

Bat House Construction and Installation

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Bat house construction and installation can be an environmentally friendly and rewarding activity. Putting up a bat house, however, does not guarantee that bats will use it. We don't know exactly why bats dwell in one house and not another, but by following a few recommendations you can increase the likelihood that bats will live in your bat house.

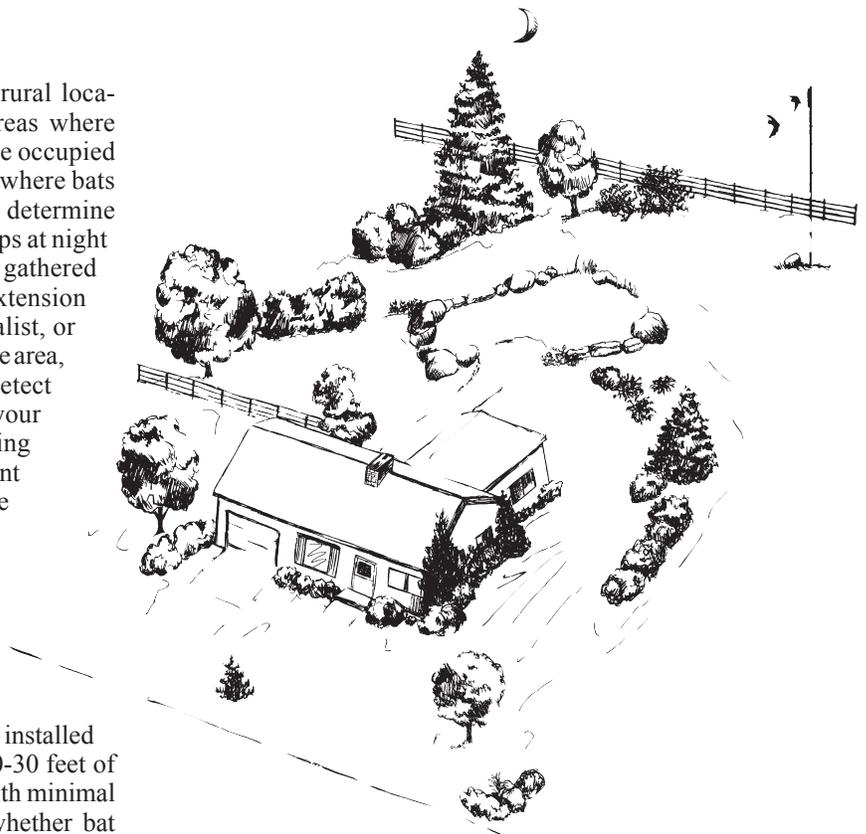
Some bats live in colonies that include tens of thousands of individuals. In Nebraska, the big brown bat (*Eptesicus fuscus*) and little brown bat (*Myotis lucifugus*) live in colonies of 10 to 200 and are the most likely candidates to occupy your bat house. Both species frequently occupy attics, belfries, barns, and other structures.

Bat House Placement

Generally, bat houses should be placed in rural locations such as on farms, acreages, or natural areas where other habitat needs are present. Bat houses will be occupied more frequently when they are installed in areas where bats already exist. Several approaches can be used to determine if bats occur in your area: 1. observe outdoor lamps at night to see if bats are feeding on the insects that have gathered there, 2. ask friends and neighbors, your local extension educator, nature center, Nebraska Master Naturalist, or wildlife officials about their knowledge of bats in the area, or 3. try using a bat detector, a device that can detect ultrasonic bat sounds. Even if bats don't live in your area, you may be able to attract them by installing bat houses. Since bats consume a significant amount of energy when flying, they are more likely to live in a structure close to food and water. Place bat houses within ¼ mile of standing water, such as a stream or pond that will provide bats with water and habitat for their prey, namely insects. Areas prone to use of insecticide may not be as successful as locations where insecticide use is limited.

