Cave Management in the United States: An Overview of Significant Trends and Accomplishments

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ABSTRACT

More than 20 percent of the United States is underlain by karst topography, the type of soluble rock landscape where caves can form. Only a small percentage of the more than 40,000 known caves in America's karst lands are owned or managed by the U.S. Government. Most American caves are privately owned, including more than a hundred commercial show caves. In recent years, the American show cave industry, government, and private-sector groups have made substantial progress in cave management in large part by reducing the gap between public understanding of caves and karst areas and what is known by scientists and cave managers. Notable successes and improvements have come largely as a result of widespread educational efforts and the growth of public-private partnerships. This paper will provide an overview of these and other significant cave management trends that are occurring throughout the United States.

Introduction

Approximately 20 percent of the United States is in karst, the type of soluble rock landscape where caves can form. Currently there are more than 40,000 caves known in America's karst areas. The U.S. Government owns a small percentage of these, less than 5%. The remaining caves are privately owned, including more than a hundred major privately owned or state operated show caves, and an additional hundred marginal show cave operations. Private ownership and management of caves in the U.S. has always been significant.

Private-public sector partnerships are playing an increasingly important role in cave management and conservation efforts in the U.S. Twenty-five years ago, few people in the United States had heard the word "karst" and most of those living in karst areas did not understand the relationship between land use and natural resources such as caves, springs, sinkholes, and other karst features. For the most part, show caves focused on entertainment. Cavers focused on caving, and government ignored caves (unless they could sell an admission). The American show cave industry, the federal government, and the private nonprofit sector have only recently begun to embrace efforts to improve public understanding caves and support for land stewardship of cave areas. Although there is still a large gap between public understanding of caves and karst areas and what is known by scientists and cave managers, the notable successes and improvements in cave management in recent years have come largely as a result of widespread educational efforts.

In this paper I will examine the important events in the evolution of U.S. cave management including:

- increased public awareness and support for conservation issues fueled by high profile environmental news events, such as the destruction and subsequent restoration of Hidden River Cave;
- an increasing emphasis on education and stewardship by show cave operators;
- volunteerism and private sector partnerships with government cave managers;
- development of new cave protection laws and regulations; and

- The growth of private nonprofit organizations and land trusts in acquiring and preserving significant caves

Increased Public Awareness and Support for Conservation in the U.S.

Cave explorers and show cave operators share a love and interest in caves which most of the public doesn't quite comprehend. Despite our best educational efforts, most Americans still have considerably more empathy for issues that affect the more familiar ecosystems on the surface. Fortunately caves have benefited from the American public's overwhelming support for conservation of natural resources, and especially for the protection of groundwater quality.

This trend can be traced to the Post World War II prosperity in the United States which created a huge middle class of people who were relatively well educated and financially able to concern themselves with issues well beyond basic survival needs. This relative prosperity coincided with a growing public awareness of the environmental problems generated by unchecked industrialization and pesticide use in agriculture.

In 1962, Rachel Carson published a book entitled *Silent Spring* which is often credited with awakening public opinion about the threats posed by water contamination from toxic chemicals dumped into the nation's lakes and waterways. High profile incidents such as the burning of the Cuyahoga River in Cleveland, Ohio; the meltdown of a nuclear reactor at Three Mile Island; a toxic waste site at Love Canal, New York; and the decimation of the American bald eagle population by DDT and similar insecticides fueled news media and public interest in conservation.

These events, and others, spawned new federal regulations, numerous environmental advocacy groups, and a whole generation of pro-conservation Americans. Although not as well known, cave systems had their share of horror stories.

After World War II, U.S. caving grew in popularity and, as post war cave explorers grew older, they began to notice a significant increase in cave vandalism. Before long, National Speleological Society grottos began organizing the first cave cleanups and restoration projects. Government officials began recognizing the existence of significant caves, in part because they were getting pressure from caving groups to visit caves they didn't even know existed. Communities dependent upon cave springs for water began discovering that the water flowing through karst areas and into their water taps was frequently contaminated.

The American Cave Conservation Association soon realized that broad public support for conservation of caves could be developed by tapping into the public's growing concern for water quality issues. The ACCA moved its headquarters from Richmond, Virginia, to Horse Cave, Kentucky, in 1987 to undertake what would be one of the decade's most remarkable cave conservation achievements.

