

Chapter 02: Introduction to Ecology (Principal concepts)

TD 01: Ecological processes (Organic matter cycle)

1-Organic matter definition:

Organic matter refers to any material that contains carbon compounds, derived from living tissues including substances such as plant and animal residues, dead organisms, and other biological materials. Organic matter plays a crucial role in nutrient cycling, soil structure and fertility. It serves as a source of energy and nutrients for soil organisms and productivity.

2-Organic matter cycle:

The majority of life on Earth is based on food chains, which revolves around organic matter production, as plants use sunlight, water and carbon dioxide to make food via the procedure of **photosynthesis**. While **decomposition** is the process by which dead organic substances (Plants, animals and humans) are broken down into simpler inorganic matter such as water, simple sugars and mineral elements.

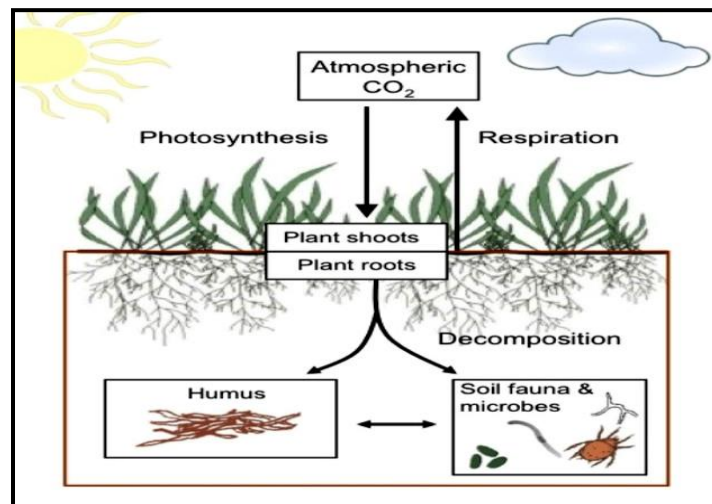


Figure 01. Matter cycle between photosynthesis and decomposition

3-Matter production (Photosynthesis):

Plants are the only autotroph organisms that serve as primary producers in food chains. They represent the foundation of the ecosystem pyramids by obtaining energy and nutrients from using sunlight through photosynthesis to make organic substances from inorganic ones, according to the following sources and equation:

- Carbon dioxide is obtained through tiny pores present in the leaves of the plant called stomata.
- Oxygen is also released through the stomata (respiration).
- Water is obtained by roots and then passed on to the leaves through the vascular plant tissue systems.

- Sunlight is absorbed by chlorophyll, a green pigment located in chloroplasts; where photosynthesis takes place.

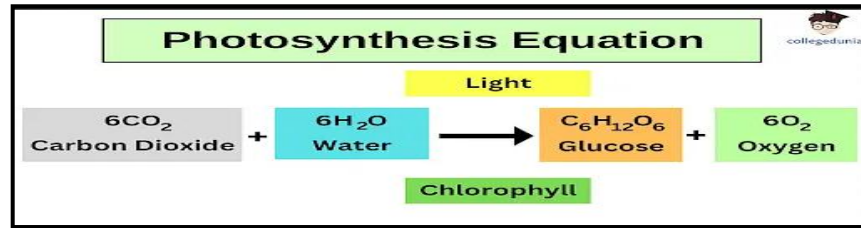


Figure 02. Photosynthesis equation

4-Matter degradation (Decomposition)

It is a basic cleaning tool of nature, and a principal metabolic process, where organic residues are degraded and decomposed by oxidative processes involving rotting organisms species (**Soil biota**). It is one of the significant and essential processes of the ecosystem that corresponds to the disintegration or rupture of complex organic matter into a simpler inorganic matter in the following steps:

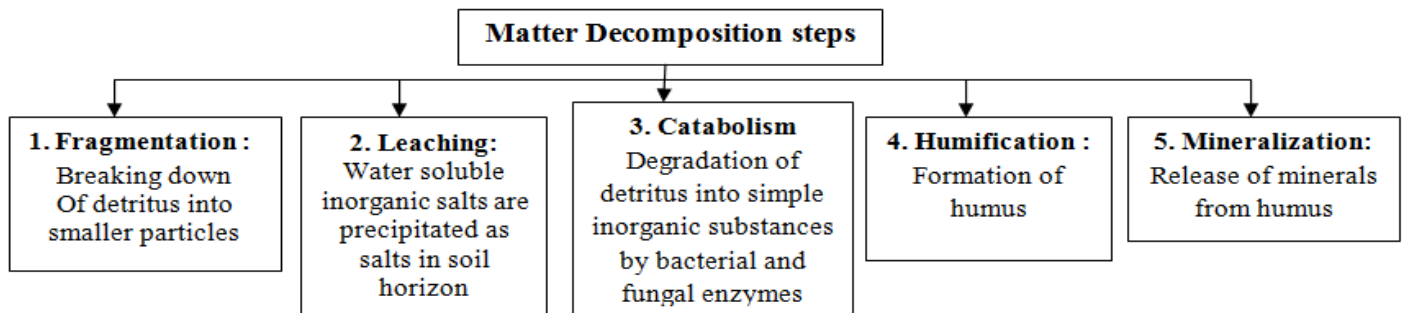


Figure 03. Main matter decomposition steps

Soil biota is a term that represents all organisms that spend a portion of their life cycle within a soil profile and constitute the land food webs (matter decomposition):

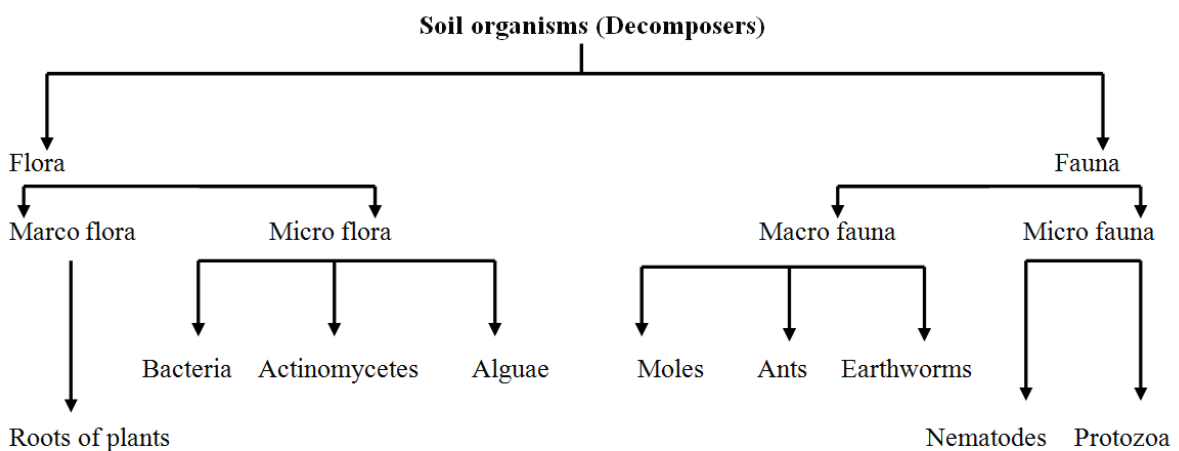


Figure 04. Soil organism's classification

TD 02 : Food chain types

1-Food chain definition:

A food chain represents a series of living creatures. It begins with producer organisms (plants which produce their own food via photosynthesis) and ends at an apex of predator (carnivores), or decomposer species (bacteria). A food chain shows how organisms are related to each other by the food they eat, in a series of degrees where each element represents a different trophic level:

Table 01. Different trophic levels of a food chain

Trophic level	Type of organism	Energy Source	Example
1st	Primary Producer	Sun	Trees, plants, algae, phytoplanktons
2nd	Primary consumer	Primary Producer	Herbivores (Grasshopper, deer, giraffe, zooplanktons)
3rd	Secondary consumer	Primary consumer	Carnivores (Frogs, lizards, crabs, wolf, small fish)
4th	Tertiary consumer	Secondary consumer	Top Carnivores (Eagle, tiger, lion, sea otters, big fishes)

2-Food chain types:

According to the ecosystem quality, food chains can be:

2-1-Grazing food chain:

This type of food chain can be found in almost all natural ecosystems. It starts from the green plants; where the major source of energy is given by photosynthesis. These primary producers are eaten by herbivores, which in turn are consumed by carnivores. The grazing food chain doesn't consist of microbes or other decomposers; it is carried out by the macroscopic organisms.

