

Teacher Packet Updated 2/18/15

Outreach Education Overview and Resource Materials
Utah Waters Van
Water Cycle Teacher Packet



EXPLORE, DISCOVER, LEARN

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&
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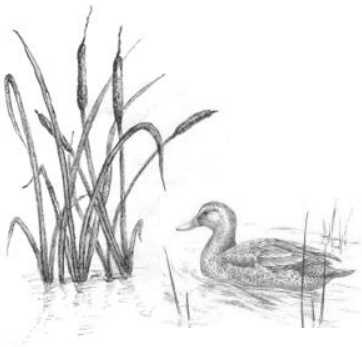
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Why is there an aquarium in a desert?

Where else in the world is water so valued and respected? It's a precious resource that defines how we live in Utah. Because we're not surrounded by oceans and immense water habitats, we have fewer opportunities to experience, understand, and appreciate the water environments that cover more than 70 percent of our planet. Loveland Living Planet Aquarium brings animals to people who might not have the chance to see them or their water-based ecosystems in a natural setting.

Our children are the future custodians of the environment, yet the majority of today's young people don't have the opportunity to understand the ocean nor their own water-dependent environments. Loveland Living Planet Aquarium provides a "living classroom," educating us all about our interdependence on our living planet's fragile ecosystems.

Loveland Living Planet Aquarium is dedicated to celebrating life on Earth by fostering a greater awareness and knowledge of Earth's diverse ecosystems and creating a deeper understanding of our place in the global system of life.

Loveland Living Planet Aquarium is committed to providing opportunities for families to learn about our interdependence with the fragile ecosystems of our planet through entertaining, interactive, educational exhibits and programs. Having this aquarium provides us with countless opportunities to understand and respect this precious resource and the living habitats it supports, both in Utah and in our planet's oceans.



Education Programs Overview

Field Trips:

We currently offer field trips for grades PreK-12. Our field trips correlate with the Utah State Core Curriculum guidelines by grade level, as well as the National Science Standards, and Utah Environmental Education Guidelines. This integrated, purpose-driven approach provides for a rich and interesting field trip for students.

More information about our field trips can be found at our website:

http://www.thelivingplanet.com/essential_grid/field-trip-programs/

Outreach Programs:

We currently offer our Rainforest Van Program to 2nd grade and our Utah Waters Van Programs to 4th grade. Our outreach programs correlate with the Utah State Core Curriculum by grade level. This integrated, purpose-driven approach provides for a rich and interesting educational opportunity for students.

More information about our outreach programs can be found at our website:

http://www.thelivingplanet.com/essential_grid/outreach-program/

Professional Development:

Loveland Living Planet Aquarium offers free teacher resource programs to public and charter school teachers. The primary goal of these workshops is to support effective science instruction in the classroom by training teachers to engage students with important, relevant science content, equipment and resources, practical applications and classroom activities.

Utah's Unique Environments: The Utah's Unique Environments program is specifically for fourth grade teachers. This workshop explores Utah's three major environments: deserts, forests, and wetlands. Teachers – as students – and, as a result, fourth-grade school children will obtain a deeper understanding of what characteristics make up Utah's environments, learn the importance of each of these environments, and study the amazing animals and plants that live in these habitats. Students will observe their own environment up close, learn how to ask questions and employ scientific inquiry to help answer their questions. Classroom materials that each teacher receives will be helpful in transforming the classroom into a young naturalist's headquarters.

Project WET: We have collaborated with USEE to offer Project WET workshops for teachers of all grade levels. Project Wet is a FREE internationally recognized program that enhances participants' learning about water! Activities in the Project Wet Curriculum and Activity Guide are correlated with state and national formal education standards. Using interactive, hands-on, cross-curricular, and often inquiry-based methods of learning, participants increase their understanding about water in Utah.

Interested in attending or hosting a teacher resource program workshop?

Contact the Education Department at LLPA for more information:

(801) 355-FISH (3474)

Wonders of the Water Cycle Program Overview

Thank you for choosing to have Loveland Living Planet Aquarium's Utah Waters Van see your 4th grade students. We look forward to visiting you!

So that our visit will run smoothly, your teacher packet provides an overview of the visit and a checklist of things to accomplish before, during, and after your experience with us.

Our core-based program is designed to be an exciting complement to what you are doing in the classroom. Loveland Living Planet Aquarium's education team examined the Utah State Office of Education's Core Curriculum for fourth grade and created our program and activities to reinforce those standards and objectives. Later in your teacher packet, we list which standards and objectives we cover in our visit.

We begin our fifty-five minute program with an introduction about the activities we will be doing. Then, students will have the opportunity to "see" the water cycle and Utah's weather by viewing a model of the water cycle. Once the students see the water cycle as a whole, we break down each step through inquiry-based, student-centered experiments. Throughout the program, students will have the opportunity to observe live Utah animals up close and determine how the different steps in the water cycle impact living things. Students will see amphibians and reptiles such as a red-spotted toad, tiger salamander, banded gecko, and a garter snake. Through observation, students will learn about adaptations of these animals. The program ends with a class discussion about how they use water and look for ways to conserve this precious resource.

Since our start in 2002, the Utah Waters Van has reach thousands of students in all of Utah's school districts! Last year, we visited over 45,000 students in 558 different elementary schools. Thank you for helping us make our program a huge success!

Utah Waters Van Program Checklist

Pre-Visit:

You should have received via email:

- _____ A confirmation sheet of our scheduled visit to your school. Please review it carefully and notify us if there are any discrepancies.
- _____ Evaluation sheet for **each** teacher to fill out & return. We appreciate your help in critiquing our programs.
- _____ Pre-visit and post-visit activities and lesson materials (this packet).

Remember to complete the pre-visit activities before our visit!

