

# What's all the fuss about *karst*? Part I — Overview *by L. Terek Ball*

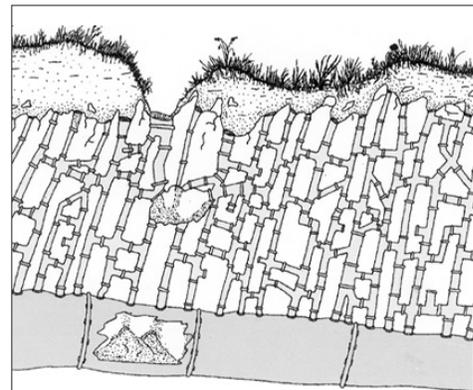
A drive through Greenbrier Valley is an aesthetically pleasing one with its rolling pastoral countryside, lush green pastures, majestic mountains, and woodlands. Yet, it becomes apparent even to the naked eye that this landscape is not your ordinary terrain. A closer look reveals surface exposures of bedrock within a landscape pockmarked by a wide assortment of funnel-shaped depressions that, except for the grass in them, can resemble a moonscape. Welcome to scenic Greenbrier County—and to the intriguing & puzzling world of *karst*!

*Karst* is a peculiar sounding word, one that most folks are unfamiliar with even though it provides the foundation upon which many of us live. So what exactly is *karst*? Simply put, *karst* is a landscape, underlain by limestone or other soluble rocks, in which the topography is chiefly formed through the dissolving of rock whereby the primary erosion mechanism is from chemical weathering or dissolution.

How does this chemical weathering or dissolution occur?

Within the earth's atmosphere there is a small amount of carbon dioxide gas. This gas reacts with precipitation to form carbonic acid—a mild, naturally occurring acid that is very common in groundwater. As the slightly acidic rainwater passes through soil, the water absorbs additional carbon dioxide and becomes more acidic. Although a weak acid, carbonic acid is the main acid that dissolves carbonate bedrock such as limestone.

Through geologic time—thousands & thousands of years—slightly acidic water dissolves and enlarges the bedrock

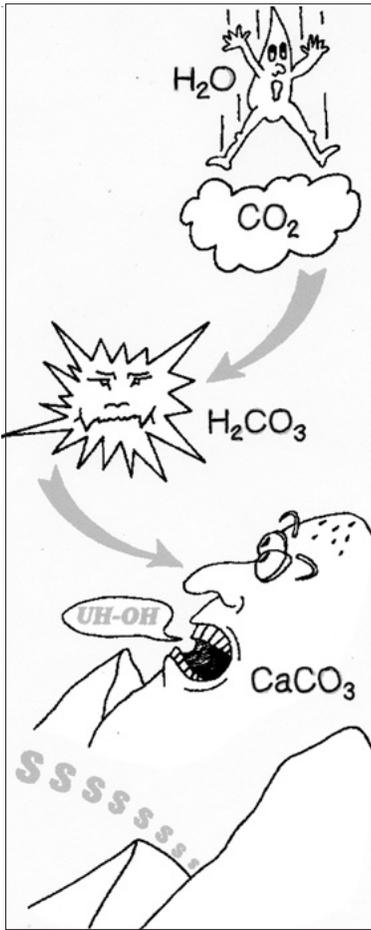


The honeycomb nature of karst results in a very high pollution potential as sinkholes and bedrock fractures provide pathways for contamination of our drinking water sources. Groundwater flows through the "pipes" to get to the water table. (The large "pipe" at the bottom.) ~ William E. Kochanov

filtration, and poor surface drainage yet well-developed subsurface drainage.

*Karst* regions constitute about 25% of the world's land surface and comprise 20% of the United States. In the eastern United States,

**Principal Karst Areas of West Virginia**  
~ *Karst Hydrology Atlas of WV*



Water (H<sub>2</sub>O) combines with carbon dioxide (CO<sub>2</sub>) to form carbonic acid (H<sub>2</sub>CO<sub>3</sub>). This is the acid that dissolves limestone (CaCO<sub>3</sub>).  
~William E. Kochanov

fractures, forming voids and caves within the bedrock and creating networks of interconnected conduits (passageways akin to a natural underground plumbing system comprised of interconnecting pipes).

## What are the features of a *karst* landscape?

*Karst* processes (the process by which acidic water dissolves soluble rock) create areas typified by sinkholes, underground streams, springs, and caves. Other characteristics of *karst* terrains include disappearing or sinking streams, few or no surface streams, thin soils and bedrock exposures, rapid groundwater flows, little groundwater

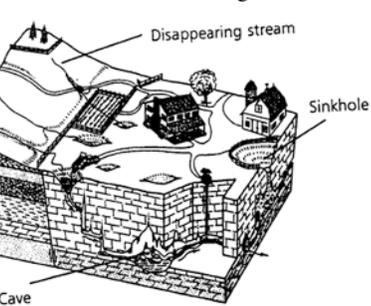


Illustration depicting karst features.  
~ *Living with Karst*

a band of karst extends from Alabama up to Vermont, cutting through eastern West Virginia on its way. Although sinkholes and caves are the most prominent indicators of *karst* terrains, *karst* features vary from place to place. Some areas are highly cavernous while others are not. Greenbrier County is a cavernous region and holds the distinction of having the highest number of reported known caves in West Virginia.

