Go to the "Slide Show" shade above

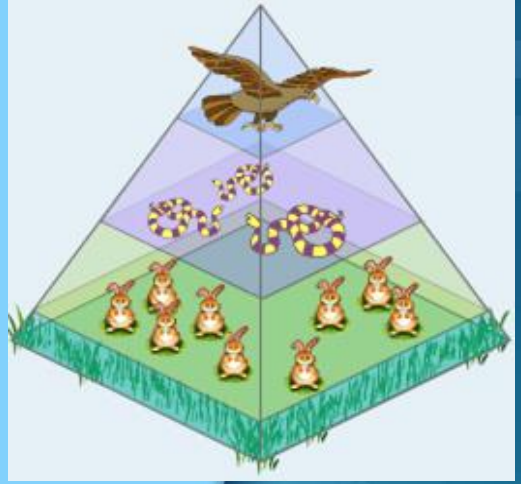
Click on "Play from Beginning"

Chapter 34:

Population Growth & Succession

WARM-UP

What are the names of organisms for trophic levels from bottom to top?



What happens to energy and biomass at each trophic level?

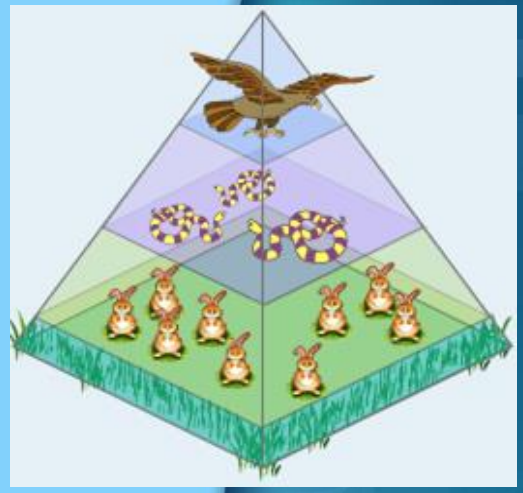
When one animal eats another, what food relationship is this?

Organisms that live upon dead animals and plants are called ____

WARM-UP

What are the names of organisms for trophic levels from bottom to top?

producers → primary consumers → secondary consumers → tertiary consumers



What happens to energy and biomass at each trophic level?

decreases to ~10% of previous level

When one animal eats another, what food relationship is this?

Predator/prey.

Organisms that live upon dead animals and plants are called ____

scavengers.

Lesson Objectives

By the end of this lesson, you should be able to:

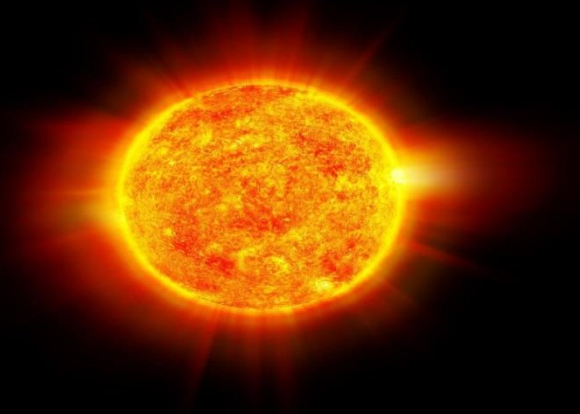
- ❑ Explain how energy and nutrients flow through an ecosystem (biogeochemical cycles).
- ❑ Describe the five major types of interactions between organisms.
- ❑ Identify community ecological interactions, including competition, predation, and symbiosis.
- ❑ Define and explain ecological succession from pioneer species to climax communities and world biomes.
- ❑ Understand population ecology, survivorship, and growth.

- **Science Practice:** **Fish Sampling Activity**

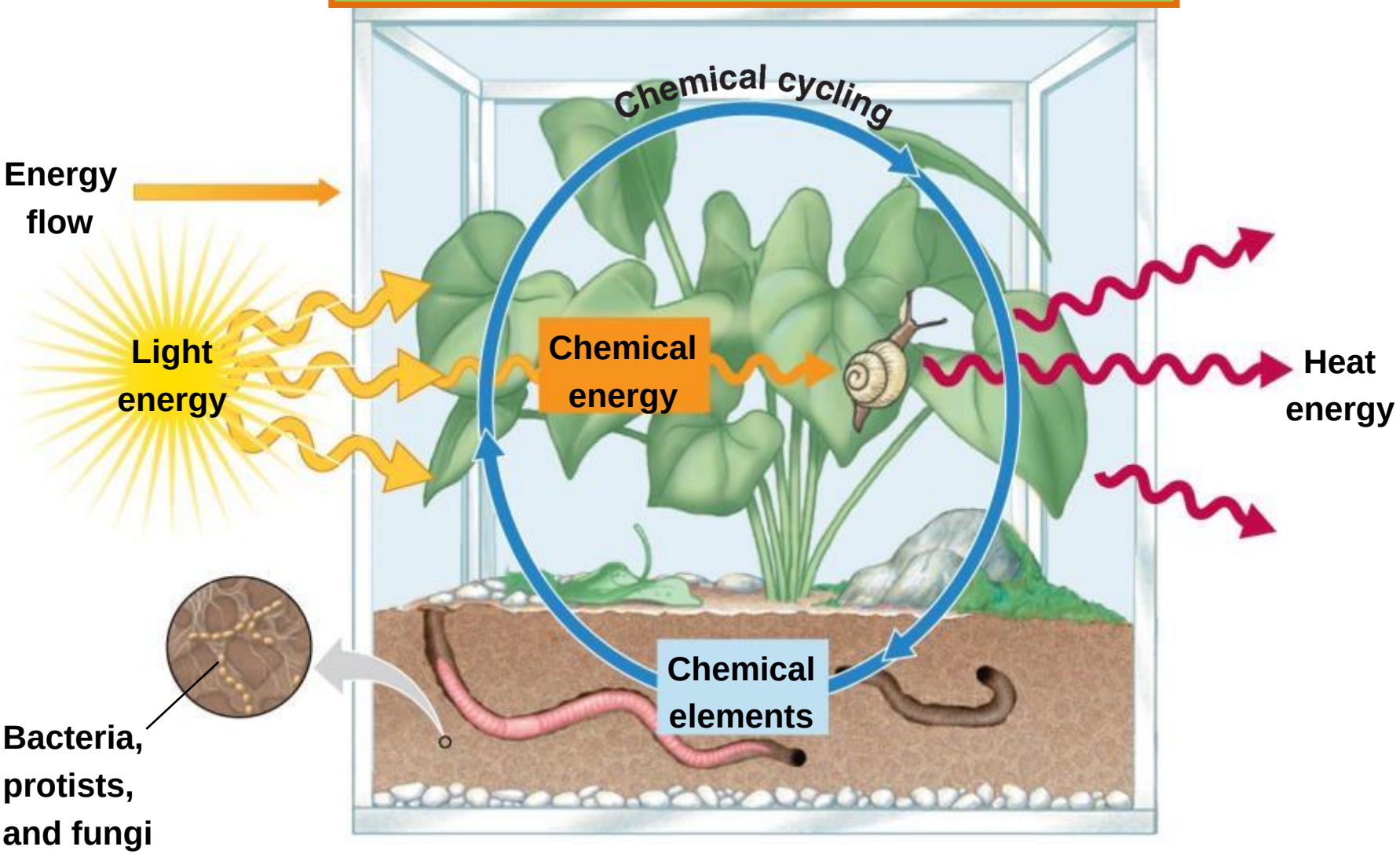
Ecosystems

In an ecosystem,

- **Energy Flows** *through* the components of an ecosystem → trophic level to trophic level in living and non-living ways.
- **Chemical Cycling** is the transfer of NON-living materials *WITHIN* the ecosystem.



Terrarium Ecosystem



Ecosystem

Energy and Matter move through an ecosystem in very different ways.

Energy moves through an ecosystem in a **one-way path**.

Energy enters an ecosystem in the form of **sunlight** and exits the ecosystem in the form of **heat**.

This energy **cannot be recycled**.

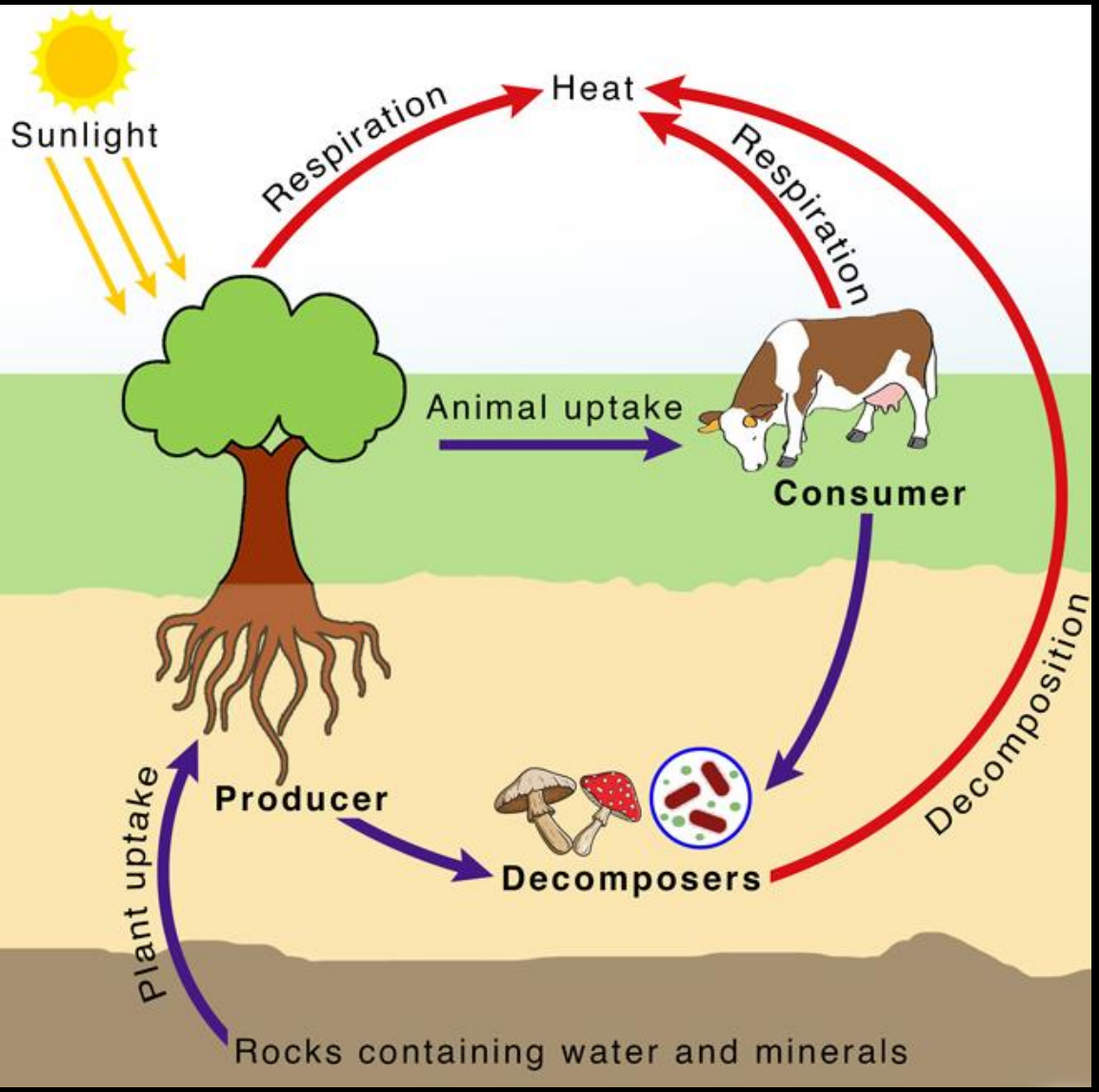
Matter, however, is recycled within and between ecosystems.

Biogeochemical Cycles

Organisms need more than just energy to survive…
They also need water, minerals, NUTRIENTS, etc.

Most organisms are made of C,H,O,N, but organisms cannot use these elements unless the elements are in a chemical form that cells can absorb and assimilate.

Biogeochemical Cycles



Matter passes between organisms and parts of the biospheres through Biogeochemical Cycles.

Matter (nutrients) can cycle through the biosphere because biological systems don't use up matter, they **transform it.**

Biogeochemical cycles pass the same molecule around again and again within the biosphere.

Water Cycle

All living things require water to survive.

- Oceans: Major Reservoir
- Main Processes:
  - Evaporation: water changes from liquid form to atmospheric gas.
  - Condensation: water vapor condenses into tiny droplets (Clouds).
  - Precipitation: water returns to Earth's surface.
  - Infiltration: water is absorbed into the ground (versus run off). Percolation.

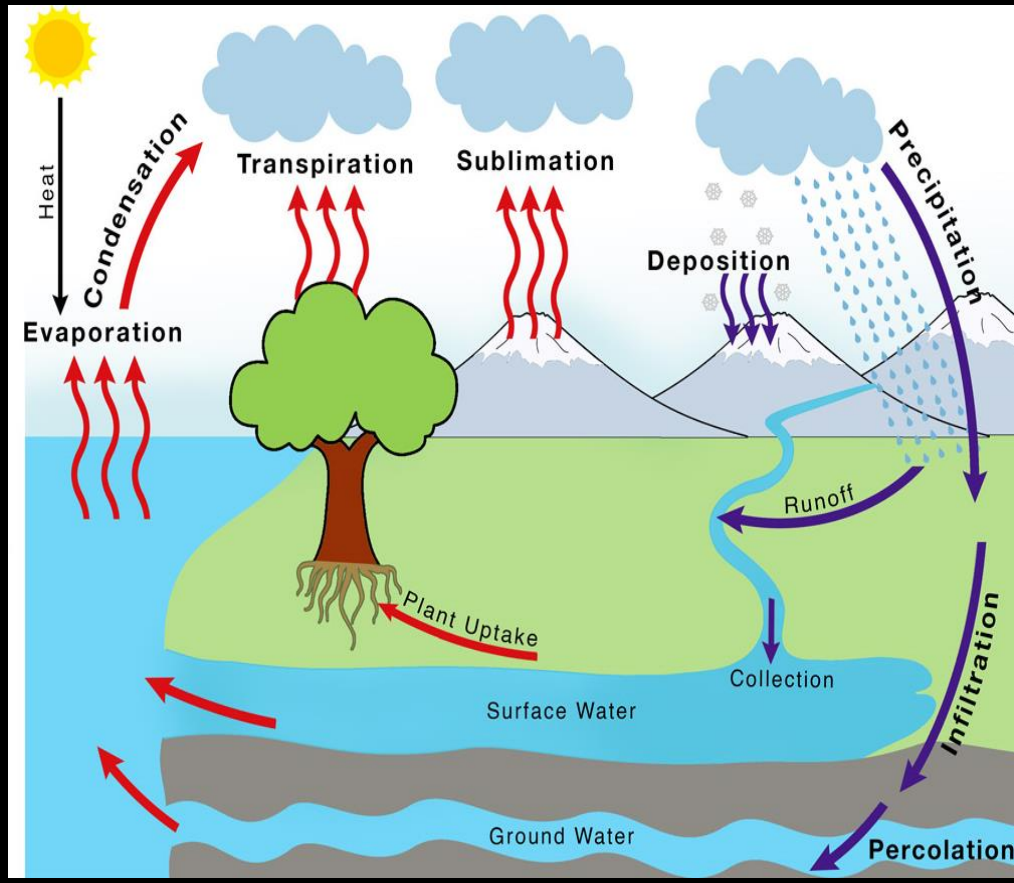
Water Cycle

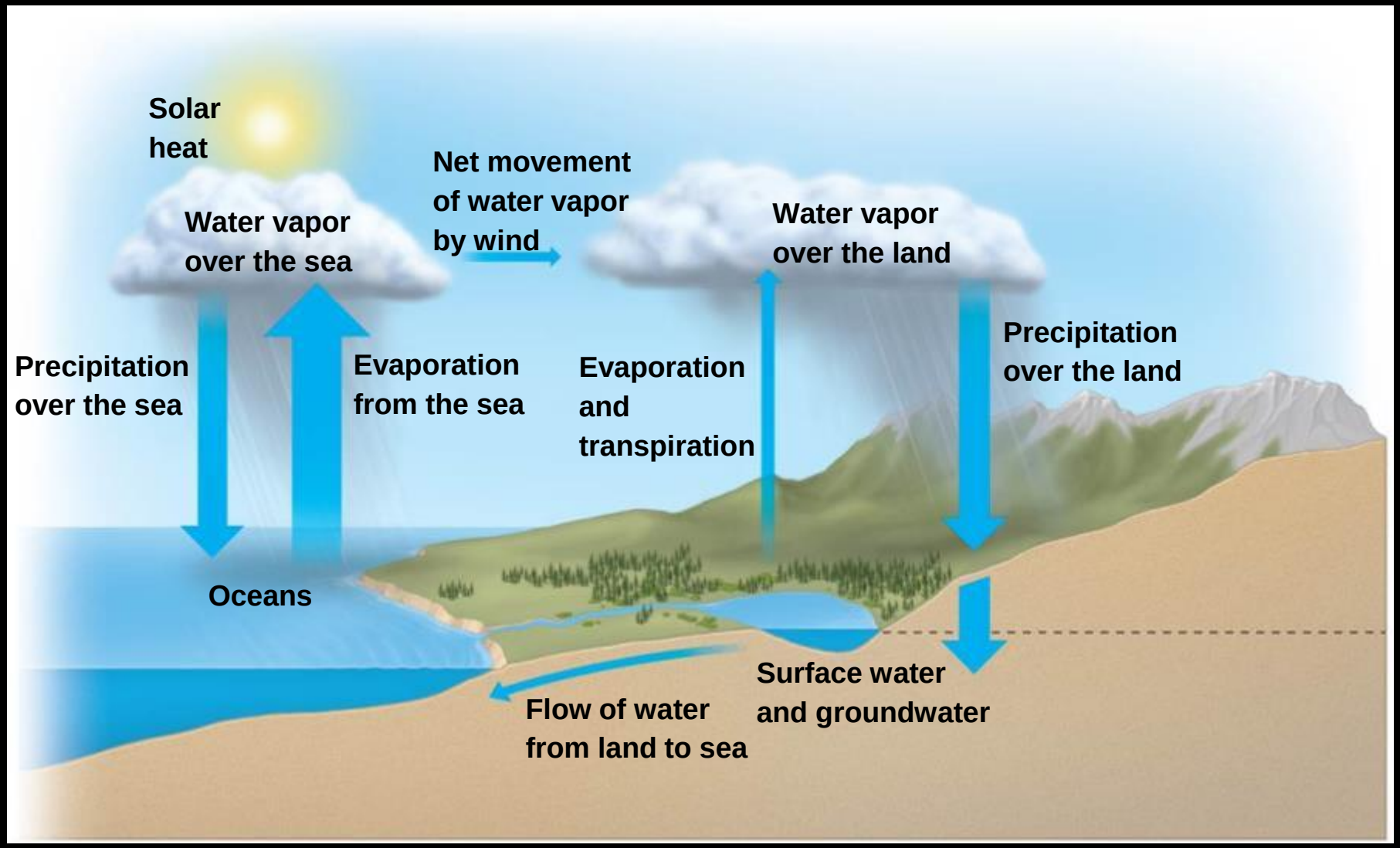
Water seeps into the soil to be absorbed by plant roots.

