Energy Flow in the Biosphere,

INTEREST GRABBER - THINK BACK TO CHAPTER 7

**ATOMS** → **MOLECULES** → **ORGANELLES**

*IMAGE SOURCES: see last slide*
CELLS → TISSUES

Similar cells working together

IMAGE SOURCES: see last slide
Different tissues working together → Different organs working together → ORGANISM

IMAGE SOURCES: see last slide
ORGANISMS ➰ POPULATIONS ➰ COMMUNITY

SAME SPECIES LIVING TOGETHER IN AN AREA

Ex: “herd”

DIFFERENT POPULATIONS LIVING TOGETHER IN AN AREA
ECOSYSTEMS → BIOMES → BIOSPHERE

ECOSYSTEMS
All the organisms that live in a place together with their NON-living environment

BIOMES
Group of ecosystems that have same climate and similar communities

BIOSPHERE
The portion of the planet in which all life exists
Organisms so similar to one another that they can breed and produce fertile offspring = **SPECIES**
Horses and donkeys are different species.

If you breed them, the result is a mule which can NOT have offspring!
The scientific study of interactions of organisms with each other and with their environment = **ECOLOGY**

The portion of the planet in which all life exists = **BIOSPHERE**

(includes land, water, atmosphere)

Extends from about 8 km above the Earth’s surface to 11 km below the ocean’s surface
WHAT SHAPES AN ECOSYSTEM?

BIOTIC FACTORS
All the living things an organism interacts with

ABIOTIC FACTORS
All the non-living things that affect an organism

Ex: climate, temperature, sunlight, soil, humidity, wind
HABITAT

= The area where an organism lives

A rattlesnake lives in a desert in the American Southwest
NICHE

= place it lives PLUS the biotic & abiotic interactions it has in that place

NICHE includes: Where it lives PLUS . . .
What it eats? What eats it?
Where in the habitat it lives?
   In a tree, in a pond, underground
Its actions... hibernating, migrating, etc
When & how it reproduces?
NO TWO SPECIES CAN SHARE THE SAME NICHE!

- **Bay-Breasted Warbler**: Feeds in the middle part of the tree.
- **Cape May Warbler**: Feeds at the tips of branches near the top of the tree.
- **Yellow-Rumped Warbler**: Feeds in the lower part of the tree and at the bases of the middle branches.

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**Competitive exclusion principle**
ALL LIVING THINGS USE ENERGY

AUTOTROPHS = PRODUCERS
Can make their own food

Most autotrophs use **PHOTOSYNTHESIS**
to capture solar energy

Main producers on land
= green plants

In water = algae
Some autotrophs can make their own food in the absence of light. They use energy stored in chemical bonds of inorganic molecules to produce carbohydrates = chemosynthesis.

Ex: Bacteria that live in hostile places like volcano vents, hot springs, and marshes.
HETEROTROPHS = CONSUMERS

Get energy from consuming other organisms

http://www.epa.gov/region5/superfund/ecology/images/fishcartoon.gif
HETEROTROPHS = CONSUMERS

HERBIVORES =

- eat only plants

CARNIVORES =

- eat only animals

OMNIVORES =

- eat both plants & animals
HETEROTROPHS = CONSUMERS

DETritivores = feed on plant & animal remains
EX: mites, earthworms, snails, crabs

Decomposers = break down and absorb organic matter
EX: bacteria & fungi
Energy flows through an ecosystem in a series of steps in which organisms transfer energy by being eaten.

CONSUMERS (Heterotrophs)

PRODUCERS (Autotrophs)

= FOOD CHAIN
In most ecosystems, feeding relationships are more complex. A **FOOD WEB** links ALL the food chains in an ecosystem together.
Each step in a food chain or web = **TROPHIC LEVEL**

**PRODUCERS**

ALWAYS make up the **FIRST** trophic level.

http://home.insightbb.com/~g.mager/Pond/Ecosystem.html
Lower levels must be bigger to support the level above.

Only about 10% of the energy from each level is passed on.
Some energy is used for life processes such as growth, development, movement, metabolism, transport, and reproduction.

The rest is lost as HEAT.
WHAT DO CELLS USE ENERGY FOR?

ACTIVE TRANSPORT

Na⁺ - K⁺ PUMP
Endocytosis
Exocytosis

See a movie

Animation from: http://academic.brooklyn.cuny.edu/biology/bio4fv/page/cell-movement.html
WHAT DO CELLS USE ENERGY FOR?

