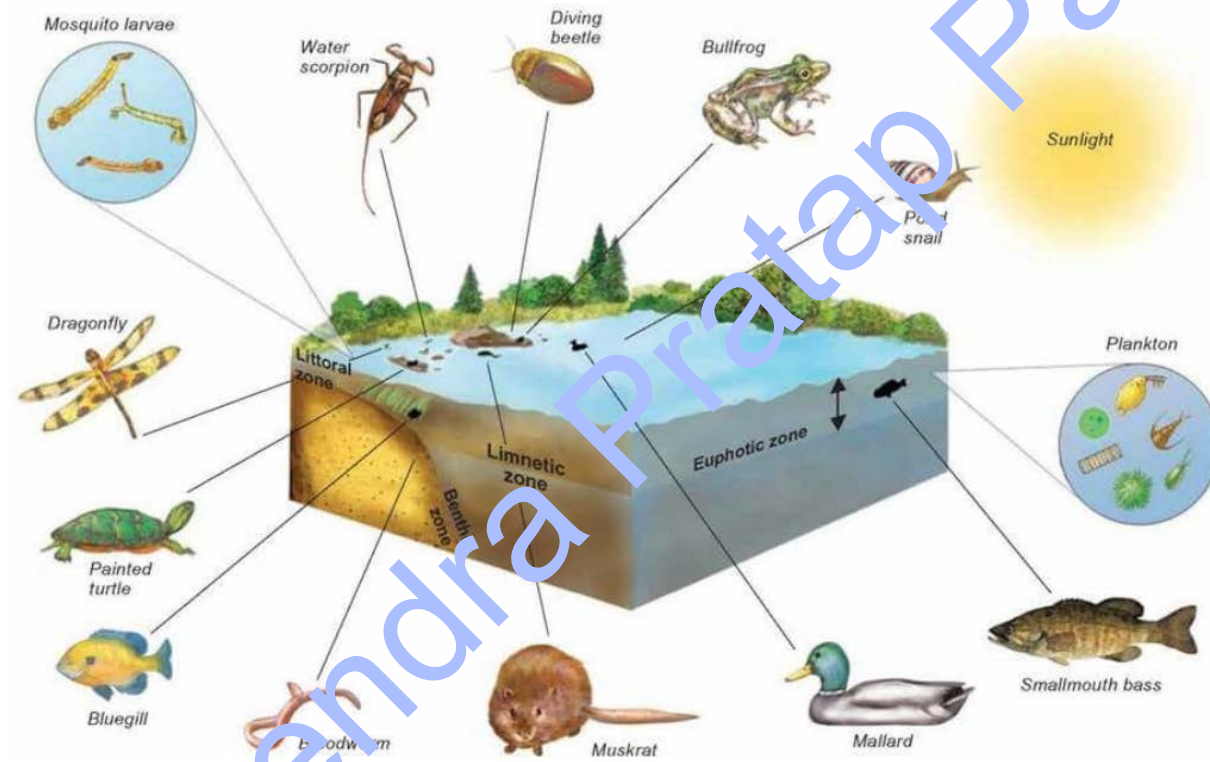
