

Ecosystems I

1. **Ecology:** is the study of relationship between organisms and its environment.
2. **Ecosystem:** it is a place where the interactions of **living** and **non living** occurs functioning together.

Roy first used the term but it was **AG Tansley**, who coined the term & fully defined the concept of ecosystem

3. **Father of ecology in India:** RD Mishra
4. **Trophic level:** it is the position of an organism that it occupies in a food chain.

• The CBD defines an "*ecosystem*" as a *"dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit"*

5. The ecosystem is a major structural and functional unit of ecology.
6. Complex ecosystem has high species diversity

- 3. The function of ecosystem is related to energy flow and material cycles within and outside the system.

7. Complex ecosystems need less energy ie more complex more stable.
8. Young ecosystems develop and change from less complex to more complex ecosystems through the process called succession.
9. Each ecosystem has its own energy budget which cannot be exceeded.
10. The function of every ecosystem involves a series of cycles eg rater, nitrogen,oxygen etc

8. The function of every ecosystem involves a series of cycles, e.g., water cycle, nitrogen cycle, oxygen cycle, etc. these cycles are driven by energy. A continuation or existence of ecosystem demands exchange of materials/nutrients to and from the different components.

11. **Ecosystem services:** are the fundamental life support services upon which human civilisation depends. Ex:direct ecosystem service-pollination indirect services- climate moderation, nutrient cycles.
12. Climatographs: graphs between avg precipitation and avg temperature

over a typical year in a biome.

(Precipitation - bar graph
temperature-line graph)

The interaction between living organisms and their environment is a two-way process.
organisms affect their surrounding and the surroundings affect the organisms.

13. Ecosystem has two components:
biotic and abiotic

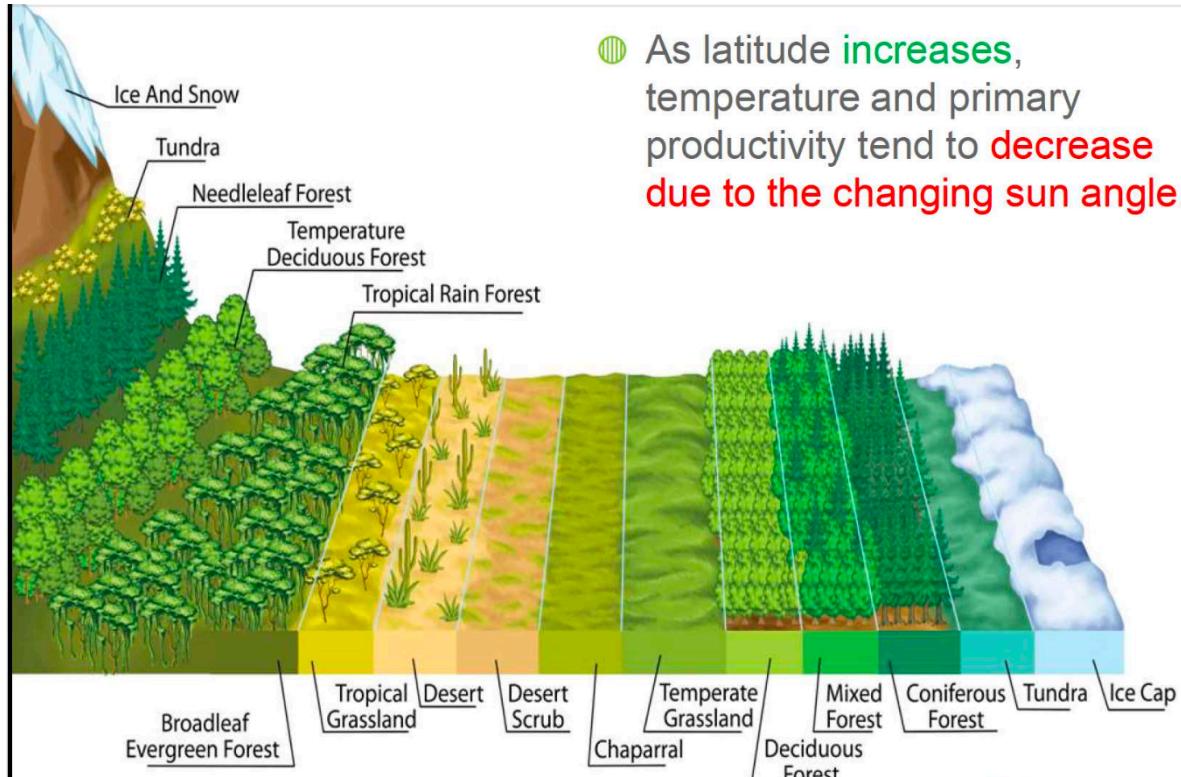
The two most significant abiotic factors in biomes are *temperature* and *precipitation*, which are influenced by:

- Latitude
- Altitude
- Prevailing winds
- Nearby mountains

14. Latitudes near the equator receive more direct sunlight and greater amount of warming.

15. As latitude(elevation above sea level) increases temperature and primary

productivity tends to decrease due to changing sun angle.



16. Biotic components:
producers(Autotrophs synthesise their own food in the presence on sunlight) & consumers(heterotrophs)

17. Heterotrophs feed on autotrophs

18. Chemosynthetic Bacteria are found in deep ocean waters and produce their own food by the process of chemosynthesis from hydrogen sulphide

19. Macro consumers:-

1. Primary consumers:they mainly feed on plants

2. Secondary consumers:carnivores feed on primary consumers
 3. Tertiary consumers:carnivores that feed on secondary consumers.
20. Omnivores:both plant and animal eaters
21. Bacteria or fungi derive energy and nutrients from dead organic matter. (detritus feeders)
22. Role of decomposers and micro-organism is very important in nutrients cycle.
23. Functions of an ecosystem:
1. Flow of energy:
 2. Continual recycling of chemical elements
24. Flow of energy between two ecosystem follows law of thermodynamics.
25. Open ecosystems: energy doesn't recycle and they need a new inflow of energy.

Energy inputs to ecosystems drive the flow of matter
--within organisms and their environment in a process called **Bio-geochemical cycle.**

26. Gross primary productivity(total energy absorbed by the producers)
—> energy lost as heat in respiration----->remaining output of energy is stored as leaves fruits stems.(net primary productivity)
27. Net primary productiviy=gross primary productivity- respiration.
28. 10% RULE: it states that only 10% of energy from one trophic level is incorporated into another. ie some energy is lost as heat.

NPP is equal to all of the carbon taken by vegetation through photosynthesis (GPP) minus the carbon lost to respiration (R).
$$NPP = GPP - R$$

Food chain	Food web
One path of energy	

- All possible energy paths type of complex food chain.

- The basic function of energy is to make the production of organic matter possible
- The total amount of organic matter in any particular ecosystem is the biomass
- Biomass increases as a result of **biological production**, the transformation of energy into matter by biological processes

