Virginia Cave Owners'

NEWSLETTER April 2017

A Message From the Chair

Cave owners, conservation partners, and cave and karst enthusiasts:

We hope you enjoy this issue of the *Virginia Cave Owners' Newsletter* (VCON) focusing on karst springs. In this edition you will find several short pieces describing springs in the Commonwealth that will be open for tours during the upcoming **Virginia Cave Week**, April 16th–22nd, in addition to other cave and karst news of interest.

And please allow me to briefly introduce myself as the new Chair of the Virginia Cave Board. I have been serving on the Cave Board since first being appointed in January 2011. I have served as a member at large and as Vice Chair prior to my election as Chair in February 2017.

My background is in forestry and environmental science and I have been working for the better part of 18 years with The Nature Conservancy of Virginia. In my current position in southwest Virginia, I head up land protection efforts with many of our projects focused on the protection of cave and karst resources. As always, if you have any questions or concerns related to caves and karst in the Commonwealth, please don't hesitate to contact me or a Virginia Cave Board member in your area.

Steve Lindeman

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A publication of the Virginia Cave Board

Due to a generous grant from the *Cave Conservancy of the Virginias*, the Virginia Cave Board is pleased to continue offering a printed version of the *Virginia Cave Owners' Newsletter*. We hope you enjoy reading it. We'd love to hear from you regarding this issue and ideas for future issues.

For more information, please contact the Virginia Department of Conservation and Recreation, Division of Natural Heritage, 16th floor, 600 East Main Street, Richmond, VA 23219, or one of the members of the Virginia Cave Board: Ms. Michele Baird, Mr. Robert Denton, Dr. Daniel H. Doctor, Mr. David Ek , Mr. John Graves, Dr. John Haynes, Mr. Richard Lambert, Mr. Steve Lindeman, Ms. Marian McConnell, Ms. Janet Tinkham, and Ms. Meredith Weberg.

Let's Hear It for Virginia Cave Week!

Virginia Cave Week promotes an understanding of Virginia's caves and the surrounding limestone habitats known as karst. Sponsored by the Virginia Cave Board, the week highlights a specific theme related to caves and karst and provides resources and educational opportunities to engage the community in conservation efforts. Educators are encouraged to involve their students using in-class activities and visitation to the state's numerous commercial caves.

The Virginia Cave Week website (**www.vacaveweek.com**) is a resource for material related to cave and karst education. Check out the different tabs for information and links having to do with caves, karst-related education, classroom activities, virtual caves, and more. Enjoy.

Karst Springs!

Each year offers different areas of focus for Virginia Cave Week. Virginia Cave Week this year runs from April 16 through April 22. The theme for 2017 is **Karst Springs**.

A karst spring is a spring that is part of a karst system. A spring is a natural resurgence of groundwater, usually along a hillside or from a valley floor. Springs in karst areas differ from normal springs: they normally have a much higher production, as they are just the end of a water-filled cave system.

The goal is to increase understanding of karst springs and emphasize the important connection between karst systems and the springs that support surface aquatic systems and have provided much of Western Virginia's drinking water, both in the past and the present day.

In addition to learning about karst springs, visit the commercial caves throughout Virginia for an awesome underground experience and to pick up free brochures on bats, the Fragile Underground, National Speleological Society, and more.

Water Is Life

By Wil Orndorff, DCR Natural Heritage Program

Water is life, or so goes a proverb. When Europeans first arrived in the Americas over 500 years ago, they may have been in search of silver and gold, but it was a reliable supply of water that determined if and where they could stay. In the Appalachians, springs by far supplied the vast majority of water to the pioneers. Visit a colonial-era house in western Virginia and you will almost invariably find the spring responsible for its location. Early forts and blockhouses were commonly built around springs to secure water supplies in the event of a siege. Not only did springs provide water for drinking, but also for irrigation, manufacturing, and food processing. Mills throughout western Virginia were powered by spring runs flowing over water wheels, and spring ponds were the site of early aquaculture.

A spring is defined as a place where water flows from the ground. To many people, springs seem magical. But over the centuries man has come to realize that springs are simply a part of the natural hydrological cycle, and form in a variety of ways when precipitation finds its way underground and returns to the surface. Springs can be found flowing from the base of ancient landslides along mountainsides, at the intersections of fractures in igneous or metamorphic rocks, or from sand and gravel deposits from ancient rivers. However, the vast majority of the world's large springs—and the ones most important to our ancestors—are karst springs. Springs producing more than a million gallons per day are not uncommon in Virginia. The flow in Bath County's Coursey Springs, one of Virginia's largest, rarely dips below five million gallons per day!

Karst springs form when precipitation has worked its way through soluble limestone and dolostone, dissolving some of the rock along the way and returning to the surface as cold, clear, mineral-rich water. Precipitation can enter the subsurface either as diffuse flow percolating through soil, or as sinking streams where flowing surface waters are captured by underground drainage.

