IN PURSUIT OF LOSING STREAMS, CAVES AND SPRINGS

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Editor's note: The following essay is the sixth in a five-year series on water resources stewardship in the Cowpasture River Watershed, sponsored by the Cowpasture River Preservation Association and published by The Recorder. The goal of the series is to create awareness among students, citizens and officials of the critical need to protect our surface and ground-water resources, and to stimulate interest in progressive stewardship.

Like most people here in the Highlands of Virginia, I have several life-long interests. Native wildflowers, as an illustration, for many a spring and summer season have given me a special closeness with nature. But my true life-long passion, which many years ago brought me into this wonderful karst terrain, are the caves of Bath and Highland Counties and the Burnsville Cove. Within the Cowpasture River drainage there are over 450 known caves and surveys of cave passages now reach a total of 210 miles. I have walked, crawled and rappelled down pits through many of those miles. My passion for exploring, understanding and protecting caves brought me the honor of serving as the President of the Virginia Speleological Survey for 32 years and many years served on the Virginia Cave Board at the pleasure of several Virginia governors.

Something that is little understood, even among cavers, is the unusual nature of the Cowpasture River valley drainage that is unique in Virginia and for the entire United States! The following are a few descriptions of the outstanding geologic and hydrologic features that make this so. The field examinations, explorations of caves, and the fluorescent dye traces of underground streams took decades to accomplish and there is still much to do in this regard. Our watershed exhibits special characteristics because it was formed in three sedimentary layers of rock – sandstone, shale and limestone. The shale layer often acts as a barrier and traps water in limestone passageways or channels below. The sandstone helps to support and control the cave passages. All this provides the conditions for some of the most complex drainage systems in the country.

The sedimentary layers underlying our watershed were severely folded and faulted in the geologic past. Our Appalachian Mountains, once higher than the great Rocky Mountains, were continuously worn down by rain, freeze and thaw with the Cowpasture River and its predecessors carrying those sediments to the sea. During this long timeless process, limestone layers were being dissolved by slightly acidic waters that enlarged cracks into narrow fissures and then into cave passages. Today the Cowpasture River valley exhibits a karst topography that includes sinking and losing streams, blind valley (a valley with no exit for streams except underground routes), caves, cave streams, and springs. This raises some fascinating questions:

- Where does surface water go as it disappears into sinkholes, losing streams beds , and blind valleys ?
- What path does this water takes as it flows through fissures, cracks, and cave passages?
- Where do these underground streams reappear at the surface as springs?

Modern cave exploration uses many tools, including: cave surveys, geological maps, fluorescent dye traces, analysis of air flow patterns, and cave scuba diving. New geologic mapping in the Cowpasture drainage basin has provided the means to make better predictions about underground stream routes and their associated cave passages. Some of the artesian springs in the Bullpasture River Gorge have been explored in dives over 200 feet deep. Fluorescent dyes, detectable at levels as low as one half parts per billion are used to trace the ultimate destinations of losing streams like Dry Run and even the Cowpasture River itself. The analysis of the mineral content, electrical resistivity and sediment content of underground streams can help to determine the characteristics of karst waters and give us clues as to its origins.

Dry Run – Sinking streams are a defining characteristic of limestone or karst terrain and Dry Run is a good example, but with an unexpected twist and turn. Dry Run begins in the valley between Jack Mountain and Warm Springs Mountain. The headwaters of Dry Run is a small branch that flows off Jack Mountain and disappears into a sinkhole. It is then diverted to the southwest under the surface divide between Dry Run and Muddy Run. A fluorescent dye trace determined that the stream comes out at Muddy Run Spring which eventually flows into the Jackson River. So, in this instance the Jackson River drainage is diverting water (called pirating) from the Cowpasture River drainage and doing so in an underground channel that passes beneath the surface water divide. Further down the valley to the northeast, Dry Run becomes a stream again flowing east towards Burnsville where it narrowly misses flowing across the limestone so prevalent in that area. Had the course of Dry Run been a little further east, it would have been captured by the large sinkholes and blind valleys with numerous cave passages in the Burnsville area which would have directed its flow to the Bullpasture instead of the Cowpasture River.

Missing the limestone of the Burnsville area, Dry Run turns to the southeast down the valley between Tower Hill Mountain and Warm Springs Mountain becoming a beautiful mountain stream with a sizable flow, fast rapids and waterfalls. But as it flows east around the end of Tower Hill Mountain, Dry Run becomes a losing stream. Below the limestone cliffs of Chimney Rocks, Dry Run begins to find its way into underground channels. In drier weather all of the water sinks underground and leaves behind a dry rocky stream bed. During wetter weather the flow is large enough that not all of the stream is captured and what's left flows robustly down to the Cowpasture River. The underground route that Dry Run takes resurges at Bracey's Spring directly into the Cowpasture River at the base of a towering limestone cliff. But this spring is

several miles upstream from the confluence of the surface Dry Run and the Cowpasture River. Water, when given a chance, will always take a shortcut!

