BrandenBark™: Artificial Bark Designed for Roost Use by Indiana Bats (*Myotis sodalis*)

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Abstract

The federally endangered Indiana bat (*Myotis sodalis*) is a concern for development projects in nearly half of the United States (N = 23 states, USFWS 2007). The habit of this species to roost and rear young under exfoliating bark of trees has put it at risk for incurring adverse impacts from most projects requiring tree clearing throughout its summer range. Highway development projects often require consideration of Indiana bat impacts because many traverse forested tracts and require swaths of tree clearing. While impact avoidance and minimization are the primary goals when considering impacts to Indiana bat habitat, complete impact avoidance cannot be accomplished in many cases while still meeting the conditions of the project Purpose and Need. Often, impact mitigation tools are needed to offset adverse impacts to this federally protected species. Here we present an artificial roost structure that mimics the natural roosting structure of Indiana bat roosts. Our artificial roost, BrandenBark™, has been shown to be used extensively by a maternity colony of Indiana bats in central Kentucky. It has also been accepted as a mitigation option for several linear development corridor projects by the US Fish and Wildlife Service in the Elkins, West Virginia Field Office. We feel that BrandenBark™ is an ideal mitigation tool for roadway development, as it can be utilized within rights-of-way or external parcels in most cases. In addition, this artificial roost structure does not have the high risk of falling which is problematic when natural roosts (snags) are left standing along roadways posing a potential safety hazard.

Introduction

Artificial roosts for bats have been available for many years and have been designed and constructed to encourage bat roosting for wildlife viewing, pest control, providing or enhancing habitat where resources are limited, and as mitigation for habitat loss. Many bat houses/condos have been designed to be similar to anthropogenic structures already used by bats such as window shutters, siding, roof tiles, attic spaces, belfries, barns, and abandoned houses (BCI 2003). Prior to this study, only two were designed to mimic the roost conditions of exfoliating bark of dead trees: the rocket-box bat house (MacGregor and Dourson 1996) and Artificial Fiberglass Bark, an isopthalic polyester resin reinforced with fiberglass, manufactured by Wesco Enterprises (Rancho Cordova, CA; Chambers et al. 2002). Both have been used at many locations with varying degrees of success (Whitaker et al. 2006, Chambers et al. 2002). While several bat species have been documented to use these tree roost mimics, the federally endangered Indiana bat (*Myotis sodalis*) has rarely been documented using such artificial roosts (Carter et al. 2001, Whitaker et al. 2006, Roby 2010).

While the natural roosting preference of Indiana bats is relatively well understood (USFWS 2007, Kurta and Kennedy 2002), only recently has information about their use of non-typical roosts been extensively reported. A maternity colony of Indiana bats was found using the attic of a church in northern Pennsylvania (Butchkoski and Hassinger 2002), while a barn in Iowa housed a large summer colony (Chenger et al. 2003). In addition, a reproductive colony was found roosting behind the siding of a suburban house in upstate New York (A. Mann, 2007 pers. comm., ESI). In Missouri, Hendricks et al. (2004) observed Indiana bats roosting in utility poles which more closely resemble natural Indiana bat roosting habitat. BrandenBark™ also incorporates the use of utility poles.

Even though such anthropogenic structures are occasionally used by Indiana bats, there has been very limited success in the purposeful deployment of artificial structures that are readily inhabited by this species. Less success has been documented with maternity use of artificial structures, especially with those specifically designed for this purpose. A total of 3,204 artificial roost structures of 9 different types were installed as mitigation and research at the Indianapolis Airport, Indiana from 1992-1996 (Whitaker et al. 2006). The use of these structures by Indiana bats has been limited, with documentation of occasional use by individuals and the use of two bat houses as a significant

maternity roost (Whitaker et al. 2006). Double chambered rocket boxes placed near known maternity roosts in southern Illinois received some use late in the summer (Carter et al. 2001) but have not been confirmed to have received consistent summer use. However, rocket boxes at Camp Atterbury did receive summer use by reproductive Indiana bats (Roby 2010). Indiana bats were shown to use Artificial Fiberglass Bark on a previously identified maternity roost tree that had lost all its bark in Kentucky (EKPC 2005, Hawkins et al. 2008). However, Indiana bats have rarely been found to use substitutes for natural roost trees on a consistent basis for maternal purposes.

We feel that the lack of success of artificial roosts designed for Indiana bats has been mainly due to the fact that current bat house designs or tree replicas do not provide the microclimate conditions and/or visual cues for a species that prefers the exfoliating bark of dead trees. This lack of design to simulate the conditions of natural exfoliating bark roosts prompted the need for such a product. BrandenBark™ was designed with the intent to mimic natural bark both with visual cues and the microclimate conditions of natural roosts.