As water makes its way from the subsurface to a karst spring, it passes through a network of conduits and fissures formed by the dissolving of bedrock. Many of these are large enough to crawl, walk, swim, or rappel through and are thus considered caves. Caves as long as 30 miles and up to a quarter mile deep have been documented behind Virginia's karst springs.

Determining where the water from a particular spring originates is no easy feat. While caves provide windows into the plumbing behind springs, only rarely do they show the whole picture. To complicate matters, subterranean flow quite commonly passes underneath surface drainage divides. Hydrologists rely on a variety of methods—geologic mapping, chemical analysis, and pump testing among them—to determine the watershed or recharge area of a particular spring. One particularly powerful technique is dye tracing, in which nontoxic, fluorescent dyes are introduced into groundwater inputs or cave streams, then absorbed by receptors in cave streams, springs, or even wells. By connecting the dots between places where a particular dye was introduced at a particular time and the locations and dates where it was recovered, maps showing subterranean flow paths can be generated. With enough dye tracing, the recharge area of many springs can be accurately determined. However, because there are so many springs in Virginia and very limited resources to perform dye tracing, we do not know the recharge areas of the vast majority of our springs.

A recent technique for evaluating spring water is determining its age, or how long it has been underground. To do this, geochemists use a variety of chemical tracers present in the water. Some of these are naturally occurring compounds, while others such as chlorofluorocarbons and tritium, are the result of specific human technological advances that introduced these chemicals into the atmosphere at specific times. In many springs the ages are complicated and not always consistent depending on which chemical age is considered. However, consistent patterns emerge. Water from springs connected to known cave systems is generally very young, from a couple of weeks to a few years in age. By contrast, water from some of the larger springs in places like the Shenandoah Valley, with few or no caves known behind them, can range from 10 to 50 or more years in age. These older springs are believed to represent flow paths extending to great depths, through thick limestone deposits, sometimes resulting in elevated temperatures as well.

In some places, like Virginia's Warm Springs Valley, the karst waters circulate deep enough to produce true hot springs. Because of radioactive decay and the insulating properties of rock, the temperature of bedrock increases systematically with depth. As a result, the temperature of spring water reflects the depth to which it circulates. Precipitation falling on the north slope of Warm Springs Mountain sinks into the limestone along its flank, and slowly descends to depths of a few kilometers, absorbing warmth from the surrounding rock before rising rapidly along the handful of dissolved fractures that lead to the valley's thermal springs. The same phenomenon occurs elsewhere in the mountains of Western Virginia, but not to a great enough extent to produce true hot springs.

Oddities among Virginia's springs are not limited to thermal springs. A spring just north of Harrisonburg is termed the "tide spring," which repeatedly flows then stops every hour or so, as it has for millennia. DCR scientists have recently discovered that similar water level oscillations occur in at least three caves along this belt of limestone four miles long, suggesting it is more than a local curiosity. Bath County's Muddy Run is fed by a spring that always flows milky due to suspended solids within the water. Sweet Chalybeate Spring in Alleghany County is naturally carbonated.

Virginia's springs have long been a popular destination for folks in search of the waters' therapeutic values, and for others just look-

ing for a good soak. During the 19th and early 20th centuries, over a dozen karst springs in Western Virginia were home to resorts where Virginians from the east retreated during the summer. The names of communities such as Orkney Springs and Rockbridge Baths pay homage to this history.

The economic and social roles that karst springs play extend well beyond resorts, however. Numerous communities across western Virginia rely on karst springs as their primary or secondary water supplies. Some counties use a combination of several springs as their primary water supplies. In addition, towns and counties own water rights to many more springs in case their flow is needed to meet future capacity. In the droughts of the early 2000s, several of these springs were brought on line to compensate for historically low reservoir levels and stream flows. And of course thousands of Virginia's citizens continue to rely on spring water for domestic water supplies. When offered the opportunity to connect to municipal water supplies, the response is typically "No thanks." Everyone knows the best tasting water flows from clean karst springs.

It would be easy to take for granted that Virginia's karst springs will always remain reliable sources of clean water. That would be a mistake. Springs may be complicated, each with its unique plumbing, but they are not magic. Every spring has a recharge area, and the land use activities that take place within recharge areas affect both the quality and quantity of spring water. Contaminants introduced by septic tanks, confined animal feeding operations, land application of biosolids, industrial discharges, and storm water runoff all find their way to karst springs. For example, in studies of karst waters in the Shenandoah Valley all samples tested for atrazine, an herbicide commonly used prior to seeding crops, have turned up positive. In a case from Warren County, fluorescent dye flushed down a toilet turned up in the owner's tap water, drawn from a karst spring!

Perhaps even more ominous than the risk of contamination is the reduction in spring flow itself. Every well drilled within the recharge area of a spring reduces its flow because the well is tapping the same subterranean reservoir that feeds the spring.