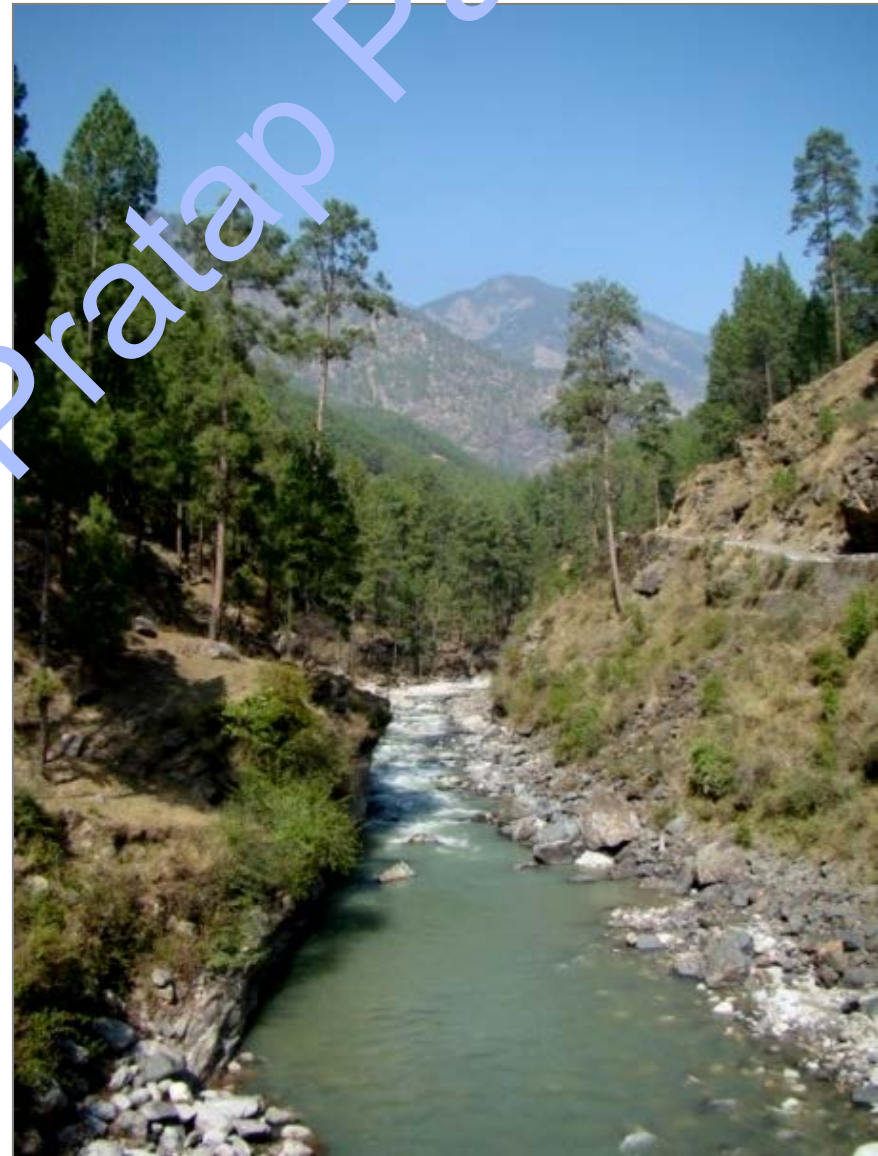