According to the *Karst Hydrology Atlas of WV*: In 1992, Pocahontas Co. reported the second highest number of caves at 559, Randolph Co. reported the third highest number at 439, and Monroe Co. reported the fourth highest number of caves at 346. At that time, Greenbrier Co. had 1,030 known caves. Since that time, 240 more caves have been identified bringing today's total number of known caves in Greenbrier Co. to 1,270.

**Davis Spring on the Greenbrier River near Fort Springs is the largest spring in WV and drains an area of about 72 sq. miles. Milligan Creek and the area around Lewisburg all drain to this spring.**

**In the Greenbrier karst springs, *cryptosporidium parvum*, *Giardia lamblia*, & *E. coli* O157:H7 (Jack-in-the-Box bacteria) have been found. All of these pathogens are zoonotics meaning they can pass from animals and infect humans.**

Because land use and development in karst regions can accelerate geological and hydrological processes unique to this type of topography, karst regions require special care and sound management. We have learned from man-induced mishaps on karst during the past several decades that mismanaged land use and development on this type of topography can lead to:

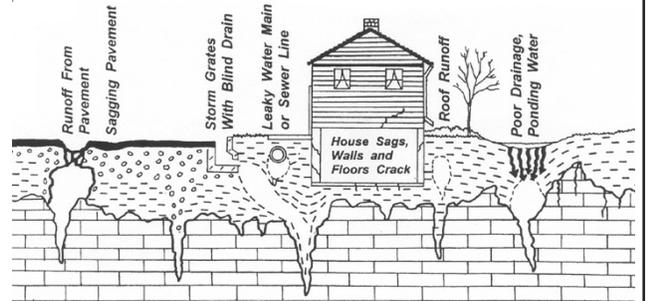
- contamination of our drinking water resources (private wells and municipal groundwater supplies);
- structural damage to private homes and public buildings due to sinkhole subsidence, collapse, or flooding;

*Karst* areas are among the world's most fascinating, diverse, resource-rich, yet problematic terrains. They contain the largest springs and most productive groundwater supplies on earth. They provide unique subsurface habitat to rare animals and their caves preserve fragile prehistoric material for millennia. Unfortunately, *karst* terrains are also the landscapes most vulnerable to environmental impacts.

**Of all the counties in the USA (more than 2,000), Greenbrier County has the fifth most obligate cave-dwelling terrestrial species—species in habitats restrictive to caves.**

***Cryptosporidium parvum* can cause gastrointestinal disorders (*cryptosporidiosis*) in humans. *Cryptosporidiosis* can be life threatening to immuno-compromised individuals including cancer patients, organ transplant patients, and HIV positive patients, among others.**

**In karst lands, altered or uncontrolled runoff can cause structures to be undermined, resulting in subsidence or damage. *Living on Karst* (Cave Conservancy of the Virginias)**



- increased maintenance & repair costs for damaged infrastructures such as roadways, utility, water, and sewage lines; and
- endangerment of rare plant & animal species found only in cave and *karst* ecosystems.

The unique attributes of Greenbrier County's *karst* topography present a myriad of challenges. As land alterations and use have been increasingly on the rise in our area during the past decade or so, particularly in the way of development, it behooves us to increase our knowledge of how *karst* "fits in" and is affected by our day-to-day activities. Only then, from a position of awareness and understanding, can we move forward in the direction of informed decision-making and responsible action.

Sound management and protection of our vulnerable karst regions and the valuable resources that they provide will require the conscientious participation of all citizens—local government officials, city & county planners, land management officials, and developers, in particular; farmers, business owners, and individual homeowners, as well.

Collaboration will be advantageous, if not essential, for developing proactive solutions to the problems associated with living on *karst* and for establishing best management practices in order to lessen the hydro-geological risks of continued growth and development within our *karst* community.

**Next issue: Part II** ... a closer look at sinkholes, the karst watershed, and the challenges associated with our ever growing karst community.

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**References:** *Growing Communities on Karst Conference* (Lewisburg, Oct. 2005), speaker presentations; *Karst Hydrology Atlas of WV* (1997) William K. Jones, Karst Waters Institute, Charles Town, WV; *Living With Karst: A Fragile Foundation* (2001), American Geological Institute; *Living On Karst: A Reference Guide for Landowners in Limestone Regions* (1997), Cave Conservancy of the Virginias; *Sinkholes in Pennsylvania: PA Geological Survey, Educational Series #11* (1999), William E. Kochanov

**The contact caves and karst area of Greenbrier County are on the "Top Ten List of Endangered Karst Ecosystems" in the world. *Karst Waters Institute, Top Ten List (2000/2001)***