



Water Conservation Education Packet:
Lesson plan activities & resources for grades K-8

September 2015

Table of Contents

	Page
Introduction	3
Kindergarten -1 st Grade	4
2 nd Grade	7
3 rd Grade	12
4 th - 5 th Grade	14
6 th - 8 th Grade	18
District Resources for Teachers	27
Parent Resources	28



Student Water Conservation Education

"The only thing that is constant is change -" Heraclitus

After almost 2,500 years these words still ring true, and in California's worst drought in history, it is now critical that students of all ages understand more about water, how they interact with it, how it affects their lives, and how to conserve it. In the past, droughts were thought of in this region as an anomaly, but moving into the future it is likely they will only increase with regularity. Otay Water District would like for students to know water's importance in their day-to-day lives, why it's important to have enough water in an ecosystem and how much water is present around them in their local watershed and in what form. Water is the key element for all life on this planet, the "universal" solvent which shapes the climates we live in. An entity completely centered on water, its growing scarcity in supply is an issue that Otay Water District is committed to conveying to students. Today's students will grow to be future stewards of California and the world, so to prepare them it is vital that they understand the processes of their environmental surroundings—asking the why and how of everything around them. Otay Water District has worked to analyze and integrate the NGSS standards used by educators to provide a comprehensive packet that contains lesson plans, activities and resources focused around water conservation that can be utilized independently by teachers in their classrooms whenever they need lesson ideas or help. These materials are intended to be a fun, hands-on way to get students to understand water as a resource and the role it plays in their lives—while remaining creative, affordable and easily integrated into the grade curriculum for teachers.

Kindergarten -1st Grade

Core Ideas:

Water is as a natural resource needed by living things, just like air and food—water is essential for every single type of life. Humans, in particular, use water for many things they do every day and create an impact on water supply, but we can always find ways to use less water and use it smarter. Following is an explanation of the water cycle, activity will integrate observable cause and effect pattern.

Lesson Activity:

After students develop an understanding of the water cycle, there are simple demonstrations to exemplify different stages of the water cycle.

Evaporation

“All Dried Up”

Get two dishes. Put about 10 ml (two teaspoons) of water in each dish. Place one dish in the sunlight, or if the sun isn't shining, place the dish under and close to a light source. Place the other dish in the shade. Observe each dish every 4 hours and also overnight and then record what happens to the water. Provide a sample table and/or chart for the kids to follow.

On the same sheet of paper as above, answer these questions with a classmate.

- Where did the water go?
- From which dish did the water disappear faster?
- What caused the water to disappear?

The process of water "going" into the air is called evaporation. On your paper list some other examples of evaporation. Discuss with your classmate what happens to water after it evaporates. Write down what you think.

Precipitation

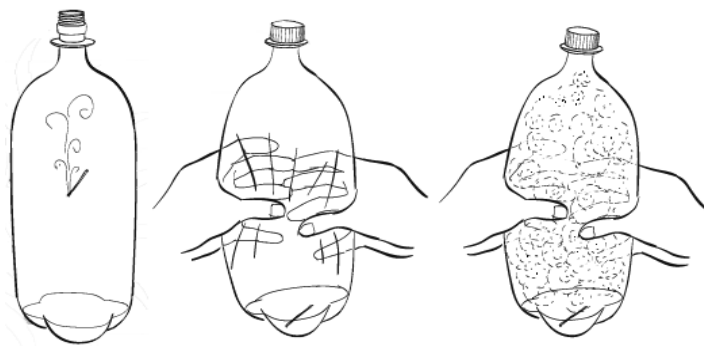
“The Rainmaker”

Materials:

- 2-liter clear plastic pop bottle
- matches
- warm water

Process:

- 1) Fill the clear plastic 2-liter bottle one-third full of warm water and place the cap on. As warm water evaporates, it adds water vapor to the air inside the bottle. This is the first ingredient to make a cloud.
- 2) Squeeze and release the bottle and observe what happens. You'll notice that nothing happens. Why? The squeeze represents the warming that occurs in the atmosphere. The release represents the cooling that occurs in the atmosphere. If the inside of the bottle becomes covered with condensation or water droplets, just shake the bottle to get rid of them.



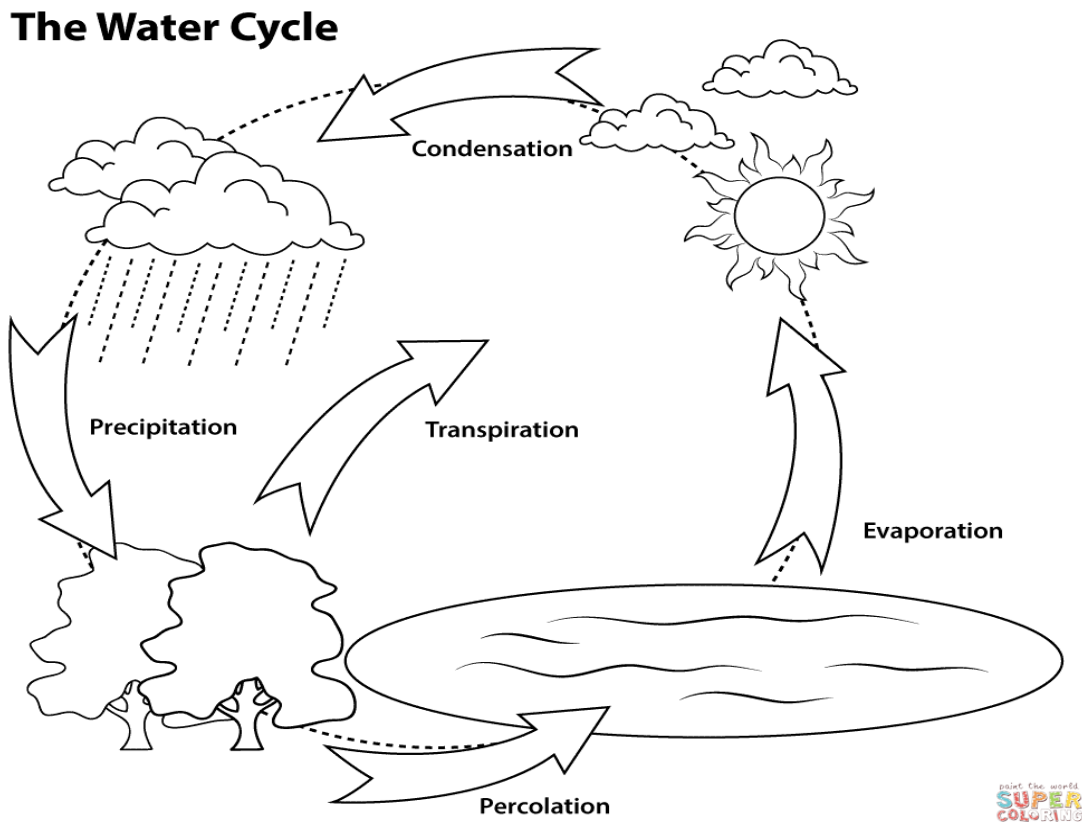
- 3) Take the cap off the bottle. Carefully light a match and hold the match near the opening of the bottle to capture the smoke (this should only be done by an adult).
- 4) Then drop the match in the bottle and quickly put on the cap, trapping the smoke inside. Dust, smoke or other particles in the air is the second ingredient to create a cloud.
- 5) Once again, slowly squeeze the bottle hard and release. What happens? A cloud appears when you release and disappears when you squeeze. The third ingredient in creating clouds is a drop in air pressure.

