The World in a Pond

For our purposes, an ecosystem includes an energy source (the sun) and all the living(plants, animals, decomposers) and nonliving (air, soil, water, etc.) components which occupy an area and interact so the unit is self perpetuating. An ecosystem might be a lake or stream and its watershed. An ecosystem is composed of a variety of habitats (areas which supply the survival needs of an organism, living thing).

Following is a brief overview of some relationships which occur in an ecosystem. See the appendix, "A Guide to the Ecosystem Concept" in the WILD Aquatic guide for additional information about ecosystems.

ECOSYSTEMS

Energy

All ecosystems must have a source of energy (usually die sun) because all organism functions such as growth and reproduction require energy. Energy moves through the ecosystem by a. series of events that link organisms together.

Plants have a green chemical called chlorophyll. Plants use chlorophyll to capture energy from the sun (solar energy) to split carbon dioxide atoms and then combine the carbon atoms with oxygen and hydrogen (photosynthesis) to make sugars (food). Solar energy is transformed into chemical energy stored in the bonds that hold the atoms of the sugar molecules. Oxygen also is released. Plants are essential to all ecosystems because they produce oxygen and food needed by all other living things

Photosynthesis:

Carbon dioxide + Water + Sunlight = Simple sugar + Oxygen

(Energy) (Food)

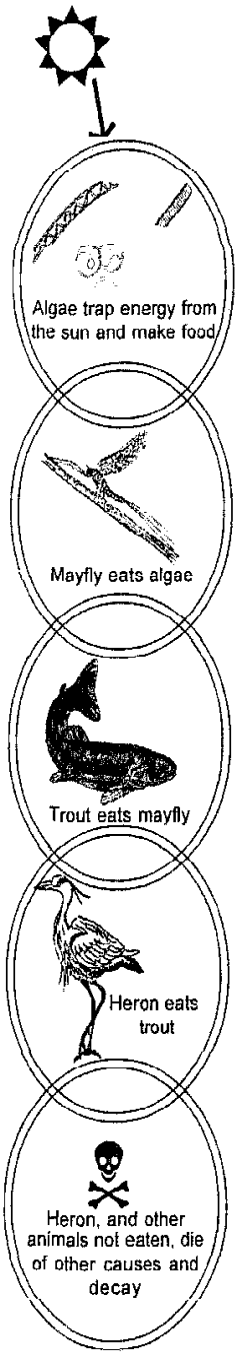
Some sugars produced during photosynthesis are broken down during respiration to release energy needed by the plant for growth and reproduction. Others are used to make "building blocks" that are combined to make plant cells, hence plant parts.

Respiration:

Simple sugar + Oxygen = Carbon dioxide + Water + Energy

(Food) (Heat)

Animals that eat plants (herbivores) use them to make animal parts or burn them to produce energy for their cell functions. Any compounds not used immediately are combined and stored as fats. Tissues of animals eaten by other animals (predators/ carnivores) are broken down and re-combined into new parts for that animal, and so on. Thus, all animals depend on plants for food.



a simple food chain

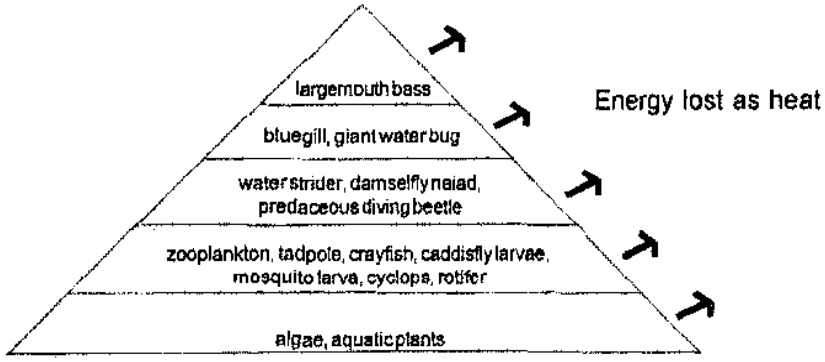
Energy flows from the sun (solar energy) to plants through photosynthesis (where the energy is transformed to chemical energy) through a series of animals being eaten by other animals. This is called a food chain. A simple food chain may start with microscopic green algae. A mayfly naiad (immature mayfly) might feed on these tiny green algae and in turn be eaten by a trout. The trout might ultimately become a meal for a great blue heron or a person.

