

*Information below is adapted from the Maine NRCS 'Structures for Wildlife Job Sheet'*

## **DESCRIPTION & HABITAT**

Bats are seen most frequently on warm nights feeding near water or around lights. They feed by catching insects while flying in the air. During the day, different species find shelter in different types of roosts including under tree bark, in tree cavities, in tree foliage, under shingles, in attics of buildings, etc. Bats prefer to roost within 1/4 mile of a water source. Snags near wetlands with open water provide ideal habitats.



Bats provide a beneficial service to man because they eat a huge amount of insects, including mosquitoes. They usually consume their weight in insects each night. Vermont has nine species of bat. Six species hibernate in caves during the winter and three species are migratory.

Bat populations have declined significantly due to White Nose Syndrome which is a fungus that invades the skin and damages the tissue in hibernating bats. Cave hibernating bats are most affected. Other sources of population decline include loss and disturbance to natural roosting sites such as old trees, caves, and old barns, as well as vandalism. Conservation-minded forest management techniques such as maintaining snags and cavity trees, reserve trees, winter harvests, etc. can benefit many of our bat species. Also, providing a bat house can help sustain local population of bats as well as providing alternative roosts to occupied buildings.

## **BAT HOUSES**

The greatest bat house success has been achieved in areas where there is a mixture of agricultural use and natural vegetation. A single chamber bat house may house 50 bats, while larger houses may attract more than 200. Most houses have 1-4 roosting chambers. The following is reprinted with permission from Bat Conservation International, <http://www.batcon.org/home/default.asp>.

### **Criteria for Successful Bat Houses**

Whether you build or buy a bat house, make sure the dimensions meet the criteria below. Following these construction and installation guidelines will greatly increase your odds of attracting bats. Small, poorly-made houses commonly sold in stores or any houses improperly installed are likely to fail.

**1. Design** - All bat houses should be at least 2 feet tall, have chambers at least 14 inches wide, and have a landing area extending below the entrance at least 3 to 6 inches (some houses feature recessed partitions that offer landing space inside). Taller and wider houses are even better (e.g. 30 to 36 inches tall x 18 to 24 inches wide). Rocket boxes should be at least 3 feet tall and have at least 12 inches of linear roost space. Most bat houses have one to four roosting chambers--the more the better. Chambers should be at least 20 inches tall; taller is better. Roost partitions should be carefully spaced 3/4 to 1 inch apart. All partitions and landing areas should be

roughened. Wood surfaces can be scratched or grooved horizontally, at roughly 1/4- to 1/2-inch intervals, or covered with durable square, plastic mesh (1/8" or 1/4" inch mesh. Include vents approximately 6 inches from the bottom of all houses 24 to 32 inches tall where average July high temperatures are 85 F or above. Front vents are as long as a house is wide, side vents 6 inches tall by 1/2 inch wide. Houses 36 inches tall or taller should have vents approximately 10 to 12 inches from the bottom.

**2. Construction** - For wooden houses, a combination of exterior plywood (ACX, BCX, or T1- 11 grade) and cedar is best. Plywood for bat house exteriors should be ½ -inch thick or greater and have at least four plies. Do not use pressure-treated wood. Any screws, hardware or staples used must be exterior grade (galvanized, coated, stainless, etc). To increase longevity, use screws rather than nails. Caulk all seams, especially around the roof. Alternative materials, such as plastic or fiber-cement board, may last longer and require less maintenance.

**3. Wood Treatment** - For the exterior, apply three coats of exterior grade, water-based paint or stain. Available observations suggest that color should be black where average high temperatures in July are less than 85 °F, dark colors (such as dark brown or dark gray) where they are 85 to 95 °F, medium colors where they are 95 to 100 °F and white or light colors where they exceed 100 °F. Much depends upon amount of sun exposure; adjust to darker colors for less sun. For the interior, use two coats dark, exterior grade, water based stain. Apply stain after creating scratches or grooves or prior to stapling plastic mesh. Paint fills grooves, making them unusable.

**Bat House Color Recommendations and Average Daily High Temperatures in July**



Areas	Wooden Houses	Plastic/Stucco Houses
1) Dark areas:	Black or dark color	dark color
2) Medium areas:	dark or medium color	medium color
3) Light areas:	Medium or light color	light color

**4. Sun Exposure** - Houses where high temperatures in July average 80 °F or less, should receive at least 10 hours of sun; more is better. At least six hours of direct daily sun are recommended for all bat houses where daily high temperatures in July average less than 100 °F. Full, all-day sun is often successful in all but the hottest climates. To create favorable conditions for maternity colonies in summer, internal bat house temperatures should stay between 80 °F to 100 °F as long as possible.

**5. Habitat** - Most nursery colonies of bats choose roosts within 1/4 mile of water, preferably a stream, river or lake. Greatest bat house success has been achieved in areas of diverse habitat, especially where there is a mixture of varied agricultural use and natural vegetation. Bat houses are most likely to succeed in regions where bats are already attempting to live in buildings.

