



# Building Homes for Bats

## A Guide for Bat Houses in British Columbia

### INSIDE THIS HANDBOOK

- Key Features of Effective Bat Houses
- Bat House Designs
- Optimal Bat House Location
- Tips for Installing a Bat House
- Frequently Asked Questions about Bat Houses

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# Contents

Background .....	1
Key Features of Effective Bat Houses .....	2
Bat House Designs.....	8
Optimal Bat House Location .....	12
Enhancing Bat Habitat on a Community Scale.....	16
Frequently Asked Questions About Bat Houses .....	17
Resources .....	20
APPENDIX 1: Register Your Bat House .....	21
APPENDIX 2: Annual Bat Count Information .....	22
APPENDIX 3: Bat House Plans .....	23

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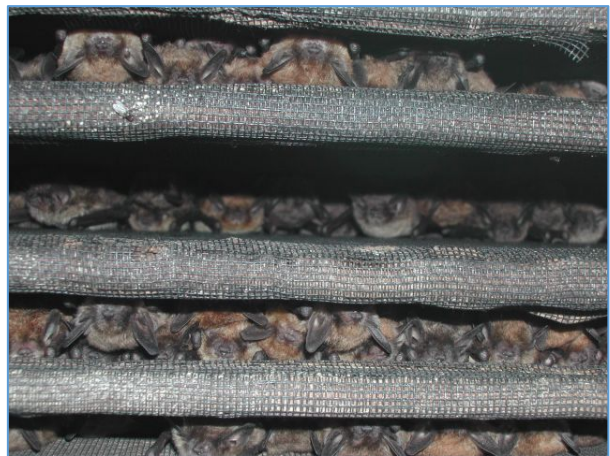
This version was updated in October 2017. Please see our website for updated versions: [www.bcbats.ca](http://www.bcbats.ca).

## Background

Bats are an essential component of healthy ecosystems and provide important control of agricultural and forest insect pests as well as flying insect populations. Two species of bats are federally endangered, and over half of the 16 bat species in British Columbia are considered to be “at risk” due to habitat loss and degradation, intentional extermination, wind turbines, pollution, climate change, and White-Nose Syndrome (WNS), a devastating disease that has decimated bat populations in the eastern parts of North America and has now been confirmed on the west coast.

Bats need our help, through protection of individuals and enhancement of habitat. You can support bat populations in your area by preserving snags (dead trees) and planting trees that will mature and provide roosting habitat. Installing a bat house is also a great way to enhance habitat for bats in your backyard. A bat house is a structure designed to provide bats with a warm, dry and safe summer roost site. Similar to birdhouses, they are often wooden “boxes” that can be installed on a high structure like a tall post or a building. Many people want bats because they want to promote backyard biodiversity or help control insects (particularly mosquitoes). Some people install bat houses in coordination with evicting bats from a building so that the bats will have an alternate roost site and the eviction will be more successful. Although **bat houses do not provide the same opportunities as natural roost structures for bats**<sup>1</sup>, they are still an excellent option for increasing summer roosting habitat where natural features are limited or where bats are already in a human-made roost. In general, preservation of diverse natural features should be a priority; however, having safe, appropriate roosting habitat may help bats recover from the impacts of WNS and other threats, and in human-altered landscapes, bat houses may help fill this need.

Bat houses are often for sale in BC at garden centres, hardware stores, craft markets and other locations, or they are home-built. Whether you buy or build a bat house, ensure that it meets the criteria for good bat house design (see section *Key Features of Effective Bat houses*). Standardized information for bat houses in BC has only recently become available, and commercially-available bat houses may not meet these new criteria for size or design. Design is important, but it is also essential to install the bat house in an optimum location for success (see section *Optimal Bat House Location*).



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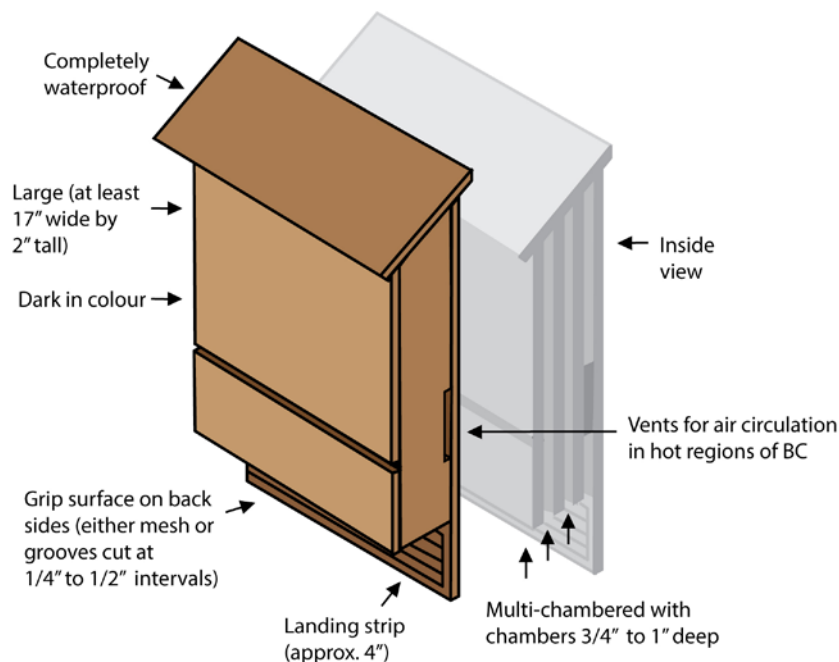
<sup>1</sup> Lausen, C.L. and Barclay, R.M.R. 2006. The benefits of living in a building: Comparing maternity colonies of big brown bats (*Eptesicus fuscus*) in rock crevice and building roosts. *Journal of Mammalogy* 87: 362-370.

The purpose of this document is to provide information about effective bat house design and placement for private landowners in BC. There is still much for us to learn about how bats determine which roost is most suitable, so try experimenting by putting bat houses in different locations, varying the dimensions, or staining one and not the other. Monitor occupancy by bats in summer by looking for guano under the bat house or observing the bat house at dusk to see if bats fly out. Register your bat house and report your results to the BC Community Bat Program (Appendix 1 or <http://bcbats.ca/index.php/bat-houses/register-your-bat-house> ) so we can continue to improve the information in this document.

## Key Features of Effective Bat Houses

There are several factors to consider when building or purchasing a bat house. Factors that influence success in attracting bats include the design, size, number of chambers, chamber spacing, surface roughness, and presence of vents and landing strip. Other factors to consider when selecting a style are cost, size of the bat colony (if you are excluding bats from a building), and location options. The most common designs on the market are bat boxes, rocket boxes and condos (see *Bat House Designs* section).

### KEY FEATURES OF A BAT HOUSE



## Size

Many bat houses sold in BC are too small for our temperate climate. For bat houses, **bigger IS better!** A larger house will provide a wider range of temperatures inside, allowing bats to choose a site that suits their needs (see side bar *Some Like It Hot!*). Bat boxes should be at least 24"<sup>2</sup> tall and 17" wide and have a landing strip of at least 4". Rocket boxes should be at least 3' tall and have at least 1' of linear roost space (meaning that each of the four sides would be at least 3" wide).

## Chambers

Chambers are the cavities that bats actually roost within. Chambers should be carefully spaced to  $\frac{3}{4}$ " (for most bat species) or 1" (for Big Brown Bats). Bat houses with wider chambers don't hold heat as well and can attract wasps, and smaller chambers do not provide adequate roosting space. **Multiple chambered bat houses not only provide added roosting space, but also give bats the opportunity to select an appropriate temperature by moving between chambers.** This range in temperature is particularly important during heat spells when bat pups can otherwise die from overheating.

## Movement Between Chambers

Holes or gaps in the dividers between chambers allow bats to move between chambers inside the bat house. These gaps can be developed by leaving a 1" gap about  $\frac{1}{2}$  way up the divider (so the divider is made out of two pieces of wood rather than one), or drilling holes about  $\frac{1}{2}$  way up (usually two 1  $\frac{1}{2}$ " diameter holes per divider)<sup>3</sup>.

## Some Like It Hot!

Bats require certain temperature ranges, depending on their sex, and whether they are raising a pup or not. Bats have the interesting ability to go into torpor (taking on the temperature of their surroundings, similar to cold-blooded animals like snakes). In doing so, they don't have to use their precious fat stores to generate heat for their bodies. When raising pups, adult females prefer warm roosts; males, which tend to roost alone during the day, are more likely to select cool roost locations. A female's need for warmth changes throughout the season, from pregnancy through to weaning her pup, and can also fluctuate on a daily basis depending on whether she is trying to nurse a pup, or save energy. The more chambers a bat house has, the greater its variety of microclimates and the more likely bats can find conditions suitable to their differing needs. Multi-chambered roosts can also attract more bats, which will raise roost temperatures and allow bats to reduce heat loss through huddling.

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<sup>2</sup> Although Canada uses metric measurements, the building industry still uses imperial so that is what is used to describe building sizes and materials.

<sup>3</sup> Greg Falxa, personal communication.

## Materials

For wood bat houses, a combination of cedar and exterior-grade plywood is best. Plywood for the exterior of the bat house should be at least  $\frac{3}{4}$ " thick with at least four plies. Pressure-treated wood should not be used due to the chemicals it may contain. Also, it can warp over time preventing use of the chambers. Be sure to use exterior-grade screws (not nails), staples, and hardware. Caulk any cracks and seams to ensure that water does not enter the house and to provide a good thermal habitat for the bats.

