

EMWP Watershed Demonstration Kit

www.eastmauiwatershed.org



The East Maui Watershed Partnership has developed an interactive learning experience to teach Maui's students about the East Maui Watershed. The watershed demo outlined in the following pages may be easily adapted to fit the needs of any watershed in Hawai'i. Feel free to print and distribute these pages to other educators.

EMWP offers this demonstration free of charge to educators and organized groups on Maui. If you would like to schedule a presentation, please call us at 573-6999 or email pr@eastmauiwatershed.org.

Objectives

- Explore how watersheds are formed geomorphically and watch how sediment is carried in this system
- Examine the changes to a Hawaiian watershed over time and how these changes affect the watershed
- Apply problem solving skills to natural resource management

Age groups

EMWP has found that this demonstration is best suited for 5th-7th grade students, though it may be adapted for other age groups.

Time

90 minutes -

EMWP couples this demonstration with a 45-minute PowerPoint slide show to give background information to students. The demonstration takes another 30 minutes, and another 15 minutes for set up and clean up.

Materials

All materials are relatively easy to find. The entire model should cost about \$30. EMWP's outreach program operates with four sets. A complete materials list is found on the following page.

Visit our website to read an article in Maui Family Magazine about this watershed demonstration.
www.eastmauiwatershed.org

*This demonstration was adapted from curricular materials developed by the
4-H Youth Development Program in San Luis Obispo County, California*

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Materials you will need for each model

Model

- Diatomaceous earth - available at pool supply stores (it is used as a pool filter)
- Plastic sweater box with lid (approximately 20"x15"x3")
- Garden trowel
- Dust mask or handkerchiefs
- Table cloth, rags, etc. for cleanup

Drip System

- About 5 inches of 1/4 inch drip line tubing - available at hardware or garden supply store
- Adjustable drip emitter - available at hardware or garden supply store
- Plastic jug or water bottle - about 1 liter
- Hot glue gun
- Awl, nail, or other sharp object
- Block of wood or other object that is slightly taller than the height of your sweater box. EMWP uses a plastic pail that double as a container for all the watershed props

Watershed Props

- Spray bottle
- Green sponges cut up to represent rainforest
- Small wooden or plastic houses and/or blocks to represent buildings
- Some green cloth, about 1"x1" to represent agriculture
- Small pieces of coral, lava rock, or pebbles - about 10 pieces, depending on size for building fish ponds
- 1"x1" piece of plastic to represent paved areas
- Food coloring to represent pollution
- Pictures of native species from your watershed, about 1"x1", laminated
- Pictures of invasive species or threats to your watershed, about 1"x1", laminated
- Window screen cut up to represent fences

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How to make the model

Preparing the model is easy. Once you have made one, you can use it again and again.

First, put on a dust mask or handkerchief before you start working with the Diatomaceous Earth (DE). DE is non-toxic but dry, powdery DE can be irritating to the lungs.

Measure about 13 cups (7 lbs) of DE into the plastic sweater box. Add about 12 cups of water. The tricky part is adding just enough water to get the right consistency. Use the garden trowel to mix it well. If the DE looks like it's turning into liquid, it's ready. If it stays dry and crumbly, add more water slowly. Avoid adding too much water - if it turns into a soupy mess, add more DE.

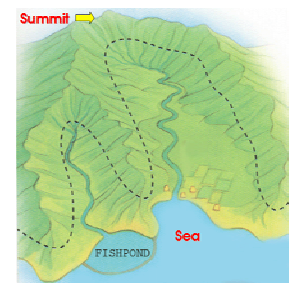
How to make the drip system

Take an awl or other sharp object and punch a hole slightly smaller than your drip tubing into the plastic bottle, about 1.5" from the bottom. Fit the adjustable drip emitter onto one end of the 5" of drip tubing. Put the other end through the hole you just made. Seal it up with the hot glue gun. Test the drip system by filling up the bottle with water and turning on the drip. Check for leaks.



Set it up

Using the trowel, make a slope with the DE in the plastic sweater box. Take the block and set the water bottle on top so that the drip emitter hangs over the high end of slope. Once the drip is turned on, this represents a constant source of water mauka or summit end of the watershed.



Tip: before taking this to the classroom, play with the DE yourself to get a good idea about how it behaves. There is a fine line between too dry and too wet. Mix well. Test the consistency by grabbing the sides of the tub and gently banging the bottom against the table. If the DE looks like it is turning to liquid, it's ready.

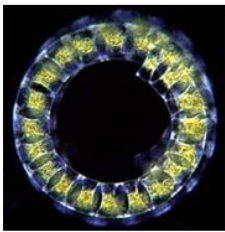
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In the Classroom

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There are a number of different ways to use this watershed demonstration. Be creative, use additional props to fit your needs. Below is a description of how EMWP uses this model.

What is it?



Explain to students that they will be making their own watershed models. Have students guess the material in the box. Give a brief talk about what diatoms are (microscopic aquatic algae), where they are found (rivers, oceans) and how they live (in colonies).

