

Ecology

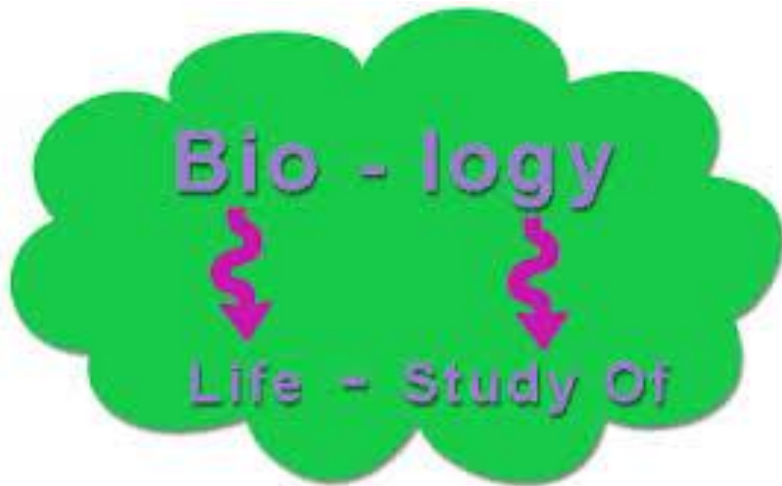
Pre-AP Biology

Pearland High School



What is Biology?

► **Biology** is the study of life!



What does it mean to be alive?

Characteristic of Life Video







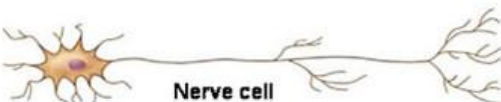

The Eight Characteristics of Life

Must have all to be living

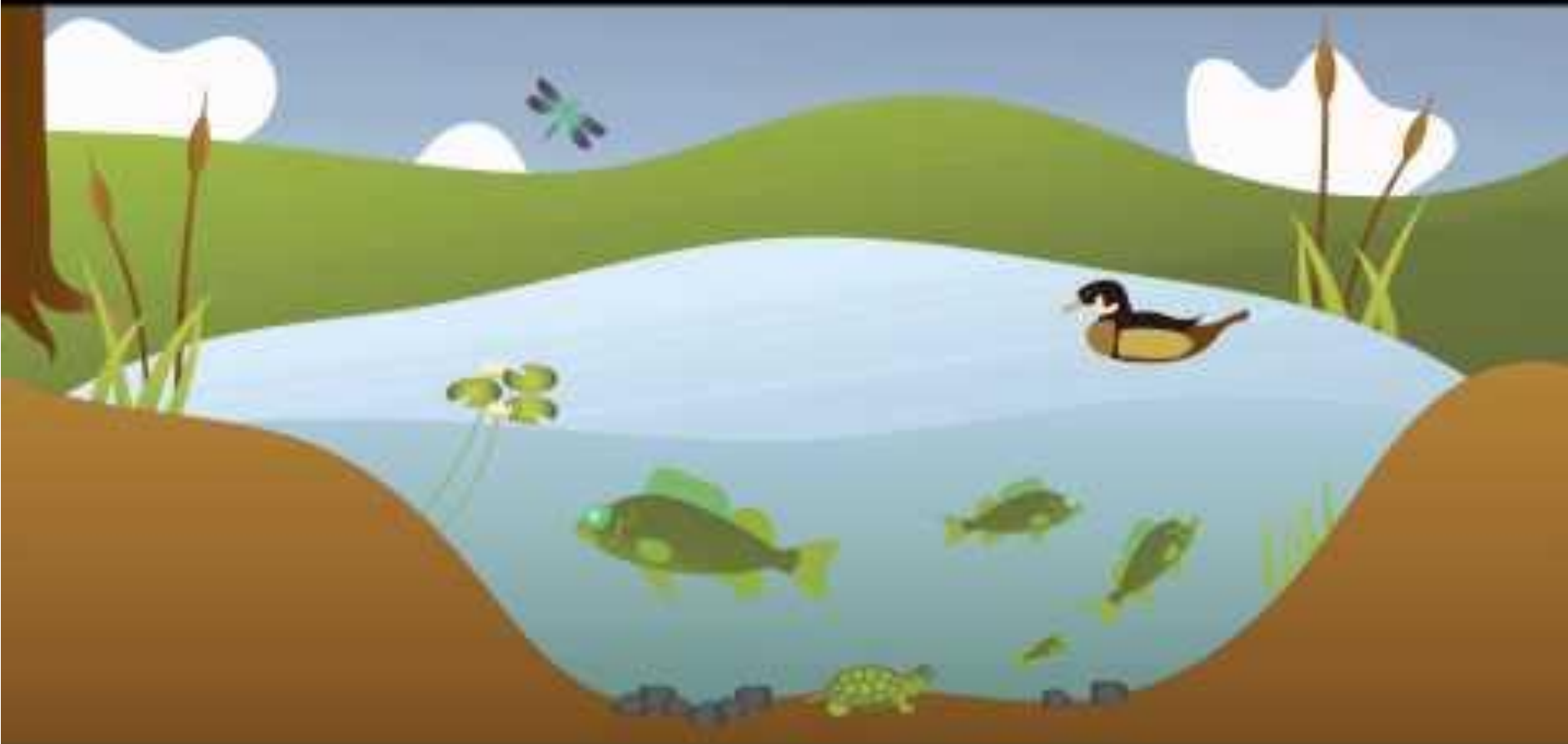
1. Organization & the presence of one (unicellular) or more cells (multicellular)
2. Response to a stimulus (stimuli)
3. Homeostasis
4. Metabolism: nutrients
5. Growth & Development
6. Reproduction
7. Change through time
8. Universal Genetic Code: DNA

Ecology

Ecology: the study of how living things interact with their physical environment

Biosphere	The part of Earth that contains all ecosystems	 <p>Biosphere</p>
Ecosystem	Community and its nonliving surroundings	 <p>Hawk, snake, bison, prairie dog, grass, stream, rocks, air</p>
Community	Populations that live together in a defined area	 <p>Hawk, snake, bison, prairie dog, grass</p>
Population	Group of organisms of one type that live in the same area	 <p>Bison herd</p>
Organism	Individual living thing	 <p>Bison</p>
Groups of Cells	Tissues, organs, and organ systems	 <p>Nervous tissue Brain Nervous system</p>
Cells	Smallest functional unit of life	 <p>Nerve cell</p>
Molecules	Groups of atoms; smallest unit of most chemical compounds	 <p>Water DNA</p>

Ecology



ecosystem

Ecological Organization

INTRODUCTION TO ECOLOGY

LEVELS OF ORGANIZATION

1. Organism (individual)

Anything that possesses all of the characteristics of life.

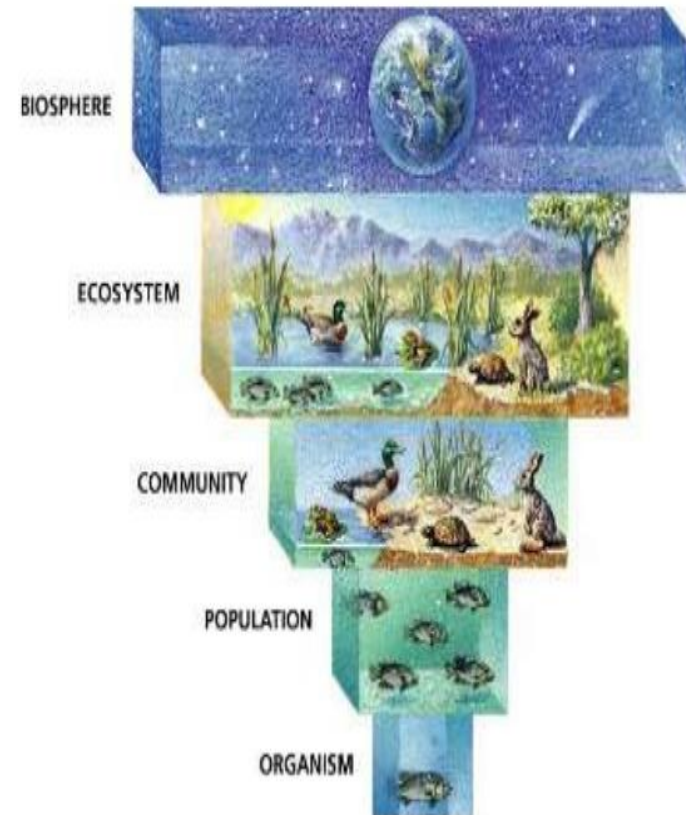
Species: a group of organisms that can mate & produce a fertile offspring

2. Population: All members of a species live in one place at one time

3. Community: a collection of interacting populations in an area

4. Ecosystem: includes all of the organisms & the non-living environment.

5. Biosphere: the portion of the earth where all life exists.

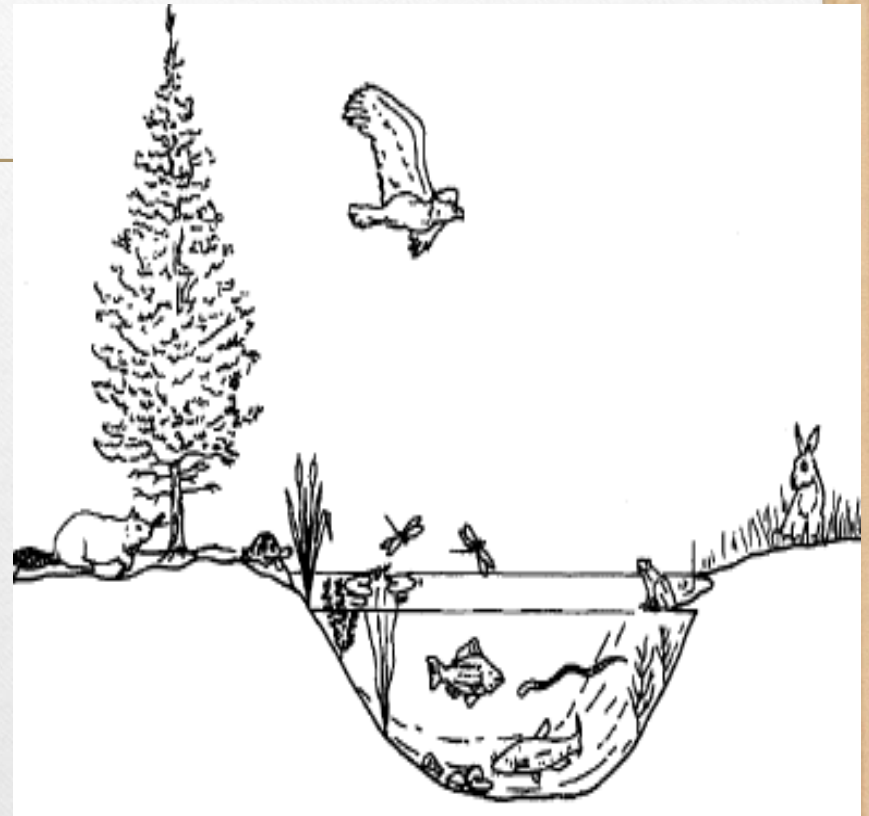
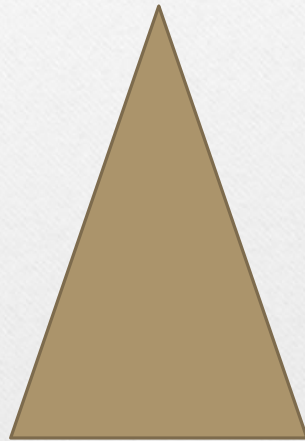


Ecological Organization

*community members in the ecosystem must interact to maintain a balance.

