TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE
NEW MEXICO

NATURAL RESOURCES CONSERVATION SERVICE
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BIOLOGY TECHNICAL NOTE NO. 64

Bat House

Design, Installation and Maintenance

To address wildlife habitat where there is a lack of natural bat roosts and where artificial structures will enhance those habitats, *and/or* to attract and utilize insect-eating bats as a control method for pest insects in crops, vineyards, orchards, and other land uses, *or* when it is necessary to evict a bat roost from a building or structure and replace it with a structure designed for bats.

Selecting a Bat House

Bat houses are generally referred to by the size, number of roosting chambers contained and by the mounting method that will be used. Provided below are a few examples.

wall mounted, single chamber

pole mounted, multi-chambered

free-standing, multi-chambered

Size. Selecting the size of a bat house can depend on several factors, including: the space available, the quantity of bats to be housed, the number of houses to be installed, economic feasibility and personal preference.

- There is a minimum size requirement, refer to the design criteria section.

If the goal is to size the bat house to a known (or desirable) number of bats, there is a quick calculation available to estimate how many bats can utilize a space:

cubic inches of roost space divided by 4 cubic inches = bat house capacity

Roosting Chambers. In short, more roosting chambers result in better bat use. Multi-chambered boxes are better at stabilizing internal temperatures and they provide increased space for bats (to help prevent overcrowding). A commonly built, economical box has four chambers.

Mounting Methods. Research has shown that bat houses installed on buildings[1], poles or dead trees are easiest for bats to locate and they have greater occupancy rates. Some mounting considerations are provided below:

- Single-chambered bat houses are not recommended to be mounted on poles since they are less thermally stable. For greatest success, install these houses on building.
- Mounting two multi-chambered bat houses back-to-back on poles (with one facing north and the other south) is ideal. Place houses approximately 3/4-inch apart and cover both with a roof or otherwise protect the center roosting space from rain.

[1] Wood, brick or stone buildings with proper solar exposure are excellent choices. However, bat houses mounted to metal buildings are rarely used.

Regardless of the type of bat house, all require the same design, construction and installation guidance provided in this document.

Criteria for Design and Construction

Whether you build or buy a bat house, the following criterion has been proven to provide the greatest success in attracting and maintaining bat use and in ensuring bat safety.

Box size must be at least 24 inches tall and 14 inches wide. Taller, wider boxes are better.

Roost chambers will extend the width of the interior of the box and be at least 20 inches tall.

The spacing between chambers (called crevices) should create a ¾ to 1 inch crevice. The best crevice size for most North American bats is ¾ inch. Larger species (such as pallid bat) should have a 1 inch crevice. Greater than one inch crevices are not recommended; they attract wasps and other non-target animals.

- Wider chambers may require spacer blocks between partitions to ensure crevice size.
- To prevent wasps from building nests at the top of the roosting chambers, extend the chambers to the roof or ceiling.

Landing areas are necessary for bats to access the roosting chambers. They can be created by extending the length of the backboard at least 3 inches below the entrance, or by having a 3 inch recessed roost chamber so bats can land on the lower inside walls. A 6 inch landing is best.

Ventilation. Where July high temperatures average ≥85°F (see figure 1), include a front ventilation slot. The vent being as long as the house is wide by ½ inch. In some designs, ventilation slots may be in a pattern or design.

- For boxes 24-36 inches tall, ventilation slots should be approximately six inches from the bottom of the house.
- For boxes taller than 36 inches, ventilation slots should be 10-12 from the bottom.
- Side vents are optional.

Roughened interior surfaces are required on the chambers and landing area to provide footholds for bats. There are generally three options:

1. Use rough-cut wood, *or*

2. roughen surfaces by mechanically creating scratches or grooves horizontally at roughly ¼-½ inch intervals ($\frac{1}{16}$ inch deep), *or*

3. cover surfaces with durable plastic mesh (⅛ or ¼ inch square mesh) securely stapled every two inches so it does not sag, buckle or curl. Mesh must not have sharp edges. Metal mesh, hardware cloth or aluminum window screen is not acceptable as these can injure bats.

Prevent leaks and drafts by ensuring tight construction with no unplanned gaps. Caulk or glue all joints.

Smooth all edges. Any screws, hardware or other sharp objects (including splinters) must not protrude into the box. Any exposed metal edges (e.g. roofs) must be smooth.

Protect the interior (optional) by applying two coats of dark, exterior grade, water-based stain (not paint). Paint fills grooves, making them unusable. Apply stain after creating scratches or grooves or prior to stapling plastic mesh.

