

## UNIT 7. ECOLOGY

### 7.1 ECOSYSTEMS AND SPECIES

An **ecosystem** is a system formed of the *biocenosis* and *biotope*; the relationships established between the populations of living things form the **biocenosis**, while the relationships with the physical factors constitute the **biotope**. A **population** is a group of individuals of the same species that have the ability to reproduce amongst themselves.

#### SPECIES

\* *As a reproductive unit.* The species is the taxonomic unit that describes all organisms capable of reproducing by producing fertile offspring.

\* *As a unit of evolution.* Due to reproduction, each species is also the unit of evolution.

Given that each species is the result of interbreeding between members over the length of their history, member organisms are more closely related to each other than to any other organisms. So they have in common certain structural and functional characteristics and share the species' gene pool.



\**As an ecological unit.* Being evolutionary units, all species are also ecological units. Each one is defined by its ecological niche: its place in nature (it lives in a certain environment, it uses certain materials, it eats certain types of food, with certain habits, it reproduces following certain habits, etc.)

### 7.2 ENVIRONMENTAL FACTORS

The environmental factors are all the components of an ecosystem, whose presence or variation influences the organism that from the biocenosis. The environmental factors can be abiotic and biotic.

**Abiotic.** These factors are the physical and chemical elements of an ecosystem.

The most important abiotic factors are:

- Temperature; most living things cannot live at temperature below 0°C or above 50°C).
- Light; essential for autotrophic organisms.
- Water; without water life cannot exist.



**Biotic.** These factors refer to any organism or the behavior of any organism which affects the life of the other organisms within the system. We can distinguish intraspecific and interspecific relationships:

- **Intraspecific relationships** are relationships between members of the same species. The most important are *competition*, where animals compete for resources such as food, mates, territory, etc., and *associations*, including related individuals (family) or not related (gregarious).

- **Interspecific relationships** are relationships between members of different species. They are classified according to the effects that individuals of interacting species have on each other, using symbols: – (negative effects), + (positive effect) and 0 (no effects). Some of the most common are Competition (-,-); Predation (+,-); Parasitism (+,-); Commensalism (+,0) and Mutualism (+,+).

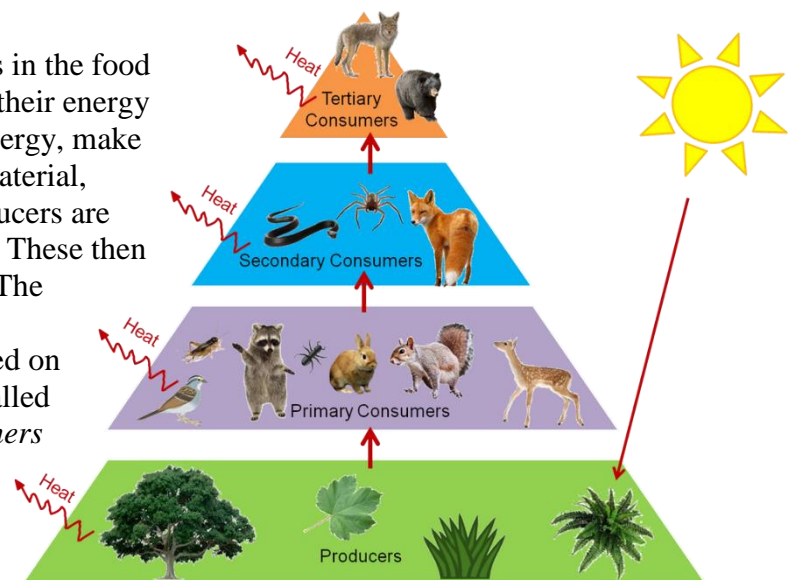
Species A	Species B	Name of Interaction
+	+	Mutualism
-	-	Competition
+	-	Predation
+	-	Parasitism
+	0	Commensalism

### 7.3 MATTER AND ENERGY IN ECOSYSTEMS

To understand the relationships within an ecosystem, it is useful to visualise the food or trophic structure. To do this, all the organisms of the biocenosis must be grouped according to how they obtain nutrients.