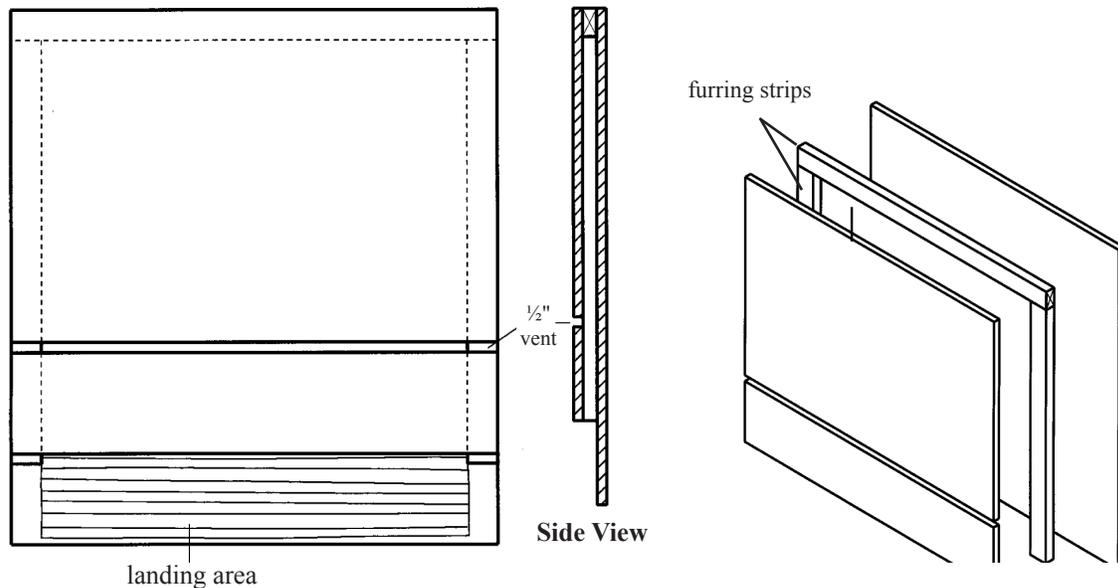
Bats are more likely to occupy bat houses installed at least 12 feet above the ground, with at least 20-30 feet of clear flight space around the bat house, in areas with minimal human disturbance. It doesn't seem to matter whether bat houses are installed against buildings or on poles, provided the house has a large landing zone.

Install bat houses on the south, southeast, or southwest side of a building, where they will be exposed to sunlight more than seven hours per day. Cover the exterior of the house, or the exterior top half, with dark or medium shades of water-based, exterior-grade paint or stain, or tar paper to increase the house's ability to trap radiant energy. While male bats occupy cooler houses, females need the heat provided by sunlight to maintain warm nurseries for their pups. Place several bat houses in a variety of areas, such as all four sides of an infrequently used barn to increase the likelihood of occupancy. Avoid placing bat houses on tree trunks, as shade will reduce the exposure of the house to sunlight and increase vulnerability to climbing predators, such as raccoons and housecats.



Install bat houses only in isolated areas.

Bat House Design



Materials Needed (makes one)

1/4 sheet (2' x 4') 1/2" ACX (exterior-grade) plywood
 One piece 1" x 2" (3/4" x 1 1/2" finished) x 8' pine (furring strip)
 20-30 coated deck or exterior-grade screws, 1"
 One pint dark, water-based stain, exterior grade
 One pint water-based primer, exterior grade
 One quart flat water-based paint or stain, exterior grade (medium or dark tones; black may be too warm for Nebraska)
 One tube paintable latex caulk
 1" x 4" x 28" board for roof (optional, but highly recommended)
 Black asphalt shingles or galvanized metal (optional)
 6-10 roofing nails, 7/8" (if using shingles or metal roofing)
 20" x 24 1/2" durable plastic mesh for footholds (optional)