Animals directly drink water or eat plants that contain water.

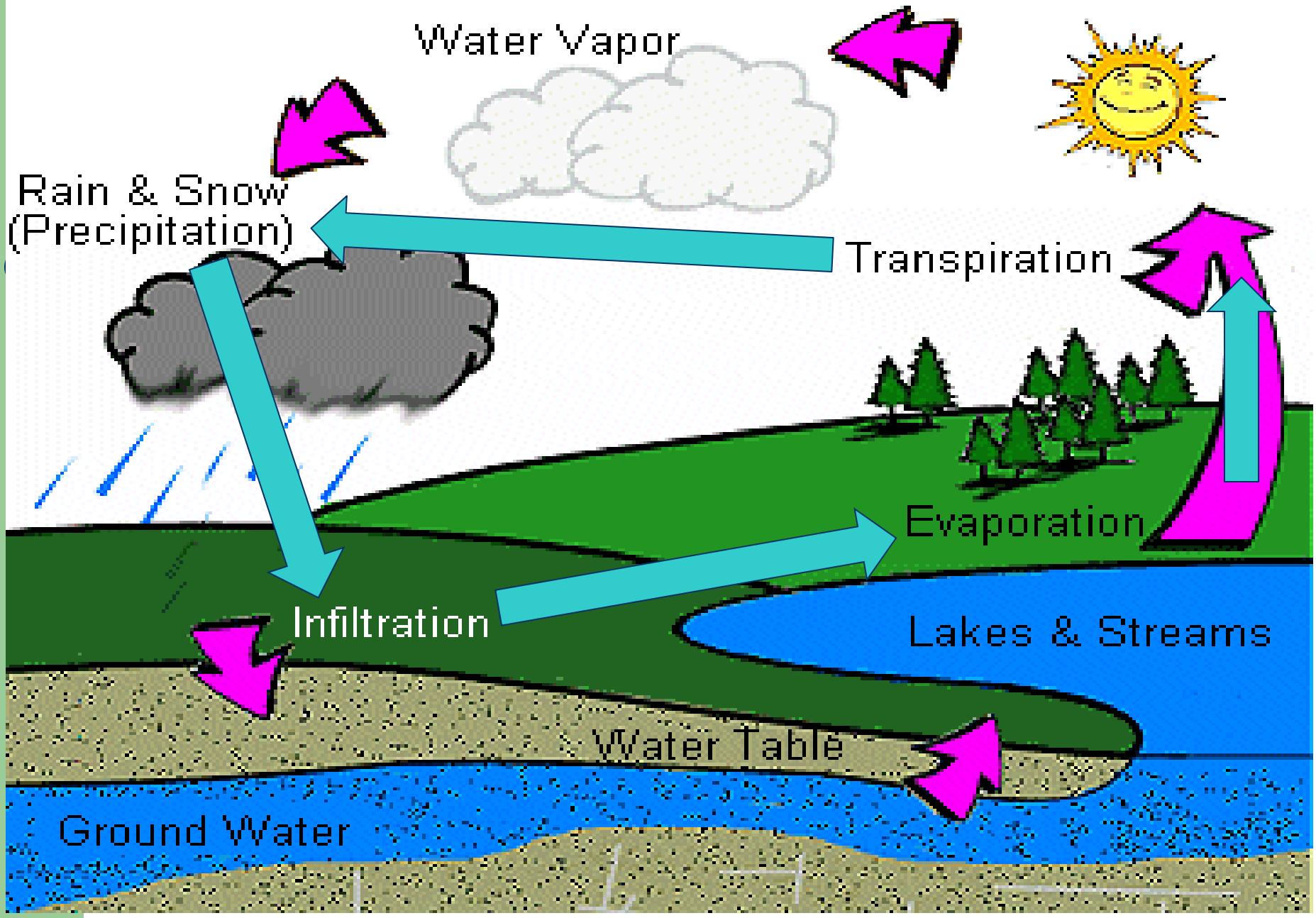
Water returns to where it came from by:

- Plant TRANSPIRATION.
- EVAPORATION from land and water bodies.




Solar heat
Net movement of water vapor by wind
Water vapor over the sea
Water vapor over the land
Precipitation over the sea
Evaporation from the sea
Evaporation and transpiration
Precipitation over the land
Oceans
Surface water and groundwater
Flow of water from land to sea

Water Cycle


Water Vapor
Rain & Snow
(Precipitation)
Transpiration
Evaporation
Infiltration
Lakes & Streams
Water Table
Ground Water

Water Cycle

http://somup.com/cFQUF4nVnJ (2:04)

http://somup.com/cFQrorVWL7 (0:46)

http://somup.com/cFQUF3nVnG (5:54)

Water Cycle Summary

TRY IT

The water cycle is driven by energy from the ___ causing evaporation to occur.

? – liquid turning to a gas.

?– water entering the atmosphere from plants

?– water vapor turning to liquid

?– precipitation that is absorbed through soil and into the groundwater below.

? – water that moves over surfaces and into lakes, rivers and streams.

?– rain, sleet and snow.

Water Cycle Summary

TRY IT

The water cycle is driven by energy from the sun causing evaporation to occur.

Evaporation – liquid turning to a gas.

Transpiration – water entering the atmosphere from plants

Condensation – water vapor turning to liquid

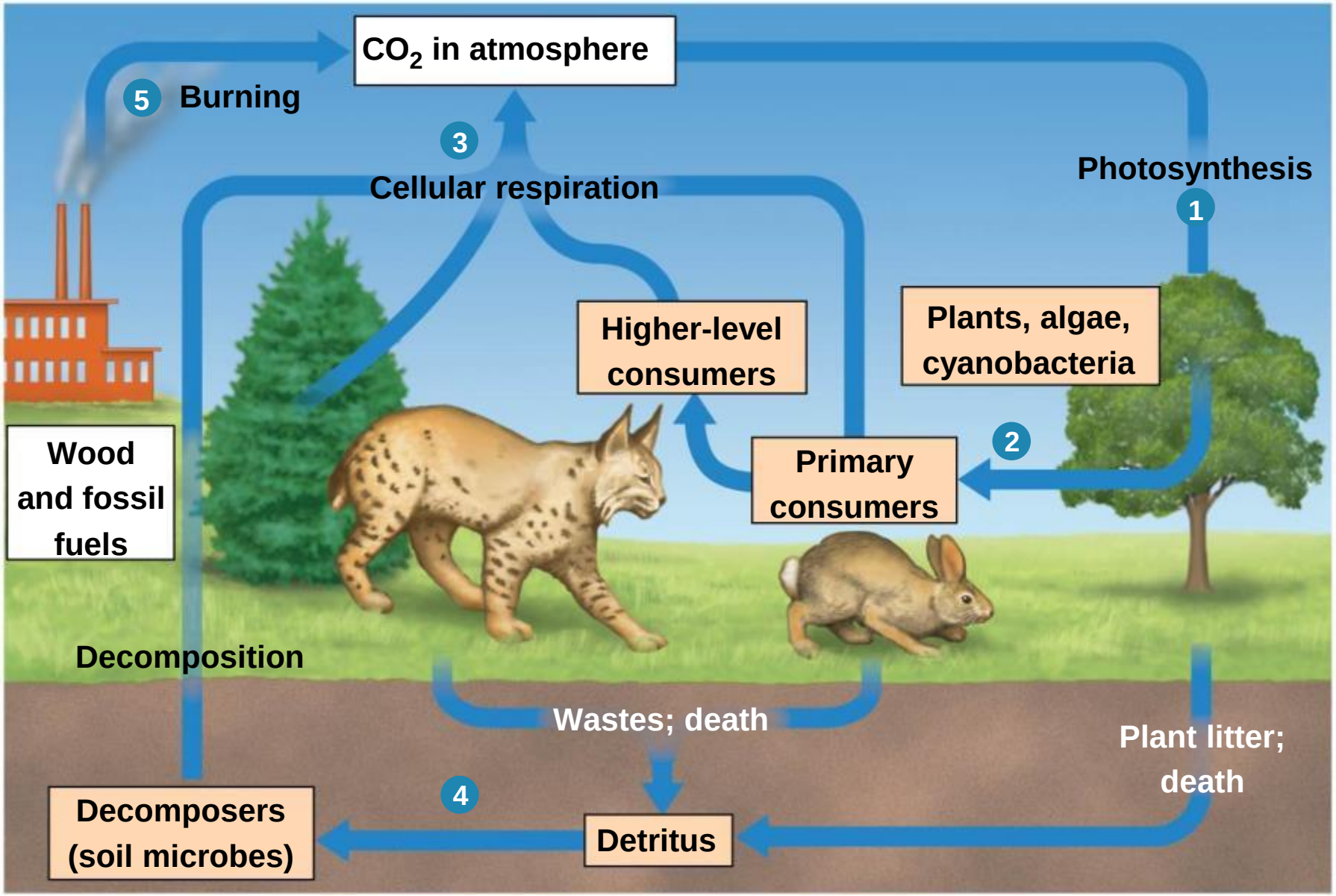
Infiltration – precipitation that is absorbed through soil and into the groundwater below.

Run-off – water that moves over surfaces and into lakes, rivers and streams.

Precipitation – rain, sleet and snow.

Carbon Cycle

- Carbon is part of all organic molecules.
- Main Reservoir: Atmosphere.
- Plants absorb it through **Photosynthesis** to produce sugar that they "burn" to make energy.
- Animals get it by eating plants or other animals.
- **Cellular Respiration** releases Carbon back to the atmosphere as CO_2.



Carbon Cycle

Greenhouse Effect

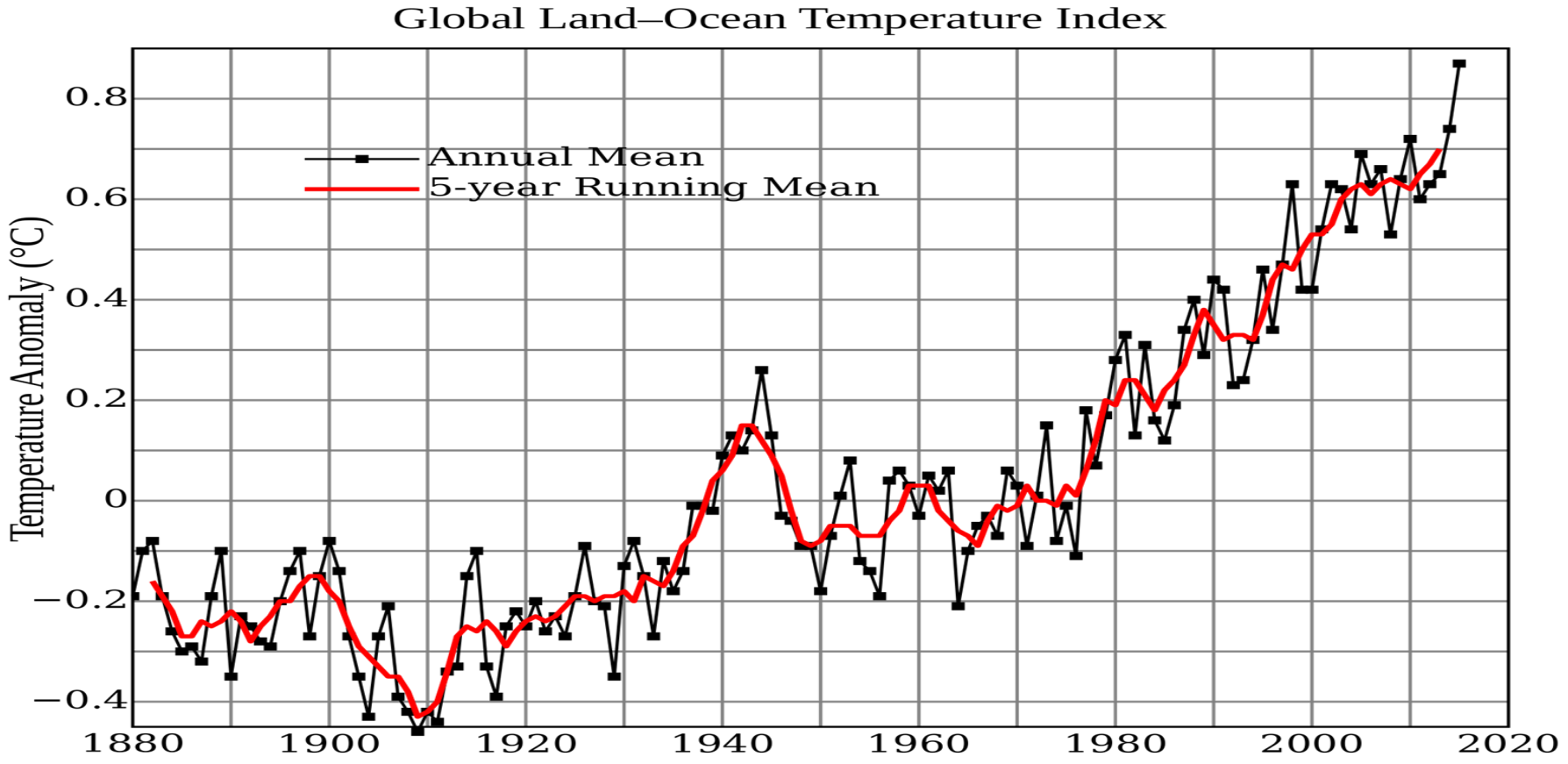
Life on Earth depends on the "**GREENHOUSE EFFECT**".

- Carbon dioxide, water vapor, and other gases **trap the heat** from the sun in our atmosphere.
- This warms the Earth and insulates it from the deep cold of space.

Carbon dioxide is a greenhouse gas, meaning that the increase of carbon dioxide also increases the greenhouse effect.

Over the past 150 years, earth's temperature has risen 1.4^{o} F,
leading to the current period of **Climate Change**.

Global Warming?



Climate Change

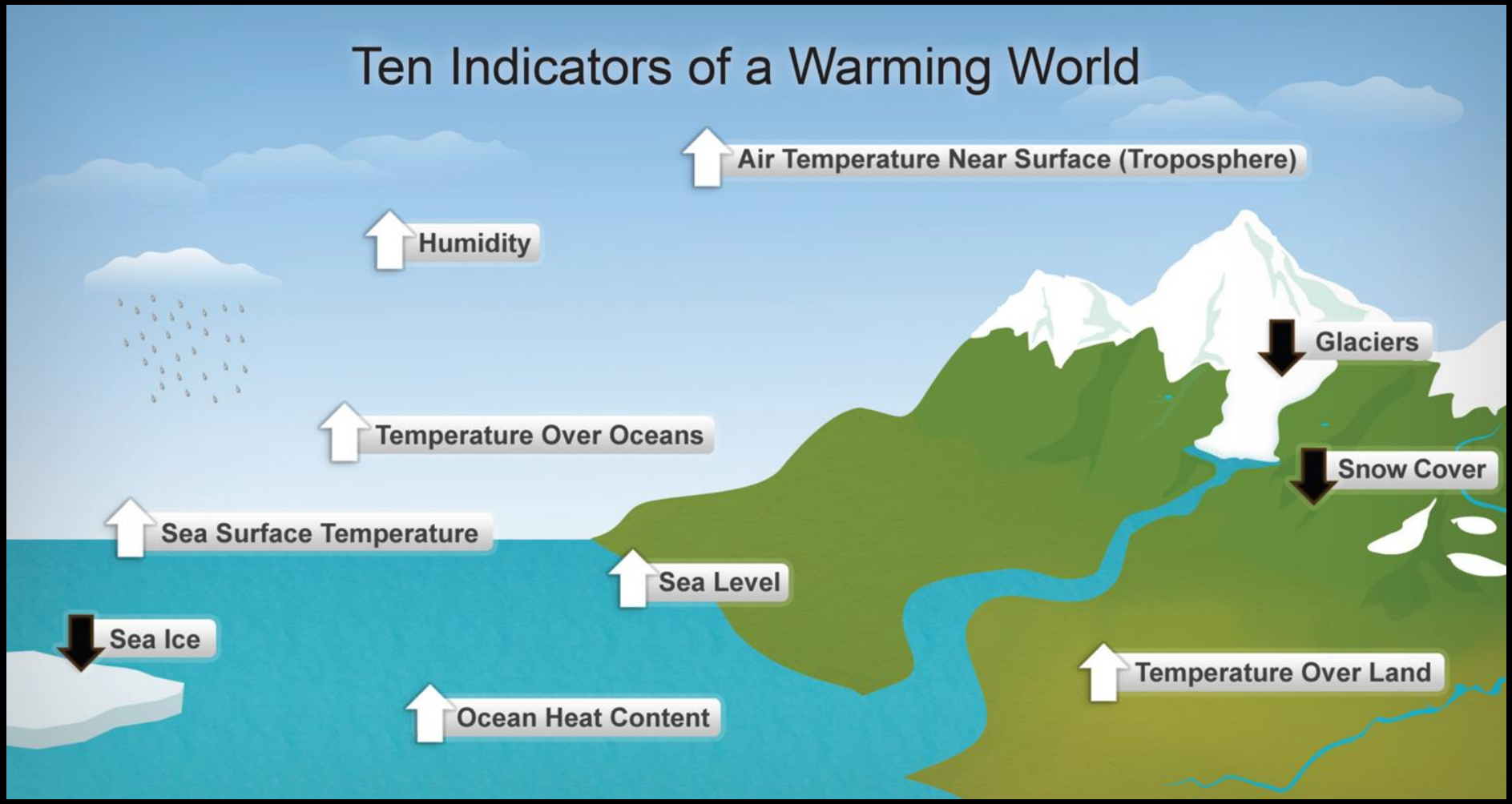
A 0.5°C increase in the average temperature of the biosphere in the past 120 years (abiotic factor).

