

# Ecology

## Ecology

The branch of biology that deals with the interrelationships amongst organisms and interaction between organisms and their environment. The organization of the living matter or organisms is observed at several levels. The different levels of organization in living world are

Molecular → Cellular → Tissue → Organ → Individual

→ Population → Community → Ecosystem

→ Biome → Biosphere

Amongst them, the levels from molecular to organ are considered lower levels of organization and rest all are higher levels of organization.

### (a) Individual:

It is the basic level of ecological hierarchy which can undergo all the life processes.

### (b) Population:

Group of similar individuals in a particular geographical area.

### (c) Community:

The Various populations of an area taken together like plants, animals bacteria, fungi, etc.

### (d) Ecosystem:

It is a segment of nature consisting of biological community and its physical environment e.g. pond, desert etc.

### (e) Biome:

The natural ecological grouping of plants and animals on the basis of climates are called as biomes.

### (f) Biosphere:

A zone consisting of land, water and air where life exists is called as biosphere.

## Environment

It is the sum total of all biotic and abiotic components, substances and conditions that surround & influence organisms. The various components of environment are interlinked as well as interdependent.

## Components of Environment

It consists of 2 major components:

### (a) Non living components:

Also called as abiotic components.

(i) Climate: It is average weather of an area including general patterns of atmosphere and seasonal variations.

(ii) Light

(iii) Temperature

(iv) water

(v) Soil

### (b) Biotic or Living components:

The living components consist of 3 types of organisms:

(i) Producers: Organisms which can prepare their own food from simple inorganic substances like  $\text{CO}_2$  and  $\text{H}_2\text{O}$  in presence of sunlight. E.g. Green plants, photosynthetic algae, photosynthetic bacteria etc.

(ii) Consumers: Those organisms which consume food prepared by producers are called as consumers. They can be:

- Herbivores: Which eat only plants and their products. Also called primary consumers.
- Carnivores: Which eat only other animals also called secondary consumers.
- Omnivores: Which eat both primary as well as secondary consumers.

(iii) Decomposers: The microorganisms which break down the complex organic compounds present in dead organisms (plants and animals) e.g. fungi, bacteria etc.

- Interrelationship Among Different components of Environment: The biotic community of producers, Consumers, Decomposers, and the abiotic environment are interdependent (depend on one another.) There is a network of relationships- a system of give- and - take between the two. The abiotic substance supply nutrients to the producer plants. The producers prepare food from these basic nutrients and sunlight. The animals are unable to synthesis their own food. They are consumers. So, the consumers eat up the food prepared by producers (plants). When the producers (plants) and consumers (animals) die, the decomposers convert the complex organic compounds of dead organisms into the simple organic and inorganic substances and return them into soil, air and water. These nutrients are again absorbed by the producers (plants). Thus there is a cyclic exchange of materials between the living community and the abiotic environment.

## Interrelationship among organisms

### (a) Mutualism or Symbiosis:

It is an association between two dissimilar organisms in which both the partners are

mutually benefited by each other. E.g. The egret bird on the back of the buffalo eating lice.

**(b) Commensalism:**

It is also a relationship between two organisms in which one partner is benefited and the other remains unaffected. This relationship may or may not involve food e.g. sea anemone gets attached to the hermit crab.

**(c) Parasitism:**

When one organism lives in or on the body or another organism and also derives food from it so that one organism is always benefited while the other is at a loss, it is called as parasitism. The former organism is called as a parasite and the later as host. E.g. malarial parasite is a parasite in the body of man and mosquito as a host.

**(d) Predation.**

It is a direct food relationship between two organisms when one eats the other. The one who eats is a predator and the organism eaten is a prey e.g. in a forest lion eats the deer.

**(e) Scavenging:**

It is the food relationship between a dead animal and its eater. Here the eater is known as a scavenger. E.g. in a forest hyenas, vultures, crows and the jackals.

**(f) Competition:**

It is an interaction between two organisms for the same thing.

**Species**

The group of individuals that are similar in form, physiology etc. can interbreed freely to give rise to new individuals is called species. Natural imbalance created to threat to biodiversity is due to:

- (i) Increasing human population
- (ii) Habitat loss
- (iii) Pollution
- (iv) Over exploitation of natural resources
- (i) Intensive agriculture.

