

Natural Heritage Resources Fact Sheet

Karst Resources of the Shenandoah and Potomac River Basins

The Shenandoah and Potomac River watersheds drain approximately 3,400 square miles of Virginia, extending westward from the Blue Ridge across the Shenandoah Valley to the edge of the Appalachian Plateau. Vertical relief from the Shenandoah headwaters at Reddish Knob to the confluence with the Potomac at Harpers Ferry is over 4,000 feet (1,219 meters). These watersheds are home to over 360,000 Virginians in eight counties.

Ancient sedimentary rocks comprise most bedrock in the watershed, except for igneous and metamorphic rocks along the western Blue Ridge. Most people live and work on the limestone, dolostone, and shale that underlie the valley floor. Over geologic time, lightly acidic groundwater has flowed through fractures in the limestone and dolostone, dissolving it to form voids and cavities. The result is **karst terrain**, a landscape characterized by abundant sinkholes, sinking streams and caverns. Caves serve as groundwater reservoirs and conduits for underground streams.

Humans share the watershed with a large number of rare and unique plant and animal species and natural communities. Much of this biodiversity depends on the karst resources of the Shenandoah Valley.

Appalachian Cave Communities

More than 500 caves, some over a mile long, are known from the Shenandoah and Potomac watersheds in Virginia. Over 50 of these caves are designated as significant under the provisions of the **Virginia Cave Protection Act**. The law prohibits vandalizing formations or historic/prehistoric resources, polluting, or disturbing naturally occurring organisms found in caves. The Valley's world famous **show caves** provide a safe way for people of all ages and abilities to experience the underground landscape.

Various organisms dwell in cave habitats, including rare species of bats and invertebrate species. Highly specialized arthropods and crustaceans have lost both vision and pigment. The Virginia Natural Heritage Program tracks more than 70 occurrences of

over 30 different globally rare species found in caves of the Shenandoah and Potomac watersheds, with many of these species known only from these watersheds. Several of these species are protected under the federal or state endangered species acts.

The **Madison Cave Isopod (*Antrolana lira*)** is Virginia's most well known and unique cave animal, known only from the Shenandoah Valley. A living fossil, this species' ancestors were stranded tens of millions of years ago

when sea level was much higher and the Valley's bedrock was in contact with Atlantic estuaries, much like today's Yucatan peninsula. The **Madison Cave Isopod** lives literally in the aquifer, found not only in caves, but also in groundwater wells. Protected under the Endangered Species Act, the isopod's survival depends on the surface-groundwater connection of karst to deliver food to its habitat. The biggest threats to its existence are land development and groundwater contamination.

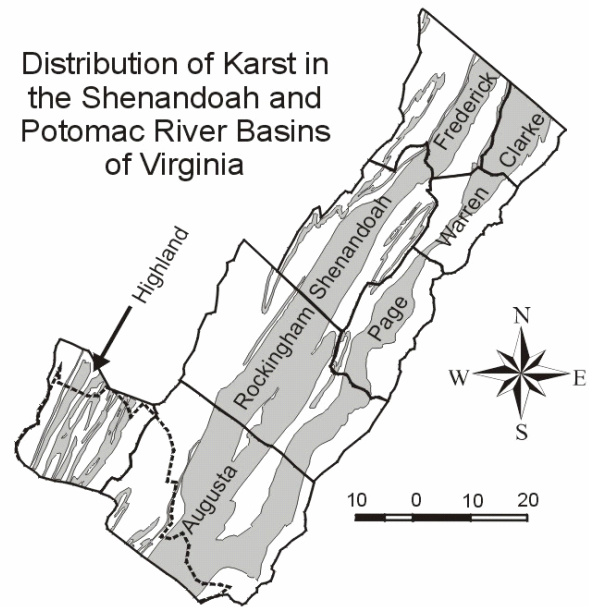
Other Karst Communities

Wet Prairies are found along the floodplain of the South River in Augusta County, where a shallow water table in the river alluvium maintains the wetland environment.