Put in order:

(small to large)
community
population
biosphere
organism
ecosystem

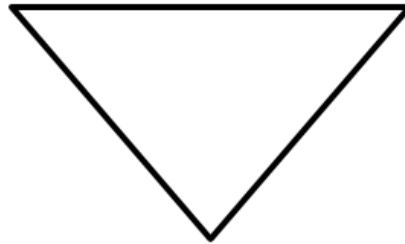


Levels of Organization

Levels of Organization

Put the following terms in order from the largest (#1) to smallest (#5).

- _____ Community
- _____ Biosphere
- _____ Organism
- _____ Population
- _____ Ecosystem

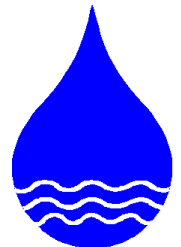


Given the list of organisms in each set below, indicate which level of organization is being studied (look at the list above!).

- A. Herd of deer: _____
- B. Rock, Bald Eagle, Crocodile, Palm Tree, Hot Weather: _____
- C. Zebra: _____
- D. Blue Whale, Squid, Sponge, Blue Marlin, Orca, Dolphin _____
- E. Lion laying in the grass spying on a giraffe: _____

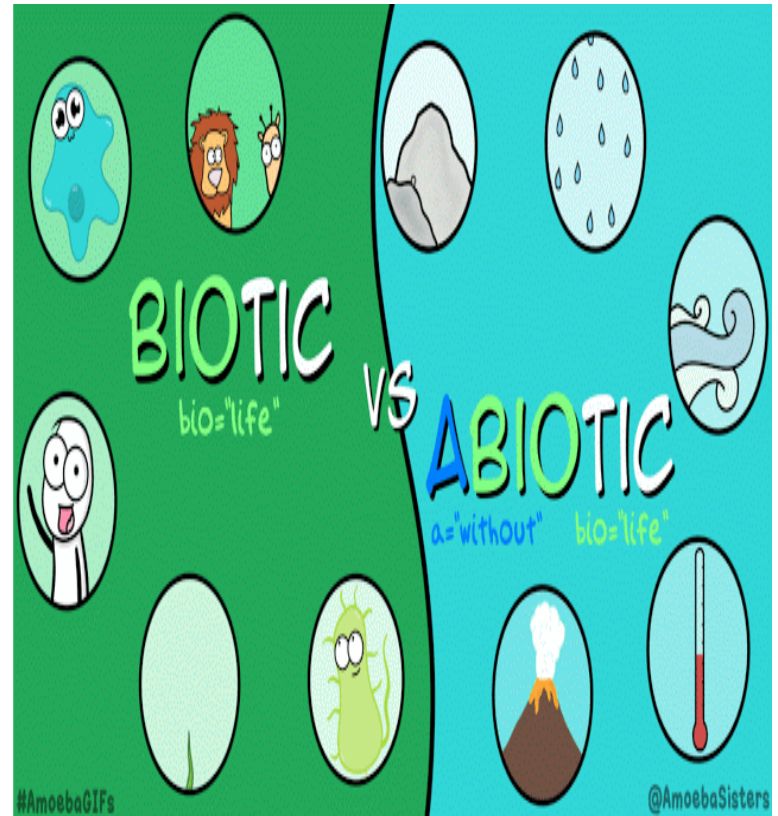
Biomes

- **Biome**: a large region characterized by a specific type of climate & certain plant and animal communities.
- A certain biome may exist in more than one location on earth.
- Biomes are terrestrial (dry) or aquatic (wet)
 - Dependent on:
 - Temperature
 - Solar radiation
 - Precipitation



Biotic and Abiotic Factors

- **Biotic factors:** Living Factors of the environment
 - Examples Predators, food,
- **Abiotic factors**- the nonliving parts of an environment.
- **Examples** temperature, moisture, light, and soil.



Biotic Factors

- **Biotic factors**: living factors which affect the ability of organisms to survive and reproduce

– Examples:

- other organisms, such as a predator, food source

Can an abiotic factor such as RAIN affect many biotic factors?

Rain - _____ - _____ - _____
 grass mole eagle

Abiotic vs Biotic Factors

Abiotic vs Biotic Factors

What is a Biotic Factor? (circle one) Living or Non-Living

What is an Abiotic Factor? (circle one) Living or Non-Living

Label the following items as A for Abiotic or B for Biotic.

LIST:

- | | | |
|----------------------|------------------|-------------------|
| 1. _____ Whale | 10. _____ Clouds | 15. _____ Pipe |
| 2. _____ Clock | 11. _____ Snail | 16. _____ Rain |
| 3. _____ Water | 12. _____ Bull | 17. _____ Gold |
| 4. _____ Fish | 13. _____ Algae | 18. _____ Plastic |
| 5. _____ Paper | 14. _____ Rose | 19. _____ Grapes |
| 6. _____ Glass | | 20. _____ Air |
| 7. _____ Aluminum | | |
| 8. _____ Metal Ruler | | |
| 9. _____ Sand | | |

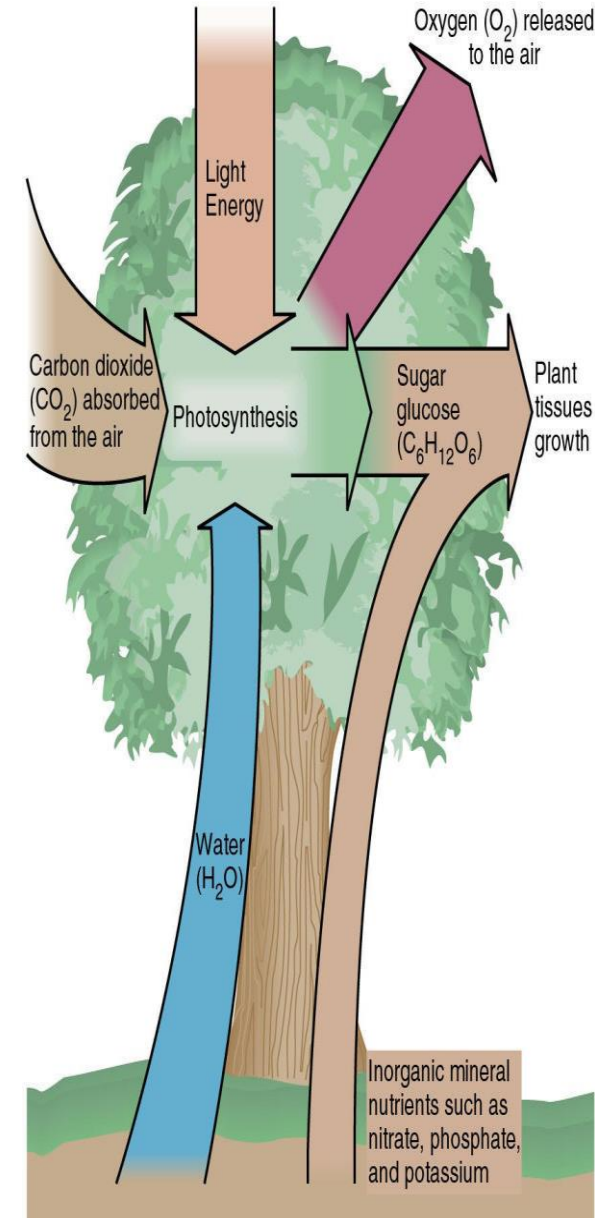
List the abiotic and the biotic factors in the following image.

Abiotic Factors	Biotic Factors

Ecosystems

An ecosystem is self-sustaining if:

1. A constant source of energy is supplied.
2. Living things use this energy and convert into organic molecules
3. A cycling of materials between organisms and their environment



Resources

- ▶ Organisms with similar needs may compete with each other for resources like:

- ▶ **Limiting Factors**

- ▶ Food
- ▶ Space
- ▶ Water
- ▶ Air
- ▶ Shelter (ADD)



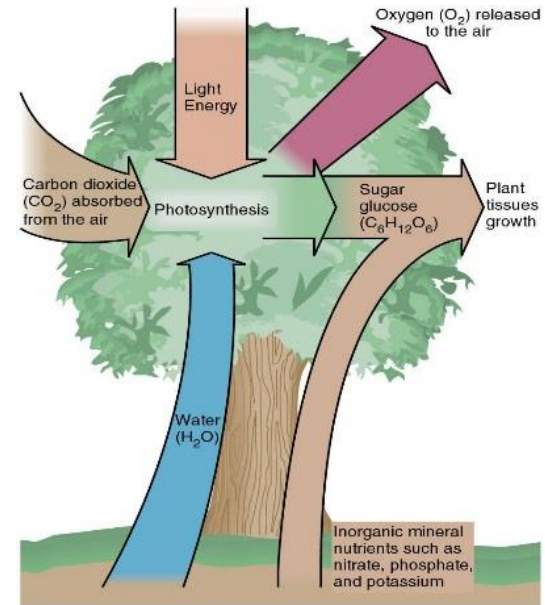
- ▶ Determines the types of organisms that exist in that environment

Nutritional Relationships

- Two types :
Autotrophs &
Heterotrophs

1. Autotrophs: organisms that synthesis their own food.(plants)

2. Heterotrophs: can NOT synthesize their own food and are dependent on other organisms for their food



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Energy Flow

Energy flows through Ecosystems

- **Producers = autotrophs**
- **Consumers = heterotrophs**

Autotrophs = Producer

AKA

Also Known As

PRODUCER

captures energy and transforms it into organic, stored energy for the use of living organisms.

