Summary of the 2014 Minnesota Northern Long-eared Bat Summer Habitat Use in Minnesota Project (Preliminary Report)

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In spring 2014 the Superior National Forest and the Minnesota Department of Natural Resources, with additional funding from USDI Fish and Wildlife Service, combined resources to conduct a pilot project to describe summer habitat use by northern long-eared bats (*Myotis septentrionalis*, MYSE) in Minnesota. This project included mist-netting, banding, transmitter deployment, radio-telemetry, acoustic recording, roost structure identification and characterization, and emergence surveys. More extensive analysis of habitat characteristics around identified roost structures will also be conducted. A second goal of this project was to develop and test methodologies to be used in future work of this type, and to expand expertise in these methodologies in Minnesota. To these ends there were 31 people from federal and State agencies, academia, and volunteers from 3 states and 1 province of Canada that both brought experience to and gained experience from this project. Prior to project initiation, a detailed Project Protocol (with data templates) was developed to insure that all participants used standardized methodology. The Project Protocol is available upon request.

Netting was conducted at 7 sites on the Camp Ripley Training Center (CRTC) located in Morrison County, and at 5 sites in Lake and St. Louis Counties on the Superior National Forest (SUNF). Over the course of 4 weeks 130 bats were captured and processed at the 12 sites. Acoustic detectors were deployed at each netting site to augment the capture data. Wing bands were placed on 103 bats for the purpose of recapture identification during winter hibernacula surveys and/or future mist-netting surveys. Transmitters were deployed on 15 individuals, primarily reproductive female northern long-eared bats. Seventy-seven relocations identified 33 different roost structures, 32 of them trees. A cabin was used by a female little brown bat. An additional tree roost structure was identified during an emergence survey. The distances between foraging areas (capture sites) and roost structures ranged from .1 mile to 1.5 miles and averaged .48 miles. Emergence survey counts ranged from 1 bat to as many 33 using the same roost tree on a particular night.

Forty sets of wing punches and swabs were obtained from *Myotis* bats and sent to the USDA FS Northern Research Station's lab in Rhinelander, WI for their work on white-nose syndrome; microbiome and population genetic analyses. In addition, hair clippings from transmittered bats were sent to the UW-LaCrosse Department of Chemistry and Biochemistry for their pilot work on mercury levels in insectivorous bats as a bio-indicator.

Netting

Methods- Mist-netting efforts were conducted on 12 nights between June 9th and July 3rd. There were 7 netting sites on the Camp Ripley Training Center in Morrison County, and 5 netting sites on the Superior NF in Lake and St. Louis Counties (see Figure 1). Sites were selected that provided a corridor, typically a road or trail, which would be used by bats for foraging or travel to and from roosting and foraging areas. The number of nets at any site ranged from 3 to 6 each night. Nets used were 2.6 meter, 6m or 9m in length depending on the width of the flyway, and 3 nets were stacked for a total height of 7.3m using the Forest Filter™ system. Nets were "opened" at approximately 30 minutes after sunset to reduce incidental capture of birds and remained open for a period of approximately 2 hours to just over 7 hours depending on capture success and desired objectives for the night. Net checks were conducted approximately every 15 minutes.

