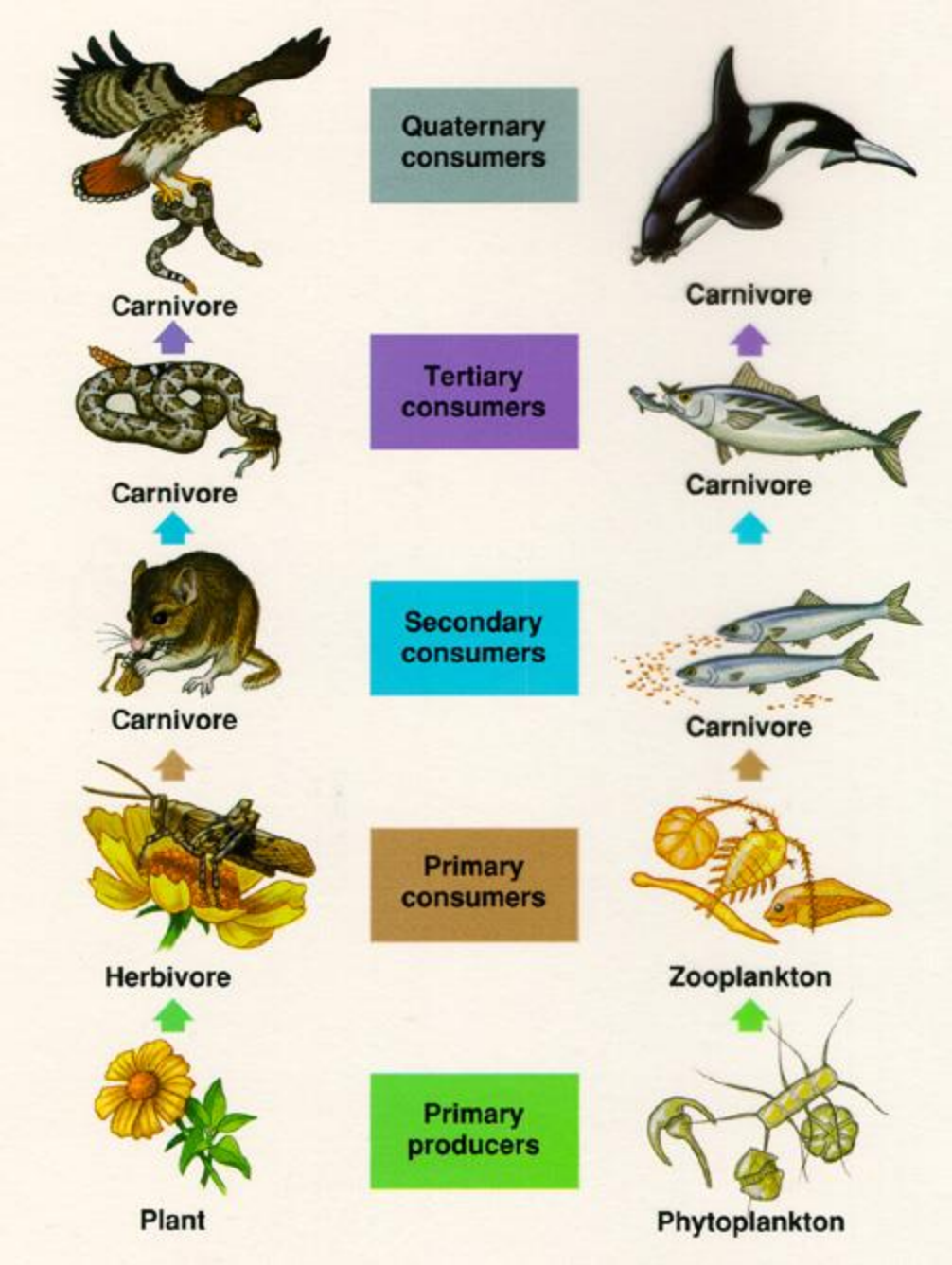
Principles of Ecology



What is Ecology?

