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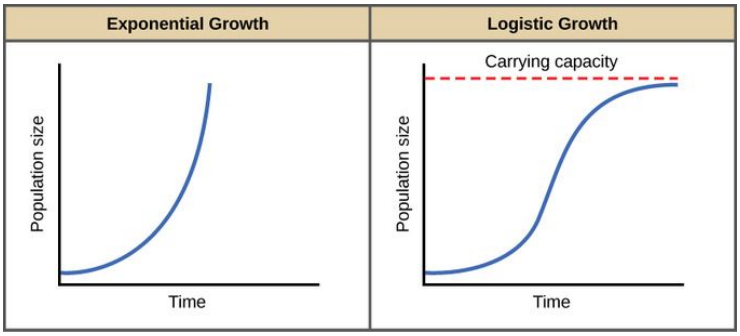
MCAS Review 5: Ecology + Populations

POPULATION ECOLOGY

Population = a group of individuals of the same species living in the same area

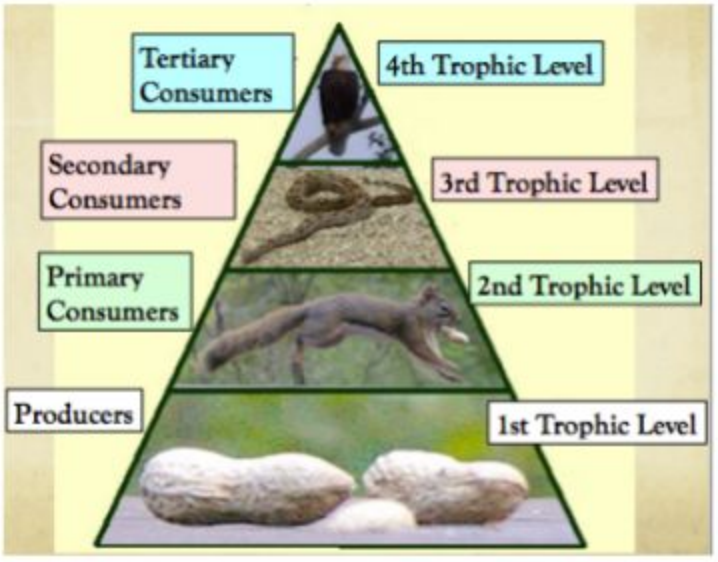


- Factors that <u>increase</u> populations
  - *Birth rate* greater than *death rate*
  - **Immigration** = movement of individuals into a population (**I**mmigration = **I**n)

- Factors that <u>decrease</u> populations = LIMITING FACTORS
  - *Death rate* greater than *birth rate*
  - **Emigration** = movement of individuals out of a population (**E**migration = **E**xit)
  - *Climate changes* = hurricanes, changing temperatures, etc..
  - *Human activity* = hunting, altering habitats, pollution, etc…
  - *Invasive species* = species brought by humans to areas where they do not belong.
    - In their new habitat, they lack their natural predators so the population grows exponentially without their normal limiting factors.
- **Carrying Capacity** = The amount of organisms that can survive in one environment

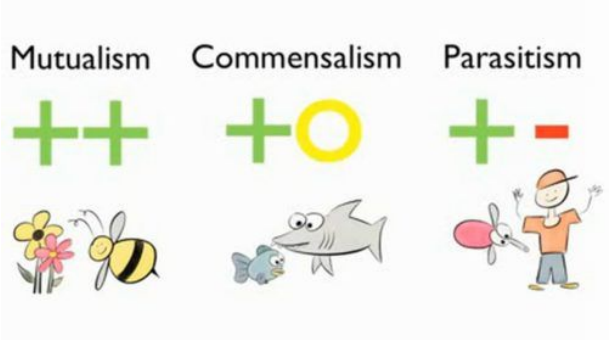
FOOD WEBS AND ENERGY

- Arrows (↔) indicate flow of energy, NOT WHAT EATS WHAT
- **Producers** = **autotrophs**, organisms that make their own food using the sun's energy. (PLANTS!!!!!, Photosynthetic Bacteria, and Algae)
- **Consumers** = **heterotrophs**, organisms that get their energy from consuming (eating) other organisms (ANIMALS and FUNGI!!!!!!!)
- **Decomposers**: break down dead organisms. (ex. Mushrooms are NOT plants!!!, and bacteria)

