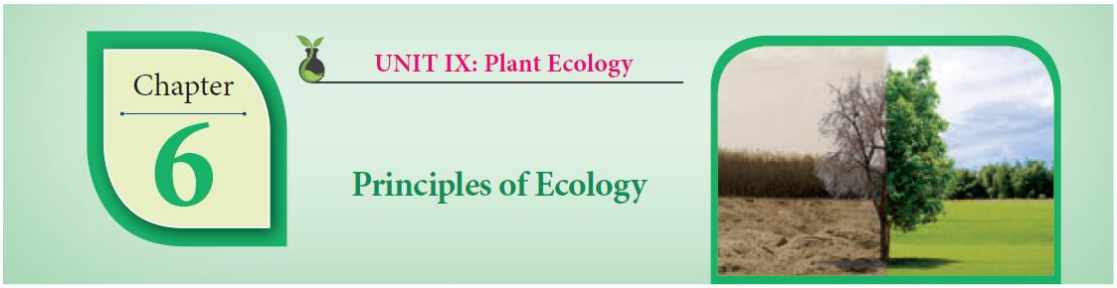

1. Definitions of ecology

Reiter (1885) "The study of living organisms, both plants and animals, in their natural habitats or homes."

Earnest Haeckel (1889) "Ecology is the study of the reciprocal relationship between living organisms and their environment."

2. **What is ecological hierarchy? Name the levels of ecological hierarchy.**

The interaction of organisms with their environment results in the establishment of grouping of organisms which is called **ecological hierarchy** or ecological levels of organization.

3. **What are the Branches of Ecology?**

Ecology is mainly divided into two branches, they are autecology and synecology.

1. Autecology is the ecology of an individual species and is also called species ecology.

2. Synecology is the ecology of a population or community with one or more species and also called as community ecology.

Many advances and developments in the field ecology resulted in various new dimensions and branches.

Some of the advanced fields are Molecular ecology, Eco technology, Statistical ecology and Environmental toxicology.

4. **What is the Biotope and Ecotope**

Biotope

❖ Habitat is a specific physical place or locality occupied by an organism or any species which has a particular combination of biotic or environmental factors.

❖ But the environment of any community is called **Biotope**.

Ecotope

• An ecological niche refers to an organism's place in the biotic environment and its functional role in an ecosystem.

• The term was coined by the naturalist **Roswell Hill Johnson** but **Grinell** (1917) was probably first to use this term.

• The habitat and niche of any organism is called **Ecotope.**

5. The differences between habitat and niche?

	Habitat	**Niche**
1	A specific physical space occupied by an organism (species)	A functional space occupied by an organism in the same eco-system
2	Same habitat may be shared by many organisms (species)	A single niche is occupied by a single species
3	Habitat specificity is exhibited by organism.	Organisms may change their niche with time and season.

6. **Define Ecological equivalents**

Taxonomically different species occupying similar habitats (Niches) in different geographical regions are called **Ecological equivalents.**

7. Define Ecological factors

➢ Many organisms co-exist in an environment. The environment (surrounding) includes physical, chemical and biological components.

➢ When a component surrounding an organism affects the life of an organism, it becomes a factor.

➢ All such factors together are called **environmental factors** or **ecological factors**.

8. **Types of tolerance of salinity, organisms?**

1. Euryhaline: Organisms which can live in water with wide range of salinity. Examples:Marine algae and marina angiosperms

2. Stenohaline: Organisms which can withstand only small range of salinity. Example: Plants ofestuaries.

9. **What is Phytoremediation.**

i. Soybean and tomato manage to tolerate presence of cadmium poisoning by isolating cadmium and storing into few group of cells and prevent cadmium affecting other cells.

ii. Rice and *Eichhornia* (water hyacinth) tolerate cadmium by binding it to their proteins.

These plants otherwise can also be used to remove cadmium from contaminated soil, this is known as **Phytoremediation.**

10. **List out the Effects of wind?**

- Wind is an important factor for the formation of rain
- Causes wave formation in lakes and ocean, which promotes aeration of water
- Strong wind causes soil erosion and reduces soil fertility
- Increases the rate of transpiration
- Helps in pollination in anemophilous plants
- It also helps in dispersal of many fruits, seeds, spores, etc.
- Strong wind may cause up-rooting of big trees.

11. **List out the Effects of fire?**

- Fire has a direct lethal effect on plants
- Burning scars are the suitable places for the entry of parasitic fungi and insects

• It brings out the alteration of light, rainfall, and nutrient cycle, fertility of soil, pH, soil flora and fauna

• Some fungi which grow in soil of burnt areas called pyrophilous.

Example: *Pyronema confluens*.

