



# WeBEE SCIENTISTS

## 4th Grade, The Thirsty Desert: Conservation and Ecology in the Sonoran Desert Lesson Plan

**Driving Question:** How has water availability influenced living things in the desert?

### Standard(s):

- 4.E1U1.8 Collect, analyze, and interpret data to explain weather and climate patterns.
- 4.E1U3.9 Construct and support an evidence based argument about the availability of water and its impact on life.
- 4.E1U2.10 Define problem(s) and design solution(s) to minimize the effects of natural hazards.
- 4.L4U1.11 Analyze and interpret environmental data to demonstrate that species either adapt and survive, or go extinct over time.

### Materials:

- Post-its or sentence strips
- Chart paper
- Transparent shoe boxes (one per group)
- Sand and/or river rocks

- Recycled shampoo/soap pumps
- Plastic cup (one per group)
- Scissors
- Lined paper
- Materials for Rain Harvesting Design Project:
  - Dixie Cups
  - Straws
  - Cardstock
  - Foil
  - Ziplock bags
  - Plastic tray with lip/edge
  - Milk cartons
  - Natural materials (sticks, gravel, leaf, mulch, rocks)
  - Clay
- Copies of student handout #1
- Copies of student handout #2
- Copies of student handout #3
- Copies of student handout #4
- Copies of student handout #5 (one per group)
- Copies of student handout #6
- Copies of student handout #7
- Copies of student handout #8
- Unit Slidedeck

**Probe:** *Time: 15 minutes*

Give students a copy of handout #1, a stock model probe. Have students identify the sources of Tucson’s water and where the water goes. Have students share their ideas after giving them time to work on it independently. Create a larger class chart of the stock model and record their ideas accordingly.

## **Phenomena:** *Time: 10 minutes*

Show students the pictures of the Santa Cruz River before and after photos. Ask students what they notice and wonder. Provide time to share their ideas with the whole group.

## **Engage:** *Time: 10-15 minutes*

Show the slow reveal pie chart in the slide deck. Provide time for students to think, pair, share between each slide/reveal.

Ask questions (also found in the speaker notes of the slide deck) such as:

- \*What do you notice? What do you wonder?
- \*What do you think the pie slices are representing?
- \*What does the chart represent?
- \*What does reclaimed mean?
- \*What does remediated mean?
- \*What questions do you have about Tucson's water usage?

Record questions students have about Tucson's water usage on the Wonder Wall in your classroom.

## **Explore:** *Time: 30-40 minutes*

Gauge students' understanding of the water table by asking them what surface and groundwater are and what relationship they have. Have them respond to these questions independently on slates, but then share with a partner.

Provide students with materials: transparent shoe boxes, a cup of river rock, a cup of sand and recycled shampoo/soap pump. They will need one set of materials per group. Ask students to create a model of the water table. They must include a hill/mountain, and a low point where water can collect to model a lake, pond, or stream. Once their model is complete, students pour water on top of the mountain to simulate rain. Make sure

they use enough water to create groundwater and surface water that fills their lake, pond, or stream.

While groups are working on their models, walk around and facilitate discussions regarding surface and groundwater, and support their collaborative work.

Lead a whole class discussion after building and interacting with the models.

\*What causes the surface water runoff to move down into the ground?

\*What happens when the water table crosses the surface?

Have students add a pump, which represents a well, to their current model. Have students pump water out of their model into a cup or graduated cylinder. Have students pump 5 times every 30 seconds to simulate 5 years of time passing.

Lead a whole class discussion after adding their wells to their model.

\*What happens to the water table when groundwater is pumped?

\*What would happen if we added more wells?

\*How does drought, which is a natural occurrence in the desert, affect surface water and groundwater?

\*Based on this experiment, what do you think has happened to the Santa Cruz River and Lake Powell?

### **Explain:** *Time: 30 minutes*

Use the slidedeck to provide students with information about Tucson's water sources: CAP, groundwater, effluent (remediated and reclaimed).

Revisit the class stock model from earlier. If you haven't already, add CAP water, reclaimed and remediated water to the inflow/outflow. CAP water should be an inflow water source. Remediated/reclaimed water should be added to the outflow and the back loop arrow.

Pass out handout #2 containing the infographic and map. Have students independently read through the infographic and map and answer the questions on the handout. After students have completed the task independently, bring them back together to discuss:

- \*What patterns do you see?
- \*What is changing?
- \*Why are there different colors on the map?
- \*Where are we located on the map?