Because organisms may have more than one food source, they are involved in a number of food chains. These networks of simple food chains overlap forming a food web.

The transfer of energy in a food web involves several trophic ("food") levels. Green plants use sunlight to make their own food, so are producers and are at the first level. Herbivores belong to the second level and are called consumers because they must "consume" food. They are unable to "produce" it. Animals that eat both plants and animals are omnivores. Carnivores (meat eaters) eat other animals.

When a plant or animal dies and is not eaten by another animal. decomposers such as bacteria and fungi break it down (make it rot). Tissues are converted back to simple compounds used by other plants. The cycle continues.

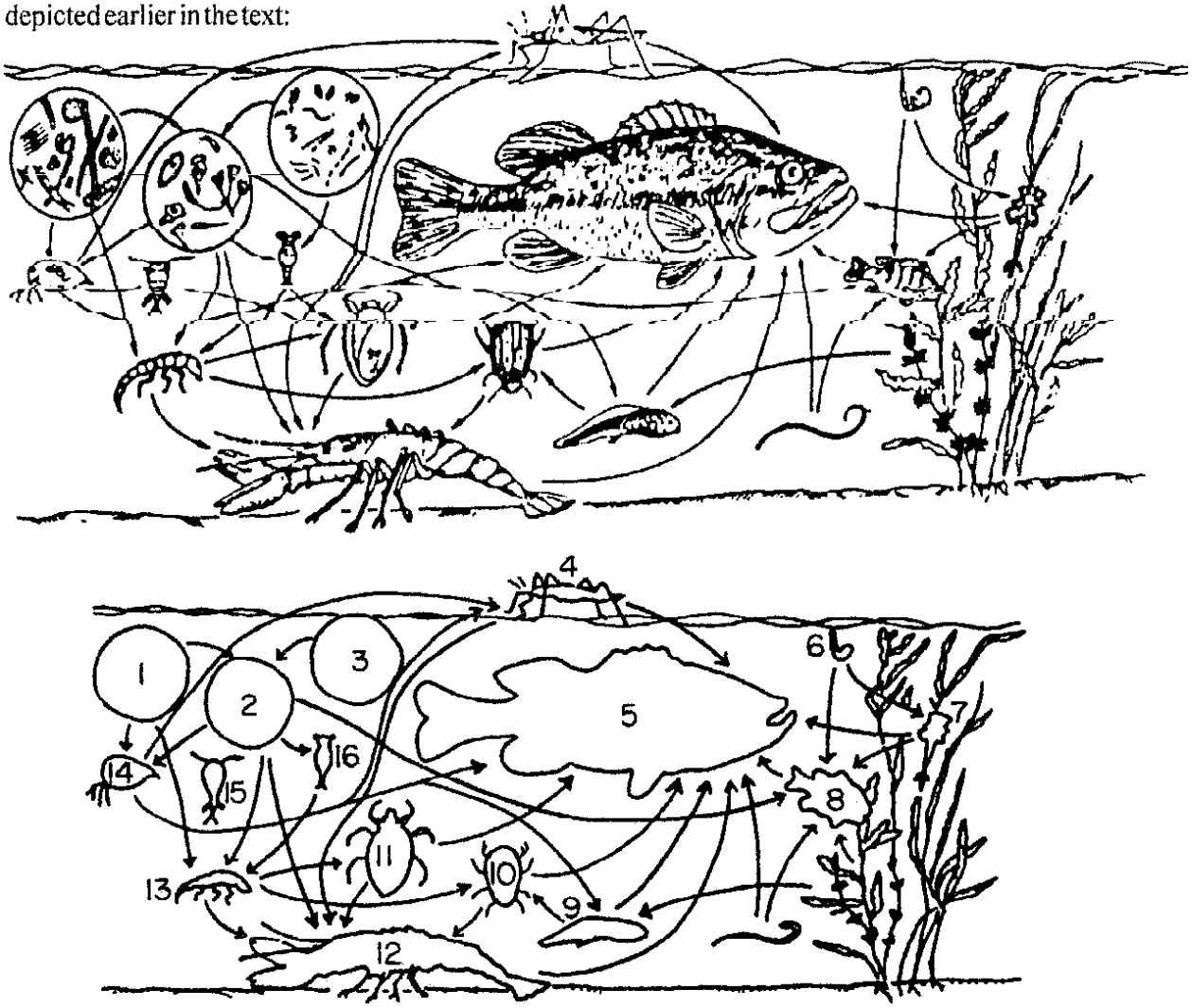
The diagram of a food web in a pond shows how complex food chains can become. Arrows point from the food item to the animal(s) which eat it. People who eat fish also are part of this food web.



