Introduction to Ecology Ch. 13

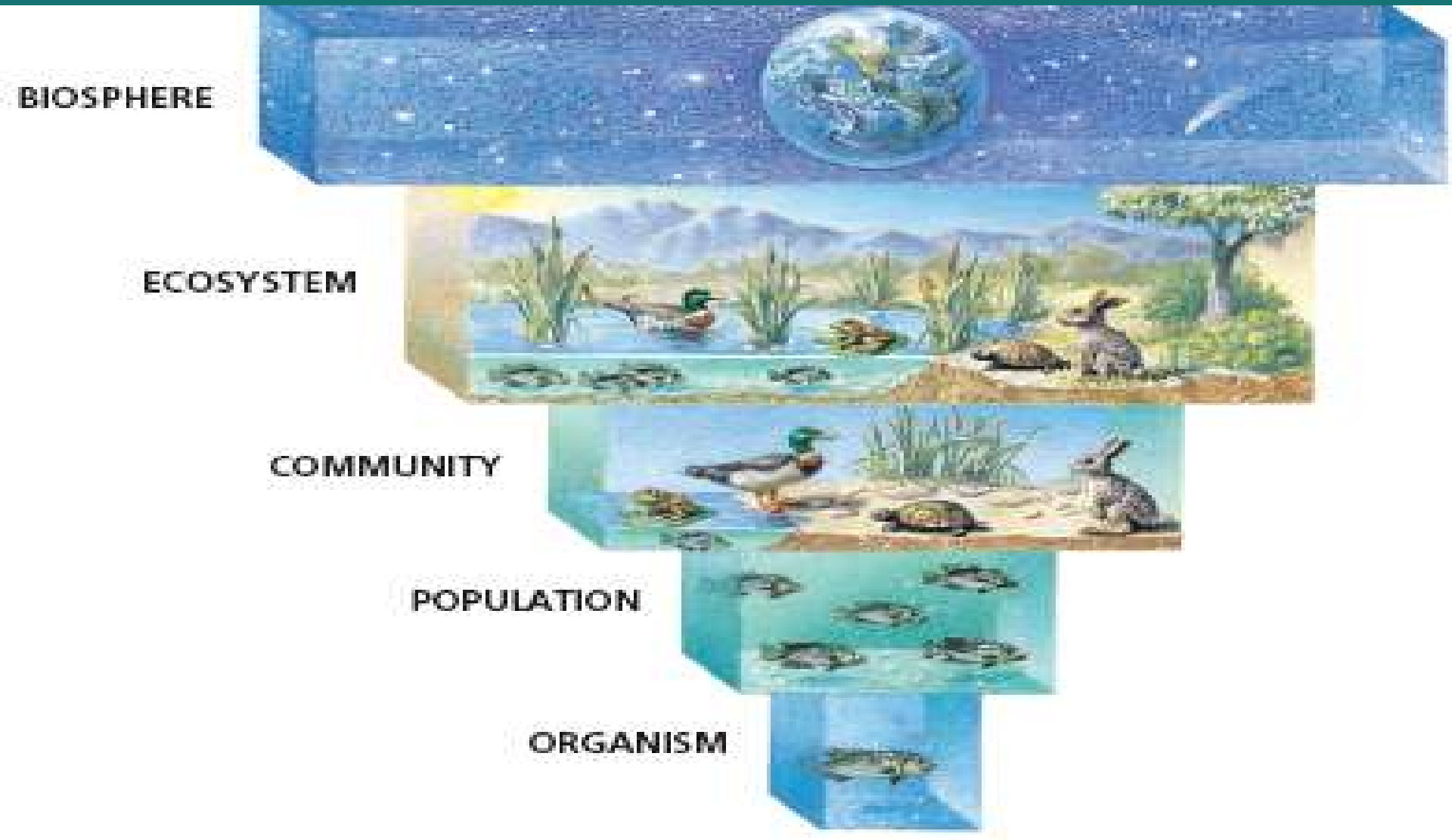
13.1 Ecologists Study Relationships

Georgia Standard SB4.a
Investigate the relationships among organisms, populations, communities, ecosystems, and biomes

What is Ecology?

- ***....the study of the interactions between organisms and the living and nonliving components of their environment.***

Levels of Ecological Organization



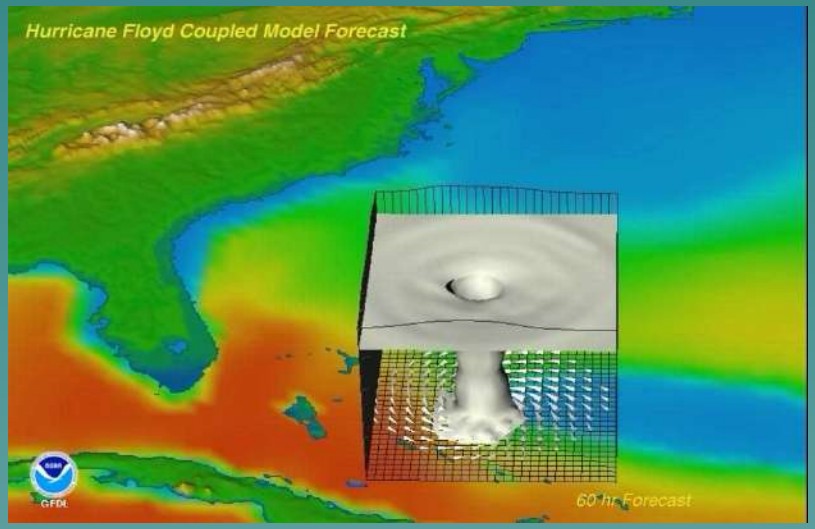
The Levels of Ecological Organization defined.

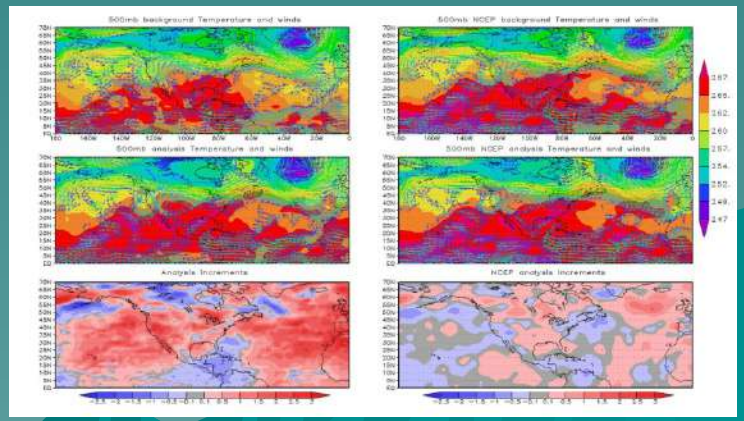
- Organism: single living thing: you
- Population: a group of a species that live in a defined area.
- Community: different species that live together in an area.
- Ecosystem: All living and nonliving things in an area.
- Biome: regional community of organisms.

How do we Research? Lab: pg.401

- Observation
- Experimentation

- Modeling: taking math and past data to predict how it will effect the ecological organisms in question.





Quadrats and Population Size

- Pg 401. Use Modeling to estimate population size.
- 1. Read the introduction.
- 2. Practice the math in the example.
- 3. Do practice problem 1 and 2.

13.2 Biotic and Abiotic Factors

- **Georgia Standard SB4.c**
- **Relate environmental conditions to successional changes in ecosystems.**

13.2 Biotic and Abiotic Factors

- **Biotic: all living things**
- **Abiotic: temperature, humidity, pH, salinity, oxygen concentration, sunlight, nitrogen, and precipitation.**

Changes in the Environment

Changing one factor in an ecosystem can effect Biodiversity.

- **Biodiversity:** The variety of life in an ecosystem.
  - **Keystone Species**: A single non-abundant species that effects the entire ecosystem

The carnivorous starfish *Pisaster ochracceus* is a keystone species in the intertidal zones of the Pacific northwest

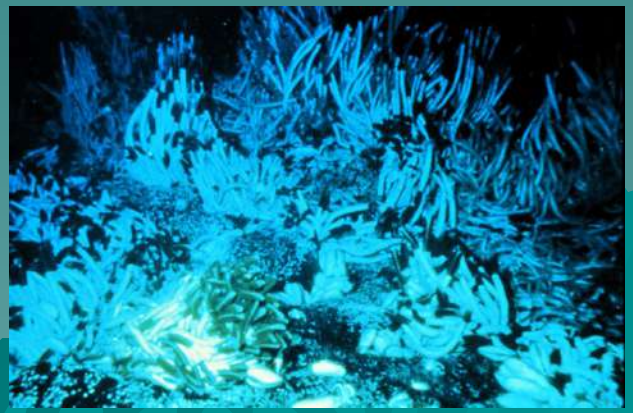
Tropic Cascade Keystone Species

13.3 Energy in Ecosystems

- **Georgia Standard SB4**
- **Students will assess the dependence of all organism on one another and the flow of energy and matter within their ecosystem.**

13.3 Energy Transfer

- Producers: Autotrophs (photo and chemo)
- Consumers: Heterotrophs

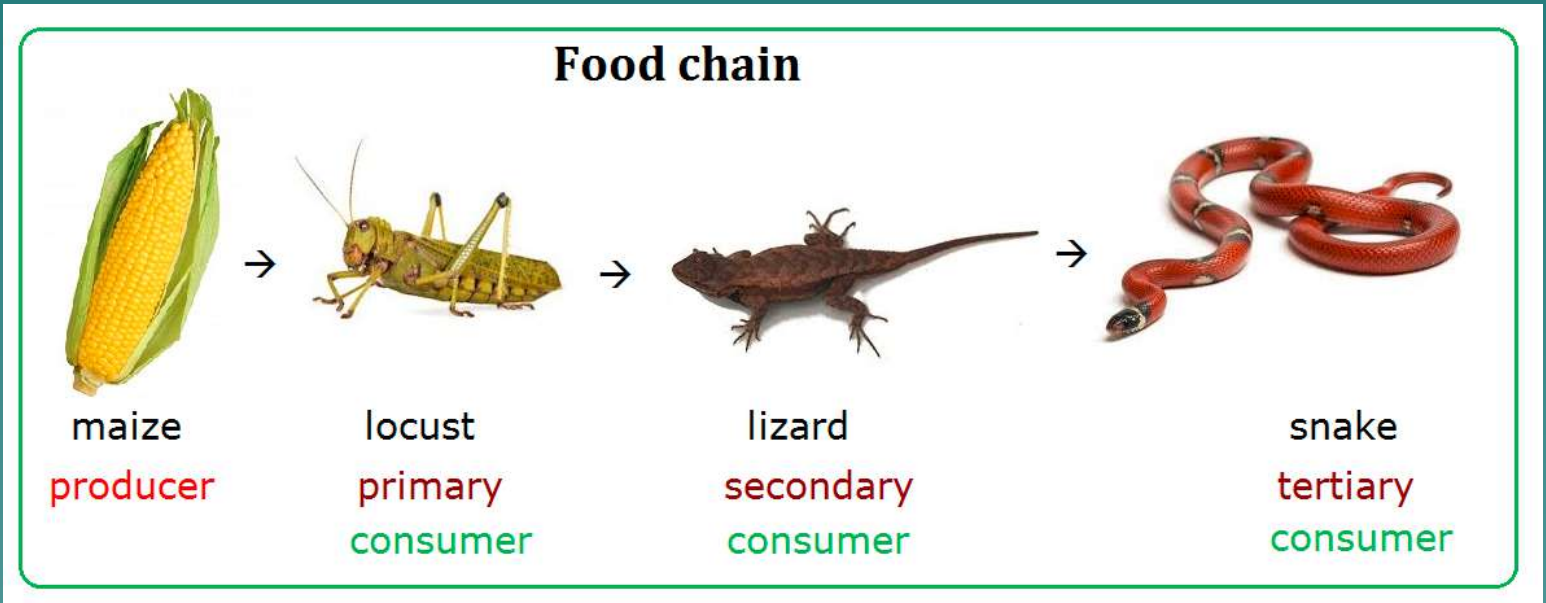


13.4 Food Chains and Food Webs

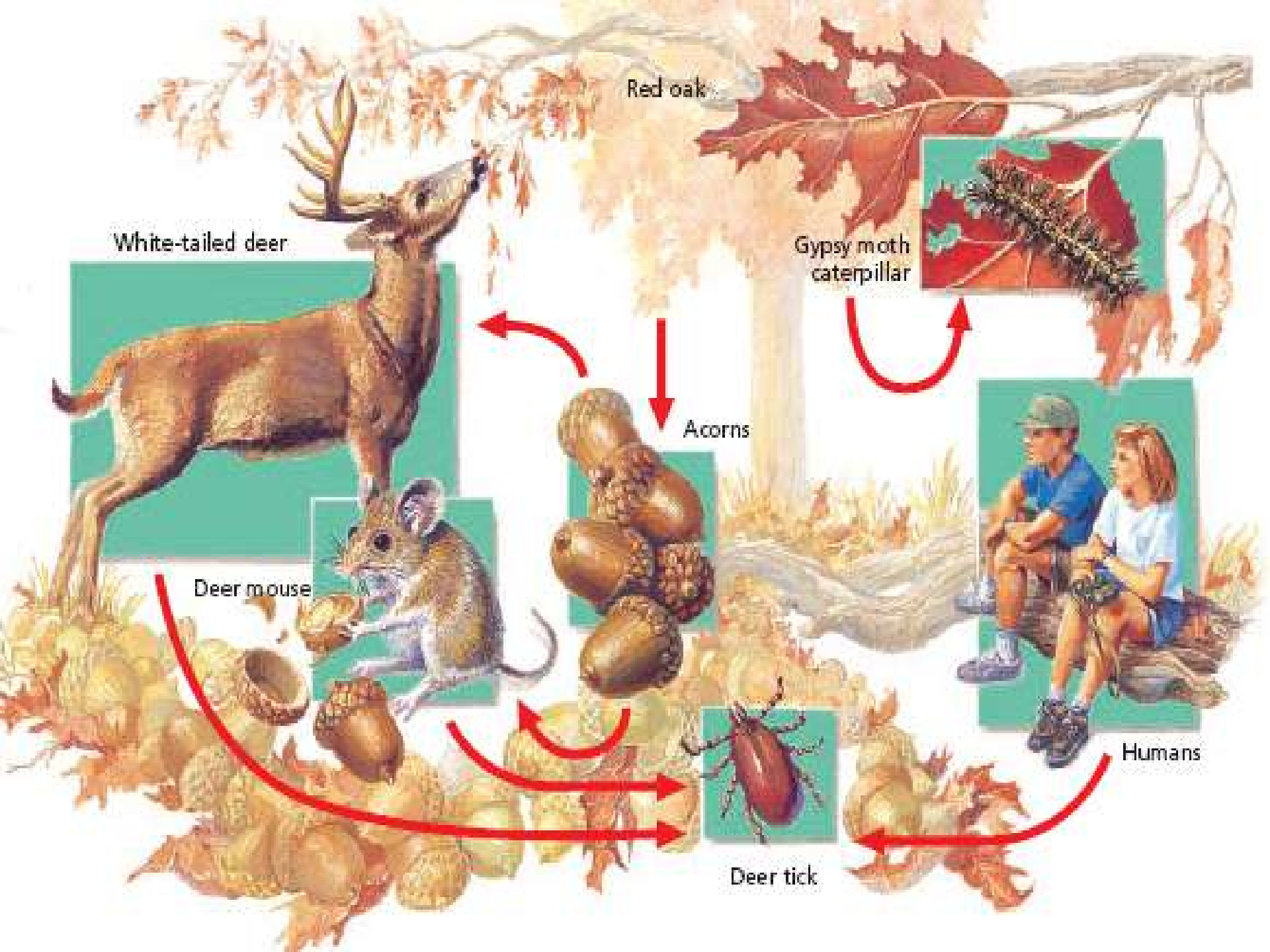
- **Georgia Standard SB4.b.1**
- **Arranging components of a food chain according to energy flow.**

What is a food chain?

