

The background features a dark teal central area on the left, transitioning into a complex pattern of overlapping, semi-transparent green triangles and polygons on the right. The colors range from light lime green to dark forest green.

# INTRODUCTION TO ECOLOGY AND ENVIRONMENTAL CONDITIONS

## What is ecology?

origin of word: *oikos* = the family household

*logy* = the study of

interesting parallel to *economy* = management of the household

many principles in common - resources allocation, cost-benefit

ratios (household management)

## definitions:

**Haeckel (1870):** “By ecology we mean the body of knowledge concerning the economy of Nature - the investigation of the total relations of the animal to its inorganic and organic environment.”

**Andrewartha (1961):** “The scientific study of the distribution and abundance of organisms.”

**Odum (1963):** “The structure and function of Nature.”

Krebs (1972):

*“Ecology is the scientific study of the processes regulating the distribution and abundance of organisms and the interactions among them, and the study of how these organisms in turn mediate the transport and transformation of energy and matter in the biosphere (i.e., the study of the design of ecosystem structure and function).”*

- ▶ **The goal of ecology is to understand the principles of operation of natural systems and to predict their responses to change.**

**ECOLOGY** is the study of relationships among organisms and between organisms and the physical environment.

These relationships influence many aspects of the natural world, including the distribution and abundance of organisms, the variety of species living together in a place, and the transformation and flow of energy in nature.

**Ecosystem:** An ecological community and its local, nonbiological community. An ecosystem is the minimum system that includes and sustains life.

It must include at least .....

It must include at least an autotroph, a decomposer, a liquid medium, a source and sink of energy, and all the chemical elements required by the autotroph.



**Environment:** All factors (living and nonliving) that actually affect an individual organism or population at any point in the life cycle.

Environment is also sometimes used to denote a certain set of circumstances surrounding a particular occurrence (environments of deposition, for example pH and the decomposer).

**Environmentalism:** A social, political, and ethical movement concerned with protecting the environment and using its resources wisely.

**Biosphere:** part of a planet where life exists.

**Community:** a set of interacting species that occur in the same place (sometimes extended to mean a set that interacts in a way to sustain life).

**Population:** A group of individuals of the same species living in the same area or interbreeding and sharing genetic information.

**Species:** A group of individuals capable of interbreeding.

**Habitat:** Where an individual, population, or species exists or can exist. For example, the habitat of the Joshua tree is the Mojave Desert of North America.

**Biome:** A kind of ecosystem. The rain forest is an example of a biome; rain forests occur in many parts of the world but are not all connected to each other.

- ▶ **Niche:** (1) The “profession,” or role, of an organism or species;
- ▶ or
- ▶ (2) all the environmental conditions under which the individual or species can persist.

**Biological diversity:** consisting of three components:

(1) genetic diversity— the total number of genetic characteristics;

(2) species diversity; and

(3) habitat or ecosystem diversity—the number of kinds of habitats or ecosystems in a given unit area. Species diversity in turn includes three concepts: species richness, evenness, and dominance.

**Succession:** The process of establishment and development of an ecosystem.

**Sustainability:** Management of natural resources and the environment with the goals of allowing the harvest of resources to remain at or above some specified level, and the ecosystem to retain its functions and structure.

Humans are rapidly changing earth's environment, yet we do not fully understand the consequences of these changes.

For instance, human activity has increased the quantity of nitrogen cycling through land and water, changed land cover across the globe, and increased the atmospheric concentration of carbondioxide.

Changes such as these threaten the diversity of life on earth and may endanger our life support system. Because of the rapid pace of environmental change in the early twenty first century, it is imperative that we better understand earth's ecology.



# Why study ecology?

**Curiosity**

**Responsibility**

**Nature as a guide**

**Sustainability**

How to study ecology? What kinds of experiments do ecologists perform?

**Observations**

**Microcosms**

**Mathematical models**

**Ecologists study environmental relationships ranging from those of individual organisms to factors influencing global-scale processes.**

**Physiological ecologists**

**Behavioral ecologists**

**Population ecology**

Faced with the complexity of nature, ecologists have divided the field of ecology into subdisciplines, each of which focuses on one of the levels of organization.

