

Ecology

Definition: The study of interactions of living things with each other and their surroundings, both living and non-living

Ecologists classify Earth's environment into two categories:

- **Biotic Environment** (with handwritten "Biotic" above) Consists of all **living things** (with handwritten "living" above) Ex: fish, fungi, humans, plants
- **Abiotic Environment** (with handwritten "Abiotic" above) Consists of all **non-living things** (with handwritten "non-living" above) Ex: rocks, water, wind, sun light, air

An ecosystem is a place where living things interact with each other and with their environment

Ecosystem = Biotic + Abiotic
 Ex: pond, marsh, desert, forest, city

Ecosystems can be as large as the entire Earth, or as small as a puddle






Trophic Levels

- The environmental place in which an organism lives is called its habitat.
- It includes the space as well as other organisms.
- An organism's niche is its role in its habitat as well as its habitat (my niche is to do the dishwasher)
- For example, a wolf and deer have the same habitat, but a different niche.
- Interactions among organisms involve feeding habits. Organisms can be classified based on these feeding habits.
- A consumer (heterotroph) is an organism that eats other organisms
- A producer (autotroph) is an organism that produces its own food (All green plants are producers)

Consumers Can Be Classified By What They Eat:

- Carnivores: Eats only meat (lions, wolves, alligators)
- Herbivores: Eats only plants (giraffes, elephants, deer)
- Omnivores: Eats both plants and animals (humans, cats)
- Scavengers: Eats dead organisms (hyenas, seagulls)
- Decomposers: Breaks down dead organisms and waste products of living things (maggots, bacteria)
- Detritivores: Organism that consumes dead material and animals wastes; includes decomposers (worms, crabs)

The trophic level is the level of consumer or producer in a food chain. A food chain can be used to show the passage of energy from one organism to another as each one is consumed. The 1st trophic level in a food ch. is always a producer. All other levels are consumers.

<u>Trophic Level</u>	<u>Organism</u>	<u>Classification</u>
 1 st	Grass ↓	Producer
 2 nd	Grasshopper ↓	Herbivore (Primary Consumer)
 3 rd	Frog ↓	Carnivore (Secondary Consumer)
 4 th	Snake ↓	Carnivore (Tertiary Consumer)
 5 th	Owl	Carnivore (Quaternary Consumer)

Symbiotic Relationships

Parasitism

A relationship in which an organism lives on or in another organism for the purpose of obtaining food, and possibly shelter and breeding space.

(Flea on a dog)

Mutualism

A relationship in which both organisms benefit.

(shark and a pilot fish)

Predation

A relationship in which one organism eats the other.

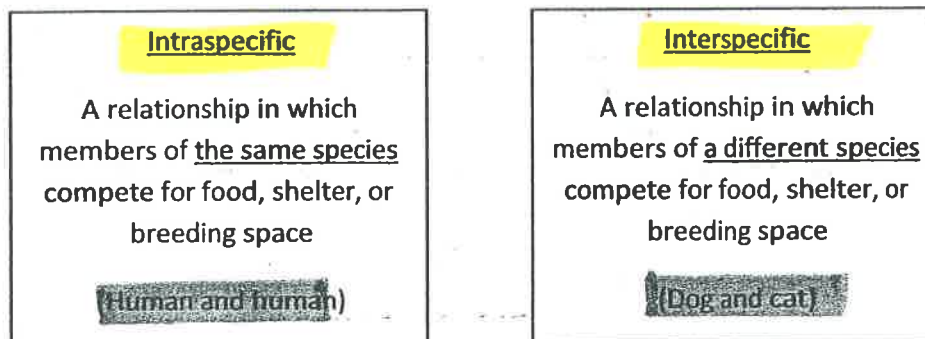
(lion and zebra)

Commensalism

A relationship in which one organism benefits and the other organism is not affected in any way.

