Final Abstract

Final Report Approved on November 5, 2025

M.L. 2020 Project Abstract

For the Period Ending June 30, 2025

Project Title: Enhancing Bat Recovery By Optimizing Artificial Roost Structures

Project Manager: Tavis Westbrook

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Funding Source:

Fiscal Year:

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 03m

Appropriation Amount: $190,000

Amount Spent: $177,911

Amount Remaining: $12,089

Sound bite of Project Outcomes and Results

This project identified key artificial bat roost characteristics that improve the reproductive success for the Little Brown Bat. The Guide to Artificial Roosts for Bats was developed to help the public effectively design, install, and monitor artificial bat boxes. Bat box use is increasing at multiple State Park study sites.

Overall Project Outcome and Results

White-nose Syndrome (WNS) is a devastating disease responsible for the deaths of millions of bats in North America. In Minnesota, WNS has caused declines of over 90% in Minnesota's populations of hibernating bats. Artificial roost structures, appropriately designed and located, provide critical summer habitat where natural roosts have been lost or do not exist. This project optimized the design and placement of artificial roosting structures within six Minnesota State Parks to support reproductive success and population recovery from this disease.

This project identified key artificial bat roost characteristics that support the reproductive success for bats that use boxes, especially the Little Brown Bat. We used these insights to optimize the roosting conditions for bats at six different locations: Sakatah Lake, Whitewater, Forestville, Gooseberry Falls, Maplewood, and Rice Lake State Parks.

The three most important findings from this study suggest:

1. Large volume bat box designs with multiple chambers are most effective; avoid using small, single-chamber boxes sold at garden stores and online retailers.
2. Installing a variety of box designs in clusters at a site increases roosting choices for bats throughout the reproductive season.
3. Because bats return to bat boxes year after year, regular monitoring and maintenance is critical to support long-term reproductive success.

The Guide to Artificial Roosts for Bats was developed to help the public and conservation partners effectively use bat boxes to optimize reproductive success. Outreach products were developed and distributed across the State Park system and at other DNR events.

This project documented significant summer colonies of Little Brown Bats that will continue to be monitored long-term. Staff at multiple State Park study sites have observed improved bat box usage. The project findings will contribute to management strategies for bat colonies while outreach materials provide opportunities to engage Minnesotans in bat conservation initiatives.

Project Results Use and Dissemination

Results, recommendations, and products were shared with the MNDNR and public:

- The Guide to Artificial Roosts for Bats was created and placed on the MNDNR website.
- Project results were shared with in-state conservation partners and regional, national and Canadian bat conservation organizations.
- Improvements were made to the MNDNR website.
- Outreach products were distributed at the Minnesota State Fair.
- A featured article was published in the Sept/Oct issue of MN Conservation Volunteer. The Department recognized this article in its October 2025 staff newsletter.
- The project was summarized and highlighted in multiple MNDNR Division and Department staff newsletters and social media

Environment and Natural Resources Trust Fund

M.L. 2020 Approved Final Report

General Information

Date: November 12, 2025

ID Number: 2020-022

Staff Lead: Mike Campana

Project Title: Enhancing Bat Recovery By Optimizing Artificial Roost Structures

Project Budget: $190,000

Project Manager Information

Name: Tavis Westbrook

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Project Reporting

Final Report Approved: November 5, 2025

Reporting Status: Project Completed

Date of Last Action: November 5, 2025

Project Completion: June 30, 2025

Legal Information

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 03m

Appropriation Language: $190,000 the second year is from the trust fund to the commissioner of natural resources to improve the survival of bats by identifying characteristics of successful artificial bat roost structures and optimizing the structures for bat use and reproduction. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

Appropriation End Date: June 30, 2025

Narrative

Project Summary: Project will identify characteristics of successful artificial bat roost structures. Data will be used to optimize bat
use and reproduction in these structures to improve survival of WNS impacted bats

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

White Nose Syndrome has devastated North America's populations of hibernating bats. In MN, counts of hibernating bats have declined approximately 95%. Strategies to combat the fungus which causes WNS are being researched but to date, nothing has been found that can be operational. Our project instead focuses on identifying and implementing strategies to optimize use and reproduction in artificial roost structures to help improve bat health and survivorship of young during the summer when they are not subject to WNS. This will help boost the numbers and health of bats returning to hibernation enabling better overwinter survivorship.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

