

ECOLOGY, LECTURE 1: INTRODUCTION TO ECOLOGY; THE SCIENTIFIC METHOD (18–24, 1148–1159)

The roots of ecology are in **natural history**, and the patient observation of natural phenomena remains at the heart of ecological science today. Ecology is a relatively young scientific discipline, only about 100 years old; however, the roots of the science can be traced back much further.

Two early essays by Linnaeus and his students—*Oeconomia naturae* (1749) and *Politia naturae* (1760)—were read by Darwin in the 1840s and probably had a strong influence on his thinking. Darwin used the phrases “**economy of nature**” and “polity of nature” when discussing ecological problems, and Darwin’s ecological worldview is encapsulated in his “**entangled bank**” metaphor.

Haeckel (1869) coined the term **ecology** from the Greek words *oikos* (“home”) and *logos* (“to study”). The coining of the term is sometimes wrongly attributed to Henry David **Thoreau**, based on a misreading of the word “Geology” in one of his journals. Although he did not use the word, Thoreau was pursuing important ecological studies at the end of his life, and his systematic notes on local flowering plants from 1852–1858 were used in a 2008 study on the effects of global warming.

Haeckel’s original definition of **ecology** was broad: “The comprehensive science of the relationship of the organism to the environment.” Charles Elton (1927) wrote that, “Ecology is a new name for a very old subject. It simply means scientific natural history.” A contemporary definition of ecology that is very widely used is from Krebs (1972): “The scientific study of the interactions that determine the distribution and abundance of organisms.”

The science of ecology has taken a central place in today’s world of environmental disasters. Ecologists have often been the first to draw attention to environmental problems (e.g., **Rachel Carson** and the effect of pesticides). In lay parlance, “ecologist” is sometimes taken to be synonymous with “**environmentalist**.” Although ecological research is often closely associated with the study of environmental problems (ecology is the science of the total environment after all), scientific ecology maintains some political neutrality by working in a hypothetico-deductive (hypothesis testing) context.

The **scientific method** begins with **observations** of natural phenomena, which give rise to **questions**. This is often a creative process that defies easy categorization. The process can be regarded as “scientific” if it leads to a testable **hypothesis** (or series of hypotheses) that explains the empirical evidence. The hypothesis may lead to concrete **predictions** that are then tested by **experiment**. **Falsificationism** (**Karl Popper**) refers to the attempt to disprove hypotheses (rather than to prove them). **Data** are simply recorded observations, whether quantitative or qualitative..

Ecology is considered to be a complex science because it works across **levels of organization**.

An **organism** forms parts of a **population** and a **community**, and these biological systems are embedded in the physical **environment**. The levels-of-organization concept usually portrays the “ecosystem” as a distinct level somehow *above* the community. However, an **ecosystem** is better understood as an integrated biophysical system at any level of biological organization. Thus, we can speak of the ecosystem of a single cell, or the ecosystem of a rotting log on the forest floor, or of the San Francisco Bay ecosystem. An ecosystem is the whole complex of environmental and biotic factors at any ecological level.