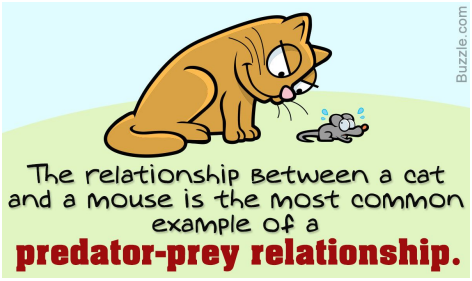


- **Trophic Levels**
  - Energy goes *down* as you go up each level of the food chain
  - Only 10% of energy is transferred to each trophic level

SYMBIOSIS AND OTHER BIOLOGICAL RELATIONSHIPS



- **Parasitism (+/-)** = one organism benefits and the other is harmed, but not killed.
    - Example: Human and mosquito
- **Commensalism (+/0)** = relationship in which one organism benefits and the other is neither harmed nor helped
    - Example: Shark and remora fish
- **Mutualism (+/+)** = relationship in which both species benefit
    - Example: Flower and Honeybee
- **Competition** = relationship in which two or more organisms compete with each other over the same food source
    - Example: Lions and Cheetahs both eating gazelles
- **Predation** = one organisms hunts and feeds on another (prey)
    - Example: Snakes (predator) and mice (prey)



