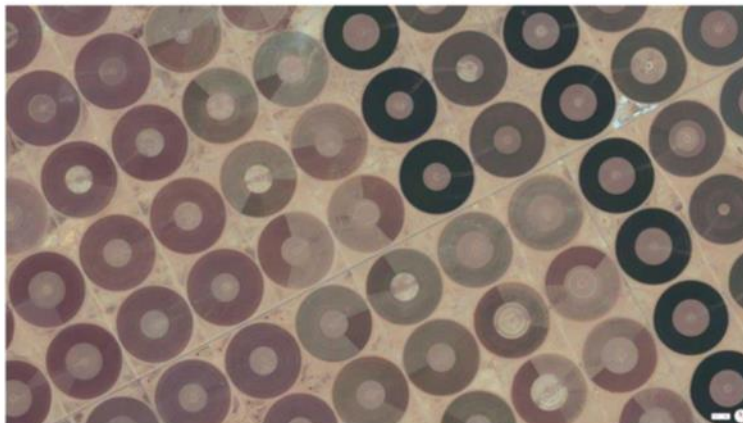




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Dust to Dust: The Changing Face of a Desert



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Lesson Title: Dust to Dust, The Changing Face of a Desert

Grade Level: 7th Eastern Hemisphere Geography

Purpose/Overview:

The study of geography, history, and the social studies in general, provide ample opportunities for students to evaluate the positive and negative consequences of human modification the Earth's surface through the use of limited and non-renewable resources. This lesson focuses on the ways imported technology rapidly transformed the arid environment of the Arabian Peninsula, only to be transformed again by human mismanagement of fossil aquifers just a few decades later.

National Geography Standards from *Geography for Life*

Geographic Elements & Standards:

1. How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information.
14. How human actions modify the physical environment.
16. The changes that occur in the meaning, use, distribution, and importance of resources.
17. How to apply geography to interpret the past.

Oklahoma Academic Standards for the Social Studies:

Content Standards:

Content Standard 1.1. Cite specific geographic information to support analysis from primary and secondary sources.

1.2. Integrate visual information, draw conclusions, and make predictions from geographic data and analyze spatial distribution and patterns by interpreting that data as displayed on globes, graphs, charts, satellite and other forms of visual imagery.

2.5. Explain and summarize how and why regions change over time through physical and human processes which operate to modify Earth's surface.

5.2. C. Evaluate the effects of human modification of and adaptation to the natural environment including the transformation of arid lands of the Arabian Peninsula through introduction of western irrigation methods.

5.3. Integrate visual information to analyze regional problems and policies having spatial dimensions in the Eastern Hemisphere.

Process and Literacy Standards:

1.1. Cite specific textual evidence to support analysis of primary and secondary sources.

2. A. 2. Write informative/explanatory texts, including the narration of historic events.

2. B. 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

2. B. 8. Gather relevant information from multiple print and digital sources.

Geographic Themes: (Five Themes of Geography)

Human-Environment Interaction

Movement

Region

Objectives:

1. **Key Topic:**

Students will be engaged in the study and analysis of the impact of recent agricultural technology on agricultural practices and use of nonrenewable water resources in Saudi Arabia at the turn of the century. Students will be given multiple opportunities to develop their skills in analyzing geographic data in the form of satellite imagery of change over time, focusing on the region of the Arabian Peninsula.

2. **Essential Questions:**

How do we, as humans, significantly impact our environment for both positive and negative consequences?

How does our environment affect the decisions we must make regarding the use and conservation of natural resources?

3. **Student Knowledge:**

Students will come to a better understanding of how human decisions to adapt desert environments for the goal of becoming self-sufficient in food production temporarily met such a goal, yet misuse of water resources ultimately doomed the effort.

4. **Application of the Lesson:**

Students will be able to apply the skills of visual evidence analysis in any given region for any topic involving environmental changes over time, whether man-made or natural. Students will also be able to transfer in future units of study the need to conserve all types of limited and unlimited resources, such as fossil fuels, air, and soil.