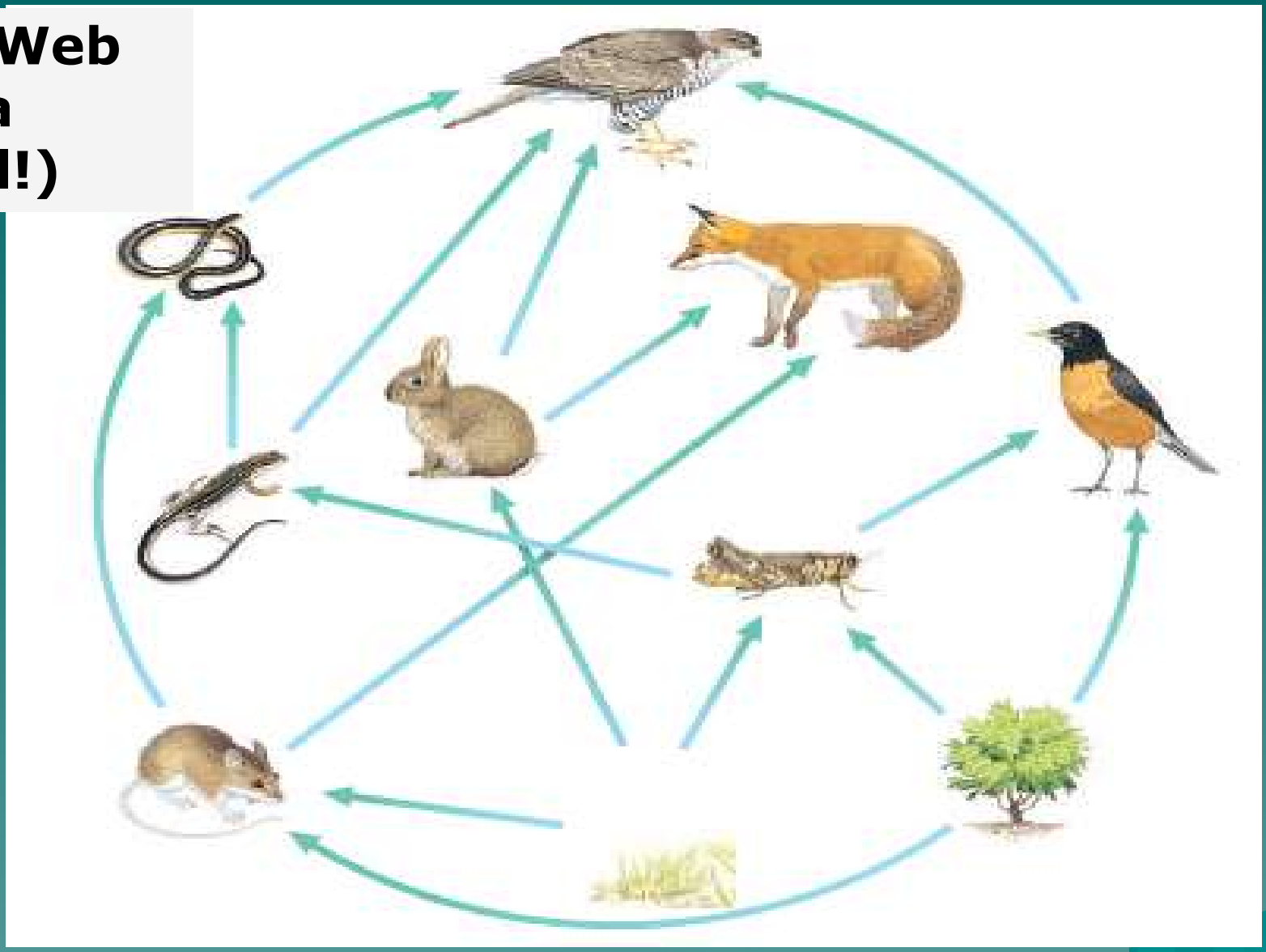
- A model that shows a sequence of feeding relationships.



Which way does the arrow point? To the stomach of the eater!


Red oak
White-tailed deer
Gypsy moth caterpillar
Acorns
Deer mouse
Humans
Deer tick

Food Web (It's a model!)



Generalists: eat a wide variety of food: sharks.
Specialists: Panda's eat only bamboo.

What are the types of Consumers?

- Heterotrophs: Herbivores, carnivores, omnivores, detritivores, and decomposers or saprophytes.

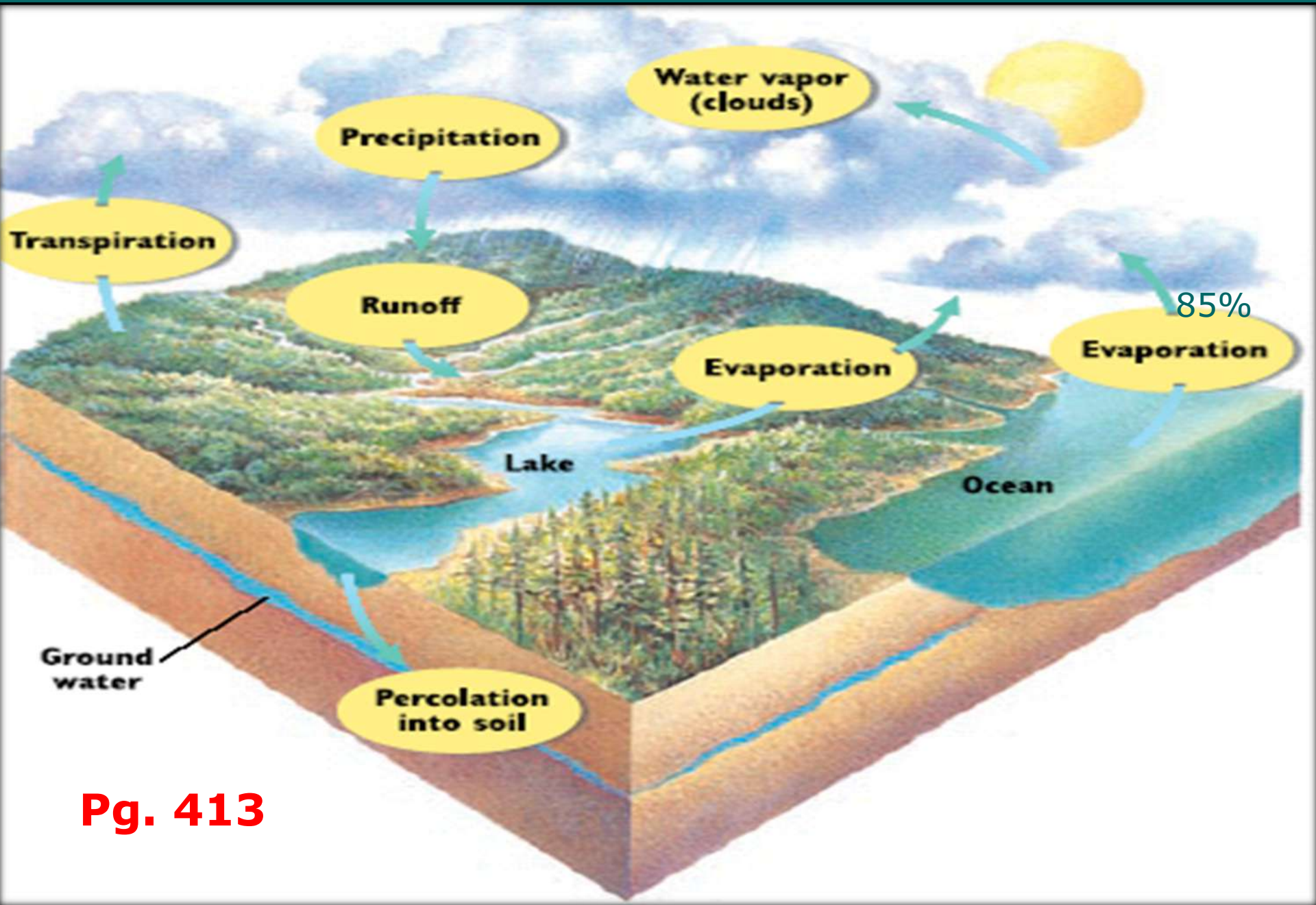
What type of consumer are you?

- Generalist: have a varied diet
- Specialists: only eat one specific organism or a few types organisms.
- Include:
  - Herbivores:Plants
  - Carnivores: Animals
  - Ominivores: Plants and Animals
  - Detritovores: **Eat** detritus, dead organics
  - Decomposers: Like fungi (**use enzymes**) break down organic matter into simple compounds.

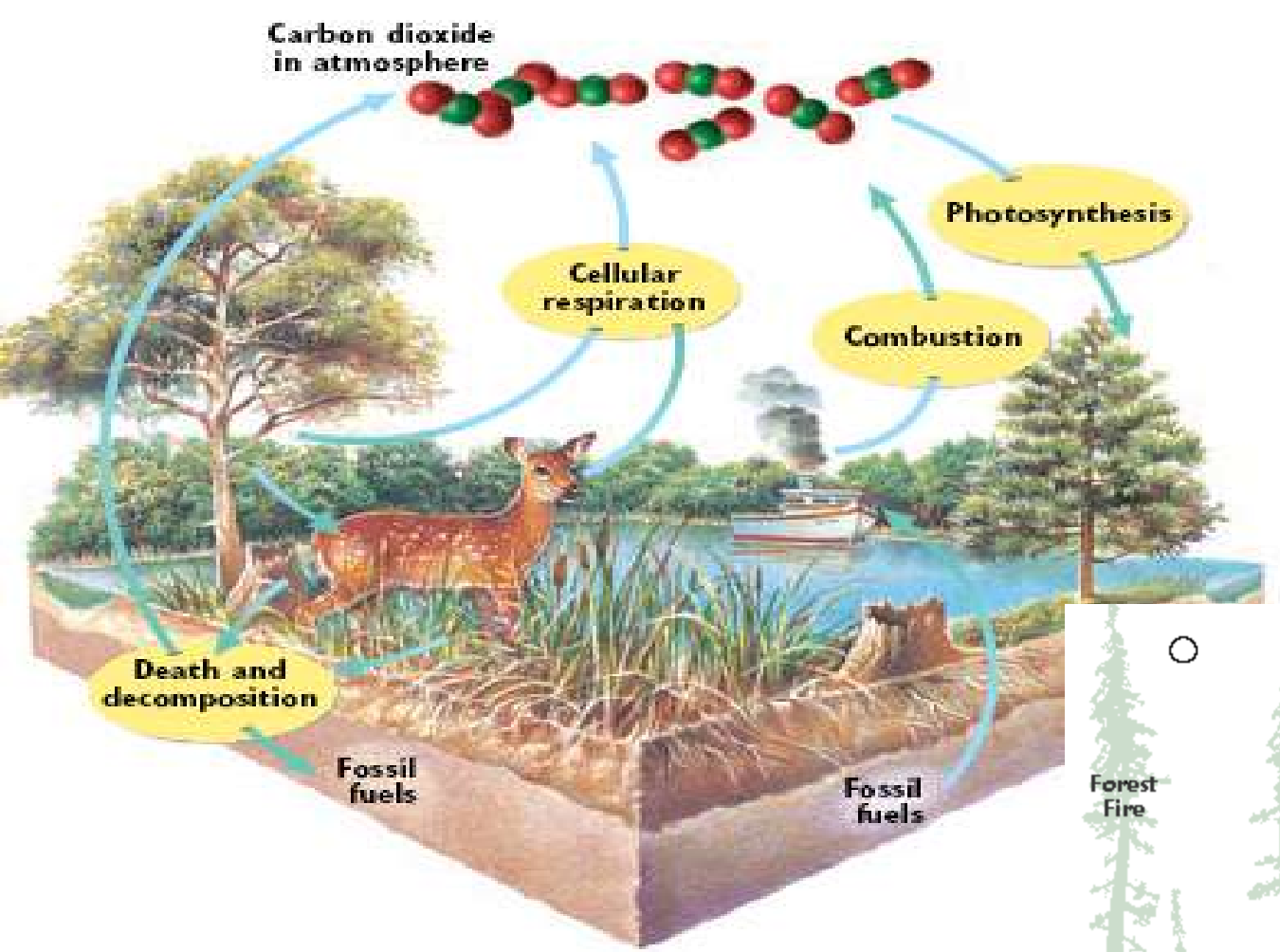
13.5 How does matter Cycle?

