Ecosystem Edventure – 5th Grade

Summary

Students will assess biotic and abiotic components of an aquatic ecosystem. Students will ID native plants and review photosynthesis. Students will learn about trophic levels and energy flow in the food web through activities. In addition, students will discuss Earth's water distribution and play a game to learn about ways that water is polluted and cleaned. *This program is 2.5 hours.*

Objectives

- Students will understand how organisms on different *trophic levels* are connected to each other
- Students will understand the *flow of energy* between organisms in a food web
- Students will conduct *water quality* tests and determine what types of *microorganisms* live in an aquatic ecosystem
- Students will understand Earth's *water distribution* and how it is polluted and cleaned
- Students will be able to *identify native plants* types using a dichotomous key

Key Terms

Trophic Levels – an abstract way of thinking about an ecosystem; organisms that share the same function in the ecosystem are grouped together. Producers (plants) are one trophic level, then primary consumers (animals that eat plants), then secondary consumers (animals that eat primary consumers), etc.

Microorganism – a living thing that is too small to see with the naked eye; could include bacteria, fungus, plankton, or even insects.

Ecology – the study of living and nonliving things and the interactions between them.

Biotic vs. Abiotic – the scientific way of saying living vs. nonliving.

Food Chain – a simple way of representing predator/prey relationships in an ecosystem; the food chain is not the whole story, it just represents one series of relationships (hawk□ snake □ mouse □ plants).

Food Web – a more accurate way to show predator/prey dynamics in an ecosystem; a food web shows ALL relationships and all the various food sources for each organism.

Food Pyramid – a food pyramid shows the trophic levels as levels on the pyramid but also indicates how energy moves through the ecosystem.

Background Information

Abiotic Aquatic Lab

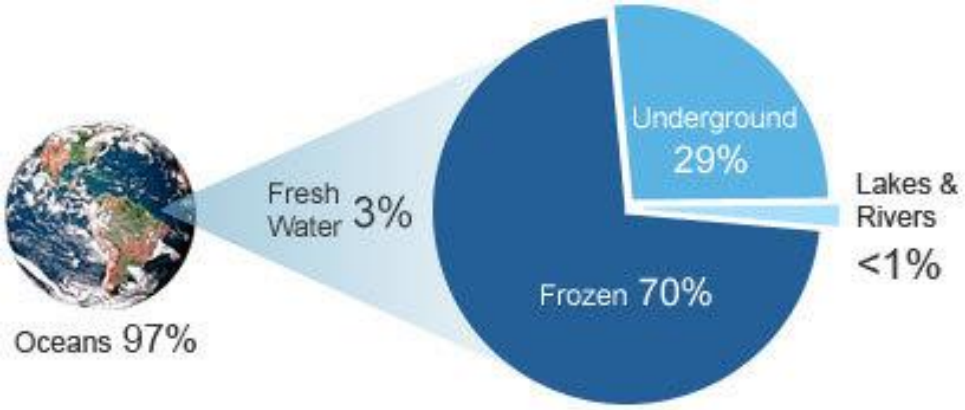
The riparian ecosystem refers to the land that occurs along waterways (comes from Latin root word *ripa*- meaning bank or shore). The students will be testing several physical factors that make this ecosystem distinguishable. pH 'power of hydrogen' is a measurement taken in a solution in order to test the strength of an acid or base. The pH is measured on a scale of 0-14, lower numbers (<7) indicate the solution is an acid, higher numbers (>7) indicate the solution is a base or alkaline. 7 is neutral. Most organisms prefer their aquatic habitat to be close to neutral, although there are some kinds of bacteria that are adapted to survive in acidic or basic environments. Turbidity is the measure of how murky the water is. It is an optical characteristic of water and is an expression of the amount of light that is scattered by material in the water. High concentrations of particulate matter affect light penetration and productivity, recreational values, and habitat quality. Salinity is a measure of all the salts dissolved in water, normally measured in ppt (parts per thousand). Most organisms are adapted to survive in either saltwater or freshwater, so fluctuations in salt levels can make these habitats uninhabitable. Nitrates are part of the nitrogen cycle, where nitrogen is constantly recycled through the living world. Plants and animals need nitrogen-based substances to build chemicals called proteins in their bodies. Plants absorb nitrogen in the form of nitrates from the soil and use it to grow. Animals get nitrogen by eating plants, or plant-eating animals. Too much nitrates in the water can lead to algal blooms and oxygen depletion in the water. Temperature is a factor that influences species distribution because organisms must either maintain a specific internal temperature or inhabit an environment that will keep the body within a temperature range that supports their metabolism.

