BAT ROOST PROTECTION: CLOSURE DESIGN USING SOFT CLOSURES

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Abstract

Gates are quickly becoming a common method to prevent human disturbance in bat roosts, both in mines and natural caves. However, the expense of a custom designed metal gate can be prohibitive for many non-profit groups or agencies. This is particularly true when it is uncertain how much traffic the site is actually experiencing. Therefore, it may be economical to consider less expensive methods to monitor and protect a site before immediately investing in a gate that may become a focus for vandalism and could require long-term maintenance. A first option includes educational signs used at the site, particularly when only a small area of the cave is off-limits to visitation. Pseudo-monitoring equipment or fake alarms can also be used to discourage visitation. Some sites have used volunteers to supervise caving activity in the area during the periods that the bats are in residence. If some funds are available, perimeter fencing around the entrance area has been successful in a number of bat roosts. Another, although expensive, choice might be installation of a commercial detector, now available on the market. These can be incorporated with a remote signal (radio, cell phone, etc.) to alert the owner(s) when site security is jeopardized. Because different bat species respond differently to gates, it behooves us to consider other options before immediately considering a gate as our only alternative.

Introduction

It is generally agreed that the benefits of protecting bat roosts from natural catastrophe or human disturbance outweigh the costs. Agriculturists (ranchers, farmers) derive huge economic benefit from the efforts of our nocturnal insectivorous allies. Also, many sub-tropical desertland plants (Turner and Brown 1994) profit from bat-pollination in the American southwest. There is some evidence that past efforts to protect bat roosts, with metal gates or structural alteration to the cave, had a detrimental impact on bat roosts (Richter *et al.* 1992, Ludlow and Gore 2000). There is a general consensus within resource agencies to gate caves and mines, when monies are available, in an effort to protect the resource. However, a gate may not be the best and only alternative available for protection of bat roosts, particularly when the gate will potentially affect the flight path of bats. Any gate, no matter how well designed and built, impacts the bats' emergence patterns through the reduction of available cross-sectional area of the passage. This may not be entirely detrimental but even a 'bat-friendly' gate will constrain the bat flight to some degree. Once a gate is installed, it requires the bats to align their flight path to exit between the bars of the gate. Our decision to protect the site must include an evaluation of the bats' ability to successfully use the available flight window after gating. It may, therefore, be worth considering alternatives to gating, particularly when the budget is not sufficient to provide a properly designed bat-friendly gate.

We must first agree on the definition of '*soft closure*' within the context of bat-roost protection. The definition for this discussion of 'soft closure' will include any manmade change to a site that discourages human disturbance, but does not reduce the cross-sectional flight area available to the bats or affect the site's microclimate. Unfortunately soft closure is often perceived as not 100 percent effective, as determined individuals can still circumvent the soft closure obstacles. But, of course, the same is true for gates, which can themselves become attractive targets for determined vandals. We will present different 'soft closure' alternatives for bat-roost protection with a general comparison between benefits. Unfortunately, a cost analysis is impossible because the requirements for protection will be so different for each site. The ability of the site resource manager to pursue these soft closure options may depend on land ownership (whether

public vs. private), as privately held land may more easily restrict access without public input. However, these soft closure options have been used in many situations throughout the United States and are well worth considering before automatically installing a metal gate.

Reasons for employing soft closure

When a cave or mine has a known bat colony (referred as 'roost-site' for our purposes) but only low-to-moderate visitation, it may be a reasonable site to initially incorporate soft closure techniques. If the soft closure methods are successful in protecting the roost, these will be potentially less expensive and will definitely be less intrusive to the bats. If a roost site is a maternity colony, the loss of maneuverability by pregnant females must be considered when initiating protection for the site. In addition, some bat species of do not adapt well to gates and a metal gate can have a long-term detrimental impact on the roost.

Budget restrictions of the group or agency attempting the resource protection may dictate the use of less expensive soft closure alternatives. A metal 'bat-friendly' gate may be beyond their financial resources and although attractive, a cheaper gate may greatly affect the bats' access to the roost. Large metal gates can be both expensive to build (plus maintain against vandalism) and often require extensive manpower for proper construction. Another constraint against metal gates for the protection of roost-sites can be the physical geometry of the cave or mine passage. Some passages are so large, that to adequately restrict human intrusion would require a massive gate structure. Worse yet, if you introduce a gate in a small passage, it becomes a very attractive spot for predators. As the bats are required to slow flight to exit the gate, a predator gains a benefit in the encounter. The risk of attracting predators can not be underestimated because the concentration of bats leaving a roost on a nightly basis can be very tempting to an animal in search of an easy meal.

