

### **Saving Water Now: The Water Conservation Problem**

Lesson plan for grades K-2

Length of lesson: 45 minutes

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#### **SOURCES AND RESOURCES:**

- Volume of Earth's Oceans:  
<http://hypertextbook.com/facts/2001/SyedQadri.shtml>
- Percent cover of the earth's surface by oceans and fresh water:  
<http://www.eoearth.org/article/Ocean>
- Dr. Jay Famiglietti's Hot Science – Cool Talks Lecture: "Last Call at the Oasis: Will there be Enough Water for the 21<sup>st</sup> Century?" October 26, 2012, UT Austin:  
<http://www.esi.utexas.edu/k-12-a-the-community/hot-science-cool-talks/last-call-at-the-oasis-will-there-be-enough-water-for-the-21st-century>
- Water profile of India  
[http://www.eoearth.org/article/Water\\_profile\\_of\\_India](http://www.eoearth.org/article/Water_profile_of_India)
- Water profile of the United States  
[http://www.eoearth.org/article/Water\\_and\\_poverty\\_in\\_the\\_United\\_States](http://www.eoearth.org/article/Water_and_poverty_in_the_United_States)

#### **POTENTIAL CONCEPTS TEKS ADDRESSED THROUGH THIS LESSON:**

§112.11-13b Scientific investigation and reasoning, Grade K-2: 1C

§112.11-13b Scientific investigation and reasoning, Grade K-2: 2E

§112.11-13b Scientific investigation and reasoning, Grade K-2: 3B

#### **PERFORMANCE OBJECTIVES:**

Students will be able to:

- Discuss how water plays a pivotal role in our everyday lives
- Discover how much of all the Earth's water is fresh water
- Associate population growth with more frequent water shortages
- Explain what water conservation dilemma is and how it affects everyone

#### **MATERIALS (per group of four):**

- 1 cup per student
- 1 sponge per student (uniform size and completely dry)
- Large clear bin
- Food coloring or dye for the water (preferably blue)
- [Student Worksheet](#)
- [Discussion Images](#)
- Globe (optional): <http://www.tintoyarcade.com/products/Globe-Beach-Ball-Earth-Map-12-inch.html?gclid=CJODir-SmLQCFWGNPAodx1gALQ>

**CONCEPTS:**

**Body of water:** Defined spaces on the surface of the earth that are occupied with water. These are often recognized by their geographical features, flows, and size. Examples include ponds, rivers, lakes, oceans, seas, streams, and many others.

**Agriculture:** This is the practice of raising stock animals such as sheep, goats, cows, etc. The most common association with agriculture is the cultivation of the earth in order to grow a variety of plants that provide some resource for humans. These resources include but are not limited to vegetables, fruits, medicines, and fibers.

**BACKGROUND:**

Every day, people need water. If people did not drink water as part of the drinks they consumed every day, they would not survive. It is also important to reflect on our everyday routines and realize how many times the average American uses water. Waking up in the morning we drink a glass of water or use the sink to brush our teeth. Even the toilets we use utilize water to properly dispose of human waste. Another common morning routine is taking a shower or bath which often uses gallons upon gallons of water. Around breakfast time some of us like to eat fruit which is first washed in the sink. Amazingly the day has only begun and we have recognized many different occasions where we regularly use water. An inexhaustible list could be written to name all of the uses for water that we have. Some of the items on that list could be as basic as growing food (agriculture), washing the car, the swimming pool, and washing our hands. It is hard to deny the fact that water plays such a dominant role in our lives as well as the lives of other plants and animals that live on the planet.

Water is often seen as an inexhaustible resource like the air we breathe. Unfortunately these ideas that cause people to consume water at an alarming rate. Perhaps the best way to understand this problem is to start from the beginning. *First, how much water is there on the planet?* By simply getting a big picture of how much water exists on the planet one can then have a base for comparison. *Second, how much of that water is clean fresh water that can be easily accessed by humans to use?* The exploration to understand what a small portion of all the water on earth is drinkable fresh water is a vital step towards understanding the water conservation issue. The last step in understanding this problem would be talk about how human overpopulation and population growth tie into this dilemma. ([See minute 14:01 in Jay Famiglietti's Hot Science – Cool Talks lecture, linked in SOURCES AND RESOURCES](#))

**PREPARATION:**

Fill each cup (one per student) with a relatively equal amount of water. Take note of how much water you are using because for the activity to be accurate you must extract roughly 2% of the total volume of water to represent the fresh water in the fresh water vs. saltwater comparison. Have the clear bin set up at the front of the class for everyone to see. The use of a food coloring or dye is highly recommended for this lesson in order to make the comparisons of water very clear and visible to the students. In order to prevent in small confusion it is recommended that a blue coloring be used.