Photoautotrophs



Producer That Captures Energy from the sun by:

–Photosynthesis

- Adds Oxygen to the atmosphere
- Removes Carbon Dioxide from the Atmosphere

Photoautotroph EXAMPLES

- **On Land**
 - **Plants**
- **In The Sea**
 - **Algae**
- **Tidal Flats & Salt Marshes**
 - **Cyanobacteria**



CHEMOAUTOTROPH

- **Capture energy from the bonds of inorganic molecules**

- No light needed
- **Hydrogen Sulfide**
- **The Process Is Called:**

Chemosynthesis



**Know the difference
between**

Photosynthesis

&

Chemosynthesis

Feeding Relationships

Key Concept:

Energy flows through an ecosystem in one direction

from producers to various levels of consumers

Energy Flow in an Ecosystem

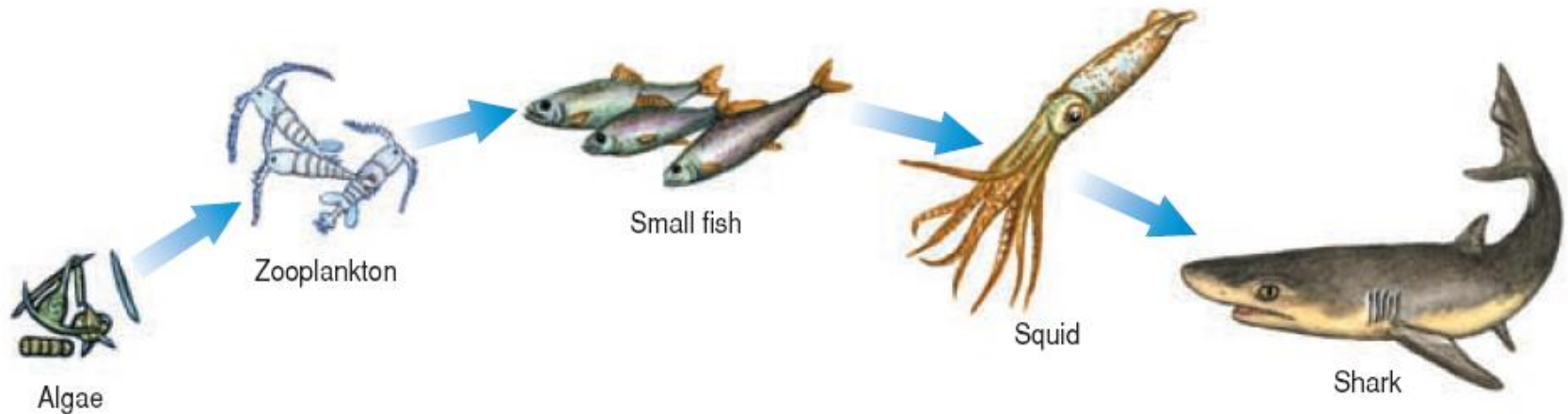
- **Food chain**: a single pathway of feeding relationships among organisms that involves the transfer of energy.



Feeding Relationships

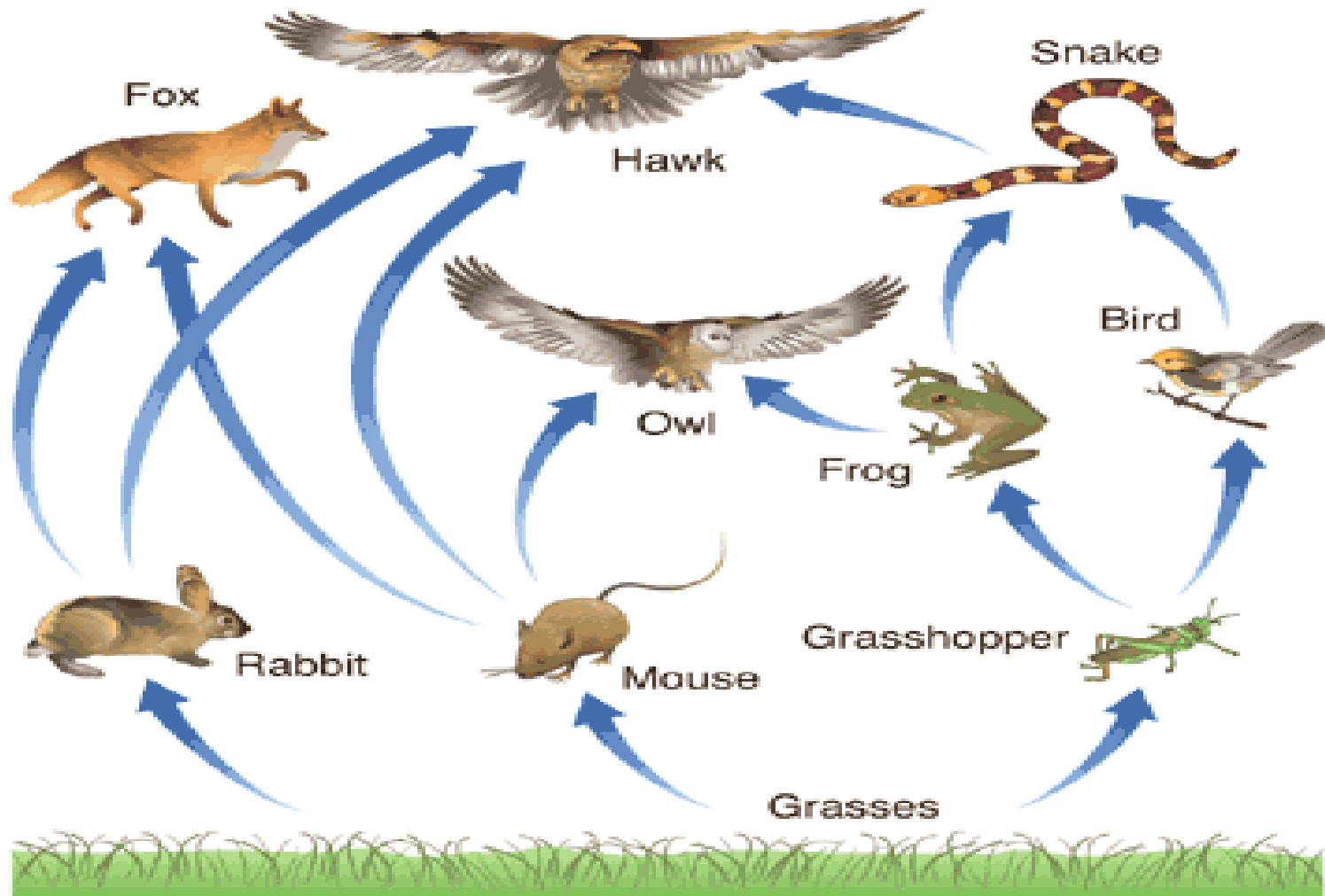
- **Food Chain**

- **Simple Energy path through an ecosystem**



Food Web

More realistic path through an ecosystem



Trophic Levels

Each Level In A Food Chain or Food Web is a **Trophic Level.**

- **Producers**

- Always The ***First*** Trophic Level
- How Energy Enters The System

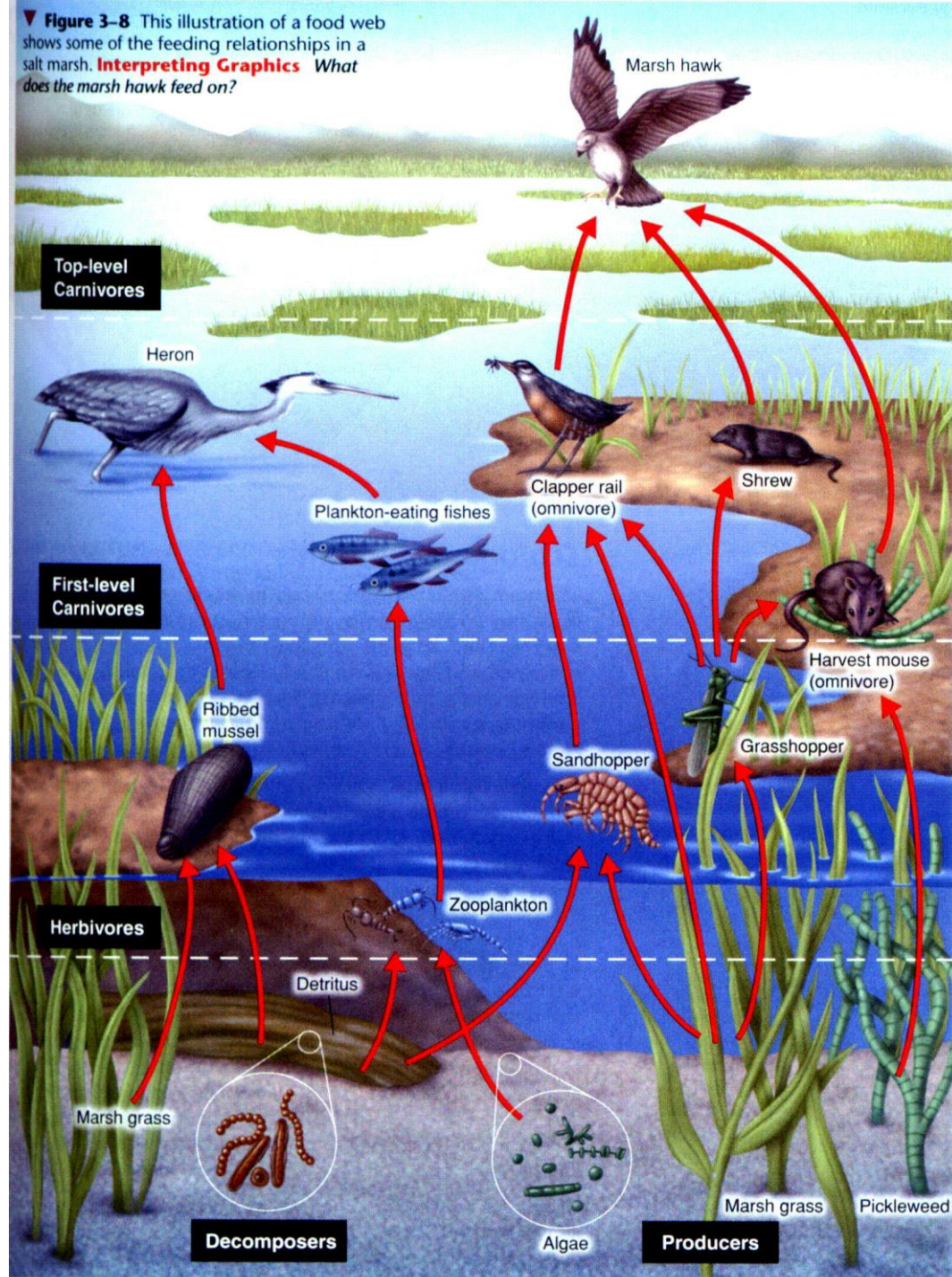
- **Herbivores**

- Second Trophic Level

- **Carnivores/Omnivores**

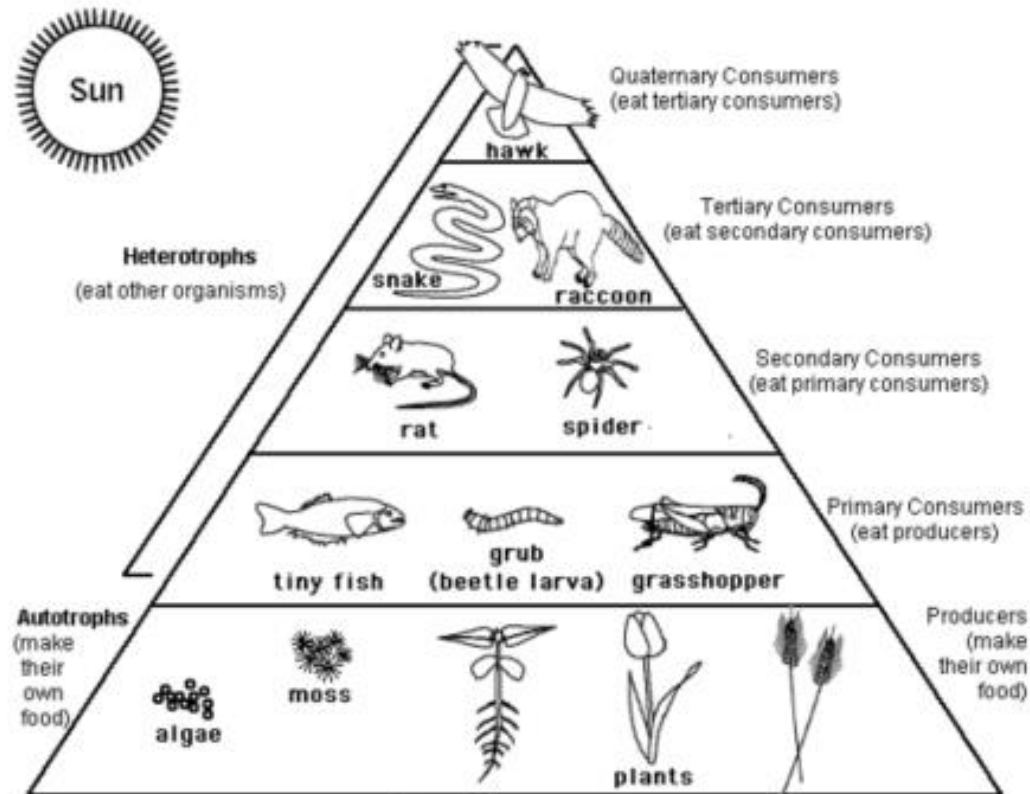
- Make Up The Remaining Trophic Levels

Each level depends on the one below it for energy.



