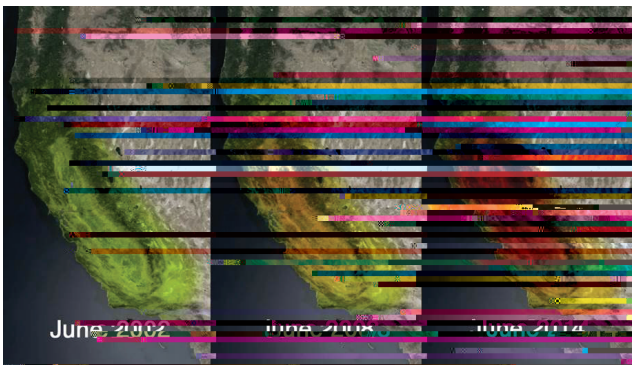
17 Enough Resources for All?

INVESTIGATION

HUMANS USE MANY natural resources. In the last activity, you learned about resources that are nonrenewable. They are limited because they form over geological time. Some examples include petroleum, metal ores such as copper, and granite. The geological processes that formed nonrenewable resources are still occurring. But it will take too long for new resources to form for them to be of use to humans in our lifetimes.

Some natural resources are **renewable**. They can be replaced as quickly as they are used by human populations. You learned about one such resource in the "Investigating Groundwater" activity. Groundwater stored in aquifers is essential to humans. Roughly 23% of freshwater used across the United States comes from groundwater. The rest comes from surface water sources. Groundwater is critical in places that lack enough surface water to meet the local population's needs. In 2010, Americans withdrew 76 billion gallons of groundwater per day. This groundwater was used for a variety of purposes, such as household water for drinking and cooking, irrigation for crops, and manufacturing.

But, even the supplies of renewable resources are not limitless. In this activity, you will explore how groundwater is used and replenished. And you will think about how the rapid growth in human population may affect access to groundwater in the future.



GUIDING QUESTION

How can monitoring natural resources help guide decisions about their use?

MATERIALS

- 1 plastic cup
- 28 blue game tokens
- 2 red game tokens
- 1 set of Aquifer Inputs and Outputs Cards
- 1 Student Sheet 17.1, "Aquifer Inputs and Outputs"
- 1 Student Sheet 17.2, "Graph of Groundwater Level in Our Aquifer"

- 1 piece of graph paper
- 1 clear metric ruler

PROCEDURE

Part A: Aquifer Inputs and Outputs

1. Place 20 blue tokens in your cup. In this model, the cup represents your community aquifer, and the tokens represent the groundwater in your aquifer. Leave the extra tokens on your table.
2. Shuffle the Aquifer Inputs and Outputs Cards, and place them face down on your table.
3. With your group of four students, use the model to learn about aquifer inputs and outputs.
   a. Decide which group member will complete each part of the model.
      - Person #1: Take one Aquifer Inputs and Outputs Card from the pile, and read all of the text on the card to your group. Each card has information about something that happened that month in your aquifer.
      - Person #2: Remove or add tokens to the aquifer cup based on the directions on the Aquifer Inputs and Outputs Card.
      - Person #3: Record what happened in the aquifer as described on the card on Student Sheet 17.1, "Aquifer Inputs and Outputs." If you removed water tokens from your aquifer, record it in the Outputs column. If you added water tokens to your aquifer, record it in the Inputs column.
      - Person #4: Count the number of tokens in your aquifer after adding or removing tokens. Plot the token or "water" level on Student Sheet 17.2, "Graph of Groundwater Level in Our Aquifer."

b. If you get a card that asks you to remove more chips than you have, remove all of your chips. Plot this point on your graph as zero. Your aquifer was empty, and your community was forced to buy water from another source.

c. Your aquifer can hold only 28 tokens. If you get a card asking you to add more tokens than will fit in your aquifer model, add tokens until you have 28, and do not use the remaining

10. Create a line graph for your data.

Depth to Groundwater Level by Year in Santa Barbara County, CA

LOCATION: SANTA BARBARA COUNTY, CA	YEAR									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Depth To Groundwater Level (Meters Below Land Surface)	94	95	95	95	94	95	96	98	99	100

Depth to Groundwater Level by Year in Imperial County, CA

LOCATION: IMPERIAL COUNTY, CA	YEAR									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Depth To Groundwater Level (Meters Below Land Surface)	45	44	44	43	42					

ANALYSIS

impacts? What is already being done, and what more can be done? Visit the *SEPUP Third Edition Geological Processes* page of the SEPUP website at *www.sepuplhs.org/middle/third-edition* for links to help you begin your research.