The Destruction and Restoration of Horse Cave

One of the most dramatic examples of the problems affecting caves occurred at Horse Cave, Kentucky. Horse Cave is a small town of 2,500 people located in south-central, Kentucky, about 15 miles from Mammoth Cave National Park. Horse Cave was once the first of more than a dozen show caves that tourists could visit on their drive south from Louisville, Kentucky, to Nashville, Tennessee.

An impressive 50-foot-wide entrance opens directly beside the town's Main Street. The owner of the Cave, Dr G.A. Thomas and his son Harry maintained a hydroelectric generator and water pumping system in the cave which provided both water and electricity to the town before the end of the 19th Century. By the 1930s, a substantial village had grown around the entrance to Horse Cave.

As the City of Horse Cave grew over it, the cave, which was later renamed Hidden River Cave, began to suffer from groundwater contamination almost immediately. A common practice was injection of sewage waste into sinkholes or even directly into cave passages through straight pipes. In 1943 a creamery moved into the town of Horse Cave and began dumping waste products, such as whey, into sinkholes upstream from Hidden River Cave. Public tours into Hidden River Cave closed the same year as the odor of raw sewage emanating from the cave entrance made visitation impossible.

Over the next 50 years, Hidden River Cave continued to be polluted by sewage from the creamery, a metal-plating plant, and the town's domestic waste treatment plant, which was injecting partially treated waste into a sinkhole. In 1987, the nonprofit American Cave Conservation Association moved its headquarters to Horse Cave and joined with local citizens to promote improvements to the waste management facilities. A new sewage plant and a 10-mile conveyance line to take treated sewage out of the sinkhole plain area were built in

1989. This stopped the primary sewage discharges into the cave.

Once the sewage problem was solved, the ACCA worked in partnership with the City of Horse Cave to purchase the cave and surrounding lands and develop the American Cave and Karst Center at the site. The Center, now called the American Cave Museum, has been open since 1993 and annually gets more than 16,000 visitors. The City owns the museum and the cave and the ACCA operates the attraction on behalf of the City. Under ACCA's leadership the Museum has developed substantial educational exhibits, teaching materials and programs; and has been influential in getting other caves in the U.S. to develop more educational tours.

Show Caves as Educators and Land Stewards

Historically, private show caves primarily focused on entertaining their cave visitors. If the cave did not have an interesting history, then the management often produced a new history (fakelore). Mythological interpretive stories may have been entertaining but they contributed little to public understanding of caves.

The government approach wasn't much better. For years, cave interpretation by federal agencies, such as the National Park Service, focused on "nature is nice and interesting." The change that was needed was to make the information relevant to visitor's lives. Today, U.S. show caves frequently provide interpretive exhibits on cave geology and other topics, and feature tours that emphasize science and educational content.

Much of the groundwork for this interest in science and education was laid by pioneers such as Tom Aley at the Ozark Underground Lab and Dr James F. Quinlan at Mammoth Cave National Park. These scientists/educators began making the public aware in the 1970s of the crucial environmental connections between caves and the surface areas around caves. Their work made caves relevant to people other than cave explorers.

Dr Quinlan's research demonstrated that the hydrologic watersheds which affected Mammoth Cave extended well beyond the national park's official boundary. He generated tremendous media interest in the pollution problems facing the south-central Kentucky karst, and was an advocate of practical groundwater monitoring techniques in karst areas.

The educational programs and the consulting services provided by the Ozark Underground Laboratory (operated by Tom Aley) influenced a new generation of cave managers nationwide and numerous school children in Missouri. Instead of focusing on entertainment, the programs at the Ozark Underground Laboratory utilized the cave as a science learning lab. Students who visited the site learned how pollutants dumped in sinkholes miles away could impact the water quality and endangered cave animals living in Tumbling Creek Cave, and how this was but an example of common conditions in karst areas.

As public awareness and interest in cave conservation spread, the show cave industry began discovering the value of integrating science education with the entertainment aspects of their businesses. A National Caves Association meeting in Horse Cave in 1988, for example, was themed "conservation is good business."

This theme has since become the business motto for Fantastic Caverns, a privately operated show cave in Missouri. Fantastic Caverns has profited immensely from this philosophy. They provide educational programs to approximately 15,000 school children annually. The students return and bring their parents.