## Landing Strip

A place for bats to land is a key feature of a bat house. Bat houses that do not have a landing strip or that have a slippery surface are usually ineffective. Landing strips should be at least 4" high and the width of the bat house, and have a rough surface.

## Rough Surface

All areas where bats will be hanging (including the landing strip and one side of each chamber) should have a rough enough surface that bats can easily grip. Plywood on its own is too slippery. There are several methods that can be used to create a rough surface:

- **Score the wood** by cutting grooves (1/16" to 1/32" deep) at  $\frac{1}{2}$ " intervals. This method creates excellent grip and has proven to be very effective although it is time consuming to build.
- **Affix fiberglass mesh** (door screen) onto the wood. This method has commonly been used in BC and is effective but there are concerns that the staples will corrode over time and guano (droppings) or bats can get trapped beneath. It is best to hide the staples between chamber spacers or on the edges of the divider plates. Avoid using metal screen since it corrodes and develops sharp points.
- Utilize a **naturally rough substrate** to build the chambers (such as rough cedar) which may be effective if it is heavily textured with deep grooves.
- **Mix a gritty substance with non-toxic stain** to create a roughly textured surface<sup>4</sup>. For example, paint boards with latex paint, sprinkle ground up cork or walnut shells (available as walking surface non-slip treatment) and then paint another layer of latex paint. This method is relatively simple yet effective. A blender can be used to grind the cork, and ground walnut shells are available through jewelry polishers or at home building supply centers for applying to decks while being painted.<sup>4</sup>
- **Use a low grit sandpaper** on a power sander<sup>5</sup>.
- Make a "scouring pad" by putting many screws or nails through a board (like the bristles of a hair brush) and "**rake**" this **nail or screw pad** over the wood to create grooves<sup>4</sup>.

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<sup>4</sup> Greg Falxa, personal communication.

<sup>5</sup> Justin Stevenson, RD Wildlife Management, personal communication.

## Mounting Brackets or Lips

Since large bat houses are quite heavy once they are built, installation can be challenging. Building a bat house with installation in mind (such as creating lips on the edges or top of the bat house to drill screws through) can make it easier. A mounting bracket can also be built onto the bat house or onto the structure to which it will be attached.

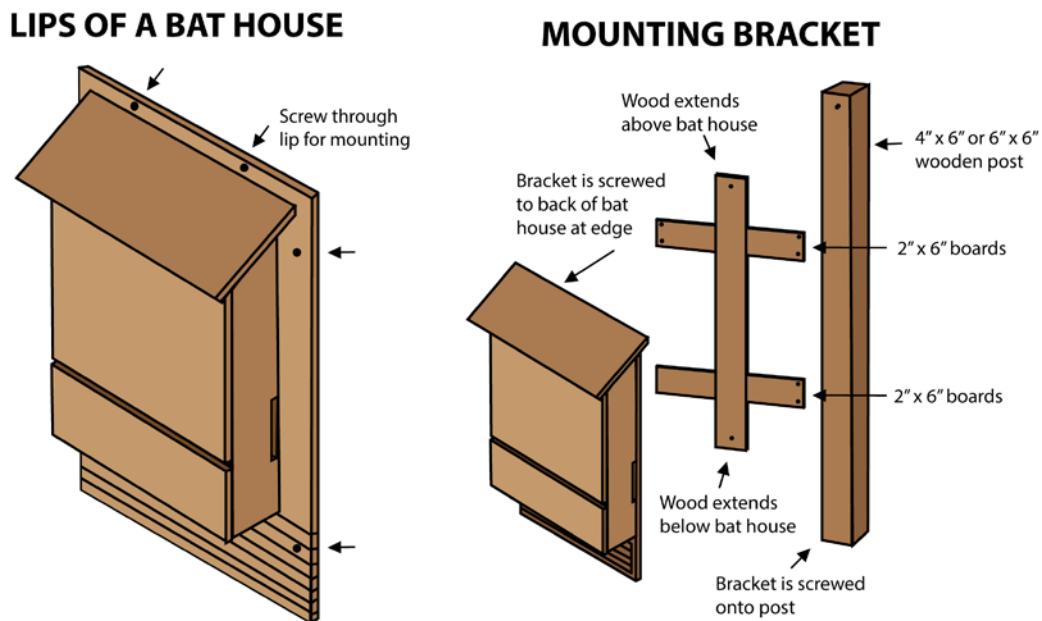


DIAGRAM SHOWING LIPS (LEFT) AND MOUNTING BRACKET (RIGHT) FOR MOUNTING BAT HOUSE.

## Vents (in hotter regions of BC)

Although not necessary in all regions of BC, vents allow air movement and increase the range of temperatures inside a roost. During intense heat, vents may be important for preventing extreme temperatures inside the bat house. Vents are approximately  $\frac{1}{2}$ " wide, and can be placed approximately  $\frac{1}{3}$  of the length of the bat house up from the bottom. The front vent should be as wide as the house. In hot areas of BC, including the Kootenays, Okanagan and Thompson/Fraser, vents are recommended whereas in the rest of the province, they are optional.

## Overheating

In hotter parts of the province, bat houses may overheat. Regular observation of your bat house can reveal if it is too hot at times, and needs to be relocated to a cooler site - an overly-hot house will cause bats to cluster at the lowest exit point during the day, or even lead to death of bats, although mortalities may be due to many causes. Never touch dead bats with your bare hands, and report any mortality to your community bat program at 1-855-922-2287. Several community bat projects are conducting research into temperatures in bat houses, to improve our understanding of bat preferences. If you are



interested in having your bat house monitored or installing temperature monitoring equipment, contact your local community bat program to discuss.

### Retaining Heat (in cooler/ northern regions of BC)

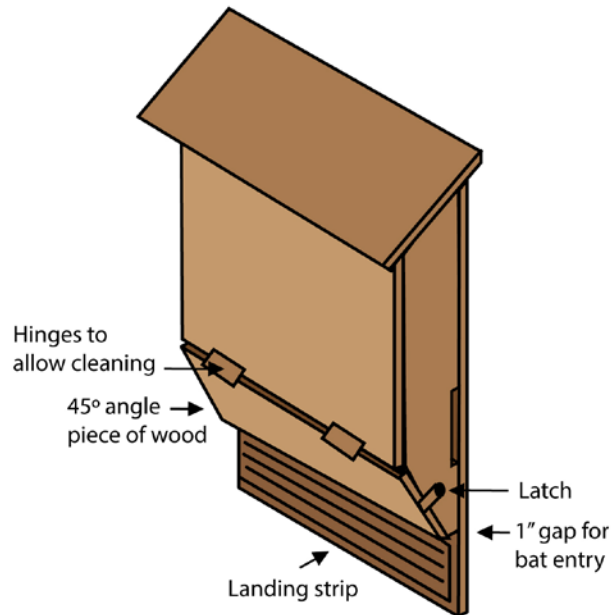
In northern BC, bat houses should be designed to retain heat. Vents should not be used. A partial bottom can be added that is at an angle of 45° or greater to reduce guano build-up and that leaves a 1" entry gap at the back (see diagram). Since guano may accumulate inside this flap, consider adding a hinge to allow for annual cleaning.

### Stain Colour

Avoid oil paints or other stains with strong odours or Volatile Organic Compounds (VOCs), which are off-gassing chemicals, since they can be harmful and/or repel bats. Use a water-based stain. Consider using all-natural products such as the "Tall Earth" stain<sup>6</sup>. Some people choose not to stain their bat house and leave it as natural wood and these bat houses have also been successful. Although mentioned in some construction plans, **staining the interior is neither required nor recommended** (unless you are using the stain as part of roughening the surface – see *Rough Surface* section above, or are installing the house immediately outside of a window, as staining may reduce smells associated with the bat house).

