

Rivers, Rivers Everywhere: The Arizona Watershed

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Grade Level 6
Duration 2 class periods

National Standards

GEOGRAPHY ELEMENT

1: The World in Spatial Terms

1. How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information

ELEMENT 2: Places and Regions

4. The physical and human characteristics of places.

ELEMENT 3: Physical Systems

7. The physical processes that shape the patterns of Earth's surface.

ELEMENT 5: Environment and Society

16. The changes that occur in the meaning use, distribution and importance of resources.

ELEMENT 6: The Uses of Geography

18. How to apply geography to interpret the present and plan for the future..

AZ Standards

MATHEMATICS

The Number System

6.NS.B.3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Statistics and Probability

6.SP.A.2. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

6.SP.A.3. Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number

6.SP.B.5. Summarize numerical data sets in relation to their context, such as by:

b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement

Standards for Mathematical Practice (MP)

6.MP.1. Make sense of problems and persevere in solving them.

6.MP.2. Reason abstractly and quantitatively

6.MP.3. Construct viable arguments and critique the reasoning of others.

6.MP.4. Model with mathematics.

6.MP.6. Attend to precision.

Arizona Social Science Standards

GEOGRAPHY

The use of geographic representations and tools helps individuals understand their world.

6.G1.1 Use and construct maps, graphs, and other representations to explain relationships between locations of places and regions.

Human-environment interactions are essential aspects of human life in all societies.

6.G2.1 Explain how cultural and environmental characteristics influence the way people modify and adapt to their environments over time.

Examining human population and movement helps individuals understand past, present, and future conditions on Earth's surface.

6.G3.2 Analyze the influence of location, use of natural resources, catastrophic environmental events, and technological developments on human settlement and migration.

Overview

Students need to understand that the question: "When will I ever need to know or use this?" is shortsighted. When they learn math, they are developing tools to solve problems in their future—some problems that they do not know yet will be problems.

Purpose

In this lesson, students will become content experts on the effects of water and can answer this question:

Where does all the water go after rain and snow and what can you and I do about it?"

Materials

- Computers with Internet access
- PowerPoint of web links for projecting materials
- Arizona's Topography and Rivers map <http://geoalliance.asu.edu/sites/default/files/maps/AZTOPO.PDF>
- Important Dams in Arizona map <http://geoalliance.asu.edu/sites/default/files/maps/AZ-DAMS.PDF>
- Water Resource Regions map

- https://water.usgs.gov/wsc/map_index.html
- Rivers, Rivers Everywhere worksheet
- Important Rivers, Streams, and Washes of Arizona
<http://geoalliance.asu.edu/sites/default/files/maps/AZ-RIV-K.PDF>
- Cubic Foot of Water worksheet
- Cubic Foot of Water Per Second worksheet
- Chasing Water-video
<https://vimeo.com/114386144>
- Cubic foot per second video
https://www.youtube.com/watch?v=V9Y67x_GPO8
- Flash floods videos
 - <https://www.azcentral.com/picture-gallery/weather/2015/09/15/arizonas-devastating-flood-history/72311510/>
 - https://geochange.er.usgs.gov/sw/impacts/hydrology/state_fd/azwater1.html
 - <https://www.youtube.com/watch?v=nup5oYJo26w>
 - <https://www.youtube.com/watch?v=2CUCnaAxECU>
 - https://www.youtube.com/watch?v=_yCnQuLLmsM
 - <https://www.cbsnews.com/video/flash-floods-tear-across-arizona-desert/>

Objectives

Students will be able to:

1. Identify the major rivers of Arizona
2. Identify the major watershed of Arizona
3. Explain how water travels in a river.
4. Identify the effects of different amounts of water on the river system of Arizona.
5. Identify the effects of dams on the Arizona river system.
6. Use math to solve real world problems.

Procedures

Prerequisite Skills: Students should have experience in studying maps; Also, students should be able to find the mean (average) given data; and be able to calculate volumes.

SESSION ONE

1. Begin the lesson by showing the flash flood video <https://www.cbsnews.com/video/flash-floods-tear-across-arizona-desert/> (1.24 min) (slide 1)
2. Have students discuss how a flash flood happens--where the water comes from and how it becomes a flash flood. Have students discuss rivers and lakes they have visited. If students identify lakes, mention that many lakes in Arizona are created by man-made dams on a river.
3. Then ask: How does water move? Does it always move south, north, east, or west? The

correct answer is: **water always moves downhill. The compass direction does not matter.**