Day of our visit, please provide the following:

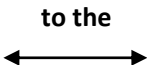
- _____ A wheelchair-accessible room of typical classroom size or larger where our educators can stay set up for the duration of the visit.
- _____ Access to 1 electric outlet.
- _____ Chalkboard or white board with writing instruments.
- _____ Teacher presence, participation, and assistance with behavior management throughout the entire presentation.
- _____ Nametags on all your students.
- _____ ***All students MUST wash their hands with soap and water after touching live animals during the program! Hand sanitizer does NOT kill all germs!***

Post-Visit:

- _____ Each teacher should fill out and return the evaluation sheet to the presenters before they leave the school, or mail the evaluations sheets to us.

Remember to complete the post-visit activities after our visit!

Wonders of the Water Cycle Program Core Connections

Connecting  to the Core Standards

Here's where Loveland Living Planet Aquarium's Utah Waters Van Program connects with the Utah State Core for the fourth grade. The connections listed below are only for the Wonders of the Water Cycle program. It is important to note that each pre-visit and post-visit activity in this packet connects to the fourth grade core. Those connections are listed in each activity and the pre-visit page.

Science Core Curriculum Correlation:

Intended Learning Outcomes for Fourth Grade Science

1. Use Science Process and Thinking Skills

c. Make simple predictions and inferences based upon observations.

4. Communicate Effectively Using Science Language and Reasoning

a. Record data accurately when given the appropriate form and format (e.g., table, graph, chart).

Standard I: Students will understand that water changes state as it moves through the water cycle.

- ***Objective 2: Describe the water cycle.***
 - a. Locate examples of evaporation and condensation in the water cycle (e.g., water evaporates when heated and clouds or dew forms when vapor is cooled).
 - b. Describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle.
 - c. Identify locations that hold water as it passes through the water cycle (e.g., oceans, atmosphere, fresh surface water, snow, ice, and ground water).
 - d. Construct a model or diagram to show how water continuously moves through the water cycle over time.
 - e. Describe how the water cycle relates to the water supply in your community.

Standard II: Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.

- ***Objective 1: Observe, measure, and record the basic elements of weather.***
 - b. Observe, measure, and record data on the basic elements of weather over a period of time (i.e., precipitation, air temperature, wind speed and direction, and air pressure).

Standard V: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

- **Objective 4: Observe and record the behavior of Utah animals.**
 - d. Compare the structure and behavior of Utah amphibians and reptiles.

Goals and Objectives of the Utah Waters Van Program

Loveland Living Planet Aquarium's education team assembled a set of measurable goals and objectives for the Utah Waters Van *Wonders of the Water Cycle* program. These goals and objectives are used by our education presenters to assist your students in learning about water during our visit.

Goal 1: Students will be excited about and express interest in science.

- Objective 1: Students will actively participate in one or all ways during the Water Cycle program (i.e.: follow directions, discussion, ask or answer questions, nod in agreement, record observations, actively participate in group experiments).
- Objective 2: At least one student in each class will demonstrate a sense of curiosity about science by asking a question about a topic covered.
- Objective 3: At the end of each Water Cycle program, most students will agree that they are excited to learn about science.

Goal 2: Students will understand the steps in the water cycle.

- Objective 1: When shown a model of the water cycle, students will discuss the relationship between heat energy from the sun and the water cycle.
- Objective 2: Students will make inferences about evaporation when shown examples of plants that secrete salt.
- Objective 3: Using materials provided, students will be able to demonstrate how pressure impacts condensation.
- Objective 4: Students will be able to explain how condensing water molecules will cause precipitation.
- Objective 5: Students will accurately record their observations about the water cycle when performing experiments that show evaporation, condensation and precipitation.

Goal 3: Students will understand how the water cycle impacts animals in Utah.

- Objective 1: Through observing a reptile and an amphibian, students will be able to compare and contrast how evaporation impacts these animals.
- Objective 2: Students will be able to discuss ways condensation effects temperature regulation in cold-blooded animals.
- Objective 3: Students will be able to hypothesize how precipitation impacts the life cycles of amphibians that live in dry environments.

Goal 4: Students will understand the relationship between humans and water as a natural resource.

- Objective 1: Given a water use chart, students will calculate how much water their entire class uses in one day.

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- Objective 2: Students will be able to state at least 3 ways humans can conserve water.
Objective 3: Students will choose to conserve water by using less water in at least 1 way in their daily lives.

Pre-visit Resources Summary

The following pages offer pre-visit resources that you can use in the classroom with your class before we visit with Loveland Living Planet Aquarium's Utah Waters Van. These resources correlate with material that will be covered during our visit or in post-visit resources.

The pre-visit resources are divided into the following sections:

Background Information: The background information contains conceptual ideas as well as basic vocabulary. It is a useful reference when using the pre-visit and post-visit lessons.

Pre-visit Lessons: There are two pre-visit lessons to prepare your students for Loveland Living Planet Aquarium's Utah Waters Van Program. Below is a summary of the lessons and cross-curricular connections. Science Core connections are listed within the lesson. Additionally, the lessons are formatted the same way as our Teacher Professional Development program lessons.

Lesson	Time Requirement	Cross-Curricular Connections
<p>What Do You Know About The Water Cycle?</p> <p>In this activity, students will be introduced to the water cycle. By reading the water cycle song, looking at a diagram of the water cycle, and drawing on personal experiences with the water cycle, students will begin to assemble an understanding of the water cycle.</p>	<p>45 minute class period</p>	<p>Social Studies: Standard 3, Objective 3 Language Arts: Standard 1, Objective 1, 2; Standard 6, Objective 1, 2, 3 Music: Standard 1, Objective 1; Standard 4, Objective 2 Life Skills: Thinking and Reasoning, Personal Growth and Character Development, Communication, Systems Thinking, Employability</p> <p>Learning Extension: Standard 3, Objective 1</p>



Background Information:

Basic Water Facts

Water is an amazing substance! It covers approximately 75% of Earth's surface. Water is found in rivers, lakes, oceans, and underground. It is even found in plants and animals. Not only are we made of water, but our lives are centered around it. We use it to drink, irrigate crops, make electricity, and other products. With so many people using water in so many different ways, we often lose sight of the fact that less than 1% of all the water on Earth is useable fresh water.