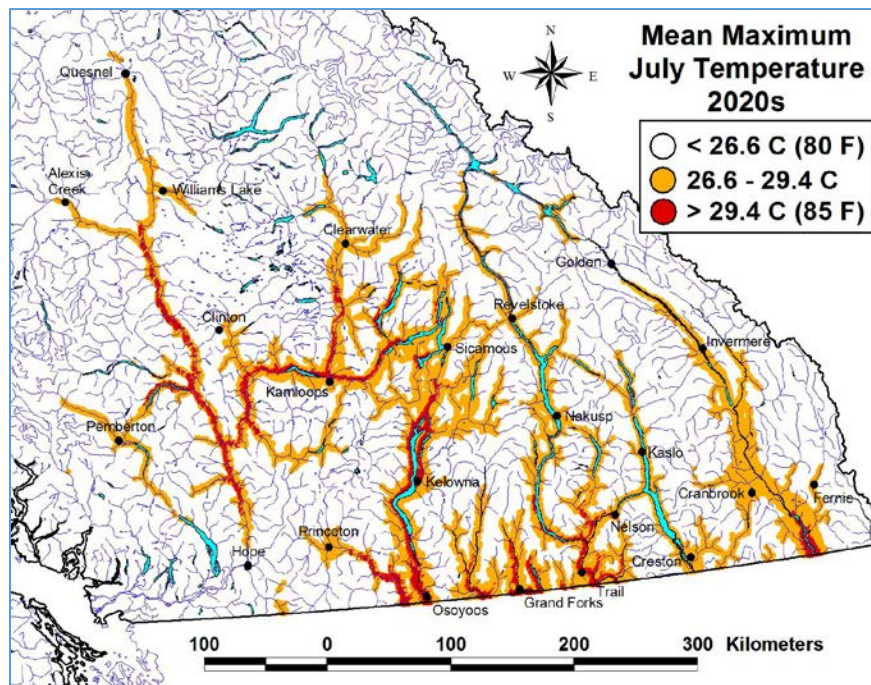
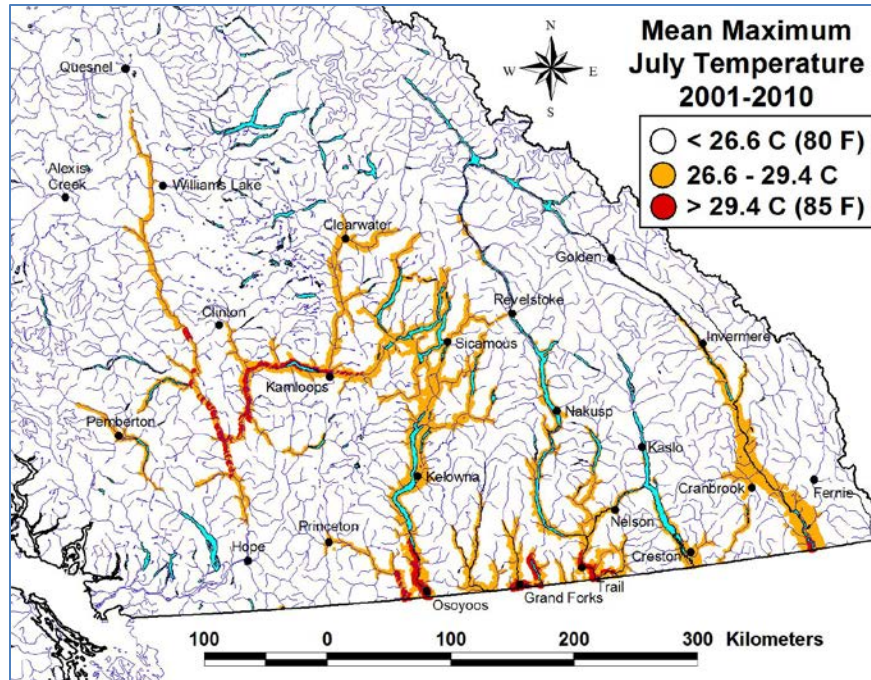
Warmth is a key feature of effective bat houses. In areas where the mean maximum July temperature is less than 29°C (85°F), bat houses should be stained black or dark colours, and areas from 29°C to 35°C (85°F to 95°F), the colour should be a lighter colour<sup>7</sup>. Based on climate data from 2000 to 2010, the only regions of the province where bat houses should not be stained black or dark are lower elevations in the Kootenays, Okanagan and Caribou (see temperature maps, below). In these regions, bat houses should be a lighter colour such as beige, light or medium brown, or even natural wood colour (e.g. transparent wood protector).

### BOTTOM OF BAT HOUSE Modified to Retain Heat



<sup>6</sup> <http://tallearth.com/>

<sup>7</sup> Tuttle, M. D., M. Kiser, and S. Kiser. 2004. *The Bat house Builder's Handbook: Second Edition*. Bat Conservation International, Austin, Texas. Available online: [http://www.batcon.org/pdfs/BHBuildersHdbk13\\_Online.pdf](http://www.batcon.org/pdfs/BHBuildersHdbk13_Online.pdf)



TEMPERATURE MAPS OF PREDICTED MEAN MAXIMUM JULY TEMPERATURE FOR SOUTHERN BRITISH COLUMBIA FROM 2000 TO 2010 (TOP) AND PREDICTED FOR 2020'S (BOTTOM). STAIN BAT HOUSES A MEDIUM BROWN COLOUR IN AREAS THAT ARE SHADED. IN ALL OTHER AREAS, STAIN THEM BLACK. MAP PREPARED BY GREG UTZIG<sup>8</sup>.

<sup>8</sup> Mapping by: G. Utzig, P.Ag. Kutenai Nature Investigations Ltd. 2015. Climate data extracted from ClimateBC v5.21 based on a 1 km provincial grid.

## Bat House Designs

There are several designs of bat houses that are known to be effective in BC. Most bat houses have one to four roosting chambers. Plans can be found in Appendix 2 or at [www.bcbats.ca](http://www.bcbats.ca).

### Bat Boxes

#### *Four-chambered Nursery Box*

**Four-chambered nursery boxes** offer ample roosting space and provide bats with the opportunity to move between chambers with changes in temperature. Multiple-chambered bat boxes can hold hundreds of bats and are more successful than single-chambered bat houses. Bat boxes can be installed on buildings or posts. An ideal set-up is to put two multi-chambered bat boxes back to back on a post – leaving a gap between them creates further roosting space.

#### *Useful adaptations to this design:*

**Lips:** An adaptation to the design that may be useful is to lower each chamber and the roof on the back board so there is an upper lip or make chambers slightly narrower so that there is a lip on either edge of the bat house for easier installation (see *Mounting Brackets or Lips* section).

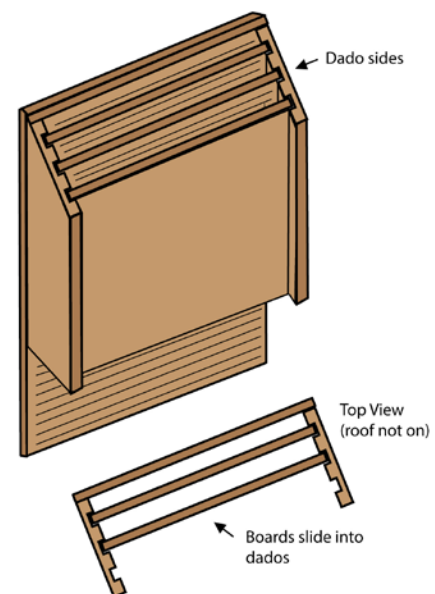
**Dados:** Some woodworkers prefer to cut grooves (dados) in side boards rather than use separate spacers to create the chambers (see diagram to right). Mass production cutting plans<sup>9</sup> using dados for woodworking programs or bat house builders are available by contacting [info@bcbats.ca](mailto:info@bcbats.ca).

**Larger size:** All bat houses can potentially be built larger. For example, large multi-chambered or single-chambered bat houses can be built approximately 50" high (double the height of the small ones) by 24" wide. They can be built as a single chamber or multiple-chambered style with the potential to hold thousands of bats. Large multi-chambered bat boxes are an excellent design for extremely large bat colonies in BC, such as colonies of over 2,000 bats. To build one, adapt the designs above to make the bat house taller or wider.

**Runways:** Ideally, back to back multi-chambered nursery boxes should have a little 'hallway' or other connection between the boxes at the back. If they are mounted back to back with no space in between, this could simply be a hole cut through the backs of



#### SIDE DADOS OF A BAT HOUSE

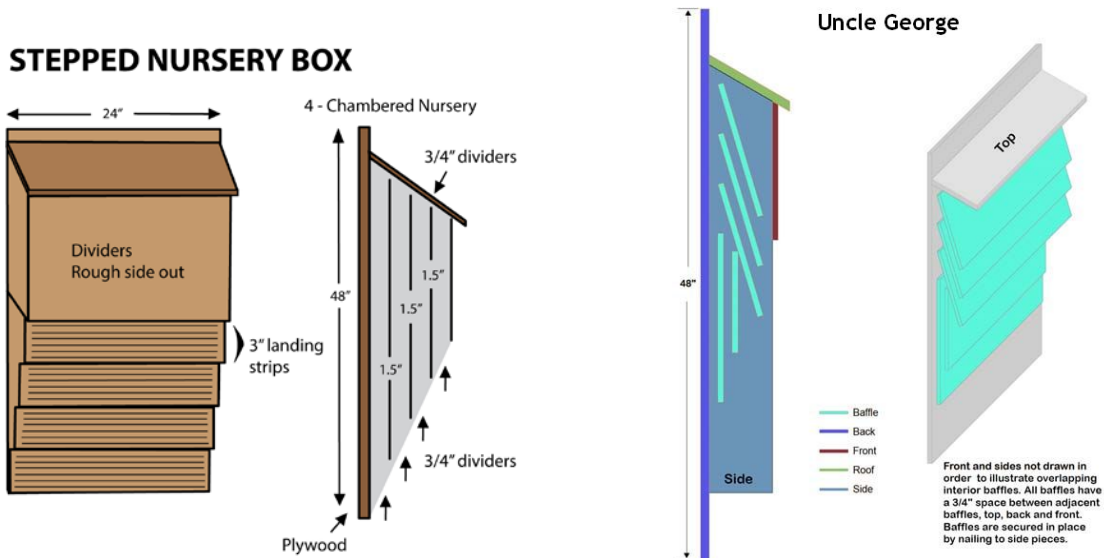


<sup>9</sup> Prepared by Donald Liszt, Woodworking Instructor, Stanley Humphries Secondary School

the bat houses approximately half way up (see *Mounting Structure* section). If the bat houses are separated by a pole or post, this could be a PVC pipe or other tube that creates an access.

### Stepped Nursery Box

The Stepped Nursery Box is an adaptation that has each chamber slightly shorter from the back to the front so the bat house forms “steps” of chambers and each chamber has its own landing strip<sup>10</sup>. An “Uncle George” design has been described for the Pacific Northwest where chambers are angled approximately 20° from vertical<sup>11</sup> but research on the use of this design indicates that they are not used as well-used as maternity roost sites except by California Myotis<sup>10</sup>. Although regular or stepped maternity boxes appear to be more successful<sup>10</sup>, there is still the potential for experimentation with all these designs in BC, particularly where they are installed on buildings.



