Ecology Unit

Chapters 3-6

BIO.SOL.1acdehim2d4a6d8abde

Biosphere

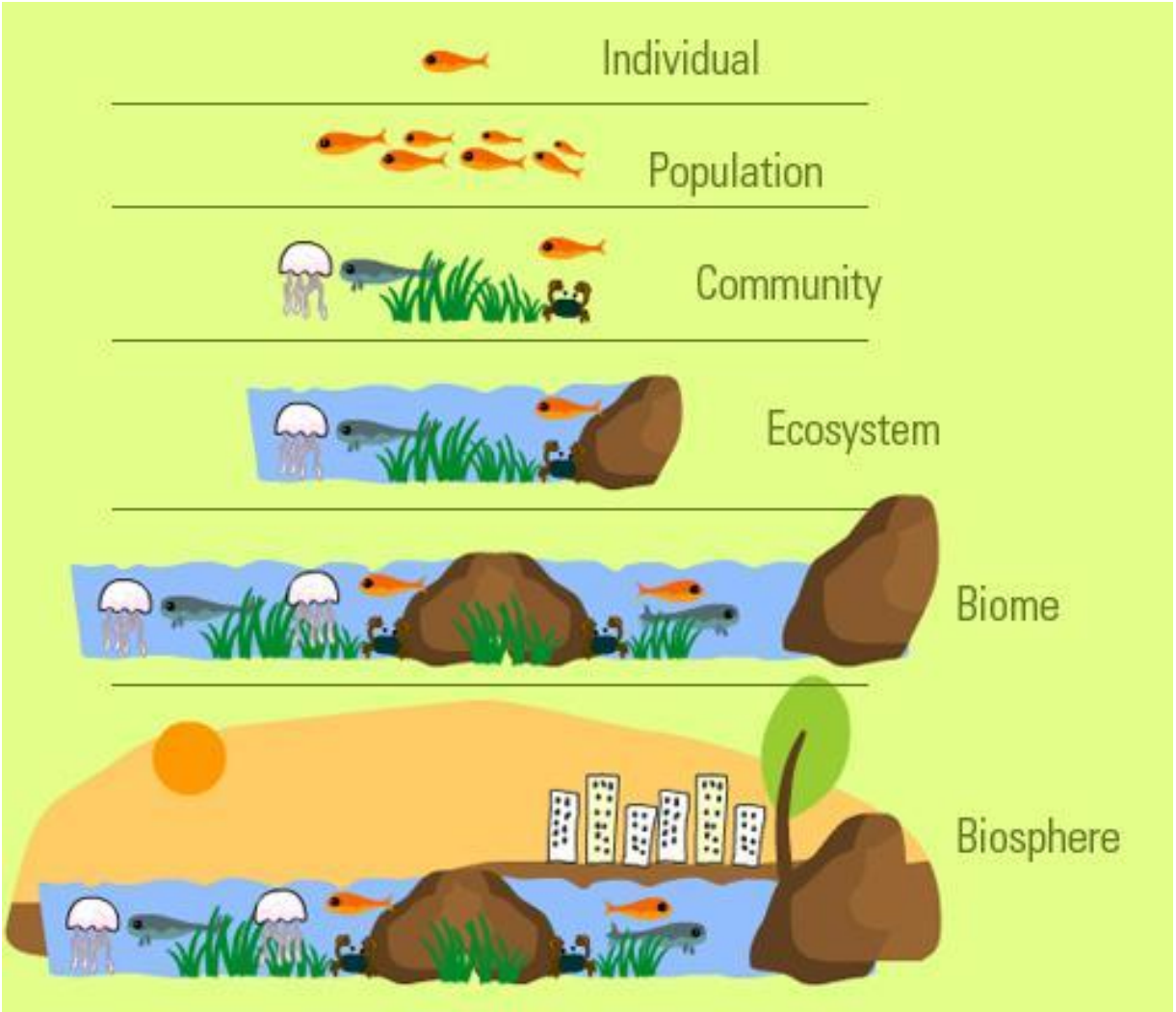
- All life on Earth and all parts of the Earth in which life exists

Ecology

- The scientific study of interactions among organisms and between organisms and their physical environment

- Ernst Haeckel (German biologist)
  - Greek for "*oikos*" meaning house or where one lives

How is life organized?



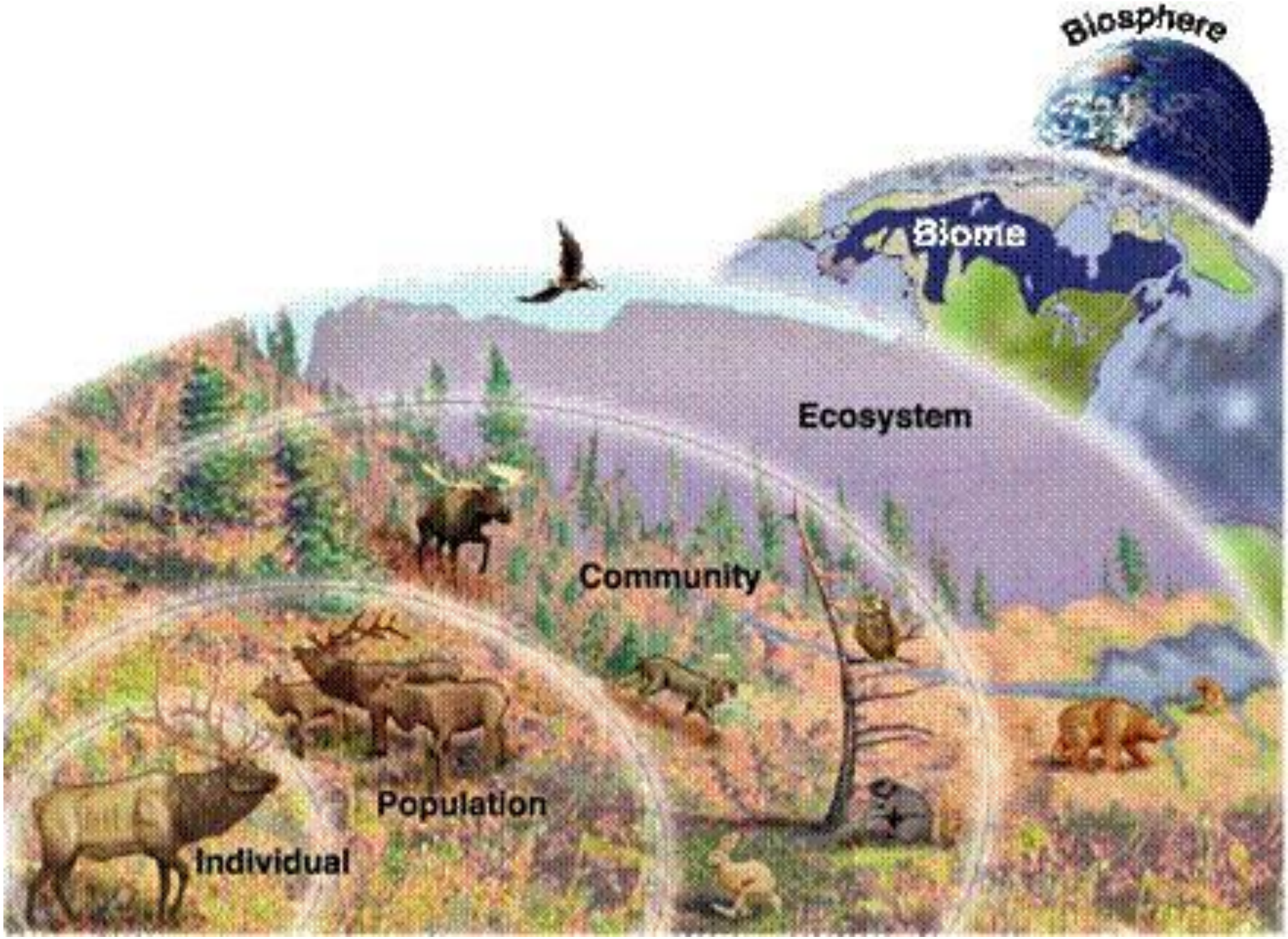
Levels of Organization

Level	Description	Example
Species	Individual	1 fish
Population	Same species, same place at same time	School of fish
Community	Interacting populations in same area at same time	School of fish plus plants
Ecosystem	A community and all abiotic factors	Coral reef
Biome	A large group of ecosystems with same climate and similar communities	Marine biome
Biosphere	All biomes on Earth	Earth

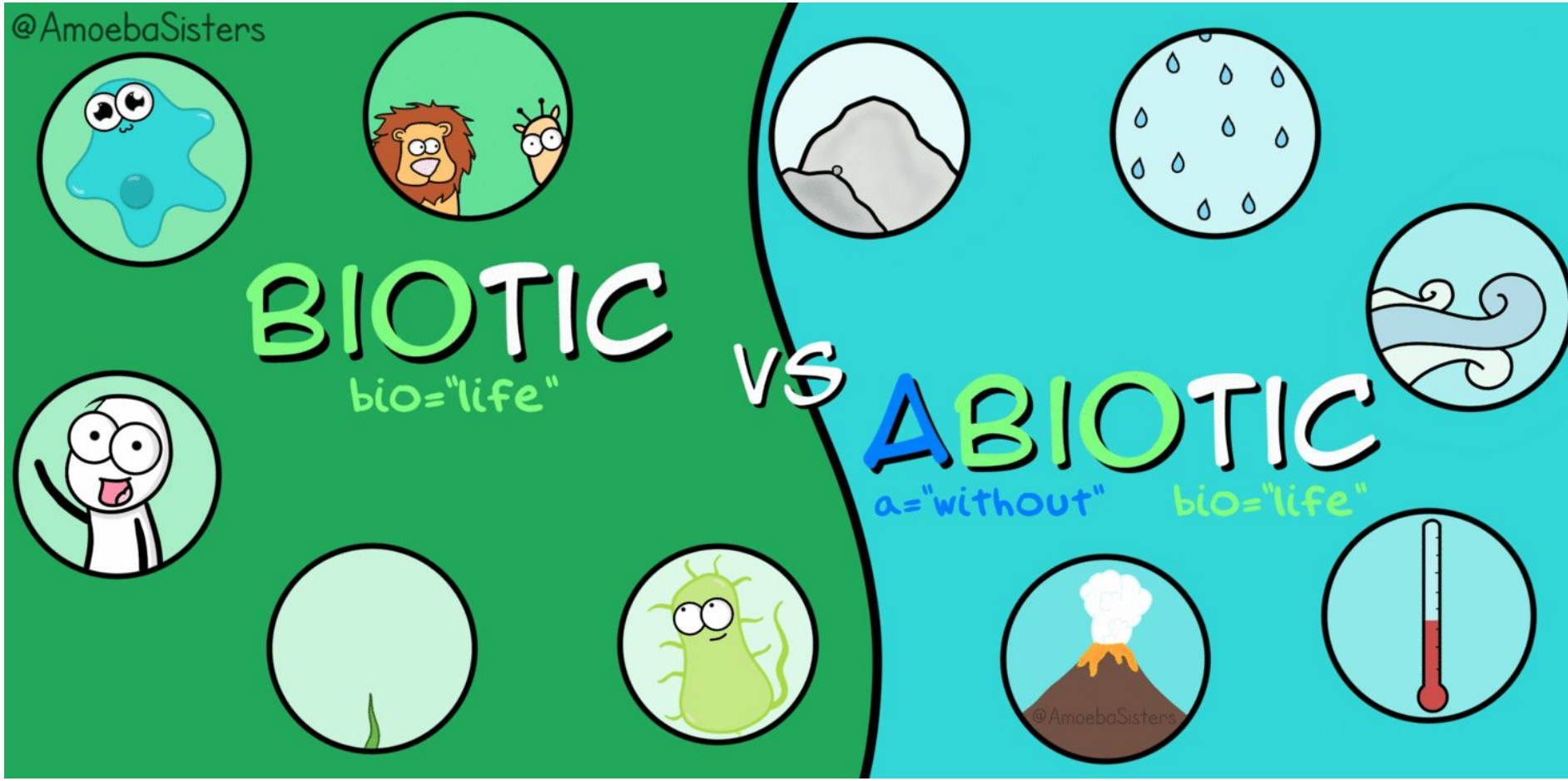
Biological Levels of Organization

Cell

@AmoebaSisters


Biosphere
Biome
Ecosystem
Community
Population
Individual

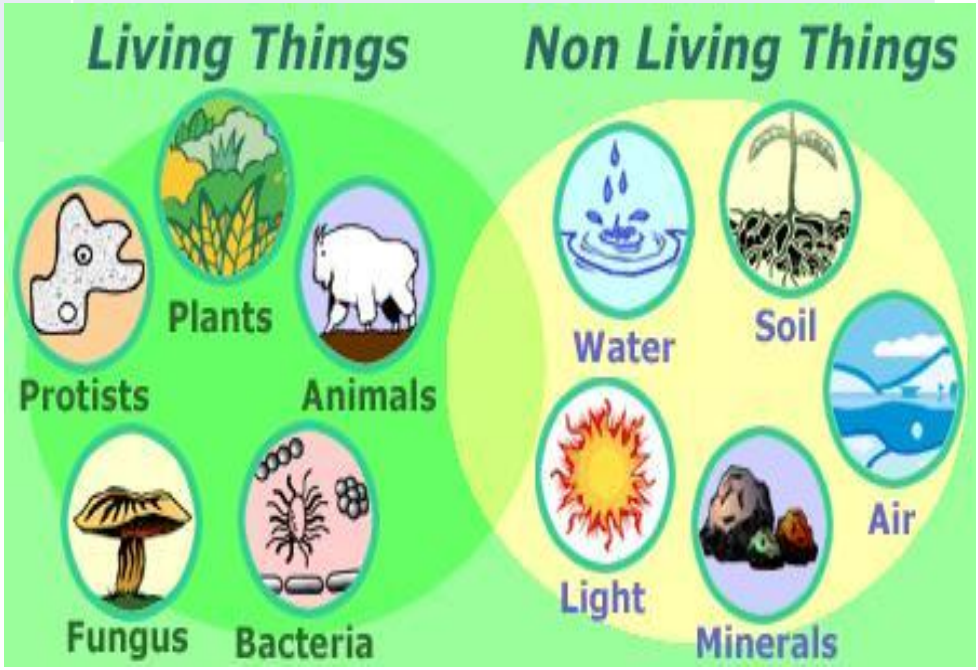
So how do we break up the environment with living and non-lining parts?



Abiotic factors	Biotic Factors
Def: the non-living factors in an environment	**Def**: Living factors in an environment
Examples: Temperature, sunlight, air, soil, water, Rain, nutrients	Examples: Fish Tiger Algae Oak tree Robin millipede

Why/How do organisms depend on abiotic factors?

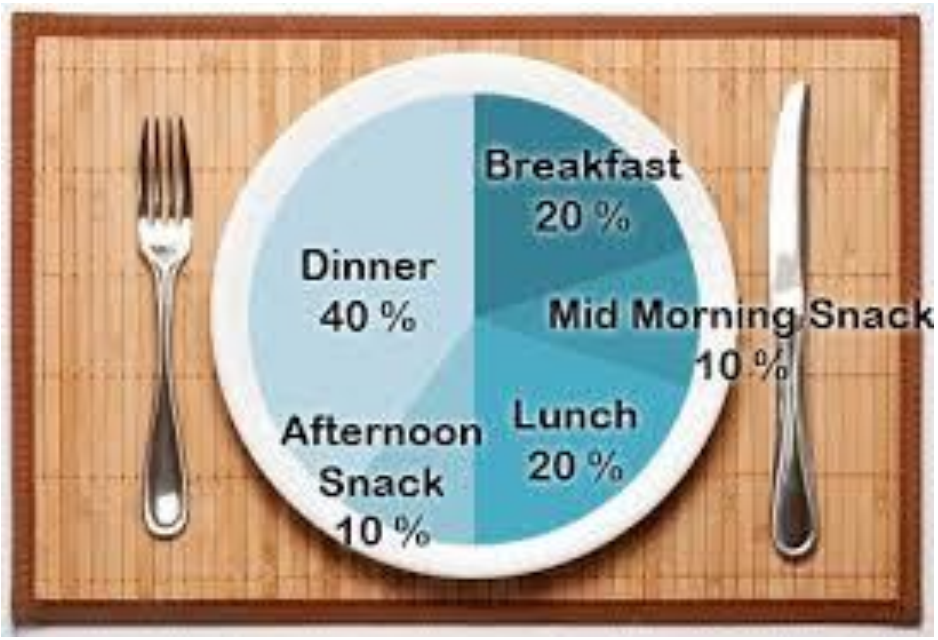
- for survival
- temperature/sunlight must be at the optimum
- rain/water amount must be at the optimum levels



Name the factors..