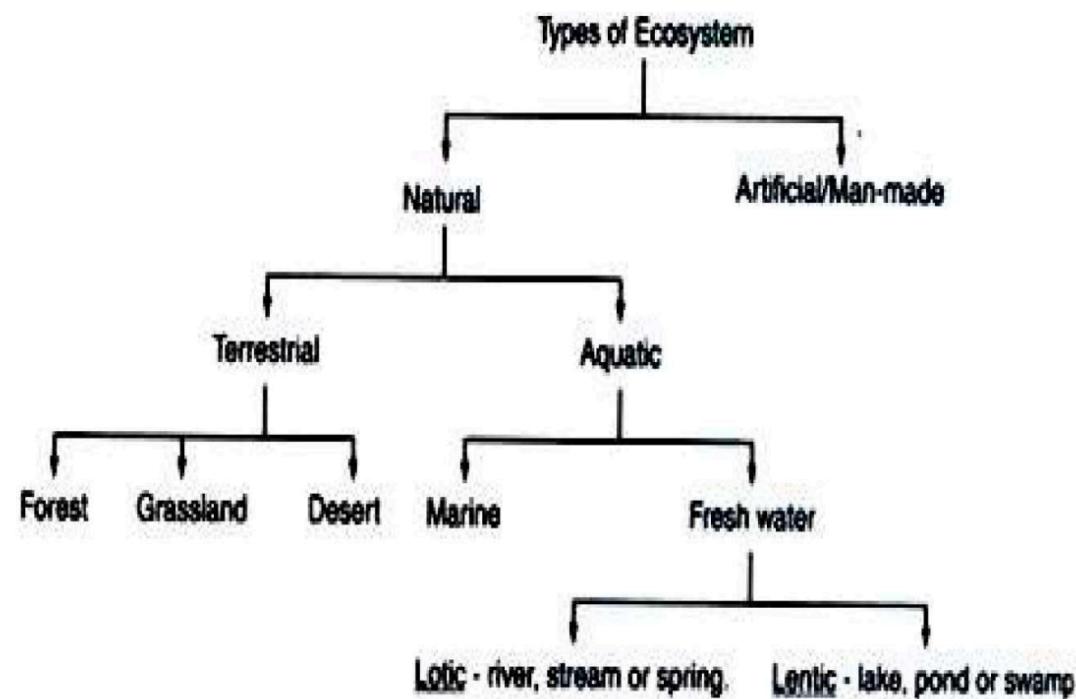
29. Bio mass=organic matter

30. Magnesium is an essential element for photosynthesis it is part of chloroplast which prepare food for plants.

31. Solar energy is converted to chemical energy by primary producers.

32. **Primary Productivity:**rate of energy capture by producers.

33.



34. Biomes are large-scale ecosystems defined by their climate, vegetation, and the interconnected communities of organisms adapted to those environmental conditions.

Aquatic Ecosystem

1. Hardness: The amount of minerals (calcium and magnesium) in freshwater.
2. Temperature measures the average kinetic energy of the water molecules (warmest near the equator)
3. Dissolved oxygen: oxygen per mL of water. It is highest in cold and turbulent

water(dissolution of gas decreases with increase in temperature).

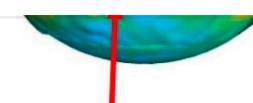
4. Rainwater is acidic due to CO₂ and ocean water is base due to CO³⁻ ions pH 8.2
5. Main salt In ocean NaCl
6. Temperature is highest where solar energy received is highest. i.e near equator.
7. **Ocean Conveyor:** is a moving system of deep ocean currents that circulate warmth across the globe
8. **The El Niño cycle** is a periodic warming of Pacific Ocean waters that disrupts global weather patterns, causing extreme events like droughts and floods.

El Niño Year

- Westerly winds diminish
- Warm water remains in Pacific
- Heavy rains occur in SA
- Surface salinity decreases, reducing upwelling
- Droughts in western Pacific, Asia, India



b.
NASA



La Nina Year

- ❖ Cold conditions dominate
- ❖ Droughts in SA, western US
- ❖ Severe weather in western Pacific,
- ❖ Good rains in India

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Marine & Ocean Ecosystems

1. **Intertidal Zone:** where ocean and land meets.(submerged during high tides and dry during low tide)
2. Ocean has two parts :Photic(receive light) and Aphotic zones