Movement

Synthesis of biomolecules

Meiosis: http://www.tokyo-med.ac.jp/genet/anm/
Cilia: http://www.sk.lung.ca/content.cfm?edit_realword=hwbreathe
Replication: http://www.beyondbooks.com/lif71/4c.asp
Transcription: http://www.wappingerschools.org/RCK/staff/teacherhp/johnson/visualvocab/mRNA.gif
Translation:
Growth and Development

REPRODUCTION

Family image from: http://babyhearing.org/Paren2Parent/index.asp
WAYS ORGANISMS INTERACT
4-2
Ways organisms interact

**COMPETITION**
Between SAME and DIFFERENT kinds of organisms
Compete with each other for available resources

**PREDATION**
Between DIFFERENT kinds of organisms
Hunt and kill other organisms to supply their energy needs

**COOPERATION**
Between SAME kind of organisms
Live together and help each other

**SYMBIOSIS**
Between DIFFERENT kinds of organisms
live in close association with another kind of organism
WHAT IS A RESOURCE?

Anything needed by an organism for life

Examples:

Nutrients, water, light, space
COMPETITION
Organisms in an ecosystem have to compete with each other for available resources. 

http://www.knology.net/~sgoswald/Eating.jpg

COMPETITION
Organisms in an ecosystem have to compete with each other for available resources: shelter

ORGANISMS IN AN ECOSYSTEM HAVE TO COMPETE WITH EACH OTHER FOR AVAILABLE RESOURCES.
COMPETITION
Organisms in an ecosystem have to compete with each other for available resources: **space/territory**

Prairie dogs - 5 to 35 per acre
Mountain lion - 1 male per 50-300 sq. mi
COMPETITION
Organisms in an ecosystem have to compete with each other for available resources: LIGHT

http://vilenski.org/science/safari/cellstructure/chloroplasts.html
INTERDEPENDENCE

All living and non-living things in an ecosystem are interconnected and changing even one thing impacts the whole ecosystem.

When one tugs at a single thing in nature, he finds it attached to the rest of the world.

~John Muir, naturalist, Sierra Club founder
COMPETITION

If resources are scarce, some organisms will starve and populations will decrease.

If resources become more plentiful, populations will increase.

Competition in nature often results in a winner and a loser . . . with the loser failing to survive!
A decrease in the prey population means some predators will starve. Fewer predators mean prey population will increase.

Increase in prey means more food for predators. Predator population will increase until there is not enough food . . . and the cycle repeats itself.
LIMITING NUTRIENT

When an ecosystem receives a LARGE input of limiting nutrient (ie., fertilizer runoff) the population increases dramatically = ALGAL BLOOM

The short supply of a limiting nutrient keeps the population in check.

http://www.greenfacts.org/images/glossary/algae-bloom.jpg
Ways organisms interact

**COOPERATION**

Between SAME kind of organisms
Live together and help each other
COOPERATION

Same species live together in groups
EX: herds, packs, colonies, families, etc

Share food & childcare responsibilities
Groom each other
Take care of sick

http://www.kenyatravelideas.com/african-elephants.html
http://www.sphoto.com/medium/meercats37.jpg
http://people.uleth.ca/~d.rendall/groom4.jpg
COOPERATION

Same species live together in groups
EX: herds, packs, colonies, families, etc

Hunt in packs

Provide protection

http://www.knology.net/~sgoswald/Eating.jpg
http://rosswarner.com/zebras1.jpg
Ways organisms interact

SYMBIOSIS

Between DIFFERENT kinds of organisms
Live in close association with another kind of organism

3 KINDS of SYMBIOSIS

**MUTUALISM**
Both organisms benefit

**COMMENSALISM**
One organism benefits; Other is neither harmed nor helped

**PARASITISM**
One organism benefits; Other is harmed in some way
MUTUALISM
“Good for me - Good for you”

Birds eat parasites living on the hides of giraffes and rhinos while enjoying protection from predators. Groomed animals lose their pests.

http://www.hugheshome.net/jon/africa02/images/rhino_bird_JPG.jpg

http://www.imbt.org/science.htm
MUTUALISM

“Good for me - Good for you”

Insects transfer pollen between plants as they gather nectar for food.
COMMENSALISM
“Good for me - Doesn’t bother you”

Pilot fish receive scraps of food dropped by shark. Shark is neither harmed nor helped
COMMENSALISM
“Good for me - Doesn’t bother you”

Hermit crabs make homes in shells abandoned by snails; Snail is not harmed by crab
PARASITISM
“Good for me – Hurts you”

Barnacles are crustaceans that attach to the surface of whales and feed on their skin and fluids; Whale is harmed
PARASITISM

“Good for me - Hurts you”

http://www.dogbreedinfo.com/guineafowltickphotos.htm

Tick feeds on dog's blood;
Dog has discomfort, can get diseases/infection from bite
PARASITISM
“Good for me - Hurts you”

Tapeworms absorb food by living inside host intestine; host is harmed

http://www.biology.ucok.edu/AnimalBiology/Platyhelminthes/tapeworms.jpg