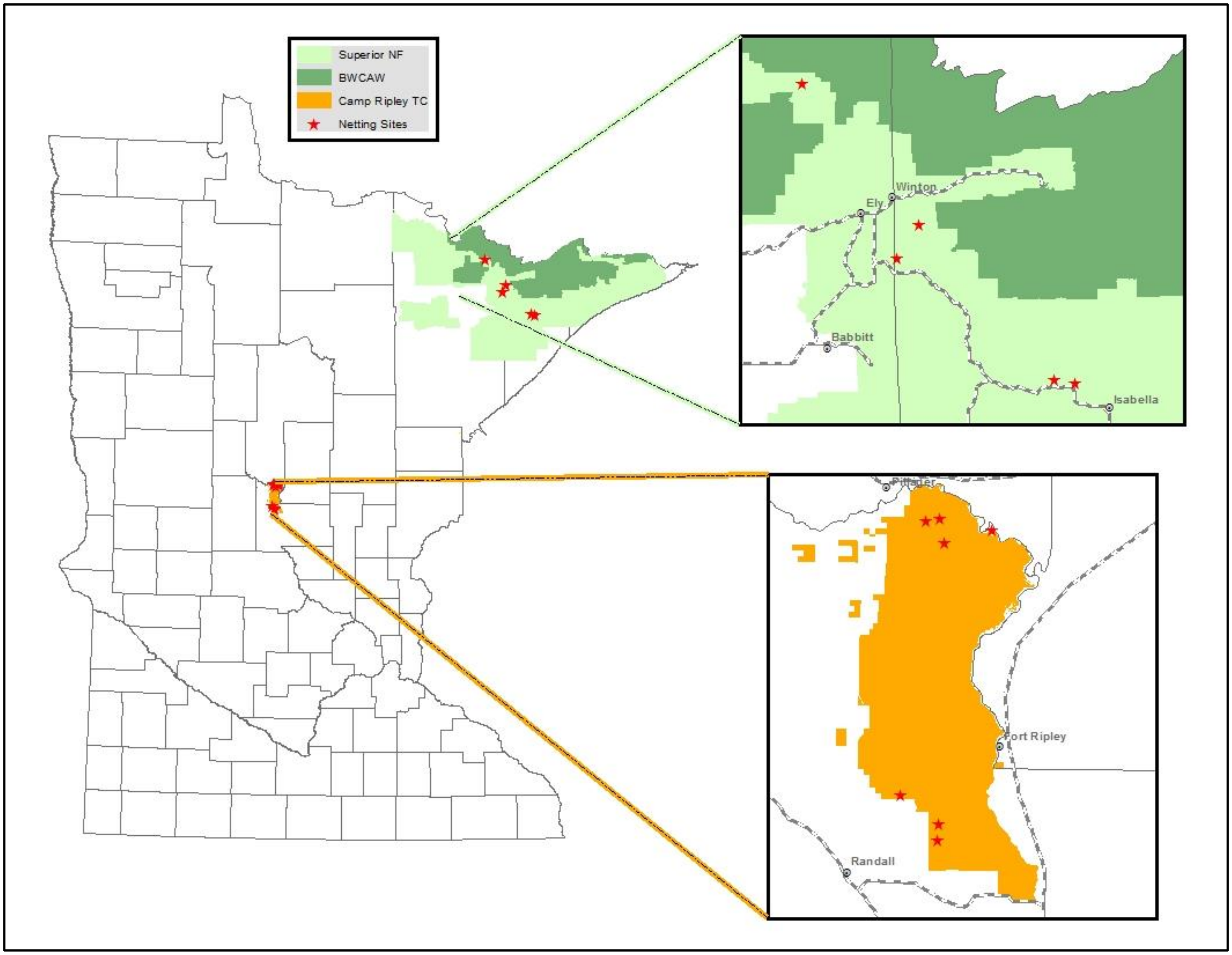

Figure 1. Netting sites on the Superior NF and Camp Ripley TC

Results- A total of 130 bats were captured (see Figure 2). Six of the 7 species of bat known to occur in Minnesota were handled with only the tri-colored bat not captured. Overall little brown bats made up a majority of the bats captured (45.4%, *n*= 59) followed by 21.5% northern long-eared (*n*= 28), 19.2% big brown (*n*= 25), 10.8% eastern red (*n*= 14), 2.3% silver-haired (*n*= 3) and 0.8% hoary bats (*n*= 1). Males made up 46.9% of the bats captured (*n*= 61), females 53.1% (*n*= 69).

