CAVE OWNERS' NEWSLETTER

A publication of the Virginia Cave Board, Department of Conservation and Recreation **No. 21, April 2009**

Letter From the Chairman

by Thomas Lera

Happy New Year! I hope everyone had a happy and safe holiday. As we begin 2009, it is the perfect time to reflect on our successes in 2008. It was a year in which the Virginia Cave Board (VCB), along with the Nature Conservancy (TNC), the Virginia Land Conservation Foundation, and the Department of Conservation and Recreation (DCR) were active in acquiring properties and conservation easements.

On October 24, TNC closed on the Jim Fulks tract of 258 acres with about two miles of Powell River frontage supporting Surgenor Cave. The property was purchased with equal funding from the Virginia Land Conservation Foundation and the U.S. Fish and Wildlife Service. Mr. Fulks will continue to be caretaker of the land for a few years under TNC ownership.

This tract of land, plus 1,200 additional acres previously acquired, supports more than 200 rare, threatened, and endangered vertebrate, invertebrate, and plant species, as well as 15 significant caves, 25 terrestrial and subterranean communities, and a mussel concentration in the Powell River of global importance.

The Lee County cave isopod, *Lirceus usdagalun*, a subterranean freshwater crustacean that occupies small cave streams, occurs in two of these cave systems. This rare isopod was federally listed as endangered in November 1992 due to its extremely limited range.

We are excited about this and several other planned acquisitions, including a potential expansion of the Ogden's Cave Natural Area Preserve.

The VCB is also beginning work on a Statewide Karst Trail System with the first installment to be located at Crystal Caverns at Hupp's Hill in Strasburg. An article in this newsletter discusses this new program. (See page 5.)

INSIDE THIS ISSUE

I anticipate more projects to come our way in this New Year. Of course the extent of our success, as always, depends on your support. Please keep your eyes and ears open and stay in contact with us. And once again, Happy New Year!

Caves Can Teach Us About Ourselves

by Dan Doctor and Christopher Swezey
U.S. Geological Survey, Reston, Virginia

Virginia Cave Week is a time to reflect upon and admire the geology and biology of caves in the Commonwealth of Virginia, and how caves help us to understand our environment. In the past, the caves of Virginia have been used as locations of shelter and ritual, as repositories of economic resources (for example, saltpeter for making gunpowder), and as showcases of exquisite natural beauty.

In recent years, however, there has been an increasing appreciation of caves as archives of past environmental changes, such as variations in climate, hydrology, and landscape geomorphology. These records of past changes are preserved within

Please see *Caves Teach* on page 2

Caves Teach from page 1

speleothems, sediment accumulations in caves and sinkholes, erosional features on cave walls, the geometric patterns of the caves themselves, fossil remains, and endemic cave-adapted species. For example, the chemistry of growth layers in stalagmites preserve detailed records of past climate changes, in the same manner as tree rings. Sediments in caves contain information on past climates, erosional history, and changing hydrologic conditions. Age control on karst features may be provided by fossils, paleomagnetic data in cave sediments, and radioactive isotope dating. Patterns of ancient hydrologic flow conditions may be inferred from sediments and sedimentary strata within caves, erosional features on caves walls, cave morphology, and the distribution of caves relative to modern drainage features. Even the distribution and evolutionary history of biological species in caves provide useful records of the past. The combination of such data obtained from caves has great potential to provide a broad picture of landscape evolution in response to changes in climate and hydrology in Virginia.

The karst record is of particular importance today because it is now clear that human activities are perturbing the environment, both locally and globally. Perturbations in climate can cause substantial modifications to landscapes and water resources, with serious consequences for ecosystems as well as for human societies and economies. The relations between changes in climate, human land use, landscape geomorphology, and hydrological systems are complex, and it is therefore difficult to predict when a specific threshold of change will be crossed. Fortunately, the geologic record preserved in caves provides an excellent key for understanding these relations. Detailed, geology-based and biology-based reconstructions of changes in climate, hydrology, and landscape geomorphology may provide a framework for understanding patterns of natural variability. These reconstructions may also provide a framework for understanding the consequences of current and future climate changes. Such geologic and biologic data are an important guide for managing and adapting to future change, no matter what the cause. As stewards of the karst areas of Virginia, we can learn much from the geologic and biologic data preserved in caves, and we can take pride in preserving these archives of Virginia history.