- Some scientists believe the rising temperature may be due to natural variations in climate … volcanoes, fires.
- Others believe it is caused by human activities adding carbon dioxide and other greenhouse gases into the atmosphere, making the atmosphere retain more heat.
  - More carbon dioxide from burning fossil fuels, cutting down trees and burning forests.

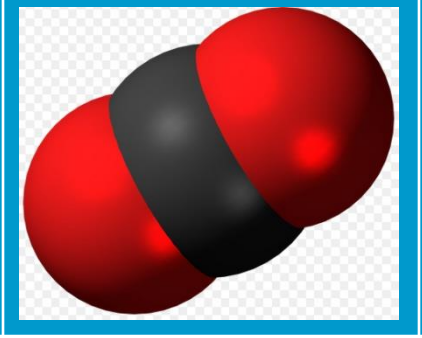
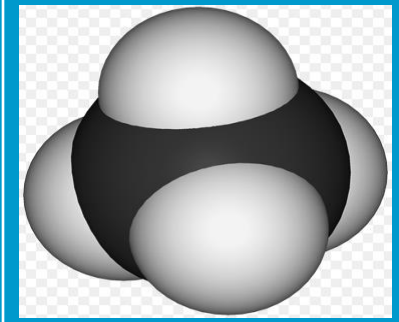
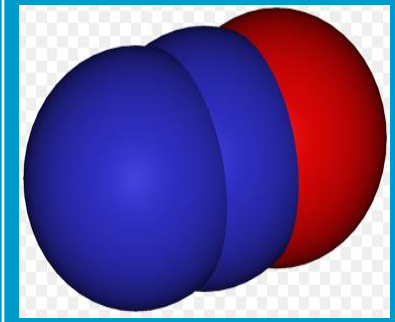
Global Warming Effects

- The **ocean** is the major absorber of CO_2. Warmer ocean water absorbs less CO_2.
- Polar icecaps melt adding freshwater to the oceans (*salt water*).
  - Ocean levels rise (removing land).
  - The different densities between salt & fresh water produces convection currents.
  - New ocean currents change weather patterns and form **severe weather.**
    - (*floods, typhoons, cyclones, tsunamis & droughts*).

Global Warming



GHG (Green House Gases)

Greenhouse Gas	Carbon Dioxide CO_2	Methane CH_4	Nitrous Oxide N_2O
			
Major "Man-made" Sources	• Burning Fossil Fuels • Deforestation	• Livestock • Manure • Landfills	• Fertilizer

Water and Ozone are also GHGs.

Global Warming → Climate Change

https://screenpal.com/watch/cq6VIEu6JC (2:24)

Nitrogen Cycle

Atmospheric Nitrogen (N_2) makes up nearly 78%-80% of air.

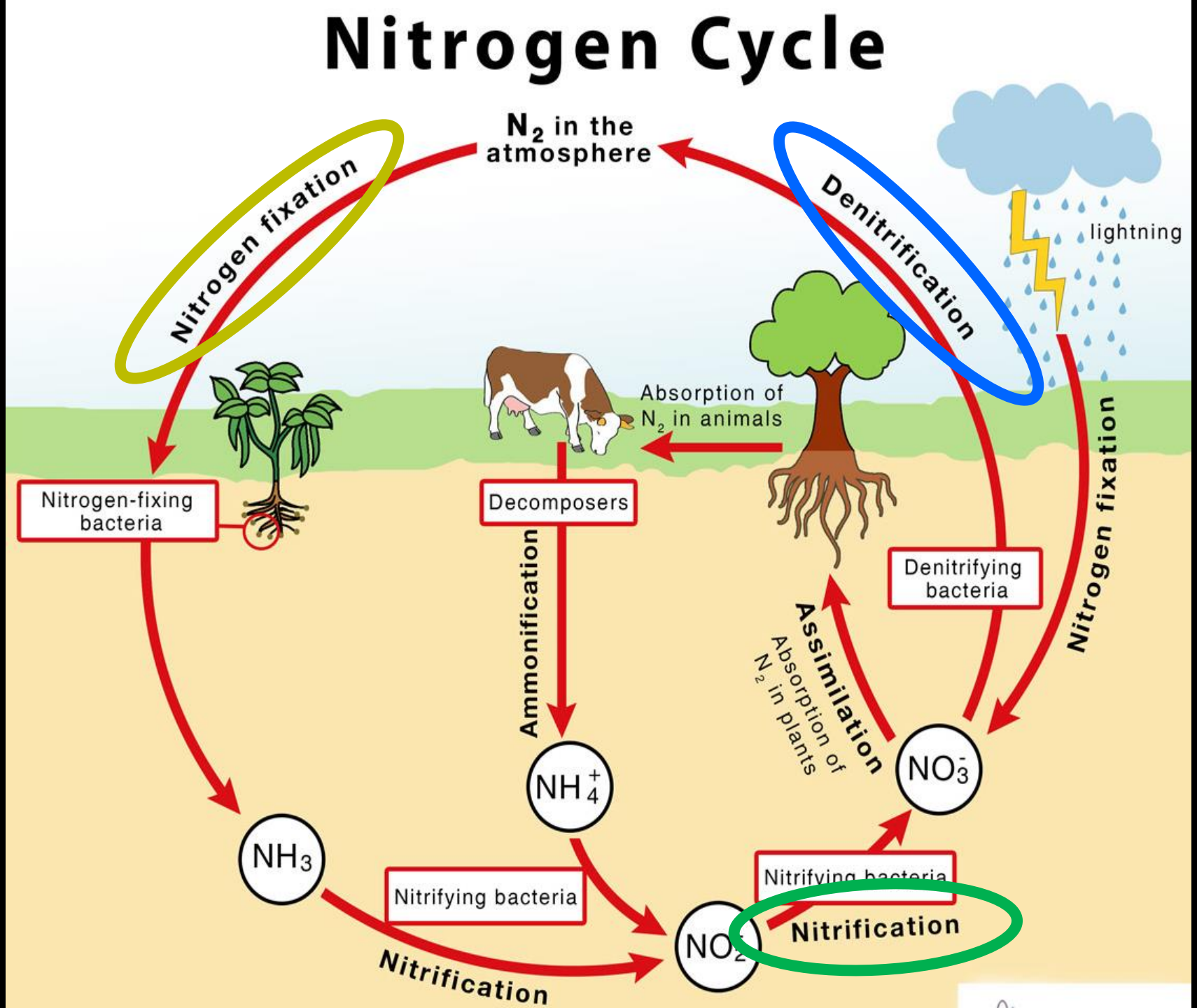
- Organisms cannot use it in that form.
- Bacteria are needed to:
  - convert nitrogen into usable forms.
  - to release it back to the atmosphere.

Bacteria "fix" it by producing ammonia (NH_3) → FIXATION.

Bacteria convert ammonia to Nitrites and nitrates that enters plants (Ex. Legumes) → "NITRIFICATION".

Animals get nitrogen by eating plants or other animals.

Bacteria also decompose organic matter and return Nitrogen back into the atmosphere → DENITRIFICATION.


Nitrogen Cycle
N_2 in the atmosphere
Nitrogen fixation
Denitrification
lightning
Absorption of N_2 in animals
Nitrogen-fixing bacteria
Decomposers
Ammonification
Denitrifying bacteria
Nitrogen fixation
Assimilation
Absorption of N_2 in plants
NH_4^+
NO_3^-
NH_3
Nitrifying bacteria
Nitrifying bacteria
NO_2^-
Nitrification
Nitrification

Community Ecology: Interactions

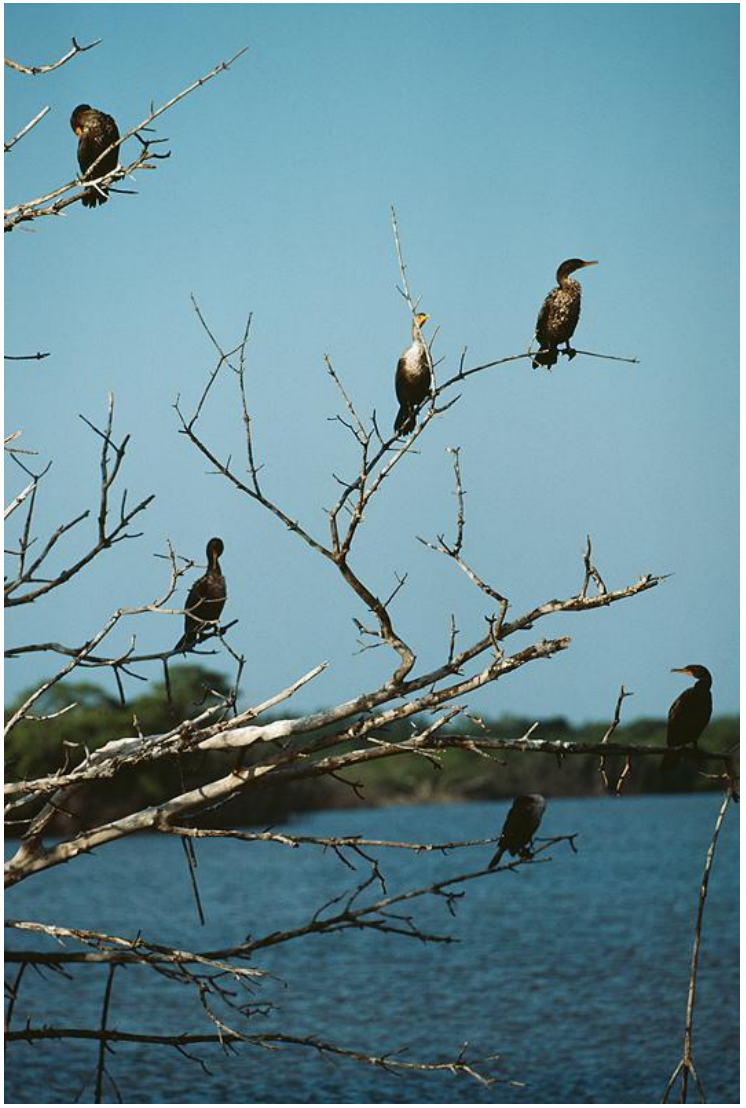
Community:

A community is all of the living organisms found in a particular area.

When organisms live in communities, they interact constantly and have a powerful effect on the ecosystem.

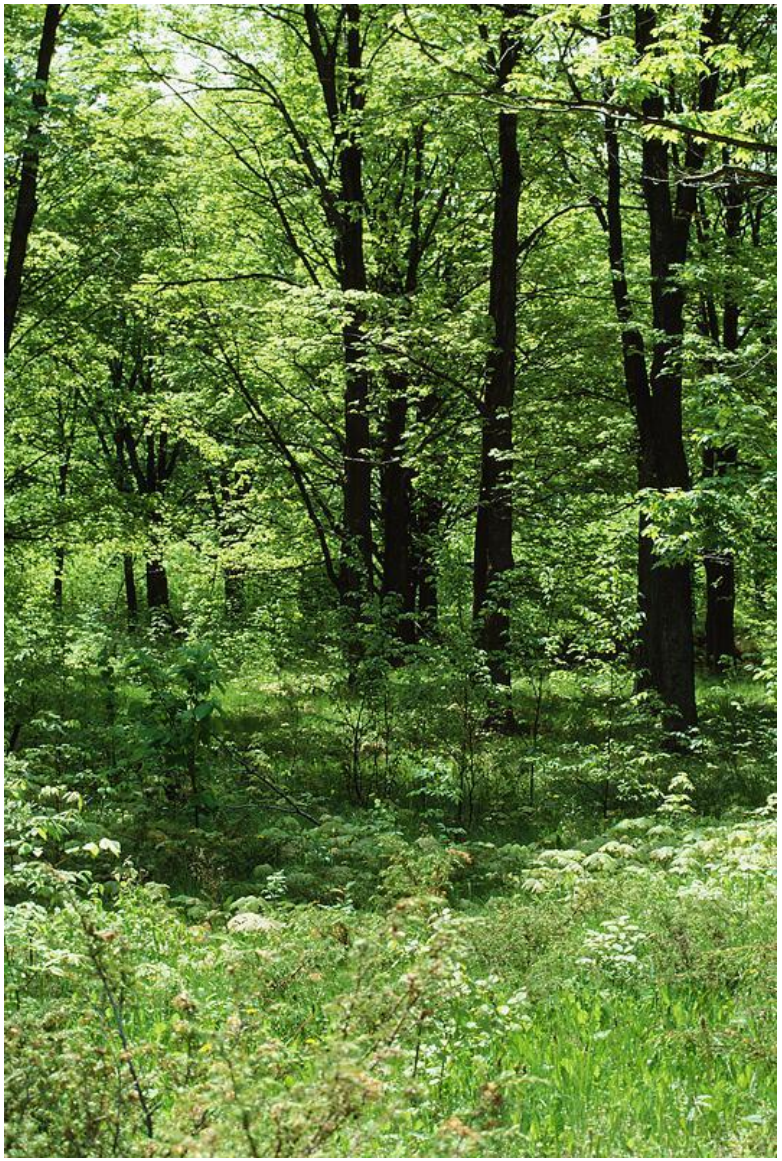
Different types of **Community Interactions** include:

1. **Competition**
2. **Predation**
3. **Symbiosis**
    a) **Mutualism**
    b) **Commensalism**
    c) **Parasitism**



Competition

Competition occurs when organisms of the same or different species attempt to use the same ecological resource in the same place at the same time.



Competition

Competition involves an interaction where two species require the same limited resource such as food, water, shelter, or sunlight.

A resource is an element needed for survival (food, water, shelter, or sunlight).

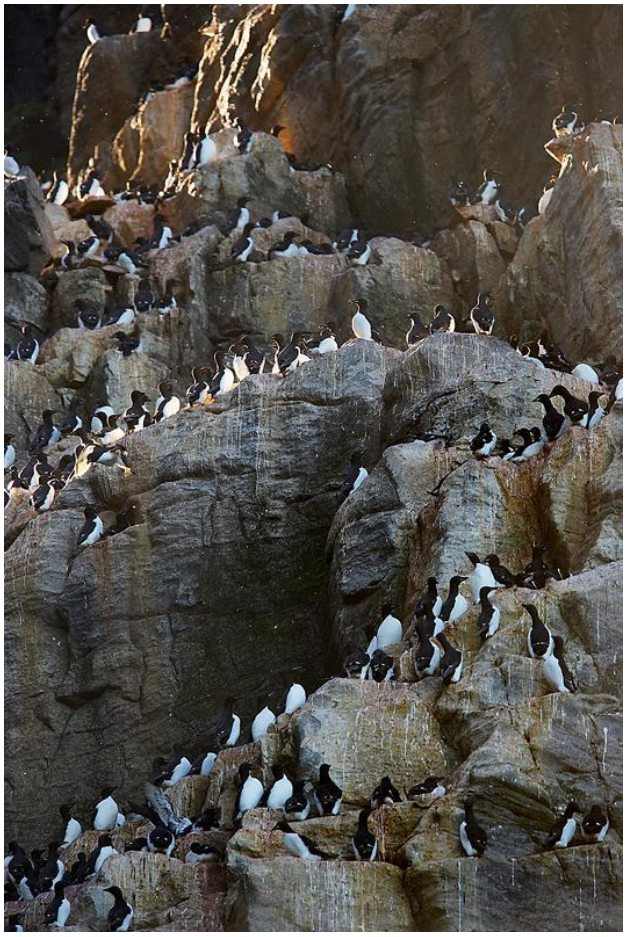
Food

Location

Sunlight

What is a Resource?

A resource refers to anything that is required for life.



Resources might include: food, water, light, nesting sites, or room to grow.

When organisms are competing for the same resource, there is often a winner and a loser.

The winner thrives and the loser fails to survive.

This is called the:
"Competitive Exclusion Principle".