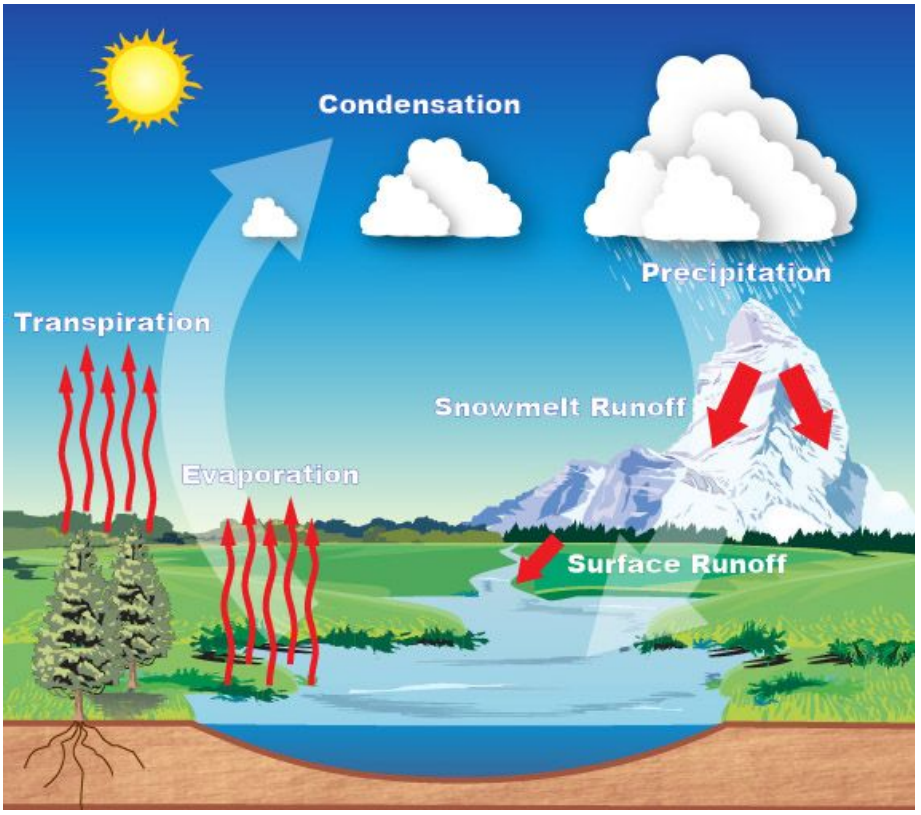
NUTRIENT CYCLES

Biotic resources = living things

Abiotic resources = non-living things

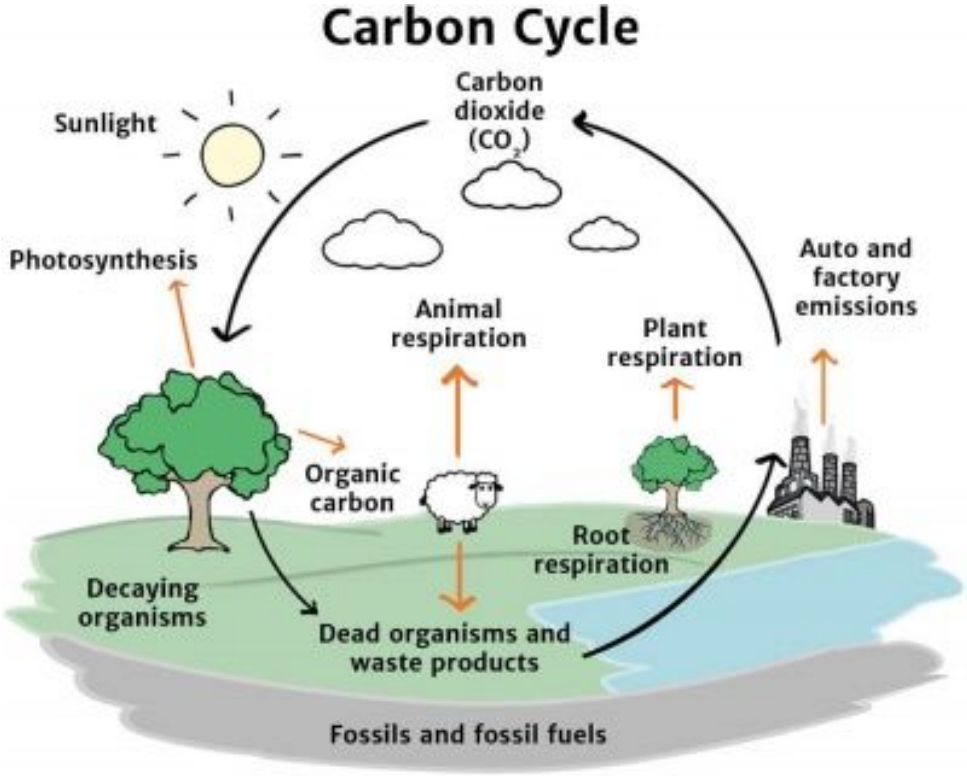
WATER CYCLE

- Water **evaporates** from lakes, rivers and oceans
- Water **condenses** in clouds
- Water **precipitates** down to the ground
- Water "runs off" **(runoff)** from higher areas to lower areas and may seep into the ground, eventually returning to rivers or lakes
- Water may be taken up by plants through **root uptake**
- **Transpiration** = evaporation of water from *leaves of plants*



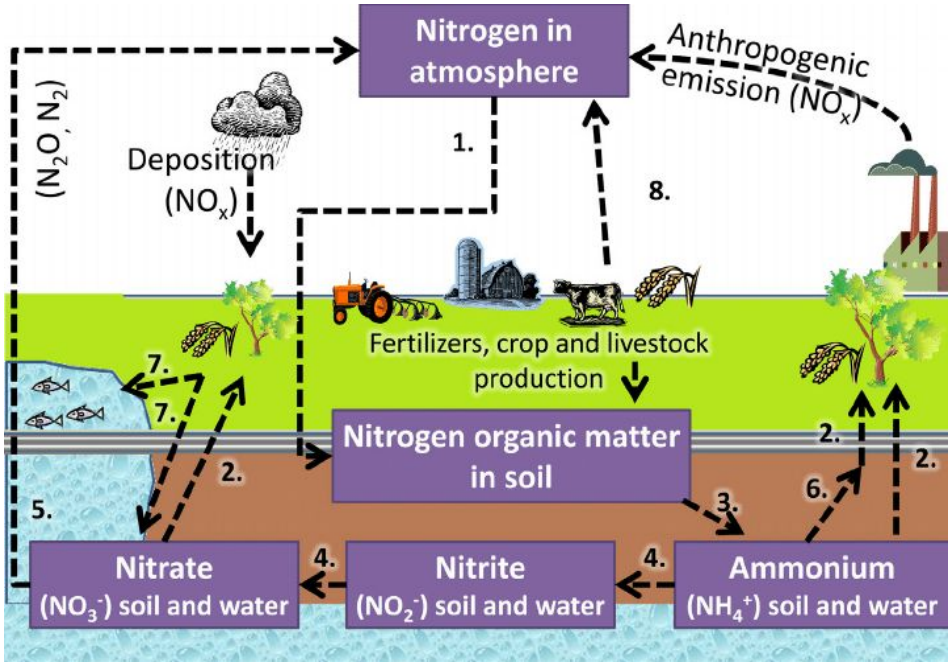
CARBON CYCLE (USUALLY FOUND IN CARBON DIOXIDE OR CO_2)

