

X. CONSIDERATIONS FOR BAT ROOST PROTECTION

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The protection of bat roosts is one of the most important issues when considering bat conservation (Pierson 1998). Destruction and disturbance of bat roost sites, especially caves, has been a notable contributor to the decline of bat populations in the US and around the world (Mohr 1972; Humphrey 1975; McCracken 1989; O'Shea et al. 2016). Conservation of roosts is more important now than ever before with the risk of human activity spreading White-nose syndrome (WNS) between sites. The abandonment of roosts by bats may result from human disturbance, direct loss of roosts from closures of the site or eviction of bats, destruction, or natural events. Human disturbance by the public, resource managers, or researchers can have negative impacts on bats using any given roost site. This is especially true at winter hibernacula, where more frequent arousals by hibernating bats can lead to the loss of fat reserves before spring arrival. Sheffield et al. (1992) provides several useful guidelines for the protection of bat roosts. Review this issue in the various chapters for more specific information related to the different roosting habitats and related conservation recommendations. In general, guidelines can include:

- Avoid revealing exact locations of bat roosts to the general public.
- Limit access to critical bat roosts to state, federal, or academic researchers with validated goals and valid permits.
- Follow WNS decontamination protocols when working at roost sites.
- Avoid or minimize disturbances within a roost.
- Research should be discontinued or minimized while bats are hibernating, and focused on early or late time periods of the hibernation season.
- Collections of specimens should be minimal and should occur outside the roost instead of inside.
- Proper gating guidelines should be followed when bat gates are installed at caves or abandoned mines.
- Exclusions, when necessary, should be conducted following appropriate guidelines and seasonal considerations, and potential alternative roosts should be considered and evaluated in the process.

There are numerous ways to protect bat roosts. These include various bat-friendly closures (bat-compatible gates, cages or cupolas, gated culverts, cable nets, half-gates, perimeter fences, and seasonal closures), buffer zones, climbing regulations, and cave registers or permit requirements. We discuss several of the most commonly implemented alternatives below. Not all roosts are created equal. Some roosts carry greater levels of importance to the local bat populations associated with them. Making decisions regarding which roosts deserve protection can be difficult. Guidelines for determining which roosts are considered biologically important to helping sustain local bat populations have been created (Neubaum et al. 2017) and may be found on the Colorado Bat Working Group (CBWG) website: <http://www.cnhp.colostate.edu/cbwg/>. In addition, the threats affecting roosts may vary depending on

the bat species under consideration. The CBWG created a user friendly threat matrix that can be queried on a species or threat basis. See chapter XII. Assessing Threats to Bat Species: The Colorado Bat Matrix, for a detailed description of the threat matrix tool and visit the interactive website at: <http://www.cnhp.colostate.edu/batmatrix/>. We address four categories of issues that should be considered when protecting bat roosts: bat-compatible gates; buffer zones; seasonal closures; and exclusions.

BAT-COMPATIBLE GATES

Gates have been used extensively in the eastern US for more than 30 years to protect critical cave roosts. However, if these gates are not bat-compatible, or if they modify the microclimate of the roost, they may actually pose a threat to bats (Tuttle 1977; White and Seginak 1987; Richter et al. 1993; Pugh et. al. 2005; Spanjer and Fenton 2005). Bat gate installation involves a number of important considerations:

- Learn the special needs of the bats using the mine or cave to be gated. Factors such as species of bat, colony size, season of use, roost type, cave/mine configuration, and other aspects will determine what type of gate to install. Gate types can include angle iron full gates, culvert gates, ladder gates, cupolas, half-gates, and slot gate designs. Knowledgeable specialists from Colorado Parks and Wildlife (CPW), Colorado Committee of the Western Bat Working Group, Bat Conservation International (BCI), or other local bat specialists with experience on the subject can be consulted to determine optimum gate design for a specific closure (also see Sheffield et al. 1992; Pierson et al. 1999; Ludlow and Gore 2000; Navo and Krabacher 2002; Navo and Krabacher 2005).
- Provide an adequate flyway for bats emerging from the roost while also allowing for effective exclusion of human intruders. Current approved bat gate designs call for 5¾ inch spacing between horizontal bars and a minimum of 2 feet between upright posts. Some designs call for 4 inch spacing between horizontal bars in the lower 3 feet of the gate to absolutely preclude children and small adults. This spacing is advisable with gates near human dwellings and high potential visitation. Materials and gate designs are factors in spacing.
- Minimize restriction and alteration of the overall mine or cave opening and surface interface in order to limit alteration of the microclimate within the roost (e.g., temperature, humidity, and airflow). This microclimate is critical to the quality of habitat provided by the roost (Tuttle 1977; Richter et al. 1993).
- Determine seasons of bat use and plan gate installation at a time when the bats are not present, or at a time that will cause minimal disturbance to the resident bats.
- Design the closure for maximum security and resistance to vandalism, considering such parameters as the mine or cave's geology, proximity to populated areas, and degree of visitation.
- Prioritize roosts for gating when necessary, considering human health and safety, preservation of sensitive species, and cost.