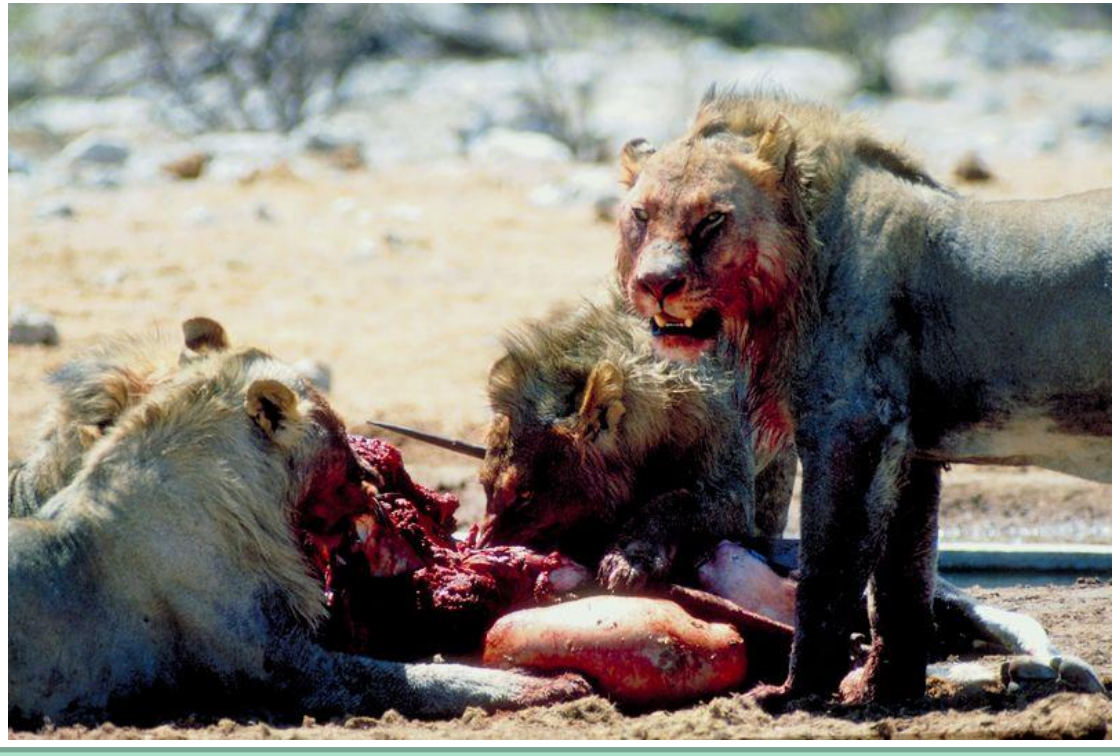
This invasive Kudzu→ smothers and strangles any other plant in its path.

COMPETITIVE EXCLUSION VS RESOURCE PARTITIONING

	Competitive Exclusion	Resource Partitioning
DEFINITION	Competitive exclusion principle tells us that two species can't have exactly the same niche in a habitat and stably coexist	Resource portioning is the division of the niche by species to avoid competition for resources
CO-EXISTENCE OF TWO SPECIES	Does not support the co-existence of two species competing for identical resources	Helps the species to coexist since it creates less direct competition between them

Predation

Predation is an interaction in which one organism captures and feeds on another organism.

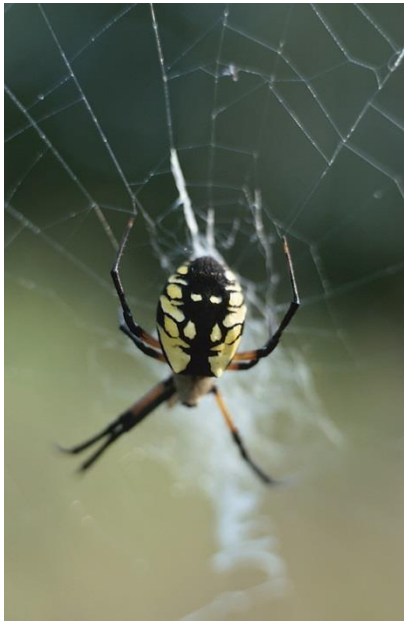


The predator is:
the organism that does the killing and eating.

The prey is:
the food organism.

Predation is a powerful force in the community. Predation determines relationships in food webs and is a very effective regulator of population size.

Predators have **tools** that make them **better predators**.



Examples: Snakes have heat sensitive pits to help them locate prey; Predators may have acute senses, fangs, claws, poison, stingers, and sharp teeth; Spiders have webs to catch their prey.

Prey must have, then, features that help them avoid being captured and eaten.

a) The prey may have the ability to ***run very fast to escape the predator.***

b) The prey may be ***camouflaged to avoid detection.***

c) The prey may have ***poisons that are advertised by bright warning colors.***

Herbivores are animals that eat plants. This makes the herbivore a predator on plants.

Many Plants also have features that protect them from being eaten by animals.

Plants and Herbivores

Plants may have:
sharp spines, thorns, sticky hairs, and tough leaves.

Plants may also produce:
chemical compounds that are poisonous, or bad tasting.

Predation

An interaction where one species kills and consumes another species for survival.

A lion kills and eats a zebra for food.

A snake kills and eats a mouse for food.

Symbiotic Relationships between Organisms

Symbiosis is *a close and permanent relationship between organisms of different species*.

There are three types of symbiotic relationships:

Mutualism

Commensalism

Parasitism

In **MUTUALISM** both species benefit from the relationship.

This bird eats the ticks on the back of the antelope.

Flowers and insects have a mutualistic relationship. The flower provides the insect with nectar, and the insect helps the flower to reproduce by spreading pollen.

Mutualism

A symbiotic relationship where both species benefit from the interaction.

Clown fish & Sea Anemone

Sparrow & Water Buffalo

Bee & Pollination

Commensalism

COMMENSALISM is the relationship between two different species in which one species benefits from the relationship. The other species is unaffected, neither harmed nor helped.

The large fish seen here is called a triggerfish. The triggerfish is able to move large rocks that create feeding opportunities for the smaller fish. There is no benefit to the triggerfish.

Barnacles are mollusks that attach to the skin of whales.

The barnacle does not **hurt** the whale nor does it **help** the whale.

The barnacle is a filter feeder and **benefits** from the constant flow of water. The whale doesn't even notice the barnacles.

Commensalism

A symbiotic relationship where one species benefits from the interaction and the other species is neither harmed nor helped.

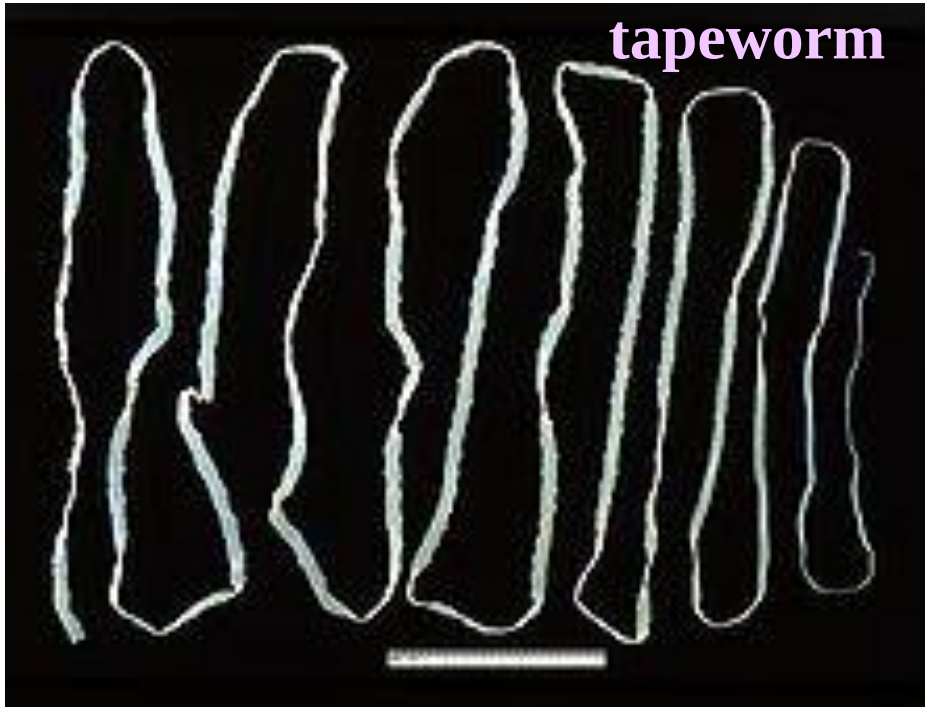
Barnacles attach to whales to catch food. Whales are unaffected.

A bird builds a nest in a tree for shelter. The tree is not affected.

Cattle graze & stir up insects for the egret to eat. Grazers are unaffected.

Parasitism

PARASITISM is the relationship between two different species in which one species is helped and the other species is harmed.

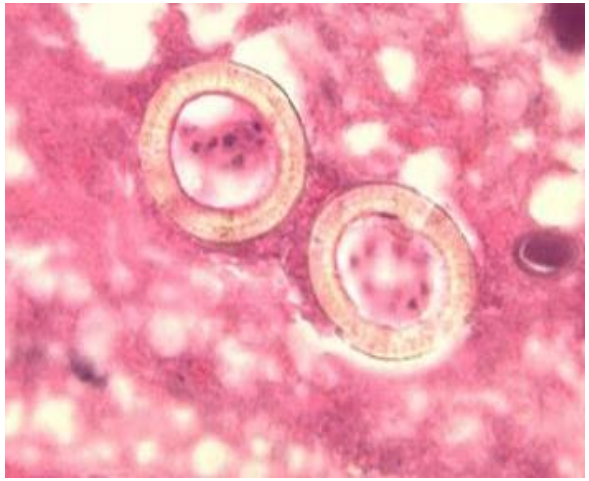


The parasite obtains its nutrition from the other organism, the host.

Parasitism

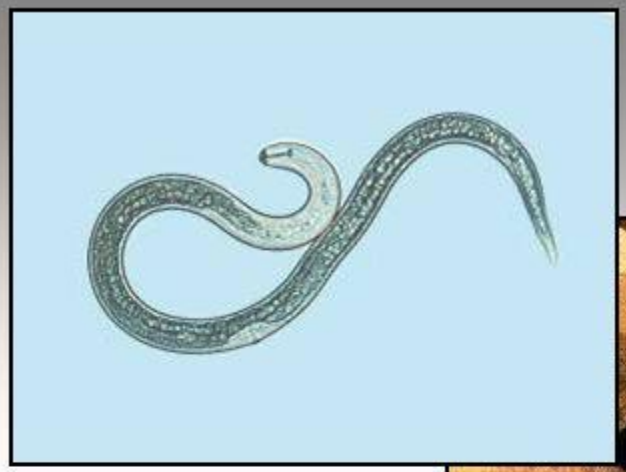
A symbiotic relationship where one species benefits from the relationship and the other species is harmed.

Fleas infest dogs, cats to gain shelter and food. The animal itches and loses blood.



Tapeworms live in human intestines stealing nutrients. The host gets sick due to lack of nutrition.

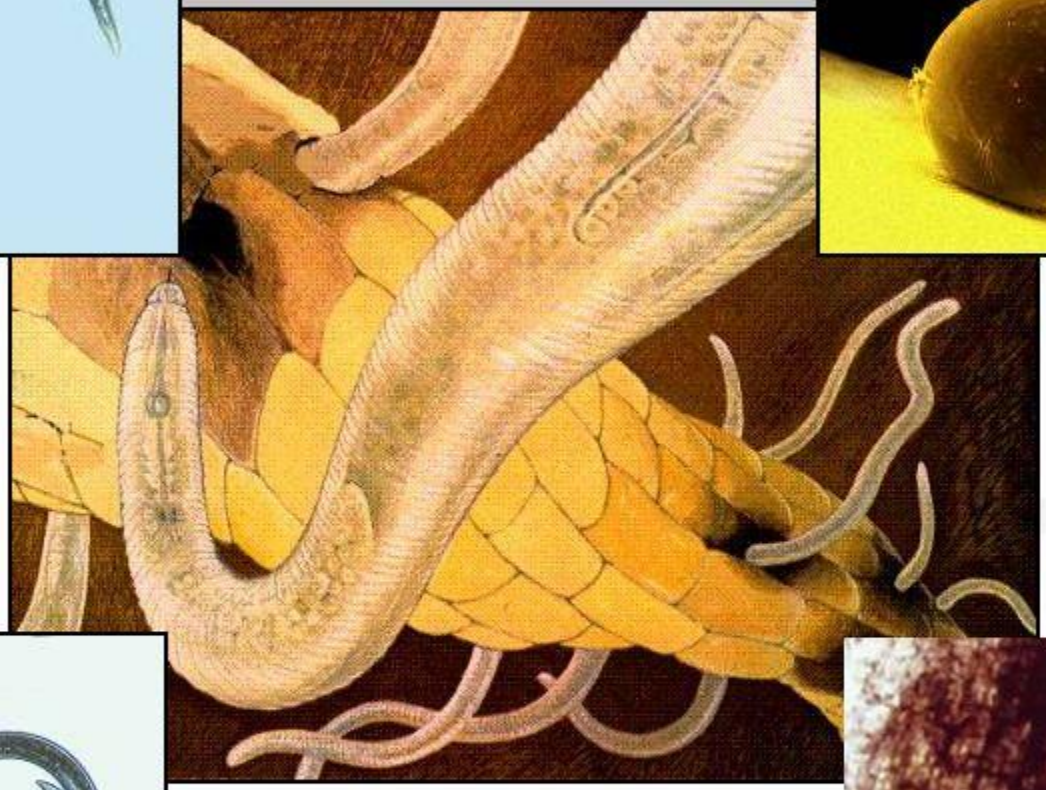
Mistletoe grows on tree trunks & branches by taking nutrients and making the tree vulnerable to disease.

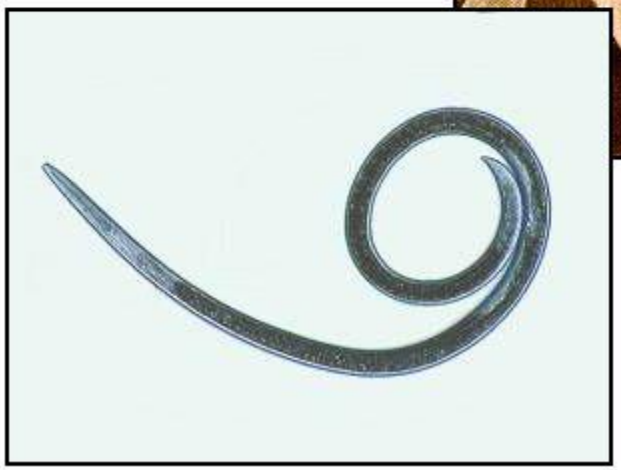


Root-lesion nematodes

ENDOPARASITES

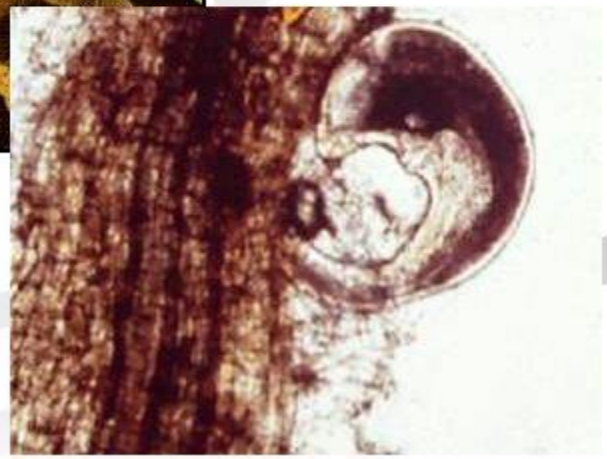
Root-knot nematodes





Dagger nematodes

ECTOPARASITES



Reniform nematodes

Ectoparasites (external) are organisms that live on the skin (outside the body) of a host, from which they derive their sustenance.

Examples: ticks, fleas, and lice.

Tick

Fleas

Lice

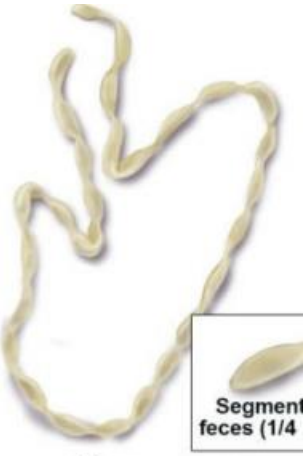
Endoparasites (internal) are organisms that live within the host's body.

Examples: some bacteria, some protists, and intestinal worms such as tapeworms.

Roundworm

Whipworm

Hookworm



Tapeworm

Organisms compete for …

QUICK CHECK

What type of symbiosis is shown?

What processes are needed related to nitrogen?

QUICK CHECK

Organisms compete for …

Food, location, sunlight

What type of symbiosis is shown?

Mutualism (birds are protected from predators and the crocodile eats some of their eggs.)

What processes are needed related to nitrogen?

Nitrogen fixation (N_2 to ammonia)

Denitrification (N_2 back to atmosphere)

Nitrification (nitrogen for plants)

Recall Interactions Among Organisms

QUICK CHECK

Identify the interaction described.

An interaction where one species benefits and the other species is neither harmed nor helped.

An interaction where both species benefit.

An interaction where one species benefits and the other species is harmed.

Humans release carbon dioxide, which is needed by plants; in return plant provide oxygen, which is needed by humans.

Tapeworms enter the intestines of a human through contaminated water; the tapeworm steals nutrients from the human.

Remora sharks attach themselves to whales by way of an adhesive disk on their dorsal surface; the remora sharks then feed off of the scraps from the whale's meals.

Recall Interactions Among Organisms

QUICK CHECK

Identify the interaction described.

An interaction where one species benefits and the other species is neither harmed nor helped.

commensalism

An interaction where both species benefit. **mutualism**

An interaction where one species benefits and the other species is harmed.

parasitism

Humans release carbon dioxide, which is needed by plants; in return plant provide oxygen, which is needed by humans. **mutualism**

Tapeworms enter the intestines of a human through contaminated water; the tapeworm steals nutrients from the human. **parasitism**

Remora sharks attach themselves to whales by way of an adhesive disk on their dorsal surface; the remora sharks then feed off of the scraps from the whale's meals.

commensalism

Ecological Succession

- A gradual change in the types of species that live in a community.
- Can be primary or secondary.
- Both types occur by the gradual replacement of one plant community by another through natural processes over time.

Primary Succession

Begins in a place without any soil ("Bare Rock");

- E.g.,After Volcano Eruptions

Pioneer Species: First to colonize the area.

- First, lichens (do not need soil to survive) grow on rocks.
- Next, mosses grow to hold newly made soil.

Pioneer Species

Lichens break down rock to form soil; when they die and decompose they add organic material to soil.

Moss traps moisture and prevents soil erosion.

