

# ECOLOGY



# What is Ecology?

- *The scientific study of interactions among organisms and between organisms and their environment, or surroundings*
- *Factors involved in ecology*
  - *Abiotic (non-living)*
  - *Biotic (living)*

# **Levels of Organization**

■ ***Organism***

■ ***Population***

- *All the members of one species in an area*

■ ***Community***

- *All the members of the different interacting species in an area*

■ ***Ecosystem***

- *All the members of a community plus the abiotic (physical) factors influencing them*

■ ***Biome***

- *Group of ecosystems that have the same climate and similar dominant communities*



# ■ ***Biosphere***

- ***Entire region of the earth where living things may be found***

# **Biotic vs. Abiotic Factors**

■ ***Factors that affect the environment:***

■ ***Abiotic (non-living)***

■ ***Wind, soil, rocks, temperature, water***

■ ***Biotic (living)***

■ ***Living (or dead) organisms***

# **Changing one factor in an ecosystem can affect many other factors:**

## **Biodiversity**

- **The variety of living things in an ecosystem.**
- **Tropical rain forests have the most biodiversity (other than oceans).**
- **Biodiversity is threatened by human activities.**

# **Changing one factor in an ecosystem can affect many other factors:**

## **Keystone Species**

- A species that has an unusually large effect on its environment.
- Loss of these species severely affects the entire ecosystem.
- Examples of keystone species:
  - Beavers
  - Elephants
  - Sea otters

# Niche vs. Habitat

## ■ **NICHE**

- *An organism's role or job in a community*
  - *What does it eat?*
  - *When is it active*
  - *How does it affect its environment?*
  - *How does its environment affect it?*

## ■ **HABITAT**

- *The physical place where an organism lives*
  - *Tree*
  - *Rock*
  - *Water*
  - *Cave*

# Types of Organisms

## ■ ***AUTOTROPH (“self-feeder”)***

- ***Also called Producers***
  - ***They get their energy from non-living sources.***
- ***Organisms that use energy from the sun to make their own food***



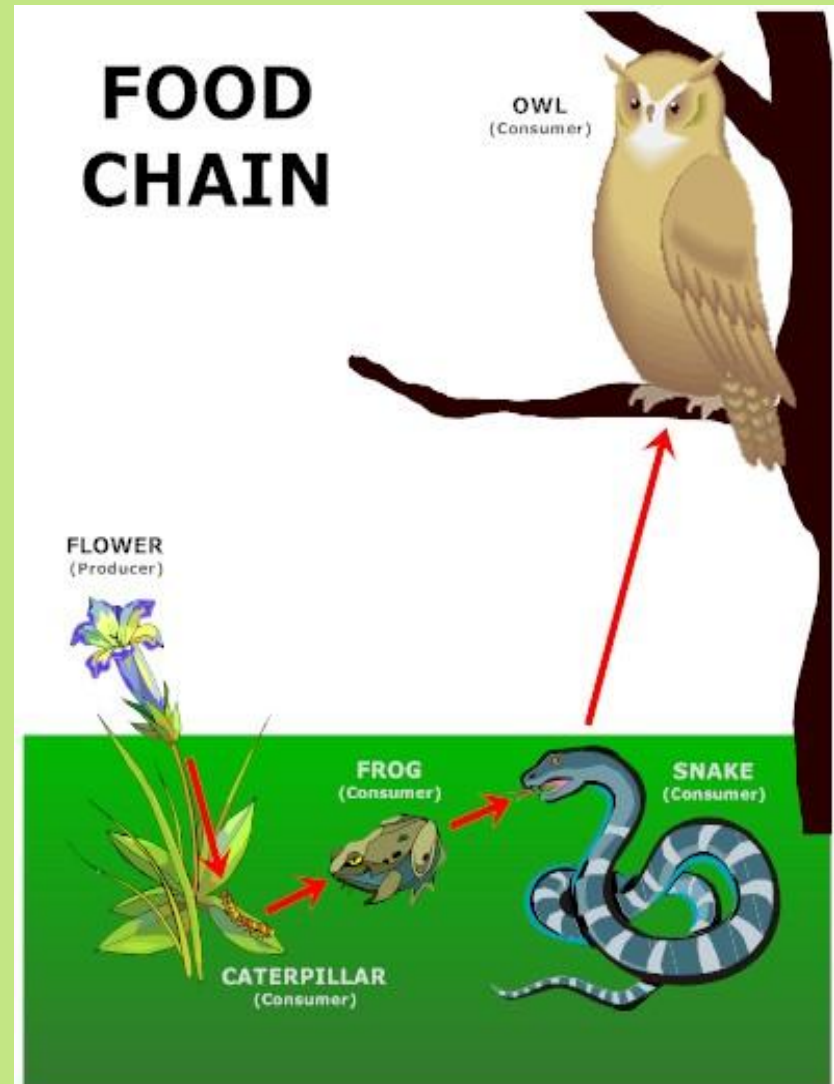
## ■ **HETEROTROPH** (“other-feeder”)

- **Get energy from other living (or once living) organisms.**
- **Also called Consumers**
  - **They are consuming other organisms as food**
- **Must go and get their food**
  - **Detritivore (Feed on dead, decomposing organisms)**
    - **Decomposers**
      - **A type of detritivore**
      - **(Feed by breaking down complex compounds and extracting the nutrients)**
  - **Carnivores (Feed on animals)**
  - **Herbivores (Feed on plants)**
  - **Omnivore (Feed on both plants and animals)**

# Food Chain

**Simple model that demonstrates how matter and energy flow through an ecosystem**

- **Each link/step/level in the chain is a “trophic level”**
  - The first level = producers
  - The second, third, or higher levels = consumers
- **As you move up the chain, the energy output decreases.**