- Plants take in CO_2 through **photosynthesis**
- Animals (and plants) release CO_2 into the atmosphere through **cell respiration**
- Living things full of carbon will **decompose** into ground when they die
- When **humans burn fossil fuels** (ex. cars, factories, etc.), it releases CO_2
- **Volcanoes** release CO_2
- Most CO_2 found in atmosphere or in ocean



NITROGEN CYCLE

- Lots of N_2 (gas) in atmosphere but we can't use it
- Bacteria do **nitrogen fixation** = taking N_2 and converting it into a form in the soil that plants can use (NH_3, NO_3, and NO_2 [nitrates/ammonia])
- **Denitrification**: bacteria turn nitrates/ammonia in soil back into N_2 in atmosphere
- Nitrogen key part of nucleic acids! (Nitrogenous bases!)
- Much of the waste of living things is nitrogenous (ex. Urea)



PRACTICE QUESTIONS

_____1. Every year, monarch butterflies from Canada and the United States spend the winter in central Mexico. The dry and mild climate in Mexico allows the monarch butterflies to survive the winter. One winter, a week of storms caused freezing temperatures and 43 cm of snow in Mexico.
What was the most likely impact of these storms on the monarch butterflies?

a. Monarch butterflies died in large numbers.
b. Monarch butterflies immediately migrated back to the United States.
c. Monarch butterflies did not migrate from Canada and the United States the next year.
d. Monarch butterflies evolved several new adaptations to survive the winter in Mexico.

____2. The size of a bird population increased by two percent in one year. Which of the following could have contributed to the population increase?

a. a decrease in the death rate of baby birds
b. an increase in the number of the birds' predators
c. an increase in the average number of parasites per bird
d. a decrease in the immigration of birds of the same species

____3. When locust populations grow too large for an area, the individual locusts are crowded and food becomes scarce. In response to these conditions, some of the locusts leave the area and find a new habitat. Which of the following terms **best** applies to the response of the locusts that leave for the new habitat?

a. Commensalism
b. Emigration
c. Hibernation
d. Mutualism

_____4. In traditional landscaping, leaves are raked off the round and bagged. In which of the following ways does this practice most significantly disrupt natural nutrient cycling?

a. It carries away microorganisms that can perform nitrogen fixation.
b. It reduces the rate of oxygen and carbon cycling via photosynthesis
c. It prevents carbon, oxygen, and nitrogen from being returned to the soil.
d. It increases the amount of carbon dioxide that is released to the atmosphere.

____5. In the past 100 years, levels of atmospheric carbon dioxide have increased as the result of the burning of fossil fuels. Other processes in the carbon cycle have absorbed some of the carbon released by this combustion. Which of the following **most likely** have absorbed excess carbon released by combustion?

