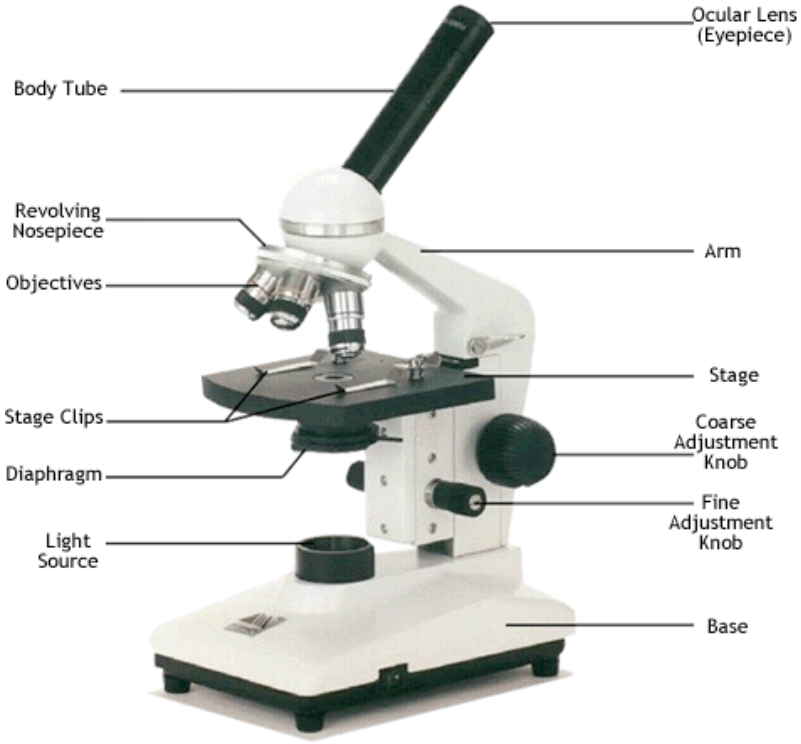
Intro. Unit and Ecology Unit
Study Guide
Adv. Biology

- **<u>Textbook: Chapters 1, 2, 3, and section 4.1</u>**
- Zebra Mussels -
  - An organism that originated in Europe that is clogging up waterways in the U.S.
  - It is cream colored with brown stripes and is headless, hairless, and has no hands.
  - They came on cargo ships from Europe crossing the Atlantic. The ship emptied its ballast, along with the zebra mussels in Lake St. Clair.
  - Their population exploded because they didn't have any predators, the female zebra mussel produced 400 zebra mussels each year, and they are so small.
  - They are a problem because they clog pipes and power lines.
  - They can be called an **<u>invasive species</u>** because their mass reproduction provides issues with overpopulation. They invaded our area.
- Scientific method -
  - Methods used to gather information and to answer questions.
  - Biologists all use similar scientific methods to gather information and answer questions. The biologists observe and infer throughout the entire process.
- Metric System -
  - Uses units with divisions that are powers of ten.
  - The system is called the International System of Units, commonly known as SI. To make communication easier, most scientists use the metric system when collecting data and performing experiments.
  - The SI units most used in biology are meter (length), gram (mass), liter (volume) and second (time).
- Characteristics of Life -
  - <u>Made of one or more cells</u> - The cell is the basic unit of life. It is a basic unit of structure and function in all-living things. All organisms are made up of one or more cell. Humans and plants are multicellular, having many cells.
  - <u>Displays organization</u> - *Organization* - arranged in an orderly way. The levels of organization in biological systems begins with atoms and molecules and increase in complexity. Each organized structure has a specific function.
  - <u>Grows and develops</u> - *Growth* results in an increase of mass to an organism, and, in many, the formation of new cells and new structures. *Development* is the process of natural changes that take place during the life of an organism. It results in different abilities.

- Reproduces - Many living things are the result of *reproduction*--the production of offspring. Reproduction is not an essential characteristic for individual organisms. *A species* is a group of organisms that can breed with one another and produce fertile offspring. If the last individual in a species does not reproduce, the species become extinct.
- Responds to stimuli - Reactions to internal and external stimuli are called *responses*. Anything that is a part of the environment and causes some reaction by the organism is called a *stimulus (*plural *stimuli*. Being able to respond to the environment is critical for an organism's safety and survival; otherwise it won't be able to reproduce.
- Requires energy - Energy is required by living things to fuel their life processes. Living things get their energy from food. Most plants and some unicellular organisms use the energy from sunlight to make their own food and fuel their activities. Other organisms can use the energy in chemical compounds to make their food. Organisms that can't make their own food, such as animals and fungi, get energy by consuming other organisms. Some of the energy that an organism takes in is used for growth, development, and maintaining homeostasis. However, most of the energy is transformed into thermal energy and is radiated to the environment as heat.
- Maintains homeostasis - All organisms keep internal conditions stable to maintain life by a process called *homeostasis*. For example, humans perspire to prevent their body temperature from rising too high. If anything happens within an organism that affects it's normal state, processes to restore the normal state begin. If homeostasis is not restored, it can result in death.
- Adaptations evolve over time - *Adaptations* are inherited changes that occur over time that help the species survive.

