



Edible Aquifers Activity Steps

1. Review what groundwater is, the geology of groundwater hydrologic systems, and groundwater hydrology (percolation, recharge, uptake, pollution)
2. Add rock layer to your aquifer model. Fill cup ~ 1/3 full with your rock layer: chocolate chips, gummy bears, fresh or dried fruits, nuts (use one or a combination)
3. Add clear soda (represents water), enough to rise a bit above the rock layer
4. Add ice cream (the confining layer): 1 scoop flattened to cover the aquifer you have just made
5. Add the crushed vanilla cookies, a sand layer:
6. Add crushed chocolate cookies, coconut, sprinkles; a top soil layer:
7. Pour clear soda onto the soil (precipitation) & observe water percolation through the system. You are recharging your aquifer.
8. Insert a well into the aquifer (straw) & begin to pump the well & uptake water (drink!). Observe the impacts of water uptake without recharge. Watch the decline in the water table.
9. Add pollutants to the top soil (food coloring, concentrated juice, or colored soda). Watch the pollutant percolate into your groundwater system.
10. Recharge the aquifer by adding more soda (precipitation; rain shower). Watch what happens to the pollutants (they will percolate into the aquifer).
11. Pump your well again and watch how and where the pollutants travel.
12. Review what you have learned as you enjoy eating your edible aquifer.

Safety

Check with your students before conducting the activity to see if anyone is diabetic, lactose intolerant, or allergic to any of the ingredients. Make substitutions if needed.

Activity Source

“Edible Aquifers” was adapted from “Edible Earth Parfaits”, published by The Groundwater Foundation, 2010. www.groundwater.org/kc/activity5.

Edible Aquifers

Objectives

To teach about the geologic components of an aquifer, the process of aquifer recharge, how pollution can get into groundwater, and how pumping from a well can cause a decline in the water table (if recharge does not equal or exceed water extraction).

You will build your own aquifer model, learn about confining layers, water tables, contamination, and water use and recharge.

Background (*sources: NOAA & wordiQ.com*)

Groundwater is any water found below the land surface. It is found as soil moisture, in *aquifers* in the pore spaces of rocks, in unconsolidated sediments, and as permafrost. Groundwater flows to the surface naturally at springs; spring seeps can form oases or swamps. A *spring* is a place where an underground stream flows out of the ground. Springs form where the *water table* meets the surface.

Groundwater may also be tapped artificially by the digging of wells. The study of the distribution and behavior of groundwater is *hydrogeology*.

Groundwater is a long-term 'reservoir' of the natural water cycle as opposed to short-term water reservoirs like the atmosphere and fresh surface water. It is naturally replenished from above when surface water from precipitation, streams, and rivers *infiltrates* into the ground.

Groundwater is often contained in aquifers, which are subterranean areas (or layers) of permeable material that channel the groundwater's flow. Aquifers can be *confined* or *unconfined*. If a confined aquifer follows a downward grade from a *recharge zone*, groundwater can become pressurized as it flows. This can create artesian wells that flow freely without the need of a pump. The top of the upper *unconfined aquifer* is called the water table, where water pressure is equal to atmospheric pressure.

The region between the land surface and the water table is called the unsaturated zone. Within the unsaturated zone water is held to soil particles by *adhesion* (molecular attraction between unlike molecules) and in pore spaces by *capillary action* (molecular attraction between molecules of water). Capillary action is the ability of a narrow tube to draw a liquid upwards against the force of gravity. It occurs when the adhesive intermolecular forces between the liquid and a solid are stronger than the cohesive intermolecular forces within the liquid.

Scientific Terms

Aquifer: a water-bearing layer of soil, sand, gravel, or rock that will yield usable quantities of water to a well

Confining layer: a layer of geologic material which hampers the movement of water into and out of an aquifer

Groundwater: Groundwater is water that comes from the ground. Groundwater exists in the pore spaces of soil and rock, and in rock fractures beneath the Earth's surface.

Infiltration: The movement of water from the ground surface into the soil.

Percolation: The movement of water past the soil and through permeable rock into the groundwater.

Recharge: Recharge is the process by which ground water is replenished.

Uptake: Uptake is the removal of water the soil (mostly through plant water uptake) and from the groundwater system (usually by wells).

Water table: The water table is the underground surface below which the ground is wholly saturated with water. The **water table** is the upper limit of abundant groundwater. Above the water table the interstices (spaces) between particles of earth are filled by air, or by air and water. Below it, every available space is saturated with water. A large amount of water within a body of sand or rock below the water table is called an aquifer.

The practice of drilling wells to extract groundwater is dependent on understanding the water table. Because wells must reach the water table, the water table depth determines the minimum depth of a viable well, and thus the feasibility of drilling it.

Age Range

4th grade through adult

Activity Duration

20-30 minutes

Materials Needed (what each component represents is *italicized* in parentheses)

- ❖ 10 oz or 12 oz clear plastic cups
- ❖ Plastic spoons
- ❖ Table cloth (for easy clean up)
- ❖ Napkins
- ❖ Clear straws (*wells*)
- ❖ Vanilla ice cream (1 quart/~8 aquifers; *confining layer*)
- ❖ Clear non-colored soda (*unpolluted groundwater*)
- ❖ Colored soda, concentrated juice, or food coloring (*pollution*) (colored soda options: root beer, strawberry, orange, grape, cranberry ginger ale)
- ❖ Blueberries or chopped fruit (*gravel, large rocks*)
- ❖ Gummy bears, Small jelly beans or other small candies (*gravel, large rocks*)
- ❖ Chocolate chips (*gravel, large rocks*)
- ❖ Walnuts, almonds, or other nuts (*gravel, large rocks*)
- ❖ Unsweetened coconut (*soil, sand*)
- ❖ Sprinkles, a variety (*soil*)
- ❖ Crushed chocolate cookies (such as Oreos; *top soil*)
- ❖ Crushed vanilla cookies (*sand; sandy soil*)