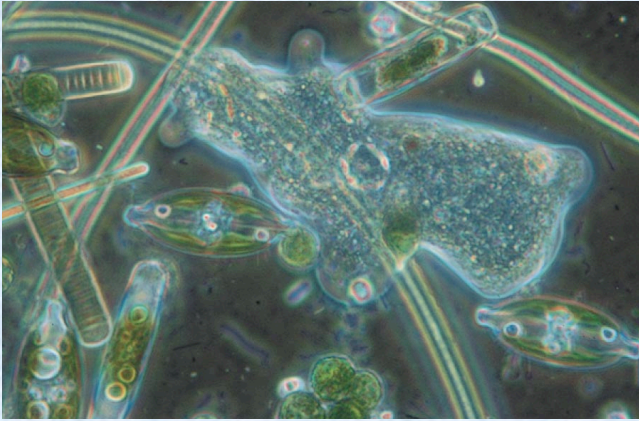




Bio 42



Ecology

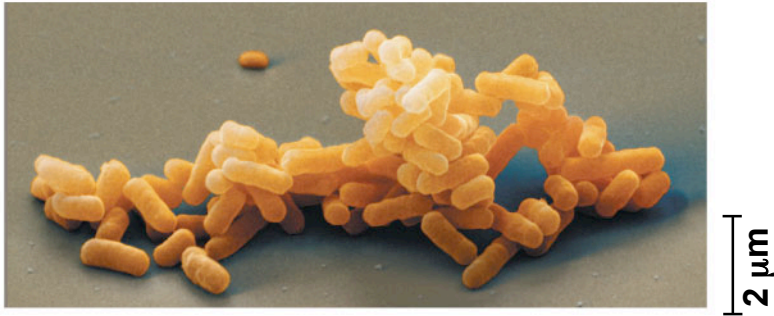
Microbial Biodiversity

Plant Biology



Biodiversity - Six Kingdoms of Life

(a) Domain Bacteria



(b) Domain Archaea



(c) Domain Eukarya



▲ Kingdom Plantae

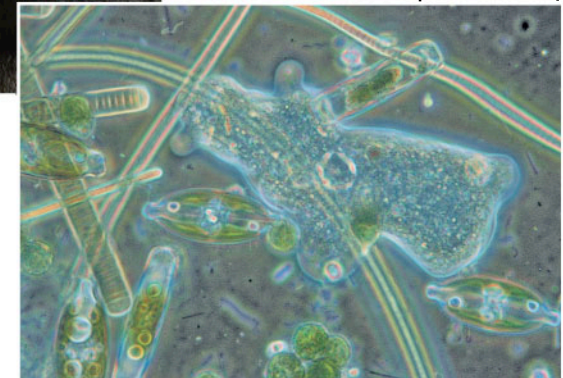


► Kingdom Fungi



◀ Kingdom Animalia

► Protists



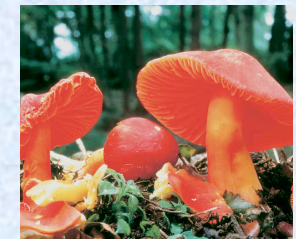
100 μm



Species

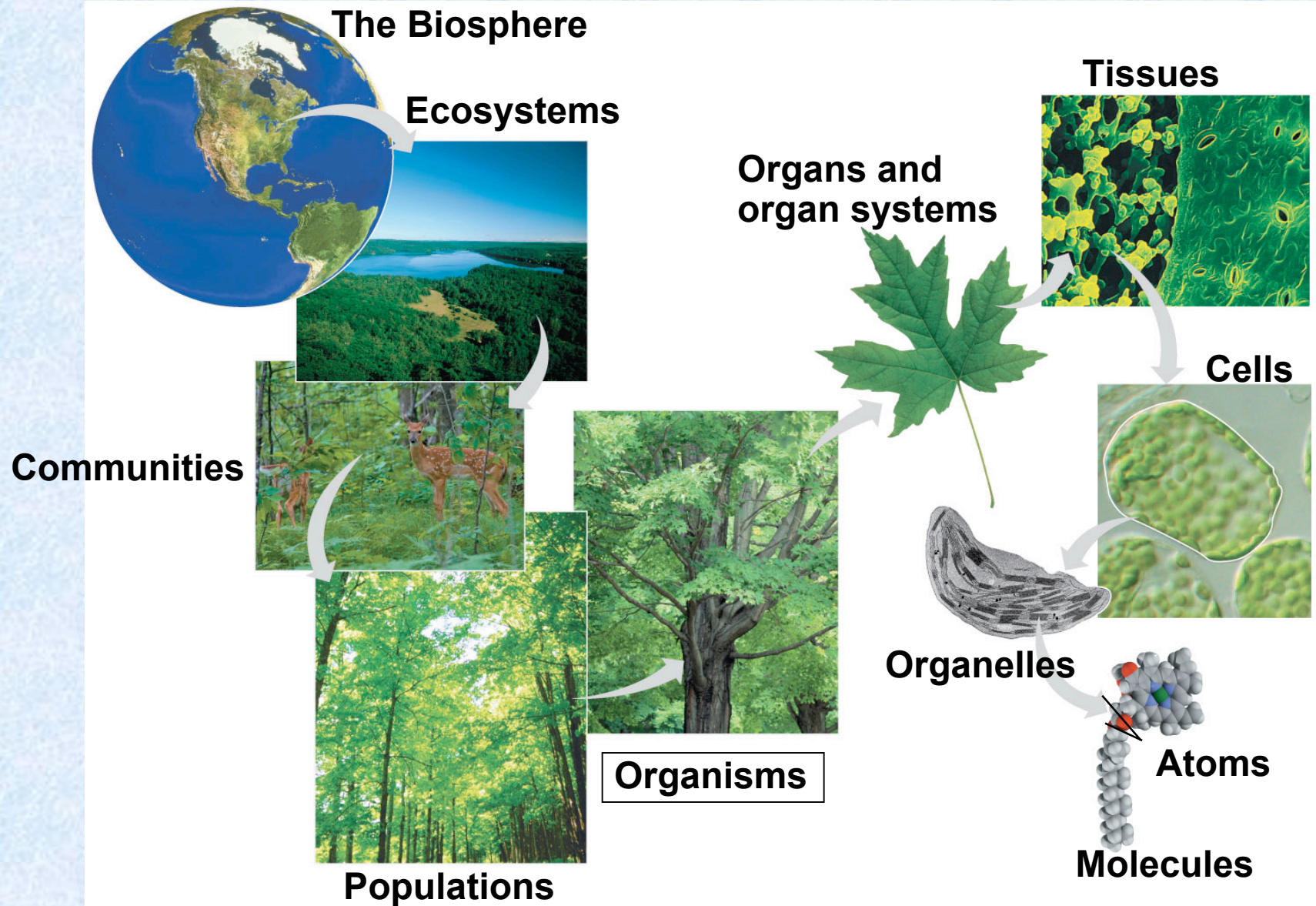


- *The smallest taxonomic group*
- *Individuals who can potentially interbreed to produce fertile offspring*
- *Cannot mate with other species*
- *Members of the same species share similar features*



Sexual dimorphism:
males & females differ in body form

Levels of Biological Organization



Levels of Biological Organization in Ecology



Biosphere:
Global processes



Ecosystem:
Energy flux and cycling
of nutrients



Community:
Interactions among
populations



Population:
Population dynamics;
the unit of evolution



Organism:
Survival and reproduction;
the unit of natural selection

Population

**Many individuals of the same species
that live in an area**

- A breeding group = Deme
- Genetic variation among individuals



Community

- All species that live in an area
- Many interacting populations form the “Web of Life”

