Inventory, Evaluation, and Management of Publicly Owned Caves in the Western United States and the Impact of the Federal Cave Resources Protection Act

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Abstract

Over the past decades many inroads have been made in the management of publicly owned caves in the western United States. Not the least of these is the Federal Cave Resources Protection Act of 1988. This act, for the first time, clearly mandates federal agencies to manage caves. A variety of management strategies and techniques have been formulated, some of which are described in this paper. Agencies are overcoming a lack of funding and a lack of qualified cave management specialists through training and use of knowledgeable volunteers. This paper, in a general sense, applies to management of all western caves but special emphasis is placed on management of lava tube caves.

Publicly Owned Caves

The concept of managing caves is nothing new, but the principles of management have changed over the years. Caves in the West were first managed for commercial or recreational purposes. In some cases improvements were added such as stairs, trails, railings, lights, and a guide was provided to entertain visitors and perhaps even share a bit of natural history. Tourist caves were the norm and the improvements provided were intended to enhance that use. The incentive was two fold: first, provide a recreation experience for visitors; second, generate income to help fund the endeavor.

Not all caves had guides, many were developed as dispersed recreation sites where the public was encouraged to come and explore on their own. The caves would be advertised on maps and in brochures and generally attracted a fair amount of use. The problem is that use was uncontrolled. Due to the remote locations in which the caves are found, vandalism was a problem. Vandalism in some cases was intentional, but frequently was unintentional. The trampling of floor features, leaving of litter, use of smoky torches or flares, taking a rock souvenir home, all contributed to a general degrading of cave resources. Many of these caves remain today open to the public as they have been for over fifty years.

Starting in the late 1960s, emphasis began to be placed on caves as an outgrowth of public concern. The Bureau of Land Management, the Forest Service, and the National Park Service in the Guadalupe Mountains of New Mexico developed joint management agreements. They agreed to a cave inventory and classification system that would be used by all. This system, with minor refinements, is still in use today. It was developed for and is well suited for the delicate and often dangerous caves of the area.

In 1986 the Forest Service and Bureau of Land Management developed directives for managing cave resources. Field units were directed and given guidance in dealing with caves. In November of 1988, President Reagan signed into law the Federal Cave Resources Protection Act which made it the policy of the United States to manage cave resources.

Federal Cave Resources Protection Act

The concept of cave management has only recently emerged as a discipline of land management. The catalyst in this emergence was the signing into law of the Federal Cave Resources Protection Act of 1988. This law makes it "the policy of the Untied States that Federal Lands be managed in a manner that protects and maintains,

to the extent practical, significant caves." Before this time there was concern, in certain circles, that cave resources were being impacted but any coordinated effort to address the situation was frustrated by the lack of a clear mandate. The Federal Cave Resources Protection Act of 1988 settled the question: now it's law.

It would seem that all problems are now solved, but that's just not so. The real work is yet to begin. When the act was drafted there was concern that "protection and maintenance" of every cave might be too burdensome and that it would be better if only "significant" caves fell under protection of the Act. In some cases, promoters of the act felt that this compromise was better than having no caves protected at all and were willing to agree to the last minute amendment.

This amendment was advanced largely as a cost-savings measure by agencies, but will probably prove to be more costly. As the Act stands, agencies will be required (in a practical sense) to evaluate caves to determine if they meet significance criteria. To impact caves before this evaluation and determination is made could place agencies into non-compliance with the purpose of the act. It is expected that projects in cave or karst areas will require investigation and evaluation prior to the start of the projects.

How will determinations of significance be made? The Departments of Interior and Agriculture are jointly developing regulations that will describe the methods to be used in making determinations. The exact methods are still under development and will require a period of public review and comment before being completed.

It is generally understood that an evaluation of cave resources will be the basis for decisions. Resources to be evaluated will include, but not necessarily be limited to: biological; geological, mineralogical, or paleontological; educational or scientific; hydrological, cultural or historical; or recreational values. Special consideration may be given to areas designated as national parks or monuments, areas of critical environmental concern, special interest areas, research natural areas, and so on when those designations were made in whole or part because of the presence of cave resources.

Cave Inventory Projects

While implementation regulations are in preparation, many offices are gathering cave data using the above criteria. They expect that the regulations will be flexible enough to take into account local differences in cave values. Since the gathering of basic data for future evaluation can proceed without the implementation regulations, many areas have decided to actively pursue cave inventories.