(small fish swimming on back of shark)

Competition



Ecology

Population: the members of a species living in the same ecosystem at a certain time

Community: the collection of different populations of all of the species in an ecosystem

Biodiversity: the # of species in an ecosystem - more species; more biodiversity

Birth rate: the # of births per unit time

Death rate: the # of deaths per unit time

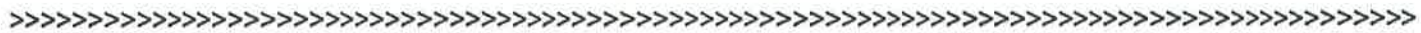
in
↓

Immigration: one or more organisms moving into an area - moving in

Emigration: one or more organisms moving out of an area - moving out

Carrying Capacity: maximum # of individuals who can be supported in an area within natural resource limits for the present and future (materials and energy, food chains, competition)

Population Density: the # of individuals who can live in an area at one time



Biotic Potential: maximum # of offspring that a species can produce

Regulated by the following factors:

- **Birth potential** (maximum # of offspring per birth)
- **Capacity for Survival** (# of offspring that reach reproductive age)
- **Procreation** (# of times a species reproduces in a year)
- **Length of reproductive Life** (age of sexual maturity and # of years able to reproduce)

Population Factors (Limiting Factors)

	<u>Population Increase Factors</u>	<u>Population Decrease Factors</u>
<u>Abiotic</u>	<ul style="list-style-type: none"> • Favourable <u>light</u> • Favourable <u>temperature</u> • Favourable <u>environment</u> 	<ul style="list-style-type: none"> • Too much or too little light • Too cold or too warm • Unfavourable environment
<u>Biotic</u>	<ul style="list-style-type: none"> • Sufficient <u>food</u> and water • Low <u>predation</u> #'s • Few <u>diseases</u> • Ability to <u>compete for resources</u> 	<ul style="list-style-type: none"> • Food and water • High # of predators • Diseases • Inability to compete for resources

Interaction of Living Things

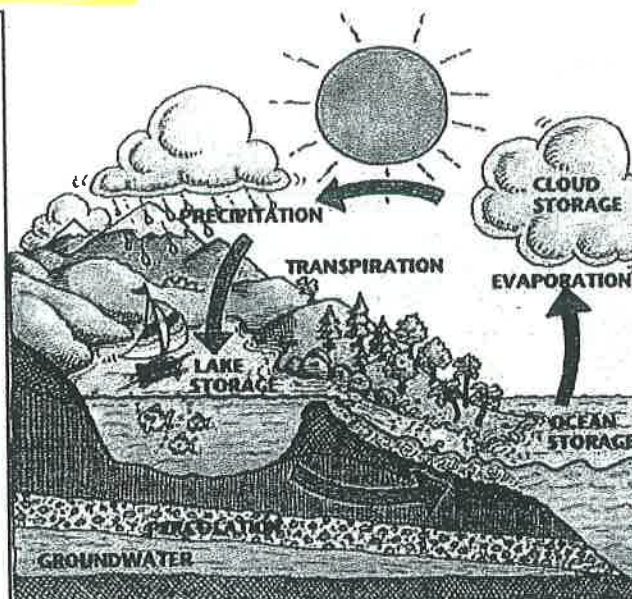
Water Cycle

Water vapour enters the atmosphere through **evaporation** (bodies of water), **transpiration** (vegetation), and **respiration** (plants/animals). Vapour then condenses, forming clouds; water collects and forms **precipitation**.

Some of the water is **absorbed into the ground**, some collects into **bodies of water**.

Plants **absorb the water**, animals **drink the water**.

When animals die their body decomposes and they **release water** from their tissue.



Carbon Cycle

Carbon is in the atmosphere and **dissolves into the oceans as carbon dioxide**. Producer (plants) **use the carbon dioxide** (plus light energy and water) to make glucose and oxygen (**photosynthesis**).

CWEGO

Photosynthesis: Carbon Dioxide + Water + Sun/energy >> (produces) glucose and oxygen

Animals **get carbon dioxide by eating producers or other animals**.