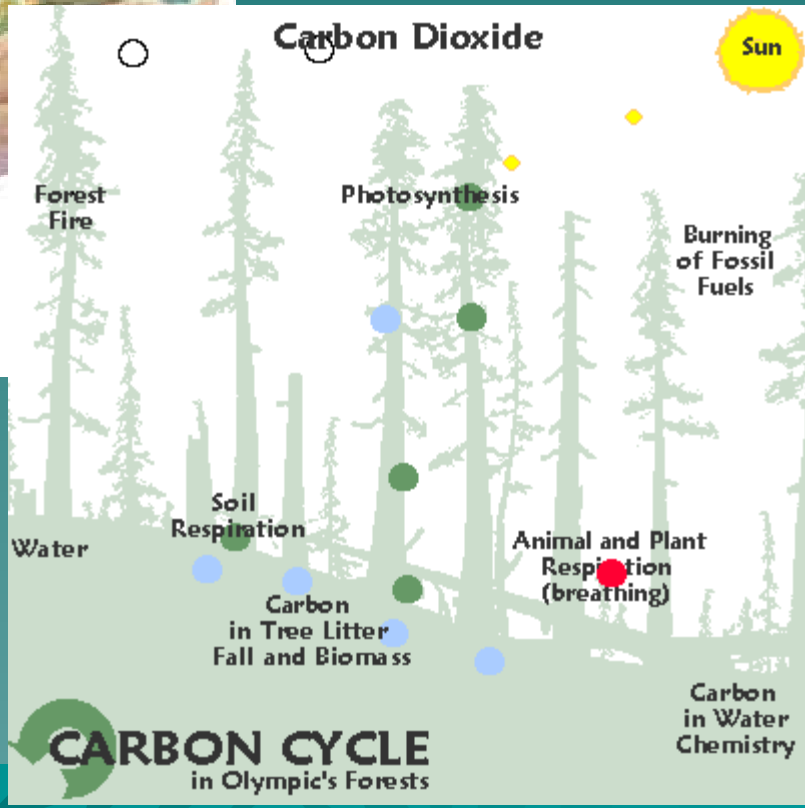
- Water cycle: Hydrologic cycle
- Biogeochemical cycles
  - Oxygen Cycle
  - Carbon Cycle
  - Nitrogen Cycle
  - Phosphorous Cycle

Ecosystem Recycling

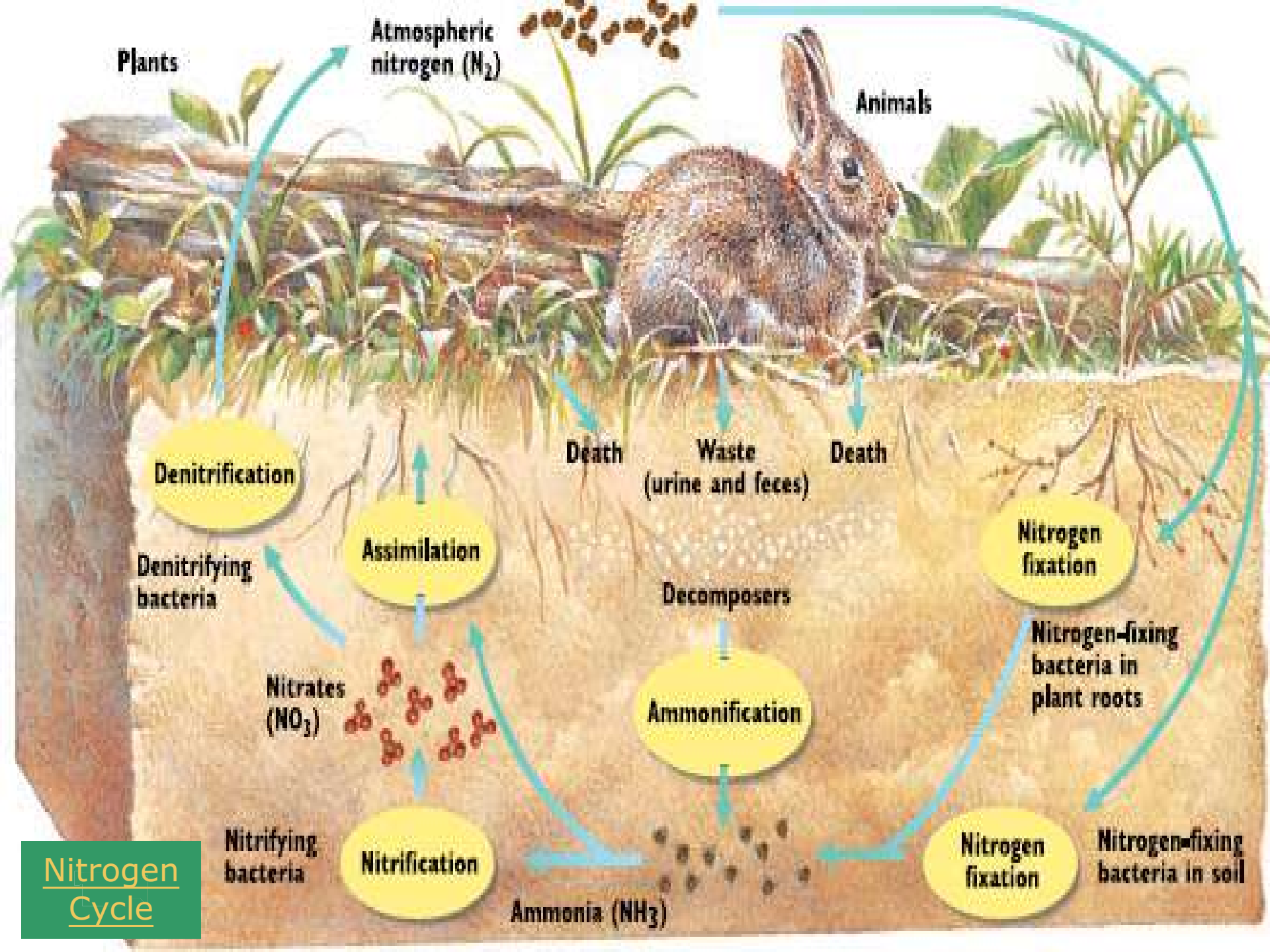


Pg. 413


Carbon dioxide in atmosphere
Photosynthesis
Cellular respiration
Combustion
Death and decomposition
Fossil fuels
Fossil fuels

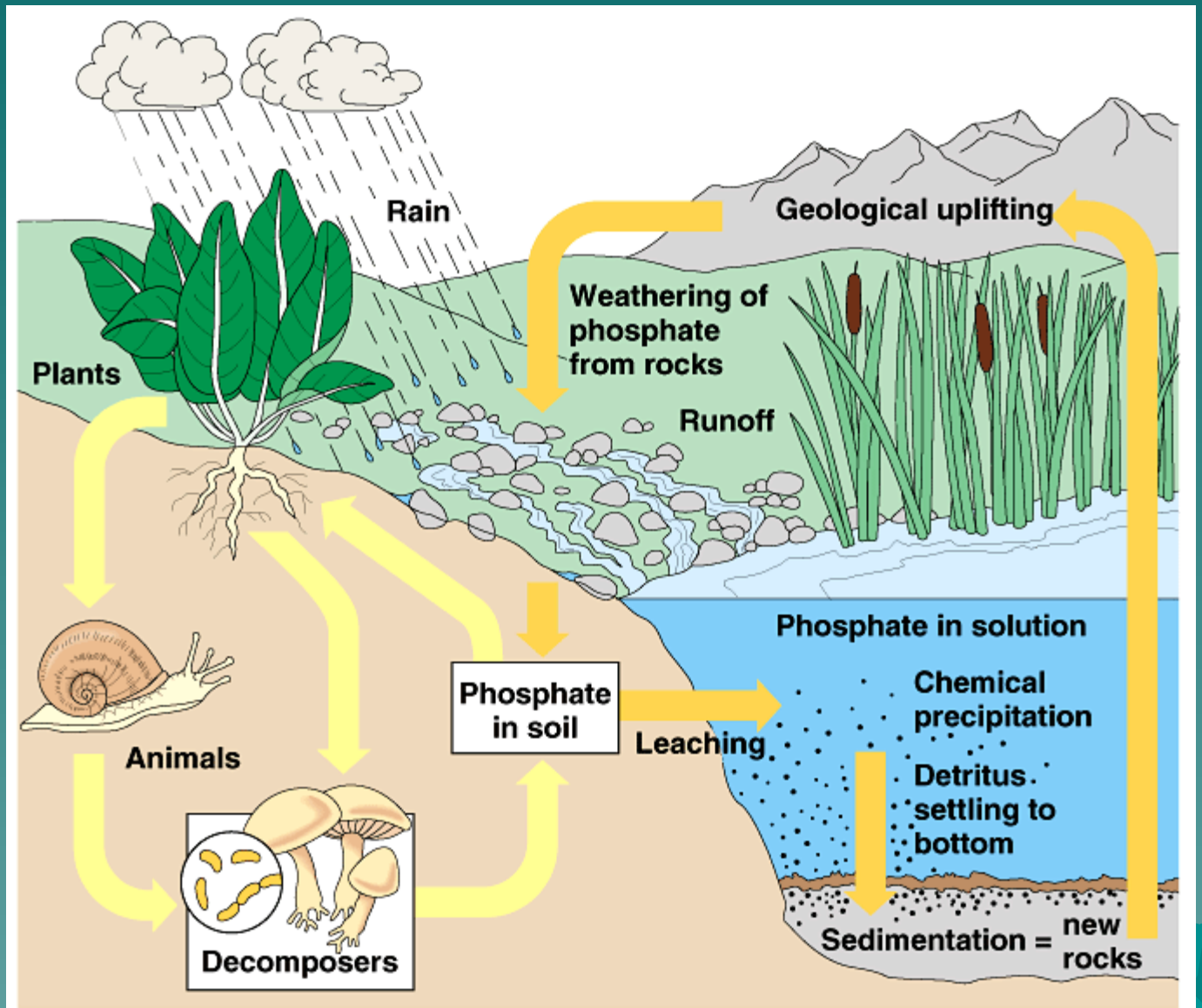

Carbon Dioxide
Sun
Forest Fire
Photosynthesis
Burning of Fossil Fuels
Soil Respiration
Water
Animal and Plant Respiration (breathing)
Carbon in Tree Litter Fall and Biomass
Carbon in Water Chemistry
CARBON CYCLE
in Olympic's Forests

Pg. 414



Nitrogen Cycle

Phosphorous Cycle pg 416



Phosphorous Cycle

13.6 Pyramid Models

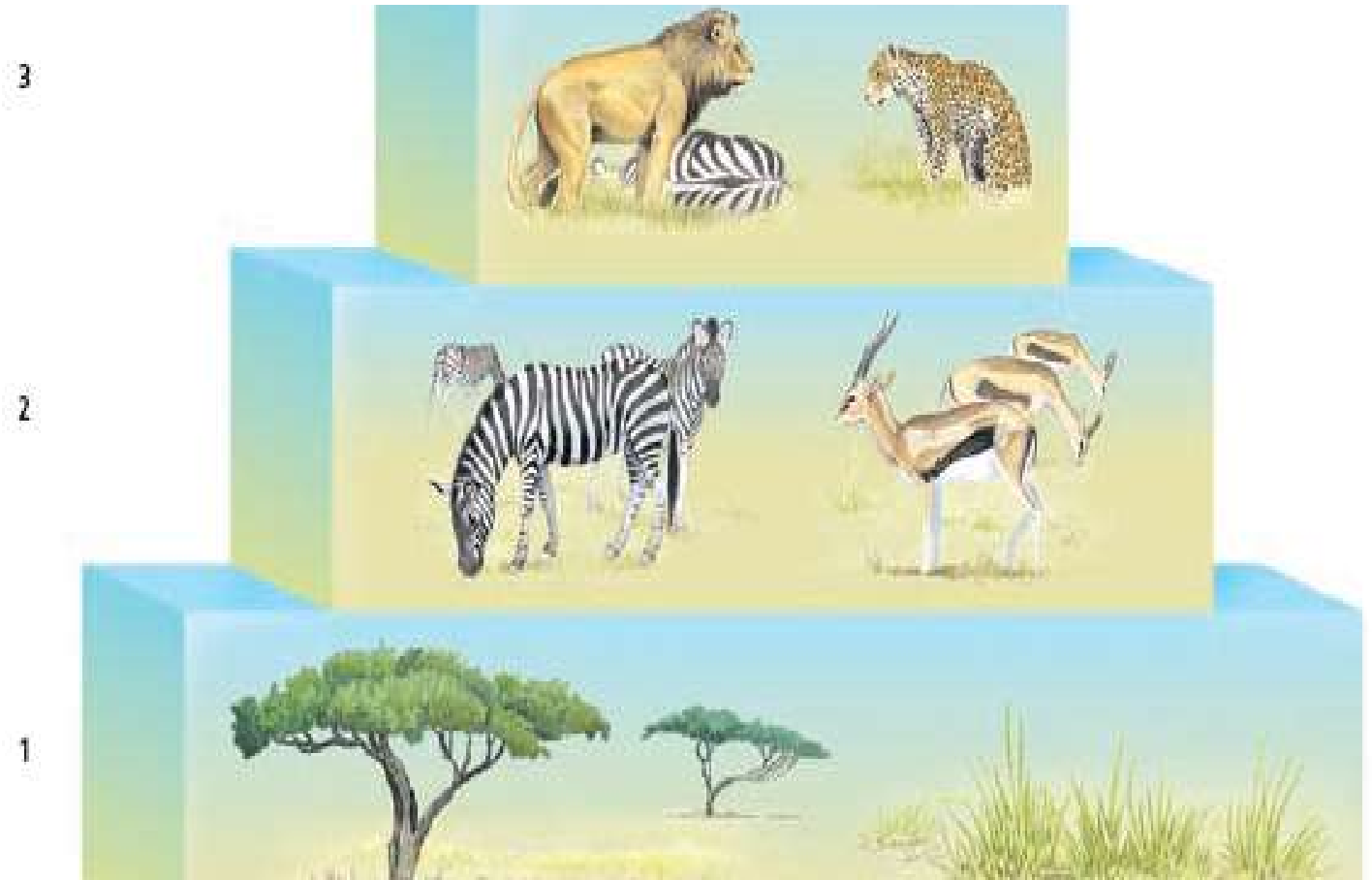
- **Georgia Standard**
- Comparing the quantity of energy in the steps of an energy pyramid

13.6 Energy Pyramid Models

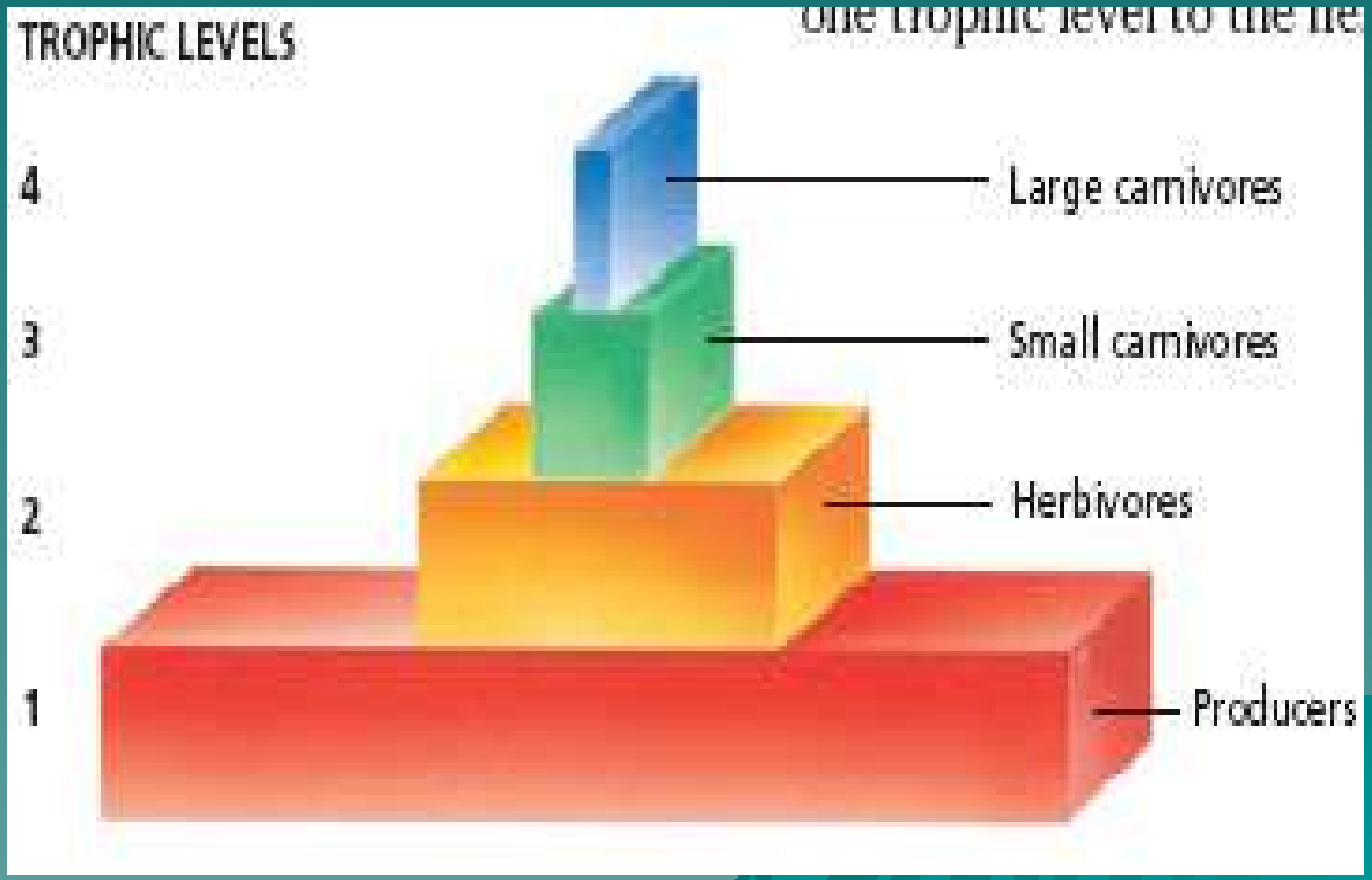
Biomass: total dry mass of organisms in a given area.