Inventories are being performed mostly by volunteers. Members of the National Speleological Society are particularly active, as well as the Cave Research Foundation, the Indiana Karst Conservancy, the Northwest Cave Institute, Prince of Wales Island Expeditions, and many others. Agencies generally lack, or have chosen not to allocate, funding for cave resource management. If it were not for so many willing volunteers, very little would be happening. Perhaps in no other resource area is there greater involvement of volunteers, or agencies more dependent upon their support, than cave management.

A danger for government officials not familiar with cave management is assuming that volunteers have all the answers. It is critical that managers exercise their responsibility to manage the resources they are charged with managing and not try to shift that responsibility to volunteers. Volunteers are an excellent source of assistance and can help generate a wealth of good ideas that can be implemented. The official must always keep in mind laws, policies, and directives and make decisions based on all factors, not just local public opinion. The manager's responsibility is to manage.

Cave Specialists

A difficulty in managing caves on public lands is a lack of qualified cave specialists. To be qualified one needs to be a generalist with knowledge of cave resources, followed by an understanding of surface management. Additionally, one needs an understanding of pertinent laws and regulations under which their agency works, and have the personal attributes needed to work with individuals of divergent interests. To be successful, an individual needs technical skill, but equally important is skill in interpersonal relationships.

Most cave specialists working for agencies are individuals who have come up through the ranks. They have generally developed an interest in caves outside of work, many times through sport caving. The interest in caves is often pursued through specialized technical training in geology, biology, or other sciences. In some cases individuals with

technical training have developed an interest in caves as an outgrowth of their specialty.

One can anticipate a steadily increasing demand for qualified individuals to work in cave management. Over the past two decades agencies have gone from no cave management specialists to the creation of positions at most important caves or cave areas. To implement the Federal Cave Resources Protection Act it will be necessary for a great many more positions to be created. This is good news for people wanting to make cave management their career. Agencies are starting to consider appropriate grade levels for differing levels of responsibility.

A variety of laws and regulations exist or will soon exist for the management of cave resources. The important point to remember is that cave management is dynamic and ever changing. As new ideas are brought forward and tried, ideas and concepts change with them. Cave management is an emerging field of natural resource management and will take its place along side traditional fields such as forestry, range, wildlife, and recreation management. Traditional management has focused entirely on surface resources, cave management focuses on those resources beneath the soil/air interface. The surface and the underground are linked and dependent upon each other in ways we are just now starting to understand.

Inventory and Evaluation of Lava Caves

When a cave inventory and evaluation process is developed it is usually developed for local use. Various authors have proposed unified systems for use across a wide range of cave types and geographical areas. Managers have found that it is better to customize the system to meet local needs. They have found that the concerns for managing lava tubes are quite different from those of limestone caves. As a result, changes are needed in the way evaluations are conducted.

Lava tubes tend to be gently sloping linear systems without the complexity normally found in solution caves. Vertical drops tend to be short, less than 100 feet, and are found only at entrances and in some mature tubes subject to erosional or depositional modification. Formations are less common in lava tubes than solution caves and are usually the result of melting or extrusion while the tube was forming. Secondary speleothems are rare due to the young age of lava tubes.

Lava tubes have generally been thought of as lacking in interest and as robust caves that can withstand great human impact. Exactly the opposite is true. Undisturbed lava tubes have been found to contain delicate coralloids near their entrances, and sometimes at other places where evaporation is accelerated. These form most readily on floors and lower wall surfaces. In arid areas gypsum flowers, crusts, and selenite needles are not uncommon. Lava stalactites and stalagmites are common in certain caves and because of their small cross sections are highly vulnerable to breakage. In some caves the floor will be encrusted by small sphericals of lava drip which can be crushed by careless explorers. Deposits of drip-eroded volcanic ash or clay often cover lava tube floors and are as important to the beauty and interest of the cave as secondary formations are to solution caves.