Protect the roof (optional) by applying shingles, metal or other similar waterproof material. A compromised roof will make the box incapable of retaining the necessary thermal conditions.

Materials

Pressure- or chemically-treated wood must *NOT* be used, as they contain substances that may be harmful to bats.

Plywood for exteriors must be exterior grade (e.g. ACX, BCX, T1-11) and should be at least 1/2-inch thick with at least four plies. Cedar and pine are also recommended.

All major components should be assembled with exterior grade screws. Nails, brads or staples do not hold well over time.

If mounting on a pole, use a schedule-40 galvanized steel pole with the inside diameter ≥2” or a 4”x6” treated wooden post.

There are numerous alternative materials available such as plastic or fiber-cement board. Contact a biologist for guidance.

Maintaining Proper Roost Temperatures may be the single most important factor for a successful bat house. Interior bat house temperatures should be warm and as stable as possible; *ideally staying between 80°F to 100°F in the summer*. This provides for the greatest range of species use and is ideal for mother bats to raise their young.

Bat house temperatures are influenced directly by the exterior color, compass orientation, the amount of sun exposure, as well as the how well the house is constructed and mounted.

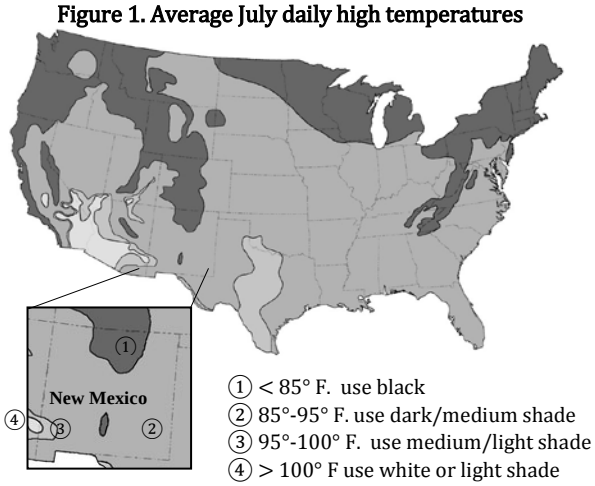
1. Exterior Color

Bat houses are far more successful at attracting bats if they are painted or stained. It helps provide the proper internal temperature for bats and increases the structure's life span.

Why? The box will heat up a few degrees faster in the morning (which is critical in the spring), and it will average about five degrees warmer during midday.

- Use exterior-quality, water-based stain or latex paint, and use flat paint for best solar absorption. Do not use oil based products as they may be harmful to bats. Provide at least three coats of paint.
- The appropriate shade of color depends upon geographic location and the amount of sun exposure (e.g. adjust to darker colors where there is less sun to help absorb the solar heat). The figure below is provided to assist in shade selection. The actual color is not as important provide the shade is correct.

Figure 1. Average July daily high temperatures



① < 85° F. use black
② 85°-95° F. use dark/medium shade
③ 95°-100° F. use medium/light shade
④ > 100° F use white or light shade

2. Compass Orientation

East-, southeast-, or south-facing are generally best for single houses in most climates. A 140° azimuth (SE) is reported to be optimal.

3. Sun Exposure

At least six hours of direct daily sun is recommended for bat houses. Full, all-day sun is often successful in all but the hottest climates. If only partial day sun is available- morning sun is preferable.

You may have to experiment to get the right placement and temperature range. You can also use a thermometer attached next to, or inside, the box to check if temperature high's/ low's.

Bat House Placement

Greatest success will be achieved in areas of diverse habitat, especially where there is a mixture of varied agricultural use, natural vegetation, wooded areas, and water. This will produce different types of insects at different times throughout the night and over a season to accommodate a resident population of bats.

Tree Cover. When possible, bat houses should be located along the edges of forest, riparian or other tree cover. Maintaining a distance of 25-50 feet is ideal; however, avoid placing the bat house closer than 20 feet to tree cover (to reduce shading and aerial predation). Take into consideration expected tree growth over the next 10 years.

Water. Most bats choose roosts within 1/4 mile of slow moving water which is available through the summer (preferably a stream, lake or wetland). Bat houses near these water edges are ideal.

- When natural water sources are not available, or they are not available through the summer, consider developing water sources designed for bats to safely use. Refer to the publication "Water for Wildlife Handbook".

Height. The bottom of the bat house must be at least 10 feet above ground; 15 - 20 feet is ideal.

Bat House Placement (Cont.)