In the opinion of this author, Fantastic Caverns does perhaps the best job of any show cave in America of providing interactive interpretive exhibits and demonstrations on their tour. The cave has a saltpeter manufacturing demonstration, an audio-visual presentation (inside the cave), an artificial palaeontological dig, and biological study areas. A special Discovery Tour goes off the main trail to explore the geologic, hydrologic, and biological aspects of the cave.

Other U.S. show caves are also beginning to offer educational programming that goes well beyond simply "showing" the cave. At Hidden River Cave, students can participate in water testing activities, play a land use management game, construct models of sinkholes, and tour educational exhibits at the American Cave Museum in the cave's entrance. Several years ago, the American Cave Conservation Association developed an educational curriculum in partnership with the National Caves Association. A number of caves have utilized ACCA's "Learning To Live With Caves and Karst" Curricula or are modifying it to meet their own needs.

Communication and technology sharing has also improved among Show Cave operators, cave managers, and scientists. During the 1980s a government sponsored series of Cave Management Symposia espoused topics such as developing thematic interpretive talks, reducing the levels of cave lighting to control algal growth, cleaning the algae growth regularly to protect the surfaces of formations from

damage. One private cave went so far as to put in drainpipes beneath cave walkways to collect the wastewater runoff from the trails. Volunteer restoration projects and workshops to remove debris and repair broken formations have become annual events at national parks and several privately owned caves.

When the American Cave Conservation Association began looking for trail construction ideas for restoring the flood-prone historic tour at Hidden River Cave they were influenced by a fiberglass walkway that had recently been constructed in Appalachian Caverns, Tennessee. This led the ACCA to developing a boardwalk made of recycled plastic. This material has worked well in wet cave environments, does not release toxic materials, and is now being used in several other caves, including Mammoth Cave. Treated lumber, in contrast, releases copper, chromium, and arsenic.

Volunteerism and Public/Private Partnerships

In the 1970s, resource managers with various federal agencies had a problem. They could not effectively manage caves on government land because cave explorers were tight lipped about disclosing cave locations. Cavers soon recognized that secrecy alone could not prevent damage to caves, especially not the damage from land use activities and groundwater contamination, however they feared that public disclosure of cave locations would lead to more serious vandalism of caves.

To overcome this secrecy, federal land management agencies, such as the U.S. Forest Service, National Park Service, and Bureau of Land Management began sponsoring symposia and seminars to encourage private partnerships with researchers, conservation groups, and cavers. This led to more trust between cave explorers and resource managers, helped create new organizations such as the American Cave Conservation Association, and led to exploration and conservation partnerships between federal agencies and organizations such as the Cave Research Foundation and the National Speleological Society.

Currently, the trend towards private/public partnerships in cave management is still growing. Government owned caves at national and state parks are beginning to rely on private contributions and volunteer labor to accomplish goals that are beyond their budgeted appropriations. At Mammoth Cave National Park, for instance, contributions from private corporations have helped build trails and restore historic entrance conditions. Volunteers groups annually provide manpower at Mammoth Cave to improve trails and remove old trail debris that had accumulated over the years. Volunteers also provide significant manpower at Carlsbad Caverns to conduct restoration work and to remove hundreds of pounds of lint that accumulates on cave formations from visitors' clothing.

Nonprofit organizations such as the American Cave Conservation Association, National Speleological Society, The Nature Conservancy, and Bat Conservation International have been working for decades to protect caves by acquiring land, sponsoring restoration projects, and constructing cave gates to control access.

Much of this work has been accomplished through partnerships with the federal government. Nonprofit groups have supplied the volunteer labor. Federal agencies, such as the U.S. Fish and Wildlife Service and the U.S. Forest Service have provided funding to purchase steel and other gating supplies.

The design and construction of cave gates has improved significantly over the past decade. Early gates were often constructed with no thought given to the effect the gate might have on animal life occupying the cave. Frequently, early gates were constructed which left little room for bats to fly in and out safely while avoiding predation. In some cases, gates were constructed which destroyed entire bat populations by making it impossible for the bats to enter or exit the cave.