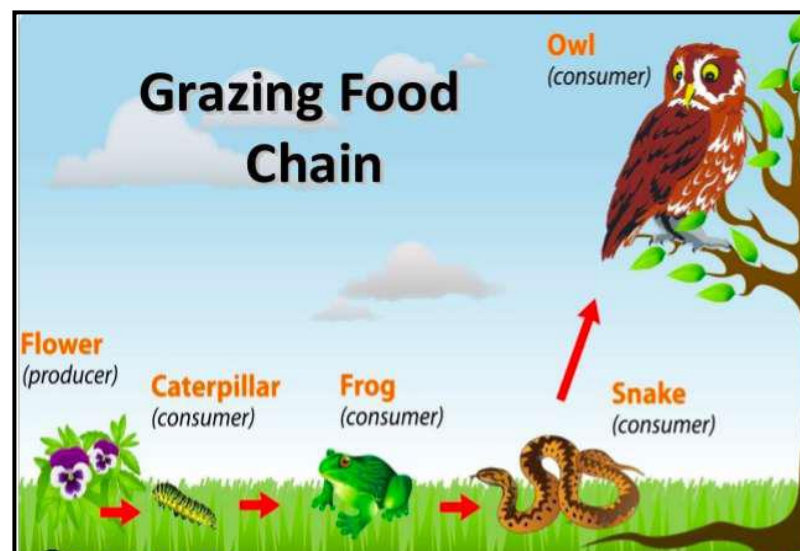


Figure 01: Example of grazing food chain

2-2-Ocean food chain:

This food chain type is very important for all living organisms in oceans. It consists of the same structure of the grazing chain, where the main producers are microscopic phytoplankton that can photosynthesize the organic matter, which means that they use the sun's light energy to produce food. In ocean food chain consumers consist of herbivores and carnivores' species known as zooplankton. Examples: Surgeon fish, turtles and sea cows..... The carnivores that eat the herbivores include sardines, herring and menhaden.....

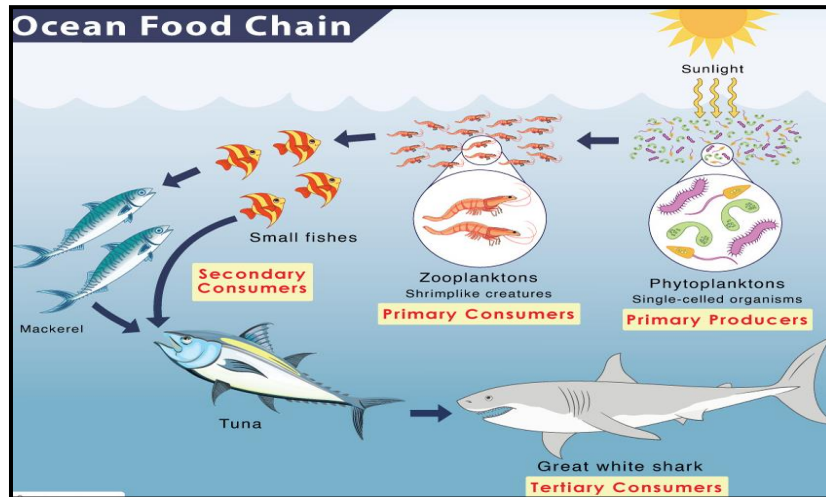


Figure 02. Example of Ocean food chain

2-3- Detrital or decomposer food chain:

The detritus food chain is less dependent on solar system, it starts from the dead organic matter such as dead bodies of animals or forest fallen leaves, which are eaten by microorganisms and then followed by detritus feeding organisms (detritivores) and their predators. This process gets completed only by the sub-soil organisms, which can either be macroscopic or microscopic.

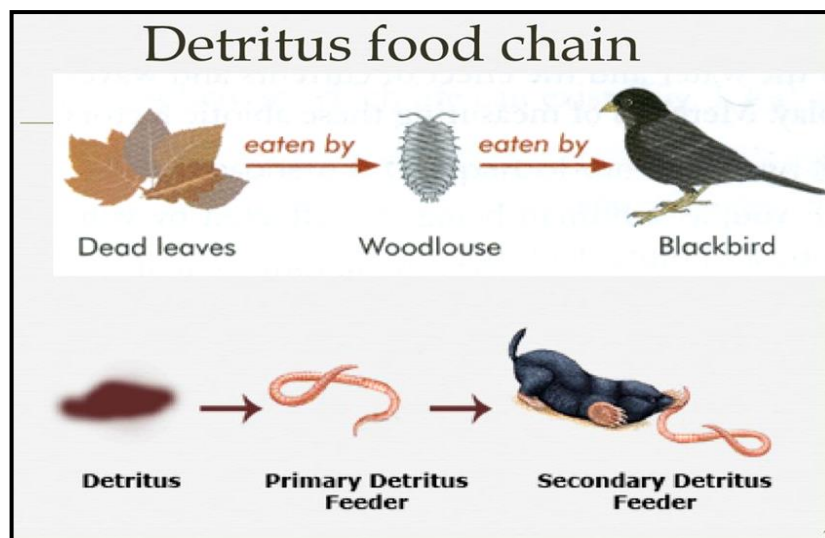


Figure 03. Example of detritus food chain