Karst, Sinkholes, and Human Activity

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Scientists, engineers, and others create geologic maps to determine the best places for people to settle, build, farm, and use land in a variety of ways. They also use geologic maps to monitor the ways that human activity might be changing the land itself over time.

As the Geologic Map of Karst in the Contiguous United States shows, much of the United States is covered by karst — a type of landscape where water dissolves rocks such as limestone, gypsum, and dolomite to form features like caves, disappearing streams, and sinkholes. About a quarter of people worldwide reside on karst or get their water from a karst aquifer.

An aquifer is an underground layer of rock and other earth materials that holds water like a sponge. These materials are permeable, meaning that liquids or gases can pass through them. People can draw groundwater from an aquifer using a well. They can then use this water for purposes such as agriculture, industry, or, once it is properly treated, drinking.

Why do karst landscapes frequently contain sinkholes, depressions in the earth's surface caused by a collapse of earth materials below? What do sinkholes mean for people who plan to build, work, and live in such areas? In this activity, you will examine geologic maps — and other maps — to consider the relationship between karst and human activity.

Materials

- 8-oz. foam cup
- 2-liter soda bottle
- 8-1/2" x 11" sheet of white paper
- Scissors
- Scouring pad or thin sponge
- Sand
- Sugar
- Computer with internet access
- Geologic Map of Karst in the Contiguous United States (Weary and Doctor, 2014)
- Florida Population Density Map
- Sinkhole Map of West Central Florida

Learning Activity Procedure

1. To understand how a sinkhole forms, make a model. Poke a hole about the width of your thumb in the bottom of your foam cup. Make a tube, about half the diameter of the cup, by rolling your sheet of paper and securing it with a paper clip or tape. Cut a circle the size of the cup bottom out of the scouring pad or sponge. Tuck this circle in the bottom of the cup.

2. a. Place the tube in the center of the cup so it rests on the sponge. b. Form a column of sugar by filling the tube with sugar. Then surround it with sand by pouring sand in the rest of the cup. c. Slowly pull the paper tube up out of the cup and pour a thin layer of sand over the sugar.

3. Cut the bottom off your soda bottle so it is about the same height as the foam cup. Fill the dish about one-third full of water. Place the foam cup in the dish of water. Watch as the water — your "groundwater" — seeps into the cup, and the sugar dissolves and seeps out. The process may be sped up by lifting the cup out of the dish, allowing sugary water to drain out the bottom of the cup.

4. Do you see a “sinkhole” forming in the surface sand over the area where the sugar dissolved? Why does a sinkhole form only over the sugar deposit? What type of rock might the sugar represent? What does the water in the dish stand for?

5. Now look at the map of Florida, where most freshwater is sourced from karst aquifers. Notice the rectangle highlighting a concentration of blue, which represents population density, along the western coast of the state. Clearly, many people have settled here, in the Gulf Coast regions in and around the city of Tampa.

6. Next, consider the geologic map of Tampa. The broad bands of color show the distribution of karst landscapes based on the types and thickness of sediments covering soluble limestone. The orange dots represent sinkholes. Look closely at the map key. Where are most sinkholes found? What type of sediment cover is associated with cover-collapse sinkholes? (To learn more about sinkholes, see https://water.usgs.gov/edu/sinkholes.html.)

7. Why do you think so many people have settled in and around Tampa? How is the availability of groundwater from a karst aquifer useful to people in a variety of ways? How might an aquifer be affected by a high or low rate of rainfall? How might it be affected by a large population drawing on that groundwater? What might be suggested by such a concentration of sinkholes?

8. Now that you have explored Florida, consider your home town or state. Visit the website of your state geological survey or state geologist (http://www.stategeologists.org/) and the National Geologic Map Database (http://ngmdb.usgs.gov/). Find a geological map for your area. What patterns do you notice? Where is karst? Where is water? Where are the population centers? What important decisions might your community face in the future?