Materials:

Changing Face of the Desert Powerpoint presentation

Image A and B handout (one copy per pair of students; option- use Powerpoint slide #5)

Image A and B Venn Diagram colored handout (one copy per pair of students)

Satellite Imagery Over Time colored handout (one copy per student)

Saudi Arabia Agricultural Project, reading passage (one copy per pair of students)

Five Themes of Geography Organizer, handout (one copy per team of 4 students)

R.A.F.T. Writing Options chart (viewed from Powerpoint)

Video: Earth From Space- Desert Growth

<https://drive.google.com/file/d/1GPR1JJYc27etdM5cejDDpIulN2SjcODd/view>

Video: Food Self-Sufficiency in Saudi Arabia

<https://drive.google.com/file/d/1OH7yRGPvir8MR3gxpm0GvB4I1I0lEpqg/view>

Rubric for R.A.F.T. Writing Assessment

Internet Access to Livebinder Resources www.livebinders.com/play/play?id=1841891

(for optional Enrichment task and Extension activity only)

Water, Oil, and Food- A Crisis in Saudi Arabia, reading passage (for optional Enrichment task only)

Rubric for Story Book (optional Enrichment task only)

What Happens When the Wells Go Dry, reading passage (for optional Extension activity only)

World Aquifers Tour (Tourbuilder lesson for Extension activity only) <https://goo.gl/tTKqTt>

Time Frame: 2 periods of 45-50 minutes; 1-2 additional days for Extension Options

Procedures:

Engage-

1. In order for students to begin thinking on the lesson's objectives, the teacher will use the slide #2 of Powerpoint presentation, *Changing Face of the Desert*, to lead a whole-class brainstorming activity. Remind students that the study of geography will take them to many regions of the world which are being changed and transformed due to human modification of the environment. In fact, the history of the world is a history of humans bringing about change through the many inventions mankind creates and develops.
2. Ask students to think about all of the many inventions that have changed our world... What invention would make it to the top of your list? Allow time for each student to contribute their top response and compose a class list of all contributions onto a master list. Encourage selected students to share why they think a particular invention has brought about such significant change.
3. Use the next slide of the Powerpoint and offer time for the class to compare its list to the public poll's responses, found on slide #3.
4. Using slide #4, introduce the Essential Questions that students will consider during this lesson. Ask students to independently note one example in which human interaction with the environment has led to both a positive and negative consequence. Allow time for students to share their responses with the class. Inform students that they will revisit the second Essential Question at the close of the lesson when they will be asked to explain the necessity of conservation of the Earth's finite and unrenewable resources.

Note: A Nearpod presentation of the Powerpoint, including student interactive activities, is available at <https://share.nearpod.com/vsph/Ue1Mz8AmrI>. (Nearpod is free software for educators, combining aspects of powerpoint presentations and interactive activities for whole class instruction. To set up Nearpod for classes, teachers need to establish their own free accounts; then, a copy of the Nearpod presentation can be added to a teacher's own library.)

Explore-

5. The teacher will assign students to work in pairs. Give each pair a printed copy of Image A and B handout. (Option: Powerpoint slide #5 can be used for viewing Image A and B. Option: classrooms with mobile devices can access Image A and B from the Livebinder link at http://www.livebinders.com/media/get_centered/MTcxMTk4MzA.)
6. Provide pairs with one minute of silence to observe both images. Inform students that these are satellite images from two very distant locations. Ask students to look for what they see in common, as well as differences. Remind students to observe patterns, drawing no conclusions to explain what they see, but merely making observations.
7. The teacher will provide one Venn diagram handout to each pair. Allow a maximum of 2 minutes for pairs to write at least 2 things they observe from both images. Note the observations in the "similarities" section of the Venn diagram. Allow an additional 2 minutes for pairs to write one things unique to each image, noting these observations in the "image A" and "image B" sections of the Venn diagram.
8. Using the reflection questions at the bottom of the Venn diagram, the teacher will lead a brief class discussion, assisting students to share any conclusions they can draw from the images' comparison. Focus the discussion on these questions, "What is your team's explanation of the patterns you observe in both images?" "How did your team reach this conclusion?"

Explain (part A.)

9. The teacher will lead a phase of whole-class instruction, beginning with use of the videoclip, *Earth From Space- Desert Growth*. This video will remind students of the value of visualizing the Earth from remote distances, such as those provided by satellite imagery. The video also begins to explain the causes for the circular patterns of vegetation growth observed in images A and B, as well as reviews how to analyze evidence from satellite images.

10. The teacher will continue using the Powerpoint presentation, slides #7-14, to explain in narrative format how the American invention of pivot irrigation transformed desert regions of the Arabian Peninsula. Point out the goal of self-sufficiency for such drastic and rapid change in agricultural practices. Help students understand the role government officials played in reaching this goal over a short amount of time. Be sure to delineate for students the differences in food self-sufficiency for a nation and food security for a nation's people. Answer and clarify any questions students may have during the presentation. However, be careful not to reveal the ending of this episode in Saudi Arabia's decisions about water usage from fossil aquifers and food production.