Water covers approximately 75% of the Earth. 97.6% of this water is found in oceans as salt water. 2.07% is frozen in ice caps, glaciers, and on the top of mountains. This leaves 0.33% as useable fresh water, the majority of which is found underground (Cunningham et al., 2007). In the west, water is very scarce. For example, Utah receives an average of 13 inches of precipitation a year. This makes Utah the second driest state in the nation (Utah Division of Water Resources, 2001).

The Water Cycle

The water cycle is the natural process where by which water is transformed back and forth between a solid, a liquid, and a vapor. The water cycle is made up of several processes:

Evaporation and Transpiration (also know as Evapotranspiration)

Evaporation is the process of a liquid turning into a vapor or gas. This occurs when the surface of the liquid absorbs enough energy to change from a liquid into a vapor. Evaporation occurs in many places. One of the most common places is a puddle of water that has formed on a sidewalk. The more energy water receives from the sun, the faster evaporation will take place. Large amounts of water evaporate constantly from the surface of oceans and large lakes. Small amounts of water evaporate from rivers, puddles, the soil, plants, and even from your skin. When water evaporates from the surface of a plant it is called transpiration. It is important to note that usually only liquids evaporate. This means that the mud in puddles, salt in the ocean, and pollutants stay on the surface of the Earth while the water changes from a liquid into a gas. This is the way that nature cleans water.

Condensation

Condensation is the process of gases turning into liquids. Three things must be present in order for water to condense. (1) There must be humidity or water vapor present in the air. (2) The temperature must change. We normally associate condensation with warm water vapor coming in contact with a cool surface. (3) There must be a solid surface. The solid surfaces on which condensation occurs are referred to as condensation nuclei. Condensation nuclei can be made of dust or smoke, or can be a window or can of soda. Examples of condensation include clouds, dew, and fog.

Precipitation

When the water droplets in a cloud grow so large and heavy that the air can no longer support them, precipitation occurs. Precipitation can take the form of rain, snow, sleet or hail. Sleet is formed when snow or hail melts on its way down through the atmosphere and then freezes again before it comes into contact with the ground.

Surface Runoff

The water that falls back on Earth flows over the surface of the Earth as rivers and streams. The movement of water over the surface of the Earth is known as surface runoff. Surface runoff transports nutrients and pollutants throughout a watershed, an area of land in which all water drains to a common point. Most of the water used by humans (78%) is surface water.

Collection/Accumulation

The surface runoff is going to move to a common point, such as oceans, lakes, ponds, or marshes. This process of the small droplets of water gathering back together is known as collection, or accumulation. This step of the water cycle stores water. Here, evaporation will occur and the cycle will continue.

Percolation/Infiltration/Seepage

Some water that falls on the surface of the Earth is going to filter into the ground. The process of water moving through the ground is called percolation, infiltration, or seepage.

Water that collects underground is called groundwater. Fifteen times more water can be found underground than in all the rivers, lakes, and streams on the surface combined. 22% of water used by humans comes from under the ground. There is really nothing mysterious about groundwater. We just can't see it like we can see water in a pond, a stream, or the ocean. This water collects below the Earth's surface in aquifers, porous spaces between soil and rock particles. The bottom of an aquifer is a layer of impermeable rock or clay that prevents the water from seeping any further. Water is also found in cracks and crevices and inside porous rocks. The top surface of groundwater is called the water table. When the water table is at the same elevation as the surface of the Earth, groundwater comes to the surface naturally in springs, lakes, ponds, and rivers. Although, the top level of the groundwater is usually underground. Groundwater can also be brought to the surface by drilling wells. Groundwater is a vital part of the water cycle and is replenished by rainfall. The amount of groundwater in different areas of the world vary, and the amount at any one place can change due to prolonged drought, heavy withdrawal for human use, or other factors. As groundwater moves through various layers of soil and rock, many impurities get filtered out. Groundwater quality is generally better than that of surface water because it is not as readily exposed to pollution sources. However, pesticides, chemicals, landfill leachate, and other materials that seep into groundwater supplies can cause groundwater to become polluted (Cunningham et al., 2007).

Water Conservation and Human Utilization

Water is one of our most important resources. We use water to produce food, provide energy, and manufacture and transport goods. Water is essential for the life of every organism on our planet. We use reservoir water for recreation and irrigation before it is cleaned and use it to produce hydroelectric power as it is drained from a reservoir. We use clean water in our homes for drinking, cooking, cleaning our bodies, dishes, and laundry. As individuals, we use large amounts of water. It is estimated that the average American uses around 180 gallons of water a day, with Utahans using an average of 320 gallons per day (Utah Division of Water Resources, 2001).

Utah is a desert state, so as Utahans, we must be extra careful with our water and practice water conservation. The following is a list of water conservation ideas:

1. Avoid watering the lawn or garden between 10 am and 6 pm.
2. Take shorter showers.
3. Wash your car over the lawn instead of the driveway.
4. Turn off the water when brushing teeth.
5. Use waste water from cooking to water plants.
6. Run the dishwasher and clothes washer only when full.
7. Keep water in the fridge for cold water.
8. Fix leaky faucets and hoses.
9. Do not use the toilet as a garbage can.
10. Encourage your friends and family to conserve water.

