

How many people can the aquifer support?

Groundwater, Drought, and Natural Resource Management

Task 1: Introduction to the Groundwater Model

Task Overview

In this first lesson of the unit, students are introduced to the Groundwater Education simulation (<http://groundwater.cee.illinois.edu/>) to explore the relationship between groundwater and surface water. Students begin to ask questions about indicators of aquifer sustainability. This lesson provides the foundation for the rest of the unit in which students will develop a computational model for data that they collect within the simulation.

Lesson NGSS Practices, Crosscutting Concepts, Disciplinary Core Ideas

Disciplinary Core Ideas:

ESS3.A: Resource availability has guided the development of human society.

ESS3.C: The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

Science & Engineering Practices:

Developing and using models

Analyzing and interpreting data

Crosscutting Concepts:

Patterns

Cause and effect

Materials:

Aquifer model or diagram

Access to computers and the Internet

Student Handout: *Aquifer Exploration*

Safety Concerns:

None

I. Opening Activity: The Dust Bowl Video

Watch PBS' *The Dust Bowl* Intro video (<http://www.pbs.org/kenburns/dustbowl/watch-videos/#2284398428>) (5 minutes, 9 seconds)

Note: Because this unit is centered around an online simulation, this video clip serves as the initial *phenomena* for which the students will refer back to as the unit progresses. The clip



provides context (both historically and for current events) to aid in the development of their understanding. This is also a good topic for collaboration across departments/disciplines.

II. Discussion

After watching the video, engage the class in a discussion about the **causes and effects** of the dust bowl.

Record student observations and questions on the board.

Answers may include ideas such as:

- Drought caused fields and crops to dry up and die. Effects: Livestock also died. Farmers could not provide for their families, mass exodus of people leaving Oklahoma.
- Government encouraged moving to Oklahoma and farming. Effects: Coupled with the drought, the land was overworked, and the ecosystem ruined.
- Heavy winds across the barren fields caused constant dirt storms. Effects: Made the air unbreathable, livestock died, people got sick and died.

Ask students these questions to make connections between the Dust Bowl and water: *From where does the water for farming come? During the Dust Bowl, where do you think people got their water for drinking and household needs?*

Record their answers, ideas, and questions. Make connections between student responses that indicate drought, water, or groundwater.

III. Introduction to the Aquifer

Using a physical model or diagram of an aquifer, point out key features of the landscape and aquifer. You can find many diagrams of aquifers online, or build a simple physical representation as a demo similar to this one: <http://sciencelearn.org.nz/Contexts/H2O-On-the-Go/Teaching-and-Learning-Approaches/Constructing-an-aquifer-model>

(*Note: it is not recommended that you have students build the “models” themselves, as it does not further the learning goals of the lesson. A quick demo or discussion of where the aquifer is located should suffice.*)

Define the term *water table* as the depth below the surface that water is found.

Discuss:

What is the difference between surface and groundwater?

What water do we use for drinking?

How do we extract the groundwater in order to use it?

How does water get into an aquifer?

Now ask the same questions but in the context of the Dust Bowl.



IV: Explore the Predetermined Conditions in Simulation

Introduce the groundwater education website to students and explain that the tool will help us understand groundwater, and the causes and effects of human and environmental activity on aquifers and water supplies. Students should use their handout, *Aquifer Exploration*, as they familiarize themselves with the simulation.

Students open a web browser and navigate to the Groundwater Simulation (<http://groundwater.cee.illinois.edu>). Instruct students to choose the *No Development* option from the dropdown menu, and to click *Begin*.

Students explore the features of the simulation by following the prompts in the handout. When students are familiar with the site, instruct them click *End* to return to the main page.

Students now load the *City* scenario and watch the animation as it cycles through five years. Students uncheck the Animation box, as directed in Part I on their handouts, and step through the animations as needed. Students record observations and write down questions they have throughout the animation.

Students then load the *City + Farm* scenario and repeat the observations as described above (also detailed on the student handout).

Discuss:

Discuss the students' observations and add to the list of the questions that the class made during the video at the beginning of the lesson.

V: Explore the No Development Scenario

Students load the *No Development* scenario in the simulation. In this scenario, the students add wells to the farm and/or city and observe the effect that pumping water has on the aquifer.

VI: Closing

Discuss with the students, or have them write reflections, about how the simulation helped them understand the *causes and effects* of the Dust Bowl as discussed earlier in the lesson.