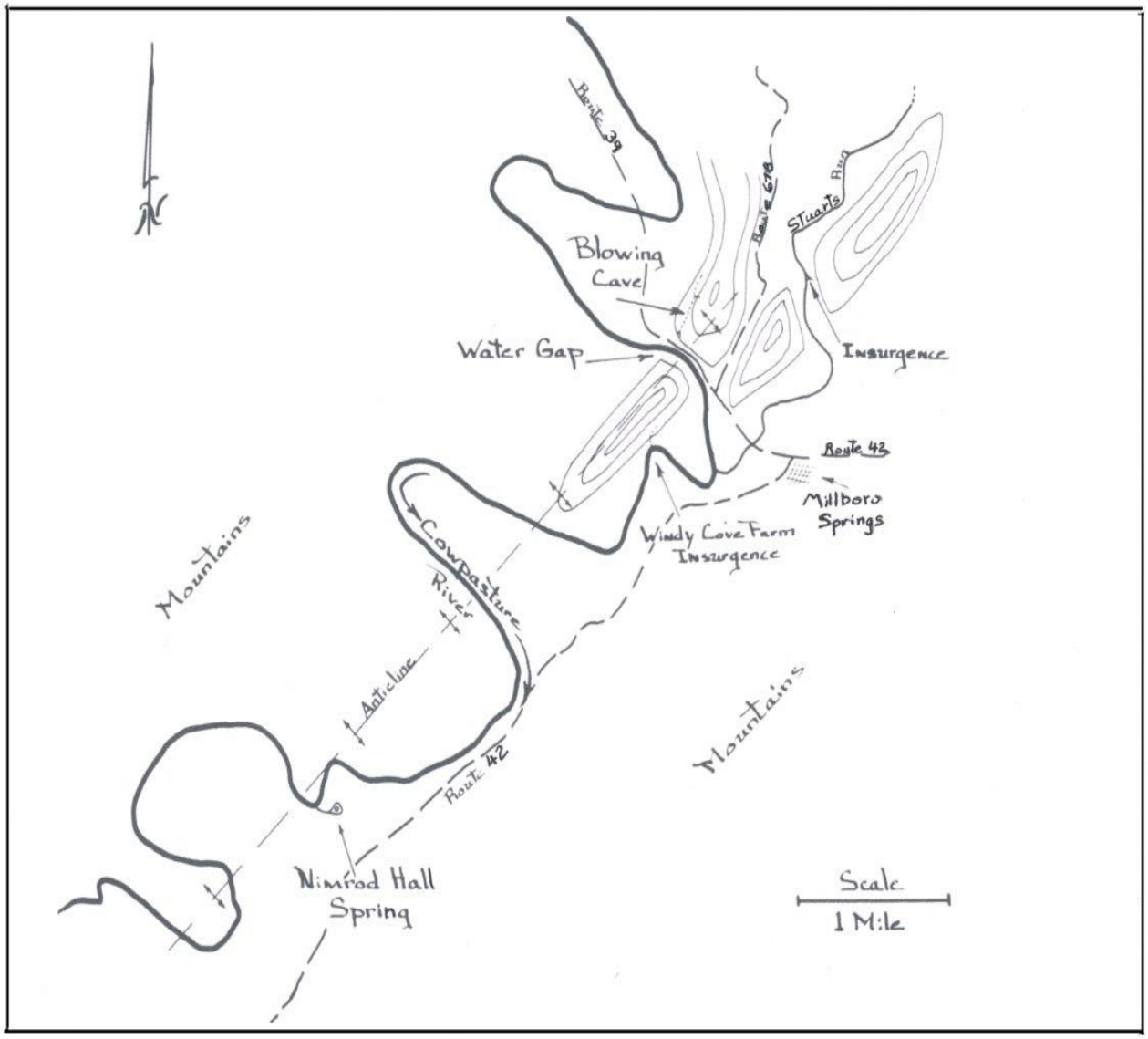
McClung Artesian Spring – If you were walking down a mountainside in a deep hollow and came upon a large spring, you might assume the spring flow came from higher up on the mountainside from the damp forest soils. But there is one spring on the flank of Bullpasture Mountain that gets its water from the adjacent Jack Mountain! It is named McClung Spring and has a large volume flow.

Some springs flow upward to the surface under pressure from rock channels deep below. They are called artesian springs. This artesian pressure is caused by the weight of water descending from higher elevations while being confined within rock channels that first descend and then ascend to a spring. The water in the higher channels pushes water through the flow route and up to the spring outlet. The unusual artesian McClung Spring is on the west flank of the Bullpasture Mountain, near the site of the pioneer Fort George. It comes from a sinking stream on the east flank of Jack Mountain. We know this because the sinking stream on Jack Mountain has been dye traced to the spring on the Bullpasture Mountain. The stream flows underground into a sinkhole into the limestone beds at an elevation more than 400 feet higher than the spring on the adjacent mountain. The down-sloping limestone beds pass deep beneath the Bullpasture River and then turn upward and reach the surface again on the west slope of Bullpasture Mountain. It is here that the spring flows into the stream bed of Mill Run. The spring is eighty feet higher in elevation than the Bullpasture River. Overlying shale beds act to seal off the underground stream keeping it to its underground channel below the valley floor and beneath the Bullpasture River. It is the difference in elevation between the sinking stream and the spring that creates the pressure (head) to push the spring water up from the depths. This is the only recorded instance in Virginia where an underground stream passes beneath a river with sufficient head to emerge 80 feet higher as a spring.