Sun: provider of energy for photosynthetic organisms.

10% rule!



Trophic Levels: Energy and the rule of 10



Ch. 14.1 Habitat and Niche

GEORGIA STANDARD: SB4.A: INVESTIGATE THE RELATIONSHIPS AMONG ORGANISMS, .

What is a habitat? Ch. 14, 14.1

- All biotic and abiotic factors where an organism lives.

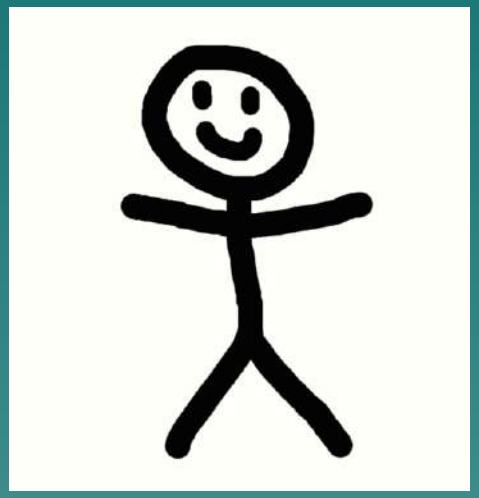
The Niche 14.1

- **Ecological Niche:** all the physical, chemical, and biological factors that a species needs to survive, stay healthy, and reproduce. (food, abiotic conditions, behavior.)
  - **Habitat:** Where it lives
  - **Niche:** How it lives in its habitat.

Fundamental Niche

….range of conditions/resources a species can potentially tolerate and use. Food, abiotic conditions, & Behavior

Humans: The world!



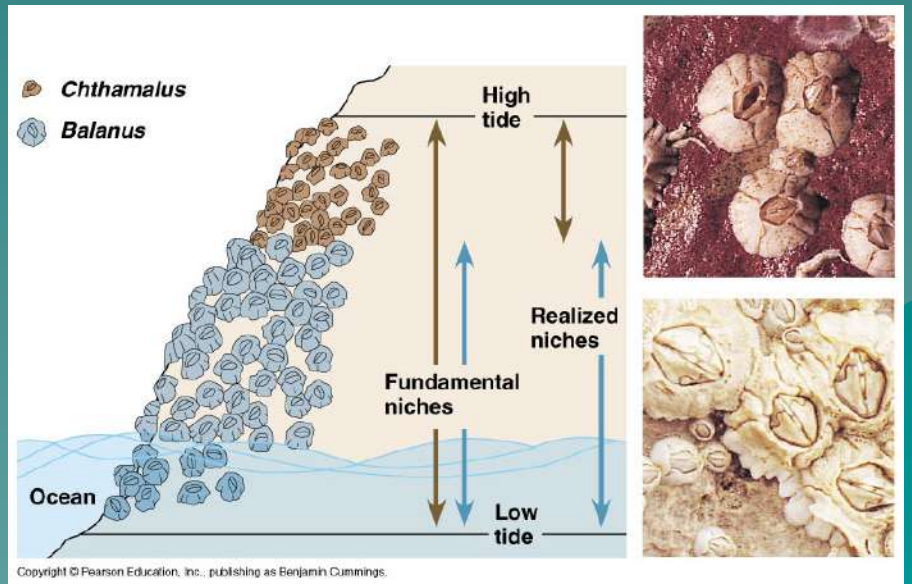
Realized Niche

….range of conditions/resources a species actually use.

You: McDonough, Ga

What happens when two species need to share the same niche?

- Competitive Exclusion. 14.1
  - The species better adapted to the niche will either push the other species into another niche or outcompete the other species (extinction).



14.1 What else can competitive exclusion result in?

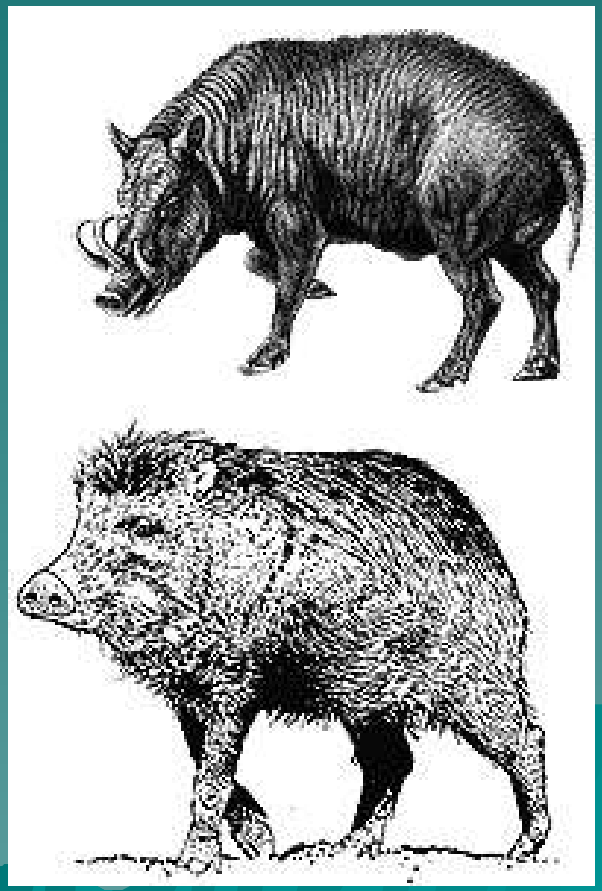
Niche Partitioning

Resource Petitioning

What else could happen? Evolutionary response

- Evolution. What is it? Oh yeah, Natural Selection.

Explain please:



Ecological Equivalents 14.1

- Don’t compete. They have the same niche, but live in different regions of the world.

Mantella frog of Madagascar

Poison Dart Frog of South America

14.2 Community Interactions

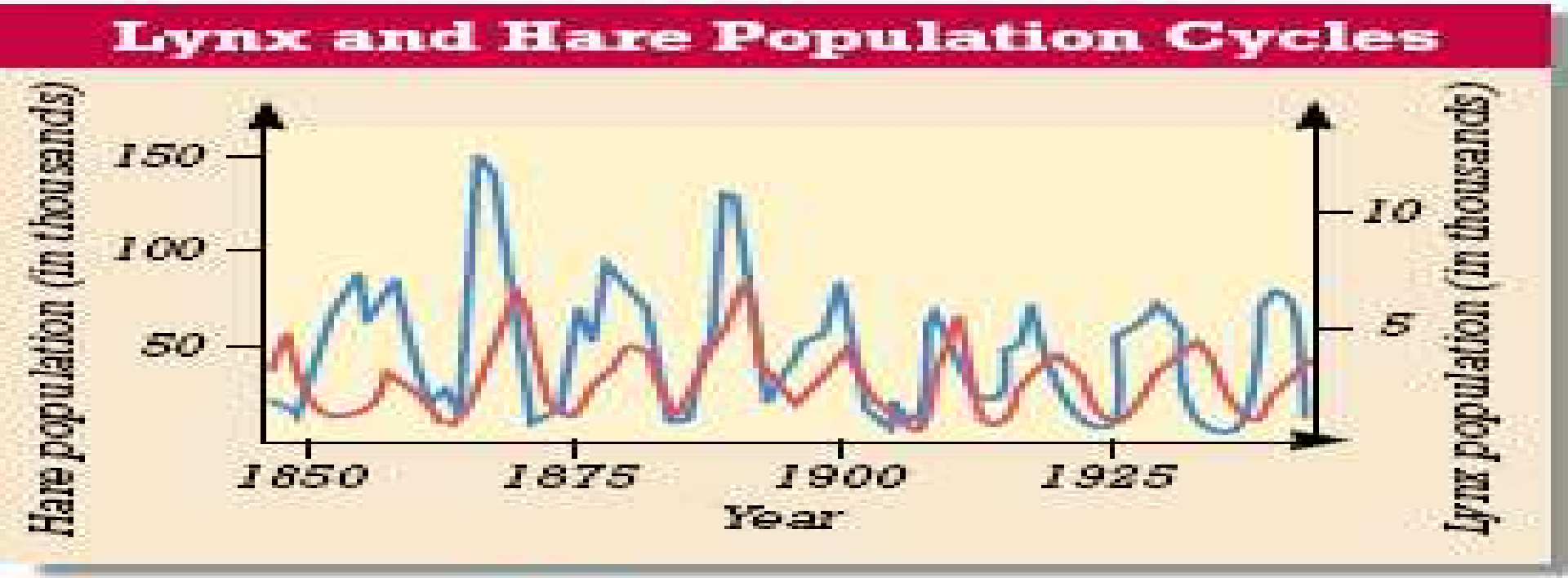
Georgia Standard:

SB4.a: Investigate the relationships among, communities.

How do organisms interact? 14.2

- Through Competition and Predation.
  - Competition: two organisms fight for limited resources.
  - Predation: One organism captures and feeds upon another.
- Through Symbiosis pg. 433
  - Mutualism: both benefit (bacteria in your intestine.)
  - Commensalism: one benefits, the other is unaffected.
  - Parasitism: one benefits, one is harmed

(a)


Lynx and Hare Population Cycles
Hare population (in thousands)
150
100
50
1850
1875
1900
1925
Year
10
5
Lynx population (in thousands)
Snowshoe hare
Lynx

(b)

Species Interactions

Ant Farmers Of The Amazon 41.50

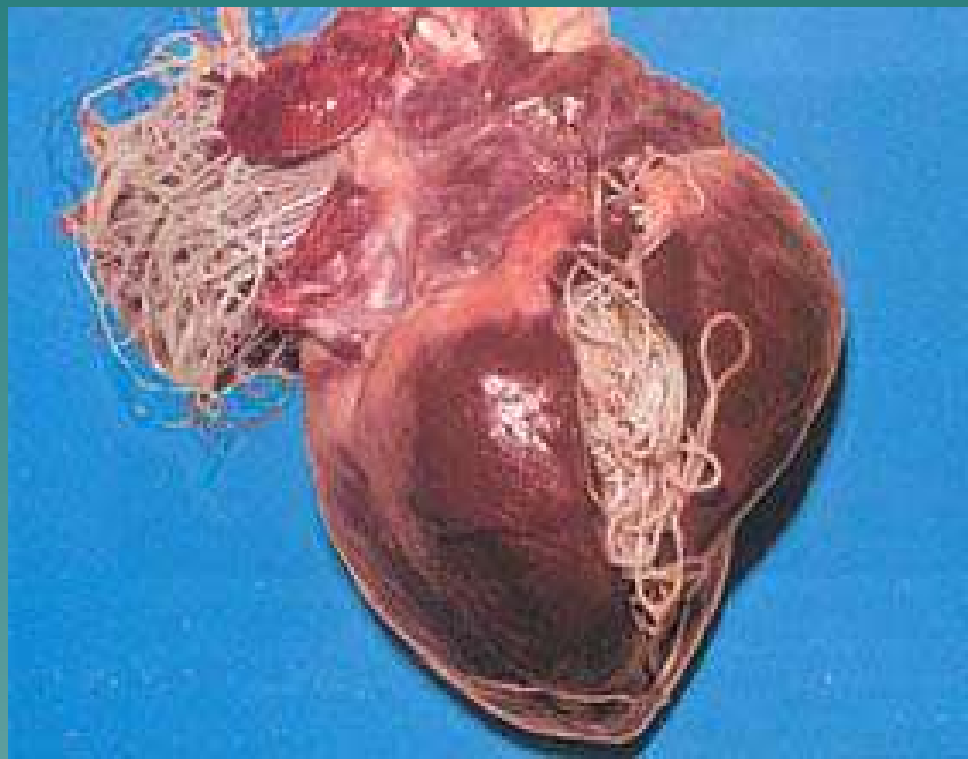
Dolphins of Laguna Brazil

Types of Symbiosis

- **Predation**

Parasitism

(a)



- **Mutualism**

....Both species benefit.

- **Commensalism**

....One species benefits and the other is not affected.

14.3 Population Density and Distribution

Georgia Standard

SB4.1 Investigate the relationships among populations.

What is population density?

