

# Energy Flow & Ecological Succession

## 1 Mark Questions

1. State what does standing crop of a trophic level represent. [Delhi 2013]

**Ans.** Standing crop represents the total mass of living material or energy content of all the organisms of a trophic level at a particular time and location

2. What is a detritus food chain made up of? How do they meet their energy and nutritional requirements? [All India 2013]

**Ans.** It is made up of decomposers, i.e. some bacteria and fungi. They meet their energy and nutrient requirements by degrading the dead organic matter of detritus

3. Mention the role of pioneer species in primary succession on rocks. [Foreign 2012]

**Ans.** Lichens are the pioneer species in the succession on rocks. They secrete acids to dissolve the rock and help in weathering and soil formation and pave way to small plant like bryophytes.

4. List any two ways of measuring the standing crop of a trophic level. [Foreign 2010]

**Ans.** Standing crop can be measured as:

- (i) Biomass of living organism in a unit area.
- (ii) Number in a unit area

## 2 Marks Questions

5. A part from being a part of food chain, predators play other important roles. Mention any two such roles supported by examples. [Delhi 2014]

**Ans.** Apart from being a part of food chain, predators play important role in:

- (i) **Maintaining the prey population** and also regulates intraspecies competition.
- (ii) **Indicating ecological disturbances** as predators are small in number and highly sensitive to ecological changes owing to their excessive adaptation.

6. It is possible that a species may occupy more than one trophic level in the same ecosystem at the same time. Explain with the help of one example. [All India 2013, 2008 C]

**Ans.** Yes, the trophic level of species represents the functional level of species in the energy flow. The preference of food habit depends on the available food and worms. A single species may occupy more than one trophic level at the same time in ecosystem. For example, sparrow is primary consumer when it eats seeds and secondary consumer when feeds on insects and worms.



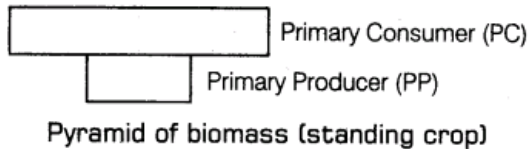
7. Name the type of food chains responsible for the flow of larger fraction of energy in an aquatic and a terrestrial ecosystem respectively. Mention one difference between the two food chains. [Delhi 2010]

Ans. Food chain in aquatic ecosystem is the grazing food chain. In terrestrial ecosystem, it is detritus food chain. Differences between grazing and detritus food chain are:

Grazing food chain	Detritus food chain
Transfer of energy starts from producers.	Transfer of energy starts from detritus/decomposing organic matter.
Less energy flows through this.	More energy flows through this.
In aquatic ecosystem, it is the major conduit for energy transfer.	In terrestrial ecosystem, it is the major conduit for energy transfer.

8. Explain standing crop in an ecosystem. Draw a pyramid of biomass when a small standing crop of phytoplanktons supports a large standing crop of zooplankton in the sea. [Delhi 2010]

Ans. Standing crop represents the total mass of living material or energy content of all the organisms of a trophic level at a particular time and location



Inverted pyramid of biomass small standing crop of phytoplankton supports large standing crop of zooplankton

9. Construct a grazing food chain and detritus food chain using the following five links each. Earthworm, bird, snake, vulture, grass, grasshopper, frog, decaying plant matter. [Foreign 2008]

Ans. Grazing food chain

Grass → Grasshopper → Bird → Snake → Vulture

Detritus food chain

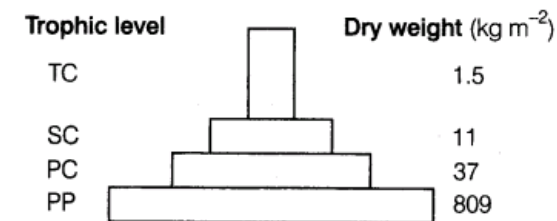
Dead and decaying plant matter → Earthworm → Bird → Snake → Vulture

### 3 Marks Questions

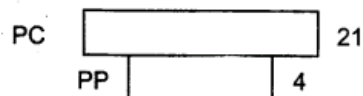
10. Differentiate between two different types of pyramids of biomass with the help of an example. [Delhi 2013]

**Ans.** Pyramid of biomass refers to the relationship between producers and consumers in terms of biomass. It can be:

- Upright, e.g. in grasslands ecosystem
- Inverted, e.g. in pond ecosystem



Pyramid of biomass shows a sharp decrease in biomass at higher trophic levels



Inverted pyramid of biomass. Small standing crop of phytoplankton supports large standing crop of zooplankton

(1)

11. Name the pioneer species on a bare rock. How do they help in establishing the next type of vegetation? Mention the type of climax community that will ultimately get established.