Food Webs, Food Chains & Pyramids

Food Webs, Food Chains and Pyramids



Questions

1. There are many more _____
than there are primary consumers.
2. Organisms that eat other organisms are called _____.

Feeding Relationships Questions

Color the circle by the correct answer

<p>1. A plant is ...</p> <ul style="list-style-type: none"> ○ A. an autotroph ○ B. a heterotroph ○ C. a primary producer ○ D. A and C 	<p>6. A person who eats a chicken that ate grain is a ...</p> <ul style="list-style-type: none"> ○ A. primary producer ○ B. primary consumer ○ C. secondary consumer ○ D. quaternary consumer
<p>2. A cow is ...</p> <ul style="list-style-type: none"> ○ A. a primary consumer ○ B. a heterotroph ○ C. an herbivore ○ D. all of the above 	<p>7. Primary consumers eat ...</p> <ul style="list-style-type: none"> ○ A. primary producers ○ B. primary consumers ○ C. secondary consumers ○ D. quaternary consumers
<p>3. Autotrophs ...</p> <ul style="list-style-type: none"> ○ A. make their own food ○ B. are the base of the food chain ○ C. are primary producers ○ D. all of the above 	<p>8. Secondary consumers eat ...</p> <ul style="list-style-type: none"> ○ A. primary producers ○ B. primary consumers ○ C. tertiary consumers ○ D. quaternary consumers

<p>1. A heterotroph ...</p> <ul style="list-style-type: none"> ○ A. is an autotroph ○ B. eats other organisms ○ C. is a primary producer ○ D. A and C ○ E. none of the above 	<p>6. A top predator...</p> <ul style="list-style-type: none"> ○ A. has no natural enemies ○ B. is a meat eater ○ C. is a heterotroph ○ D. all of the above ○ E. none of the above
<p>2. A cow (that eats plants) is ...</p> <ul style="list-style-type: none"> ○ A. a primary consumer ○ B. a heterotroph ○ C. an herbivore ○ D. all of the above ○ E. none of the above 	<p>7. A detritivore ...</p> <ul style="list-style-type: none"> ○ A. is an autotroph ○ B. eats decomposing matter ○ C. kills animals ○ D. all of the above ○ E. none of the above
<p>3. If a person eats a vegetable, the person is acting as ...</p> <ul style="list-style-type: none"> ○ A. a primary producer ○ B. a primary consumer ○ C. a secondary consumer ○ D. a tertiary consumer ○ E. a quaternary consumer 	<p>8. As nutritional energy passes through the food chain, energy ...</p> <ul style="list-style-type: none"> ○ A. is lost ○ B. is gained ○ C. remains constant ○ D. increases, then decreases ○ E. decreases, then increases

Consumers

- **Herbivores**
 - Eat Only Plants
- **Carnivores**
 - Eat Only Other Animals
- **Omnivores** (That's You)
 - Eat Plants & Animals
- **Detritivores**
 - Feed On **Dead** Plant & Animal Remains
- **Decomposers**
 - Breaks down organic matter
 - Fungi & Bacteria

Consumers

Heterotrophs eat other organisms to obtain energy.

- **Omnivores** (That's You)
 - Eat Plants & Animals
- **Detritivores**
 - Feed On **Dead** Plant & Animal Remains
- **Decomposers**
 - Breaks down organic matter
 - Fungi & Bacteria

Types of Carnivores

- ✓ **Predators**: animals which kill and consume other animals (prey)
- ✓ **Prey**: animals which are killed by predators



More Predator/Prey Relationships



Types of Carnivores

- ✓ Scavengers: animals that feed on other animals that they have not killed

Examples: crows vultures hyenas



Which is the Predator?



Deer Predation & Starvation Graphing Activity

Deer: Predation or Starvation

Name _____

Scenario: In 1997 the deer population of an island forest reserve about 518 square kilometers in size was about 2000 animals. Although the island had excellent vegetation for feeding, the food supply obviously had limits. Thus the forest management personnel feared that overgrazing might lead to mass starvation. Since the area was too remote for hunters, the wildlife service decided to bring in natural predators to control the deer population. It was hoped that natural predation would keep the deer population from becoming too large and also increase the deer quality (or health), as predators often eliminate the weaker members of the herd. In 1997, ten wolves were flown into the island.

The results of this program are shown in the following table. **The Population Change is the number of deer born (deer offspring) minus the number of deer that died (predation and starvation) during that year.** Fill out the last column for each year (the first has been calculated for you).

Year	Wolf Population	Deer Population	Deer Offspring	Predation	Starvation	Deer Population Change
1997	10	2,000	800	400	100	+300
1998	12	2,300	920	480	240	

Population Growth

3 factors that can affect population:

1. - number of births

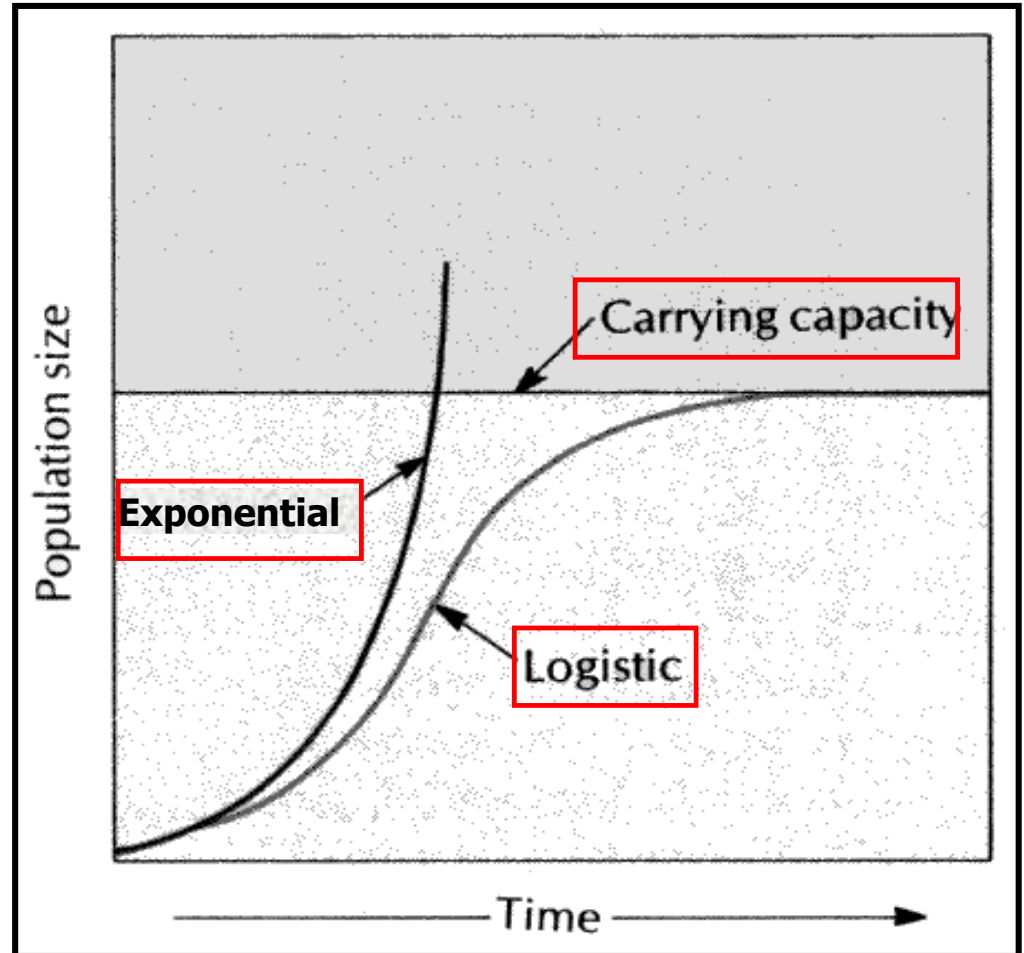
2. - number of deaths

3. - number of individuals that enter or leave the population

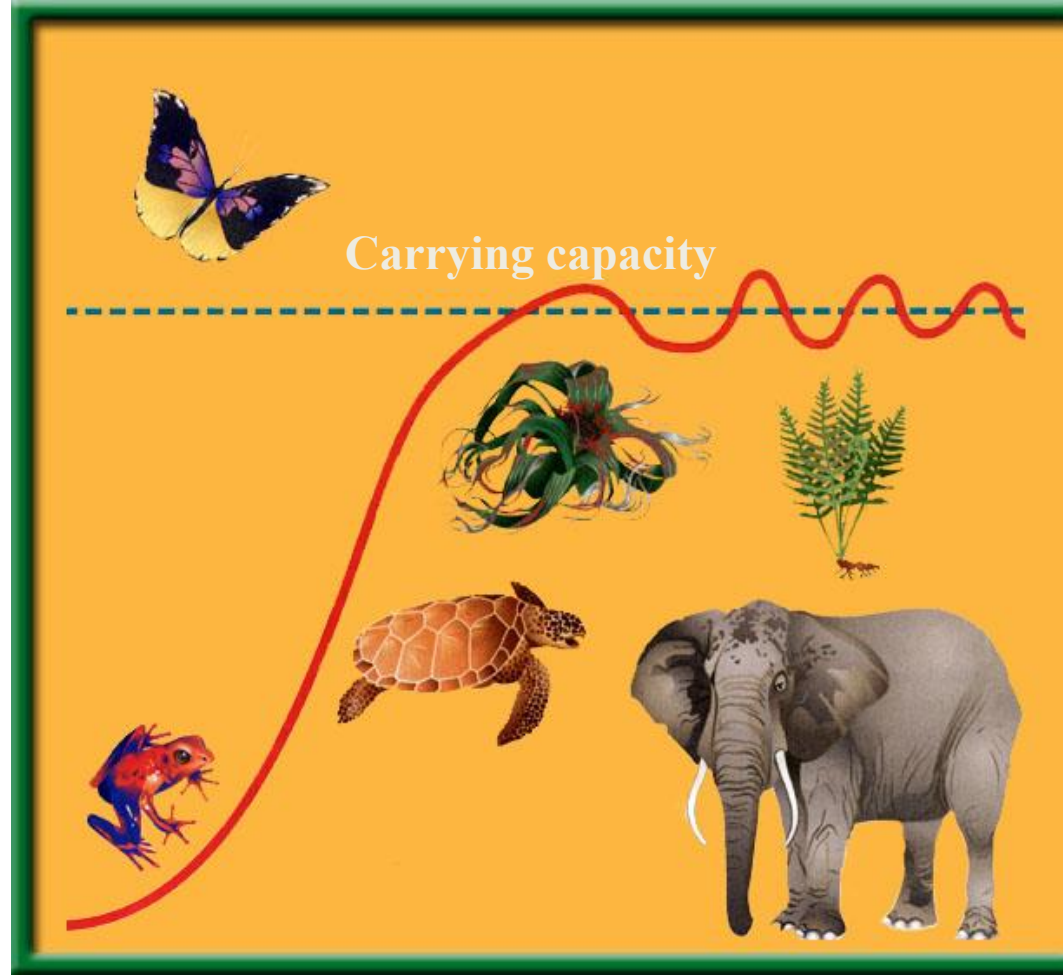
- **Immigration** - movement of individuals **into** an area (entering)
- **Emigration** - movement of individuals **out** of an area (exiting)

Population Growth

- **Logistic growth** (S curve) - occurs when a population's growth slows or stops (limits on growth)
- **Exponential growth** (J curve) - occurs when the individuals in a population reproduce at a constant rate (no limits on growth)
- **Carrying capacity** - largest number of individuals of a population that a given environment can sustain.