Water Vocabulary

Aquifer: A layer of sediment, rock, or soil that contains significant amounts of water.

Cloud: A visible mass of small water droplets suspended at a relatively high altitude.

Collection/Accumulation: The collection of water in any form upon any surface.

Condensation: The process of water vapor in the air turning into liquid water.

Condensation Nuclei: A tiny particle in the air such as dust or smoke on which water vapor condenses to form water droplets.

Conserve: To use or manage wisely; preserve or save.

Dew: Water that has condensed on a cool surface appearing as small droplets, especially over night.

Evaporation: Change of a liquid, such as water, into a vapor.

Evapotranspiration: The sum of water lost to the atmosphere from the evaporation and transpiration processes.

Groundwater: Water beneath the Earth's surface.

Humidity: Dampness or moisture in the air and atmosphere.

Percolation/Infiltration/Seepage: The gradual movement of water through the pores of soil and rock.

Precipitation: Water that falls to the Earth from condensation in the atmosphere as rain, snow, hail, or sleet.

Resource: A supply that can be drawn upon when needed.

Runoff: Precipitation that flows off the land into streams, rivers, lakes, and other collections of water.

Transpiration: Process by which water is transferred into the atmosphere from a plant surface, such as a leaf. Accounts for 10 percent of the moisture in the atmosphere.

Temperature: The degree of hotness or coldness of a body or environment.

Watershed: A geographic area of land in which all water drains to a common point.

Water Vapor: Water in a gaseous form.

Water Cycle: The natural process by which water continuously circulates on, above, and below Earth transforming back and forth between a solid, a liquid, and a vapor.

Animal Vocabulary

Adaptation: A physical characteristic or behavior that assists an organism in survival in its environment.

Amphibian: A cold-blooded vertebrate animal that spends part of its life on land and part in water.

Reptile: A cold-blooded vertebrate with unique skin that is dry and covered with scales.

References

Cunningham, W.P., Cunningham M.A., & Saigo, B.W. (2007). *Environmental science: A global concern*. Boston: McGraw Hill.

Utah Division of Water Resources. (2001). *Utah's water resources: Planning for the future*. Retrieved June 9, 2008 from <http://www.water.utah.gov/waterplan/>.

United States Geological Survey. (2012). *The Water Cycle*. Retrieved August 8, 2012. <http://ga.water.usgs.gov/edu/watercycle.html>



What Do You Know About The Water Cycle? Pre-visit Lesson 1

Alignment to Utah Core Curriculum:

Grade Level: 4th Grade

Intended Learning Outcomes (ILOs):

1. Use science process and thinking skills.
2. Manifest science interests and attitudes.
3. Understand important science concepts and principles.
4. Communicate effectively using science language and reasoning.

Science Core Curriculum:

Standard I: Students will understand that water changes state as it moves through the water cycle.

Objective 1: Describe the relationship between heat energy, evaporation and condensation of water on Earth.

Objective 2: Describe the water cycle.

Enduring Understanding:

On Earth, matter is not created nor destroyed. It cycles from one state to another. The cycling of matter requires energy.

Essential Questions:

1. What is the energy source that drives the water cycle?
2. What are five steps of the water cycle?
3. How are humans connected to the water cycle?

Activity:

Length of Activity:

45 minutes

Materials Needed:

“What Do You Know About The Water Cycle” activity sheet for all students in your class

Materials Provided:

Digital copy of the “What Do You Know About The Water Cycle” activity sheet

Procedure:

1. Copy enough activity sheets for all the students in the class.
2. Hand out an activity sheet to each student.
3. Ask the students to read the Water Cycle Song, look at the diagram of the water cycle, and try to remember information they have learned about the water cycle or

experiences that they have had with the water cycle (for example, playing in snow, swimming in a lake, etc.).

4. When the students have completed these tasks, ask them to fill out the “What Do You Know About The Water Cycle?” section of the activity sheet. They can do this part of the activity individually or in groups, but all students should complete an activity sheet.
5. After all the students have filled out their activity sheets, come together as a class.
6. Answer the “What Do You Know About The Water Cycle?” section of the activity sheet as a class. Draw out the answers to the questions. Compare the students’ answers to information that you would like the students to know about the water cycle.
7. After they have answered the questions, sing the Water Cycle Song.

Formative Assessment Strategies:

This activity can be used as a post-visit activity as well. Compare the activity sheet completed before Loveland Living Planet Aquarium’s Utah Waters Van visited your class to the activity sheet filled out after the visit from Loveland Living Planet Aquarium’s Utah Waters Van.

Learning Extensions:

Consider having your students write other verses of the water cycle song. In these verses have them include other steps of the water cycle, including runoff, collection or accumulation, percolation or infiltration, and transpiration.

Booklist

Reference Book:

Cunningham, W.P., Cunningham M.A., & Saigo, B.W. (2007). *Environmental science: A global concern*. Boston: McGraw Hill.

For students:

Wick, W. (1997). *A drop of water: A book of science and wonder*. New York: Scholastic Incorporated.

Websites

Environmental Protection Agency:

http://www.epa.gov/ogwdw/kids/flash/flash_watercycle.html

NASA: <http://kids.earth.nasa.gov/droplet.html>

United States Geological Survey: <http://ga.water.usgs.gov/edu/watercycle.html>

Research:

Michaels, S., Shouse, A., Scheingruber, H. (2007). *Ready, set, science!: Putting research to work in K-8 science classrooms*.

This book highlights practical application of current science education research into kindergarten through eighth grade science classrooms.

What Do You Know About The Water Cycle?