**Results of natural imbalance**

In biodiversity it leads to extinction of species. According to IUCN, species are categorized as:

1. Extinct: The taxon has been completely eliminated or died out from earth e.g. Dodo

2. Endangered: The taxon is facing a high risk or extinction and can become extinct at any moment. E.g. Red panad, Blue whale, Wild ass etc.
3. Vulnerable: Presently the population is sufficient but is undergoing depletion e.g. Antelope (black buck)
4. Rare species: They are the species with natural small populations, either localized or thinly scattered and are at risk from pests pathogens etc. e.g. Great Indian bustard, clouded leopard.

**Food Chain**

The food (or energy) can be transferred from one organisms to the other through food chains. The starting point of a food chain is a category of organisms called producers. Producers are, In fact, Plants. So we can say that at the food chains begin with a green plant (or grass) which is the original source of food. The sequence of living organisms in a community in which one organism consumes another organisms to transfer food energy is called as food chain. In Simple words, a list of organisms (living beings) showing “who eats whom” is called a food chain, e.g. in a grassland or forest, there is a lot of grass. This grass is eaten up by animals like deer and this deer is then consumed by a lion.

Grass → Deer → Lion  
(Producer)      (Herbivore)      (Carnivore)

Grass is the producer organism which uses sunlight energy to prepar food like carbohydrates by the process of photosynthesis. Grass is consumed by a herbivore called deer, then deer is consumed by a carnivore called. Lion.

A food chain represents single directional (or unidirectional) transfer of energy. It cannot take place in the reverse direction from lion to deer and from deer to grass.

**(a) Importance of Food chain:**

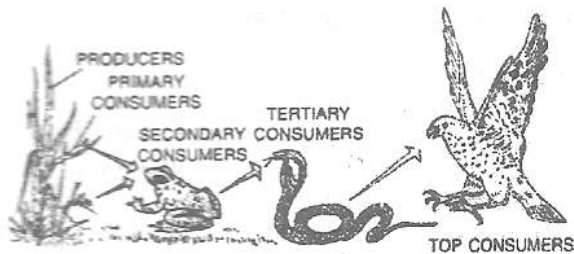
The study of food chain in an area or habitat helps us in knowing various interactions amongst the different organisms and also their interdependence.

**(b) Examples of Food chain:**

Grass → Insects → Frog → Snake (Top)  
 (Producer) (Herbivore) (Carnivore carnivore)  
 Plants → Worms → Birds → Cat  
 (Producer)(Herbivore) (Carnivore) (Top Carnivore)

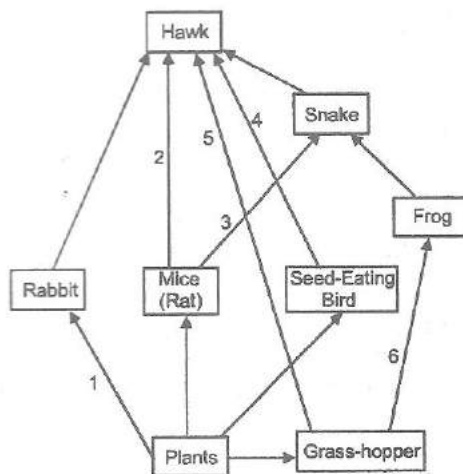
### (c) Functions of Food chains:

1. The food chains depict (tell us) the structure of living components of the ecosystem or biosphere.
2. The food chains transfer energy and materials between various living components of an ecosystem or biosphere.
3. Longer the food chain, less is the energy available to the final member of food chain.



### Food Web

- Food web: Network of a large number of food chains existing in an ecosystem is called is called as food web.