Virginia Cave Week Resources

by Barbara Moss

Earth Day, April 22, falls during Virginia Cave Week, celebrated April 19-25. Students in almost every science class will be doing research on Earth Day, as well as Virginia Cave Week (VCW). What does this mean for cave owners and our caves?

Activities during past VCW celebrations have included field trips to show/commercial caves along Interstate I-81, 'teacher packets' that include information about caves and the critters within, and groundwater activities. These packets have been made available to teachers at the commercial caves, as well as by written request to the Virginia Cave Board. Online resources have been made available on the Virginia Cave Board Web site, as well as through the National Speleological Society (NSS): *Learn More about Caves* links.

Resources gathered by members of the Virginia Cave Board: http://www.vacaveweek.com/

NSS Environmental Education Committee pages: http://caves.org/committee/education/learnmoreaboutcaves.htm

The print and online information helps teachers instill the idea of conservation and preservation of our land and the water beneath it. The students also learn about pollution as it relates to our drinking water, how fragile bats and other creatures are that live in and use the caves, and how land use and development can impact the cave for years, or generations, to come.

How can a cave owner help? Consider sharing some of your experiences, related to protecting your cave or preserving the area around it, with students or classes in your area. An informed child will grow up to be a caring adult and community leader.

Bats and Wind Farms

by Jesse J. Richardson, Jr.

Windmills have long dotted the agricultural landscape, with the roots of wind energy originating in Persia in 500–900 AD, where the first windmills were developed to pump water and grind grain (Energy Information Administration). The transition from small-scale windmills pumping water on farms to industrial windmills used to generate electricity did not start until the early 1970s.

Since its modest beginnings, wind power has become the fastest growing energy industry in the world. "World wind power use has multiplied nearly fourfold over the last five years, a growth rate matched only by the computer industry" (Brown). Although Europe is moving quickly to "harvest" the wind, many countries have yet to enter this phase. Today, wind power in the form of "wind farms" is being promoted as a source of income for landowners (farmers), tax revenue for local government and schools, a solution to the energy crisis, a growth business, and an environmentally sound method of electric generation.

However, some concerns exist with respect to wind energy generation. This article focuses on the impact of wind turbines on bats. A 2004 study estimated 1,500–4,000 bat deaths from wind turbines on Backbone Mountain, Maryland. Subsequent studies also raised concerns about an inordinate number of bat deaths caused by wind turbines, although the results have not been consistent. A Government Accountability Office (GAO) report in 2005 showed that at wind farms outside the Appalachians, fewer than one to four bats were killed each year per turbine. However, some speculate that the GAO report summarized studies that may have focused mainly on birds and underestimated bat kills.

Until recently, however, the connection between the wind turbines and bat deaths puzzled researchers. Researchers were particularly puzzled by the lack of any apparent external trauma to the bats.

A May 2007 study by the United States National Research Council shows that the moving blades cause a drop in air pressure that makes the delicate lungs of the bats suddenly expand, bursting the tissue's blood vessels. This phenomenon is known as "barotraumas" and is also found in scuba divers.

United States Geological Survey research indicates that certain types of bats may be more susceptible to wind turbine hazards, and researchers suspect that mating and migration habits may be linked to the deaths. Foremost, the majority of bats killed by wind turbines are migratory tree bats—species that rely on trees as roosts throughout the year and migrate long distances. Currently, more than three-quarters of the bat fatalities observed at wind energy sites consist of migratory tree bats. Species include hoary bats, eastern red bats, and silver-haired bats.

In addition, the vast majority of bat fatalities by wind turbines occur in the late summer and autumn months. This time frame coincides with the period of autumn migration and mating behavior in tree bats. The seasonal nature of the deaths, along with the predominance of migratory tree bats indicate that these bats may be attracted to the wind turbines.

To date, no evidence exists that a single member of an endangered bat species has been killed by a wind turbine. However, the statistics may not be complete, because when researchers sought dead bats around wind machines, bat corpses may have been missed or already taken by predators.

In addition, researchers have information on only about 10 percent of the wind energy facilities in the U.S. and Canada. Little information has been gathered from California, Texas, and New Mexico where bat diversity is highest and turbines are being built in large numbers. More information on migration routes is needed to determine if some wind farm sites are more likely to kill bats than others.

Considering these characteristics gives clues as to how we may minimize the deaths. Industry and federal agencies have partnered to raise and spend about two million dollars looking for solutions. Some research groups are investigating ways to keep the bats away from wind turbines. A University of Aberdeen group is attempting to use radar emissions as a "bat-scarer."