ECOSYSTEM



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1) Environment

1.1) Biosphere

1.2) Habitat

1.2.1) Difference between Habitat and Environment

1.3) Ecosystem

1.3.1) Classification of Ecosystems

1.3.2) Difference between Ecology, Environment & Ecosystem

1.4) Components of an Ecosystem

1.4.1) Abiotic Components

1.4.2) Biotic Components

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1. Environment

- Environment is the natural component in which biotic (living) and abiotic (non-living) factors interact among themselves and with each other.
- These interactions shape the **habitat** and **ecosystem** of an organism.

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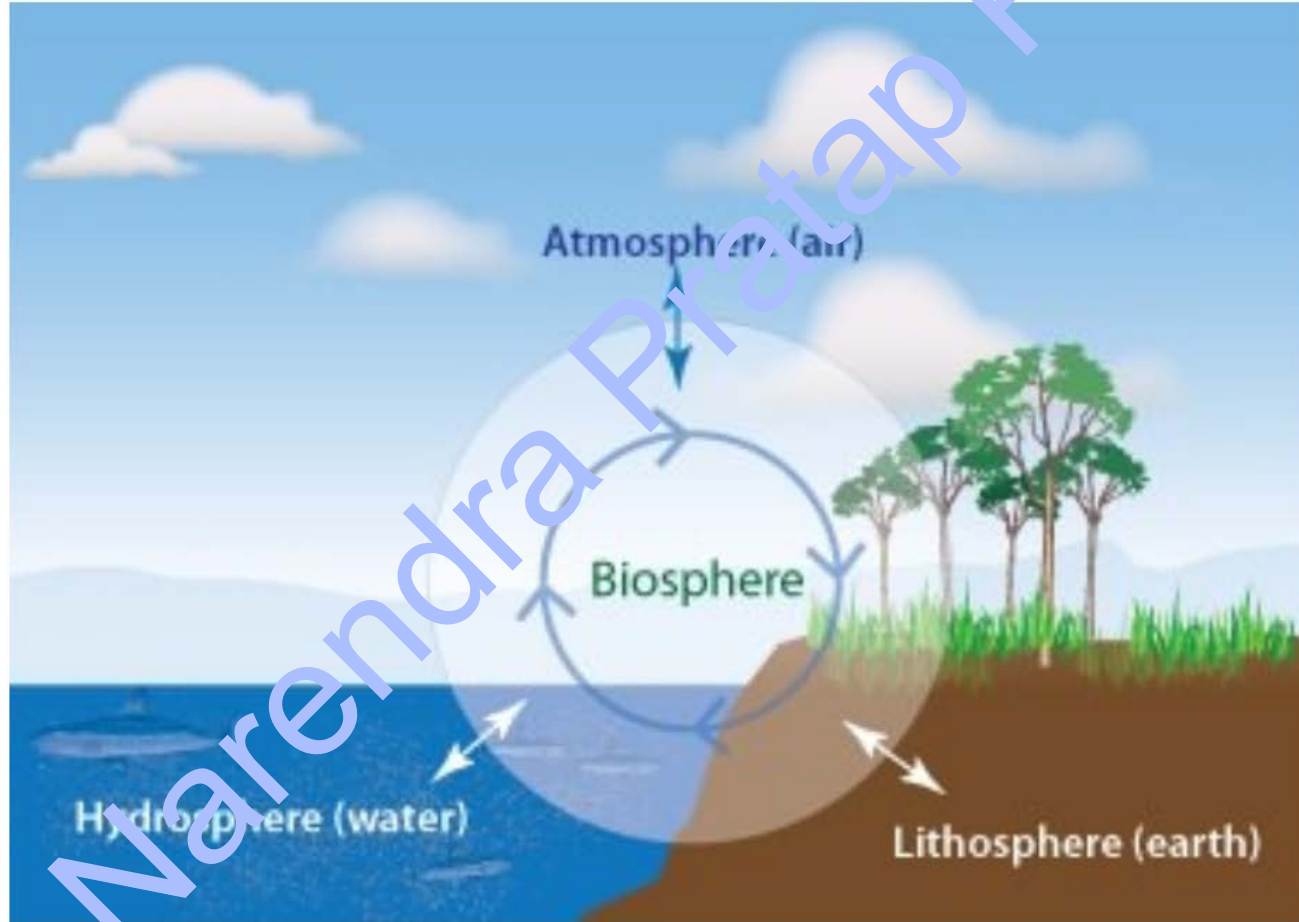
- In a biological sense, environment constitutes the physical (nutrients, water, air) and biological factors (biomolecules, organisms) along with their chemical interactions (chemical cycles – **carbon cycle, nitrogen cycle** etc.) that affect an organism or a group of organisms.
- All organisms are dependent on the environment to carry out their natural life processes and to meet their physical requirements (food, energy, water, oxygen, shelter etc.).

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1.1 Biosphere

- The biosphere is the **biological component (supporting life)** of the earth which includes the **lithosphere, hydrosphere** and **atmosphere**.
- The biosphere includes all living organisms on earth, **together with the dead organic matter** produced by them.

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Biosphere (Source)

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- The biosphere is **absent at extremes** of the North and South poles, the highest mountains and the deepest oceans since existing hostile conditions there do not support life (**life is the characteristic feature of the biosphere**).