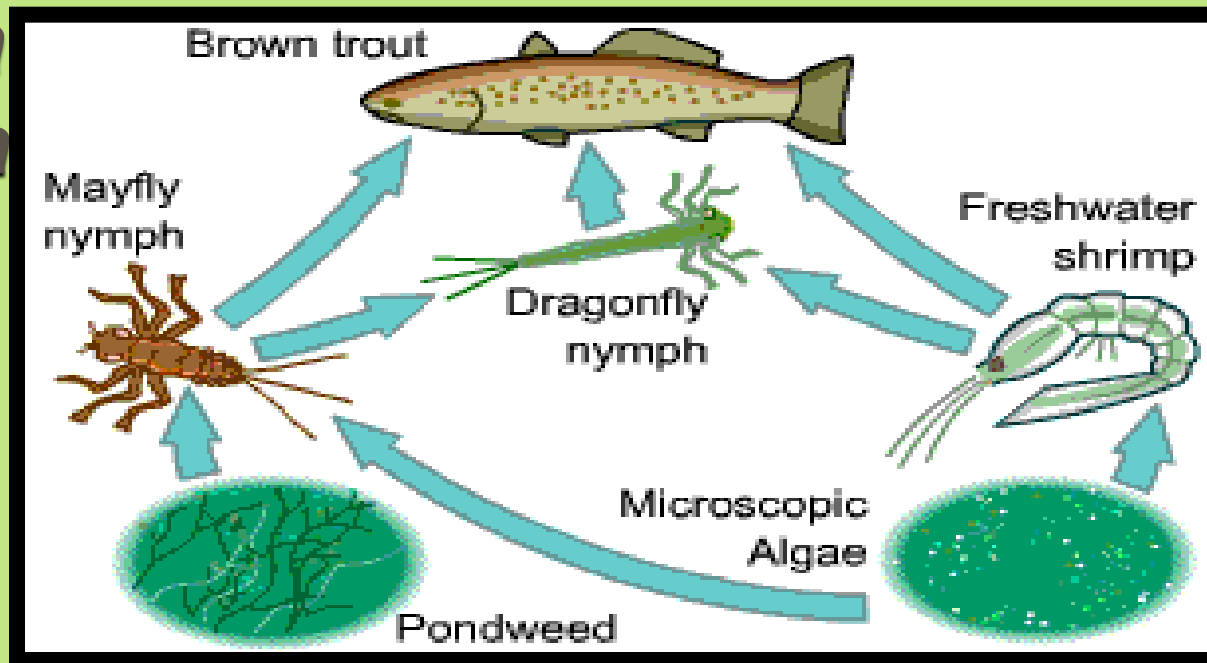
■ *Rule of 10:*

- *Only 10% of the energy at any trophic level can be passed to the next level.*
- *The other 90% is lost as heat.*

