**CHAPTER 3**

**BIOTIC FACTORS**

Biotic factors encompass all the direct interactions that living organisms exert on one another. These interactions, known as coactions, are of two types:

* **Homotypic** or intraspecific, when they occur between individuals of the same species.
* **Heterotypic** or interspecific, when they take place between individuals of different species.

**1. Homotypic Coactions**

**1.1 Group Effect**

The group effect refers to changes observed in animals of the same species when they are grouped in pairs or larger numbers. This effect is observed in many insect and vertebrate species, which can only reproduce and survive normally when their populations are sufficiently large.

**Example:** It is estimated that a herd of African elephants must contain at least 25 individuals to survive: fighting off enemies and foraging for food are facilitated by communal living.

**1.2 Mass Effect**

In contrast to the group effect, the mass effect occurs when an overcrowded environment leads to severe competition with detrimental consequences for individuals. The negative effects of this competition impact metabolism and physiology, resulting in disruptions such as reduced fertility, lower birth rates, and increased mortality. In some organisms, overcrowding triggers phenomena known as **self-elimination**.

**1.3 Intraspecific Competition**

This type of competition can occur even at very low population densities and manifests in various ways:

* Territorial behavior, where an animal defends a certain area against intrusions by others.
* The maintenance of a social hierarchy with dominant and subordinate individuals.
* Intense competition for food among individuals of the same species, especially at high population densities. The most common consequence is a decline in population growth rates.

In plants, intraspecific competition, linked to high densities, primarily involves water and light. It results in fewer seeds being produced and/or significant mortality, drastically reducing population numbers.

**2. Heterotypic Coactions**

The coexistence of two species can have a neutral, beneficial, or detrimental influence on each other.

**2.1 Neutralism**

Neutralism occurs when two species coexist independently, with no influence on one another.

**2.2 Interspecific Competition**

Interspecific competition is defined as the active pursuit by members of two or more species of the same environmental resource (food, shelter, breeding sites, etc.).

In interspecific competition, each species adversely affects the other. The competition is stronger between species that are more closely related.

However, two species with identical needs cannot coexist indefinitely; one will inevitably be eliminated over time. This is known as Gause's principle or the competitive exclusion principle.

**2.3 Predation**

A predator is any free-living organism that feeds on another organism, killing its prey to consume it. Predators can be polyphagous (attacking many species), oligophagous (feeding on a few species), or monophagous (surviving on only one species).

**2.4 Parasitism**

A parasite is an organism that does not live freely: at least at one stage of its development, it is attached to the surface (ectoparasite) or inside (endoparasite) of its host.

Parasitism can be considered a special case of predation. However, parasites are not true predators because their goal is not to kill the host. Parasites must adapt to encounter the host and survive at its expense, while the host must adapt to avoid or eliminate the parasite. Like predators, parasites can be polyphagous, oligophagous, or monophagous.

**2.5 Commensalism**

This is an interaction where one species, the commensal, benefits from the association, while the host species neither benefits nor is harmed. The two species exhibit mutual tolerance.

**Example:** Animals that settle and are tolerated in the shelters of other species.

**2.6 Mutualism**

Mutualism is an interaction where both partners derive benefits, such as protection from enemies, dispersal, pollination, or nutrient exchange.

**Example:** Tree seeds must be dispersed far away to survive and germinate. This dispersal is carried out by birds, monkeys, etc., which also benefit from the tree (food, shelter, etc.).

An obligatory and indispensable association between two species is a form of mutualism reserved for the term **symbiosis**. In this relationship, neither species can survive, grow, or develop without the other.

**Example:** Lichens are formed by the association of an alga and a fungus.

**2.7 Amensalism**

This is an interaction where one species is eliminated by another that secretes a toxic substance. In plant interactions, amensalism is often called **allelopathy**.

**Example:** The walnut tree releases a toxic volatile substance through its roots, explaining the sparse vegetation beneath it.