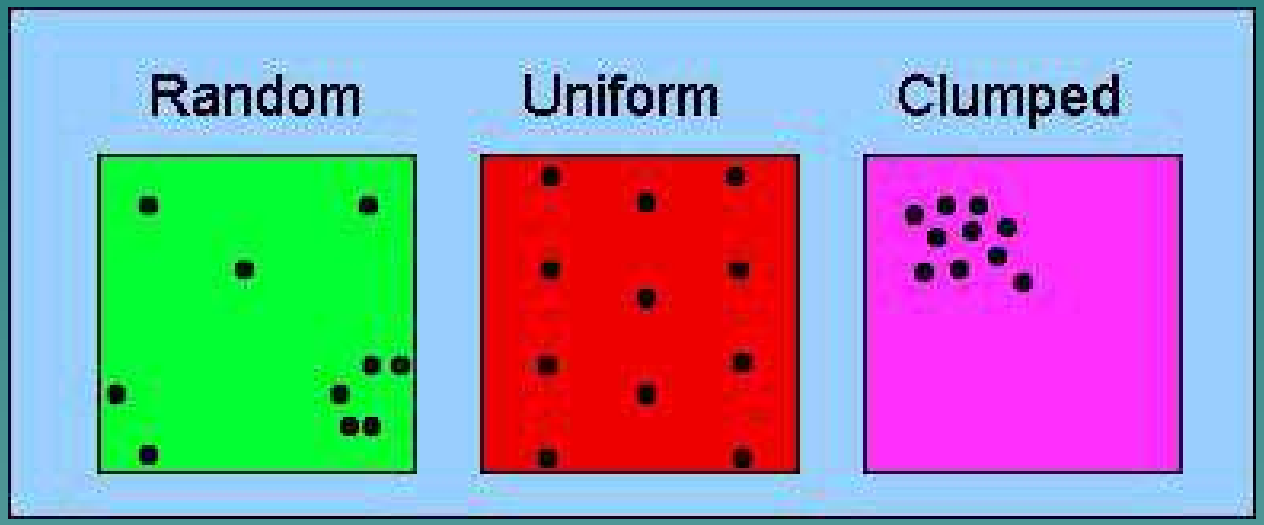
A measurement of the number of individuals living in a defined space.

Formula:

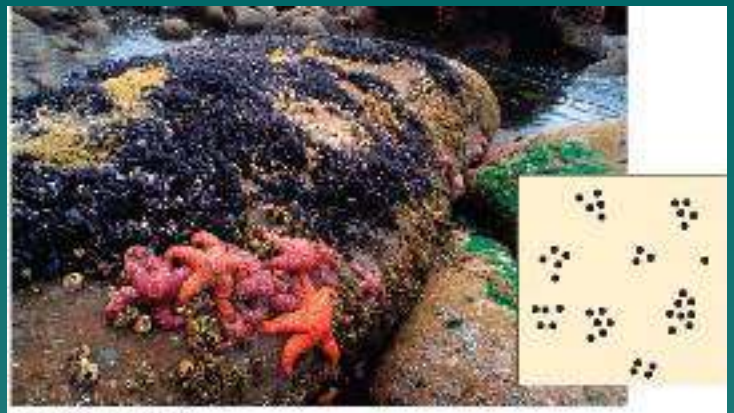
$$\frac{\text{\# of individuals}}{\text{Area (units}^2\text{)}} = \text{Population density}$$

14.3 How are populations dispersed?

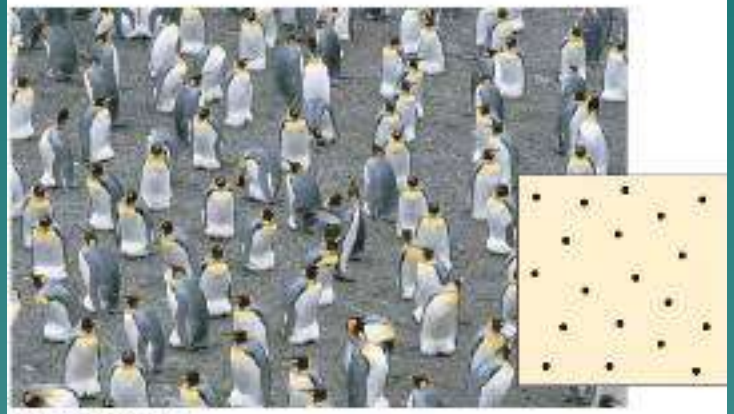
- Clumped: Minnows
- Uniform: Hawks
- Random: Dandelions



Which one are humans?

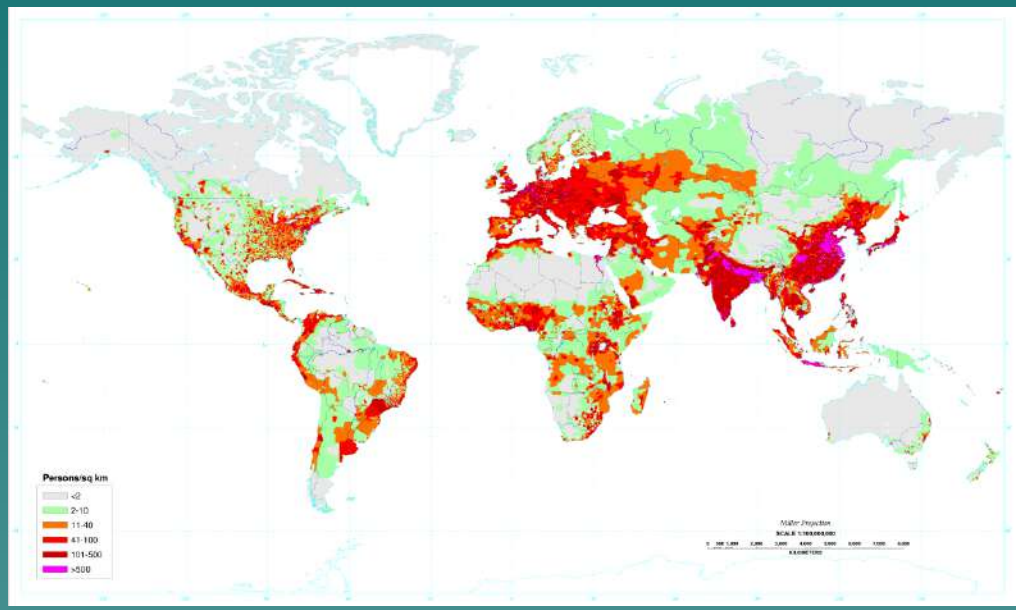


(a) Clumped



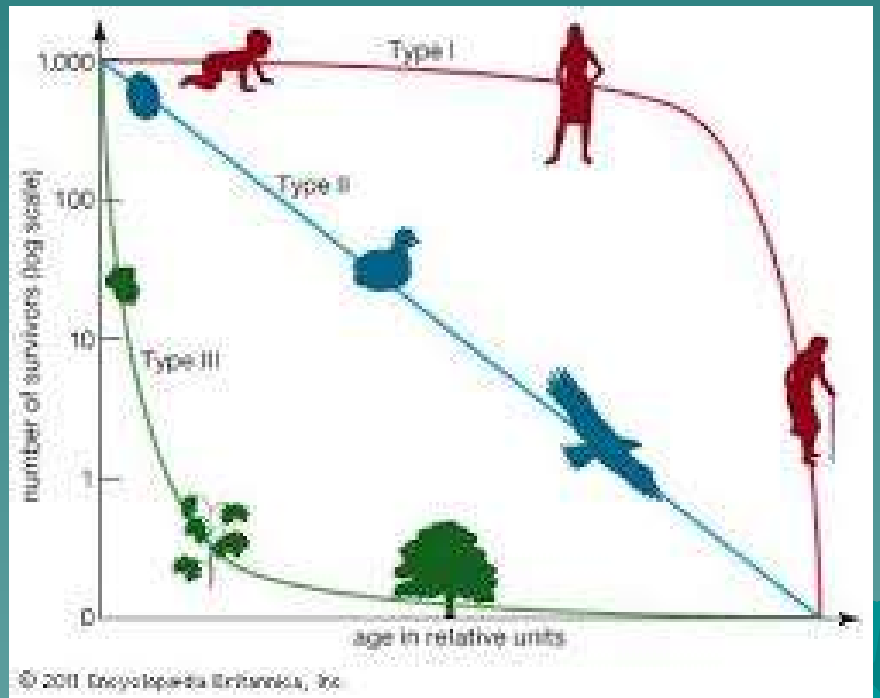
(b) Uniform

(c) Random



How can reproductive strategies of a species be described…

- Survivorship curves: a generalized diagram showing the number of surviving members over time from a measured set of births.



14.4 Population Growth Patterns

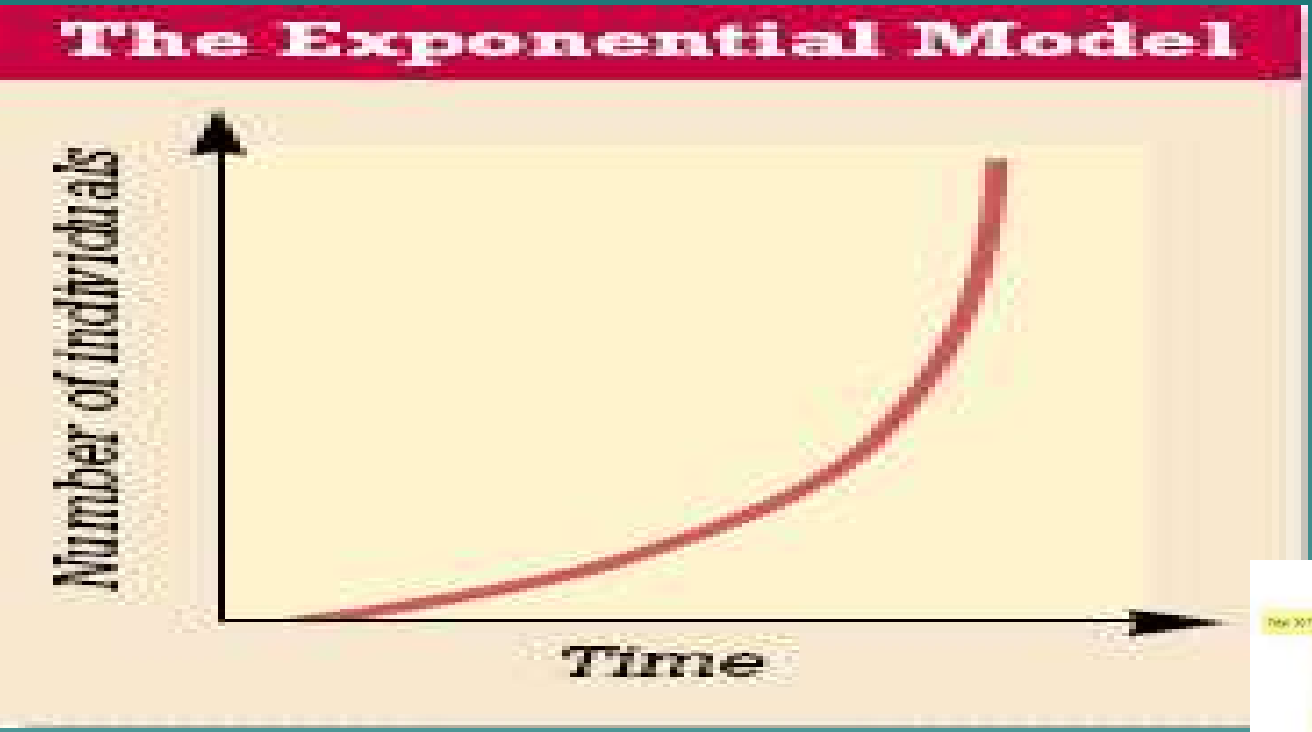
Georgia Standard:

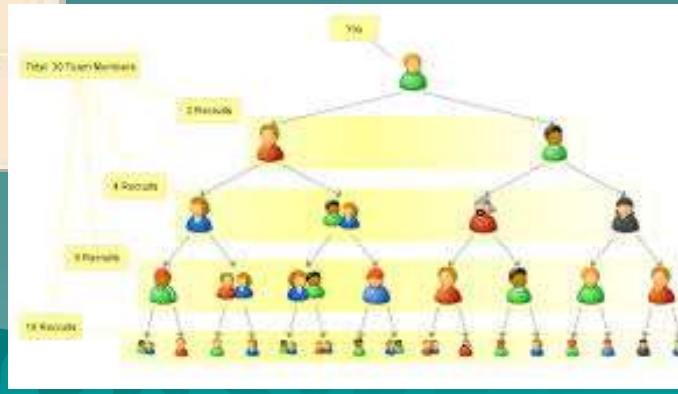
Investigate the relationships among populations.

14.4 Measuring Populations

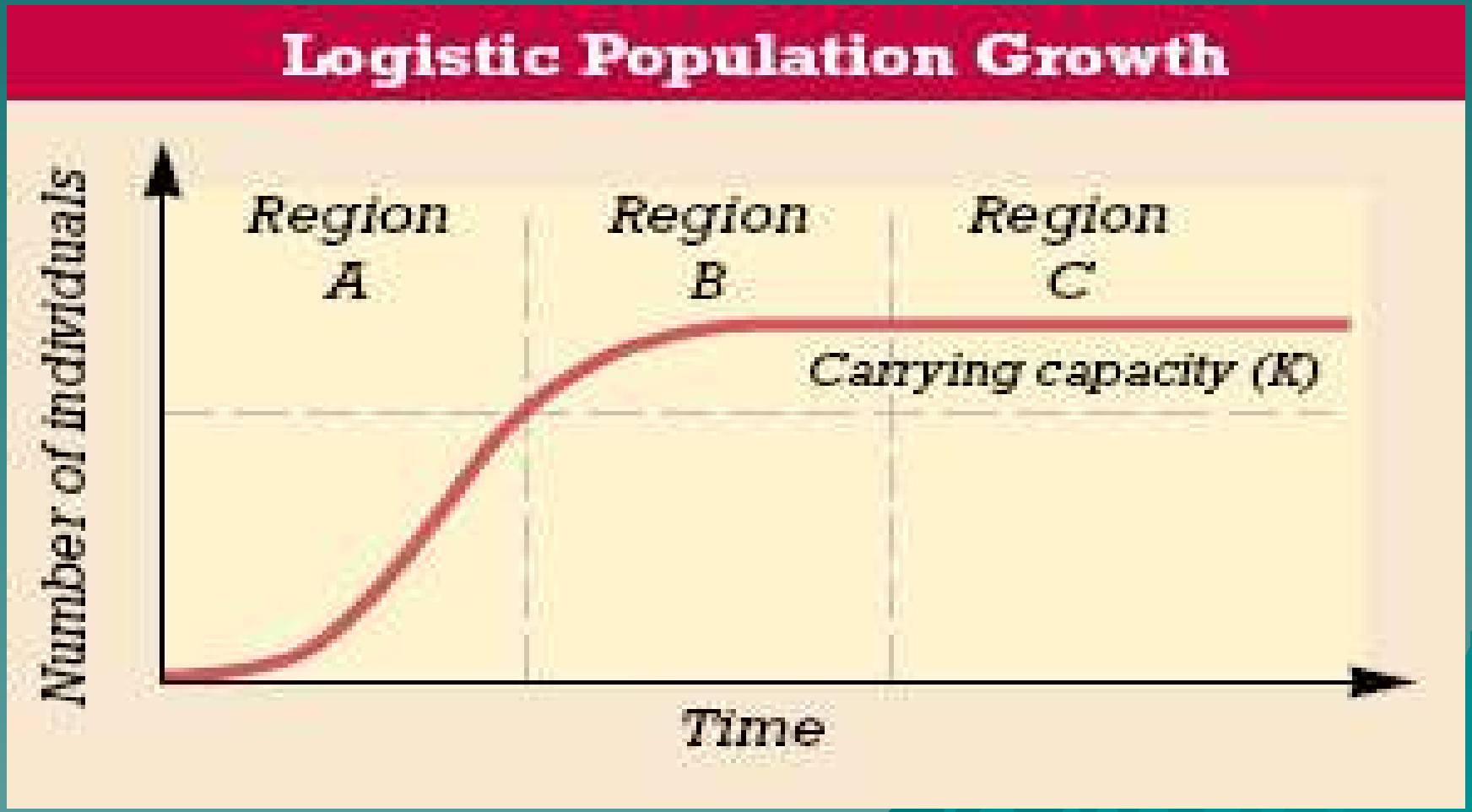
- Growth Rate: Birth, Death, Emigration, Immigration
- Demographers assume immigration and emigration are zero when calculating growth rate.