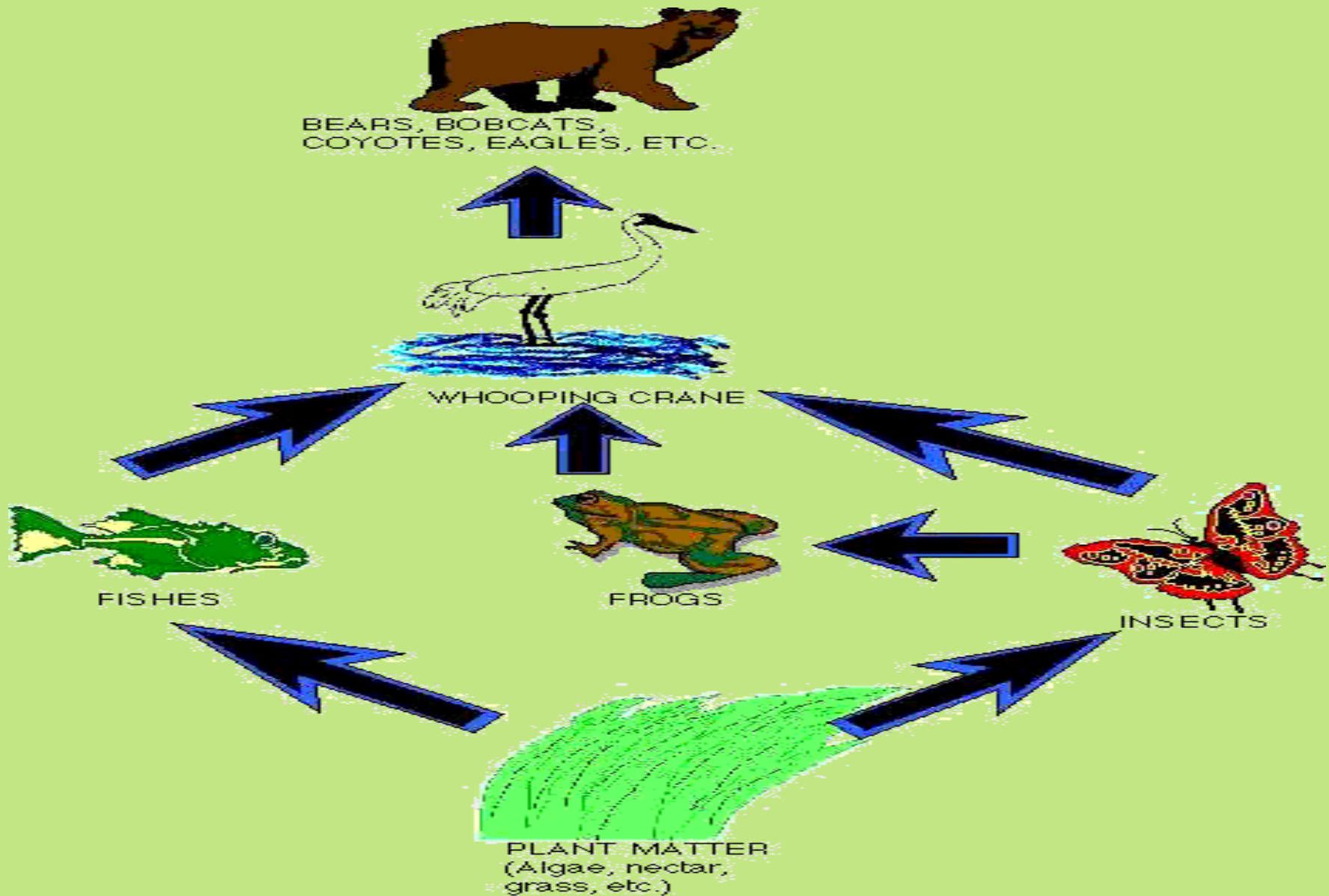
# Food Web

■ *All of the possible feeding relationships in a community at each trophic level*

■ *Is a  
cha*



# Food Web



# **Pyramid Models**

■ ***Pyramids can be used to show relationships in the environment.***

■ ***Types of pyramids:***

- ***1.) Energy pyramid***
- ***2.) Biomass pyramid***
- ***3.) Pyramid of numbers***