Artificial Roosting Habitat

BrandenBark™ is artificial roosting habitat for bats that has been designed to mimic the natural exfoliating bark of dead trees. BrandenBark™ utilizes the realistic polyurethane elastomeric Flex-Bark© created by Replications Unlimited (Hazelwood, MO) but has been modified to allow bats to grip and hang from the bark's undersurface. Bark patterns are available that mimic a variety of tree species, including many species known to be used by Indiana bats, which appropriately provides both the visual and structural roosting opportunities required by Indiana bats. BrandenBark™ was developed by wildlife biologists at Copperhead Environmental Consulting, Inc. (Copperhead) and Fort Knox military installation who, after experimenting with artificial bark types previously available, were looking for a better alternative. The design team then approached Replications Unlimited, one of the leading producers of artificial outdoor scenery for zoos, parks, and displays in the United States, to produce a product that could be used to replace potential roosts that have been removed during development or natural succession.

To determine if BrandenBark™ provides suitable conditions for a maternity colony of Indiana bats, we installed the bark at the Fort Knox Indiana Bat Management Area (IBMA) in Kentucky near known maternity roosts that had degraded in habitat quality since 2007. We installed 21 BrandenBark™ structures over four years. Structures were generally clustered in groups within close proximity to one another (ranging from 1-10). A typical BrandenBark™ structure is composed of a 7.6 m telephone pole that is placed 1.5 m deep in the ground and packed with gravel. The poles are untreated with the exception of the 1.5 m portion in the ground to help prevent decay. A sheet of BrandenBark™ was attached to the top of each pole with a gap allowing for bats to access under the bark. In order to document bat use, guano traps constructed of wooden supports and window screen were attached to each pole approximately 1 m above the ground.

BrandenBark™ roosts were determined to have been used if guano was present within the trap. Those roosts with large numbers of bats present were typically easy to distinguish by the amount of bat vocalizations (squeaking) under the bark and presence of guano in the traps. Active use by bats was determined by conducting exit counts at roosts with fresh guano and audible squeaking. Selected structures with bat activity were sampled using mist nets in order to verify the species composition of bats actively using the roosts. In addition, select Indiana bats captured at the roosts were outfitted with radio-transmitters (0.38-0.42 g LB-2, Holohil Systems, Canada) and tracked for 8-10 days. In total, we placed 82 transmitters on 76 adult female and young of the year (radio transmitters were attached to some bats more than once) Indiana bats and monitored their roosting activities during the maternity season (15 May – 15 August 2009-2012) or post-maternity season (16 August – 15 October 2011). Each day that a radio-tagged bat was located in a BrandenBark™ roost was considered a bat day, i.e., 1 bat in 1 roost for 1 day.

BrandenBark™ Use

Over the course of our study, we found that bats selected BrandenBark™ roosts on a regular basis. Hundreds of roost observations have been made to determine occupancy over the four year study. At least one BrandenBark™ roost was occupied by bats every time that monitoring occurred, and in many cases, multiple roosts were occupied

on the same day. During a typical visit to the site, at least one roost was occupied by >10 bats with most visits revealing one or more roosts with 50-200 bats. Use was higher in areas that with larger number of structures in close proximity to one another. Of the six structures installed in 2012, five were documented having bat use within 60 days of installation and all six were utilized within 85 days. Emergence counts were conducted on BrandenBark™ structures throughout the year, but mainly within the maternity season (May 15-Aug 15, USFWS 2007). We conducted 62 independent exit counts at 12 different BrandenBark™ structures where, on average, 85.2±9.4 bats were counted exiting per roost. This includes five counts where no bats exited and a maximum number of 242 individuals emerging from a single BrandenBark™ structure. Overall exit counts have yielded a total 1,892 bat days in BrandenBark™ over the four year study.

To date, 268 bats of three species have been confirmed roosting in BrandenBark™ structures via capture and subsequent in-hand identification. This number includes 220 Indiana bats (82% of capture), 46 little brown bats (*M. lucifugus*, 17%), and 2 northern bats (*M. septentrionalis*, 0.7%). Most capture events consisted of a single species occupying a particular roost, but interspecies cohabitation did occur on occasion. The capture of 156 adult females (many reproductively active) and 54 juvenile Indiana bats shows clear evidence of maternity use of these structures. Ten adult male Indiana bats have been caught, but mainly in the autumn. Little brown bats also used the structures as maternity roosts as evidenced by the capture of 38 female and 7 juvenile along with 1 non-reproductive male.

Thirty-eight percent of the BrandenBark™ roosts were confirmed to house reproductively active female Indiana bats via capture or radio-telemetry. All of these would be considered primary roosts for Indiana bats based on ≥30 bats exiting the roost on two or more evenings (Callahan et al. 1997). Seven of the 21 BrandenBark™ structures were used by radio-tagged Indiana bats and we documented 34% of all bat days (N = 74) in BrandenBark™ roosts during the four year study. All BrandenBark™ roosts used by radio-tagged Indiana bats were in areas where BrandenBark™ structures were clustered in groups. In general, most bats consistently occupied one or two roosts during the periods of radio tracking, resulting in the low number of roosts being utilized.