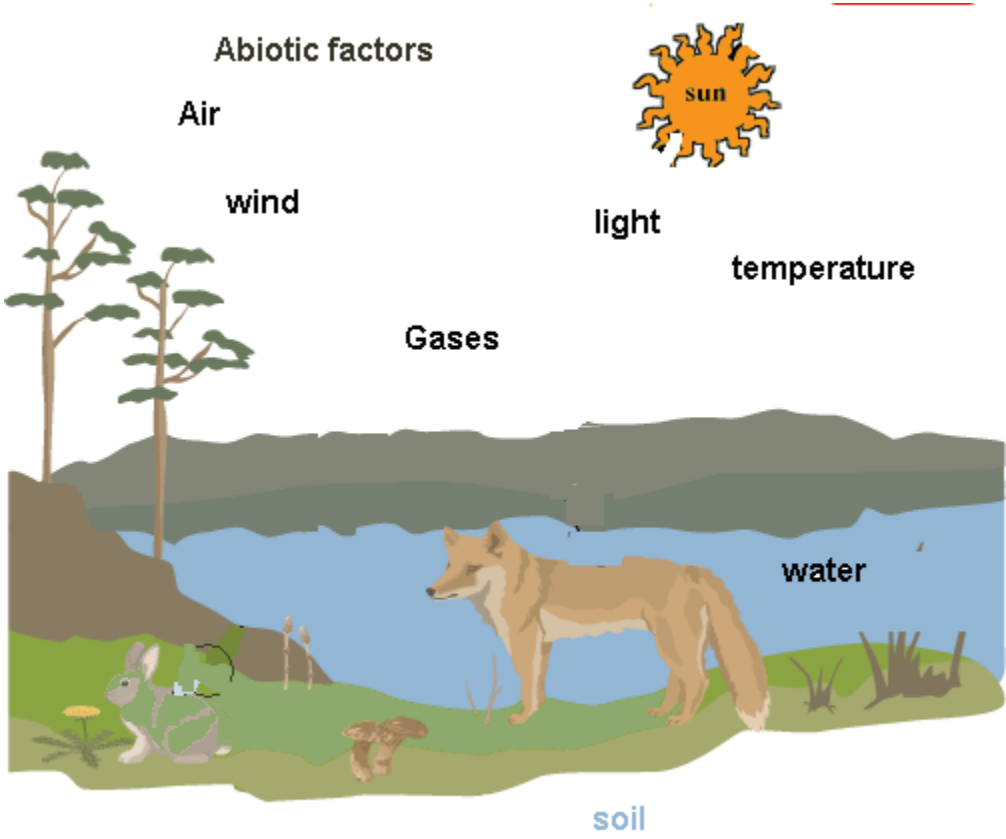
- Ecology is the study of interactions that occur between organisms and their environment

Biosphere

- Recall that the biosphere includes *all living things*
- In order to better understand the biosphere, we must first understand how living things are affected by nonliving (*abiotic*) and living (*biotic*) things present in their environment

Abiotic Factors

- Abiotic factors are the nonliving parts of the environment
- EX: temperature, humidity, light, soil
- Why should we include these factors when studying living things?

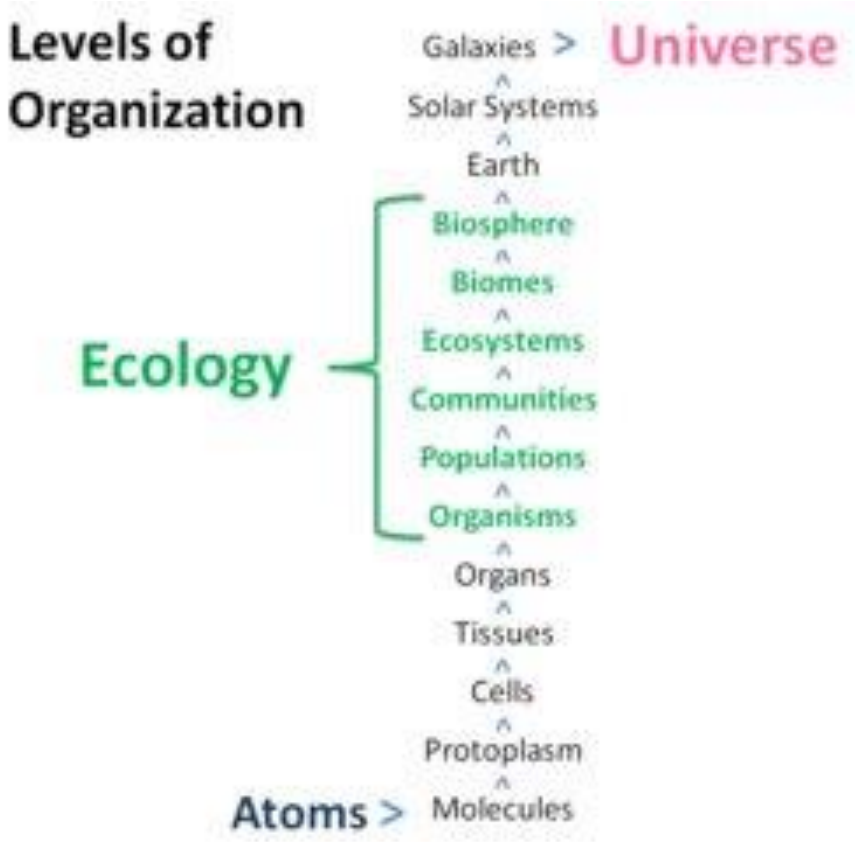


Biotic Factors

- Biotic factors are living things that inhabit an environment
- All organisms depend on other living things directly or indirectly for: food, shelter, reproduction, or protection