### Single-Chamber Bat Box

Single-chamber (small) bat boxes **are ideally at least 2' wide and 2' high**. Although they are easier to make than other designs, we do not recommend these houses. Observations in the Kootenays have indicated that single-chambered bat boxes are more often used by males or non-reproductive females<sup>12</sup>. These bat houses occasionally provide a roost space for up to 50 bats. *They must be installed on the side of a heated building to be effective*. Since they don't offer the temperature gradient that multi-chambered bat houses do, they can also become “bat traps” in hot spells, with pups getting too hot and dying. Although single chambered bat boxes may be simpler to construct, cost less and are less heavy to mount in high places, **multi-chambered bat houses are safer for bats and more effective as roost sites**.

<sup>10</sup> Greg Falxa, personal communication.

<sup>11</sup> [http://cascadiaresearch.org/bats/BatBoxPreference\\_screen-view.pdf](http://cascadiaresearch.org/bats/BatBoxPreference_screen-view.pdf)

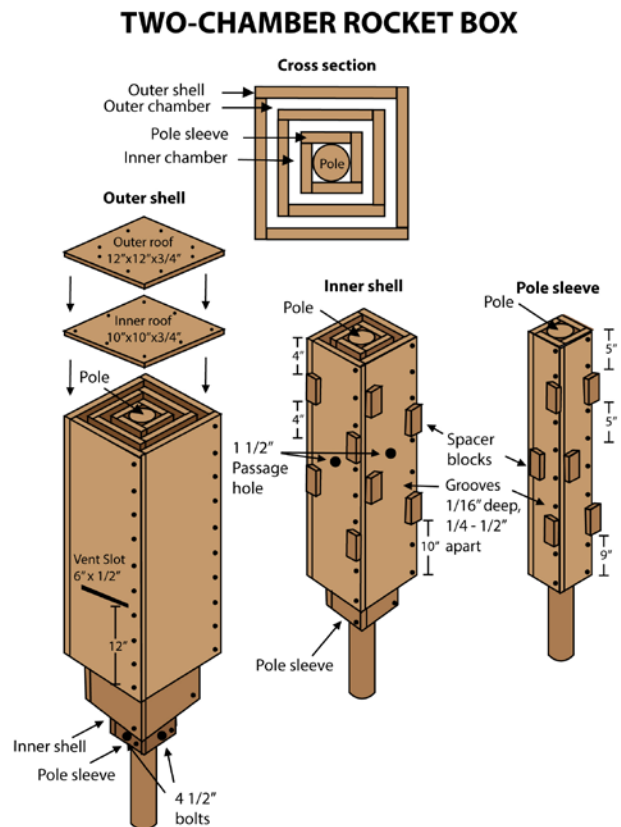
<sup>12</sup> Juliet Craig, personal observation.

## Rocket Boxes

Another form of bat house is the rocket box. Two-chambered rocket boxes have been extremely successful on the coast of BC, especially for Yuma Myotis, a common bat species. There are two styles of rocket boxes.

### Two-chambered Rocket Box

Two-chambered rocket boxes are usually 3 ft. (1 m) tall and contain concentric roosting chambers around a post or pole. By increasing the number of square roosting chambers, the rocket box becomes wider and can house more bats as well as provide more micro-climate options. Installation of this bat house style simply requires fixing the post in the ground and putting the bat house on as a “cap”. These bat houses are extremely effective in attracting roosting bats which is likely because the chambers face all cardinal directions and thus provide a multitude of microclimates within the bat house. For example, bats could follow the warmth of the sun’s radiation throughout the day by shifting inside the box. On very hot days, they can also avoid the heat by moving to the north side of the box.



### Simple Rocket Box

Simple rocket boxes are made from a 4" by 4" post that has wedges cut into it and is then covered by an outer plywood box. The materials are cheap and they are easy to construct. *However, their success rate has not yet been determined in BC.* As there are less microclimate options, it is possible this style would be less popular than a double or multi-chambered rocket box.

## Bat Condos

Bat condos are very large structures that can potentially house thousands of bats. They are costly and time consuming to build but can house large colonies of bats (more than 6,000). Because they provide a variety of microclimates, bat condos are designed for use by multiple species of bats, and both males and females. Condos typically provide roosting chambers towards the outside of the structure (e.g. under planking), in addition to roosting chambers inside the structure. Bat condos are generally built on poles that elevate the structure well above the ground. The increased height has multiple benefits such as providing bats with a sufficient height off the ground for take-off and landing, avoiding predation, and decreasing the likelihood of potential vandalism and disturbance.



There are many different designs, including 'mini condos', and 'bat motels'. In BC, where climate is colder, the designs should be modified to partially close chambers to trap air and thus increase roosting temperatures. Decreasing gap size between roosting boards will also help trap warm moist air when bats are roosting as a group. Additionally, creating purposeful gaps between exterior boards or planks during construction can increase the variety of microclimates created for bats in the structure. Bat condos can be considered when there are large bat colonies being evicted from a building, for wildlife and restoration projects, and for increased insect control. If you are considering building a bat condo, contact your local community bat program to discuss options.

## Slabs

Slabs are a wooden board or metal flashing secured on a wall of a building under the eaves that provides a dry crevice for roosting on the exterior of the building. Short strips of wood can be used as spacers to create the roosting chamber (approx.  $\frac{3}{4}$ " ). The overhanging roof of the building should protect the roost from precipitation but it is important that the top of the chamber be sealed to trap heat. One slab/sheet of wood will create a single chambered roost or they can be layered to create multiple chambers. The length of the roost can be as long as one wishes to make it and the entire roost can be made of scrap lumber.



These types of bat houses mimic the conditions that wall or shingle roosting bats often use. Guano and urine can mark the wall of the building so installing slabs on outbuildings and not on homes may be preferable. One may have to compromise on choosing the best aspect (e.g. south) versus which side of the building is acceptable to become marked (e.g. east or west).

## Gable Vents

Gable vent covers may provide roosting habitat for bats. These slotted structures cover the openings that allow airflow from attic spaces, and are installed over existing vents and tough screening to ensure that bats do not enter the attic. Airflow from the attic helps warm the bat house. Adjusting the size of the slats will accommodate different species (3/4" for Little Brown or Yuma Myotis, 1" for Big Brown). Some houses may come with slotted gable vents – in this case, ensure that the screening is solid, to ensure that bats do not enter the attic. Other houses may require a retro-fit to add a bat-friendly vent cover. As with slabs, these bat houses may result in guano or urine staining of the wall below the structure.

## Optimal Bat House Location

The location of a bat house is critical to its success. There are many factors to consider when selecting a site including solar exposure, habitat, mounting, obstacles, protection from predators, and wasps. In summary, bat houses should be placed:

- at least 10' (3 m) high but 12' to 20' is better,
- south, east or west facing to ensure correct sun exposure,
- in an uncluttered location that does not have branches, buildings, or poles in front of it, and
- away from lights or high wind.



NURSERY BAT BOX ON SHED (LEFT) AND TWO-CHAMBERED ROCKET BOX ON POST (RIGHT). PHOTOS COURTESY OF JULIET CRAIG AND ALYSIA DOBIE.

## Height

The base of a bat house should be at least 3 m (10') above the ground although 12' to 20' is better. The height is measured from what a bat would perceive as the "ground" which may be the roof of a shed or other building if the bat house is mounted above a structure (such as a lower roof) rather than the ground.

## Sun exposure

An important criterion for bat house location is sun exposure. If you have several possible sites to choose from, observe the site during the summer to determine sun exposure (this could change depending on the time of the year). Bat houses placed on a post should face due south to allow for the best temperature gradient. Bat houses placed on buildings may face east, west or south, depending on the ideal hours of direct sun (see below).

For the hottest regions of BC including lower elevations of the Okanagan, Kootenay, and Thompson areas (shaded red in temperature maps) select sites with approximately 6 hours of direct sun each day (e.g. away from direct afternoon sun). Ideally a bat house in these hot regions will face east or south-east, to be exposed to morning sun and not the hot afternoon sun. A spot with afternoon shade is ideal. For warmer regions of BC (shaded orange in temperature maps), place bat houses in areas with 6 to 10 hours of direct sun. In all other areas of BC, place bat houses to receive as much sun as possible (at least 10 hours). In most regions of BC, bat houses should be placed in direct sun, facing south or southeast, to receive at least 10 hours of direct exposure each day.

## Obstacles

Bats like a clear path to fly out of their house so that they can detect predators and easily avoid obstacles. Bat houses should be placed in open areas where there is no or little clutter such as on a post in the middle of a field or on the side of a building with no obstructions for at least 5 m. If a bat house is mounted on a tree (not recommended), the branches should be de-limbed below and around the bat house to create an open, uncluttered area.

## Habitat

Ideally, bat houses should be situated near good foraging and drinking habitat such as streams, rivers, lakes or ponds. Bat houses within 400 m of a larger pond or lake have been known to have great success than those farther away<sup>13</sup>. However, it is still worth installing a bat house in areas away from water since bats can travel many kilometres each night to drink and forage. Forest openings are good settings for placing a bat house as they have good solar exposure and are uncluttered. If a bat house is being installed in combination with bat exclusion from a building, you may wish to try several bat houses in different locations including at least one near the current roost site. However, placing a bat house where bats are exiting and entering the building is not always the best location, depending on solar exposure, clutter, and other factors. It is more important for the bat house to be in a high, uncluttered and warm location than it is to be near the current roost site. Avoid mounting bat houses close to bright lights and select sites that are free from heavy winds.