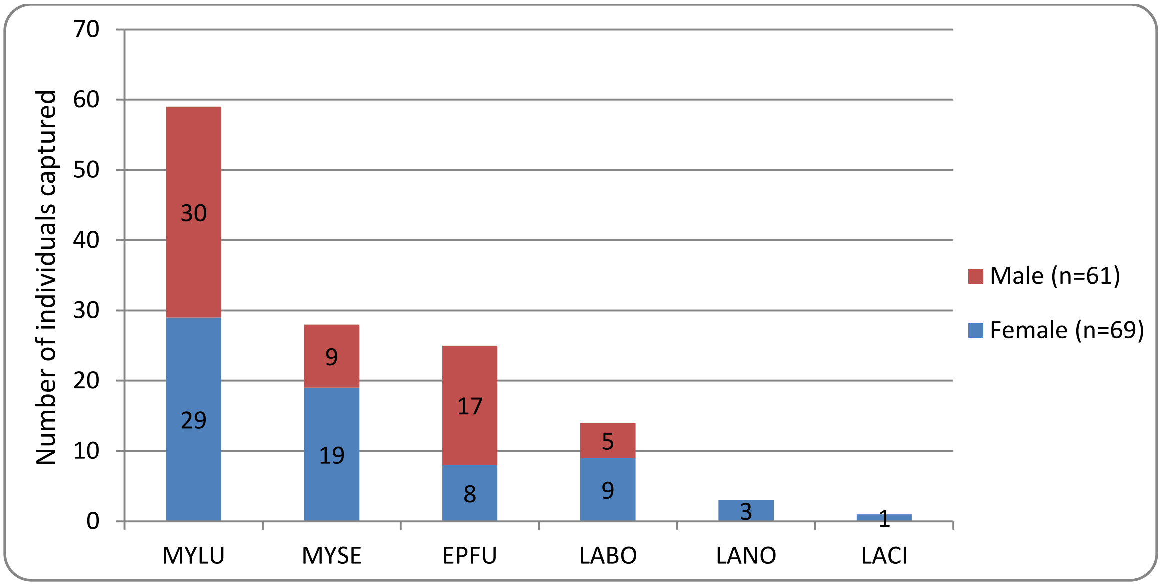

Figure 2. All bats handled by species[1], sex (*n*= 130)

At Camp Ripley (CRTC), 46.5% of the bats captured were little brown (*n*= 40), 4.6% were northern long-eared (*n*= 4), 29.1% were big brown (*n*= 25), 16.3% were eastern red (*n*= 14), 3.5% were silver-haired (*n*= 3), and no hoary bats were caught (see Figure 3). On the Superior (SUNF), 43.2% were little brown (*n*=19), 54.5% were northern long-eared (*n*= 24) and 2.3% were hoary bats (*n*= 1). No big brown, eastern red or silver-haired bats were captured on the Superior. See Figure 3.