Please see *Wind Farms* on page 4

Wind Farms from page 3

In addition, a large portion of the kills occur at lowest speeds. At those speeds, the turbines are not generating appreciable energy, so it may be possible to increase the size and speed of the blades to minimize deaths. Researchers are currently conducting tests to see if raising the "cut-in" wind speed at which rotors begin to turn will save bats—particularly during peak migration periods. Researchers also hypothesize that newer wind machines— those with fewer but longer rotors—will kill fewer bats.

Laurie Jodziewicz, of the American Wind Energy Association in Washington, D.C., said where the turbines are placed may be the key. "Bats are not being [killed] at all the wind projects all over the country—it is happening in some places and not others," she said. "We're trying to determine before construction what areas might be risky."

Siting of the wind turbines may avoid most bat kills. Build wind farms out of the migratory paths of bats—most that are killed seem to be bats migrating between Mexico and Canada. In addition, siting wind turbines off-shore would also prevent bat deaths.

More research is needed to more particularly determine how and why bats are attracted to wind turbines and whether and how bats can be deterred from being around wind turbines. Applying this knowledge will allow bats and wind energy to coexist.

References

Baerwald, Erin F., Genevieve H. D'Amours, Brandon J. Klug, and Robert M.R. Barclay (2008). *Barotrauma is a significant cause of bat fatalities at wind turbines.* Current Biology 18, R695-R696, August 26, 2008.

BBC News. "Wind farms put pressure on bats." Retrieved December 14, 2008. http://news.bbc.co.uk/2/hi/science/nature/7581990.stm

Blum, Justin, *Researchers Alarmed by Bat Deaths from Wind Turbines*, WASHINGTON POST, January 1, 2005, *available at* http://www.washingtonpost.com/wp-dyn/articles/A39941-2004Dec31.html (last visited January 9, 2009).

Brown, Lester R. *The Missing link to Bush's energy plan*, Colorado Springs Independent, June 7, 2001, *available at* http://www.csindy.com/csindy/2001-06-07/yourturn.html (last visited on January 9, 2009).

General Accounting Office, *Wind Power: Impacts on Wildlife and Government Responsibilities for Regulating Development and Protecting Wildlife*, GAO-05-906, 59 pp. (September 2005).

Handwerk, Brian. August 25, 2008. "Wind Turbines Give Bats the 'Bends,' Study Finds," National Geographic, Retrieved December 14, 2008. http://news.nationalgeographic.com/news/2008/08/080825-bat-bends.html

Lipman, Larry. November 13, 2005. "Bats and Windmills Prove Deadly Mix," Cox Newspapers Washington Bureau, Retrieved December 16, 2008. http://www.coxwashington.com/reporters/content/reporters/stories/2005/11/13/BC_WINDMILLS_BATS_ADV13_COX.html

USGS. "Bat Fatalities at Wind Turbines: Investigating the Causes and Consequences." Retrieved December 14, 2008. http://www.fort.usgs.gov/BatsWindmills/

Rationale for Development of the Virginia Karst Interpretive Trail

by Babs B. Funkhouser, Director, Crystal Caverns at Hupp's Hill Historic Park

Whenever anyone studies the geomorphology of the Great Valley of Virginia, the word "karst" inevitably crops up. Simply stated, karst topography results when water dissolves layers of soluble, usually carbonate, bedrock, such as limestone or dolomite. Sinkholes and cenotes, caves and extensive cavern systems, disappearing and reappearing streams, complex underground drainage systems, and many other features confer a unique appearance to this landscape form.

Please see *Rationale* on page 5

Rationale from page 4

But where in the world did the word "karst" come from? In 1689, a Slovenian geographer named Janez Vajkard Valvasor published the first description of the fantastic, dramatic landforms and hydrologic phenomena of a small region in southwestern Slovenia. The region is named "Kras" in the Slovene language, but Valvasor published his work in German, and the name was translated as "Karst." Derived from the pre-IndoEuropean root word "karra," which means "stone," Latins called the region the "Carusardius". Croatians named it the "Krs," while Italians refer to it as "Carso." In English usage, the region is referred to as the Classical Karst. Serbian geologist Jovan Cvijic's 1893 publication of *Das Karstphanomen* firmly established the Dinaric Kras region, which extends throughout the area of former Yugoslavia and includes the Classical Karst, as the type area for the study of dissolutional landforms and aquifers. Geologists finally accepted the regional name Karst as the diagnostic term for karst topography worldwide.