Levels of Organization

- To help ecologists study the interactions of the biotic and abiotic parts of the world, they have organized the living world into levels:
- Organism → Population → Community → Ecosystem → Biome

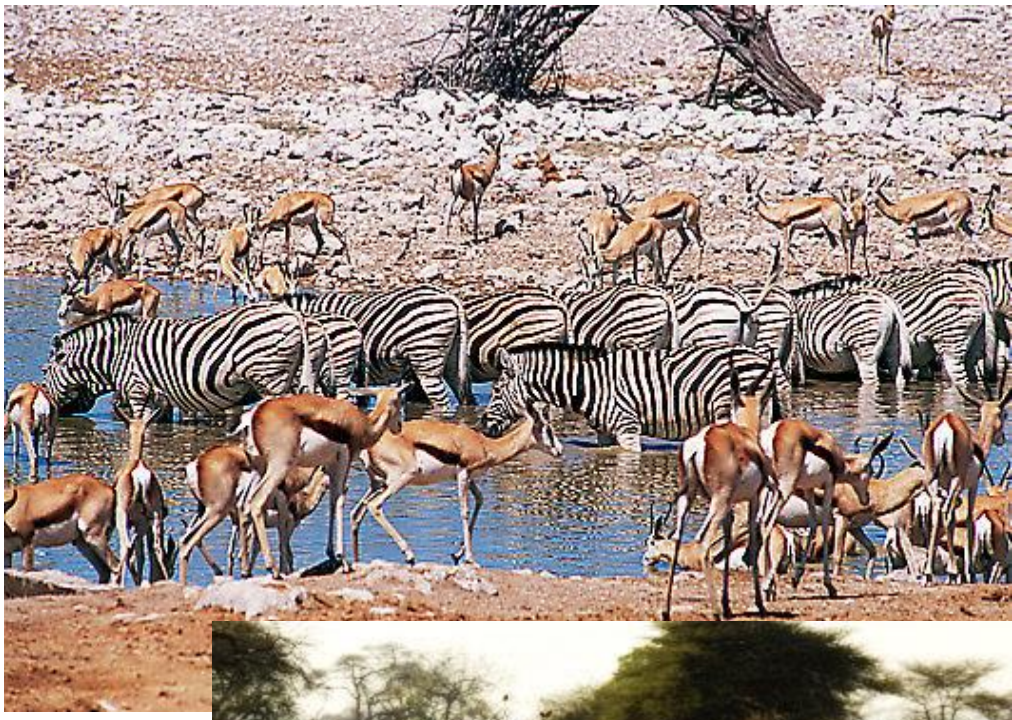


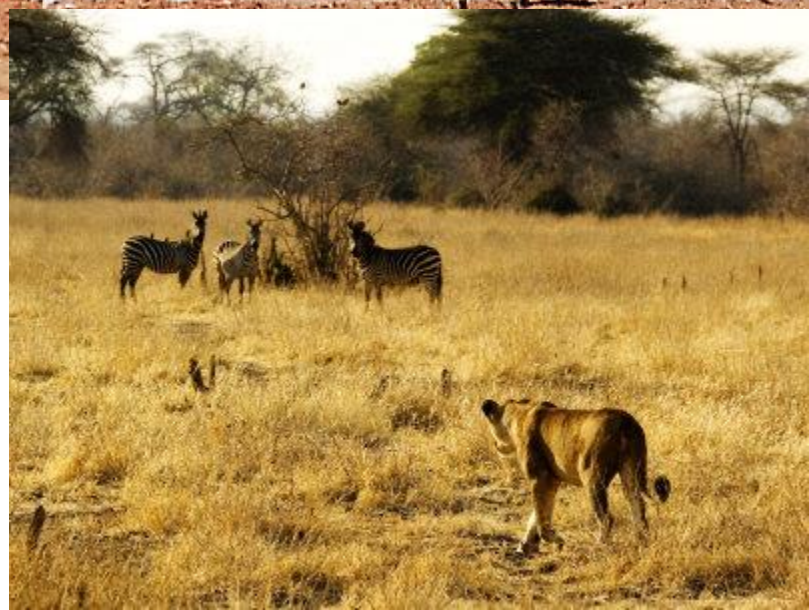
Population

- A *population* is a group of organisms of the same species that interbreed and live in the same area at the same time
- Members of the same population compete with each other for food, water, mates, or other resources
- EX: Zebras compete with each other for the same food source, reproduction, and water source