Explanation:

Water vapor, water in its invisible gaseous state, can be made to condense into the form of small cloud droplets. By adding particles such as the smoke, enhances the process of water condensation and by squeezing the bottle causes the air pressure to drop. This creates a cloud!

- For a quick video showing the same experiment go to: <https://youtu.be/E8AvfXar9zs>

Water cycle coloring sheet



Activity Sources:

- <http://thewaterproject.org/resources/lesson-plans/evaporation-experiment>
- http://www.lyvemedia.com/delta/grade/6/weather_and_water/investigation_6/part_4/weather_inv6_part4_mats_gettingready.html
- <http://www.weatherwizkids.com/experiments-cloud.htm>
- <http://www.supercoloring.com/coloring-pages/simple-water-cycle>

Resources:

For teachers looking for some help creating a comprehensive lesson plan for the water cycle, this *Learning to Give* page provides multiple lesson plan ideas with comments and suggestions from other educators.

- <http://learningtogive.org/lessons/unit370/lesson2.html>

Classes with computer time available can utilize this interactive explanation of the water cycle for a fun activity.

- <http://apps.southeastwater.com.au/games/se-water-cycle.swf>

If crayons, markers, etc. are available the EPA provides a coloring and activity book with their water conservation mascot, "Thirstin."

- http://www.epa.gov/safewater/kids/pdfs/activity_grades_k-3_activitybook.pdf

For an illustrative and word free example of the water cycle from National Geographic Kids UK this image is a great info graphic.

- <http://www.ngkids.co.uk/science-and-nature/water-cycle>



2nd Grade

Core Ideas:

Water is a big part of weather and climate—it starts in the atmosphere and works its way down to the earth’s surface through rain, snow, hail, and fog. Students can make observations about when each of these conveyances from the atmosphere to the earth’s surface might occur—i.e. there will be rain when they see storm clouds in the sky, or there’ll be fog when you’re near the ocean and it’s early in the cooler mornings. Students can learn what a drought is and the cause-and-effect connection can be made right now since we’ve been in a drought with warm dry weather, therefore, fewer storm clouds and less rain.

Activities:

Waters of the Earth

Introduction:

Earth, as seen from space, is clearly a water planet. About 71% of the surface of the planet is covered by water. Water is found in the oceans, rivers, ponds, lakes, groundwater, ice caps, glaciers, and in the atmosphere as water vapor and clouds. Water changes state and moves from place to place through the water cycle of evaporation, condensation, and precipitation. Although earth’s water supplies seem almost limitless when viewed from an ocean beach, water forms only a thin film on the surface of the planet. The average depth of the oceans is about 3.5 - 4.0 km, while the average radius of earth is 6371 km.

What to Expect:

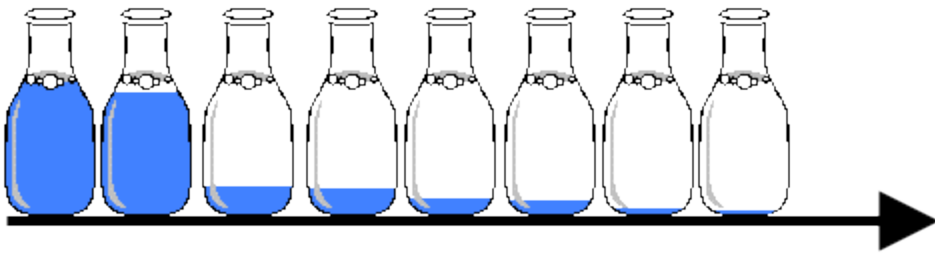
Some of these volumes are so small the class will need to gather around the display to see the water being added. The clear bottles with blue colored water in them clearly labeled, make a dramatic display for the school or community.

Materials:

- Seven two-liter bottles
- Food coloring
- Water
- Labels for bottles
- Graduated cylinders
- Calibrated droppers for 1 ml.

Procedure:

- 1) Color about 2 liters of water blue with food coloring.
- 2) For younger students: have students measure out the volumes, add each amount to a separate bottle. (For older students: have students use these figures to calculate volumes. Students can fill the bottles and set up a display for the school in a prominent place.)



Type of Water	Percentage of Earth's Water Supply	Volume of Water to Use in Bottle
All of the earth's water	100 %	2,000 ml
All earth's salt water (oceans)	97.2 %	1,944 ml
All earth's fresh water	2.8 %	56 ml
Fresh water locked up as ice	2.3 %	46 ml
Underground fresh water	0.4 %	8 ml
Surface fresh water	~ 0.05 %	1 ml
Water in soil and air	~ 0.01%	0.2 ml

Discussion:

Have students discuss what they observed in the demonstration and how it relates to the current drought in California. Then, have students form into groups to create their own public service announcement posters on saving water.



Image of Lake Oroville in Northern California comparison photos. Sourced from California Department of Water.

Water Weather Words

To get students used to certain weather vocabulary, an easy level word cross puzzle is a fun option to let them work independently but work their spelling skills.

Water Weather Words

Find all the words that shape the environment around us!



Ocean	Climate
Snow	Wet
Clouds	Dry
Rainstorm	Flood
Drought	Fog

Water Weather Words

Find all the words that shape the environment around us!



Ocean	Climate
Snow	Wet
Clouds	Dry
Rainstorm	Flood
Drought	Fog

Edupics.com

Edupics.com

Activity Sources:

- http://www.sea.edu/academics/k-12_detail/waters_of_the_earth
- <http://www.edupics.com/wordsearch/eng/wordsearch.php>
- Full sized word cross puzzle:

Water Weather Words

Find all the words that shape the environment around us!



Ocean

Snow

Clouds

Rainstorm

Drought

Climate

Wet

Dry

Flood

Fog

Resources:

If computer time is available the EPA has an interactive site for a quick refresher on the water cycle with the EPA's mascot "Thirstin."

- http://www.epa.gov/safewater/kids/flash/flash_watercycle.html

For computer activities the Arizona Department of Water Resources provides a memory mix-and-match game that requires the matched pairing of water saving objects.

- <http://wateruseitwisely.com/tip-tank-game/>

There is also a weather game show quiz that tests student's basic knowledge of weather elements.