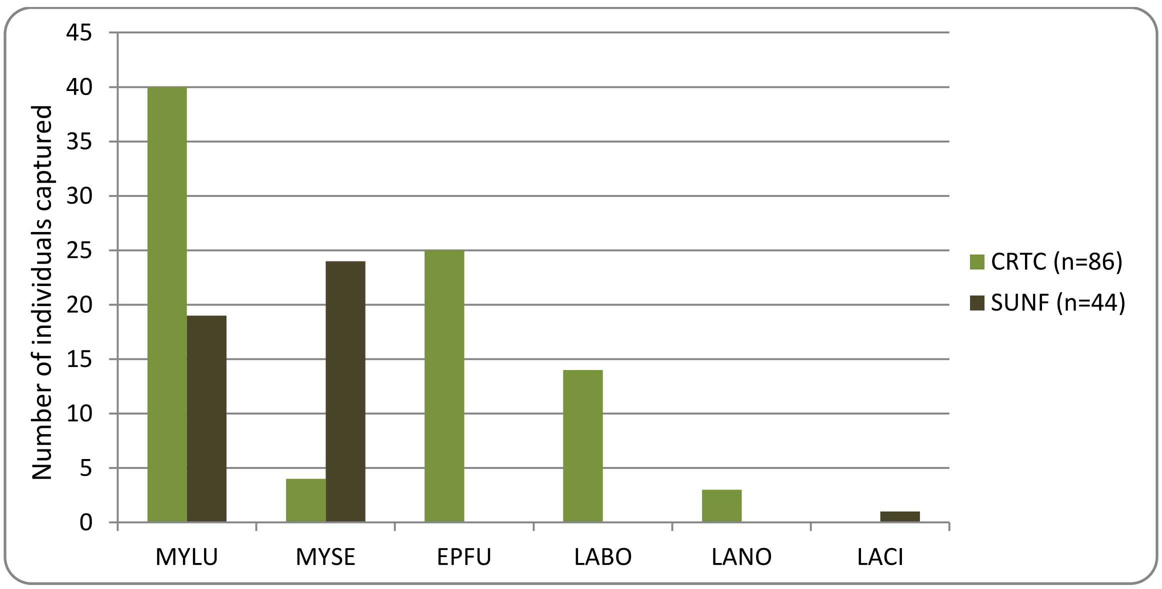

Figure 3. All bats handled by species[1], location (*n*= 130)

Acoustics

Methods- Anabat acoustic bat detectors were set out at each netting site (see Figure 4). This was done to identify additional bat species using the area that were not documented by capture in the mist-nets. Typical placement was along a flyway in which at least one of the mist-nets was located. Additional detectors were placed in adjacent areas that would likely be used by foraging bats such as along the edges of field or along other flyways. Calls were recorded during the night's mist-netting activities and then downloaded and archived for future analysis.

[1] Species codes: **MYLU**- Little brown bat, *Myotis lucifiguous,* **MYSE**- Northern long-eared bat, *Myotis septentrionalis,* **EPFU**- Big brown bat, *Eptesicus fuscus,* **LABO**- Eastern red bat, *Lasiurus borealis,* **LANO**- Silver-haired bat, *Lasiurus noctivagans,* **LACI**- Hoary bat, *Lasiurus cinereus*,

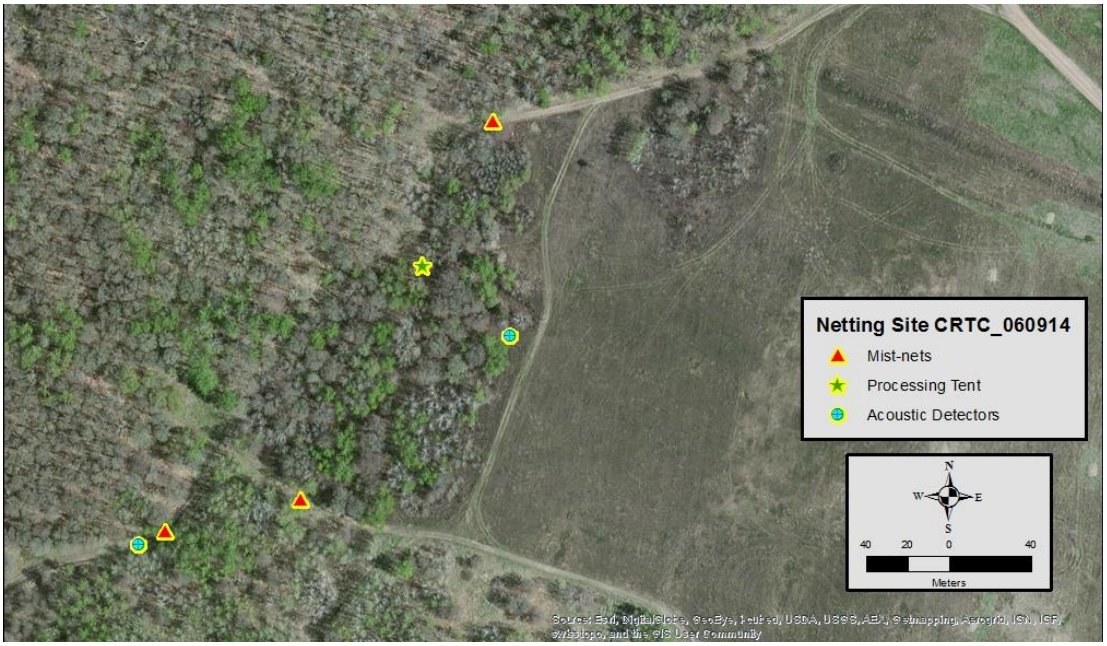

Figure 4. Typical netting site showing acoustic detector placement

Results- Numerous call files were recorded and analyses will be conducted as time and personnel allow. Preliminary analysis indicates that more species were detected acoustically than were captured during a particular netting session. Once analyses have been completed this report will be updated to reflect the most current data.