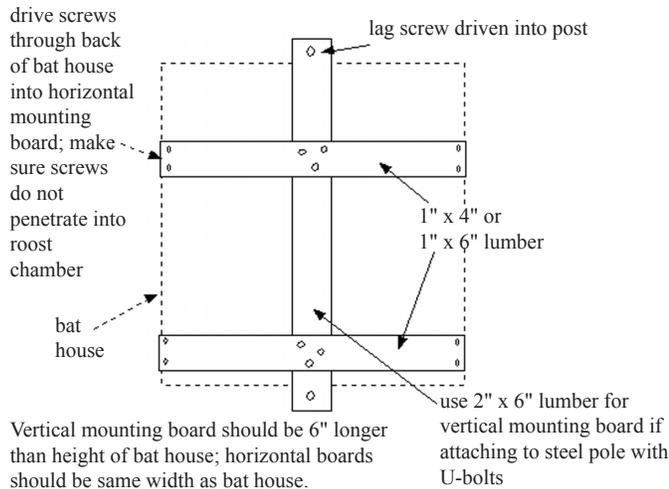
Recommended Tools

Table saw or handsaw	Caulking gun
Variable-speed reversing drill	Paint brushes
Screwdriver bit for drill	Hammer (optional)
Tape measure or yardstick	Tin snips (optional)

Construction Procedure

1. Measure and cut plywood into three pieces:
 26 1/2" x 24"
 16 1/2" x 24"
 5" x 24"
2. Roughen inside of backboard and landing area by cutting horizontal grooves with sharp object or saw. Space grooves about 1/4" to 1/2" apart, cutting 1/32" to 1/16" deep. Durable plastic mesh for footholds can be substituted for roughening to provide footholds for bats. Attach one 20" x 24 1/2" piece to backboard after staining interior (step 3), but prior to assembly.
3. Apply two coats of dark, water-based stain to interior surfaces. Although an optional step, staining the interior helps to darken the chamber and preserve the wood. Do not use paint, as it will fill grooves, making them unusable.
4. Measure and cut furring strip into one 24" and two 20 1/2" pieces.
5. Attach furring strips to back, caulking first. Start with 24" piece at top. Roost-chamber spacing will be 3/4" front to back.
6. Attach front to furring strips, top piece first (don't forget to caulk). Leave 1/2" vent space between top and bottom front pieces.
7. Caulk around all outside joints to further seal roost chamber.
8. Attach a 1" x 4" x 28" board to the top as a roof, if desired (optional, but highly recommended).
9. Paint or stain exterior three times (use primer for first coat).
10. Cover roof with shingles or galvanized metal (optional).
11. Install according to instructions.

Bracket



Pole Installation: Consult with Diggers Hotline of Nebraska at (800) 331-5666 and local zoning regulations prior to installing your pole. Your soil type determines how deep you must anchor the pole. Minimum suggested depth is 3'. The hole for the pole should be 8" wider in diameter than the pole to make room for the concrete. Line the bottom of the hole with 2-3" of crushed stone to allow for water drainage. Watch for and avoid overhead power lines before raising the pole. Obtain assistance when it is time to raise the pole. Ensure the pole is vertical with a level and secure it with concrete. Brace poles with boards and stakes to keep them straight during the curing process. If you have any questions on proper installation of a pole, consult with a local contractor.

Houses should be attached before the pole is raised. Attach the houses to a pole by first constructing a mounting bracket from three pieces of 1" or 2" lumber. [bracket image] For metal poles,

Mounting Bat Houses on Poles

Equipment:
21' long pole — wood 4" x 6" or metal pipe 2" wide (internal), concrete, and a small bag of 1" crushed rock. For greater stability, install the bat houses between two poles.

use 2" x 6" lumber and secure the mounting bracket to the pole with U-bolts or carriage bolts.