### Trophic Levels

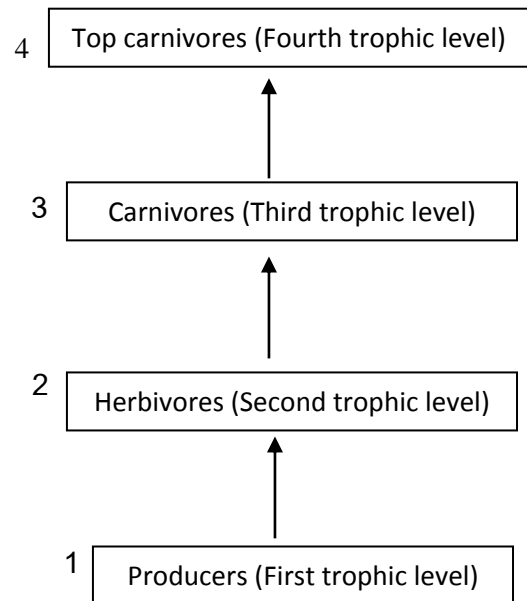
The various links (or steps) in a food chain at which the transfer of food (or energy) takes place are called trophic levels. In a food chain, each link representing an organisms is known as a trophic level.

- (i) The plants are producers and constitute the 'first trophic level'.

- (ii) Herbivores (which feed upon plants) constitute the 'second trophic level'.

- (iii) Carnivores (that feed upon herbivores) constitute the 'third trophic level'.

- (iv) Large carnivores or top carnivores (which feed upon the small carnivores), constitute the 'fourth trophic level'.



### Ecological Pyramids

The food chains involving various living organisms (or species) in a community can be represented graphically by drawing pyramids which are known as ecological pyramids. Three types of ecological pyramids can be constructed for a community of organisms in an ecosystem.

These are:

- (i) Pyramid of numbers (based on the number of organisms present in each trophic level)
- (ii) Pyramid of mass or Biomass (based on the biomass of organisms present in each trophic level)
- (iii) Pyramid of energy (based on the energy content of each trophic level)

### Pollution

The contamination of the environment with substances that are harmful to living beings is called pollution.

- Pollutants: Any material or act of man, or nature which leads to pollution is called as pollutants.

- **Air Pollution:**  
The presence of chemicals in the atmosphere in undesirable quantities and duration harmful to human health and the environment is known as air pollution. The substance which contaminate the air are called air pollutants.

- **Air pollutants and Their Effects:**
  - (i) Carbon monoxide (CO): This is the main air pollutant. It combines with haemoglobin of the blood and blocks the transportation of oxygen. Thus, It impairs respiration and it causes death.
  - (ii) Unburnt hydrocarbons: Out of them 3, 4 – benzyrene is the main pollution. This causes cancer in lungs.
  - (iii) Oxides of nitrogen: These oxides of nitrogen form photochemical smog in the atmosphere and release ozone. The oxide pollutants of nitrogen are nitric oxide (NO), and nitrogen di oxide (NO<sub>2</sub>). The entry of these pollutants causes various various diseases in animal like- respiratory trouble such as emphysema, bronchitis, Swelling of lungs and lung cancer etc.
  - (iv) Aerosol: The aerosol like C.F.C. (Chloro fluoro carbon) release into the atmosphere from the refrigerators, air conditioners and jet planes deplete or reduce the ozone layer. This thin layer of ozone is also known as ozone hole results in the increase in temperature of the earth.

- **Control Air pollution:**

- (a) Use of unleaded petrol should be encouraged.
- (b) Less polluting fuels such as CNG (Compressed Natural Gas.) should be used.
- (c) Regular pollution – check on vehicles should be made.
- (d) We should plant more trees
- (e) Industries should not be established at one place.

## **Water Pollution**

Any undesirable contamination of water is called water pollution. The substance that pollute water are called water pollutants.

The water pollution is caused by many sources such as sewage water, industrial wastage,

agricultural wastage, domestic wastage, hot water of thermal plants and nuclear reactors etc.

- **Effects of water pollution:**

- (a) Industrial wastes discharged into the water bodies contain a lot of toxic substances that make water unfit for drinking and bathing. The chemical released include arsenic, lead and fluorides which lead to toxicity in plants and animals.
- (b) Untreated domestic sewage when released into water bodies becomes a breeding ground to a number of waterborne disease carriers.
- (c) Pollution of water also leads to a reduction in the number of aquatic plants and animals due to destruction of habitat and nesting places.
- (d) Eutrophication: The entry of nutrient-rich water results in a thick growth of algae, called algal bloom and many other weeds. Soon these plants cover the entire surface of water. This is called eutrophication.
- (e) Water contaminated with sewage may contain bacteria, virus fungi and parasites which causes diseases like cholera, Typhoid and jaundice.