Banding

Banding Methods- Wing bands were placed on bats for the purpose of recapture identification during winter hibernacula surveys and/or future mist-netting surveys. Fifty Porzana bands were obtained from USDI Geological Survey (USGS) sized for marking *Myotid* bats (See Figure 5). MN DNR possessed additional bands for marking of larger bats and *Myotid* bats when the Porzana bands had all been used. Bands were attached to the forearm of individuals in accordance with locally established protocols for marking sexes (males banded on the right forearm, females on the left). Porzana bands were attached using the manufacturer supplied banding pliers. Other bands were attached by hand, squeezing the bands so as to not pierce the wing membrane but tight enough to prevent the band from slipping off.

Banding Results- Numbered bands were affixed to the wings of 103 of the 130 bats captured (79.2%). Some bats received transmitters along with bands; while some received transmitters only (see Table 1). Due to the limited quantity of bands and transmitters, not all bats were marked.

	MYLU	MYSE	EPFU	LABO	LANO	LACI	Totals
Band Only	49	7	20	13	3	1	93
Xmitter Only		5					5
Both	3	7					10
Unmarked bats	7	9	5	1			22

Table 1. Banding/marking of captured bats

Banding information will be entered in to the Bat Population Database maintained by the USGS to assist in documenting any future recaptures of banded individuals.

Figure 5. Porzana band on a male little brown bat.

Telemetry

Telemetry Methods- Transmitters (Holohil LB-2N and LB-2X) were attached primarily to reproductive female (pregnant or lactating) *Myotid* bats (Figure 6). We attempted to re-locate bats fitted with radio transmitters each day that the transmitter was assumed to be active by walking in to locate the individual roost structures. Due to access issues there were 2 triangulated locations where the roost structures were not identified. Several searches by fixed-wing aircraft fitted with antennas were conducted in an attempt to locate bats that were presumed to have moved from the ground search area.

Figure 6. Northern long-eared bat with transmitter

Telemetry Results- A total of 15 transmitters were deployed on *Myotid* bats, 12 on female northern long-eared bats, and 3 on little brown bats, 2 female and 1 male. There were 5 bats transmittered on Camp Ripley and 10 on the Superior NF. Bats were relocated 77 times identifying 33 different roost structures. On 4 occasions 2 transmittered bats were located in the same tree; these were bats that had received transmitters on the same night at the same netting site. In one location 3 transmittered bats alternated roosting with each other over a period of 4 days. Table 2 below summarizes locations of individual bats identifying days they were able to be located, number of trees used during that time, range of distances from capture site (foraging area) to roost trees and the average distance from capture site to roost trees identified.

	F01	F02	F03	F04	F05	F06	F07	F08	F10	F11	F12	F13	F14	M15
No. of days	9	8	8	7	5	4	4	2	4	1	10	5	5	6
No. of trees used	3	5	1*	3	4	3	2	1	3	1	5	3	2	2
Distances from capture site (miles)														
Range	1.5	.2-.5	0.7	.3-.4	.3-.4	.4-.8	0.4	0.4	.2-.6	0.5	.1-.6	.4-.7	.2-.3	0.1
Avg	1.5	0.3	0.7	0.4	0.4	0.5	0.4	0.4	0.4	0.5	0.3	0.5	0.3	0.1
			*Roost structure was a building											
	CRTC bats		SUNF bats											

Table 2. Bat telemetry location summary

Roost Structures

Methods- Roost structures were identified by "walk in" locations of transmittered bats during the day. One additional roost structure was identified during an emergence survey when surveyors noted bats also emerging from a tree adjacent to the identified roost tree. Roost trees were visited at a later date to record characteristics of the trees used and associated habitat types (see "Habitat Work").

Results- Of the 34 roost structures identified 97.1% (n= 33) were trees (see Table 3). Trees were predominantly aspen (51.5%, *n*= 17) followed by 21.2% red oak (*n*= 7), 9.1% red maple (*n*= 3), 6.1% basswood (*n*= 2), 3.0% black ash (*n*= 1) and 3.0% jack pine (*n*= 1). Two snags could not be identified to species. The non-tree roost structure was in the roof area of a seldom used resort cabin. This site was used by a female little brown bat that travelled approximately .75 miles from her capture site to this location. She used this roost site for a period of 10 days until the transmitter failed.

