

ACTIVITY 14

Water, Water Everywhere?

Summary:

Participants explore the availability of water for human use.

Grade Level:

3-8

Time:

Two 30-45 minute periods

Learning Objectives:

Participants will be able to:

- ◆ Appreciate how little water is actually available for human use.
- ◆ Discuss how humans use water.
- ◆ Formulate ideas to conserve water.

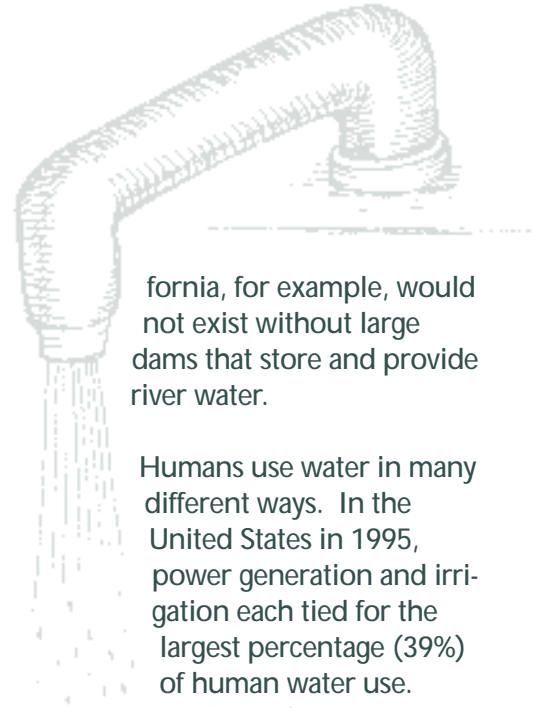
Materials Needed:

- ◆ 2 large, clear plastic containers or an aquarium (at least 4 gallons)
- ◆ 2 or 3 smaller buckets or other containers (1 gallon or less)
- ◆ 2 or 3 measuring beakers (or measuring cups)
- ◆ Calculators
- ◆ Several water droppers
- ◆ World map
- ◆ Reference materials, and/or chart, (p.111)

Background:

Water is a **finite resource**, that is, the water we have on the planet is all we have. We cannot make more. So, it's possible that the glass of water a person drinks today may have been in a dinosaur's intestine millions of years ago. One of water's unique characteristics is its versatility; it exists on Earth in many different forms, often changing from one state to the next (liquid to solid, solid to liquid, liquid to gas, gas to liquid).

Ninety-seven percent of the Earth's water is ocean water, as yet largely unusable to humans for drinking, sanitation, cooking, or growing crops for food. Two percent is frozen in icecaps and glaciers. Another small portion consists of salty inland seas and lakes, soil moisture, and the atmosphere, which leaves less than one percent available for human domestic use. This small portion of the water supply consists largely of underground reservoirs of water called **ground water**, but also includes the small amount in freshwater lakes and rivers. Oddly enough, it is from rivers, the smallest (0.0001%) portion of Earth's water supply that humans obtain most of their water. This supply is unevenly distributed across the Earth. Arid and semi-arid regions, which receive little precipitation, build dams to store what little water is available. The large cities of Cali-



fornia, for example, would not exist without large dams that store and provide river water.

Humans use water in many different ways. In the United States in 1995, power generation and irrigation each tied for the largest percentage (39%) of human water use.

Water is used in power generation largely to cool the electricity-generating elements, though there is also hydroelectric power, which generates power as water flows over large turbine blades. Irrigation accounts for such a large percentage because so many crops grown in the U.S. would not thrive as well with only water they receive from rainfall (many areas that grow crops receive little rain). Other water uses include public water supply, which accounts for most drinking water and domestic uses (e.g., washing the dishes, laundry, the car, watering the lawn), industrial and mining use, water for livestock, and commercial use. Wastewater treatment is another important use of water for humans, though it is not counted in human water consumption because it deals with water that has already been used.