What is the advantage of developing such subdisciplines within ecology?

# Ecosystem Structure

1. **Biotic Levels = living organisms**
  - a. **Individual Organisms**
  - b. **Populations**
  - c. **Communities**

## 2. Abiotic Components = nonliving portion of biosphere

a. **Lithosphere**

b. **Hydrosphere**

c. **Atmosphere**

# Ecosystem Function

## A. Individual Requirements, Tolerance Ranges and Limiting Factors

## B. Habitat Specific Adaptations

1. marine ecosystems
2. freshwater ecosystems
3. terrestrial ecosystems



C. Feeding Strategies: herbivores, carnivores, omnivores, detritivores

D. Production & Productivity

1. respiration vs production
2. gross vs net productivity
3. primary & secondary productivity

E. Trophic Levels and Food Webs: producers consumers decomposers

F. Pyramids of Numbers and Biomass

G. Biogeochemical Cycles

H. Energy Flow & Trophic Structure factors that limit productivity ecological efficiency

and the "10% rule" length of food chains

I. Interactions: all organisms interact with other organisms in various ways

1. Individual Interactions:

a. symbioses: mutualism commensalism parasitism

b. predator / prey relationships

c. competition

i. intraspecific competition

ii. interspecific competition

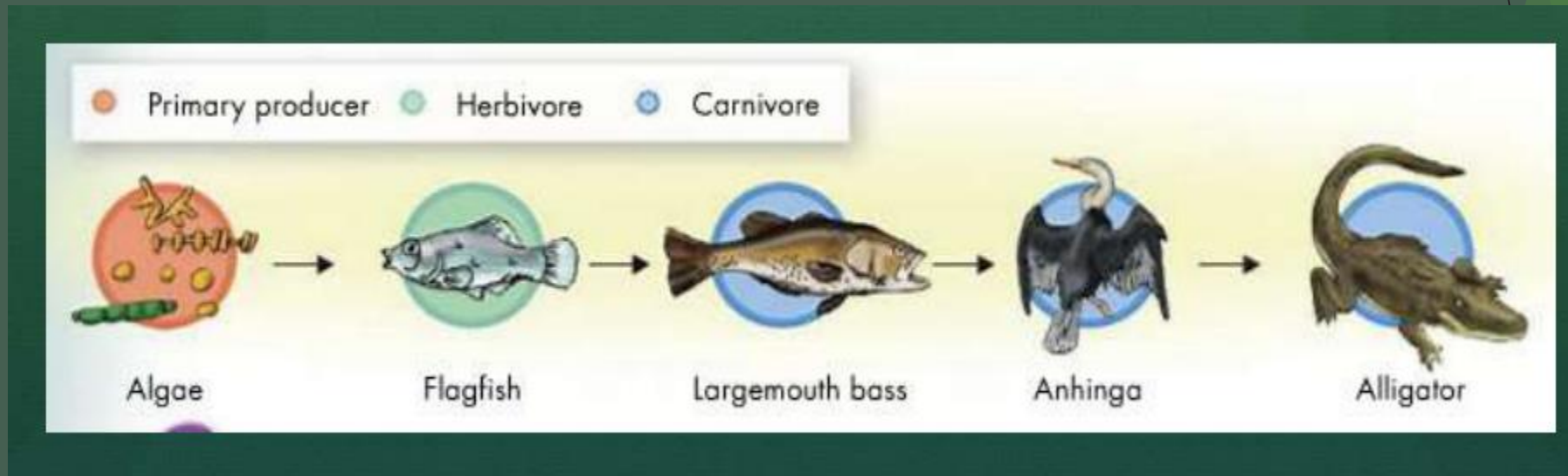
2. Population level interactions (Population Ecology) fluctuations  
in populations and genetic variation immigration and emigration  
isolation and evolution local extinctions

3. Community level interactions (Community Ecology) concept of  
the niche foraging theory community structure

# Energy flows in ecosystems

Energy flows through an ecosystem in one direction, from primary producers to consumers!

Food chain - series of steps in which organisms transfer energy by eating and being eaten.



# Energy flows in ecosystems

- ▶ Food web

**Conservation Biology**

**Restoration Biology**

**Landscape Ecology**