	POTR5	QURU	ACRU	TIAM	FRNI	PIBA2	Unkn	Total
Live	15	4	3	2	1	1	0	26
Dead	2	3	0	0	0	0	2	7
Total	17	7	3	2	1	1	2	33

Table 3. All roost trees by species[2]

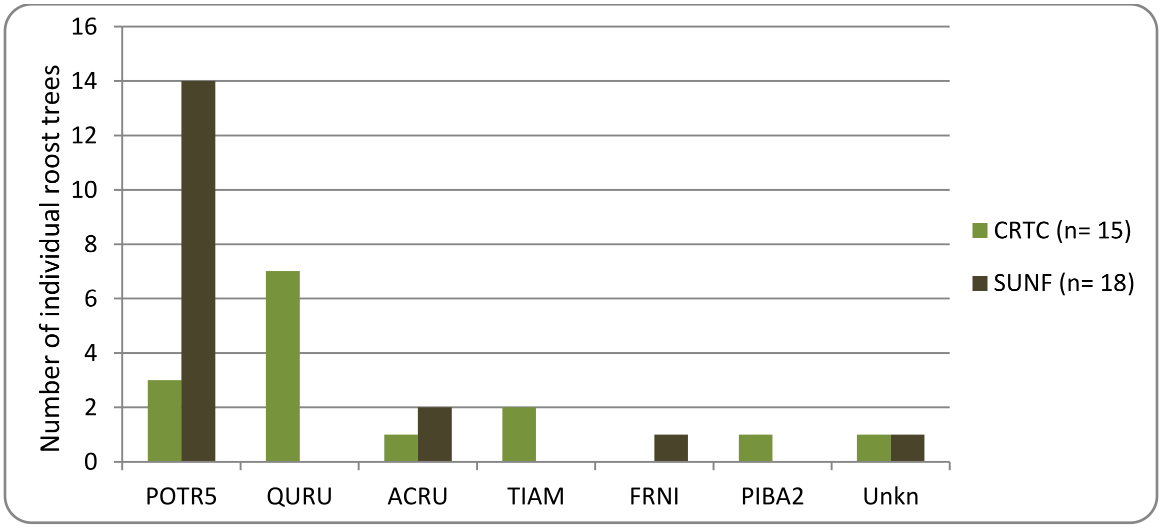

Figure 8. All roost trees by species[2], location (*n*= 33)

[2] Species codes: **POTR5-** Trembling aspen, *Populus tremuloides*, **QURU-** Red oak, *Quercus rubra*, **ACRU-** Red maple, *Acer rubrum*, **TIAM-** Basswood, *Tilia americana,* **FRNI-** Black ash, *Fraxinus nigra*, **PIBA2-** Jack pine, *Pinus banksiana*.

Roost trees identified to species on Camp Ripley were predominantly red oak (50.0%, *n*= 7) followed by 21.4% trembling aspen (*n*= 3), 14.2% basswood (*n*= 2), 7.1% red maple (*n*= 1) and 7.0% jack pine (*n*= 1). Red oak diameters (dbh) ranged from 5”-24” ($\bar{x}$ =15.6”, σ= 5.8”), aspen diameters ranged from 16”-22.5” ($\bar{x}$ =18.2”, σ= 2.9”). See Table 4 below.

CRTC	POTR5	QURU	ACRU	TIAM	FRNI	PIBA2
n	3	7	1	2	0	1
dbh range	16.0-22.2	5.0-24.0	13.5	13.0-15.0		7.5
Mean	18.2	15.6	13.5	14		7.5
StdDev	2.9	5.8	N/A	N/A		N/A

Table 4. CRTC roost tree data

Figure 7. Roost tree F02_A (CRTC)

Figure 8. Roost tree F10_A (SUNF)

Roost trees identified to species on Superior NF were predominantly trembling aspen (82.3%, *n*= 14) followed by 11.8% red maple (*n*= 2) and 5.8% black ash (*n*= 1). Aspen diameters ranged from 9.1”-18.0” ($\bar{x}$ =12.9”, σ=2.4”). See Table 5 below.

