Construct a Watershed Model

Adapted from "A MyScienceBox Lesson Plan" by Irene Salter (http://www.mysciencebox.org)

Summary

Simple materials are turned into models of wetlands and watersheds in this simple activity. Students follow the path of the water (and urban runoff) to a lake and develop an initial understanding of what watersheds are. Then some students add sponges to the borders of their lake to simulate wetlands and compare watersheds with wetlands to those without. Students extrapolate the role of watersheds as reservoirs in times of drought, as sponges in times of flood, and as filters for pollution. Finally, students compare watersheds with wetlands to those without after a "toxic chemical spill" (Koolaid drink mix) to see the effects of pollution throughout the watershed as well as to discover the role of wetlands in reducing the harm of severe pollutants to a lake.

Materials

Each team of 3 students needs:

- 1 plastic shoebox-sized container (great for organizing supply closets later on!)
- 1 kitchen sponge cut into 4 rectangular pieces (the yellow sponges with the green scrubtrayg material are cool because kids can observe a color change in the yellow "soil" portion of the sponge while the green material simulates plants living in the wetlands)
- 1 water spray bottle (available at most hardware stores near the cleaning supplies or at plant nurseries for watering and misting plants)
- a multi-color assortment of water-based markers

The teacher needs:

- a stack of white cardstock paper (each team will use 3 sheets)
- 1 packet of colored drink mix like Koolaid or Hawaiian Punch
- 1 spoon
- optional - map or satellite image of the school and neighboring areas showing the watershed

Everyone needs:

- a copy of the Watershed and Wetlands Questions
- a sink to clean sponges and dump dirty water
- a trash can

Procedure

- Group students into teams of 3 that later pair up into groups of 6

Part 1 – Building a watershed

1) Tell students to imagine that it is raining. Ask the students: "Where does raindrop go after it hits the school building? Where does it go from there? Where does it end up?" They should be able to trace it to a gutter. You may need to prompt them towards naming the rest of the route.
2) Discuss the idea of a watershed. It includes all the land that water flows over and through to get to a larger body of water. Help students imagine what this means in terms of a raindrop that falls in different places in your watershed. Use a map if you want. It is not important that all the kids completely understand the idea right now. The activity that follows should help consolidate the idea for kids that aren't getting it right away.
3) Tell the students that they will be building models of watersheds and observing what happens to their models when it "rains". Briefly demonstrate what they will be doing to make their watershed (see steps 5-8) so they can see a nearly finished product before setting the kids loose.
4) Split the class into groups of 3 and have 1 member of each group collect 3 sheets of cardstock and 1 watershed tub. The rest of the group should clear everything off the tables except for a pencil for each student (they may get wet).
5) Crumple the sheet of cardstock into a ball then slowly flatten it out again. You should have a piece of paper with many valleys and ridges. Pick one end to be the top; this end will have tall mountains. The other end will be near a lake.
6) First, add water to your watershed. Make students think about where to put these rivers. Will they be at the tops of ridges or in the valleys? Where might lakes form?
7) Next add natural areas – animals, trees, plants, rocks, sandy banks. Add urban and agricultural areas – houses, cars, schools, farms, gardens, factories, roads, cars. Make students think about where to put various things. Where would you find forests? Where would you find meadows? Where would animals want to live? Where might it be very rocky? Where would people want to build houses? How would they get to their houses? Where would they work and go to school? Where would their food come from? Would you want to build a farm at the top of a mountain? Allow 5-10 minutes for students to finish their watersheds. They should be very colorful.
8) Carefully fit the watershed into the plastic tray so that the mountainside is propped up on the narrow end of the tray (the mountain end) and the land slopes gradually towards the far end of the tray (the lake end), leaving a 2-3 inch gap between the end of the paper and the lake end. Wedge the paper snugly in place leaving as little gap as possible between the sides and the paper.
9) Take one of the markers and prop the mountain end of the tray up a little. This is to make sure that a lake forms on the lake end and does not run back under the land.
10) The 3 students should take turns spraying the paper using the fine mist setting. Spray for 3-5 minutes until there is a decent sized puddle in the lake end.
11) Give students the Watershed and Wetlands Questions handout and give students a few minutes to answer the first set of questions. The questions do not have to be used during class. You could use the questions to being a class discussion or use them as a homework assessment.
12) When students have finished writing their answers, begin a discussion of how this model represents a watershed and how different things affect the watershed. If you still have the diagram of your watershed on the board, you could add these ideas to your diagram. Now is the time to really consolidate the idea of a watershed. Some questions could include:
    - What path did the rain take through your watershed?
    - What effect do natural areas have on the watershed? Urban areas? Agricultural areas?
    - What is "runoff"? Is runoff different in natural versus urban versus agricultural areas? It is important to distinguish erosion from urban runoff.
    - What affect does runoff have on the lake?
    - What is a watershed? How is this model similar to a real watershed? How is it different?