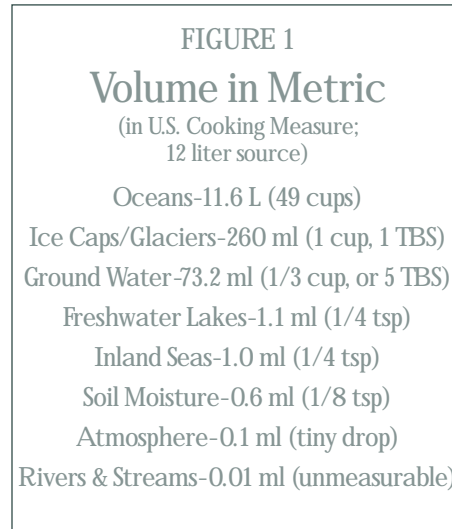
Water, Water Everywhere?

What to Do:

1. Introduce the activity by asking participants, *Where in the world is the most amount of water found?* (The oceans.) *Where are other places water can be found?* (Ice-caps, ground water, inland lakes and seas, freshwater lakes, the atmosphere, in soil, rivers and streams.) Write, or have participants write the answers on a board or a large piece of paper. Next, have them brainstorm the order in which water on Earth exists, from greatest volume (oceans) to the least volume (rivers and streams).

2. Tell participants that for the purposes of this activity, the group as a whole will begin with 12 liters (about 3.2 gallons) of water, which will represent all of the water on Earth. The group should have the measuring beakers (or measuring cups) handy at the start of this activity. Piece by piece, they will remove different bodies of water that are effectively not available for human use. Each time they remove a "body of water," they should place the water in a separate container.

3. Ask participants to first remove water that represents the ocean. See Figure 1 for the approximate amount of water they should remove. Have participants sit or stand in a circle around the "world's water supply." They should decide with which measuring beaker or cup



they will begin, and then should each take turns (and pass the beaker/cup to the next participant) to do their part to remove the water. Count for them, or have them count along to make sure the right number of units is removed. Have them dump their full cups into another gallon or large container.

4. Next, they should remove the water stored in icecaps and glaciers, then inland seas, then (if it is possible at this point) a tiny bit for soil moisture and the atmosphere combined. As the water bodies become progressively smaller, allow participants to decide to use different measuring beakers, cups, or water droppers to extract the water.

5. When all these are done, ask, *What is left?* Tell participants that humans can use only about what they see left in the large container,

less than 1% of the world's water! Add to that the fact that most water used by humans is from rivers and streams, which is only 0.0001% of all the water on Earth! Challenge participants to think about how they would have extracted 0.0001% of the water they had in the large container. Ask participants, *How do humans get enough water?* (Some examples: Dams contain water so that it can be easily extracted, pipelines and aqueducts move water to a particular place to be used, wells are drilled to extract ground water.)

6. After participants have discussed the small amount of water available for humans to use, ask them, *What do people do with the water we use?* Have them create a list (see examples below).

Domestic uses: cooking, cleaning, teeth brushing, bathing, to flush toilet, watering lawn, etc.

Commercial uses: restaurants, car washes, public restrooms, etc.

Industrial uses: mining, for cooling large engines, etc.

Electricity: cools power generators, runs hydroelectric dams

Irrigation: agriculture, livestock

Ask, *Where do people get this water?* Have participants brainstorm a list (see examples below).

- Public supply (largely from river- or stream-fed reservoirs)
- Well water (from ground water)





ACTIVITY 14

Water, Water Everywhere?

- Cisterns or other rain-catching devices (largely individuals; this practice is rare)

7. Wrap up the activity by asking participants, *How can we do all this with so little of the Earth's water? What does this mean to us on a daily basis? If we have so little water, what do we do if it is polluted? What are some positive steps we can take to conserve water and prevent water pollution?*

Extension: *If there is time, have participants test out ways they can conserve water first-hand by doing the following activity.*

1. Ask participants, *How is this water distributed? Do people in the desert have the same amount of water as those living near a large freshwater lake?* Ask them to identify areas of the U.S. and the world that are arid or semi-arid, those on the other end of the spectrum that receive plenty of rainfall, and areas that fall in between. Use an

atlas if necessary. Ask, *What do people in areas with little water resources do to function?* (Use dams to create reservoirs, develop aqueducts or pipelines to move water further, recycle used water, conserve water.)