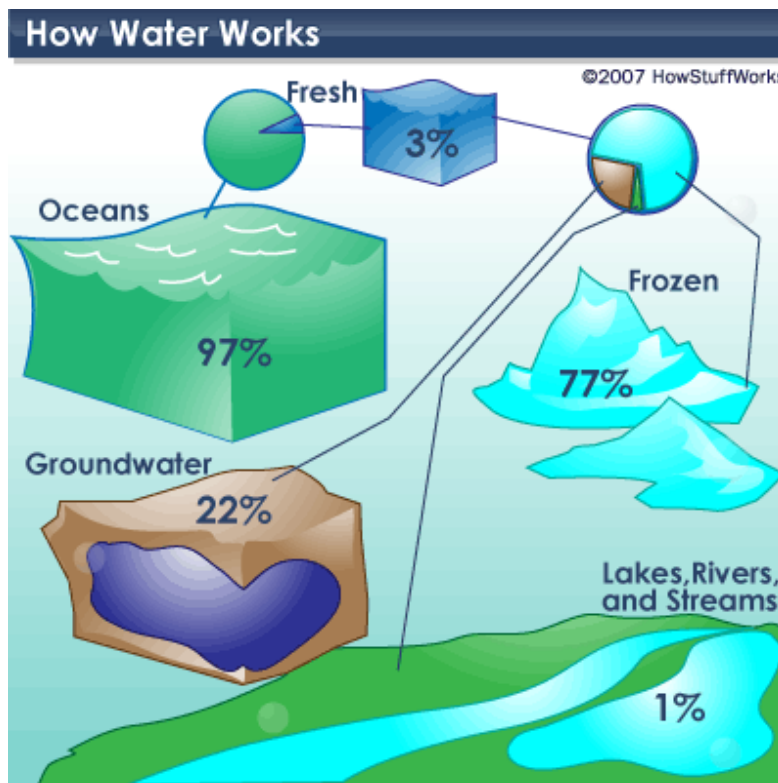
- <http://www.cotf.edu/ete/modules/k4/online/Wonline1.html>

For a visual of different forms, fresh water can take NASA's Climate Kids offers a gallery of fresh water sources from around the world.

- <http://climatekids.nasa.gov/freshwater-gallery/>

The same site also provides a video on the Ocean's importance on the earth and more information on how the ocean affects climate.

- <http://climatekids.nasa.gov/ocean/>



3rd Grade

Core Ideas:

The earth has several different systems and a key one is the hydrosphere, which begins in the atmosphere and brings water down to the earth's surface, where it becomes available to us in many ways, one of them being drinkable fresh water. Freshwater is accessible to us once it reaches land through naturally formed sources such as rivers, lakes, snow pack, and aquifers—but also through man-made sources, such as dams and man-made reservoirs. Activities in this section will help give students examples of descriptions and distributions of water and fresh water in various types of reservoirs on earth.

Activities:

Water in Earth's Hydrosphere

NASA provides a special series for teachers looking for help and ideas in creating lesson plans around water on earth. The following webpage gives an activity that was developed to give participants an understanding of the hydrosphere. In this hour long activity, participants learn about the hydrosphere by making observations and taking measurements. They will go outside and use scientific equipment to investigate temperature, pH, and transparency of a body of water. They will use this qualitative and quantitative data to understand why it is important to know about the condition of freshwater sources in many places in the natural environment and how these places are connected in the water cycle. This activity can always be simplified or modified for younger students to meet their knowledge of activity content.

Visit the link to download resources including lesson plan's teacher guide, student capture sheet and PowerPoint presentation.

- <http://pmm.nasa.gov/education/lesson-plans/water-earths-hydrosphere>

Crash Course Kids

The YouTube series Crash Course Kids is a great video for students that provides informative and engaging videos on all kinds of topics—two most relevant to this section would be the videos explaining the earth's biospheres. For all four biospheres there is a two part series which will be linked below; the second video contains the hydrosphere content, but for a comprehensive experience both can be viewed.

- Four Spheres Part 1 (Geo and Bio): Crash Course Kids #6.1 (<https://youtu.be/VMxjzWHbyFM>)
- Four Spheres Part 2 (Hydro and Atmo): Crash Course Kids #6.2 (https://youtu.be/UXh_7wbnS3A)

Resources:

If computer time is available to class, there is the Project Wet: Water Education for Teachers interactive discover water site. Here students will be able to learn more about the water cycle, oceans, fresh water, watershed, and how to use water wisely.

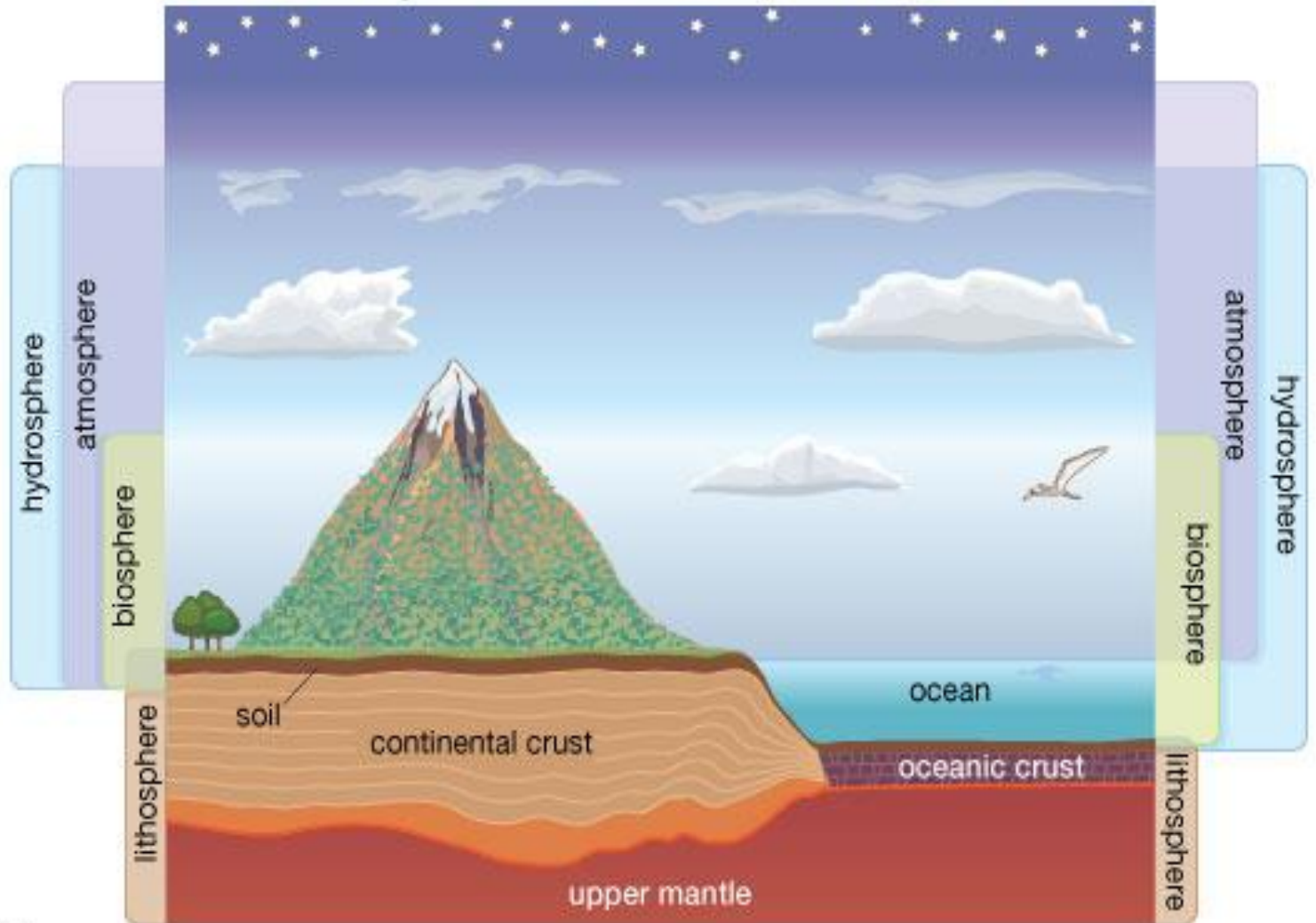
- <http://www.discoverwater.org/>

To show students how reservoirs work, the EPA has a demonstration activity that can be followed up by critical thinking questions.

http://water.epa.gov/learn/kids/drinkingwater/upload/2005_03_10_kids_activity_grades_4-8_howpeoplegetwater.pdf

Below is a relatively detailed but easy to understand diagram of the biosphere from the Encyclopedia Britannica.