4. Divide students into groups of no more than 4. Distribute the Rivers, Rivers Everywhere worksheet. Say, "To become content experts on Arizona's river system, you need to learn the definition of a few terms before we can begin. Use the Internet and write the definition of the words at the bottom of the worksheet."
5. Next, distribute copies of the Arizona Topography and Rivers map <http://geoalliance.asu.edu/sites/default/files/maps/AZTOPO.PDF> and project it. (slide 2) Have students find at least 6 rivers and fill in A on the worksheet. List the rivers on the white board. Have them color the 6 rivers with a blue marker/pencil.
6. Project the watershed map (slide 3) found at: https://water.usgs.gov/wsc/map_index.html. Have student fill B on the worksheet.
7. So students can list major rivers and tributaries of the watershed, project (slide 4) or distribute Important Rivers, Streams, and Washes of Arizona map <http://geoalliance.asu.edu/sites/default/files/maps/AZ-RIV-K.PDF> and fill in C on the worksheet and label the tributaries on their AZ Topography and Rivers map.
8. Project (slide 5) or distribute the Important Dams in Arizona map. <http://geoalliance.asu.edu/sites/default/files/maps/AZ-DAMS.PDF> Have students find and label on their map 5 dams on the Colorado River and the year when they were completed and fill in D on the worksheet.
9. To research how much water flows down the Colorado River at the entry of the Colorado River into AZ (Lee's Ferry), project slide 6. Have students complete E on the worksheet.
10. Project slide 7 and have students complete the water flow section of D on the worksheet.
11. End the session by having students look at slide 8 and discuss what happened in Yuma in 1916? 1934?

SESSION TWO

*Prior to this Session: Write the following information on the white board. Calculating Volume = Rectangles: length x width x height
Cylinders: $\pi r^2 \times \text{height}$ and divide the classroom so there is a "river" down a section of the room.*

1. Divide students into several groups: Group 1 will construct a 1 cubic foot container skeleton using 12 rulers and tape. Make it sturdy enough that they can walk around with it. Have Group 1 calculate how many cubic inches of water would fill their container.
2. Have other groups select a container for items in the classroom and calculate the volume of their

container. Have all students fill out the worksheet Cubic Foot of Water.

3. Let students visualize by marking on wall how much 100 cubic feet of water is with tape measurer (10 ft x 10 ft square or a 8 x 12.5 rectangle). Have student Try to determine how much space you would need for 1000 cubic feet of water and for 10,000 cubic feet of water. Have students calculate how much each of these amounts would weigh.
4. Watch video on dams. (Pete McBride Chasing Water-18:21minutes)
<https://vimeo.com/114386144>
5. Point out the taped line on the floor of the classroom. Have a student walk down aisle as if they are a river and talk about what is happening. If each student is 100 cfs, 1000 cfs, 10,000 cfs, or 100,000 cfs. Now have a student be a river of 10,000 cfs. Talk about what is happening when it, as water, travels down its river. Now have 2 students travel as if they were the river, then 3, then 4. Discuss what the river looks like, how much water it is and what it looks like as a river.
6. Discussion should include what is the size of this water, how much weight does this water have, and how many gallons of water we are seeing pass before us each second.
7. Show video of 1 cfs (1.21 min).
https://www.youtube.com/watch?v=V9Y67x_GPO8 . Discuss what students were thinking about amount, speed, power as they watched the video.
8. Distribute the Cubic Foot of Water Per Second worksheet and have students complete the worksheet.
9. Talk about floods of Arizona from the past
<https://www.azcentral.com/picture-gallery/weather/2015/09/15/arizonas-devastating-flood-history/72311510/>
https://geochange.er.usgs.gov/sw/impacts/hydrology/state_fd/azwater1.html
10. Closure: Watch a 4 minute video or 8 minute video of some flash flooding similar to first flash flood they saw and discuss why trying to control water might be good and might be bad.
<https://www.youtube.com/watch?v=nup5oYJo26w>
<https://www.youtube.com/watch?v=2CUCnaAxECU>
<https://www.youtube.com/watch?v=yCnQuILmsM>

Assessment

Geography:

Rivers, Rivers Everywhere worksheet and the labeled Arizona's Topography and Rivers map can be graded for completeness and accuracy. Mastery will be considered 80% or higher.

Mathematics

The Cubic Foot of Water and the Cubic Foot of Water Per Second worksheets can be graded for completeness and accuracy. Mastery will be considered 80% or higher.

Extensions

- Discuss the Water Cycle in relation to water flow, especially evaporation
- Have students describe what the effects there would be if 1" of rain on were to fall on 100 square miles.
- Have students identify the effect(s) of a dam on a river and calculate the amount of water stored up with normal rainfall and with dam outflow of 10,000 cfs.
- As a class, calculate how long Lake Powell will have water with current climatic conditions.

Sources

- Colorado River - Wikipedia
https://en.wikipedia.org/wiki/Colorado_River
- <https://water.usgs.gov/watercensus/colorado.html>
- <https://www.usbr.gov/lc/riverops.html>
- <https://nwis.waterdata.usgs.gov>
- <https://waterdata.usgs.gov/nwis>
- www.exo.net/~emuller/activities/A%20Cubic%20foot%20of%20water.pdf A cubic foot of water
- <https://www.azcentral.com/picture-gallery/weather/2015/09/15/arizonas-devastating-flood-history/72311510/>
- https://geochange.er.usgs.gov/sw/impacts/hydrology/state_fd/azwater1.html
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<http://geoalliance.asu.edu/maps/arizona>
- <https://geology.com/topographic-physical-map/arizona.shtml>