Locations to Avoid:

Flight Obstructions and Predator Perches. Ensure that the bat house is placed at least 20 feet from the nearest tree branches, wires or potential perches for aerial predators. Ten feet below the box should also be free of shrubby vegetation, debris or other flight obstacles.

Shade. Avoid shaded, cool locations. Bat houses installed on live trees are often not successful, largely due to shading.

Night Light. Bat houses should not be lit by bright lights, avoid placing boxes near yard or security lights. Do not mount on light poles.

Bright Shiny Surfaces. Do not mount bat houses over bright or shiny surfaces that can reflect light directly into the box.

Pesticides. Bats may not be able to live in areas of heavy pesticide use due to the lack of available insect food sources.

Air Quality and Wind. Bat houses should not be located near burn barrels or air vents with smoke, fumes or exhaust. Avoid windy areas such as exposed hilltops.

Disturbances. Avoid locations where the bat house may be vibrated, bumped or otherwise disturbed. e.g. a post-mounted house in a pasture where livestock will rub on the post.

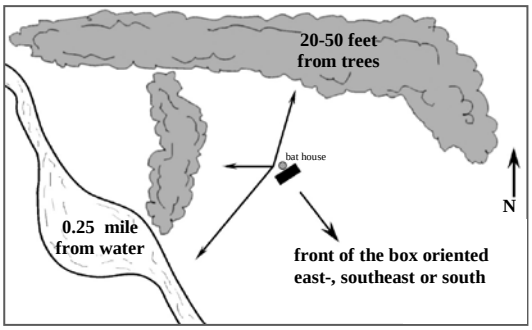
Metal Building. Bat houses built on metal buildings are rarely used.

Roads. Avoid locations directly along busy roads where they are vulnerable to traffic.

Guano. Most bat houses have open bottoms, which keeps guano from accumulating inside. Guano will, however, end up on the ground underneath, so avoid placing bat houses directly above windows, doors, walkways, etc.

- 2-4 inch spacers between a bat house and the wall may reduce guana deposits on the wall.
- A potted plant or a shallow tray may be placed underneath, but do not use a deep container (unless 1⁄4-inch or smaller mesh covers the entire top of the container), as baby bats that fall from the bat house could become trapped inside.

Figure 2. Desirable bat house location.



Timing of Installation

Bat houses can be installed at any time of the year, but they are more likely to be used during their first summer if installed before the bats return in spring.

When evicting bats from a building or structure

When using bat houses in conjunction with excluding bats from a building or structure, install adequately sized bat house(s) at least two to six weeks before the actual eviction.

The bats should be evicted at a time in the early spring or fall when flightless young are not present. Use a one-way valve design that will permit bats to exit, but not return. Refer to the NMSU publication Bats in Buildings: Proper Exclusion Techniques in New Mexico Guide.

Occupancy

Be patient. Ninty percent of bat houses will occupied within two years, with 50 percent occupancy in the first year (IBC 2011). If a bat house remains unoccupied after two full years, consider repositioning of modifying the house.

Bats have to find new roosts on their own. They investigate new roosting opportunities while foraging at night, and are expert at detecting crevices, cracks, nooks and crannies. Existing evidence strongly suggests that lures or attractants will *not* attract bats to a bat house.

Bats will generally not overwinter, except in extreme southern locations. But they are loyal to their warm-season roosts and will return to a bat house year after year as long as it continues to meet their needs.

Operation and Maintenance

I. Check the bat house once a year for gaps or cracks caused by deteriorating caulk or warped wood. Caulk or repaint bat houses during the winter months, when bats are not present.

II. Wasp and mud dauber nests should be cleaned out each winter after bats and wasps have departed. These wasps are beneficial, and bats will coexist with them, but they can pose problems if they become too numerous. Dried nests are easily broken up with a yardstick or similar long, thin object. If more regular cleaning is necessary, conduct it at night when the bats are out foraging.

III. When cleaning guano, dampening the droppings then disinfected the areas with a solution of 1 part bleach to 20 parts water. Seal dropping in a plastic bag for disposal.

Monitoring

Bat houses should be monitored at least once a month (preferably more often) to detect potential problems such as predators, overheating, wood deterioration, etc.

- If pups are found dead below the box, it generally indicates overcrowding. Install additional bat houses to alleviate the problem.
- If predation or use/disturbance by ground animals is a concern, consider using a predator guard on the poles.

Safety

A HEPA filtered face mask and gloves should be worn when handling bat houses or bat guano, or when disturbing the soil below a bat house. Clothes worn while should be washed immediately.

