SAN ANTONIO RIVER AUTHORITY

HOW MUCH FRESHWATER IS ON OUR PLANET?

Create a Model of Distribution

EDUCATIONAL ACTIVITY

HOW MUCH FRESHWATER IS ON OUR PLANET?
Create a Model of Distribution

OBJECTIVES

- Students will understand that water is renewable but finite natural resource.
- Students will create a model demonstrating the availability of freshwater to humans.
- Students will research water usage, effects and conservation solutions.

TOPICS

- **Freshwater**
- **Conservation**

FOR AGES 9+

SCIENCE TEKS ALIGNMENT:

***3*rd Grade:**
Science 7.C

4th Grade:
Science 7.C

7th Grade:
Science: 8.C

Aquatic Science:
4.A, 7.A,12. A-E

Environmental Science:
5.B, C, D.

Earth and Space Science:
1.B,C, 3.B,C,12.A

Depending on the extent to which the students are challenged, this has the potential to be a cross curricular STEM lesson.

BACKGROUND MATERIAL

Water is a precious natural resource that all living organisms need for survival. Water covers about 71% of the Earth's surface. It is estimated that there are 358,000,000,000,000,000,000 (quintillion) gallons of water on our planet. This is a lot of water! Scientists estimate that 97% of all this water is saltwater which humans cannot drink, but it is essential to the health of our planet.

This lesson will focus on the remaining 3% of water on our planet that is freshwater. Can you figure how much freshwater we have? Scientists estimate that 80% of all our freshwater is frozen in our polar ice caps and glaciers. Therefore, 2.5% of all the water on our planet is frozen freshwater. That leaves only 0.5% to liquid freshwater, but unfortunately some of that is polluted or too difficult to retrieve. Scientists estimate that humans only have access to about 0.0025% of all the water on our entire planet.

Humans cannot produce water, but it continues to be cleaned and replenished through the natural process of the hydrologic cycle (water cycle). Can you believe we have been using the same water that the dinosaurs, wooly mammoths and ancient civilizations drank?

There are many ways in which water is directly used by humans. We must have clean freshwater to drink in order to survive. We also use water for household needs, such as cooking, washing, and flushing toilets. Did you know that a person can live on one gallon of water a day which includes drinking, washing, and cooking? However, the average American consumes approximately 90 gallons of water a day. There are over 7 billion people on our planet! Can you imagine if each person on Earth used 90 gallons of water each day? How many gallons of water would be used daily? How about annually? Clearly, it is necessary that we take actions to conserve our precious water. It could be as simple as remembering to turn the water faucet off when soaping up our hands or brushing our teeth.

We use water in ways that many people are unaware. For example, we use freshwater in agriculture for growing food and raising animals. In fact, it is estimated that agriculture uses about 70% of our freshwater supply. Raising cattle (beef) requires about 2,600 gallons of water per pound. Even one avocado requires about 60 gallons to grow!

Water is needed for medical uses, such as hydrotherapy, hemodialysis, medical and dental equipment, in manufacturing products such as food, paper, cell phones and steel; and industrial use, such as cooling towers. It is also used to generate energy, such as thermoelectric and hydroelectric, and used to extract fuel. Its amazing how much we depend on this limited natural resource.

The majority of freshwater comes from underground (groundwater) aquifers in the form of springs. Locally in Bexar County, there are nearly 2 million people in the San Antonio area that depend on the Edwards Aquifer for their freshwater needs. The Edwards Aquifer (Balcones Fault Zone) is a large underground porous layer of limestone that allows water to pass through. The Carizzo-Wilson Aquifer provides freshwater to Wilson County and parts of Karnes County; and the Gulf Coast Aquifer provides freshwater to the southern parts of Karnes County and Goliad County. Allof the people living in their counties depend on groundwater to meet their basic needs.

The headwater of the San Antonio River is a freshwater spring, named “The Blue Hole.” The water seeps up from the Edwards Aquifer and flows 240 miles through Bexar, Wilson, Karnes and Goliad County, where it merges with the Guadalupe River just 10 miles from the San Antonio Bay. There are several freshwater springs that feed the San Antonio River. This amazing natural resource is the reason why many Native Americans lived along these flowing rivers and why the Spanish missionaries decided to build their missions here. The city of San Antonio was established here because the fresh flowing water was plentiful and accessible. https://www.edwardsaquifer.net/

KEY TERMS

Aquifer is an underground body of saturated rock through which water can easily move. Aquifers provide the Earth's groundwater.

Conservation means careful use of our resources.

Groundwater is water that flows or collects beneath the Earth's surface in saturated soil

Hydrologic cycle also known as the water cycle is powered by our Sun and is the continuous movement of water on our planet. Through the process of evaporation and transpiration, water becomes water vapor and enters our atmosphere. Through condensation and precipitation, water returns to the surface of our Earth.

Spring is a point at which water flows from an aquifer to the Earth's surface.

Surface Water is water on the Earth's surface such as ponds, lakes, rivers, wetlands, floodwater and runoff.