At this point, the Diatomaceous Earth (DE) should be a bit crumbly, to represent a'a lava rock. Explain that the model right now represents your Hawaiian island just after the eruption of Madame Pele's wrath. What you see in the box is a'a lava rock. Ask if anyone has seen a'a before. If you're on the Big Island, the answer is probably going to be a resounding YES! Explain that the Hawaiian islands have all experienced millions of years of wind and rain, and that changes the landscape. Ask them to watch and note the changes. Take the spray bottle and spray water all over the model. This will cause the DE to "erode" and soften the edges of the a'a. The lava rock has been transformed into soil.



Watershed Info

Now that we have the student's attention, we go through a PowerPoint slide show that gives an in-depth discussion about watersheds, Hawaiian rainforest ecology, and natural resource management. This slide show is not available online due to file size, but if you are interested in learning more, contact us at pr@eastmauiwatershed.org. You may substitute this slide show with your own information, or continue with the watershed demonstration. Students will, however, need some background information to better participate in the demonstration.

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The Formation of Watersheds

This section teaches students about the geomorphology of a watershed. Encourage students to touch, get dirty. DE dries to a powder form, and does not stain. Divide students into groups of 2-6; each group gets its own watershed model.

Have students use the trowel to move the DE into a slope and flatten it out a bit. Add water from the water bottle until the DE is just beginning to liquefy (don't use the spray bottle, this would take too long).

Avoid adding too much water, as this will make soup. If this happens, you will have to wait for some of the water to drain out or add more powdered DE (make sure you and/or students have dust masks on!). It's best for the teacher to be familiar with what the ideal consistency is, so that she or he can help students get to the right point.

Once the slope is ready, have students turn on water to about 4 drips/second. Watch what happens. Make sure kids have "hands-off". The model won't work if the students keep touching it.

Pay particular attention to the following:

- EROSION - where soil is washing off the banks
- DEPOSITION - where soil is being deposited
- Changes in the creek channels and banks

After a few minutes, slow the water drip down to 1 drip/second. Have students walk around and check out each other's watersheds - no two are alike. Point out marshes, cliffs, gulches, long sandy beaches, and other interesting formations, especially if they are similar to something you have on your island (i.e. sometimes a deep, wide gulch forms and I liken it to Kaupo Gap on Maui).



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Flora and Fauna

The watershed the students have just created looks like a Hawaiian watershed millions of years ago. It is barren, without life. But it didn't stay that way. What came first to the islands? Plants and animals. Remember, native plants and animals are those that came by three ways, wind, wings and waves, without the help of humans. Have students place the laminated pictures of native plants, birds, insects, and aquatic creatures in the watershed. Take the green sponges and put in forests.



Polynesians

What came next? Polynesians. And with them, they brought along many cultural practices, like farming lo'i and fish ponds. Have students add huts (small blocks), lo'i (green cloth) and fish ponds (coral, lava rock or pebbles) to the watershed.

Europeans and today

Who came after the Polynesians? Europeans, Americans, people from all over the world now live on the Hawaiian islands. Just like the Polynesians, these people also altered the land. Have students add more homes, hotels, malls and parking lots (black piece of plastic).

Changes

Note that the watershed has changed quite a bit since the beginning. Some students may have put new developments amongst the habitat of native plants and animals. Explain that in real life, this did happen, and the result was the extinction of many species. Native plant and animal species that survived were "pushed back" into the upper parts of the watershed. For added effect, you might remove the laminated picture of an extinct bird from the students' watershed and say "this one is now forever gone from your watershed and Hawaii; this species is extinct".

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Invasion

Review with the students what they've done so far - they have created a watershed and added different elements to represent the changes to the watershed over time. Tell them that you are now going to add two "bad things" to their watershed. You want them to think about how these things will affect their watershed, and what they can do about it. The "bad things" are invasive plants, animals, dirty hiking boots, mosquitoes, etc. This gives the power of a natural resource manager in their hands. Tell them they will be presenting their management ideas to the classroom later. Many of them will immediately fence in the pigs and deer. Some may even try to fence in mosquitoes.

While they are contemplating what to do about their new invaders, go about the different watershed groups and add another factor, "pollution", using the a food coloring. Place one drop onto the sponge "forest" and one drop on the black plastic "parking lot" and have a student create a big storm using the spray bottle. Have students pay attention to where the pollution goes, and how fast it moves.

Review

Once everyone has had a chance to finish their watershed, discuss and review the activity. Have student groups present their ideas about natural resource management. Talk about hikes into native forest, career opportunities, etc.

Clean up

It is best to have students first dip their hands and arms in a bucket of water to remove the majority of the DE before washing in the sink. Otherwise, the plumbing gets clogged. Remove all the props from the box and let the water sit undisturbed for at least 5 minutes. The DE will sink and the water will rise. Carefully pour off the water, preferably into soil (not the sink!). Let it sit for another 5 minutes, then again pour off the water. Put the lid back on and store it. The watershed model can be re-used over and over again.