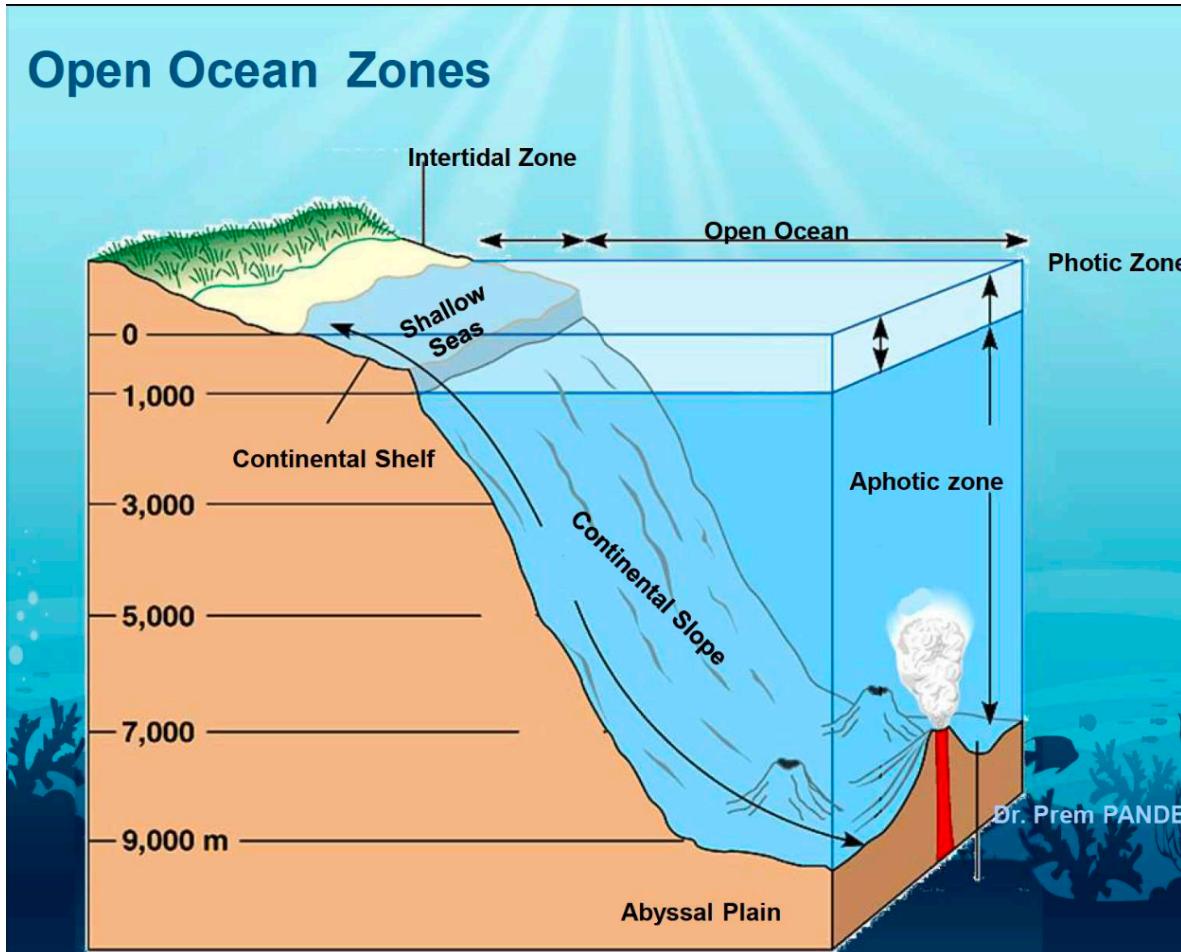
Rocky shores	Sandy shores
Substrate is hard and stable	Substrate is shifting and unstable
Erosion is slow	Erosion is fast
Black sand	Volcanic rock
Brown sand	Quartz
White sand	Coral

3. Marine ecosystem are largest of earths aquatic ecosystems. They cover 2/3 of earths land.
4. **Coral reefs are ecosystems built on the exoskeleton of coral polyps.. they are found in warm, shallow and sunlight water**
- 5.

- 🐠 Coral is a symbiotic relationship between two organisms:
 - 👉 Polyps, which build the calcium carbonate exoskeleton.
 - 👉 Algae, which photosynthesize most of the coral's food.
- 🐠 Calcium carbonate is an important sink in the carbon cycle and helps to maintain ocean pH.

6. Ex coral reef: Great Barrier Reef Australia
7. Corals get bleached due to global warming and they expelled algae.
8. Open ocean: part of ocean beyond continental shift.
9. Many aphotic zones species are bioluminescent and can produce and emit light(result of chemical reactions by symbiotic bacteria)
10. The Abyssal plane receives no sunlight and all food webs are based

around scavenging and decomposition.

