ALABAMA COOPERATIVE Extension SYSTEM

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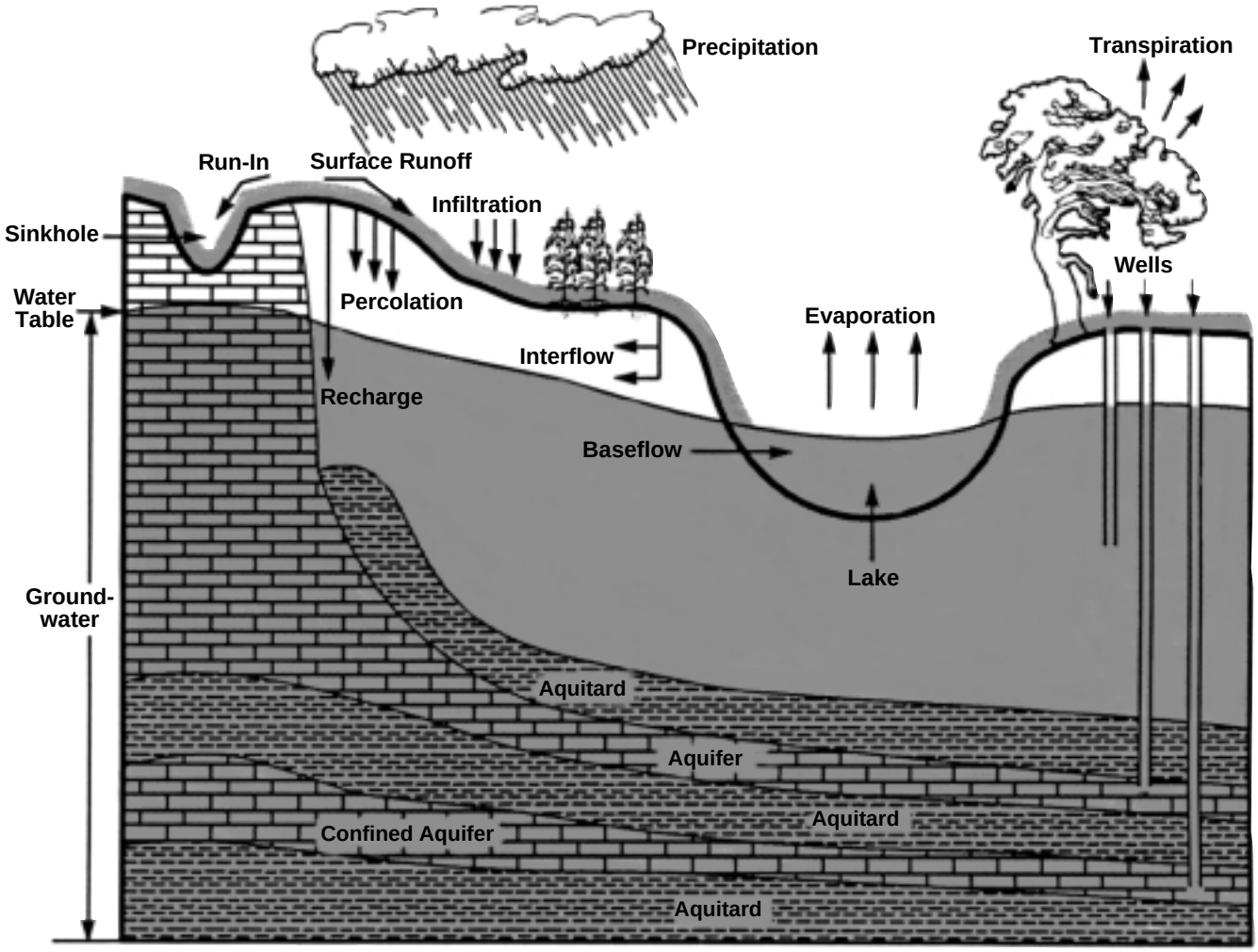
ALABAMA A&M AND AUBURN UNIVERSITIES

Getting To Know Water

How Nature Recycles And Purifies Water: The Hydrologic Cycle

Water is a natural resource that is continuously renewed as illustrated in the hydrologic or water cycle shown below. In this process water is in constant motion cycling from ocean to sky to earth. The cycle is powered by solar energy and gravity. This process could be called the earth's water circulation system.

Water supply is regulated by the hydrologic cycle. Local occurrence, quantity, and quality can be modified to some degree, but water is not destroyed by human activity. The total amount of water on earth has remained constant for millions of years.