The Exponential model: J shaped: unlimited resources.





The Logistic Model S-shaped: Limited resources



Populations grow until they reach….

- **Carrying capacity:** the maximum number of individuals of a particular species that the environment can normal and consistently support.

- **Population Crash:** when a population declines dramatically in a short period of time.

What limits population size?

- **Density dependent factors:** Competition, Predation, Parasitism, and Disease
- **Density independent factors:** Natural disasters, unusual weather, Human activities.

Perils of Small Populations: Loss of Genetic Variation

Population Regulation

- Density Independent Factors pg. 444

....weather, floods, and fires have the same effect regardless of population size.

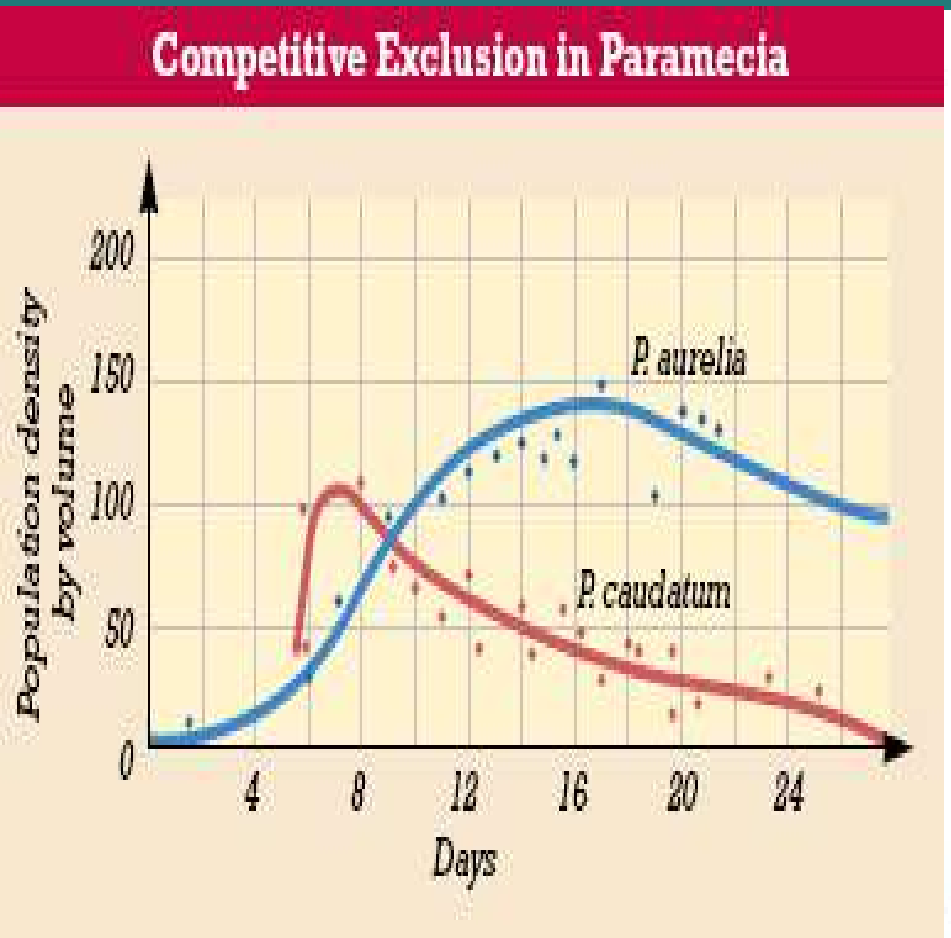
- **Density Dependent Factors**

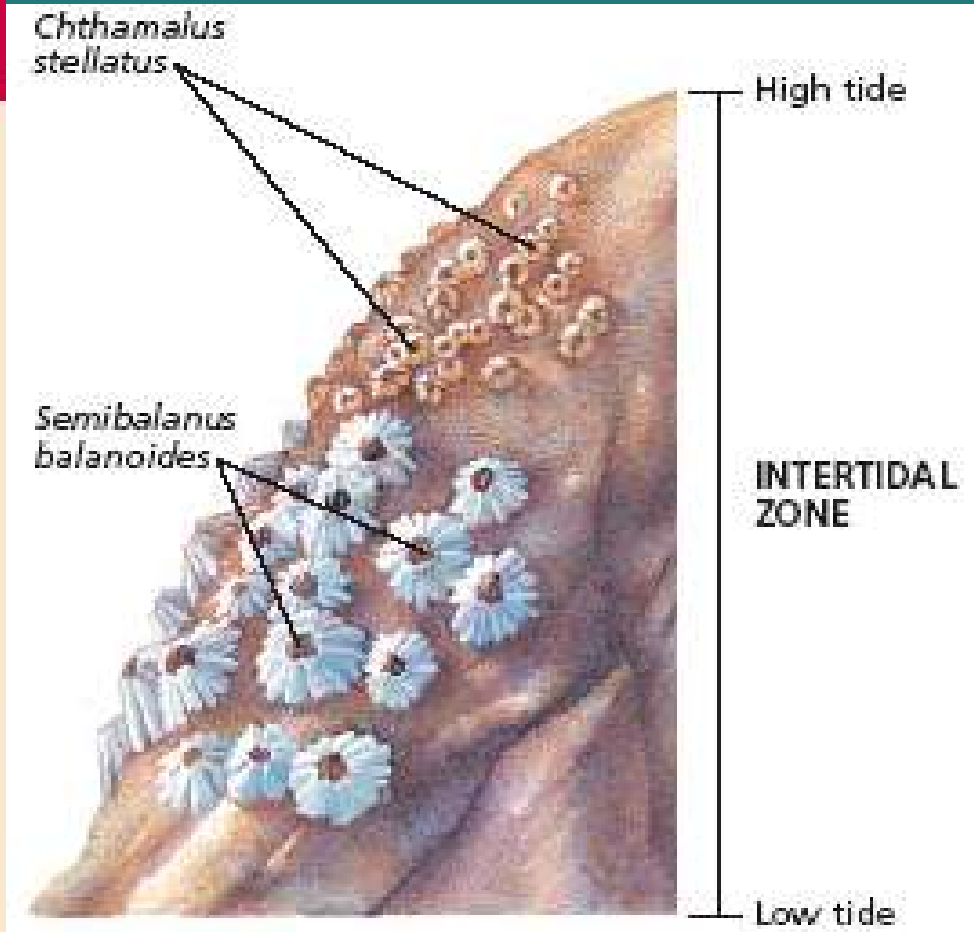
....include resource limitations and are triggered by increasing population density.

Lab

- Data Analysis Lab
- Pg 442
- Do Q 1-3
- Read Figure 14.13
- Write a paragraph summarizing your learning.

Competition
....Competitive Exclusion





Succession 14.5

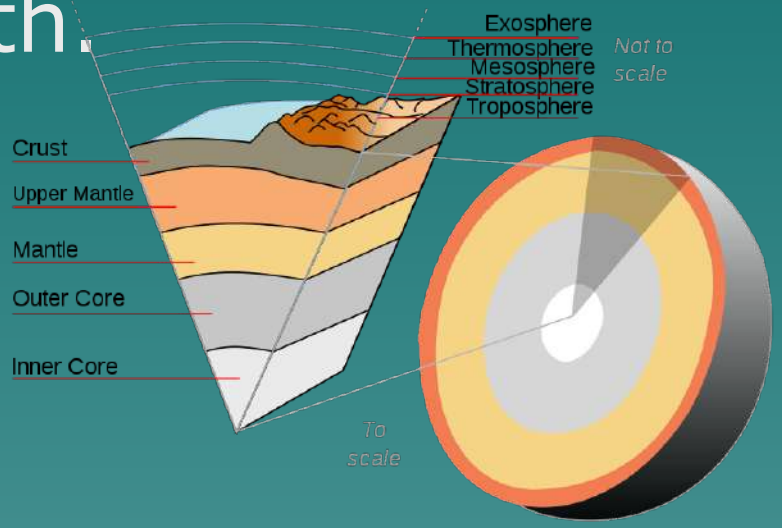
- Primary Succession

Secondary Succession

Climax Community

Ch. 15.1 Life in the Earth System

- Biosphere: where life exists on under and above the earth.
  - Hydrosphere
  - Atmosphere
  - Geosphere



Feedback systems: Parts of the biosphere interact and effect each other and life on planet earth. More CO2 might mean more Plants.

15.2 Climate

- Long-term pattern of weather conditions in a region.
  - Microclimate: climate of a small specific place within a larger area.
- Three Main Climate Zones on Earth Go to Figure 15.3
  - Polar: North and South ends of the planet
  - Tropical: Surrounds the equator
  - Temperate: we live here

What influences the earths climate

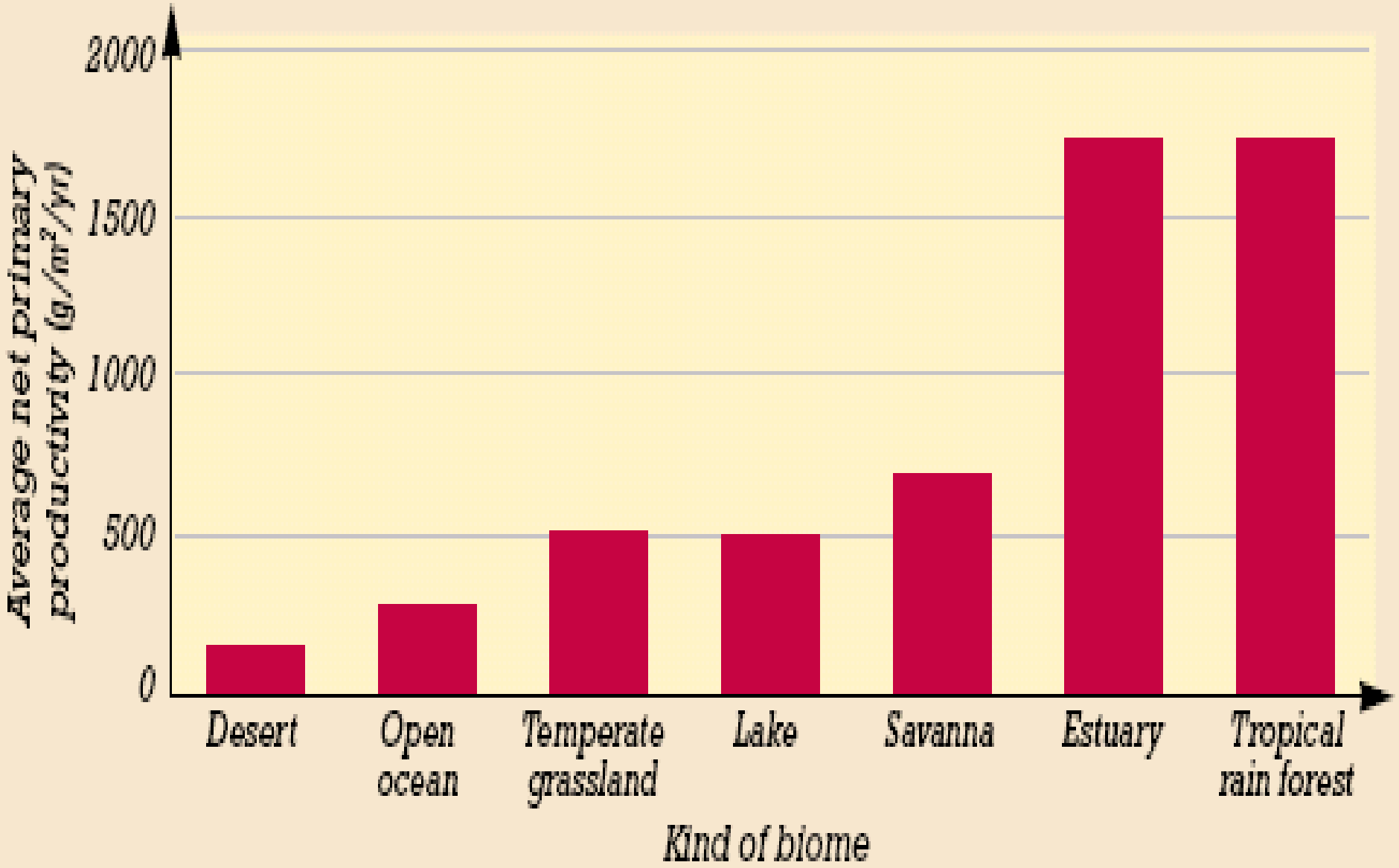
Influence of Sunlight: Angle of the sun. Direct= most energy and most heat.

Air and Water Movement: Warmer temp are less dense than cooler. Creates Convection currents.

Landmasses: Costal areas have less climate change than inland. Why? What quality of water does this?

