

Activity 3: A Personal Water Audit

Overview

Students imagine how they would use only 5 gallons of water per day. They then explore their own water footprint by conducting a personal water audit of their direct water use over the next 24-hour period. On day 2, students are introduced to the idea of virtual, or embodied, water and estimate the amount of virtual water they consume.

Objectives

Students will:

- conduct a personal water audit to calculate the amount of water they directly consume
- estimate the virtual water embodied in the goods they consume
- consider ways to reduce their direct and indirect consumption of water

Inquiry/Critical Thinking Questions

- How do I consume water directly and indirectly?
- Where do opportunities exist to reduce my water consumption?

Time Required

- One 20-minute class, plus homework
- One 60-minute class

Key Concepts

- water consumption
- virtual water
- water footprint
- water audit

National Standards Addressed

National Council for the Social Studies

3. People, Places, and Environments
7. Production, Distribution, and Consumption

National Science Education Standards

- F. Science in Personal and Social Perspectives

National EFS Standards

- 2.1 Interconnectedness: Systems Thinking
- 3.1 Personal Action: Personal Responsibility

Materials and Preparation

Handout: *Personal Water Audit: Direct Water Use*, 1 per student

Handout: *Personal Water Audit: Virtual Water Use*, 1 per student

Internet Access, day 2

Tools: A 1-gallon container/bucket and a 5-gallon container/bucket

Activity—Day 1

Introduction

1. Share with students the following statement:
“The UN suggests that each person needs 20-50 liters of water a day to ensure their basic needs for drinking, cooking, and cleaning.”¹
2. Write “20-30 liters” on the board and tell students that this is equivalent to 5.3-13.2 gallons (or have them convert this themselves).
3. Show students the 1-gallon container and the 5-gallon bucket to get a sense of these volumes.
4. In think-pair-share format, ask students to imagine they only have access to 5 gallons of water per day over the next week. How would they use this water? Which activities would they prioritize and which activities would they cut?

¹ UN Water, “Statistics: Graphs and Maps,” accessed October 11, 2012, http://www.unwater.org/statistics_san.html.

Activity 3: A Personal Water Audit *continued*

Steps

1. Explain that over the next couple of days, each person will examine his or her water footprint.
2. Pass out and go over the *Personal Water Audit: Direct Water Use* handout with students. Explain that this worksheet should be completed over the next 24 hours.
3. Discuss how water is measured (gallons per minute) and mention that it is often possible to find the rate of water flow or amount of water used per activity (for example, gallons per flush) written on a faucet or toilet.
Option: If you have a sink in your classroom, you can also show how to determine the gallons per minute of a sink by collecting water in a bucket for 10 seconds and multiplying by 6.
4. Ask for a female and male volunteer to check the flow rate of the school toilets and sinks (or do this ahead of time) and have students record this on their worksheet.
5. Ask students to complete the rest of this water audit worksheet for homework.

Activity—Day 2

Introduction

1. Ask students to recall what the idea of virtual water means. (*For example, the virtual water in an apple would include the amount of water required for the tree.*)
2. Ask students to order the following products in terms of least to most virtual water used in their production, based on their best guess.
 - a cotton shirt
 - a pair of jeans
 - 1 kilogram of beef
 - 1 kilogram of wheat
 - a bed sheet

3. Ask students how water is used to produce each of these products. (*For food, the answer is almost always to water crops, either for human consumption or to water and feed livestock. Water is also used during manufacture of processed or packaged food. For manufactured goods, the most common uses are sanitation, dilution, and cooling. In the case of a bed sheet, water is used to create the fabric dye.*)
4. Share the following information with students and have them compare it with their guesses:¹
 - 1 kg of wheat = 1,300 liters of water
 - cotton shirt = 4,100 liters
 - bed sheet = 9,750 liters
 - pair of jeans = 10,850 liters
 - 1 kg of beef = 15,000 liters

Steps

1. Pass out and go over the *Personal Water Audit: Virtual Water Use* handout with students.
2. Allow students the rest of class to use the following websites to fill out this portion of the audit:
 - *Water Footprint Product Gallery*
<http://www.waterfootprint.org>
Have students use the product gallery (“Product Water Footprints” link in the lefthand menu) to find virtual water amounts. This is also the website students will use to calculate their entire water footprint.
 - *National Geographic: The Hidden Water We Use*
<http://environment.nationalgeographic.com/environment/freshwater/embedded-water/>
Have students explore the product details and the product comparisons to find virtual water use.

¹ A.K. Chapagain and A.Y. Hoekstra, “Water Footprints of Nations,” Value of Water Research Report Series (UNESCO-IHE Institute for Water Education), November 2004, <http://www.waterfootprint.org/Reports/Report16Vol1.pdf>, 6.