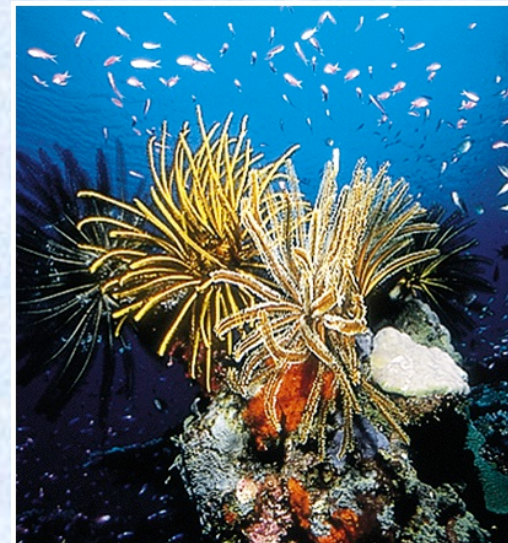
Example:
Rocky intertidal community



Ecosystem Earth's Environments

Species & Habitats

The community
+
All physical
&
chemical aspects of
the environment



Terrestrial Ecosystems: on Land



Forests



Savannas

Deserts



Aquatic Ecosystems: in Water

Marine & Freshwater



Biosphere: All places on earth where life exists

- **Atmosphere**
- **Hydrosphere**
- **Lithosphere**

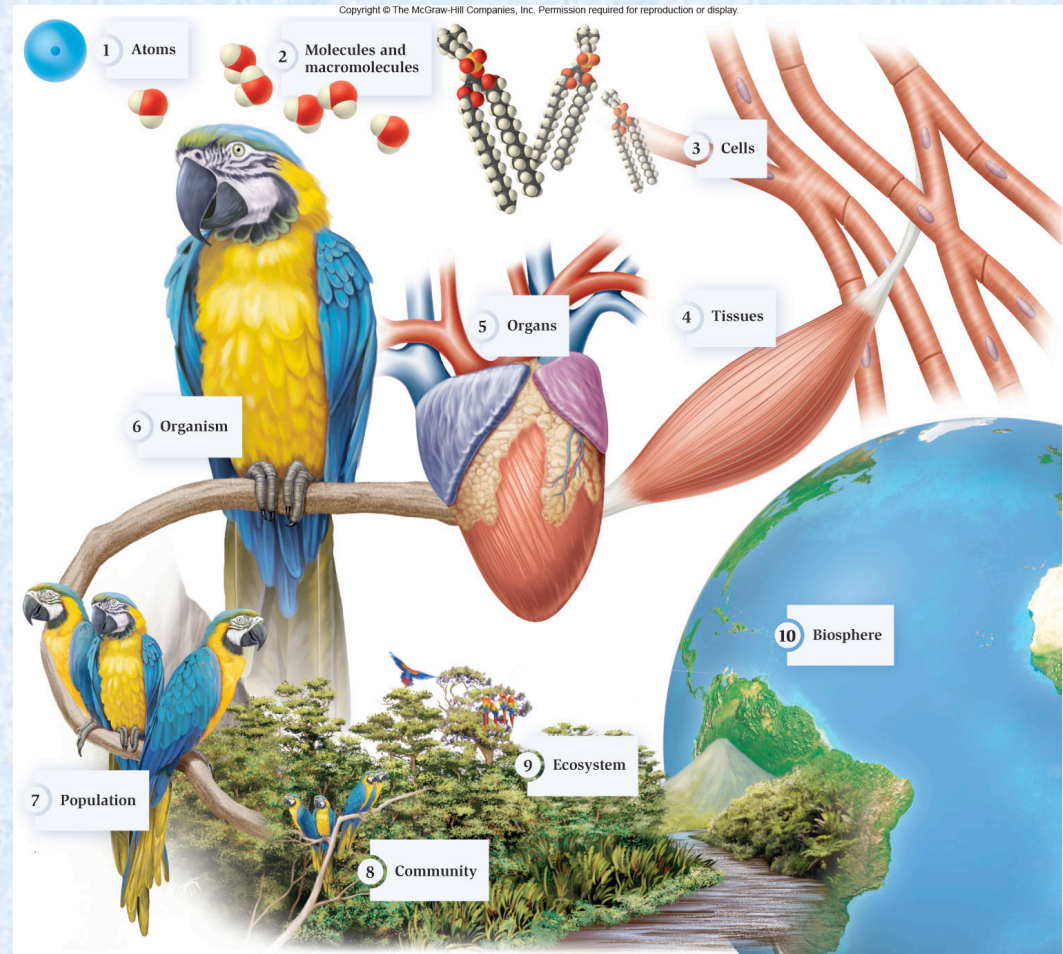
Ecosystems are connected
by nutrient cycling in
the biosphere