- **Prevention from water pollution:**

- (a) Bathing and washing clothes near water bodies such as lakes, Ponds, and rivers should be restricted.
- (b) Pollution-control rules enforced by the government should be strictly followed.
- (c) Water should be treated before releasing in river. Water treatment plant should be installed in all industrial areas.
- (d) We all should follow Reduce, reuse and recycle rule.
- **Useful plant:** The great necessities of life-food, clothing, shelter and several other things-are supplied in great parts by plants. Thus plants have become a part of his life.
- **Cultivation and production of useful plants or farm animals and their management is called husbandry.**
- **Study of economically useful plants and plant products is known as Economic botany.**
- **Plants are of special importance in medicine to cure human beings. Study of plant medicines on body part is known as pharmacology.**

- Classification given by A.F. Hill 1952 is considered to be the most useful. Hill classified economically important plants in groups such as-

(i) Food plants: Cereals, pulses, vegetables and fruit. Cereals is the most important source of food and fodder.

(ii) Additional food plants: Spices, beverages.

- Soyabean is the richest source of vegetarian protein.
- Inflorescence is used as edible part in cauliflower.
- Beta vulgaris is the major source of sugar in world.

(iii) Plants of Industrial use: Plants used in production of fibers, rubber, gum and essential oils, fatty oils, sugar and starch.

(iv) Medicinal plants: Medicinal plants, chewing plants, narcotics.

- Rauwolfia serpentina is a medicinal plant.
- In Brahmi leaves are the source of medicine.
- Opium, Morphine, Heroin are used as sedative or pain reliever.
- Morphine is obtained from Papaver somniferum

S.No.	Name of the plant	Part Used	Medical value treatment for
1.	Sarpagandha	Root	For blood pressure, Snake bite, mental disorders
2.	Opium	Latex from unripe	Narcotic, sedative in relieving pain
3.	Quinine	Bark of Cinchona	For malaria
4.	Aconite	Root	Rheumatism
5.	Jalap	Root	Constipation
6.	Ishapgul	Seeds & their husk	Constipation & dysentery
7.	Chamomile	Flower	Sprains; bruises; rheumatism
8.	Sacred basil	Leaf	Sore throat &

	(tulsi)		skin diseases
9.	Eucalyptus	Leaf	Sinus problems
10.	Datura and poppy	Seeds	Pain killers
11.	Neem	Leaf	Antiseptic property, skin diseases such as exzema, scabis, etc
12.	Casara	Bark	Constipation & sluggishness

### EXERCISE

- Ecology is the study of relationships between
  - Water and environment
  - Organisms and environment
  - Soil and water
  - All of the above
- Which of the following pyramid is upright always?
  - Pyramid of number
  - Pyramid of energy
  - Pyramid of biomass
  - All of the above
- Total organic matter present in an ecosystem is called
  - Biomass
  - Biome
  - Litter
  - Food
- The species, which are in danger of extinction are referred to as.
  - Endangered species
  - Vulnerable species
  - Threatened species
  - Rare species
- The importance of ecosystem lies in
  - Flow of energy
  - Cycling of materials
  - Both of the above
  - None of the above
- The pyramid of numbers in grassland ecosystem will be
  - Upright
  - Inverted
  - Irregular
  - Linear
- Vultures in an ecosystem are
  - Predators
  - Scavagers
  - Consumers
  - Top carnivores

