GUIDE TO

ARTIFICIAL ROOSTS FOR BATS

DEPARTMENT OF NATURAL RESOURCES

Purpose

This document contains current recommendations for building, installing, maintaining, and monitoring bat boxes in Minnesota. These artificial roosts support bat populations by providing shelter for females raising pups. Installing carefully planned artificial habitat like bat boxes can improve the chances of maternity colony success, aiding struggling populations by providing long-term reproductive habitat. Use the information in this guidance document to learn how you can help your local bats.

Acknowledgements

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Focal monitoring parks:

- Forestville Mystery Cave
- Gooseberry Falls
- Lake Vermillion Soudan Underground Mine
- Maplewood
- Rice Lake
- Sakatah Lake
- Saint Croix
- Whitewater

Inventoried Parks and other DNR lands:

- Beaver Creek Valley
- Camden
- Carley
- Charles Lindbergh
- Fort Ridgley
- Indian Lake State Forest Campground
- Jay Cooke
- Lake Bemidji
- Lake Maria
- Lake Shetek
- Mille Lacs Kathio
- MN Valley State Recreation Area
- Monson Lake
- Old Mill
- Scenic
- Sibley
- Trails and Waterways Area 3A
- Tettegouche
- Wild River
- William O'Brien

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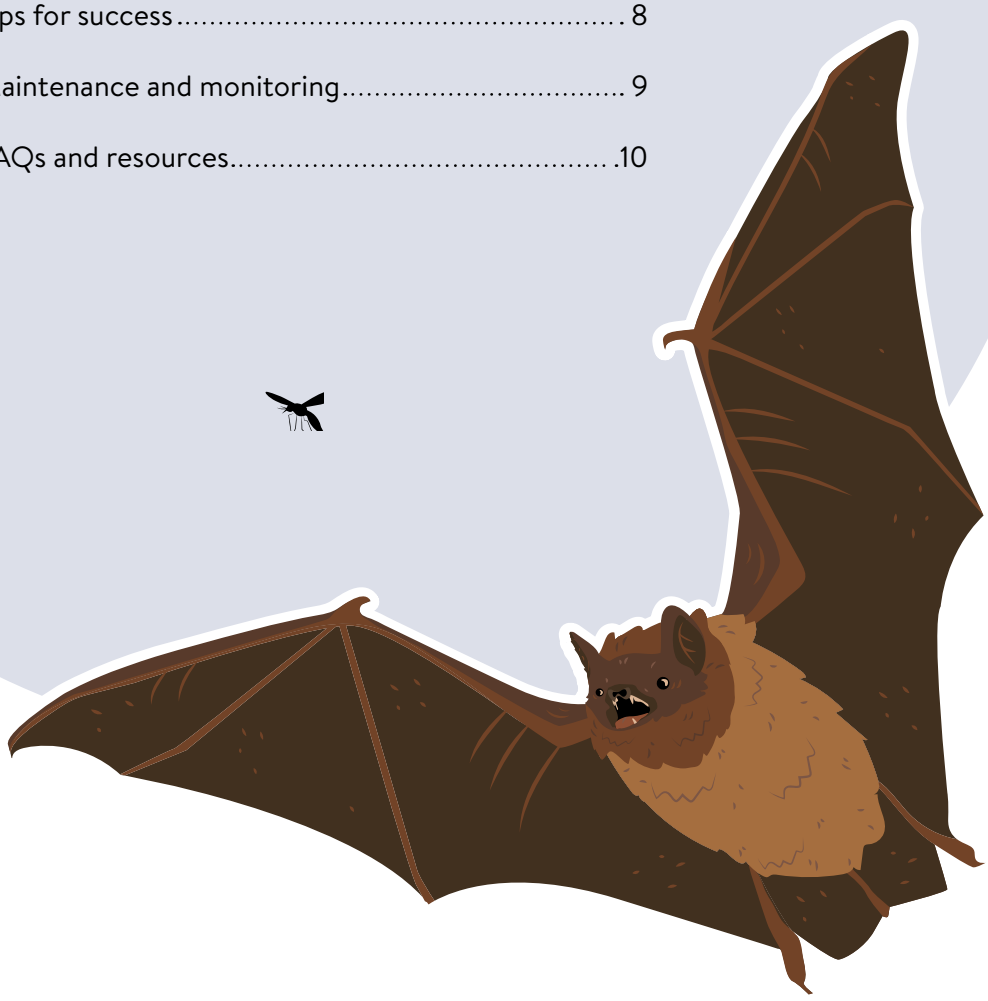
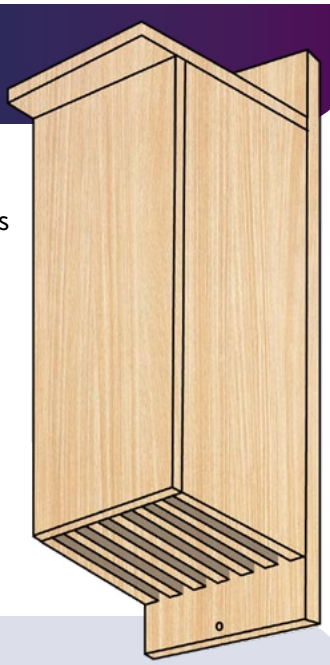