12. **What are the Indicators of fire with suitable example?**

Pteris (fern) and *Pyronema* (fungus) indicates the burnt up and fire disturbed areas. So they are called indicators of fire.

13. **Explain the Soil types**

Based on soil formation (**pedogenesis**), the soils are divided into

1. Residual soils –These are soils formed by weathering and **pedogenesis** of the rock.

2. Transported soils – These are transported by various agencies.

13. **Define Soil Profile**

Soil is commonly stratified into horizons at different depth. These layers differ in their physical, chemical and biological properties. This succession of super-imposed horizons is called soil profile.

14. **List out the Types of soil particles**

Based on the relative proportion of soil particles, four types of soil are recognized.

	Soil type	Size	Relative proportion
1	Clayey soil	Less than 0.002 mm	50% clay and 50% silt (cold / heavy soil)
2	Silt soil	0.002 to 0.02mm	90% silt and 10% sand
3	Loamy soil	0.002 to 2mm	70% sand and 30 % clay / silt or both (Garden soil)
4	Sandy soil	0.2 to 2 mm	85% sand and 15% clay (light soil)

15. **Explain the soli classification based on plant distribution?**

Based on the water retention, aeration and mineral contents of soil, the distribution of vegetation is divided into following types.

1. **Halophytes:** Plants living in saline soils
2. **Psammophytes:** Plants living in sandy soils
3. **Lithophytes:** Plants living on rocky surface
4. **Chasmophytes**: Plants living in rocky crevices
5. **Cryptophytes**: Plants living below the soil surface
6. **Cryophytes**: Plants living in ice surface
7. **Oxylophytes**: Plants living in acidic soil
8. **Calciphytes**: Plants living in calcium rich alkaline soil.

16. **Explain the Different interactions of plant**

Interaction type		**Combination**		**Effects**	**Examples**
1.Positive interaction					
1	**Mutualism**	(+)	(+)	Both species benefitted	Lichen, *Mycorrhiza* etc.
2	**Commensalism**	(+)	(0)	One species is benefitted and the other species is neither benefitted nor harmed	orchids, Lianas etc.
2.Negative interaction					
4	**Predation**	(+)	(-)	One species benefitted, the other species are harmed	*Drosera, Nepenthes* etc.
5	**Parasitism**	(+)	(-)	One species benefitted, the other species are harmed	*Cuscuta, Duranta,Viscum* etc.
6	**Competition**	(-)	(-)	Harmful for both	Grassland species
7	**Amensalism**	(-)	(0)	Harmful for one, but the other species are unaffected	*Penicillium* and *Staphylo coccus*

17. **What is the insectivorous plant?**

A number of plants like *Drosera* (Sun dew Plant), *Nepenthes* (Pitcher Plant), *Diaonaea* (Venus fly trap), *Utricularia* (Bladder wort) and *Sarracenia* are predators which consume insects and other small animals for their food as a source of nitrogen.

They are also called as **insectivorous plants**.

18. **What is the Velamen?**

The epiphytic higher plant (**Orchids**) gets its nutrients and water from the atmosphere with the help of their hygroscopic roots which contain special type of spongy tissue called **Velamen.**

19. What is the Holoparasites?

The organisms which are dependent upon the host plants for their entire nutrition are called **Holoparasites**.

They are also called **total parasites**.

20. **What is the Hemiparasites**

The organisms which derive only water and minerals from their host plant while synthesizing their own food by photosynthesis are called **Hemiparasites**.

They are also called **partial parasites**.

Examples:

- *Viscum* and *Loranthus* are **partial stem parasites**.
- *Santalum* (Sandal Wood) is a **partial root parasite**.

21. **What is the Amensalism or antibiosis**

It is an interspecific interaction in which one species is inhibited while the other species is neither benefitted nor harmed.

The inhibition is achieved by the secretion of certain chemicals called **allelopathic** substances. Amensalism is also called **antibiosis.**

Ex- *Penicillium notatum* produces penicillin to inhibit the growth of a variety of bacteria especially *Staphylococcus*.

22. **Short notes on Co-evolution**

The interaction between organisms, when continues for generations, involves reciprocal changes in genetic and morphological characters of both organisms. This type of evolution is called Co-evolution. It is a kind of co- adaptation and mutual change among interactive species.

Examples:

Corolla length and proboscis length of butterflies and moths (*Habenaria* and Moth).

Bird's beak shape and flower shape and size.

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23. **Explain the Morphological adaptations of Hydrophytes:**

In root

•Roots are totally absent in *Wolffia* and *Salvinia* or poorly developed in *Hydrilla* or well developed in *Ranunculus.*

•The root caps are replaced by **root pockets**. Example: *Eichhornia*

In stem

• The stem is long, slender, spongy and flexible in sub-merged forms.