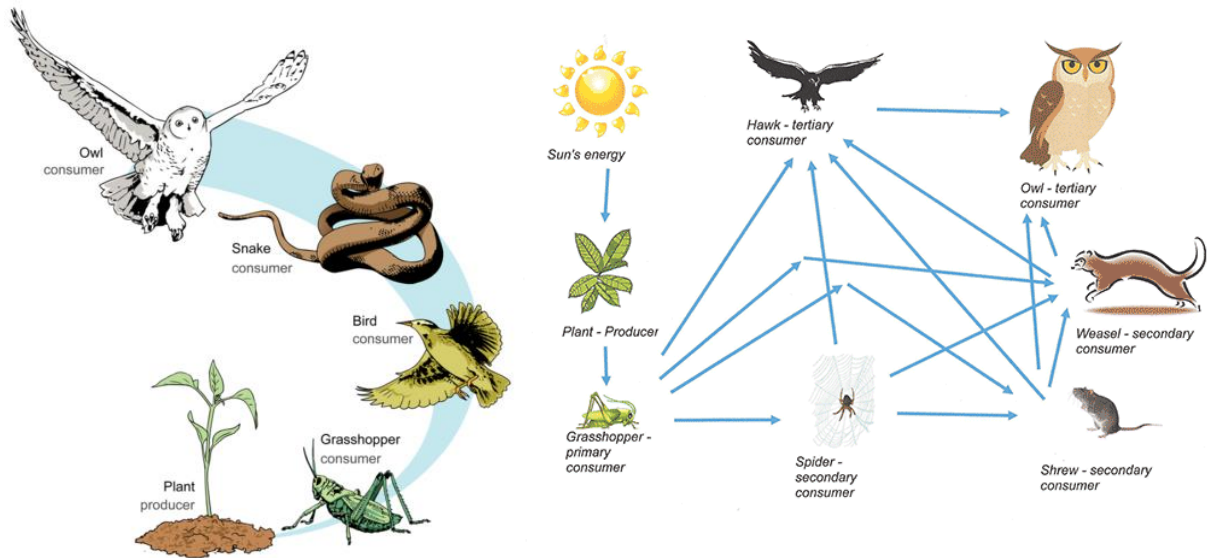
#### TROPHIC LEVEL

The position an organism occupies in the food chain. Green plants, which obtain their energy directly from sunlight from this energy, make organic material from inorganic material, form the level of **producers**. Producers are autotrophs – they make their food. These then are the base of all food pyramids. The **consumers** are heterotrophic organisms. *Primary consumers* feed on plants (the producers), these are called herbivores. The *secondary consumers* feed on the primary consumers. The tertiary consumers feed on the consumers from the level below, etc. Many animals belong to different trophic levels. The decomposers obtain their energy from the chemical decomposition of dead organisms or from the waste products of plants and animals. They are above all, bacteria and fungi. The role they play is vital, they return the organic material to the environment as inorganic material, so that it can be re-used again by plants.



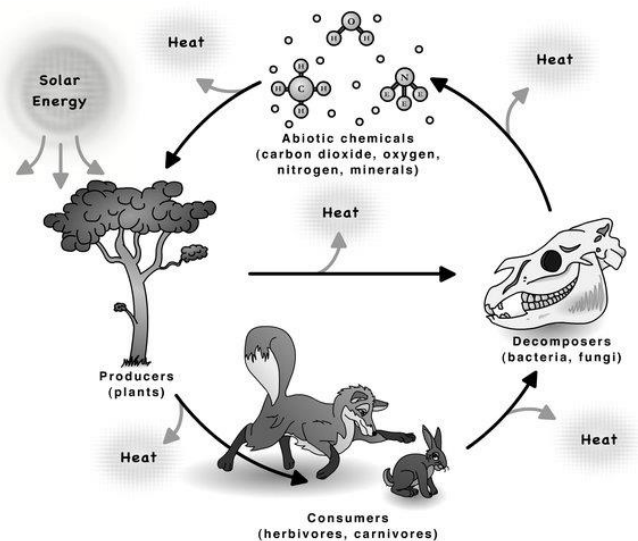
A **trophic chain** is a diagram which has drawings or the names of the different organisms in the different trophic levels of the ecosystem. The feeding relationship is indicated by arrows. The tip of the arrow indicates the organism which eats, and the end of the arrow the organism which is eaten.