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- *H2O Conserve: Calculator*
<http://www.h2oconserve.org/wc.php>
This calculator (link on the left) asks students a series of questions about home water use and lifestyle choices such as diet and goods they buy. The website also provides information about how to reduce their water use.
3. After students have completed the entire personal water audit (direct and virtual water use), give small groups a few minutes to share their results and reflections.
 4. Reflect on the activity with the following questions.

Discussion Questions

1. What surprised you most about your water footprint?
2. How does your direct water use compare to the embodied water used to create the foods you eat and the products you buy and use?
3. How aware do you think people in your region are about how much water they use? How do you think this level of awareness compares to people around the world who collect their water by hand?
4. Do you think the amount of virtual water embedded in a product should be included on product labels? Whose responsibility is it to monitor the amount of water used to

produce goods: manufacturers, consumers, or governments?

5. Why does the amount of virtual water in foods differ?
6. How could today's water consumption affect the water consumption of future generations?

Additional Resources

- **Website:** *Freshwater*
<http://environment.nationalgeographic.com/environment/freshwater>
National Geographic's freshwater initiative works to inspire and empower individuals and communities to conserve freshwater. There are a number of featured articles, videos, and tips on how to do so. The website also provides a water footprint calculator to gauge the impact of both direct and indirect water consumption.
- **Website:** *POV Borders/Environment: Water*
<http://www.pbs.org/pov/borders/2004/water/index.html>
POV creates a number of documentaries for public television. This section of their website is dedicated to helping people take notice of the environment around them, so that they can be more engaged to act as its stewards. A number of features look at how we use water every day.

Personal Water Audit: Direct Water Use, page 1

To begin conserving water, it helps to know how much we use on a regular basis. Over the next day or two, you will estimate the amount of water you consume directly using the following process.

Step 1: Identify and record the flow rate for each of the activities listed in the table that applies to your home. If you cannot locate the information on each appliance in your home (such as the gallons per minute (GPM) for your faucets), then use the averages listed below:

Faucets	Low-flow Model: 1.5 gallons/minute	Standard Model: 2.2 gallons/minute
Toilet	Water-efficient Model: 1.2 gallons/flush	Pre-1994 Model: 5.2 gallons/flush
Shower	Low-flow Model: 2.5 gallons/minute	Pre-1994 Model: 4 gallons/minute
Bath	1/3 Full: 15 gallons	2/3 Full: 30 gallons
Automatic Dishwasher	Post-2009 ENERGY STAR Automatic Dishwasher: 5.8 gallons/load (or less)	Pre-1994 Automatic Dishwasher: 9 gallons/load for short cycle 14 gallons/load for pots & pans cycle
Laundry	Energy Star Model: 15 gallons/load	Standard Model: 23 gallons/load
Watering Yard (3 days/week)	Water-efficient Landscaping: 118 gallons	Traditional Landscaping/Turf: 500 gallons
Car Washing	Bucket/hose with shutoff nozzle: 20 gallons/wash	Open hose with no shutoff nozzle: 180 gallons/wash

Step 2: Monitor your water use. Use a timer or clock to monitor the time you use appliances whose water use is measured in gallons per time (i.e., showers and faucets). Also, record the number of times you use appliances whose water is measured per use (i.e., toilet, bath, automatic dishwasher, laundry machine, etc.). Note: If you rinse your dishes before placing them in the dishwasher, then record this water use under "Kitchen Faucet." You can start a tally and then total this at the end of 24 hours.

Step 3: Factor in drips and leaks. Use the drip calculator from USGS (<http://ga.water.usgs.gov/edu/sc4.html>) or the American Water Works Association (<http://www.awwa.org/awwa/waterwiser/dripcalc.cfm>) to calculate how much water is wasted by leaks and drips.

Step 4: Calculate your total. For all activities (except for "outdoor water use" and possibly "other") simply multiply the rate of water flow with the total time used. For example:

$$1.5 \frac{\text{gallons}}{\text{minute}} \times 15 \text{ minutes} = 22.5 \text{ gallons}$$

$$5.2 \frac{\text{gallons}}{\text{flush}} \times 6 \text{ flushes} = 31.2 \text{ gallons}$$

Sources: "Daily Water Use: Conserving vs. Non-conserving," Elk Grove Water District, accessed October 11, 2012, <http://www.egws.org/pdf/DailyWaterUseGuide.pdf>. ENERGY Star website, accessed October 11, 2012, http://www.energystar.gov/index.cfm?c=products.pr_find_es_products.