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<sup>13</sup> Tuttle, M. D., M. Kiser, and S. Kiser. 2004. *The Bat house Builder's Handbook: Second Edition*. Bat Conservation International, Austin, Texas. Available online: [http://www.batcon.org/pdfs/BHBuildersHdbk13\\_Online.pdf](http://www.batcon.org/pdfs/BHBuildersHdbk13_Online.pdf)



## Protection from Predators

House cats are one of the largest predators of bats in BC, although raptors, weasels, and other animals may prey on bats. Predation can be avoided by mounting a bat house up high, since cats may be able to kill bats if the access point to the bat house is too low. A slippery sheet-metal guard can be wrapped on the bottom of a wooden post or tree to deter cats or other ground-based predators. To reduce predation by raptors, try to mount the bat house at least 20' (6 m) from the nearest tree branches, wires or other potential perches for aerial predators. Bat houses on stand-alone poles should have multiple nails in the top to deter predatory birds from perching on top.



OWL ON BAT HOUSE (LEFT) AND GUARD FOR NON-FLYING PREDATORS (RIGHT). BAT HOUSES MOUNTED ON POLES SHOULD HAVE SPIKES ON TOP TO PREVENT AERIAL PREDATORS FROM PERCHING. PHOTOS COURTESY OF MICHELLE EVELYN (LEFT) AND RICK O'NEILL (RIGHT).

## Interaction with People and Pets

Bat houses should be placed high enough to avoid direct contact between people (e.g. curious children) and pets. To minimize the chance of young children coming into contact with a bat that may fall from the roost, bat houses and condos in public spaces, such as parks and school grounds, should be placed in sites that do not experience a high level of human activity. This site selection will also reduce potential vandalism and disturbance issues.

## Mounting Structure

Bat houses can be successfully placed on poles or posts or on the sides of buildings or outbuildings. **Bat houses mounted on wood, brick, or stone buildings with good solar exposure are good choices** since the building helps radiate heat into the bat house during the evenings. Mounting on a building is critical for single-chambered bat houses.

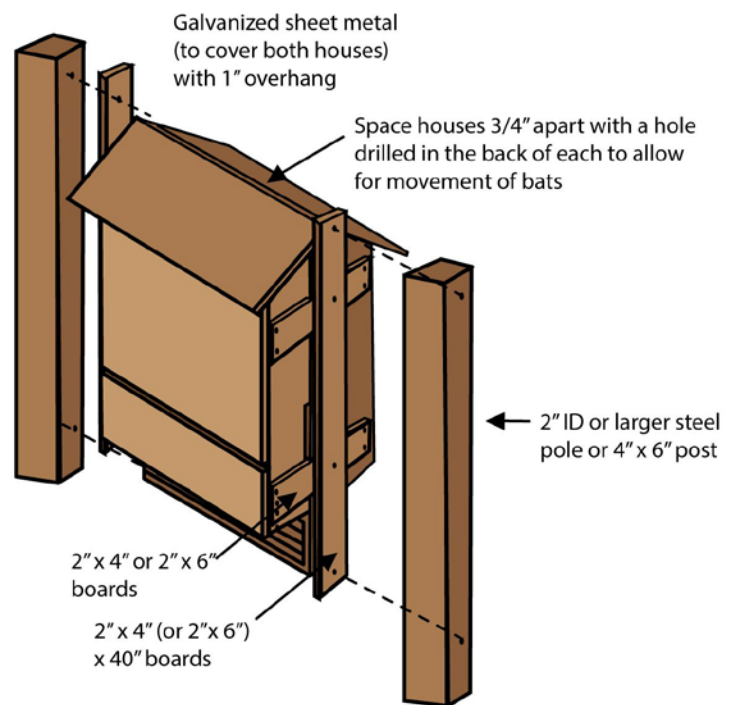
Bat houses mounted on 20' (6 m) poles (wooden, 4' by 4' or metal) put 4' in the ground have been successful since they can be mounted high, face any direction, and placed free of clutter. **An ideal scenario for bat-boxes is to mount two multi-chambered bat houses back to back on a pole** so that one faces north and the other faces south (see diagram)

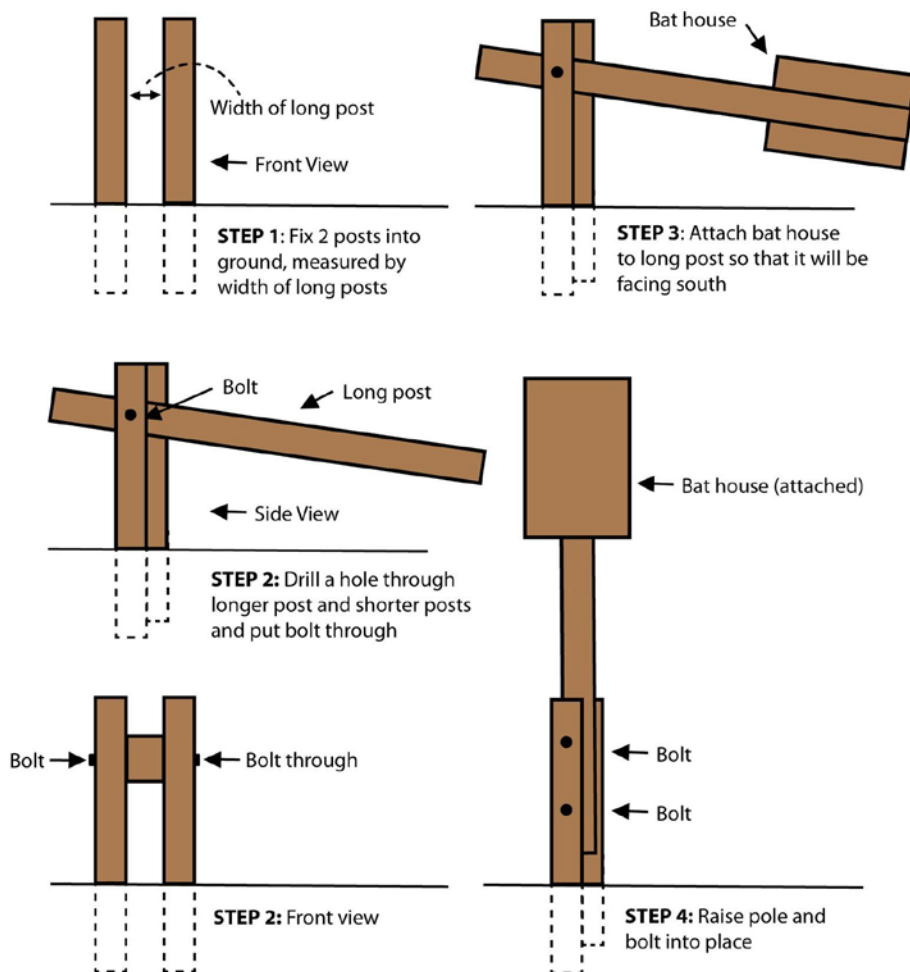
with opportunities for bats to move between them (see *Movement Between Chambers* section). The bottom of the posts can be braced to make them more secure and prevent them from being blown over. Any house mounted on a single post should have the post very securely planted and braced, as swaying of the bat house in wind may make it unappealing to bats, and possibly dangerous to humans!

Trees and snags are not recommended since they are more difficult for bats to find, more vulnerable to predators, and usually receive less sun exposure. However, trees that are significantly de-limbed (to act as poles) are successful. Although power and telephone poles are usually in excellent locations, these structures are not permitted since they prevent maintenance activities.

## Tips for installation

To install a pole or a post for a bat house, consider fixing one or two short posts in the ground and then levering a tall pole up (see figure below). Another option is to mount an eye hook to the roof of the bat house and then hoist it into position for securement.





INSTALLATION OF A POLE-MOUNTED BAT HOUSE.

## Enhancing Bat Habitat on a Community Scale

Community considerations for bat conservation should emphasize habitat conservation and restoration, including planting of bat-friendly tree species such as cottonwood, in conjunction with discussions about creating supplementary artificial roosting habitat. Communities can take a larger-scale approach, and should definitely consider bat condos. A community event to build many bat houses, a condo, or even a bat barn, can draw upon volunteers for donation of wood, supplying of tools, and labour for construction. These houses can then be erected strategically in the community to ensure a distribution of houses with different microclimates. For example, having two bat houses (e.g. north and south facing) on the same pole may be more beneficial than having each bat house on its own pole away from each other. The community construction of a bat condo should definitely be considered in areas where there is ample foraging habitat to support a large population of bats.

## Frequently Asked Questions About Bat Houses

### Do all bat species use bat houses?

No, many species of bats in BC only roost in natural structures such as trees, cliffs and caves. However most of the bat species that use buildings, most commonly the Little Brown Myotis, Yuma Myotis and Big Brown Bat, will also use bat houses. One exception is the Townsend's big-eared bat, a rare species in BC that roosts in buildings but requires large cavernous roosts and not the small chambers found in conventional bat houses. In Washington, California Myotis and Silver-haired Bats also regularly use bat houses<sup>14</sup>.



TOWNSEND'S BIG-EARED BATS ROOST IN LARGE, CAVERNOUS STRUCTURES. PHOTO BY PAIGE ERICKSON-MCGEE

### When should I put up a bat house?

Although a bat house can be installed at any time of year, bats are likely to move into a bat house when they first return from winter hibernation in April or May. If the bat house is being installed in combination with eviction, install the bat house at least two to six weeks before the actual exclusion.

### How long until bats move into my bat house?

The success of a bat house depends on the design, location, and whether or not there are bats in the neighborhood looking for a roost site. When a bat house is installed in combination with exclusion of a colony from a building, it has a high chance of being successful. In other situations, it may take time before the bat house is used. Weathering of the wood may influence the suitability of the bat house.