11. Conclude this phase of direct instruction by viewing the videoclip, *Food Self-Sufficiency in Saudi Arabia*. Conduct a brief class discussion to compare and contrast details about the transformation of deserts provided by the video versus those grasped through the Powerpoint presentation. What additional questions do students have at this point? Make a class list of questions yet unanswered.

Expand-

12. The teacher will join pairs together into groups of four. Provide each member of the team with a copy of the *Satellite Imagery Over Time* colored handout. (Option: Powerpoint slide #17 can be used for viewing the four images. Option: classrooms with mobile devices can access online imagery at http://www.livebinders.com/media/get_centered/MTcxMjgzMzE).

13. The teacher will inform the class that teams will be working together to dig deeper into the transformation of the Nafud region of the Arabian Peninsula, as an example of how pivot irrigation impacted the desert environment. Using the four images, ranging from 1986 to 2003, allow teams 4-5 minutes will begin to draw conclusions from the evidence provided from the images and from the knowledge they gained during the Explain phase of the lesson. Encourage students to discuss their conclusions openly with team members, challenging and supporting conclusions, based on the evidence provided.

14. The teacher will provide each team with one copy of the handout *Five Themes of Geography Organizer*. Review the Five Themes of Geography briefly, if necessary. Draw the class's attention to the theme of Location, at the bottom of the organizer. Ask teams to volunteer a piece of evidence from the satellite images that would support the relative location of the events seen in the images.

15. The teacher will allow teams ten minutes to note their conclusions in the remaining places on the Five Themes Organizer. (Option: Teams may assign one student to serve as the team's "recorder. Or, the teacher may wish to provide one copy of the organizer to each team member for noting the team's responses independently.) Each team should attempt to note at least two signs of evidence supporting each of the Five Themes.

16. Conduct a brief class discussion. How did analyzing four images over time help visualize modifications to the Earth's surface? Based on the progression of changes seen in these four images, what do students predict an image taken this year would look like? Ask student volunteers to explain their predictions to the class.

Explain (part B)-

17. The teacher will respond to student predictions by completing the Powerpoint presentation. Slides #19-26 explain the dependence of irrigated fields on finite resources of the fossil aquifers lying beneath the Arabian deserts. Allow time on slide #21 for students to use the line graph of Saudi grain production from 1976 to 2006 to test the various predictions made in step 16 of this lesson. Also, pause on slide 25 for students to examine the level of stress on aquifers throughout the region of Southwest Asia and North Africa. Help students make the connection between overuse of water resources and the climate of a region. Use slide #26 to examine aquifers around the world. What other regions are overstressed? Does climate also play a key role in these regions? Note the aquifers of North America, especially those accessed by farmers of the Great Plains. What do students know about the climate of our region, compared to that of the Arabian Peninsula?

18. The teacher will conclude the instructional phase of the lesson by asking students to return to their original pairs. The teacher will provide one student in each pair with a copy of the article *Saudi Arabia Agricultural Project* and provide the other student in each pair with a copy of the article, *Water, Oil and Food Crisis*. Allow students 3-4 minutes to read the articles. Students may wish to use a highlighter to note new information about the recent transformation of the natural environment of Saudi Arabia. When completed, student pairs will verbally share with each other any additional information they learned from the reading passages. Encourage students to be specific in their sharing because such information will be useful for their final assessment.

Evaluate (Assessment):

19. The teacher will introduce the authentic assessment writing task by using slide #29 from the Powerpoint presentation. The R.A.F.T chart will provide students with the many options available for their written assessment. The teacher should review all steps of the process below.

Student Directions:

A. You will be assuming the role of a person directly impacted by the decisions over water usage in Saudi Arabia recently. (Look at the chart; select a person from the "ROLE" category.) You will express your thoughts and share information you have learned through the eyes of the person you are portraying.

B. You will choose an audience (person or group of people) that you want to hear your thoughts and opinions. * Choose a logical person to whom your role would want to communicate. (Look at the chart; select a person from the "AUDIENCE" category.)

C. You next will decide how you will express your thoughts in writing. (Look at the chart; select one type of communication from the "FORMAT" category.) * Choose a logical form of communication that your role would use.