Community

- No species lives independently
- While populations are composed of individual organisms, communities are made up of different populations
- A *community* is made up of interacting populations in a certain area at a certain time
- EX: zebras live with lions, giraffes, elephants, and gazelles





Ecosystem

- An ecosystem is made up of interacting populations in a community and the community's abiotic factors
- EX: Populations of animals and plants interact with each other and with the abiotic components of the area (waterhole)

Biomes

- Types of abiotic factors, like climate, humidity, temperature, and precipitation all work together to create different biomes where specific animal and plant species are found

Feeding Relationships

- All organisms must "eat" in order to have energy to reproduce, grow, find food, and defend themselves.
- Ultimate source of energy for all life: *sun*

Feeding Relationships

- Autotrophs /Producer- an organism that uses light energy to make energy-rich compounds
- Radiant energy from the Sun is converted into chemical energy that organisms can breakdown for metabolism
- EX: plants, green algae

Feeding Relationships

- Consumers/Heterotrophs depend upon autotrophs for nutrients and energy
- EX: deer, mice, lions, birds

Feeding Relationships

- A heterotroph that feeds only on autotrophs is called an *herbivore*
- EX: deer, mice, squirrels, zebras, giraffes, rabbits

Feeding Relationships

- A heterotroph that eats only other heterotrophs is called a *carnivore*
- EX: tigers, lions, wolves, hawks, owls

Feeding Relationships

- A heterotroph that feeds on other heterotrophs as well as autotrophs is called an *omnivore*
- EX: bears, humans, raccoons, possums

Feeding Relationships

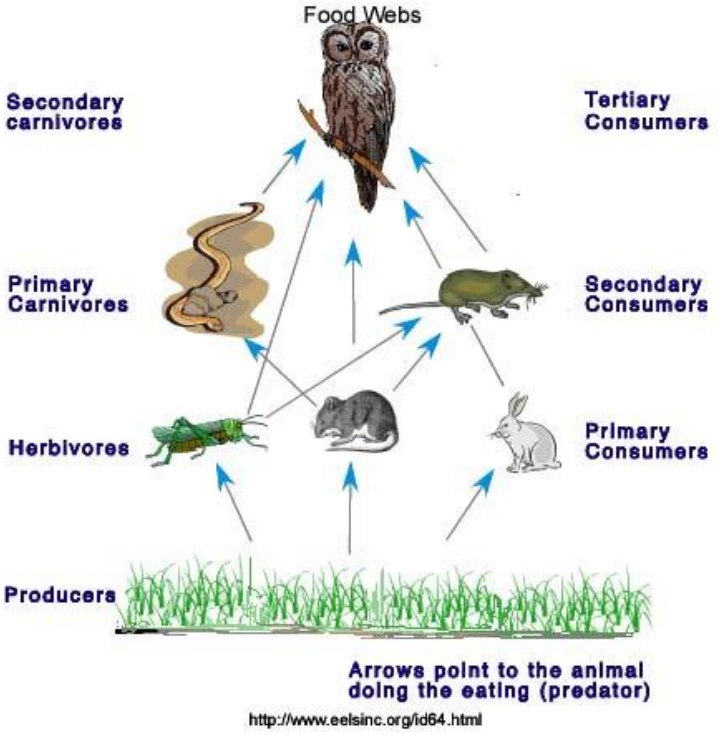
- Some heterotrophs do not kill for food, but still eat other heterotrophs. These are called *scavengers*, and they eat animals that have already died.
- EX: Vultures, buzzards, ants, beetles

Feeding Relationships

- Some organisms break down complex compounds of dead and decaying animals and plants into simpler molecules that can be absorbed. These organisms are called *decomposers*.
- EX: bacteria, fungi, worms