### I've had a bat house for years but never had any bats. Why not?

First, check the bat house design. Does it have a landing strip, multiple chambers, and some sort of "grip" for the bats inside? Is it stained an appropriate colour and placed in a high, open location? Is it a good design for this region, meaning that it has multiple narrow chambers and is quite large? If the bat house is a good design and in a good location, then it could simply be that there isn't currently a colony of bats seeking a summer roost site. However, if a colony of bats is evicted from their roost site, either intentionally (e.g. exclusion from a building), or unintentionally (e.g. a large tree falls down, rock feature

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<sup>14</sup> Greg Falxa, personal communication.

is disturbed), they may require a new roost site. If the bat house appears to be suitably designed and placed yet still not occupied by bats, then leave the bat house for at least three years before replacing it or moving it to an alternative location.

### Are there tricks to attracting bats to bat houses?

Besides ensuring a good design and location for the bat house, there are few other attractants. There is no evidence to support the practice of scenting the bat house with bat guano to improve the likelihood of occupation where a colony is to be excluded. If bats are being excluded from an attic, the bat house could be left inside the attic for several weeks before installing it so that it absorbs the smell of the colony; again, there is no evidence that this is necessary or effective. Guano from other locations should definitely not be applied to new bat houses, in the interest of controlling the spread of any bat diseases or parasites.

### How can I tell if bats are using my bat house?

Look under the bat house for guano after several days of dry weather. If it is difficult to see, lay a light plastic sheet or piece of cardboard under the bat house for several days to catch any falling guano. Alternatively, set up a permanent monitoring structure such as a screen platform. Never place a bucket or any other container that bats cannot get out of under a bat house unless you put in a stick or some other object that bats can use to crawl out. If bats are using the bat house as a day or maternity roost, they can usually be observed departing within 30 minutes of dusk in good weather. In summer, watch the bat house for at least fifteen minutes before sunset to 30 minutes after for signs of use. If bats are using the bat house, participate in the **Annual BC Bat Count**



SCREEN TO CATCH GUANO UNDER BAT HOUSE CAN BE USED TO MONITOR THE BAT HOUSE FOR ACTIVITY AS WELL AS COLLECT GUANO FOR GARDENING (LEFT). PHOTO COURTESY OF GREG FALXA. BC RESIDENTS MONITOR BAT HOUSE AT DUSK (RIGHT). PHOTO COURTESY OF JULIET CRAIG.

### Should I be concerned about the guano under the bat house?

There are no known health risks associated with bat guano in BC. In some areas of North America, a disease called histoplasmosis is associated with inhalation of bird and bat guano. Fortunately there are no documented cases of locally-acquired histoplasmosis in humans or animals in BC, indicating that the risk of acquiring this disease in this province is minimal. However, surveillance for this fungus in bat guano in BC has been limited so if you do have to clean up bat guano, particularly in an enclosed space, spritzing the area with water to keep the dust down and wearing a mask is suggested. For more information on histoplasmosis see [www.ccohs.ca/oshanswers/diseases/histopla.html](http://www.ccohs.ca/oshanswers/diseases/histopla.html).

### Will having bat houses in my yard interfere with attracting birds?

Bats and birds use different habitats for food and shelter so they do not compete. Installing a bat house does not affect attracting birds to your yard and often swallow boxes and bat houses are used in combination for insect reduction.

### Does a bat house require maintenance?

A solidly-built, caulked, and painted bat house will require little maintenance. Wasp nests can be a problem for bats. Limiting the size of chambers to ¾" helps reduce occupation by wasps as does ensuring partitions are built to the roof of the bat house (without a gap at the top). During winter months, check the bat house and remove wasp nests by banging out each chamber using a broom handle or a paint roller extension pole.

### Where can I get a bat house?

Check with your local bat project to find out if there is someone locally selling bat houses, or if your community bat project has funding to cover your bat house materials or donate a bat house to you. Look at your local garden, nature, or hardware store to ask if they sell them, but ensure that they meet the criteria of good bat house designs in BC. See the list of "Bat house Sources" in the Resources section of this document. Another option is to build your own bat house or have someone handy build it for you. Bat house plans are found at the end of this document or on the website [www.bcbats.ca](http://www.bcbats.ca).

### How do I register my bat house?

Please consider registering your bat house to help us learn more about bat preferences! You can find a registration form in Appendix 1, on our website at <http://bcbats.ca/index.php/bat-houses/register-your-bat-house>, or call the Community Bat Program at 1-855-9BC-BATS (1-855-922-2287). We will be interested in knowing what type of house, what colour, how high you mounted it, what direction it faces, how long it has been in place, and if it is occupied by bats.

### How can I participate in the Annual Bat Count?

If you have bats in your bat house or another structure, and you enjoy watching them, please consider counting them as they exit to be a part of the Annual BC Bat Count (Appendix 2). Instructions and data forms can be downloaded from <http://bcbats.ca/index.php/get-involved/participate-in-the-bc-bat-count> or inquire with your local community bat project.

## Resources

### BC Community Bat Program

- [www.bcbats.ca](http://www.bcbats.ca)

### Bat house design and placement

- Bat house Builders Handbook
  - [http://www.batcon.org/pdfs/BHBuildersHdbk13\\_Online.pdf](http://www.batcon.org/pdfs/BHBuildersHdbk13_Online.pdf)
- Bat Conservation International
  - <http://www.batcon.org/resources/for-specific-issues/artificial-roosts>
- Organization for Bat Conservation
  - <http://www.batconservation.org/>
- Bat Conservation and Management
  - <http://www.batmanagement.com/Batcentral/batcentral.html>

### Bat house Plans

- Four-chambered nursery bat box:  
<http://www.batcon.org/pdfs/bathouses/FourChamberNurseryHousePlans.pdf>
- Single-chambered bat house:  
<http://www.batcon.org/pdfs/bathouses/SingleChamberBHPlans.pdf>
- Two-chambered rocket box:  
<http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1001&context=icwdmother>
- Simple rocket box: [http://www.batsnorthwest.org/rocketbox\\_plans.pdf](http://www.batsnorthwest.org/rocketbox_plans.pdf)
- Bat Can (for purchase): <http://batmanagement.com/Ordering/batboxes/batcan/batcan.html>
- Gable vent cover: <http://www.batguys.com/resources/suburban-bat-house.html>

### Bat house Installation

- <http://www.batmanagement.com/Batcentral/boxinstall/install1.html>
- <https://www.batcon.org/pdfs/bathouses/InstallingYourBatHouseWoodenPostSteel%20Pole.pdf>

### Bat house Sources

**Check with your local community bat project first** since there may be a local builder/source.

- Canadian Bat Houses (<http://canadianbathouses.com/>)
- Urban Nature Store (<http://www.urbannaturestore.ca/wild-birding/other-wildlife/bats-bat-houses/>) – the larger models
- Backyard Bird Centre (<http://backyardbird.ca/collections/bat-houses>) – the larger models
- Natural Insect Control (<http://www.naturalinsectcontrol.com/product.php?id=000000307>)
- Lee Valley Tools (<http://www.leevalley.com/en/wood/page.aspx?p=70692&cat=2,51555&ap=1>)  
– bat house needs to be stained an appropriate colour. Available in-store only at Victoria, Coquitlam and Vancouver
- Amazon Canada (several designs – look for key features) e.g. [http://www.amazon.ca/Looker-Bat-Triple-Chamber-House-Triple/dp/B000FLTO6A/ref=pd\\_sim\\_86\\_6?ie=UTF8&dpID=41xeZ3H4huL&dpSrc=sims&preST=A\\_C\\_UL160\\_SR160%2C160\\_&refRID=0N3BEMVC6NCQ8D3ZZ5P2](http://www.amazon.ca/Looker-Bat-Triple-Chamber-House-Triple/dp/B000FLTO6A/ref=pd_sim_86_6?ie=UTF8&dpID=41xeZ3H4huL&dpSrc=sims&preST=A_C_UL160_SR160%2C160_&refRID=0N3BEMVC6NCQ8D3ZZ5P2)

## APPENDIX 1: Register Your Bat House

Since little is currently known about the optimal characteristics of bat houses in BC, we encourage you to report on the success (or lack of success... these data are important too!) of your bat houses. By registering your bat house and reporting on its success, you can be part of an ongoing project to identify the characteristics of successful bat houses. If you have a bat house, please let us know!

You can fill out this form online at <http://bcbats.ca/index.php/bat-houses/register-your-bat-house> , or print it, fill it in, and mail to BC Community Bat Program, Attn: Mandy Kellner, Box 593, Brackendale, BC, V0N1H0 or scan and email to [info@bcbats.ca](mailto:info@bcbats.ca) .

Your name \_\_\_\_\_

Your email \_\_\_\_\_ Your phone \_\_\_\_\_

Nearest town \_\_\_\_\_ When did you install your bat house? \_\_\_\_\_

Did you put the house up as part of an exclusion from your own house? Yes  No  Unknown

Have you ever seen signs that your bat house has been occupied? (check for guano (droppings) below the house, listen for squeaks, or watch the house at dusk – you cannot always see the bats inside)

Yes  No  Unknown

How big is your bat house? (e.g. 80cm\*8-cm\*20cm, 4 chambers) \_\_\_\_\_

What kind of house is it and how many chambers does it have ? (e.g. 3-chamber maternity)

\_\_\_\_\_

What colour is your bat house? (e.g. painted or stained black, brown) \_\_\_\_\_

What direction is your bat house facing ? (e.g. south-west) \_\_\_\_\_

What is your bat house installed on? (e.g. pole, side of shed, side of house) \_\_\_\_\_

How high up is the top of your bat house? \_\_\_\_\_

How much open space is around your bat house (distance to nearest branches, obstacles)? \_\_\_\_\_

How close is the nearest freshwater body (lake, pond, creek, river)? \_\_\_\_\_

Has anyone done any testing to determine which species of bats are using your house?