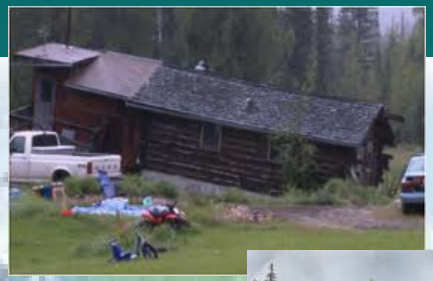
Adaptions to Climate

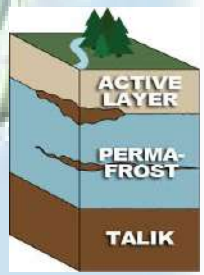
CH. 15.3 Comparative Productivity of Ecosystems



Terrestrial Ecosystems 15.3

tardigrade

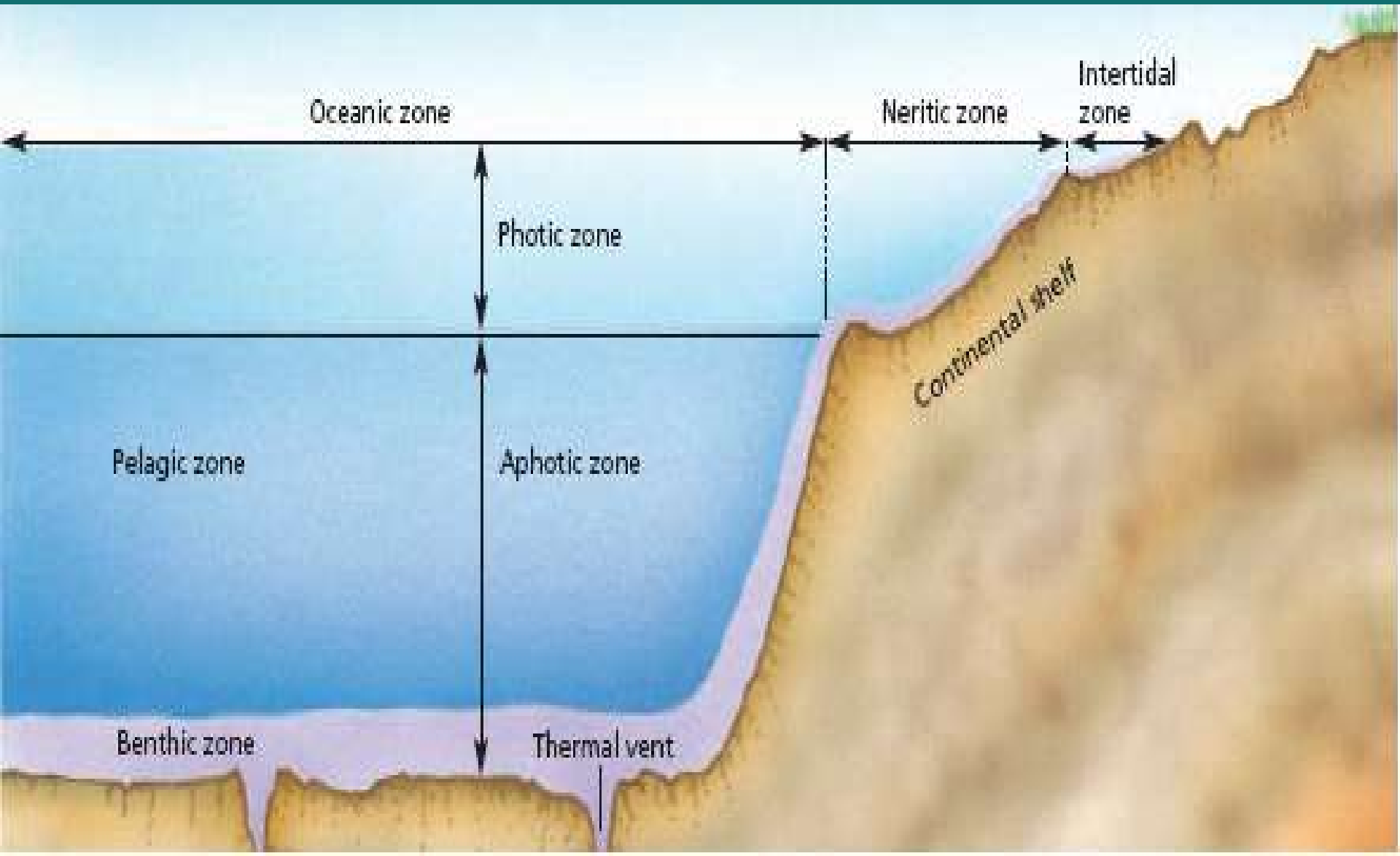




Arctic Tundra occurs in the far north of the northern hemisphere, north of the Taiga. Characteristically the subsoil to tundra is usually Permafrost, or permanently frozen ground.

Biome	Average yearly temperature range	Average yearly precipitation	Soil	Vegetation
Tundra	−26°C to 12°C	<25 cm	moist, thin topsoil over permafrost; nutrient-poor; slightly acidic	mosses, lichens, dwarf woody plants
Taiga	−10°C to 14°C	35–75 cm	low in nutrients; highly acidic	needle-leaved evergreen trees
Temperate deciduous forest	6°C to 28°C	75–125 cm	moist; moderate nutrient levels	broad-leaved trees and shrubs
Temperate grassland	0°C to 25°C	25–75 cm	deep layer of topsoil; very rich in nutrients	dense, tall grasses in moist areas; short clumped grasses in drier areas
Desert	7°C to 38°C	<25 cm	dry, often sandy; nutrient-poor	succulent plants and scattered grasses
Savanna	16°C to 34°C	75–150 cm	dry, thin topsoil; porous, low in nutrients	tall grasses, scattered trees
Tropical rain forest	20°C to 34°C	200–400 cm	moist, thin topsoil; low in nutrients	broad-leaved evergreen trees and shrubs

Aquatic Ecosystems
Oceans 15.4

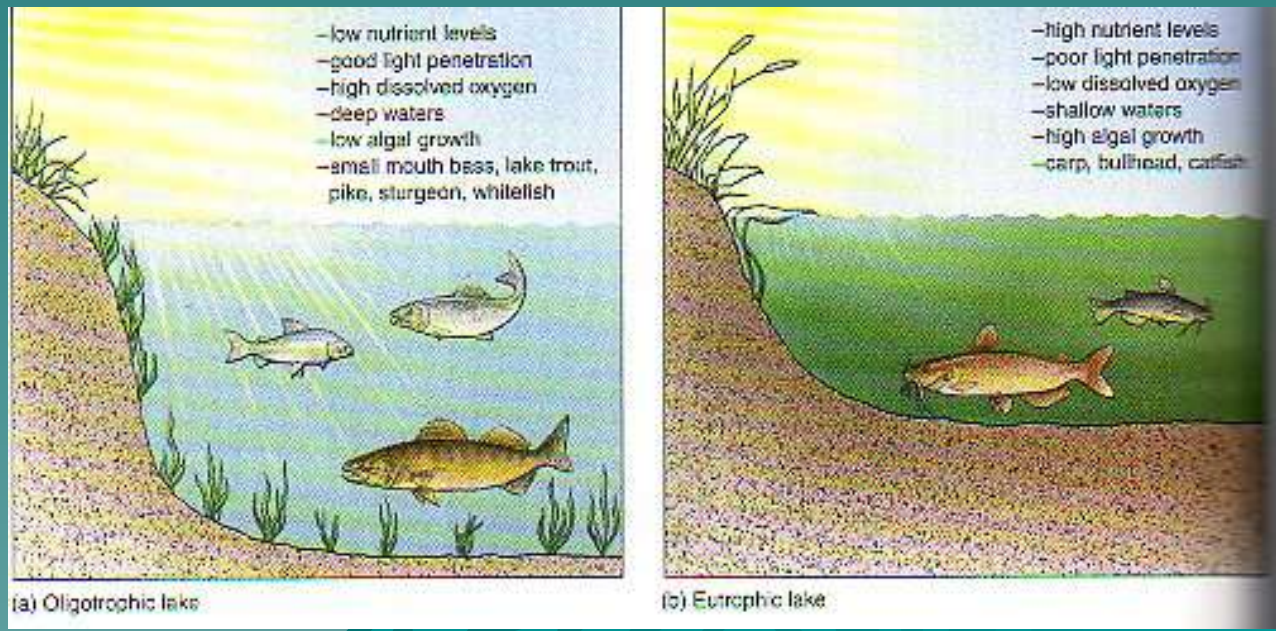


Estuaries

- Where freshwater rivers meet oceans.
  - Full of phytoplankton and zooplankon
  - 75% of fish we eat come are dependent on estuaries
  - Refuge and spawning habitat
  - Many under theat. Think Chattahoochee.

Aquatic: Fresh Water

- Eutrophic Lakes: low light
- Oligotrophic Lakes

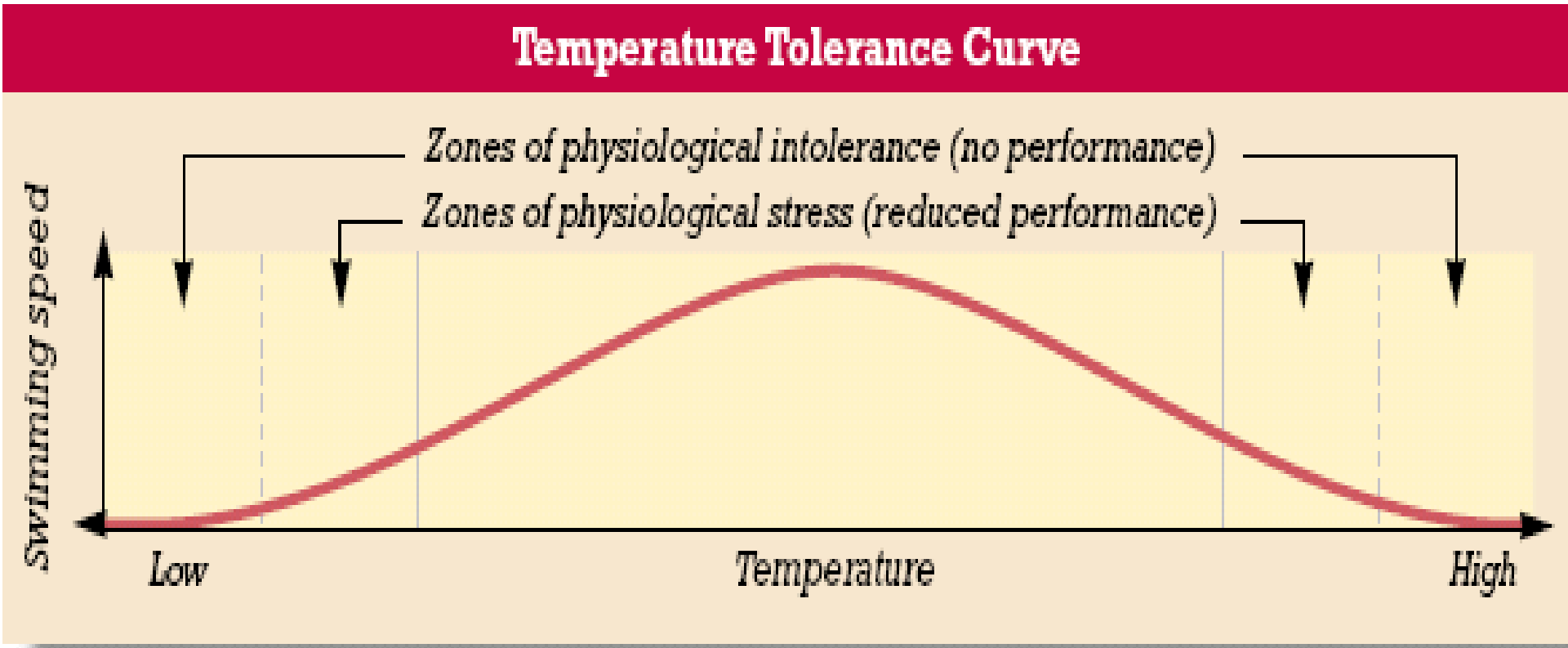


How Technology can help.

Dr. Thomas' Article On "Green Clean"

Enduring Changes

- Performance Vs. Environmental Changes



Responding to Changes

- Acclimation

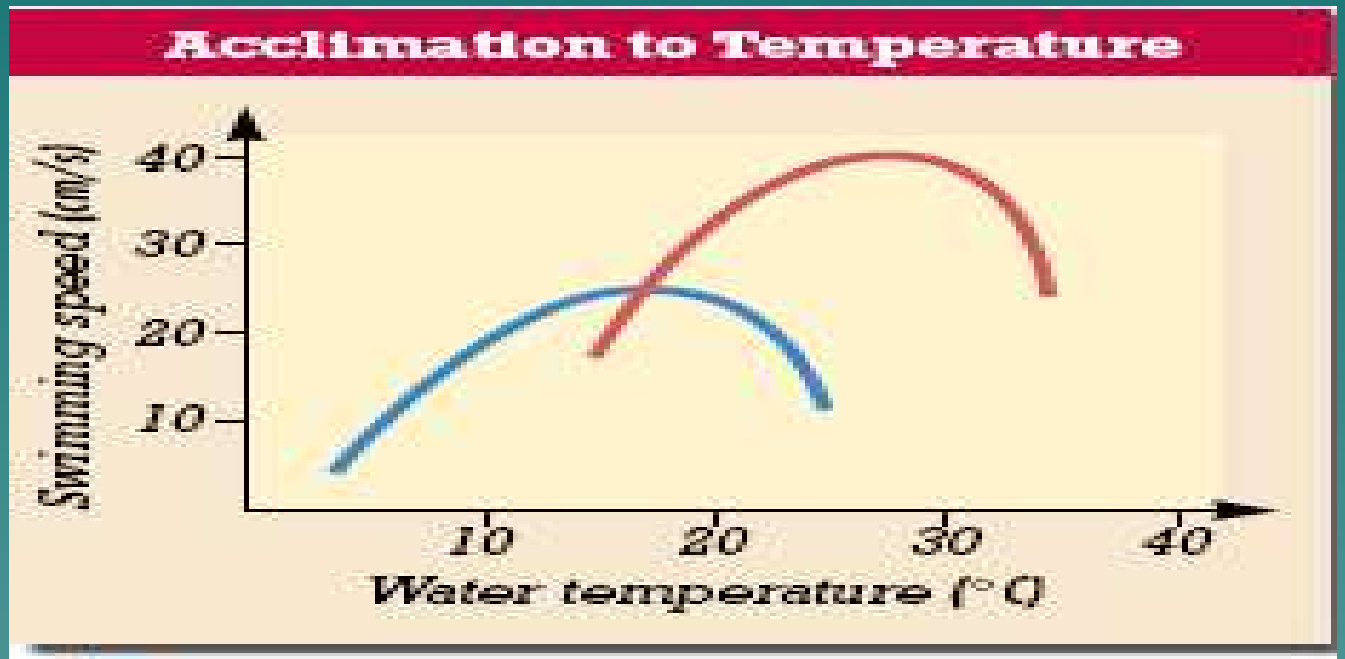
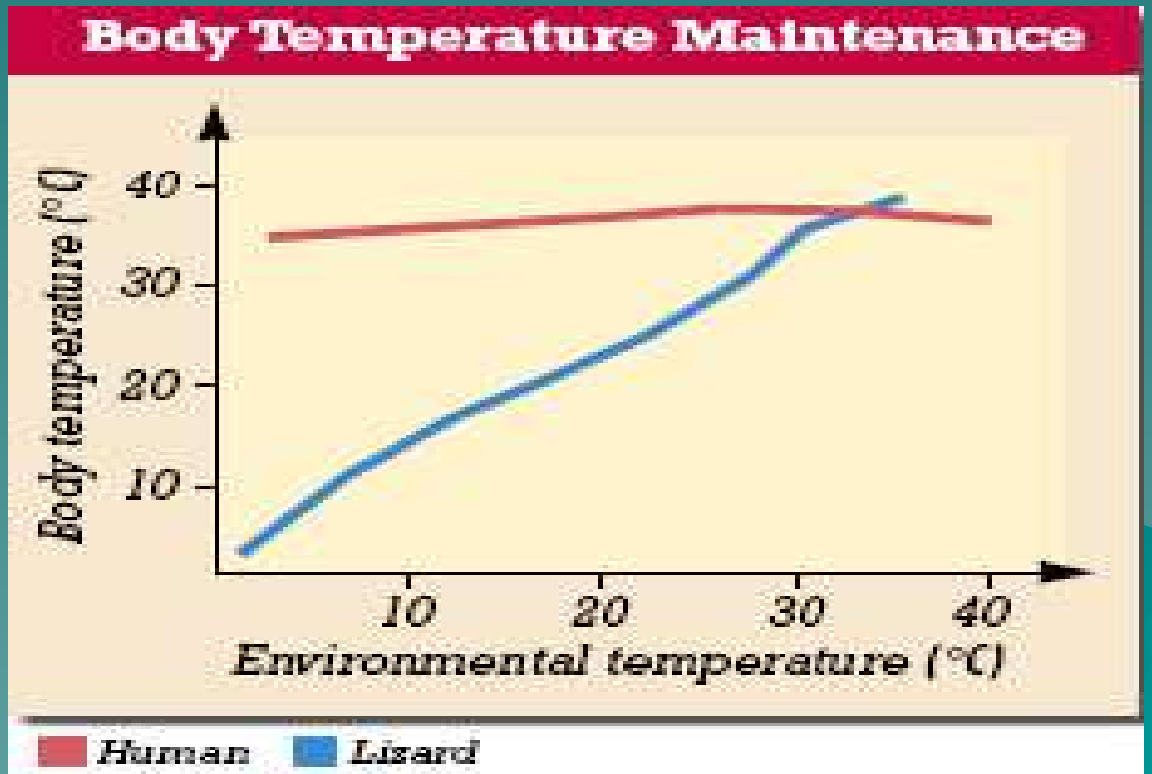


FIGURE 19-9

Fish raised at 25°C are acclimated to higher temperatures and are able to tolerate much warmer temperatures than the fish raised at 5°C.

