

ABIOTIC FACTORS

A- Climatic factors :

1. Definition of climate :

Climate is the set of atmospheric and meteorological conditions specific to a region of the globe. The climate of a region is determined by studying meteorological parameters (temperature, humidity, rainfall, wind strength and direction, sunshine duration, etc.) assessed over several decades.

2. Main climatic factors :

The elements of climate that play an ecological role are numerous. The main ones are temperature, humidity and rainfall, daylight and photoperiod (the division of the day between the duration of the daylight phase and the duration of the dark phase). Others, such as wind and snow, are less important, but in some cases can play a significant role.

2.1. Temperature:

Temperature is the most important element of climate, since all metabolic processes depend on it. Phenomena such as photosynthesis, respiration and digestion follow van't Hoff's law, which states that the speed of a reaction is a function of temperature.

The vast majority of living organisms can only survive in a temperature range between 0 and 50°C on average. Temperatures that are too low or too high trigger a state of dormancy (quiescence) in some animals, known as estivation or hibernation. In both cases, development comes to a virtual halt.

The limits of geographic ranges are often determined by temperature, which acts as a limiting factor. Very often it is the extremes of temperature rather than the averages that limit the establishment of a species in an environment.

2.2 Humidity and rainfall :

Water represents 70 to 90% of the tissues of many species during their active life. Water supply and loss reduction are fundamental ecological and physiological problems. Depending on their water requirements, and consequently their distribution in the environment, there are :

Aquatic species that live permanently in water (e.g. fish);

Hygrophilous species that live in damp environments (e.g. amphibians);

Mesophilic species with moderate water requirements that tolerate alternating wet and dry seasons;

Xerophilous species that live in dry environments where the water deficit is accentuated (desert species).

2.3. Light and sunshine :

Sunshine is defined as the time during which the sun shines. Solar radiation is essentially made up of visible light, infrared rays and ultraviolet rays. Illuminance is important not only because of its intensity and nature (wavelength) but also because of the duration of its action (photoperiod). The photoperiod increases from the Equator towards the Poles. At the Equator, days are strictly equal to nights throughout the year. At the Tropics, the inequality remains slight and practically without influence. At very high latitudes, i.e. beyond the Arctic Circle, nights and days are longer than 24 hours, reaching 6 months of days and 6 months of nights at the Poles themselves. The atmosphere acts as a screen or, better still, a filter, blocking out some radiation while allowing others to pass through. In effect, the atmosphere absorbs some of the sun's rays and diffuses others.

In addition to these two actions, there is the phenomenon of reflection.

2.4. Wind :

Wind results from the movement of the atmosphere between high and low pressure. The impact of this factor on living beings can be summarised as follows:

- It has a drying effect because it increases evaporation.
- It also has a considerable cooling effect.
- Wind disperses animals and plants.
- Insect activity is slowed by the wind.
- When gales blow down trees in the forest, they create clearings in which young trees can grow.
- Wind has a mechanical effect on plants, which lie on the ground and take on particular forms known as anemomorphosis.

2.5. Snow:

This is an important ecological factor in the mountains. Snow cover protects the ground from cooling. Under one metre of snow, the ground temperature is -0.6°C , compared with -33.7°C at the surface.

B- Edaphic factors :

1. Definition of soil :

Soil is a complex and dynamic living environment, defined as the natural surface formation, with a loose structure and variable thickness, resulting from the transformation of the underlying parent rock under the influence of various processes: physical, chemical and biological, in contact with the atmosphere and living beings. It is made up of a mineral fraction and organic matter. Plants and animals draw water and mineral salts from the soil and find the shelter and/or support they need to flourish.

2. Edaphic factors :

2.1. Soil texture :

Soil texture is defined by the size of the particles that make it up: gravel, sand, silt, clay.

There are three main types of structure:

Particular: where the soil elements are not bound together, the soil is very loose (sandy soil).

Massive: where the elements of the soil are bound together by cement (organic matter, limestone) to form a highly resistant discontinuous or continuous mass (clay soils). This type of soil is compact and not very porous. It does, however, prevent the vertical migration of temperature- and humidity-sensitive animals, thus prohibiting their existence.

Fragmentary: where the elements are bound together by organic matter and form aggregates (heterogeneous assembly of substances or elements that adhere firmly to one another) of varying sizes.

This structure is the most conducive to life for living organisms, as it contains a sufficient proportion of voids or pores which encourage root life and biological activity in general, by allowing air and water to circulate.

2.3. Soil water :

Water is present in the soil in four specific states:

Hygroscopic water: comes from atmospheric moisture and forms a thin film around soil particles. It is retained very energetically and cannot be used by living organisms.

Non-absorbable capillary water: occupies pores with a diameter of less than 0.2 mm. It is also retained too vigorously to be used by living organisms. Only certain highly adapted organisms can use it.

Absorbable capillary water: located in pores between 0.2 and 0.8mm in size. It is absorbed by plants and allows the activity of bacteria and small protozoa such as flagellates.

Gravity water: temporarily occupies the largest pores in the soil. This water runs off under the action of gravity.

2.4. Soil pH :

Soil pH is the result of a combination of various soil factors. The soil solution contains H⁺ ions from :

Alteration of the parent rock

Humification of organic matter (synthesis of humic acid)

Biological activity

The effect of acidifying fertilisers

The pH also depends on the nature of the plant cover and climatic conditions (temperature and rainfall):

Basic pH levels (above 7.5) are characteristic of soils developed on calcareous parent rock. They are generally found in dry or seasonally dry climates and under vegetation with rapidly decomposing leaves.

Acidic pH (between 4 and 6.5) is much more common in wet, cold climates where organic matter accumulates. They are characteristic of coniferous forests. They form mainly on siliceous and granitic rocks.

Living organisms such as protozoa can withstand variations in pH from 3.9 to 9.7, depending on the species:

Some are acidophilic while others are basophilic. Neutrophiles are the most common in nature.