**ENGAGE:**

Teacher says: Today we are going to talk about something that we use every day and barely take the time to even realize it. We can drink it, swim in it, play in it, wash ourselves with it and even grow food with it. Can anyone tell me what they think I am talking about?..... That's right, I'm talking about water. Raise your hands if what I say applies to you. You wash your hands at least once a day (pause and wait for students to raise their hands after each statement). You take a bath or shower almost every day. You use the toilet at least once a day. You like to go swimming in a pool. You rinse your toothbrush under the faucet after you have used it. Wow, I saw a lot of hands raised for all of those. While sometimes you realize that you are using water like when you drink it or when you are washing with it there are other times where you might not notice its use. A good example of this is cooking. Almost everything you cook to eat uses water at some point like boiling noodles in a pot of water or mixing in water to make a soup. Another example of water use that you might not directly see is agriculture. Agriculture is the word that describes the growing of plants that give us resources like fruits, vegetables, cotton, and many other things. As you might already know plants are living things that require water, light, and nutrients to live and grow which means that water is just as important to them as it is to us.

Now that we have talked about how water plays a role in our lives let's shift gears and talk about water on the planet. When we look at maps or the globe what color signifies water?..... Correct, the color blue is the universal symbol for water on almost any map or globe you will see. In what kinds of places can water naturally be found?

Possible student responses:

- "Water can be found in lakes."
- "I'm pretty sure that the ocean is water."
- "Small creeks are water."
- "Rivers are water and so are small ponds."

Teacher says: Great, those are all great examples of **bodies of water**. Now let's discuss the two different categories of water. Water can be categorized as either fresh water, which means we can drink it and use it for various purposes, and saltwater which we cannot drink and has limited uses. What is largest body of water that has saltwater in it?..... Excellent, the ocean is right. If anyone has been to the beach before they will know that the water in the ocean is very different from the water in the pool. This water is very salty and might burn if you get it onto any of your cuts or scratches. This water is very different from fresh water. Can anyone tell me what bodies of water have fresh water?..... Yes, some examples include lakes, rivers, ponds, etc. Before we go onto the activity for the day, raise your hands if you think there is more fresh water than saltwater in the world..... Okay, now raise your hands if you think that there is actually more saltwater than fresh water on the planet..... Interesting.

**EXPLORE:**

Teacher says: In order to get understand why we must conserve fresh water, we are going to do some fun activities.

**Activity 1:** Understanding how much fresh water and saltwater there is on earth

1. The teacher first hands out a cup of water to each student. The level of water should be equal in each cup, and measured to represent. (the water can be dyed a color for visual effect)
2. Once each student has their cup of water tell them that about 70% of the earth's surface is covered by water and to imagine that the water they hold in their hands is going to represent every bit of water that there is on earth.
3. Next, the students will form a line and will pour their cups of water into a clear bin at the front of the class. As the students pour their water in keep reminding them that this water represents all of the water on earth. The teacher is recommended to have a globe at the front of the class to depict the surface of the earth that is water (see materials for alternative globe option). It is also vital to emphasize that the activity is finding the saltwater to fresh water ratio. The oceans do not occupy 70% of the Earth's volume! In fact, the oceans occupy less than 1% of the Earth's entire volume. The globe can be used to emphasize this point as well.
4. Once every student has poured their water into bin the students should go back to their seats.
5. The teacher will point at the bin and once again state that the water that is in the bin represents all of the water on earth. Then, ask the students to list the bodies of water that they remember from earlier on in the lesson. Once they say the bodies of water remind them that the bin of water represents all of the oceans, seas, lakes, rivers, ponds, etc... in the world.
6. With the class paying careful attention the teacher will use an eye dropper or small clear container to remove approximately 3% of the volume of water. (To do this in an accurate fashion, the teacher should know roughly how much water was given to each student to pour into the bin.)
7. Once the 3% of water is withdrawn show the class the comparison between the two quantities of water by placing the 3% water withdrawn in a smaller glass container.
8. After the comparison is clear that one amount of water is much more than the other the teacher will tell the class that the large bin represents all of the seawater/saltwater that exists on earth. The smaller amount represents all of the fresh water lakes, rivers, streams, ponds, and ice/frozen water that exists on earth. Remind them that fresh water is the water we are dependent on and can drink and use for other purposes.