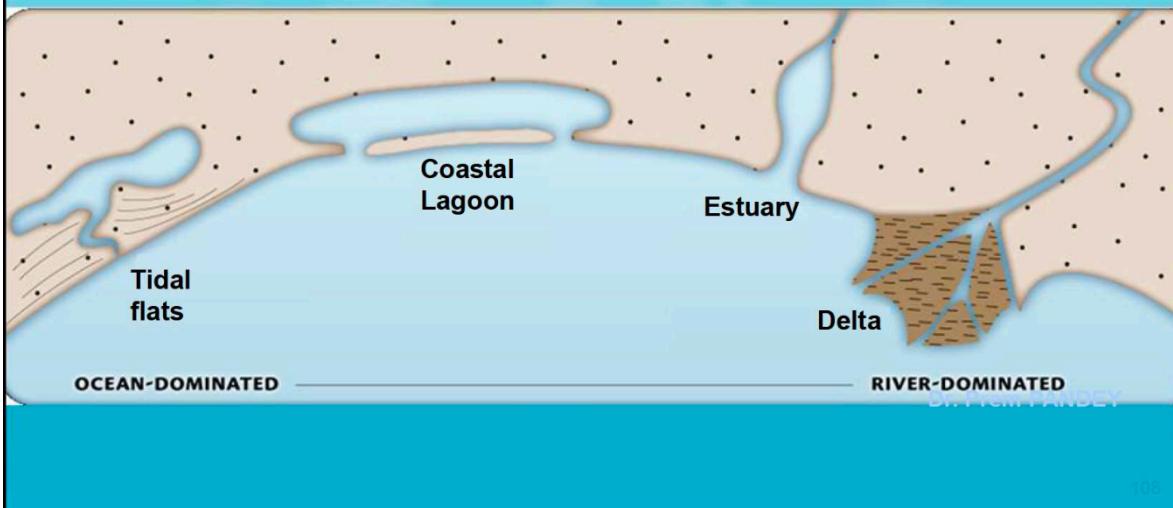


11. **Marine Snow:** the abyssal plain receives a constant flow of detritus(dead matter) from above.

Coastal Ecosystems

1. Wetlands along the shoreline and in shallow seas.
- 2.

-  **Tidal flats** are saltwater wetland areas that are continually covered and uncovered by the tides.
-  **Coastal lagoons** are saltwater pools that are separated from the ocean by sandbanks or coral reefs.
-  **Estuaries** are partially-enclosed bodies of water where river water mixes with sea water, forming brackish water.
-  **Deltas** are landforms at river mouths formed by deposited sediment.



3. As river approaches oceans speed slows down and then it deposits the sediment that it carries and forms river delta.
4. Salt marshes are tidal flats dominated by grasses and herbs.
5. Seagrass bed contain submerged plants that resemble grass.
6. Mangrove forest have trees with roots that can filter salt.
7. Mangrove forest provide coastal protection by dissipating 90% of wave energy.

8. Dissolved oxygen levels change from high tide to low tide due to the variation in water movement, mixing, and salinity. At high tide, oxygen-rich ocean water flows in, increasing oxygen levels. At low tide, the water becomes more stagnant, and oxygen levels may decrease due to limited mixing and higher concentrations of organic matter that consume oxygen.

9. An adaptation in larger fish to survive low tide is their ability to slow down their metabolism.

Fresh water ecosystem

They are different from marine ecosystems because they have low salt content.

Freshwater ecosystems are of two types:

Lotic ecosystem	Lentic ecosystem
Flowing water	Relatively still water
Ex: springs , rivers	ex: Lakes ponds

1. Flow is unidirectional.
2. There is a state of continuous physical change.
3. There is a high degree of spatial and temporal heterogeneity at all scales (microhabitats).
4. Variability between lotic systems is quite high.
5. The biota is specialized to live with flow conditions.