- **Limiting factor** - a factor that causes population growth to decrease
 - ▶ Any biotic or abiotic factor that restricts the existence, numbers, reproduction, or distribution of organisms



In reality carrying capacity looks like this

Human Disturbances are **NOT**
A limiting factor*** They're
Density-Independent factors

2 kinds of limiting factors:

- Density-dependent limiting factor
 - Exp. competition, predation, parasitism, disease

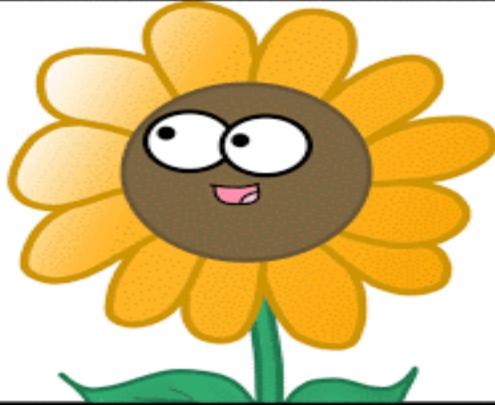
biotic



abiotic

- Density-independent limiting factor
 - Exp. Unusual weather, natural disasters, seasonal cycles, certain human activities

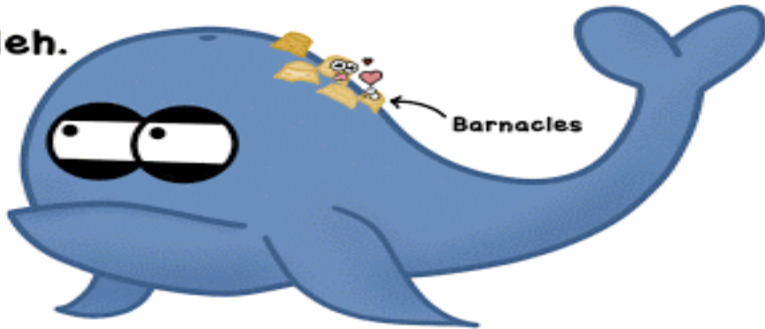




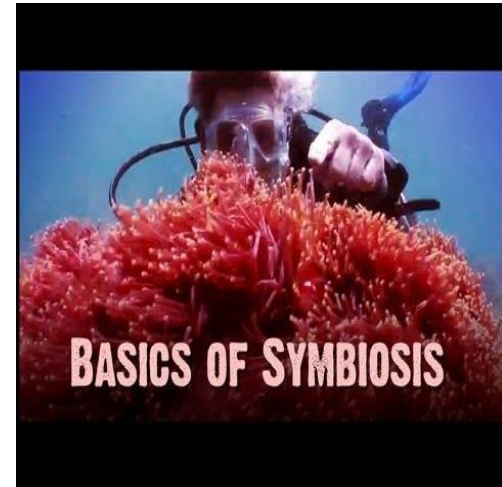
MUTUALISM

COMMENSALISM

Meh.



PARASITISM



[Video](#)

Symbiotic Relationships

- **Symbiosis**: living together with another organism in close association

–Types of symbiosis:

- Commensalism ○ ○
- Mutualism ○ ○
- Parasitism ○ ○

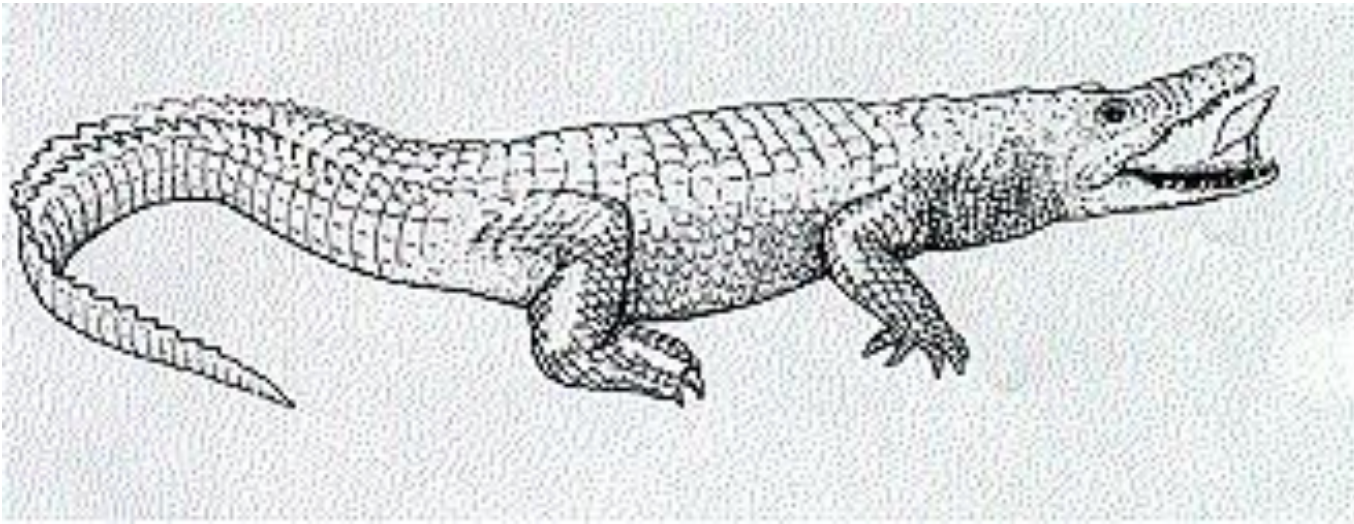
Types of Symbiosis

- **Commensalism**: one organism is benefited and the other is unharmed (+,0)
 - Example: barnacles on whales, orchids on tropical trees



Types of Symbiosis

- **Mutualism**: both organisms benefit from the association (+,+)
 - Example: Nile crocodile opening its mouth to permit the Egyptian plover to feed on any leeches attached to its gums.

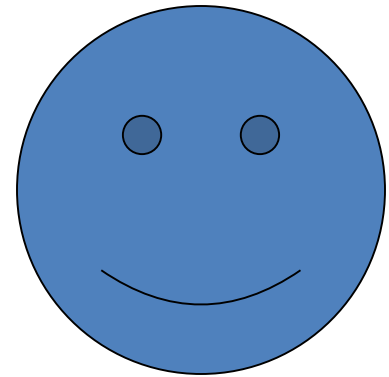


Types of Symbiosis

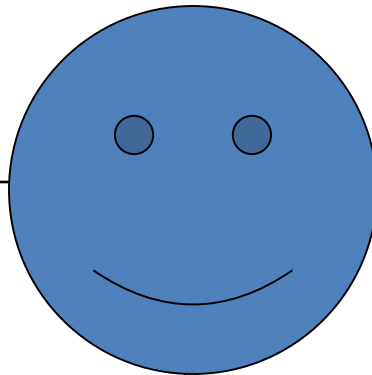
- **Parasitism**: one organism benefits at the expense of the host (+,-)
 - Example: tapeworm and heartworm in dogs
 - athlete's foot fungus on humans
 - leech sucking blood from host



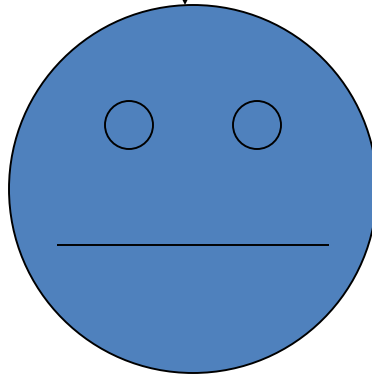
Symbiosis



Mutualism



Parasitism



Commensalism

Good Buddies Activity

Activity: "Good Buddies"

Elements of any ecological system live in an intricate web of interdependence. When two species of organisms live in close association with each other, their relationship is called "symbiotic." In a symbiotic relationship, at least one of the organisms directly benefits from its close association with the other organism. There are three major forms of symbiotic relationships: commensalisms, mutualism, and parasitism.

Define the following terms:

1. Commensalism - _____
2. Mutualism - _____
3. Parasitism - _____

Procedure:

1. For each pair of organisms, read the description of the symbiotic relationship involved between organisms.
2. Determine the type of relationship and circle it.
3. Tell how each organism is affected. Helped = 😊 Harmed = ☹️ Not helped or harmed = 😐

Organisms	Type of Relationship	Effect on Organism	Description of symbiotic relationship involved between organisms.
-----------	----------------------	--------------------	---

Name _____

Date _____

Symbiotic Interactions

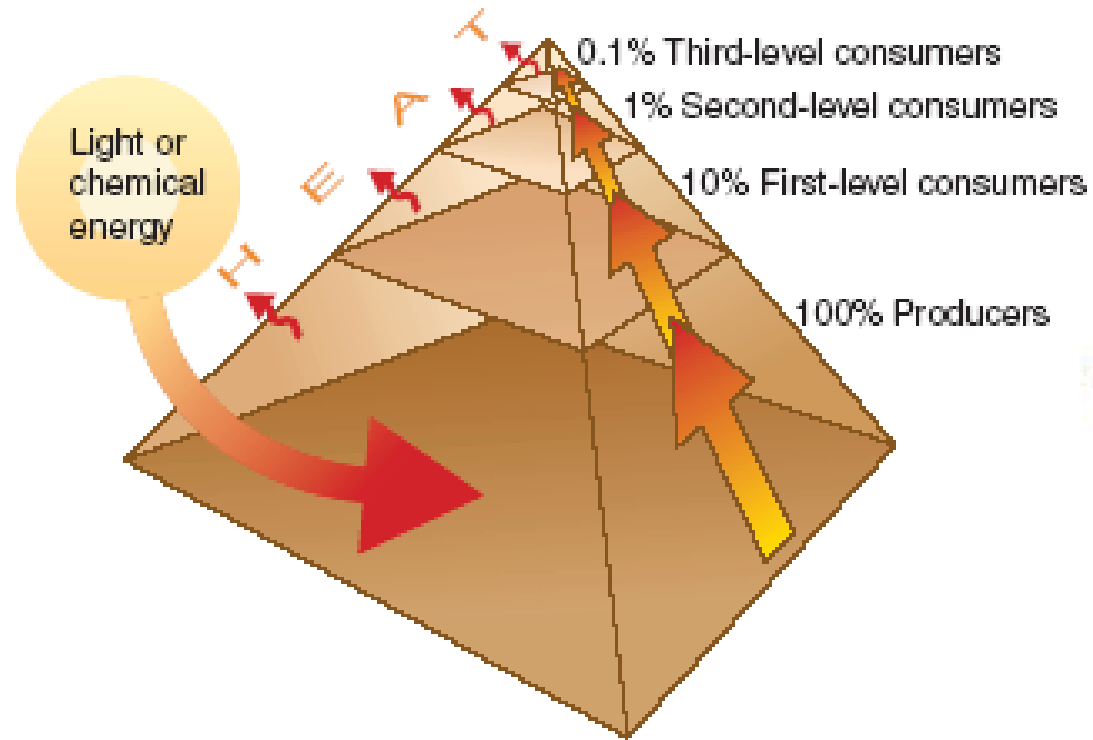
Read each scenario below. First, indicate which kind of symbiotic interaction is being described. Write P for parasitism, M for mutualism, or C for commensalism. Be prepared to explain your reasoning for your choices.

