

Chapter 1: Concepts in ecology

1.1 Ecology

Etymology: from the Greek “oikos” meaning house or dwelling, and “logos” meaning science or knowledge.

Ecology is the science that studies environments and the conditions of existence of living organisms, as well as the relationships established among them and with their environment, or more generally with nature. Ecology was defined by the German biologist Ernst Haeckel in 1866 as “the science of the relationships of organisms with the surrounding world, that is, in a broad sense, the science of the conditions of existence.”

Ecology is a science whose object is the relationships between living beings (animals, plants, microorganisms) and their environment, as well as with other living beings. Its object is therefore discussed, encouraged, documented, and transmitted, making ecology a science that is increasingly open to systematic and rapid popularization.

Modern ecology emerged from an awareness of the effects (pollution, depletion of natural resources, disappearance of living species, climate change, etc.) of human activities on the environment (industry, transportation, use of fertilizers, industrial waste, etc.). It therefore considers humans as a component of the ecosphere.

1.2 Environmentalism

Environmentalism is a school of thought and a movement that seeks to respect natural balances and to protect the environment from the harmful effects of industrial society. It is a position driven by concern for protecting nature and humankind itself from pollution, degradation, and various forms of destruction resulting from the activities of industrial societies.

From the 1980s onward, environmentalism gained real political importance, first in Germany, then in France and throughout the European Union. During the 1990s, its influence became evident through the participation of green (environmentalist) parties in several European governments.

1.3 History of ecology

At first glance, nothing seems more natural than the link between the theory of evolution, as founded by Charles Darwin, and ecology, defined by the Darwinian Ernst Haeckel in 1866. And yet, when one reviews the history of both over the past 150 years, it becomes clear that this history is far from being shared. On the contrary, they appear as parallel sciences, often unaware of one another when they are not mutually hostile. This lack of understanding cannot be reduced to a problem of schools of thought or individuals. The “struggle for life” is understood in a completely different way by the two scientific currents.

The term ecology was coined in 1866 by the German biologist Ernst Haeckel. However, he noted that the discipline only began to gain importance from the 1930s onward. It should also be noted that “since the late 1960s, ecological concerns have been driving forces behind associative, ideological (environmentalism), and political movements.” The figure of the ecologist in the sense of a “supporter of environmentalism,” commonly referred to as an environmentalist or ‘green’ activist, thus became distinct from that of the ecologist as a “specialist in ecology.” Finally, the basic unit of scientific ecology is the ecosystem.

Ecology came to the forefront during the 1960s–1970s. Since then, a new form of social demand has emerged, particularly in the political, associative, and educational fields. During this same period, the first works devoted to the history of ecology began to appear. They show that ecology is a scientific discipline that is already more than a century old, whose concepts were forged in Europe during the nineteenth century. Moreover, historical studies devoted to environmentalist movements demonstrate that concerns about the harmful consequences of certain human activities on the environment long predate the “seventies.”

Ecology is a relatively recent science whose scientific independence dates back little more than a century, which represents a rather short lifespan when compared with other sciences such as biology or chemistry, for example, which have existed for several centuries. Consequently, ecology offers a distinctive historical trajectory, marked in particular by a significant number of conceptual borrowings from related sciences such as biology, zoology, and botany, among others.

1.4 Methodology

In studying relationships, the ecologist does not separate the living organism from its context, but rather examines it as a whole. The ecologist no longer considers the organism in a constant, theoretical environment, but instead in a world governed by continually changing forces.

Example: The case of the echinoderm *Echinaster sepositus* (sea star) and the crustacean *Eupagurus prideauxi* (hermit crab), whose distribution appears to correspond to strict stenohalinity, yet which in laboratory conditions can tolerate strong decreases in salinity, even when these are applied abruptly.

Many other examples could be cited to illustrate the divergence between results obtained in laboratory experiments and those observed in nature.

The ecologist studies what actually occurs under natural conditions; their field of observation is nature itself-the very place where the organism or the population under study lives.

1.5 Field of application

Ecological studies conventionally focus on three levels: the individual, the population, and the community.

An individual is a specimen of a given species. This level concerns autecology, the branch of ecology that studies the relationships between a single species and its environment. It defines the limits of tolerance and the preferences of the species with respect to various ecological factors and examines the effects of the environment on morphology, physiology, and ethology (behavior).

A population is a group of individuals of the same species occupying a particular area at a given time. This level concerns population ecology or population dynamics, the science that studies the qualitative and quantitative characteristics of populations. It analyzes variations in the abundance of different species in order to identify their causes and, if possible, to predict them.

A community or biocenosis is the set of populations within the same environment, including animal assemblages (zoocenosis) and plant assemblages (phytocenosis), which live under the same environmental conditions in close proximity to one another. Each of these three levels constitutes a distinct branch of ecology.

1.6 Definition of basic terms

Phytocenotics = Phytosociology: a botanical discipline that studies plant associations (*cenosis* = association).

Zoocenotics: studies animal associations.

Climatology: climatology is the science of climate. It's based on the analysis of the statistical distribution of meteorological variables, mainly temperature and precipitation, in a given region over a period of thirty years.

Edaphology: studies the physical and chemical conditions of the solid phase of the soil as a living environment.

Biocenotics: studies living animal and plant communities in a given environment at a given time. It concerns synecology, which is the science that analyzes the relationships among individuals belonging to different species within the same community and their relationships with the environment

Ecobiocenotics: studies natural environments while taking into account both environmental conditions and living organisms.

Autecology: studies the relationships between a single species and its environment. It examines behavior (ethology), functioning within the environment, bioenergetics, and interactions with the environment of a given individual; the term was introduced by Schröter (1896).

Synecology: synecology, or community ecology, is a branch of ecology that studies the relationships among populations of different types within a biocenosis. It addresses issues such as predation, competition, parasitism, the evolution of biocenoses, and their productivity.

Ethology: the study of behavior at the levels of the individual, population, and community.

Biogeography: focuses on the observation and explanation of the distribution of living organisms across the planet.