1. Riverine ecosystem: lotic ecosystem.

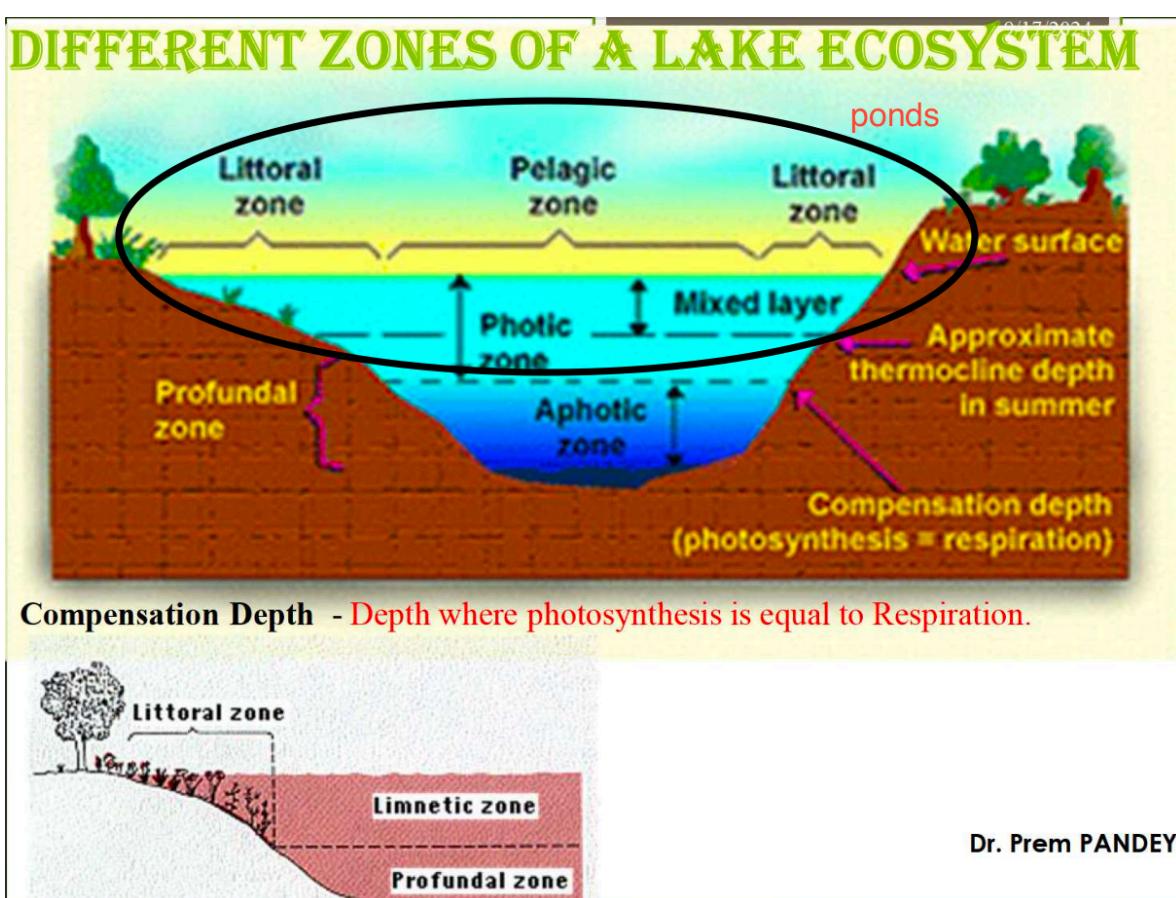
- **Bacteria:** Bacteria are present in large numbers in lotic waters. Free-living forms are associated with **decomposing organic material, biofilm on the surfaces of rocks and vegetation (Slime),** in between particles that compose the substrate, and suspended in the water column.

2. Algae consisting of phytoplankton and periphyton are the most significant source of primary production in most streams and rivers.
3. Phytoplankton float freely in water and thus are unable to maintain populations in fast flowing streams. (found in slow moving rivers and backwaters). They are autotrophic.
4. Periphyton are filamentous tufted algae that can attach themselves to objects being washed away by fast currents. They form a gelatinous unanchored floating mat.

ponds & pools	lakes
They have their entire bottom surface exposed to water	They do not have their entire bottom surface exposed to water.

5. Largest freshwater lake: Lake Baikal

6. Littoral , pelagic and benthic



7. **Compensation Depth:** where rate of photosynthesis =rate of respiration.

8. Longest Lake in India: Vembanad and largest in kerela and it also is the largest wetland system in India after Sunderbans.

9. Chilika lake:braksih water lagoon
10. Wular Lake : largest fresh water lake in Asia
11. Loktak Lake: floating lake because of phumdis

Wetland Ecosystem

It is a distinct ecosystem that is flooded by water either permanently or seasonly where oxygen free processes prevail.

The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the **unique hydric soil**.

Wetlands are lands transitional between terrestrial and aquatic systems

Conditions for wetland:

1. Water present on land or in roots must be saturated during growing seasons
2. Plants that grow in wet conditions.
3. Soil should be poorly drained that exhibit anaerobic conditions.
4. Wet lands are not necessarily wet all year round.

Wetlands are called as natures kidneys because they cleanse our environment
They can contain free or brackish or combination of

both

Kuttanad wetlands:

- Kuttanad, the 'Rice Bowl of Kerala', lies at the very heart of the backwaters in Alappuzha district.
- It has been speculated that it is perhaps the only place in the world where farming is done up to 2 meters below sea level.

Saline environment: develops crops tolerant to saline environments in combination with the use of saline soil and water resources.