Importance of bat boxes



Bat boxes are artificial roosting structures that provide vertical crevices for bats to rest during the day. Bats use boxes in spring, summer and fall. Female bats gather in bat boxes to give birth and raise their pups. Effective bat boxes can become important habitat for supporting bat populations, especially when bats are excluded from buildings.

Species in need

Hibernating bats in Minnesota have declined drastically since 2016 due to the fungal disease White-Nose Syndrome (WNS). At most hibernation sites, little brown bats have declined by over 90%. Suitable habitat can help surviving bat populations recover. Bat boxes primarily house maternity colonies raising their pups. Sites where pups can safely be raised can support the recovery of impacted bat populations in Minnesota.

Who's in the box?

Only two of Minnesota's eight bat species frequently use bat boxes. These are the same species that often use buildings as summer roosts.

This species hibernates in caves and mines where WNS infections occur, as a result they have become less common in Minnesota.

In addition to caves and mines, this species hibernates in buildings where they are less likely to be infected by WNS. Their populations have not declined as drastically as other impacted bat species.

A long-term solution

Research has shown that bats will return to the same roosting site for many years. With little brown bats living more than 32 years, reliable roosts are important! Bat box maintenance and upkeep will ensure bats can access this habitat throughout their lives.

Why temperature matters

Bats need a warm roost (86 - 104°F) to raise their young. Too hot and bats may overheat, leading to mortality. Too cold and bats must expend their energy reserves to keep warm. Installing multiple boxes near each other, or clustering boxes, increases the variety of available roost temperatures for bats. This allows females to choose between boxes and select ideal conditions for their pups throughout the season. Since temperatures in boxes change throughout the day and across the season, a variety of box designs and sun exposure are crucial to support healthy bat populations.

Installation scenarios

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No two bat box installation sites are alike and the reasons for choosing to install bat boxes vary. Consider these examples when planning, selecting a site, and installing bat boxes.

Backyard boxes

Homeowners may be interested in putting up boxes in their yard to attract bats. In urban areas, it is important to consider the location of boxes relative to human activity. Place boxes in areas where people and pets will not be walking or playing directly below boxes. In a small yard, consider the space needs for at least two boxes. In rural areas, place boxes near water sources, along woodland edges, and in open fields.

Roosts for bats excluded from buildings

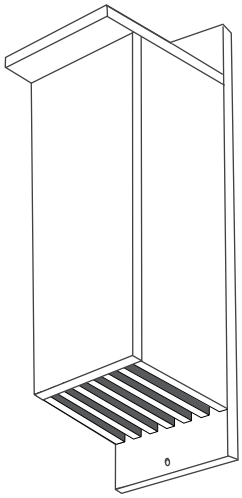
If a bat colony is excluded or prevented from roosting in a building where they are established, bat boxes may provide alternative roost sites. Counting bats leaving the building at night, before the exclusion project is conducted, will determine how many bats will be displared. Sites with 20-100 bats may require fewer boxes (less than 3) compared to a site with more than 300 bats (more than 3).

Workshops and community efforts

Bat box building workshops can be a fun and rewarding community effort. However, when establishing new box clusters, it is important to consider the lifespan of the boxes and the commitment to maintaining them long-term if bat colonies become established. Community program efforts can go a long way when combining education about bats, establishing bat box clusters, monitoring box usage with evening emergence counts, and repairing or replacing weathered boxes through time.