Energy Needs

- Organisms need energy for <u>growth, reproducing</u>, and their own <u>metabolic</u> processes
- **<u>NO</u>** energy thus **<u>NO</u>** life processes



Autotrophs

- These organisms use sunlight to make food
- AKA primary producers
- Deep down in the ocean = NO light
  - Use the chemicals in hydrogen sulfide vents
  - Go thru chemosynthesis

Heterotroph

- Organisms that obtain food by consuming other living thing
- AKA consumer

Herbivore

- Eats only plant material

Carnivore

- Eats only meat

Omnivore

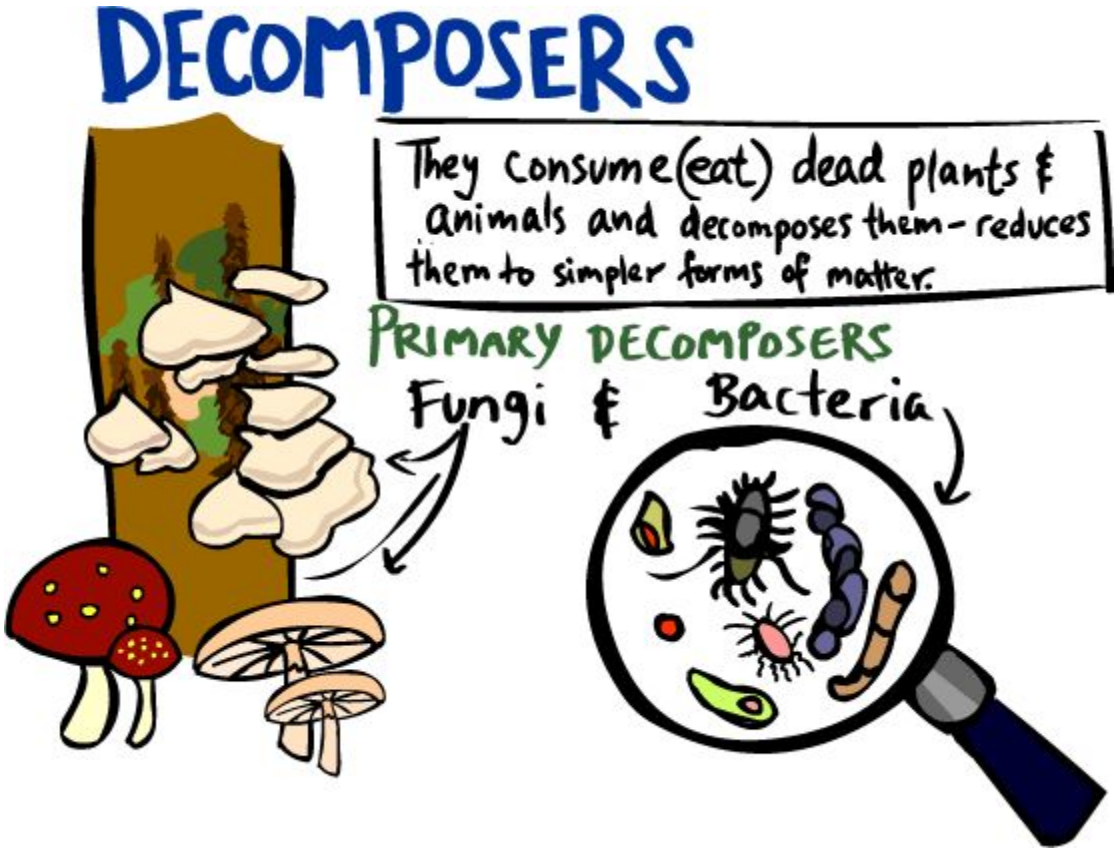
- Eats both plants and animals

Scavenger

- Consumes carcasses of other animals

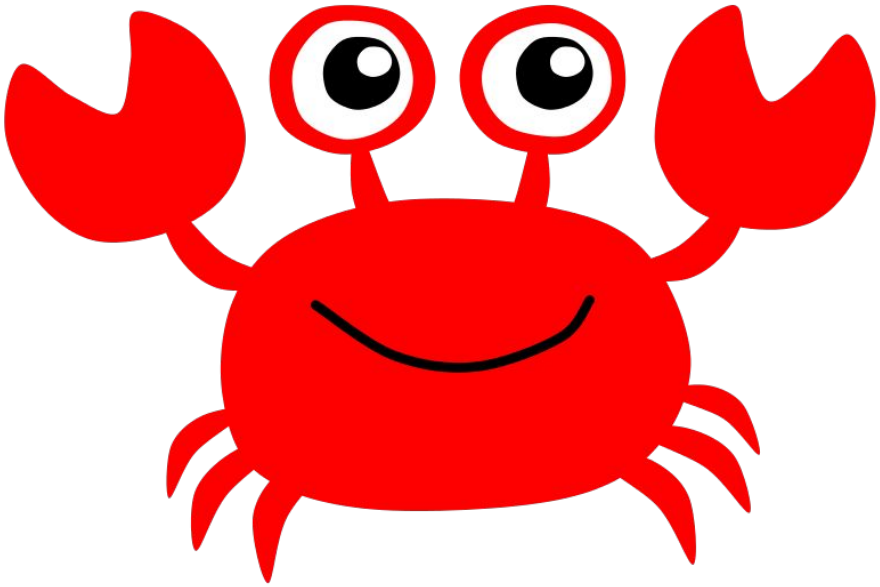
Decomposer

- Eats by chemically breaking down organic matter



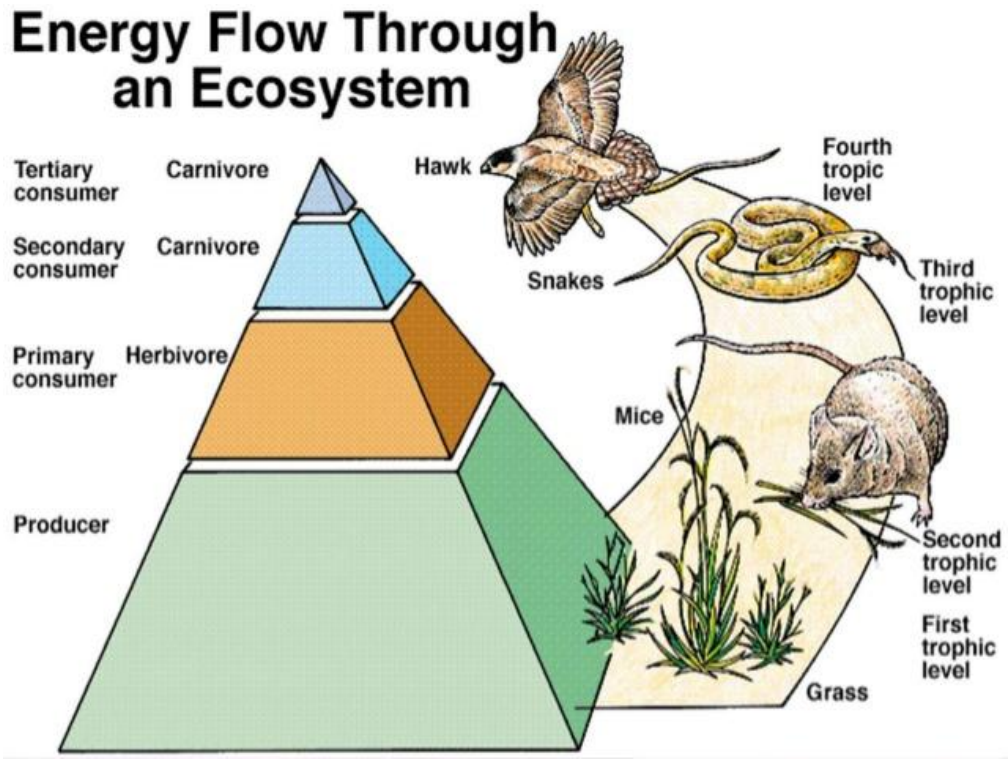
Detritivore

- Feeds on plant and animal remains and other dead matter



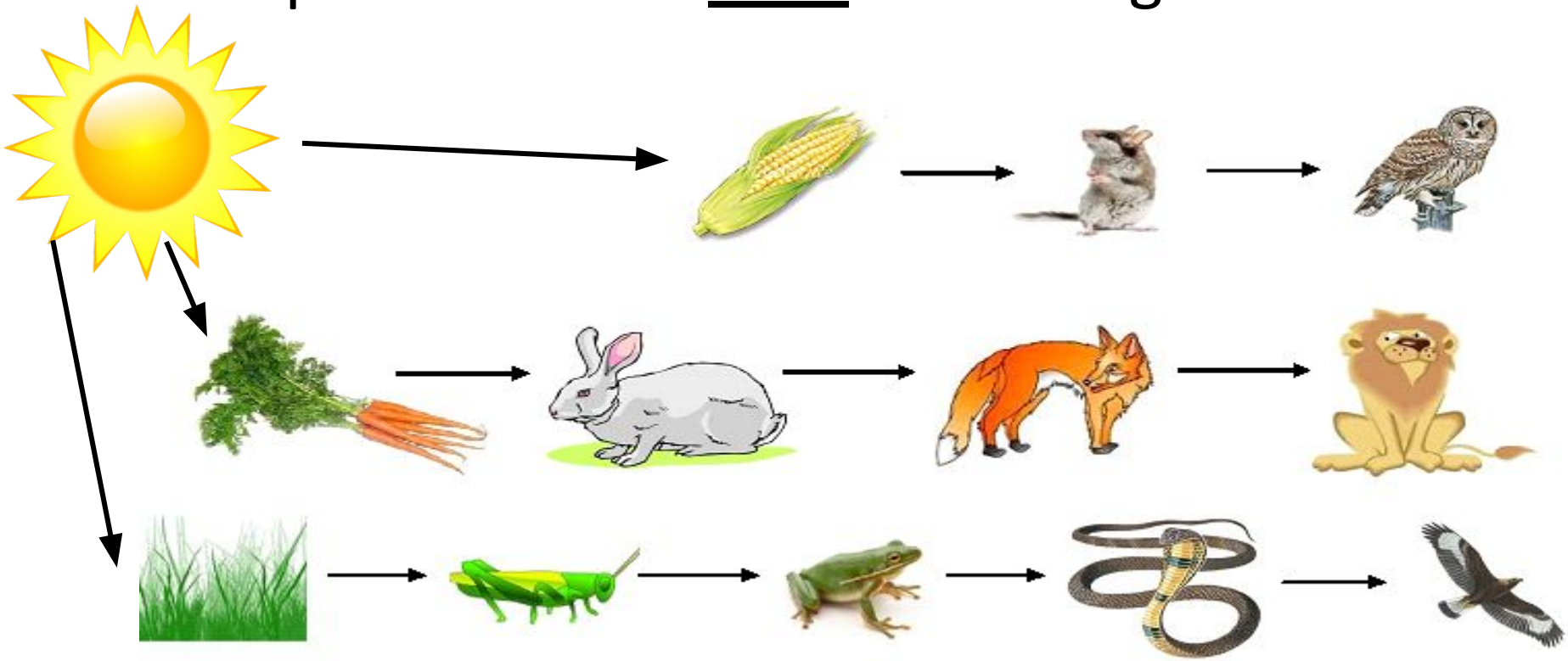
Energy flow in Ecosystems

- Energy flows through ecosystems in a <u>1</u> way stream from <u>primary producer</u> to various <u>consumers</u>



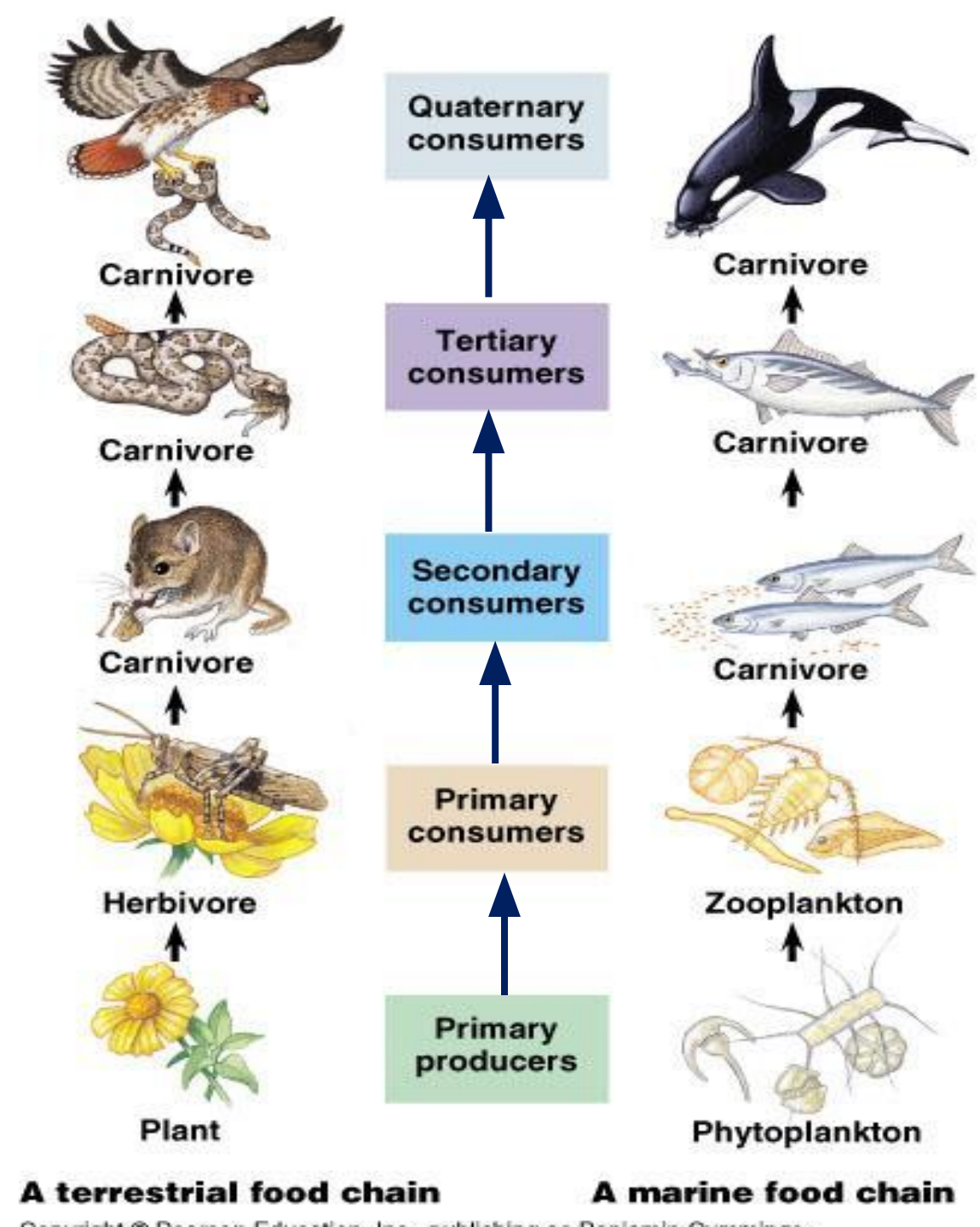
Food Chain

- A series of steps in which organisms transfer energy by eating and being eaten
- Does a food chain have an end?
- Always starts with an autotroph
- Arrow points to who does the eating



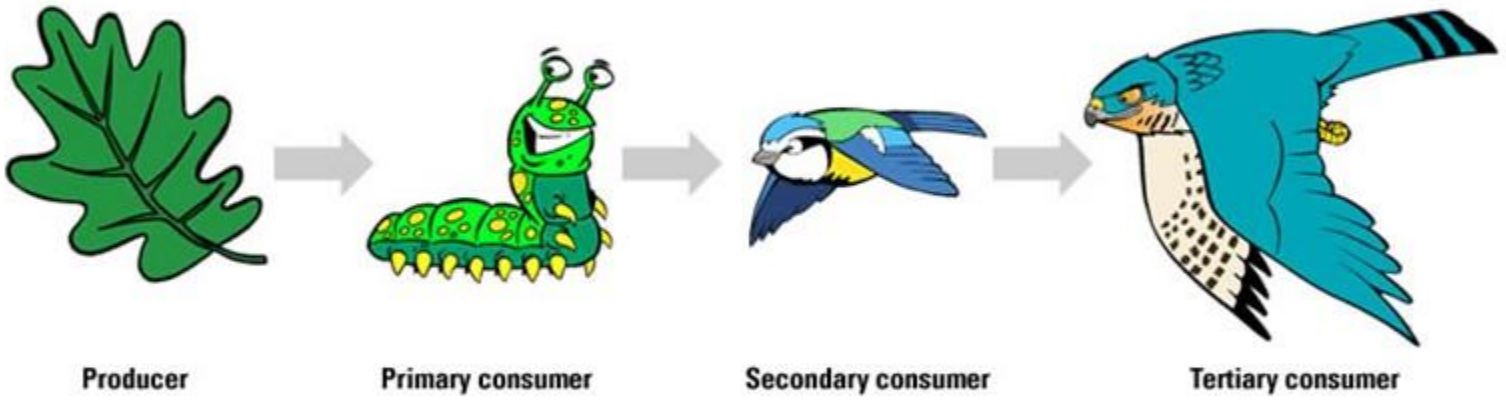
Food Chain

- Arrows will **always** point to the organism **DOING** the "eating"