Additional instructions for installing two bat houses back to back: Before assembly, cut a horizontal $\frac{3}{4}$ " slot in the back of each house about 9" from the bottom edge of the back piece to permit movement of bats between houses. Join the two boxes with (1" x 4" x $\frac{1}{4}$ "), screwed horizontally to each side. To provide additional roosting space, leave a $\frac{3}{4}$ " space between the two houses, and roughen the wood surfaces (or attach plastic netting). Use one 1" x 4" x 34" vertical piece, attached to each side over the horizontal pieces, to block light and yet allow bats and air to enter. A galvanized metal roof, covering both houses, protects the center roosting area from rain. Eaves should be about $\frac{1}{2}$ ". Ideally, mount the two bat houses back to back between two poles; facing the fronts north/south is probably the best orientation.

Bat House Design

Bat house design also is an important consideration to increase bat occupancy. In general, bats prefer larger bat houses over smaller ones. Bat houses should be at least 24 inches tall x 16 inches wide x 4 inches deep (1,536 cubic inches) [see bat house design]. Houses should be multi-chambered and approximately $\frac{1}{3}$ taller than wide to provide space for bats to move up and down as temperatures fluctuate inside the bat house. The wood should be rough cut or have $\frac{1}{8}$ -inch horizontal grooves cut along its vertical length at $\frac{1}{4}$ - to $\frac{1}{2}$ -inch increments to provide bats with footholds. The wood should be free of arsenic-based wood preservatives. Caulk any gaps and crevices along seams to eliminate drafts and keep the inside of the house at the preferred temperature. Never paint the interior of the house. The roof should be watertight and able to shed water easily.

Some bat enthusiasts smear bat droppings, called "guano," on the interior of bat houses or place droppings on the ground underneath to attract bats. It is unclear as to whether the presence of bat guano increases the likelihood of a bat house becoming occupied.

If bats are being evicted from a building, bat houses could be installed to provide them with replacement housing. Evicted bats may move into nearby bat houses.

Bat House Maintenance

Avoid using insecticides or other pesticides around bat houses. Wasp nests can be removed, at night, with a long pole, provided bats are not present. Bat houses should be inspected and repaired each time the colony leaves for the winter. Pay special attention to the seams, roof, and structural integrity of the house. Make repairs as needed but avoid using chemical products. If you decide a sealant (e.g., caulk) is needed, be sure it is thoroughly dry before reinstalling the bat house to prevent harm to bats.

If you maintain more than one bat house, wear vinyl gloves and exchange the gloves, and wash and disinfect your hands between houses to minimize the potential for transmitting bat diseases, especially White-nosed Syndrome.

Alternative Bat Houses

Biologists discovered that bats frequently took up residence beneath corrugated aluminum sheets, installed around trees to protect wood duck nest boxes from raccoon predation. You can construct this alternative bat shelter using aluminum sheets, tar paper, or similar material around tree trunks or poles. The sheets were 20-90 inches wide and secured to the tree trunks so that the bottom edge stood 2 to 4 feet above the water line. To make one, find a suitable tree or pole in the middle of a pond or lake. These are ideal, as they receive

ample sunlight and are close to much needed water. Trees at field edges or in windbreaks also may work, provided sufficient sunlight is available. Wrap the pole or tree with the bottom of the sheet at least 3 feet above the water line or 12 feet above the ground surface. Place the sheet higher on the pole or tree, if possible, to give the bats more room to gain altitude to fly. Secure the entire top edge of the sheet tightly to the tree or pole with aluminum nails to keep out rain. Leave the bottom of the sheet open to allow bats free access and for guano to fall out. Ideally, the bottom should flare out about ½-1 inch at the narrowest point, from the pole or tree. Check the sheeting in the off-season to ensure the top is secure and that guano has not clogged the bottom to maintain the site's suitability for bat occupancy.

Potential Benefits and Hazards of Bat Houses

Bats that live in Nebraska eat only insects. Their diet includes a wide variety of flying insects, including many that are annoying to people, including mosquitoes or pests to gardens or agricultural crops such as cucumber or corn rootworm beetles, moths, stinkbugs, June bugs, and leafhoppers. Where bat numbers are sufficient, their foraging may be a significant factor in reducing populations of insect pests. Further, some insects are deterred by bat echolocation, the mechanism that bats use to locate prey. At least one study reported that bat-like sounds over corn deterred moths and reduced damage by corn borer larvae. It is unreasonable, however, to expect bats to eliminate all flying insects that might be considered a problem.