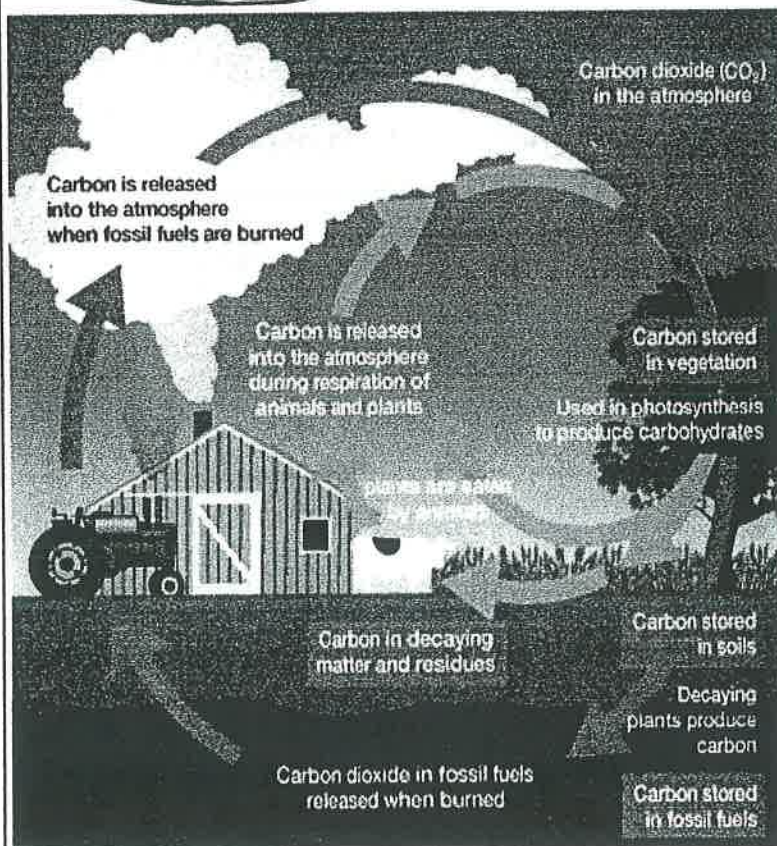
Animals and plants then undergo respiration, and **return the carbon dioxide into the atmosphere**.

GOCWE

Cellular Respiration: Glucose + Oxygen >> (produces) carbon dioxide + water + energy

Carbon dioxide is returned to the atmosphere, soil, and water. Oil and coal result from the accumulation of plant and animals remains that **have not decomposed**, and this is why the **burning of fossil fuels releases carbon dioxide into the atmosphere**.

CWEGO GOCWE



Nitrogen Cycle

All living things need nitrogen! (Protein and DNA)

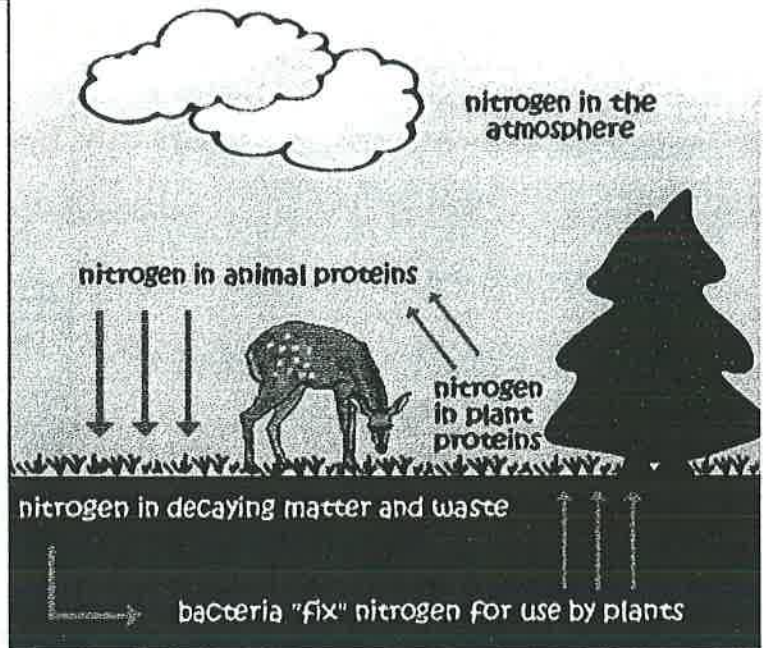
Plants absorb nitrogen compounds from the soil (**nitrates**).