•In free floating forms the stem is thick, short stoloniferous and spongy; and in root edfloating forms, it is a rhizome.

•Vegetative propagation is through runners, stolon, stem and root cuttings, tubers, dormant apices and offsets.

5mark

Explain the Dispersal of Fruits and Seeds

- Both fruits and seeds possess attractive colour, odour, shape and taste needed for the dispersal by birds, mammals, reptiles, fish, ants and insects even earthworms. The seed consists of an embryo, stored food material and a protective covering called **seed coat**.
- As seeds contain miniature but dormant future plants, their dispersal is an important criterion for distribution and establishment of plants over a wide geographical area.

- The dissemination of seeds and fruits to various distances from the parent plant is called seed and fruit dispersal.
- It takes place with the help of ecological factors such as wind, water and animals.

❖ Seed dispersal is a regeneration process of plant populations and a common means of colonizing new areas to avoid seedling level competition and from natural enemies like herbivores, frugivores and pathogens.

- Fruit maturation and seed dispersal is influenced by many ecologically favourable conditions such as Season (Example: Summer), suitable environment, and seasonal availability of dispersal agents like birds, insects etc.
- Seeds require agents for dispersal which are crucial in plant community dynamics in many ecosystems around the globe. They offer many benefits to communities such as food and nutrients, migration of seeds across habitats and helps spreading plant genetic diversity.

Dispersal by Wind (Anemochory)

The individual seeds or the whole fruit may be modified to help for the dispersal by wind. Wind dispersal of fruits and seeds is quite common in tall trees. The adaptation of the wind dispersal plants are

• **Minute seeds:** Seeds are minute, very small, light and with inflated covering.Example: Orchids.

• **Wings:** Seeds or whole fruits are flattened to form a wing. Examples: Maple, *Gyrocarpus, Dipterocarpus* and *Terminalia*

• **Feathery Appendages:** Seeds or fruits may have feathery appendages which greatly increase their buoyancy to disperse to high altitudes. Examples: *Vernonia* and *Asclepias.*

• **Censor mechanisms:** The fruits of many plants open in such a way that the seeds can escape only when the fruit is violently shaken by a strong wind. Examples: *Aristolochia* and Poppy.

Dispersal by Water (Hydrochory)

Dispersal of seeds and fruits by water usually occurs in those plants which grow in or near water bodies. Adaptations of hydrochory are

• Obconical receptacle with prominent air spaces. Example: *Nelumbo*.

• Presence of fibrous mesocarp and light pericarp. Example: Coconut.

• Seeds are light, small, provided with aril which encloses air.Example: *Nymphaea*.

• The fruit may be inflated. Examples: *Heritiera littoralis*.

• Seeds by themselves would not float may be carried by water current. Example: Coconut.

Dispersal by Animals (Zoochory)

Birds and mammals, including human beings play an efficient and important role in the dispersal of fruit and seeds. They have the following devices.

i. Hooked fruit: The surface of the fruit or seeds have hooks,(*Xanthium*), barbs (*Andropogon*), spines (*Aristida*) by means of which they adhere to the body of animals or clothes of human beings and get dispersed.

ii. Sticky fruits and seeds:

a. Some fruits have sticky glandular hairs by which they adhere to the fur of grazing animals. Example: *Boerhaavi*a and *Cleome*.

b. Some fruits have viscid layer which adhere to the beak of the bird which eat them and when they rub them on to the branch of the tree, they disperse and germinate. Example: *Cordia* and *Alangium*

iii. Fleshy fruits: Some fleshy fruits with conspicuous colours are dispersed by human beings to distant places after consumption. Example: Mango and *Diplocyclos*

Dispersal by Explosive Mechanism (Autochory)

Some fruits burst suddenly with a force enabling to throw seeds to a little distance away from the plant. Autochory shows the following adaptations.

• Mere touch of some plants causes the ripened fruit to explode suddenly and seeds are thrown out with great force. Example: *Impatiens* (Balsam), *Hura*.

• Some fruits when they come in contact with water particularly after a shower of rain, burst suddenly with a noise and scatter the seeds.Examples: *Ruellia* and *Crossandra.*

Example: *Ecballium elatrium* (Squirting cucumber) *Gyrocarpus* and *Dipterocarpus.*

Human aided seed dispersal

Seed Ball: Seed ball is an ancient Japanese technique of encasing seeds in a mixture of clay and soil humus (also in cow dung) and scattering them on to suitable ground, not planting of trees manually.

This method is suitable for barren and degraded lands for tree regeneration and vegetation before monsoon period where the suitable dispersal agents become rare.

Advantages of seed dispersal:

• Seeds escape from mortality near the parent plants due to predation by animals or getting diseases and also avoiding competition.

