropical desert climate there results from persistent high pressure and subsidence at that latitude.
- The prevailing southwest monsoon winds that bring rain to much of the subcontinent in summer tend to bypass the Thar to the east.
- High rainfall variability and coefficient of variation result in frequent droughts in this lowrainfall.
- Based largely on field- and aerial photo-based mapping, CAZRI first prepared a desertification



Desertification

- Desertification is caused by factors such as:
 - o drought,
 - o climatic transitions,
 - tillage for agriculture,
 - overgrazing and deforestation.
 - Problems of soil erosion & increased run-off.
- UNCCD is the body of UN, working for combating global desertification and land degradation.



 Sustainable Development Goal (SDG) target 15.3 states: "By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world."

 India is signatory to the United Nations Convention on Combating Desertification (UNCCD). We are committed to combat desertification and land degradation and intends to achieve land degradation neutral status by 2030.

BENEFITS OF DESERT

- Mineral rich
- Farming with artificial irrigation facilities
- Solar power generation
- Desert tourism like in jaisalmer
- War and weapon testing like in Pokhran

Adapted biodiversity



AQUATIC ECOSYSTEM

 Ecosystem in which community of organisms interact and live with their biotic and abiotic environment inside water, is called as aquatic ecosystem.

Main types are freshwater and marine ecosystem.



TYPES OF AQUATIC ECOSYSTEM

- FRESHWATER ECOSYSTEM
 - They have salinity levels less than 5 ppt (parts per thousand)
 - Lentic Ecosystem- or still water ecosystem. Eg. ponds, lakes
 - Lotic Ecosystem- or running water ecosystem. Eg. riverine

ecosystem

TRANSITIONAL ECOSYSTEM

- Includes wetlands
- Brackish water bodies like estuaries and mangroves
- Swamps and marshes

MARINE ECOSYSTEM

- Having salinity levels more than 35 ppt
- Eg. shallow seas and open oceans



Estuaries

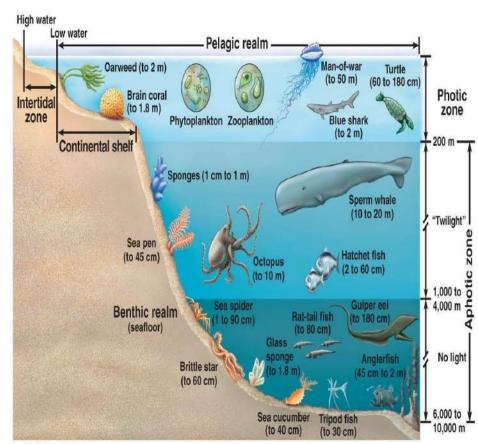
BASED ON LIGHT PENETRATION

1. PHOTIC ZONE

- It is the upper zone of aquatic ecosystem where adequate sunlight penetration is there, for photosynthesis to take place. Also it is respiration zone.
- It is usually upto 200m deep, however depth depends on transparency of water.
- Also called as **euphotic zone** and is upto where the light level is 1% of that at the surface.

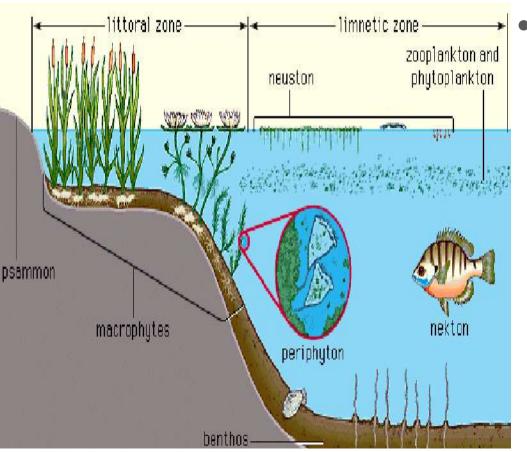
1. APHOTIC ZONE

- Region where light penetration is limited or absent
- Only respiration take place
- Also called as profundal zone



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ZONAL CLASSIFICATION OF AQUATIC ORGANISMS



- They are classified as :
 - Neuston- organisms which at airwater interface
 - Periphyton- organisms attached to rooted plants like algae
 - Plankton- microscopic plants like algae (called phytoplanktons) and animals like crustaceans (called zooplanktons)
 - Nekton- animals which are good swimmers and size varies from larger to largest. Eg. blue whale
 - Benthos- organisms living in the bottom layer of water mass

FRESHWATER ECOSYSTEM

- These ecosystem has less amount of dissolved salts
- more diurnal and seasonal variation in temperature occurs. Even freezing of surface water occurs in temperate and polar regions.
- There is high amount of suspended load in bodies like river which impacts the amount of light entering it.