Summer roosting sites are one of the most important habitat components for Minnesota's hibernating bat species. Natural roosts typically consist of tree cavities or loose bark. Unfortunately, roost in dead trees and even live trees are ephemeral and not always in optimal locations. Artificial roost structures have been shown to provide greater capacity and protection for roosting bats than natural sites. Artificial roost structures can also be placed in optimal locations to maximize use and conditions needed for roosting bats and young. Artificial roost structures, appropriately designed and located, also provide critical habitat where natural roosts have been lost or do not exist (Mering and Chambers, 2014). Outcomes of our project will be disseminated publicly via DNR outreach channels and broadly as part of the WNS Conservation and Recovery Working Group companion effort to have a broader effect on bat survival throughout North America.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

1) Identify characteristics of artificial bat roosting structures that optimize bat roosting and reproduction.
2) Utilize that information to install and/or relocate artificial roost structures on state park lands to maximize usage and reproduction.
3) Disseminate the results within MN and throughout North America via the WNS Conservation and Recovery Working Group to achieve better usage of roosting structures and reproduction across a much broader area.

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Assessment and Analysis of Artificial Roost Structures, and Application of Information to Optimize Bat Occupancy and Reproduction

Activity Budget: $190,000

Activity Description:
This project will collect and analyze data on existing artificial bat roost structures on state park and state recreation area lands. These data will be used to install or relocate existing roosting structures to maximize bat utilization. Best management practices for constructing, installing and maintaining bat roosting structures will be communicated to the public via the DNR website and other outreach products. The information will also be shared with the North American WNS Conservation and Recovery Working Group which is assembling similar data from across the United States and Canada.

Activity Milestones:

Description	Approximate Completion Date
Inventory of existing artificial bat roosting structures on state park and SRA lands.	November 30, 2021
Summarize data and identify locations of structures to monitor	May 31, 2022
Construct and install certain structure styles, locations or orientations if needed	May 31, 2022
Collect and analyze environmental and bat utilization data	June 30, 2023
Install or relocate structures at optimal locations, orientation and style	November 30, 2023
Continue data compilation and initiate web page and outreach products	June 30, 2024
Monitor structures installed to provide optimal conditions for bat utilization	November 30, 2024
Summarize findings and finalize web page and outreach products	June 30, 2025
Repair or replace 4-6 additional existing bat roost structures that are in disrepair or needreplacement	June 30, 2025
Procure and distribute supplemental outreach products to State Parks and other DNR staff. To bedistributedtopublic	June 30, 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Gerda Nordquist and staff	MN Dept. of Natural Resources MN Biological Survey	Gerda and her staff will be providing expertise and staff time to all phases of the project.	Yes
Dr. Cori Lausen and student Susan Dulc	White Nose Syndrome Conservation and Recovery Working Group	They are conducting similar work. We are matching protocols to be able to aggregate some data. We will provide our findings to them as part of a effort in the US and Canada to communicate how to best construct, locate and maintain bat roosting structures that best enhance bat survival.	No