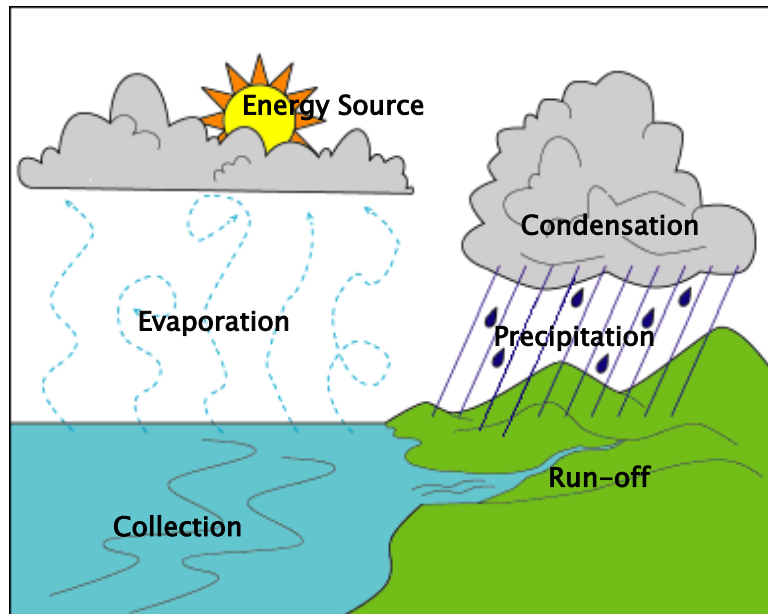
Name: _____ Date: _____

Water Cycle Song

Sang to the tune of She'll Be Coming Around Mountain

Water travels in a cycle, yes it does.
Water travels in a cycle, yes it does.
It goes up as *evaporation*.
It forms clouds as *condensation*.
Then comes down as *precipitation*, yes it does!

The Water Cycle



What Do You Know About The Water Cycle?

1. Energy Source for the water cycle: _____
2. Evaporation: _____
3. Condensation: _____
4. Precipitation: _____
5. Run-off: _____
6. Collection: _____

Post-visit Resources Summary

The following pages offer post-visit activities that you can use in the classroom after we visit with Loveland Living Planet Aquarium’s Utah Waters Van. These resources correlate with material that will be covered during our visit or in pre-visit materials.

Post-visit Lessons: There are five post-visit lessons to assist your students in learning the information for Loveland Living Planet Aquarium’s Utah Waters Van Program. Below is a summary of the lessons and cross-curricular connections. Science Core connections are listed within the lesson. Additionally, the lessons are formatted the same way as our Teacher Resource Pilot Program lessons.

Lesson	Time Consideration	Cross-Curricular Connections
<p>A World of Water This activity is designed to introduce students to the locations where water is held.</p>	<p>60 minute class period</p>	<p>Language Arts – Standard 1, Objective 1 Mathematics – Standard 1, Objective 1; Standard 4, Objective 1 Life Skills: Thinking and Reasoning, Personal Growth and Character Development, Communication, Systems Thinking, Employability</p> <p>Learning Extension – Standard 5, Objective 1</p>
<p>The Wonderful Water Cycle This activity is designed to help students learn about the water cycle by demonstrating water cycle processes within a small container</p>	<p>30 minutes for the initial observations 15 minutes every day over a period of a week to make observations 30 minutes for the conclusion section of “The Wonderful Water Cycle” activity sheet</p>	<p>Language Arts – Standard 1, Objective 1; Standard 6, Objective 1 Life Skills: Thinking and Reasoning, Personal Growth and Character Development, Communication, Systems Thinking, Employability</p>
<p>The Shortest Shower In this activity, students come to understand the importance of conserving water.</p>	<p>10 minutes each day to record students’ times 30 minutes to calculate who had the shortest shower</p>	<p>Language Arts – Standard 1, Objective 1 Mathematics – Standard 1, Objective 2 Social Studies – Standard 1, Objective 2, 3; Standard 3, Objective 1 Life Skills: Thinking and Reasoning, Personal Growth and Character Development,</p>

		Communication, Systems Thinking, Employability
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A World of Water

Post-visit Lesson 1

Alignment to Utah Core Curriculum

Grade Level: 4th Grade

Intended Learning Outcomes (ILOs):

1. Use science process and thinking skills.
2. Manifest science interests and attitudes.
3. Understand important science concepts and principles.
4. Communicate effectively using science language and reasoning.

Utah Science Core Curriculum Standards and Objectives:

Standard I: Students will understand that water changes state as it moves through the water cycle.

Objective 1: Describe the relationship between heat energy, evaporation and condensation of water on Earth.

Objective 2: Describe the water cycle.

Enduring Understanding:

Earth is considered a blue planet due to the vast amounts of water on it. However, only a small portion of that water is available for human consumption.

Essential Questions:

1. How much water do we have on Earth compared to land?
2. Where is water located on Earth?
3. What percent of all the water on Earth is fresh usable water?

Activity:

Length of Activity:

60 minutes

Materials Needed:

- Globe/Map of the Earth
- Photocopies of "A World of Water" activity sheet
- 2 containers for each group
- Markers and masking tape to label containers
- 1 measured tablespoon of salt for each group
- 1 1/4 measured cups of water for each group
- 1 1/4 measured cups of vegetable oil for each group
- Blue food coloring
- 1 large clear container for each group

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- 1 measured cup for each group
- 1 measured tablespoon for each group
- 1 measured teaspoon for each group
- 1 dropper for each group

Materials Provided:

Digital copy of “A World of Water” activity sheet

Helpful Hints:

- If a dropper is not available, consider dipping the end of a pencil into the liquid and using it as a dropper.