• Dispersal also gives a chance to occupy favorable sites for growth.

• It is an important process in the movement of plant genes particularly this is the only method available for self-fertilized flowers and maternally transmitted genes in out crossing plants.

• Seed dispersal by animals help in conservation of many species even in human altered ecosystems.

2. **Detail write about the Positive interactions**

One or both the participating species are benefited, it is positive interaction. Examples; Mutualism and Commensalism.

a. Mutualism: It is an interaction between two species of organisms in which both are benefitted from the obligate association. The following are common examples of mutualism.

Nitrogen fixation

Rhizobium (Bacterium) forms nodules in the roots of leguminous plants and lives symbiotically. The *Rhizobium* obtains food from leguminous plant and in turn fixes atmospheric nitrogen into nitrate, making it available to host plants.

Other examples:

• Water fern (*Azolla*) and Nitrogen fixing Cyanobacterium *(Anabaena)*.

• *Anabaena* present in coralloid roots of *Cycas*. (Gymnosperm)

• Cyanobacterium (*Nostoc*) found in the thalloid body of *Anthoceros.*(Bryophytes)

• Wasps present in fruits of fig.

• Lichen is a mutual association of an **alga** and **a fungus**.

• Roots of terrestrial plants and fungal hyphae- **Mycorrhiza**

b. Commensalism: It is an interaction between two organisms in which one is benefitted and the other is neither benefitted nor harmed. The species that derives benefit is called the **commensal,** while the other species is called the **host**. The common examples of commensalism are listed below:

Epiphytes

The plants which are found growing on other plants without harming them are called epiphytes. They are commonly found in tropical rain forest.

The epiphytic higher plant (**Orchids**) gets its nutrients and water from the atmosphere with the help of their hygroscopic roots which contain special type of spongy tissue called **Velamen.** So it prepares its own food and does not depend on the host. They use the host plant only for support and do not harm it in any way.

• Many orchids, ferns, lianas, hanging mosses, *Peperomia*, money plant and *Usnea* (Lichen) are some of the examples of epiphytes.

• Spanish Moss –*Tillandsia* grows on the bark of Oak and Pine trees.

3. **Write about the Negative interactions**

When one of the interacting species is benefitted and the other is harmed, it is called **negative interaction.** Examples: predation, parasitism, competition and amensalism.

a. Predation: It is an interaction between two species, one of which captures, kills and eats up the other. The species which kills is called **predator** and the species which is killed is called a **prey**. The predator is benefitted while the prey is harmed.

Examples:

• A number of plants like *Drosera* (Sun dew Plant), *Nepenthes* (Pitcher Plant), *Diaonaea* (Venus fly trap), *Utricularia* (Bladder wort) and *Sarracenia* are predators which consume insects and other small animals for their food as a source of nitrogen. They are also called as **insectivorous plants**.

b. Parasitism: It is an interaction between two different species in which the **smaller partner** (parasite) obtains food from the **larger partner** (host or plant). So the parasitic species is benefited while the host species is harmed. Based on the host-parasite relationship, parasitism is classified into two types they are holoparasite and hemiparasite.

Holoparasites

The organisms which are dependent upon the host plants for their entire nutrition are called **Holoparasites**. They are also called **total parasites**.

Examples:

• *Cuscuta* is a total stem parasite of the host plant *Acacia*, *Duranta* and many other plants. *Cuscuta* even gets flower inducing hormone from its host plant.

Hemiparasites

The organisms which derive only water and minerals from their host plant while synthesizing their own food by photosynthesis are called **Hemiparasites**. They are also called **partial parasites**.

Examples:

• *Viscum* and *Loranthus* are **partial stem parasites**.

• *Santalum* (Sandal Wood) is a **partial root parasite**.

*** Competition:** It is an interaction between two organisms or species in which both the organisms and species are harmed. Competition is the severest in population that has irregular distribution. Competition is classified into intraspecific and interspecific.

1. **Intraspecific competition:** It is an interaction between individuals of the same species. This competition is very severe because all the members of species have similar requirements of food, habitat, pollination etc. and they also have similar adaptations to fulfill their needs.

2. **Interspecific competition:** It is an interaction between individuals of different species. In grassland, many species of grasses grow well as there is little competition when enough nutrients and water is available. During drought shortage of water occurs.

***Amensalism:** It is an interspecific interaction in which one species is inhibited while the other species is neither benefitted nor harmed. The inhibition is achieved by the secretion of certain chemicals called **allelopathic** substances. Amensalism is also called **antibiosis.**

• *Penicillium notatum* produces penicillin to inhibit the growth of a variety of bacteria especially *Staphylococcus*.

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