Personal Water Audit: Direct Water Use, page 2

Activity	Flow Rate or Gallons per Use	Total Time(s) Used	Total Amount of Water Used (Gallons)
Home Bathroom Faucet	$\frac{\text{gallons}}{\text{minute}}$	minutes	gallons
School Bathroom Faucet	$\frac{\text{gallons}}{\text{minute}}$	minutes	gallons
Home Toilet	$\frac{\text{gallons}}{\text{flush}}$	flushes	gallons
School Toilet	$\frac{\text{gallons}}{\text{flush}}$	flushes	gallons
Shower	$\frac{\text{gallons}}{\text{minute}}$	minutes	gallons
Bath	$\frac{\text{gallons}}{\text{bath}}$	baths	gallons
Kitchen Faucet	$\frac{\text{gallons}}{\text{minute}}$	minutes	gallons
Dishwasher	$\frac{\text{gallons}}{\text{load}}$	loads	gallons
Laundry	$\frac{\text{gallons}}{\text{load}}$	loads	gallons
Outdoor Water Use	gallons	gallons	
Leaks/Drips		gallons	
Other (list activities):			gallons
Total Gallons of Water Used per Day:			

Personal Water Audit: Direct Water Use, page 3

Use the results from your personal water audit (direct water use) to answer the questions below.

1. What most surprised you about your water use?

2. What activity do you do that uses the most water? The least water?

3. Which activities do you consider necessary to meet your basic needs? Which activities do you consider beyond your basic needs?

4. What are 3 specific steps you could take to reduce the amount of water you consume?

5. How did conducting this audit increase your awareness of water consumption?

6. What will your next step be with respect to water conservation?

Personal Water Audit: Virtual Water Use, page 1

Directions: In the table below, list the basic items or goods you use in a typical day for each of the categories. Using either National Geographic's *The Hidden Water We Use* or Water Footprint's *Product Water Footprints*, write down the amount of water that goes into producing that product. In the last column, explain how or why water was needed to produce this good. If you are unable to locate the exact product, try to substitute something similar. For example, if you cannot find turkey, use chicken.

Product/Good	Why Water is Used	Amount of Water Used Note: 1 liter = 0.26 gallons
Diet: Write down the ingredients used for a typical meal.		
Energy: Write down the types of fuel you use to heat your home and water, and fuel your transportation.		
Clothing: Write down the materials used to create the clothing (including shoes) you wear.		
Total Virtual Water Used:		

Personal Water Audit: Virtual Water Use, page 2

Now use Water Footprint's Extended Calculator (under "Your Water Footprint" in the lefthand menu) to determine your total water footprint.

Total Water Consumed: _____

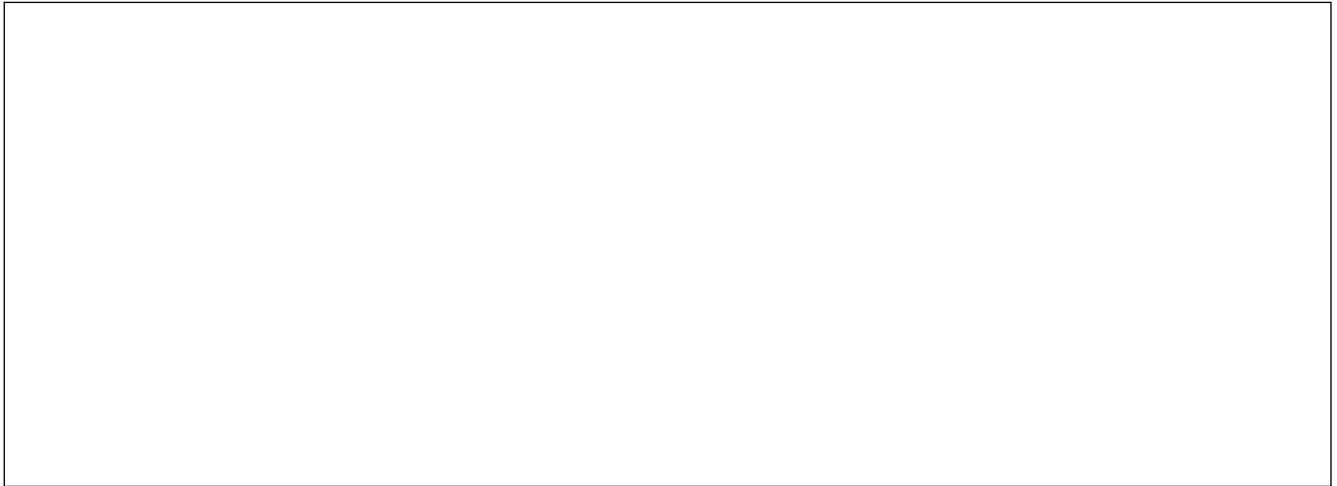
Use the results from your personal water audit (virtual water use) to answer the questions below.

1. What most surprised you about your virtual water consumption?

2. What goods or products do you use that require the greatest amount of water?

3. How did your water consumption compare for each of the categories (food, domestic use, industrial) summarized by the Water Footprint's Extended Calculator?

a. Create a bar graph to compare these categories. Include a bar to represent your total water use.



b. Summarize and analyze this bar graph in words.

4. How did this activity change your understanding of water consumption?