Earth's environmental spheres



© 2008 Encyclopædia Britannica, Inc.

4th - 5th Grade

Core Ideas:

This section will focus on explaining to students what a watershed is and how it affects the freshwater available to populations. Students will learn about the different watershed elements, how plant life and geographical location are important factors to watersheds and their supply.

Activities:

For an introduction to what a watershed is and how it functions with an brief article titled “We All Live In A Watershed,” which can be followed by the overview on the importance of vegetation to a watershed titled, “Green and Leafy and Important”

- <https://www.swfwmd.state.fl.us/education/kids/watershed.php>
- <https://www.swfwmd.state.fl.us/education/kids/greenleafy.php>

Following a lesson plan explaining watersheds if the classroom has computer time available. The Nature Conservancy has an interactive watershed protection web activity. This will tie together what a watershed is with the concepts of interdependency and geographic location, elevation, etc.

<http://www.nature.org/ourinitiatives/habitats/riverslakes/multimedia/how-we-protect-watersheds-interactive.xml>

Watershed Tourist

Total Time Required: 1 ½ hours (1-2 class periods)

Setting: Classroom

Goals for the Lesson:

- Students will identify all of the watersheds to which they belong.
- Students will read maps to identify bodies of water.
- Students will place these bodies of water from smallest to largest, in order of flow.

Materials Needed:

- Maps of area showing water ways
- Chart paper and markers
- White construction paper
- Crayons or markers
- Pencils



Methods:

Explain how water flows from a small body into a larger body. Define watershed as the area of land where water flows into a specific body of water. Point out each of the “watersheds” in the book.

Display a local map that has bodies of water labeled. Ask what water is near our school? Point out the correct body of water on the map. Follow it to the next largest body of water and keep going until it reaches the ocean or terminal lake. Record each body of water on chart paper, in the order which they are encountered.

(Day 2, if time does not allow for completion in Day 1) Explain the project to the class. Ask if students have gone on vacation. Explain that many times as tourists we get postcards to send to people or to save as souvenirs of our trip. Today we will be tourists in our own watersheds and we would like postcards from each place to tell about our trip. We will need to make these as a class (or make several sets, if class size is large). Show examples of picture postcards from various locations, if desired.

Directions for project: Have students use crayons or markers to create a picture of each watershed on construction paper. Each postcard should be labeled with the name of the place (for example “Greetings from Spruce Creek!”). You may need to brainstorm a list of distinguishing features or places of each watershed on the chart paper from before. Depending on class size, assign students one postcard each and have teams of students work to create multiple sets of cards, or have students work in pairs or small groups and make one set for the whole class. For example if there are 6 bodies of water for your watershed list and there are 24 students in the class, your class could create 4 sets of postcards by having 4 different students create a postcard for each body of water. Or you could have groups of 4 students work together to create one postcard and only make one class set of postcards.

As an example, for my local school the watersheds would include: Slab Cabin Run, Spring Creek, Bald Eagle Creek, West Branch Susquehanna River, Susquehanna River, Chesapeake Bay, and Atlantic Ocean.

Evaluation:

Have the entire class or teams (depending on how the project was divided) place their postcard sets in order from most local (smallest) to largest watershed. Then display in order.

Extension:

If you would like to include a writing activity, have students write messages on their postcards about what they are doing on their “vacations”.

Activity Source:

- <http://ecosystems.psu.edu/youth/sftrc/lesson-plans/water/k-5/tourist>

For additional information, photos, and diagrams visit the [San Diego Wildfire Education Project](#) page on the San Diego watershed

Resources:

For lesson plan ideas that incorporate both watershed education and conservation awareness, *Learning to Give* has a lesson called “What Is a Watershed,” which helps students understand the importance of a watershed and ways in which water pollution occurs.

- <http://learningtogive.org/lessons/unit374/lesson2.html>

To demonstrate to students how plants interconnect with water, the EPA has an activity that’s titled “Role Of Plants In Water Filtration” and show that depending on whether materials are dissolved or suspended in water, soils and plant roots can remove some or all of this material as the water moves down through soil.

- http://water.epa.gov/learn/kids/drinkingwater/upload/2005_03_10_kids_activity_grades_4-8_plantsinwaterfiltration.pdf

For a variation on giving students a relative view on the earth's water content versus land mass, Nature Bridge provides an activity that will show students how to be able to examine the earth's water systems from a global perspective. Students will understand how land and water are connected on the planet.

- <https://www.naturebridge.org/sites/default/files/Earths%20Water%20as%20an%20Apple.pdf>

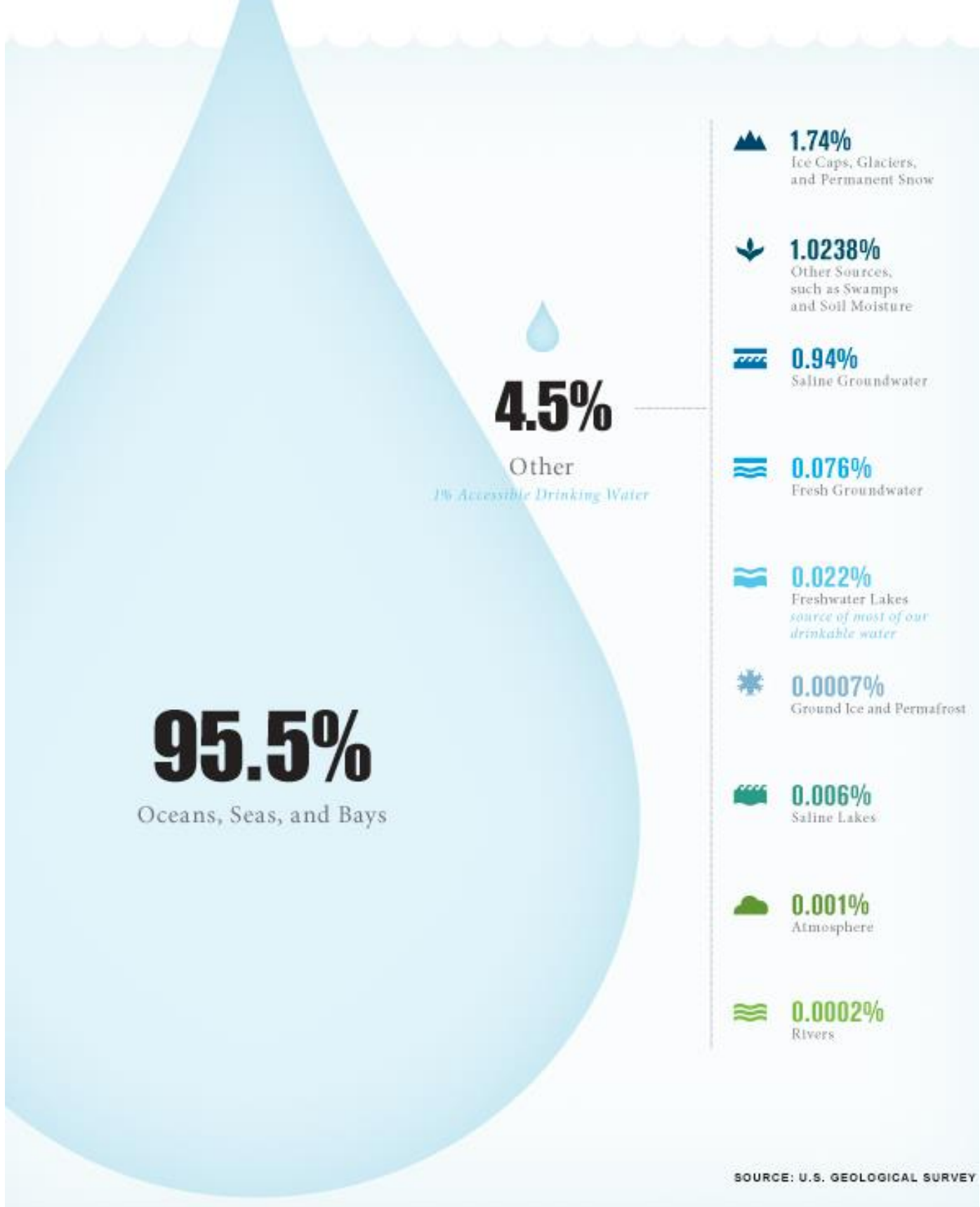
A simple diagram of a watershed which can later be applied to individual examples with only some of these elements

