Summary of Bat Research in Camp Ripley Training Center and Arden Hills Army Training Site, MN 2016

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Summary

Crews from the Environmental Office at Camp Ripley Training Center (CRTC) captured 92 bats in CRTC from June 6th – 24th, and 99 bats at Arden Hills Army Training Site (AHATS) July 6th – 10th, 2016. Bats of seven species were captured during mist-netting surveys, including the first recorded capture of an evening bat (*Nycticeius humeralis*) in the state of Minnesota. We attached transmitters to 3 pregnant northern long-eared bats at CRTC and 3 lactating little brown bats at AHATS. Three northern long-eared bat roost trees were identified at CRTC. The little brown bats captured at AHATS were tracked to two roosts, both in buildings. Roost trees at CRTC varied in height and decay stage. The roosting patterns observed at CRTC were similar to roosting patterns we have observed in other areas of Minnesota, where bats appear to be using a variety of available trees. This report details work done at CRTC and AHATS as part of a statewide study of northern long-eared bats. A report summarizing results of the statewide project will be available in early 2017.

Introduction

Bats are a critical component of Minnesota's ecosystems. A single bat may eat 1000 insects per hour, and the state's bats likely provide many millions of dollars in pest control each year (Boyles et al. 2011). Seven species of bats are known residents of Minnesota: little brown bats (*Myotis lucifugus,* MYLU), northern long-eared bats (*Myotis septentrionalis*, MYSE), big brown bats (*Eptesicus fuscus,* EPFU), tricolored bats (*Perimyotis subflavus*, PESU), silver-haired bats (*Lasionycteris noctivagans,* LANO), eastern red bats (*Lasiurus borealis*, LABO), and hoary bats (*Lasiurus cinereus,* LACI).

There are four Minnesota bat species (northern long-eared bat, tricolored bat, little brown bat, and big brown bat) that hibernate in caves during the winter, and then disperse widely across the state in spring, summer, and fall. Very little is known about the summer habitat use of these species. These four cave-hibernating bats are all Species of Special Concern in Minnesota.

The U.S. Fish and Wildlife Service listed the northern long-eared bat as Threatened under the federal Endangered Species Act in April 2015, largely due to the impact of white-nose syndrome on bat populations (U.S. Fish and Wildlife Service 2016). White-Nose Syndrome (WNS) is caused by the fungus *Pseudogymnoascus destructans* which leads to increased winter activity and extremely high mortality rates of cave-hibernating bats (Frick et al. 2010). WNS has been moving through bat populations in the eastern states and provinces, with range expansions of WNS occurring every year (Turner et al. 2011). *P. destructans* was detected in Minnesota in 2013, and bat mortalities from WNS were first recorded during January 2016 at Lake Vermilion - Soudan Underground Mine State Park, near Soudan, MN (Minnesota Department of Natural Resources 2013, 2016a).

Maintaining reproductive success will be critical to the viability of Minnesota's bat populations as WNS spreads in Minnesota. Obtaining knowledge about maternity roosts before a population decline occurs will be critical for future efforts to reduce negative impacts of forest management and provide high quality habitat to support recovery of bat populations. Even if mortality rates can be reduced, there is still likely to be a drastic reduction in bat populations. Implementing management strategies that minimize mortality will be important as WNS continues to affect Minnesota bats.

In 2015, the Minnesota legislature approved $1.25 million in Environment and Natural Resources Trust Fund (ENRTF) funding for the project *Endangered Bats, White-Nose Syndrome, and Forest Habitat*, the goal of which is to collect data on the distribution and habitat use of the northern long-eared bat in Minnesota. This project is being conducted by the Minnesota Department of Natural Resources (MNDNR), the University of Minnesota Duluth – Natural Resources Research Institute (NRRI), and the USDA-Forest Service (USFS). Data for this project are being collected from across the state during 2015-2017. Data from the first year of this project were summarized in a report released in the fall of 2015 (Swingen et al. 2015). Camp Ripley Training Center (CRTC) and Arden Hills Army Training Site (AHATS) served as two of 15 study sites for this project during 2016, with personnel from the Camp Ripley Environmental Office mist-netting bats and conducting radio-telemetry and roost tree characterization.

