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# K-12 Partnership Lesson Plan

# Sara Parr Syswerda

# *Conserving Water and Calculating Your Water Footprint*

## Overview

Students will record their own water usage at their house for a week and estimate their daily water consumption. They will then be re-assigned to a different country where their water will be limited to the average usage of people in that location. The students will have to decide what they will use their allocation of water for, and then listen to how much other groups got to use and what they chose to use their water for. At the end, we will brainstorm why some locations have more water to use than others, and how that can lead to conflicts among different groups.

**Objectives**

At the conclusion of the lesson, students will be able to:

* Identify wasteful water practices
* Explain differences in water usages in different areas
* Understand the impact that water availability has on society

**Length of Lesson**

Four 45 minute class periods

**Grade Levels**

K-12

**Standards covered (NGSS)**

Disciplinary Core Ideas:

* **MS-ESS3-3**: apply scientific principles to design a method for monitoring and minimizing a human impact on the environment
* **MS-ESS3-4**: construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth’s systems

Cross Cutting Concepts:

* Patterns
* Energy and matter in systems

Science and Engineering Practices

* Planning and carrying out investigations
* Analyzing and interpreting data
* Engaging in argument from evidence
* Obtaining, evaluating, and communicating information

***Previous Michigan Standards Met:***

* **E1.2B**: identify and critique arguments about personal or societal issues based on scientific evidence
* **E1.2f**: critique solutions to problems, given criteria and scientific constraints
* **E1.2k**: analyze how science and society interact from a historical, political, economic, or social perspective

**Materials**

* A handout for each student to record their personal water usage for the week
* A posterboard for each group (or powerpoint presentation using an LCD projector) for their water plan
* Calculator and handout for each student to formulate their groups water usage plan

**Background**

### A powerpoint is included on the “Conserving Water” lesson page on the KBS GK-12 website that provide background information.

### Activities of the session

Day 1:

Hand out forms where students will keep track of all their activities that use water in their household (See student worksheet 1). These will include activities where students themselves are using water, such as showering or drinking, as well as things like dishwashers, clothes washing machines, cooking, garden watering, etc. Have students keep track of their usage for a day (or a few days if you have more time). If they get a water bill, have their parents write down how many gallons they used last month for a better estimate.

Day 3:

1. Have the students come in and calculate their total water usage using numbers or estimates for each activity (see student handout 1). Each day’s total will be added up, and the average daily usage will be calculated. You can also get water usage for the school from your administrative/accountant person.
2. Take a moment or two to ask the students about how much water their families used. After hearing from a few students, ask if the students’ parents have to pay a water bill, or if they get their water from a well. Ask the students if they think their usage would be different if they had to pay for water or not.
3. Next explain that most of the water usage of students wasn’t from the actual home usage, but from their consumption of goods that require water to be made. (see student handout 2). Explain that even some things that don’t seem like they require water (like paper or industrial goods), do since electricity production, industrial processing, the extraction of oil, and the production of most metals all require water. Crops require water to grow, and more water is generally required in processing food crops (ie. making wheat into pasta). Take a look at student handout 2, and ask the students if anything on the sheet surprises them.
4. Next, divide the students into groups of 3-4 students and assign each group a different area of the world. Each group will be given a handout that describe their location, climate, population, and average daily water budget(see student handout 3). Students will then create a presentation (either on posterboard or powerpoint) on their country including background information on location, climate, population, and daily water budget as well as their proposed water usage plan.

Groups will include:

* Greece
* Australia
* Egypt
* China
* Turkmenistan

Day 4: Formulating water use plans and presentations

1. Each group should be given the a rubric for how the presentation will be graded.
2. Presentations should be 5-7 minutes long, and each group member should speak during the presentation.
3. Presentations should outline the water use plan of the country the students are representing. These plans should outline what the average person will be able to consume, considering their current water budget constraints. They should use student worksheet 2 as a budget sheet when deciding what they are going to consume, and their total must be less than or equal to the average per capita water use in their country.

Day 6:

Presentations to the class of their water use plans, followed by a discussion about why some countries had such different water usage levels. These discussions should focus on some areas having resources, both water and monetary resources, that others don’t. The students should know that in some areas, water is more expensive to extract, and some people don’t have as much money. You can extend this to talking about ground- and surface water resources, depending on the grade level, but the general point that it is important to communicate is that the US uses more water per capita than any other country in the world (1788 gal/person/day), and that students can make choices that lead them to consume less water. Pass out the handout that indicates ways that students can save water.

**Resources**

* <http://waterfootprint.org/en/>
* http://www.gracelinks.org/824/water-program

**Extensions and Modifications**

This could be modified using data from other sites and customized to be local to other areas of the country if the data is available.

This could also be extended into water budgets based on climate data, rainfall, evapotranspiration, and groundwater fluxes.

**Assessment**

 Presentation Grading Rubrics

<http://www.ncsu.edu/midlink/rub.pres.html> is one of my favorites.

<http://ed.fnal.gov/lincon/w01/projects/library/rubrics/presrubric.htm> is also good and includes a grading scale. It is best to include the length of the presentation as a factor, as well as the use of data to support their argument.