Another factor placing the flow of karst springs at risk is global warming. Cooperative studies by DCR and Virginia Tech scientists have shown that the amount of recharge to a karst aquifer is related to evaporation and the length of the growing season. As the Earth continues to warm, both will probably increase, reducing the amount of water reaching the karst aquifer. The aquatic systems relying on karst waters will be stressed with significant effects on multiple species as base flow in late summer continues to reduce.

Karst springs are clearly a significant component of Virginia's Natural Heritage, one long taken for granted yet critical to our natural systems. An ancient Chinese proverb offers wisdom to guide us: when drinking the water, remember the spring. Let's hope it's not too late.

A slightly longer version of this article is available with photos of karst springs on the Virginia Cave Week website.

The Batie Springs and the Natural Bridge of Lee County

By Steve Lindeman, Chair VCB

Two beautiful springs flow from limestone rock and join to form Batie Creek, which flows under the Natural Bridge of Lee County, Virginia, and into the Powell River. The springs and natural bridge are located approximately two miles southwest of Jonesville, Virginia, in an area known as The Cedars. This area of Virginia is defined by its underlying limestone geology, forming a karst area significant both historically and biologically. In fact, this spring and natural bridge were first described by Daniel Boone in the late 1700s and they are now located on the historic travel-way known as The Daniel Boone Wilderness Trail. The Cedars, with its shallow soils and numerous karst features, is home to many state rare plants and animals and several species listed by the U.S. Fish & Wildlife Service as federally endangered. Prior to the early 1980s, Thompson Cedar Cave, which provides water to Batie Springs, was noted for its diverse and profuse aquatic life, including the Lee County cave isopod, *Lirceus usdagalun*. During the late 1980s and early 1990s, researchers documented the progressive decline and disappearance of most of the original aquatic fauna in the Batie ecosystem, leading to the listing of this isopod under the Endangered Species Act. The decrease in biological diversity and increase in numbers of a few species indicated that the ecosystem was adversely affected by nonpoint source pollution. Today, the quality of water in both the Batie West and East Springs and the creek formed at their confluence is much improved due to cleanups of sawdust and other contaminants on nearby properties.

The Natural Bridge of Lee County is an arch that is actually used as a bridge. State Route 662 crosses it; the Natural Bridge can be very easy to miss when driving over it. According to a local geologist, the Natural Bridge of Lee County is a classic remnant karst arch left behind as the ancient limestone around and under it dissolved away over the eons. This limestone originally formed in shallow seas over 450 million years ago during what geologists term the Ordovician period, was later warped upward during the formation of the Appalachian mountains, and eventually was exposed by erosion, forming today's Powell Valley. The Batie Springs are key hydrogeological features. The eastern spring marks the return to the surface of Fleenortown Creek, which disappears into a sinkhole along US Route 58 near Jonesville. Along its journey, this creek appears briefly in the bottoms of two sinkholes, forming karst windows, before it emerges from Batie East Spring and joins with the western spring to become Batie Creek. The northwestern spring in the karst window

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Virginia Cave Week is April 16–22, 2017
Our theme this year is *Karst Springs*. See **http://www.vacaveweek.com/** for more details .

Karst Springs Tours During Virginia Cave Week

April 18, 6–8:30 p.m.: Walking tours of the karst springs of The Cedars. Call 804-786-7951 to reserve a space.

April 20, 6–8 p.m.: Intermittent discussions of McKay Springs in Front Royal. Call 703-203-6975 to reserve a space and time.

April 22, 12–4 p.m.: One mile walking tour of the Springs of Winchester. Call 703-727-5925 to reserve a space.

April 22, 12 noon: Karst springs tour covering Aqua Spring and its Sinking Creek, Owl Cave, and Water Sinks Cave recharge points. It will include a short walking tour of Water Sinks Cave. We will also look at Coursey Springs. Call 540-468-2722 to reserve a space.

The Batie Springs and the Natural Bridge of Lee County

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includes water from the stream in Thompson Cedar Cave and from other sinkholes and sinking streams to the north.

The property containing these springs and the northern entrance to the Natural Bridge was purchased from the Mason and Barton families by The Nature Conservancy in 2010. It was transferred to the Virginia Department of Conservation and Recreation in 2013 as an addition to the Cedars Natural Area Preserve. The Department of Natural Heritage now manages close to 1,800 acres in this site as the Cedars State Natural Area Preserve. In addition to the subterranean fauna of Thompson Cedar and other caves, rare biota identified within one-half mile of this tract include a rare limestone dolomite barren terrestrial community, three state rare plants (wild hyacinth, Canada bluets, and white blue-eyed-grass), and one rare bird species (loggerhead shrike). For more information on this unique place, and the Cedars NPA, visit this website: **http://www.dcr.virginia.gov/natural-heritage/natural-area-preserves/thecedars**.

Walking tours of the karst springs of The Cedars will take place on Tuesday, April 18 from 6 to 8:30 p.m. Please call 804 786 7951 to reserve a space.