Procedure:

1. Photocopy enough “A World of Water” activity sheets for all students in your class.
2. As a class, examine a globe or map of the Earth. Ask the class to estimate how much of the Earth is covered with water and land. Is there more land or water covering the Earth’s surface? What percent of the Earth’s surface is covered by land? What percent of the Earth’s surface is covered by water?
3. After the class has had an opportunity to discuss how much of the Earth is covered by water, explain that approximately 75% of the Earth’s surface is covered by two kinds of water, salt water and fresh water.
4. Hand out “A World of Water” activity sheet to all students and divide them into small groups.
5. Ask your groups to generate a list of the locations where we can find water on Earth. Ask them to record their list on “A World of Water” activity sheet. For example, oceans, rivers, lakes, the atmosphere, plants, etc.
6. Ask each group to think about what they know about portions or percentages of water found in various locations on Earth.
7. Hand out the supplies to each group. Each group should receive:
 - a. 2 containers. One container should be filled with water and salt, then labeled “Salt Water.” The other bottle should be filled with blue food-colored vegetable oil and labeled “fresh water.”
 - b. 1 large clear container
 - c. 1 cup
 - d. 1 tablespoon
 - e. 1 teaspoon
 - f. 1 dropper
8. Tell your students that they are going to be combining portions of the salt water and the fresh water that represent water that is found in various locations on Earth into the large clear container. At the end of the activity, all the water in the clear container will represent all of the water on Earth.
9. Write on the board how much salt water and fresh water should be added to the large container. Note that the order listed below is the order that the water should be added to the large clear container:
 - Salt water
 - a. Oceans: 1 cup
 - b. Salt Lakes: 1 drop

Fresh water: blue food-colored vegetable oil

- c. Glaciers: 1 tablespoon
- d. Ground Water: 1 teaspoon
- e. Fresh Water Lakes: 3 drops
- f. Rivers: 1 drop
- g. Atmosphere/Gas: 1 drop

10. Have students pour the amounts needed for each location into the clear container which will hold all of the water on Earth. Students should take turns so that they are all involved.

11. After all the portions of water are in the large container. Ask students to fill out the rest of “A World of Water” activity sheet.

Formative Assessment Strategies:

Students will successfully answer the review questions following the initial activity.

Learning Extensions:

Create a bar graph of the percentages of water found in various locations on Earth. This can be done as a class, small groups, or individually by the students.

Oceans	: 97.6%	Salt Lakes: 0.007%	Glaciers: 2.07%
Ground Water:	0.29%	Fresh Lakes: 0.012%	Atmosphere/Gas: 0.001
Rivers:	0.0001%		

Data can vary due to environmental factors

Source: U.S. Geological Survey

Booklist

Reference Book:

Cunningham, W.P., Cunningham M.A., & Saigo, B.W. (2007). *Environmental science: A global concern*. Boston: McGraw Hill.

Websites

United States Geological Survey:

<http://ga.water.usgs.gov/edu/earthwherewater.html>

Research:

Krueger, A., & Sutton, J. (2001). *EDThoughts What We Know About Science Teaching and Learning*. Denver, Colorado: McREL.

Hands on experiences help students make meaning about scientific phenomena and help students move from more concrete to abstract levels of thinking. Ongoing learning assessment with timely, focused feedback helps students attain deeper understanding.

Michaels, S., Shouse, A., Scheingruber, H. (2007). *Ready, set, science!: Putting research to work in K-8 science classrooms*.

This book highlights practical application of current science education research into kindergarten through eight grade science classrooms.



The Wonderful Water Cycle

Post-visit Lesson 2

Alignment to Utah Core Curriculum

Grade Level: 4th Grade

Intended Learning Outcomes (ILOs):

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Utah Science Core Curriculum Standard:

Standard 1

Students will understand that water changes state as it moves through the water cycle.

Utah Science Core Curriculum Objective:

Objective 1

Describe the relationship between heat energy, evaporation and condensation of water on Earth.

Objective 2

Describe the water cycle.

Enduring Understanding:

Scientific inquiry can be used to help understand the natural world. The water cycle can be observed and recorded using scientific inquiry.

Essential Questions:

1. What is the energy source of the water cycle?
2. What are the three steps of the water cycle that were observed during this experiment?
3. How does scientific inquiry help humans learn about the water cycle?
4. How does scientific inquiry help scientists learn about the world?

Common Misconceptions:

- Contrary to many students understanding, steam is not a form of evaporation. Steam is a form of condensation.

Activity:

Length of Activity:

30 minutes for the initial observations

15 minutes every day over a period of a week to make observations

Teacher Packet Updated 2/18/15

30 minutes for the conclusion section of “The Wonderful Water Cycle” activity sheet

Materials Needed:

Photocopies of “The Wonderful Water Cycle” activity sheet for each group

Materials Provided:

“The Wonderful Water Cycle” activity kit. You received this when we visited your class with the Utah Waters Van Program. It contains 1 large plastic bowl, 1 small plastic cup, 1 plastic bag, and 1 elastic.

Digital copy of “The Wonderful Water Cycle” activity sheet

Helpful Hints:

- This activity is designed to be a week long. It is recommended that the activity begins on a Monday.
- If two teaspoons of dirt are not available for this activity consider using salt instead.
- If water does not condense in the small cup, try a few more cycles of heating and cooling “The Wonderful Water Cycle” activity kit.
- If time does not permit, this activity can be done as a class activity instead of working in groups.