Primary Succession – Surtsey Island (Iceland)

Primary Succession

The soil layer thickens, and grasses, wildflowers, and other plants begin to take over.

These plants die, and they add more. nutrients to the soil

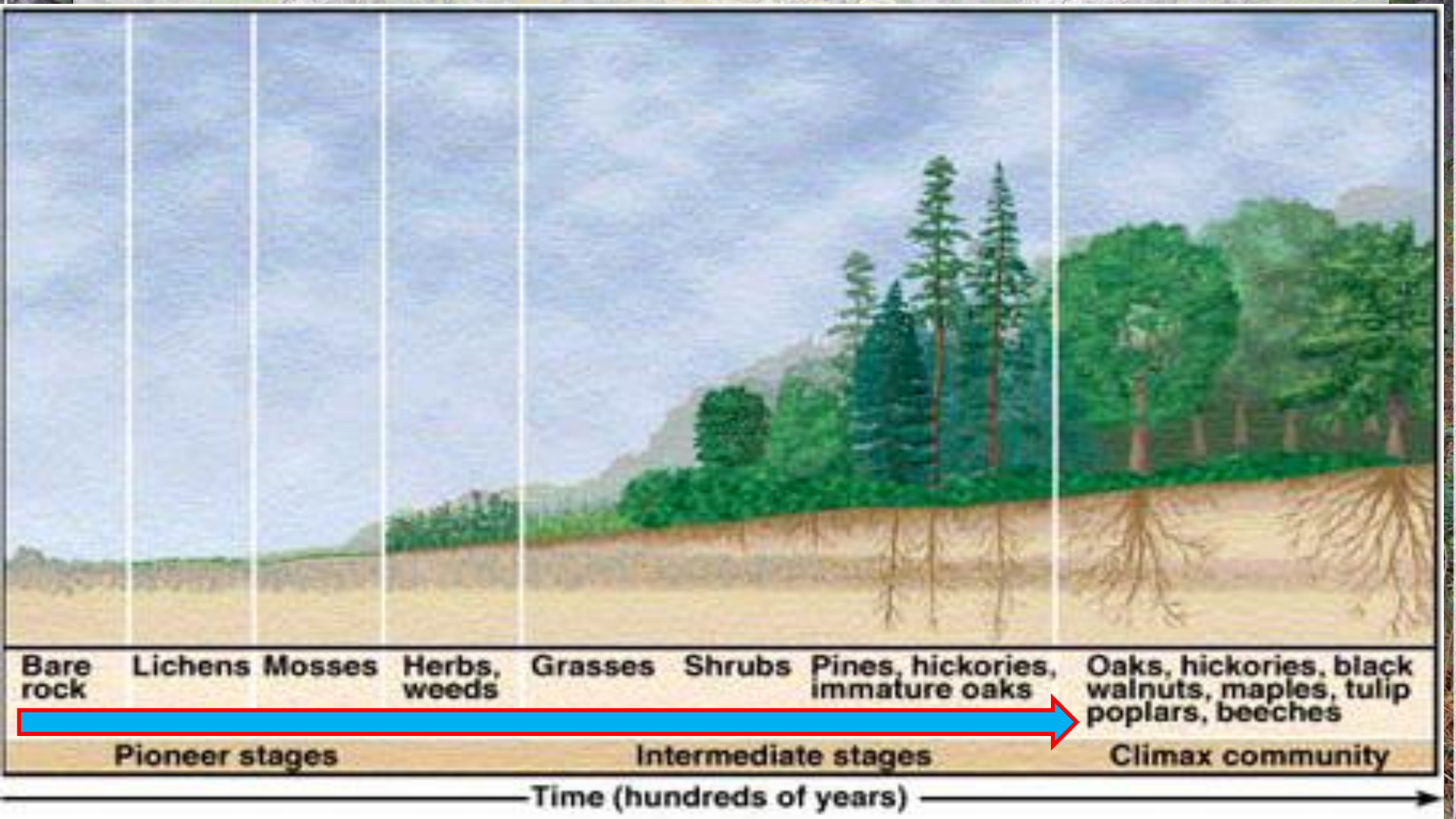
Shrubs and trees can survive now.

Primary Succession

Insects, small birds, and mammals have begun to move into the area.

What was once bare rock, now supports a variety of life.

Primary Succession



SECONDARY Succession

- Begins in a place that already has soil and was once the home of living organisms.
- Community has been disturbed, but not destroyed.
- Occurs faster and has different pioneer species than primary succession
- Example: After Forest Fires.

SECONDARY Succession

Secondary succession can be described as the colonization of a habitat that once supported plant and animal life but was abandoned due to ecological disturbance.

Types of ecological disturbances such as hurricanes and floods can empty a habitat.

CLIMAX COMMUNITY

A stable group of plants and animals that is the END result of the succession process.

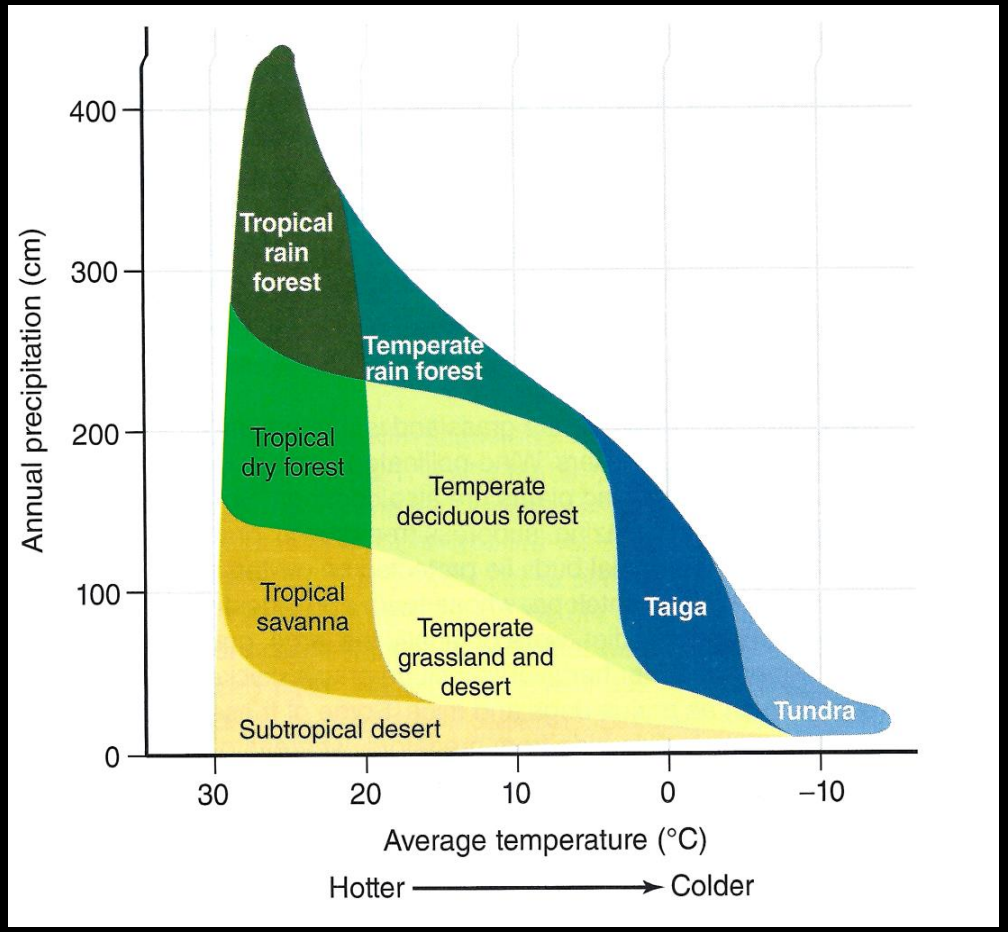
Does not always mean big trees, but can be Grasses in prairies and Cacti in deserts.

Communities and Ecosystems

Community: group of interacting populations

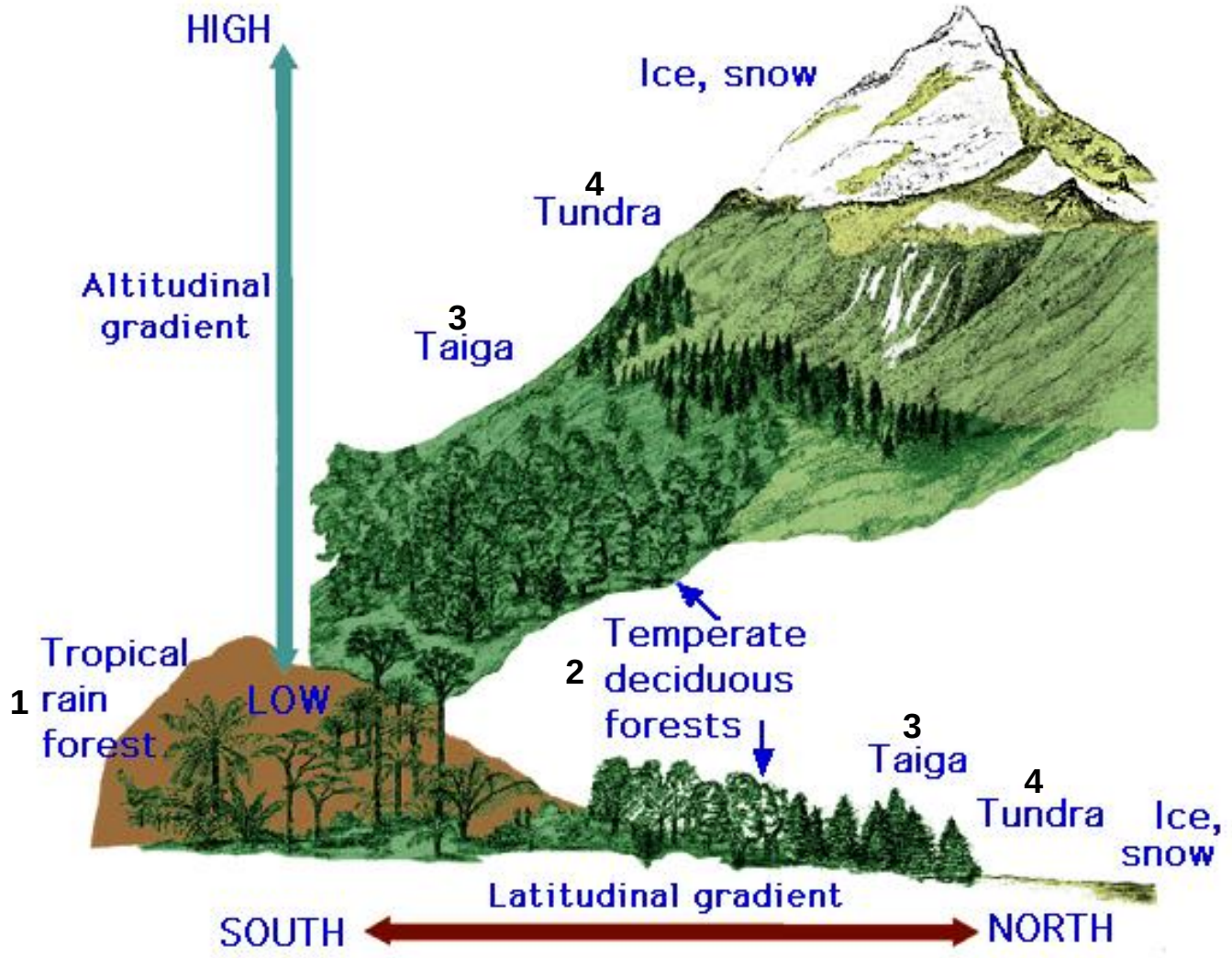
Ecosystem: Biotic Community + the Abiotic or nonliving environment.

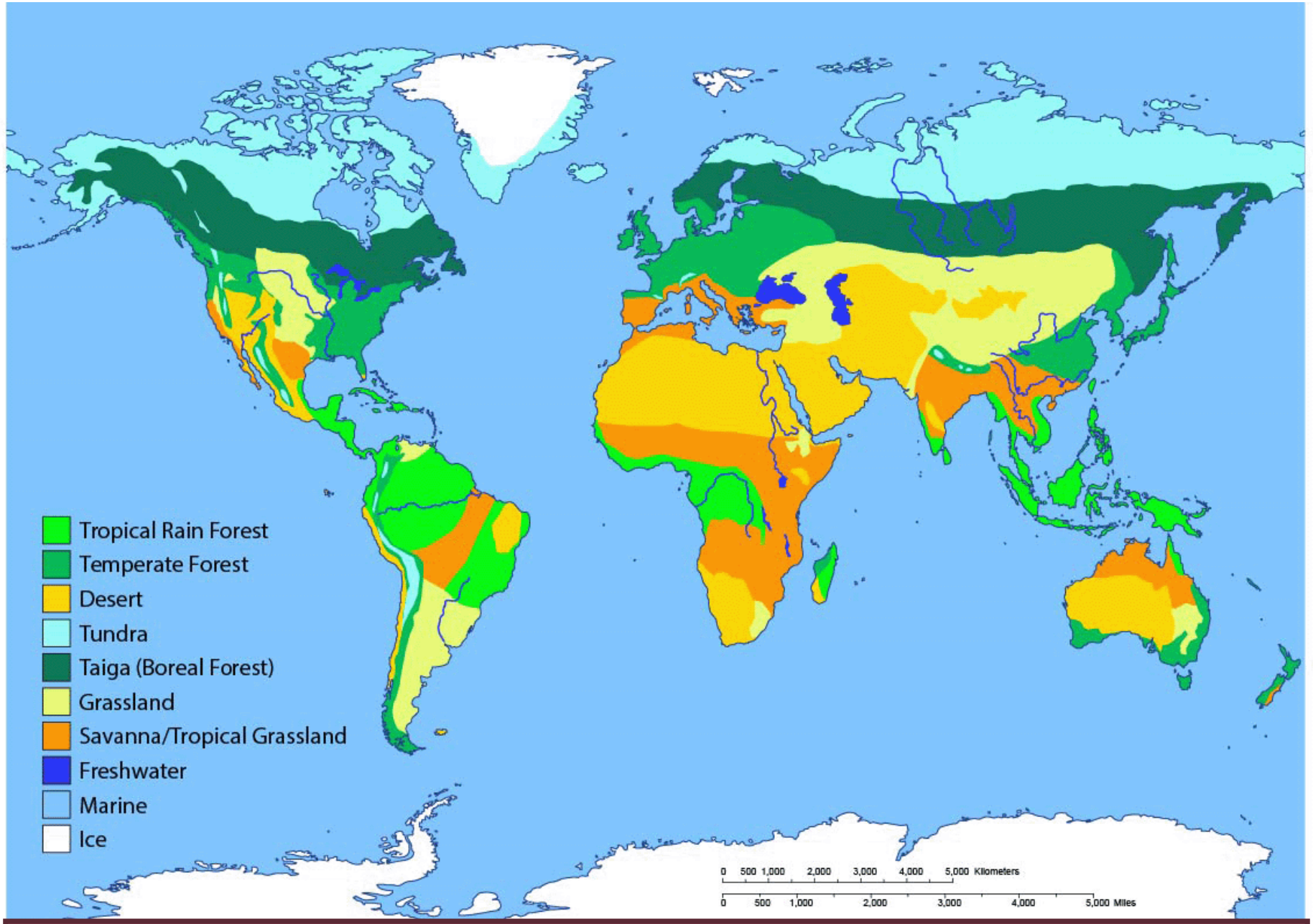
Biomes: Major types of Ecosystems that occupy large geographic areas and share a characteristic climate and group of species.



World Biomes

A biome is a **CLIMAX COMMUNITY** of plant and animal life that is typical for a broad region with one kind of climate:





World Biomes

Tropical Rainforest

Rainfall: 600 cm/year. Average Temperature 25º C.

(Located at the equator) lush with tropical plants, trees, rivers, streams and rich, fertile soil. Most of the trees in the tropical rainforest keep their leaves.

Contain 50% of all plant and animal species on earth.

Temperate Deciduous Forest

Rainfall: 100 cm/year. Temperature Range 30º C to -30º C.

These forests have FOUR distinct seasons – as compared with the tropical rainforest – with many evergreen and deciduous trees, which are trees that shed their leaves in the fall and winter.

Cold winters and warm summers support a variety of bird and animal life including bears that hibernate during the winter months, deer, elk, squirrels, foxes, wolves, coyotes and other small mammals.

Taiga (Boreal Forest)

Rainfall: 60 cm/year. Average Temperature 0º C.

Also called boreal forests.

As the LARGEST of the seven LAND biomes, taiga consists mostly of conifers like fir, pine and cedar with needle-shaped leaves that stay green most of the year.

Long, cold winters force migratory birds south and mammals to develop thick, white coats in the winter.

Trees block sunlight to forest floor … only lichens and moss can grow.

Desert

Rainfall: 25 cm/year. Average Temperature 25º C.

The desert biome is best known for its hot, dry summers and cold winters. Most deserts receive little rainfall, and some of the plants evolved to retain water to thrive.

Cacti developed spines to protect their fleshy hulls that store water for those arid months. Snakes, lizards and other cold-blooded reptiles winter underground only to come out when the weather turns warm.

Grasslands

Rainfall: 25-75 cm/year. Temperature Range 20º C to 30º C.

Represent the great prairies or plains dominated by grasses, treeless plains and large herds of grazing animals like buffalo, bison or deer in the United States.

Enough rain falls to keep grasses and herbs growing, but dry summers and fires keep trees from taking hold.

Savanna

Rainfall: 50-130 cm/year. Temperature Range 10º C to 30º C.

Unlike grasslands, savannas receive enough rain to support trees in groups or dotted throughout the environment. But they do form canopies (no forests).

Rainy season lasts up to 8 months. Dry season brings drought.

Tundra

Rainfall: 25 cm/year. Average Temperature -12º C.

Large swaths of land marked by flat, cold plains support low grasses, plants and green moss in the summer.

