DISCOVERY
SCIENCE CENTER

6th GRADE

<u>Sixth Grade Science Content Standards</u>

Plate Tectonics and Earth's Structure

1. Plate tectonics accounts for important features of Earth's surface and major geologic events. As a basis for understanding this concept:

d. Students know that earthquakes are sudden motions along breaks in the crust called faults and that volcanoes and fissures are locations where magma reaches the surface.
e. Students know major geologic events, such as earthquakes, volcanic eruptions, and mountain building, result from plate motions.
f. Students know how to explain major features of California geology (including mountains, faults, volcanoes) in terms of plate tectonics.

Shaping Earth's Surface

2. Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment. As a basis for understanding this concept:

a. Students know water running downhill is the dominant process in shaping the landscape, including California's landscape.
b. *Students know* rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural and recurring patterns.
c. *Students know* beaches are dynamic systems in which the sand is supplied by rivers and moved along the coast by the action of waves.

Ecology (Life Science)

5. Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. As a basis for understanding this concept:

a. *Students know* energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis and then from organism to organism through food webs.
b. *Students know* matter is transferred over time from one organism to others in the food web and between organisms and the physical environment.
c. *Students know* populations of organisms can be categorized by the functions they serve in an ecosystem.

e. *Students know* the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.

Explaining El Niño

Storm systems that have tormented Southern California with crashing surf and flooded streets have made the term El Niño a household word, but what is El Niño? Peruvian fishermen named warm currents in the Pacific Ocean El Niño, after the Christ child, because they often appeared around Christmas time. More recently, El Niño refers to the periodic disruption of the ocean-atmosphere system in the Pacific.

To begin, have the students research the Pacific trade winds and determine where and in what direction the trade winds usually blow. Students should sketch these on the *World Map* handout.

Next, cover the bottom of a shallow tray with water and ask the students to blow in one direction across the top of the water. They should try to blow for as long as possible in the same direction. What happens to the water in the tray? What happens when the blowing stops? Students should see that the water is pushed to the far side of the tray and piles up at the edge when they blowing. When the blowing stops, the water will return to level. How does this relate to El Niño?

Typically, trade winds blow across the Pacific Ocean towards the West. These winds push the warm surface water westward to the coasts of Australia and Indonesia, raising the level of the water almost 50 cm (20 inches) and causing the water temperature to be about 8°C warmer in the western Pacific than off the coast of South America. Warm moist air and heavy rainfall are associated with the warmer water. During El Niño, normally occurring every 2 to 7 years, the trade winds relax and the warmer water makes its way east toward America bringing the heavy rainfall with it. Rainfall decreases in the Western Pacific Ocean coastal areas, causing drought in Indonesia and Australia, and increases in the Eastern Pacific Ocean coastal areas, often times flooding areas of the American west coast. Typically lasting 12 to 18 months, the movement of warm air and water associated with El Niño is significant enough to affect weather on a global scale as well as disrupting the habitats of many fish, birds and other marine animals.

Plant Adaptations

Much of Southern California is a semi-arid environment whose native plants can survive with a minimal amount of water. In the urban parts of Orange County, such as our neighborhoods and school yards, we see a great diversity of non-native, often ornamental, plants. Many of these plants would not be able to survive naturally in Orange County, since our typical average annual rainfall is so slight. However, whether it is native or non-native, the plant itself displays clues about how much water it needs to survive. One of those clues is in the size of the plant’s leaves. Have the class perform the three following experiments to determine how leaf size and other factors determine the plant’s water intake.

Experiment 1

Materials Needed:

- a living house plant or potted plant
- a plastic sandwich bag
- a twist-tie for securing the bag closed

Place the living plant near a window. Cover one of the largest leaves with the sandwich bag and secure the bag closed with the twist-tie. (Be careful not to injure the plant by twisting the tie too tightly.) Observe the bag after several hours.

Upon observation, you will see that the bag has collected water from the plant's leaves. Plants absorb water from the soil through their roots. This water travels up the stem to the leaves and that which is not used during the process of photosynthesis is released through the leaf. This loss of water is called transpiration.

Knowing that a plant loses water through its leaves, do you think a plant with larger or smaller leaves would lose more water? Do you think a plant that has a waxy covering would retain more or less water than one without a waxy covering? Do you think a light-colored leaf or a dark-colored leaf would lose the most water? Can you think of any experiments to test your hypothesis?

Experiment 2

Materials Needed:

- three separate paper towel sheets
- water
- baking sheet (cookie sheet)
- waxed paper

Wet each of the paper towel sheets so they are equally damp, but not dripping. Lay one of the paper towels so it is flat on the cookie sheet. Roll a second paper towel lengthwise and place it on the cookie sheet near the first paper towel. Roll the third paper towel lengthwise, then cover it by rolling a sheet of waxed paper around it. Place the waxed paper-covered towel roll on the cookie sheet with the other two towels. (Make sure the waxed paper is securely wrapped around the paper towel.) Position the cookie sheet so it will receive direct sunlight from a window. Then leave undisturbed for twenty-four hours.

Unroll the paper towels the next day and compare the dampness of the three towels. The flat towel should be dry. The rolled towel should be dry on the outside, but still damp in areas on the inside. The waxed paper-covered towel should be the wettest of all.

The more surface area a leaf has, the greater the amount of transpiration that can and will occur. Plants that have very large leaves transpire great amounts of water and therefore need to live near where water is abundant, such as the sycamore tree which lives in the riparian woodland.

