Unit 1
Ecological Organization

YOUR WORLD
YOUR TURN
Lesson 1.1 Studying Ecology

Objective: Describe the six levels of ecological organization (starting with the simplest level) and give an example of each.

Ernst Haeckel defined ecology in 1866 as “the body of knowledge concerning the economy of nature—the total relations of the animal to both its inorganic and organic environment.”
Levels of Ecological Organization

- The study of how organisms interact with each other and with their environments.
- Scientists study ecology at various levels of organization.
- There are 6 levels of ecological organization.
Lesson 1.1 Studying Ecology
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- **organism** – (individual) a form of life considered as an entity
  Ex) an animal, plant, fungus, protist, or bacteria

- **population** – all of the individuals of a species that live in the same area

- **community** – collection of all the different populations that live in one area

- **ecosystem** – a community of living organisms and their interrelated physical and chemical environment

- **biome** – distinct ecological communities of plants and animals living together in a particular climate

- **biosphere** – all the organisms and the part of Earth where they exist
Biome Project
(20 pts)

Task: Given your assigned biome, create a brochure or poster that highlights the following:

- Region(s) of world biome is located
- Climate
- Vegetation
- Animal diversity

*Include pictures of each of the above.*
From 1900 to 2000, the white-tailed deer population of New York state grew from about 20,000 to more than 1 million. Densities of more than 100 deer per square mile occur in some metropolitan areas.
Habitat vs. Niche

- **niche** - the role played by an organism in an ecosystem
  Ex) food preferences, requirements for shelter, special behaviors, and the timing of its activities (e.g., nocturnal, diurnal), interaction with other organisms and its habitat

- **habitats** – provides food, water, shelter, and space in a suitable arrangement
Biotic and Abiotic Factors

- **biotic factors** - parts of an ecosystem that are living or used to be living
  
  Ex) animals, vegetation, fungus, etc.

- **abiotic factors** - parts of an ecosystem that have never been living
  
  Ex) water, rocks, soil, minerals, etc.

**Did You Know?** Decaying organisms are biotic factors as long as their structure remains cellular.
Population Size

- **population size** - the number of individuals in a population at a given time.

- Sudden and dramatic decreases in population size can indicate an unhealthy population headed toward extinction.

- Ecologists often use **sampling** techniques to estimate population size.

**Did You Know?** The passenger pigeon was once North America’s most abundant bird. Hunting drove them to extinction in less than 100 years.
Lesson 1.2 Describing Populations

Population Density

• **population density** - measure of how crowded a population is

• Larger organisms generally have lower population densities.

• **Low population density:**
  More space, resources; finding mates can be difficult

• **High population density:**
  Finding mates is easier; tends to be more competition; more infectious disease; more vulnerability to predators

Northern pintail ducks
Lesson 1.2 Describing Populations

Population Distribution

- **population distribution** - how organisms are arranged within an area

  - **random distribution:** Organisms arranged in no particular pattern

  - **uniform distribution:** Organisms evenly spaced

  - **clumped distribution:** Organisms grouped near resources; most common distribution in nature
Lesson 1.2 Describing Populations

Age Structure

- Relative number of organisms of each age group within population
- Can be used to predict future population growth of a population
Lesson 1.2 Describing Populations

Sex Ratios

- **sex ratio** - proportion of males to females
- Age structure diagrams give information about sex ratios.
- For a monogamous species, the ideal sex ratio is 50:50.
From 1800 to today, the human population has grown from about 1 billion to more than 6.8 billion—an exponential rate of increase.
Birth and Death Rates

- A population’s relative birth and death rates (mortality and natality) affect how it grows.
- Survivorship curves show how the likelihood of death varies with age.
Immigration and Emigration

• In addition to births and deaths, population growth is affected by immigration and emigration—individuals moving into and out of a population.

• Migration, seasonal movement into and out of an area, can temporarily affect population size.
Calculating Population Growth

- Determined by the following equation:
  \[(\text{birthrate} + \text{immigration rate}) - (\text{death rate} + \text{emigration rate})\]
- Growing populations have a positive growth rate; shrinking populations have a negative growth rate.
- Usually expressed in terms of individuals per 1000

Did You Know?
Immigration contributes more than 1 million people to the U.S. population per year.
Exponential Growth

• Population increases by a fixed percentage every year.
• Normally occurs only when small populations are introduced to an area with ideal environmental conditions.
• Rarely lasts long.
Logistic Growth and Limiting Factors

- Growth almost always slows and stops due to limiting factors.

- **Limiting factors:** Environmental characteristics slow population growth and determine carrying capacity.
  - **Density-dependent:** Influence changes with population density.
  - **Density-independent:** Influence does *not* change with population density.
Biotic Potential

• An organism’s maximum ability to produce offspring in ideal conditions

• Many factors influence biotic potential, including gestation time and generation time.

• Organisms with high biotic potential can recover more quickly from population declines than organisms with low biotic potential.