Pass out handout #3. Have students construct an explanation about what is happening to Tucson's groundwater. Make sure they use evidence from the infographic and map to support their thinking. They should also use vocabulary such as groundwater, surface water and runoff.

### **Explore:** *Time: 20-25 minutes*

Students will be working in groups to research one of three animals: the Desert Pupfish, the Sonoyta Mud Turtle, and the Chiricahua Leopard Frog. Students will specifically look for information about how the scarcity of water has affected these species. They should be able to share at the end of the reading how their animal is affected by water availability. This will help them in the next lesson when they make a claim about how their species is affected by water scarcity.

Resources for each animal:

[Desert Pupfish](#)

[Sonoyta Mud Turtle](#)

[Chiricahua Leopard Frog](#)

## **Explain:** *Time: 30-45 mins*

Pass out handout #4 and provide access to their species fact sheet (found online, but also printable). Have students independently complete their claim, evidence, reason (CER) worksheet. Once they finish their graphic organizer, they should write their CER as a paragraph on the lines provided.

## **Explore:** *Time: 30 mins*

Students brainstorm ways they use water at home. Pass out handout #5, water activity cards (one per group) and have students cut them out. They will use these cards to make predictions about which activities at home use the least to most amount of water. They order these cards horizontally from the least to most water-hogging activity. Have students share their groups' answers and review the correct order. *Least to greatest: Hand washing, teeth brushing, dishwasher, washing machine, shower, bath, toilets, lawn.*

Pass out handout #6. Review the at home water tracking sheet. Explain how to track water for showers by timing how long their showers are then multiplying the gallons per minute. Have students make predictions about how much water they think their **family** or **household** uses in a day. It is important for students to know that they are tracking the total water usage for the entire house to keep results consistent. Review the example water tracking sheet. Have students make observations from this tracking sheet. Ask questions such as:

- \*How were the total gallons of water calculated for showers?
- \*How many people took showers?
- \*Which activity used the most water? The least?
- \*Why was the bath column left empty?

## **Explain:** *Time: 25-30 mins*

Have students review their water usage tracking sheet (handout #6). They should have their total water usage for their household calculated and the total of water per person in the household. Have them share with a partner which of their household activities used the most and least water. Bring them back together for a whole class discussion:

- \*How their prediction compared to their actual amount of water used.
- \*What surprised them about their water usage.
- \*What used the most water.
- \*What used the least amount of water.

Ask students to look at the last column of their water usage. Have students write the name of that activity (shower, tooth brushing, etc.) on a post-it. Teachers could draw a graph on the whiteboard or use one in the slide deck. Then invite students to place their post-it on the graph under the appropriate category.

Lead the class through a discussion about your whole class results found on the graph.

- \*What was the biggest water-hogging activity as a class?
- \*How could we reduce or conserve the amount of water used for this activity?
- \*Which activity used the least amount of water? Why do you think that is?

## **Elaborate:** *Time: 25-30 mins*

Have students reflect on their household's water usage, specifically, in which use is their household best saving water, and what is something that they need to improve on because they use too much water.

Pass out handout #7. Students will be writing argumentative letters to people in their households about how they can work together as a family to use less water and why that is important. Make sure they use evidence from their water usage tracking sheet and what they have learned from this

unit. First, begin by having students fill out their letter writing graphic organizer. Once they have completed their graphic organizer, they should begin drafting an argumentative letter to the members in their household.

## **Evaluate:** *Time: 3 sessions–30 mins each*

**Session 1:** Review the design challenge including the task, possible features of their home, constraints and materials. Pass out handout #8. In groups, have students complete page 2 of handout #8. This will ask them to outline what they know about rainwater harvesting, and brainstorm ideas for rainwater harvesting for their model home. Afterwards, they will draw their plan for their model home before building. Once they have planned their home, they will have a chance to build it using available materials.

**Session 2:** In this session, groups should test their rainwater harvesting home design. Make sure that all groups use a uniform amount of water so that it is consistent amongst all groups. Have them spray their water from a spray bottle to simulate rain. Once groups are done testing their rain water harvesting designs, have them reflect on what they noticed and why. There are discussion questions in the slide deck, for a whole class discussion. Then have students complete page 2-3 in handout #8. Afterwards, provide students with time to work together to improve their design in order to capture more rainwater on their second test.

**Session 3:** Students should test their redesigned rainwater harvesting system in order to reflect upon what worked and how they improved it (page 3 of handout #8). Students should also score their design and collaboration during this project using the design rubric on page 4 of handout #8.

Consider having groups demonstrate their rainwater harvesting systems for other groups so they have an opportunity to share their designs.