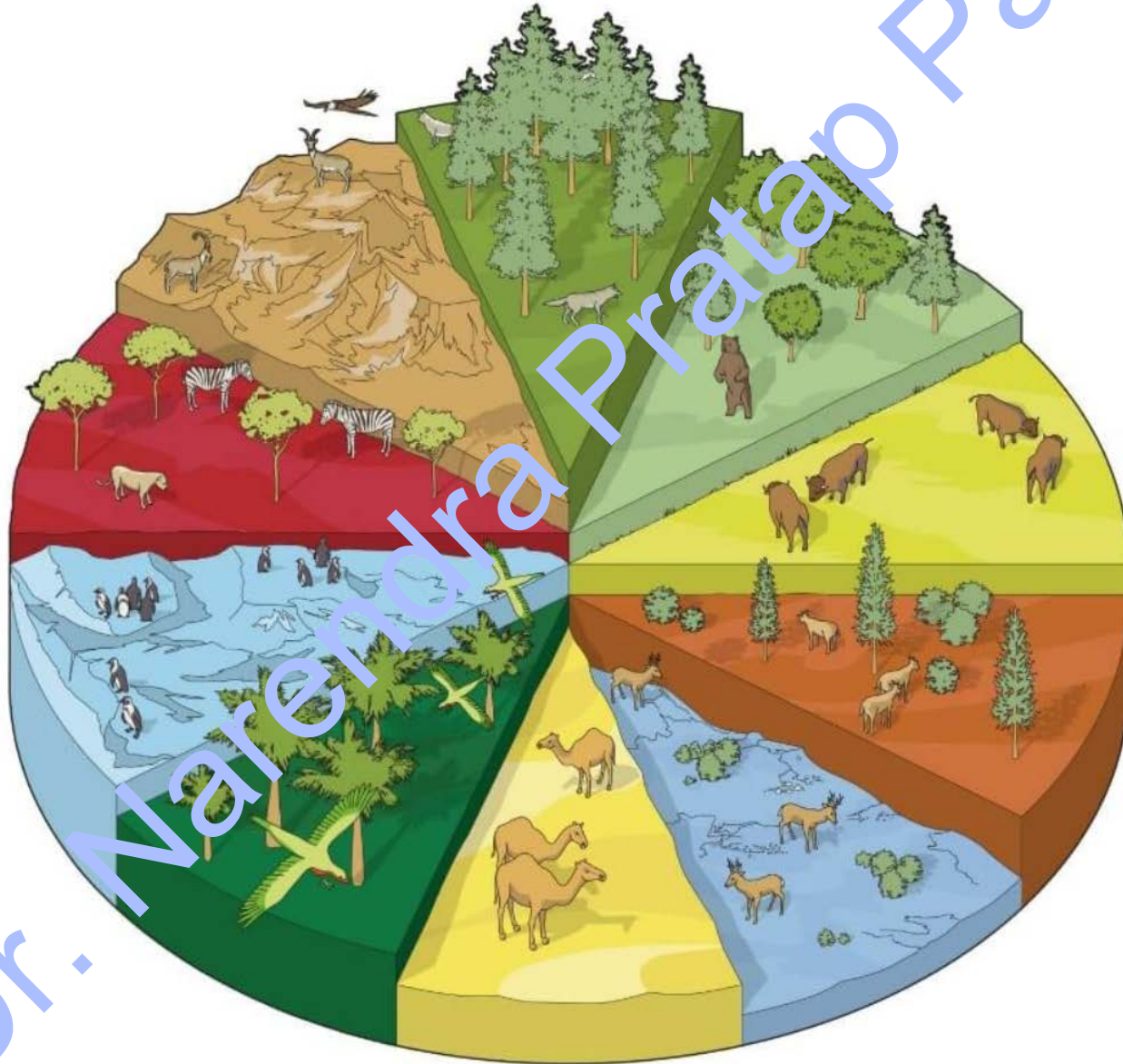
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1.2 Habitat

- **Habitat is the physical environment in which an organism lives (address of an organism).**
- **Many habitats make up the environment.**
- A single habitat may be common for more than one organism which have similar requirements.
- For example, a single aquatic habitat may support a fish, frog, crab, phytoplankton and many others.
- The various species sharing a habitat thus have the same 'address'. E.g. Forest, river etc.

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Difference between Habitat and Environment

- A habitat always has **life** in it, whereas the environment does not necessarily have life in it.
- **All habitats are environments, but all environments are not habitats.**
- A habitat is always a **preference of one species.**
- An environment could be a preference of many species that could eventually become many habitats.
- Usually, the environment governs the properties of a habitat, but not vice versa.

