UNIVERSITY OF ARKANSAS
DIVISION OF AGRICULTURE
PUBLIC POLICY Center

Arkansas Water Primer Series:

Water Basics

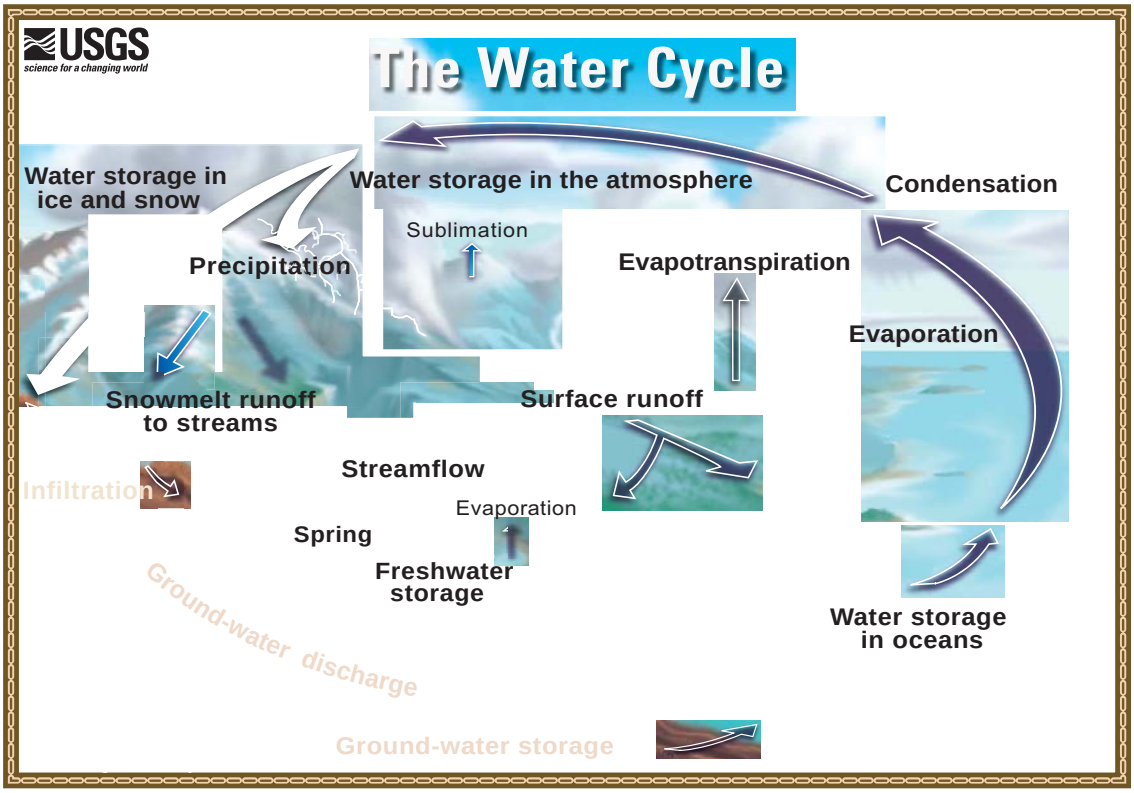
Introduction

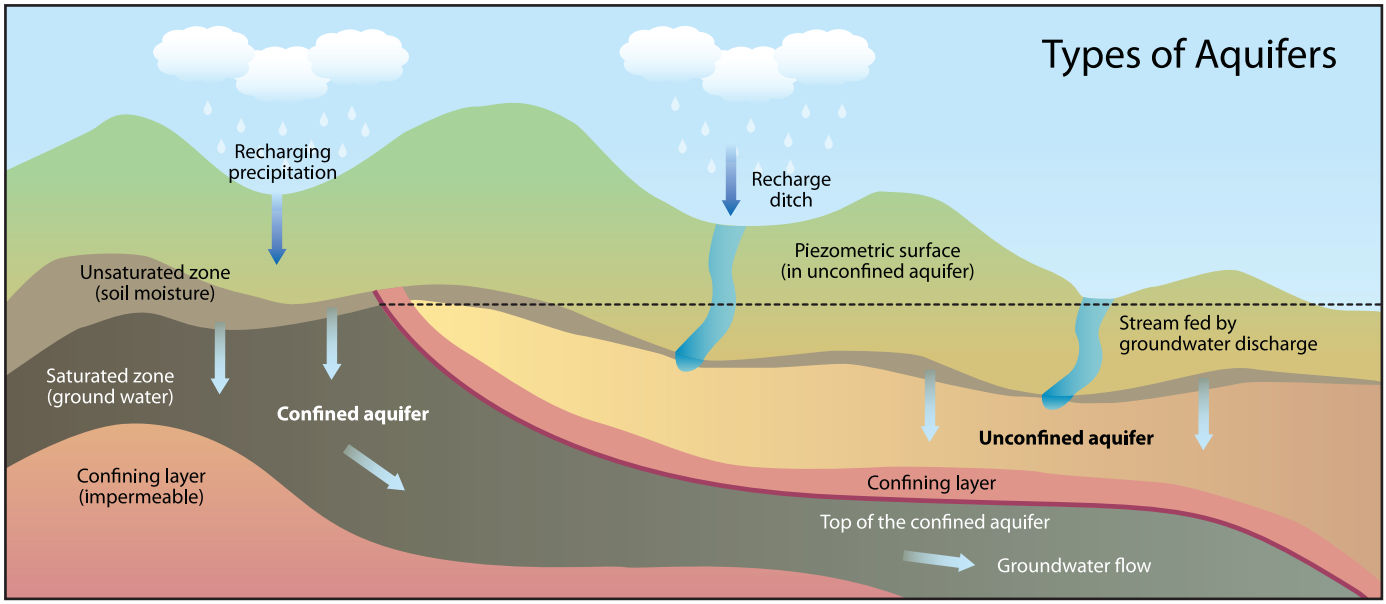
It is vital that citizens and policy makers understand the importance of water and how to ensure its use for future generations. Water is a finite, non-renewable resource. Although water covers approximately 75 percent of the Earth's surface, only 3 percent is fresh water that can be consumed and used. Of that, two-thirds is frozen in glaciers, polar ice caps and icebergs. The remaining 1 percent of the total world water supply is available as surface water or groundwater. An overview of water, where it comes from and how it's used is fundamental to understanding how and why water policies, laws and regulations have been established. It is also key to the development of proper water resource management tools.

The Hydrologic Cycle

The water we use today is the same water that has been used for millions of years. It is continuously circulating and being recycled through a process called the hydrologic cycle. There are five processes at work in the cycle:

- Evaporation from the Earth's surface and evapotranspiration from plants that introduce water into the atmosphere
- Condensation of water vapor
- Precipitation
- Infiltration – water that seeps into the ground and
- Runoff – water that ends up in waterbodies, including streams, rivers, lakes and oceans.





The hydrologic cycle controls the amount of water available for use and where. All of the processes influence water availability at a specific location at a particular point in time. The speed with which water moves among stages in the cycle and the amount of time it spends in storage at any stage affect water availability. Population increases, rising living standards and industrial and economic growth are contributing to an imbalance in the hydrologic cycle. Not only is the world using more water, it is discharging more wastewater. Urbanization and poor irrigation practices are also factors that influence the availability of usable water. All of these variables plus many more are negatively affecting the amount of usable surface and groundwater.

Understanding Groundwater

Groundwater originates as precipitation or as seepage from surface waterbodies. Where water infiltrates the ground, gravity pulls the water down through the pores until it reaches a depth where all of the spaces are filled with water. At this point, the soil or rock becomes saturated. The water level that results is called the water table. The water table is not always at the same depth below the land surface. During periods of high precipitation, the water table can rise. Conversely, during periods of low precipitation and high evapotranspiration, the water table can fall. The area below the water table is called the saturated zone. The water in the saturated zone is called groundwater. The area above the water table is the unsaturated zone.