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
Best management practices for constructing, installing and maintaining bat roosting structures will be communicated to the public via the DNR website and other outreach products. The information will also be shared with the North American WNS Conservation and Recovery Working Group which is assembling similar data from across the United States and Canada
The Minnesota Environment and Natural Resources Trust Fund (ENRTF) will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the ENRTF Acknowledgement Guidelines.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?
Initial collection of artificial roost structure characteristics, testing of unrepresented designs and usage analysis will occur the first 2 years of the project. Years 3 and 4, structures will be relocated, better designs installed, etc. to achieve higher usage and reproduction. Results will be shared with citizens/agencies in MN and via the WNS Conservation and Recovery Working Group with the intention of leading to better designed structures and placement broadly. The Division of Parks and Trails has adequate funding and staffing to ensure that structures are maintained in state parks to provide optimal roost sites for the foreseeable future.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Reintroduction and Interpretation of Bison in Minnesota State Parks	M.L. 2015, Chp. 76, Sec. 2, Subd. 03h	$600,000
State Park Pollinator Habitat Restoration	M.L. 2017, Chp. 96, Sec. 2, Subd. 08d	$672,000
Restoring Forests in Minnesota State Parks	M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 08e	$250,000
Saving Endangered Pollinators through Data-Driven Prairie Restoration	M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 08a	$800,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount	$ Amount Spent	$ Amount Remaining
Personnel										
Bat specialists		Collect and analyze roost structure data. Assist in report preparation and outreach product content.			25%	2	X	$96,500	-	-
Division of Parks and Trails staff		Collect structure and usage data. Construct and install or relocate roosting structures.			30%	0.6	X	$7,000	-	-
Information and Outreach Specialist		Assist in creating/posting project content on the DNR website. Assisting with creation of other project outreach materials			36%	0.1	X	$1,000	-	-
							Sub Total	**$104,500**	**$104,500**	**-**
Contracts and Services										
							Sub Total	**-**	**-**	**-**
Equipment, Tools, and Supplies										
	Equipment	Bat acoustic detectors, night vision glasses, data loggers, supplies required for this equipment	Collect roost structure data and bat occupancy					$11,500	$11,500	-
	Tools and Supplies	Lumber, hardware	Materials needed to construct, repair, or replace optimal artificial roost structures					$17,000	$17,000	-
	Tools and Supplies	Outreach Materials - 5 different products have been designed for this project. Quantities listed are estimates. Bat House Recommendations and Best Management Practices Document (500, + permanent digital home on MNDNR website)), Bat Posters (5000), Bat Cards (7000), Bat Stickers (10000), Bat Tattoos (10000). See attachments for examples of items.	The outreach items have two main purposes. 1. The Bat House Recommendations and Best Management Practices document will inform the public and other conservation organizations of the results of this study and the recommendations we have that will improve bat usage of artificial roosting boxes,					$11,702	$11,702	-

			thereby supporting bat conservation and population recovery from White-nosed syndrome; 2. The other 4 outreach products will be given away at outreach events and state park naturalist programming as a means to raise awareness of the bats of minnesota and engage the public on how they can use artificial bat houses to support bat conservation and population recovery from the effects of WNS.							
							Sub Total	**$40,202**	**$40,202**	**-**
Capital Expenditures										
							Sub Total	**-**	**-**	**-**
Acquisitions and Stewardship										
							Sub Total	**-**	**-**	**-**
Travel In Minnesota										
	Miles/ Meals/ Lodging	Travel to monitor bat roosts, attend outreach events (mileage, lodging, meals). Expenditures will be in accordance with Commissioner's Plan.	Monitor bat roost structures, attend outreach events to disseminate information.					$24,000	$15,332	$8,668
							Sub Total	**$24,000**	**$15,332**	**$8,668**
Travel Outside Minnesota										
							Sub Total	**-**	**-**	**-**
Printing and Publication										

	Printing	Printing of outreach materials, roost building instructions	Primarily for outreach to the public and other agencies, organizations.					$2,000	$2,000	-
							Sub Total	**$2,000**	**$2,000**	**-**
Other Expenses										
		Direct and Necessary Costs	Direct and necessary costs to cover HR support ($4,138), Safety support ($749), Financial support ($2,042), Communication support ($1,388), IT support ($9,843), Planning support ($1,138)					$19,298	$15,877	$3,421
							Sub Total	**$19,298**	**$15,877**	**$3,421**
							Grand Total	**$190,000**	**$177,911**	**$12,089**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Personnel - Bat specialists		Collect and analyze roost structure data. Assist in report preparation and outreach product content.	**Classified :** We are requesting approval to use ENRTF funds to cover a portion of the salary of MNDNR classified and unclassified personnel while they assist on this project. This funding will be used to pay project-associated costs consistent with the approved work plan. The existence of these positions is partly dependent on funding for this project. Work that otherwise might have been assigned to these positions will be covered by other MBS staff or deferred till a later date.
Personnel - Division of Parks and Trails staff		Collect structure and usage data. Construct and install or relocate roosting structures.	**Classified :** We are requesting approval to use ENRTF funds to cover a small amount of the salary of Parks and Trails personnel while they assist on this project. This funding will be used to pay project-associated costs consistent with an approved work plan. Work of these individuals which needs to be addressed while they are assisting on this project will be covered by other staff at the park or deferred till a later time.
Personnel - Information and Outreach Specialist		Assist in creating/posting project content on the DNR website. Assisting with creation of other project outreach materials	**Classified :** We are requesting approval to use ENRTF funds to cover a small amount of the salary of an Information and Outreach Specialist. This funding will be used to pay project-associated costs consistent with an approved work plan. Work of the Information/Outreach specialist needing to be addressed while they assist on this project will be covered by interpretive staff, information officers or similar positions or deferred till a later date.