Wetlands are among the most productive ecosystems in the world, comparable to rain forests and coral reefs.



Functions of wetlands:

1. Improve water quality by filtering sediments
2. Provide breeding grounds for fish and shellfish
3. Modifying the effects of flooding by slowing runoff
4. Provide food and recreation for summer.
5. This helps recharge and discharge groundwater(store during excess and release during dry periods)
6. They also reduce momentum and prevent soil erosion
7. They assist in flood control.
8. They store carbon instead of releasing it to the atmosphere. Thus they help moderate global climate
9. They help retain sediments and increase soil fertility.
10. They help filtering out water pollution
11. Mangroves can protect shorelines from strong winds and reduce the impact of hurricanes and tsumnamis.

Threats to wetlands

- 1.development : draining of wetlands for

constructions

2. Global warming

3. Sand and gravel mining

Ramsar Conventions

Convention on wetlands signed in Ramsar, Iran

States to plan for wise and sustainable use of all wetlands in their territories

Forests Ecosystems

It is a large area of land covered with trees or other woody vegetation.

According to UN FAO forests is a land of more than 0.5% ha with a canopy cover of more than 10% which is not primarily tree under agricultural or other specific non forest land

1. **Canopy:**upper layer or habitat zones

formed by mature tree crowns

2. Emergent layer is the upper most layer and it receives the most direct sunlight

3. **Highest net primary productivity area of forest:Canopy**

4. Understory: the layer of vegetation below the canopy where only 5%

sunlight reaches

5. Forest floor is the bottommost layer of the forest which has community centred around decomposition.

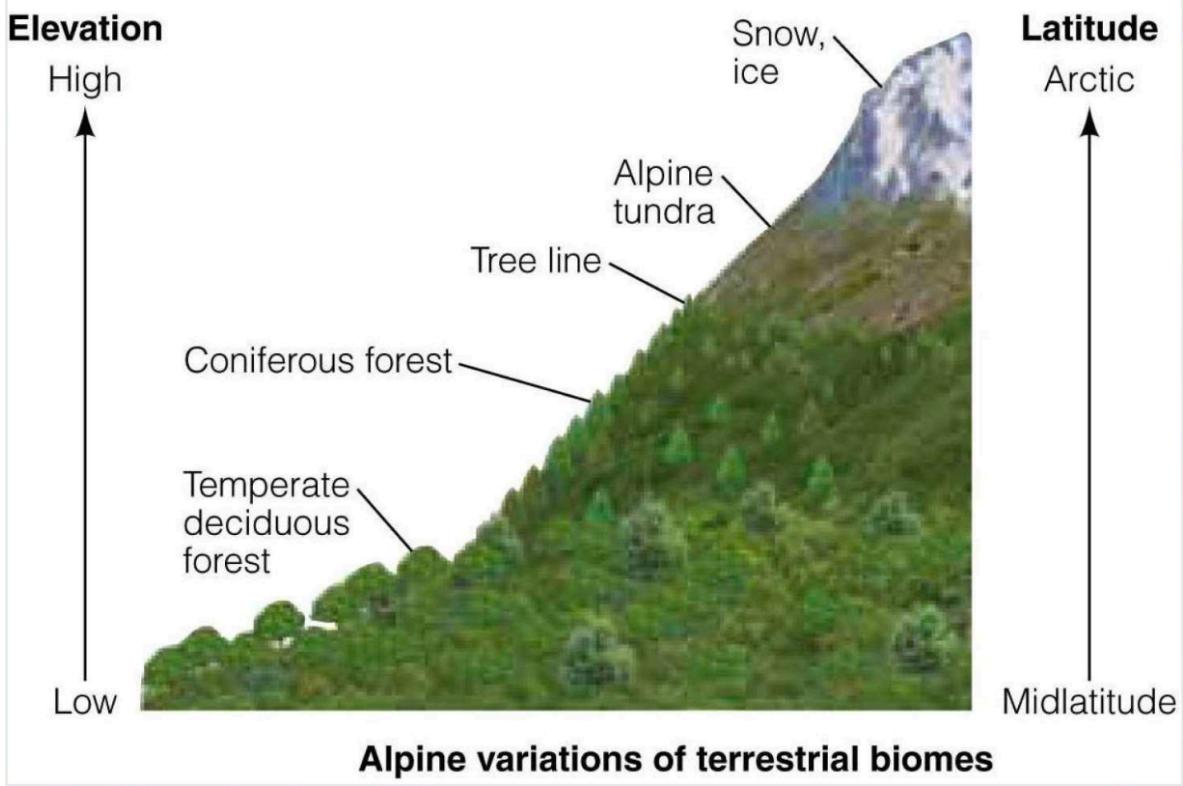
Broadleaf trees	Coniferous trees
Wide maximise sun absorption	Narrow wax coated leaves
Prone. To moisture loss via transpiration	Absorb less sunlight and transpire less water
Shed leaves during prolonged dry seasons or winters.	Not shed leaves during cold or dry season

