

Ecology Gateway Notes & Prompts

Flow of Energy Through an Ecosystem

In order to live, organisms must obtain energy and nutrients

- Heterotrophs
 - Obtain energy and nutrients from the food they eat
- Autotrophs
 - Obtain energy from the sun
 - Obtain nutrients from the soil.
- Producer
 - Uses energy from the sun and carbon from the environment to make its own food.
 - “bottom of the food chain”
 - Why are producers necessary in any ecosystem? Make energy from the sun available/usable for heterotrophs.
- Consumer
 - Obtains energy through eating other organisms
 - Herbivore: eats only plants
 - Carnivore: eats only animals
 - Omnivore: eats both plants and animals
 - Primary consumer: eats producers
 - Secondary consumer: eats the consumers that eat the producers
 - Means of obtaining nutrition
 - Predation
 - Ecological interaction in which one organism (predator) feeds on another living organism (prey).
 - Predator may or may not kill the prey.
 - Scavenging
 - An animal ingests dead plants, animals, or both.
 - Vultures, termites, beetles
 - Decomposer (Saprophytes)
 - Breakdown (absorb nutrients from) non-living organic material—corpses, plants, waste of living organisms—and convert them to inorganic forms.
 - Bacteria, fungi

Why are decomposers necessary in any ecosystem?

Symbiosis

- “Living Together”
 - Ecological interaction in which two or more species live together in a close, long-term association.
1. Mutualism
 - Both partners benefit
 - Ants and aphids
 - aphids supply sugars to ants; ants protect aphids from insect predators
 2. Commensalism
 - One species benefits, the other is neither harmed nor helped
 - Birds and bison
 - birds feed on insects flushed out of grass by grazing bison
 - Barnacles and whales
 3. Parasitism
 - One species (the parasite) benefits; the other (the host) is harmed.
 - One organism feeds on and usually lives on or in another.
 - Bacterial infection of animals, Fungus infects trees, Malaria

Important Ecological Terms

Abiotic factors

- **Nonliving** chemical or physical factors in the environment.

- **Examples: Air, soil, water, wind**

Biotic factors

- **Living** organisms in the environment.
- **Examples: Plants, animals, fungi, microorganisms**

Ecosystem

- **All** living and nonliving things in a given area

Community

- **All living organisms** that inhabit a given area.
- A group of populations

Population

- A group of individuals belonging to the **same species** that live together in the same area

Competition

- Two or more organisms require the same resource that is in limited supply.
- Food, shelter, light, water, mates
- The strongest organism will win the competition and will be more likely to live and pass its genes on to the next generation (**natural selection**).

Habitat

- Place or environment in which populations live

Niche

- Role of a species in an ecosystem
- Relationships, activities, resources used

Succession

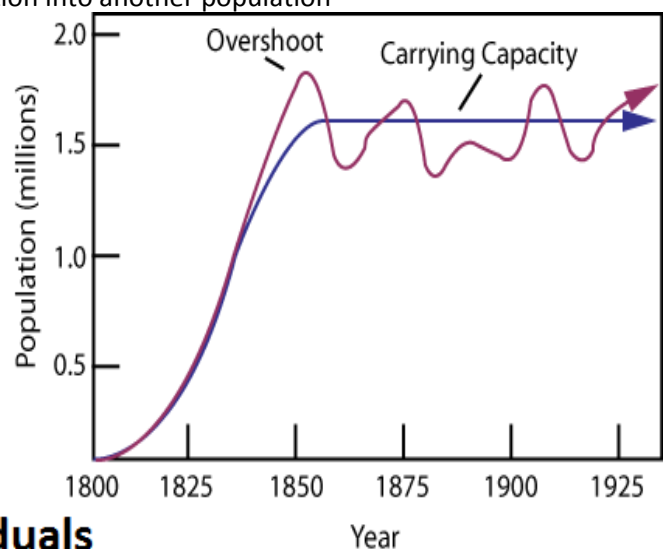
- The series of predictable changes that occurs in a community over time
- Primary succession occurs on a surface where no soil exists. Example: bare rock, areas covered by volcanic ash
- Secondary succession occurs in an area where a disturbance changes an existing community without destroying the soil.
 - Example: plowed land, area burned by wildfire

Population Change

- Immigration – The movement of individuals into a population from another population (population increase).
- Births – An increase in births increases the population size.
- Emigration – The movement of individuals out of a population into another population (population decrease).
- Death – When individuals die, the population decreases.