A. animals **B.** glaciers **C.** plants **D.** rocks

____6. The northern spotted owl is listed under the Endangered Species Act as a threatened species in its primary range of Washington, Oregon, and California. Which of the following **most likely** contributed to the northern spotted owls population decline?

a. increases in rodent populations
b. loss of trees from forest habitat
c. prevention of wildfires in forests
d. decreases in mountain lion populations

_____7. Which of the following lists identifies organisms that are producers in food webs?

a. Algae, ferns, and sunflowers
b. Mushrooms, bacteria, earthworm
c. Termites, red foxes, shrews
d. Woodpeckers, cardinals, and grasshoppers

_____8. Which of the following relationships is an example of mutualism?

a. A lion eats a gazelle
b. A virus uses both a bird and a horse as hosts
c. A bacterium breaks down dead plant materials.
d. A bird eats food particles from a crocodile's teeth.

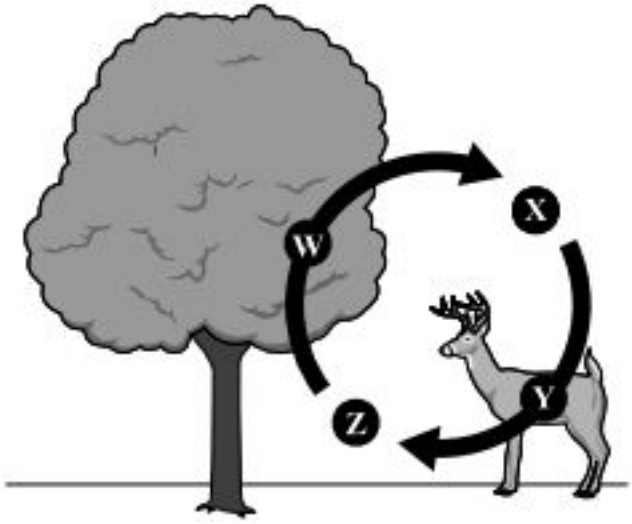
_____9**.** Which of the following processes releases **primarily** oxygen into the atmosphere?

A. Combustion B. osmosis C. photosynthesis D. respiration

____10. Which of the following statements best explains why invasive species often threaten, or hurt, native species in an ecosystem?

a. Invasive species often have less genetic diversity than native species.
b. Invasive species often lack natural predators in their new environment.
c. Invasive species often form mutualistic relationships with native species.
d. Invasive species often cause short-term droughts (no rain) in their new environment.

_____11. Plants and animals play major roles in cycling materials in ecosystems. The diagram below represents one particular cycle. Letters W and Y represent different processes. Letters X and Z represent different gasses.



Which of the following statements correctly identifies part of this cycle?

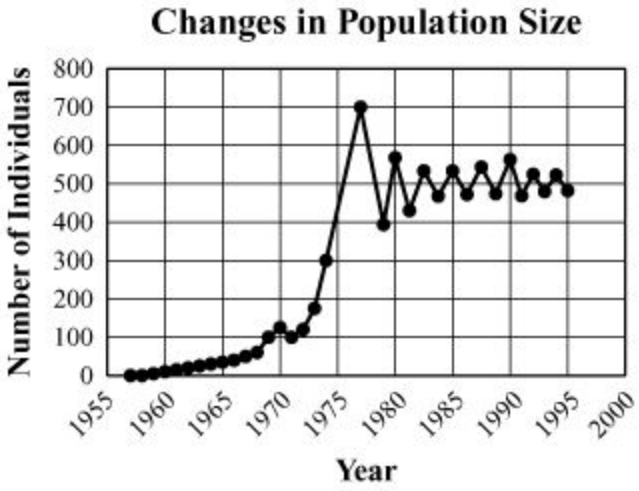
a. Letter W represents cellular respiration.
b. Letter X represents oxygen gas.
c. Letter Y represents transpiration.
d. Letter Z represents nitrogen gas.

____12. Black bears can be found in several areas in Texas and Mexico. The size of one of these bear populations decreased when some individuals from the population moved to another area. .

Based on this information, what caused a decrease in the size of this bear population?

a. Emigration
b. Extinction
c. Natural Selection
d. Speciation

____13. The graph below shows the changes in the population size of a mammal species introduced onto an isolated island in 1957.



Which of the following conclusions is best supported by the data?

a. Every year, more individuals were born than died.
b. The predator of this mammal was removed from the island in 1990.
c. The population decreases were the result of low immigration rates.
d. In the 1980s, the mammal's population size stayed around its carrying capacity.