DNA testing  acoustic surveys  mist net surveys  dead bat sample  no testing

If so, what species were detected?

Big Brown  Little Brown  Yuma  California Myotis  Townsends  I don't know

The Annual BC Bat Count is an important province-wide bat monitoring effort. Volunteers across BC count bats emerging from known roosts 1-2 times between Jun 1 and 21 (before pups can fly) and 1-2 times between Jul 21 and Aug 15 (when pups are flying with their moms). Would you be interested in including your house in the count?

Yes, I would like to participate  Yes, if a Community Bat team member can help

No, my house has never been occupied and is not suitable  No, I do not wish to participate

May we contact you by email or phone in the future to get updates on use of your bat houses? Yes  No

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## APPENDIX 2: Annual Bat Count Information

# Participate in the BC Annual Bat Count



**WHAT:** A citizen-science program in B.C. to annually monitor bat roost sites.

**WHY:** Half the bat species in BC are considered to be of conservation concern. Even the common little brown bat is being proposed for designation as an “endangered” species because of high mortality rates from the disease, White Nose Syndrome. The disease is not yet in BC but is predicted to arrive in the next decade. To be able to effectively manage and conserve bats in the face of the many threats, we need to know how their population numbers are doing year to year. The BC Bat Count will contribute towards gathering this important information.

**WHO:** Anyone who is interested in collecting valuable information to help monitor our bat populations.

**WHERE:** A roost site (such as abandoned houses, attic, barns, church steeples, bridges, bat-houses and other structures) on your property or somewhere else.

**WHEN:** Ideally, participants conduct four bat counts per summer - **two between June 1 and 21** (before pups can fly) and **two more between July 21 and August 15** (when pups are flying and exiting the roost). Doing all four bat counts will allow us to best compare data from year to year and between sites. If it is difficult to do four counts, consider the following options:

- Level 1: **Bat Reporter** - 1 count over the summer (try between July 21 – August 15)
- Level 2: **Bat Tracker** - 1 count between June 1 – 21 and one count between July 21 - August 15
- Level 3: **Bat Enthusiast** – 2 counts between June 1 – 21 and 2 counts between July 21 – August 15

### **HOW:**

- Check [www.bcbats.ca](http://www.bcbats.ca) “Get Involved” tab for most recent data forms and instructions.
- Arrive at your bat roost by sunset. Bats may begin to emerge around sunset and so don’t be late! Some species may emerge closer to civil twilight so don’t worry if it takes a little while to see the first one.
- Count bats for one hour or until it is too dark to see, whichever comes first.
- The air temperature should be at least 12°C with low wind speed. Some bats will not fly if the weather is too cold, windy or drizzly, and roost emergence counts under non-ideal weather conditions will underestimate population size.
- Sit or stand outside so that the bats' exit point is visible from a comfortable distance. More than one person might be needed if bats are exiting from multiple points. Try to have the light sky behind the bats exit point, to make it easier to count.
- Tally the bats as they fly out for their nightly insect-eating. You may wish to use a hand “clicker” to make counting easier, or video the emergence to count later on your screen.

For more information: [www.bcbats.ca](http://www.bcbats.ca) or 1-855-9BC-BATS

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APPENDIX 3: Bat House Plans

## Four-chamber Nursery House

**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') ¾" 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, 1½"  
 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, ¾"

### 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)
1½" 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 ¼" to ½" apart, cutting ½" to ⅙" deep.
3. IF DESIRED, 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 1½" 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 1½" 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 ⅝"- or ¾"-inch HDPE plastic mesh [such as Internet product #1672 (1-800-328-8456; www.internetmesh.net)] and attach every two inches with ⅝" 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.

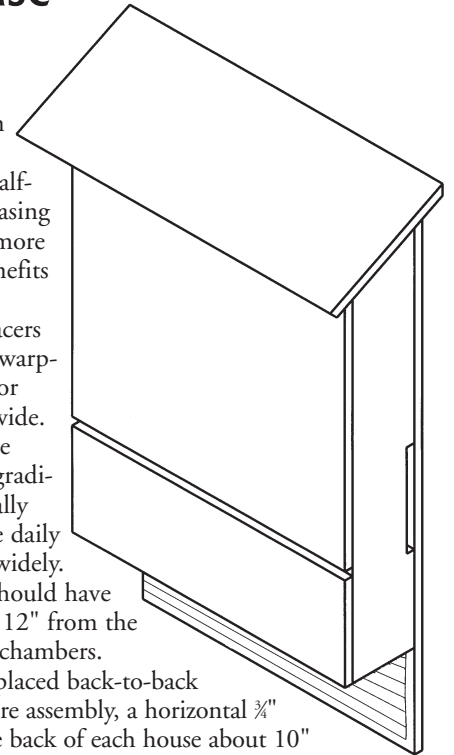


FIGURE 4  
*Four-chamber  
 Nursery House  
 Assembly Diagrams*

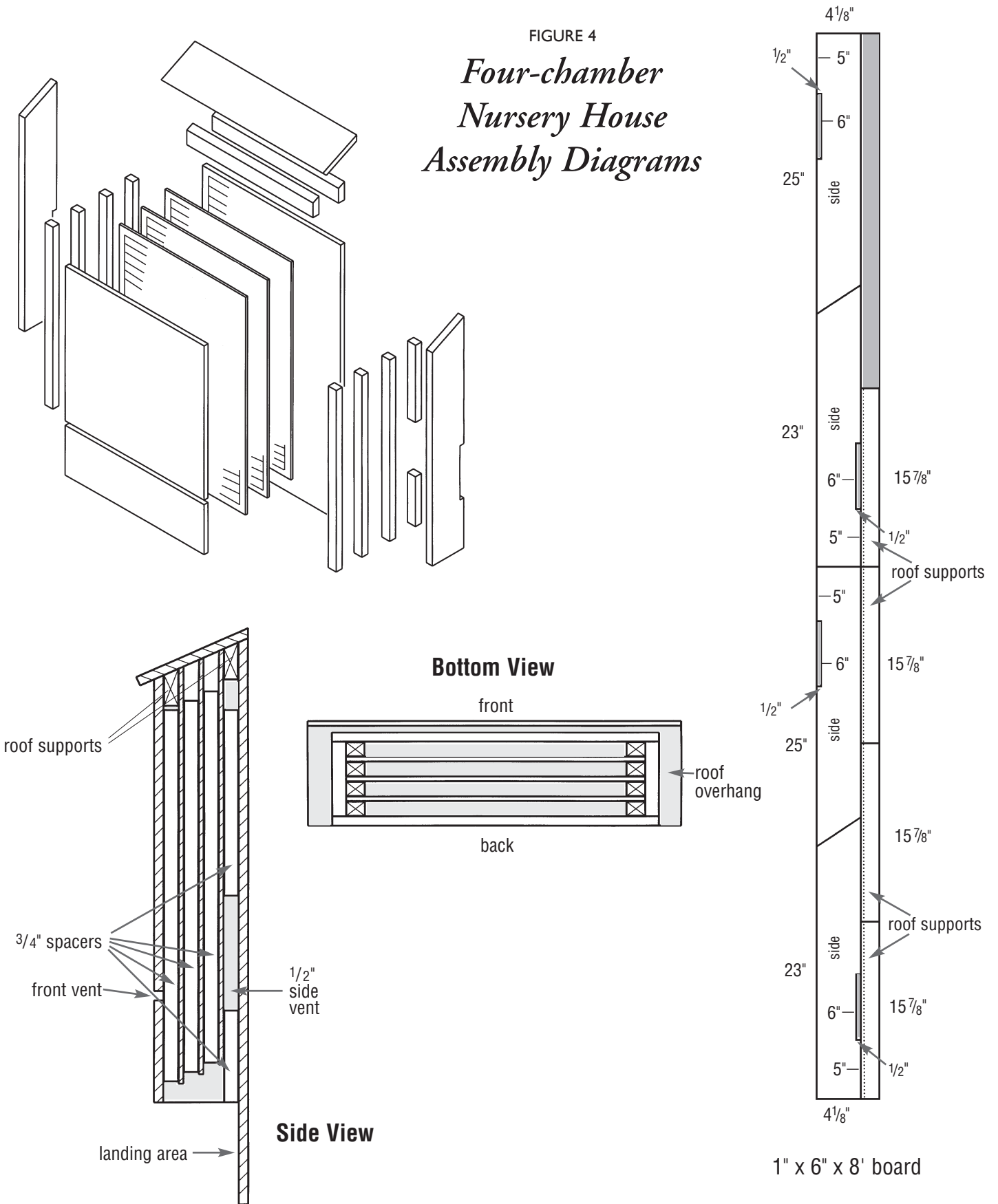
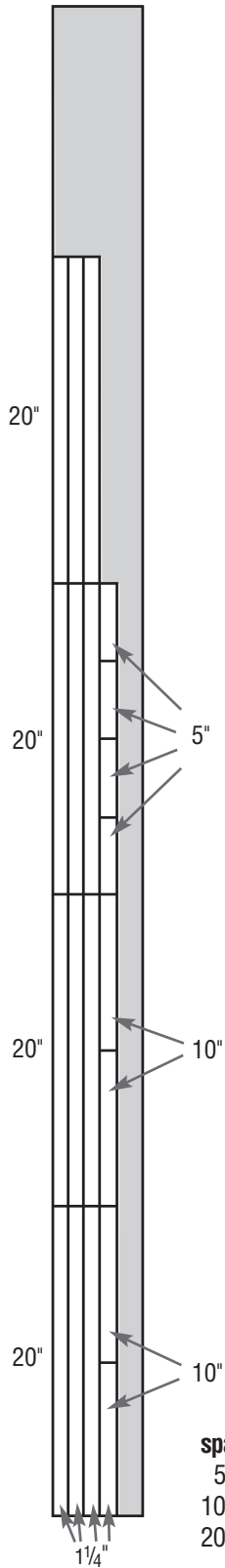