- <http://www.waynecountynysoilandwater.org/what-is-a-watershed/>



Our World's Water Supply

Where Does it Come From?



SOURCE: U.S. GEOLOGICAL SURVEY

6th - 8th Grade

Core Ideas:

This section will focus on cycling through all of the previous section ideas and creating a comprehensive, but holistic model to describe the water cycle, water's role in the ecosystem and water's many states and how they're affected by particle motion, temperature, and reaction when thermal energy is added or removed. Activities and demonstrations will work to construct a scientific explanation based on empirical evidence and exercise students' ability to construct oral and written argument.

Activities:

Exploring the Water Cycle

Within NASA's Precipitation Education resource they have a lesson plan that will re-introduce students to the water cycle—which will place an emphasis on having students understand the processes that take place in moving water throughout Earth's systems. Included on the webpage is a teacher's guide, a student capture sheet, a PowerPoint presentation and a pre and post assessment sheet for the presentation.

- <http://pmm.nasa.gov/education/lesson-plans/exploring-water-cycle>

In Your Watershed

National Geographic has a lesson plan and activity for asking students what they think the term “watershed” means. Display for students the satellite image of the Chesapeake Bay watershed provided on the webpage. Then explain that a watershed is the land area from which surface runoff drains into a stream, channel, lake, reservoir, or other body of water. Tell students that people are either directly or indirectly connected to bodies of water, which connect to land.

For the activity and supplementary lesson resources visit:

- <http://education.nationalgeographic.com/activity/in-your-watershed/>
- This material is based in part upon work supported by the National Science Foundation under Grant No. DRL-1114251. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

Where Does My Water Come From?

For students to learn more about where water comes from there is the Where Does My Water Come From? Webpage, which informs both teachers and students where water is sourced from in different regions of California.

- <http://www.watereducation.org/where-does-my-water-come>

Where Does Your Water Come From

The EPA has an activity which analyzes the everyday American's water usage and sourcing—a good tie-in for students once they've learned where their water comes from in each region of California, respectively.

Background:

Every day, the average American uses about 50 gallons of water for drinking, bathing, cooking, and maintenance. Most people, however, are unaware of the source of their water. In the United States, about 88% of the population is supplied by community water supply systems. The other 12% is supplied by non-community means, such as campgrounds, resorts, and private wells. Sixty-four percent of public water systems use surface water as their source, the other 36% use groundwater from wells. The aesthetic properties of the drinking water from these public systems is often affected by the source of the water. Ground water often has a slightly metallic taste, and may contain high amounts of minerals. Surface waters, on the other hand, usually have a musty taste and look cloudy. Treatment techniques aim to produce a water that is: safe for human consumption; appealing and good tasting to the consumer; and conforms to applicable State and Federal regulations at the lowest possible cost.

Objective:

This taste test will illustrate the differences between groundwater and surface water, highlight some of the common contaminants in natural water, and encourage student thought on the sources of drinking water.

Materials Needed:

- 1 gallon of distilled water
- 1 gallon of tap water (identify the source)
- 1 gallon of mineral water (or private well water, if available)
- 1 gallon of filtered tap water
- Cups for the class

Procedure:

1. Mark a set of 4 cups for each student. Label each cup 1 through 4 and fill them with the different types of water. Make sure that similarly labeled cups contain the same type of water.
2. Indicate on the board the different types of water present in the four cups. Have the students work together in groups to try to identify different tastes, smells, and appearances in the water. Have each group write down their observations on each water sample, and identify which cup has which type of water.
3. After everyone has completed their observations, have the students mark their guesses on the board. Ask the students what types of impurities they would expect to find in the different types of water, and if their senses confirmed their intuitions. Record these observations on the board.
4. Reveal to the students which samples contained which type of water. Discuss with the students their observations and what other impurities might be found in these waters. Also discuss the source of water for the community. If anyone in the class lives in a location supplied by a private well, ask him/her to describe the water at their home, and how it compares to other water he/she drinks in the community.

Follow-up Questions:

1. What are some possible sources of water in your community?
2. Which type of water tasted the best? Why?
3. Which type of water would you consider safer to drink, groundwater from a spring or surface water from a stream?

Activity Source:

- http://water.epa.gov/learn/kids/drinkingwater/upload/2005_03_10_kids_activity_grades_4-8_where_water_comes.pdf

Examining the Effects of Pollution on Ecosystems

Purpose:

Students recognize that hazardous waste may have far-reaching impacts on ecosystems and these impacts are not always easy to identify. Students become familiar with several types of tests used to measure the environmental effects of hazardous waste pollution. In the process, they learn that no single assessment procedure is applicable to all ecosystems and no single test is adequate to assess pollution impacts on an entire ecosystem. They examine a case study and discuss the limitations of current ecosystem assessment methods for establishing cause-and-effect relationships, especially for mixtures of chemicals in the environment.

Background:

The impact of hazardous waste on the environment is thought to be widespread and in some areas severe. Establishing cause-and-effect relationships between exposure and ecosystem damage is a major challenge. An ecosystem—such as a marsh—is a highly complex structure, consisting of all living organisms in a given area and their interactions not only among themselves but also with the environment. Even a mature ecosystem—one that has achieved stability over time—is constantly adapting to changes. Some of these changes are due to natural influences such as animal migration patterns, weather, erosion, and sedimentation. Other changes, however, are the result of habitat encroachment and human pollution. This pollution is often in the form of complex mixtures of chemicals in widely varying concentrations.