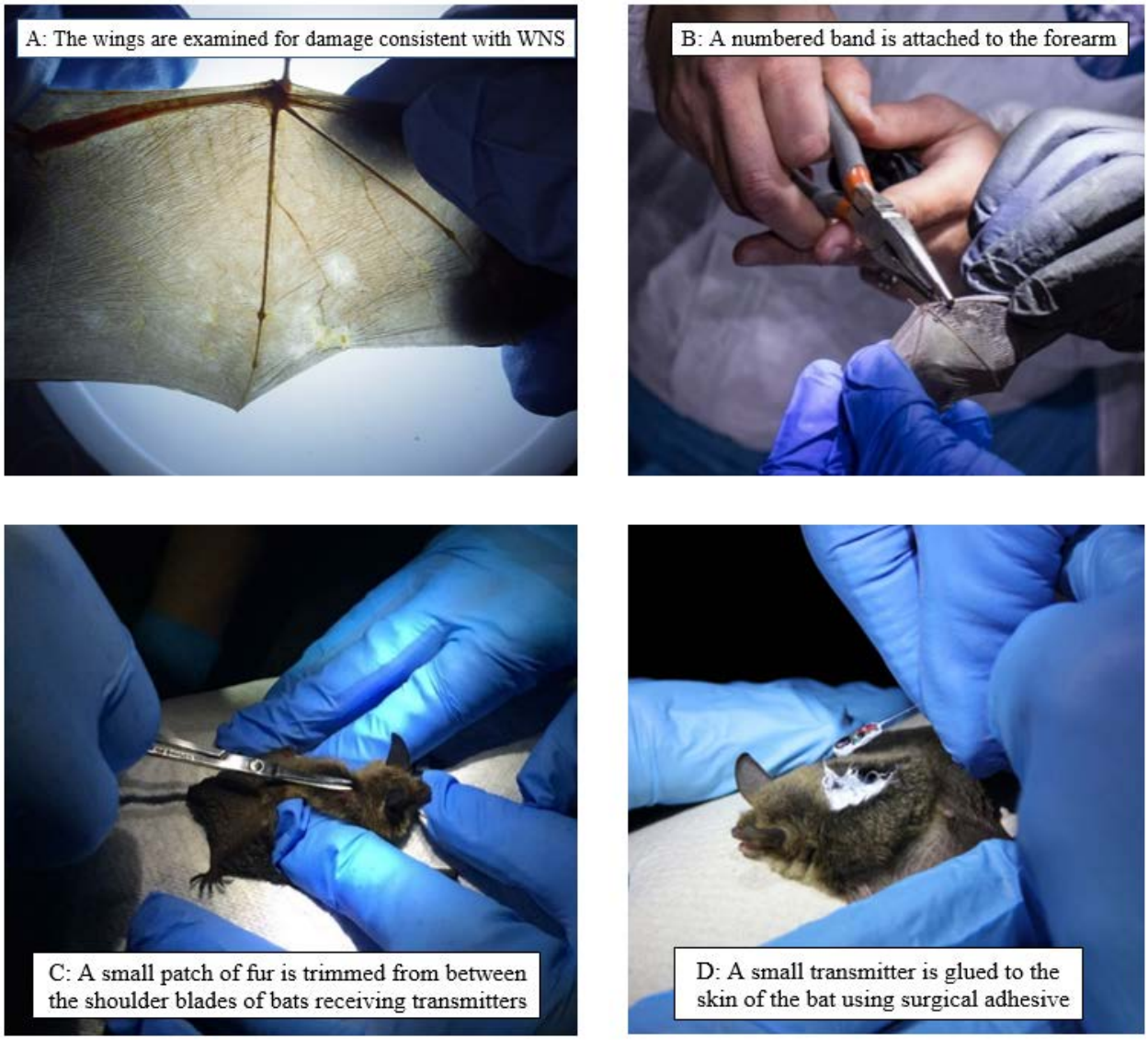
Methods

Bat Capture/Processing

Fine mesh mist-nets (Avinet Inc., Dryden, NY, USA) were set up along forested roads that could act as travel corridors for bats. Each night, 2–4 mist-nets were set up within 200 m of a central processing location. Mist-nets were opened after sunset, and checked every 15 minutes for 2–5 hours, depending on capture rates and weather conditions. Captured bats were placed in cloth bags until processing.

Figure 1. Photos showing the techniques for capturing and processing bats. Photo Credits: A – Superior National Forest; B, D – Brian Houck, NRRI; C – Peter Kienzler, NRRI.

Figure 2. Photos showing techniques for processing bats and attaching bands and transmitters. Photo Credits: A – Christi Spak, MN DNR; B – Ryan Pennesi, USFS; C – Sarah Baker, NRRI; D – Morgan Swingen, NRRI.



We identified each captured bat to species by morphology, and determined sex, age, and reproductive condition by physical examination. Each captured bat was weighed and measured, and the wings were inspected for damage potentially caused by WNS (Fig. 1, Fig. 2). Each bat was then fitted with an individually-numbered lipped aluminum wing band (Porzana Ltd., Icklesham, United Kingdom).