_____14. The energy that primary consumers use for metabolism and growth comes directly from which of the following sources?

a. organic compounds synthesized by producers
b. organic compounds released by decomposers
c. organic compounds stored in carnivore tissues
d. organic compounds stored in carnivore tissues

____15. Which of the following statements describes one way that energy is transferred in a food web?

a. Plants provide energy to consumers.
b. Energy is cycled between producers
c. Producers store energy made by animals.
d. Consumers get energy directly from sunlight

_____16. A female *Hymenoepimecis* wasp will temporarily paralyze a spider and then lay an egg on the spider's abdomen (stomach). After the paralysis wears off, the spider resumes its normal activity. When the egg hatches, the larva grows by sucking its required nutrients from the spider. *PARALYZE = YOU CANNOT MOVE

What type of relationship exists between the spider and the *Hymenoepimecis* wasp?

a. Commensalism
b. Mutualism
c. Parasitism
d. Predator-prey

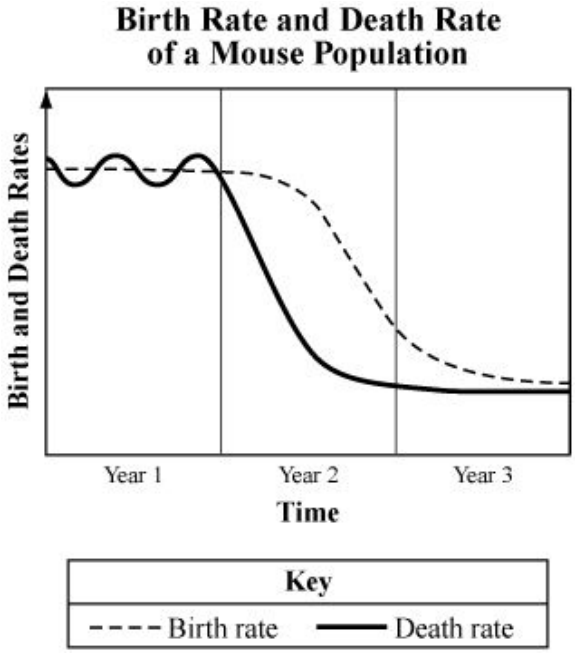
____17. Tiger beetles chase small spiders, which they catch in their strong jaws and then eat. What is the ecological relationship between tiger beetles and spiders?

a. Competition
b. Mutualism
c. Parasitism
d. Predator-Prey

____18. If the producers in a food web were removed, which of the following changes would **most likely** occur?

a. The entire food web would collapse over time
b. The food web would depend on the decomposers for energy.
c. The consumers would begin making energy for the food web.
d. The populations of the remaining organisms in the food web would increase

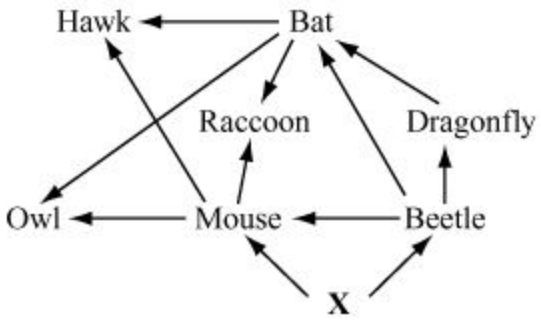
19. The graph below shows the birth rate and the death rate of a mouse population over a three-year period. The immigration rate and the emigration rate of the population are equal.



a. Describe what happens to the size of the population for **each** year shown on the graph. Explain your answers.

b. Identify **three** factors that could affect the death rate of the mouse population, and explain why each factor affects the death rate.

20. A food web is shown below.



An organism in the food web is labeled X.

a. Identify **and** describe the ecological role of organism X in the food web.
b. Identify the organism in the food web whose population size would likely increase the most if the bat became extinct. Explain your answer.

There are many types of relationships between organisms, including competitive and predator-prey relationships.

a. Identify two organisms in the food web that have a competitive relationship. Explain your answer.
b. Identify two organisms in the food web that have a predator-prey relationship. Explain your answer.