UNIT 5. ECOSYSTEMS
1. ECOSYSTEM

- Ecosystem refers to the organism which live in a particular area, the relationship between them, and their physical environment.

- Ecosystem have two components:
  - **Biocenosis**: is the set of living being in the ecosystem: animals, plants, fungi and all types of microorganisms.
    - Biotic factors are the effects which other organisms have on a living being in its environment.
  - **Biotope**: is the inorganic part of the ecosystem, the physical environment.
    - Abiotic factors are the physical and chemical elements in an ecosystem which affect living organisms.
1. ECOSYSTEM

ECOSYSTEM = BIOCENOSIS + BIOTOPE
HABITAT: is the physical place where a species lives. It provides the natural conditions the species need to survive.

ECOLOGICAL NICHE: is the way a species relates to the biotic and abiotic factors in an ecosystem.
Two species can share the same habitat. However, they do not usually occupy the same ecological niche simultaneously or permanently. If both species eat the same food, require the same temperature, etc., they will compete with each other. The species which adapts best will exclude the other one.
Living organisms can be classified according to the way they obtain food.

- **Producers**: are living beings which make their own organic matter from carbon dioxide, water and mineral salt. To do this producers use energy from the Sun during photosynthesis (autotrophic nutrition). E.g: Plants, algae and some bacteria are producers.

- **Consumers**: are living being which cannot produce their own organic matter. They feed on organic matter produced by other beings, and transform it into their own organic matter (heterotrophic nutrition). Types:
  - **Primary consumers**: feed on producers (herbivores)
  - **Secondary consumers**: are carnivores and feed on primary consumers. Some of them are omnivores and feed on producers as well.
  - **Tertiary consumers**: feed on primary consumers and secondary consumers. Some of them are omnivores and feed on producers as well.

- ** Decomposers**: are living beings which decompose organic matter into inorganic matter. Producers use this inorganic matter in the process of photosynthesis.
3. HOW DO LIVING THINGS OBTAIN FOOD?

- **Producers**
- **Consumers**
- ** Decomposers**
4. WHAT IS TROPHIC DYNAMICS?

- **Trophic dynamics** is the system which describes the position of a living beings in a food chain. The system uses trophic levels to explain what an organism eats or is eaten by.

- **Food chain**: are a way of representing the passing of food among the living beings of an ecosystem (each trophic level provides food for the next level). They always begin with a producer which transfers its matter and energy to a primary consumer, and this may be followed by a secondary consumer, to finish with decomposer.
4. WHAT IS TROPHIC DYNAMICS?

- **Trophic networks (web):** are a set of trophic chains that cross over because they have common steps.

- It is difficult to find isolated trophic chains in an ecosystem. A very complex ecosystem may have an enormous trophic network made up by thousands of trophic chains.
In ecosystems, matter and energy are transmitted through the food relationship between organisms.

Energy flow

Ecosystems must receive energy constantly to work properly. The energy which makes an ecosystem function comes from the SUN. The luminous energy which reaches an ecosystem is converted into chemical energy when it is taken in by living beings (autotrophic). Then the energy goes from one being to another by means of food. From level to level, only a small proportion of energy is used to build new biomass. The rest is lost as calorific energy (heat). Due to this energy loss at each trophic level, it takes a lot of producers to support a few of the top consumers. We can say that energy circulates as a flow, following a LINEAR PATH.
5. HOW ARE MATTER AND ENERGY TRANSMITTED?

- Material flow.

- Inorganic matter in an ecosystem is taken by autotrophic living beings which transform it into organic matter. Heterotrophic beings eat this organic matter and then it goes from one of them to another by means of food. The waste and corpses are transformed into organic matter again by decomposers. In this case, we say that matter circulates in the form of a CYCLE.
6. WHAT IS TROPHIC PYRAMIDS?

- **Trophic pyramid**: is a graphic representation of a particular characteristic at each trophic level.

- **There are three types of trophic pyramid**
  - **Number pyramid**: Represent the number of individuals at each trophic level per unit of area or volume of an ecosystem.
  - **Biomass pyramid**: This represents the biomass, or amount of organic matter which forms an individual, a trophic level or an ecosystem. Biomass is measured in grams or kilograms of dry organic matter per unit area or volume.
  - **Energy pyramid**: This represents the energy stored at each trophic level at a certain time. It also shows the flow of energy through the trophic levels.
7. WHAT ARE BIOTIC RELATIONS?

- The **biotic relations** are the interactions among the living beings in an environment.

- There are two types of biotic relations: interspecific relations and intraspecific relations.

  - **Interspecific relationships:** They are interactions among organisms of different species. They can be:
    - **Mutualism:** This is a relationship between two or more individuals for mutual benefit.
    - **Commensalism:** This is a relationship between two living organisms where one benefits, but the other is not affected.
    - **Inquilinism:** This is a specific form of commensalism in which one organism uses another organism for housing.
    - **Parasitism:** This is a relationship in which one species (a parasite) lives at the expense of another species (the host), and harms the host in the process.
    - **Depredation:** This is a relationship in which one individual (a predator) kills and eats another living being (the prey).
7. WHAT ARE BIOTIC RELATIONS?

- Interspecific relationships:
  - MUTUALISM
  - COMMENSALISM
  - INQUILINISM
7. WHAT ARE BIOTIC RELATIONS?

- Interspecific relationships:
  - Parasitism
  - Depredation
Intraspecific relationships: They are interactions among organisms of the same species. They can be:

- **Gregarious:** This describes groups of individuals, not necessarily related, which live together for some time to provide mutual help.
- **Colonial:** Related individuals live together.
- **Social:** This describes groups of individuals organised in a hierarchy. Work is distributed within the group. Individuals usually have anatomic and physiological differences.
- **Familiar:** This describes groups of related individuals which live together to procreate and protect the young.
7. WHAT ARE BIOTIC RELATIONS?