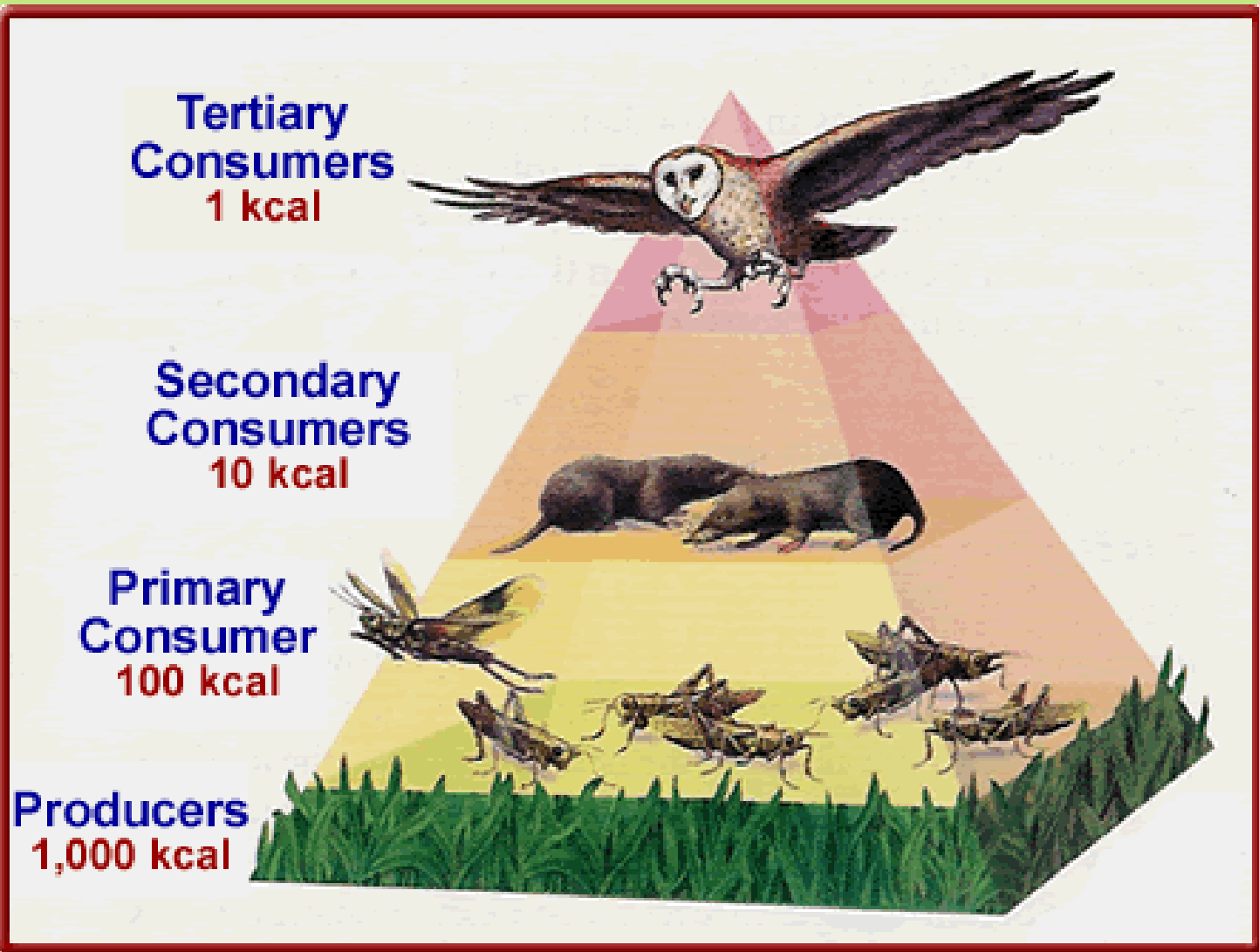
# Energy Pyramid

- *Compares the energy used by producers and consumers.*

- *General rule:*

- *Available energy decreases as you move up a food chain.*

# Energy Pyramid



# **Biomass Pyramid**

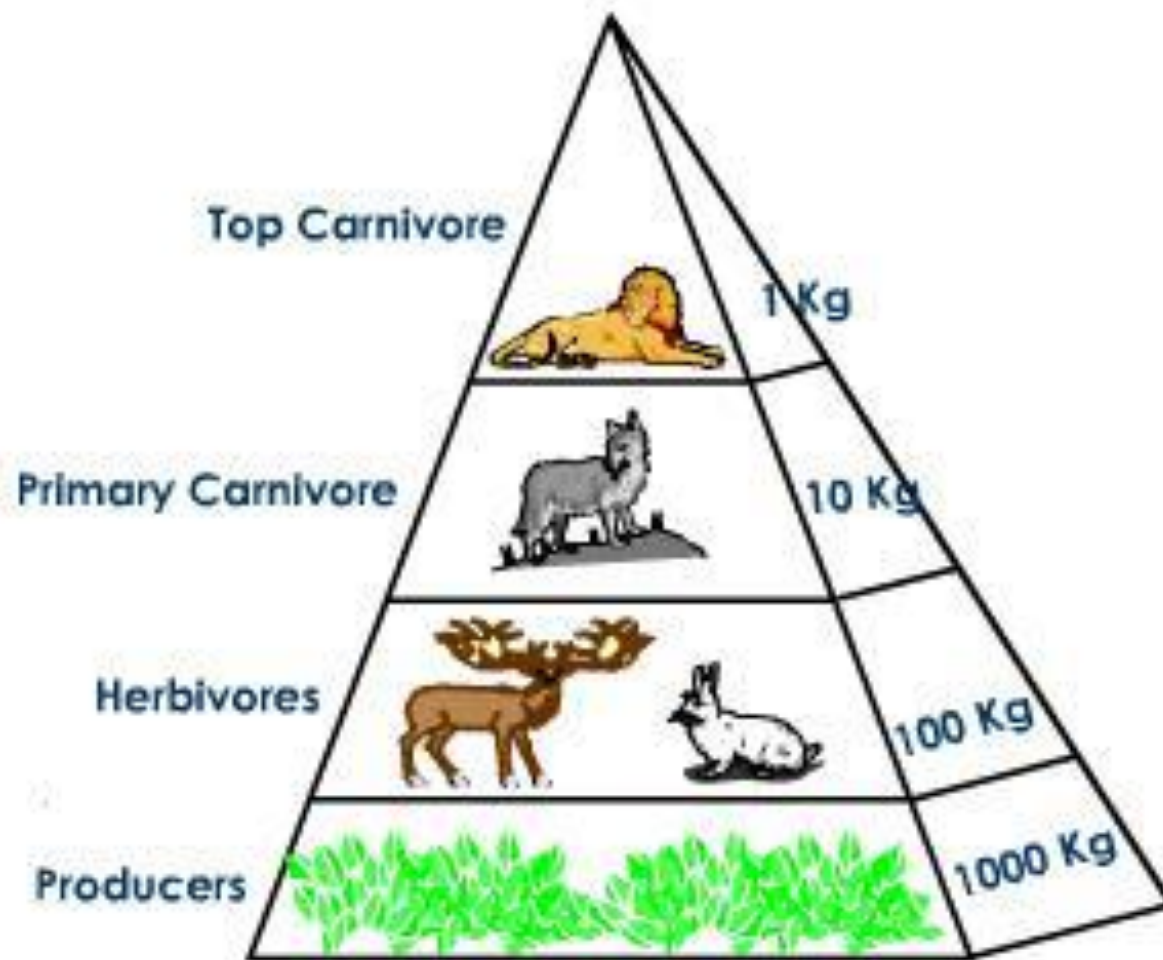
## ■ ***Biomass***

- ***The amount of living matter in an environment.***

## ■ ***Biomass Pyramid:***

- ***Shows the amount of mass needed at one trophic level to support the next level up.***
- ***General rule: Biomass decreases as you move up a food chain.***