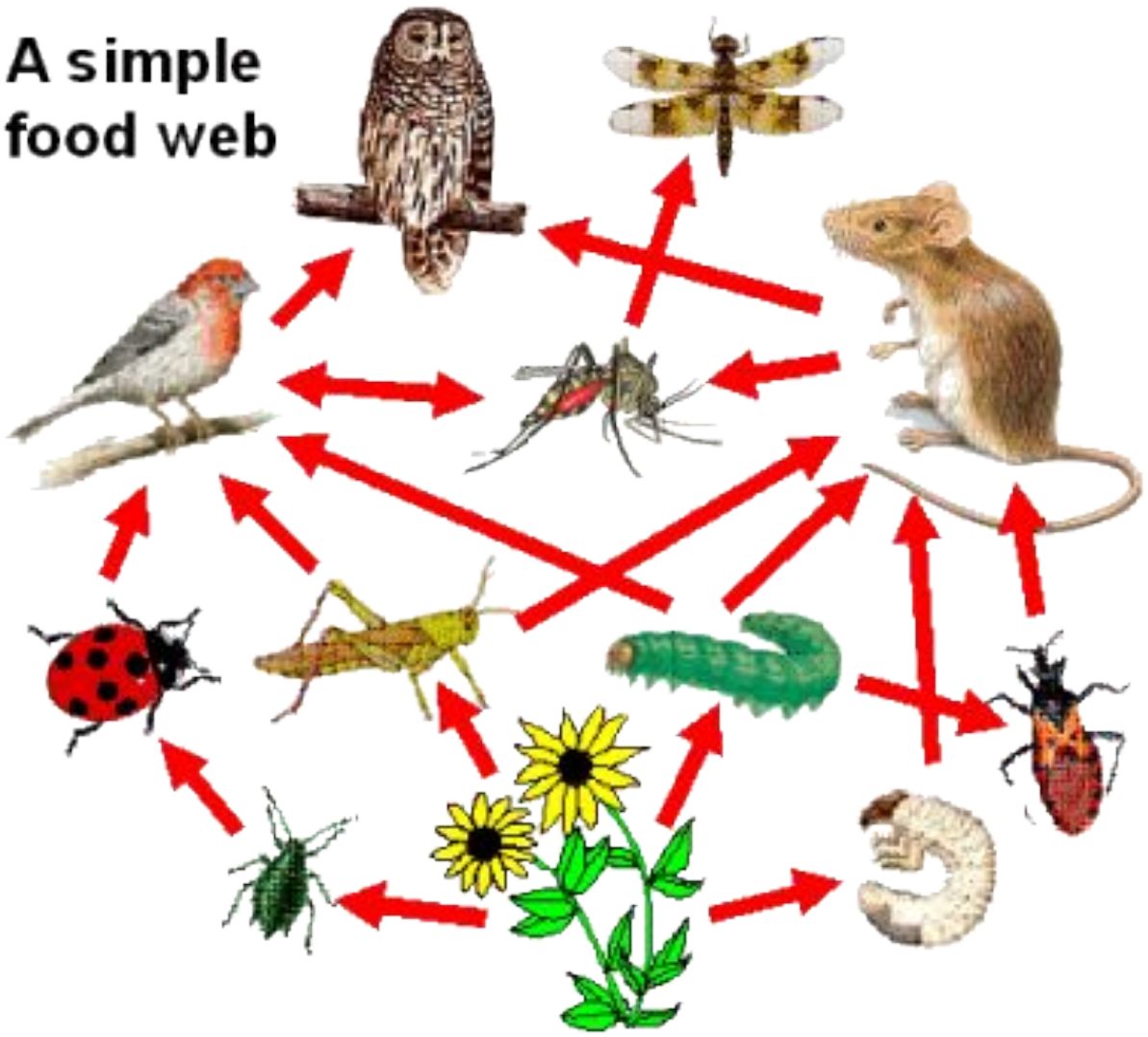


Food Chain order

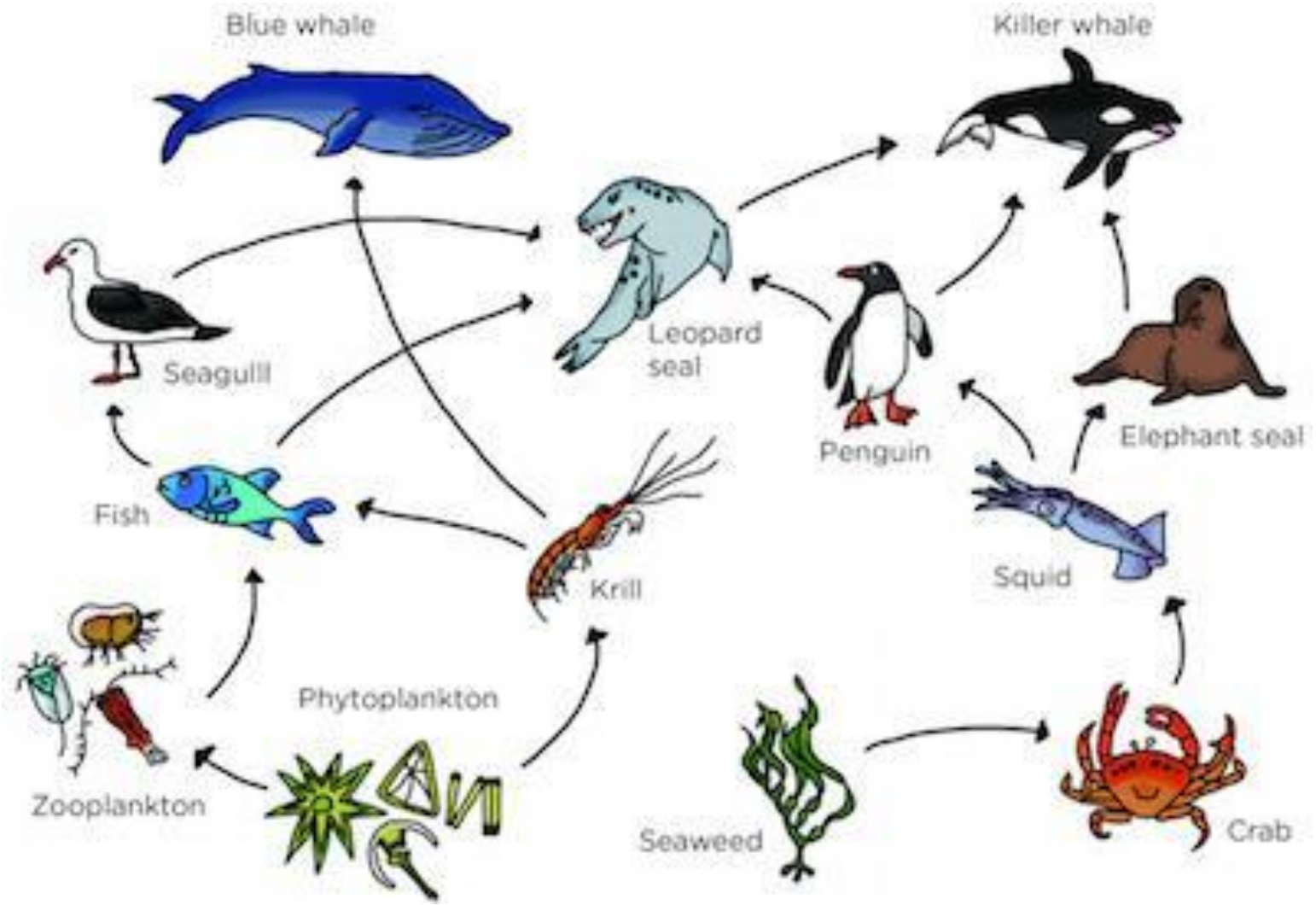
- **Autotroph → herbivore → omnivore → carnivore**
  Primary consumer — Secondary consumer — Tertiary consumer



Food Web



- Network of complex interactions formed by the feeding relationships among the various organisms
- A bunch of interconnected <u>food chains</u>


Blue whale
Killer whale
Seagull
Leopard seal
Penguin
Elephant seal
Fish
Krill
Squid
Phytoplankton
Zooplankton
Seaweed
Crab

Decomposer & Detritivore Importance

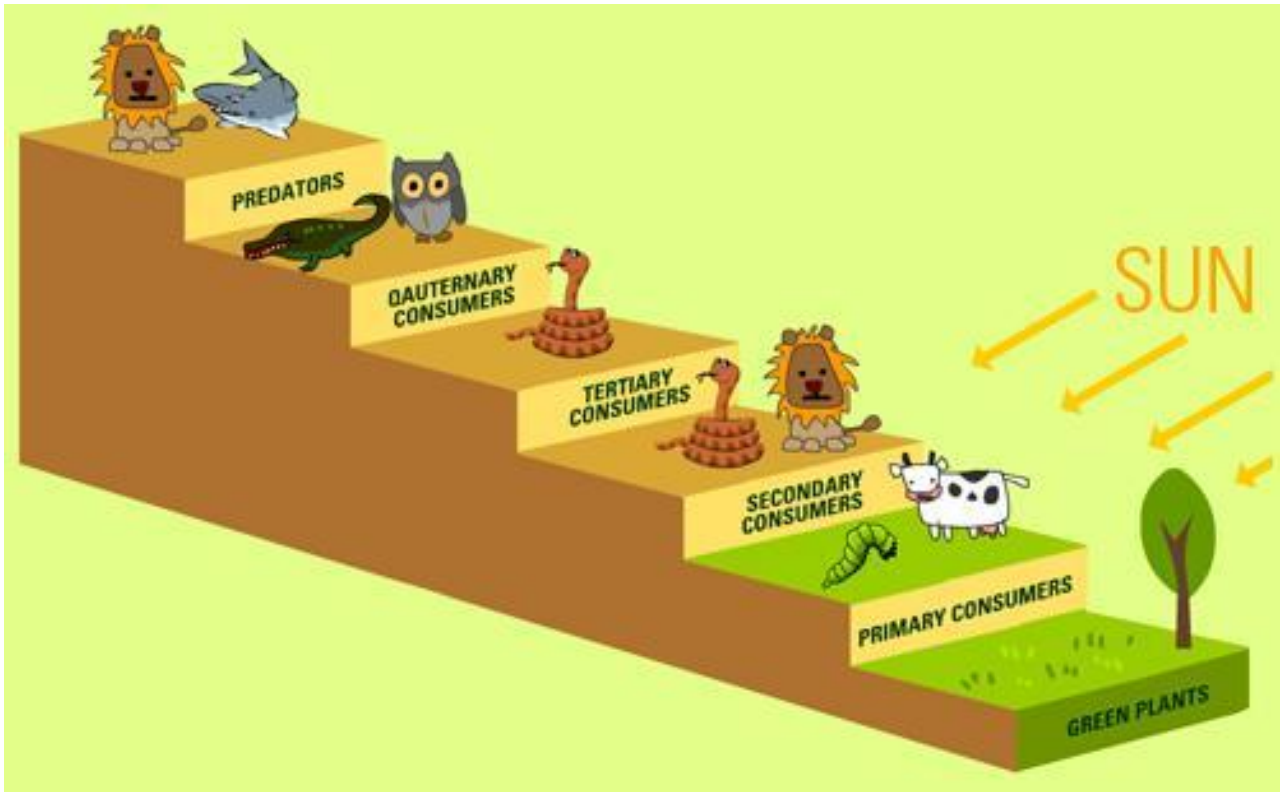
- Plants would just die if not eaten
- Decomposers convert this dead material to detritus
- This is eaten by detritivores
- Decomposers cycle nutrients needed for autotrophs to grow
- Without decomposers nutrients would remain locked in dead organisms

Questions to think about

- What would happen if the sun began to lose energy?
- What would happen if an area lost all primary consumers?

Trophic levels

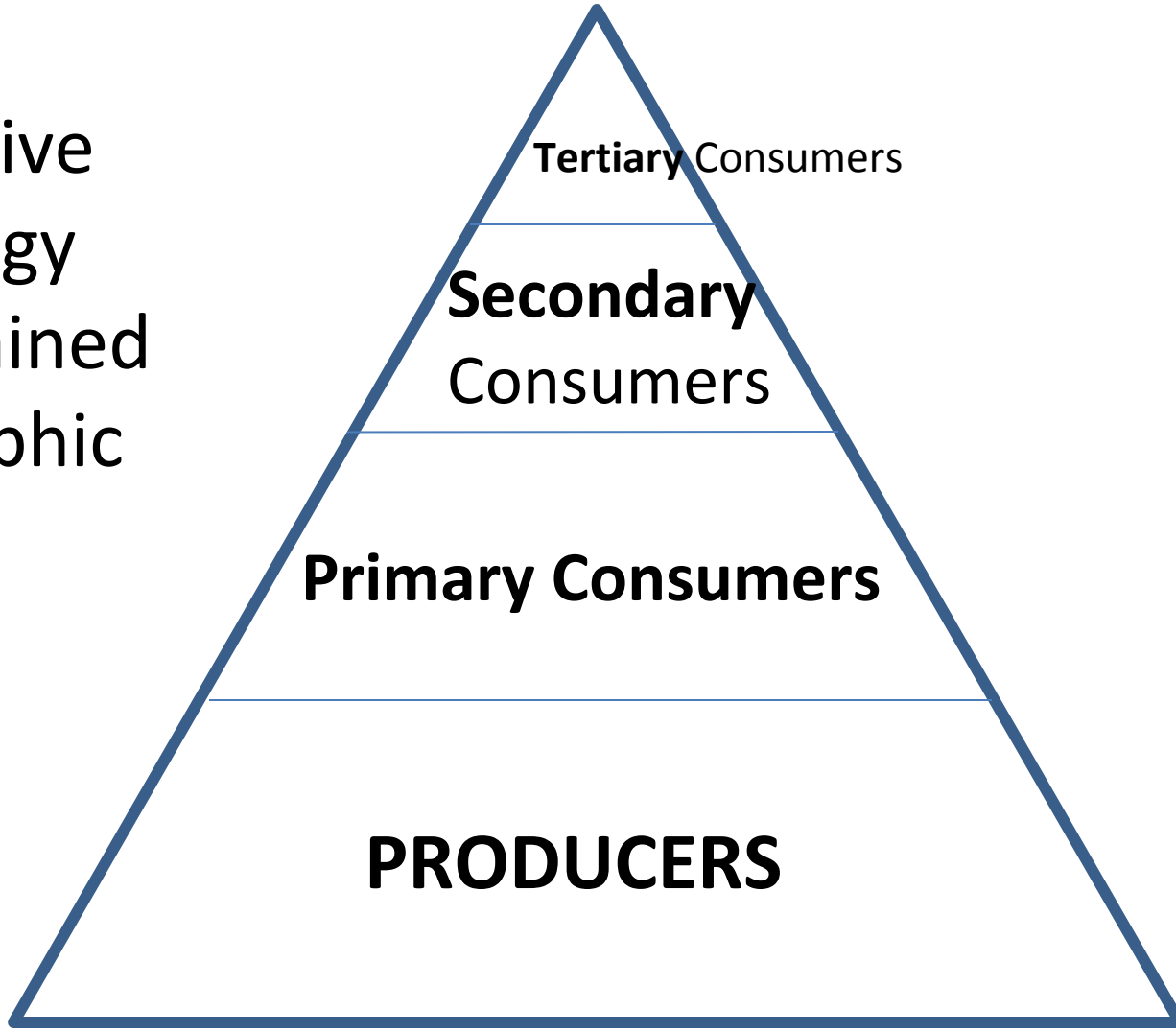
- a step in a food chain
  - Each organism in a food chain is a feeding step



Ecological Pyramid

Add to notes

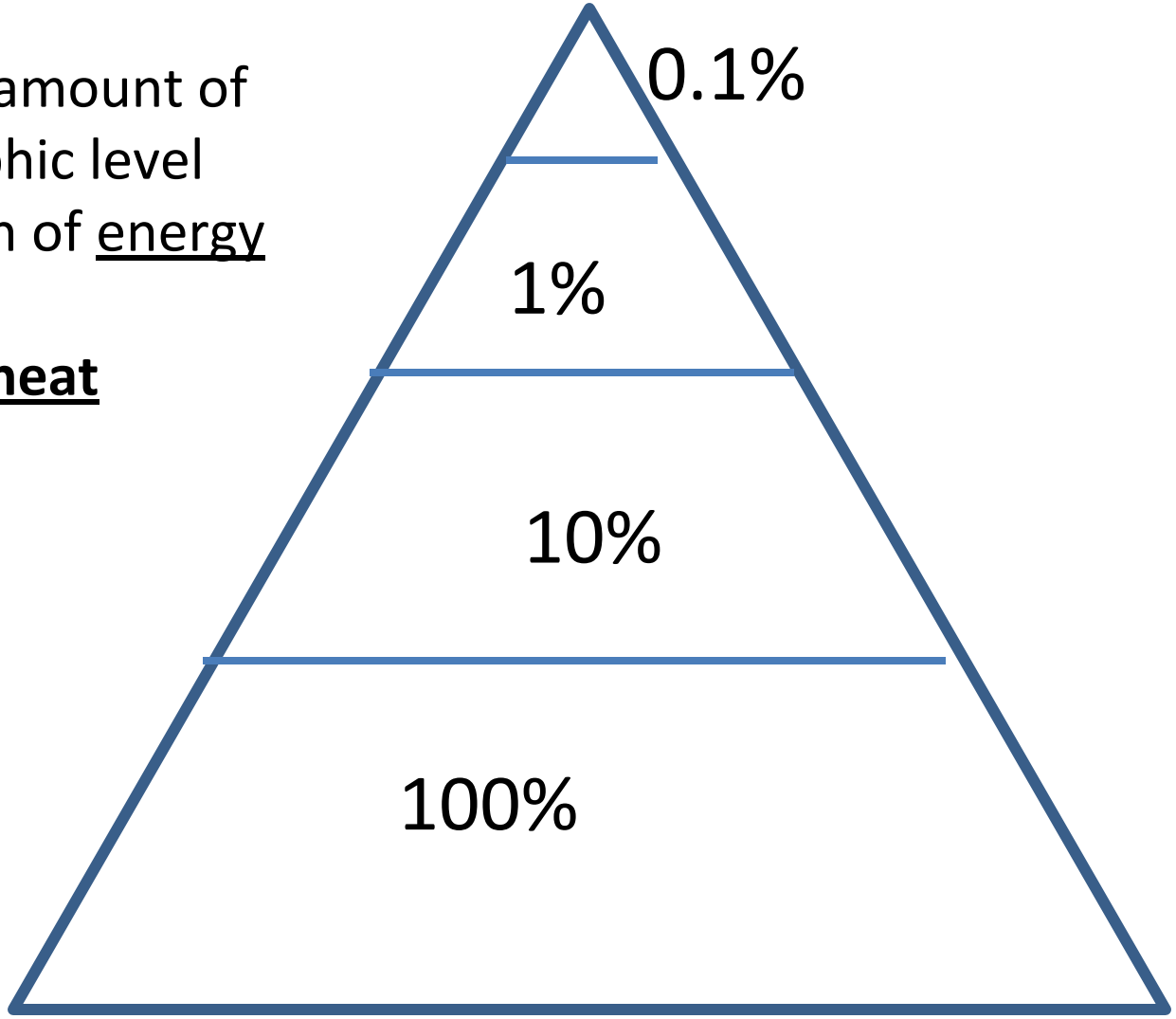
- Shows the relative amount of energy or matter contained within each trophic level in a food chain/web