Radio-transmitters (A2414 Advanced Telemetry Systems Inc., Isanti, MN, USA; or LB-2X, Holohil Systems Ltd., Carp, ON, Canada) were attached to most reproductive adult female MYSE. We trimmed a small section of hair in the center of the back, and attached the transmitter to the skin using surgical adhesive (Perma-Type, Permatype Company Inc., Plainville, CT, USA, Fig. 2). Bats were released at the capture site after processing.

Tracking/Roost Tree Characterization

Bats with radio-transmitters were tracked to their roosts each day, until the transmitter failed or the transmitter fell off. Data recorded at each roost included roost type, tree species, and decay stage. At dusk, crews returned to the roost to conduct emergence surveys. During an emergence survey, personnel watched the roost from 30 minutes before sunset to 1 hour after sunset. During the emergence survey we recorded the number of bats emerging in each 10-minute interval, the location of the exit point, and whether or not the bat with the transmitter left the roost.

Crews returned to each roost tree to conduct a more detailed tree characterization after bats left. This included measuring roost tree diameter at breast height (DBH), tree height, decay stage, canopy closure, slope, aspect, and recording details about the vegetation surrounding the roost tree. All trees were marked with a numbered aluminum tree tag with the text “NLEB” (for Northern Long-Eared Bat) stamped on the tag (Fig. 3).

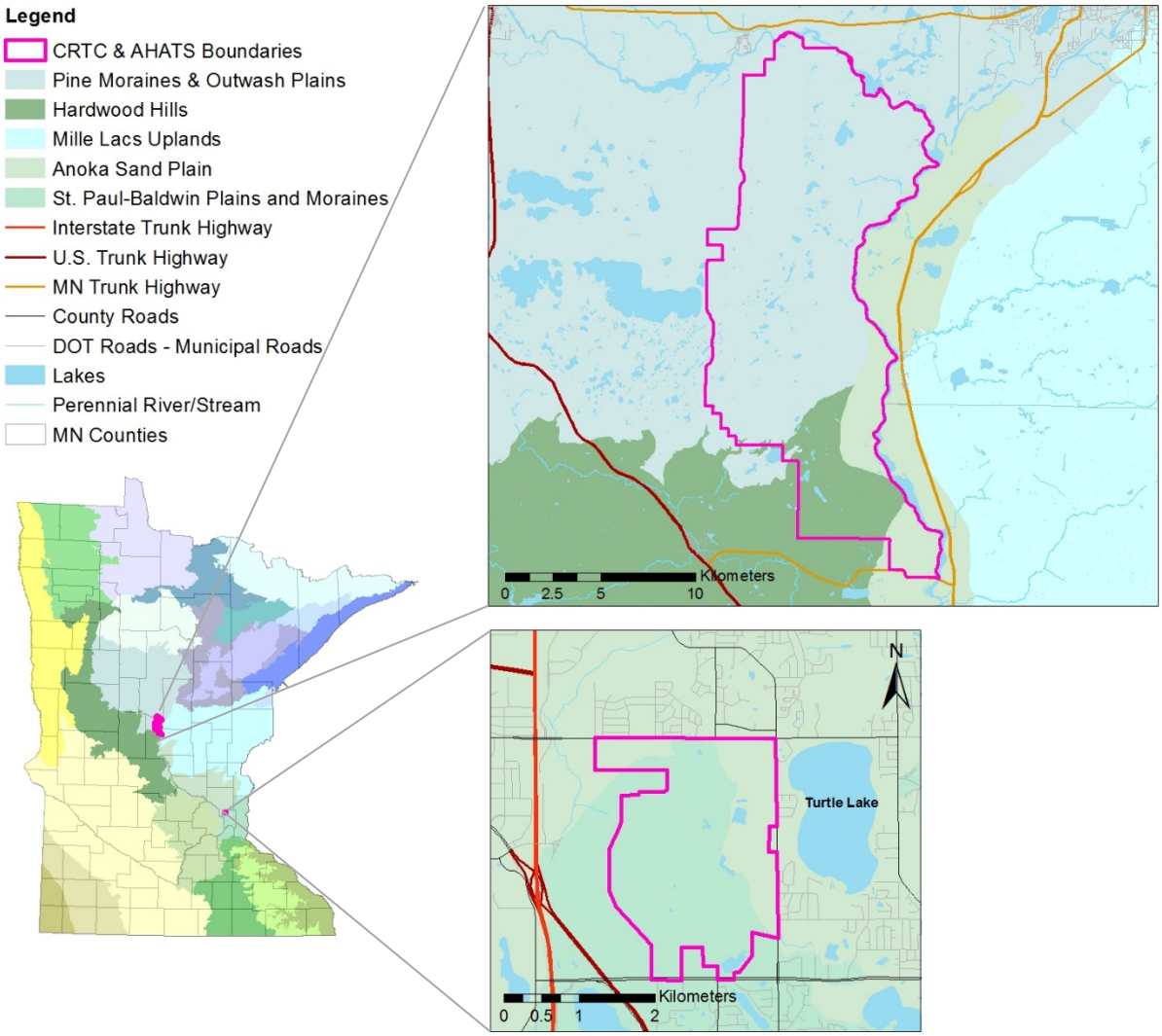
Figure 3. Photo of the type of aluminum tree tags used to permanently mark northern long-eared bat roost trees at Camp Ripley Training Center, June 2016.