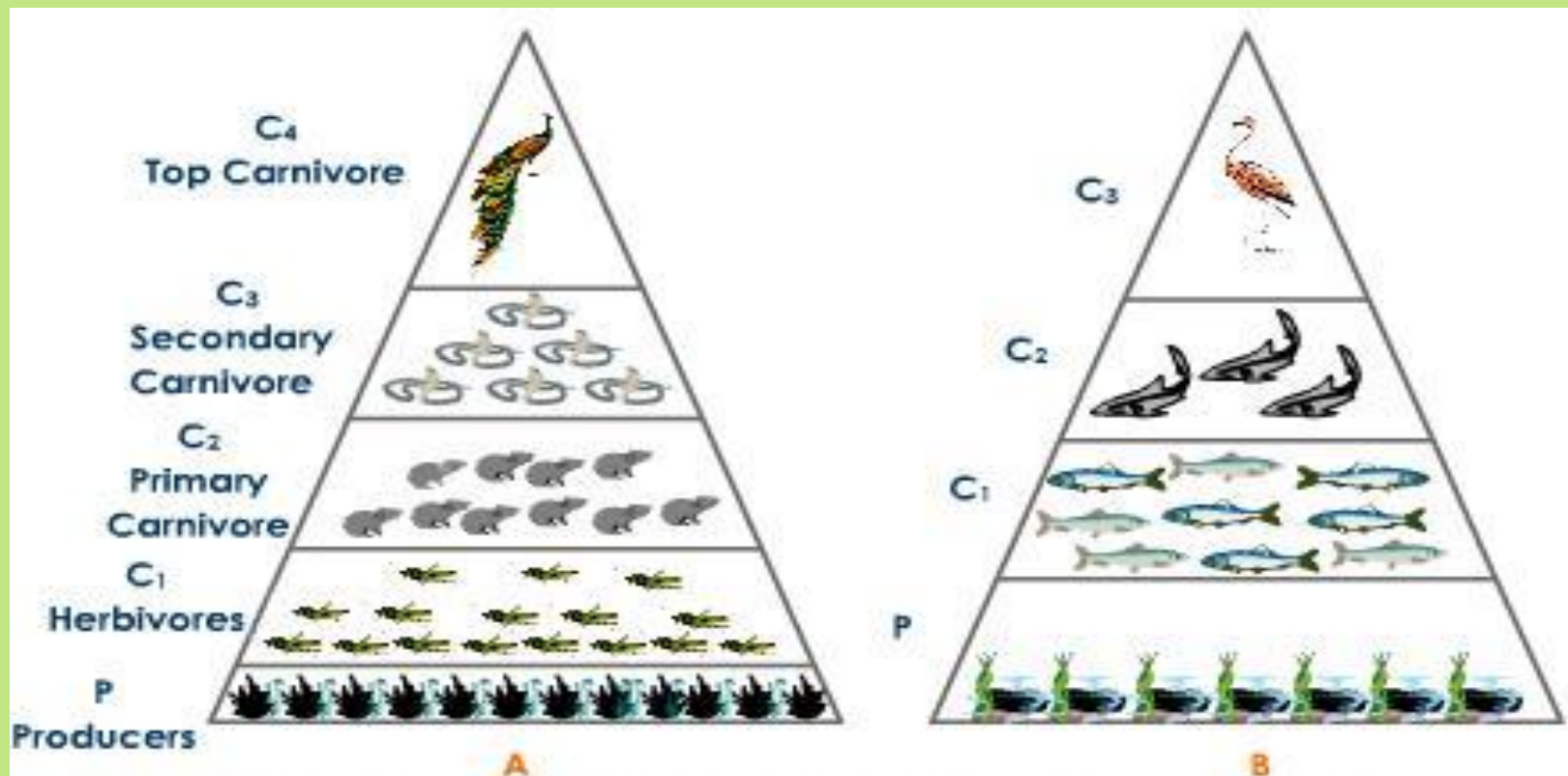
# Biomass Pyramid



Upright Pyramid of biomass in a Terrestrial Ecosystem

# Pyramid of Numbers

■ ***Indicates the relative number of organisms at each trophic level in an ecosystem.***



Upright Pyramids of Numbers. (A) In a Grass Land (B) In a Pond

# **Community Interactions**

- ***Organisms within a community can have many types of relationships with other organisms.***
- ***Examples of these relationships are on the following slides.***

# **Community Interactions**

## **■ Competition**

- Occur when organisms attempt to utilize the same resource or place at the same time**

## **■ Predation**

- One organism captures and feeds on another organism**
  - Predator-Prey Relationship**

## **■ Symbiosis**

- Two species live closely together**

# **“Living Together”**

## ■ *Three types of symbiotic relationships*

### ■ COMMENSALISM

- One organism benefits, while the other is neither helped nor harmed
- Example: \_\_\_\_\_

### ■ MUTUALISM

- Both organisms benefit
- Example: \_\_\_\_\_

### ■ PARASITISM

- One organism benefits at the other's expense
- Example: \_\_\_\_\_
- How is this different from predator-prey relationships?