Some plants called legumes contain **nitrogen-fixing** bacteria, making them capable of converting their nitrogen to ammonia and then to nitrates.

Animals obtain their nitrogen by eating plants or other animals.

When plants and animals die, they go through **nitrogen-fixing** (converting their nitrogen to ammonia and then to nitrates).

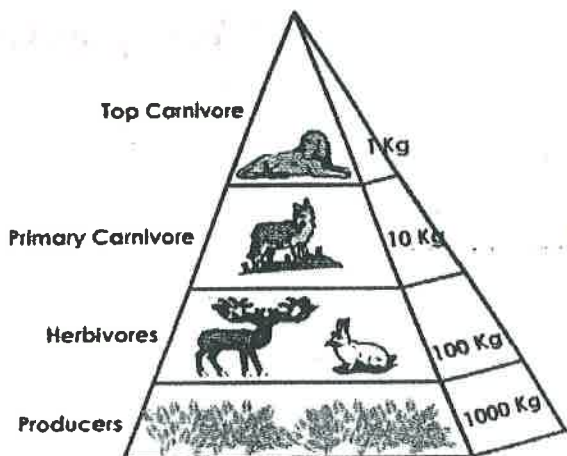
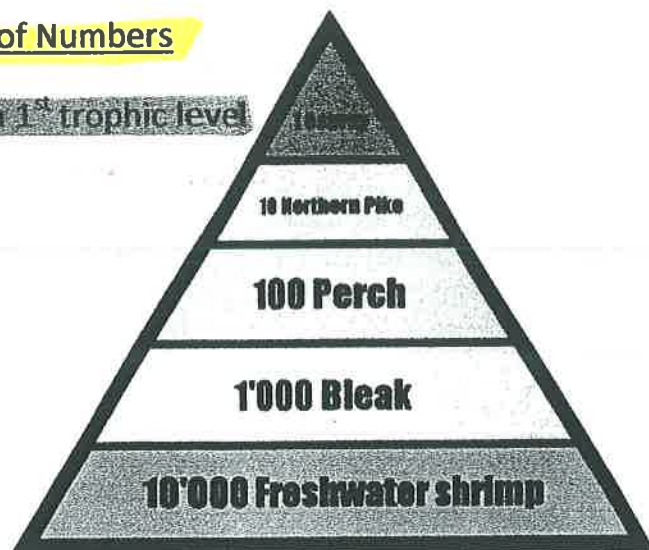
A small amount of nitrogen is fixed into nitrates by lightning, eventually entering the soil.



Ecological Pyramids

Pyramid of Numbers

- Usually greatest number of organisms in 1st trophic level
- Number decreases as you move up



Upright Pyramid of biomass in a Terrestrial Ecosystem

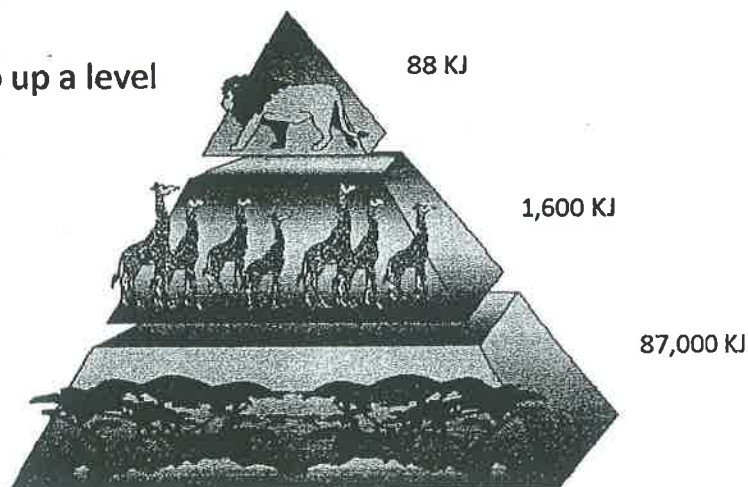
Pyramid of Biomass

- Takes into account the size of organisms
- Based on # and size of an organism
- Calculated by total dry mass