D. Finally, decide what you want to write about. (Look at the chart; select an option from the "TOPIC" category.)

E. Complete these requirements for your R.A.F.T. Writing Assessment:

Your writing must be approximately 100-150 words in length.

Use specific facts and information to demonstrate what you have learned.

You must include A.)an explanation of HOW and WHY the environment has been transformed,

B.) a description of one POSITIVE effect of the transformation and

C.) a description of one NEGATIVE effect of the transformation.

F. Review the rubric for grading to check that you have completed the task.

Resource Citations:

Rubin Center for International Affairs <http://www.rubincenter.org/meria/2008/06/elhadj.pdf>
State of the Planet, Columbia University, September 14, 2011
<http://blogs.ei.columbia.edu/2011/09/14/water-oil-and-food-%E2%80%93-a-crisis-for-saudi-arabia-and-the-world/>
Center for Strategic and International Studies, March 12, 2010,
<https://www.csis.org/analysis/addressing-our-global-water-future>
Full Planet, Empty Plates”, Earth Policy Institute, http://www.earth-policy.org/images/uploads/book_images/FullPlanetAllChaps.pdf
Pivot Irrigation in Saudi Arabia, <https://svs.gsfc.nasa.gov/11290>
Earthview, Saudi Wheat and Fossil Water, <https://www.usgs.gov/news/earthview-saudi-wheat-experiment-relied-fossil-water>
Earth From Space, Desert Growth, <https://www.youtube.com/watch?v=aeWGQ9rj7P8>
Wheat Farming in Saudi Arabia, <https://www.youtube.com/watch?v=kYHH8mzxFOk>
Farming in the Desert, Almarai Farming Division,
<https://www.scribd.com/document/59688808/New-Almarai-Presentation-Jan-09>
Water and Development, Global Issues, <http://www.globalissues.org/article/601/water-and-development>
One-Third of Largest Aquifers Highly Stressed, National Geographic,
<https://blog.nationalgeographic.org/2015/07/09/with-one-third-of-largest-aquifers-highly-stressed-its-time-to-explore-and-assess-the-planets-groundwater/>
What Happens to the U.S. Midwest When the Water's Gone, National Geographic,
<https://www.nationalgeographic.com/magazine/2016/08/vanishing-midwest-ogallala-aquifer-drought/>

Enrichment-

The teacher may wish to provide an optional research task, which would provide opportunities for students to publish online their learning. Apply what you have learned, but access additional information that will be helpful in writing your book by reading the article, *Water, Oil and Food-A Crisis in the Middle East*. Use the following set of directions for a successful and enriching experience of online publishing:

A. Your Task: You have been selected to produce a children's book about the use of limited water resources of Southwest Asia, using the recent events in Saudi Arabia as an example.

B. Your Goal: Help young students around the world to better understand the impact humans have on their environment and the need to make wise decisions about using finite natural resources.

C. The Contents: You will use what you have learned about the changes brought about by human actions in the arid environment of the Arabian Peninsula. In addition, you may use additional resources found at www.livebinders.com/play/play?id=1841891 under the “Enrichment” tab. Each page of your story book will have a specific focus. Your story book should also contain visuals (clip art, photo, map, or graph) which support your story. Follow the rubric for grading the story book; it will guide you through each page of narration.

D. Final Publication: You may create your book using any software or app you wish. Recommendations include Story Jumper. An example is found at <https://www.storyjumper.com/book/index/48380026/Drip-Drip-Drip-Diary-of-a-Desert>. However, you may use other software such as Powerpoint or Book Creator (for Macs and Ipad).

Extension-

1. The teacher should explain to students that the experiences of the Saudi people, its government, and its farmers is a micro-study of similar mismanagement of the limited groundwater resources of many of the world's aquifers. Ask students to discover more about water issues around the globe by reading the article, *What Happens When the Wells Go Dry*. Conduct a brief classroom discussion and develop a class Venn diagram comparing the Saudi experience to events happening in the United States.

2. Allow class time for students to use mobile devices or computer labs to take the online Tour at <https://goo.gl/tTKqTt>. This tour enhances student skills of interpreting satellite imagery, allowing students to actively engage with images of the locations of seven of the world's largest aquifer, many of which are currently under stress. At each stop on the "tour" students are asked to engage in one activity, using the satellite images, videoclips, maps, and graphs related to each stop. The teacher may wish to conduct the tour as a whole class activity or permit time for individual investigations.