



## **Ecology: Notes**

### **In this lesson...**

- Habitat & Levels of Organization
- Symbiosis
- Ecological Pyramid
- Ecological Succession
- Biochemical Cycle
- Population
- Keystone Species
- Eutrophication
- Biomagnification
- Global warming



## **Habitat & Levels of Organization:**

- **Ecology:**
  - The study of interactions that take place between organisms and their environment
- **Habitat:**
  - Place a plant or animal lives
- **Niche:**
  - An organism's total way of life
- **Abiotic factors:**
  - The nonliving parts of an organism's environment
  - Include air currents, temperature, moisture, light, and soil
  - Affect on an organism's life
- **Biotic factors:**
  - All the living organisms that inhabit an environment
  - Organisms depend on others directly or indirectly for food, shelter, reproduction, or protection
- **Simple levels:**
  - Atom
  - Molecule
  - Organelle
  - Cell
  - Tissue
  - Organ
  - System
- **Levels of organization:**
  - Organism/Species
    - An individual living thing that is made of cells, uses energy, reproduces, responds, grows, and develops
  - Population
    - A group of organisms, all of the same species, which interbreed and live in the same place at the same time
  - Community
    - All the populations of different species that live in the same place at the same time
  - Ecosystem
    - Populations of plants and animals that interact with each other in a given area with the abiotic components of that area (terrestrial or aquatic)



- Biosphere
  - The portion of the Earth that supports life
- **Organism groups:**
  - Autotrophs
    - A group of organisms that use the sun's energy to convert water and carbon dioxide into glucose (food)
    - Also called producers
    - Examples:
      - Plants
      - Algae
  - Chemotrophs
    - Another form of autotrophs
    - Lack the chloroplast organelle that contains the pigment chlorophyll found in all organisms and some autotrophs which is used for photosynthesis
    - Get energy from inorganic substances
    - Live in places with no sunlight
    - Examples:
      - Bacteria
      - Deep sea worms
  - Heterotrophs
    - Organisms that do not make their own food
      - Also called consumers
      - Scavengers, herbivores, carnivores, omnivores, and decomposers are all heterotrophs
      - Examples:
        - Rabbits
        - Deer
        - Mushrooms



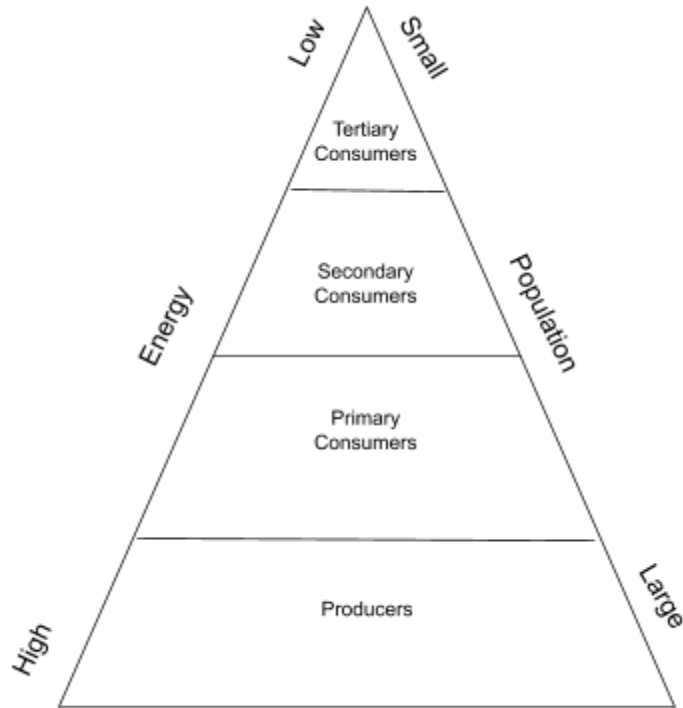
### **Symbiosis:**

- The **relationship between 2 organisms of different species** that benefit one or both organisms
- **Mutualism**
  - A symbiotic relationship that benefits both organisms involved
- **Commensalism**
  - A symbiotic relationship that benefits one organism and the other is not helped or harmed
- **Parasitism**
  - A symbiotic relationship that benefits one organism and the other is harmed