Pyramid of Energy

- Shows the relative amount of energy at each trophic level
- Only a small portion of <u>energy</u> passes to next level
- Rest is released as **<u>heat</u>**

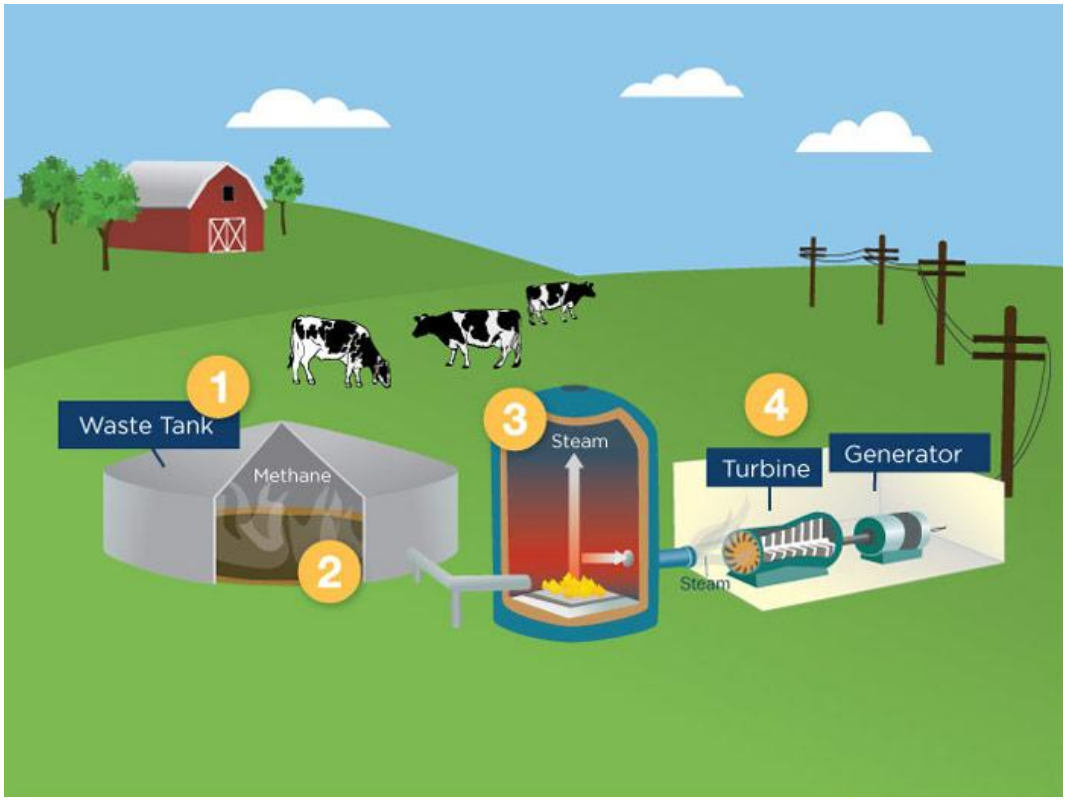
10% rule =
<u>10%</u> gained
<u>90%</u> is lost
(waste & heat)



Pyramid of Biomass

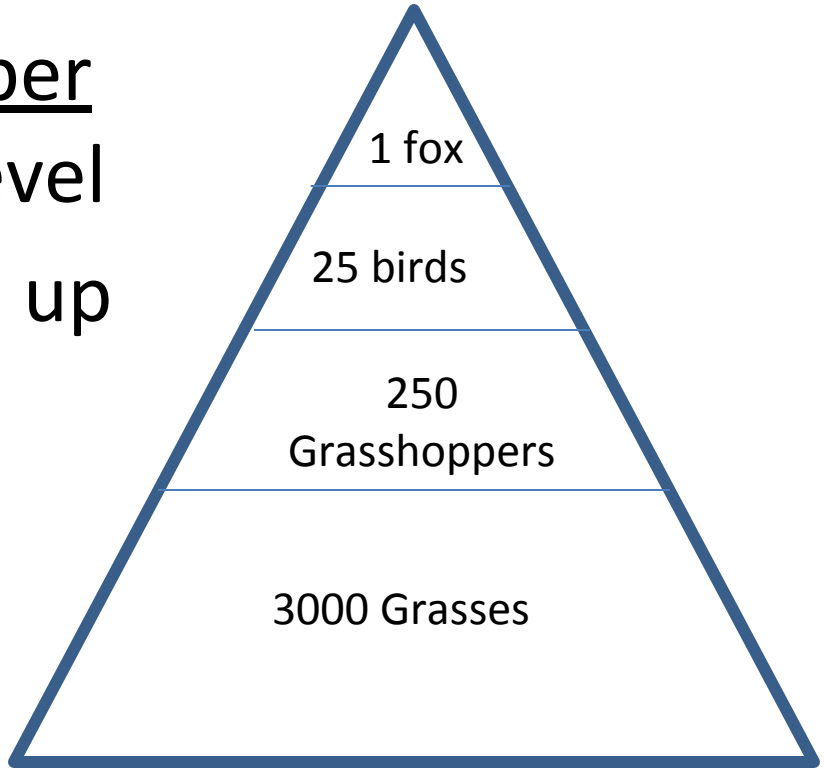
Biomass= the total amount of living tissue within a given trophic level

- The pyramid shows the relative among of living <u>organic</u> matter available



Pyramid of Numbers

- Show the relative number of individuals at each level
- Will decrease as you go up
- Why?



Stop

- Necklace Activity
- Food Chain Activity
- Food Web Activity

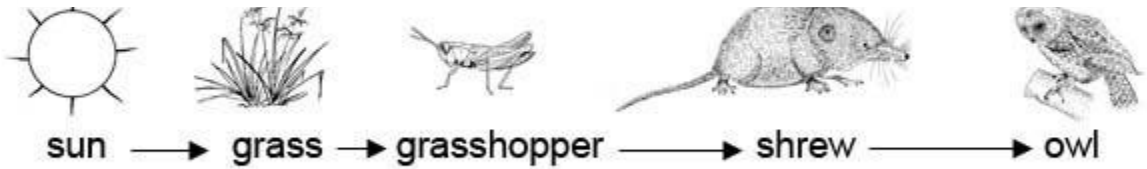
Nutrition & Energy Journal Quiz Check

Pg 150

- **1)** _____ break down organic matter.
- **2)** Animals that eat both plants and meat are called ____.
- **3)** The process used by autotrophs to make food energy from the sun is called _____.
- **4)** Organisms that rely on other organisms for their energy are called ____.
- **5)** Organisms that make their own food are called ____.
- **6)** Explain the difference between a detritivore and a scavenger.
- **7)** If a person eats a steak, from a cow, the person is acting as a _____.
- **8)** Tertiary consumers will eat ____ consumers.
- **9)**If a person eats a salad, the person is acting as a _____.

Energy Flow in Ecosystems Quiz Check

Pg 150



1. Name the producer in the food chain.
2. Name the 3rd level consumer in the food chain.
3. What organism is the herbivore in the food chain?
4. What is the main energy source for this food chain?
5. Why does a food chain usually never go past 4 trophic levels?
6. Explain the difference between a food web and food chain.
7. How much biomass would the shrew receive?
8. Using the 10% rule from the Energy pyramid, how much would the owl receive?

What would happen if…?

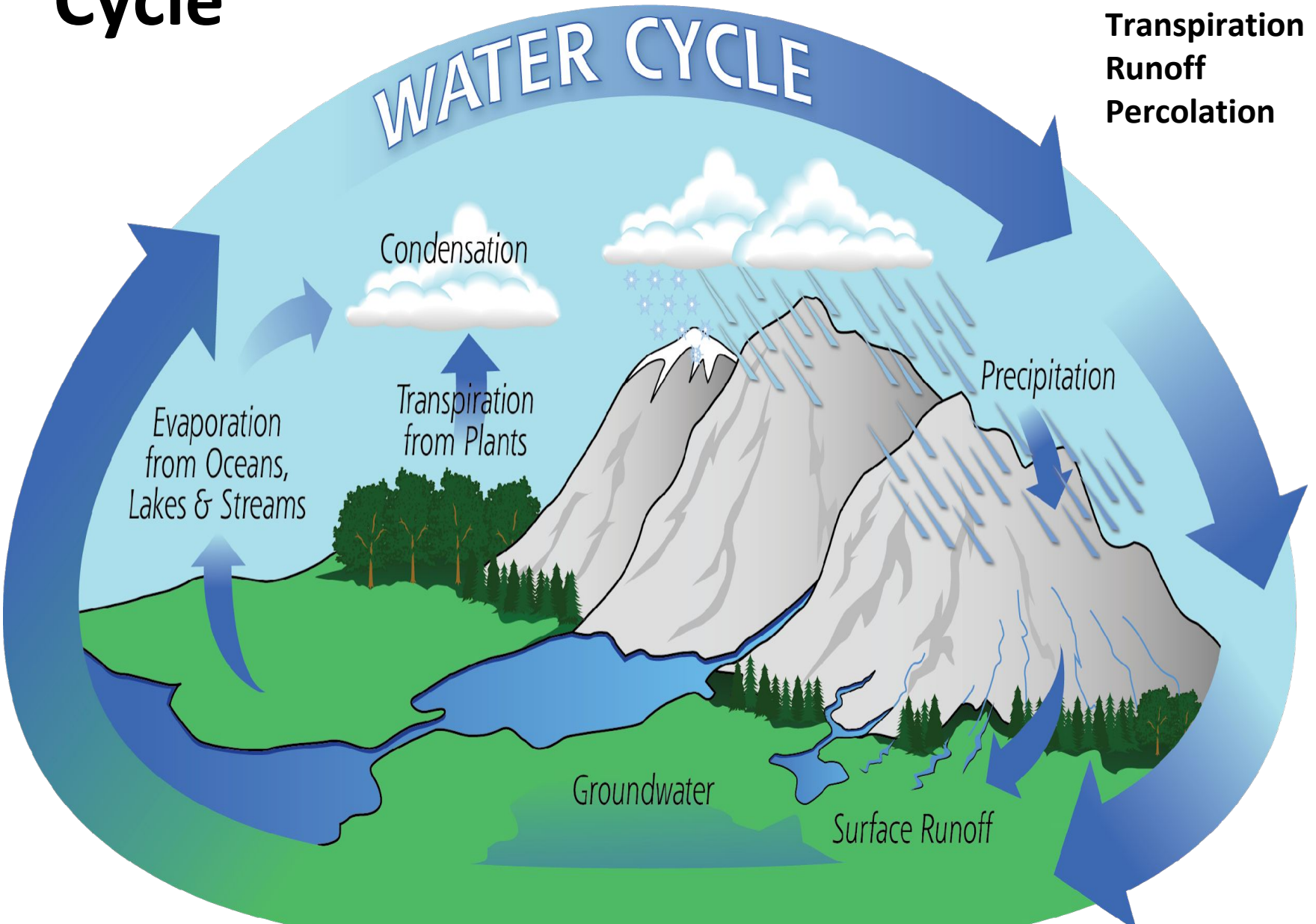
- Matter was bound in living matter and never recycled
  - ***Life would cease***
- Made up of ***C, H, O, N***
- Matter is recycled with and between ecosystems
- Elements pass from 1 organism to another thru the biosphere in closed loops

Cycles in the Biosphere

- Energy is **transformed** into usable forms to **support** the functions of an **ecosystem**.
- A constant supply of usable energy is needed, but **matter** must be **cycled** through the biosphere.
- The **cycling** of nutrients in the **biosphere** involves both **matter** in living organisms and **physical** process found in the **environment** like **weathering**
- Called **BIOGEOCHEMICAL CYCLES**

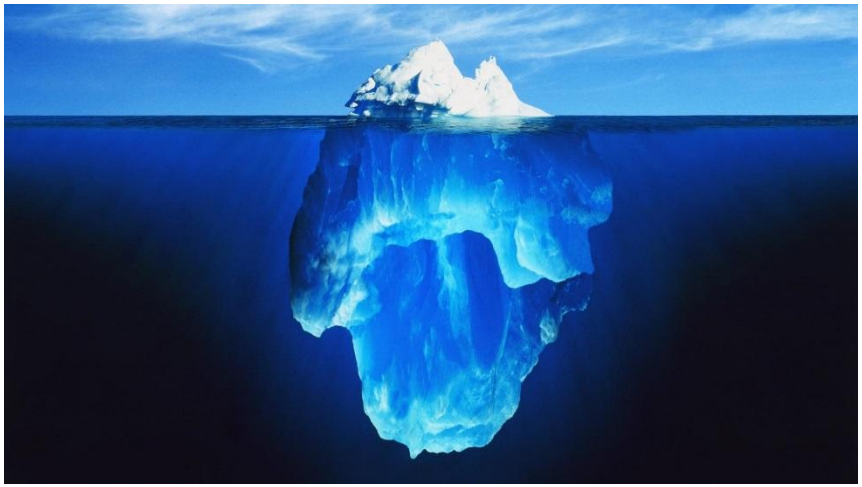
Water Cycle

Precipitation
Evaporation
Condensation
Transpiration
Runoff
Percolation



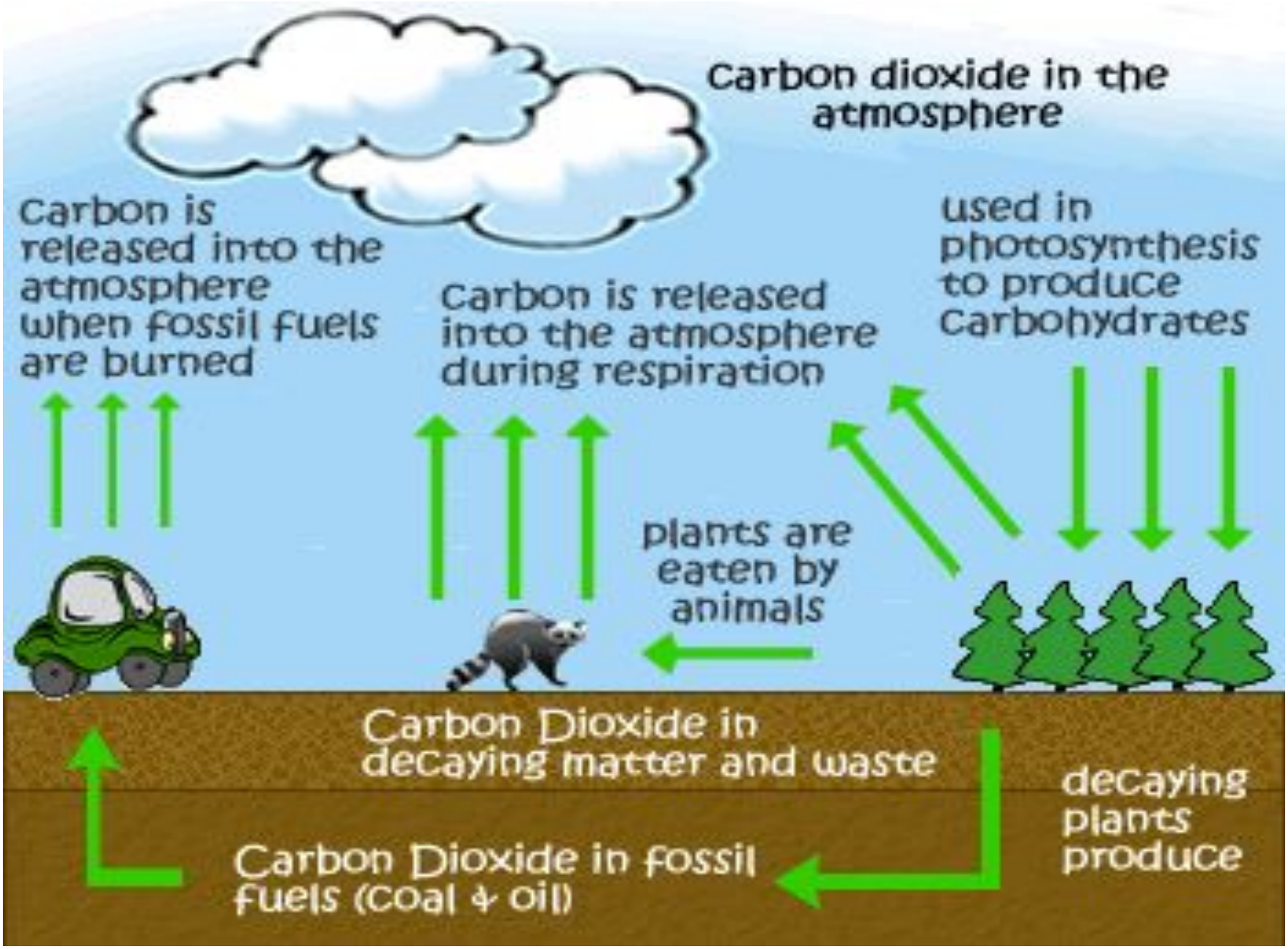
~Water Cycle~

- Why is Freshwater important? = ***all life needs it***
- How much freshwater is there on earth? ***3%***
- How much is available? ***31%***
- The rest is *frozen* ***(69%)***



~Carbon and Oxygen Cycle~

- Carbon is found in **all living things**
- Photosynthesis converts **CO2** and **H2O** into **carbohydrates** and releases **O2**
- Autotrophs breaths in **CO2**, breaths out **O2**
- Heterotrophs breaths in **O2** and breaths out **CO2**
- Carbon when buried makes **fossil fuels.** These release **carbon** which adds **CO2** to the atmosphere


Carbon dioxide in the atmosphere
Carbon is released into the atmosphere when fossil fuels are burned
Carbon is released into the atmosphere during respiration
used in photosynthesis to produce carbohydrates
plants are eaten by animals
Carbon Dioxide in decaying matter and waste
Carbon Dioxide in fossil fuels (coal & oil)
decaying plants produce

How much CO2?