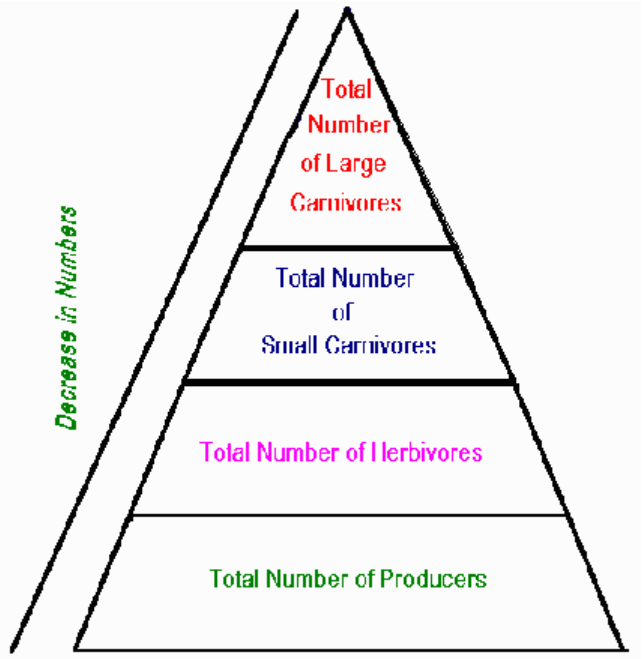
How Energy Flows in an Ecosystem

- These herbivores, carnivores, decomposers, and scavengers work together to create the food chain/food pyramid in an ecosystem

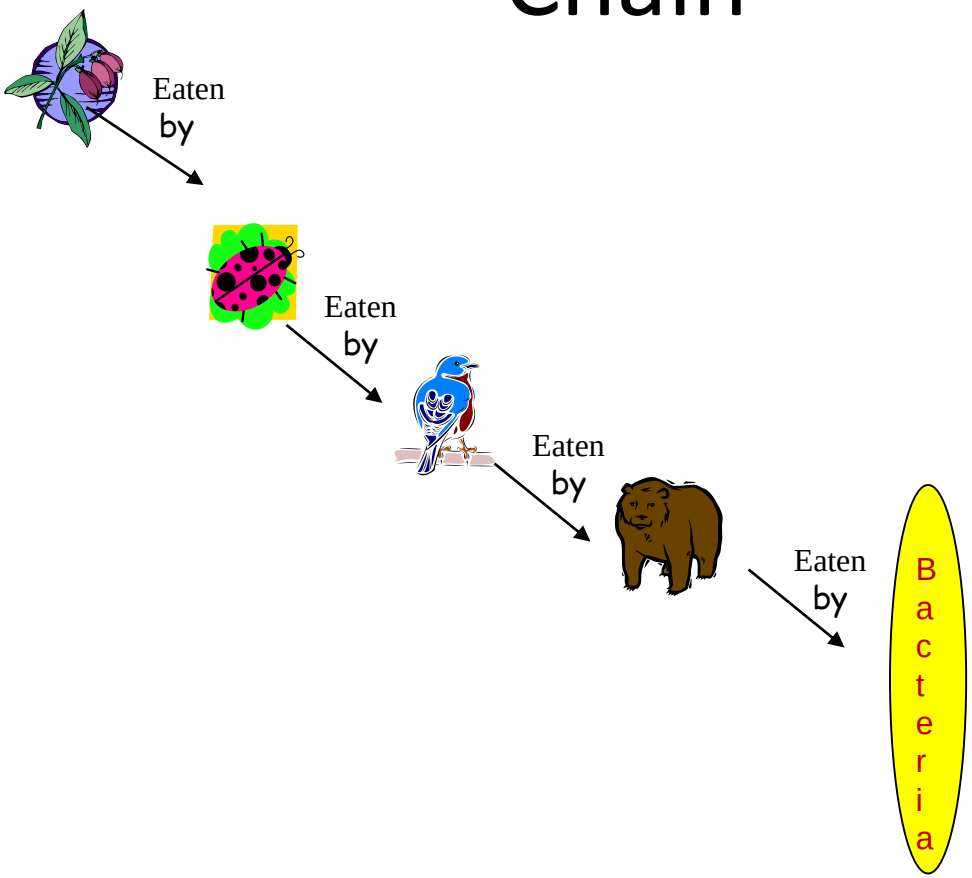


Trophic Levels and Food Chain

- Trophic level: A feeding level in an ecosystem
- Food chain: lineup of organisms that shows who eats who
- Shows how matter and energy move through an ecosystem