[Delhi 2009]

**Ans.**(i) Lichens are the pioneer species on a bare rock.

(ii) The lichens secrete some acid to dissolve rock and help in weathering and soil formation.

(iii) Later, some small bryophytes invade and hold the small amount of soil.

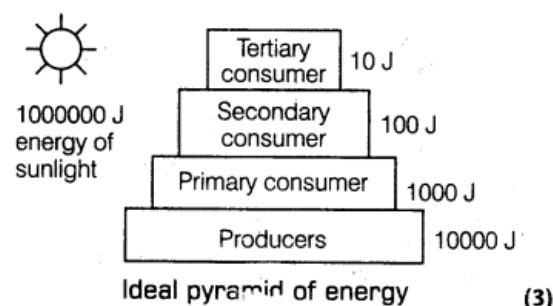
(iv) The bryophytes are succeeded by herbs, shrubs and ultimately big trees.

(v) At last, a stable climax forest is formed.

(vi) Mesophytic climax community will be established from xerophytic habitat.

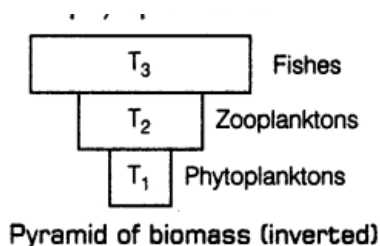
12. Construct an ideal pyramid of energy, when 1000000 J of sunlight is available. Label all its levels. [Delhi 2009]

**Ans.**



13. Construct a pyramid of biomass starting with phytoplanktons, label three trophic levels. Is this upright or inverted? Why? [All India 2009]

**Ans.** The pyramid is inverted because the biomass of fishes is much more than that of the phytoplanktons.



14. Define a climax community. How does a sere differ from a serai community? [Delhi 2008 C]

**Ans.** Climax community can be defined as a community which gets established at the terminal stage of succession and remains in equilibrium with the environment,

Difference between sere and serai community

Sere	Seral community
An entire sequence of communities that successively change in a given area.	Each of the community that gets established between the pioneer and climax communities.

## 5 Marks Questions

15.(i) Differentiate between primary and secondary ecological successions.

(ii) Explain the different steps of xerarch succession occurring in nature. [Foreign 2014]

**Ans.**(i) The differences between primary and secondary ecological succession can be summarised as:

Primary succession	Secondary succession
Initiates in area where organisms never existed, i.e. bare areas.	Initiate in areas where communities are recently destroyed.
The absence of the soil, humus and reproductive structures of organisms.	The presence of the soil, humus and reproductive structures from organisms of previous communities.
Takes a long time, i.e. several hundred to thousands of years to reach climax stage.	Takes comparatively less time (50-200 years) to reach climax or stable stage.

(ii) The different succession in occurring in xerarch re can be summarised as:

- The pioneer species lichens grows on hare rocks
- They secrete some acids that dissolve rock, help in weathering and soil formation.
- Allows small plants, e.g. bryophytes to invade and hold some soil.
- These are succeeded by bigger plants in order as herbs, shrubs and finally big trees.

16.(i) With suitable examples, explain the energy flow through different trophic levels. What does each bar in this pyramid represent?

(ii) Write any two limitations of ecological pyramids. [Delhi 2014 c]

**Ans.**(i) The energy flows unidirectionally from the first trophic level (producers) to last trophic level (consumers), and as the energy flows from one trophic level to another, some energy is always lost as heat into the surrounding environment. So, the amount of energy flowing



decreases at each successive trophic levels.

This can be explained with the help of a diagram of a grazing food chain.