**Trophic networks** are representations of all the trophic chains in an ecosystem and how they interconnect with each other.



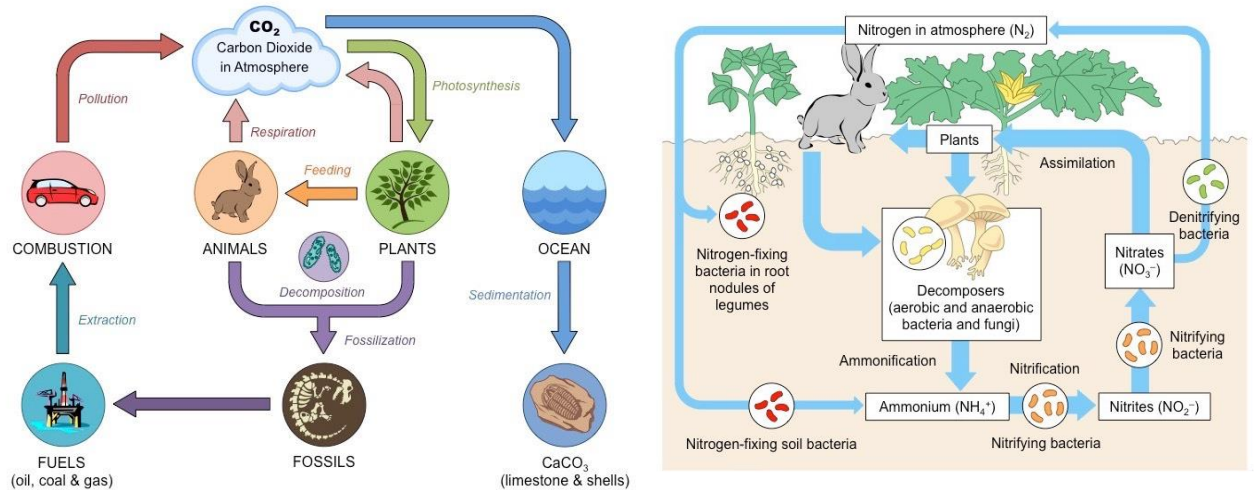
### THE FLOW OF ENERGY

Energy enters the ecosystem via the producers (plants), as energy from the sun. Plants using photosynthesis, convert light energy, into chemical energy, this energy is then stored in the bonds of the products. This energy is then transferred from level to level as food; a good part of the energy is lost from one level to another, mainly in the form of heat (e.g. from respiration), so the chain rarely has more than five levels, since the fifth level rarely contains sufficient energy to support a sixth. Energy is also wasted in the products of excretion.



## CIRCULATION OF MATERIAL

We have already seen that the energy is not a cyclical process, due mainly to the waste from respiration and excretion. Nevertheless, the material is recycled. The chemicals involved are cycled (*biogeochemical cycles*) they pass from living things (in different trophic levels) to their environment (rocks, water, air). E.g. the Carbon cycle, the Nitrogen cycle



## 7.4 TROPHIC PARAMETERS

### BIOMASS

The mass, fresh or dry of living things per unit of area (for terrestrial communities), or unit of volume (in aquatic communities)