Much of the tundra includes PERMAFROST – frozen ground – just beneath the ground's surface. Mice and other small creatures go underground during winter freezes.

Desert TRY IT	Are very dense, warm and wet forests. This biome is home to millions of plants and animals. This rainforest is divided into 4 layers – *emergent, canopy, understory* and *forest floor*. This biome is endangered.
Taiga/Coniferous Forest	Is a forest in a cool, rainy area. It has warm summers and cold winters (often snowy) This biome has 4 different seasons – Summer, Winter, Autumn and Spring. Many people live in this biome. A wide variety of mammals, birds, insects, and reptiles can be found in the deciduous forest biome.
Tundra	Is found on every continent except Antarctica. Occurs when rainfall is very low. Has regular droughts followed by very hot temperatures. Mainly used for farm land to grow crops. There are very few trees and shrubs There are many different words for this biome they include: savannas, pampas, campos, plains, steppes, prairies and veldts.
Grasslands (Savanna, Prairie)	Is the coldest of all the biomes. It means 'treeless plains' and includes Antarctica, the Arctic Circle and very high alpine mountain areas. This biome has very cold temperatures, high winds and heavy snowfall. Plants grow low to the ground.
Tropical Rainforests	The driest biome which covers about 1/3 of the Earth's surface. Hot and dry environment with very little rain and extreme temperatures. It can get very hot during the day and very cold during the night. Plants and animals have to adapt to cope with the lack of water, extreme temperatures and lack of food. Plants can include cacti and animals include reptiles, birds and small mammals. Not very large mammals live here.
Decidicous Forests	Is the largest land biome. Cold, harsh climate. Low rainfall and snow. Very cold and long winters. Animals include wolves, bears and huskies. Plants include coniferous (Christmas) trees, pines, shrubs and fir trees.



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Marine Biomes

The marine biome is **the world's largest biome, covering three-quarters of the earth's surface**.

The types of ecosystems found in this biome are **oceans**, **coral reefs**, and **estuaries**; all are saltwater environments.

oceans

coral reefs

estuaries

Population Ecology: Characteristics

POPULATION:

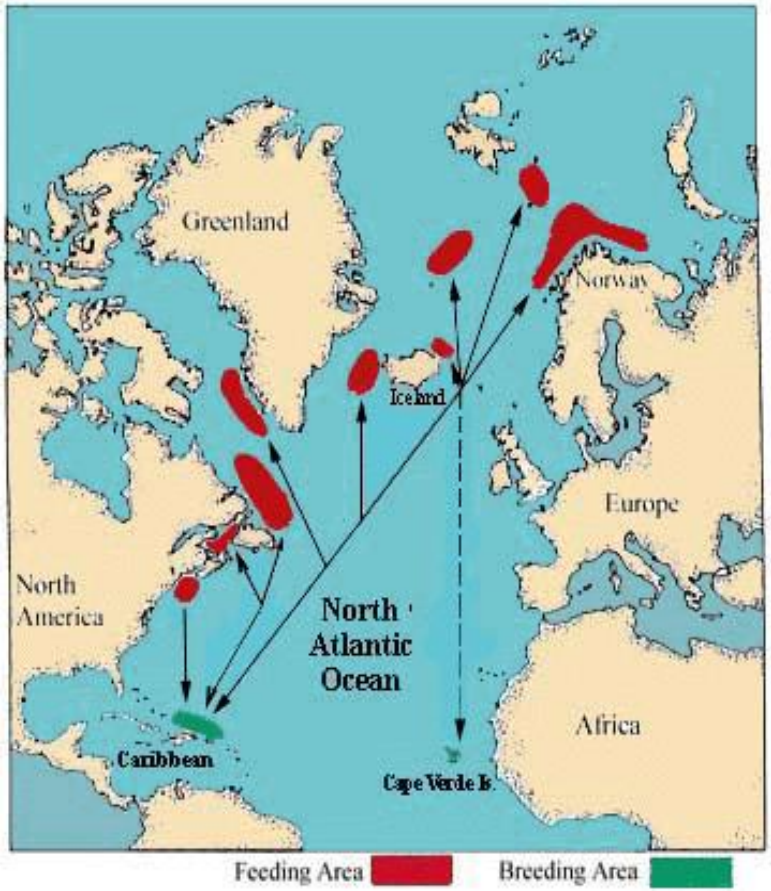
A group of individuals of the same species that live in the same area at the same time

Important characteristics of a population →

1. Geographic Distribution
2. Density
3. Growth Rate
4. Age Structure

1. Geographic DISTRIBUTION
is *the range of the population.*

The "RANGE" is the area that is inhabited by the population.



The range can vary in **size**. It may be just a few centimeters, such as the mold on a piece of bread.

Or the range may be huge, such as the migration area of whales.

2. Population DENSITY

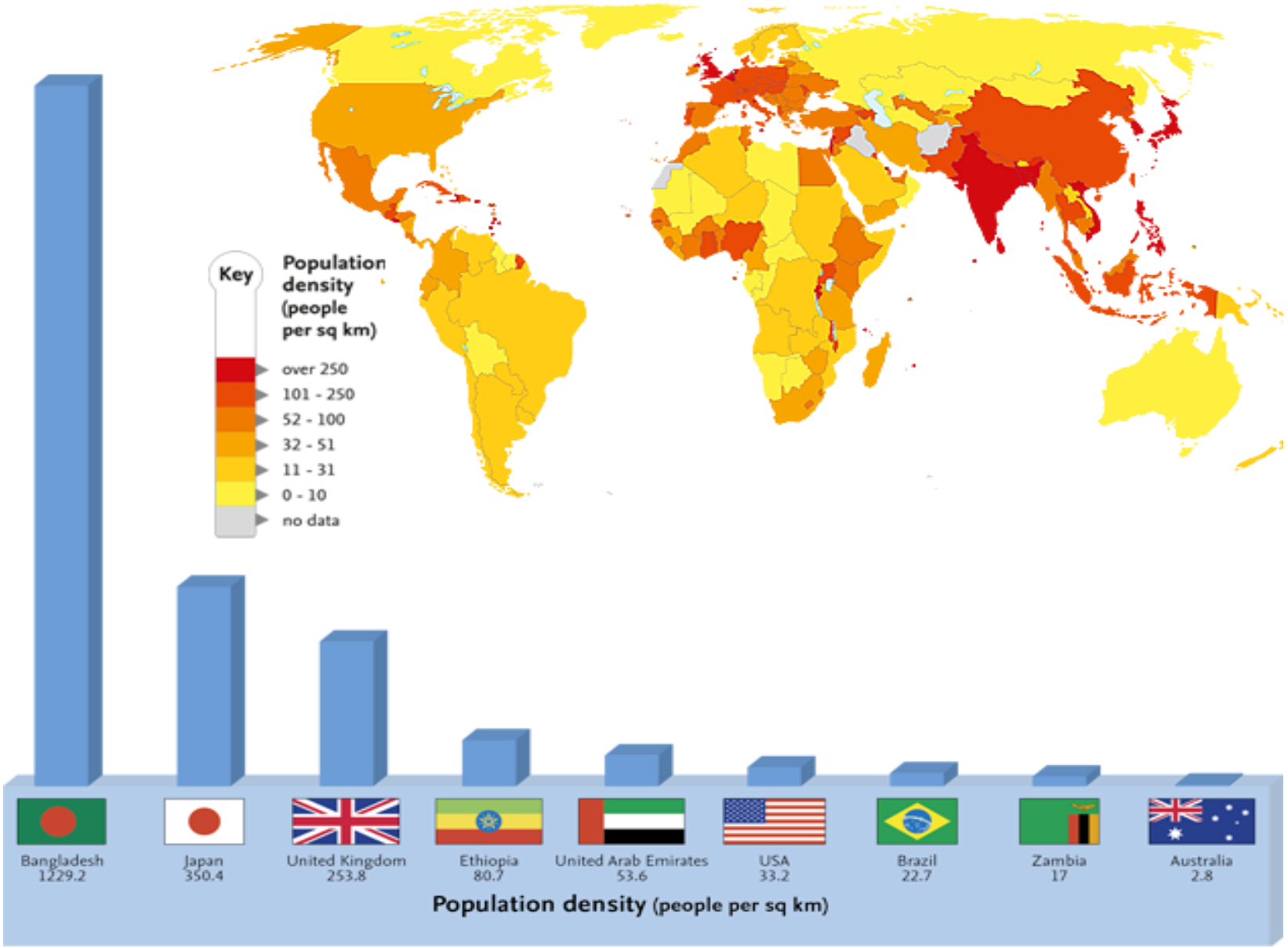
Population Density is: **the number of individuals per unit area**.

Density is one of the main characteristics that describes a population.

Density varies on the **species** and the **ecosystem**.

Some populations have **low** densities, while other populations have **high** densities.

World Population Density



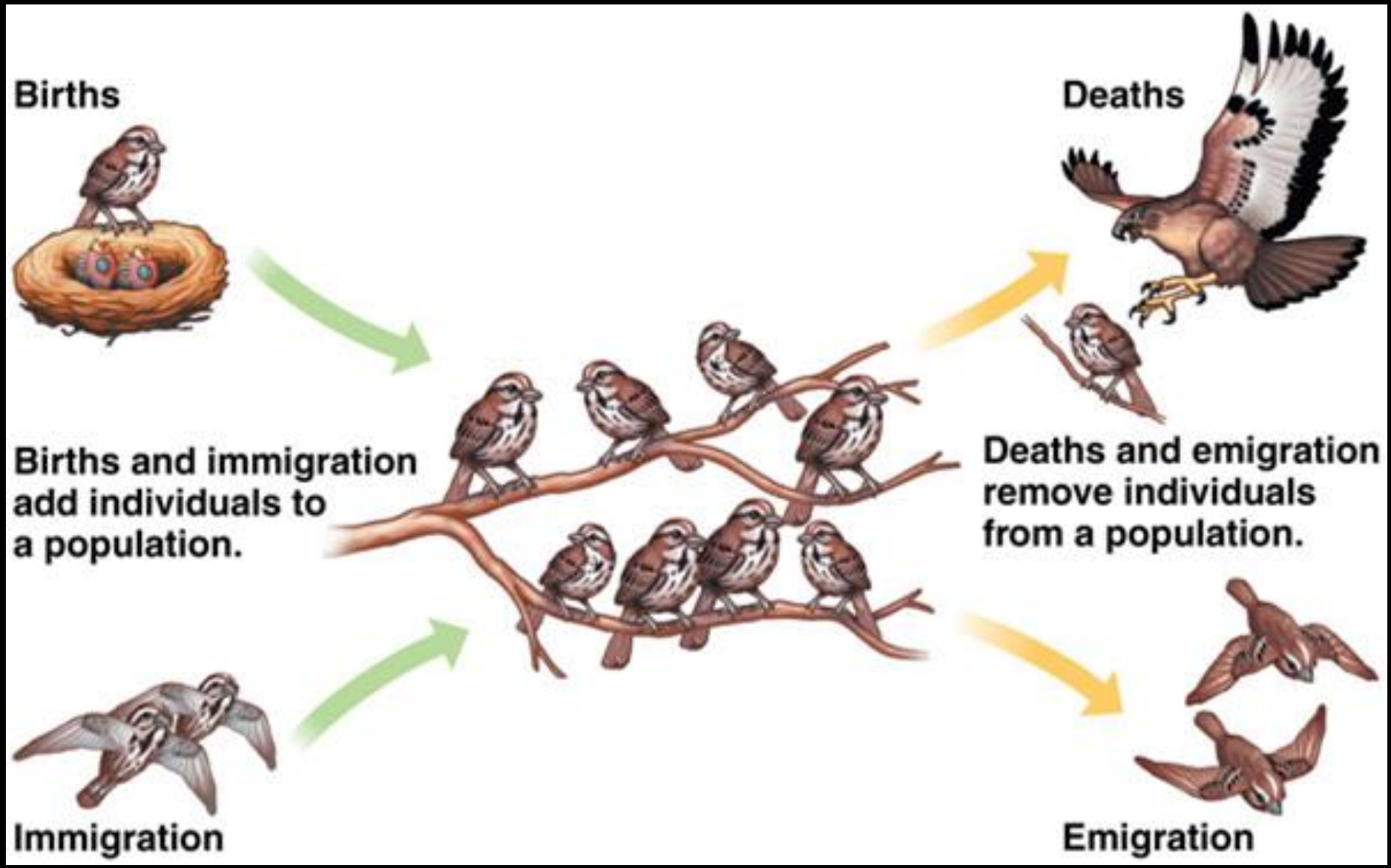
3. Population GROWTH

Some populations grow, others remain stable, and other decline

Population size is affected by:

- Number of Births
- Number of Deaths
- Number of individuals that enter or leave the population:
  - Immigration = movement of individuals into area (growth).
  - Emigration = movement of individuals out of population (decline) to find food, shelter, or safety.

Population Growth

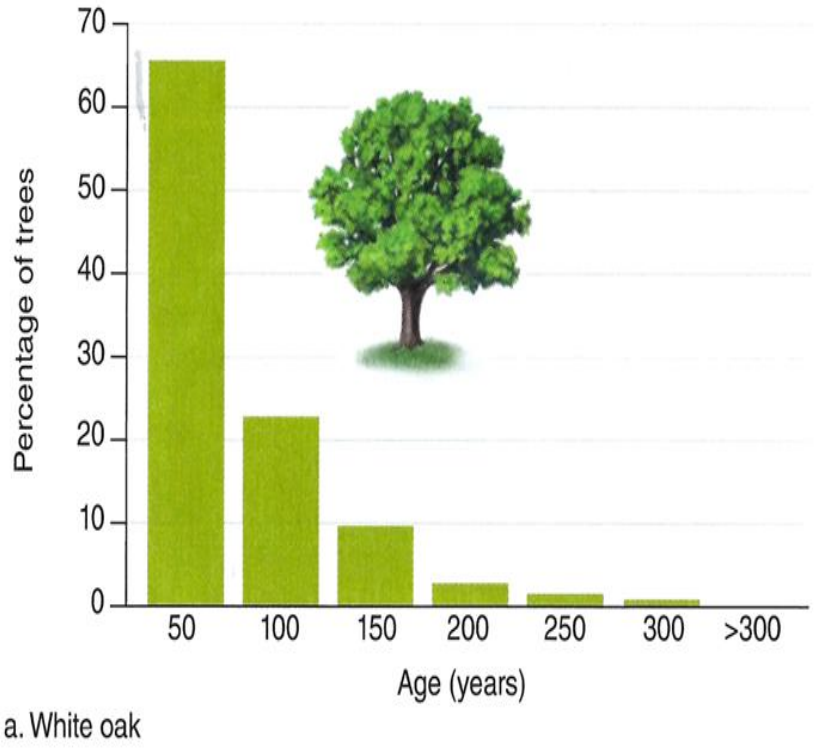


4. Population AGE Structure

A Population's Age Structure (distribution of age classes), helps determine whether it is growing, stable, or declining.

- Population dominated by younger individuals indicates high potential for future growth.
- Population dominated by older individuals will be stable, or may even decline.

Population AGE Structure



a. White oak

b. Cottonwood

Figure 18.3 **Age Structures.** (a) This white oak population is dominated by younger individuals, indicating high potential for future growth. (b) This population of cottonwoods has few individuals in the youngest age classes. Lacking young trees, the population may not survive.

Population AGE Structure

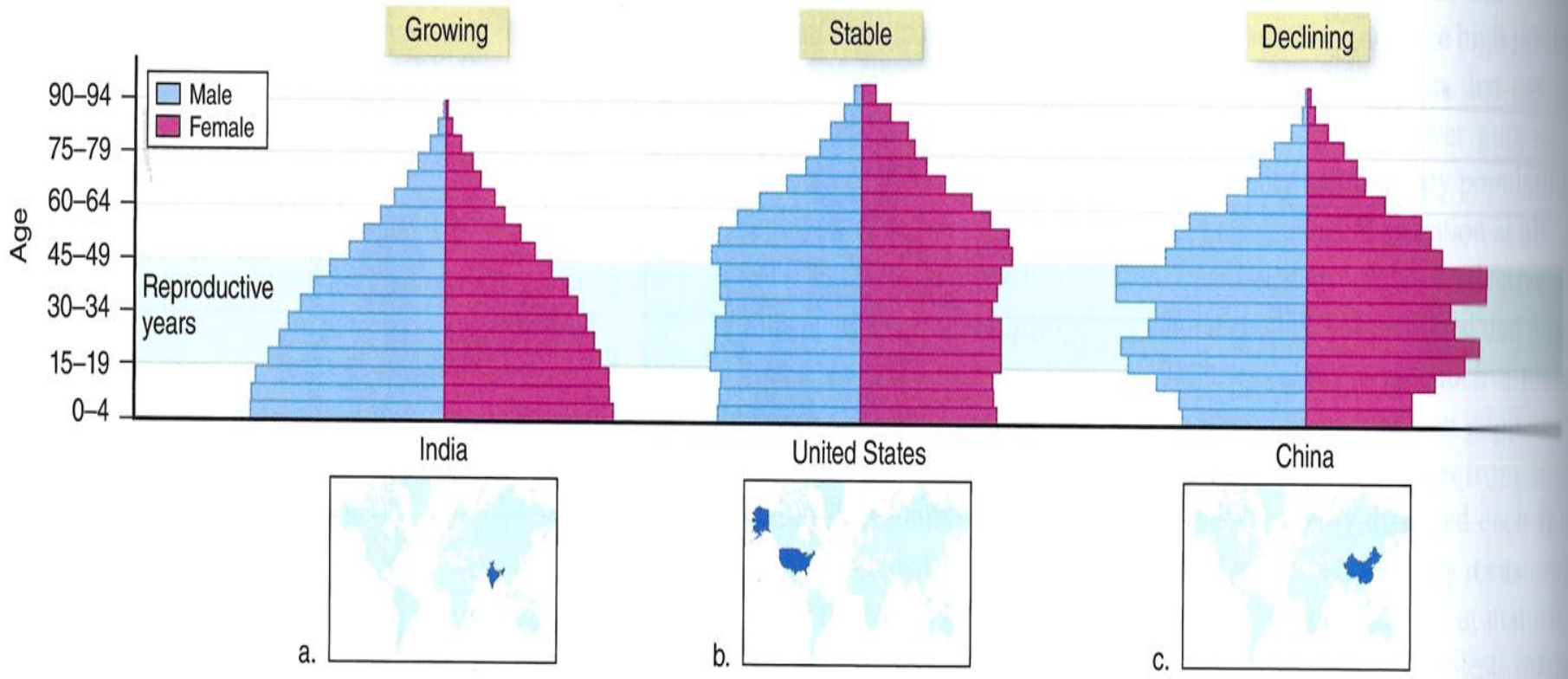


Figure 18.16 **Age Structures for Three Human Populations.** In age structure diagrams, the width of each bar is proportional to the percent of individuals in that age class. (a) India's population is likely to continue to grow because a high proportion of individuals are in prereproductive age classes. (b) The population of the United States is stable, with roughly equal numbers of people in each age group. (c) China's future growth rate should decline because most of its members are in reproductive or postreproductive age classes. (Data from U.S. Census Bureau, International Data Base.)