- Intraspecific relationships:

  GREGARIOUS
  ![Image of a group of zebras](image1)

  COLONIAL
  ![Image of coral](image2)

  SOCIAL
  ![Image of a group of bees](image3)

  FAMILIAL
  ![Image of elephants](image4)
7. TERRESTRIAL ECOSYSTEMS

- **Terrestrial ecosystems**: are ecosystems where organism can live on land, surrounded by air.

- The distribution of organism in the ecosystem depends mainly on abiotic factors related to the climate: temperature, light and humidity.

- There are three large climate zone in each hemisphere:
  - **Frigid zone**: cold zone from the Poles to the polar circles.
  - **Temperate zone**: area between the polar circles and the Tropics.
  - **Torrid zone**: hot zone between the Tropic of Cancer and the Tropic of Capricorn.
# 7. Terrestrial Ecosystems

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Terrestrial Ecosystem</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frigid zone (cold zone)</strong></td>
<td><strong>Tundra</strong></td>
<td>- Permanently frozen soil</td>
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<tr>
<td></td>
<td></td>
<td>- Flora: moss, lichens</td>
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<tr>
<td></td>
<td></td>
<td>- Fauna: reindeer, white foxes, lemmings</td>
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<tr>
<td><strong>Temperate zone</strong></td>
<td><strong>Taiga</strong></td>
<td>- Long, dark, cold winters; abundant snow</td>
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<td></td>
<td></td>
<td>- Short, warm, humid summers</td>
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<tr>
<td></td>
<td></td>
<td>- Flora: pine, fir trees</td>
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<td></td>
<td></td>
<td>- Fauna: bears, lynxes, wolves</td>
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<tr>
<td><strong>Mediterranean forest</strong></td>
<td></td>
<td>- Cold and warm seasons; abundant rainfall</td>
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<tr>
<td></td>
<td></td>
<td>- Flora: oak, beech, chestnut trees</td>
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<tr>
<td></td>
<td></td>
<td>- Fauna: bears, foxes, squirrels, mountain lions</td>
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<tr>
<td><strong>Grassland (Savannah)</strong></td>
<td></td>
<td>- Warm, dry summers; mild winters; low rainfall</td>
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<td></td>
<td></td>
<td>- Flora: Holm oaks, cork oaks</td>
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<td></td>
<td></td>
<td>- Fauna: rabbits, reptiles, wild boars, a variety of birds</td>
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<tr>
<td><strong>Desert</strong></td>
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<td>- Dry, wet seasons; warm temperatures all year round</td>
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<td></td>
<td></td>
<td>- Flora: grass, shrubs, some trees</td>
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<tr>
<td></td>
<td></td>
<td>- Fauna: zebras, giraffes, gazelles, lions</td>
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<tr>
<td><strong>Rainforest</strong></td>
<td></td>
<td>- Very high daytime temperatures, very low night time temperatures; extremely low rainfall</td>
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<td></td>
<td></td>
<td>- Flora: cacti</td>
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<td></td>
<td></td>
<td>- Fauna: camels, lizards, birds, small mammals</td>
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<tr>
<td></td>
<td></td>
<td>- High rainfall and high temperatures all year round</td>
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<tr>
<td></td>
<td></td>
<td>- Different layers of flora and fauna</td>
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<tr>
<td></td>
<td></td>
<td>- Flora: small to very large trees</td>
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<tr>
<td></td>
<td></td>
<td>- Fauna: snakes, iguanas, bats, birds, monkeys; a wide variety of insects.</td>
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</tbody>
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8. AQUATIC ECOSYSTEMS

- **Aquatic ecosystems**: are ecosystems where organisms can live surrounded by water.
- In these ecosystems, the abiotic factors which most influence the distribution of organisms are: light, temperature, pressure, salinity and oxygen.
- There is less diversity of species in freshwater than in marine ecosystems

<table>
<thead>
<tr>
<th>FRESHWATER ECOSYSTEMS</th>
<th>MARINE ECOSYSTEMS</th>
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<tbody>
<tr>
<td>About 0.3% of the surface water on Earth is contained in fresh water ecosystems.</td>
<td>About 97% of water on Earth is contained in marine ecosystems</td>
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<tr>
<td>The salinity of fresh water is 0.18g/L</td>
<td>The salinity of seawater is 35g/L</td>
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<tr>
<td>Types:</td>
<td>Tides, currents and waves cause a lot of movement in the water.</td>
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<tr>
<td>- <strong>Lentic ecosystems</strong>: There are found in standing or still water, such as pools, ponds and lakes. They vary in deep (deep areas are not exposed to light)</td>
<td>Marine ecosystems are classified into different zones, according to the depth and distance from the coast.</td>
</tr>
<tr>
<td>- <strong>Lotic ecosystems</strong>: There are found in running water, such as streams and rivers. Living beings have adapted to living in running water. This water is highly oxygenated.</td>
<td>- Intertidal zone: This is the area between tide marks.</td>
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<td>- Neritic zone: This area receives ample sunlight. The sea floor is covered with seaweed and is very rich in life.</td>
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<td>- Pelagic zone: This is the part of the open sea which is a long way from the coast.</td>
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<td></td>
<td>- Abyssal plain: Pressure at this depth is very high. The temperature is around 2-3ºC. There is little food and very little light reaches the sea floor.</td>
</tr>
</tbody>
</table>
8. AQUATIC ECOSYSTEMS

A. Intertidal zone
B. Neritic zone
C. Pelagic zone
D. Abyssal zone

Zones in marine ecosystems