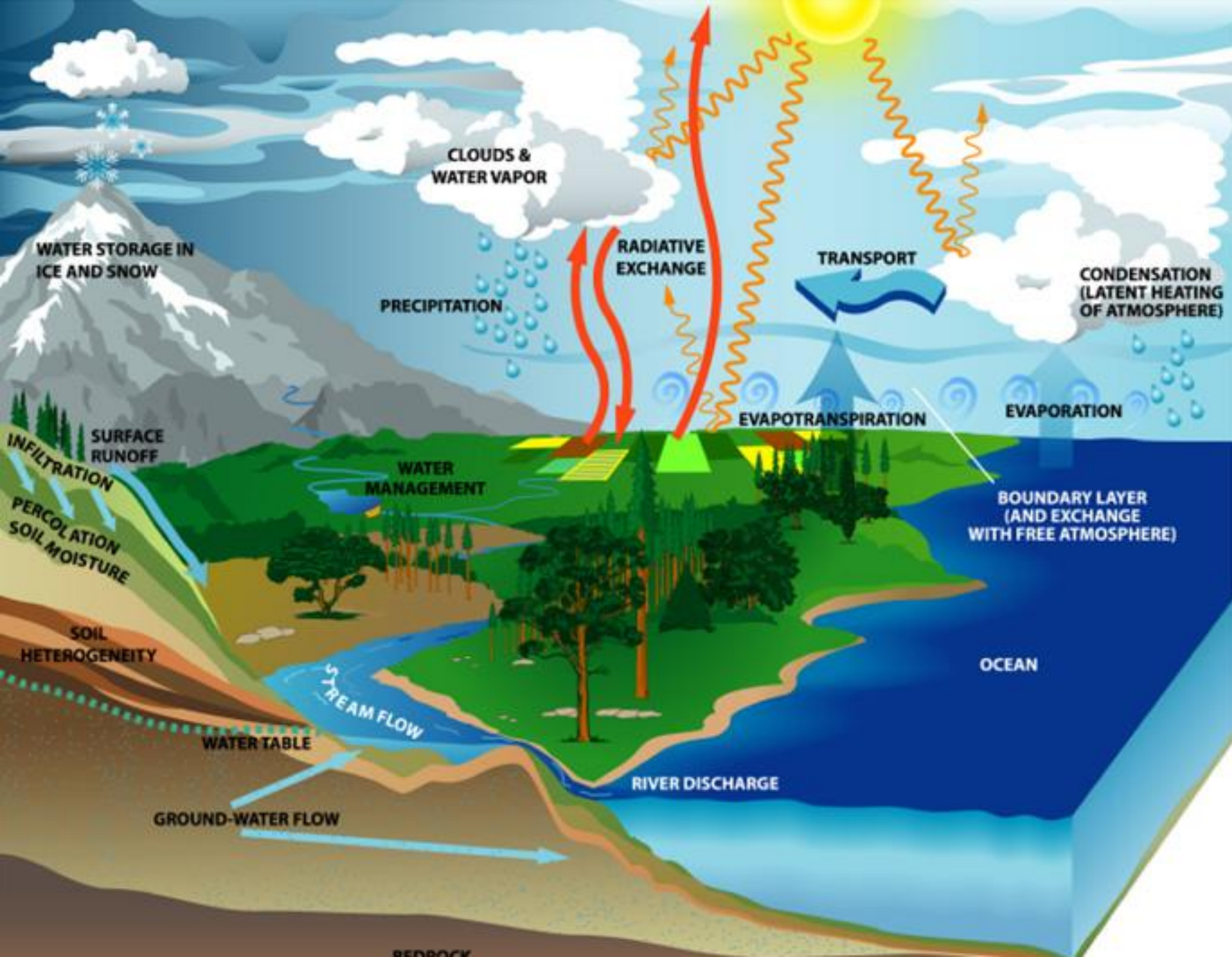
# Summary of Symbiotic Relationships

Relationship	Organism 1	Organism 2
Mutualism	Helped/Benefits	Helped/Benefits
Commensalism	Helped/Benefits	Not helped ; Not harmed
Parasitism	Helped/Benefits	Harmed