Smaller surface areas allow less water loss. Therefore plants that have very tiny leaves can survive in areas where plants with large leaves would dry up. In other words, the chamise can live in the driest areas of the chaparral because it has very tiny lives.

Some plants retain water by covering their leaves with a waxy coating, as does the scrub oak. So, if you see a plant with large leaves, you know it requires a great deal of water to survive. Plants with small or stiff, wax-covered leaves do not require as much water. Do you think the color of a plant's leaves help it lose or retain water?

Experiment 3

Materials Needed:

- two thermometers
- one piece of black construction paper
- one piece of white construction paper
- tape

Fold the piece of black construction paper in half and tape around the side and one end only to create a pocket or envelop in which you can slide one of the thermometers. (The thermometer should be completely encased inside the paper pocket.) Repeat this activity with the white paper and the second thermometer. Place both pocketed thermometers outdoors in the sunlight side-by-side where they will not be disturbed for at least 30 to 40 minutes.

Have the students predict which of the thermometers will read the highest temperature upon later inspection. Relate the colors of the paper pockets to the shades of green in leaves and ask the students, which plant will get hotter (absorb more sunlight), the one with light green leaves or the one with dark green leaves?

Later check and record the temperature reading from each of the thermometers. The thermometer in the white pocket should read cooler than the one in the black pocket. The darker color absorbs more of the sunlight and therefore, over a period of time, increases the temperature of the surface of the leaf. Plants that can survive in the hottest biotic communities (chaparral, desert) tend to have light-colored leaves (or as we learned before, may have small leaves, or be coated with wax).

Leaf Displays

Creating a collection of leaves is an effective lesson for facilitating closer observation of leaf types. Leaf collections can be made in a variety of ways. One way is to have the students collect and press leaves between large amounts of paper towels, then pile heavy objects, such as books on the stacks for two to three weeks, until the leaves have dried out. It is best to give the students certain criteria for selecting the leaves, such as shape, size, color or texture.

A second method for “collecting” leaves can by through photographs, sketching , or leaf-rubbings. In these ways, the students do not necessarily need to pick the leaves off of the plants.

If collecting marine plants, such as seaweeds, the students can place a piece of rinsed seaweed on a 5” by 7” index card. Then place a piece of waxed paper over the seaweed and place paper toweling beneath the index card before sandwiching this unit between heavy books for two to three weeks. When dried, the seaweed will stick to the index card after removal of the waxed paper and paper toweling.

Salt Water vs. Fresh Water

Southern California is about as geologically diverse an area as you can find. Within forty-five minutes from Orange County you can visit the ocean, the mountains, the desert, and almost anything in between, including prime examples of rural and urban communities. An essential element for life is water ~ and while we are bordered by the Pacific Ocean, our freshwater sources are limited. The distribution of Southern Californian plants and animals is often dependent on or restricted by the type and amount of water available. This activity will demonstrate osmosis and how organisms are affected by the saline (salt) content of the water.

Osmosis is the movement of liquids through membranes. The cell’s membrane is permeable: it has very tiny holes that allow the passage of certain materials in and out of the cell. A liquid moves across the membrane toward the liquid of greater density. More dissolved materials cause a liquid to have greater density. Therefore, salty water is more dense than freshwater.

Materials Needed:

- salt
- teaspoon two shallow bowls
- a cucumber, cut into slices
- masking tape and pen

Label one bowl “SALTWATER” using the tape and pen. Label the second bowl “WATER.” Fill both bowls about half full of water. Stir in one or two spoonfuls of salt into the bowl labeled “SALTWATER.” Place four slices of cucumber into each bowl and wait at least thirty minutes. Remove the soaked cucumber slices and test their flexibility by carefully bending them back and forth. Record the results.

Now switch the slices and place those that were in the saltwater into the freshwater instead, and visa versa. Wait for at least thirty minutes. Then test the cucumbers for their flexibility again. Record the results.

The cucumbers soaked in saltwater become limp while the cucumbers soaked in the freshwater become firm. The cucumbers have a certain amount of liquid naturally inside their cells. When placed in the saltwater, the liquid inside the cells is drawn out of the cucumber through osmosis, causing the cucumber to become limp. (The liquid inside the cells passes through the membrane to the liquid of greater density.)

Cucumber cells are naturally denser than freshwater; therefore, when placed in the freshwater, the cell's membrane allows the addition of water, causing the cells to swell and become firm.

Marine and freshwater animals' cells respond the same way. Fish have similar cells, whether they are marine or freshwater inhabitants. Marine fish tend to dehydrate or lose water due to their salty surroundings, so they compensate for this by drinking lots of extra water, secreting salt from their gills and urinating very small amounts of water. Freshwater fish have the opposite problem and tend to bloat with excess water inside their bodies. Therefore, they have to urinate large amounts of water. Even though their cells perform similarly, their bodies are designed to function differently. That is why a marine fish cannot live long in freshwater, not can a freshwater fish live in the ocean.

Extensions

Obtain a topographical map of Southern California in order to locate the various features discussed in the background information, such as the Transverse and Peninsular Ranges, the Mohave and Colorado Deserts, and more.

Students can create a bulletin board using the map and pressed leaves, magazines pictures of plants and animals, photos, sketches, etc. to depict some of the biotic communities of Southern California.