Tree roots are often found emerging from ceiling cracks and extending to the cave floor. These provide one of the few nutrient sources for cave adapted invertebrates and are easily damaged by either careless explorers or removal of trees from the surface. Cave biota is usually more scarce in lava tubes due to the lower levels of nutrient input but are highly evolved. Some researchers feel that only a small part of the populations are found in the humanly passable openings and that large parts of the population inhabit contraction cracks in the lava flows. In desert areas lava tubes have been found to provide refuge to plants, animals, and insects that inhabited the surface when climates were wetter and colder than they are today. The microenvironment found in cave entrances often provides the only remaining habitat for species which have otherwise become extinct on the surface.

Pack rat middens and dried pack rat urine called amberat is an important source of information concerning past climates and vegetative types. Rat middens in dry caves hold samples of thousands of years of vegetative history as does pollen embedded in amberat.

Ice deposits during the Pleistocene epoch provided a water source for native Americans. Around the entrances can be found evidence of extensive village sites and in the caves are found great quantities of charcoal from fires built to melt the ice. The cold-trapping nature of lava tubes has made them nearly exclusive in this past human applica-

tion. In other areas, such as Hawaii, where surface water is nonexistent due to the porous nature of the lava fields, early humans collected dripping water. Because lava caves were a focus of prehistoric use, they are among the best preserved and important sites for deciphering human history.

A Lava Tube Evaluation Method

The common practice is to evaluate lava tubes using resource categories from the Federal Cave Resources Protection Act. The following system is used at Mount St Helens National Monument to create a cave evaluation and classification matrix. Values are compiled using the resource rating guide. The matrix is a convenient method of displaying the relative importance of cave resources and is helpful when making classification determinations.

The value of developing resource value ratings is that they can be done with relatively little field work. At Mount St Helens a group of local cave experts was asked to rank caves according to their values. Following an extensive inventory project, there was no appreciable change in ranking. This shows that initial classification is possible prior to doing an extensive inventory. The quality of the product will, however, depend upon the use of knowledgeable experts and the existence of some prior work.

Resource Rating Guide

The following rating guide provides, in a simplified narrative form, brief statements that can be used to assign a value to respective resources. When viewed in a larger matrix it is possible to compare relative values between

Sample Cave Evaluation and Classification Matrix
Mount St Helens National Volcanic Monument

Cave Name	Biological	Hydrol-ogical	Historic	Recre-ational	Geological Paleontol-ogical, etc	Educa-tional, Scientific	Cave Classifica-tion
Ape Cave	2	1	3	3	3	4	2
Barneys Cave	2	0	1	2	2	2	3
Beaver Cave	4	0	1	3	3	3	1
Beaver Bay Cave	3	0	1	2	2	3	3
Bat Cave	5	0	1	3	4	5	1
Breakdown Cave	2	0	1	1	1	1	3
Blue Ribbon Cave	2	0	1	3	4	3	1
Christmas Canyon Cave	2	0	1	2	4	4	3
Column Cave	3	0	1	1	3	1	3
Dollar-And-A-Dime Cave	3	0	1	4	3	4	3
Dogwood Cave	1	0	1	2	2	1	3
Duckwalk Cave	2	0	1	1	1	1	3
Flow Cave	3	0	1	3	3	3	3

Table 1 – An evaluation and classification matrix is useful for displaying the relative importance of various resource values.

caves. The relative values can be used as an indication for certain management needs such as gating, restricted access, special surface management, and so on. One should use this approach with great caution and not rely solely on the ratings for management direction. Good judgment and careful analysis of individual caves should never be overlooked.

Biological Resources

Value	Explanation of Value
0	Biological components lacking.
1	Biological components exist but of low apparent significance.
2	Biological components present and numerous, sensitivity low.
3	Biological components present, numerous, and of moderate sensitivity.
4	Biological components numerous and sensitive to disturbance.
5	Biological components very numerous and highly sensitive to disturbance. Habitat is critical to species survival. The cave contains unique species, or ones found on state or federal sensitive, threatened, or endangered species lists.

Hydrological Resources

Value	Explanation of Value
0	Hydrologic components lacking.
1	Hydrologic components present but of low importance.
2	Hydrologic components present but of low sensitivity.
3	Hydrologic components present and of moderate sensitivity.
4	Hydrologic components important and very sensitive.
5	Hydrologic components complex and highly sensitive.

Cultural or Historic Resources

Value	Explanation of Value
0	Cultural resources lacking.
1	Potential for cultural resources low.
2	Potential for cultural resources moderate.
3	Cultural resources present or implicated by historic records. Site may be eligible for the National Register of Historic Places.
4	Cultural resources present and sensitive to disturbance. Site eligible for the National Register of Historic Places.
5	Cultural resources present and highly sensitive to disturbance. Site eligible for the National Register of Historic Places.