- https://opb.pbslearningmedia.org/resource/tdc02.sci.life.eco.energyuse/snapshot-of-us-energy-use/?utm_source=WeAreTeachers&utm_campaign=PBSLearningMediaArticleSer&utm_medium=Article3&utm_content=SnapshotEnergyUse#.WuHP_WIrK71
- Start at 1:24

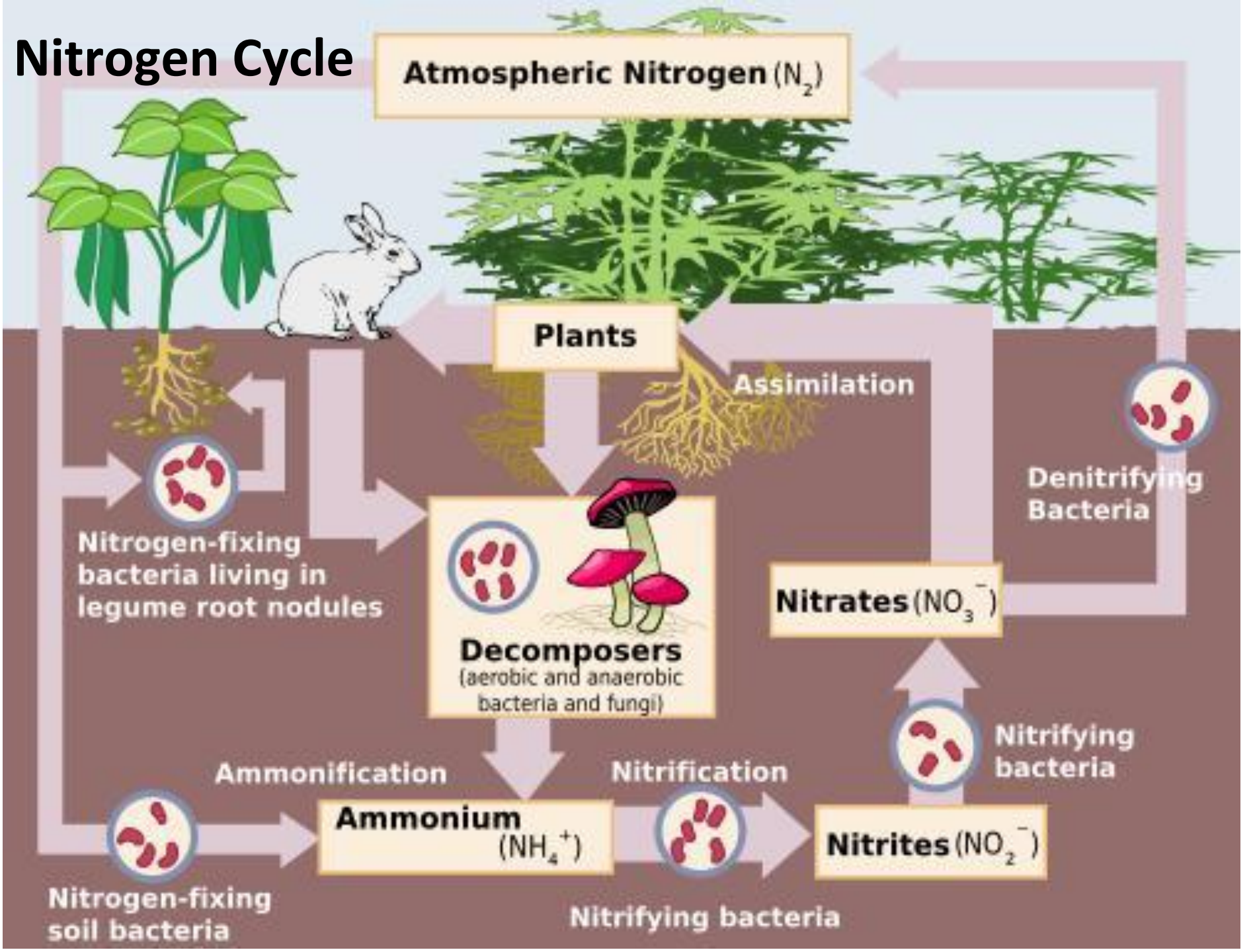
Renewable energy per country

https://www.electricitymap.org/?page=map&solar=false&remote=true&wind=false

~Nitrogen Cycle~

- Nitrogen is found in plants
- It is the most abundant in the atmosphere (78%)
- **Nitrogen Fixation**: process of capture and conversion of nitrogen into usable forms for plants
  - Limiting factor because they need it to make proteins
- **Denitrification:** soil bacteria convert fixed nitrogen compounds back to nitrogen gas to return to the atmosphere

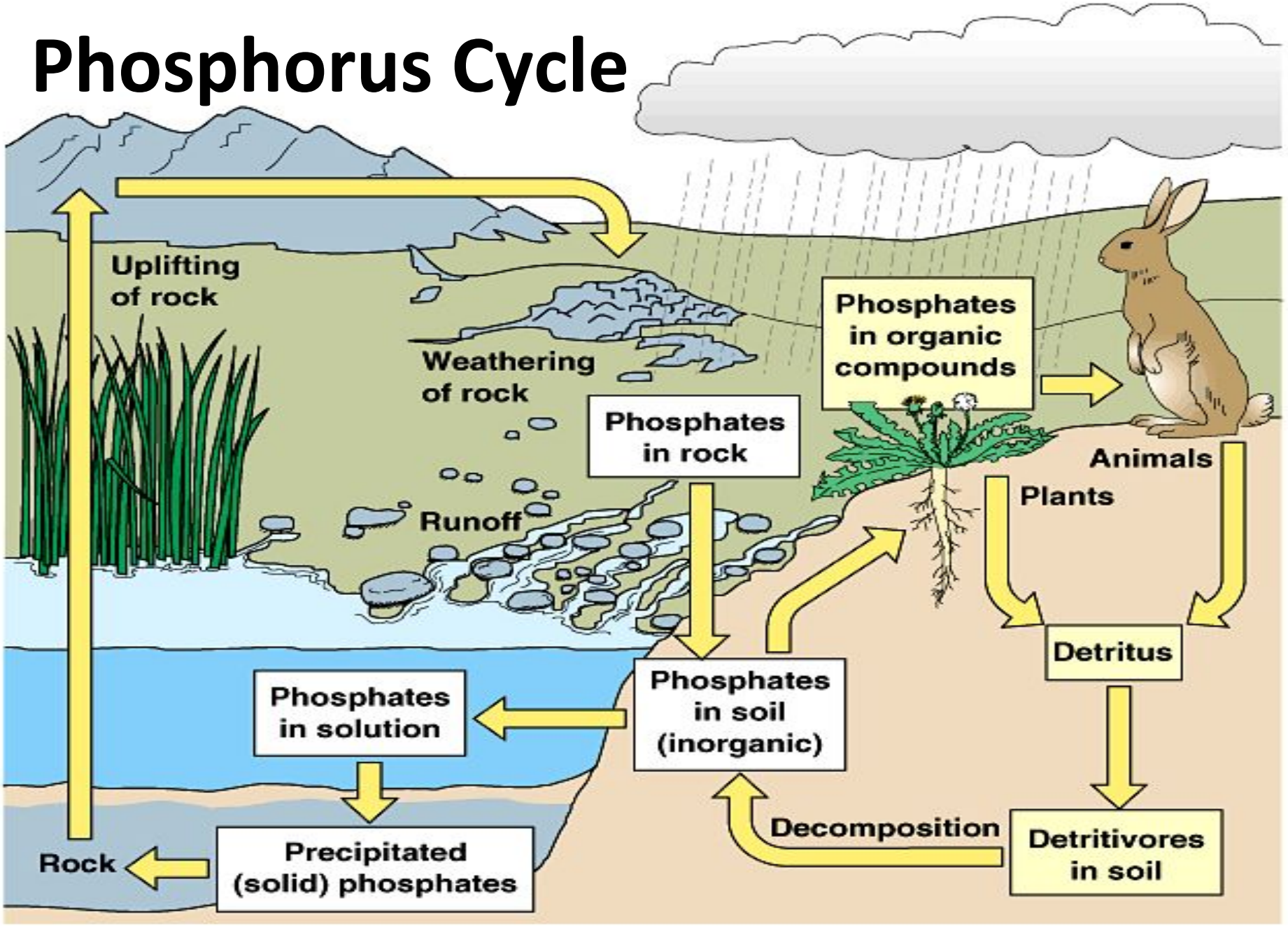
Nitrogen Cycle



~Phosphorus Cycle~

- Essential for growth and development and making of RNA/DNA
- Rocks/sediments gradually wear down and **phosphorus** is released
- Some phosphorus stays on land and cycles between organisms and soil
- Some phosphorus can wash into rivers where it is dissolved and settles back into rocks

Phosphorus Cycle



Cycle Journals

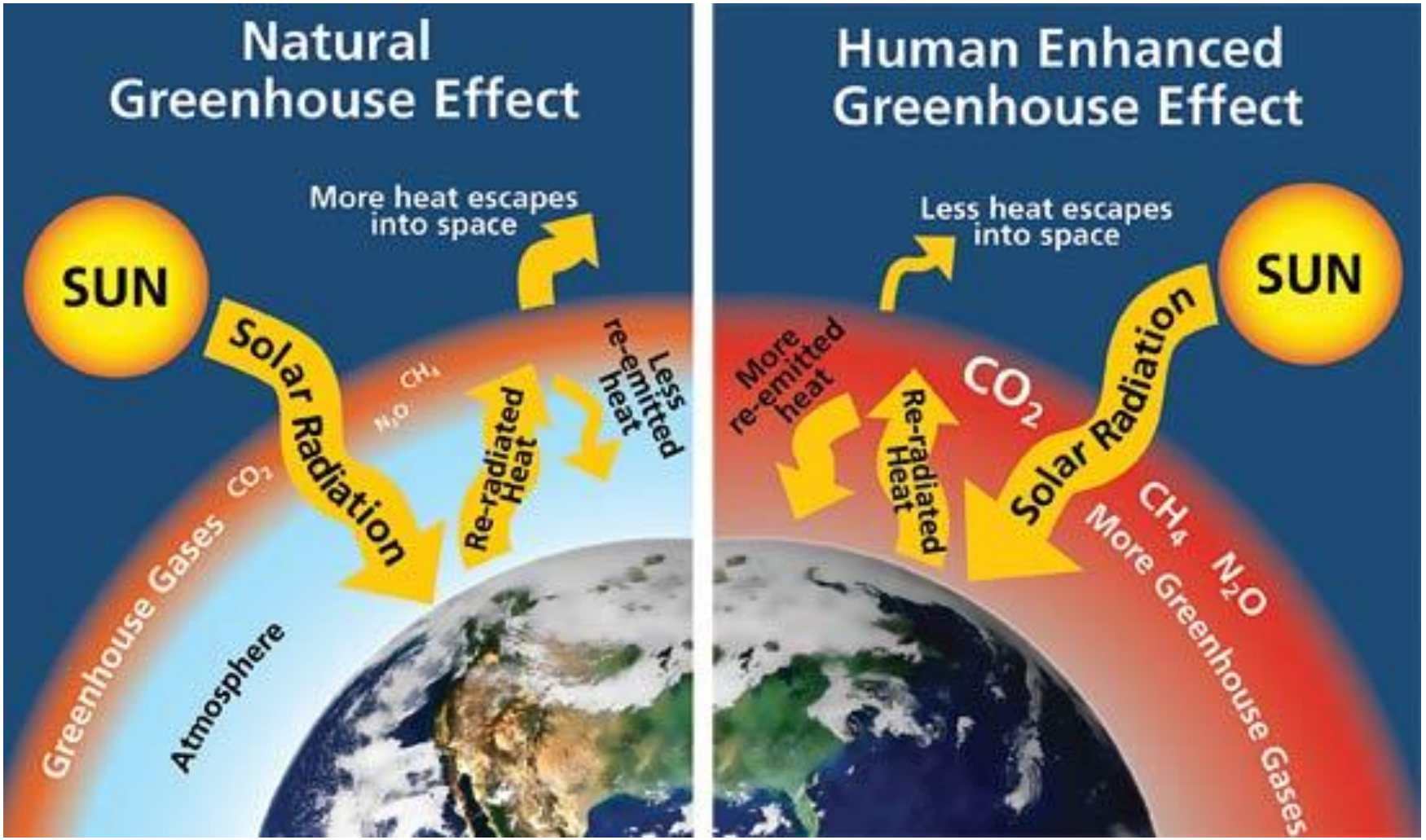
- **Water Cycle Diagram = pg. 152**
  - Complete the blanks
  - Give it some color 😊

Chapter 4
Ecosystems and Communities

Biomes

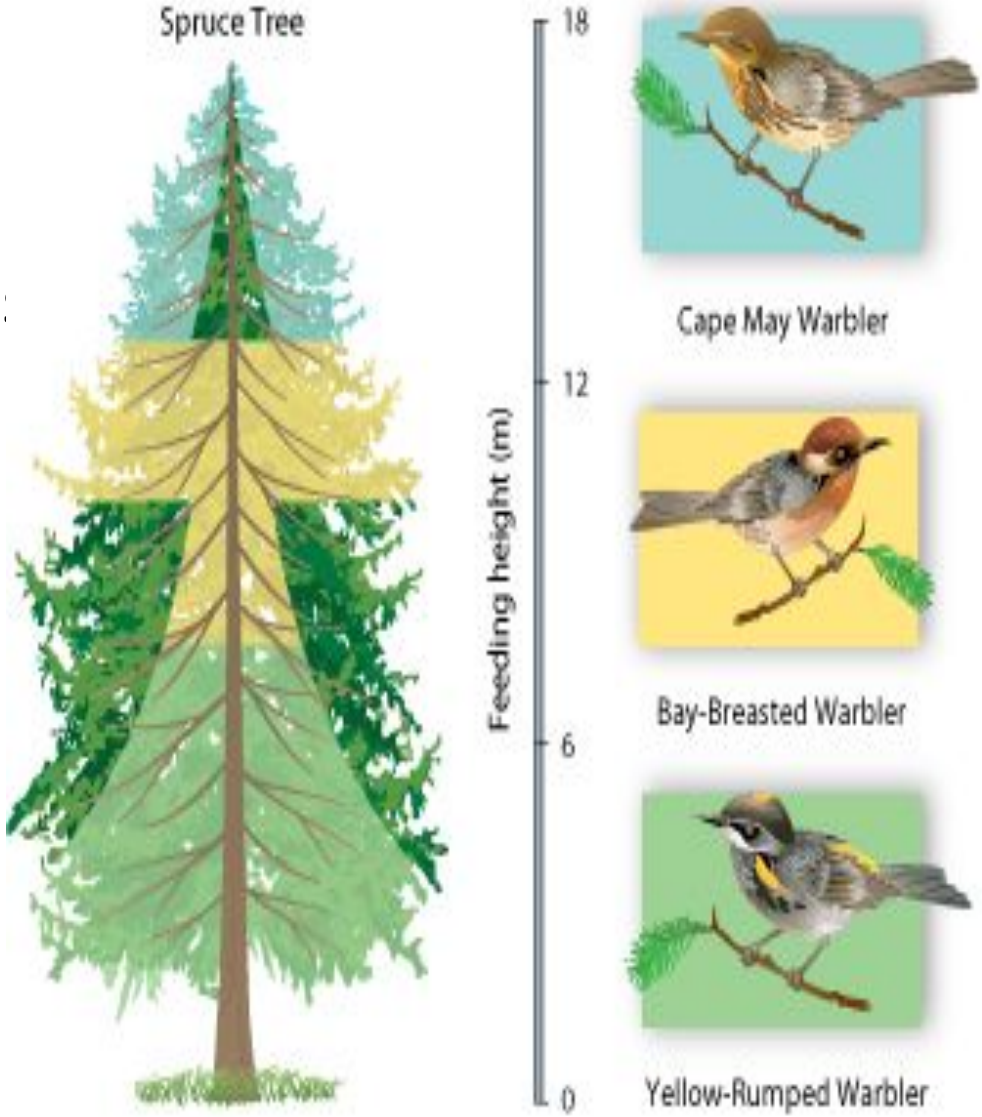
- **Weather**
  - Day to day conditions on earth
- **Climate**
  - Year after year patterns of temperature and precipitation
- **Greenhouse effect**
  - Process by which certain gases trap sunlight energy in earth's atmosphere as heat
  - CO_2, methane, water vapor

Greenhouse Effect



Habitat vs niche

- **Habitat**
  - Where an organism lives
  - *Example= in a tree*
- **Niche**
  - Role/position in the environment
  - *Example= seed eater*



What's Yours?