Usually each level is 10% of previous level

Pyramid of Energy Flow

- Measures the total energy
- Energy always decreases as you go up a level
- Kilojoules = KJ



Ecology Unit Review

1. An ecosystem includes biotic and abiotic organisms
2. **Biotic:** living things **Abiotic:** non-living things
3. Photosynthesis: the process by which green plants use carbon dioxide, water and sunlight to make their own food.
4. Photosynthesis equation: $\text{CO}_2 + \text{H}_2\text{O} \xrightarrow{\text{SUN/ENERGY}} \text{GLUCOSE} + \text{O}_2$
carbondioxide + water ^{sun} energy glucose + oxygen
5. Cellular Respiration: when plants and animals return carbon dioxide to the atmosphere
6. Cellular Respiration Equation: $\text{GLUCOSE} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{ENERGY}$
glucose + oxygen → carbon dioxide + H₂O + energy
7. **A food chain** is a diagram that shows the passage of energy from one organism to another. Sun is vital to a food chain because the 1st trophic level in a food chain needs the Sun. *(the producers)*
8. **Producer:** (Autotroph) an organism that produces its own food (green plants)
9. **Consumer:** (Heterotroph) an organism that eats other organisms
10. **Greatest producer of energy:** producers
11. The feeding levels of an ecosystem: the trophic levels (1st level is always a producer)
12. Decomposers break down dead organisms and detritivores consume the dead organisms *Recycle nutrients*
13. **Carrying capacity** refers to the number of individuals who can be supported in a given area within natural resource limits, and without degrading the natural social, cultural and economic environment for present and future generations
14. Four factors that affect carrying capacity: materials, energy, food chains and competition
15. **Pyramid of Numbers:** the # of species in a trophic pyramid
16. **Pyramid of Biomass:** total dry mass of a species
17. **Pyramid of Energy Flow:** total amount of energy flow per species in the pyramid
18. The carbon cycle is special because it keeps our climate in balance
19. The four major exchanges in the carbon cycle are photosynthesis, decomposition, respiration and decay
20. **Nitrogen Fixation:** when plants and animals die, the decomposers convert their nitrogen to ammonia and then to nitrates
21. Nitrification/decomposition: when plants release the nitrogen into the atmosphere
22. Interspecific or Intraspecific
 - a) pelicans competing with each other for sea bass and ocean perch: Intraspecific
 - b) pelicans competing with dolphins for sea bass and ocean perch: Interspecific
 - c) black squirrels seeking mates: Intraspecific
 - d) mice and rabbits eating clover: Interspecific
 - e) raccoons and black bears seeking blueberries: Interspecific
 - f) ferns and small trees reaching for the sunlight on a forest floor: Interspecific
 - g) male deer fighting during mating season: Intraspecific
23. **Density-dependent:** a factor that influences individuals in a population to a degree that varies in response to how **crowded (dense)** the population is.

Food shortage, competition, disease, increase of predators

Density-independent: a factor that influences individuals in a population in a manner that does not vary with the extent of **crowding** present in the population.

fire, flood,
climate change,
drought

9.

- a) competition for nesting dens by foxes due to over crowding: density-dependent
- b) loss of habitat when a mudslide occurs: density-independent
- c) a forest fire wipes out all of the rabbits in a provincial park: density-independent
- d) animals are crowded so a parasite is quickly passed from animal-to animal: density-dependent
- e) a drought causes a food shortage: density-dependent
- f) over-grazing by a large herd of deer kills the grass and causes a food shortage: density-dependent

24. Biotic factors affecting the decreasing population of polar bears: Population of their prey decreases, humans hunting them, berry plants decrease

25. Abiotic factors affecting the decreasing population of polar bears: Icebergs melt