Box designs

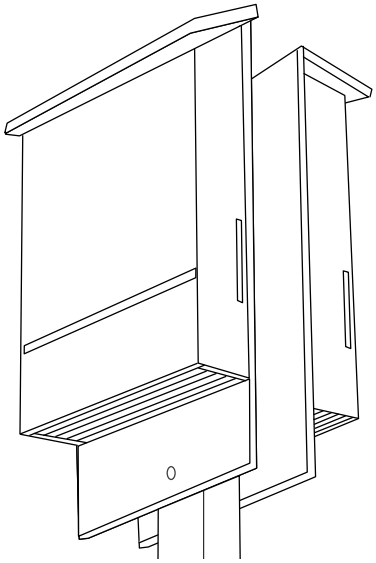
These box designs are effective in Minnesota. In general, tall boxes with multiple chambers are preferred designs by bats. A combination of these designs in a single location increases temperature choices. In Minnesota, maternity colonies were documented using boxes with a volume greater than 3,000 cubic inches.



Johnson Box

Designed by former MNDNR Wildlife Manager Earl Johnson, this box is easy to build...and bats love it!

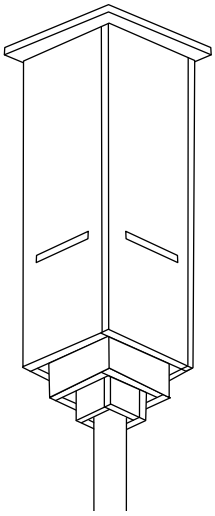
Find building plans here: files.dnr.state.mn.us/eco/mcbs/johnson-bat-house-design.pdf



Multi-Chamber Nursery

Long-standing successful box design promoted by Bat Conservation International.

Find building plans here: batcon.org/wp-content/uploads/2020/09/4-Chamber-Nursery-House-Plans.pdf



Two-Chamber Rocket Box

This design provides bats access to all four sides of the box, providing more internal temperature choices that can benefit bats.

Find building plans here: batcon.org/wp-content/uploads/2020/04/RocketBoxPlans.pdf

Bat Condos: extra-large roosts for bats

Condos are extra-large free-standing structures that accommodate large bat colonies (400 or more bats). These structures can be important when large colonies are excluded from buildings, or sites where bat colonies are already established in a cluster of bat boxes. For the best return on your investment, use bat condos at sites where large bat colonies are documented.

Find building plans here: wiatri.net/inventory/bats/volunteer/roosts/img/WDNRBatCondo.pdf

Single-chamber boxes

Avoid single chamber boxes. These box types are commonly sold in hardware and garden stores or by online retailers due to their small size. These boxes do not provide suitable temperatures and tend not to be used by bats.

Building tips and modifications

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- Pine, oak, and cedar are the most common wood types used to construct bat boxes. Do not use pressure or chemically treated wood.
- Plywood can be used for interior chamber partitions.
- Use boards that are at least ½ inch thick for building box exteriors.
- Construct boxes with a ¾ inch chamber width for little brown bats, or a 1 inch chamber width for big brown bats
- Scour or roughen the landing zone below box entrances and interior surfaces for bats to grip. Do not use mesh or screen inside boxes or on the landing zone. These materials can tear over time and trap bat pups.
- Always construct boxes using weatherproof screws instead of nails.
- To ensure the box is weatherproof, seal seams using caulk or construction adhesive.
- Use non-toxic paint or stain for box exteriors to protect the wood from moisture and sunlight. Do not paint or stain interior box surfaces.
- Paint boxes shades from dark to light brown. Avoid painting west facing boxes black as they are more likely to overheat.
- Modify box plans to increase volume by adding additional chambers. Maternity colonies in Minnesota were found to use boxes with a volume greater than 3,000 cubic inches.
- Consider adding 1½ inch diameter holes to interior partitions so bats can move between chambers.
- Add vents to large boxes.

Citation: Holroyd S. et al. (2023). Best Management Practices for the Use of Bat Houses in the US and Canada. US Fish and Wildlife Service.

wcscanada.org/resources/best-management-practices-for-the-use-of-bat-houses-in-the-us-and-canada/

Little brown bats fill a multi-chamber nursery. Over 100 bats can gather in these boxes.

Installing bat boxes

1. Orient boxes facing different solar aspects. Include at least one east facing box for morning sun.
2. Place in open areas near forest cover, keeping boxes at least 20 feet away from tree branches. Do not place boxes on trees.
3. Provide choices by clustering multiple large-volume boxes together.
4. Boxes are best used as alternative roosts when bats are excluded from a building.
5. Ensure shrubs, young trees, and tall plants do not grow to box entrance heights over time to maintain clear flight paths for bats leaving boxes.
6. Install boxes less than ¼ mile from clean drinking water sources and forest cover.