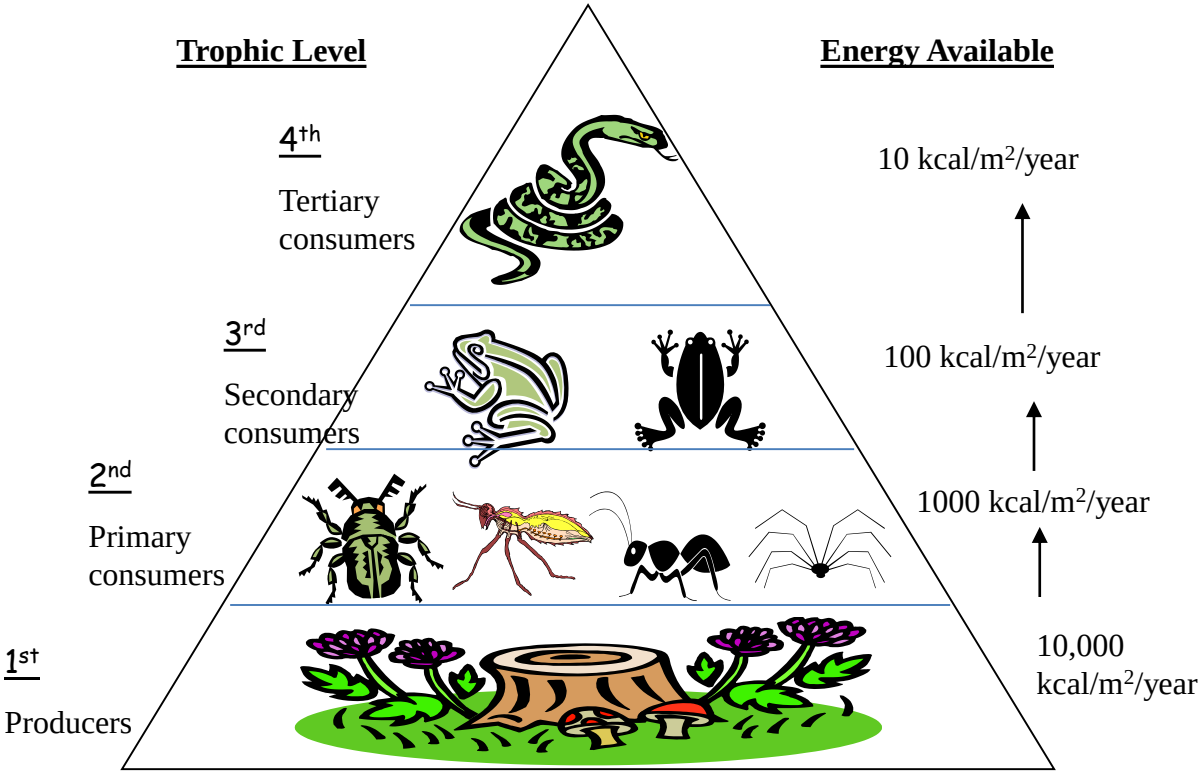
Trophic Levels and Food Chain



Energy Pyramid

- Every time an organism eats, it obtains energy from its food
- So energy is transferred from the 1st trophic level to the 2nd trophic level to the 3rd trophic level and so on.
- Some of this energy is lost along the way during an organism's metabolism and as heat. This energy can be measured in kilocalories (kcal)
- *Energy pyramid* - picture showing how much energy is transferred to the different trophic levels in a food chain

Energy Pyramid



Energy Pyramid

- Notice that there are many more producers than there are consumers, and many more primary consumers than there are secondary consumers, etc
- When the producer is eaten by the consumer, it is an exchange of energy. Ironically, 90% of the energy that the producer had is lost, and the consumer only receives 10% of it. Therefore, to get enough energy to survive, the consumer must eat more producers, meaning that, to sustain the consumers, there must me many more producers.
- Also, there is much more energy to available to producers, which facilitates faster growth and larger numbers of producers

Survival Relationships

- In biomes all animals are part of some type of survival relationship
- *Predator-prey:* predators are consumers that hunt and eat other organisms called prey
- Predators have no natural enemies

Survival Relationships

- *Symbiosis:* relationship in which one species lives on, in, or near another species and affects its survival
- Three types:
  (1) Mutualism
  (2) Commensa
  (3) Parasitism

Mutualism

- Mutualism: type of symbiosis in which both species benefit
    - Ants living in the tropical acacia trees- trees are protected when ants attack animals that try to feed on the tree and ants receive nectar and shelter from the tree.