Educators and youth workers might consider bat house construction as a fun activity for young people, with the educational and conservation values gained by helping bats as foremost goals. Bat house construction is just another way that humans can coexist with wildlife in a mutually beneficial manner.

The number of bats across North America is in decline, especially in the eastern United States, due to a recently discovered fungal disease called White-nosed Syndrome (WNS). WNS causes bats to lose valuable energy reserves and die during hibernation. The disease is highly contagious among bats, but does not affect humans. Care should be taken to disinfect tools and equipment between handling bat houses, exploring caves, or frequenting other bat hibernacula.

Bats also present potential dangers. Bat houses increase the likelihood of human-bat encounters. Flightless pups occasionally fall out of bat houses within easy reach of children and pets. Although rare, such encounters can result in bites and exposure to rabies. Risk can be reduced by teaching children to never handle bats and by keeping the vaccinations of pets current. Place fencing or ornamental plantings around the base of the bat house mounting pole or site to minimize access to pups if they should fall out and to reduce disturbance to the colony. Bat bites are extremely difficult to see on skin. If there is any possibility that a person or animal was bitten by a bat, seek medical attention immediately. If the bat is still present and not flying when the suspected bite occurs, capture the bat without damaging its head so that it can be tested for rabies. A downed bat can be captured by sweeping it into a bucket or similar container or by throwing a heavy cloth such as a towel over it and gently rolling it into the cloth or towel. Wear leather working gloves to protect your hands.

Bat droppings inside caves, buildings, or structures can encourage the growth of fungal spores that can cause histoplasmosis. This fungal disease is typically found in more eastern and southern parts of the United States where the climate is hotter and more humid. This fungus occurs naturally in the environment and can become more concentrated, and therefore more infectious, when piles of guano are present inside caves or structures. Avoid disturbing the guano or performing any activity around the bat guano that might cause the spores to become airborne. If guano is present inside a structure and needs to be removed, read the suggestions found in this NebGuide and at the Centers for Disease Control, <http://www.cdc.gov>.

Bat guano makes an excellent fertilizer. It must be used with care, however, as it contains enough nitrogen that it could “burn” your plants.

Resources

- Bat Conservation International (<http://www.batcon.org>) and its bat house research project (<http://www.batcon.org/bhra/>) has regularly-updated and reliable information on bat conservation and bat houses.
- Belton, P., and H. R. Kempster. 1962. A field test on the use of sound to repel the European corn borer. *Entomologia experimentalis et applicata* 5:281-288.
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- Tuttle, M. D., M. Kiser, and S. Kiser. 2004. *The Bat House Builder's Handbook*. University of Texas Press, Austin, 35 pp.
- Whitaker, J. O., Jr. 1995. Food of the big brown bat, *Eptesicus fuscus*, from maternity colonies in Indiana and Illinois. *American Midland Naturalist* 134:346-360.
- Williams-Whitmer, L. M., and M. C. Brittingham. 1995. A homeowner's guide to northeastern bats and bat problems. Pennsylvania State University, University Park, PA (23 pages).
- For more information on bats, see NebGuide G1667, *Bats in and Around Structures*, <http://www.ianrpubs.unl.edu/sendIt/g1667.pdf>.
- Internet Center for Wildlife Damage Management, <http://icwdm.org>, is a collaborative effort by the University of Nebraska-Lincoln, Clemson University, Cornell University, and Utah State University dedicated to provide research-based information on all aspects of wildlife damage management.
- Special thanks to Bat Conservation International, <http://www.batcon.org/>, for permission to reprint the bat house construction guidelines. Building instructions for the more advanced “Rocket Box” bat house can be obtained at <http://icwdm.org>.

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