- **Control of Internal Conditions**

....Conformers and Regulators



- Escape

....Dormancy and Migration

Today's Environment

- **Exploding Human Population**

Human Population Graphs

....increasing demand for energy, food, and space.

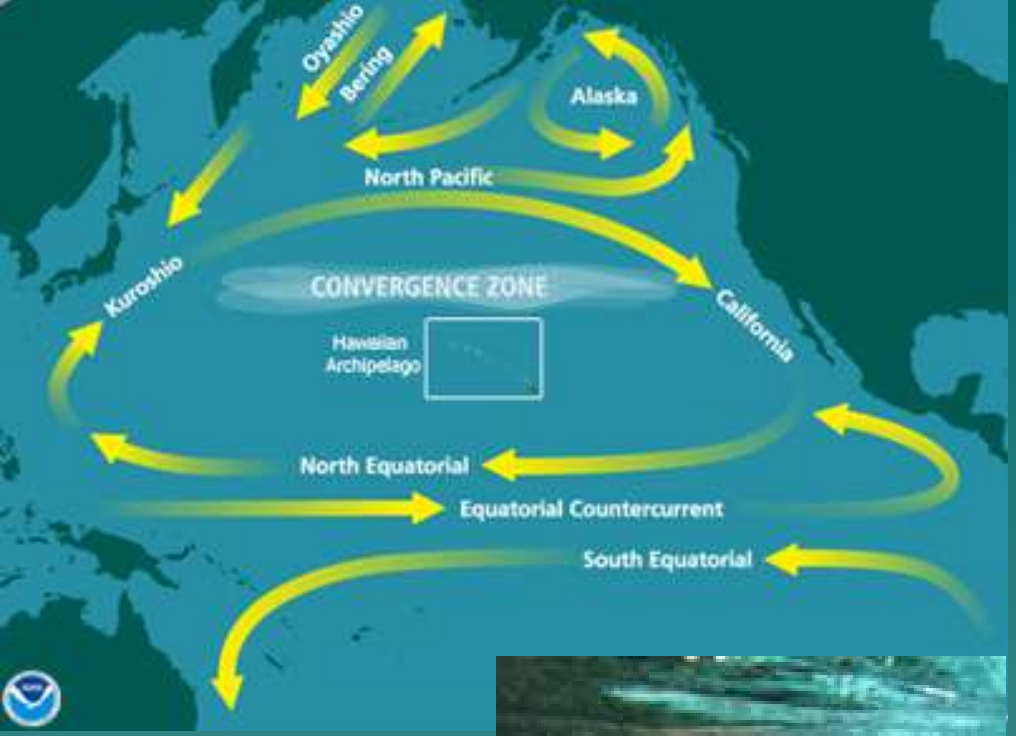
Population: A group of individuals of one species living in one area who interbreed and interact.

- **Sixth Mass Extinction**

....Loss of habitat, pollution, over hunting and fishing.

Oil Rig Disasters...oops!

The Great Pacific Garbage Patch



The size of Texas

GPP

Pacific Garbage Patch

Thinning Ozone Layer

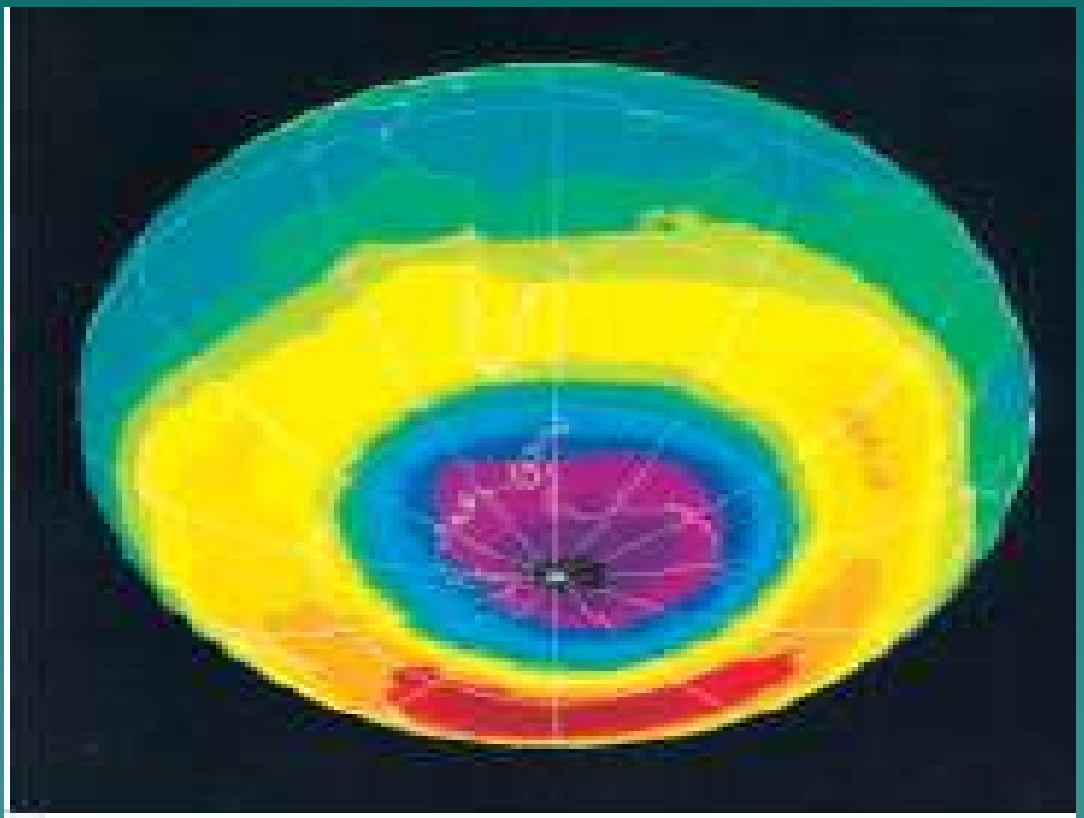


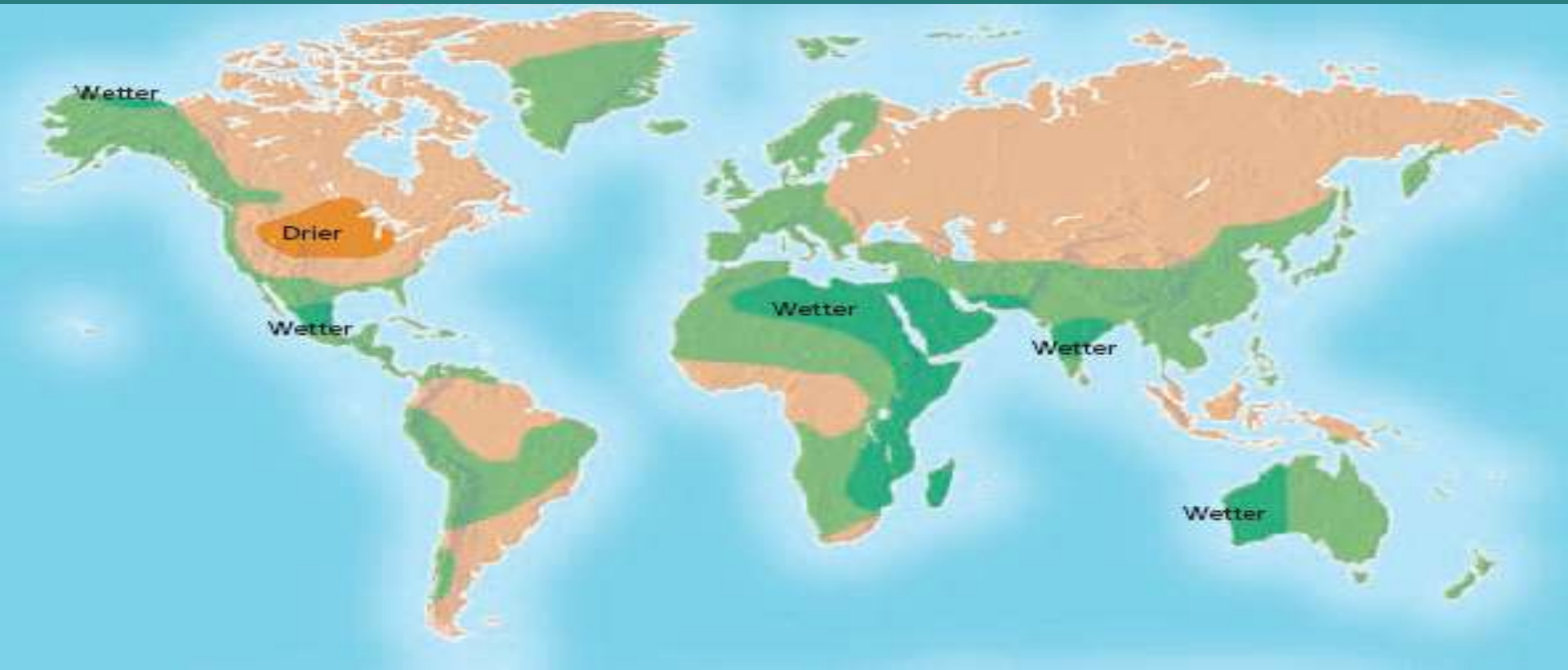
FIGURE 19-3

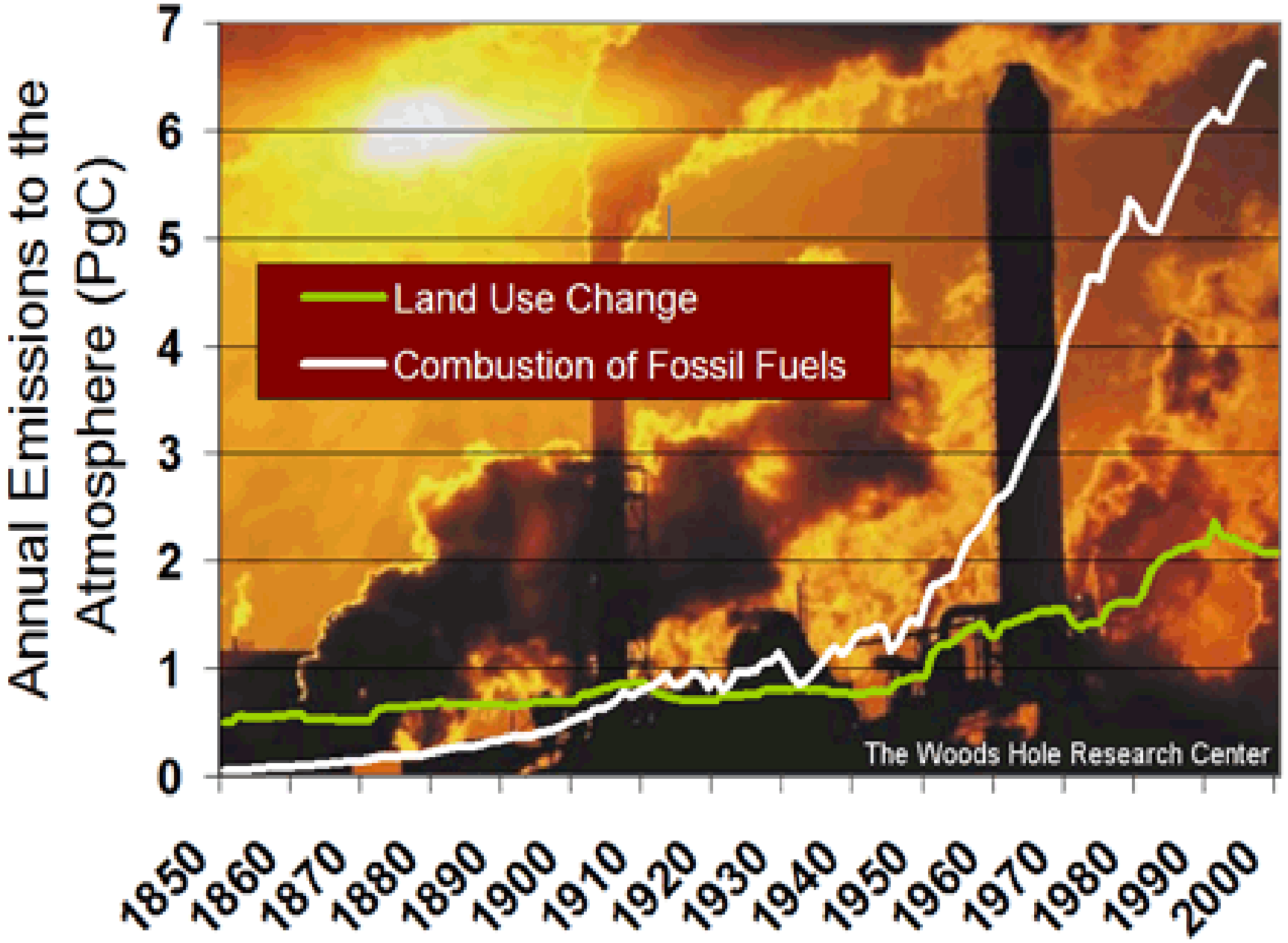
The ozone shield over Antarctica fluctuates in density seasonally, sometimes to a low of half the original density. The ozone shield is diminishing all over the planet as well.

ozone

Clamatic Changes

- Global Warming and the Greenhouse Effect.




Annual Emissions to the Atmosphere (PgC)
7
6
5
4
3
2
1
0
Land Use Change
Combustion of Fossil Fuels
The Woods Hole Research Center
1850
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000