- Microscope
  - History - Before microscopes were invented, people believed that diseases were causes by curses and supernatural spirits. Microscopes enabled scientists to view and study cells.
  - Types -
    - Simple Light Microscope - the first person to record looking at water under a microscope was Anton van Leeuwenhoek. He uses a simple light microscope.
    - Compound Light Microscope - uses a series of lenses to magnify objects in steps. Objects can be magnified up to 1500 times.
    - Electron Microscope - Allowed scientists to see structures inside the cell that they couldn't see before. This microscope uses a beam of electrons, rather than light to magnify structures up to 500,000 times.

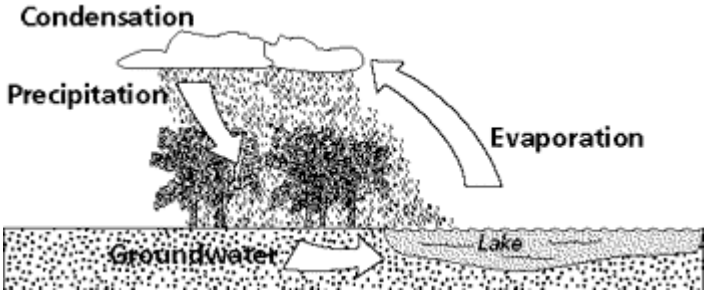
- Parts



- What is ecology? - Ecology is the study of interactions that take place between organisms and their environment.
- Biotic Factors - the **living factors** in an organism's environment. For example, in the habitat of a salmon the biotic factors include all of the organism that live in the water, such as other fish, algae, frogs, and microscopic organisms. Organisms that live on the land adjacent to the water might be biotic factors for the salmon.
- Abiotic Factors - the **nonliving factors** in an organism's environment. The abiotic factors for different organism vary across the biosphere, but organisms that live in the same geographic area might share the same abiotic factors. These factors might include temperature, air or water currents, sunlight, soil type, rainfall or available nutrients. For example, the abiotic factors for salmon might be the temperature range of the water, the pH of the water, and the salt concentration of the water.
- Levels of organization in an ecosystem
  - Organism
  - Population
  - Biological community
  - Ecosystem
  - Biome
  - Biosphere
- Niches - the role or position than an organism has in its environment. It is how it meets its needs for food.
- Habitats - an area where an organism lives.

- Predation - the act of one organism consuming another organism for food. The organism that pursues another organism is the predator, and the organism that is pursued is the prey.
- Prey
- Scavengers - eat animals that have already died.
- Decomposers - break down the complex compounds of dead and decaying plants and animals into smaller molecules that can be more easily absorbed.
- Autotrophs - an organism that collects energy from sunlight or inorganic substances to produce food. Autotrophs are the foundation of all ecosystems because they make energy available for all other organisms in an ecosystem.
- Heterotrophs - an organism that cannot make its own food and feeds on other organisms. They are called consumers.
- Symbiotic relationships
    - Parasitism - a relationship in which one organism benefits at the expense of another organism. Parasites can be external, such as ticks and fleas, or internal, such as bacteria, tapeworms, and roundworms.
    - Commensalism - a relationship in which one organism benefits and the other organism is neither helped nor harmed.
    - Mutualism - the relationship between two or more organisms that live closely together and benefit from each other.
- Food chains - a simple model that shows how energy flows through an ecosystem. For example in a typical grassland food chain, the flower uses energy from the Sun to make its own food. The grasshopper gets its energy from eating the flower. The mouse gets its energy from eating the grasshopper. Finally, the snake gets its energy from eating the mouse. Each organism uses a portion of the energy it obtains from the organism it eats for cellular processes to build new cells and tissues. The remaining energy is released into the surrounding environment and no longer is available to these organisms.
- Food webs - a model representing the many interconnected food chains and pathways in which energy flows through a group of organisms. Feeding relationships usually are more complex than a single food chain because most organisms feed on more than one species. Birds for instance, eat a variety of seeds, fruits, and insects. The model most often used to represent the feeding relationship in an ecosystem is a food web.
- Ecological pyramids
    - Energy - illustrates that the amount of available energy decreases at each succeeding trophic level. The total energy transfer from one trophic level to the next is only about 10% b/c organisms fail to capture and eat all the food energy available at the trophic level below them.
    - Biomass - the total weight of living matter at each trophic level. The pyramid represents the total weight of living materials available at each trophic level.
    - Numbers - shows that population size decreases at each higher trophic level.

