Understanding Aquifers: What They Are and What They Are Not

First, a disclaimer. I am not trained in geology, hydrology or any related field. I am certainly not an “expert” in these fields, so what I say below is likely to be an oversimplification. But I know many people are interested in our aquifers and may also have some misconceptions about them. Hopefully, I can shed some light on the subject.

First, I think a very common misconception is that an aquifer is a large underground “lake” or an underground cavern filled with water. Another common misconception is that the water in an aquifer is separate from and/or different from the water in our creeks, rivers and lakes.

My dictionary defines an aquifer as “a water-bearing stratum of permeable rock, sand or gravel”. I think the best way to envision an aquifer is to think about filling a water glass to the top with sand, so that the glass is “full” of sand. But you can still pour some water into the glass, slowly, and you won’t displace the sand. You can see the level of the water in the glass, and you will eventually fill it up with water also. Even though the sand had “filled” the glass, there was still room to add water to the glass—the water was simply filling the spaces between the sand grains; the spaces usually referred to as “pores”.

Some aquifers are actually strata of unconsolidated sand or gravel, although many, if not most, are in fact rock. Sandstone rock is, in its simplest form, just sand grains stuck together to form a rock. Many other types of rock, including limestone, which would look to us to be a “solid” rock, do indeed have pores that can hold water.

In order to be a significant aquifer, the formation has to have three important properties: 1: sufficient pores to hold a useful amount of water, 2: the pores have to be connected together enough to allow for the flow of water (something that is referred to a “permeability”), and 3: the formation has to be above a layer of rock that is not permeable.

If the pore space is too small, referred to as a low-porosity formation, then it can’t hold enough water to be useful to humans. If the permeability of the formation is so low that water will not flow from the rock into a well-bore, then it can’t support a useful water-well. (Historically, in the oil field, low permeability formations are made useful by fracking.) Finally, if there is no low-permeability formation below the strata in question, then water will not accumulate in that strata but will simply seep deeper underground—something has to “confine” the water in a permeable formation to keep it in place.

Those of us who live in the San Antonio TV coverage area are accustomed to hearing about the Edwards aquifer and its state of recharge or depletion. The Edwards is an unusual aquifer in that it actually has places where the water resides in pools or “lakes”

or large cracks and holes in the limestone, and in addition, there are places on the surface where during heavy rainstorm events, rainwater can actually flow directly from the surface down into the aquifer. These characteristics make the Edwards unusually easy to be recharged by rainstorm events and for the water to easily flow through the highly permeable formation. But even the Edwards is not a giant cavern full of water covering many miles.

In our area, underneath the Edwards in many places lies one or more aquifers often referred to as the trinity. These aquifers are much slower to display any recharge reaction to a rainstorm event. Like many other aquifers around the country, exactly where and how they are recharged is not as clear, but it probably involves either water seeping into the ground and down through many layers of soil and rock, or possibly in places where the formation is close to the surface, it is recharged from creeks or streams.

Up in the panhandle where I grew up, we have the famed Ogallala aquifer, a giant sandstone aquifer stretching to Nebraska, and which is being seriously depleted by years of use.

Water from both the Edwards and the other aquifers may in places provide the springs that feed our creeks and rivers, and in other places water from the creeks and rivers may help recharge the aquifers. And we don't always know where all of those places are. It is all the same water, it just resides in different places at different times and in time it will all flow downhill to the ocean, evaporate and start the process all over again.

Until next time…

Jim Stanley is a Texas Master Naturalist and the author of the books "Hill Country Ecology," "Hill Country Landowner's Guide" and "A Beginner's Handbook for Rural Texas Landowners." He can be reached at jstmn@ktc.com. Previous columns can be seen at www.hillcountrynaturalist.org , or at Riverside Nature Center at https://riversidenaturecenter.org/past-blogs-from-a-friend/