2. Tell participants to imagine that they are going on a trip to an area with very little water. This could be somewhere widely known for its dryness such as the Mojave Desert, or it could simply be an area experiencing a hot, dry summer, and water is hard to find (the mountaintops of Pennsylvania after several weeks without rain, for example). Through the amazing advances in technology, they were able to carry with them a can of frozen grape juice concentrate (that is still frozen!). Break participants into small groups. If possible, have a volunteer oversee small groups.

3. Tell each group that, with only enough water to fill up 5 soda bottles, 1/2 a can of grape juice concentrate (have two groups share), a pitcher, a spoon, a small amount of soap, and a small measuring cup, they must do the following:

- Make enough grape juice for everyone in their group;
- Clean up everything so that there is no visible trace of grape juice or soap to be found anywhere (the

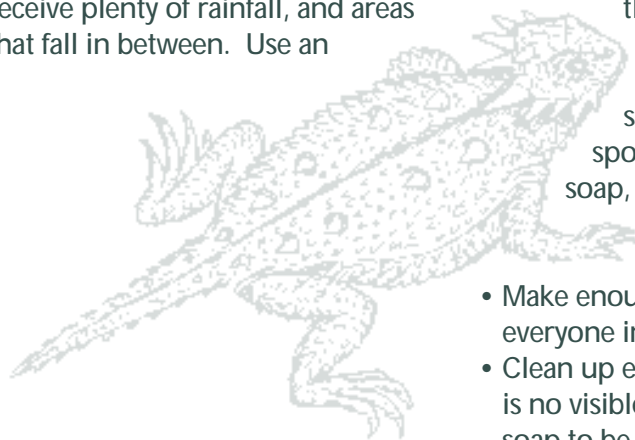
pitcher, bottles, cans, etc.)

- Brush their teeth (they don't have to actually do it, they just have to have enough water); and
- Wash their hands.

Note: *Grape juice works well because it can be a challenge to clean up after it, though any mix that calls for water (dehydrated milk, fruit punch, orange juice, etc., will work). If participants are going to drink the juice, make sure that none of them have diabetes or other dietary restrictions. Substitute a sugar-free drink product as needed.*

4. If the large container of water is clean, participants can use it for their water source, but they must make every effort to keep it clean. At the end of this activity, they should decide how to use any remaining water — relatively clean water can be used to water plants, for example.

5. Wrap up by asking participants if they were surprised by the amount of water they really needed to do everyday tasks. *Was it more or less than they expected? Ask, Why is it important to try to save water, even in areas that have plenty of water? What else could they do to conserve water?* Discuss the other uses of water in the United States, and around the world. *What are ways all people can conserve water?*





Water, Water Everywhere?

For Younger Participants Grades (K-2):

Talk to participants about where people get the water they use. Ask, *Where else is there water? Can we drink ocean water? What is bigger, the ocean or a river?* It is best if they can directly relate the availability of water to something they have experienced. To introduce this activity, ask them where in the world receives only a little bit of rainfall. *What do they think people do there?* Ask if their parents have ever had to stop watering the lawn or washing the car because of a drought, i.e., when there has not been enough rain. Then ask how else they could conserve water. Lead participants through the extension activity above, but use 12 liters (3.2 gallons) and several other containers for the whole class instead of splitting participants into groups. After they have completed the extension activity above, review some of the concepts of conserving water.

For Older Participants (Grades 9-12):

Ask participants to look at a world map. *How is a great deal of the Earth's freshwater distributed? Which parts have more water? Which areas have very little water?* (For example, the Great Lakes in North America have a lot of freshwater, while deserts like the

Mojave in some of the western states, and the Sahara in northern Africa are very dry.) Ask, *Where is the nearest freshwater source to you? Do you live in a dry or water-rich area?* Ask participants to explain their answers. Have these participants do a project similar to the extension activity, but have them help cook a meal that uses water, like macaroni and cheese.