Open and closed forests

Open forests	Closed forests
Tree canopies do not form continuous closed cover	They have tree canopy coverage of 60-100%
They are mixture of trees shrubs and grasses	

They occur in savanna , semi arid and sub-humid and humid tropics	They absorb less sunlight and transpire less water
Shed leaves in winter and prolonged dry seasons	Remain evergreen throughout the year

Forest types



Tropical Rainforests

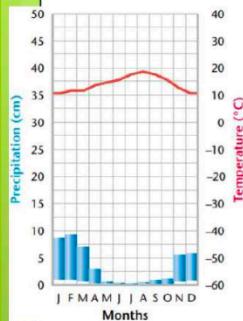
They receive high rainfall and are warm. They have highest net primary productivity of all land based ecosystems. They have broadleaf trees only

Temperate Rainforests

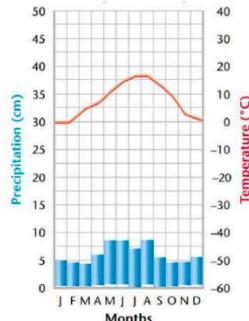
They also receive high rainfall but have seasonal temperature change. Broadleaf and coniferous trees only

Deciduous Forests	Moderate precipitation and significant temperature change. Broadleaf trees which shed leaves in winters
Boreal Forests, taiga	Coldest and driest of all forests . They have coniferous trees only
Mediterranean forests chaparral	Highly seasonal rainfall and that also during winters

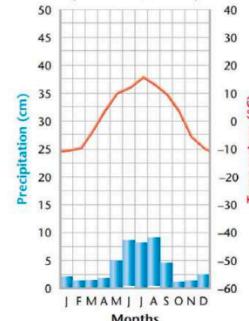
Identify the type of forest present in each climatograph:



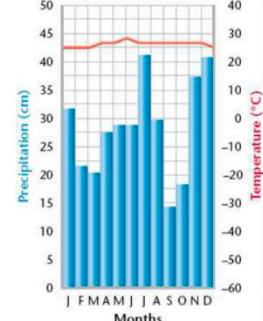
Wet winters, Warm to hot -dry summer temperatures
Seasonal precipitation



Seasonal temperatures
Moderate precipitation



Seasonal/cold temperatures
Seasonal precipitation



Warm temperatures
High precipitation

- The tropical rainforest biome has four main characteristics:

- very high annual rainfall,
- high average temperatures,
- nutrient-poor soil, and
- high levels of biodiversity (species richness).

Important zone: On the edges of the stream which is RIPARIAN ZONE

S. No .	Date	Event
1	September	Clean Up The World Campaign
2	16 th September	International Day for Prevention of Ozone Layer
3	18 th September	World Water Monitoring Day
4	22 nd September	World Car-Free Day
5	4 th October	World Animal Day
6	5 th October	World Habitat Day
7	16 th October	World Food Day
8	17 th October	International Day for Eradication of Poverty
9	6 th November	International Day for Preventing the Exploitation of the Environment in War and Armed Conflict
10	2 nd December	National Pollution Prevention Day
11	11 th December	International Mountain Day
12	2 nd February	World Wetland Day
13	21 March	World Forest Day
14	22 nd March	World Water Day
15	23 rd March	World Metrological Day
16	22 nd April	Earth Day
17	9 – 10 May	World Migratory Birds Day
18	22 nd May	International Day for Biological Diversity
19	23 rd May	World Turtle Day
20	5 th June	World Environment Day
21	8 th June	World Ocean Day
22	15 th June	Global Wind Day
23	17 th June 2024	World Day to Combat Desertification

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