To Further Enhance Bat Conservation

Provide plants that attracts and support a diversity of beneficial insects for insect-eating bats. Refer to Biology Technical Note No.59 Habitat Development for Beneficial Insects.

Protect flowering plants that are important food sources for pollinating bats, such as saguaro organ pipe cactus, and Palmer's agave. Refer to the brochure "Bats are Pollinators Too".

Decrease disturbance and destruction of cave and abandoned-mine roosts by education, fencing or gating. Refer to the publication "Bats in Mines" and "Managing Abandoned Mines for Bats".

Leave snags in forests, riparian and woodlands to serve as natural roost sites. Bats often roost in tree hollows, under loose bark and in old snags. Refer to the publication "Forest Management and Bats".

Enhance or restore natural wetlands by using NRCS practice standard (659) Wetland Enhancement or (657) Wetland Restoration.

Modifying a bridge to serve as a home for bats by working with your local highway department. Refer to publication "Bats in American Bridges".

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"A colony of 150 Big Brown Bats can protect local farmers from 33 million root worms in a single summer."
– Bat Conservation International

Bats Most Likely to Occupy Bat Houses in New Mexico

New Mexico is home to 27 species of bats. Several of these species frequently use man-made structures such as attics, barns, or bat houses for roosting sites. Provided below are a few of the species most likely to use a bat houses.

Little brown bat *(Myotis lucifugus)*
Distribution: Widely distributed from central Alaska to central Mexico.
Ecology and Behavior: Usually hibernates in caves and mines. During summer, it often inhabits buildings and other man-made structures where females form nursery colonies of hundreds or even thousands of individuals. Where most males spend the summer is unknown, but they likely are solitary and scattered in a variety of roost types. Colonies usually are close to a lake or stream. This species seems to prefer to forage over water, but also forages among trees in rather open areas. When foraging, it may repeat a set hunting pattern.
Roosting Temperature: They prefer hotter roosts than most bats, typically 110^{o} F during the day.
Food Habits: Mostly midges but also gnats, craneflies, beetles, wasps, water boatman, mosquitoes, and true bugs.
Reproduction: Mating occurs in autumn, but also may occur during the hibernation period. One baby is born in May, June, or early July. When the mother is at rest during the day, she keeps the baby beneath a wing. Lifespan may be > 20 years.

Big brown bat (*Eptesicus fuscus)*
Distribution: Southern Canada through southern North America into South America, including many Caribbean islands. Ecology and Behavior: These bats are closely associated with humans and are familiar to more people in the United States than is any other species of bat. Most summer roosts are located in attics, barns, bridges or other man-made structures, where colonies of a few to several hundred individuals gather to form maternity colonies. They move into caves, mines and other underground structures to hibernate only during the coldest weather. Where most of these bats winter remains unknown. This species emerges at dusk and flies a steady, nearly straight course at a height of 20-33 feet in route to foraging areas. Its large size and steady flight make it readily recognizable. Apparently, some individuals use the same feeding ground each night, for a bat can sometimes be seen following an identical feeding pattern on different nights. After feeding, the bat flies to a night roost to rest; favored night roosts include porches of houses, garages with open doors, or a breezeway.
Roosting Temperature: They prefer cooler temperatures that average 95^{o} F during the day.
Food Habits: Beetle specialist, but also consume ants, flies, mosquitos, mayflies, stoneflies and other insects.
Reproduction: Mating occurs in autumn and winter, and a delayed fertilization takes place in the spring. In the western United States, usually only one baby is born each year.

Pallid Bat ***(****Antrozous pallidus)*
Distribution: South central British Columbia to Central Mexico.
Ecology and Behavior: Common in arid regions with rocky outcroppings, particularly near water. This gregarious species usually roosts in small colonies of 20 or more individuals in rock crevices and buildings, but occasionally it roosts in caves, mines, piles of rocks and in tree cavities. Relative to other bats, pallid bats emerge from roosts relatively late, but the time of evening emergence varies seasonally. Mothers and offspring may emerge and forage together. Pallid bats walk on the ground with a variety of strides and gaits, and they can hover or glide momentarily.
Food Habits: Chiefly feeds on large (1-3 in in length) prey that is taken on the ground or, perhaps less frequently, in flight within a few meters of the ground or from the surfaces of vegetation. Prey items include flightless arthropods such as scorpions, crickets, and solpugids, ground-roving insects such as darkling ground beetles, scarab beetles, predacious ground beetles, carrion beetles and grasshoppers, and prey that are picked from the surface of vegetation, including cicadas, katydids, preying mantids, long-horned beetles, and sphingid moths. Pallid bats are known to eat lizards and rodents.
Reproduction: One or two babies are born in May or June.

