GLOBAL VERSION / MODULE 4

DROPS OF KNOWLEDGE FOR RIVERS OF CHANGE

GLOBAL TEACHING AND LEARNING MATERIAL

A hands-on guide to teaching
and learning about
water, sanitation, hygiene,
and the environment

SWAROVSKI
WATERSCHOOL

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BACKGROUND INFORMATION

Day to day activities and survival of every family, regardless of size, composition, nationality, or social and economic status, depends on water. All families everywhere need water for preparing food, bathing, cleaning our homes and clothes, and for activities such as growing vegetables or fishing. Recreation is an important part of children's development, and clean waterways provide a place for many people to have fun swimming, hiking, or traveling by boat.

Although the need for water is universal, the amount of water that we use—how we receive, store, and dispose of it—is not equal between countries or in different areas of the same country.

Many people overuse and waste a lot of water without thinking, while others do not have enough to stay clean and healthy. Some people are able to turn on the tap, and water flows to meet their needs. For others, having water at home can mean walking long distances to fetch just enough water to meet the family's needs for a day or two. When considering the safety of water for drinking, if supplies must be transported by hand, it is important to remember that containers for carrying and storing water must be kept clean and covered.

For many children in low-income countries, especially girls, carrying water takes time away from going to school, depriving them of the education that can increase their opportunities for earning wages as adults. Having a water source inside or near the home helps keep water free of contamination during transportation, and reduces the time required to collect water, thereby improving safety and opportunities for education, productive activities, and recreation.

DID YOU KNOW? We use 70% of our worldwide water sources for agriculture and irrigation, and only 10% for household purposes.[1]

Pressure on water resources is partly due to increasing demand for feeding livestock: producing meat requires 8–10 times more water than producing grain does.[2]

SOURCE: **(1)** AQUASTAT, "Water Use," Rome: Food and Agriculture Organization of the United Nations, 2015, http://www.fao.org/nr/water/aquastat/water_use/index.stm. **(2)** UN Water, "Statistics Detail," 2014, www.unwater.org/statistics/statistics-detail/en/c/211815.

All over the world, people both rich and poor are drinking water that is mostly of unknown quality from plastic bottles that create waste. In the United States, the Natural Resources Defense Council conducted a four-year review of the bottled water industry and the safety standards that govern it. The study included a comparison of national bottled water rules and national tap water rules, as well as independent tests of more than 1,000 bottles of water. The conclusion was that there is no assurance that just because water comes out of a bottle it is any cleaner or safer than water from the tap. In fact, an estimated 25% or more of bottled water is really just tap water in a bottle, sometimes treated, sometimes not.[16]

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THEMATIC CONCEPTS

Water footprint – The water footprint of a product is the volume of freshwater it takes to produce the product, including the water consumed and polluted during the various steps along the supply chain. This indicator can be used to measure both the direct and indirect water use of a consumer, a manufacturer, or an entire country.

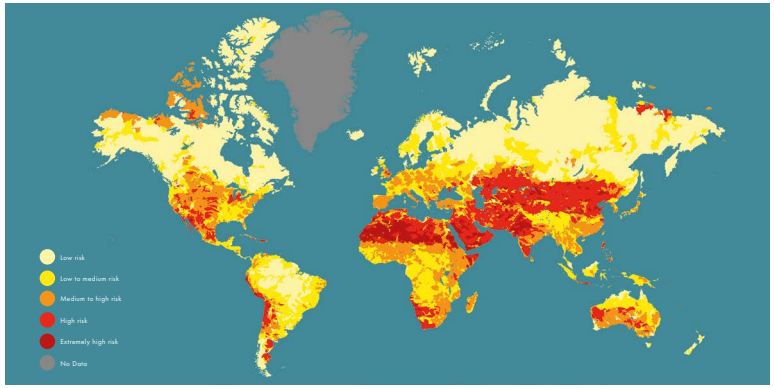
Blue and green water – "Blue" refers to water that is used for irrigation and in processing. "Green" water is from precipitation (rain or snow). In regions with high amounts of precipitation, not so much blue water is needed, which explains why the same product growing in different parts of the world may have a different water footprint in each region. In India, growing 1 kilogram (2 pounds) of cotton consumes 11,000 liters (2,905 gallons) of water; 41% of that amount is rainwater, the rest is from irrigation.

Virtual water – Large quantities of the world's water are used for agriculture and industry, and "virtual" water is the water that has been used to produce the food we eat, the things we use, and even the clothes we wear.[17]

16 NRDC, "Executive Summary: Bottled Water – Pure Drink or Pure Hype?," New York: Natural Resources Defense Council, July 15, 2013, www.nrdc.org/water/drinking/bw/exesum.asp. **17** Water Footprint Network, "What Is a Water Footprint?," Enschede, The Netherlands, www.waterfootprint.org.