Study Area

Bats were captured for the large-scale study at 15 locations around the state of Minnesota, including CRTC and AHATS. CRTC and AHATS are managed by the Minnesota Department of Military Affairs and used for training and other activities of the Minnesota National Guard (Minnesota Department of Natural Resources and Minnesota Army National Guard 2016).

CRTC covers approximately 53,000 acres of land in Morrison and Crow Wing Counties, including mature pine and hardwood forests (Fig. 4). CRTC is also bordered by two major rivers: the Crow Wing River to the north, and the Mississippi River to the east. AHATS covers 1,500 acres in the Twin Cities Metropolitan area and is comprised of forests, open fields, and marsh/wetland. It is located within the city limits of Arden Hills (Ramsey County), and is surrounded by both residential and industrial areas.

Figure 4. Map showing the Ecological Subsections overlapped by Camp Ripley Training Center (top right) and Arden Hills Army Training Site (bottom right) in Minnesota.

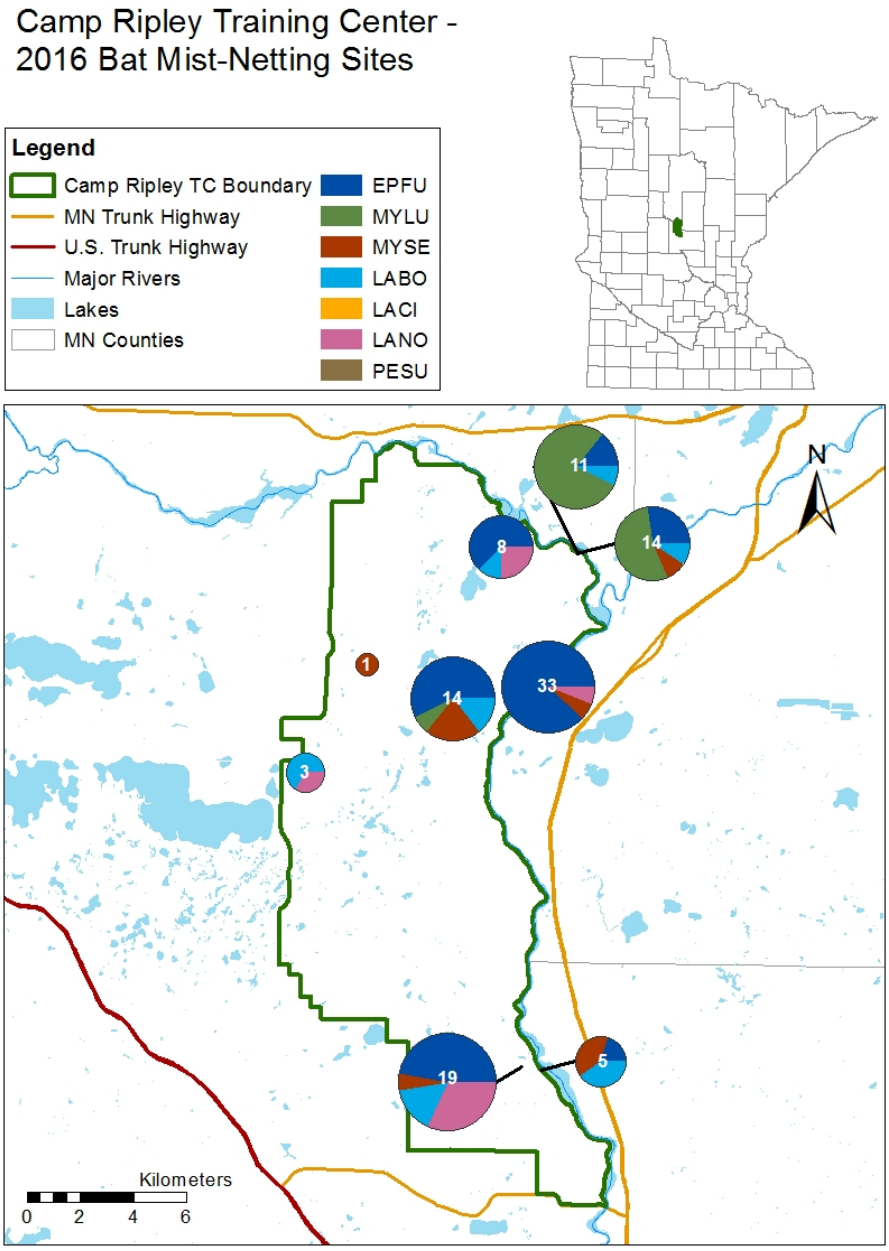


Results

Mist-Netting

We mist-netted bats at ten sites in CRTC on the nights of June 6th – 9th, 13th, 15th, and 20th – 23rd, 2016 (Fig. 5). We captured and processed 92 bats of 5 species over a total of 214 net-hours (Table 1). All bats captured were adults, and 36 of the 64 female bats captured were determined to be pregnant at the time of capture. Seventy-two of the 92 bats captured showed some wing damage consistent with that caused by WNS, but none showed severe wing damage.

Figure 5. Map of bat mist-netting sites at Camp Ripley Training Center, June 6th – 24th, 2016. The pie chart at each net site indicates the proportion of species captured at that site, and the size of the pie chart represents the total number of bats captured at that site relative to other sites.



We mist-netted bats at four sites in AHATS on the nights of July 6th – 9th, 2016 (Fig. 6). We captured and processed 99 bats over a total of 72.75 net-hours. We captured 6 species, including the first verified record of an evening bat (*Nycticeius humeralis*, NYHU) in Minnesota (Table 2). Forty-two of the bats captured were juveniles, and 28 of the 53 female bats captured were lactating at the time of capture, including the evening bat. Sixty-eight of the 99 bats captured showed some wing damage consistent with that caused by WNS, but none showed severe wing damage.

Figure 6. Map of bat mist-netting sites at Arden Hills Army Training Site, July 6th – 9th, 2016. The pie chart at each net site indicates the proportion of species captured at that site, and the size of the pie chart represents the total number of bats captured at that site relative to other sites.

