

Silt: A Dirty Word

Can land-based activities influence aquatic wildlife and its habitat? Experience what happens to a stream and its flow of water when silt and/or sand are added to the water.

Concepts

Sedimentation causes a change in water flow.

Objectives

Students will:

- describe how sand and/or silt affects water flow
- identify human activities that add sand and/or silt to surface water.

Duration

One hour

Method

Students create a model to simulate changes to a stream and its water flow when silt and/or sand are added to the system.

Materials

For each group of three or four students:

1. a clear plastic one-gallon container, such as a storage box
2. enough pea-sized gravel to cover the bottom of the container
3. enough water to fill the container to one inch from the top
4. one cup coarse sand
5. one cup silt (silica powder from the edge of a stream)
6. three straws per person

Preparation

Before class, set up one demonstration – a container with gravel covered by water – so that the students can see how to proceed. Post a large sheet of paper on the wall for groups to record their results.

Background

Sedimentation of streams and rivers happens when excess amounts of silt (fine dirt and sand) and other particles enter these waterways from the surrounding watershed. Sedimentation occurs as surface erosion or mass erosion. Surface erosion sends small amounts of particles into the water, while mass erosion dumps huge amounts of dirt into water (such as mudslides). Causes of surface erosion vary, such as hiking and fishing trails, over-used campsites, or cattle trampling and consuming streamside vegetation that holds soil in place. Logging, mining, and road construction can also contribute to surface erosion. Mass erosion is more severe, and occurs on hillsides or areas altered by human activity such as clear-cut logging, road construction, home building, and sometimes certain agricultural practices.

Regardless of its source, sedimentation can affect aquatic wildlife by reducing nutrients, diminishing sunlight to plants, and altering stream energy and velocity. Sedimentation can also block the flow of water to organisms residing in bottom substrates. The flow of clean water is important in most aquatic environments because flowing water often carries dissolved oxygen that aquatic animals need for respiration. Depletion of oxygen in bodies of water affects organisms even at early stages of development. For instance, some fish lay their eggs in gravel that receives a flow of clean water, either from a stream or river or from spring water percolating up from the lake bottom. As the water flows over the eggs, it delivers dissolved oxygen to them. If the eggs do not receive enough oxygen, they die.

Silt and sand enter streams through erosion. Silt and sand act like concrete to block water movement, and thus diminish the amount of oxygen reaching the developing eggs. Once the erosion-causing activity is stopped, streams may cleanse themselves. (Depending on the extent of the problem, self-cleaning can take from one to 50 years.)

The major purpose of this activity is to show that aquatic wildlife and its habitat can be influenced by land-based activities in the surrounding watershed. Students experience what happens to a stream and its flow of water when silt and/or sand are added to the water.

Questions to discuss with students might be: What role might wetlands play in this issue? How might the affects change in an urban environment? What happens to sediment now that Ballona Creek is in a cement channel?

Materials

For each group of three or four students:

7. a clear plastic one-gallon container, such as a storage box
8. enough pea-sized gravel to cover the bottom of the container
9. enough water to fill the container to one inch from the top
10. one cup coarse sand
11. one cup silt (silica powder from the edge of a stream)
12. three straws per person

Preparation

Before class, set up one demonstration – a container with gravel covered by water – so that the students can see how to proceed. Post a large sheet of paper on the wall for groups to record their results.

Activity

1. Place students into groups of three or four. Ask each group to gather the supplies and set up their demonstration. Ask the students why oxygen is important to aquatic animals. Explain the three parts of the procedure (Steps 3, 4, and 5 below) and ask them to predict what will happen as each sediment type is added to the water.
2. Each person in the group should simultaneously blow bubbles into the water with their straw. The group then discusses the ease or difficulty in blowing the bubbles and records its observations on the sheet on the wall.
3. Instruct the groups to add one cup of sand to the water, and then blow bubbles again. The group then discusses the difficulty level and records its observations on the master sheet on the wall.
4. Now add one cup of silt to the water, and blow bubbles again. The group then discusses the difficulty level and records its observations on the master sheet on the wall.
5. Conduct a class discussion about the demonstration and results, and what these results might mean to aquatic organisms and their need for clean water. How does the sand and silt get into the water in nature? Which of these sources are human and which are natural? What can happen to fish and other aquatic organisms if too much sediment gets into aquatic systems?

Extension

Research and discuss ways to minimize the addition of sand or silt in natural aquatic systems.

Evaluation

1. Write on a chart or blackboard all the observations and ideas generated by the students; engage them in a discussion about the meaning of these results.
2. Ask each group to create two illustrations: 1) a healthy stream that could support a variety of aquatic life; and 2) a human activity that causes siltation in that stream.
3. Examine a map with construction zones or new housing to identify local sources.

Additional Resources

Silt: <http://en.wikipedia.org/wiki/Silt>

Sediment: <http://www.cuyahogariverrap.org/SedimentBrochure.pdf>

Sample Observations Chart

Each group of students selects one difficulty level for each water type by placing a check in the appropriate box in its column. They may record additional observations in the boxes as well.

| Difficulty Levels | Group 1 | Group 2 | Group 3 | Group 4 |
|--------------------------|----------------|----------------|----------------|----------------|
| Clean Water | | | | |
| Easy to blow | | | | |
| Less easy to blow | | | | |
| Hard to blow | | | | |
| | | | | |
| Sand in Water | | | | |
| Easy to blow | | | | |
| Less easy to blow | | | | |
| Hard to blow | | | | |
| | | | | |
| Silt in Water | | | | |
| Easy to blow | | | | |
| Less easy to blow | | | | |
| Hard to blow | | | | |