8. Which of the following cycle would be affected if decomposers of an ecosystem vanish  
(a) Producer cycle  
(b) Consumer cycle  
(c) Decomposer cycle  
(d) Biogeochemical cycle
9. Biogeochemical cycle is also known as  
(a) Gaseous cycle      (b) sedimentary cycle  
(c) compound cycle      (d) Cycle of matter
10. Primary source of energy in an ecosystem is  
(a) Sugar stored in plants  
(b) Heat liberated during respiration  
(c) Solar energy  
(d) Heat liberated by fuel burning
11. Which one of the following in the pyramid is most delicately balanced in the chain?  
(a) Top carnivore      (b) plant  
(c) herbivore      (d) Small carnivore
12. The correct sequence of increasing organizational complexity is-  
(a) Species, population, community and ecosystem  
(b) Population, community, species and ecosystem  
(c) Population variety, ecosystem and community  
(d) Species, variety, population and ecosystem
13. Individuals of the same species inhabiting a particular locality form-  
(a) Community      (b) population  
(c) flora      (d) fauna
14. In an aquatic ecosystem, maximum biomagnification is seen among  
(a) Fish      (b) Phytoplanktons  
(c) Zooplanktons      (d) Macroscopic plants
15. How much energy is consumed from one trophic level to another trophic level?  
(a) 5%      (b) 10%  
(c) 15%      (d) 20%
16. The best solution to stop environmental pollution is- (NTSE stage-I/Raj./2007)  
(a) Water conservation  
(b) Land conservation  
(c) Control on industries  
(d) Population control
17. Soil erosion due to running water can be checked by: (NTSE stage-II/2007)  
(a) Animal grazing  
(b) Afforestation  
(c) Building reservoirs  
(d) Cultivation on steep slopes
18. Biogas is a mixture of: (NTSE stage-II/2007)  
(a) Methane and carbon dioxide  
(b) Methane and Hydrogen  
(c) Propane and benzene  
(d) Nitrogen and Hydrogen
19. Examine the following statements.  
(NTSE stage-II/2007)  
(A) Conservation of wild life is to maintain essential ecology processes and life supporting systems.  
(B) There is no direct relationship between the preservation of wild life and human progress.  
(C) The wild Life (Protection) Act prohibits trade in idle and endangered species.  
(D) Afforestation is a threat to our economy, quality of life and environment.  
Which one of the following alternatives in true?  
(a) A and B      (b) A and D  
(c) C and D      (d) A and C
20. The soil which contains the highest amount of humus is- (NTSE stage-II/2008)  
(a) Desert soil      (b) Black soil  
(c) red soil      (d) clay soil
21. DDT (Dichloro diphenyl trichloro ethane) has been found to pollute our soil and water bodies and has been banned from being used as a pesticide because it is- (NTSE stage-II/2008)

- (a) Non biodegradable , non-selective in action, toxic and is accumulated in animals
- (b) Non- biodegradable extremely selective in action, toxic but not accumulated in animals
- (c) Biodegradable, non-selective in action, toxic and is accumulated in animals
- (d) Biodegradable, selective in action, toxic but not accumulated in animals.

Which one of the following alternatives is correct?

- (a) A is true, B is false
- (b) B is true, A is false
- (c) B is true, C is false
- (d) D is true, A is false

**22.** Study the statements given below concerning water. **(NTSE stage-II/2008)**

- (a) Many cities are located on the banks of a water body.
- (b) Total amount of water on the earth is constant.
- (c) Ground water is always pure.
- (d) Bawris (water bodies) are a traditional method of water storage.

Which statements are true?

- (a) A, B only
- (b) A, B, C only
- (c) B, C, D only
- (d) A, B, D only

**23.** Match the items in column I with column II.

**(NTSE stage-II/2008)**

	Column-I		Column-II
A.	Jim Corbett National Park	a	One horned rhinoceros.
B.	Gir sanctuary	b	Tiger
C.	Bandipur National park	c	Asiatic lion
D.	Kaziranga National Park	d	Indian Elephant

Which one of the following alternatives is correct?

- (a) A-c, B-d, C-a, D-b
- (b) A-b, B-c, C-d, D-a
- (c) A-a, B-b, C-d, D-d
- (d) A-d, B-c, C-b, D-a

## ANSWER - KEY

### ENVIRONMENT

Q.	1	2	3	4	5	6	7	8	9	10
A.	B	B	A	A	C	A	B	D	D	C
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	A	B	A	B	D	B	A	D	D
Q.	21	22	23							
A.	A	D	B							