Precipitation is one of the most familiar parts of the hydrologic cycle. Precipitation that falls on the land surface enters into many pathways of the hydrologic cycle.

When precipitation builds up on the soil surface, **surface runoff** occurs. This water moves by **overland flow** into a stream channel or other body of water. The sun warms the water surface thus changing water into vapor, a process known as **evaporation.**

Evaporation is not restricted to streams, lakes, or oceans. Water intercepted by the leaves of plants or held in the upper layers of soil can also evaporate into the atmosphere. In the air this water vapor condenses to form clouds which eventually release their moisture in the form of precipitation. And thus, the water-cycle repeats itself.

When precipitation falls on a porous soil surface, some of the water will seep into the ground by a process called **infiltration.** Some water clings to soil particles and is drawn into the roots of growing plants. It is transported to leaves where it is lost to the atmosphere as vapor. This process is called **transpiration.**

Another portion of water that enters the soil can move either vertically or laterally through the soil. Significant lateral movement of water through soil is called **throughflow** or **interflow.** Downward movement of water through the soil is called **percolation.**

Percolating water eventually makes its way to a **saturated zone,** where all spaces between rock and soil are filled with water. The top of the saturated zone is the **water table.** The water filling the spaces between soil particles and rock in the saturated zone is called **groundwater.**

Groundwater can be stored in two types of geologic regions: **aquifers** or **aquitards.** If water can permeate or move through the geologic material the region is called an aquifer. If water *cannot* move through the material the region is an aquitard.

Aquifers and aquitards vary in their occurrence, thickness, continuity, and depth. A **confined aquifer** is bounded on the top and bottom by aquitards. In contrast, **unconfined aquifers** are overlaid by permeable layers and are generally found close to the land surface.

Groundwater flows through rock and soil layers of the earth until it discharges as a spring or seep into a stream, lake, or ocean. The groundwater contribution to a stream is called **baseflow,** while the total flow in a stream is called **runoff.**

The water that has moved through the soil is once again warmed by the sun, changed into water vapor, becomes a cloud, and falls to the earth as precipitation. The cycle is completed again.

Natural Purification

As water moves through the hydrologic cycle it tends to be purified. Many separate processes contribute to this purification.

Distillation. On evaporation, the salts of the sea are left behind. This world-wide distillation process results in rain water containing only traces of non-volatile impurities, along with gases dissolved from the air.

Crystallization of ice from ocean water results in relatively pure water in the form of icebergs.

Aeration of surface water that trickles over rocks allows volatile impurities, previously dissolved from mineral deposits or other sources, to be released into the air. Aeration also promotes rapid growth of microscopic plant and animal organisms that use certain water contaminants for food and energy.

Sedimentation. Solid particles are removed in slow-moving streams and lakes.

Filtration. When water moves through sand, suspended matter such as silt and clay is removed.

Oxidation. Through a complicated series of steps, all naturally occurring organic matter—plant and animal tissues, as well as their waste products—is changed in water to simple molecules common to the environment.

Dilution. Dilution with relatively pure water can reduce the concentration of most pollutants to harmless levels.

Conclusion

Three key points should become clear after this brief discussion of the hydrologic cycle. First, nature controls the movement of water on earth; there is little we can do to alter the hydrologic cycle. Second, the portion of precipitation that either flows off the earth's surface or enters it to eventually become groundwater is variable. These two statements lead to a third: As water moves over and through the earth's surface, it can transport some of the things we place in or on the soil as well as materials that occur there naturally.

Important Terms

In discussing the water cycle, we often have to use many scientific terms. All of the terms that appear below are discussed in the text and appear there in bold type. Many of the terms are illustrated in The Hydrologic Cycle.

Precipitation
Surface Runoff
Overland Flow
Evaporation
Infiltration

Transpiration
Throughflow
Interflow
Percolation
Saturated Zone
Water Table
Groundwater
Aquifer
Aquitard
Confined Aquifer
Unconfined Aquifer
Baseflow

References

Bicki, Thomas J. 1989. Water Quality And The Hydrologic Cycle. Land And Water Number 13. Illinois Cooperative Extension Service. University of Illinois at Urbana. Champaign, IL.

Fetter, C. W. 1988. Applied Hydrogeology. 2nd ed. Merrill Publishing Company. Columbus, OH.

Hermanson, Ronald E. 1991. Washington Groundwater: A Vital Resource. EB1622. Washington Cooperative Extension Service. Washington State University. Pullman, WA.

Magette, William L. 1990. Ground Water Protection: An Introduction. Water Resources 22. Maryland Cooperative Extension Service. The University of Maryland. College Park, MD.

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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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