Carrying capacity

- The maximum number of individuals of a particular species that the environment can normally and consistently support.
- Carrying Capacity typically changes when the environment changes:
 1. Increase/Decrease in prey population
 2. Increase/Decrease in predator population
 3. Increase/Decrease available habitats
 4. Increase/Decrease available mates



Population Density

- A measurement of the number of individuals living in a defined space.
- The formula is Population density

of individuals

Area (unit²)

Population Crash

- A dramatic decline in the size of a population over a short period of time.
- Decline occurs due to limiting factors.
- **Density Dependent Limiting Factors:** factors that are affected by the number of individuals in a given area.

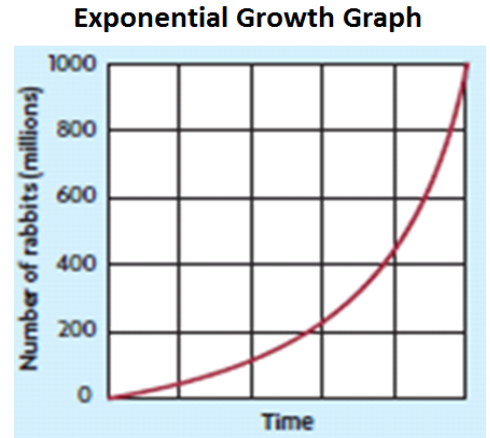
1. **Competition**-the larger a population size, the greater the competition for food, water, shelter, and mates.
2. **Predation**-the population of a predator can be directly affected by the number of available prey.
3. **Parasitism and Disease** -spread more quickly in more dense populations. The more crowded an area, the easier the spread of disease and parasites.

• **Density-Independent Limiting Factors** are the aspects of the environment that limit a population's growth regardless of the density of the population.

- There are 3 major examples of density-independent limiting factors:
 1. **Unusual Weather**-Extreme cold or drought.
 2. **Natural Disasters**-Floods, fires and volcanoes don't care how many organisms are in the population.
 3. **Human Activity**-Destruction of habitat and hunting.

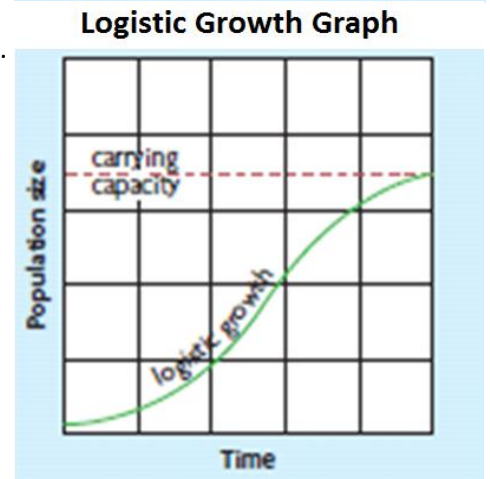
Exponential Growth

- When resources are unlimited, a population has the opportunity to grow rapidly.
- Occurs when a population size increases dramatically over a period of time.
- The resulting curve is called a **J-Curve**.



Logistic Growth

- occurs when a population begins with a period of slow growth followed by a brief period of exponential growth before leveling off at a stable size.
- The point at which the population reaches limited resources and STOPS growing is called Carrying Capacity.
- The resulting curve is called an S-curve.



Food Chain

- **Linear** pathway of energy transport through an ecosystem
- algae → krill → cod → seal → killer whale → bacteria
- Producers always come first in the food chain.
- Decomposers always come last in the food chain; they will break down dead organisms and allow nutrients to be recycled.
- Arrows indicate the **direction** in which **energy** flows through the ecosystem.

Food Web

- A **network** of interconnected food chains in an ecosystem
- Producers are at the beginning.
- Decomposers are at the end.
- Arrows indicate the **direction** in which energy flows through the ecosystem.