Mexican/Brazilian free-tailed bat *(Tadarida brasiliensis Mexicana)*
Distribution: Southern Oregon to eastern Nebraska, and south through Mexico.
Ecology and Behavior: In the western U.S., it is most commonly associated with dry, lower elevation habitats, yet it also occurs in a variety of other habitats, and is found up to at least 3,000 m. in some of the western mountain ranges. Highly colonial with maternity colonies ranging in size from a few hundred to 20 million. The most commonly used natural roosts are caves and rock crevices on cliff faces. This species also roosts in abandoned mines and tunnels, highway bridges and large culverts, buildings, and bat houses.
Food Habits: They fly more than 50 km to reach foraging areas. Bats from one colony may cover areas as large as 400 km2 and move at speeds over 40 km/hour and at altitudes of 3,000 meters or more. Foraging occurs at high elevations and also at heights of 6 to 15 meters. They consumes a large variety of agricultural pests, mostly moths, but also flying ants, weevils, stink-bugs and ground beetles.
Reproduction: Birth usually occurs between mid-June and mid-July. Adult mass is reached in as little as three weeks, and first flight occurs 2-3 weeks later.

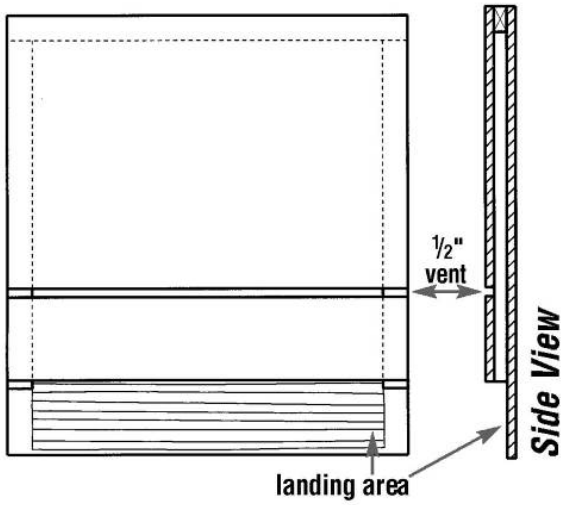
Single-chambered Bat House Design (wall mounted only)

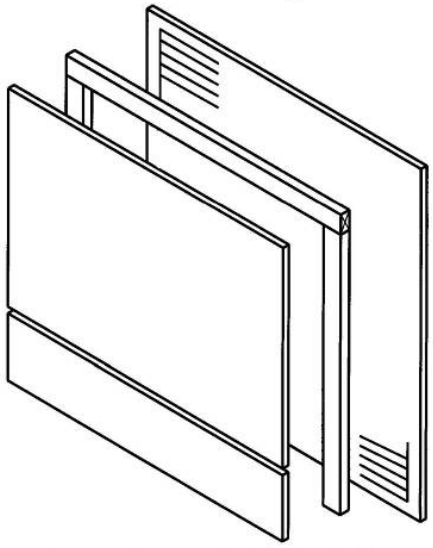
Materials (makes one house)

¼ sheet (2' x 4') ½" AC, BC or T1-11 (outdoor grade) plywood
One piece 1" x 2" (¾" x 1½" finished) x 8' pine (furring strip)
20 to 30 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
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 to10 roofing nails, ⅞" (if using shingles or metal roofing)

Recommended tools

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





More bat-house plans and additional information can be found in BCI's *Bat House Builder's Handbook*, available at *www.batcatalog.com*.

Construction

1. Measure and cut plywood into three pieces:
   26½" x 24" 16½" x 24" 5" x 24"
2. Roughen inside of backboard and landing area by cutting horizontal grooves with sharp object or saw. Space grooves ¼" to ½" apart, cutting 1/32" to 1/16" deep.
3. Apply two coats of dark, water-based stain to interior surfaces. Do not use paint, as it will fill grooves.
4. Cut furring strip into one 24" and two 20½" pieces.
5. Attach furring strips to back, caulking first. Start with 24" piece at top. Roost chamber spacing is ¾".
6. Attach front to furring strips, top piece first (caulk first). Leave ½" vent space between top and bottom front pieces.
7. Caulk all outside joints to further seal roost chamber.
8. Attach a 1" x 4" x 28" board to the top as a roof (optional, but highly recommended).
9. Apply three coats of paint or stain to the exterior (use primer for first coat).
10. Cover roof with shingles or galvanized metal (optional).
11. Mount on building (south or east sides usually best).