Biotic Aquatic Lab

Studying the biotic (living) components of an ecosystem can tell you a lot about the ecosystem's health. The number of organisms found is significant, but the amount of variety is more important. Students in this lab will investigate water samples from our pond under microscopes. They are likely to see algae, phytoplankton, and possibly even zooplankton. We occasionally even see insects in these samples. **Algae** are a varied group of plant-like **protists** (mostly single-celled microscopic organisms) which have a very simple structure, with no true tissues. Most types of algae are found in water, but they can grow in any suitably damp conditions, including in soil, on rocks, and even on other living things.

Earth's Water

All the Earth's water is continually being recycled between the Earth, the atmosphere, and living things; this is called the **Water Cycle. Evaporation** is the process by which the surface molecules of a liquid change into a gaseous state. The sun drives this process - water evaporates more easily in hot conditions, such as in the desert, rather than outside on a cloudy winter day. **Condensation** is the process of a gas cooling to form a liquid, it happens because of temperature changes. As warmer air (containing water vapor) floats up into the sky, where it is cold, condensation happens and tiny liquid water particles form the clouds. **Precipitation** occurs when cloud droplets combine to form heavier drops and begins to fall from the sky in the form or rain, sleet, snow, or hail. **Infiltration** occurs when precipitation falls on the landscape and starts to soak into the ground. This happens because of gravity. Water also seeps upwards and sideways, too, from the ground into the bottom of rivers, lakes, and the oceans. Some of the water you see flowing in a river has come up from the ground. Water that falls as rain drains into rivers, then into the sea. **Water pollution** is caused by untreated water from houses and factories flowing into rivers and the sea. 90% of dirty wastewater in developing countries flows straight into rivers, lakes, and the sea. This untreated water pollutes drinking water and is very harmful to people's health. **Sewage** should be cleaned before it is pumped into the sea. In a sewage works system, the water is filtered to remove waste and then left in sedimentation tanks for the solid particles to settle. Bacteria decompose any remaining organic matter and break it down into harmless substances. The ENC is part of the Newport Bay watershed. A **watershed** is an area of land where all the water drains into a central location, normally a larger body of water. For many coastal cities and even cities further inland in California, most watersheds empty into the Pacific Ocean. The below graphic shows the distribution of freshwater on Earth; note that within that 3%, only ~1% is easily accessible to us in lakes and rivers. Water is a precious resource!



Plants

Photosynthesis is the process by which plants use energy from the sunlight to make food from water and carbon dioxide. The equation for photosynthesis is: $6CO_2 + 6H_2O$+ light □ $C_6H_{12}O_6 + 6O_2$ (or carbon dioxide plus water and sunlight = sugar and oxygen). **Transpiration** is the loss of water vapor through leaf stomata. As the outer leaf cells lose water by transpiration, the concentration of minerals and sugars inside them increases. So water from the cells farther in passes into the outer cells, to replace the water that has been lost. The inner cells in turn take water from cells farther down, and so on. Water is 'pulled' up through the plant from the roots, which take in more from the soil. This upward movement of water is called a transpiration stream. A **Dichotomous Key** is a helpful tool that scientists use to identify a grouping of organisms (birds, insects, plants, etc). The key asks simple questions that help your narrow down the options one step at a time. The answers to your questions will eliminate some of the choices and eventually you will end up at the ID of your organism. This is a fun way for students to learn – it's like a 'choose your own adventure' book!

Energy in an Ecosystem

All animals are part of a **food web**. A **food chain** is a series of living things, each of which is eaten by the next in line (see note above about food chain vs. food web). The position of a living thing within a food chain is its **trophic level**, with plants at the first level. Plants are called producers, because they make food, which provides energy. Animals in a food web are called **consumers**. Within a food web, an herbivore is a **primary consumer**. An animal that eats a primary consumer is called a **secondary consumer**, and so on. Food webs also contain organisms called **decomposers**. These include bacteria, fungi and many invertebrates. They break down organic matter and return minerals to the soil. Most of the food an animal eats is used up by its body and some is stored. When that animal is eaten, the next consumer only gains the stored energy. Therefore, much less energy is available at the next stage in the chain. Each trophic level has far fewer consumers in it than the level below. This is because the animals have to eat more food to get the energy they need. Please see the below visual aid which shows how energy is decreased by an entire order of magnitude with each trophic level. This food web is displayed as a pyramid in order to highlight the loss of energy between trophic levels.