Ecosystems are complex and dynamic (ever changing). This makes linking any one effect to a specific cause very difficult. Conditions cannot be controlled sufficiently to allow the effects of individual pollutants to be observed. Only recently have scientists begun to focus attention on finding ways to determine the major effects of hazardous waste on ecosystems.

Researchers have built laboratory models of ecosystems to study environmental pollution in controlled settings. But models can provide only simple representations of real ecosystems that contain thousands of living species. They cannot provide adequate measures of the diversity of species and the complexity of the relationships among all the living organisms that make ecosystems unique.

There is no single best strategy or design for assessing environmental pollution that is appropriate for every situation. The characteristics of the area and the specific objectives and issues of concern must be considered in determining how to proceed. Nevertheless, scientists generally use four major categories of tests to assess the impact of hazardous waste on ecosystems:

- **Chemical and physical tests** to measure contaminant levels, pH, oxygen levels, and other environmental conditions.
- **Toxicity tests** to determine if the pollution can or is causing adverse biological effects in ecosystem species.
- **Biomarkers** to indicate actual exposure.
- **Field surveys.**

Preparation:

1. Assemble the following materials:
 - Copies for each student of [Student Handout 1](#), *Major Categories of Tests for Ecological Assessment*, found at the end of this activity.
 - Copies for each student of [Student Handout 2](#), *Case Study: Tidal Bay Ecological Assessment*.
2. Read the student handouts to prepare your lecture.
3. Distribute copies of [Student Handout 2](#) and assign students to read the case study for homework.

NOTE: In this lesson, students will encounter a large number of scientific terms and phrases. Depending on the grade level in which you use the lesson and the skill level of your students, you may need to spend extra time introducing unfamiliar vocabulary and preparing your students for this lesson

Procedure:

Day 1:

1. Ask the class to define an ecosystem. Then ask the class to distinguish between an ecosystem and the environment. (An ecosystem is a specialized community, including all the component organisms that forms an interacting system, for example, a marsh. An environment is the totality of conditions surrounding an organism.)
2. Organize the students in groups of 3 or 4 and ask each group to write down how hazardous waste released into the environment can affect plants (flora) or animals (fauna) in an ecosystem. Ask them to list as many possibilities as they can think of in 10 minutes.
3. Ask each group how many ideas they wrote down.
4. Ask the group with the fewest ideas to lead off by naming one effect of pollution. Ask the rest of the class if they agree that the named effect can result from pollution. Ask those who agree to explain why they agree. Ask those who do not agree to explain their reasons.
Continue the discussion by asking each group in turn to add to the list. Have a student write the ideas on the chalkboard as they are mentioned. Some possible effects that could be listed include:
 - Gaps in vital food chains or nutrient cycles.
 - Reproductive problems such as eggshell thinning or loss of nesting materials.
 - Developmental effects such as malformed chick beaks.
 - Tumors such as fish tumors.
 - Critical organ damage such as liver, kidney, or skin lesions.
 - Immune system dysfunction leading to, for example, viral infections in dolphins.
 - Altered individual or population growth rates.
 - Changes in population and community organization.
 - Loss of total biomass (flora and fauna).

- Relative loss of taxa or species abundance in defined areas such as fish kills, amphibian mortality, and macroinvertebrate depletion.
- Loss of species diversity.

Some of the students' ideas may overlap because one adverse ecosystem effect can impact another since life in ecosystems is interdependent. For example, reproductive and developmental problems in birds may ultimately cause a decrease in species abundance and diversity, which in turn may alter community organization.

Students may not come up with many ideas. In a way, this reflects the current state-of-the-science in ecological assessment. It can be difficult to determine what is occurring or could occur in an ecosystem as a result of pollution; effects are often very subtle unlike those of habitat loss, which usually tend to be very obvious. Leave the list on the chalkboard.

5. Distribute the Student Handout, Major Categories of Tests for Ecological Assessment. You may wish to have students discuss the various types of tests in more depth before proceeding.
6. Ask the students which category or categories of tests could be used to study each of the adverse effects listed on the chalkboard. Have students explain the choices they make. Encourage the rest of the class to comment on various answers.

Day 2:

1. Give each student a copy of the Student Handout, [Case Study](#): Tidal Bay Ecological Assessment. Give them about 30 minutes to read it in class or as homework. Questions and guidelines are in the text to assist them in their review. Ask them to answer as many of the questions as possible.
2. For the remainder of the class period, discuss the case study and the students' answers to the questions. An [Instructor's Answer Key](#) is included at the end of this lesson for your use.

Extensions (Optional)

- After allowing each group to add to the list of ideas about how hazardous waste can adversely affect ecosystems, ask students to rank the items according to their importance. Have them discuss their choices.
- Point out during the discussion that sometimes investigators limit ecological components of concern to commercially important species (e.g., blue crabs in the Chesapeake Bay). Have students discuss how this might influence public attitudes with respect to proposed environmental regulations or legislation.

Activity Source, also containing teacher's answer key: http://www.epa.gov/superfund/students/clas_act/haz-ed/act06.htm

Changes of State

The American Chemical Society has a comprehensive website for chemistry experiments based on respective grade and state standards. For 8th grade changes in the state of water, they have an entire module which aims to have students help design experiments to test whether the temperature of water affects the rate of evaporation and whether the temperature of water vapor affects the rate of condensation. Students also look in more detail at the water molecule to help explain the state changes of water.

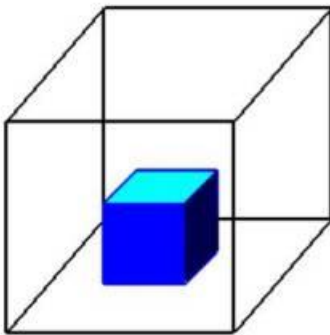
Links provided are for each experiments in each section within the module:

1. [Heat, Temperature, and Conduction](#)
2. [Changing State—Evaporation](#)
3. [Changing State—Condensation](#)
4. [Changing State—Freezing](#)
5. [Changing State—Melting](#)