- Describe your habitat?

- What is your niche?
- What will your niche be?

Removal of the keystone sea otter : sea urchins overgraze kelp and destroy the kelp forest community.

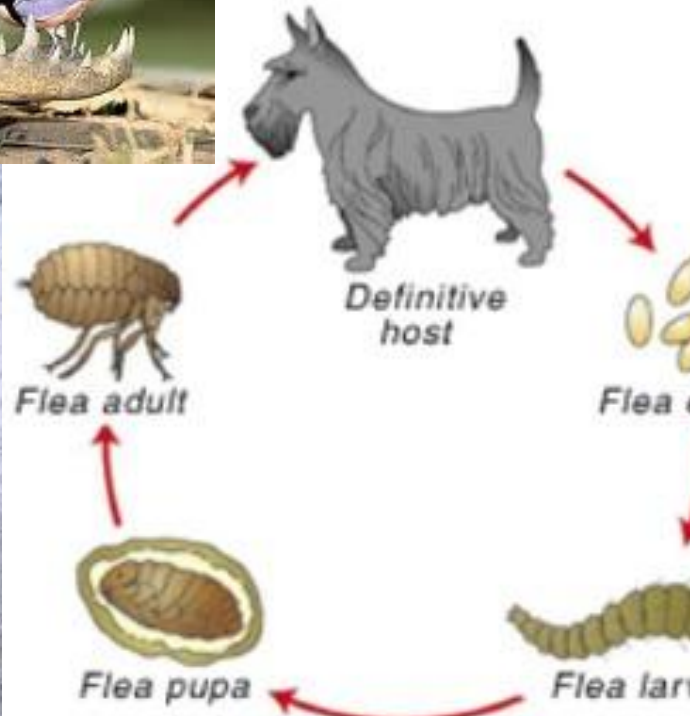
- **Tolerance**
  - The ability to survive and reproduce under a range of environmental conditions
- **Keystone species**
  - Single species that is not usually abundance in a community yet exerts strong control on the structure of the community

Tolerance

- Why can humans have a wider limit of tolerance compared to other animals?
  - Can alter their environment

Community Interactions

Species Interaction	Description	Species A	Species B	Book Example
COMPETITION	2 species use the same resource	-	-	Fighting over a water hole
PREDATION	Predator (pursuer) vs Prey (consumed)	+	_ (dies)	Cat eats a mouse
HERBIVORY	Herbivore eats a plant	+	-	Cow on grass
MUTUALISM	Both species benefit since live close together	+	+	Clownfish + sea anemone
COMMENSALISM	1 organism benefits and other is neither harmed nor helped	+	0	Bird in a tree
PARASITISM	1 organism benefits at expense of other	+	_	Tick + dog


Definitive host
Flea adult
Flea pupa

Interactions Sorting

- Species Interactions Sort
  - Mutualism = 18 cards
  - Parasitism= 11 cards
  - Commensalism= 13 cards

- What is a Tree Worth – Page 151

~Interactions Check~

Page 149

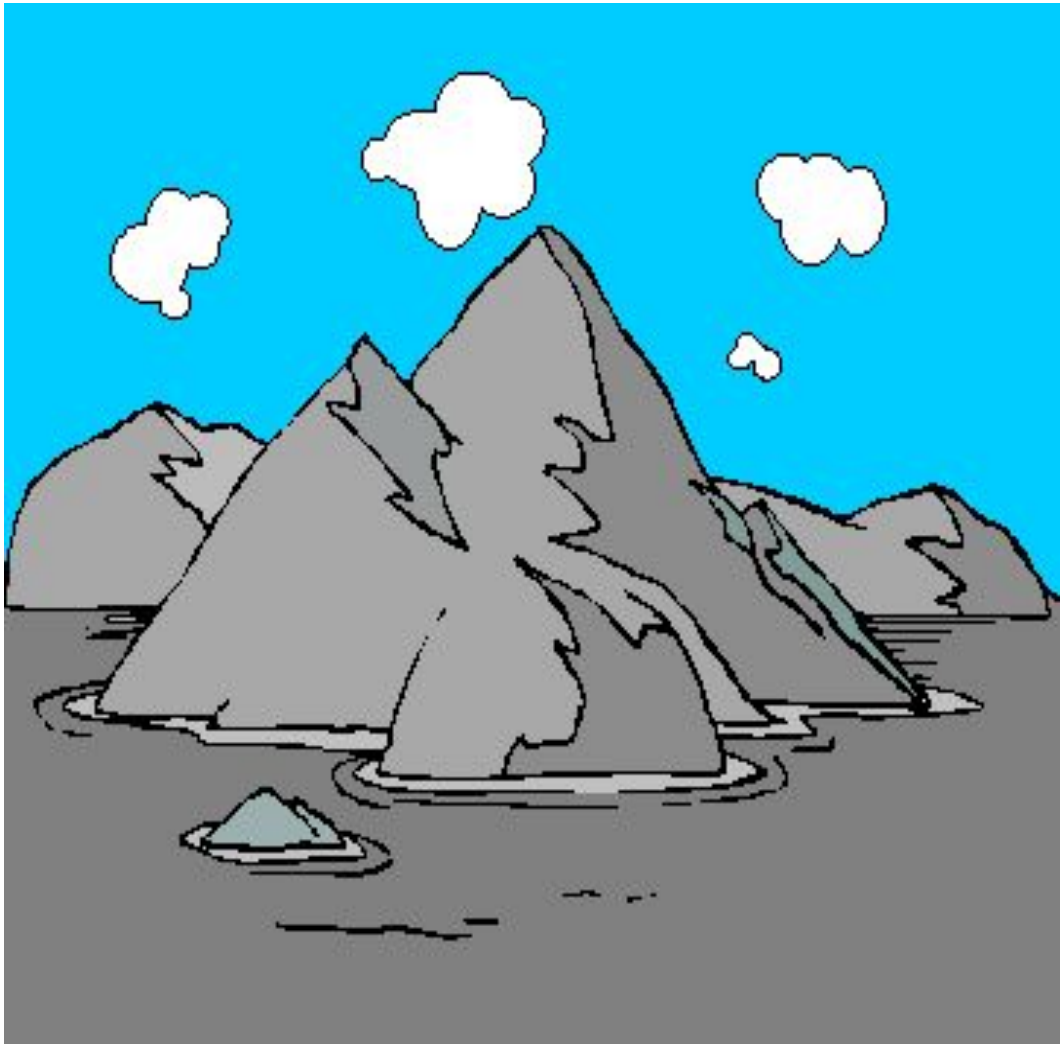
Matching

____ 1. Biotic Factors
____ 2. Parasitism
____ 3. Habitat
____ 4. Abiotic factors
____ 5. Commensalism
____ 6. Niche
____ 7. Mutualism
____ 8. Predator
____ 9. Prey
____ 10. Symbiosis

A. Organisms that hunt and eat other organisms
B. Any relationship in which 2 species live closely together
C. Both species benefit from relationship
D. An area where an organism lives
E. Organisms that are hunted and eaten
F. All living organisms in an environment
G. All strategies and adaptations a species uses for survival
H. Non-living parts of an environment
I. 1 organism benefits and the other is neither harmed nor helped
J. Organism lives on or in another and harms it

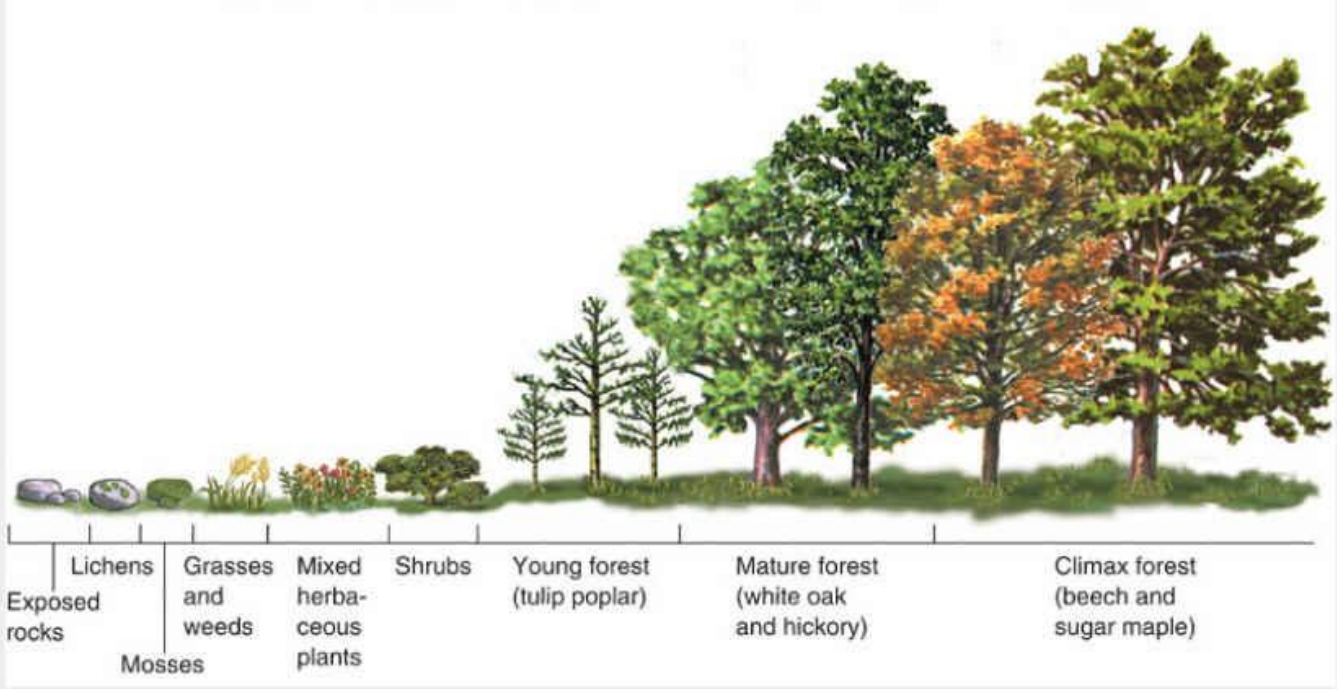
Succession

- Ecosystems change over time especially after disturbances as some species die out and new species move in



Ecological succession

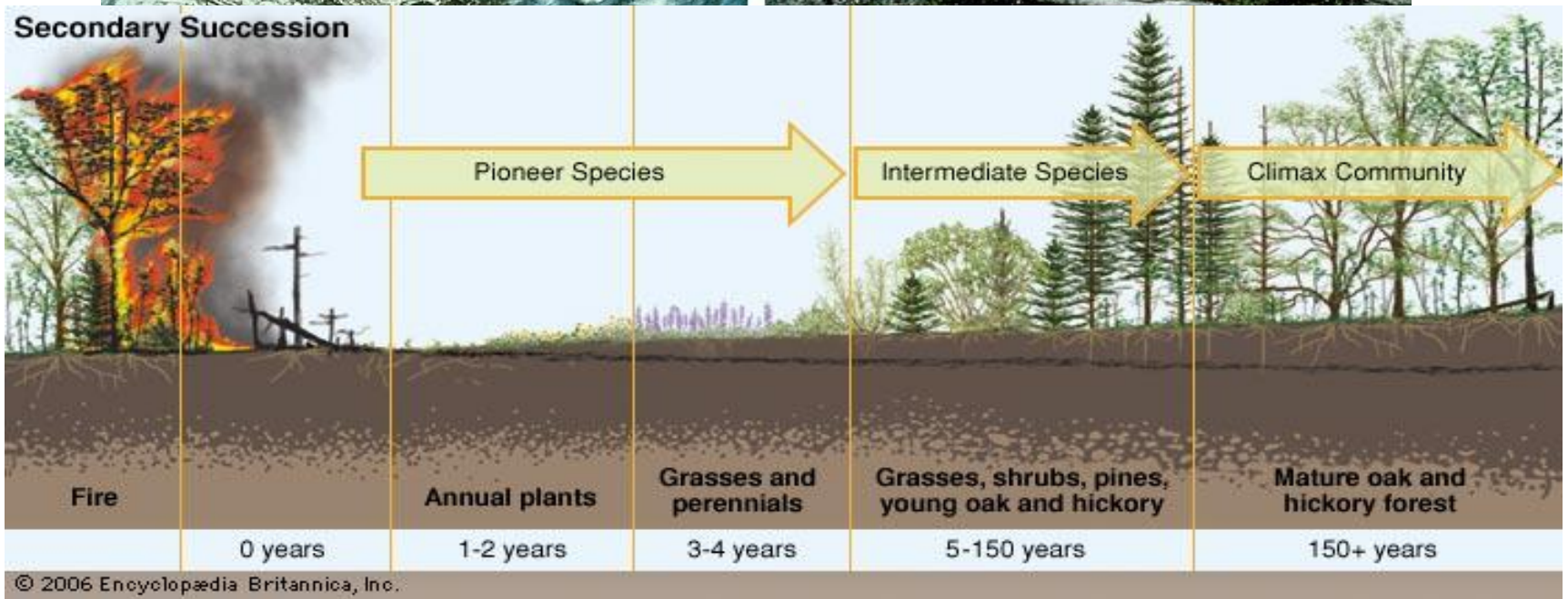
- A series of more or less predictable changes that occur in a community over time



PRIMARY SUCCESSION	SECONDARY SUCCESSION
-succession occurs in an area in which NO trace of previous community is present -Establishment of an area with exposed rock with **NO** topsoil	- Succession that occurs in an area that was partially destroyed by disturbances - Change after a community of organisms has been removed (soil still intact)

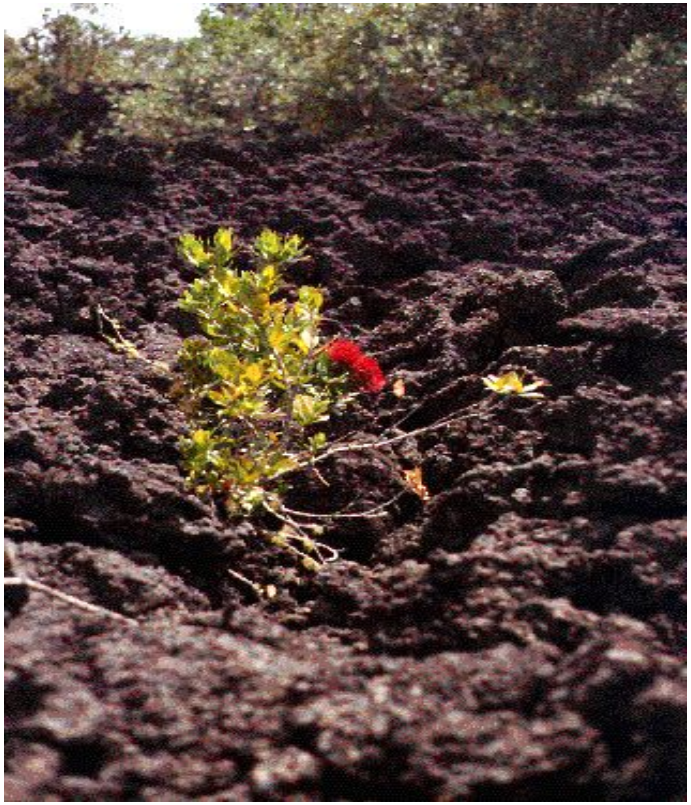
PS

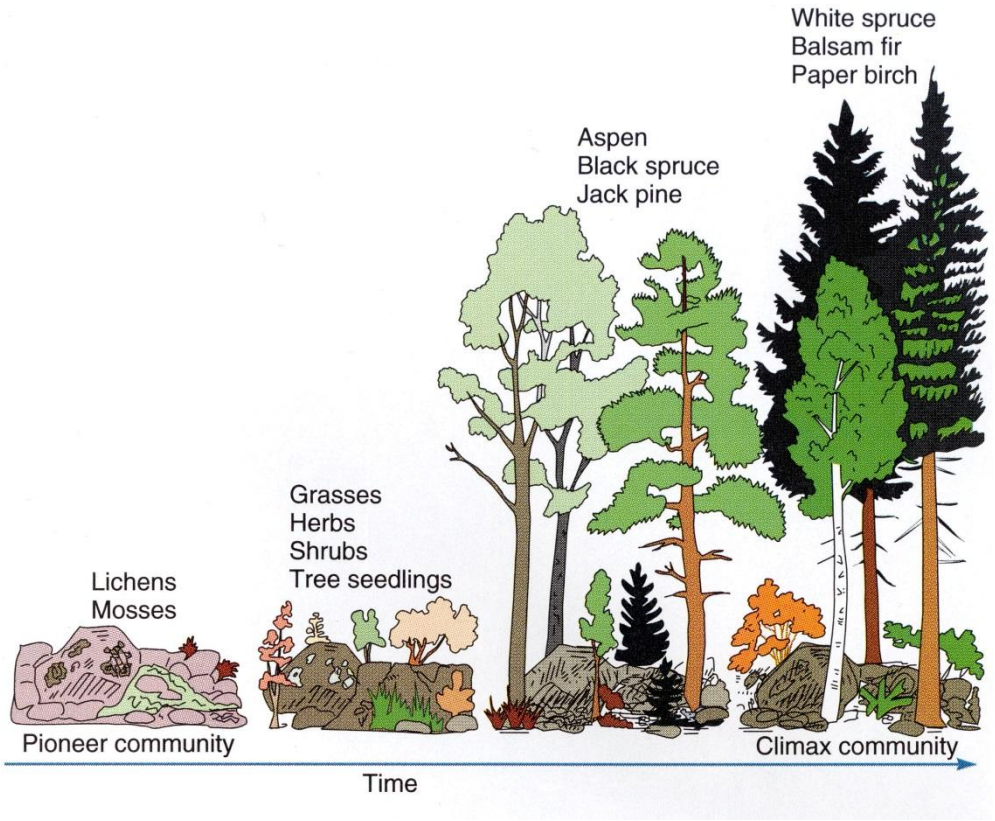
SS



Succession

- **Pioneer Species**= 1st organisms to appear
- **Climax Community**= stable mature community