*Global warming & Climate change
is a Biosphere problem*

Subdisciplines in Biology study different levels of biological organization

- Biochemistry
- Molecular biology
- Cell biology
- Microbiology
- Physiology
- Anatomy
- Organismal biology
 - Botany
 - Zoology
- Ecology
- Conservation Biology
- Evolutionary Biology





Ecology

**The study of interactions
between organisms & the environment**

*and their influences on
species distributions & abundances*

Distribution

Geographic location of a species

Abundance

Numbers of individuals = Population size



Environments

*are composed of
Biotic & Abiotic factors*



Biotic = living
Other organisms in area



Abiotic = non-living
Physical & Chemical conditions
*ex: temperature, rainfall, sunlight
salinity, oxygen, soil nutrients*

*All species are affected
by biotic & abiotic factors*



“The organism is the life cycle” T. Newberry

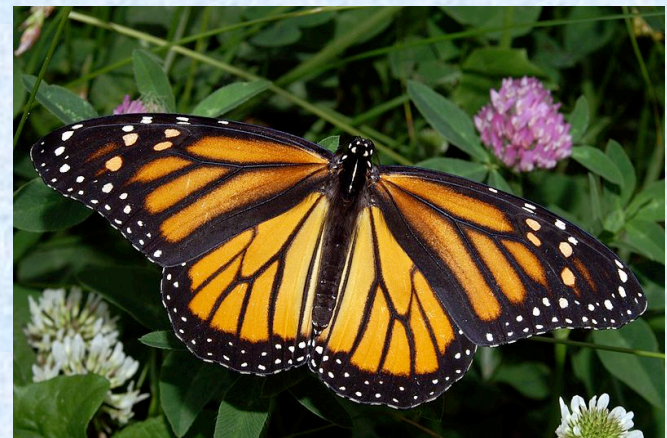
Abiotic factors determine growth & abundance of milkweed host plants:

Rainfall, temperature, soil type



Abiotic factors affect growth and mortality of monarchs:

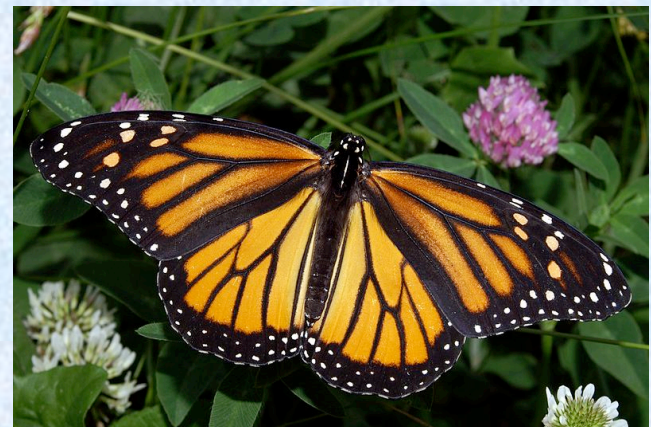
Temperature, rain & snow, wind



Biotic factors affect abundance & health of milkweed host plants:
Other herbivores (aphids, beetles, bugs) & pathogens (fungi)



Biotic factors cause mortality in monarchs:
Predators (wasps, birds), parasites (insects), competitors (insects)