The pyramid of energy is always upright and each bar in the pyramid indicates the amount of energy the present at each trophic level in a given time or per unit area:

(ii) The limitations of ecological pyramids are:

- It does not consider the same single species operating at two or more trophic levels.
- It assumes simple food chains that do not exist in nature and do not accommodate food web.
- Saprophytes, detritivores and decomposers are not given any place in pyramids, despite their vital role in ecosystem (any two).

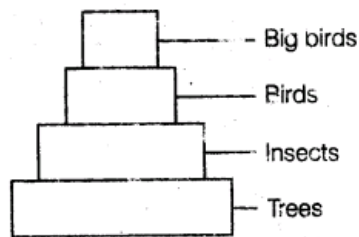
**17. Explain how does a primary succession start on a bare rock and reach a climax community? [Delhi 2012]**

**Ans.** Primary succession rocks The species of organisms that first invade a bare area are called pioneer species. The pioneer species on a bare rock are usually lichens. Lichens secrete acids which dissolve rocks, thereby leading to weathering and soil formation. This paves the way for small plants or bryophytes which hold the soil. They are succeeded by bigger plants and ultimately an entire forest gets established. Forests represent the climax community in this succession.

**18.(i) Draw a pyramid of numbers of a situation, where a large population of insects feed upon a very big tree. The insects in turn, are eaten by small birds which in turn are fed upon by big birds.**

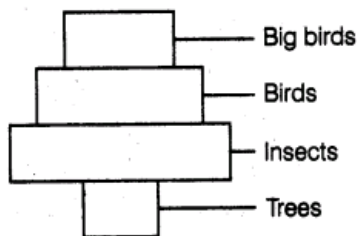
**(ii) Differentiate giving reasons, between the pyramid of biomass of the above situation and the pyramid of numbers that you have drawn. [Delhi 2012]**

**Ans.** (i) Pyramid of numbers showing interaction between trees, insects, birds and big birds.



**Pyramid of number (interaction)**

(ii) (a) Pyramid of number is spindle-shaped as the number of insects is maximum. The number of trees and birds are less than the insects. The number is gradually decreasing at each trophic level.



**Pyramid of number (spindle-shaped)**

(b) The pyramid of biomass in this ecosystem is erect because the biomass decreases at each trophic level.

**19.(i) Explain the significance of ecological pyramids with the help of an example.**

**(ii) Why are the pyramids referred to as upright or inverted? Explain. [All India 2012]**

**Ans. (i) Significance of ecological pyramids**

They graphically represent the relation between producers and consumers. To calculate

energy, content, biomass or numbers, organisms of that trophic level needs to be calculated. A trophic level represents only a functional level not a species as such. A given species may occupy more than one trophic level in the same ecosystem at the same time. The ecological pyramids provide an over all idea of the trophic levels occupied by an organism in an ecosystem.

Example A sparrow is a .primary consumer, when it eats seeds, fruits, peas and a secondary consumer when it eats insects and worms.

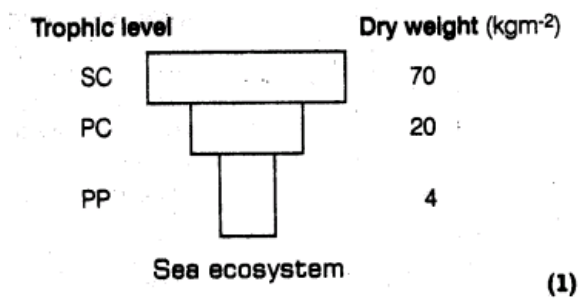
(ii)**Upright pyramids** When producers are more in number and biomass than the herbivores and herbivores are more in number and biomass than the carnivores. Energy at a lower trophic level is always more than at a higher trophic level. Pyramid of energy is always upright.

**Inverted pyramids** When the numbers of producers are less and consumers increase and become largest in top consumer level. Pyramid of number and biomass may be inverted

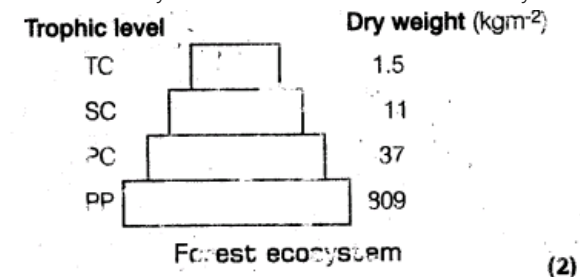
**20.(i) Draw the pyramids of biomass in a sea and in a forest. Explain giving reason, why the two pyramids different.**

**(ii) Pyramid of energy is always upright. Explain.[HOTS; Foreign 2010]**

**Ans.**(i) (a) The pyramid of biomass in a sea ecosystem is inverted. Because, the sum total of the weight of phytoplankton (producer) is far less than a few fishes feeding at higher trophic levels.