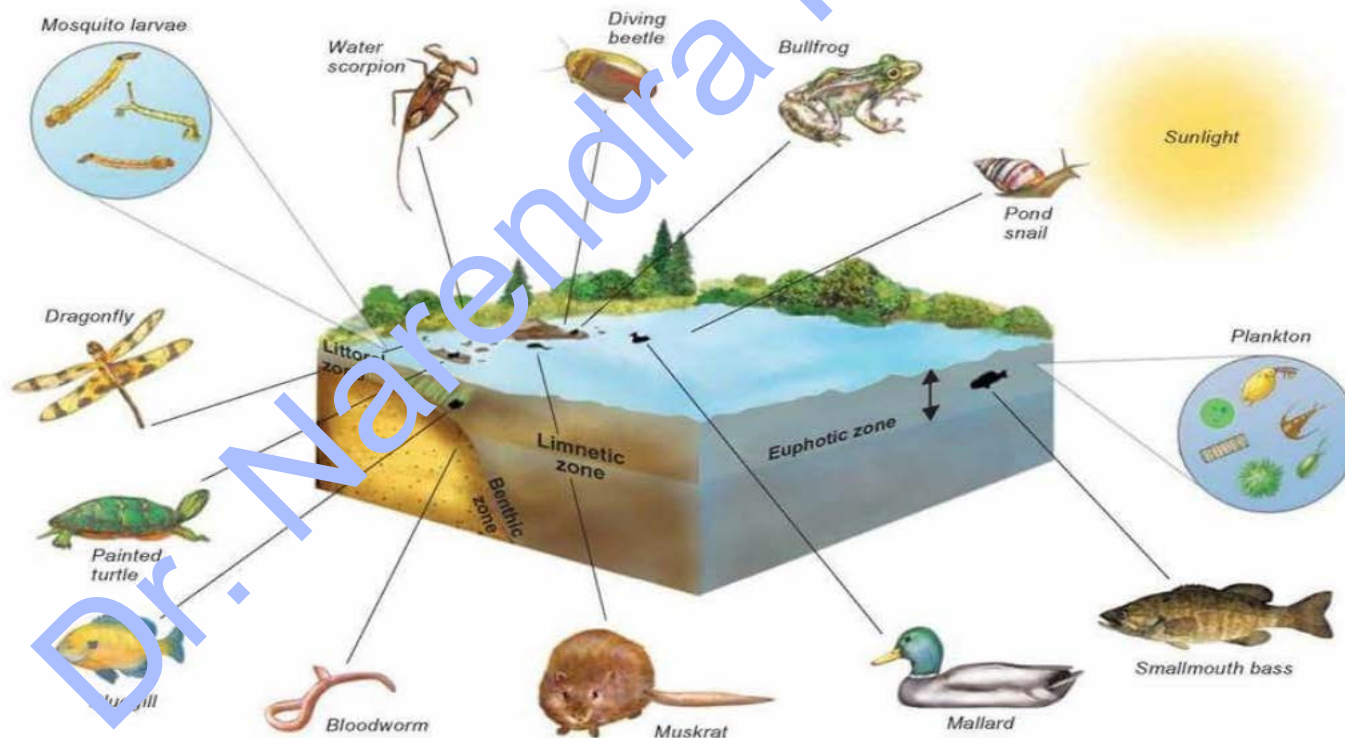
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1.3 Ecosystem

- An ecosystem can be visualised as a **functional unit of nature**, where living organisms (producers, consumers, and decomposers) interact among themselves and also with the surrounding physical environment.
- An ecosystem can be of any size but usually encompasses **specific and limited species**. E.g. **Aquatic Ecosystem**. (This is how ecosystem is different from Environment)
- In the ecosystem, biotic and abiotic components are linked together through **nutrient cycles** and **energy flows**.

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- Everything that lives in an ecosystem is dependent on the other species and elements that are also part of that ecological community.
- If one part of an ecosystem is damaged or disappears, it has an impact on everything else.

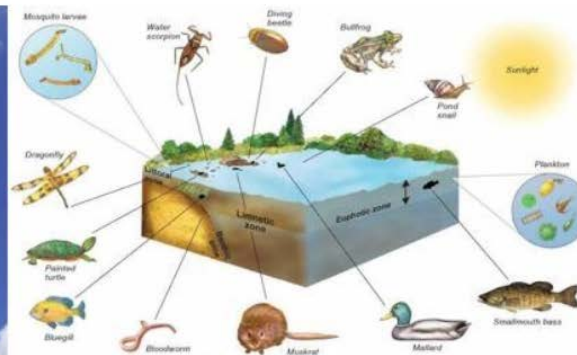


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Classification of Ecosystems

- Forest, grassland and desert are some examples of **terrestrial ecosystems**; pond, lake, wetland, river and estuary are some examples of **aquatic ecosystems**.
- Crop fields and an aquarium are human-made ecosystems.