Non ENRTF Funds

Category	Specific Source	Use	Status	$ Amount	$ Amount Spent	$ Amount Remaining
State						
In-Kind	Reinvest in MN (RIM) funding	For supervision of zoologists (bat specialists) and assist with oversight and guidance on project.	Secured	$40,000	$40,000	-
In-Kind	General Fund and Parks & Trails Legacy Fund. MN Statutes 85.53 PARKS AND TRAILS FUND	For NR Program supv. oversight, direction of project. NR program supervisor is project manager for this effort.	Secured	$40,000	$40,000	-
In-Kind	General Fund and Parks & Trails Legacy Fund. MN Statutes 85.53 PARKS AND TRAILS FUND	For NR Program Coordinator - database development and administration. Also some data collection and analysis.	Secured	$30,000	$30,000	-
			State Sub Total	**$110,000**	**$110,000**	**-**
Non-State						
Cash	WNS Aid to States and Tribes (USFWS)	Utilized by MN Dept. of Natural Resources for efforts to address White Nose Syndrome	Secured	$10,000	$10,000	-
			Non State Sub Total	**$10,000**	**$10,000**	**-**
			Funds Total	**$120,000**	**$120,000**	**-**

Attachments

Required Attachments

Visual Component

File: aeabf00a-bc7.pdf

Alternate Text for Visual Component

It shows a map of the US and Canada depicting the locations of White Nose Syndrome confirmed and suspected locations. There are also pictures of bat roosting structures....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Background Check Form-Enhancing Bats	9b582011-5cb.pdf
2022 Artificial Roost Intensive Monitoring Locations	9f764f78-0aa.jpe
Assembling Bat Roost Temperature Sensors for Installation	e8c4c792-7a1.jpe
Taking Detailed Bat Roost Measurements	8fa285c0-c0c.jpe
New Roost Box Installation	b239fc83-00a.jpe
Training Parks and Trails Staff	e87f9e0f-3a4.jpe
Parks and Trails Artificial Bat Roosts Presentation (12/2/2022)	3aec7bef-3c6.pptx
Scientific and Natural Areas Program - Summer 2024 Newsletter	bdeba42f-071.pdf
Preferred box design #1 - 4 chambered nursery	99c8158e-743.jpe
Preferred box design #2 - rocketbox	1c9c595b-c08.jpe
Preferred box design #3 - Johnson box	7502f6b3-4e3.jpe
Artificial Bat Box Condo - Forestville State Park	d13dcf48-22f.jpe
MN Bat Festival Outreach_Oct2025	3348a75a-0d1.jpe
Bat House sticker outreach material	d0c03e56-487.pdf
Bat House Temp Tattoo Outreach Material	101690cd-a35.pdf
Bat House Species ID Cards	ede2a223-3e3.pdf
Bat House Species Poster	3d821008-711.pdf
Guide To Artificial Roosts For Bats	1ce6d00d-ef3.pdf
Replacement Bat Boxes_1	5b73efa2-a3a.jpe
Replacement Bat Boxes_2	a07128c1-89d.jpe
February 2025 Parks and Trails Staff Newsletter	91b8bf0c-e19.jpe
June 2025 MNDNR Staff Newsletter	e924ca6c-8c5.pdf
Better Bat Boxes - MN Conservation Volunteer	186c3405-e2f.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

There are not substantive changes from the proposal to work plan stage. Thee timeline in the work plan was updated to correspond with the new date for project funding/initiation which resulted from the pandemic delay.

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the Commissioner's Plan applies.

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

No

Does the organization have a fiscal agent for this project?