And karst topography does occur all over the globe: it covers 10 percent of the Earth's surface overall, but is particularly pertinent to us as it accounts for 20 percent of the U.S. landscape and a large proportion of the Shenandoah Valley. Fully 25 percent of the human population inhabits karstic landforms, which means that one billion souls are living on this sensitive landscape.

Referring to karst as sensitive is not an overstatement. Karst, by its very nature as a landscape that resulted from dissolution of soluble bedrocks, contains many hollow features underground. The potential for, and actual occurrence of, polluted groundwater is great. Water supplies from wells may become unsafe when industrial or human and animal waste runs unimpeded through sinkholes into the caves below. From there, contaminants easily flow into aquifers, bypassing the normal filtering that occurs in a porous aquifer where soil literally strains out impurities. Many people ignorant of this fact have dumped immense quantities of toxic substances into sinks, seeing them as convenient trash pits but not as sources of the water they will later drink.

Karst also poses challenges to the development of our living surfaces. Sinks can and do enlarge naturally, but human impact on karst terrain also plays a large role. Ever-increasing population growth has resulted in excessive water withdrawal that lowers underground water levels and reduces or removes the buoyant support of shallow caverns' roofs, causing collapse of the structure. Vibrations from construction activity or explosive blasting may also trigger sinkhole collapse. This progressive erosion of underground spaces is largely unseen, and when the roofs of an underground system suddenly collapse, buildings, cattle, cars, parts of highways, and farm machinery have been swallowed up or damaged. Before building a new structure, it's always a good bet to investigate the subsurface situation.

Educating our citizenry about the challenges of living on karst is clearly an idea whose time has come. There is an ever-growing need to inform our people about their land and water, and how their water is affected by their own activities. To this end, all levels of government and regional conservation groups are exploring ways to disseminate information about cave and karst issues. Clearly, there are pitfalls involved in living on karst that require sound management strategies, but these must result from informed decisions. But, while defining and discussing karst management strategies in a scientific publication serves a need, nothing compares to seeing the actual features, not just drawings or photos in a book. The strategy is to get people to actually view karstic features firsthand.

Visiting karst sites allows a visitor to place a karstic feature in context, which helps in understanding how it forms. For example, at Hupp's Hill Historic Park, visitors can not only tour a great little show cave, Crystal Caverns, but they can also begin to understand the geologic processes that formed the various karstic features associated with the show cave. From a position atop Hupp's Hill along the interpretive walking trail, visitors can view a sinkhole plain down in the hollow and in this way they can learn about groundwater recharge. Sinkholes seen along the walking trail are similar in form to sinkholes located above the cave, and to get a new perspective on such sinkholes, visitors can then descend into the one that is the main entrance into Crystal Caverns. Later on the tour, they can see that a sinkhole collapse on the surface has resulted in sediments falling into the cave

Please see *Rationale* on page 6

Rationale from page 5

and blocking part of the passage. This sediment was later partially re-excavated as water flowed through and out of the cave, and which then finally was completely drained of water, exposing the air-filled voids underground, and allowing us to explore its passages. To this day, water periodically rises and falls within the cave. Putting these discrete features together allows us to understand a more complete picture of karstic processes.

But karst interpretation can also educate visitors about more than the geologic processes involved at the site. Karst features are often hosts for unique biological species, thus highlighting their place within the local ecosystem. Two of the three caves located just a few acres away from each other in Hupp's Hill Historic Park are the home of a unique species of amphipod. Despite their obvious lack of surface connection they undoubtedly have been connected through subsurface water conduits.

The Hupp's Hill caves also provide a cautionary tale about what constitutes proper management of sensitive, non-renewable natural resources. In the not so distant past, the sink above one cave that houses the endangered amphipod species served as a trash pit for refrigerator and car parts, leaking freon and rust into the aquifer below the layers of limestone.

Does this sound too cerebral and academic? Actually, studying karst is rather fun. Karst interpretation gives us all an opportunity to enjoy learning more about the places where we live, work, and play. Whether we are viewing the Valley's spectacular show caves, the Yucatan's deep cenotes used for ritual human sacrifice, or China's breathtaking karst towers, it's really nice to understand how such features came to be formed. Karst features draw tourists from all over the world, and that helps the local economy, too.