A food "pyramid" can he used to depict the smaller numbers of organisms at successive levels. Plants are at the base of the pyramid with a few "top carnivores" at the peak. As energy moves from one trophic level to the next through organisms, energy is lost as heat to maintain cellular functions of each organism. The sloping sides of the food pyramid show less energy is available at each level. An ecosystem can support only so many organisms, as many as can be supported by the energy available. This is called the carrying capacity of the ecosystem.

Every function in life requires energy. Large quantities of energy must be spent in the maintenance and repair of body tissues, and in the performance of functions such as feeding, circulation, and hunting for food. Enough food must be taken in order to have the energy to maintain these functions. Therefore, animals must have a constant supply of food to produce energy.

Following is an example of the different feeding levels in the aquatic food web depicted earlier in the text:



Key: 1)algae 2) zooplankton 3) bacteria 4) water strider 5) largemouth bass 6) mosquito larva 7) damselfly naiad 8) bluegill 9) tadpole 10) predaceous diving beetle 11) giant water bug 12) crayfish 13) caddisfly larva 14) water flea 15) cyclops 16) rotifer

Nutrient Cycling

All living organisms are made up of tiny units called cells and all require certain substances such as carbon, nitrogen, and oxygen to make cell parts. They also need oxygen for respiration. Like energy, these substances are passed through the food chain continuously by a process called nutrient cycling.

Minerals are released from the earth by weathering and erosion into soil, streams, rivers, lakes, and oceans. Some elements like carbon, nitrogen, and oxygen also are found in the atmosphere.

Following is one example of the concept of nutrient cycling:

Carbon Cycle

The carbon cycle is the movement of carbon through the earth's ecosystem. The main source of carbon is carbon dioxide (CO_2) in the atmosphere. Plants use carbon dioxide through photosynthesis. The CO_2 is broken down into carbon (used by the plant to make plant parts) and oxygen. Herbivores eat plants and digest them into simple compounds. Some are "burned" during respiration to produce energy for the animal. Carbon combines with oxygen during respiration and is given off as CO_2.

Carbon not released during respiration is used in building blocks for animal cells and stored in the animal tissue. This carbon is passed to predators feeding on these animals. Carbon incorporated into plant or animal tissues may also be released when the organism dies and decomposes—is broken down by bacteria and fungi. Carbon may be locked in plants for many years—coal and oil are carbon compounds formed from plants and animals that lived millions of years ago. Burning of plants (e.g., wood) or fossil fuels releases carbon in the form of CO_2.

Ecosystem Health

All components of an ecosystem (plants. animals, rocks, dirt, water. etc.) are connected to each other. If a species is removed from the ecosystem, it affects the animals that eat it as well as the plants or animals it eats. Biodiversity (the numbers of species of plants, animals, and microorganisms) is an indication of the health of ecosystems.

Environmental conditions in an ecosystem change. Species unable to survive changes and reproduce may even disappear from the ecosystem (be extirpated). Changes can be greatly accelerated by human activities. If one species disappears from an ecosystem such as a lake or river, the rest of the system is affected.

Changes in one ecosystem can impact others. For example, drainage of a wetland or straightening of a stream channel not only impacts that wetland or stream, it also increases the amount of water passed to other streams and rivers. Increased volume and velocity of water entering a stream can eliminate habitat and make it impossible for certain species to survive, decreasing biodiversity….