Mitigation Tool

Summer habitat loss is one of the greatest anthropogenic impacts to the Indiana bat, and regulatory agencies often require mitigation to account for habitat removal. The majority of Indiana bat mitigation has applied to winter habitat. Much of the summer habitat mitigation has not been utilized near the impact area, resulting in mitigation that was poorly representative of the impact. Previously, most mitigation methods for summer habitat have largely been ineffective, required long development times, or were short-term solutions. BrandenBark™ has been shown to be used extensively by a maternity colony of Indiana bats, can be utilized onsite or nearby, and addresses summer habitat loss immediately. We recommend that BrandenBark™ roosts be placed in forested openings or along edge habitat grouped in clusters of 3-5 roosts structures. They can be installed cost effectively, be placed on existing rights-of-way (ROWs) or small out-parcels of available land such as wetland/stream mitigation sites, and is a long term solution with little to no maintenance. In many cases, projects requiring summer habitat disturbance also necessitate long term monitoring. BrandenBark™ is ideal for these circumstances as it can be easily monitored for bat use, and bat species can be verified through capture.

The research and development of BrandenBark™ has been conducted in close coordination with the USFWS, therefore the lead federal agency for Indiana bat regulation is familiar with the product. It has been approved by USFWS as a mitigation tool and is being implemented for linear corridor project mitigation in West Virginia and in Wildlife Management Areas in Kentucky with known Indiana bat maternity colonies. This solution is especially effective in circumstances when appropriate roosting habitat is scarce and the long term availability of the artificial trees provided by BrandenBark™ structures allows for consistent year to year monitoring of known Indiana bat maternity colonies for projects that require post-construction monitoring.

Literature Cited

Bat Conservation International. "Designing Better Bat Houses." *Batcon.org*. Bat Conservation International, Spring 1993. Web. 20 May 2013.

Butchkoski, C. M., and J. D. Hassinger. 2002. The ecology of Indiana bats using a building as a maternity site. Pages 130-142 in The Indiana Bat: biology and management of an endangered species (A. Kurta and J. Kennedy, eds.). Bat Conservation International, Austin, Texas.

Callahan, E. V., R. D. Drobney, and R. L. Clawson. 1997. Selection of summer roosting sites by Indiana bats (*Myotis sodalis*) in Missouri. Journal of Mammalogy 78(3):818-825.

Carter, T., G. Feldhamer, and J. Kath. 2001. Notes on summer roosting of Indiana bats. Bat Research News, 42(4):197-198.

Chambers, C.L., V. Alm, M.S. Siders and M.J. Rabe. 2002. Use of artificial roosts by forest-dwelling bats in northern Arizona. Wildlife Society Bulletin 30(4):1085-1091.

Chenger, J. 2003. Iowa Army Ammunition Plant 2003 Indiana Bat Investigation. Prepared by Bat Conservation and Management, Inc., Carlisle, PA. for Iowa Army Ammunition Plant, Middletown, IA.

(EKPC) East Kentucky Power Cooperative. 2005. Biological Assessment. Effects on the Indiana bat Associated with Construction of the Proposed Little Mount 161 – 12.5 kV Distribution Substation & 161kV Transmission Line Tap. Unpublished report submitted to U.S. Fish and Wildlife Service, Kentucky Field Office, Frankfort, Kentucky.ESI - Mann, A., Gilley, L. M., and V. Brack, Jr.. 2006. 2005 Summer mist net and radio-telemetry surveys for the federally-endangered Indiana bat for Phase 1 of the Millennium Gas Pipeline Project, Orand and Rockland Counties, New York. Unpublished report to Millennium Pipeline Company, Binghamton, New York. 78 pages plus appendices.

Hawkins, J., P. Sewell, and M. W. Gumbert. 2008. Indiana bat survey and anthropogenic stimuli study conducted at US Army Garrison Fort Knox and Brashears Creek study sites during summer 2007. Copperhead Environmental Consulting, Inc. Paint Lick, KY.

Hendricks, W. D., R. Ijames, L. Alverson, J. Timpone, M. Muller, N. Nelson, and J. Smelser. 2004. Notable roosts for the Indiana bat (*Myotis sodalis*). Pp. 133-138. In Proceedings of Indiana bat and coal mining: a technical interactive forum. OSM, Alton, IL and Coal Research Center, SIU, Carbondale, IL.

Kurta, A., and J. Kennedy, eds. 2002. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.

MacGregor, J. and D. Dourson. 1996. Post bat house design. Daniel Boone National Forest, Winchester, KY.

Roby, P. 2010. Bat survey of Camp Atterbury with emphasis on roosting of Indiana bats and evening bats. Unpublished Report for AMCE, Lexington, KY.

Stone, W. E. and B. L. Battle. 2004. Indiana bat habitat attributes at three spatial scales in northern Alabama. Bat Research News 45(2): 71.

Whitaker, J. O. Jr., D. W. Sparks, V. Brack, Jr. 2006. Use of artificial roost structures by bats at the Indianapolis International Airport. Environmental Management 38:1 28-36.

USFWS (United States Fish and Wildlife Service). 2007. Indiana bat (*Myotis sodalis*) draft recovery plan: first revision. U.S. Fish and Wildlife Service, Fort Snelling, MN. 258 pp.