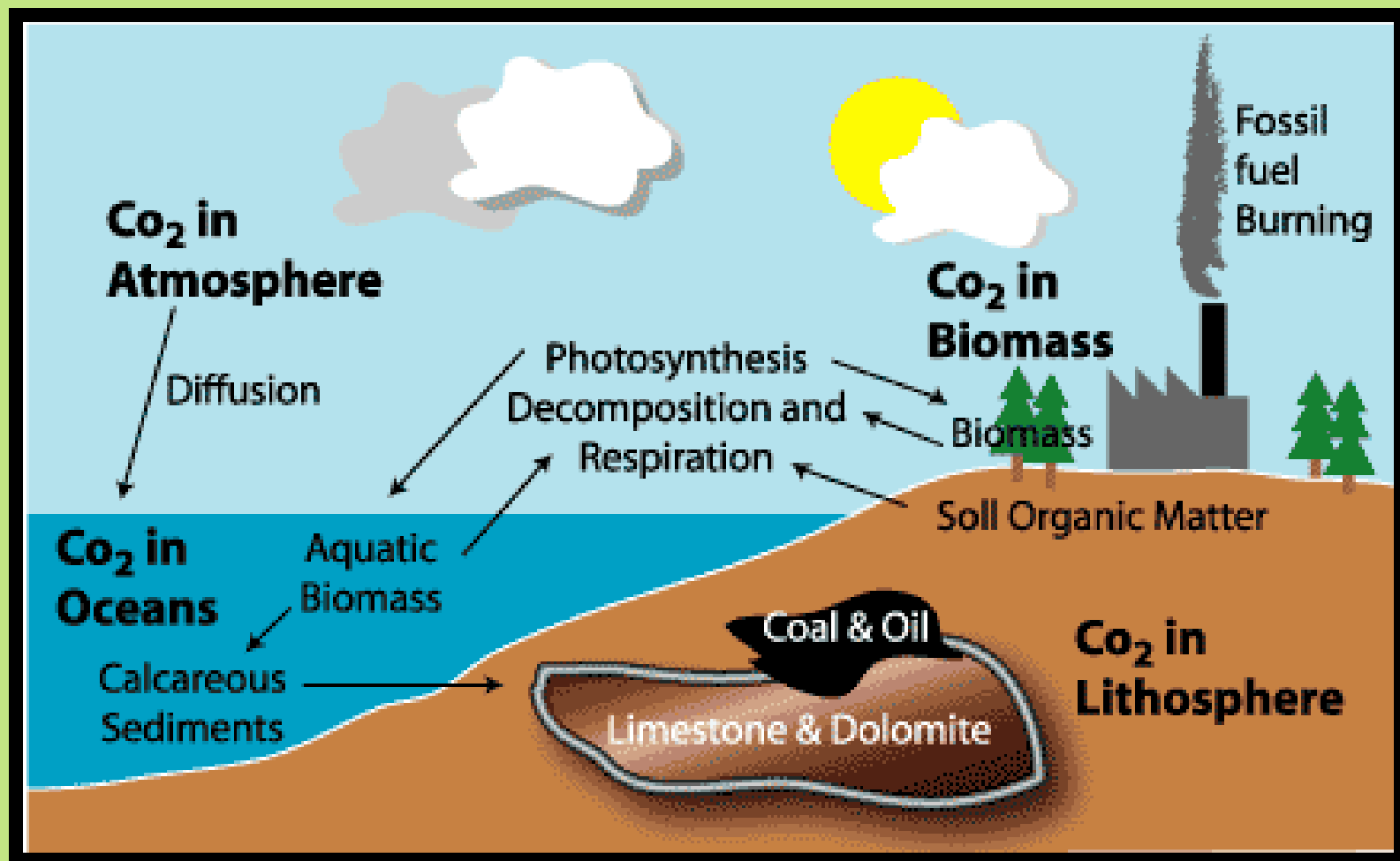


# Cycles of Matter

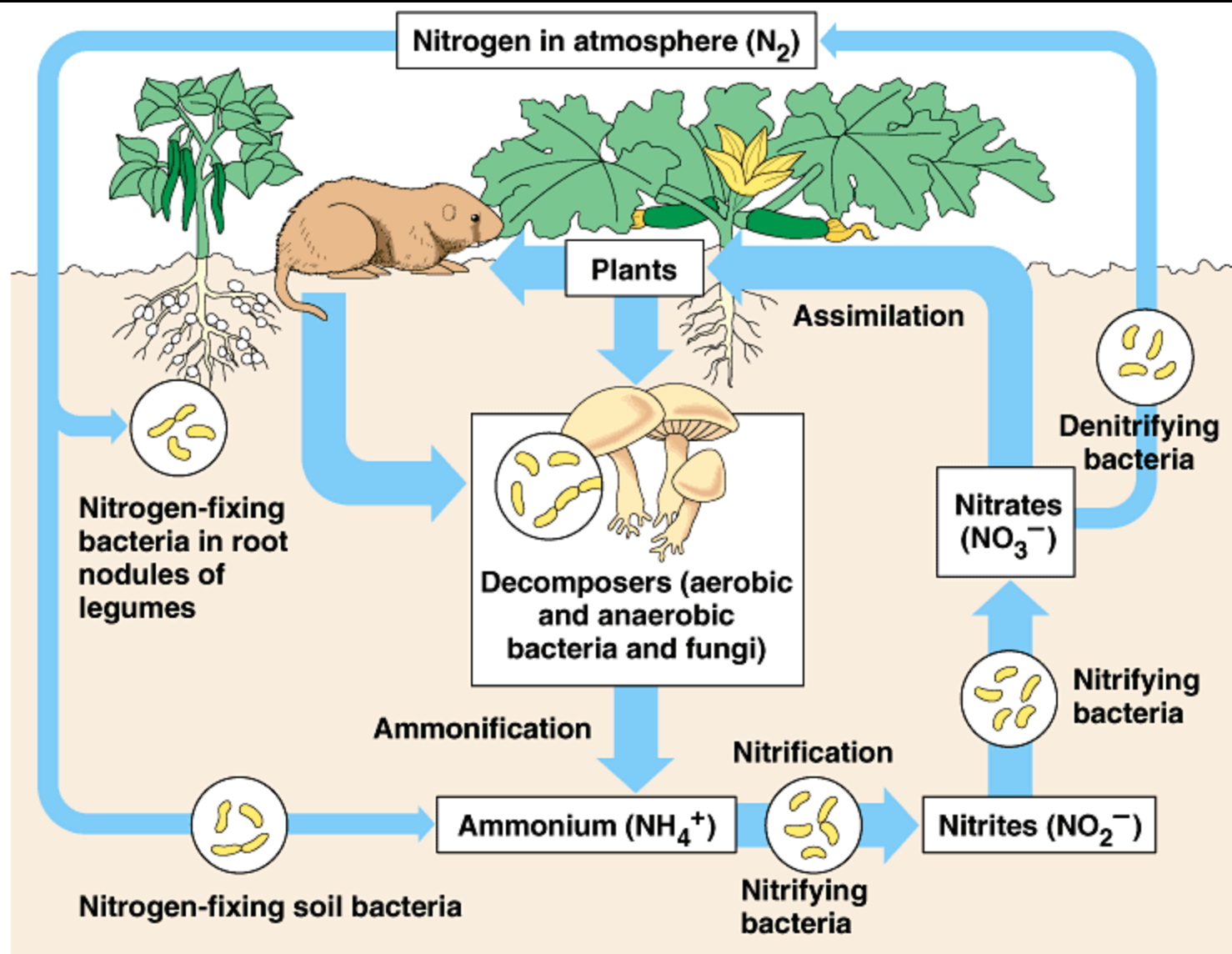
- *Water Cycle*
- *Carbon Cycle*
- *Nitrogen Cycle*
- *Phosphorus Cycle*