Water body is a stream, river, lake, or ocean that receives the runoff water from a watershed.

Watershed is an area of land that drains to a single point, such as a river, a lake or a stream.

PROCEDURES

Using the metric system, as demonstrated in the video, is a more precise measuring system. The metric units are provided in the procedures as noted in parenthesis ( ). However, if you don't have metric units of measurements, we are providing you with other lesson materials that typically are available at home. The customary standard measurements given are approximations.

A. In the gallon jug, put a few drops of blue food coloring first and then add 16 cups of water. (Metric: pour 1000 ml into the cylinder) This blue water represents all the water on our planet which is approximately 358,000,000,000,000,000,000 (quintillion) gallons.

B. From this gallon jug extract 7 ½ Tbsp. which is a little less than 1/2 a cup of water and pour into the clear measuring cup or jar. (Metric: pour 30 ml into the cylinder). This represents all the freshwater which is only about 3% of all the water on our planet.

C. 80% of this is frozen in glaciers and polar ice caps. Extract 20% which is equal to about 1 ½ Tbsp and pour into a small jar or cup. (Metric: pour 6 ml into the little cylinder). This represents all the liquid fresh water on our planet.

D. Label the gallon jug (Metric: 970 ml) "97% saltwater." Label the measuring cup (Metric: 24 ml) "2.5% frozen freshwater". Label the smallest cup (Metric: 6 ml) "0.5% Liquid Freshwater".

E. But wait, we are not finished! Some of that liquid freshwater is polluted or just too difficult to access. Scientists estimate that we only have access to about 0.003% of all the water on our planet. This amounts to about a drop. Use your dropper and extract a small amount of water from the smallest cup (Metric: 6 ml). For customary measurements place 2 drops (Metric: 1 drop) in the metal container. Listen carefully for the sound of that drip! This represents the total amount of unpolluted water accessible to humans. Label the metal cup with the drop of water, "0.003% liquid unpolluted freshwater accessible to humans."

MATERIALS

- 3 graduated cylinders, 1000 ml, 100 ml, and 10 ml

If you don't have the tools to measure in milliliters use the following:

- 1 gallon container
- 2 clear jars or clear measuring cups
- Tablespoon (Tbsp)

- Eye Dropper
- Small metal measuring cup
- Paper and pencil for labeling each container

OPTIONAL

- Blue food coloring

	If you wish to use **U.S. customary measurements** (Approximately)	If you have **metric units** (most measuring cups show milliliters)
This represents all the water on our planet.	1 Gallon or 128 ounces	1000 ml
97% is Saltwater	About 15 cups or 124 ounces	970 ml
3 % is freshwater:	About 8 Tbsp. or 3.84 oz	30 ml
2.5% is frozen	About 6 Tbsp or 3.20 oz	24 ml
0.5% is liquid	About 1 Tbsp or 0.64 oz	6 ml
.003% of all the water on Earth is unpolluted and accessible to human	About 2 drops	.05 ml = 1 drop (20 drops per 1 milliliter)

GUIDING QUESTIONS

- What did you learn from this model of distribution?
- What does the drop represent?
- How do you feel?
- Why does it matter?
- When you turn on the faucet at home, where is this water coming from?
- What can you do to conserve water?

EVALUATION/ENRICHMENT

Websites to visit:

- The Texas Water Development Board offers a plethora of online K-12 educational information and free materials: http://www.twdb.texas.gov/publications/brochures/conservation/index.asp
- Water Footprint Calculator: https://www.watercalculator.org/footprint/the-hidden-water-in-everyday-products/
- Center for Disease Control for other uses of water: https://www.cdc.gov/healthywater/other/index.html
- Union of Concerned Scientists for understanding water's many roles: https://www.ucsusa.org/resources/how-it-works-water-electricity
- Groundwater Association: https://www.ngwa.org/what-is-groundwater/About-groundwater/information-on-earths-water
- San Antonio River Authority: https://www.sara-tx.org/

Elementary Students

will research water usage in households and suggested conservation solutions. They will persuade others to conserve water in a creative way, such as writing a song (jingle), developing a conservation game, creating a collage, writing a story, or creating a video.

Upper Grades Students

Students will choose one of the topics listed below, or the teacher assigns topics to groups. They will research the quantity of water used, the effects that it may have on our water supply, and conservation solutions. They will present their findings to classmates in an effective way that students will understand and inspire others to take-action. The effectiveness of the lesson may be evaluated by the student.

1. agriculture (growing crops)
2. agriculture (livestock)
3. household needs (cooking, washing, flushing toilets)
4. medical uses (hydrotherapy, hemodialysis, medical and dental equipment),
5. freshwater recreation
6. manufacturing to produce paper, steel,
7. industrial use of cooling towers
8. electricity generation - thermoelectric
9. electricity generated - hydroelectric
10. fuel extraction
11. fighting fires

SUSTAINABILITY TIP:

- Reuse water from the activity by giving it to the plants.
- Remember to turn off the water while soaping down your hands for 20 seconds.