Biotic Interactions

Associations between different species in a community

4 basic types of interactions

(based on cost/benefit analysis for both species*)

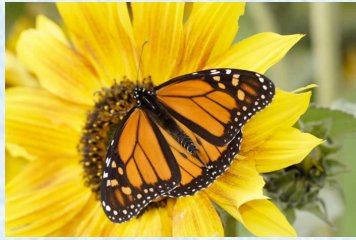
Species A / Species B

+ = benefit

- = cost

0 = no effect

** based on Reproductive Success*



Mutualism + / +



Flowering Plants & Animals

Pollination

– movement of pollen between flowers

+ Plant gets sperm transport

+ Animal gets food:

nectar & pollen

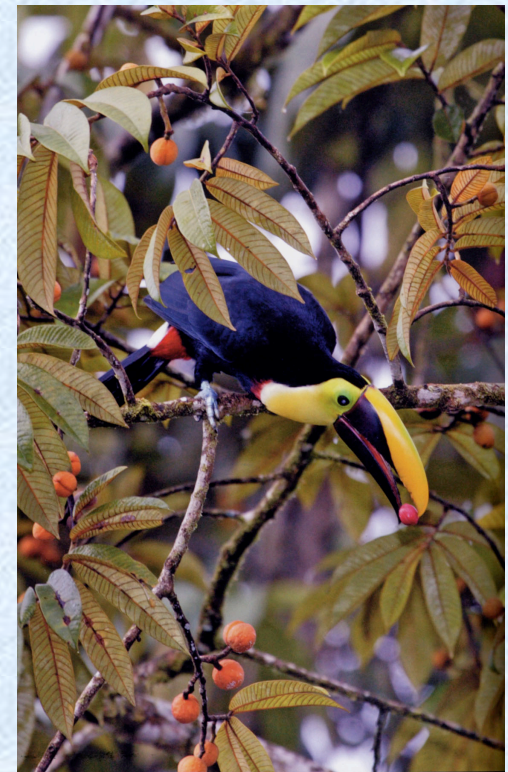


Mutualism + / +

Flowering Plants & Animals

Seed dispersal

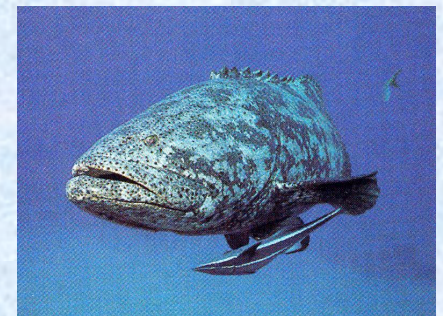
- movement of seed away from parent plant
- + Plant gets embryo transport
- + Animal gets food (fruit)



Commensalism + / 0

“to feed at the same table”

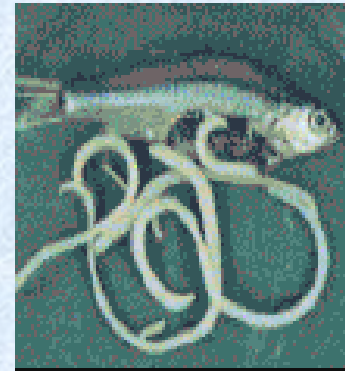
- **Epiphytes on trees**
 - Smaller plants get habitat in sunlight
 - Ex: lichens, mosses, ferns, orchids, bromeliads
 - No effect on tree
- **Animals eat “left overs” of other animals**
 - Sharks are messy feeders
 - Remoras (fish) ride on shark and eat pieces of food in water
- **Phoresis = Animal hitchhikers get a ride**
 - Clam larvae disperse upstream on fish gills



Parasitism/Predation + / -

Both feed on another species

Parasites



Predators



Predation + / -

Predator - kills & eats a whole individual
Prey dies

- Carnivores eating prey



- Herbivores that act as predators:

- eat whole plant
- eat a seed (embryo inside)



