Why It Is Important to Study Water Flow in Karst in the Area of a Concentrated Animal Feeding Operation, Especially in the Buffalo National River Watershed

In karst lands, water from precipitation falls on the land and drains through the soil, creating a subterranean system of voids, mini-caves, and caves. These openings become preferred pathways for water, sediment, and waste to flow downstream to springs, creeks, and the main hydrologic drain, the Buffalo River. Karst water flow is very fast, and essentially no filtration or attenuation of contaminants from the water occurs. Because most of these pathways are not visible from land surface, we use non-toxic tracers to determine where they flow. In the case of our Buffalo River studies, these tracers are dyes. They are the accepted scientific method of flow determination, and they provide an unequivocal fingerprint that flow occurred from where it was put in to where it comes out. This method has been used in thousands of cases worldwide, and has served as the basis of resolving source of contamination issues wherever there is karst.

The unique situation of the Buffalo National River and the principle of allowing concentrated animal feeding operations (CAFOs) in its watershed includes these considerations: 1) much of the watershed (>60%) is on karst; 2) CAFOs create huge amounts of highly concentrated waste; 3) this waste is essentially untreated, and has been proven to cause public-health problems from tainted water quality in hundreds of cases throughout the U.S. and the world; 4) the vulnerability of these types of fast-flow, underground drainage basins require a thorough study of the groundwater flow and the karst conditions in the area prior to a major change of land use in the area, something that our current regulations do not ask for, or even mention; 5) the small farms and private landowners downstream utilize springs and groundwater for multiple uses, including drinking water supplies, and the closer they are to the CAFO on karst, the greater the risk; 6) the Buffalo National River is one of the high primary-contact streams in the state and the region, which means swimming, canoeing, fishing, and other water activities bring our citizens and our tourists into direct contact with this water, thereby putting them at risk if contamination is escaping from CAFOs; and 7) the recent (12/02/14) legal decision by Judge D. Price Marshall, U.S. District Judge for the Eastern District of Arkansas, found that two "federal agencies arbitrarily and capriciously guaranteed loans to the C&H Hog Farm near the Buffalo National River by failing to take a hard look at environmental impacts and not following proper procedures to protect threatened and endangered species."

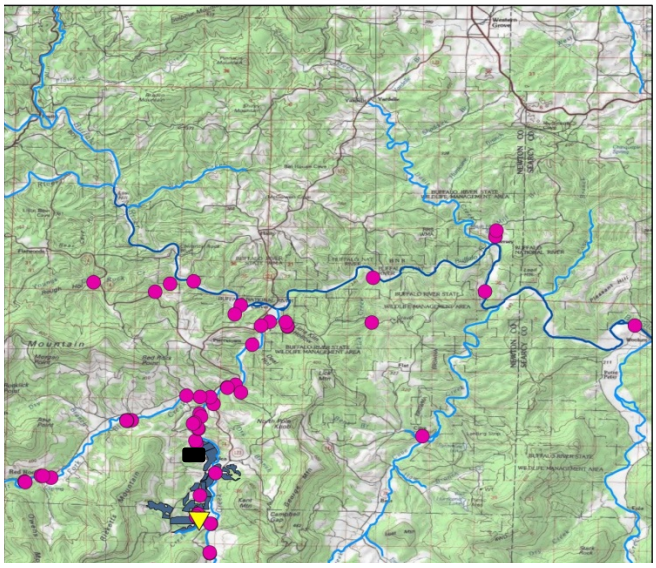

Figure 1. Dye-trace results, summer 2014. Yellow triangle is input well, blue shapes are pig waste spreading fields, black rectangle is CAFO. Pink circles are dye detects, 5 of which are in the Buffalo National River.

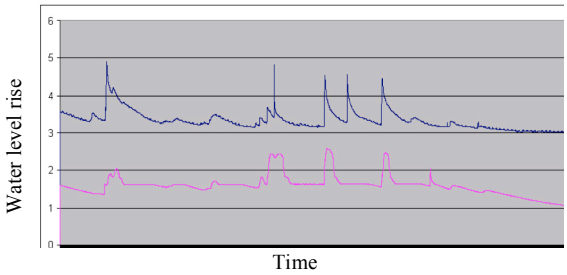

Figure 2. This shows the response of Big Creek, in blue, to water level in the input well in response to rain during the summer of 2014. The total time duration of the record is from May 5 through September 7. When it rained, shown by the spikes on the curves, the water that reached Big Creek within several hours of the rise in water level in the well. This indicates that the well is recharged rapidly, and allows us to conserve (expensive) dye by placing it in a known groundwater flow path rather than spreading it across the land surface.

Figure 3. Sinkhole in a tributary stream capturing all streamflow with dye upstream from spreading fields in Ozark National Forest. In karst, surface water and groundwater are one resource, going into sinkholes and coming out springs.

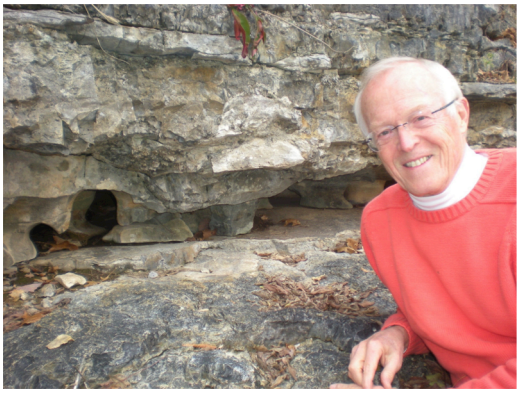

Figure 4. Many of the karst voids in the area underlain by the Boone Formation are in thin limestone between layers of chert (flint). They are interconnected voids that lead from input to output below land surface, and although they are not easily seen, they transmit water and contaminants rapidly without filtration.

Figure 5. Karst conduit in pure limestone showing stain from sediment and water that moved through this void previously. Because the water can move so fast in karst openings, there is little chance for contaminants to be filtered or attenuated.

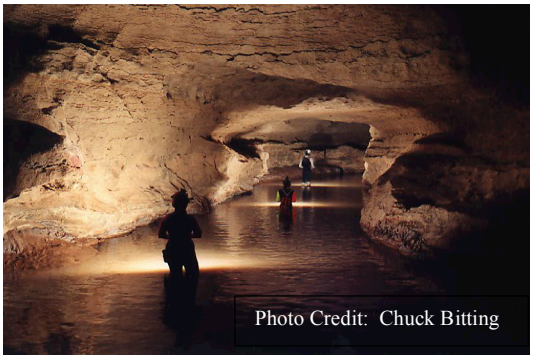

Figure 6. Some conduits in relatively thick, pure limestone are huge, and allow humans (and much water) to enter. The Buffalo National River has the largest concentration of caves in Arkansas. This cave is an example of how fully developed the karst is in this part of the Natural State.

Figure 7. Collapse of a water treatment lagoon in Texas, which was caused by the weight of the overlying water breaching the approximately 1 foot protective seal. Catastrophic collapses in karst are not uncommon.

It is very important that we, as citizens of the Natural State, call for karst science that is not diminished or vilified, speak out loudly to our friends, contact our legislators, and share this message with our entire community. Meaningful karst research is essential to protect this river. If you have questions, please contact me. Van

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Figure 8. This spliced together photo shows a pool in Big Creek which is used for swimming, baptisms, and fishing. The dark, near-horizontal lines are dissolved voids in the limestone identical to Figure 4. Vertical fractures allow water from above to enter the karst and exit through Big Creek.