- _____ 1. Some shrimp and crab live and capture food from within the tentacles of giant anemones.
- _____ 2. A pearlfish spends the day inside the alimentary tract, or intestines, of a sea cucumber. The fish emerges from the sea cucumber at night to feed on small crustaceans. The pearlfish gets a safe place to live. The sea cucumber does not gain anything from the relationship, nor is it harmed.
- _____ 3. A cymothoid isopod lives inside the mouth of a snapper fish. The isopod severs blood vessels in the fish's tongue, causing the tongue to atrophy and degenerate. The isopod then feeds its remnants on top of the base of the fish's tongue.

Homework

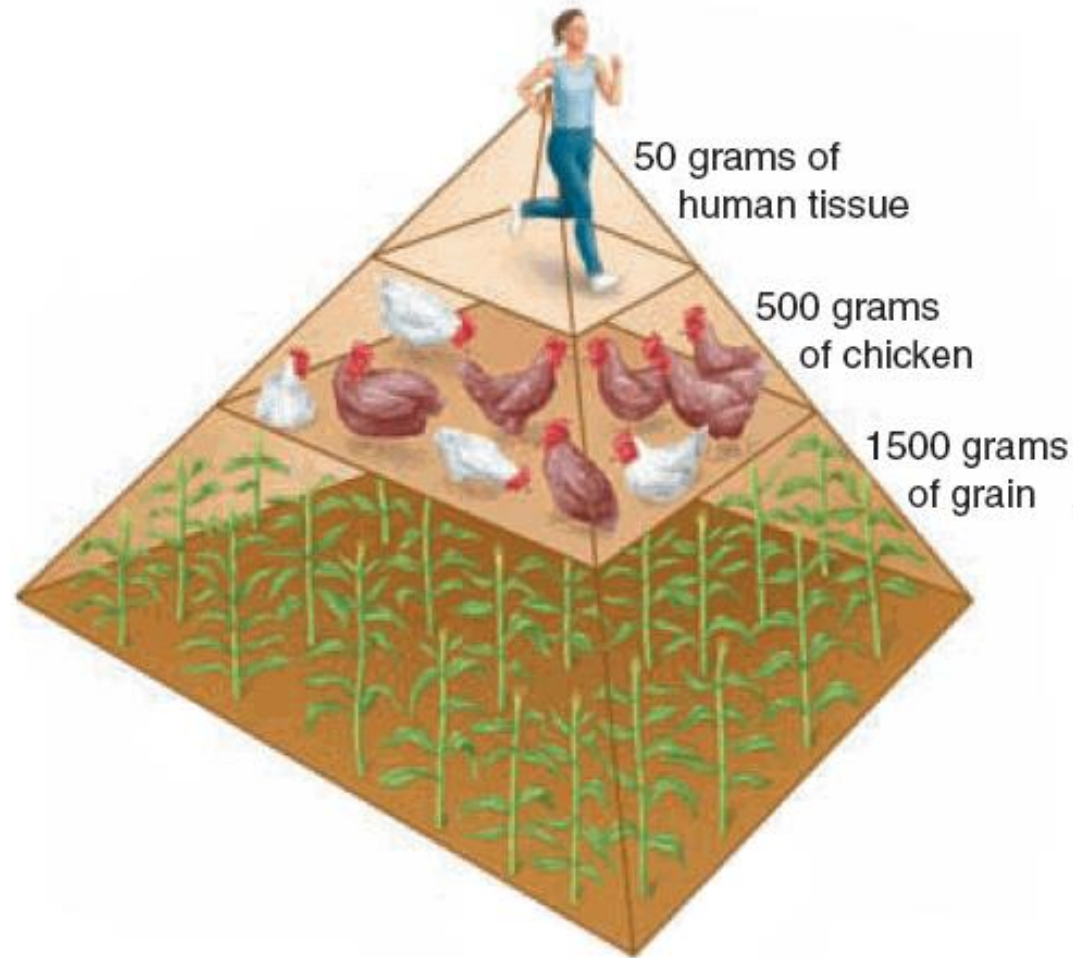
Energy Pyramid

- shows the amount of energy available at each trophic level
 - Only use 10% of the energy
 - 90% is lost as HEAT



Biomass Pyramid

- Shows the amount of living organic matter at each trophic level
- Most biomass??
 - Base (bottom) of the pyramid



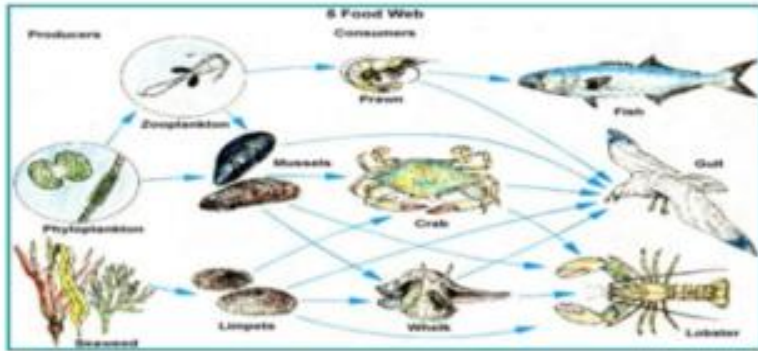
Pyramid of Numbers

- Shows the relative number of individuals at each trophic level



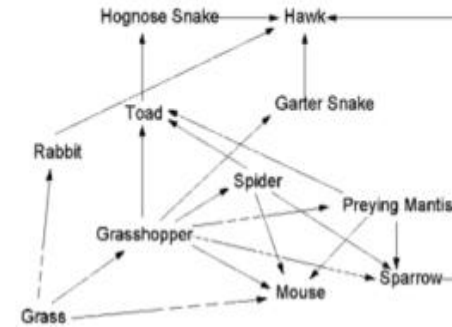
Aquatic Food Webs & Pyramids

Aquatic Food Web



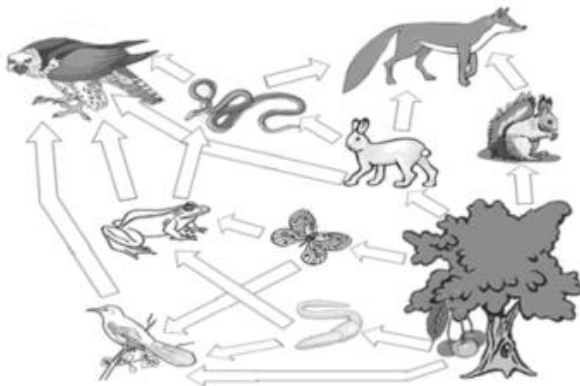
PG. 8

4. What would happen if crabs were removed from this ecosystem? Think about what organism populations would increase or decrease in number as a result of this and WHY.



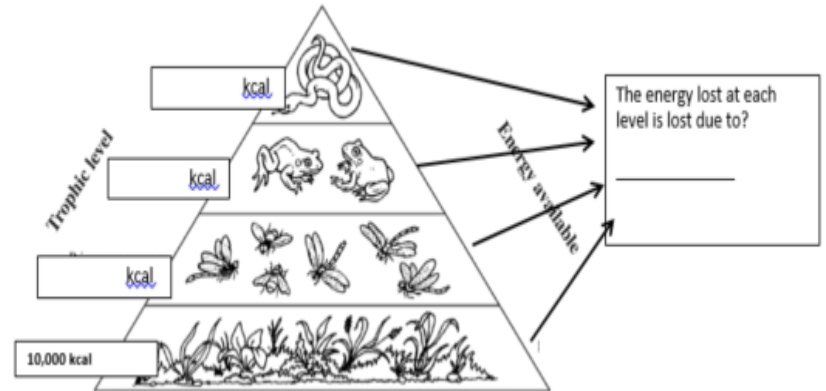
PG. 9

10. How many food chains can you find that with grass as the producer and a hawk as the final consumer?



PG. 10

The diagram below shows an energy pyramid. Fill in the correct amount of available energy at each level.



PG. 11

Ecological 3D Pyramid

Ecological Energy Pyramid

Name _____

Period ____ Date _____ Seat ____

Directions:

1. Label each level of the pyramid side 1 with the following terms as you move up the pyramid: producer (autotroph), primary consumer (herbivore), secondary consumer (carnivore / omnivore), tertiary consumer (top carnivore).
2. Label each level of the pyramid side 2 with the following terms as you move up the pyramid: Biomass = 1000 g/m²/yr, 200 g/m²/yr (20%), 30 g/m²/yr (15%), 3 g/m²/yr (10%).
3. Label each level of the pyramid side 3 with the following terms as you move up the pyramid: Sun = 1,000,000 J of sunlight available, 10,000 J used for growth and reproduction (G&R) , 1,000 J used for G&R (10%), 100 J used for G&R (10%), 10 J used for G&R (10%)
4. On the pyramid side 4 draw a picture of what might belong in each level:
1st: flowers, grass, trees, algae
2nd: caterpillars, cows, grasshoppers, beetles, small fish
3rd: humans, birds, frogs, penguins, seals, larger fish
4th: lions, dogs, snakes, killer whales