An ECOLOGICAL FOOTPRINT is a measure of Resource Consumption

The U.S. Census Bureau projects a global population of

- 8.5 billion people within the next 15 years.
- 9.5 billion by the mid-21st century.

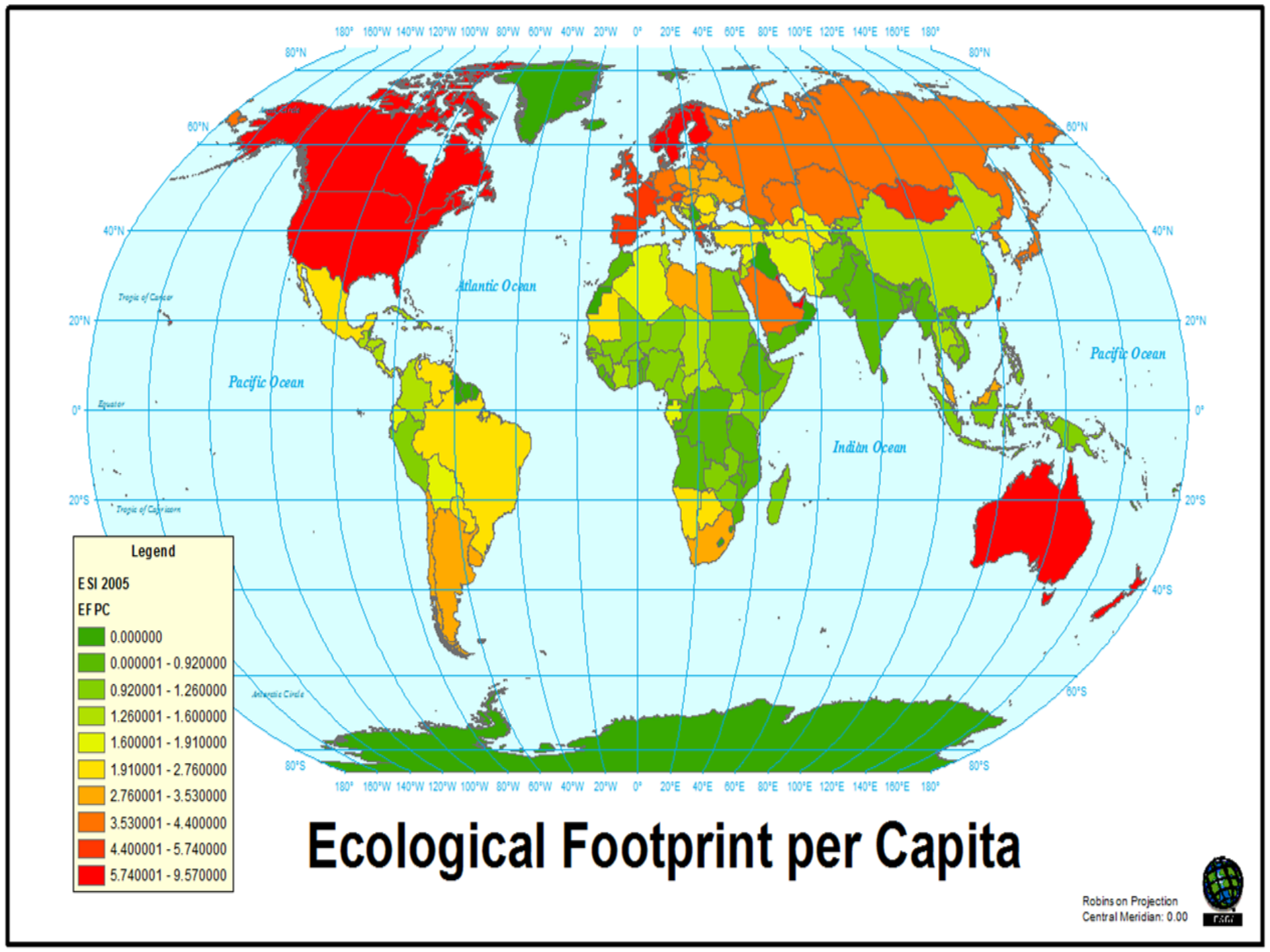
Do we have sufficient resources to sustain 8+ or 9+ billion people?

To accommodate all the people expected to live on our planet by 2025, the world will have to *double* food production.

An Ecological Footprint is a measure of Resource Consumption

An **Ecological Footprint** is an estimate of the amount of land required to provide the raw materials an individual or a nation consumes, including food, fuel, and housing.

Many activities impact our Footprint. If everyone lived like you, we'd need 5.6 Planet Earths to provide enough resources.



Ecological Footprint per Capita

An Ecological Footprint is a measure of Resource Consumption

The growing demand of the human population for food, fibers, and water has largely been satisfied at the expense of other ecosystem services, but these practices cannot continue indefinitely.

SUSTAINABILITY is the goal of developing, managing, and conserving Earth's resources in ways that meet the needs of people today without compromising the ability of future generations to meet theirs.

Survivorship Curves

Show the probability of dying at a given age.

Graphs data that shows the number of survivors remaining in a population at each age.

Fall into 3 patterns that reflect the balance between number of offspring and the amount of parental care for each.

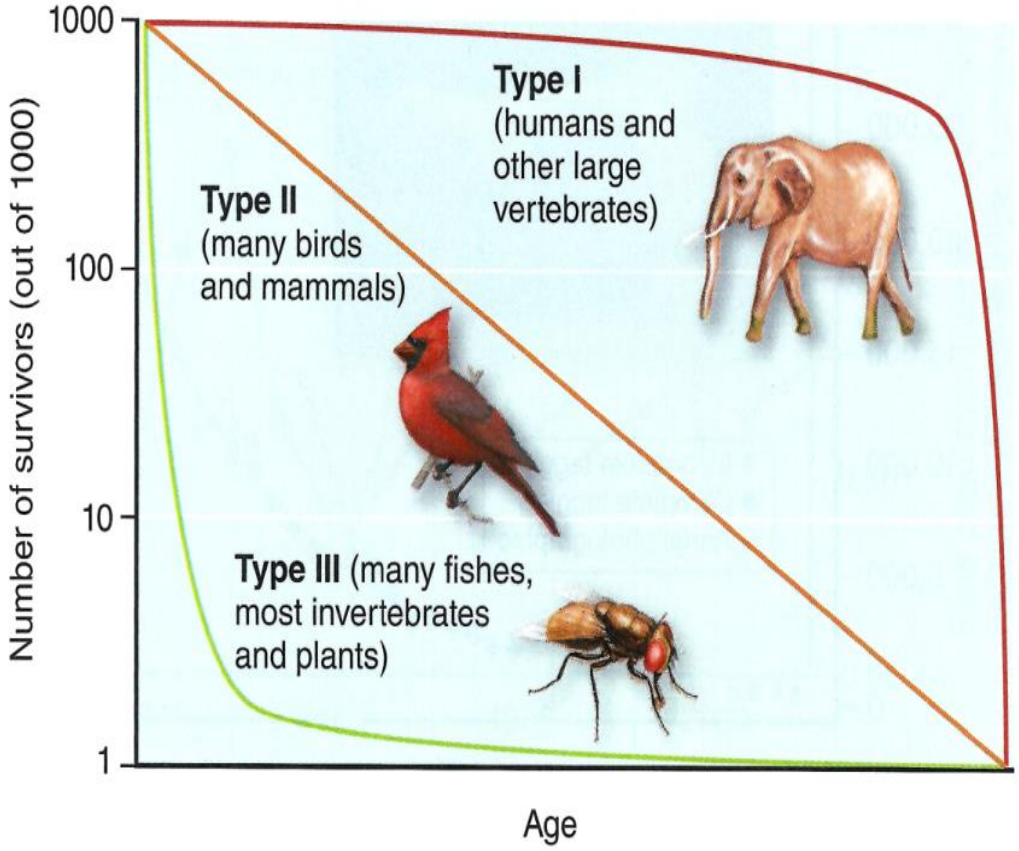
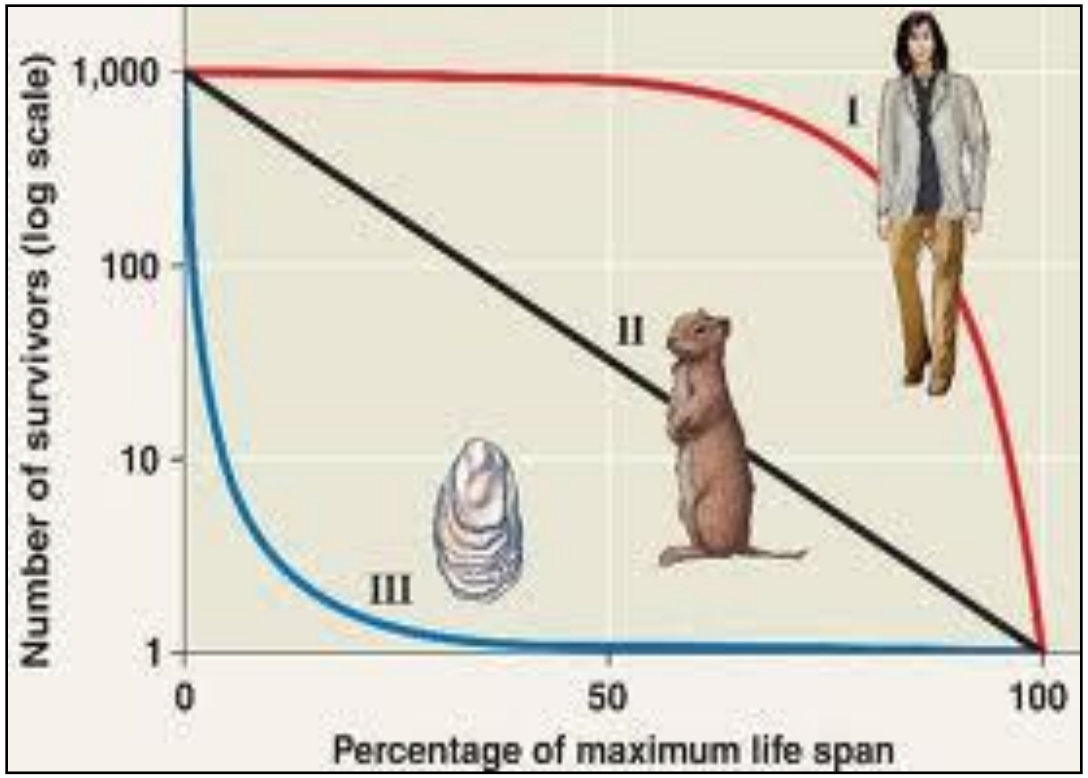


Figure 18.5 **Three Survivorship Curves.** In type I species, most individuals survive to old age, whereas in type III species, most individuals die young. Type II species are in between, with constant survivorship throughout the lifespan.

Type I Survivorship Curve:

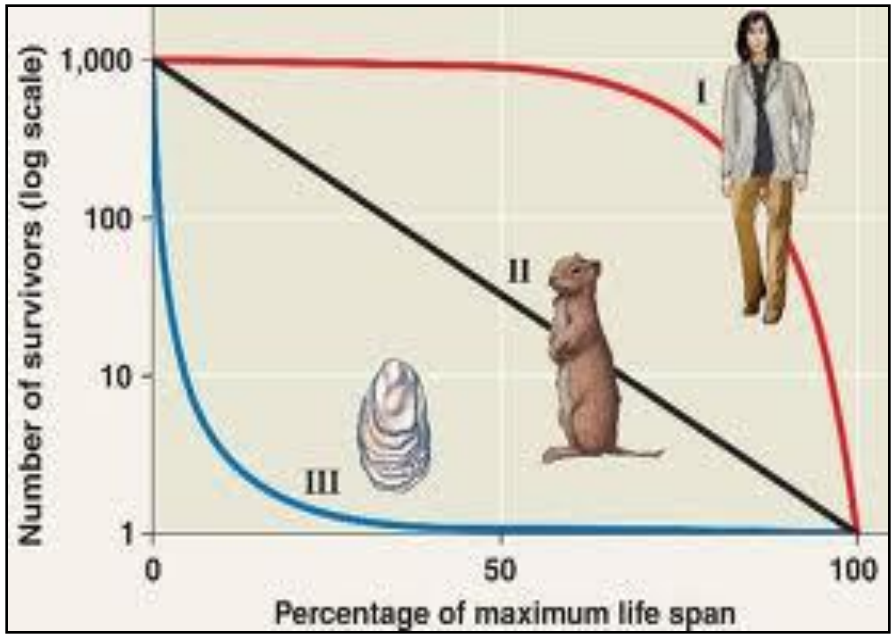


a) Curve I is flat at the start, indicating a low death rate in the early and middle stages of life.

b) It drops steeply near the end indicating a high death rate as the organisms become older.

c) An example is large mammals that produce very few offspring, but provide them with good parental care.

Type III Survivorship Curve:



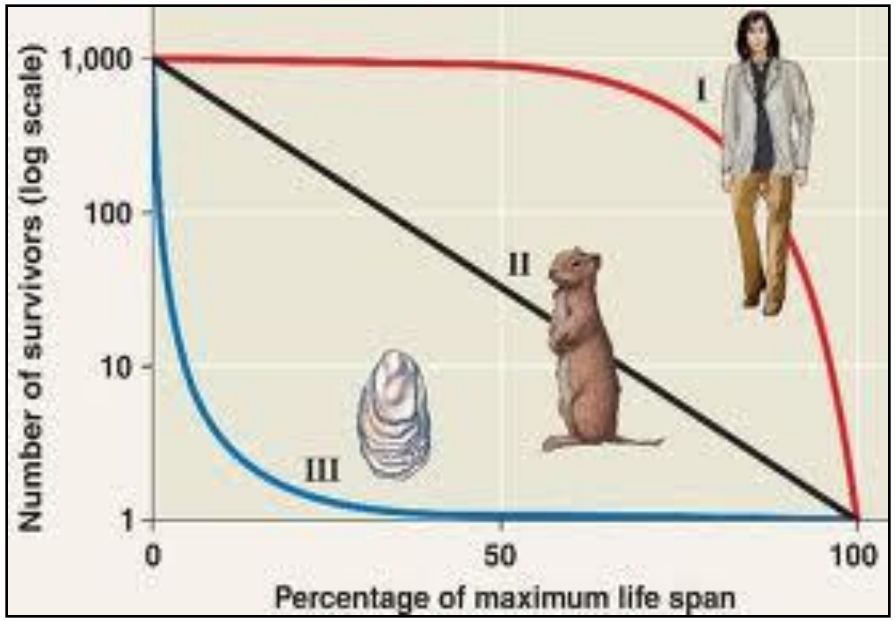
a) Curve III drops sharply at the start, indicating a high death rate among the young.

b) It flattens out as death rates decline for the few that do survive the early die-off.

c) This would include organisms that produce large numbers of offspring, but provide them with little or no care.

d) Examples include: fish, many plants, and most marine invertebrates.

Type II Survivorship Curve:



a) Curve II is intermediate to the above 2 curves.

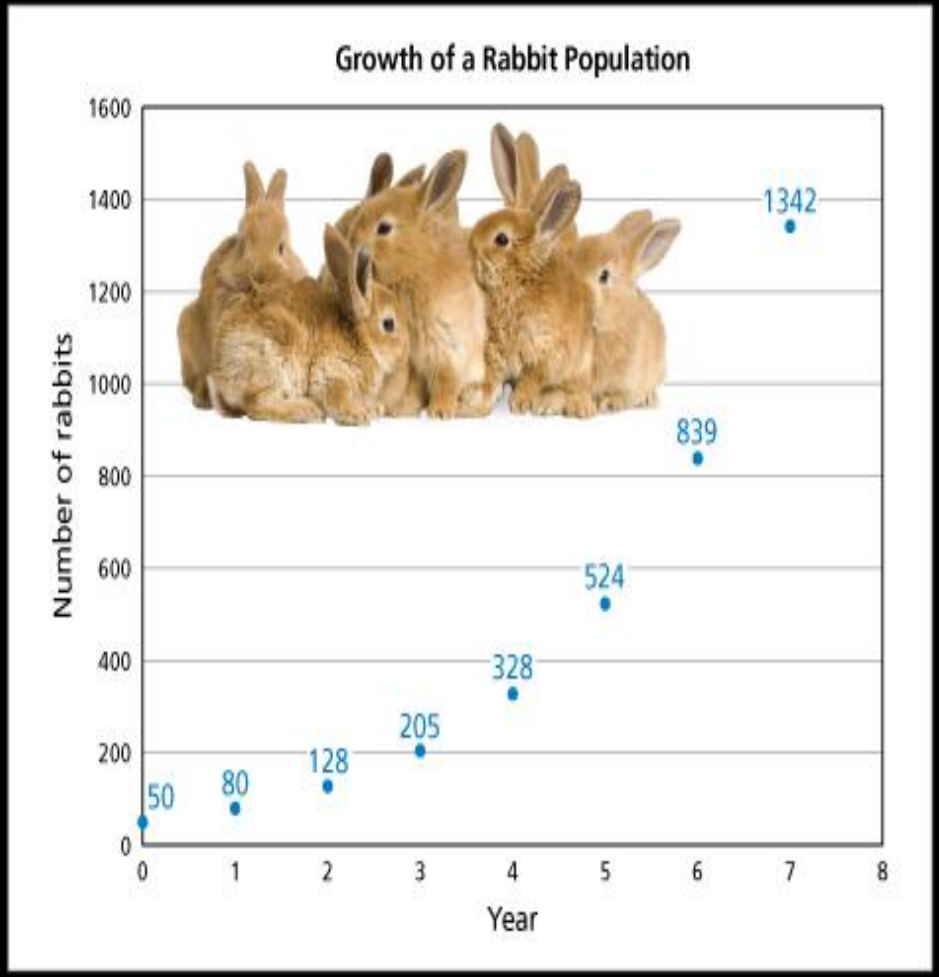
b) There is a constant *death rate* over the organism's life span.

c) This may occur in Rodents and Lizards.