ACTIVITY 4.1: IS THERE ENOUGH WATER TO GO AROUND?

When access to water is limited, interpersonal communication, compromise, and understanding are critically important. When people are faced with limited supplies of this essential resource, the question of control will invariably surface. Who is allocating the water? Who owns the rights to the water? If someone owns the land over groundwater or adjacent to water in rivers and lakes, do they own the water? This activity is designed to encourage students to vicariously experience water shortages and find ways to work among themselves to share water equally.



Source: http://www.un.org/waterforlifedecade/scarcity.shtml

Time: 30 minutes, on 2 consecutive days / **Thematic Areas:** Social Studies, Life Skills / **Goal for Learning:** Students will be able to understand the concepts of water shortages and cooperation.

Materials: ☐ 1 jug of water / ☐ Paper cups or glasses (1 per student)

ACTIVITY STEPS:

1 Ask the students not to drink any water early in the day, and if it is possible, go outside or do some physical movement before you begin the activity. Even two or three minutes of running in place or jumping will build up thirst.

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2 Make sure that the amount of water in the jug will not be enough to serve everyone in the room. Give each student a cup and begin to pass the jug of water around so each person can pour some into her or his cup and take a drink.

3 Pay close attention to the facial expressions and remarks made by the students who do not get a drink. Engage all of the students in a discussion about how this situation can be changed. Are some students more cooperative than others? Do the thirsty students appear to be more demanding or more engaged in the process?

4 Talk about what is happening and consider if there is always enough water where you live. (Note: In wealthy countries, some weather emergencies/ natural disasters can cause water and power outages that create temporary scarcity of water.)

5 Ask students how they cope when water is limited. Can they understand the need to restrict water use in some places so that there will be enough to go around?

6 The next day, repeat Steps 1–3 and begin by passing the water jug to the students who did not get any water the day before. Do they approach the process differently? Now that they have experienced the shortage, will they try to gauge their water use so that there will be enough to go around?

OBSERVATION AND DISCUSSION:

Ask the students who do not get any water to talk about what it felt like to be left out. Did they have the same understanding of the situation before the activity?

Ask all of the students how they feel about the person who was supplying the water to others but left them feeling thirsty.

ADDITIONAL RESOURCES:

CELF, "The Weight of Water." Chappaqua, New York: Children's Environmental Literacy Foundation, 2014. Available at: http://www.celfeducation.org/Websites/celf/images/The%20Weight%20of%20Water%20.pdf

Goodman, Donna, Every Body Counts, Every Drop Matters, New York: United Nations Department of Public Information, 2003, p. 68

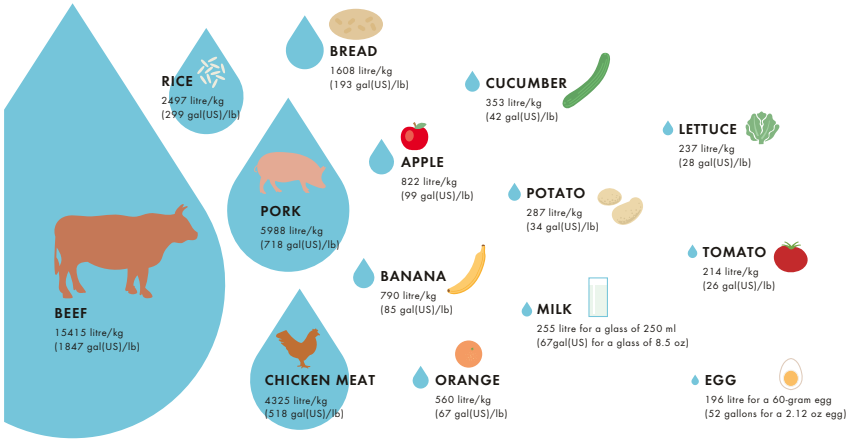
New York City Department of Environmental Protection, "Environmental Education," www.nyc.gov/html/dep/html/environmental_education/index.shtml

ACTIVITY 4.2: WATER IS EVERYWHERE – THE HIDDEN MYSTERY OF WATER IN OUR HOMES (Adapted from the Swarovski Waterschool China)

Water and family life are very closely linked. We need to use water for all kinds of household activities–from preparing the meals we eat each day to washing, cleaning, growing flowers, or caring for pets. Where tap water is available, we see the water coming out of a pipe. We also see water in cups and bottles, washing machines and sinks, showers and bathtubs, and toilets. But is the water we see the only water that is used by households?

Water is also essential for making almost everything we use at home, even though we may not see any water in these products. The factories that produce food need water for steaming, boiling, marinating, and fermentation. Soy sauce, vinegar, soft drinks, and juices are all mostly made up of water. If we eat chicken or drink milk, we should be mindful that water was needed to raise the livestock that provided this food. Water was also used in making the dough for the bread we eat.