(b) Pyramid of biomass in a forest ecosystem is upright because producers are more in biomass than primary consumers. Primary consumers are more than secondary consumers and secondary consumers are more than tertiary consumers (top).



(ii) Pyramid of energy is never inverted. Because, when energy flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step. Each bar in the energy pyramid indicates the amount of energy present at each trophic level in a given time.

**21.(i) Explain how a hydrarch succession progresses from hydric to mesic condition from a stable community?**

**(ii) Why is the rate of secondary succession faster than that of primary succession? [Delhi 2010c]**

**Ans.**(i) Hydrarch succession occurs in wet areas, or water, leading to successional series that progress from hydric to the mesic condition. In hydrarch succession, pioneers are phytoplanktons. These phytoplanktons with time are replaced by free floating angiosperms, followed by rooted hydrophytes, sedges, grasses and finally the trees, leading to mesic condition.

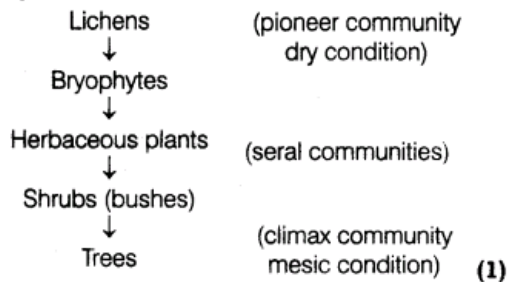
(ii) The secondary succession is faster than primary succession because it begins in areas where natural biotic communities have been destroyed such as abandoned farm lands, burned

or cut forests. Since, some soil is present succession is faster than primary succession. At any time during primary or secondary succession, natural and human induced disturbance can convert a particular serai stage of succession to an earlier stage.

**22.Explain how xerarch succession progresses from xeric to mesic condition and form a stable climax community. You may use a flow Chart.[All India 2010 C]**

**Ans.**Xerarch succession occurs in dry areas and the series progress from xeric to mesic condition. The climax community remains stable as long as environment remains unchanged. With time the xerophytic habitat gets converted into a mesophytic one.

**Stages of xerarch succession are:**



It occurs in following steps as shown in flow chart:

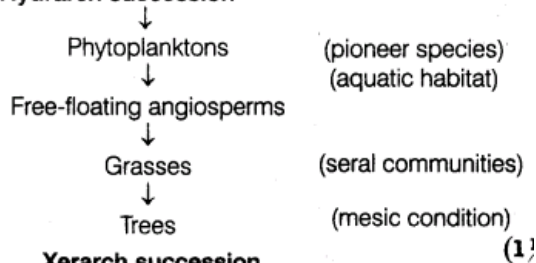
- (i) Lichens secrete some acids which dissolve rocks and help in weathering and soil formation,
- (ii) Bryophytes invade and hold some soil.
- (iii) Bryophytes are succeeded by herbs, shrubs and ultimately big trees.
- (iv) At last, a stable climax forest is formed.
- (v) Finally, a xerarch condition is converted into a mesic one.

**23.All successions proceed to a similar climax community, the mesic. Explain. [HOTS; All India 2008]**

**Ans.**All succession proceed to a similar climax community, i.e. the mesic.

- (i) Succession of plants occurs as hydrarch or xerarch.
  - (ii) Hydrarch succession occurs in water bodies and the successional series progress from hydric to mesic conditions.
  - (iii) Xerarch succession takes place in dry areas and the series progress from xeric to mesic conditions.
  - (iv) Hence, both xerarch and hydrarch conditions lead to medium water conditions (mesic).
- So, it can be said that all successions proceed to a similar complex community.

**Hydrarch succession**



**Xerarch succession**