Difference between Ecology, Environment & Ecosystem



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- **Ecology** is the study of interactions between organisms, organisms and the surroundings occurring within an ecosystem or environment.
- An ecosystem is a functional unit of the environment (mostly biosphere).
- An environment is a group of ecosystems.

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ECOSYSTEM

Environment ==> Can be almost everything or a small region.

Habitat ==> Area where an organism lives.

Biosphere ==> The region on earth that supports life.

Ecosystem ==> Producers, Consumers, Decomposers and their relationships (tiny environment). It is the functional unit of the environment.

ECOSYSTEM

- **Ecology** is the study of interactions between organisms, organisms and the surroundings occurring within an ecosystem or environment.
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Q. Which one of the following is the best description of the term “ecosystem”?

- a. A community of organisms interacting with one another
- b. That part of the Earth which is inhabited by living organisms
- c. A community of organisms together with the environment in which they live.
- d. The flora and fauna of a geographical area.

ECOSYSTEM

Explanation:

- A community of organisms interacting with one another – no specific term.
- That part of the Earth which is inhabited by living organisms ==> biosphere.
- A community of organisms together with the environment in which they live ==> ecosystem.
- The flora and fauna of a geographical area ==> biodiversity.



COMPONENTS OF ECOSYSTEM



ECOSYSTEM

1.4 Components of an Ecosystem

- The components of the ecosystem are categorized into abiotic or non-living and biotic or living components. Both the components of the ecosystem and environment are the same.

Abiotic Components

- Abiotic components are the inorganic and non-living parts which act as major limiting factors.

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Limiting factor

- A lot of factors determine the survival of an organism. One single factor can limit the range of an organism.
- This single factor is called as a **limiting factor**.
- For example, **seeds don't germinate quickly in evergreen rain forests** in spite of good rains and vegetation as the surface soil is **heavily leached** (nutrients washed away by running water). Here, poor soil is the limiting factor.
- Likewise, **germinated saplings may not survive due to lack of light** because of the dense canopy. Here, the absence of light (shade of the forest) is the limiting factor.

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Q. If a tropical rain forest is removed, it does not regenerate quickly as compared to a tropical deciduous forest. This is because

- a. the soil of rain forest is deficient in nutrients
- b. propagules of the trees in a rain forest have poor viability
- c. the rain forest species are slow-growing
- d. exotic species invade the fertile soil of rain forest.

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Explanation:

- The soil of rain forest is deficient in nutrients (true): Rainforest ⇒ It rains almost every day ⇒ The topsoil is continuously washed away ⇒ nutrients are also washed away (leaching of nutrients) ⇒ very little fertility remains in topsoil ⇒ most of the seeds don't germinate for years ⇒ regeneration is very slow (it takes decades). But the layer below topsoil (sub-soil) is very fertile. Thus, plants grow very quickly once their roots reach the sub-soil and if they receive enough sunlight.

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- Propagules of the trees in a rain forest have poor viability (true): Propagule \Rightarrow detachable structure that can give rise to a new plant, e.g. a bud, sucker, or spore (sexual reproduction in plants). Seed-bearing plants are more significant than propagules in a rainforest.
- The rain forest species are slow-growing (false): The plant species in rainforests compete for sunlight. Hence, they grow as rapidly as they can.

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- The rain forest species are slow-growing (false): The plant species in rainforests compete for sunlight. Hence, they grow as rapidly as they can.
- Exotic species (non-native) invade the fertile soil of rain forest: this statement is wrong as the rainforest soil is heavily leached. Hence, they are not fertile. But exotic invasive species are a threat to the rainforests, especially when the forests are cleared.

Answer: a)

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Light

- The spectral quality of solar radiation is important for life.
- The UV component of the spectrum is harmful to many organisms.

Rainfall

- Majority of biochemical reactions take place in an aqueous medium.

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Temperature

- A few organisms can tolerate and thrive in a wide range of temperatures (they are called **eurythermal**).
- A vast majority of them are restricted to a narrow range of temperatures (**stenothermal**).