Groundwater is found in aquifers, which consist of soil or rock in the saturated zone that can yield significant amounts of water. In an "unconfined aquifer" the top of the aquifer is defined by the water table. "Confined aquifers" are bound on the top by impermeable material such as clay. Water in a confined aquifer is normally under pressure and can cause the water level in a well to rise above the water table. If the water rises above the ground surface, it is designated a flowing artesian well. A "perched water table" occurs when water is held up by a low permeability material and is separated from a second water table below by an unsaturated zone. In the saturated zone, groundwater flows through the pores of the soil or rock both laterally and vertically.

Water moving from an aquifer and entering a stream or lake is called groundwater discharge, whereas any water entering an aquifer is called recharge. In Arkansas, groundwater typically discharges from aquifers to replenish rivers, lakes or wetlands. An aquifer may receive recharge from these sources, an overlying aquifer or, more commonly, from precipitation followed by infiltration. The recharge zone is that area, either at the surface or below the ground, that provides water to an aquifer and may encompass most of a watershed.

The Importance of Groundwater

Groundwater is an important resource. It replenishes Arkansas' streams, rivers and habitat. It is also an important source of fresh water for drinking,

irrigation and industry. Approximately 9 out of 10 public water systems use wells to tap groundwater. Arkansas is the fourth-largest user of groundwater in the U.S., behind only California, Texas and Nebraska in total groundwater withdrawal, according to 2000 U.S. Geological Survey data. This is a significant statistic considering Texas and California are the country's two most populous states.

In Arkansas, 94 percent of groundwater withdrawals are used for irrigation. A majority of the groundwater consumption in Arkansas comes from two major aquifers – the Mississippi River Valley alluvial aquifer (the Alluvial Aquifer) and the Sparta-Memphis Aquifer. The Alluvial Aquifer is the most productive aquifer within Arkansas. It provides most of Arkansas' groundwater used for irrigation and fish farming; the Sparta-Memphis Aquifer provides most of the groundwater for industry and public supply.

Understanding Surface Water

The average American uses 100 gallons of water each day.