With the help of the U.S. Fish and Wildlife Service, the American Cave Conservation Association developed a style of cave gate that does not seem to adversely affect most species of bats. The placement and construction of new ACCA bat gates takes into consideration the potential for altering airflow and consequently humidity and temperature conditions; provision of adequate spacing between bars for bats to move in and out of the cave; and reduction of flood problems, such as blockage of the entrance by debris piling up against the gate. In cooperation with various federal agencies, Bat Conservation International, and The Nature Conservancy, the ACCA has been involved in construction of more than 150 new gates on caves and mine openings in the United States over the past 20 years.

New Laws and Regulations

Spurred by nonprofit groups and increasing public support, a flood of new laws and regulations in the U.S. has been created to protect caves and cave resources. During the 1970s,

the federal government passed laws protecting archaeological sites and endangered species. In the 1980s and 1990s, the nation's environmental movement brought new regulations to protect drinking water, such as the Clean Water Act, and, through the Environmental Protection Agency, began providing significant levels of funding for enforcement of these laws, education about point source and non-point source pollution, and clean up of toxic waste sites.

Several cities in karst areas, such as San Antonio, Texas; Lexington, Kentucky; and Springfield, Missouri, have adopted sinkhole ordinances to help control land use that occurs in surrounding karst areas. In 1988, as a response to strong support from cavers through the U.S., the Federal Cave Resources Protection Act was passed by Congress. This law protected cave resources on lands owned by public agencies such as the U.S. Forest Service and Bureau of Land Management, but was not designed to protect caves that were privately owned.

Caving groups also pushed for state laws to protect caves from acts of vandalism. Currently, 22 U.S. states have laws protecting cave resources. Many of these laws are weak and have rarely been tested in the courts. The highest profile cave vandalism case in recent years involved three individuals who broke into a cave at Mammoth Cave National Park in 1995 and mined more than 800 pounds of cave formations. The individuals were caught and sentenced to jail terms. The sentencing was stiffer than usual because a national park was involved.

Unfortunately, privately owned caves are frequently vandalized with little or no consequences to the perpetrators. This is primarily a reflection of the value that the U.S. places on individual property rights. Private cave owners in the U.S. do not want government involvement in the management of their caves. Consequently, groups like the American Cave Conservation Association have focused on education and providing assistance to help property owners protect their caves, and, hopefully, increase their desire to do so.

The Growth of Nonprofit Groups and Land Conservancies

As public support for conservation has grown and matured over the past half century, so has the affluence of conservation organizations, including caving groups. Land conservancies are among the most successful of modern conservation organizations in the U.S. They avoid the controversy of advocacy, which often entails going against business interests. Instead, most conservancies focus on raising money to purchase and protect land. Usually, a nonprofit Conservancy can provide a landowner with tax benefits in return for an easement in perpetuity or donation of land to a Conservancy. The Nature Conservancy is now the largest private cave owner in the United States with at least 113 Conservancy preserves in the United States centered around cave ecosystems.

Numerous other caves have been acquired or protected by archaeological conservancies, statewide conservancies, and various local cave conservancies. Members of the National Speleological Society have purchased and managed caves through the efforts of groups such as the Butler Cave Conservation Society, Indiana Karst Conservancy, Perkins Cave Conservation and Management Society, Texas Cave Management Association, and Greater Cincinnati Grotto. The Society also manages nine cave preserves. The Cave Conservancy of the Virginias and the Richmond Area Speleological Society have provided funding support for cave acquisitions and educational projects. The Southeastern Cave Conservancy has become one of the fastest growing conservancies and has acquired more than a dozen caves over the past decade. The American Cave Conservation Association now manages Hidden River Cave and provides substantial technical support services for those interested in managing and conserving caves.

Conclusion

Cave conservation in the United States is evolving rapidly and has primarily originated from citizens rather than the government. High profile environmental disasters helped create a pro-environmental public in the 1970s. This has led to the creation of numerous nonprofit groups and conservancies which are becoming involved in cave management, and a stronger focus on science and education among show cave operators.

The most significant trend in the U.S. is the growth and expansion of partnerships between government and private organizations in purchasing and managing significant caves, conducting scientific research, and educating the public. Perhaps the most important change in cave management philosophy has been towards a science based interpretative style, which makes information about caves and the karst landscapes meaningful and relevant to the cave visitor.