Prey Defense



Camouflage



Toxins



Spines



Mimicry



Cooperation

Parasitism + / -

- Parasites feed on a part of organism
- A single parasite does not kill host
a group of parasites may kill host



Most Herbivores are parasites:

- eat part of plant



Carnivorous Parasites

- Ectoparasite
 - live on outside of host body
ex: fleas
- Endoparasite
 - live inside of host
ex: intestinal worms

Pathogens

Microbial parasites
that cause disease in host
ex: Bacteria, Fungi, Protozoans

Competition - / -

- Both species use a limited resource
- Each species does better if other is absent



Urchins compete for food



Hermit crabs compete for shell

Competition - / -

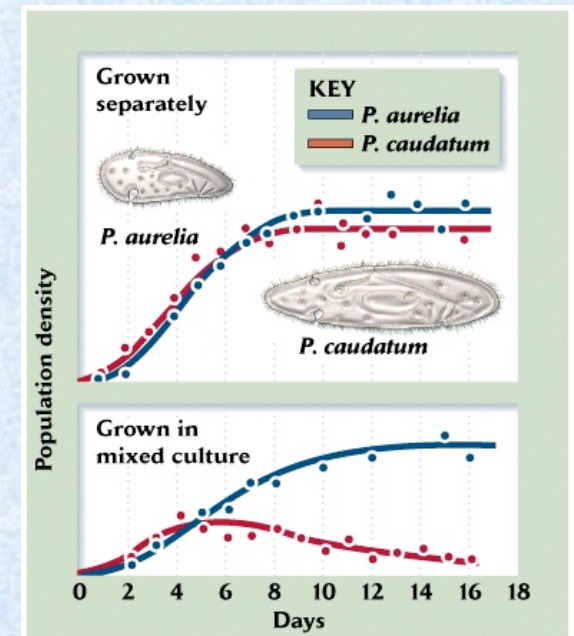
Resource = things from environment needed for survival

Ex: Food, water, sunlight, space, soil nutrients

- Limited resource is one that is in short supply

Two outcomes:

- **Competitive exclusion**
 - 1 species becomes locally extinct
 - cannot exist with other
- **Coexistence**
 - both species can live together
 - share the resource by using them in different way
 - reduces competition