- 6. Mounting** - Bat houses should be mounted on buildings or poles. Houses mounted on trees or metal siding is seldom used. Wooden, brick, or stone buildings with proper solar exposure are excellent choices, and locations under the eaves often are successful. Economy houses work best when mounted on buildings. Mounting two bat houses back to back on poles is ideal (face one house north, the other south). Place houses 3/4 inch apart and cover both with a galvanized metal roof to protect the center roosting space from rain. All bat houses should be mounted at least 12 feet above ground; 15 to 20 feet is better. Bat houses should not be lit by bright lights.
- 7. Protection from Predators** - Houses mounted on sides of buildings or on metal poles provide the best protection from predators. Metal predator guards may be helpful, especially on wooden poles. Bat houses may be found more quickly if located along forest or water edges where bats tend to fly; however, they should be placed at least 20 to 25 feet from the nearest tree branches, wires or other potential perches for aerial predators.
- 8. Avoiding Uninvited Guests** - Wasps can be a problem before bats fully occupy a house. Use of 3/4-inch roosting spaces reduces wasp use. If nests accumulate, they should be removed in late winter or early spring before either wasps or bats return. Open-bottom houses greatly reduce problems with birds, mice, squirrels or parasites, and guano does not accumulate inside.
- 9. Timing** - Bat houses can be installed at any time of the year, but are more likely to be used during their first summer if installed before the bats return in spring. To help exclude a colony from a building, install the bat houses at least two to six weeks before the actual eviction, if possible.
- 10. Importance of Local Experimentation** - It is best to test for local needs before putting up more than three to six houses, especially comparing those of different darkness and sun exposure.

*Bat house information below is from Bat Conservation International (BCI). Additional designs are available at: <http://www.batcon.org/resources/getting-involved/bat-houses>*

*Note that single chamber houses are no longer recommended by BCI.*



## Four-chamber Nursery House

**Materials (makes two houses) • Diagrams on pages 12 & 13**  
 $\frac{1}{2}$  sheet (4' x 4')  $\frac{1}{2}$ " AC, BC or T1-11 (outdoor grade) plywood  
 $\frac{1}{2}$  sheet (4' x 4')  $\frac{1}{2}$ " AC or BC (outdoor grade) plywood  
Two pieces 1" x 6" ( $\frac{1}{2}$ " x  $\frac{5}{8}$ " finished) x 8' pine or cedar  
One lb. coated deck or exterior-grade screws, 1"  
20 to 25 coated deck or exterior-grade screws, 1"  
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,  $\frac{1}{2}$ "

### Recommended tools

Table saw or circular saw	Paintbrushes
Variable-speed reversing drill	Hammer (optional)
Screwdriver bit for drill	Tin snips (optional)
Tape measure or yardstick	Bar clamp (optional)
Caulking gun	Sander (optional)
$1\frac{1}{2}$ " hole saw or spade bit	

### 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  $\frac{1}{4}$ " to  $\frac{1}{2}$ " apart, cutting  $\frac{1}{2}$ " to  $\frac{3}{8}$ " 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 1 $\frac{1}{2}$ " 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  $\frac{1}{2}$ " (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 1 $\frac{1}{2}$ " 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  $\frac{1}{8}$ " 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 1 $\frac{1}{4}$ " 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  $\frac{1}{2}$ " 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 10 $\frac{1}{4}$ ", screwed horizontally to each side, will join the two boxes. Leave a  $\frac{1}{8}$ " 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 1 $\frac{1}{2}$ " 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 top-to-north retain heat. Slope the sides and bottom at an angle of 45° or greater to reduce guano build-up. Leave a  $\frac{1}{8}$ " 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  $\frac{1}{8}$ "- or  $\frac{1}{4}$ "-inch HDPE plastic mesh [such as Internet product #1672 (1-800-328-8456; [www.internetmesh.net](http://www.internetmesh.net))] and attach every two inches with  $\frac{1}{8}$ " 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.

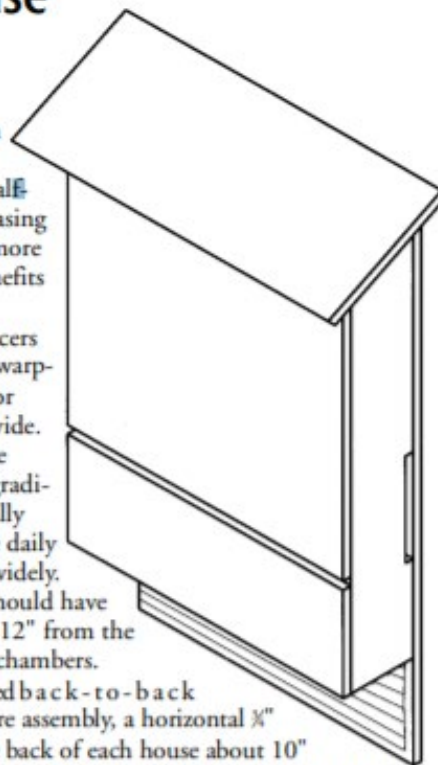


FIGURE 4

# *Four-chamber Nursery House Assembly Diagrams*