The understanding of this ratio is vital to understanding the water conservation dilemma. The bottom line is that fresh water, is not an endlessly abundant resource on the planet. In fact, fresh water is very limited both in terms of access and in terms of quantity relative to saltwater contained in the earth's oceans.

**Activity 2:** Understanding the effects of population growth on water consumption rates

1. Cover a large surface with a layer of water. This can be as simple as pouring water in a single puddle onto the ground, on a table, or on a large tray. It is key that the water remains in a puddle which means the surface should be wood, tile, or plastic.

2. Have the students gather around the table so they can all see the large puddle of water.
3. Hand a dry sponge to each student and instruct them to hold on to their sponge and only use it as directed by the teacher.
4. The teacher should now pick a student and use them as an example in order to explain the activity.  
Teacher says: This student here is going to represent a single person. He/she lives in a small town that is found in the middle of nowhere. It is very hot and barren and the only source of water is a tiny pond which is given by this puddle we have here.
5. The teacher then instructs the student to place the dry sponge in the center of the puddle. Whether noticeable or not the perimeter of the puddle should be slightly decreasing since the water is being absorbed by the sponge.
6. The teacher then explains that the sponge represents the student and the water that he/she consumes over a period of time. The teacher will also point out that not much water was removed from the puddle. If that student was the only resident of the town, he/she could live there for a long time with little or no problem in terms of water usage.
7. Now instruct the students the place their dry sponges in the puddle a couple at a time. Allow the students to now stand back and notice the puddle be completely absorbed by all of the dry sponges.

Teacher asks: Where did all of the water go?.....That's right, it was all sucked up by the sponges. What do the sponges represent again?... People, right? So what did we just see happen in this example?..... Correct, all of the people used up all of the town's water.

**EXPLAIN :**

Teacher says: We just performed two very important activities. Can someone explain what we say happen in the first activity and what we learned from that activity?

Possible student responses:

- "We saw that a tiny bit of the water was drinking water..... there is much more saltwater than there is fresh water."
- "The amount of saltwater in the oceans and seas is much greater than the amount of fresh water found in all of the lakes, rivers, ponds, and ice in the world."
- "There isn't as much fresh water as I hoped. There doesn't seem to be much fresh water at all."

Teacher continues: Great comments! One thing I would like to make clear is that the first example we did was a simple representation. What we showed was not that there are only several drops of fresh water for every large bin of saltwater. What we showed was that much of the water on earth is actually saltwater rather than fresh water. What about the second activity? What did everyone notice from that activity and what was the lesson to be learned from it?

Possible student responses:

- "We saw that one person can take up some water while a bunch of people use a lot of water."
- "The sponges represented people and when there were more sponges the puddle disappeared faster and faster until it was all gone."
- "One person could live off that water for a while but if there are a lot of people using the water it will not last long."

Teacher continues: Those are some very nice responses! It is true that one single sponge did very little to soak up or use up the water. However, many sponges together were able to use up almost every drop of the water. This activity was a great way to show how water wells and aquifers are depleted by human consumption. Ground water is also a resource that has been severely depleted around the world. A great example of this is the State of California which has the largest population of any state in the US. From the period of the 1930's till now, the extraction and use of groundwater in particular regions in the state have caused the ground level to actually decrease by several stories! Imagine a tire being deflated; the ground water is what occupies the space that the ground rested on. Without this water the ground actually sank lower and lower. ([See minute 30.32 in Jay Famiglietti's Hot Science – Cool Talks lecture, linked in SOURCES AND RESOURCES](#))

These activities are designed to make the analogy for water depletion more tangible and observable. We have addressed the fact that a very small amount of all of the water on earth is fresh water. We have also brought to the table the fact that our dependence on water is causing it to dramatically decrease.

**ELABORATE:**

Teacher says: Lets elaborate on the sponge activity that we did. We all had sponges of similar sizes which represented us as individuals. When these sponges were placed in an environment where there is water the sponges absorbed a great deal of it. What would have happened if all of our sponges were larger? Try to describe how it would have effect the size of the puddle over a particular period of time.