No

Work Plan Amendments

Amendment ID	Request Type	Changes made on the following pages	Explanation & justification for Amendment Request (word limit 75)	Date Submitted	Approved	Date of LCCMR Action
1	Amendment Request	• Budget - Personnel • Budget - Capital, Equipment, Tools, and Supplies	In 2022, inflation had a significant impact on the cost of project tools, supplies, and equipment. The project has expended nearly all of its budget allocated for equipment. Additional supplies will be needed in 2023 to purchase lumber and other materials to construct artificial bat roosting boxes. This amendment is requesting the movement of $7,500 out of the project labor allocation and into the tools/supplies/equipment allocations.	January 3, 2023	Yes	January 4, 2023
2	Amendment Request	• Activities and Milestones • Budget - Personnel • Budget - Capital, Equipment, Tools, and Supplies • Budget - Travel and Conferences • Attachments	Request to move $16,000 from labor and $1000 from travel to pay for additional project outreach materials and supplies. Reasoning = MNDNR creative services=$0; bat specialist had less in-person data collect and travel than anticipated. Additional supplies will allow for critical repair and replacement of additional artificial bat houses. We've created a package of outreach material (see attachments). This change will fund significantly more outreach product to distribute to the public.	May 19, 2025	Yes	May 20, 2025

Status Update Reporting

Final Status Update August 14, 2025

Date Submitted: August 13, 2025

Date Approved: October 13, 2025

Overall Update
The overall outcomes of this project have been successfully met. The projects' inventory and monitoring efforts over the previous four years provided tangible insights into what artificial bat roost characteristics are supporting reproductive success. We used these insights to optimize the roosting conditions at six different State Park locations.

The three most important findings from this study suggest:
1. Large volume bat box designs with multiple chambers are most effective; avoid using small, single-chamber boxes sold at garden stores and online retailers;
2. Installing a variety of box designs in clusters at a site increases roosting choices for bats throughout the reproductive season;
3. Because bats return to bat boxes year after year, regular monitoring and maintenance is critical to support long-term reproductive success.

A guidance document has been developed to help the public and conservation partners effectively use bat boxes to optimize reproductive success. The study findings and the guidance document have been shared broadly within the MNDNR, Wildlife Conservation Society Canada, and the White-nosed Syndrome (WNS) Conservation and Recovery Working Group. We anticipate that there will continue to be opportunities to share and disseminate this information after this project concludes.

Activity 1
In May, staff purchased and replaced 4-6 additional boxes at two study sites. Emergence counts were conducted in June to monitor bat box usage. Consistent with other observations during this study, these locations are showing an increase in bat use from previous years, a positive sign that the modifications to box design and arrangement are increasing bat box usage. Staff continue to observe daily and seasonal box-switching behavior, another interesting finding from this study.

All research findings have been summarized, and a guide (Guide to Artificial Roosts for Bats) has been developed to educate the public and conservation partners to effectively use bat boxes. The guide is available to the public via the MNDNR website. It was also shared with conservation partners during the national White-nose Syndrome virtual meeting and Midwest Bat Working Group meeting.

A suite of four additional outreach products were designed and produced, including: Bat species info cards; Bat species info poster; Stickers; Temporary tattoos. These products were distributed to DNR staff who interact with the public, like State Park naturalists. The DNR plans to distribute some of this material at the MN State Fair and the Minnesota Bat Festival.

See attachments.
(This activity marked as complete as of this status update)

Dissemination
The Guide to Artificial Roosts for Bats was shared with the USFWS WNS Communications, WNS Conservation and

Recovery Working Group, and the Midwest Bat Working Group.

The Guide to Artificial Roosts for Bats was shared with the Wildlife Society of Canada, who are primary authors of Best Management Practices For The Use of Bat Boxes In U.S. and Canada (2023).

Improvements were made to MNDNR website, incorporating updates and a link to the guide.

The outreach products and project were highlighted in the June 6th MNDNR Staff Newsletter.

An update on the project was highlighted in the Feb 2025 Parks and Trails Director's Update.

An article highlighting this work and project are going to be featured in the Sept/Oct issue of the MN Conservation Volunteer.

MNDNR staff created signage for the MN state fair about bat conservation, including a QR code that links to the guide.

Project findings were presented to multiple professional conferences, including Minnesota Wildlife Society Annual Meeting, National White-Nose Syndrome Meeting, Midwest Bat Working Group Annual Meeting, and Wildlife Academy (MNDNR Fish and Wildlife Symposium).

Project findings were presented to multiple public audiences including the Biodiversity Annual Report-Out and Fond Du Lac Tribal Community College.