Calcareous Seeps and Fens are small wetland communities, centered around springs and associated *travertine* deposits, that harbor many rare and unusual species adapted for calcium-rich soils.

Shenandoah Valley Seasonal Ponds form in depressions found along the west slope of

Distribution of Karst in the Shenandoah and Potomac River Basins of Virginia



the Blue Ridge where talus deposits overlie limestone bedrock. The Virginia Sneezeweed lives only in these seasonal ponds, flowering only when they dry up in late summer.

Xeric Calcareous Cliffs form when streams undercut limestone bedrock. Because little soil develops on these highly exposed habitats only stunted trees, shrubs and sun-loving herbaceous plants grow on the shallow soils of these cliff edges and steep slopes.

Other Karst Resource Benefits

Historically, caves provided shelter, cool storage areas for food preservation, ceremonial sites, and saltpeter, a key ingredient in gunpowder. Many public and private water supplies in use today are karst springs that provide relatively clean, reliable drinking water.

Caves provide clues to past environments and cultures for geologists, paleontologists, and archeologists. The limestone and dolomite rocks contain ancient marine fossils and more recent sediment deposits. The

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remains of Ice Age creatures such as mammoths and giant sloths have been found preserved in cave sediments, and radiometric dating of sediments and cobbles allows interpretation of how our environment has changed over time. In addition, well-preserved human skeletons, writings, and tools discovered in caves open a window on earlier inhabitants and cultures.

Karst Resources and Water Quality

The conduits found in karst terrain directly link surface water and groundwater, making karst resources susceptible to contamination. Activities on the land surface can and often do impact surface and groundwater supplies. Pollutants in the groundwater system may move through drinking water wells as they move toward springs or seeps in streambeds where they resurface. And heavier than water pollutants may sink, slowly releasing toxic constituents into the aquifer.

Within the Shenandoah River watershed there are three primary types of land cover, forest, agriculture, and urban areas. Forests cover just over 50 percent of the watershed, primarily along the mountainous areas in the George Washington National Forest and in Shenandoah National Park. Little water pollution is generated in the mature forest areas. Logging and land clearing practices in forested areas, however, can cause significant erosion of hillsides that can impact streams and caves. Use of Virginia Department of Forestry Best Management Practices (BMPs) can help limit these impacts.

Agriculture, including pastureland and cropland, comprises about 40 percent of land use in the watershed. Because of the intensity of some farming practices, agriculture is a significant source of groundwater and surface water quality degradation in the watershed. Bacteria, fertilizer and pesticides run off from storage areas, cropland, and pastureland into surface waters or sinkholes. Direct livestock access to streams is a major source of sediment, nutrients, and bacteria. Implementation of agricultural BMPs, as specified by Virginia's Soil and

Water Conservation Districts, can help to reduce water quality degradation. Disposing of animal waste from the Valley's poultry industry presents a challenge for both industry and conservationists. DCR's Nutrient Management Program works to ensure that poultry litter, biosolids, and animal waste are applied at appropriate rates and times with proper buffers for streams, rock outcrops and sinkholes.

Urban and residential land use is growing rapidly in the watershed. Pollutants from urban areas include sediment from construction sites, and petroleum, antifreeze and de-icing salts in runoff from paved surfaces. DCR Urban Programs staff can help identify best management practices for stormwater management in karst. Im-

proper stormwater management can cause sinkholes to form on adjacent properties. Other urban contaminants include fertilizer, pesticides, and spilled or leaked sewage or chemicals, including petroleum from underground storage tanks. Because septic systems and underground storage tanks are hidden from view, owners are often not aware that pollution is occurring.

Given the close connection between surface and underground resources in karst, people must take care that their activities do not impact our shared water supplies and natural resources. Comprehensive community planning, appropriate land use, open space preservation, use of best management practices, and monitoring are all tools necessary for effective management and conservation of karst resources.