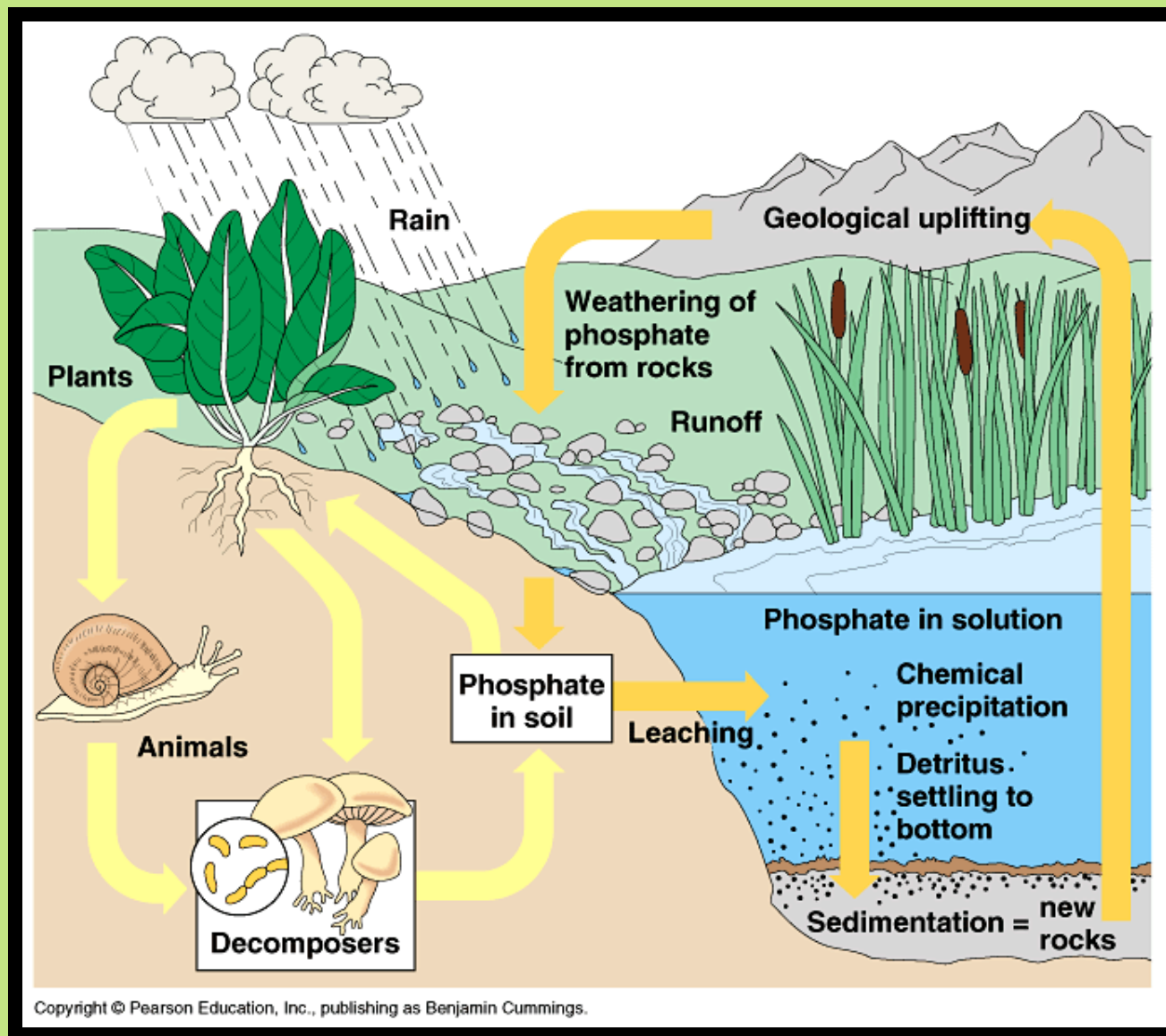
# Carbon Cycle



# Nitrogen Cycle



# Phosphorous Cycle



# Changes in an

## environment

### **■ Limiting factor**

- ***Any factor (biotic or abiotic) that restricts the existence, numbers, reproduction, or distribution of organisms***
  - ***Some factors may have a direct impact on one organism and an indirect impact on others***
- ***Changes in an ecosystem happen as organisms move in and out and increase and decrease population sizes***

# Succession

■ **Orderly, natural changes that take place in a community**

■ **Primary Succession**

- **Succession that occurs on surfaces where no soil exists**
  - **Example: After volcanic eruption or on rocks exposed when glaciers melt.**
  - **The first species (pioneer) to appear are Lichens.**

■ **Secondary Succession**

- **Succession in which a disturbance of some kind changes the existing community without removing the soil**
  - **Examples: After wildfires; after land cleared then abandoned from farming.**
  - **The first species (pioneer) to re-appear are grasses**

■ **Climax Community**

- **Final stage, no succession will occur due to the**

# Primary Succession (200+ yrs.)



(a)



(b)



(c)



(d)



(e)



(f)

# Lichens



# Secondary Succession

## 70-100 yrs



# **Earth's Resources**

## ***Natural Resources***

- ***Any part of the natural environment used by humans for their benefit***

## ***Renewable Resources***

- ***Natural resources that are replaced or recycled by natural processes during our lifetimes***

## ***Non-Renewable Resources***

- ***Resources that are available in limited amounts and are not replaced or are recycled by natural processes that take longer than our lifetime.***
  - ***Ex. Fossil Fuels***
    - ***Substances made from the remains of organisms buried underground for millions of years***

# Types of Resources

- *Land Resources*
- *Forest Resources*
- *Ocean Resources*
- *Air Resources*
- *Water Resources*

# **Biomes**

## ■ ***Land Biomes (a.k.a. Terrestrial Biomes)***

- ***Tropical Rainforest***
- ***Tropical Dry Forest***
- ***Tropical Savanna***
- ***Desert***
- ***Temperate Grassland***
- ***Temperate Woodland & Shrubland***
- ***Temperate Forest***
- ***Northwestern Coniferous Forest***
- ***Taiga (Boreal Forest)***
- ***Tundra***

## ■ ***Ocean/Water Biomes (a.k.a. Aquatic Biomes)***

- ***Marine***
- ***Freshwater***



# **Aquatic Biomes**

## ■ ***Marine Biomes***

### ■ ***Ocean/saltwater areas***

#### ■ ***Divided into two zones***

- ***Photic zone – shallow enough for sun to penetrate***
- ***Aphotic zone – deeper water that doesn't receive sunlight***

## ■ ***Freshwater Biomes***

### ■ ***Rivers, streams, ponds, & most lakes***

- ***Temperature variations within freshwater biomes limit the kinds of organisms that can live there***
- ***Light variations also effect the organism populations***

# **Terrestrial Biomes**

■ ***Three factors determine which biome will be dominant in a terrestrial location***

■ ***Latitude & Longitude***

■ ***Location on the planet***

■ ***Altitude***

■ ***Height from sea level***

■ ***Precipitation***

■ ***Amount of rainfall that the area gets***