Status Update Reporting

Status Update January 1, 2025

Date Submitted: February 3, 2025

Date Approved: March 14, 2025

Overall Update

The final year of bat roost utilization data was collected and added to the project dataset this reporting period. We returned to six state park locations to monitor box usage and determine whether the box style and/or arrangement modifications made at these sites increased box utilization by bats. Boxes were counted at least three times during the field season. Four state park locations utilized sensors to collect a third season of box temperature data. At three locations, temperature sensors were placed in boxes that were repainted with lighter colors to record any reductions in internal temperatures. Sensors were retrieved last fall and the data are being analyzed this winter for inclusion in the project's final report.

A large nursery box that was installed last spring at Forestville SP (see attachments) was rapidly occupied by little brown bats and has become the central anchor structure for the cluster of twelve bat boxes at that particular site.

An artificial bat box guidance document is being developed this winter. The guidance will include a quick reference checklist, and explanation of box designs, box building tips and modifications, box installation and arrangement BMPs, box maintenance and monitoring, a FAQ, and additional resources.

Activity 1

A third and final year of monitoring, both temperatures and bat roost utilization data, took place this past year. The goal of data collection this year is to quantify whether the changes we have made at the study sites to the roost structure number, arrangement, style, volume, and color correlate to observed increases in box utilization by bats. All monitoring data and equipment was successfully retrieved by November 30th and data are being analyzed this winter.

Meetings regarding digital and print media, as well as outreach products and deliverables have and are taking place. The project team is using internal MNDNR web and social media expertise in order to develop outreach products and digital content. A draft bat box guidance document has been prepared, and will continue to be refined and reviewed in 2025. Printing quantities of the guidance document will allow DNR staff the opportunity to provide to State Park visitors and the general public. The project is on target to be completed by June 30th, 2025.

Dissemination

A number of findings and results of this project have been disseminated and communicated to the MNDNR and other agencies and organizations working on bat conservation issues. Presentations and project updates given during this last reporting period included:

- Information sharing about this project with Cori Lausen PhD, Wildlife Conservation Society Canada's Director of Bat Conservation. Cori is the lead author of the US/Canada Bat Box Best Management Practices document (July 2024)
- Bat emergence program during Dark Skies event, Forestville State Park (August 2024)
- Bat presentation, McGregor Marsh Scientific and Natural Area (SNA) (August 2024)
- Podcast interview, Catch My Drift Podcast (August 2024)
- Bat presentation, River Bend Nature Center (September 2024)
- MN Bat Festival, MN Valley National Wildlife Refuge, 900+ attendees (October 2024)

Status Update Reporting

Status Update July 1, 2024

Date Submitted: July 8, 2024

Date Approved: August 16, 2024

Overall Update

This past winter and spring, the project team finalized the list of key characteristics shown in this study to optimize bat roosting and reproduction in artificial roosting structures within the Minnesota State Park system. Those characteristics are:

1. Installing multiple bat boxes in a cluster formation to provide microclimate and social thermoregulation choices for bats throughout the summer.
2. Using multi-chamber boxes with internal volumes >2,000 in3. Preferred box designs: 4-chambered nursery box, Johnson box, and rocket box (attachments)
3. Utilizing box colors such as brown or green instead of black to mitigate against potential overheating events during peak summer temperatures.
4. Large bat condos are beneficial when included in cluster formations placed for large maternity colonies.
5. Avoid single chamber boxes as bats do not utilize them.

Box style, number, volume, arrangement, and color were modified at eight State Park study sites to align with the optimal bat roost characteristics identified by the project team. Sites are being monitored this summer to determine if bat occupancy and reproduction increases at these locations. Boxes will be counted at least three times during this field season using spotlight count and/or evening emergence count methods.

Activity 1

The addition and/or relocation of artificial roosting structures at eight state park study sites was completed this past spring. There were temperature sensors installed in a smaller subset of roosting boxes in order to capture a third year of temperature data.

A third year of bat roost utilization data collection is underway. The goal of data collection this year is to quantify whether the changes we have made at the study sites to the roost structure number, arrangement, style, volume, and color are correlated to increased bat utilization. The project is following the project work plan as scheduled.

Some early conversations regarding web page and outreach products have taken place. Starting in the fall of 2024, the project team will be transitioning to this final aspect of the overall project. The project team will be leveraging internal MNDNR web and social media expertise in order to develop outreach products and web content.