Homework – LAB GRADE

- Amoeba Sisters Succession

Succession

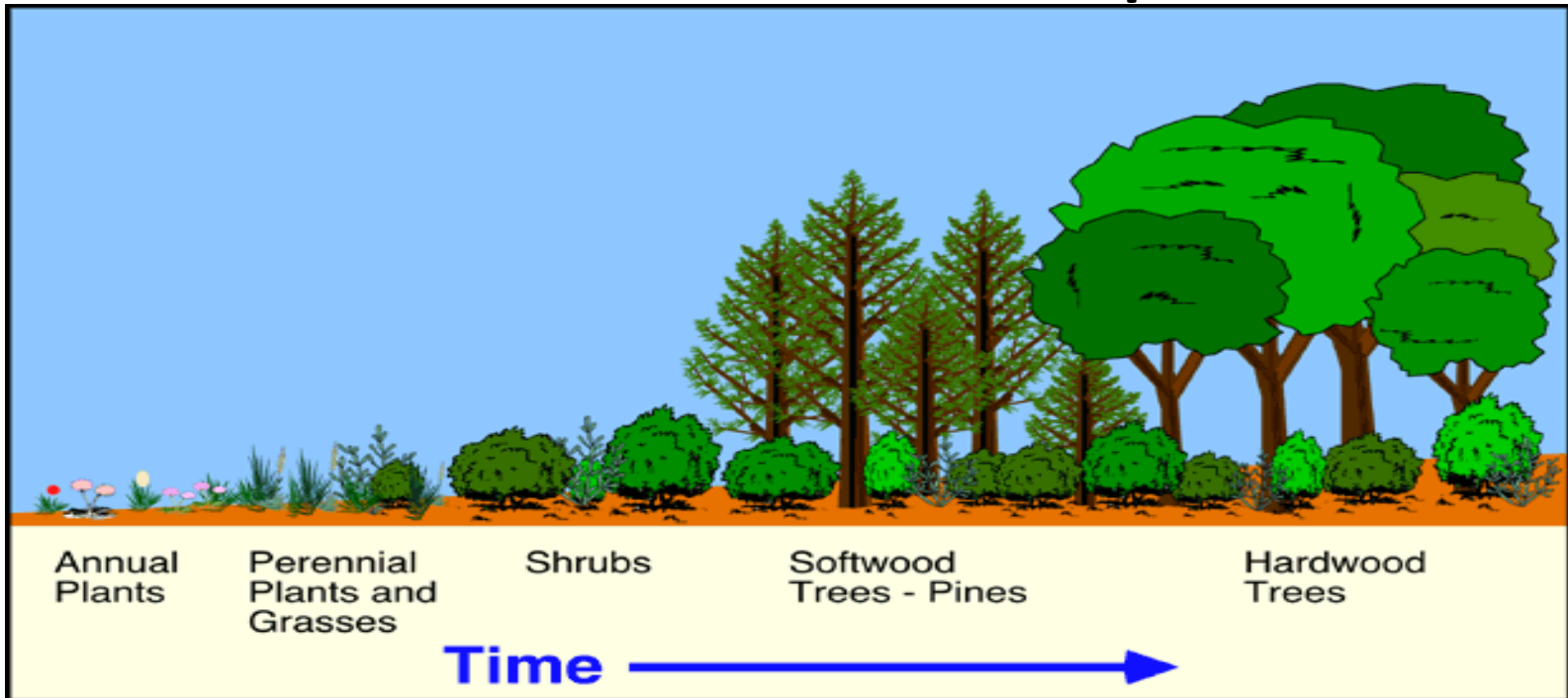
- **Succession**: a gradual process of change and replacement of populations in a community.
 - **1. Primary Succession**: The development of plant communities in an area that has never supported life. In an area that contains no Soil
examples: bare rock, lava flow or glaciers.
 - **Pioneer organisms**: the first organisms to inhabit a given location
(example: lichens on bare rock)
 - **2. Secondary Succession**: is the change of species that follows disruption of an existing community. In an area that contain soil
Example: created by natural disasters or human activity
- Ecosystems tend to change until a **climax community** is formed.

Climax Community

- **Climax community**: a community that has reach a stable state.
 - populations remain stable and exist in balance with each other and their environment
 - ecosystems may reach a point of stability that can last for hundreds or thousands of years



Succession Example



- If the PHS football field is not mowed, would it be primary or secondary succession?

Biodiversity

- **Biodiversity**: the differences in living things in an ecosystem
 1. Increased biodiversity increases the stability of an ecosystem.
 2. Increased biodiversity increases the chance that at least some living things will survive.

High Biodiversity vs. Low Biodiversity

Which one has the most Biodiversity



Ecology Web Quest

PAPER ecology Webquest

Name: _____ Date: _____ Period: _____

Part I: Ecosystems

You will go to the following websites and answer the questions that go along with that website.

<http://www.vtaide.com/png/foodchains.htm>

1. In the following chart you will take the words and provide an example and description of each word.

Word	Example	Description
Producer		
Consumer		
Carnivore		
Herbivore		
Secondary Consumer		
Tertiary Consumer		
Decomposers		

Habitat & Niche

- *Habitat* is the place a plant or animal lives
- *Niche* is an organism's role in life



Habitat and Niche Worksheet

HABITAT and NICHE Activity Sheet

Name: _____

Date: _____

A. Match the habitat to the correct organism:

1. Monkey: _____
2. Polar Bear: _____
3. Shark: _____
4. Fungus: _____
5. Squirrel: _____
6. Frog: _____
7. Puffin: _____
8. Buffalo: _____
9. Palm tree: _____
10. Wild flowers: _____



- a. Arctic
- b. Pond
- c. Ocean
- d. Prairies
- e. Sea-side Cliffs
- f. Tropical Beach
- g. Field
- h. Rotting Log
- i. Oak Forest
- j. Tropical Rain Forest

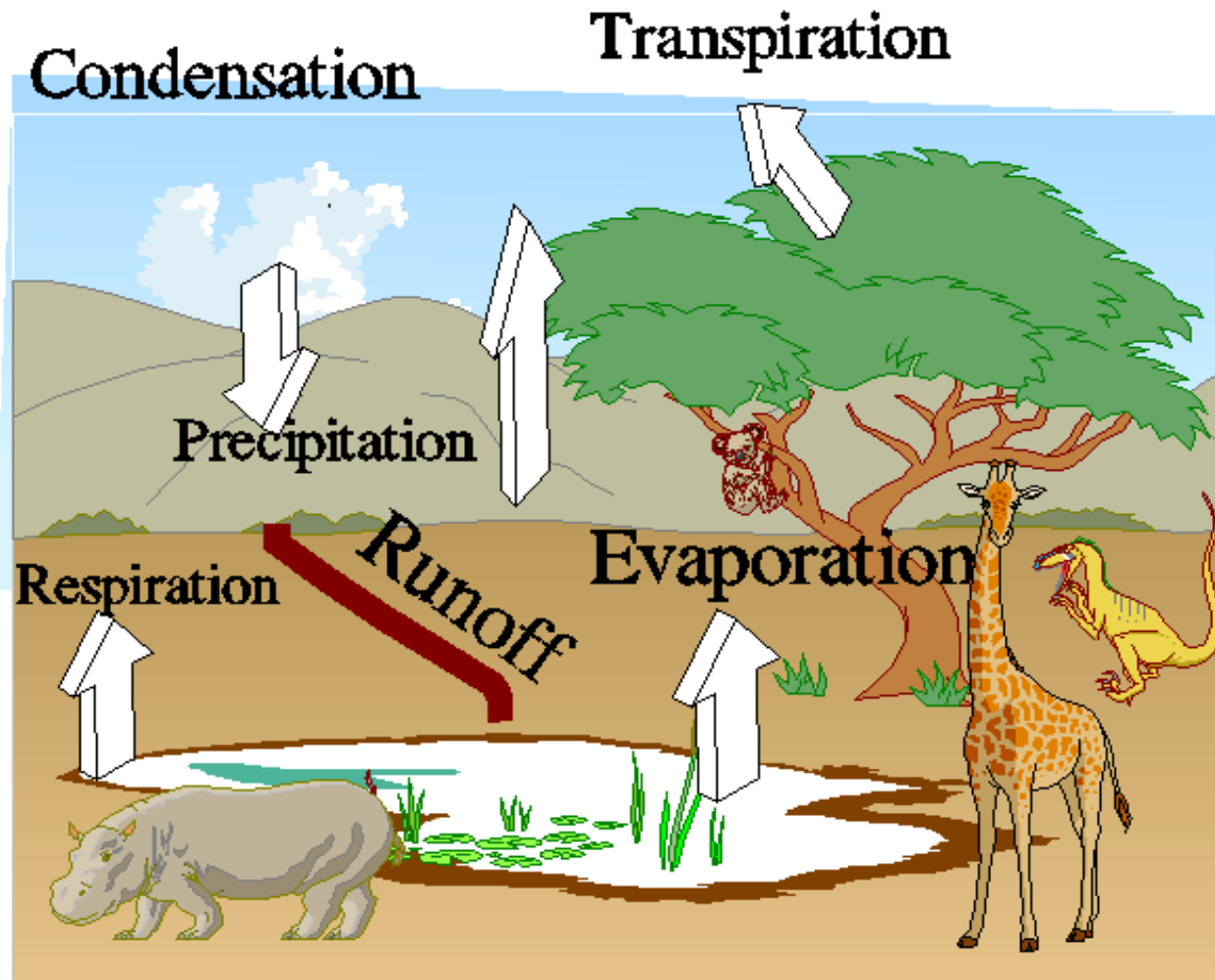
Material Cycles

- Material Cycles:
 - In a self-sustaining ecosystem, materials must be recycled among the organisms and the abiotic environment.
 - The same materials can be reused.
 - Examples of Cycles:
 - Water
 - Carbon-Oxygen
 - Nitrogen

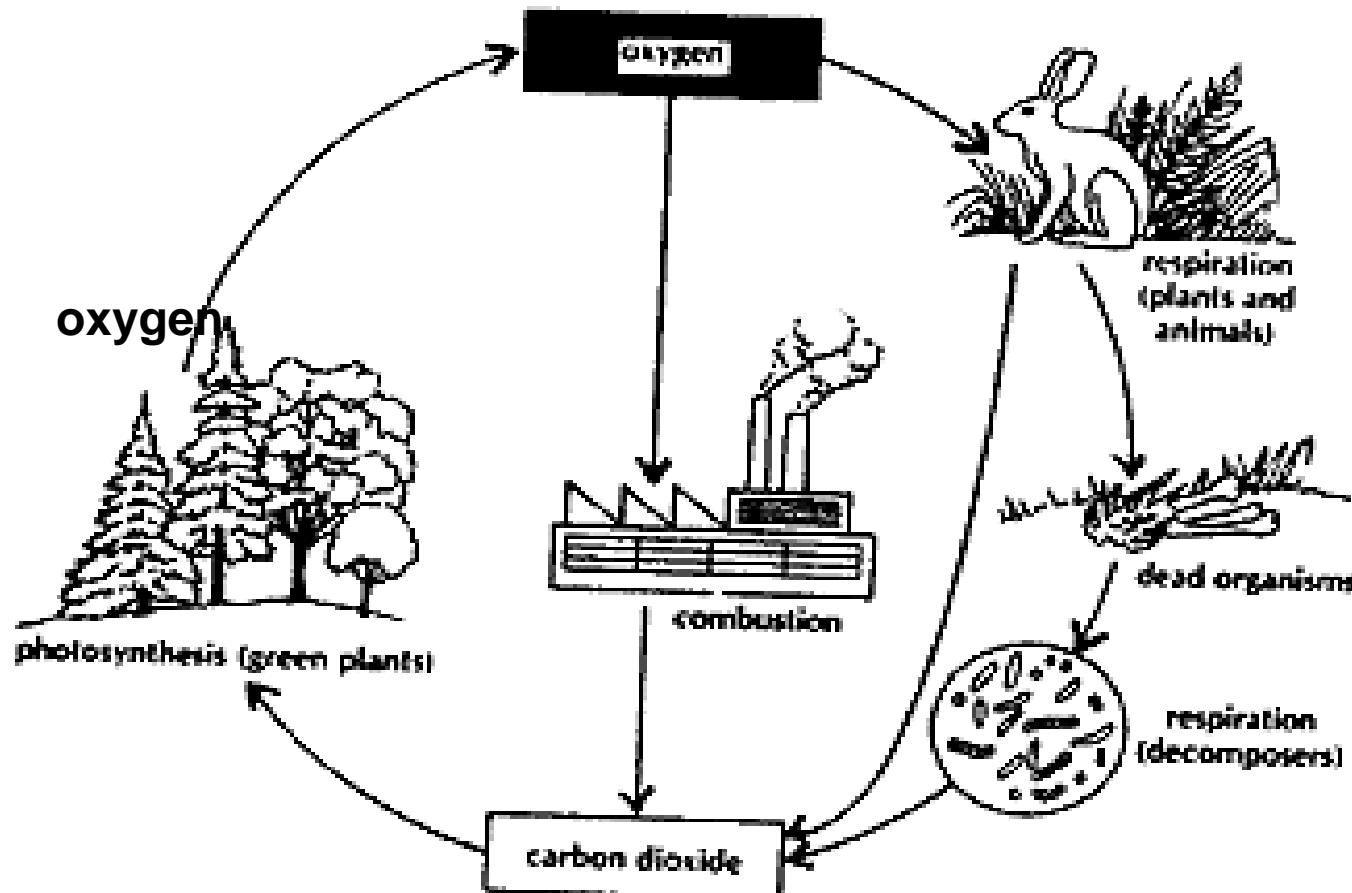
Water Cycle

- Water Cycle: involves the processes of
 - Photosynthesis
 - Transpiration
 - Evaporation and condensation
 - Respiration
 - Excretion