### Ecological Pyramids:

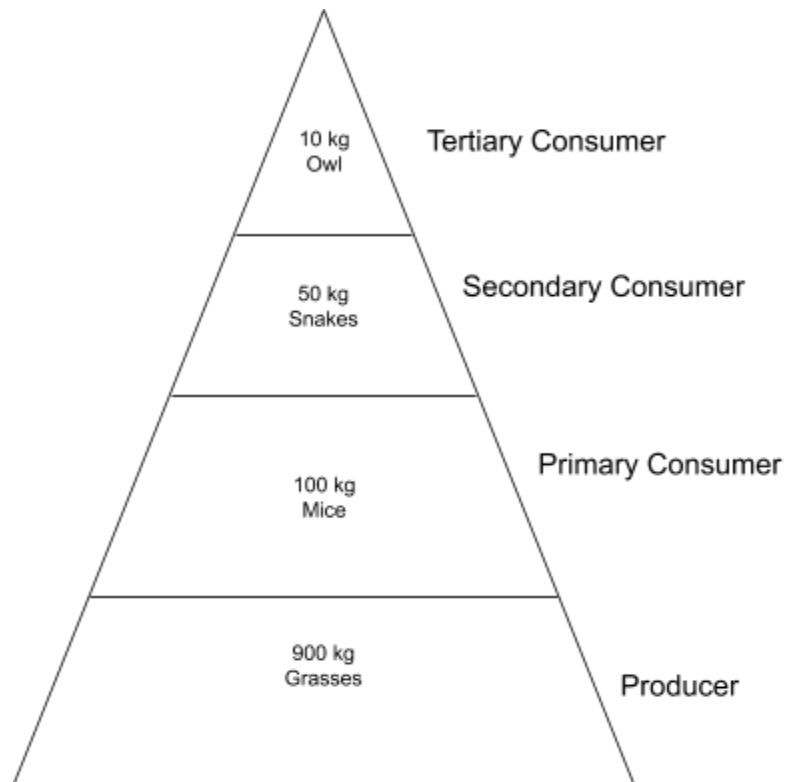
- **Models that show how energy flows through ecosystems**
  - Represent trophic levels

### Pyramid of Energy:



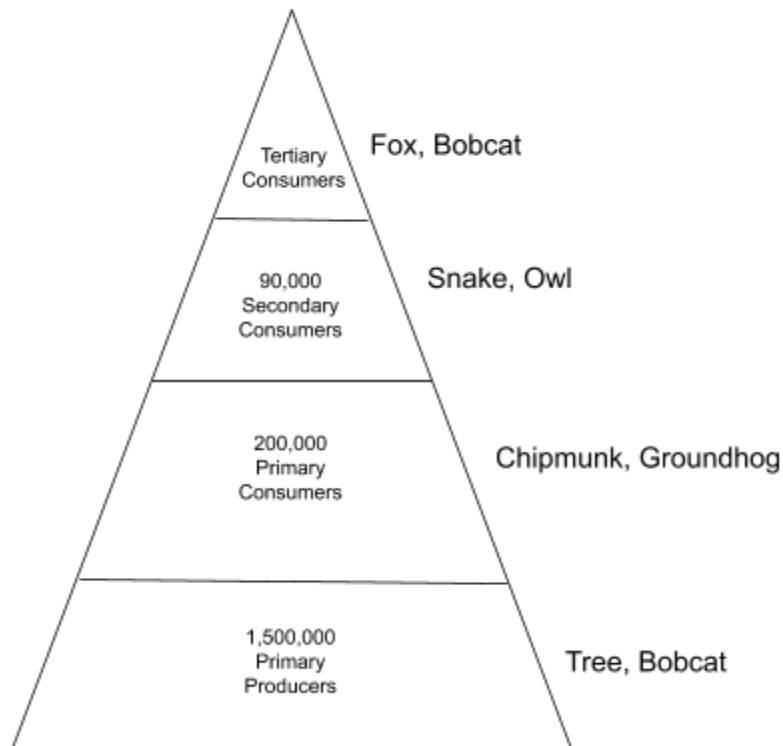
- **10% of energy is passed from one trophic level to the next**
- Most of the energy is lost as heat
- Each level represents the amount of energy that is available to that trophic level
- As you move up the pyramid, the **energy decreases**

Pyramid of Biomass:



- Biomass
  - The **total mass of living matter** at each trophic level
- As you move up the pyramid, the **biomass decreases**
- Biomass is **measured in kilograms**

### Pyramid of Numbers:



- Represents the **number of organisms present at each trophic level**
- As you move up the pyramid, the **number of organisms decreases**