Then there is the electricity that was used to manufacture goods and process food, as well as the electricity that we use at home for lighting, heat, and power. The power plants that generate electricity use huge amounts of water for cooling.



Source: http://waterfootprint.org/en/resources/interactive-tools/product-gallery/

Electric power generation in the United States, for example, is responsible for more than 40% of all freshwater withdrawals in the country, or around 100 billion gallons a day.[18]

When we look closely, we see that water is an indispensable part of all our household items, including furniture, electrical appliances, cleaning products, and toiletries. So, water use is both visible and invisible!

In this activity, students will carry out a survey of household goods to learn about the "hidden" water used to make everyday items. This will enhance their awareness of the importance of water in our daily lives, particularly their awareness of the fact that water is everywhere.

18 Union of Concerned Scientists, "How It Works: Water for Electricity," http://www.ucsusa.org/clean-energy/energy-water-use/water-energy-electricity-overview **19** Siegle, Lucy, "Arjen Hoekstra's Innovation: The Water Footprint," The Guardian, October 2, 2010, www.theguardian.com/environment/2010/oct/03/innovator-arjen-hoekstra-water-footprint. **20** United Nations Environment Programme, "Water Footprinting," http://www.unep.fr/scp/publications/details.asp?id=DTI/1411/PA.

They will also learn about the water footprint—the unseen water used in consumer products and services—a concept originated by Arjen Hoekstra in 2002 to enhance awareness of how water is being misused, not only for entire countries, but also at the personal level.[19] The water footprint also applies to environmental impacts. As defined by the United Nations Environment Programme, for example, the water footprint "is based on the pure measure of water quantity used and the associated (direct and indirect) environmental impacts resulting from the use of it such as: damages on freshwater resources, ecosystems and human health."[20]

On a daily basis, knowing the water footprint of a consumable item can help us make choices that will conserve water. For example, an apple weighing 150 grams (5,3 ounces) has a water footprint of 125 liters (33 gallons), the average cup of coffee has a water footprint of 130 liters (34 gallons), and a hamburger can have a water footprint of 2,400 liters (634 gallons). A team of researchers from universities in the Netherlands, South Africa, China, and Spain has developed a calculator you can use to measure your own water footprint; see the Water Footprint Networks web page, "Personal Water Footprint," at http://waterfootprint.org/en/waterfootprint/personal-water-footprint.

Time: 50 minutes **/ Thematic Areas:** Science, Mathematics, Social Studies **/ Goal for Learning:** Students gain an understanding of the water used to produce everyday items, and learn how to apply the water footprint concept to their own lives.

Materials: ☐ Paper / ☐ Pens, pencils, rulers, etc. (that students will use to design their water footprint survey of household goods)

ACTIVITY STEPS:

1 Briefly introduce the concept of hidden water in our homes, and note that the processes used to manufacture all household goods result in wastewater. Then set out tasks for the students, who will be searching their homes for items that have hidden water and making a record of what they find.

2 This activity step can be adapted according to the students' ages and home-life situations. As needed, help the students design an investigation chart, explaining that they should independently choose the information or statistics to be recorded. First, they will list all the household goods that are relevant to them, and select the items that they are most interested in investigating. Second, they will count up other goods in the house that can be investigated.

3 At this stage, teachers should provide guidance on the water footprint concept and how it can be used. Students will then collect and record all the relevant data for the chart they have designed, including the number of items with hidden water, and learn about calculating the water footprint statistics for these items.

4 After calculating the water footprint of various items, students will carry out their investigation and complete their survey chart.

5 Organize a class conference as a platform for students to share their research process and results with their classmates, and for teachers to expand on the water footprint concept. Students can use this knowledge in daily life when considering the water footprint of the items they consume and use.

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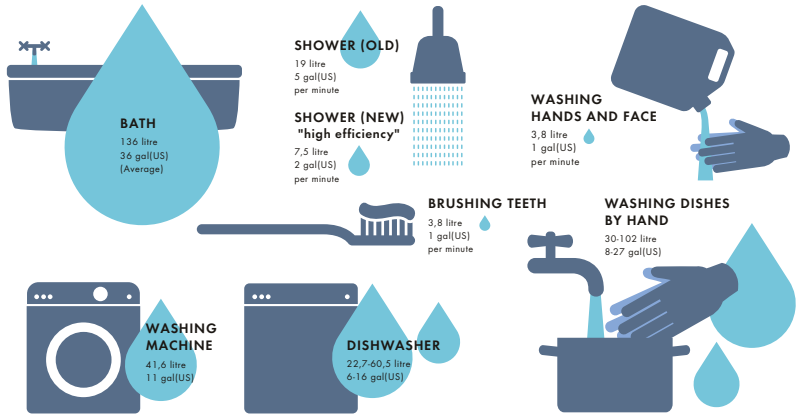
ADDITIONAL RESOURCES:

Grace Communications Foundation Water Program, "Water Footprint Calculator," www.gracelinks.org/1408/water-footprint-calculator; "Water Saving Tips: Food Choices," www.gracelinks.org/2975/water-saving-tips-the-water-in-your-food; and "The Hidden Water in Everyday Products," http://www.gracelinks.org/285/the-hidden-water-ineveryday-products

Save Our Water, "How You Can Help!" Association of California Water Agencies and California Department of Water Resources, 2015, http://saveourwater.com/what-you-can-do

ACTIVITY 4.3: HOW OUR FAMILIES USE WATER

This activity is designed to foster children's dialogue with other children and with their families and neighbors, creating better understanding of how water is used in our communities. Do we have piped water? Surface water such as a lake or river? Other sources of water? How does the community interact with water? Do people travel by boat? Are there bridges? Is there a treatment plant? These are just some of the questions that can be asked and answered.



Source: http://water.usgs.gov/edu/activity-percapita.php

Time: 30 minutes / **Thematic Areas:** Civics, Social Studies / **Goal for Learning:** Comprehension of how much water we use, where the water comes from, and where it goes.

Materials: ☐ Pencils / ☐ Paper

ACTIVITY STEPS:

1 Ask students to make a list of all the activities their family uses water for, then estimate how much water is used in each activity. Note that water can be saved during daily activities such as brushing your teeth, taking a bath or shower, and watering the garden.

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2 Ask them to find out where the water they use comes from and, if possible, make arrangements to visit the source. (Note: If the source is an underground well or public distribution system, continue to Activity 4.4 to learn about pumping.)

OBSERVATION AND DISCUSSION:

Ask students to talk about what happens to the water after it is used.
For example, when you flush the toilet, where does it go? Have you ever seen water being reused?

Ask students to share some examples of how water can be reused.
Mention the various times when they can save water, and ask if they have other ideas.

ACTIVITY 4.4: PUMPING WATER UP

After an underground source of water is found, the next step is bringing the water to the surface for access. Delivering water from an underground source such as an aquifer requires a pump. Pumps of all kinds use air pressure to create suction that draws the water up out of the ground.

Suction is created when an opposing force is removed. A drinking straw can be used for a simple demonstration of this principle. When you place a straw in a glass of water, the air pressure pushing down on the water inside the straw is the same as the air pressure pushing down on the water outside the straw. All is in balance. This is the same principle that is used when a pipe is installed to reach an underground aquifer. In a water-delivery system, the pump removes the opposing force inside the pipe by creating a vacuum. The air pressure outside the pipe does all the work.

Time: 30 minutes / **Thematic Areas:** Science, Mathematics / **Goal for Learning:** Discover the science behind water pumping.

Materials: ☐ Drinking straw / ☐ Clear glass of water / ☐ Eye-dropper or turkey baster

ACTIVITY STEPS:

1. Place a straw in a glass of water. Note that the level of water in the glass and in the straw is the same. Explain to students that this is because the air pressure in the straw and in the glass is equal.

2. Hold a finger securely on top of the straw and lift the straw out of the glass: the same amount of water will remain in the straw. When you release your finger (and so, the air pressure), the water will fall out.

3. Place the empty straw back in the glass and use your breath to remove the air pressure from inside the straw, creating suction that causes the water to be drawn up into your mouth. As long as you continue to suck the air pressure out of the straw, the water will continue to rise and flow; the moment that you stop, the flow also ends.

4. Explain that water pumps use different mechanisms to create the same effect, drawing water out of an aquifer and into a tap.

5. To extend the activity, conduct this simple demonstration of pumping water with the use of an eyedropper or turkey baster: when you place the eyedropper or baster into the water, nothing happens until you squeeze the bulb (exhaling the air from the tube and creating a vacuum). As you release the bulb, the water is drawn up into the tube. The tube of the eyedropper or baster is now full of water. If a hole and another tube were added to distribute the water, it would function as a water tap.

OBSERVATION AND DISCUSSION:

Ask students to brainstorm examples of places where water is pumped in their own lives. For example, how does the water get into their homes? Consider visiting a local water source or utility and talk about how the water travels.

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WATER PUMP, SWS INDIA

"Water is fundamental to life and is the common denominator of all sustainable development challenges. We need water to produce food and we need water to produce energy. Improving access to freshwater is about enabling millions of girls to go to school instead of walking kilometres to fetch water."

— IRINA BOKOVA, DIRECTOR-GENERAL, UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION (UNESCO)[20]

21 UNESCO, "Message from Ms Irina Bokova, Director-General of UNESCO, on the occasion of World Water Day," March 22, 2014. Available at: www.unesco.org/new/en/unesco/events/prizes-and-celebrations/celebrations/international-days/world-water-day-2014.