Note: This will require having very responsible participants AND volunteers to oversee small groups. Any boiling of water should be carefully supervised. If participants would like to simulate the water requirements of a community, they should also set aside a large amount (on average, about 6 times as much for all domestic tasks combined!) of water for irrigation and electricity. Have them determine the amount of water they need for their project, but make sure they are aware of how much water they are using. Groups should use small containers to get water.

Questions:

- How much of the Earth's water supply is available for us to use?
- What areas of the Earth have less water for human use than other areas?
- How do people use water?
- How can we conserve water?

Adaptations:

Refer to general adaptations on pages 11-16.

Hearing Disabilities:

- Model each step of the experiment as you explain the directions.
- Use an empty glass to help illustrate the concept of finite, explaining that there is no "recipe" for water — once it is gone, it is gone.
- Create a poster of the Earth's water supply for participants to follow as they do the experiment. Use pictures of each of the items (i.e., oceans, ice caps, lakes, etc.) and pictures of the corresponding measurement devices.
- Have a picture of the Earth on the "world's water supply" container to help reinforce learning.
- Have the sign language interpreter narrate the action of the activity as needed.
- Encourage active participation in the discussion.

Learning/Cognitive Disabilities:

- Model each step of the experiment as you explain the directions.
- Use an empty glass to help illustrate the concept of finite, explaining that there is no "recipe" for water — once it is gone, it is gone.
- Create a poster of the Earth's water supply for participants to follow as they do the experiment. Use pictures of each of the items (i.e., oceans, ice caps, lakes, etc.) and pictures of the corresponding measurement devices. Do not use





ACTIVITY 14

Water, Water Everywhere?

metric measures unless the group is familiar with them. Simplify as needed.

- Use measuring cups with handles instead of measuring beakers. Use different colors of measuring tools for each size for individuals who have difficulty reading (e.g., a blue cup measure, a yellow tablespoon, a white teaspoon). You can also paint the handles different colors to achieve the same effect. Correspond the colors with the drawings of the measures on the poster.
- Have a picture of the Earth on the “world’s water supply” container to help reinforce learning.
- Assist participants in tracking their measurements or have partners assist as needed. Consider placing a sticker or a mark on the poster (if using) as each resource is removed to help participants keep track.
- Have participants chant “I am removing the ocean,” etc. as they proceed through each water removal step of the activity.
- Encourage active participation in the discussion. If participants are having difficulty coming up with human water uses or resources give them topics like cooking and have them site examples of water use in cooking. If they are still having difficulty, give them two examples and have them choose the one that fits. For example: *Do you use water to make a can of soup or to walk a dog? Do people get water from a well or a solar panel?* Remember to allow the par-

ticipants time to come up with their own answers and to have as much independence as possible.

- Have participants simulate brushing their teeth to reinforce learning.
- Complete the younger participant version of this part of the activity as appropriate.

Motor Disabilities:

Overall:

- Set water containers on a surface, such as a chair, that participants who use wheelchairs can reach down into.

For participants with limited muscle strength, coordination, or dexterity of the hands:

- Use measuring cups with handles instead of measuring beakers. Build up the handles of measuring spoons with tape, foam, or bandage material. Have partners assist with water removal as needed. Build up the handle on the spoon with tape, foam, or bandage materials as needed.
- Have partners assist as needed.

Visual Disabilities:

Overall:

- If possible, have large print and Braille measuring cups and spoons available. An alternative is to label traditional measuring cups (with handles) and spoons in permanent black marker using large, block print and in Braille.
- Narrate the action of the activity

as needed.

For participants with low vision:

- Put a piece of tape at the water line each time water is removed. Mark on the tape in permanent black marker
- Have a variety of magnifiers available.