The 2007 Virginia Outdoors Plan strongly recommends development of a Virginia Karst Trail "to help educate the public about karst resources in the Commonwealth. This thematic trail will promote resource management goals and best management practices that help landowners protect sensitive karst resources such as caves, springs, and sinkholes. The trail will focus on above ground features and tourist caves throughout the state's valley and ridge physiographic province. The Virginia Karst Trail, endorsed by the Virginia Region of the National Speleological Society, will benefit the state through increased educational, commercial, and tourism opportunities."

To afford our citizenry and visitors such opportunities, the Virginia Cave Board is spearheading the development of this regional karst interpretive trail. Actually, the interpretive system we envision is more of a network of trails based on individual watersheds. Of course, organizing karst features by watersheds has an imperfect facility, as karstic features such as sinking streams may originate in one watershed area and terminate within another watershed. The area that contributes to the underground flow of groundwater to a spring does not necessarily conform to the topographic area of a watershed, that is, the area defined by connecting the highest points of elevation around a spring or stream. So, karstic watersheds are essentially shared throughout the entire area. The evidence we have of this is the occurrence of the Madison Cave Isopod, which pops up in places that may seem like disconnected surface watersheds, but that are in fact connected underground. But using watersheds to define karst trails nevertheless imposes a surface organization onto what is a very complicated system of water conduits under the surface, allowing travelers greater ease in following directions to the karst interpretive sites.

This kind of network will be able to grow through time. The first trail to be completed in the network will likely be on the northern end of the Shenandoah Valley because part of the work has already been done. There is an existing karst interpretive walking trail and a manned information kiosk at Hupp's Hill Historic Park, thus giving interpretation of northern Valley karstlands a head start. But we can work on several trails concurrently, with varying completion dates, and even add more features into existing trails, until we interpret all accessible Virginia karst areas owned by participating property owners, and perhaps even ultimately linking up with similar trails in adjoining states.

Like karst itself, interpreting karst opens up limitless possibilities.

Keeping Up With White Nose Syndrome

by Barbara Moss

"*A Myotis* bat with white nose syndrome"

from http://www.dcr.virginia.gov/natural_heritage/cavehome.shtml

White Nose Syndrome (WNS) is a malady that has caused the deaths of thousands of bats. The name was derived from a distinctive ring of fungal growth around a bat's muzzle. WNS has been found in more than 25 caves and mines in the northeastern U.S. Newspapers and magazines across the country have reported on WNS in their area, making it difficult to bring readers of the Cave Owners' Newsletter the most up-to-date information in a timely manner.

To find the most recent information on WNS and its effect in your area, please use the Internet. The Virginia Cave Board has a Web page of links to keep you apprised of current research and incidents in Virginia and other states, in addition to a copy of the letter outlining protocols for visiting wild caves.

http://www.dcr.virginia.gov/natural_heritage/cavehome.shtml

"A *pipistrelle* bat, killed by the White Nose Syndrome"

from http://www.dcr.virginia.gov/natural_heritage/cavehome.shtml

For additional information please contact the **Virginia Department of Conservation and Recreation, Division of Natural Heritage**, 217 Governor Street,3rd Floor, Richmond, VA 23219 or one of the following members of the Virginia Cave Board:

Dr. David Culver
427 Foxridge Drive
Leesburg, VA 20175

Dr. Daniel H. Doctor
USGS
12201 Sunrise Valley Drive
Reston, VA 20192

Ms. Barbara Funkhouser
Crystal Caverns at Hupp's Hill
33229 Old Valley Pike
Strasburg, VA 22657

Mr. Andrew Harrison,
PG
3513 Grandview Drive
Richmond, VA 23225

Dr. John R. Holsinger
Dept. of Biological Sciences
Old Dominion University
Norfolk, VA 23529

Mr. Thomas Lera
7733 Inversham Drive, No. 167
Falls Church, VA 22042

Ms. Judy Molnar
Virginia Living Museum
524 J. Clyde Morris Boulevard
Newport News, VA 23601

Ms. Barbara L. Moss
7713 Shreve Road
Falls Church, VA 22043

Mr. Jesse J. Richardson
VT Urban Affairs and Planning
207 Architecture Annex
Blacksburg, VA 24061

Mr. David R. Socky
6572 Woodbrook Drive SW
Roanoke, VA 24018-5402

Ms. Meredith Weberg
8061 Kittiwake Court
Springfield, VA 22153

We're on the Web! Visit us at:

http://www.dcr.virginia.gov/dnh/cavehome1

Department of Conservation and Recreation, Division of Natural Heritage
217 Governor Street, 3rd Floor
Richmond VA 23219-2010
RETURN SERVICE REQUESTED