Atmosphere

- 21% oxygen helps in the survival of many organisms; **78% nitrogen prevents spontaneous combustion** and 0.038% carbon dioxide helps primary producers in the **synthesis of carbohydrates**.

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Organic compounds

- Proteins, carbohydrates, lipids etc. are essential for energy transfer in the living world.

Inorganic compound

- Carbon, carbon dioxide, water, sulphur, nitrates, phosphates, and ions of various metals are essential for organisms to survive.

ECOSYSTEM

Altitude

- **Vertical zonation of vegetation** is caused due to altitude.
- Change in temperature with altitude is a limiting factor.

Buffering capacity of the earth

- A **neutral pH (pH of 7)** is maintained in the soil and water bodies due to the buffering capacity of earth.
- The neutral pH is conducive for the survival and sustenance of living organisms.

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Salinity

- Some organisms are tolerant of a wide range of salinities (**euryhaline**).
- Others are restricted to a narrow range of salinities (**stenohaline**).

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ECOSYSTEM

Effect of Abiotic Components on Terrestrial Primary Producers (Plants)

Light

- Extremely **high intensity** favours **root growth** than **shoot growth** which results in **increased transpiration**, short stem, **smaller thicker leaves**.
- On the other hand, **low intensity of light** retards **growth, flowering and fruiting**.
- When the intensity of light is less than the minimum, the plants cease to grow due to the **accumulation of CO₂** and finally die.

ECOSYSTEM

- Of the visible part of the spectrum, **only red and blue are effective in photosynthesis.**
- **Plants grown in blue light are small, red light results in elongation of cells (etiolated plants).**
- **Plants grown in ultraviolet and violet light are dwarf.**

ECOSYSTEM

Frost

- Frost results in **freezing the soil moisture**.
- The plants are **killed due to increased transpiration when their roots are unable to supply moisture**.
- Water in the intercellular spaces of the plant gets frozen into ice. This results in **increasing concentration of salts and dehydration of cells**.
- Also, frost leads to the formation of canker (various plant diseases with similar symptoms caused by a wide range of fungi, bacteria, and viruses).

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Snow

- Snow acts as a blanket, prevents a further drop in temperature and **protects seedlings from excessive cold and frost.**
- Accumulation of snow on tree parts can break the branches or even uproot the tree.
- Snow shortens the period of vegetative growth.

ECOSYSTEM

Temperature

- High-temperature results in the death of plant due to **coagulation of protoplasmic proteins** (some bacteria can survive high temperatures because of their **protoplasmic proteins that don't coagulate at normally high temperatures**).
- High temperature disturbs the balance between respiration and photosynthesis.

ECOSYSTEM

Atmosphere

- 21% oxygen helps in the survival of many organisms; **78% nitrogen prevents spontaneous combustion** and 0.038% carbon dioxide helps primary producers in the **synthesis of carbohydrates**.

Organic compounds

- Proteins, carbohydrates, lipids etc. are essential for energy transfer in the living world.

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Biotic Components

Primary producers or Autotrophs (self-nourishing)

- Primary producers are green plants, certain bacteria and **algae** that **carry out photosynthesis**.
- In the aquatic ecosystem, **microscopic algae (plankton)** are the primary producers.

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Consumers or Heterotrophs or Phagotrophs (other nourishing)

- Consumers are incapable of producing their own food.
- They depend on organic food derived from plants, animals or both.
- Consumers can be divided into two broad groups namely micro and macro consumers.

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Macro consumers

- Herbivores are **primary consumers** which feed mainly on plants. E.g. sheep, rabbit, etc.
- **Secondary consumers** feed on primary consumers. E.g. wolves, dogs, snake, etc.
- Carnivores which feed on both primary and secondary consumers are called **tertiary consumers**. E.g. lion (can eat wolves), snakes etc.
- **Omnivores** are organisms which consume both plants and animals. E.g. man, bear, **pig**, etc.

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Micro consumers or **Saprotrophs** (decomposers or osmotrophs)

- They are **bacteria and fungi** which obtain energy and nutrients from dead organic substances (**detritus**).
- **Earthworm** and certain soil organisms (such as **nematodes** and **arthropods**) are detritus feeders and help in the decomposition of organic matter and are called **detrivores**.



To do science is to search for repeated patterns (Macarthur, 1984)

Thank you