Post considerations

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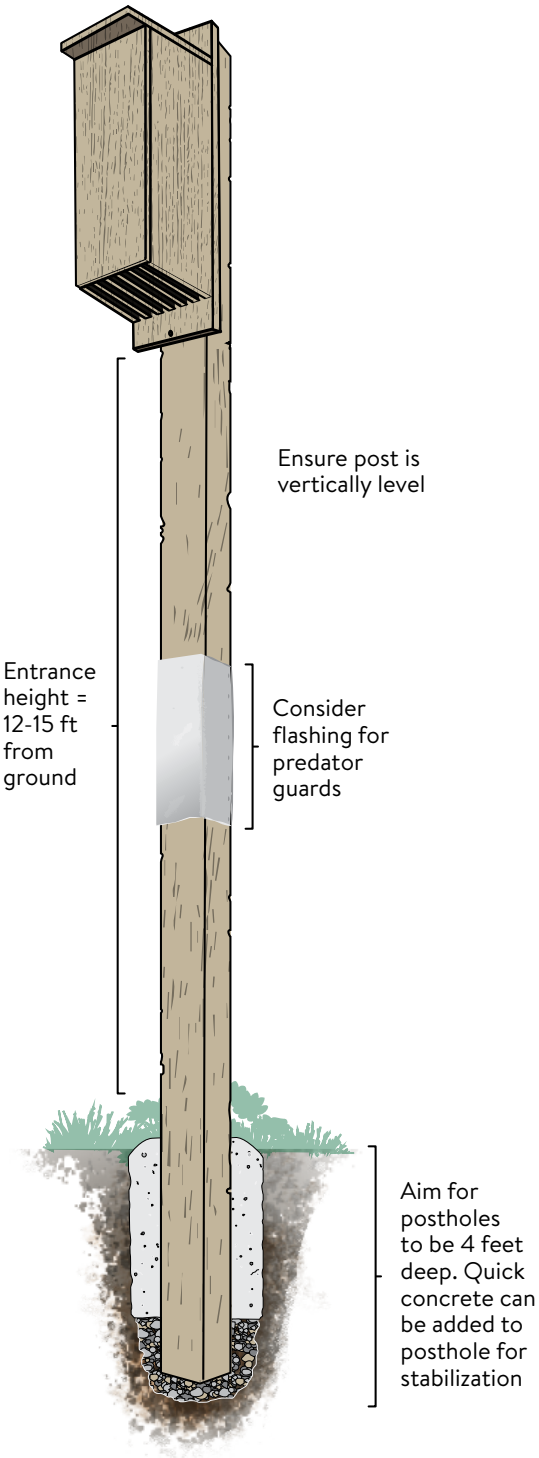
Boxes are commonly installed on buildings or free-standing posts, providing flexibility for choosing box locations. Posts may be metal or wood. Read below to learn how posts should be installed.



Posts built to lower to the ground with a pivot point can make long-term maintenance easier and safer. Follow the steps below to create a pivoting post.

1. Install two exterior posts into the ground at the recommended depth. Exterior posts must be installed so that the main post can fit between them. The height of the exterior posts should be at least ¼ the total length of the main post.
2. Set the main post between exterior posts. Drill two holes through all three posts: one hole near the top of the exterior posts and one near the ground.
3. Secure the main post to the exterior posts using bolts, nuts, and washers.
4. To lower the post, remove the bolt near the ground. This allows the main post to swivel on the top bolt. Consider affixing a rope to the bottom of the main post to maintain tension and help lower or raise it safely.
5. Once lowered, bat boxes can be installed, inspected or maintained.
6. Remember, don't lower posts when bats are present!

Tips for success

Box design matters!

- Johnson Box, Multi-chamber Nursery, and Rocket Box designs are shown to work in Minnesota. See page 4 to find links to building plans.
- Avoid small, single-chamber boxes often sold by hardware or garden stores and online retailers. Maternity colonies don't use them.
- Paint the exterior of the boxes medium-to-dark brown to soak up the sun.

Install for safety and comfort

- Cluster three or more bat boxes together or near each other.
- Install boxes facing different directions with a mix of sun and shade. This provides a variety of temperatures inside for bats to choose. At least one box should face east.