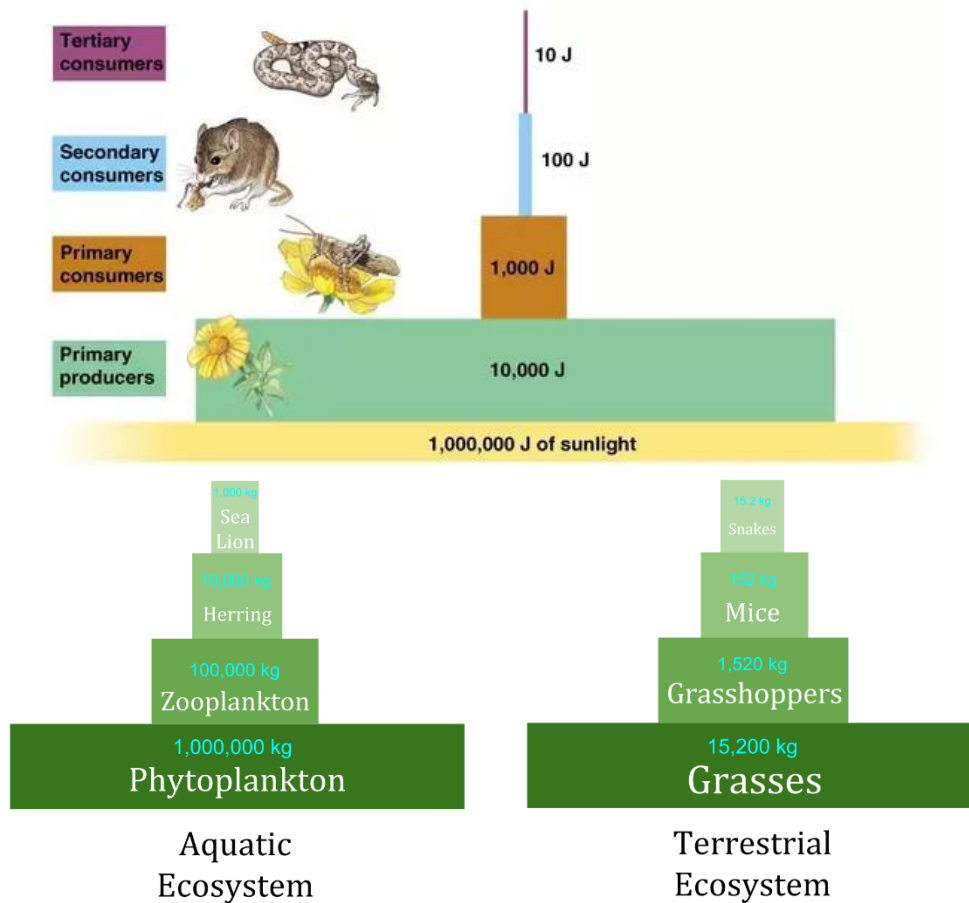
### PRODUCTIVITY

The capacity at which an organism, population or community assimilates energy. Primary production is the total quantity of the organic material (biomass) synthesized by the producers (green plants) of an ecosystem. Secondary production is the biomass produced by the heterotrophs.

### ECOLOGICAL PYRAMIDS

A mode of presentation, using horizontal bars, one on top of the other, such that each of the bars represents the same characteristic in the ecosystem. The length of each bar is proportional to the value represented and each step on the pyramid is one link in the food chain, such that the height of the pyramid is a function of the length of the chain. There are food pyramids, biomass pyramids, energy, population etc.





### ECOLOGICAL BALANCE SUCCESSION

This is an evolutionary process of the biocenosis, in which species replace others in the same biotope, beginning with the pioneer community (initial community) to end up with the climax community. Succession is produced due to changes in the physical environment, due to changes in the climate, or due to other changes caused by the community, or by other organisms close by that cause changes in the environment. The *primary succession* is that which initiates a virgin biotope (one which has never been inhabited by living organisms), e.g. a new volcanic island. The *secondary succession* is that which takes over after the primary succession has been eliminated or outcompeted.

### CLIMAX

This denotes the final stage of a geobotanic succession, in equilibrium with the conditions of the environment. This constitutes the optimum biological stability of a community – the culmination from: primary → secondary → tertiary → ..... → climax