Options for Soft Closure

One of the cheapest, and often effective, methods to discourage visitation to bat roosts is to reduce or eliminate vehicular access to the site. This will not work for all sites, given the myriad of legal access issues, but if you can reduce access by obstructing the roadway with a locked gate, then the longer cross-country hike will begin to 'weed-out' some of the less dedicated explorers. It is even better if you can permanently close the road by physical barrier such as installing boulders and scarifying the old roadway bed for a short distance.

A second low-cost alternative to consider when initiating protection of a site is to install educational signs at the entrance to inform visitors of the importance of bats and their vulnerability to human disturbance. It is particularly important to list the dates that the cave is closed to visitation on this educational sign. Trespassing can often be reduced if the explorers understand that the site is closed for an important reason but that they will have access at other times of the year. If your illegal entry is by a specific group (grottos, scout groups, locals) an educational program with a particular focus might be recommended. You are much further ahead if you can change your explorers from adversaries to allies in the protection of the site. At one roost site in southern New Mexico the educational sign has been installed inside the cave because the bats roost in a side passage off the main corridor. It is only that passage that is off-limits during the season the bats are in residence. This allows the rest of the cave to be visited throughout the year. However, extreme care must be taken that this situation is closely monitored because it is based on an honor system and disturbance may still occur. This alternative is a compromise that may only work when the explorers are as concerned about protecting the roost site as the resource manager.

A third alternative, which can be installed alone or in conjunction with other soft closure techniques, is the placement of alarm systems or pseudo-security devices. Past experience has shown that these devices can be effective at discouraging people, particularly when supplemented with an educational sign. It is surprising, but these devices have become the focus of vandalism, as it is believed that they are actually monitoring the site. Because the pseudo-security device is so inexpensive to construct (a medium sized box chained to the wall with a blinking LED and a soldered antenna can suffice), it

can be effective in discouraging the more timid intruder or diverting attention from other, more expensive protection efforts.

Another technique to employ when protecting a roost-site is to involve volunteers in monitoring the site and discouraging illegal visitation by their presence. This method is particularly effective if the roost-site is used only during a specific time period (i.e. not a year-round bat roost). If the roost-site is on private land, these volunteers can include the landowner. In southern Arizona, a roost site used retirees who chose to spend some of their free time volunteering for worthwhile causes. Cave clubs (grottos) will often adopt a roost-site as a specific grotto project and thus allow the volunteer effort to be distributed among a number of people.

The last option is perhaps the most expensive soft-closure alternative, but it can provide the most permanent site protection. To keep out visitors, a perimeter fence can be constructed around the entrance area. Fences have been very successful in protecting roost sites without altering the site's microclimate or constraining the flight path of the bats. Also, a fence can be built by less-trained labor (no welding required) and can be built during any season, because it is not constructed in the actual passage used by bats. The effectiveness of the fence can be improved by installing barbed wire along the top. Also, rocks placed in concrete can be installed where necessary to tie the fence to the ground and eliminate access under the bottom of the fence. Another method to reduce explorers crawling under the fence is to run a secondary wire along the bottom. This makes it more difficult to pull up the fence to gain access to the site. At a number of sites in southern Arizona, the natural topography of the ground around the entrance allows the design of the perimeter fence to be even less intrusive to the bats' flight. The slope of the land established the location of the fence such that the top of the fence is at the same elevation as the bottom of the entrance. This allows the bats total access at the entrance during emergence.

Options for Monitoring

It is important to initiate a monitoring program with most soft-closure alternatives to insure that they are effective in keeping out unauthorized visitors, especially in the beginning when people will attempt to circumvent the barrier. The cheapest and easiest monitoring method is to sweep the floor clear of footprints in a narrow portion of the site's passage. Subsequent monitoring visits to the cave or mine can then narrow the time of intrusion and concentrate efforts to catch trespassers on site.

