

Course: Global Functioning of Ecosystems Chapter 1

Introduction

Ecology is a science that studies the interactions of living beings (biodiversity) with their environment and with each other within that environment (the whole being referred to as an "ecosystem"). By extension, ecology also refers to a school of thought (environmentalism or political ecology) that is embodied in various movements whose common goal is to integrate environmental issues into social, economic, and political organization. The ultimate goal is to establish a new model of development based on a radical transformation of the relationship between human activity and the environment.

Currently, ecology is defined as the science that studies the conditions of existence of living beings and the interactions of all kinds that exist between these living beings on the one hand, and between these living beings and their environment on the other. It is therefore the science of the organization of Nature, its mechanisms, and the interaction of its parts.

Ecology (from the Greek *oikos*: house, habitat, and *logos*: science, knowledge). The term "ecology" was coined in 1866 by the German biologist Ernst Haeckel, who defined it as "the science of the relationships of organisms with their surrounding world, that is, in a broad sense, the science of the conditions of existence."

Ecology is the study of the conditions of existence of living beings (biocenoses) in interaction with each other and with the environment (biotope) they occupy. The biotope and biocenoses together form a whole called ecosystems. Ecological studies conventionally focus on three levels (Mackenzie and Virdee, 2000): the individual, the population, and the community.

- An individual is a specimen of a given species.
- A population is a group of individuals of the same species occupying a particular territory at a given time.
- A community or biocoenosis is the totality of populations in the same environment, animal populations (zoocoenosis) and plant populations (phytoenosis) that live in the same environmental conditions and in close proximity to one another.

The individuals of a species form



populations that form



communities, which form



an ecosystem

Each of these three levels is the subject of a division of ecology:

- The individual concerns autoecology: this is the science that studies the relationship between a single species and its environment. It defines the tolerance limits and preferences of the species studied with regard to various ecological factors and examines the effect of the environment on morphology, physiology, and ethology.
- Population ecology concerns population ecology or population dynamics: this is the science that studies the qualitative and quantitative characteristics of populations: it analyzes variations in the abundance of various species to identify the causes and, if possible, predict them. • Biocenosis concerns synecology: it is the science that analyzes the relationships between individuals belonging to different species within the same group and between these individuals and their environments. physiology and ethology.
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I- Concepts of Biocenosis and Ecosystem

An ecosystem, or ecological system, is a functional system that includes a community of living organisms and their environment. An ecosystem is a relatively stable and integrated unit based on photosynthetic organisms. It is considered a kind of collective entity made up of transient individuals. Some of these individuals can live for several thousand years (large trees, for example), while some microorganisms can only live for a few hours or even a few minutes. The ecosystem as a whole tends to remain stable, without being static. Once its balance is achieved, it can last for centuries without changing (except in the event of major natural disasters or violent human intervention).

The ecosystem is composed of two elements: a biotope and a biocenosis.

Biocenosis + Biotope = Ecosystem

a- The Biotope:

The biotope is the living environment where ecological conditions are considered homogeneous and well defined, integrated into an ecosystem. Each biotope is also characterized, in principle, by the fauna and flora that inhabit it; this is the biocenosis.

The biotope is the inert part of the environment, the set of specific physical and chemical characteristics that directly or indirectly affect the organisms it hosts. This effect may last throughout the organism's entire life or only part of it. The characteristics of a biotope can be classified as: climatic (climate), pedological (soil), geological (subsoil), hydrographic (characteristics and movement of water), and topographical (relief, altimetry).

b- Biocenosis:

Biocenosis is the totality of living beings that inhabit the same biotope, a given ecosystem, or a hydrosystem. The nature of the community of species is comprehensive; it is an assemblage of life: microorganisms, plants, and animals. All these actors live in dynamic equilibrium in the territory they occupy, with variations in population over time.

By definition, a biocenosis includes all the inhabitants of a given ecosystem. An open biocenosis can welcome new species, while a closed biocenosis

does not accept any new species. Ecological communities can take various forms specialized in a group of organisms:

A zoocenosis for the fauna community. A

phytocenosis for the plant community.

A microcenosis (or microbiocenosis) for the microbial community and microorganisms.

A mycocenosis for the community of fungi and mushrooms.

The geographical extent of a biocenosis is limited by the requirement for a more or less uniform composition of species. A field cultivated for agriculture is an agrobiocenosis which, together with the physical and chemical environment (biotope), forms an agrosystem. On a large geographical scale, the main factor determining the type of communities is the climate. Changes in abiotic factors (humidity, temperature, orogenic movements, thawing, etc.) or the arrival or introduction of foreign or opportunistic organisms, typically an invasive species, result in a series of adaptations with native species. Successions are linked to the evolution of species. Sometimes it is difficult to define a boundary between different communities in nature, and in many cases a gradual gradation from one community to another is observed. The transition zones that appear between two completely different communities are called ecotones and are particularly rich in species.

The concept of an ecosystem is multi-scale, meaning that it can be applied to portions of varying sizes within the biosphere, such as a lake, a meadow, or a dead tree. Depending on the scale of the ecosystem, we have

- a micro-ecosystem: for example, a tree.
- a meso-ecosystem: for example, a forest.
- a macro-ecosystem: for example, a region.