Commensualism

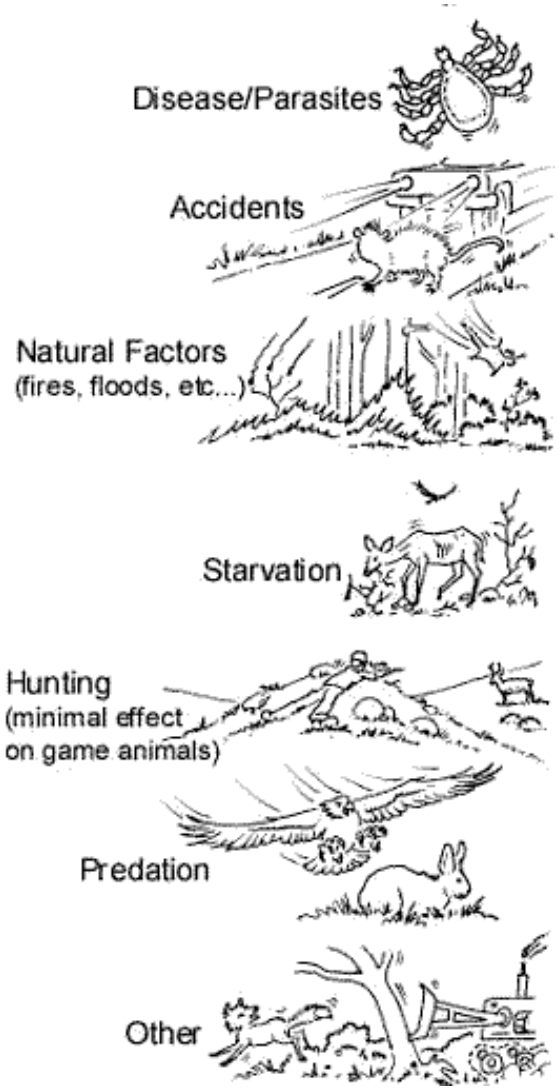
- Commensalism: type of symbiosis in which one species benefits and the other species is neither harmed nor benefited
  - Spanish moss grows on the branches of trees. The moss gets a habitat and the tree gets nothing.
  - Whale have barnacles that live on them. The barnacles have somewhere to live, but do not affect the whale.

Parasitism

- Parasitism: type of symbiosis in which one species benefits and the other species is harmed
  - Parasite: organism that harms but does not kill another organism
  - Host: organism that is harmed by a parasite
  - Ticks feed on dogs, people, etc. The ticks get food (blood) and the hosts lose blood and can be infected with disease.
  - Best parasites do not kill their hosts…why?

Limiting Factors

- A **limiting factor** or **limiting resource** is a factor that controls a process, such as organism growth or species population size or distribution
- Examples of limiting factors include: availability of food, predation pressure, or availability of shelter



Carrying Capacity

- As a result of limiting factors (like food availability, disease, predation, etc) no population will continue to increase forever
- The **carrying capacity** is the largest number of individuals in a population that a given environment can support

Growth Rate

- The growth rate of a population is affected by three things:
- (1) the number of births
- (2) the number of deaths
- (3) the number of individuals that enter or leave the population
  - Immigration – individuals that enter the population
  - Emmigration – individuals that leave the population

Human Population Growth

- If birth rate is greater than death rate, population will grow
- If death rate is greater than birth rate, population will decrease
- Current human population growth is *exponential*
- Will the population continue to grow unchecked?