Dissemination

Some of this projects early findings have been disseminated and communicated to the MNDNR and other organizations working on bat conservation issues. Presentations and project updates were given to:

- Minnesota Biological Survey program annual roundup meetings (Jan 2024)
- Midwest Bat Working Group annual meeting (April 2024)
- White-Nose Syndrome national meeting (June 2024)

During this reporting period, outreach activities that took place where project team members were able to share project updates and findings include:

- Becoming an Outdoors Woman winter workshop, January 2024– Presentation
- Central Lakes College, February 2024 – Presentation
- St. Croix State Park, June 2024 - Interpretive program and bat count
- SNA Nature Notes Newsletter, June 2024 (attachment)

Status Update Reporting

Status Update January 1, 2024

Date Submitted: January 17, 2024

Date Approved: February 6, 2024

Overall Update

Outcomes #1

Actions were taken during the 2023 field season at select State Park sites to test and improve bat occupancy and utilization of artificial roost boxes. The data collected in 2022 indicates that the clustering of multi-chamber boxes with larger volume is preferred by maternity colonies. Additionally, temperature data suggests a combination of boxes with a variety of sun exposure(s) are providing more microclimate choices for reproductive females. Lastly, temperature data suggests there are a number of artificial roost boxes in the study that consistently reach lethal internal temperatures.

Outcome #2

Summer monitoring continued at six state parks in 2023. Temperature sensors were installed in boxes at four of those parks. Boxes with temperature sensors were monitored using spotlight checks as well as emergence counts to verify and quantify bat occupancy. Temperature sensors were retrieved from boxes this fall. Data analysis is ongoing.

Twelve additional roost boxes were installed at six park locations in 2023, and an additional 13 roost boxes will be installed next year. Eight boxes are being moved or modified to improve use by bats and reduce lethal internal temperatures.

Outcome #3 will be addressed in future project updates.

Activity 1

A second year of data collection occurred during 2023 to determine important variables contributing to bat use of artificial roosts. Early findings suggest the presence of multiple, large, multi-chambered boxes, positioned in a group with various aspect/solar exposure contributes to increased use by maternity colonies. Temperature data suggests varied placement can increase microclimate choices for reproductive females throughout the year. Both years of monitoring data suggest bats frequently switch roosts throughout the summer, and sites with multiple boxes installed in a cluster with varied conditions had high use from both little brown and big brown bats.

To achieve milestone #5, eight State Park sites were identified for improving bat roost structure configuration. At sites where additional boxes are needed, an internal review was conducted by DNR cultural resource unit staff in order to ensure new box locations would not adversely affect cultural resources. Plans are in place to build additional boxes over the winter. Installation will occur spring 2024, and monitoring is planned for summer 2024. As mentioned in the summary above, an additional 13 roost boxes will be installed next year, and eight boxes are being moved/modified to improve use by bats and reduce lethal internal temperatures.

Dissemination

This project is still in data collection, experimentation, and monitoring phases. During the reporting period, one outreach activity took place where project team members were able to share early project findings:

MN Bat Festival, October 2023 – Outreach Presentation, Table Activity

Status Update Reporting

Status Update July 1, 2023

Date Submitted: July 18, 2023

Date Approved: August 10, 2023

Overall Update

Outcomes #1 and #2

Last season's bat occupancy data, internal box temperature data, and bat vocalization data was analyzed by project staff this past winter. Interesting early findings include:

- Artificial bat box use is not static or consistent. Roost switching at sites was frequently observed
- Artificial bat box use was observed to be dependent on the time of the year. This behavior is likely related to the reproductive status of the bats using the roost boxes

The data analysis suggests the most important variables influencing artificial bat box usage are box design, box size, box position/aspect, internal box temperature, and the number of boxes at a site (grouping). Further experimentation is needed in order to rank the importance of each variable.

Actions are being taken during the 2023 field season at select State Park sites to improve bat occupancy and utilization of artificial roost boxes. Additionally, continued intensive monitoring of bat utilization and occupancy is taking place at multiple State Park locations.

Outcome #3 will be addressed in future project updates.

Two photo attachments provided in this update

Activity 1

As mentioned in the overall update above, and to achieve milestone #4, the data collected in 2022 was organized, aggregated, and analyzed during this past winter. Early findings suggest the most important variables influencing artificial bat box usage are box design, box size, box position/aspect, internal box temperature, and the number of boxes at a site (grouping)

For the 2023 field season, two types of activities are occurring at select State Park locations.