Types of Population Growth

Growth may be:
EXPONENTIAL or Logistic.

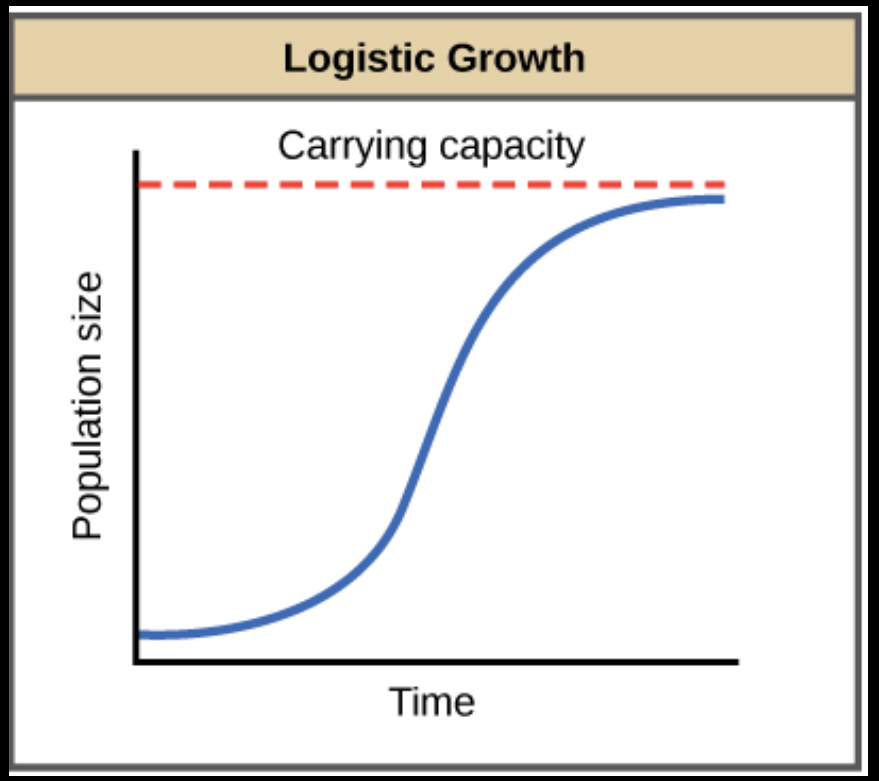
- Growth is Exponential when resources are unlimited (ideal conditions).
  - This produces a J-Shaped curve.



Types of Population Growth

Eventually, Limiting Factors will restrict population growth, causing it to level off based on:

- Density-Dependent: Lack of food, lack of space, disease, etc.
- Density-Independent: Volcanic eruption, Tsunami, and other natural disasters.

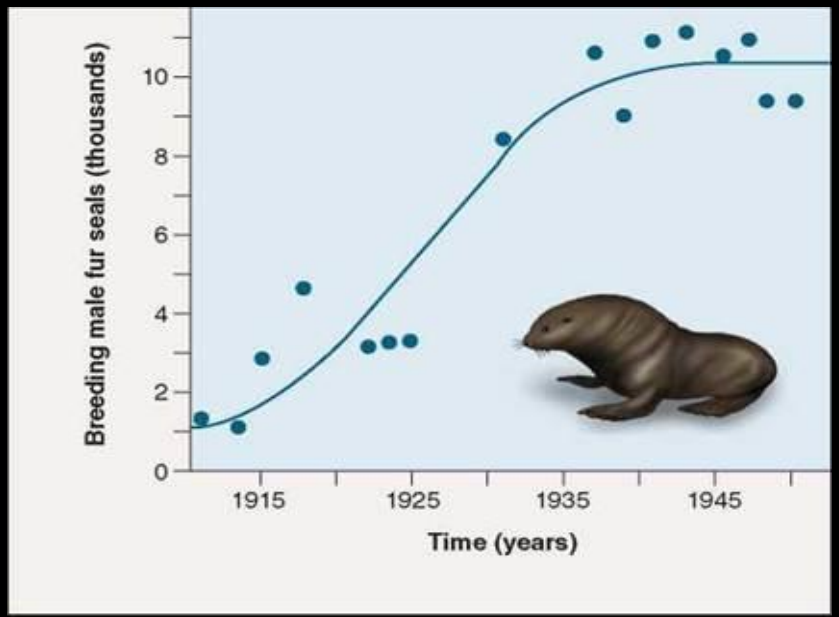


Carrying Capacity

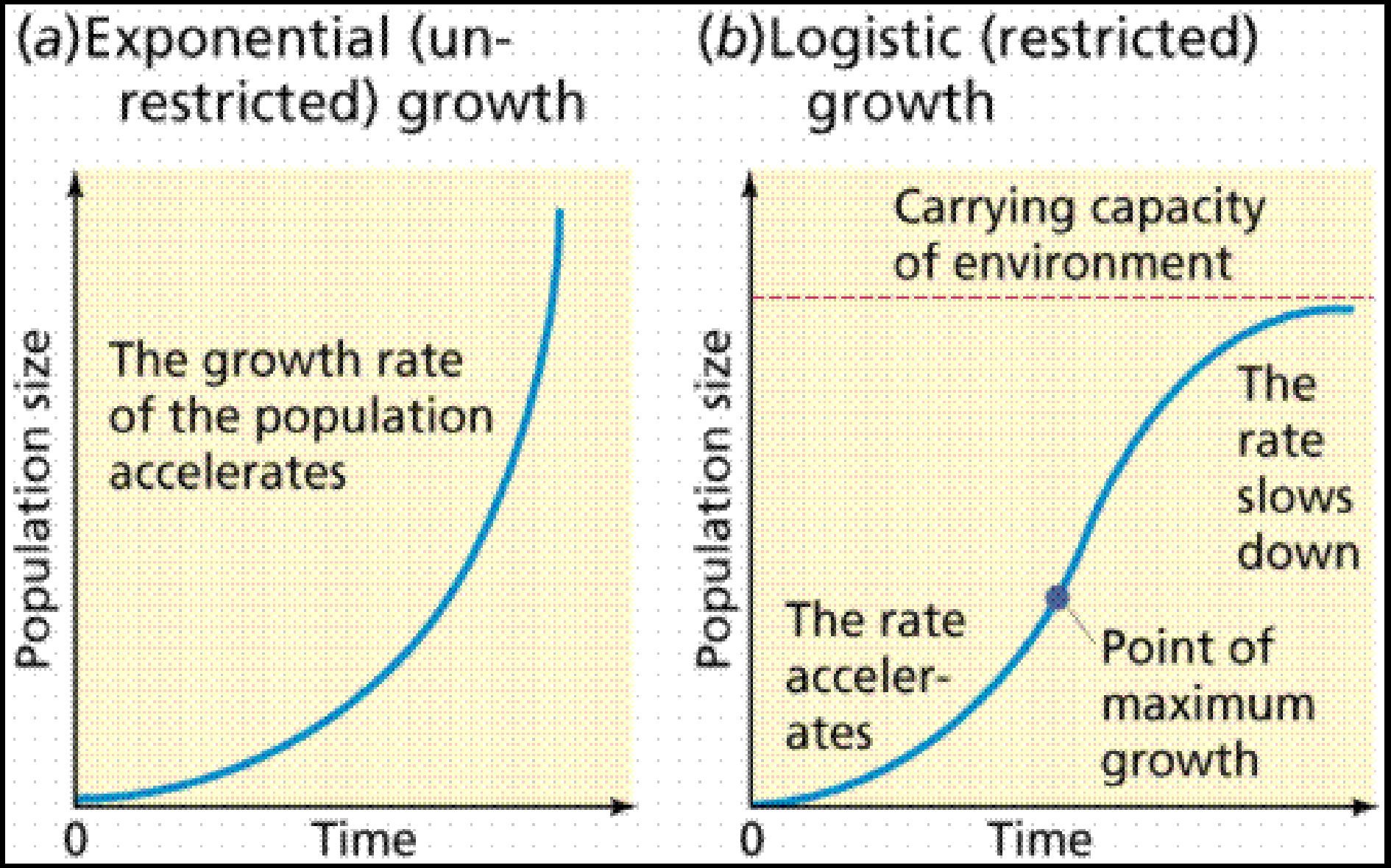
In response to these Limiting Factors the population may stabilize at the habitat's CARRYING CAPACITY (K).

- Maximum number of individuals that the habitat can support indefinitely.

- This results in LOGISTIC Growth (S-shaped curve).



Types of Population Growth



Population Growth

r -selected species

K -selected species

How is **r-selected species** different from **K-selected species**?

Population Growth

The essence of the concept of r- and K-selection is that organisms strive to **maximize their fitness for survival**

- **in either uncrowded (r-selection)**
- **or crowded (K-selection) environments**.

This relates to the **selection of combinations of traits in an organism that trade off between quantity and quality of offspring.**

- R selection has exponential growth but low survivorship due to ecological disruptions. Resources are used for Reproduction.
- K selection has logistic growth with higher survivorship due to more stable and predictable environments. Resources are used to maximize long-term survival.

Population Growth

R-selected Species

Fast Population growth
(R = growth rate)

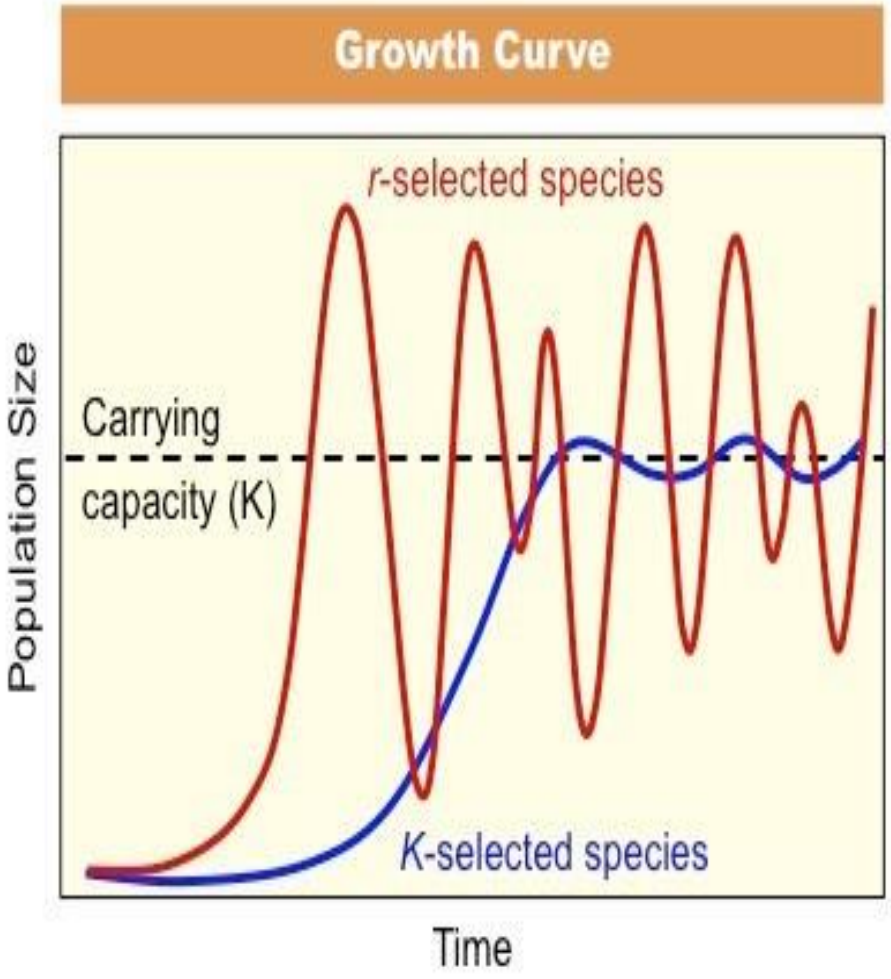
- High REPRODUCTION rate
- Many offspring
- Little parental care
- Small body size
- Early maturity
- Type III survivorship curve
- Short life span

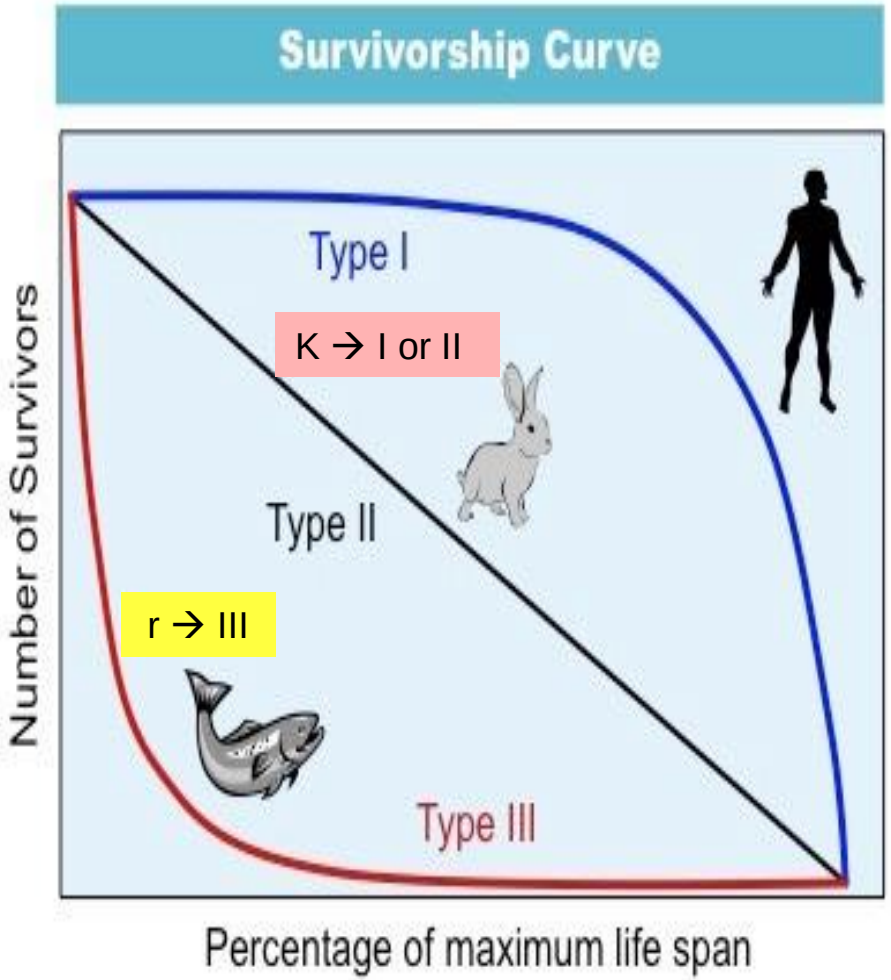
K-selected Species

Growth related to
(K = carrying capacity)

- Low reproduction rate
- Few offspring
- High parental care
- Large body size
- Late maturity
- Type I or II survivorship
- Longer lifespan

Population Growth





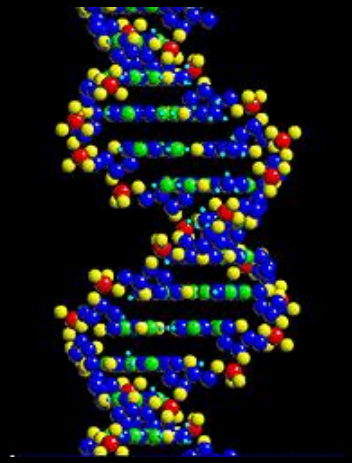
Biodiversity

- The variety of Life on Earth.
- Biodiversity is threatened by:
  - Habitat Loss
  - Pollution
  - Climate Change
  - Invasive Species
  - Overexploitation

Biodiversity

Biodiversity is conserved by tools such as:

- Habitat Restoration
- Limited Harvest (Fishing)
- Economic Incentives
- Biotechnology



Four characteristics of population ecology:

QUICK CHECK

An ___ ___ is an estimate of the amount of land required to provide the raw materials an individual or a nation consumes, including food, fuel, and housing.

3 patterns that reflect the balance between number of offspring and the amount of parental care for each are ___ curves.

R-selection has ___ growth with much ___, described by a ___-shaped curve.

K-selection has ___ growth with high ___ care, limited by ___ ___.

Four characteristics of population ecology: Geographic Distribution; Density; Growth Rate; Age Structure

An **Ecological Footprint** is an estimate of the amount of land required to provide the raw materials an individual or a nation consumes, including food, fuel, and housing.

3 patterns that reflect the balance between number of offspring and the amount of parental care for each are survivorship curves.

R-selection has exponential growth with much reproduction, described by a J-shaped curve.

K-selection has logistical growth with high parental care, limited by carrying capacity.

QUICK CHECK