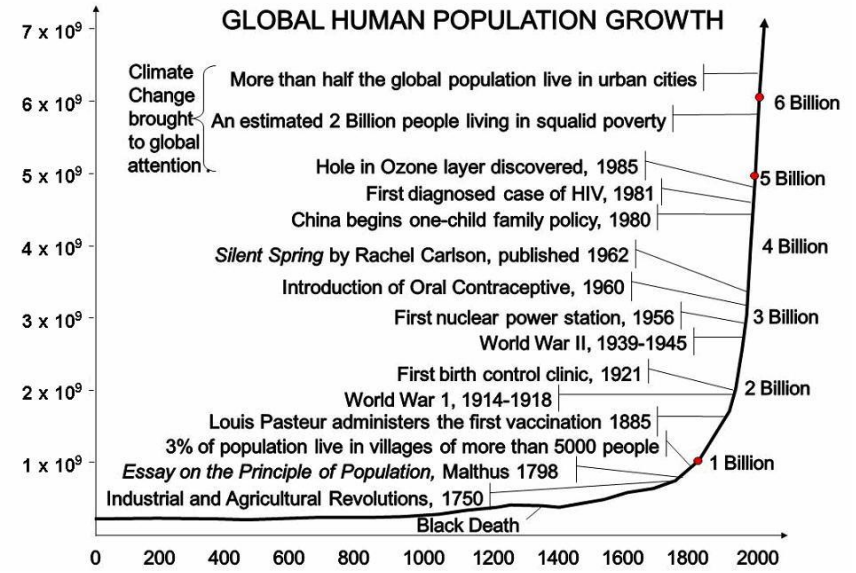
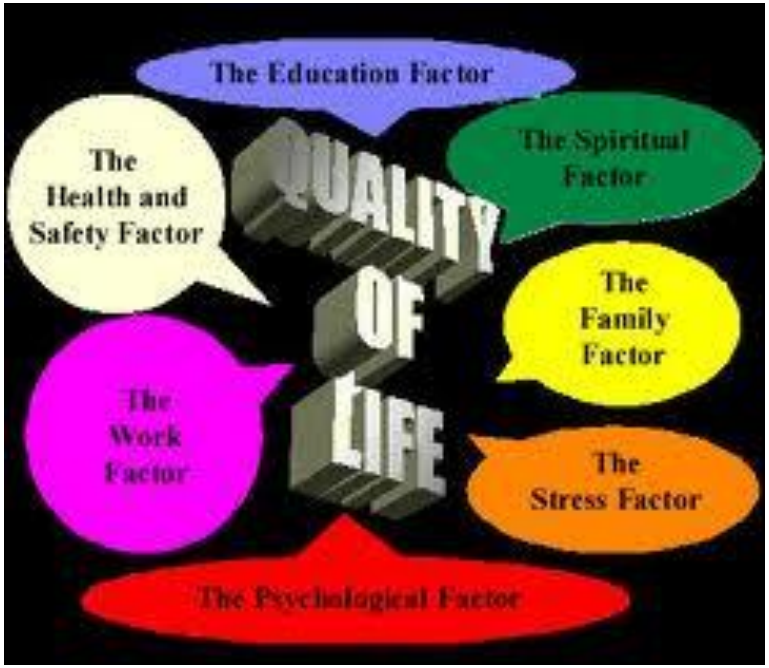


Image 10 : Les contrôles sur la Population Humaine Population vs Les Catalyseurs de l'augmentation de la Population

Human Population Growth Discussion

- Human (or any species) growth cannot continue unchecked-why?
- What resources do we need to survive as a population?
- Are we just concerned about longevity of life? Or do we also care about anything besides physical necessities?



How does human population growth affect biodiversity?

Logistic Growth

- As resources become less available, the growth of a population slows or stops.
- An s-shaped curve of this growth pattern is called **logistic growth**

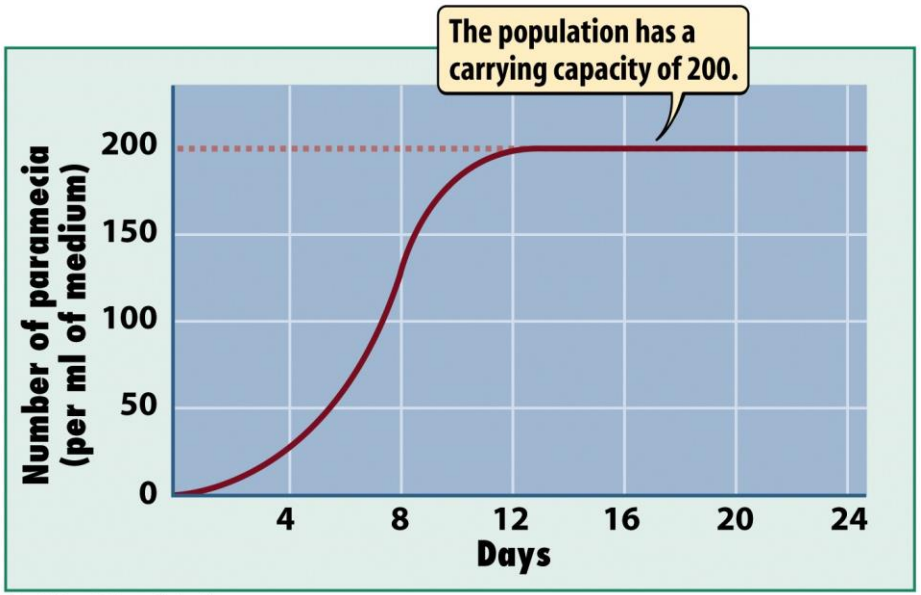


Figure 34-6 part 1 Discover Biology 3/e

What can affect population size: Disease

- Competition for limited resources, predation, and disease can all affect the size of a population
- EX: *Dutch Elm Disease* – Elm trees are attacked by a fungus spread by a beetle. Result: many elm tree populations have been decimated by this fungus
- EX: *Pfiesteria*- a toxic heterotrophic dinoflagellate associated with fishkills and algal blooms.