

PERFORMING A NEEDS ASSESSMENT FOR POTENTIALLY GATING A CAVE OR MINE

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Abstract

A needs assessment for a potential gating project can be boiled down to a central question: Does a given cave or mine need a gate or not, and if so, then what kind? In order to answer this composite question, a number of other questions must be addressed.

- Are there safety issues such as unstable rock or shafts deep enough to cause entrapment or injury?
- Are residential areas with children nearby (they can fit easily through the 5 3/4 inch bar spacing of a standard bat gate)?
- Is the entrance in an obvious location, near where people congregate, or marked on published maps?
- Conversely, is the opening obscure, remote, and hard to find even if you know where to look?
- What are the current human uses of this underground space? Are they appropriate?
- Who are the stakeholders (in the broader sense of the term)?
- What would be the impact on esthetics of the entrance if it were gated?
- Are there ways to minimize that impact?
- Does the cave or mine contain cultural resources worthy of special protection?
- What are the history and/or prehistory of this mine or cave?
- Did any events important to the nation's development occur here?
- Are resources related to a prior culture present?
- Does the cave or mine contain natural resources worthy of special protection?
- Did it at one time house any currently endangered or threatened species?
- Would gating a given entrance cause significant changes in microclimate, water or wildlife movement?
- What are the existing microclimatic conditions?
- Are these conditions suitable for species currently using or that formerly used this underground space?
- Has the entrance been modified to enhance human use?
- Is restoration of prior conditions needed?

Based upon the answers to these questions concerning safety plus cultural and natural resources, a determination of need for a gate on a mine or cave entrance can generally be determined. However, it is important to keep in mind that site-specific unanticipated factors may also need to be considered.

Considerations in Conducting a Needs Assessment

Welfare of People

Above all, human health and safety must be given priority when considering a gate for an entrance. If people are being injured or killed, then our chances of conserving natural and cultural resources will greatly diminish. One of the preferred designs is the Airflow Bat Gate designed by Roy Powers (Nieland 1998). It causes minimal changes to air flux, allows bats and other animals to pass, in most cases, and is reasonably resistant to forced entry. However, children and even small adults can pass between the bars. Most caving parties are composed of people too big to pass through, so this has not been a problem to date. In a situation where the entrance is near a neighborhood or recreational facility, then additional security measures will be needed. This could be in the form of a perimeter fence with signs warning of the danger analogous to those around electrical power substations. Determining the critical proximity is a matter of judgement. If the site is within the roving range of children, then take the extra steps. With increasing sprawl, currently gated entrances will need to be evaluated for adequate protection of both the people and resources in question.



Figure 1. Photos are examples of obvious and obscure entrances. The one on the left is on a bluff high above Green River in Mammoth Cave National Park. It is easily visible and is also an Indiana Bat hibernation site. The photo on the right is of a cave entrance that people with a map often fail to find. It is not gated.

Assuming an entrance is beyond the reach of unsupervised children, similar but slightly different criteria apply. If the mine or cave opening is in an obvious location, near where people congregate, or is marked on published maps, then inexperienced and poorly equipped people will be attracted to it (Olson 1999). These types of sites almost always require some kind of closure. On the other hand, if the opening is obscure, remote, and hard to find even if you know where to look, then gating it may simply draw attention, and establish a trail to it (see figure 1 for examples of both situations). Unless an initial approach by a curious individual would likely have dire consequences, you could allow obscurity to protect the resource and people from each other.

Current Human Use

It is important to learn if people are using a given underground space, and to determine if that use is appropriate. Recreation often accounts for most human use of caves or mines, but it is possible that a given site may be significant to Native Americans, or even to a group using the site for respiratory Speleotherapy. The treatment of respiratory ailments such as asthma by exposure to air in certain caves and mines is prevalent (and effective) in Europe, but is little known in the U.S. In any case, tactful inquiry with user groups and consideration of use compatibility with resource sensitivities is very important. Generally, people interested in a cave or mine will become allies with the managing agency in protecting resources if they are treated with respect.

If safety and/or resource factors indicate that a gate is advisable, consideration should be given to the potential impact on entrance esthetics if it were gated. So far as we know, esthetics is a purely human concern, but it is safe to say that entrances can be quite beautiful as indicated by the number of published photographs. Therefore, when conducting a needs assessment we must anticipate visual detriments and find ways to minimize them. This type of impact has two facets: (1) visual intrusion of the gate itself, and (2) damage caused during installation or replacement (see figures 2 and 3).

That potential visual impairment of a cave entrance can become controversial is illustrated by the example of Owl Cave in Mammoth Cave National Park (MCNP). The cave is an archaeological site in which plundering was ongoing and graffiti marred the walls, even out on precarious ledges high above the floor (see figure 2). With the resource damage and safety issues, the need for a gate was clearly indicated. Nonetheless, Joe Meiman (MCNP) and Chris Groves (Western Kentucky University) opposed gating the cave due to potential for diminishing the beautiful sunbeams that shine through the entrances in winter. I mention them specifically to emphasize that opposition on the basis of esthetics may come from unexpected sources, not just fringe groups unfamiliar with the issues. In this case, the cave was protected without diminishing the beauty of winter sunbeams via the use of flat "louvered" bars set at the incident angle of the sun at winter solstice (see figure 2).