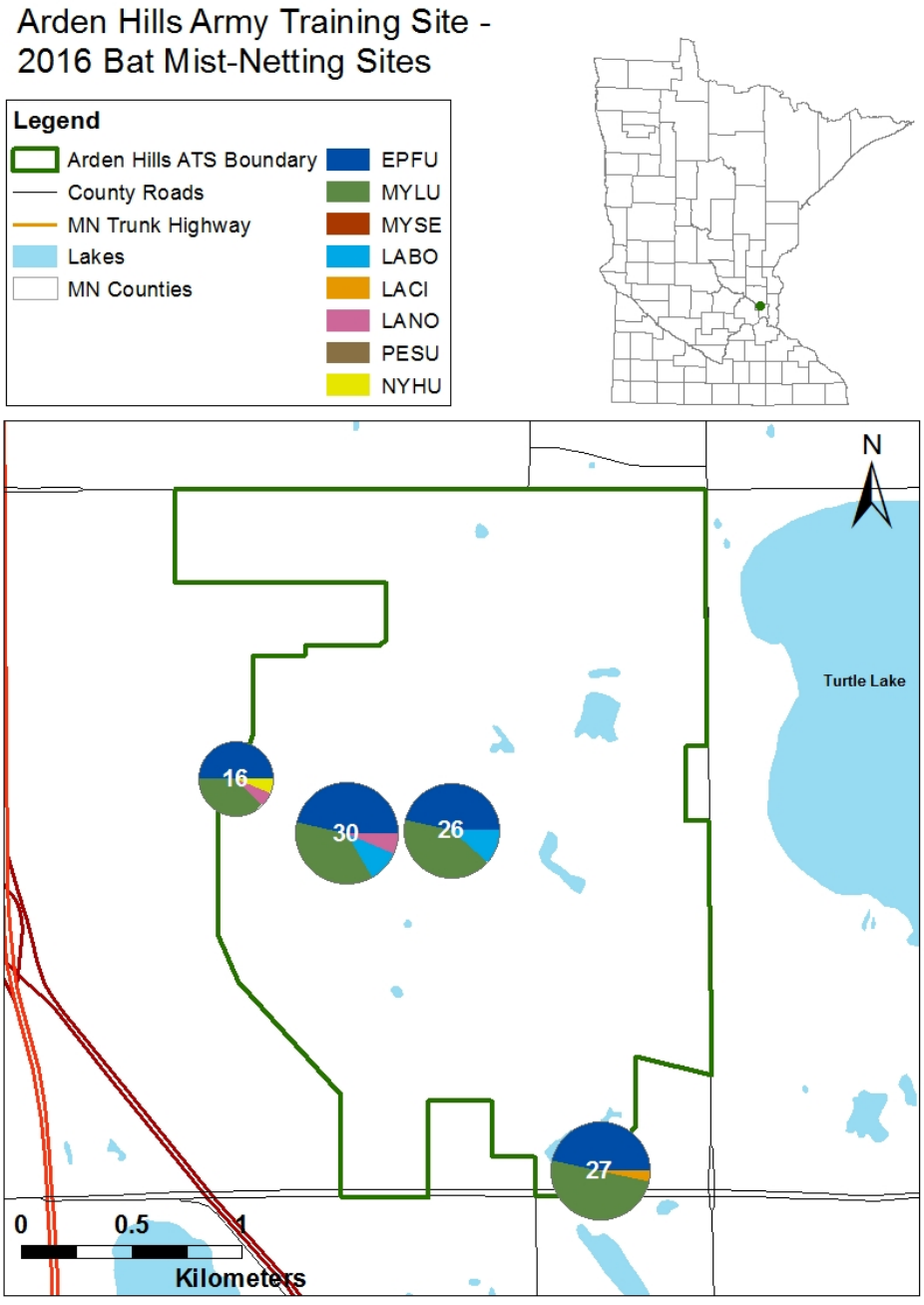


Table 1. Bats captured and processed at CRTC, June 6th – 24th 2016 by species and sex. An additional 16 big brown bats (EPFU), the majority of which were female, were captured on one evening and released without processing due to a large capture event and limited processing time

	Species Code							
Sex	**EPFU**	**LABO**	**LACI**	**LANO**	**MYLU**	**MYSE**	**PESU**	**Grand Total**
Female	31	5	0	9	14	5	0	**64**
Male	12	7	0	1	4	4	0	**28**
Grand Total	**43**	**12**	**0**	**10**	**18**	**9**	**0**	**92**

Table 2. Bats captured and processed at AHATS, July 6th – 10th 2016 by species and sex.

	Species Code								
Sex	**EPFU**	**LABO**	**LACI**	**LANO**	**MYLU**	**MYSE**	**PESU**	**NYHU**	**Grand Total**
Female	22	3	1	1	25	0	0	1	**53**
Male	25	3	0	2	16	0	0	0	**46**
Grand Total	**47**	**6**	**1**	**3**	**41**	**0**	**0**	**1**	**99**

We attached radio-transmitters to three of the five female MYSE captured at CRTC; all three were pregnant at the time of capture. Two transmitters were placed on bats in Training Area 11 in the southeast corner of CRTC on the night of June 14th, and one in Training Area 56 in the central part of CRTC on the night of June 21st. We also attached transmitters to three little brown bats (MYLU) in Training Area 8 at AHATS on the night of July 9th.

Radio-Telemetry/Tree Characterization

Of the three MYSE with transmitters at CRTC, only one was successfully relocated with radiotelemetry. That bat was tracked to three unique roost trees over six days, all in red maple trees (*Acer rubrum*) (Fig. 7). The roost trees were of nearly equal diameter (30.5–30.7 cm diameter at breast height (DBH), average: 30.6 cm), but varied in decay stage. Two trees were live but declining, and one was dead (Fig. 8). Tree height ranged from 16.6–19.4 m with an average of 18.1 m. The distance from the capture location to the first roost for the MYSE at CRTC was 2,706 m, and the average distance moved between consecutive roosts was 255 m (range: 188 – 344). A complete list of roost trees at CRTC is in Appendix A. A detailed map of movements between roost trees at CRTC by the bat with a transmitter is in Appendix B.