For participants who are blind:

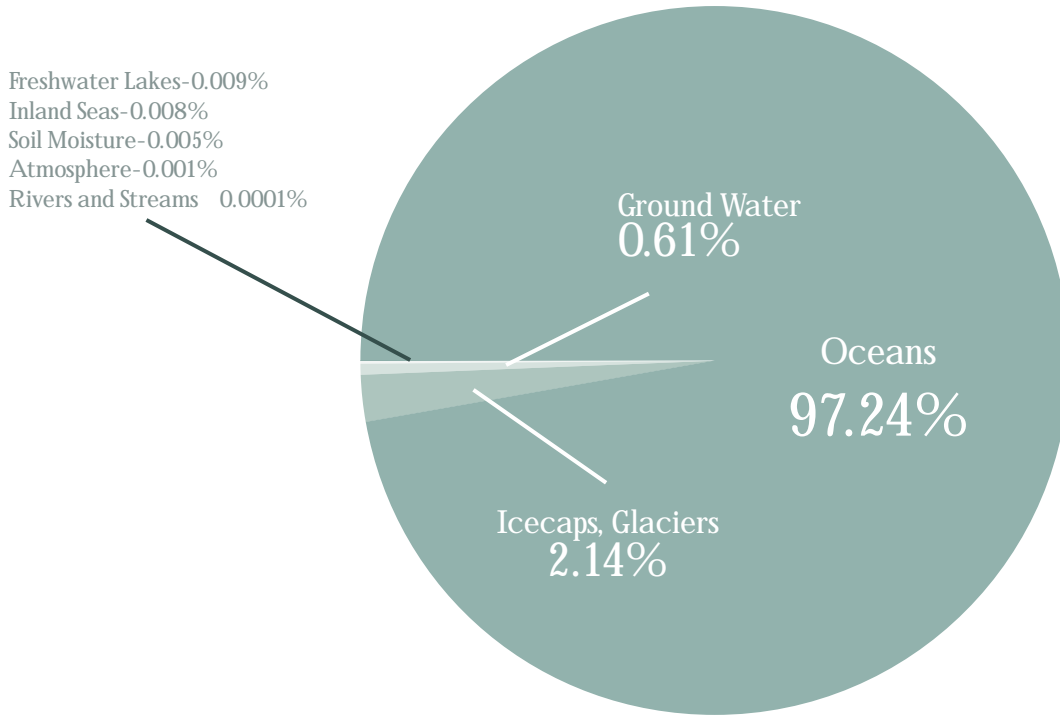
- Have participants feel the water level of the “world’s water supply” before any water is removed, and then again after each round to reinforce learning.
- Provide good orientation directions for the water removal process. Do this experiment on a tabletop and have participants stand over the containers to complete. Have the receiving container directly next to the water supply.
- Have partners assist as needed. If possible, have a relief map world map available for participants to explore.
- Have partners verbally guide participants through steps of the extension activity and assist as needed.





Water, Water Everywhere?

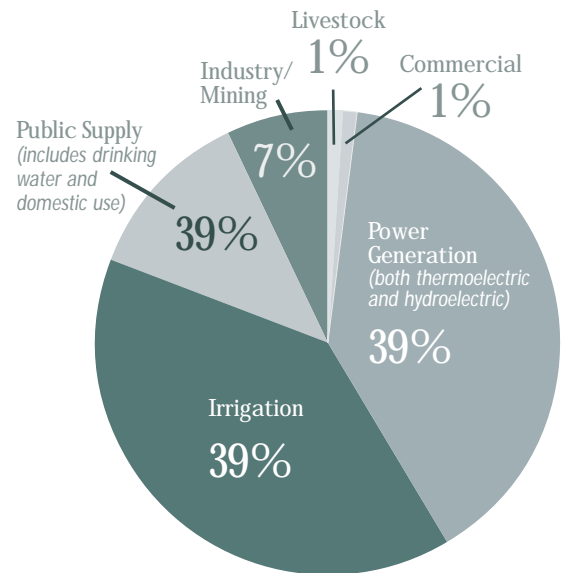
Earth's Water Supply



Water Usage

*In order for humans to extract ground water in a safe, cost-effective manner, the water must be fairly easy to drill to access it, and any contaminants fairly easy to remove.

**Freshwater lakes, as well as rivers and streams, are prone to various natural and man-made contaminants which must be treated and/or removed. Often, rivers are dammed to make extraction easier.



1995 U.S. Water Use

Source: U.S. Geological Survey, 1995.