Another inexpensive method to monitor a site will more closely evaluate the time of intrusion. A counter hidden in a narrow portion of the passage can be triggered by light from a headlamp or by breaking an infrared beam whenever a person passes. If the counter is attached to a data logger, the exact time of the intrusion can be determined. This helps concentrate the efforts of personnel protecting the site because it gives them a better idea when to visit the site and potentially catch intruders.

A more costly method to monitor the site is a motion detector or pressure pad hidden in the floor. Technology has reduced the cost of many of these systems but care must be taken when selecting this option. The equipment will need to be 'cave-proof' so that the circuitry is resistant to high humidity and potentially corrosive air. Generally, electronics will be sensitive to such adverse conditions and additional protection will be required (waterproof container or additional potting of electronics). This option may require frequent upkeep and would not be recommended unless volunteer personnel are interested in equipment maintenance.

The last monitoring technique can be the most expensive if the site is prone to vandalism. The installation of an infrared video camera can be very effective in discovering who and when the cave is visited. Similar equipment is often used by wildlife biologists at remote water holes to monitor animal use and could be triggered by the person's movement. However, this option is much more expensive, particularly if the camera is vandalized or stolen, and the power requirements for such equipment will be difficult at a remote site. In addition, to successfully catch any trespassers at the site, the motion detector, pressure pad or video camera must be linked to some form of communication system (pager, cell-phone, radio or satellite) to alert the resource manager at the time of

intrusion. This adds to the expense but may be very useful in reinforcing the effectiveness of a soft closure alternative.

Review of Soft Closure Options

Closure Efforts
· Restrict access to site
· Education signs
· Pseudo-security
· Site Volunteers
· Perimeter Fence
Monitoring Efforts
· Monitor Tracks
· Infra-red counter
· Motion Detector
· Pressure Pad
· Video Camera

How do we decide what's best?

How do we decide which soft-closure alternative is the best solution for our situation? Unfortunately, there is no magic equation that spits out the exact answer when we provide our site constraints. However, an expensive metal gate should not necessarily be your first choice, particularly if you consider the other options available to you.

As stated earlier, a critical factor in your decision for site protection will be your evaluation of the requirements for this particular bat roost and flight maneuverability of the bat species using the site. Gates may appear to be a 'quick fix' for your problems; however, gates can be expensive, vulnerable to vandalism and can therefore require long-term maintenance, for which you will rarely have funds allocated. You must also remember that doing nothing is not the same as soft closure. Soft closure is still a modification of the site in an effort to protect the roost without affecting the flight path of the bats or altering the microclimate of the roost in any way. Interesting enough, soft closure can provide information on the importance of a particular roost to the bats themselves. If a reduction in human disturbance brings about an increase in bat population, then additional protective measures may be warranted. This has been particularly true in southern Arizona. One site on the Fort Huachuca Military Reservation that had a visitation problem installed a very bat-unfriendly gate in the entrance for a few years, that is probably what finally drove the last bats away. Instead of gating two other historic (but abandoned) bat roosts, the first gate was removed and the three sites were fenced as described previously and supplemented with motion detectors tied to a communication system. The reduction in human disturbance was sufficient over 8 years that one site now has 8000+ *Myotis velifer* (cave myotis) and 3000+ endangered *Leptonycteris curasoae* (lesser long-nosed bat) using the site each summer.

Last, but not least, remember that there are others wrestling with similar resource issues and problems. Our ability in this computer-age to network within non-profit groups and resource agencies allows us to learn how others have tackled comparable situations. The bottom line is that we all wish to protect bat roosts but we must keep in mind that although we feel that the metal gate that we have designed is the best solution and will be readily accepted by the animals, the bats have the final vote.

Literature Cited

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Bob Buecher is a registered professional engineer and land surveyor. He was Project Manager for the Pre-development Baseline Study for Kartchner Caverns, in southern Arizona. There he directed studies of the cave microclimate, geology, mineralogy, biology, hydrology, geophysics, and mapping of the cave. The cave has a maternity colony of cave myotis (*Myotis velifer*) and the study stressed low disturbance techniques to monitor the bat population. He has designed and built cave gates, motion sensors, and bat counters to be used in remote sites.

[Note: 4 illustrations in the original paper were not scanned and included in this version]