Water Cycle



Carbon-Oxygen Cycle



Carbon-Oxygen Cycles

- Carbon-Oxygen Cycle:
involves the processes of
 - Respiration
 - Photosynthesis

Nitrogen Cycle

- Nitrogen Cycle:
 - Organisms must have nitrogen to produce proteins and amino acids
 - Living things cannot use nitrogen gas in the air
 - Life is possible due to nitrogen-fixation
 - Nitrogen Fixation: Nitrogen gas is converted to ammonia

Nitrogen Fixers

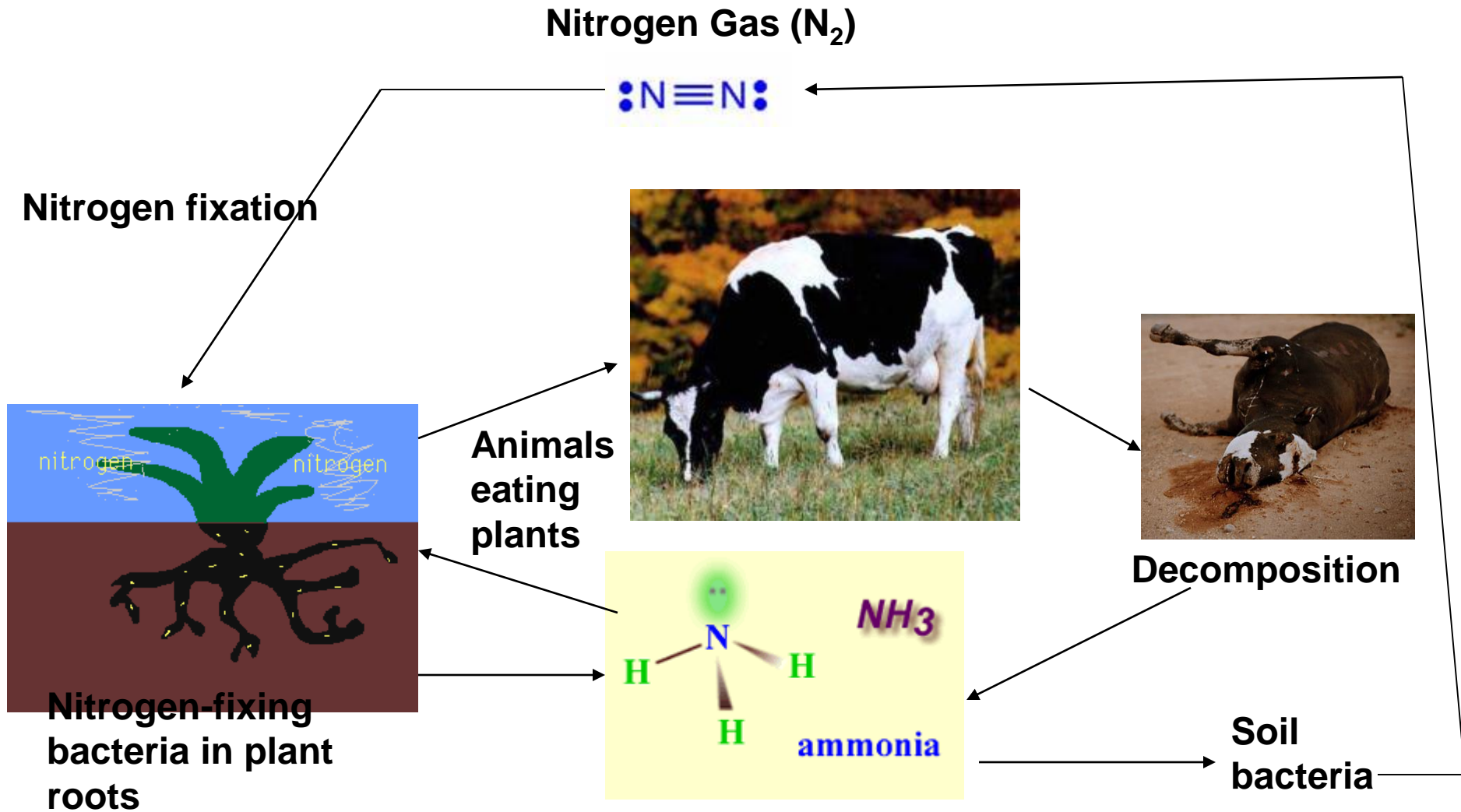
- **Legumes**: peas and beans contain nitrogen-fixing bacteria in their roots
 - Clover and alfalfa are other examples of nitrogen fixers

Bean
Plant



Alfalfa

Nitrogen Cycle



Biomagnification and the Infamous
DDT--Video

Cycling matter through ecosystems

2 Principles of Ecology

3 Cycling of Matter

TEKS 11(B), 12(E)

MAIN IDEA

Write the Main Idea for this lesson.

Recall the definition of the Review Vocabulary term.

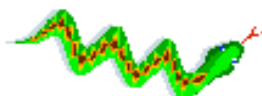
cycle

.....
REVIEW VOCABULARY

cycle

Homework

Food Chain, Food Web, and Food Pyramid Lab



Name _____

Date _____

Period _____

Objective: A2 - Analyze the flow of mater & energy through trophic levels using various models, including food chains, food webs, & ecological pyramids

* Focus Question:

Why should the number of prey be greater than the number of predators in a balanced ecosystem?

Background Information

A **food chain** shows how each living thing gets its food. Most food chains have no more than four or five links because the animals at the end of the chain would not get enough food (and hence energy) to stay alive. Most animals are part of more than one food chain and eat more than one kind of food in order to meet their food and energy requirements. These interconnected food chains form a **food web**. Arrows are drawn from food source to food consumers; in other words, you can substitute the arrows with the words "eaten by". An ecological **food pyramid** is a graphical representations of the trophic structure of ecosystems.

Materials

Bag with various organisms and arrows

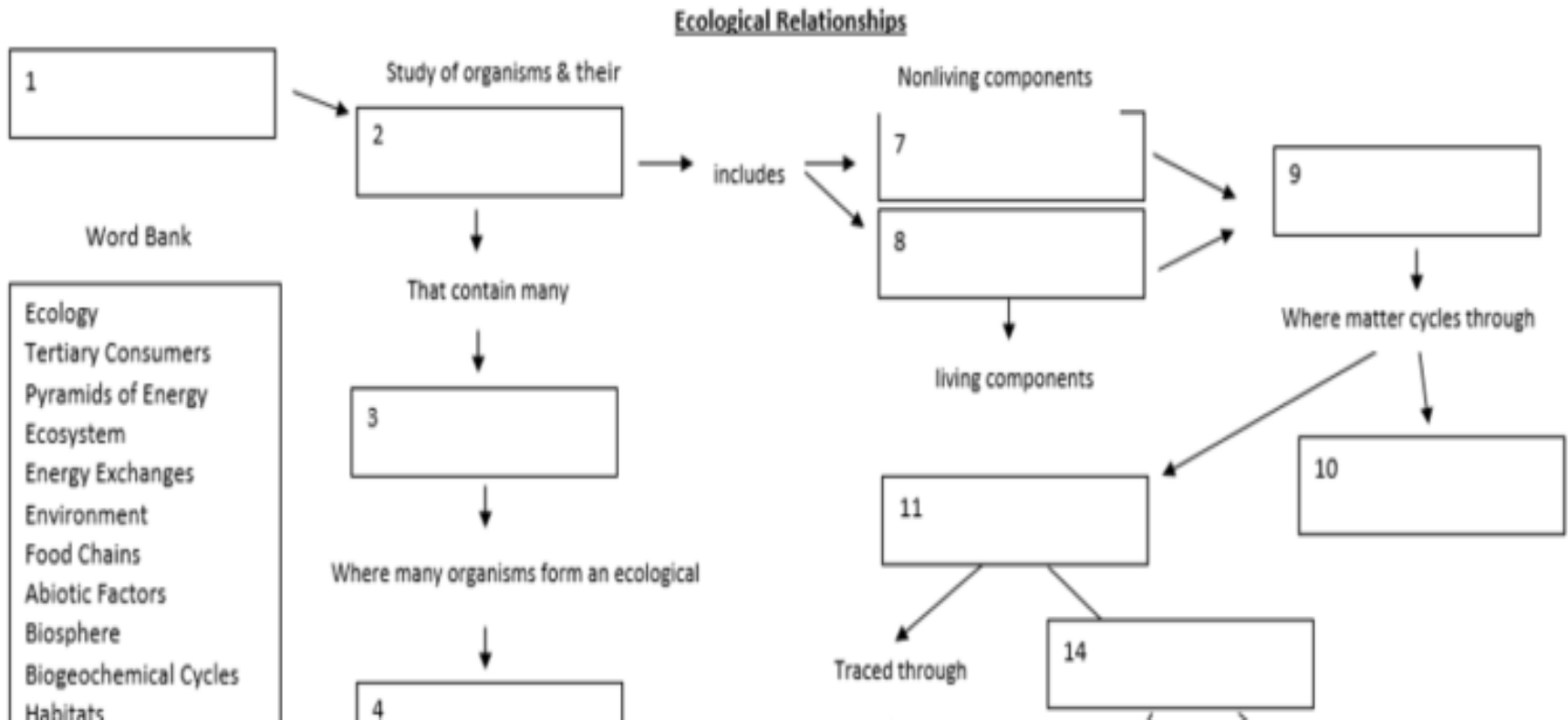
Pyramid of numbers



Procedures and Questions

1. Examine the pictures on the cards. Sort them by producer, primary consumer, secondary consumer, and tertiary consumer *by making 5 food chains* and fill in the chart below. The chart below will not be completely filled in.

Ecological Relationships Concept Map



Homework