SEVERAL FRESHWATER ECOSYSTEMS

- PONDS- small body with standstill water where communities depend on their environment for their nutrients and survival. They have considerable amount of light penetration.
- **RIVER** it is a body of moving water, where flow of nutrients is a significant feature.
- LAKES

LACUSTRINE ECOSYSTEM:

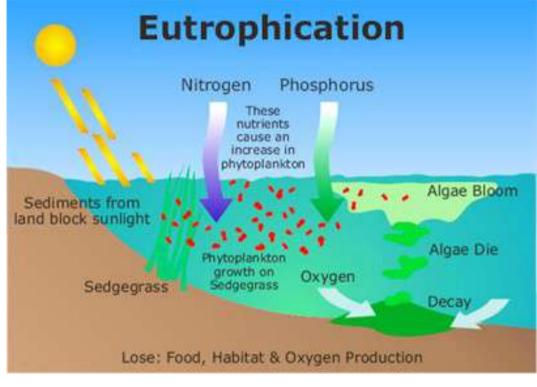
- It is a large water body of standstill water (usually more than 10 hectares), surrounded by land. They have a life cycle, where a lake is born due to geological or geomorphological processes. It grows with changes in its morphological function and finally dies out due to sedimentation or filling of plant material.
- It gets its water from run-off, river or groundwater discharge. Generally it is shallow and of medium size, but it can be as large as Caspian sea or as deep as lake Baikal (2 km depth).
- They can be freshwater or brackish water lake (eg. Sambhar lake).

CLASSIFICATION OF LAKES (BASED ON NUTRIENTS):

- 1. Oligotrophic: very low in nutrients
- **2. Mesotrophic :** moderate amount of nutrients
- **3. Eutrophic :** highly rich in nutrients

POLLUTION IN LAKES:

- Sewage and waste water disposal
- Encroachment for developmental activities
- Run-off from agriculture and industries
- Dumping of solid waste and litter
- Oil pollution
- Global warming
- Acid rain
- **EUTROPHICATION**: It is the process of nutrient enrichment of an aqueous ecosystem due to addition of nitrogen and phosphorus like nutrients from natural or artificial sources, leading to excessive growth of algae and depletion of Oxygen in the water body. Actions like fertiliser overuse and run-off from agricultural fields and industries is the major cause for eutrophication.



Transitional Ecosystem

₩ETLANDS

- Wetlands are defined as: "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" - by Ramsar Convention
- occur where the water table is at or near the surface of the land,
 or where the land is covered by water.
- Ramsar convention is an international treaty, which aims at conservation and sustainable and wise use of wetlands around the world. It was signed in city of Ramsar in Iran, on 2nd Feb 1971.
- List of Ramsar wetlands is mentioned in a register called "Montreux Record".



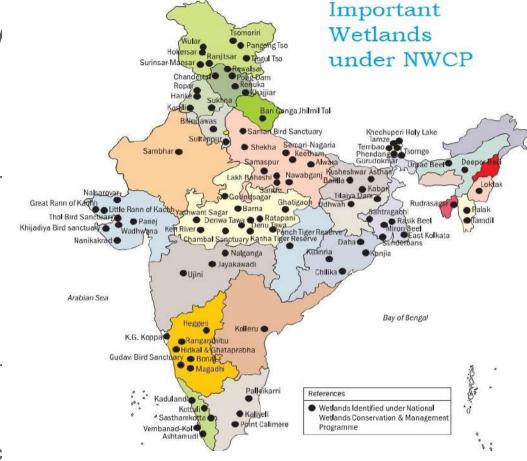
Five major wetland types are generally recognized:

- marine (coastal wetlands including coastal lagoons, rocky shores, seagrass beds and coral reefs);
- estuarine (including deltas, tidal marshes and mudflats, and mangrove swamps);
- lacustrine (wetlands associated with lakes);
- riverine (wetlands along rivers and streams);
- palustrine (meaning "marshy" marshes, swamps and bogs).

As per Ramsar convention report, they perform many vital functions, for example:

- water storage
- storm prevention and flood mitigation
- Drought control
 - shoreline stabilization and erosion control
- groundwater recharge
- Water purification
- stabilization of local climate condition particularly rainfall and temperature.

There are **37 wetland sites in India** whic are recognised as **Ramsar site of International importance**



Wetlands are regulated under the Wetlands (Conservation and Management) Rules, 2017

MANGROVES

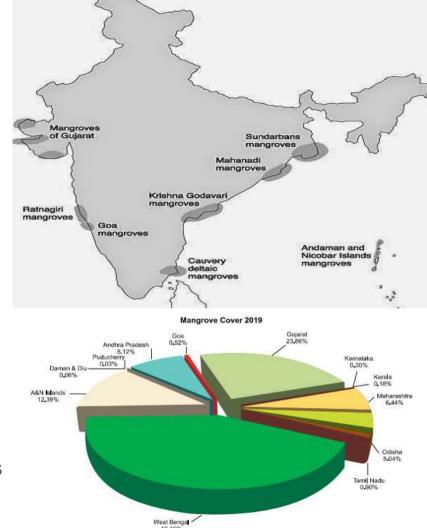
- As per **FAO**:
- mangroves are trees and shrubs growing below the high-water level of spring tides. Mangroves are the characteristic littoral plant formations of tropical and subtropical sheltered coastlines.
- Mangroves depend on terrestrial and tidal waters for their nourishment, and on coastal soils and silt deposits from upland erosion as substrate for support.
- They are one of the **highly productive terrestrial ecosystems** They are one of the **highly productive terrestrial ecosystems** They are one of the **highly productive terrestrial ecosystems** They are one of the **highly productive terrestrial ecosystems** They are one of the **highly productive terrestrial ecosystems** They are one of the **highly productive terrestrial ecosystems** They are one of the **highly productive terrestrial ecosystems** The are the things the transfer of the **highly productive terrestrial ecosystems** The are the transfer of the **highly productive terrestrial ecosystems** The are the transfer of the **highly productive terrestrial ecosystems** The are the transfer of the **highly productive terrestrial ecosystems** The are the transfer of the **highly productive terrestrial ecosystems** The are the transfer of the **highly productive terrestrial ecosystems** The are the transfer of the **highly productive terrestrial ecosystems** The are the transfer of the **highly productive terrestrial ecosystems** The are the transfer of the **highly productive terrestrial ecosystems** The are the **highly productive**
- on earth
- They are salt tolerant trees, also called as **halophytes**, and have special salt filtration capability for water absorption.
- They are adapted to anaerobic soil conditions of waterlogged areas and have special roots called blind roots or pneumatophores.