Recreational Value	
Value	Explanation of Value
0	Cave lacks recreational value.
1	Recreational value low. Little or no scenic appeal.
2	Recreational value low but receiving some use. Scenic values low.
3	Recreational values, scenic values, and use moderate.
4	Recreational values, scenic values, and use high.
5	Recreational values, scenic values, and use very high. A major cave of regional or national significance.

Geological, Mineralogical, or Paleontological Value	
Value	Explanation of Value
0	Features of significance lacking.
1	Some interesting features present.
2	Features present and resistant to disturbance.
3	Features present and of moderate sensitivity to disturbance.
4	Features numerous and of high value. Features sensitive to disturbance.
5	Features rare, valuable, numerous and/or of great sensitivity to disturbance.

Educational or Scientific Value	
Value	Explanation of Value
0	Cave lacking educational or scientific value.
1	Cave with low educational or scientific value.
2	Cave with features that can be used for educational or scientific study but are otherwise considered common to the area.
3	Cave which provides opportunity for educational or scientific use.
4	Cave providing *unusual* opportunity for educational or scientific use.
5	Cave with *unique* opportunity for interpretation and public education or scientific study.

Cave Classification

At Mount St Helens caves are placed into one of three classifications depending upon the resource value.

Many different cave classifications are possible depending upon the type of resources, resource sensitivity, and expected impacts. No classification system has been widely employed but all have certain similarities. It is more important that systems

Cave Classification	
Class	Explanation of Classification
Class 1	**Sensitive Caves.** Caves considered unsuitable for exploration by the general public either because of their pristine condition, unique resources, or extreme safety hazards. They may contain resources that would be impacted by low levels of visitation. These caves are not shown on maps or discussed in publications intended for general public use such as guides, brochures, and magazines.
Class 2	**Directed Access Caves.** Caves with directed public access and developed for public use. These caves are shown on maps or have signs directing visitor access. Frequently have guided tours and artificial lighting. Regardless of the level of development, public visitation is encouraged. The caves may have sensitive resources that are protected.
Class 3	**Undeveloped Caves.** Caves that are undeveloped or contain unmaintained or minimal developments that are suitable for exploration by persons who are properly prepared. In general, these caves contain resources that resist degradation by recreational use. However, public use will not be directed toward them.

Table 3—At Mount St Helens caves are placed into one of three classifications. Each classification carries specific management direction.

be adjusted to fit local conditions than to try for uniformity. Over time, as various systems are employed, refinements will no doubt occur, making future systems better than those used today.

Standards and Guidelines

A common method of describing management actions is through use of standards and guidelines. This allows a manager to develop a list of standard actions that will be applied whenever cave resources are encountered. The following is a listing of standards and guidelines common in the Northwest.

- Logging, road construction, and other uses of heavy equipment above or in the vicinity of a cave with a thin roof, or over the course of such a cave, should be restricted if there is potential for damage.
- Vegetation in the vicinity of a cave entrance or over a cave's course should be retained if required to protect the cave's microenvironment.
- Cave entrances should not be altered or used as disposal sites for slash, spoils, or other refuse.
- Management activities should not be permitted within any area draining into a cave if they may affect the cave ecosystem with sedimentation, soil sterilization, the addition of nutrients or other chemicals, or will change the cave's natural hydrology.
- Surface drainage shall not be diverted into caves.
- Public access should be limited if required to prevent damage to the cave ecosystem, artifacts, or other features.
- The location of caves will be kept confidential when needed to protect archaeological sites, habitat for endangered wildlife, sensitive cave biota, and unique geological features.
- Communication and cooperation between the agency, caving organizations, and recreationists will be fostered. Exchanged information will not be made public if it could lead to the degradation of sensitive caves.
- Caves with high resource value, high hazard, or high public use will be subject to a written cave management plan. The plan will describe specific management measures, methods of implementation, and a monitoring plan to determine effectiveness of the management measures.

Depending upon the local conditions and the expected impacts, many other standards have been written. Here again, it is important to tailor management strategy to local needs and expected impacts and not limit one's thinking to actions which have been taken elsewhere.