SUNF	POTR5	QURU	ACRU	TIAM	FRNI	PIBA2
n	14	0	2	0	1	0
dbh range	9.1-18.0		8.25-12.7		8.8	
Mean	13.3		10.48		8.8	
StdDev	2.4		N/A		N/A	

Table 5. SUNF roost tree data

Emergence Surveys

Methods- When possible, emergence surveys were conducted on identified roost trees. Surveyors would position themselves at least half an hour before sunset with a clear view to observe the cavity entrance (if known) or the most likely area of the tree that would be used by bats. The number of bats seen emerging from the tree was recorded until the surveyor was no longer able to see due to darkness. Where possible, telemetry receivers and acoustic detectors were also used during the surveys. Surveyors at Camp Ripley TC used night vision goggles (NVG's) during their surveys.

Results- Emergence survey counts noted from 1 bat to as many 33 using the same roost tree on a particular night (See Table 6). Higher counts were typically recorded at Camp Ripley likely due to the availability of NVG's for the surveys.

	Number of bats seen emerging				
	1-5	5-10	10-20	20-30	30+
CRTC	3	1	1	2	2
SUNF	7	3	2	0	0

Table 6. Number of roosts surveyed by number of bats seen emerging

Analysis of emergence observations combined with telemetry and acoustical data is pending. Once these data have been compiled and analyzed this report will be updated with the most current information.

Habitat Work

Methods- In addition to the roost tree data collected and summarized in the "Roost Structures" section above, more detailed stand and landscape level data was collected in the form of MN DNR relevés and will be analyzed at a future date.

Results- Once these and any additional habitat data have been compiled and analyzed this report will be updated with the most current information.

Additional Research

Methods- In addition to data collection for this project we also cooperated with the USDA Forest Service's Northern Research Station lab in Rhinelander, WI in collecting wing punches and swabs from *Myotid* bats to support their ongoing research on white-nose syndrome; microbiome and population genetic analyses. Forty sets of wing punches and swabs (20 each from the Camp Ripley and Superior NF sites) were collected using individual sterile punches and swabs. Wing punches and swabs were not obtained from bats that received transmitters. Samples were stored in vials and frozen, then shipped to the lab for their analysis.

Figure 9. Wing swabbing a little brown bat

For their pilot work on mercury levels in insectivorous bats as a bio-indicator, hair that was clipped from 14 of the 15 bats that were fitted with radio transmitters was collected in individual Whirl-Paks™, frozen and sent to the UW-LaCrosse Department of Chemistry and Biochemistry.

Results- All analyses and results on these additional research projects are pending and will be reported by the respective researchers.

Acknowledgements

Thanks to all who put in so much to make this project a success. This was an incredible team effort by an incredible team. From project initiation, through planning and development, and throughout implementation there were a number of people who really put a lot of time and effort in to making it happen and getting it done. Specifically I would like to recognize from the Superior National Forest Susan Catton, Kari Kirschbaum, Dave Grandmaison and Lissa Grover. From the MN DNR Rich Baker, Gerda Nordquist and Christi Spak. From the Camp Ripley Environmental Office Brian Dirks and Nancy Dietz. Brad Smith and Molly Foley (Superior NF), Adam Maleski and John Sipe (Central Lakes College) and Joel Flory (Borealis Ecological Services) put many hours in afield under typical Minnesota summer conditions (heat, humidity and bugs) to collect telemetry, emergence and habitat data. There were many more who contributed to the overall accomplishments of the project, but these people all put in those extra miles.

Project Cooperators and Sponsors

- USDA Forest Service, Superior National Forest
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- USDI Fish and Wildlife Service
- MN DNR Division of Parks and Recreation
- MN DNR Division of Forestry
- MN DNR Division of Fish and Wildlife
- USDA Forest Service, Eastern Region
- USDI Geological Survey
- Central Lakes College, Natural Resources Program
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