

How Much Water Do We Really Have?

Objective:

Students visually learn how much freshwater is available on Earth by cutting an apple into the corresponding size fractions that represent salt water, land, and freshwater. Students learn a method of keeping our waterways cleaner.

Background Information:

It is difficult for students to visualize how much freshwater we have on Earth because students can easily turn on the faucet and watch gallons of water pour out. In this activity, an apple is used to represent the Earth. Three-fourths of the Earth's surface is covered with salt water, which may not be used for drinking by human beings. To demonstrate this, you will first cut an apple into four pieces and set three of these pieces away. This last piece represents land that may be used by humans. You will then cut this piece in half, as the other part is too mountainous, or too hot. You will keep cutting the apple down into smaller slices until you are ultimately left with a small slice that represents the amount of freshwater on Earth. This slice represents $\frac{3}{100}$ of the total apple (or Earth), which means that less than 1% of the Earth's surface contains drinking water! This activity is from the book "The Growing Classroom".

After showing the students that there really is not that much water on the surface of the Earth compared to the Earth's vast size, have the students brainstorm ways that they can save water or pollute the water less. We can pollute the water less by using natural, biodegradable dishwashing liquids. If dishwashing liquids that are not biodegradable end up in our watersheds, they can destroy life in nearby bodies of water. Water has surface tension, which causes the molecules to stick together. Some very beneficial insects depend on this property of water, as they are literally able to walk on water! In the remaining part of this lesson, students will carefully balance paper clips (representing the insects) on the surface of the water. Once the paper clip is balanced, they will add a drop of dish washing liquid that is not biodegradable. This liquid causes the molecules to interact with each other differently, and will end up destroying the surface tension of the water's surface. The paper clip (insect) will plummet to the bottom of the pool of water! By choosing biodegradable dish washing liquids, we can reduce the damage that humans have on the life of insects in our aquatic ecosystems. See the website listed below for more information.

Materials:

- 1 Apple for class
- Knife
- 1 small bowl for each child
- 1 fork for each child
- 1 paperclip for each student
- Pitchers of water
- Biodegradable dish washing liquid
- Non-biodegradable dish washing liquid.

Preparation:

1. Read through the procedure below.
2. Buy the materials listed above.
3. Fill a couple of pitchers with water.

Procedure:

1. Pretend that this apple is the Earth. How much of the Earth do you think is covered with freshwater that we can drink? How much do you think is covered with land?
2. Our goal is to find out how much water there is on earth for us to drink.
3. Cut the apple into four quarters and set 3 of them aside. Explain that those three quarters represent the surface of the Earth that is the ocean. The remaining quarter represents the earth's surface that is not under salt water.
4. Cut this quarter in half and set one piece aside. The remaining piece is the part that is suitable for humans to live in. The part that was set aside was too hot, cold, or dry.
5. Now cut the remaining piece (where humans can live comfortably) into four pieces. Set three of them aside. These pieces represent land that is occupied by factories, cities, or highways. The one remaining piece represents the land that is presently tilled and supplies our food and clothing.
6. Cut a small piece from this last slide. This represents the amount of freshwater on the earth's surface. It represents less than 1% of the earth's vast surface that contains drinking water!
7. Ask the students the following questions:
 - Do we have enough land to farm for all of the people on Earth?
 - Do we have enough water for us to drink?
 - Who takes care of our water and land?
 - What can we do to preserve the water that we do have?
 - How can we treat the water to make sure that it is not polluted?
8. Record ideas regarding how we should treat our freshwater on the board. Tell students that you are going to use the remaining time in class to focus on one way we can potentially pollute our waters: through the use of non-biodegradable liquid dish soap.
9. Ask students if they have ever seen any insects standing on water? Explain that they are able to do so through the surface tension of the water molecules sticking together. Many aquatic insects are beneficial!
10. Explain that there are two types of liquid dish soap: one that is biodegradable, which breaks down easily into forms of chemicals that are already found in the environment, and liquid dish soap that is not biodegradable. Non-biodegradable dish soap can pollute our water if it ends up in our watersheds. A common way that dish soap can enter nearby bodies of water is when people decide to wash their own car outside. Often they use dish soap and dump the soapy water on pavement when they are through. This soap then travels to nearby aquatic ecosystems during the next rain.
11. Divide the class up into groups of two. Pass out a bowl, a paper clip, and a fork to each student. Fill the bowls with water.
12. Tell the students that they are going to pretend that the paper clip is an insect. Tell them it is possible to have the paper clip float on top of the water, just as insects are able to walk on the water. Tell them to place the paperclip on the edge of the fork,

- and to slide it gently off of the fork onto the top of the water. After a couple of tries, the paperclip should float on top of the water.
13. Now have each group of two determine which bowl they are going to add the biodegradable dish soap to and which bowl they will add the non-biodegradable dish to.
 14. Have the students add one drop of soap to each bowl.
 15. Ask the students “What happened to the paper clip that had the dish soap that is not biodegradable? It should have sunk. The surface tension of the water is often destroyed by dish soap, killing many aquatic insects because they are no longer able to live on the surface of the water.
 16. What happened to the paper clip when the biodegradable dish soap was added? Hopefully nothing! The chemicals in the biodegradable dish soap are natural ones that are easily broken down and used by different microorganisms in aquatic environments. This type of dish soap does not pollute, nor does it destroy the lives of many aquatic insects!
 17. Be sure to save time to clean up. Once the students have cleaned up their work areas, have them brainstorm some other steps that they can take to preserve the freshwater in their community.

Sources:

Jaffe, Roberta and Gary Appel. The Growing Classroom. Parsippany: Dale Seymour Publications, 1990.

<http://www.epa.gov/OWOW/NPS/kids/SINKSWIM.HTM>