Blowing Cave and Nimrod Hall Springs – The most interesting aspects of karst springs in the Cowpasture River basin are the routes taken by underground streams. Thomas Jefferson, in his *Virginia Papers*, described a strong breeze blowing from the entrance of Blowing Cave located along the Cowpasture River at Windy Cove. Jefferson observed that the breeze blowing from the entrance was strong enough to keep weeds prostrate at a distance of 20 yards. Unfortunately this cave entrance no longer exists because of road construction. But the strong breeze is not the most significant feature of this cave. About 1800 feet from the entrance, a muddy cave passage opens along the ceiling of a large room. Thirty feet below in the bottom of the room flows a bold cave stream with a strong current. It flows from a sump which is a submerged cave passage. The source of this cave stream has never been determined. It can be followed downstream flowing in a northerly direction for about five hundred feet where another sump is reached. The cave was surveyed and produced a most surprising result. The calculations show the cave stream

to be 13 feet lower than the Cowpasture River flowing by the cave entrance. This is a very unusual situation. Normally the water table is level with the river . A cave passage lower than the river ought to be filled with water. But not so in this instance. That the cave stream flows northward and directly away from the Cowpasture River is also puzzling. When a fluorescent dye was placed in the cave stream, it was detected 3 days later, and 3 ½ miles to the south at Nimrod Hall Spring. This dye traces determined that the cave stream must double back on itself and then must also flow beneath four meanders of the Cowpasture River before resurging at Nimrod Hall. This is true because the underground cave stream flows southward through cave passages in the limestone beds contained within Windy Cove ridge (a geologic anticline). The valley floor has thick beds of shale that have no caves. In other words, the cave stream is trapped in the Windy Cove ridge while the Cowpasture River meanders down the wide valley on top of this shale formation. Later investigations showed Stuart Run, a surface stream flowing down the valley from Chestnut Ridge, also becomes a losing stream and its underground stream can be followed in a cave passage to a depth of 40 feet below river level. Dye traces show it also flows to Nimrod Hall Springs.

There is yet another chapter to this amazing hydrologic setting. About a quarter mile upriver from the site of old Camp Wallawhatoola, which was located on the west side of the river, is a stretch of river bank that is against the base of the Windy Cove ridge and here the limestone is briefly exposed to the river. A short distance above the river bank is the entrance to a small cave known as the Cave of the Wallawhatoola. I had heard rumors that part of the river could be heard pouring into this cave. I spoke with the owner of Nimrod Hall in 1971 who said when the springs volume diminished, it was routine to travel up river to this area and clean the leaves and debris from around the rocks along the river's edge below this cave. After clearing the debris, whirlpools would form along the river's edge as part of the river flowed underground and the Nimrod Hall Springs would regain it full flow rate. Interestingly, the pirated river water flows north after it enters the cave. The cave is on the west bank of the Cowpasture and the Nimrod Hall Springs are on the east bank. This means the underground flow of the river must pass beneath the river! In Virginia, this is the only known location where three underground streams each travel several times below meanders of a major river and then resurge as a major spring.



Coursey Springs – Perhaps the strangest conundrum of underground streams routes in Virginia is near the town of Williamsville where the underground Cowpasture River flows beneath the Bullpasture River. About four miles northeast of Williamsville, the Cowpasture River becomes a losing stream during dry periods. This underground Cowpasture River drainage has been dye traced for five miles to the south where it reemerges as Coursey Springs and where the Virginia Department of Game and Inland fisheries has a state-of-the art fish cultural center. Coursey Springs is one of the largest cold water springs in Virginia. This productive karst spring is an ideal water resource for the State's Fish Cultural Center because it delivers a huge volume of cool water appropriately cold for raising trout. The long distance the surface water travels underground has reduced its temperature to near the nominal temperature of the region (about 50 degrees).

The geologic structure here is similar to Windy Cove gap. The Cowpasture River becomes a losing stream when the river flows against the flank of the Bullpasture Mountain where there are limestone exposures. The river eventually loses its entire flow into the limestone channels beneath the surface river bed in this area. Four miles downstream, the Bullpasture River flows from the west through the Bullpasture Gorge and just east of Williamsville, flows for a half mile across thick beds of shale to its confluence with the Cowpasture River. Deep below and within limestone beds the underground Cowpasture River crosses perpendicularly beneath the Bullpasture River! In order for the underground Cowpasture River to rise at Coursey Springs, it must pass up from the limestone layers through a strata of sandstone and perhaps even through some shale. Because there is much folding and faulting in the geology of what we call the Valley and Ridge Province, it is likely that a sharp fold or a fault brings the limestone close enough to the surface to allow the Cowpasture River water and other ground water streams to resurge at Coursey Springs.

Karst springs are the final expression of the complex interrelationships between surface watersheds and ground water aquifers. Finding and understanding these relationships has been challenging and satisfying. And, not so incidentally, led to the discovery of many previously unknown caves.

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