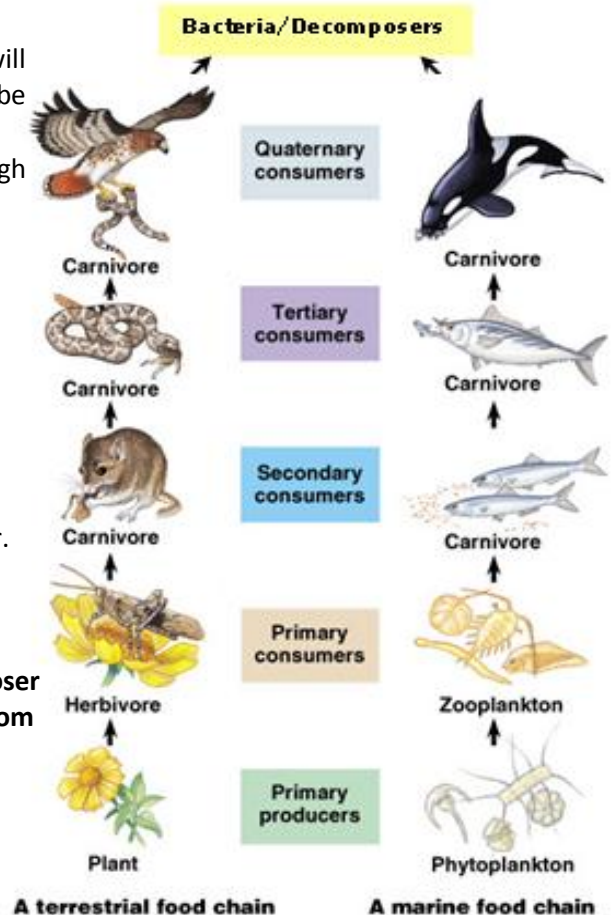
Practice:

1. Draw a food chain with at least five organisms. Label all organisms as being a producer, a consumer, or a decomposer. Make sure arrows are drawn to show how the energy is transferred.

Producer **Consumer** **Consumer** **Consumer** **Decomposer**
 Grass → Grasshopper → Bird → Cat → Mushroom

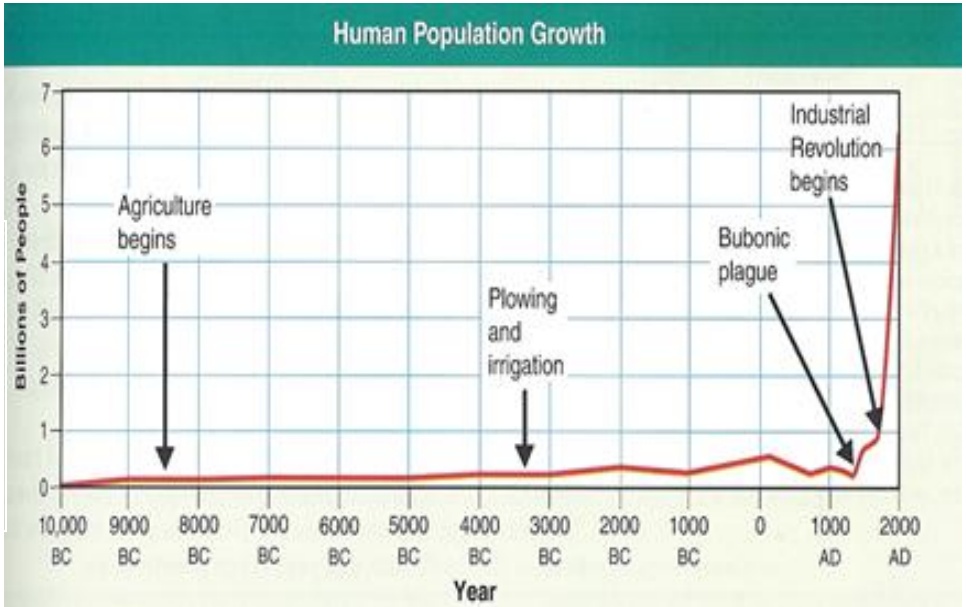
2. How does a food chain prove the Law of Conservation of Matter and Energy?