Optional modifications to the single-chamber bat house

1. Wider bat houses can be built for larger colonies. Be sure to adjust dimensions for back and front pieces and ceiling strip. A ¾" support spacer may be needed in the center of the roosting chamber for bat houses over 24" wide to prevent warping.
2. To make a taller version for additional temperature diversity, use these modifications: From a 2' x 8' piece of plywood, cut three pieces: 51" x 24", 33" x 24" and 12" x 24". Cut two 8' furring strips into one 24" and two 44" pieces. Follow assembly procedure above.
3. Two bat houses can be placed back-to-back, mounted between two poles, to create a three-chamber nursery house. Before assembly, cut a horizontal ¾" slot in the back of each house about 9" from the bottom edge of the back piece to permit movement of bats between houses. Two pieces of wood, 1" x 4" x 4¼", screwed horizontally to each side, will join the two boxes. Leave a ¾" space between the two houses, and roughen the wood surfaces or cover the back of each with plastic mesh (see item 5 below). Do not cover the rear exit slots with mesh. One 1" x 4" x 34" vertical piece, attached to each side over the horizontal pieces, blocks light but allows bats and air to enter. A galvanized metal roof, covering both houses, protects the center roosting area from rain. Eaves should be about 3" in southern areas and about 1½" in the north.
4. Ventilation may not be necessary in cold climates. In this case, the front should be a single piece 23" long. Smaller bat houses like this one will be less successful in cool climates. However, those mounted on buildings maintain thermal stability better and are more likely to attract bats.
5. Durable plastic mesh can be substituted to provide footholds for bats. Attach one 20" x 24½" piece to backboard after staining interior, but prior to assembly.

Multi-chambered Bat House Design

Materials (makes two houses) • *Diagrams on pages 12 & 13*

½ sheet (4' x 4') ½" AC, BC or T1-11 (outdoor grade) plywood
½ sheet (4' x 4') ⅜" AC or BC (outdoor grade) plywood
Two pieces 1" x 6" (¾" x 5½" finished) x 8' pine or cedar
One lb. coated deck or exterior-grade screws, 1⅝"
20 to 25 coated deck or exterior-grade screws, 1¼"
20 to 25 exterior-grade screws, 1"
One quart dark, water-based stain, exterior grade
One quart water-based primer, exterior grade
Two quarts flat water-based paint or stain, exterior grade
One tube paintable latex caulk
Black asphalt shingles or galvanized metal
12 to 20 roofing nails, ⅞"

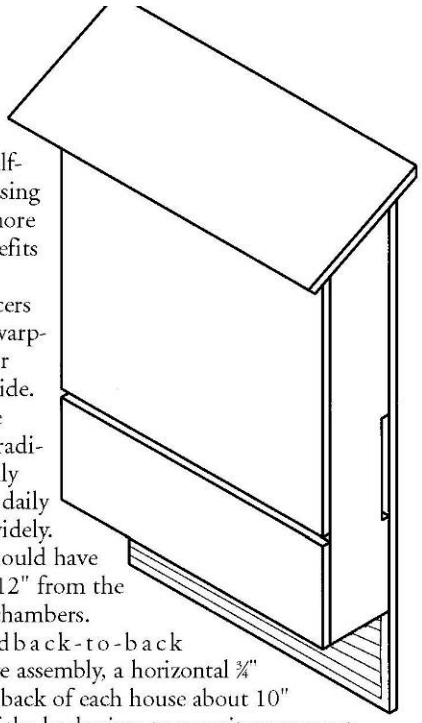
Recommended tools

Table saw or circular saw
Variable-speed reversing drill
Screwdriver bit for drill
Tape measure or yardstick
Caulking gun
1½" hole saw or spade bit
Paintbrushes
Hammer (optional)
Tin snips (optional)
Bar clamp (optional)
Sander (optional)