Part 2 – Adding Wetlands

13) Tell students that they will now build another watershed. This time, we will compare watersheds with wetlands to those without. Open a discussion of what students think wetlands are. Have they ever seen one? What does it look like? What kinds of plants and animals live there? If they don't know the term wetland, they will likely have heard of a marsh and can bring up a good mental picture.
14) Pair teams up with one another. One team will have a wetland represented by sponges at the border between the land and the lake; the other will do the activity exactly as before (in the third rendition, they will switch roles so that everyone has a wetland once).
15) Clean up the materials and allow groups to create a new watershed with a new sheet of cardstock paper. It should not take as much time this time nor is it necessary for the watersheds to be as elaborate.
16) Set up the trays as before, however, one team should add a tightly packed row of damp sponges to the border between the land and the lake. **THE SPONGES MUST BE DAMP**. They should not be sopping wet, nor should they be wrung out as much as possible. They should be somewhere in between so that some water could still be wrung out if you tried.
17) Place the watershed with wetlands directly beside the watershed without wetlands and prop up the mountain end with a marker.
18) Allow it to rain an equal amount on each watershed. The students should make an effort to squirt the 2 watersheds an equal number of times. As it rains, encourage them to notice any differences between the 2 watersheds.Stop when a decent sized lake had built up – about 3 minutes.
19) Give students a few minutes to answer the second set of questions. When students have finished writing their answers, begin a discussion of what the role of watersheds might be. Some questions you may want to consider include:
    - Were there any differences in how quickly each lake filled? What does that mean about what wetlands do in times of heavy rain? Introduce the idea of wetlands as sponges during wet times and reservoirs during dry times to even out the flow of water.
    - What happened to the color of the bottoms of the sponges? What does this represent? Introduce the idea of wetlands as filters for pollution.

Part 3 – Toxic Waste!

20) Have students hypothesize what might happen to a watershed if a truck carrying pesticides crashed along a highway near a creek. What parts of the watershed might be affected?
21) Students will now have a chance to test their ideas on their models. As before, there will be one team with a wetland and one without, however they should switch roles. A spoonful of pesticide will be added to each watershed before it rains.
22) Clean up the materials and allow groups to create a new watershed with a new sheet of cardstock paper. Set up the trays as before, placing the watershed with wetlands directly beside the watershed without wetlands and prop up the mountain end with a marker.
23) At this point, the teacher should go around and add a teaspoonful of drink mix to the middle of each watershed.
24) Allow it to rain an equal amount on each watershed. Notice any differences between the 2 watersheds. Stop when a decent sized lake had built up – about 3 minutes.
25) Give students a few minutes to answer the final set of questions. When students have finished writing their answers, begin a discussion about the differences between non-point source pollution (runoff) and a pesticide spill. This activity should clearly illustrate how a single event in one location can affect a very large area and affects all downstream water users including wildlife in the marsh and the lake. Students will observe that while a wetland can soak up some pollution, some will also leak through into the lake. Can it be cleaned up once it gets into the water? Emphasize that although a waste spill is far more dramatic, urban non-point source pollution accounts for the vast majority of the pollution in most watersheds.
26) Given what we've discovered about watersheds and wetlands, what can we do to help them thrive? Have students brainstorm ideas.
27) Clean up.

Watersheds and Wetlands Questions

Part 1 – Building a watershed

1. Describe the path that the rain took through your watershed.

2. What happened to the drawings that represented natural areas (creeks, trees, plants, animals, wildlife)? What does this represent in nature?

3. What happened to the drawings that represented urban areas (houses, schools, factories, roads, cars)? What does this represent in the real world?

4. What effect did the runoff from natural and urban areas have on the lake that formed at the bottom of the land area?

5. The models we are using are not perfect. What is wrong with our watershed models? How are they different from a watershed in the real world?

Part 2 – Adding wetlands

1. How quickly did the lake with a wetland fill up compared to the lake without wetlands?

2. How much water is the lake with a wetland compared to the lake without wetlands?

3. Look at the underside of the wetlands. What happened? What does this represent?

4. The models we are using are not perfect. What is wrong with our wetland models? How are they different from a wetland in the real world?

Part 3 – Toxic waste!

1. The drink mix represented pesticides. What other real world toxic wastes could affect a watershed.

2. Where did the toxic waste go in your watershed?

3. What parts of the watershed were affected? What parts were not affected?

4. Describe any differences between the watershed with wetlands and the watershed without wetlands.