Where Did the Lake Go?
The Drying Up of Lake Chad

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Grade Level	6-7
Duration	2-3 class periods

National Standards	AZ Standards	Arizona Social Science 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 3. How to analyze the spatial organization of people, places, and environments on Earth's surface **Element 5: Environment and Society** 14. How human actions modify the physical environment 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.	**MATHEMATICS** **Geometry** 6.G.A.1. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques to solve mathematical problems and problems in real-world context. 7.G.B.6. Solve mathematical problems and problems in a real-world context involving area of two-dimensional objects composed of triangles, quadrilaterals, and other polygons. Solve mathematical problems and problems in real-world context involving volume and surface area of three-dimensional objects composed of cubes and right prisms. **Standards for Mathematical Practice** 6.MP.1. and 7.MP.1. Make sense of problems and persevere in solving them. 6.MP.2. and 7.MP.2. Reason abstractly and quantitatively. 6.MP.4. and 7.MP.4. Model with mathematics.	**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 7.G1.1 Use and construct maps and other geographic representations to explain the spatial patterns of cultural and environmental characteristics. **Human-environment interactions are essential aspects of human life in all societies.** 6.G2.1 Compare diverse ways people or groups of people have impacted, modified, or adapted to the environment of the Eastern Hemisphere. 7.G2.1 Explain how cultural demographic patterns, economic decisions, and human adaptations shape the identity of nearby and distant places. **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. 7.G3.3 Evaluate the influences of long-term, human-induced environmental change on spatial patterns and how it may cause conflict and promote cooperation. **Global interconnections and spatial patterns are a necessary part of geographic reasoning.** 6.G4.2 Describe how natural and human-made catastrophic events and economic activities in one place affect people living in nearby and distant places.

Overview

All living things depend on fresh water to survive and lakes provide much of that fresh water. When a lake

dries up the impact on the environment is tremendous.

Purpose

In this lesson students will become aware of the significance a lake can have on an area and how a change in the lake can directly affect the lives of humans and other living things. Students will explore the rate of change in area of Lake Chad in Africa over the years.

Materials

- Vocabulary
- Diagram of the Water Cycle or use plain paper
- Water Cycle Diagram (labeled) https://geoalliance.asu.edu/sites/default/files/maps/Water_Cycle_s.pdf
- Water Cycle Diagram (labeled)
- Africa map https://geoalliance.asu.edu/sites/default/files/maps/AFRICA2_0.PDF
- Lake Chad's Location in Africa map (with country names) https://geoalliance.asu.edu/sites/default/files/maps/Africa_Lake_Chad.pdf
- Lake Chad Data Sheet
- Satellite images and photos of Lake Chad
- Why We Need Lakes worksheet
- Readings entitled Lake Chad and Africa's Lake Chad Shrinks by 20 Times Due to Irrigation Demands
- Didn't There Used to be a Lake Here? The Drying Up of Lake Chad 1963-1997 (4 maps)
- Colored pencils
- Math Practice and Answer Key
- Calculators (optional)
- Projection device

Objectives

The student will be able to:

1. Describe the effects of shrinking lakes.
2. Locate Lake Chad and surrounding countries on a map of Africa.
3. Diagram the water cycle.
4. Practice changing numbers from fractions to decimals to percentages.
5. Compare the change of areas of Lake Chad over time by accurately completing grids.

Procedures

SESSION ONE

1. Begin the lesson by asking students what they know about the hydrosphere: the moisture surrounding earth and all of the water on earth.
2. Project and discuss the lesson Vocabulary involving the water cycle and the math terms such as area.
3. Distribute the Water Cycle Diagram handout or unlined paper. Project the Water Cycle (labeled) image. https://geoalliance.asu.edu/sites/default/files/maps/Water_Cycle_s.pdf Have students copy the diagram on their paper.
4. Discuss sources for fresh water shown in the diagram. (For example, springs, mountain snow, run-off from rains, underground storage areas, lakes, rivers, etc.)
7. Point out the "lake" on the diagram. Discuss how people use lakes (recreation, drinking water, etc.). Discuss how animals use lakes (breeding areas, drinking, hunting, etc.).
8. End the session by having students discuss any lakes they know are shrinking. (Lake Mead, Roosevelt, etc.).

SESSION TWO

1. Distribute Africa maps to students https://geoalliance.asu.edu/sites/default/files/maps/AFRICA2_0.PDF and project the Lake Chad's Location in Africa (with country names) map. https://geoalliance.asu.edu/sites/default/files/maps/Africa_Lake_Chad.pdf
2. Have the students label Lake Chad and surrounding countries. Project and read as a class, Lake Chad Data Sheet.
3. Show the satellite images and photos of Lake Chad.
4. Distribute to partners one copy of the Why We Need Lakes worksheet and the two readings on Lake Chad. Have one partner read Lake Chad and the other partner read Africa's Lake Chad Shrinks by 20 Times Due to Irrigation Demands. Then have them complete together the worksheet.
5. If time, watch YouTube Video Lake Chad: Rate of its shrinking is getting faster (2.02 min) https://www.youtube.com/watch?v=mwh9jmhayqw which mentions that terrorists are in the area and gaining support from those desperate due to the economy of the area.

SESSION THREE

1. Project the map, Didn't There Used to be a Lake Here? The Drying Up of Lake Chad 1963. Distribute the Math Practice worksheet. Review how to

determine area by counting the blocks and estimating partial blocks into whole ones (2 half blocks equals 1 whole block).
2.Model how to do the 1963 math exercise with the students. Since 1963 does not have data prior to 1963, you will need to explain how to do the last three columns with “pretend” figures.
3. Then have students do the math exercises for 1973, 1987, and 1997.

Assessment

Geography
Students will still cite at least 2 ways that people, animals, and plants would be affected by a decrease in the size of a lake. Mastery is considered 100% (2 or more ways in the 3 categories plus a drawing).

Mathematics
Students will determine the difference in area of Lake Chad from one date to another. Students will calculate the rate of change from fractions to decimals to percentages. Mastery is considered a score of 80% or higher.

Extensions

Students can create a "hands-on" demonstration to demonstrate a lake drying up using:

- shallow pie an or cookie sheet
- sand
- water
- heat lamp
- fan

Spread sand in shallow pie pan or cookie sheet. Add water. Place a heat lamp over the pan. Place a fan to blow over the water. Explain that this demonstrates evaporation.