- Procure funding and landowner consent for bat gates on private lands.
- Conduct public outreach programs to agencies, industry, and private landowners to promote bat-compatible closures where they are warranted.
- A monitoring program should be part of any gating program. This is especially important when modifications to traditional gate designs are used, and before wide-spread use of such modifications are implemented to ensure continued bat use of roost sites.

Specific designs for bat-compatible gates can be found in Navo and Krabacher 2005, Fant et al. (2009), Pierson et al. (1999), and Tuttle and Taylor (1998).

BUFFER ZONES

Buffer zones may be useful in protecting bat roosts (Elliott 2012). Policies were developed to protect caves on federal lands in 1994 by the Deschutes National Forest and the Oregon and Washington Bureau of Land Management (BLM). Included in the recommendations were a number of policies to protect bat habitat. On lands administered by the BLM, "no new surface disturbing activities would be authorized within a 350 foot radius of a cave opening or any known cave passages which may adversely impact any significant or potentially significant cave resource value." On the national forest, trees are not to be harvested within a 150–200 foot radius of cave entrances and infeeder drainages where slopes are less than 30 degrees. On slopes steeper than 30 degrees next to cave entrances, ground-disturbing activities are prohibited. Clear-cutting is not allowed within 250 feet of caves with significant bat populations. Forested corridors between cave entrances and nearest foraging areas are to be maintained at a 150–200 foot radius. If the nearby foraging area is a stream, then trees are not to be harvested 75–100 feet on either side. Hoosier National Forest in Indiana uses a similar 150–200 foot radius buffer around cave entrances and infeeder drainages.

On the Tongass National Forest in Alaska, surface disturbing activities are restricted a minimum of 100 feet from the edge of any karst feature (e.g., sinkhole, collapsed channel, stream infeeder, or cave) if associated groundwater contributes to a significant cave, stream or domestic water supply. No surface disturbing activity will occur on land directly overlying any known significant cave or waters contributing to the cave (USFS 1996).

Pierson et al. (1999) provides for more generous buffers than the above agencies. They suggest a buffer zone of 2 miles around all Townsend's big-eared bat (*Corynorhinus townsendii*) roost sites for pesticide spraying. They also recommend no prescribed burning or vegetative alteration in shrub-steppe or pinyon/juniper habitats within a 1.5 mile radius of *C. townsendii* roost sites. For forested habitat, no more than half can be subjected to prescribed burning per decade within a 0.5 mile radius of the roost site and only when bats are not present. For timber harvesting they suggest maintaining a buffer zone of 500 feet (horizontal radius) around all roost entrances.

SEASONAL CLOSURES

Another useful protective measure for bat roosts is seasonal closures. Seasonal closures can be used

during critical time periods such as maternity or hibernation periods. A general guide for seasonal closures suggested by Pierson et al. (1999) and Navo (2001) is to close caves used for hibernacula to recreational visitor use from October 15–April 15, close maternity caves from April 15–August 31, and swarming sites from September 1–October 15. These critical time periods of hibernation, swarming, and maternity activity may vary regionally and need to be determined by a qualified biologist. There will also be site-specific flexibility to seasonal closures. Seasonal closures can be considered on climbing activities or any other recreational activity in and around roost sites.

EXCLUSIONS

Prior to closure work at winter/fall roosting sites that will not have a bat gate installed; exclusion of bats may be recommended. The exclusion is intended to help prevent the entry and use of the site by bats, and prevent the trapping of bats inside the reclaimed mine feature. This would involve screening out bats by placing chicken wire (1 inch mesh or more) across the entire opening, as well as any un-gated but open access point to the mine complex. The exclusion effort should take place a minimum of 3 nights/days prior to the start of any construction activities. Longer periods of time (i.e., 1 week) are appropriate, if possible. The chicken wire should cover the opening from the top to about 5-6 inches from the floor or bottom of the opening. This will help prevent bats from entering the mine, and also allow any bats that may be inside the mine prior to the exclusion effort, to escape for the mine before the closure operations begin. This would suggest that exclusions begin by September 1 at these fall/winter sites. They can go up at any time prior to the start of the fall transition season, but no later than September 30, to avoid weather related variations to fall bat activity. In addition, exclusions are not considered functional from October 1 – April 15, because reduced activity of bats.

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