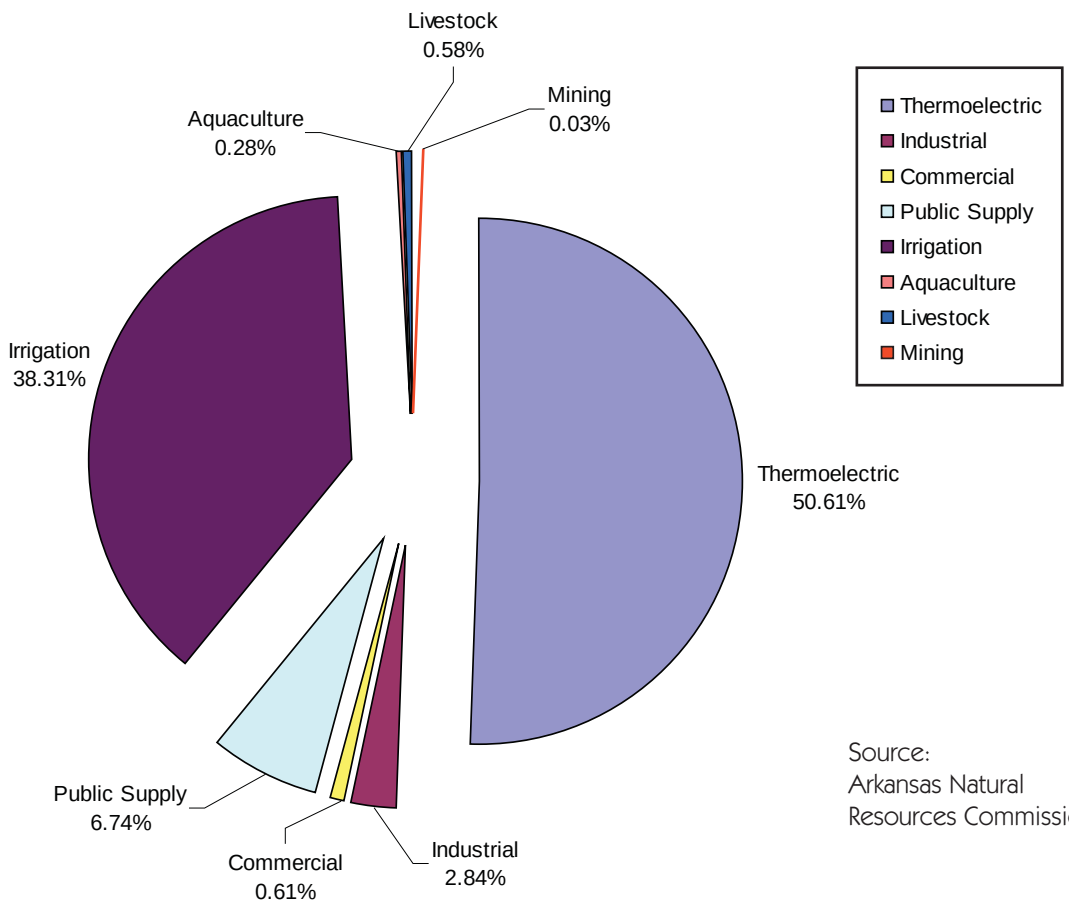
It takes 1,303 gallons of water to produce a single hamburger.

What is poured on the ground today can end up in the drinking supply many years later.

Sources: U.S. Geological Survey, U.S. Environmental Protection Agency

Surface water is the most visible part of the hydrologic cycle. It refers to bodies of water above the ground such as streams, rivers, lakes and reservoirs. Surface water is naturally replenished by precipitation. Approximately 30 percent of surface water comes from groundwater percolating up to the top. Surface water is lost through discharge to the oceans, evaporation, evapotranspiration and subsurface seepage. Groundwater and surface water are not isolated components of the hydrologic cycle. They

Surface Water Use by Category for Arkansas (2005)



Source:
Arkansas Natural Resources Commission

interact in a range of topographic, geologic and climatic landscapes. For example, a stream in a wet climate might receive groundwater inflow, but a stream in an identical physiographic setting in an arid climate might lose water to groundwater.

The Importance of Surface Water

Surface water is the largest source of fresh water. Streams and reservoirs supply approximately 50 percent of the nation's drinking water, primarily in urban areas. Streams, reservoirs, lakes and downstream estuaries are also vital aquatic ecosystems that provide important environmental and economic benefits. Approximately half a million acres of the state are covered by natural and man-made surface lakes. Thermoelectric power generation and irrigation of agricultural crops consume the largest amounts of Arkansas' surface water. Almost four billion gallons of surface water are used in Arkansas daily. The larger population centers in the Arkansas Valley and the Ouachita Mountains account for a significant percentage. In these areas, shallow groundwater is often too poor in quality for household use. The ridge and valley-type topography of the region is well suited for constructing dams to provide reliable supplies of potable water for local communities.

*A **drainage basin** is a geographical area which contributes surface water runoff to a particular point. There are five major drainage basins within Arkansas. The principal rivers in these drainage basins are:*

- *Mississippi – St. Francis*
- *White – Cache*
- *Arkansas*
- *Ouachita and*
- *Red.*

Additional Resource

Fact Sheet 109 (FSPPC109) – *Glossary of Water-Related Terms* – contains a comprehensive list of terms used in the Arkansas Water Primer Fact Sheet Series.

The University of Arkansas Division of Agriculture's Public Policy Center provides timely, credible, unbiased research, analyses and education on current and emerging public issues.

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