

## Understandings:

### 1. Define species.

- Species is defined as a group of organisms that can interbreed with each other and produce fertile offspring. This means that when the offspring of two species is unable to reproduce (and as a result passing on their genes) the two species are not in the same species. Two examples are ligers (tiger and lion) and mules (horse and donkey). In other words, they are cross-breeding.

This reproductive separation leads to distinguishable characteristics.

### 2. Define population, and state that organisms of same species may be separated in different populations.

- A population is a group of same species, living at the same place at the same time.

However, two populations of same species may live in different areas, and therefore not interbreed. But as long as they still have potential of interbreeding and produce offspring, they are still considered as same species.

On the other hand, genes in one population might gradually change and might come to a point where the two populations can no longer interbreed. Nevertheless, it is very hard to determine the exact point of when this happens.

### 3. State the two methods in which species gain nutrition.

- The method of nutrition can be divided into two groups:

Autotrophic species, or self-feeding organisms, have the ability to produce their own organic compound from inorganic compounds such as CO<sub>2</sub>. Almost all green plants have this ability.

Heterotrophic species, or feeds-from-other organisms, obtain their organic compounds by feeding on others. All consumers are heterotrophic.

However, we must be aware that there are unicellular organisms that have both autotrophic and heterotrophic traits. They are known to be mixotrophic. An example is *Euglena gracilis*, which use photosynthesis when there is sufficient light and endocytosis when there is lack of light.

### 4. Explain producers.

- Producers are a group of organisms that are autotrophic.

### 5. Explain consumers.

- Consumers are a group of organisms that are heterotrophic.

Consumers feed on either living organisms (mosquitos) or organisms that just died (all predators). Then they ingest the food and digest, hence gaining nutrients.

## 6. Explain detritivores.

- Detritivores are a type of heterotrophs that feed on dead organisms, a.k.a. decomposers. Detritivores ingest and digest internally, just like consumers. Ex, worms.

## 7. Explain saprotrophs.

- Saprotrophs are also a type of heterotrophs that feed on dead organisms. The only difference between saprotrophs and detritivores is that saprotrophs secrete digestive enzymes and hence digest organic matter externally. Then they absorb the digested material. Ex, bacteria and fungi.

## 8. Define community.

- A community is a collection of populations of different species living together. All species are dependent on each other, hence they always form some sort of community. Ex, bees pollinate flowers by getting nectar as reward.

## 9. State that ecosystems are formed when a community interacts with abiotic factors.

- Communities and abiotic factors, such as weather, water, rock, soil, sun exposure, etc. form this complex system of interactions where they affect each other, but in a balance. This system of biotic factors (living things) and abiotic factors is called an ecosystem.

## 10. Give a visual representation of an ecosystem.

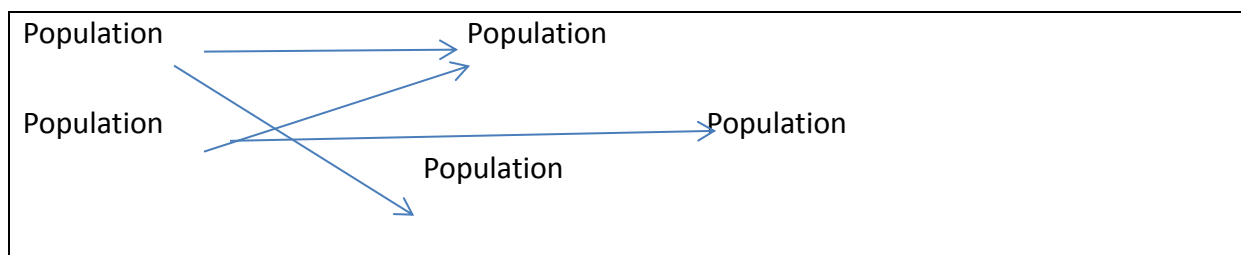
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Abiotic factors: Sun, water flow, altitude, wind, pH, temperature etc.

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Biotic factors:

Community



(Populations can be detritivores, primary, secondary etc. consumers and producers)

## 11. State that autotrophs and heterotrophs gain nutrients from abiotic environment.

- We know that autotrophs can produce their own nutrients from  $\text{CO}_2$  and nutrients from their roots (mainly NPK).

Heterotrophs can also gain inorganic nutrients from the abiotic environment, such as Na, Ca, and K.

## **12. Explain the nutrient cycle.**

- This is the general cycle for all nutrients, including Carbon and Nitrogen and all other important nutrients.

The main idea is that all nutrients are recycled if we just let the ecosystem do its job.

Organisms use inorganic/organic matter to live, all organisms decompose and get broken down into small elements and other organisms use it again to live.

## **13. Explain the sustainability of ecosystems.**

- Ecosystems can basically last forever as long as sun is active. However, we humans interfere and make it no longer sustainable. Humans deplete of fossil fuels are too fast, which increases the carbon release, which organisms cannot replenish fast enough.

A sustainable ecosystem needs these things:

1. Nutrient availability.
2. Something that have ability of detoxification of waste products. Ex, bacteria use the toxic ammonium as an energy source.
3. Continuous supply of energy (sun).

## **Applications and skills:**

### **1. Be able to classify species into autotrophs, consumers, detritivores or saprotrophs by looking at their mode of nutrition.**

- Ask some basic questions to reach conclusion.

1. Is ingestion taking place?
2. If yes, does it feed on dead or living/recently killed animals?
3. If no, does it secrete enzymes?

### **2. Be able to set up a mesocosm.**

- Mesocosm is a small ecosystem, usually to test the sustainability of nutrient cycle.

### **3. Test for association of two species by using chi-squared test.**

- Yes, this is done in class.

### **4. Be able to discuss the results, and whether it is reliable or not.**

- Yes.