Construction

1. Measure, mark and cut out all wood according to the sawing diagrams on pages 12 and 13.
2. Roughen interior and landing surfaces by cutting horizontal grooves with sharp object or saw. Space grooves ¼" to ½" apart, cutting 1/32" to 1/16" deep.
3. Apply two coats of dark, water-based stain to interior surfaces. Do not use paint, as it will fill grooves.
4. Attach side pieces to back, caulking first. Use 1⅝" screws. Make sure top angles match.
5. Attach 5" and 10" spacers to inside corners per drawings on page 12. Use 1" screws. Roost chamber spacing will be ¾" (front to back). Do not block side vents.
6. Place first roosting partition on spacers even with bottom edge of roof. Place 20" spacers on partition and screw to first spacers (through partition), using 1⅝" screws.
7. Repeat step 6 for remaining spacers and partitions.
8. Attach front to sides, top piece first (caulk seams). Be sure top angles match (sand if necessary). Leave ½" vent space between top and bottom front pieces. A bar clamp may be useful if sides have flared out during construction.
9. Attach roof supports to the top inside of front and back pieces with 1" screws. Don't let screws protrude into roosting chambers.
10. Caulk around all top surfaces, sanding first if necessary to ensure good fit with roof.
11. Attach roof to sides and roof supports with 1¼" screws. Caulk around roof and side joints to further guard against leaks and drafts. Don't let screws protrude into roosting chambers.
12. Paint or stain exterior three times (use primer for first coat).
13. Cover roof with shingles or galvanized metal.

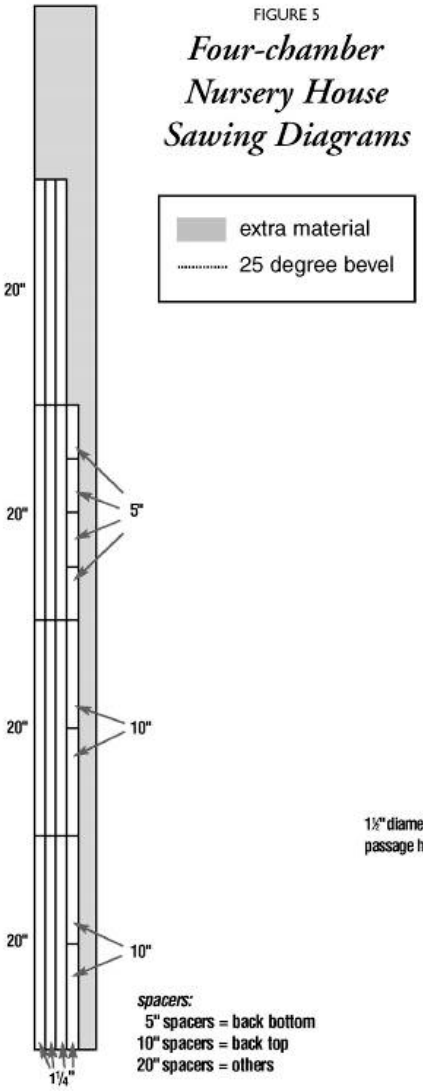
Optional modifications



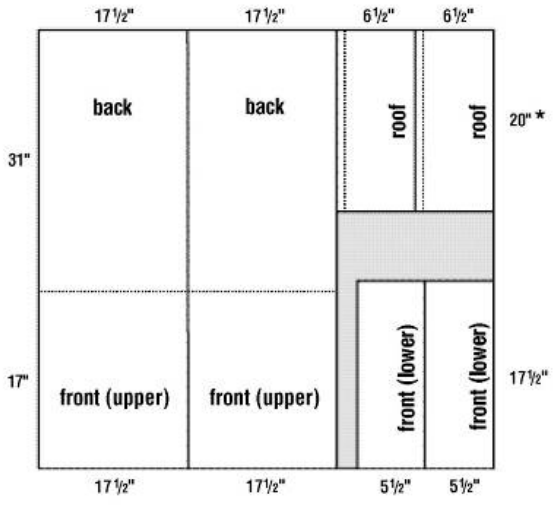
1. These nursery-house dimensions were chosen to permit construction of two bat houses per half-sheet of plywood. Increasing house width to 24" or more or adding partitions benefits bats and attracts larger colonies. Additional spacers are required to prevent warping of roost partitions for houses more than 24" wide.
2. Taller bat houses provide improved temperature gradients and may be especially useful in climates where daily temperatures fluctuate widely. Bat houses 3' or taller should have the horizontal vent slot 12" from the bottom of the roosting chambers.
3. Two bat houses can be placed back-to-back mounted on poles. Before assembly, a horizontal ¾" slot should be cut in the back of each house about 10" from the bottom edge of the back piece to permit movement of bats between houses. Two pieces of wood, 1" x 4" x 10¾", screwed horizontally to each side, will join the two boxes. Leave a ¾" space between the two houses, and roughen the wood surfaces or cover the back of each with plastic mesh. One 2" x 4" x 40" vertical piece, attached to each side, over the horizontal pieces, blocks light but allows bats and air to enter. Use a 2" x 6" vertical piece if securing houses with U-bolts to metal poles. A galvanized metal roof that covers both houses protects them and helps prevent overheating. Eaves should extend about 3" in front in southern areas and about 1½" in the north.
4. Ventilation may not be necessary in cold climates. In that case, the front of the bat house should be a single, 23"-long piece. Far-northern bat houses may also benefit from a partial bottom to help retain heat. Slope the sides and bottom at an angle of 45° or greater to reduce guano build-up. Leave a ¾" entry gap at the back and be sure the bottom does not interfere with access to the front crevices. A hinged bottom is required to permit annual cleaning.
5. Durable plastic mesh can be substituted for roughening. Attach mesh to backboard, landing area and one side of each partition after staining interior, but prior to assembly. Use ⅛"- or ¼"-inch HDPE plastic mesh [such as Internet product #1672 (1-800-328-8456; www.internetmesh.net)] and attach every two inches with 3/16" Monel® or stainless steel staples.
6. Make partitions removable by attaching small cleats with thumbscrews to the bottom of side pieces for support. Spacer strips are unnecessary if grooves for partitions are cut in the side pieces with a router or dado saw blade.