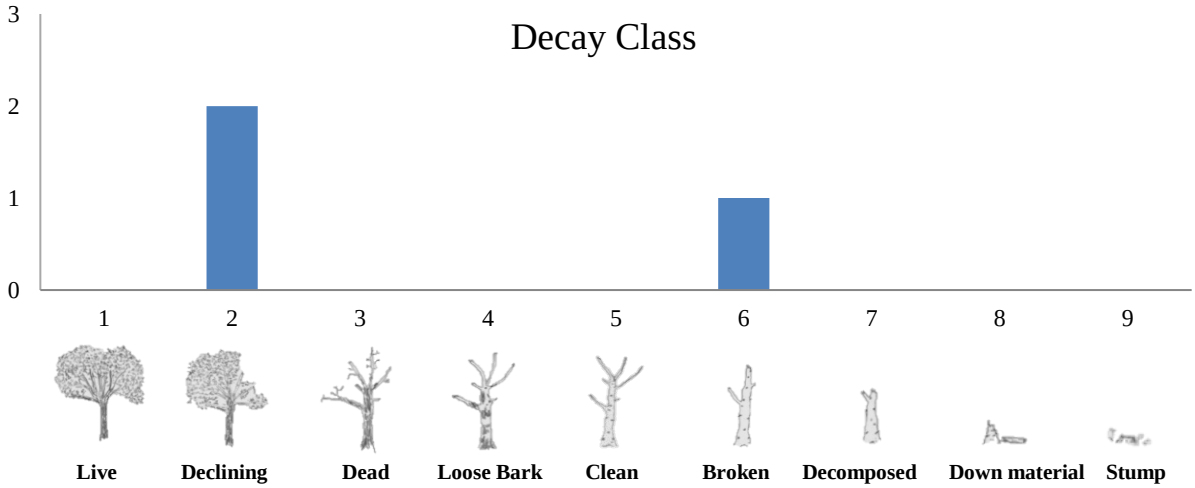
Two of the three MYLU with radio-transmitters at AHATS were tracked to two separate roosts in buildings, 2,191 and 2,225 m from the capture site. These bats roosted in these buildings during the entire tracking period. The third transmitter at AHATS was not successfully relocated at a roost, although it was relocated while foraging at night. One of the buildings was a privately-owned home located south of AHATS, and the other was a church building also located south of the AHATS property.

Figure 7. Photos of the three roost trees (all red maple – *Acer rubrum*) identified at Camp Ripley Training Center, June 2016. All had cracks or seams running vertically along the main trunk of the tree

Field crews were able to conduct six emergence counts on the three identified roost trees at CRTC. Bats were observed exiting the roost tree in all of those surveys. Colony size (number of bats observed in one emergence count) ranged from 14–32, and averaged 23.8.

Five emergence counts were also conducted at the two buildings located near AHATS, with permission from the landowners. Emergence counts at these locations recorded 297–494 bats emerging. The transmittered bats at those locations were little brown bats (MYLU), so those buildings are not considered northern long-eared bat roosts.

Figure 8. Histogram showing variation in decay stage among three northern long-eared bat roost trees identified at Camp Ripley Training Center, June 2016.



Discussion

The one northern long-eared bat tracked at Camp Ripley Training Center used tree species common in the forest, and moved often, which is consistent with findings both at other sites in this project and in other areas of the NLEB range. Under the Endangered Species Act, there are restrictions on tree harvest within 150 ft of known, occupied roost trees from June 1st – July 31st. For more details on these restrictions, please visit the website of the U.S. Fish and Wildlife Service (https://www.fws.gov/midwest/nleb/). We intend to use the data collected in this project to inform future management decisions regarding the northern long-eared bat as WNS continues to spread across the United States.

Crews captured or observed five of the seven species of bats resident in Minnesota at Camp Ripley Training Center. Only hoary bats (*Lasiurus cinereus*) and tricolored bats (*Perimyotis subflavus*) were not captured or observed during this survey, which was not unexpected. Hoary bats are notoriously difficult to capture due to their flight patterns, and tricolored bats have a relatively limited range in the state. Tricolored bats have been observed hibernating in small numbers in southeastern Minnesota (Nordquist and Birney 1985), and at least two have been found hibernating in the northeastern part of the state (Knowles 1992). Summer captures of tricolored bats are uncommon – out of the more than 1000 individual bats captured over the past four summers as part of this project and pilot studies, only one tricolored bat was recorded.

Five of the seven species of bats resident in Minnesota were captured at Arden Hills Army Training Site, in addition to the first capture of an evening bat (*Nycticeius humeralis*) in Minnesota (Minnesota Department of Natural Resources 2016b). It is yet unknown if that capture represented a lone individual or a range extension for that species, however Wisconsin also recently documented the first maternity colony of evening bats in that state (Wisconsin Department of Natural Resources 2016).