### Ecological Succession:

- **Natural or gradual changes in the types of species that live in an area**
- **Primary succession (volcanoes or glaciers):**
  - Lichens that do not need soil to survive grow on rocks
  - Mosses grow to hold newly made soil
  - Mosses and lichens are known as pioneer species
- **Secondary succession:**
  - Begins in a place that already has soil and was the home of living organisms
  - Occurs faster and has different pioneer species than primary succession
  - Example:
    - After forest fires
    - Manmade
- **Climax community**
  - Stable group of plants and animals that is the end result of the succession process

## **Biochemical Cycle:**

- **Natural cycles by which a nutrient moves through the environment**
- **Water cycle (hydrological cycle)**
  - Water is needed for all biochemical reactions in the body
    - Brain consists of 90% water
    - Regulates body temperature
    - Blood consists of 83% water
    - Detoxifies
    - Bone consists of 22% water
  - Transpiration
    - The process by which water is carried through tubes (xylem) in the plants from the roots to small pores (stoma) on the underside of leaves, where it evaporates
- **Carbon cycle**
  - Organic molecules contain carbon
  - There are four organic molecules (macromolecules):
    - Proteins
    - Lipids (fats)
    - Carbs
    - DNA
  - Two processes that cycle carbon:
    - Photosynthesis by plants, algae, and cyanobacteria
      - Removes carbon dioxide from air and water and produces oxygen and carbohydrates
    - Cellular respiration
      - Returns carbon to the air and oceans as carbon dioxide
      - The process of making energy from glucose (sugar)
- **Nitrogen cycle**
  - Nitrogen is found in proteins, DNA, and RNA in the human body
  - The Earth's atmosphere contains 78% nitrogen
  - Nitrogen fixation:
    - Lightning or nitrogen fixing bacteria combine and fix nitrogen with hydrogen to form ammonium which can be used by plants





## **Population:**

- **A group of organisms of the same species living in a given area**
- **Exponential growth** (makes a J shaped curve)
- **Logistic growth** (makes an S shaped curve)
- **Carrying capacity:**
  - The maximum population size that can be supported by available resources
- **Density dependent factors:**
  - Biotic factors in the environment that have an increasing effect as population size increases
  - Examples:
    - Disease
    - Competition
    - Parasites
- **Density independent factors:**
  - Abiotic factors in the environment that affect populations regardless of density
  - Examples:
    - Temperature
    - Drought
    - Storms

## **Keystone Species:**

- **A plant or animal that plays a unique and crucial role in the way an ecosystem functions**
- Without keystone species, the ecosystem would be dramatically different, or cease to exist all together
- Examples:
  - African elephants: help maintain the savannah ecosystem as a grassland instead of a woodland or forest
  - Hummingbirds: Engage in beneficial interactions and pollinate



### **Eutrophication:**

- When lakes, streams, and estuaries are overfertilized causing plants and algae to bloom and eventually die, causing the ecosystem to crash due to lack of oxygen
- **Six stages of the eutrophication process:**
  - Addition of nitrates
  - Growth of plants (algae)
  - Death of plants
  - Growth of bacteria
  - Lack of oxygen
  - Suffocation
- **Biochemical oxygen demand (BOD)**
  - The rate of oxygen used by the organism in the ecosystem
  - Used as an indicator for eutrophication

### **Biomagnification:**

- Also known as “bioamplification,” the process by which **substances become more concentrated in the bodies of consumers as one moves up the food chain (trophic levels)**
- **Bioaccumulation**
  - The process by which substances not readily broken down or excreted can build up and be stored in living tissue, usually fatty tissue.
- **DDT**
  - A pesticide that was widely used until being banned in the U.S. in 1972
  - Accumulated in living tissue (fatty tissue)
  - The high concentration of DDT caused failure of eggs and thinning of shells in birds
- **Other biomagnification/bioaccumulation chemicals:**
  - Mercury
  - PCBs



## **Global warming:**

- **Greenhouse gases**
  - Gas that is relatively transparent to solar radiation but absorbs and emits in the infrared which is a type of radiation the earth emits
  - Examples:
    - Water vapor
    - Carbon dioxide
    - Nitrous oxide
    - Methane
  - Greenhouse gases make the earth warmer by slowing the loss of infrared radiation
  - Global warming molecules are:
    - Carbon dioxide
    - Nitrous oxide
    - Methane
    - PHS