- Cycles:
  - Water - water moves in a cycle between organisms on land, the land itself, and the atmosphere. All organisms need water. Plants need water because a plant splits water to produce oxygen. The events of the water cycle are evaporation, condensation, transportation, precipitation, and run off.



  - Nitrogen - the largest concentration of nitrogen is found in the atmosphere, however it can't be readily used by plants and animals. Nitrogen Fixation is the process of capture and conversion of nitrogen into a form that is useable by plants. Consumers get nitrogen by eating plants or animals that contain nitrogen. (Dissolved CO_2 - Decomposers through cellular respiration. **<u>OR</u>** Living thing goes through cellular respiration and dissolves CO_2.) Nitrogen is returned to the soil when: an animal urinates, an organism dies - decomposers transform the nitrogen and into ammonia. Organism in the soil convert ammonia into nitrogen compounds that can be used by plants.
  - Phosphorous - Phosphorus is essential for the growth and development of organisms.
  - There are two cycles - short and long term
    - Short term - phosphates are cycled from the soil to producers and then to consumers. When organisms die, decomposers return the phosphorous to the soil where it can be used again. Phosphorus moves from short to long term though precipitation and sedimentation to form rocks.
    - Long Term - weathering or erosion of rocks that contain phosphorus adds phosphorus to the cycle. Phosphorous in the form of phosphates may only be present in small amounts in soil and water.
  - Carbon - The process of photosynthesis and respiration causes carbon to cycle through the environment. Organisms that respire releases carbon dioxide and water - producers use the carbon dioxide and water for photosynthesis. When decomposers break down dead and decaying organism, they go through cellular respiration and release carbon dioxide. Burning fossil fuels release carbon dioxide back into the environment.
- Succession:
  - Primary - the colonization of barren land by communities of organisms. It takes place on land where there are no living organisms.
  - Secondary - the sequence of changes that takes place after an existing community is severely disrupted in some way. It occurs in areas that previously contained life, and on land that still contains soil. It takes more time than primary succession to reach a climax community.
- Climax communities - a stable mature community that undergoes little or no change in species.

- Pioneer species - the first species to take hold in an area like primary succession.
- Biomes: where they are located, what lives there (primary plants/animals), characteristics and climate (precipitation and temperature)
  - **See Notes Section 3.2**
- Population growth:
  - Linear - populations of organisms do not experience linear growth, rather it starts out slowly and resembles a J-shaped curve.
  - Exponential (J-shaped) - as a population gets larger, it also grows at a faster rate. The graph of a growing population starts out slowly, then begins to resemble a J-shaped curve. The initial increase in the # of organism is slow b/c the # of reproducing individuals is small. Soon the rate of pop. growth increases b/c the total # of individuals that are able to reproduce ahs increased.
  - S-shaped curves - limiting factors such as availability of food, disease, predators, or lack of space will cause population growth to slow. Under these pressures, the population may stabilize in an S-shaped curve.
- Limiting factors - such as availability of food, disease, predators, or lack of space will cause population growth to slow
- Carrying capacity - the # of organisms of one species that an environment can support indefinitely is its carrying capacity. When a pop. overshoots its carrying capacity, then limiting factors may come into effect and deaths begin to exceed births and the pop. falls below carrying capacity.
- Density dependent factors - # of individuals in a given area. They include disease, competition, predators, parasites, and food. (People live close together.)
- Density independent factors - can affect all populations, regardless of their density. Most are abiotic factors such as temperature, storms, floods, drought, and major habitat disruption.
- Competition - a density-dependent factor. When only a few individuals compete for resources, no problem arises. When a population increases to the point at which demand for resources exceeds the supply, the population size decreases.
- Stress - When populations of certain organisms become crowded individuals may exhibit symptoms of stress. Animals can exhibit a variety of stress symptoms that include aggression, decrease in parental care, decreased fertility, and decreased resistance to disease. They become limiting factors for growth and keep populations below carrying capacity.