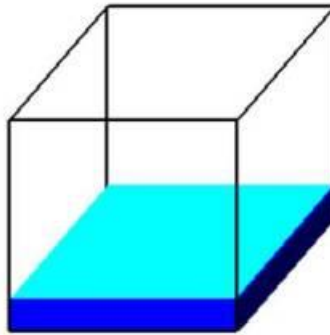
Phases of Matter

Glenn
Research
Center



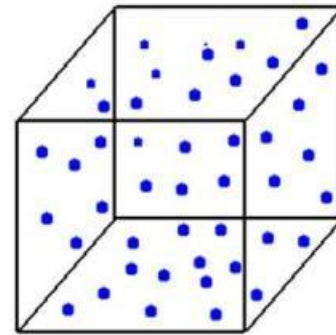
Solid

Holds Shape
Fixed Volume



Liquid

Shape of Container
Free Surface
Fixed Volume

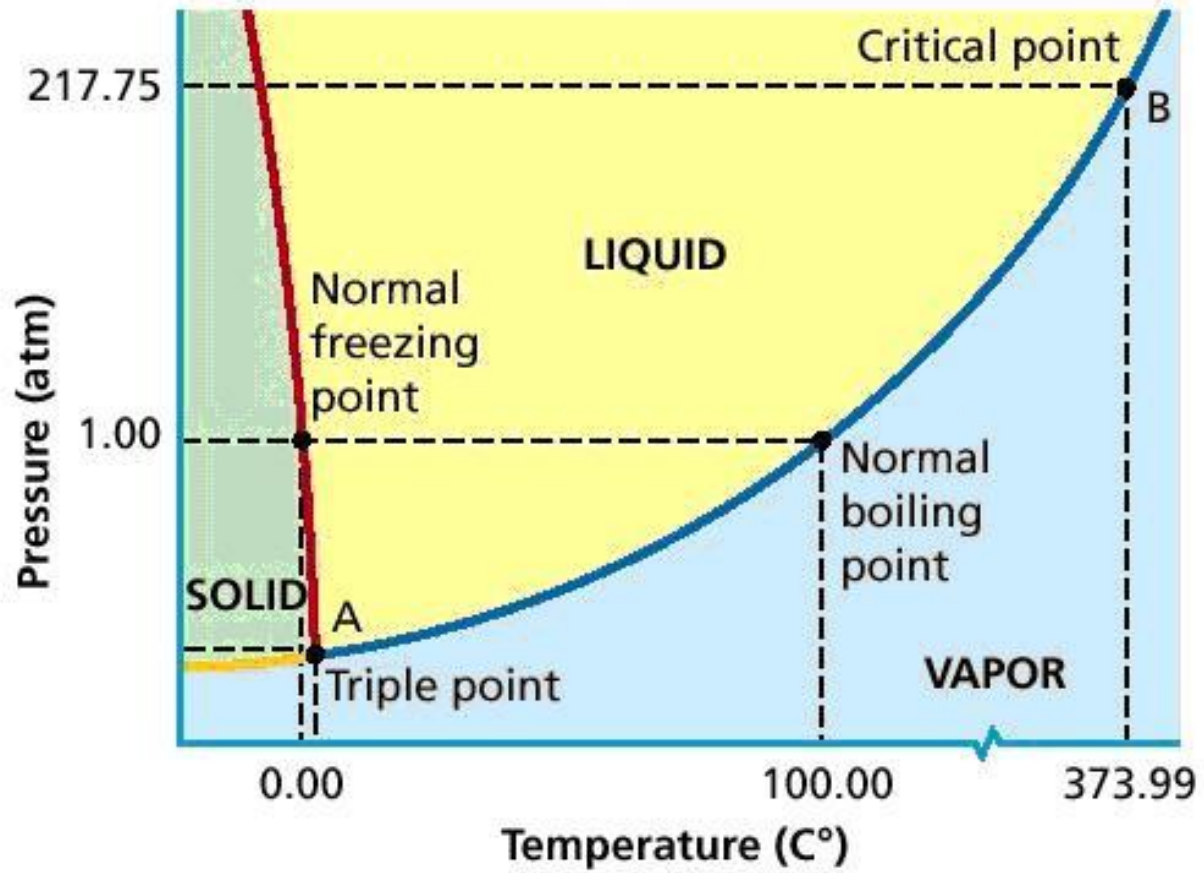


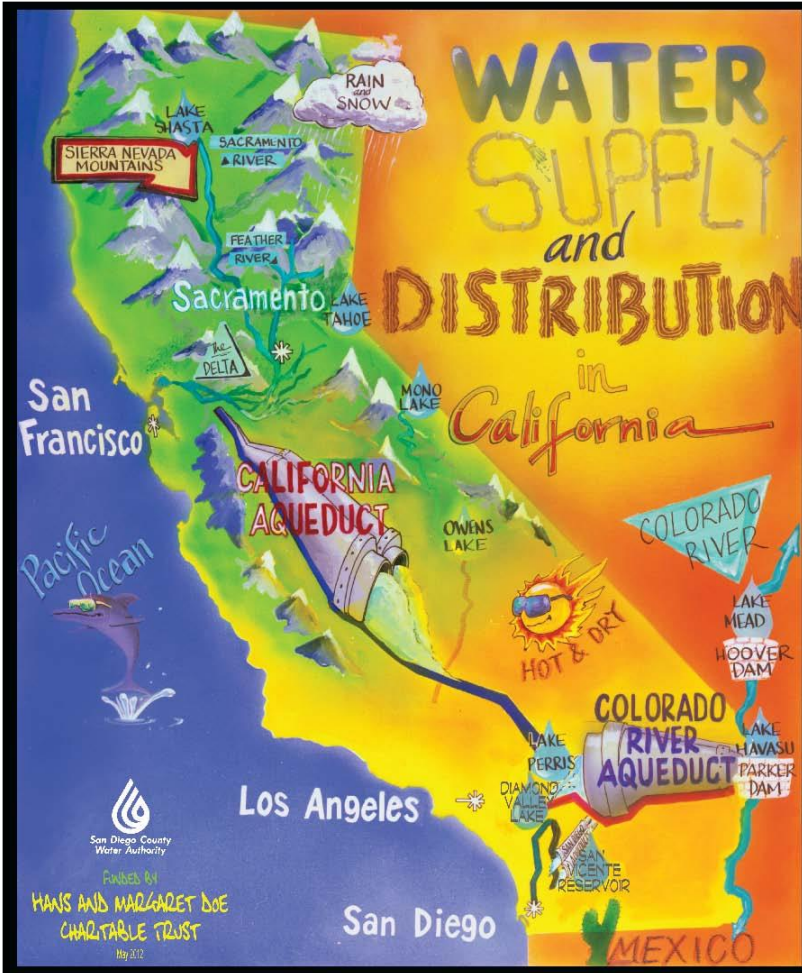
Gas

Shape of Container
Volume of Container

25

Phase Diagram for H₂O





Parched Times

California, as with many other places, cycles through times of drought and times of abundant rain. With these two maps have students identify specific regions of California, the type of climate associated with that region and then correlate that information with the drought severity map. Have students talk amongst themselves or as a class: Where has the drought become more severe in the past year? Do you see a pattern or trend in the areas with varying levels of drought severity? What are repercussions of the drought in these diverse regions—less water for crops, for huge populations? Does the drought here in California affect the water supply of all these hydrologic regions, or only some? What are the effects of the drought on these regions wildlife and ecosystems—on trees, animals, soil and fires?

U.S. Drought Monitor California

December 16, 2014
(Released Thursday, Dec. 18, 2014)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	98.41	94.42	77.94	32.21
Last Week 12/5/2014	0.00	100.00	99.72	94.42	79.69	55.08
3 Months Ago 9/14/2014	0.00	100.00	100.00	95.42	81.92	58.41
Start of Calendar Year 12/01/2013	2.61	97.39	94.25	87.53	27.59	0.00
Start of Water Year 9/30/2014	0.00	100.00	100.00	95.04	81.92	58.41
One Year Ago 12/17/2013	2.61	97.39	94.25	82.53	27.59	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
David Miskus
NOAA/NWS/NCEP/CPC



<http://droughtmonitor.unl.edu/>

Resources:

The EPA has an activity source book that solely provides activities and experiments for students to learn more about water and its functions in the world around us.

