The Karst of SW and NW Illinois: A Tale of Two Aquifers

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Our research efforts on the karst of the Midwestern US began in 1990 when we examined water quality problems associated with cover-collapse sinkhole in the sinkhole plain of southwestern Illinois. We found that private septic systems were ineffective in treating sewage (based on state regulations), and were often discharging into sinkholes and, as such, directly into the karst aquifers. Agricultural chemicals (nitrate and pesticides) were a major contributor to groundwater contamination, as well. Because of the highly susceptible nature of karst aquifer, we created state-wide maps of the karst regions of Illinois based on the distribution of closed depressions on USGS topographic maps, aerial photographs, and the occurrence of shallow (< 15 m overburden) carbonate bedrock. Recently available Lidar elevation data have allowed us to better identify sinkholes even through thick tree canopies. Hillshade models allowed us to observe variations in the size, shape and distribution of cover-collapse sinkholes and proposed a new theory on sinkhole evolution within groundwater basins. Currently, we are using the Lidar Hillshade models to create a karst database by digitizing all of the sinkholes in the state of Illinois.

In 2007, a large confined animal feeding operation (CAFO) was proposed for Jo Daviess County in northwestern Illinois which is part of the Driftless Area. In spite of the area being mapped as karst in our mid-1990s work, the dairy owners found geologic consultants to state that the areas was not karst. A grassroots group was formed to fight the CAFO and the Illinois State Attorney General requested additional field work in the area by the ISGS. Following about a year of field work, a locally-contentious court case between the grassroots group and the dairy ensued. Eventually, the U.S. Environmental Protection Agency got involved and the dairy owners decided to cut their losses and move their operation to a karst area in Wisconsin. Our work continues in this area in concert with the League of Women Voters of Jo Daviess County.

The work we have conducted on the karst areas of the state has allowed us to make comparisons based on differences in the geology of the areas. It is well known that the fractures, crevices, conduits, and caves within carbonate bedrock make up the porosity of the karst aquifers. In the course of our work, we observed large differences in the degree of dissolution along bedrock fractures in Illinois’ karst areas, and the size, quantity and distribution of cover-collapse sinkholes. Two extreme examples of secondary bedrock porosity include southwestern Illinois’ sinkhole plain and northwestern Illinois’ Driftless Area. The karst of southwestern Illinois, dominated by Mississippian limestone, is dramatic in that it is an area of wide crevices, long caves and abundant, large-diameter sinkholes. The karst of northwestern Illinois, dominated by fractured dolomite, is more diverse with large crevices, relatively large sinkholes, and tube-like caves in Silurian bedrock, and smaller crevices, much smaller sinkholes, and crevice caves in Ordovician dolomite. During the drought of 2012, croplines (formed by alfalfa, soy beans and corn growing in thin soils) were found to be a reflection of the fractures and crevices of the underlying Ordovician bedrock and were mapped from aerial photography. Groundwater quality was similar in both karst areas and recent work revealed the presence of pharmaceutical and personal care products, and microplastics in the aquifers of both areas.