ACTIVITY 4
Shoebox Watersheds

Background Information:

Bonita Creek is much more than its name suggests. More than a creek, the restoration site represents part of a 'watershed'. A watershed is an area of land that captures rain and sends it downhill by gravity to streams, rivers, lakes, and eventually out to sea. The basis of the watershed is the simple principle that water only runs downhill when under the grip of gravity. Much of the water that falls on the hills surrounding Bonita Creek are absorbed by plant roots, becomes trapped in soil, or evaporates. Some actually makes it all the way to San Diego Creek and from there out into Newport Back Bay.

Now if you visit Bonita Creek, you may notice that the creek is flowing, even when there is not a single cloud in the sky and no rain in sight. In general, creeks can flow year round regardless of the weather for a number of reasons. The water may be coming from snow melting higher in the mountains, or from underground springs. In the case of Bonita Creek however, most of the water comes from an un-natural source: landscaping from housing developments and commercial buildings. Water travels down storm drains (those openings along the edge of roads) and through pipes and eventually into the creek. Water running downhill, whether from natural or not-so-natural sources is called 'runoff'. Environmental scientists and planners want to make sure that runoff water is as clean as possible before it leaves the watershed and enters natural bodies of water such as Newport Back Bay. This is where the vegetation—and the revegetation—of hillside slopes are important in keeping runoff water clean.

When water first falls as rain, it is fairly clean. But as it travels along the ground, it can pick up soil and chemicals (called 'nutrients') from the soil. Erosion will eat away hillsides, depriving them of these nutrients and other materials necessary for a working ecosystem. The remaining hillside plants will suffer as a consequence. Eventually, the eroded materials can build up in streams, ponds, lakes, and coastlines, and in doing so threaten the plants and animals that live there. Erosion can also threaten neighboring habitats as well as houses and other buildings as creeks and rivers can become overwhelmed with too much debris causing water to build up and flooding to occur. Therefore, it is important that the soil along watershed slopes stay there, even in heavy rain. The key to keeping soil put and the watershed slopes stabilized is the vegetation that grows along the slopes. In the following experiment, you will have a chance to see just how important plants are in keeping hillsides from washing away.

Healthy watershed plants have another important function in Bonita Creek and in other natural places near human developments. The runoff that comes from those developments (such as farmlands, houses, and businesses) contains chemicals that are unhealthy for plants and animals. Pesticides, detergents, engine oil, and fertilizer can accumulate in natural bodies of water and soil to unhealthy levels. To alleviate the effects of these chemicals, watershed and creek plants—with the help of ecologically friendly bacteria--absorb and breakdown many of the chemicals before they cause too much damage.

In this activity, tet's see just how effective plants are in keeping soil from eroding away by building a model of a watershed using some grass seed, potting soil, and a plastic shoebox.

What You Need:

- At least two plastic shoeboxes, or similar plastic storage container (you don't need the lids).
- Potting soil mix (enough for each plastic shoe box to fill within a centimeter of the top).

What You Need Continued:

- Grass seed.
- A watering can with a sieve/shower cap (if you don't have one, a metal coffee with small nail holes in the bottom will work just fine. Anything that simulates a rain shower will do).
- Two small clear glass containers such as jars.
- A larger tray or similar container to prop up your shoebox at an angle and to collect runoff water.

Make A Prediction:

Can you predict how effective plants are in keeping runoff water clear and keeping soil in its place?

What To Do:

Preparation:

1. Place potting soil into one of the plastic shoe boxes.
2. Plant grass seed in this shoe box. Follow the instructions on the packet of grass seed for proper planting.
3. Place the planted shoebox in a well-lit area and tend it with proper watering until a healthy growth of grass appears. You may want to trim your makeshift watershed to encourage a thick growth of plants. It will take at least 2 -3 weeks under optimal conditions to get a good growth of plants.
4. Once the planted shoebox is ready, place a similar quantity of soil in the second shoebox. Water it as well, but no plants (this is your plantless hill side slope).
5. Make sure that both shoeboxes have about the same amount of moisture. You can get a sense of this by weighing them.

Experimentation:

1. Place the planted shoebox in the test tray at an angle to create a slope, as on a hillside. This can be achieved by leaning the shoebox on the side of the collection tray. You may want to experiment with different setups here, taking advantage of materials you have on hand. Just keep in mind that you are creating an artificial hillside.

Experimentation Continued:

2. Now it is time for a simulated rainstorm. Using your rainmaking device let it rain on your shoebox watershed. Water will move down the shoebox and eventually collect in the collection tray. Note how much water you use, as you have expose the plantless shoebox with the same amount of water.

3. Collect the water from the collection tray into the clear glass container for examination later.

4. Repeat the experiment with the plantless tray.

Review Your Results:

Review your results and see how well your prediction did.

Compare the runoff water from both trays. Do they differ? If so, how? Which water sample would you want to swim in, or drink?

Take It A Bit Further:

Idea One: How steep is too steep?

See how the angle of your shoebox watershed (the 'slope') affects the runoff. How much more can you tilt your plant shoebox compared to the plantless one? How much can you tilt your shoebox before you have a mudslide?

Idea Two: It's (almost) all in the roots

The stems and leaves of hillside plants help to knock out some of the punch of raindrops before they strike the soil below, helping to keep soil in place. But the real champ in controlling erosion is not what grows above the soil, but below. Demonstrate the importance of plant roots by mowing your shoebox lawn. This can be done safely with scissors. Make sure you cut the grass down to the base, but leave the roots undisturbed. Repeat the experiments above to see if you get similar results with only the roots remaining.

Idea Three: When soil loses the 'good stuff'

When water passes through soil, much of the important nutrients that promote healthy plant growth are lost. This process is called 'leaching', and is similar to when you make coffee or tea by pouring hot water through the ground coffee or tea leaves. The coffee or tea represents the flavors that were leached out. Plants help to hold onto much of these nutrients so they don't end up washing away in the rain.

To demonstrate leaching, take some of the leftover potting soil (enough for several small plant pots) and place it in cheesecloth. Tie the top to make a large soil tea bag. Let this bag soak in water for several days, squeezing it occasionally to get the nutrients to leach out. Now take the soaked soil out and place it in several small plant pots (this will be your experimental group). In several other pots, place unaltered potting soil (this group is your control group because here you made to changes to the soil). Plant seeds in each pot (radish seeds work well, but corn is another option). Make sure the soil is about the same moisture level in all pots first so as not to bias your experiment (now that is a word to look up!). This can be done by first letting your soils dry out completely then adding the same amount of water to each soil type just before planting. Place all the pots in the same location and provide them with the same amount of water and sunlight (Why is that important?). Also, do not give them any form of fertilizer such as plant food.

Later, compare the size and appearance of the plants and they grow. How can you make a graph of your results? Can you predict how leaching will affect plant growth?