No northern long-eared bats were captured at AHATS, which may be due in part to the amount of surrounding urbanized area. Northern long-eared bats do not often roost in human structures unlike other common bats such as the little brown and big brown bats. Northern long-eared bats are also “clutter specialists” – and often forage in interior forest and along forest edges. Northern long-eared bat populations may be smaller in highly urbanized areas due to the lack of large contiguous blocks of forest.

Seventy-two bats captured at Camp Ripley Training Center and 68 bats captured at Arden Hills Army Training Site had wing damage consistent with WNS, which suggests that these bats were either hibernating in one of the known hibernacula in the state where WNS or *P. destructans* have been confirmed, or that there may be additional infected hibernacula in the state. Of the 646 bats captured during summer 2016 across Minnesota as part of the overall project, 43% showed some wing damage consistent with WNS.

This is one of 13 site-level reports from the 2016 field season, and is intended for use by the manager(s) and staff at Camp Ripley Training Center and Arden Hills Army Training Site. A report summarizing and discussing the results from all locations will be available in early 2017 (Swingen et al. 2016).

Acknowledgements

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Additional funding was provided by the MN Department of Military Affairs (MN Army National Guard).

Literature Cited

Boyles, J. G., P. M. Cryan, G. F. McCracken, and T. K. Kunz. 2011. Economic importance of bats in agriculture. Science 332:41–42.

Frick, W. F., J. F. Pollock, A. C. Hicks, K. E. Langwig, D. S. Reynolds, G. G. Turner, C. M. Butchkoski, and T. H. Kunz. 2010. An emerging disease causes regional population collapse of a common North American bat species. Science 329:679–682.

Knowles, B. 1992. Bat hibernacula on Lake Superior's North Shore, Minnesota. Canadian Field-Naturalist 106:252–254.

Minnesota Department of Natural Resources. 2013. Fungus dangerous to bats detected at 2 Minnesota state parks. Press Release 9 Aug 2013.

Minnesota Department of Natural Resources. 2016a. First case of white-nose syndrome, a disease that can kill bats, confirmed in Minnesota. Press Release 9 March 2016.

Minnesota Department of Natural Resources. 2016b. First new bat species discovered in Minnesota in more than a century. Press Release 1 Aug 2016.

Minnesota Department of Natural Resources and Minnesota Army National Guard. 2016. Minnesota Army National Guard, Camp Ripley Training Center and Arden Hills Army Training Site, 2015 Conservation Program Report, January 1- December 31, 2015. Compiled by Nancy J. Dietz and Brian J. Dirks, Camp Ripley Series Report No. 25, Little Falls, M.

Nordquist, G. E., and E. C. Birney. 1985. Distribution and status of bats in Minnesota. Final Report to the Nongame Wildlife Program. Minnesota Department of Natural Resources.

Swingen, M., R. Baker, T. Catton, K. Kirschbaum, G. Nordquist, B. Dirks, and R. Moen. 2015. Preliminary Summary of 2015 Northern Long-eared Bat Research in Minnesota. NRRI Technical Report No. NRRI/TR-2015/44. University of Minnesota Duluth.

Swingen, M., R. Baker, T. Catton, K. Kirschbaum, G. Nordquist, B. Dirks, and R. Moen. 2016. Summary of 2016 Northern Long-eared Bat Research in Minnesota. NRRI Technical Report No. NRRI/TR-2016/41. University of Minnesota Duluth.

Turner, G. G., D. M. Reeder, and J. T. H. Coleman. 2011. A five-year assessment of mortality and geographic spread of white-nose syndrome in North American bats and a look to the future. Bat Research News 52:13–27.

U.S. Fish and Wildlife Service. 2016. Final 4(d) rule for northern long-eared bat. Federal Register 81, no. 9. 14 Jan 2016, pp. 1900-1922.

Wisconsin Department of Natural Resources. 2016. Discovery of new bat species in Wisconsin cheers biologists. Weekly News Article published September 13, 2016. Accessed 14 Sep 2016 at <http://dnr.wi.gov/news/Weekly/article/?id=3723>.

Appendix A. Table of NLEB Roost Tree Specifications

Roost Tree ID (Tag #)	Common Name	Species	DBH (cm)	Height (m)	Status	Decay Class
451	Red Maple	*Acer rubrum*	30.5	18.2	Live	2
452	Red Maple	*Acer rubrum*	30.5	19.4	Live	2
453	Red Maple	*Acer rubrum*	30.7	16.6	Dead	6

Appendix B. Maps of Bat Movement

Map showing the site at which bats were mist-netted on June 20th, 2016 (yellow triangle) in Camp Ripley Training Center. The map also shows the locations of the roost trees (colored circles) used by the female northern long-eared bat that was captured on June 20th and given a radio-transmitter.