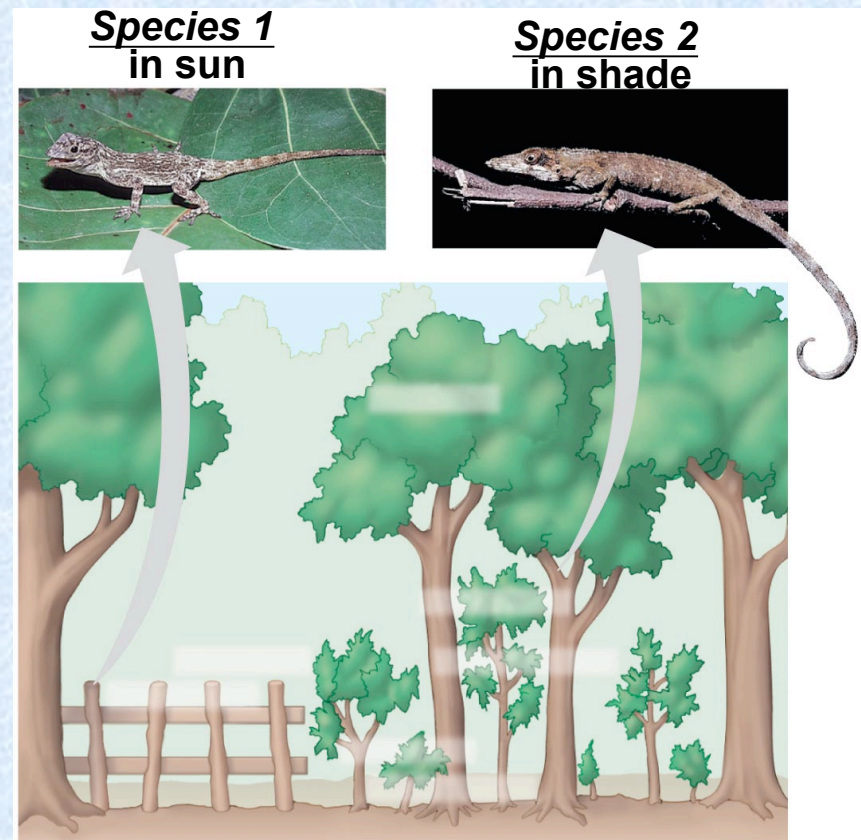


Resource Partitioning

- *Allows Coexistence instead of Competition*
by “Sharing” resources

- Species use resources in different ways

- 7 species of lizards live together
- All species are predators
(*same food needs*)
- “Share” food by feeding at different heights or in different areas
(*each uses slightly different resources*)



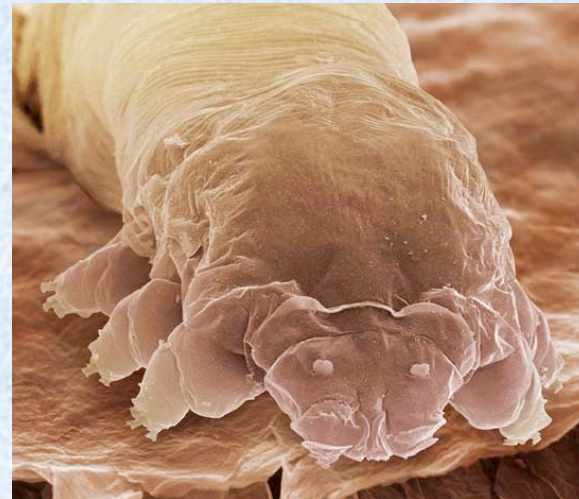
Symbiosis

Sym -> together; Bios -> life

Symbiotic Relationship:

A very close association where one species lives in or on the other species

- Parasitism
- Commensalism
- Mutualism



Ex: Commensalism

Follicle mites in eyelashes

Coral & Algae: symbiotic mutualism

Algae lives inside of coral body

+ Alga gets nitrogen & safety

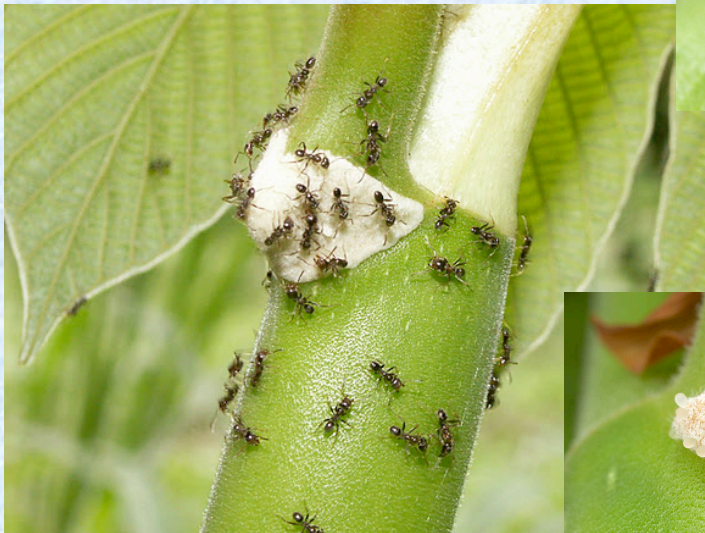
+ Coral gets sugar (food)



Indirect Effects of Species Interactions

Ant Plants

- *Ants protect plants from herbivorous insects*
- *Plants provide shelter & food for ants*



Cecropia trees & Atta ants

**Species in the community are linked by biotic interactions
into the web of life**

Some interactions are direct:
one species affects another

Others are indirect:
one species affects another through a 3rd species

Ants can have positive or negative effects on plants

***Ex: Ants protect plants
from herbivorous insects***



***Ex: Ants protect herbivorous
insects from predators***