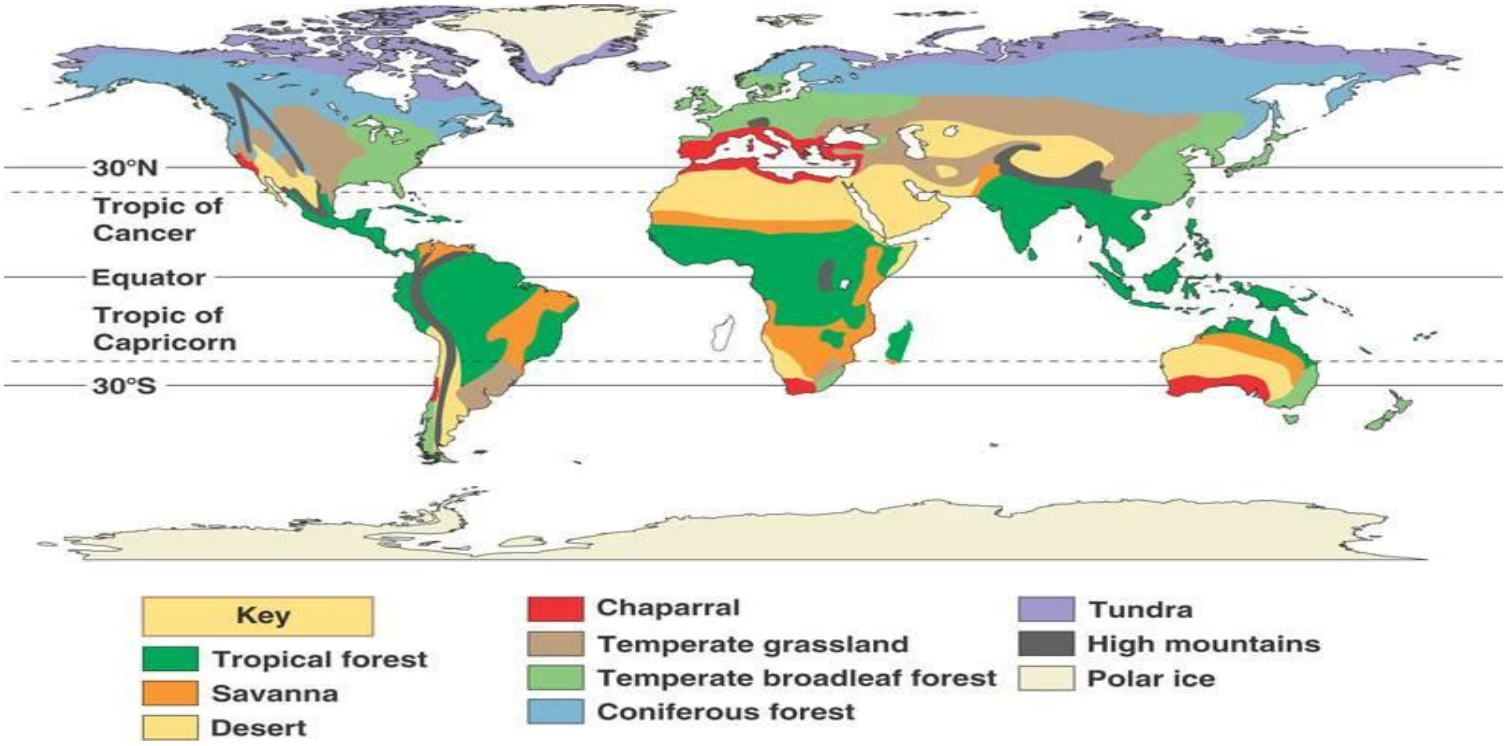


Tree Worth

- Calculate how much oxygen the following group of trees produces per year: 1 large tree, 2 medium trees, and 4 small trees.
  - 1010 lbs
- Calculate how many humans can survive for a year on the oxygen produced from the following area: 12 small trees, 8 medium trees, and 6 large trees.
  - 6 humans
- The Di Stefano yard has 4 large trees, 4medium trees and 4 small trees - do these trees support the 4 of us? Prove your answer
  - No we are short about 384 pounds (poor Sadie)
- If Mrs. D's car produces 3774 pounds of carbon dioxide per year, about how many years would it take for just the trees in her yard to absorb this amount of CO2 pollution?
  - About 6.6 years
- How much money would it cost to produce the amount of oxygen needed for every human on Earth for one year?
  - 76 trillion dollars
- List the common names of 10 different types of tree species found in our area.

Biome

- Group of ecosystems that share similar climate and typical organisms
- Classified by their <u>plants, temperature, rainfall and animals</u>



Tundra


Boreal Forest
Coniferous forest
Taiga


Temperate Forest
Deciduous Forest

Woodlands/ Shrublands

Savannah


DESERT


TROPICAL
RAINFOREST

Freshwater

Marine Ecosystem

Movie

- Tundra=
- Taiga/Boreal Forest=
- Temperate Deciduous= Forest
- Savannah= *The Lion King*
- Desert=
- Tropical Rain Forest=

STOP

- Complete biome activity
- Complete biome worksheet

Pg 154

Succession Quiz Check

Word Bank: Secondary, Climax, Succession, Pioneer, Primary, Organisms, Less, Change

_____ is the process of gradual, natural change and species replacement in an ecosystem over time. _____ succession takes place on land where there are no living _____, like after a volcanic eruption. The first species to live in the area, once cooled off, are called _____ species. _____ succession is a pattern of change that takes place after an existing community is destroyed, such as a wildfire. After time passes, little or no _____ occurs – when this is the case, this community is called a _____ community. Secondary succession may take _____ time than primary succession to reach the stage of climax community.

~Biome Check~

Page 155

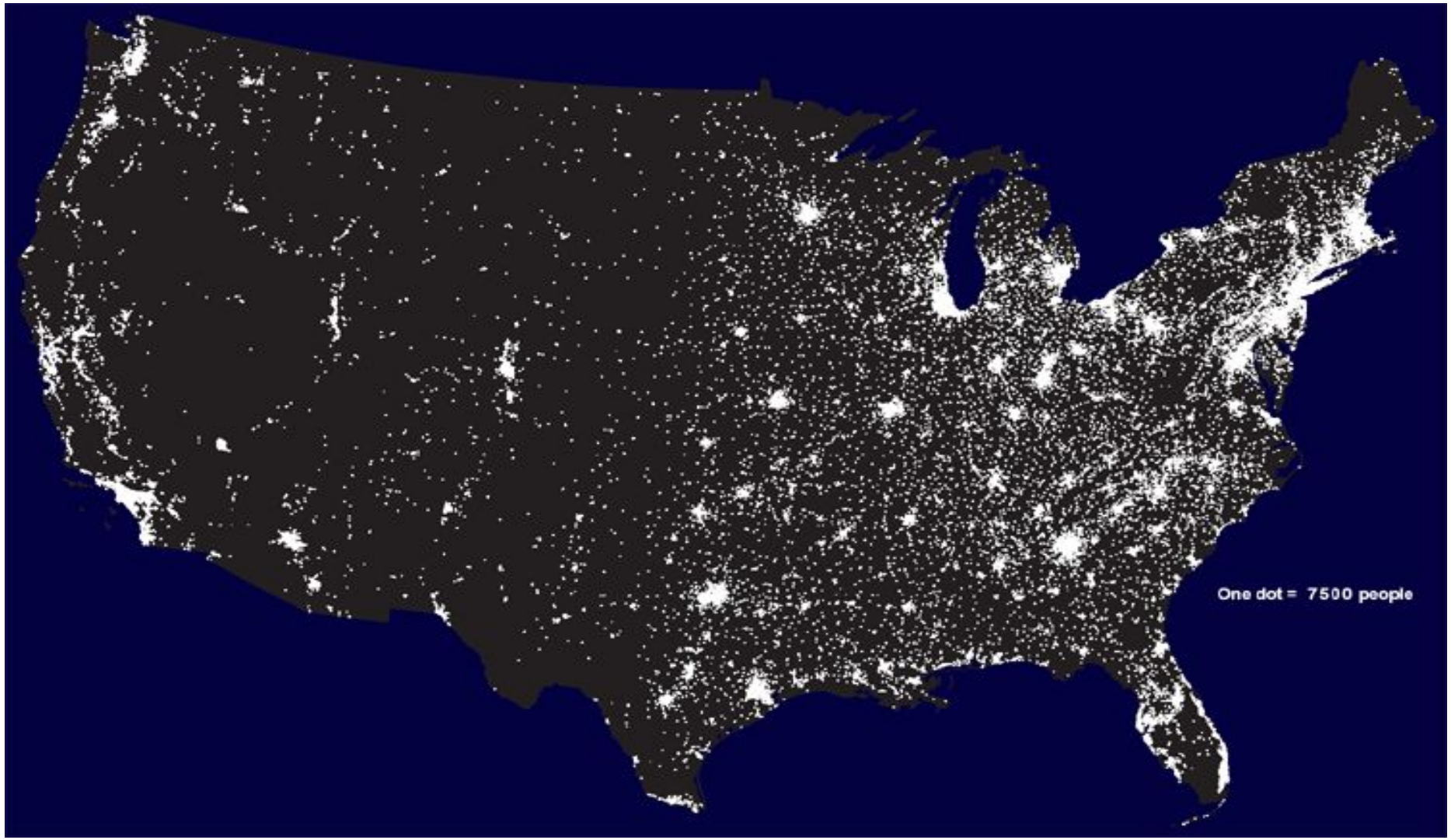
Matching

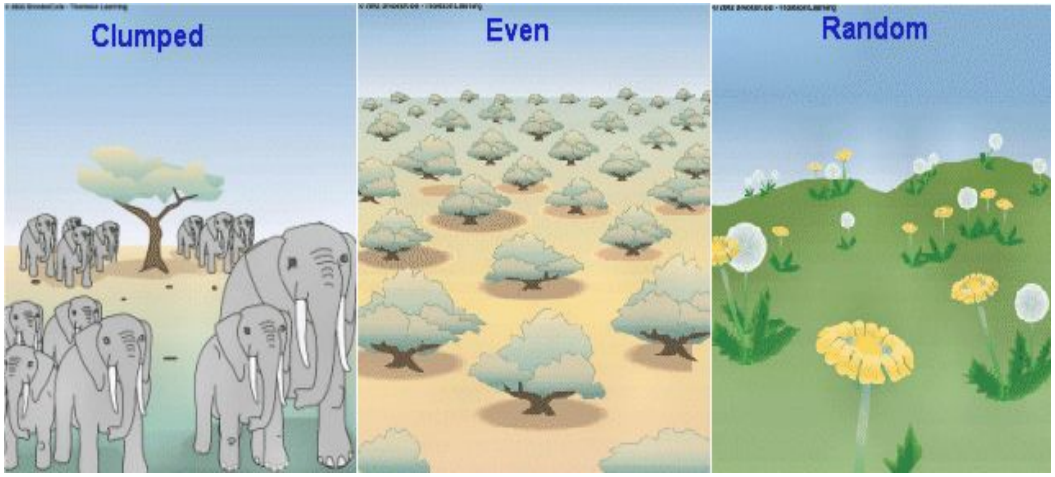
____ 1. Desert
____ 2. Tropical Rainforest
____ 3. Temperate forest
____ 4. Savannah
____ 5. Tundra
_H_ 6. Wetlands
____ 7. Ocean
____ 8. Estuaries
____ 9. Taiga
____ 10. Lake

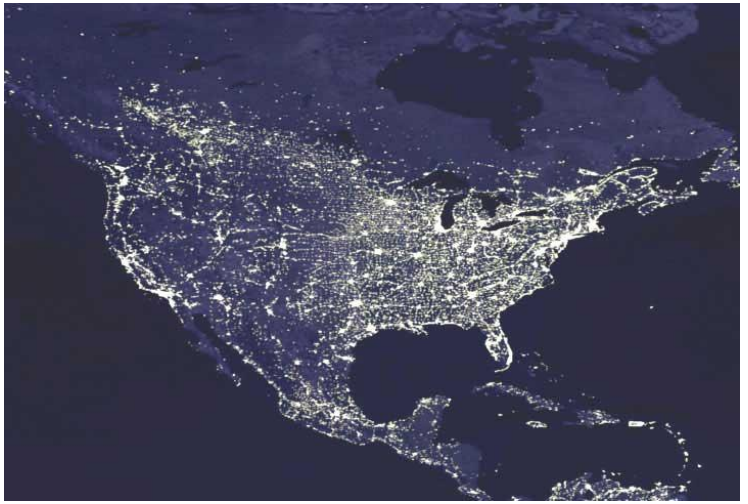
A. Standing body of water with low salinity
B. Home to many insects with precipitation year-round.
C. Plants include a variety of grasses, home to lions
D. Area where freshwater and saltwater mix
E. Dry ecosystem with porous soil, home to cacti
F. Has a layer of permanently frozen soil; permafrost
G. Exists only in northern hemisphere, coniferous forest
H. Thin layer of water that covers soil; birds use it for nesting and feeding
I. Animals such as chipmunks, bears, and bats hibernate in winter; leaves fall in the autumn
J. Covers the largest part of the biosphere

11. What is the difference between weather and climate?
12. Name 3 limiting factors for a biome.
13. What biome is your favorite – why?