- Monitoring: Intensive monitoring and occupancy checks are continuing for a second season at multiple State Park locations in order to establish a more robust dataset.
- To address milestone #5, the project team delivered and installed additional boxes (of a different box design) at five State Park locations this spring. Occupancy checks will be conducted at these locations this summer to monitor for use and occupancy. Additionally, the project team intends to move and/or repaint bat boxes in the fall of 2023 to study the importance of those variables in improving box usage.

Dissemination

This project is still in data collection, experimentation, and monitoring phases. However, two notable outreach activities took place during this update period where project team members were able to share early project findings:

MN Landscape Arboretum, June 2023 – Outreach Presentation

MN Master Naturalists, April 2023 – Outreach Webinar

Status Update Reporting

Status Update January 1, 2023

Date Submitted: January 3, 2023

Date Approved: January 4, 2023

Overall Update
Fieldwork and data collection continued in earnest for the remainder of 2022. Bat occupancy data, internal box temperature data, and bat vocalization data were collected at 55 artificial roosting boxes at six different state park locations across the state. Bat box occupancy was recorded frequently during the spring, summer, and fall by state park staff. Data collection devices and sensors were removed from the field in October and November, and some initial data analysis has begun. Outcomes #2 and #3 will be addressed in future project updates. The project team will be using the field observations, data collected, and results of the data analysis to achieve these outcomes later in the project timeline.

Activity 1
Intensive bat roost monitoring took place in 2022, focused on 55 artificial roost boxes at six different state parks across the state. Sensors collected internal box temperature data throughout the spring/summer/fall. Additional data that was collected included bat occupancy data and detailed box dimension information. Acoustic recording devices were deployed at these six sites to document bat species and bat activity near the roost boxes being monitored. The project team was able to retrieve all of the sensors from the field and has started data analysis. It is too early to report any findings but it is likely that there will be summaries of the 2022 data collected in the next project update (June 2023).

Dissemination
This project is currently in data collection/monitoring phases. One informal project update was provided in December to interested DNR staff who attended the MN Biological Survey 2022 season roundup meeting. Future updates will include more information regarding how our project findings will be communicated within the Agency, the scientific community, and to the general public.

Status Update Reporting

Status Update July 1, 2022

Date Submitted: July 15, 2022

Date Approved: July 20, 2022

Overall Update
Fieldwork began in earnest in the late summer of 2021 and data continues to be collected in 2022. An intensive monitoring plan was developed by the project team during winter 2021 and has been implemented at 55 artificial roost boxes at six different state park locations across the state. Data collection has been focused on characteristics that may influence utilization by bats, including box style, condition, color, size, location, aspect, and internal temperature. Outcomes #2 and #3 will be addressed in future project updates. The project team will be using the field observations, data collected, and results of the data analysis to achieve these outcomes later in the project timeline.

Four images have been added to the attachments section.

Activity 1
An inventory of artificial bat roost boxes across the state park system was completed in the fall of 2021. A total of 136 boxes were inventoried at 25 different state park locations. Based on this information, the project team determined that there were an adequate number of existing structures to move forward with a project monitoring plan without having to build and install new roost structures at this time. The statewide inventory was also foundational in developing an intensive monitoring plan during winter 2021. Unique fieldwork plans and methodologies were developed and tested by the project team, followed by purchasing supplies and communicating the monitoring plan to state park staff assisting with data collection. Intensive monitoring is underway, focused on 55 artificial roost boxes at six different state parks across the state. Temperature sensors were installed at these locations during March-May. Additional data being collected this summer includes bat occupancy data and detailed box dimension information. Acoustic recording devices will be deployed later this summer to document bat species and bat activity at these six locations. The project team looks forward to retrieving, analyzing, and summarizing the data collected during the 2022 field season.

Dissemination
This project is currently in data collection/monitoring phases. Future updates will include more information regarding how our project findings will be communicated within the Agency, the scientific community, and to the general public.

Under alternate funding, project team members Melissa Boman and Gerda Nordquist attended the national white-nose syndrome (WNS) conference in June 2022. At the meeting, the importance of locating summer maternity colonies and continued protection or enhancement of habitats used by bats were discussed as recovery strategies in states where the disease has already been established. Fieldwork for this project has already confirmed that artificial roost boxes are being used as important maternity and roosting sites at multiple state park locations.