Installing boxes back-to-back on a post is a great way to offer bats temperature options.

Rocket Boxes allow bats to move around different sides of the box, providing access to different solar aspects inside a single box.

- Bats need good foraging habitat and sources of water for drinking. Install boxes in areas where forest and water sources are less than ¼ mile away.
- Install bat boxes on posts or buildings where guano accumulation is not a concern.
- Do not install bat boxes on trees, which allow predators easy access and can shade boxes too much.
- Boxes are not meant to replace tree habitat, but they do help supplement building roosts when bats need to be excluded. Install your boxes before excluding bats for best results.
- Monitor and maintain your boxes long-term. See page 9 for more details.

Keep boxes at least 20 feet from trees and branches. Box entrances should be 12-15 feet from the ground.

Maintenance and monitoring

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It is important to have a maintenance and monitoring plan in place for bat boxes to provide quality habitat through time. Once bats move in, they will return every year and will depend on those boxes throughout their lives.

Wasps and bats

Wasps may be attracted to bat boxes. While wasps cohabitate peacefully with bats, over multiple seasons wasp nests can fill up roosting space. Monitor boxes for wasp activity. Paper nests and other debris should be knocked out of the box in winter after all bats and wasps have left the box. Do not attempt to knock wasp nests out when bats are present and never use insecticides in boxes.

Structural leaks or damages

Bat boxes made of wood will degrade and become unsuitable for bats over time. Make sure to revisit bat boxes every year to check on their condition. Look for opening seams, loose boards, rotting components, or leaning and unstable posts. Repair or replace boxes as needed, after bats have left for the winter.

Bat occupancy

Make sure to monitor your boxes to see if bats move in and track how many bats use them! Indicators that bats might be using a box:

- Guano accumulation below the box or on the post
- Hearing sounds coming from the box during the daytime
- Seeing bats flying near boxes in the evening

To count the total number of bats in a box, sit facing the box at sunset, with the sky as a backdrop. Begin counting after the first bat emerges. End the count once it is too dark see bats flying or 15 minutes after the last bat flies out.

FAQs and resources

How can I attract bats to use my boxes?

As secondary cavity and crevice users, bats cannot create their own roost sites. As a result, bats are curious animals that appear to keep an eye out for new roosts, especially in areas where bats have been excluded from buildings. Boxes installed according to these recommendations will naturally attract bats. Adding guano, or bat feces, into a box will not attract bats and could unintentionally spread disease.

How long will it take for bats to find my boxes?

Seeing bats colonize a group of boxes can vary widely depending on landscape context, proximity to known roosts, and insect or water availability. In general, it should not take more than a few years to see bats using your boxes. If boxes go unoccupied for more than a few years, it is likely that the installation is not suitable or preferred by bats.

Do I need to worry about rabies?

While bats are a known vector species for rabies, occurrences are generally low. However, bat boxes should be placed away from walking paths or areas where children and pets play. Avoiding physical contact with bats is the best way to prevent any potential for rabies transmission.

Do I need to worry about guano below a bat box?

Bat guano is an incredible fertilizer with high amounts of nitrogen. You can benefit from the bats by planning wildflower gardens below boxes, which will benefit from the added nutrients from bat guano! Avoid placing boxes in areas you wouldn't want guano accumulating, such as on a deck or porch.

I have bats in my house and want them to move out, how do I encourage them to move into a bat box?

Bats are unlikely to abandon building roosts for bat boxes. For boxes to successfully provide an alternative roost site for bats, you will need to conduct an *exclusion*. This is the process of installing one-way exit devices that allow bats to leave a building but not re-enter. Once all bats have left, the building entrances can be permanently sealed. Ensure that boxes are installed before the exclusion is conducted for bats to quickly find them. Boxes are most successful when placed on or near the building where the exclusion work is completed. Remember, multiple boxes are best for large colonies. For more information on exclusions, visit the Bats of Minnesota web page in the list of resources below.

Other Resources

- Bats of Minnesota web page: mndnr.gov./mammals/bats.html
- MNDNR Bat Observation Report: mndnr.gov./reportbats/index.html
- Specific bat questions? MNDNR Info Desk: 651-296-6157 or 888-MINNDNR (646-6367)
- *Best Management Practices for the Use of Bat Houses in the U.S. and Canada.* wcscanada.org/resources/best-management-practices-for-the-use-of-bat-houses-in-the-us-and-canada/