Chapter 5
Population Dynamics







- **Populations**: 1 species that live in one place at one time
- **Population Density** = number of organisms per area
- **Population Dispersion**= spacing of a population in an area

  (3 types= Uniform, clumped or random)

Population Growth Rate Equation

http://www.census.gov/popclock/

- Equation

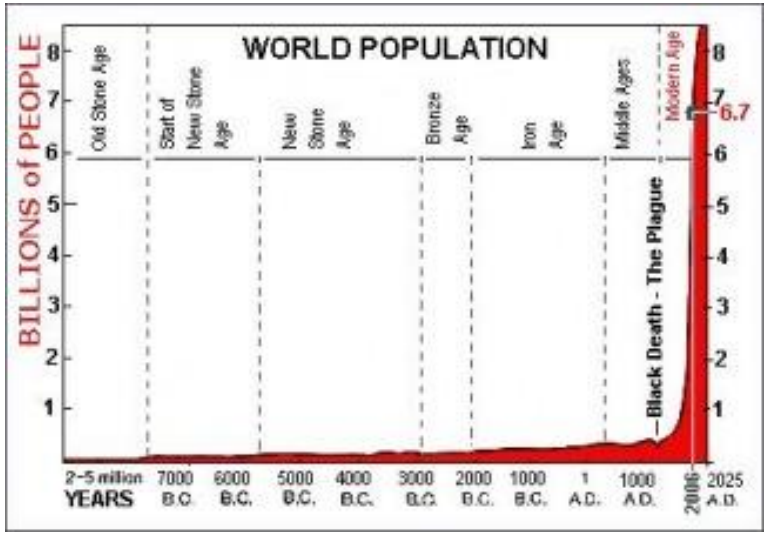
$$GR = (B+I) - (D+E)$$

Practice

How do you get a ???
Zero population growth
Positive population growth
Negative population growth

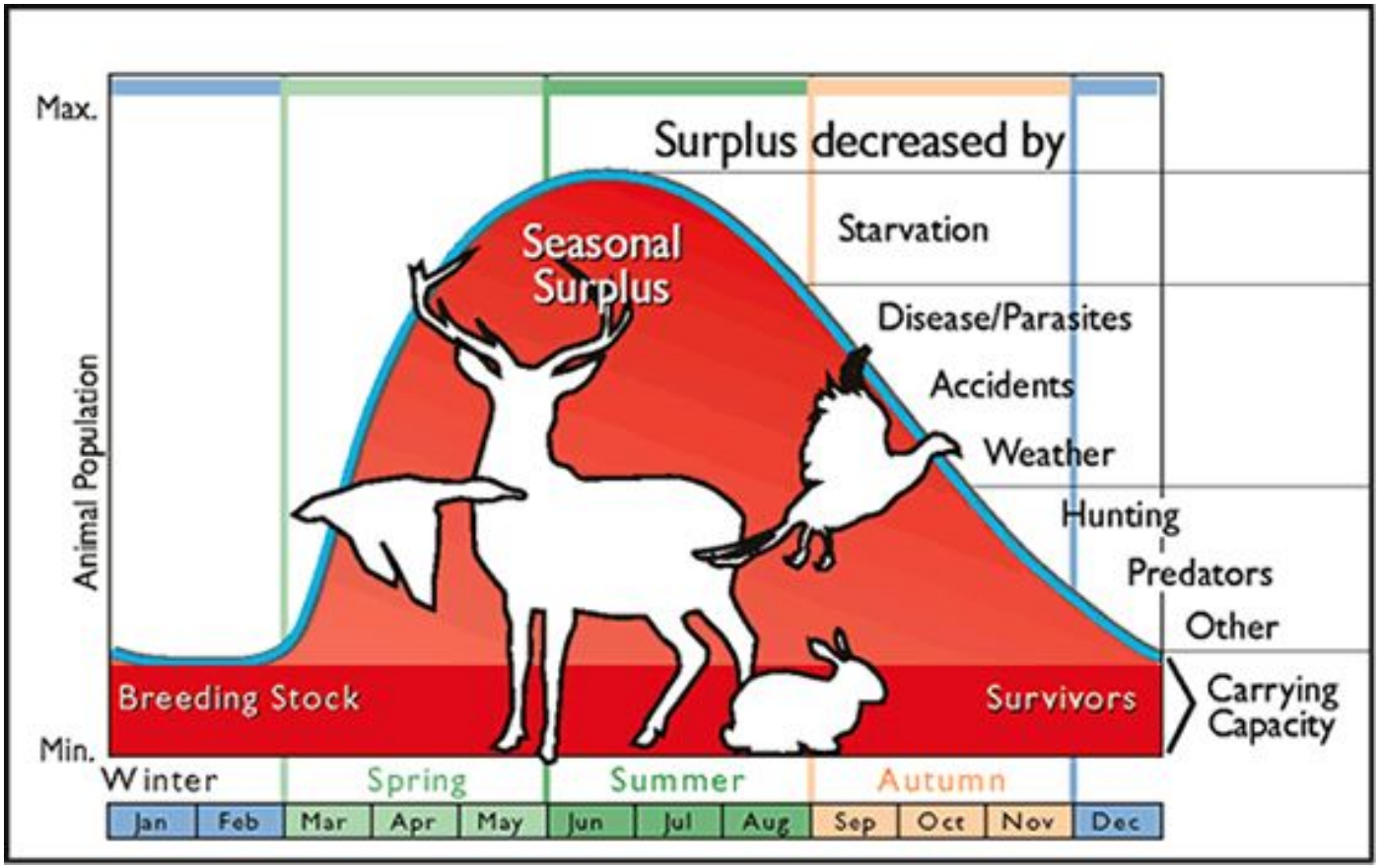
Human Populations

- **Demography** = the study of human populations
- **Exponential Growth**: grows very fast
  - J curve
  - Needs ideal conditions



Carrying Capacity

- The max number of individuals that an environment can sustain



Human Carrying Capacity? What do you think?

Human Growth

- What are some technological advances that have helped human growth?

~Developed vs Developing~

DEVELOPING COUNTRY

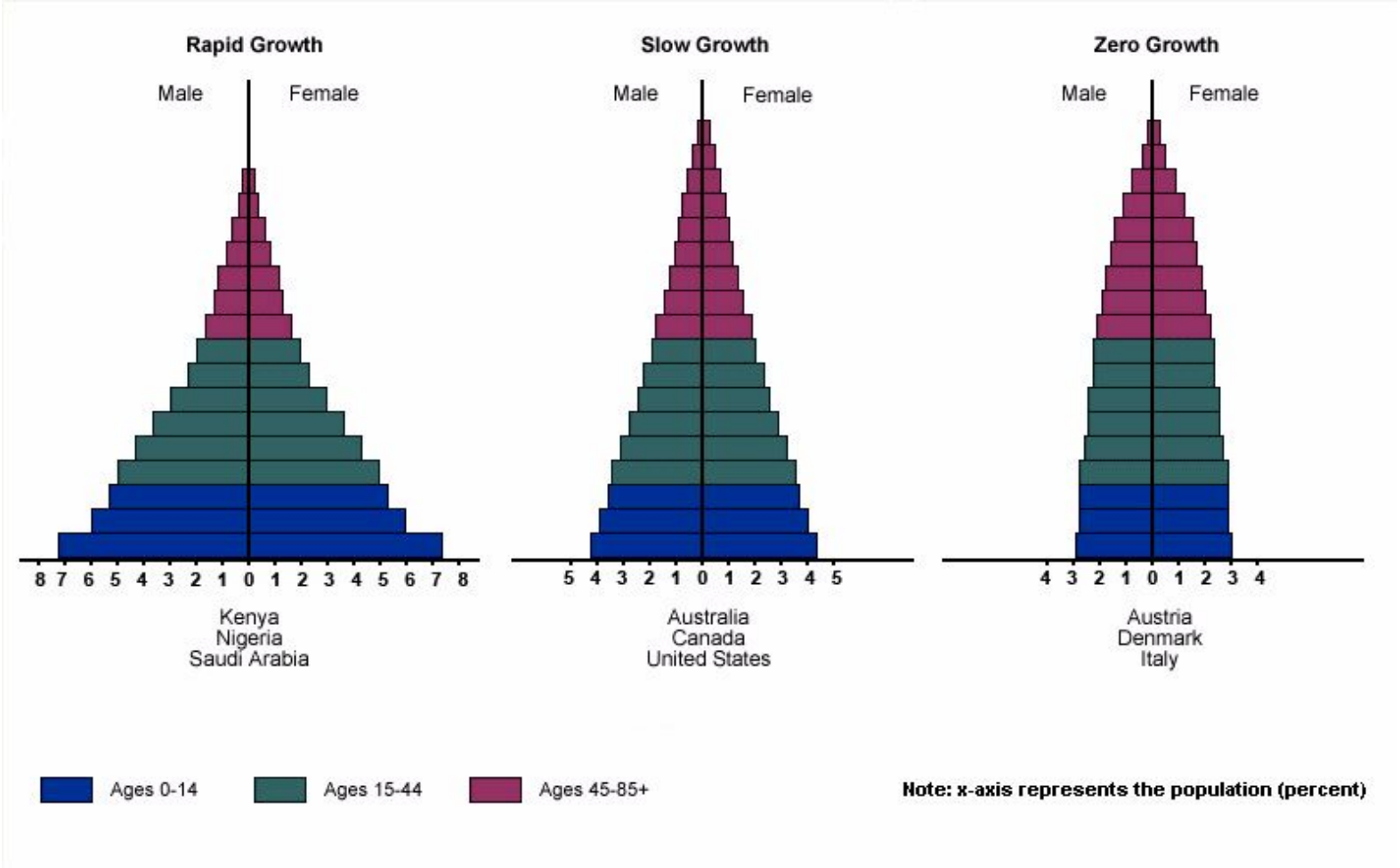
- Farm based
- Poorer
- Less technology
- Poor health
- Examples
  - Haiti, Afghanistan, Sudan, Yemen

DEVELOPED COUNTRY

- Lots of jobs
- More wealth per person
- More technology
- Good health
- Examples
  - USA, England, Japan

Age Structure Graph

Shows population at a certain age



Limiting Growth

- **Limiting factors**=
  - a factor that controls the growth of a population
  - Examples
    - Parasite, predation, disease, natural disaster

	DENSITY INDEPENDENT FACTORS	DENSITY DEPENDENT FACTORS
Definition	A factor that affects all populations regardless of population density	Factors that depends on population density
Abiotic/ biotic	Abiotic factors	Biotic factors
examples	Drought Flood Hurricane Wildfires	Predation Disease Parasitism Overcrowding

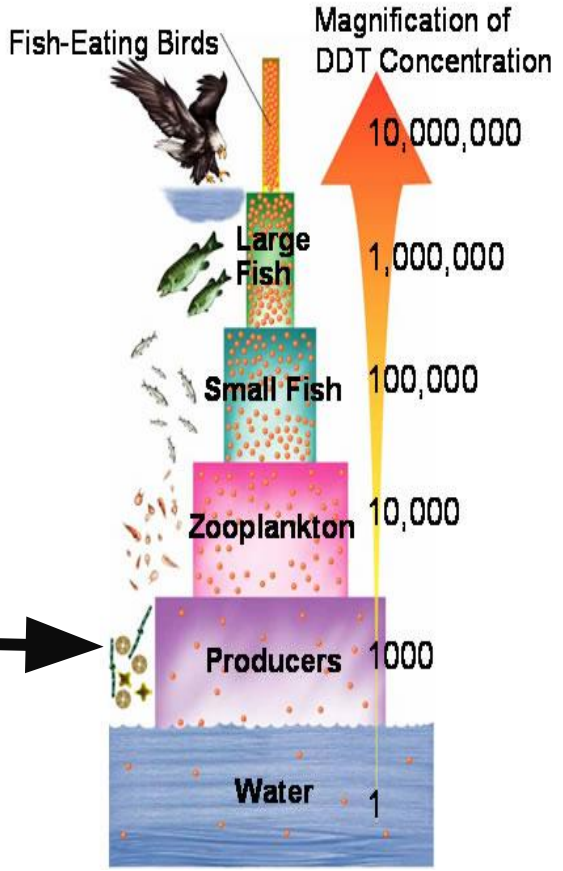
Are We Too Crowded? Pg 156

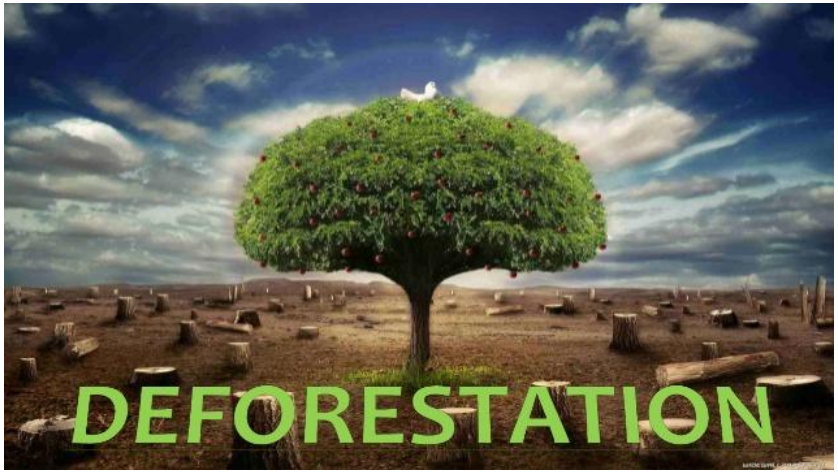
Class Size	Length of room	Width of room	Area (m^2) of Room	Total people	Population Density (people/m^2)	3 observations of your classroom
Full Size						
Half Size						
Fourth Size						
Eighth Size						

Chapter 6
Biodiversity and Conservation

How do we Affect Land?

- Overgrazing
- Deforestation
- Pollution
- Biomagnification



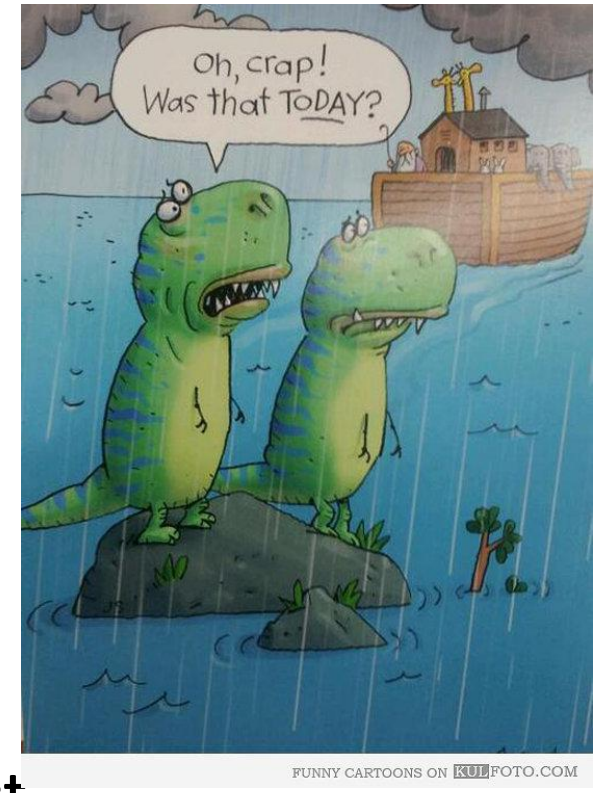


Biodiversity

- What is Biodiversity?
  - Variety of life in an area

Threats to Biodiversity

- **Background extinction**
  - Gradual process of species becoming extinct
- **Mass extinction**
  - Large percent of species go extinct
  - Name the species that has caused the greatest amount of extinction
    - *Homo sapiens*



Biodiversity Threats

	Description	Affects	Ex
Natural Resources	All materials found naturally (fossil fuels)	Using more than can replenish	Oil spills
Overexploitation	Excessive use of species with economic value	Animals hunted to near extinction	Bison Sea turtles rhino
Habitat Fragmentation	Separation of habitat into smaller pieces	Relocate Confined to smaller areas	deer
Pollution	Changes to air, water, soil	Adapt, relocate or die	DDT – bald eagles Acid rain – forests/fish
Introduced Species	Non-native species brought into an area	Destroys habitat Increases predation	Fire ants Snake head Rabbits in Australia

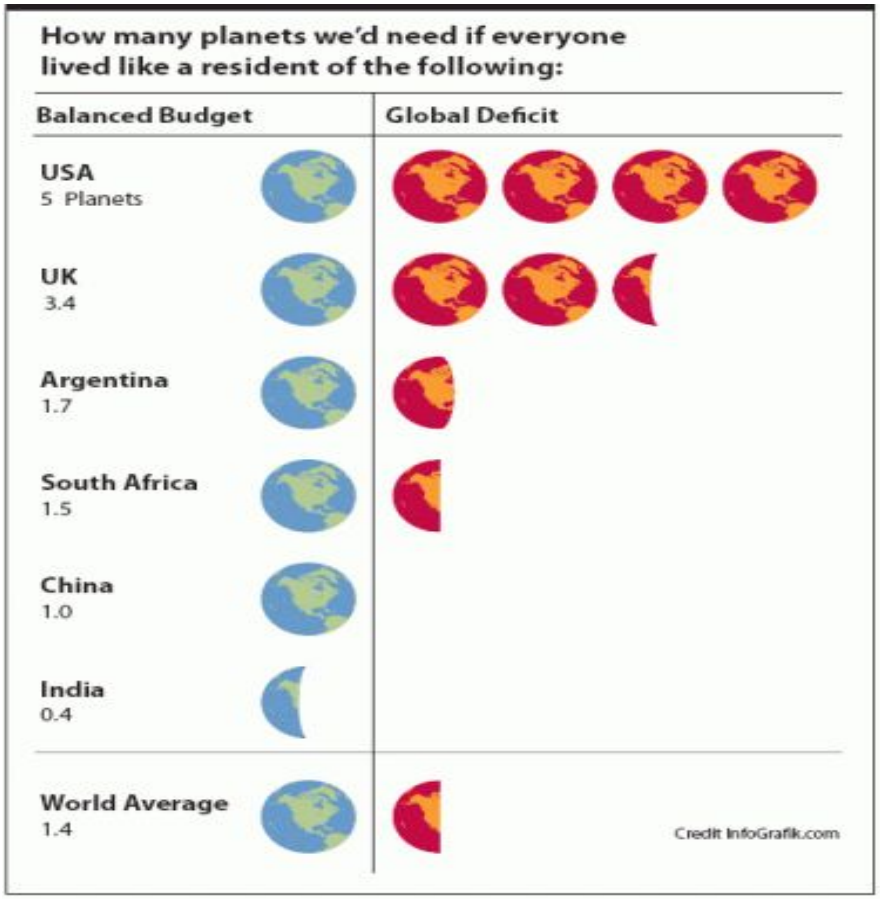
Snakehead

Conserving Biodiversity

- 1) Protect Individual Species
- 2) Preserve Habitats
- 3) Preserve Ecosystems
- 4) Conserve Natural Resources
- 5) Protect Biodiversity Hot Spots

Ecological Footprint

- Shows the productive area of Earth needed to support 1 person in a particular country
- America is 4x the global average



~Ecology in Action~

- 1) Recognize a problem in the environment
- 2) Research to find the cause
- 3) Change our Behavior

My Pledge 😊

So there will be a Tomorrow

I Pledge to RECYCLE at my School

What is your pledge?

Page 153