FIGURE 5

Four-chamber Nursery House Sawing Diagrams

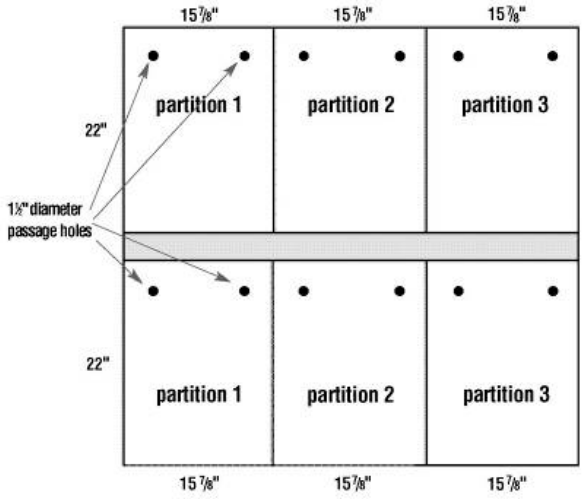


1" x 6" x 8' board

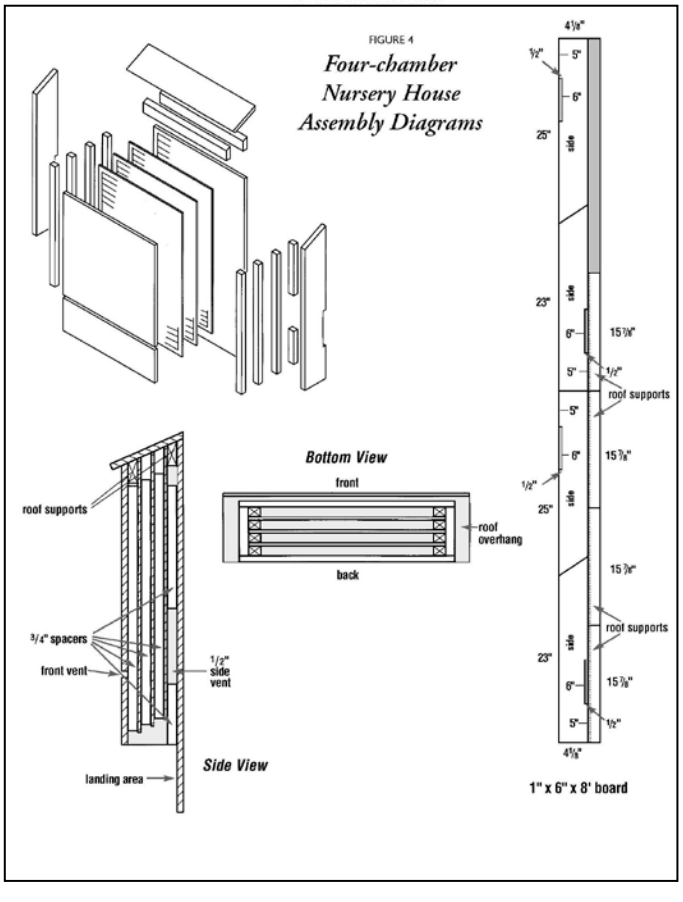


4' x 4' x ½" plywood

* 19" if mounted between two poles



4' x 4' x ⅜" plywood



1" x 6" x 8' board