- <http://water.epa.gov/learn/kids/drinkingwater/upload/The-Water-Sourcebooks-Grade-Level-6-8.pdf>

For a webpage that can be paired with a worksheet, the National Drought Mitigation Center has a “Drought for Kids” page that contains an animated video explaining what drought is and several links to further explain to students everything from how the drought affects their lives, to how we can protect ourselves from drought.

- <http://drought.unl.edu/droughtforkids.aspx>

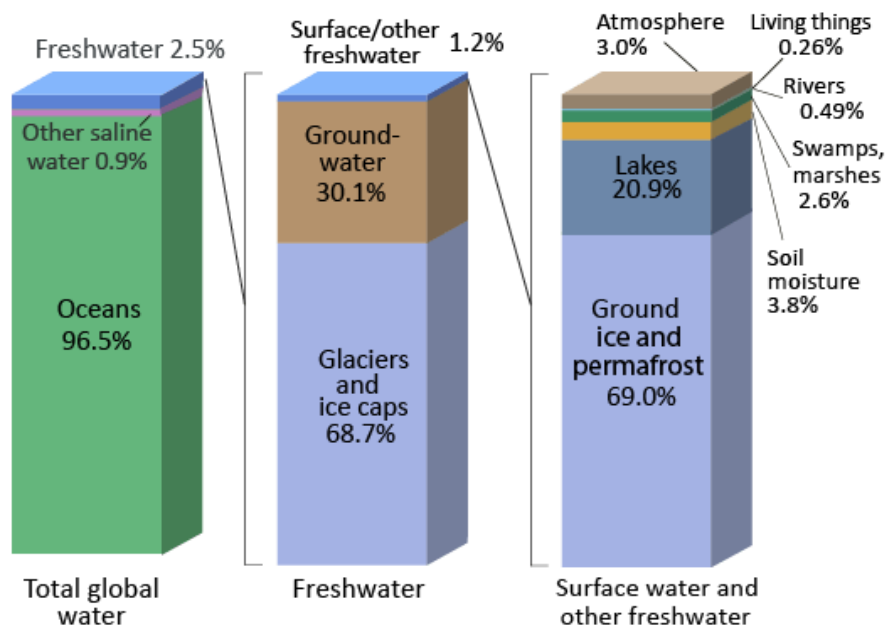
For students with a proficient understanding of water and beginning to learn its molecular properties, the USGS has a water properties true/false quiz that is an easy activity to test knowledge pre and post lesson.

- <http://water.usgs.gov/edu/activity-tf-properties.html>

For a lesson plan which really emphasizes the drought, PBS has a lesson plan titled “In the California Drought, What Is My Role?” This lesson asks students to think critically about the effects of drought, their personal water use and how best to conserve water. The webpage contains all the necessary handouts for the lesson plan.

- http://www.pbs.org/newshour/extra/lessons_plans/california-drought-what-is-my-role-lesson-plan/

Where is Earth's Water?



Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, *Water in Crisis: A Guide to the World's Fresh Water Resources*.
NOTE: Numbers are rounded, so percent summations may not add to 100.

District Resources for Teachers

With the state and region facing a water supply crisis, Otay Water District is firmly committed to supporting water sustainability educational programs. Otay Water District provides field trips to the Water Conservation Garden, school assemblies, and Splash Labs.

Free School Bus Tours to the Water Conservation Garden

The District funds up to 30 school bus tours each school year. Funding includes reimbursement for the school bus to the Water Conservation Garden and a tour by Water Conservation Garden's Ms. Smarty Plants. Watch the video below to learn more about Garden Tours. Contact pam@thegarden.org to inquire about available funding.



Splash Labs

School Assemblies Grades K-6

WaterSense Resources for Teachers

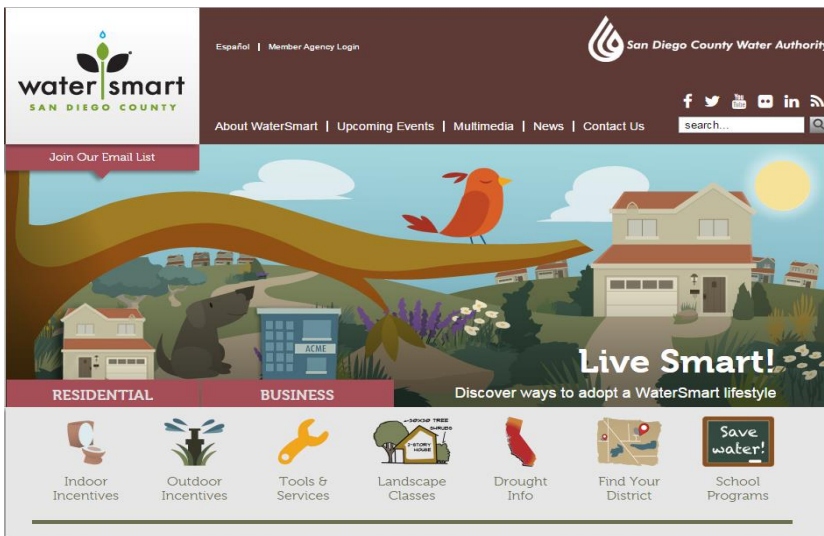
All the links for these resources are available at:

<http://www.otaywater.gov/education/resources-for-educators-and-students/>

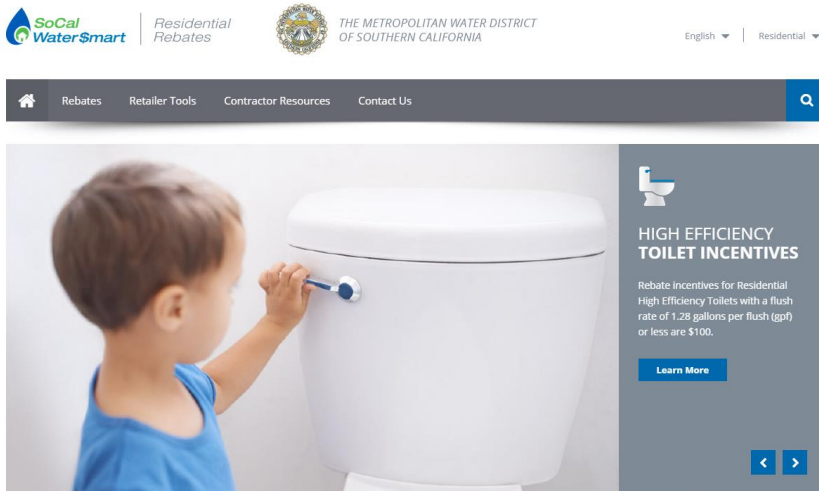
Parent Resources

Conservation is important not only in education, but in practice at home as well. San Diego County Water Authority and Metropolitan Water District of Southern California offer rebates for everything from toilets to sprinkler nozzle heads. Additionally, the city of San Diego provides an entire site dedicated to residential landscape information and resources for a more “California Friendly” landscape.

SDCWA Website: <http://www.watersmartsd.org/>



MWD Website: <http://socalwatersmart.com/>



City of San Diego Landscape Watering Calculator: <http://apps.sandiego.gov/landcalc/start.do>

Homeowner’s Guide Flipbook: <http://www.sdcwa.org/landscape-guide-flipbook/>

Easy Water Wise Gardening: <http://www.sandiego.gov/water/pdf/waterwisegardening.pdf>