The energy is not disappearing but is being transferred from one organism to another.

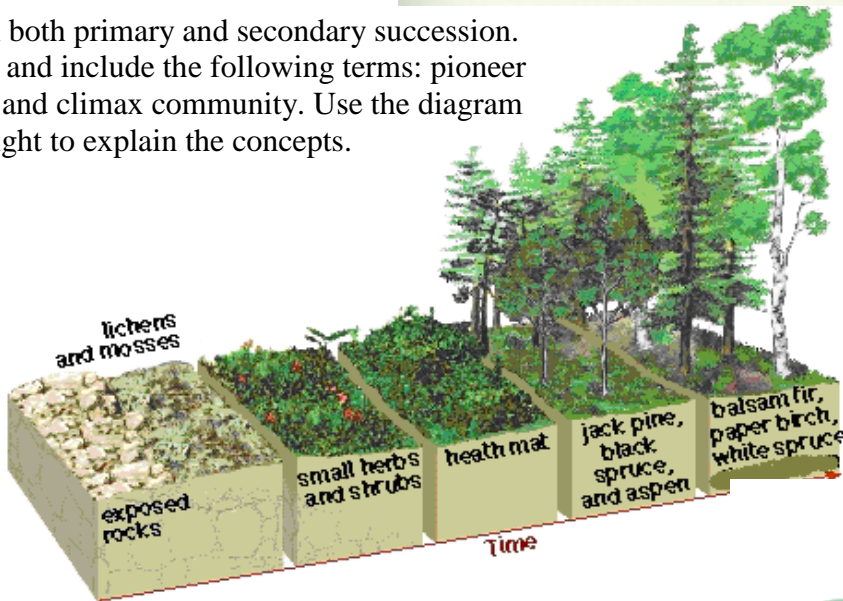


Write a paragraph (5-8) sentences on each of the 5 prompts below. Be sure and address all of the question and refer to the diagram in your writing.

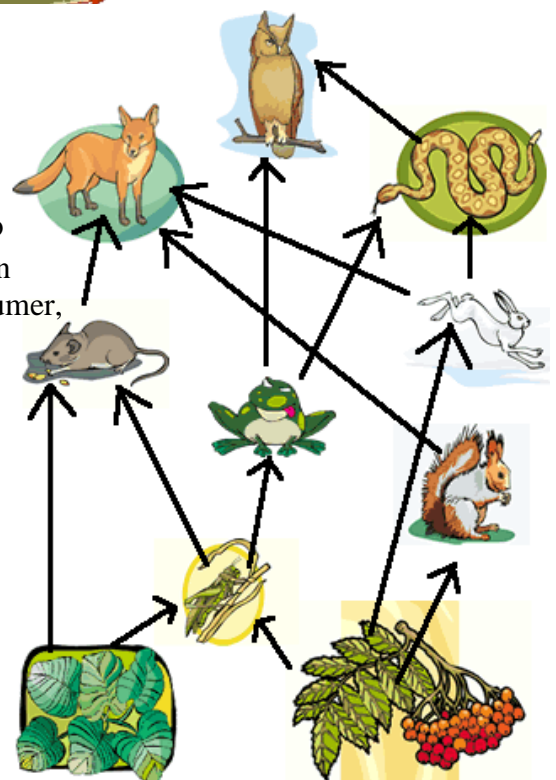
1. What is an ecosystem? Be sure to include and explain the following terms: abiotic and biotic.
2. Explain the function of a population graph. Be sure and include the following terms: exponential growth, logistic growth, and population crash. Refer to the graph to the right to provide specific examples of each in your writing.



3. Explain both primary and secondary succession. Be sure and include the following terms: pioneer species and climax community. Use the diagram to the right to explain the concepts.



4. Explain the differences and similarities between a food web and a food chain. Be sure and include the following terms in your writing: producer, primary consumer, secondary consumer, tertiary consumer, carnivore, omnivore, and herbivore. Refer to the diagram to the right to provide examples and explain concepts



5. Select an organism from the diagram above. Explain the effects on the ecosystem if that organism were removed. Provide both positive (if any) and negative impact on the ecosystem.