Procedure:

1. Make photocopies of “The Wonderful Water Cycle” activity sheet for all the students in your class.
2. Talk with your students about how one could go about solving a scientific problem or question. Explain how scientists follow a process that is used to systematically gather information about the natural world. Explain to your students that they will be following a scientific process to gather information about the water cycle.
3. Assemble “The Wonderful Water Cycle” activity kit that you received during Loveland Living Planet Aquarium’s Utah Waters Van Program.
 - a. Place two teaspoons of dirt in the large plastic bowl.
 - b. Fill the large plastic bowl half way with warm water. Thoroughly mix the dirt into the water. If any dirty water was spilled into the small plastic cup, wipe clean before proceeding.
 - c. Place the plastic bag over the large plastic bowl and close the opening of the bag with the elastic.
 - d. Place a small rock or penny in the middle of the bag, above the small plastic cup.
 - e. Place the container in direct sunlight, under a heat lamp, or incandescent light bulb.
4. Divide your class into small groups. Hand out “The Wonderful Water Cycle” activity sheet to each group in your class.
5. Allow your students an opportunity to observe “The Wonderful Water Cycle” activity kit. Be sure to have your students record their observations on “The Wonderful Water Cycle” activity sheet.
6. Explain to your students that you will be placing leaving “The Wonderful Water Cycle” activity kit in the warm environment for a couple of days. Then, the activity kit will be moved to a cool environment for a few days.

7. Ask your students to develop a hypothesis about what they discuss in their groups what they think will happen to the water and dirt in “The Wonderful Water Cycle” activity kit after the heating and cooling cycles. Ask them to record this expected result as their hypothesis.
8. The next two days, allow your students time to make observations on “The Wonderful Water Cycle” activity kit in the warm environment where it was placed after being assembled. Be sure to have your students record the information on “The Wonderful Water Cycle” activity sheet.
9. At the end of the third day, move “The Wonderful Water Cycle” activity kit to a cool location.
10. The following two days, allow your students to make observations on “The Wonderful Water Cycle” activity kit in the cool environment. Be sure to have your students record the information on “The Wonderful Water Cycle” activity sheet.
11. Explain to your students that over the last few days they have made observations, collected data, and recorded the data. These actions are part of the process that scientists use to answer questions. Explain to your students that once the data is collected scientists analyze the data and draw conclusions, or make inferences based on the data. Explain to your students that you would like them to analyze their data by completing the “Conclusions” section of “The Wonderful Water Cycle” activity sheet.

Formative Assessment Strategies:

Students will successfully answer the review questions following the initial activity.

Learning Extensions:

Take your students outside for a water cycle hike. Walk around your school yard looking for example of steps in the water cycle.

Booklist

Reference Book:

Cunningham, W.P., Cunningham M.A., & Saigo, B.W. (2007). *Environmental science: A global concern*. Boston: McGraw Hill.

Websites

Planet Guide: http://www.planetguide.net/book/chapter_2/water_cycle.html

Research:

Anderson, K.L., Martin, D.M., & Faszewski, E.E. (2006). Unlocking the power of observation. *Science and Children*, 44, (1), 32-35.

This article discusses how observation is the cornerstone of the inquiry process, which lays the groundwork for future scientific learning. Suggestions are given on how to help students make good observations and how to help students communicate those observations. Also included is an assessment checklist and rubric for assessing students' observation abilities.

Teacher Packet Updated 2/18/15

Krueger, A., & Sutton, J. (2001). *EDThoughts What We Know About Science Teaching and Learning*. Denver, Colorado: McREL.

Hands on experiences help students make meaning about scientific phenomena and help students move from more concrete to abstract levels of thinking. Ongoing learning assessment with timely, focused feedback helps students attain deeper understanding.

Louv, R. (2006). *Last child in the woods: Saving our children from nature-deficit disorder*. Chapel Hill, North Carolina: Algonquin Books.

Richard Louv's book brings together a body of research highlighting the connection between direct exposure to nature and healthy childhood development. In chapter eight, he compiles recent studies that suggest nature may be a useful therapy for Attention Deficit Hyperactivity Disorder (ADHD). Researchers from the University of Michigan, Stephen and Rachel Kaplan coined the term "the restorative environment" after their studies showed subjects had an ability to think more clearly following participation in a wilderness program.

Michaels, S., Shouse, A., Scheingruber, H. (2007). *Ready, set, science!: Putting research to work in K-8 science classrooms*.

This book highlights practical application of current science education research into kindergarten through eight grade science classrooms.

The Wonderful Water Cycle

Names: _____ Date: _____

1. **Write a hypothesis.** Based on your observation and knowledge of the water cycle, write a hypothesis about what you think will happen to the mixture in the small cup after the warming and cooling cycles.

2. **Collect and record your data.**

Day 1: Observations Immediately After Assembling the Water Cycle Experiment Kit	

Warm Environment

Day	Observations

Cool Environment

Day	Observations

3. Conclusion.

A. What is in the small plastic cup at the end of the activity? _____

B. What is in the large plastic bowl at the end of the activity? _____

C. Why is the dirt in that location at the end of the activity?

D. Draw in the space below how each stage of the water cycle was shown in this activity?

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E. What do you think would have happened if the water cycle experiment kit had initially been placed in a warmer environment?

F. What do you think would have happened if the water cycle experiment kit had initially been placed in a cooler environment?

G. How can you relate this activity to Great Salt Lake with its high salt content?

H. If you were to do this activity again, what would you do differently? Why?

The Wonderful Water Cycle

Names: KEY _____ Date: _____

1. **Write a hypothesis.** Based on your observation and knowledge of the water cycle, write a hypothesis about what you think will happen to the mixture in the small cup after the warming and cooling cycles.

Answers to this may vary.

2. **Collect and record your data.** Describe the environment surrounding the water cycle experiment kit and the environment inside of the water cycle experiment kit. For example, you could ask yourself these questions: Does the environment surrounding the water cycle experiment kit feel warm or cool? Is the water cycle experiment kit in a sunny window? What is the temperature of the environment when measured with a thermometer? How has the amount of water in the small cup inside the water cycle experiment kit changed?

Day 1: Observations Immediately After Assembling the Water Cycle Experiment Kit	
Observations will vary.	

Warm Environment

Day	Observations
	Observations will vary.