MANGROVES IN INDIA

 Mangroves are distributed over entire coastline of India, covering 4,975 sq km area, which forms 0.15% of total geographical area of country- as per ISFR 2019. Eg.sundarbans

ROLE OF MANGROVES

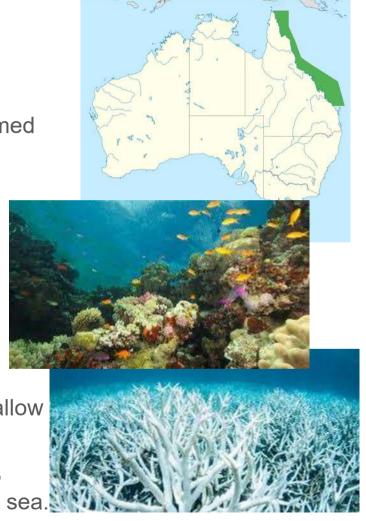
- Complex roots of mangroves helps in dissipation of energy of sea waves, thus protecting coastal areas from tsunami, storm surges
- Arrest coastal erosion and sea water pollution
- They are important carbon sink
- Act as fertile breeding ground for many species
- Source of livelihood for coastal communities
 with products like honey tanning wax & fishing



MARINE ECOSYSTEM

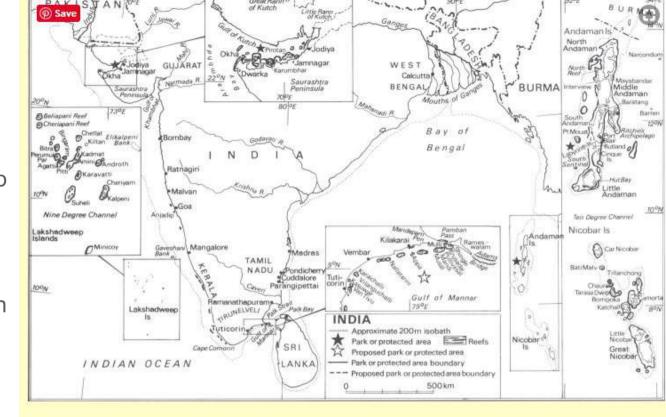
CORAL REEFS

- 1. They are underwater ecosystem, where reefs are formed by bonding together of coral polyps, using calcium carbonate.
- 2. They are very diverse ecosystems and thus called as rainforest of the oceans.
- 3. They live in symbiotic relationship with zooxanthellae algae, near surface of water, to allow algae undergo process of photosynthesis. Also these algae provide vibrant colors to corals.
- 4. Usually they are found in tropical and sub-tropical shallow waters, but can also occur in deep & colder oceans
- Great barrier reef is the largest such system in India, located off the coast of Queensland, Australia in coral sea.



CORALS IN INDIA

- They are spread over entire 7500 km coastline of India.
- Islands of Lakshadweep and several islands in A&N have originated from dead corals.
- MoEF has come up with guidelines for prevention of coral reef from bleaching
- Also, there are CRZ norms 1991- for protection of all marine resources.



There are four major coral reef areas in India:

Gulf of Mannar

· Gulf of Kutch

- Andaman and Nicobar Islands
- · Lakshadweep Islands and

There is also scattered coral growth on submerged banks along the east and West coasts of the mainland.

Benefits from coral reefs

 They not only provide habitat to marine biodiversity, but also prevents shoreline erosion, near coast, have high economic value, sustenance fishing and attract large scale tourism.

Menace of Coral Bleaching

Separation of algae from coral polyps due to natural or anthropogenic causes, leads to whitening of corals- called as **coral bleaching**.

- **Natural causes :** temperature & pH variations, sediment deposition & nutrient enrichment, salinity and climate change.
- Anthropogenic causes: mining, dredging, deep sea fishing, marine debris and pollution, sunscreen, tourism, diseases and other issues.

<u>Various protection measures</u>: have been taken like marine protection areas, coral farming, relocation or using heat tolerant symbionts.

Thank you