Possible student responses:

- “If the sponges were larger, then they would have the ability to absorb more water.”
- “Bigger sponges means bigger people and bigger people use more water”
- “I think that if the sponges were larger they could not only absorb more water but they would also do it much faster.”

Teacher continues: Those responses were spot on! The use of a larger sponge would actually represent an individual that uses more water at any given time. Since all of these individuals live in the same town, it would make sense that they would all be large sponges then because they have similar lifestyles and needs. This would also correspond to a situation where all of the people were small sponges. The rate at which water would be consumed would be dramatically less than that of the large sponge or even the medium sponges which we used. An example of a large sponge could be someone who waters their plants every single day and forgets to turn off the water at night, or someone who has a farm and uses lots of water to give to all the livestock and crops. These people use large amounts of water regularly and can be considered “large sponges.” Can anyone describe to me what kind of societies and environments we could find people who could be thought of as large and small sponges? You can give real world examples or simply hypothetical scenarios.

Possible student responses:

- “The sponges could represent a group of people who use a lot of water in a small amount of time..... I can't really think of anywhere like that.”
- “The small sponges are like the people who don't have access to water all the time and are required to salvage it.”

- “Can Americans be examples of the large sponges?”

Great! “Small sponges” can be considered the opposite of “large sponges” in terms of the amount of water they use. We explained that “large sponges” use lots of water regularly but “small sponges” don’t use much water at all either because there is little to be shared or because they use it in little amounts.

Teacher continues: Very interesting comments..... I believe that some more facts and information might open your eyes and allow you to make more accurate references with the analogies we just described. Let’s start all the way on the other side of the globe in India. India is a very large country with a population of over a billion people and still growing! That’s a lot of sponges! India’s main sources of water are not too different from the sources of water in the US. These include rivers such as the Ganges, lakes such as Dal Lake, and aquifers such as the Shale aquifer. However, a combination of their massive population and high rates of pollution have severely cut down on the quantity of clean fresh water available per person. Let’s now look at the US. This country has a population of over 300 million and is still growing slowly. One of the major differences between the US and India is not the fact that they have drastically different quantities of water available. The major differences are that the US is more successful at preventing water contamination in comparison to India and also that the population to water availability ratio is much more in favor of the US. Unfortunately these facts are the prime causes for overconsumption in the US.

Water shortages caused by overconsumption and population growth are becoming more and more frequent in the US, particularly in the southern and western most portions (i.e. Texas, California, New Mexico, and Arizona) [\(See minute 32.10 in Jay Famiglietti’s Hot Science – Cool Talks lecture, linked in SOURCES AND RESOURCES\)](#)

This entire problem/situation is being called the water conservation dilemma. This means that there is a problem in terms of the amount of clean fresh water available to all the people who need it to survive. Though there are several solutions offered to fixing this problem, it is up to your generation to act upon them.

### **EVALUATE:**

Today we looked at a very important issue that really impacts all of us right now and is going to impact is even more in the near future. We did to fun activities to help us understand how little fresh water there is in comparison to the vast amounts of saltwater that exist on earth. The other activity we did focused on creating a relationship between rates of water consumption and water availability over time. Imagine what your lives would be like if you had to make the transition from the high level water consumers that you are right now (large sponge) to the minimalist water consumers (small sponge) that you will have to become with the water shortages that are occurring around the world and the US.

Several images that tie into the large vs small sponge analogy can be found in the materials section. Use these images as a springboard for class discussion. Talk about which images the class believes to be an example of a “small sponge” or a “large sponge.” If possible, continue the discussion by giving other examples the students can think of.

Next, have a copy of the “Saltwater vs Fresh Water” worksheet (see materials) be given to each student. Have them look at the examples and determine which ratio is accurate in depicting the Earth’s saltwater to fresh water ratio.

Large Sponge and Small sponge discussion images









[http://environment.nationalgeographic.com/environment/freshwater/drinking\\_-\\_water-sanitation/](http://environment.nationalgeographic.com/environment/freshwater/drinking_-_water-sanitation/)



[http://growingtables.blogspot.com/2012\\_03\\_01\\_archive.html](http://growingtables.blogspot.com/2012_03_01_archive.html)



Place a checkmark next to the set of circles that accurately depicts the amount of freshwater on earth compared to the amount of saltwater on earth.

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