Figure 2. View into Owl Cave on left. Graffiti on exposed ledges and artifact pilfering necessitated a gate. Impact to pretty sunbeams entering the cave was minimized by angling flat bars like venetian blinds. No bat use had been previously documented.

Nothing lasts forever, and this includes cave gates. Each time a gate is installed, some damage is done to cave walls, ceilings, and floors along with their associated resources (see figure 3). With corrosion, damage from forced entries, and research developing better designs, it becomes clear that it's time to put the old gate "out to pasture." More often than not, a replacement gate is sited in a new location, which then spreads the damage. Gates are not malicious and are trying to protect people from themselves and the cave resources from the same people. Furthermore, the existing (not necessarily the original) gate may not be in the best location for movement of wildlife, and while the new structure is put in place, the old one provides some security. Still, damage to entrance walls is gradually increased by successive gate replacement, and the Historic Entrance of Mammoth Cave serves as an example. Therefore, to the degree possible gates should be designed with minimum impact removal and replacement in mind.



Figure 3. Holes drilled into the ceiling of Mammoth's Historic Entrance to accommodate bars of a previous gate.

Past Human Use

Mines in the U.S. are generally from historical time periods, but there is always the potential for an aboriginal mining site nearby and so this possibility should be checked out. Be they in mines, caves, or even nearby, if there are resources related to a prior culture, prehistoric or otherwise, then a specific plan for their documentation and protection should be developed and implemented (Simek et al 1999). In the historical realm, products from mining were often important to our nation's development (see figure 4). There may be relict equipment or historic structures worthy of special protection within and near the mine or cave. Historical researchers with academic credentials and organizations with interest in historic preservation may desire and deserve access to these resources. Again, these people should be regarded as allies unless otherwise demonstrated.



Figure 4. Wooden salt-peter-mining pipes made during the War of 1812 are shown at left above, and a box vat with hewn trough is shown on the right. The small white object is a temperature and relative humidity data logger deployed as part of an effort to stop condensation from developing and dripping onto the artifacts.

Natural Resources

A given cave or mine may contain biological, geological, or bio-geological resources worthy of special protection. Bio-geological resources include fossil and sub-fossil remains, and living geo-microbiological populations. On the biological end, endangered and threatened species such as bats come to mind (see figure 5). These of course are protected under the Endangered Species Act, but all native species inhabiting a cave or mine should be given consideration. Gates, partial gates, and fences around an entrance should not cause significant changes in microclimate, water or wildlife movement. Where security structures are needed, having them be environmentally neutral is important for geological as well as biological resources. Condensation of moisture or desiccation of areas formerly moist can cause the destruction of evaporite minerals or their deposition in places with negative consequences. Such shifts in moisture patterns greatly alter habitat conditions for cave life. Small terrestrial invertebrates adapted to humid cave conditions are particularly susceptible to desiccation (see figure 6). Finally, enhancement of air exchange through an entrance must be approached with great caution since increased influx of cold winter air can increase the rate of rock fall in the variable temperature zone, and this has implications for human safety (Olson 1996).



Figure 5. Endangered or threatened species of bats are a major consideration in determining the need for a gate on a mine or cave. The lumpy clumps in the ceiling of this dome are hibernating bats.

To the greatest extent possible, conduct an inventory of biological, geological, and paleontological resources in concert with documenting existing microclimatic conditions. Then, via literature search and consultation with appropriate specialists, determine if these conditions are suitable for species currently using or that formerly used this underground space. Cultural and natural resource evaluations go hand in hand. Historical research may indicate how and when the entrance was modified to enhance human use, and what species may have been present in the past. Lacking historical records, paleontological inventory (see figure 6) along with carbon 14 dating can provide information on what species were present at a given location and time period (Toomey et al 2001). From the foregoing, it can be determined whether restoration of prior conditions is needed. Bats are obviously a group of particular focus, and bio-assessment protocols for these species have been developed. The full spectrum of considerations for determining potential need for a gate (and, if so, then what kind) is more complex than one might expect. Hubbard's Cave in Tennessee is a case in point. It has both natural and cultural resource issues in addition to persistent illegal entry (Call and Powers 1999).



Figure 6. Though emphasis is rightly placed on the needs of bats, all biota should be considered. Cave crickets are a keystone species in cave ecosystems too (photo courtesy of Gary Berdeaux of Diamond Caverns). Dead bats talk or at least their remains can tell you what and when environmental conditions existed in the past at a given site.

Conclusion

Careful consideration of human health and safety issues, ongoing use by interested parties, plus cultural and natural resources can generally be used to determine whether or not a gate on a mine or cave entrance is needed. Any one of these values can lead to a positive gating decision, but it is probably just as common for multiple areas of concern to trigger that conclusion. In these cases, it is important to minimize personal or group bias in prioritizing values, and to figure out a solution that addresses all concerns. In every case, it is important to keep in mind that there may be factors unique to a given cave or mine that also need to be considered. If, after evaluation, a security structure is indicated, then it is appropriate to begin developing a project strategy. One final point I will add is to make sure that a chosen structure is secure. A gate or fence should be able to resist conventional or readily available hand tools. Put in a secure gate even if break-ins seem unlikely. Massive damage from illegal mining of speleothems in Floyd Collins Crystal Cave within Mammoth Cave National Park resulted from an inadequate gate.

Literature Cited

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