Cool Environment

Day	Observations
	Observations will vary.

3. Conclusion.

A. What is in the small plastic cup at the end of the activity? water and no dirt

B. What is in the large plastic bowl at the end of the activity? less water and a lot of dirt

C. Why is the dirt in that location at the end of the activity?

There is dirt in the large plastic bowl at the end of the activity because dirt does not evaporate.

D. Draw in the space below how each stage of the water cycle was shown in this activity?

The sun is the energy source for the water cycle. The energy from the sun heats the water in the small plastic cup.

The water in the large plastic bowl changes from a liquid into a gas or a vapor. This step of the water cycle is called evaporation.

As the water vapor rises into the atmosphere it comes into contact with the cool surface of the plastic bag and changes back into a liquid from a gas. This step of the water cycle is called condensation.

The water collects on the surface of the plastic bag until it is too heavy and then falls as rain. This step of the water cycle is called precipitation.

The water falls into the small cup and forms a body of water. This step of the water cycle is called collection or accumulation.

E. What do you think would have happened if the water cycle experiment kit had initially been placed in a warmer environment?

The water may have evaporated faster.

F. What do you think would have happened if the water cycle experiment kit had initially been placed in a cooler environment?

The water may not have evaporated as fast or at all.

G. How can you relate this activity to Great Salt Lake with its high salt content?

Great Salt Lake is a closed basin or watershed. This means that there are no rivers or streams that leave Great Salt Lake going to another body of water like an ocean. The majority of water that leaves Great Salt Lake leaves through evaporation. Most minerals, including salts, which enter Great Salt Lake, stay in Great Salt Lake because they do not evaporate, thus contributing to Great Salt Lake's high salt content.

H. If you were to do this activity again, what would you do differently? Why?

Answers to this may vary.



The Shortest Shower

Post-visit Activity 3

Alignment to Utah Core Curriculum

Grade Level: 4th Grade

Intended Learning Outcomes (ILOs):

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests

Utah Science Core Curriculum Standard:

Standard 1

Students will understand that water changes state as it moves through the water cycle.

Utah Science Core Curriculum Objective:

Objective 2

Describe the water cycle.

Enduring Understanding:

Utah is the second driest state in the nation and yet we have the second highest per capita consumption of water. To live a more sustainable life, we must learn to conserve water in our everyday lives.

Essential Questions:

1. What are ways that humans can conserve water?
2. How much water is saved by taking a shorter shower?

Activity:

Length of Activity:

10 minutes each day to record students' times
30 minutes to calculate who had the shortest shower

Materials Needed:

1 chart similar to the one below
1 "Shortest Shower Award"

Materials Provided:

Digital copy of the chart similar to the one below
Digital copy of the shortest shower award

Procedure:

1. Make a chart like the one shown below. Write the names of the students in your class in the left hand column.

Name of Student	Time spent showering on							Total Time Spent Showering	Average Time Spent Showering
	Sun	Mon	Tues	Wed	Thu r	Fri	Sat		

2. For one week, have each student time his or her showers. Record the number of minutes and seconds each student's shower takes.

3. At the end of the week, total the minutes and seconds each student has spent showering. Divide this total by the number of showers taken by the student to determine the average shower length.

4. Fill in "Shortest Shower Award" and present to the student who has averaged the shortest shower time.

6. Compare the average time spent showering to the amount of water used in the average showers listed below.

- A ten-minute shower uses more than 100 gallons of water.
- A two-minute shower uses about 24 gallons of water.
- An average full bathtub uses more than 40 gallons of water.

5. Have a class discussion with your class about the reasons that they would want to or not want to conserve water. Possibly discuss ways that your students can conserve water.

Formative Assessment Strategies:

Students will discuss as a class reasons why they would want to conserve water and ways to conserve water.

Learning Extensions:

Websites:

Central Utah Water Conservancy District: <http://www.cuwcd.com/>

Division of Water Resources: <http://www.conservewater.utah.gov/>

Utah State University: <http://extension.usu.edu/drought/htm/home>

World Watch Institute: <http://www.worldwatch.org/>

The Shortest Shower Award

is presented to _____

for conserving water by averaging

only _____ minutes per shower

between _____ and _____

GREAT JOB!!!

Signed _____



Additional Water and Wetland Resources for Educators:

Division of Water Resources - Water Education: Water information and ideas for educators

1594 W. North Temple
Salt Lake City, UT 84116
801-538-7230
<http://www.watereducation.utah.gov>

EPA Environmental Kids Club

<http://www.epa.gov/kids/water.htm>

EPA Wetlands Information

<http://www.epa.gov/owow/wetlands/>

Project Wet : Water education for teachers

<http://www.projectwet.org>

Utah Wetland/Environmental Sites:

Bear River Migratory Bird Refuge (<http://www.fws.gov/bearriver/>)

Utah Botanical Center (<http://utahbotanicalcenter.org/>)

Farmington Bay Waterfowl Management area

(http://wildlife.utah.gov/habitat/farmington_bay.php)

Great Salt Lake Shorelands Preserve

(<http://www.nature.org/wherewework/northamerica/states/utah/preserves/art5834.html>)

Provo River Restoration Project

(<http://www.mitigationcommission.gov/prrp/prrp.html>)

Utah Lake Wetlands Preserve

(http://www.mitigationcommission.gov/wetlands/wetlands_ulwp.html)

Utah Society for Environmental Education:

A nonprofit umbrella organization that that guides, informs, and represents Utah environmental education (EE) providers and links state and national efforts.

<http://www.usee.org>

USU Water Quality Extension

<http://extension.usu.edu/cooperative/waterquality/>

USGS: The Water Cycle for Kids and Students: Advanced Students

<http://ga.water.usgs.gov/edu/watercycle-kids-adv.html>

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