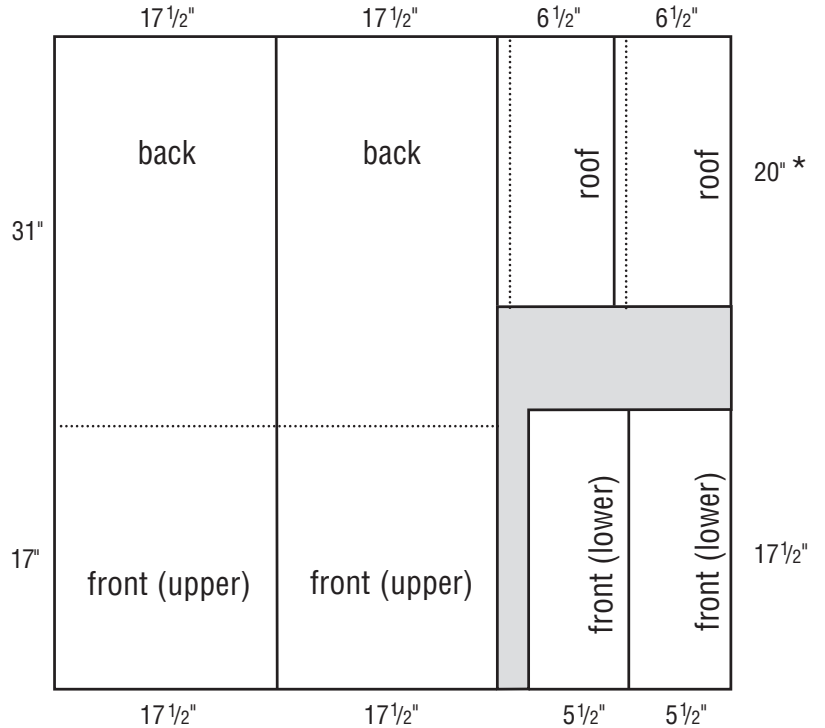
FIGURE 5

*Four-chamber  
Nursery House  
Sawing Diagrams*

extra material  
 25 degree bevel

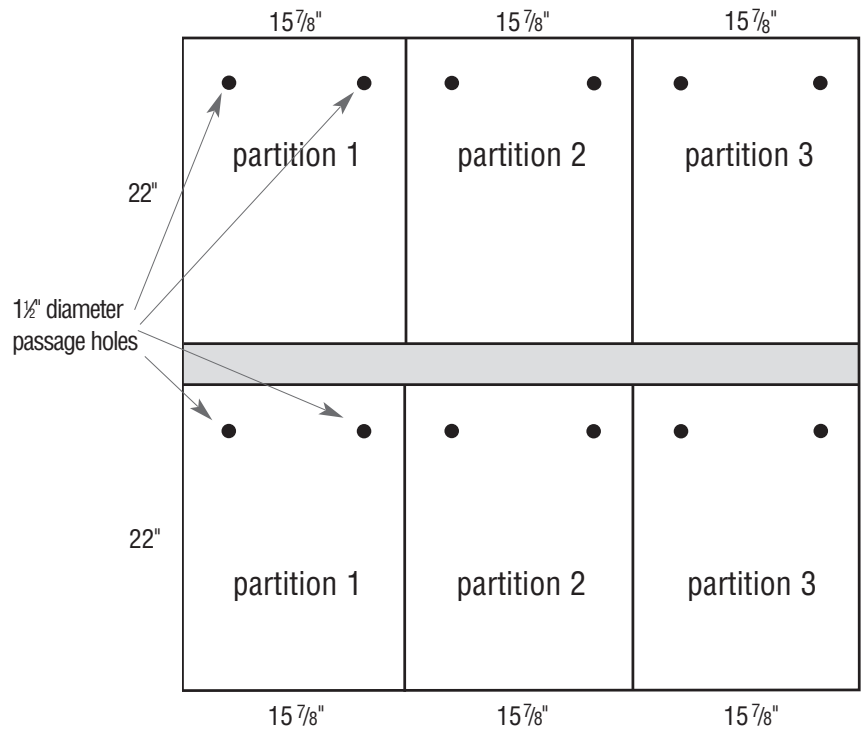


1" x 6" x 8' board



4' x 4' x 1/2" plywood

\* 19" if mounted between two poles



4' x 4' x 3/8" plywood

Plans from: Tuttle, M. D., M. Kiser, and S. Kiser. 2004. The Bat-House Builder's Handbook: Second Edition. Bat Conservation International, Austin, Texas.

## Two-chamber Rocket Box

### Materials (makes one house)

- 2" diameter (2 3/8" outside diameter) steel pole, 20' long
- Two 1" x 4" (3/4" x 3 1/2" finished) x 8' boards\*
- Two 1" x 8" (3/4" x 7 1/4" finished) x 8' boards\*

\* Western red cedar or poplar preferred

- Two 1" x 10" (3/4" x 9 1/4" finished) x 6' boards\*
- 24" x 24" x 3/4" piece of AC exterior plywood
- Box of 100 exterior-grade screws, 1 1/2"
- Box of 100 exterior-grade screws, 1 1/4"
- 16 to 32 exterior-grade screws, 2"

- 20 to 30 roofing nails, 7/8"
- One quart water-based primer, exterior grade
- Two quarts flat, water-based stain or paint, exterior grade
- Asphalt shingles or dark galvanized metal
- One tube paintable latex caulk
- Two 1/4" x 4 1/2" carriage bolts, washers and nuts

### Recommended tools

- Table saw or circular saw
- Caulk gun
- Hammer
- Tape measure
- Square
- Jigsaw, keyhole saw or router
- Sandpaper or sander
- Rasp or wood file
- Variable-speed reversing drill
- 1 1/2" hole saw or spade bit
- 1/8" and 1/4" drill bits
- Screwdriver bit for drill

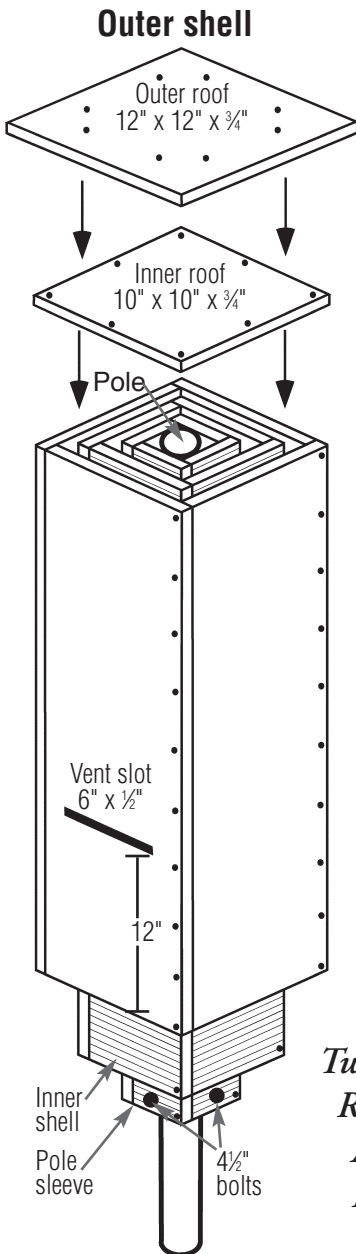
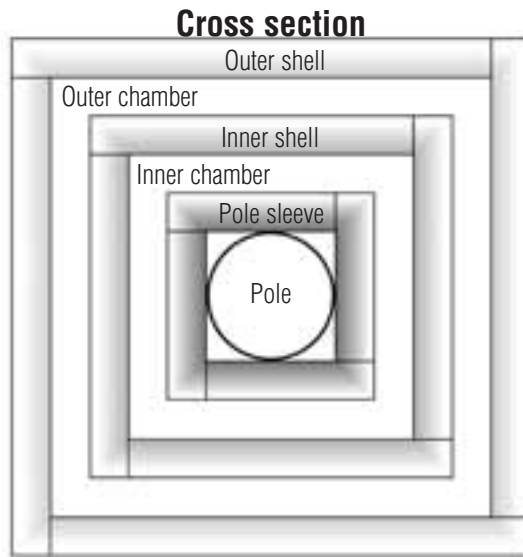
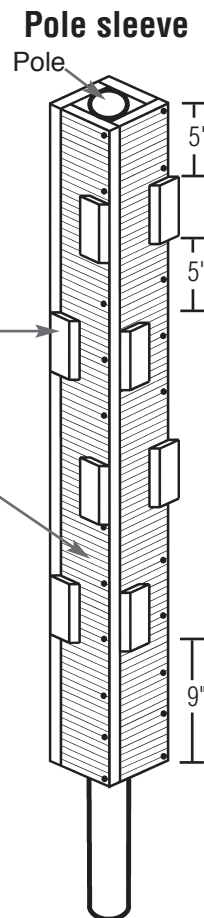
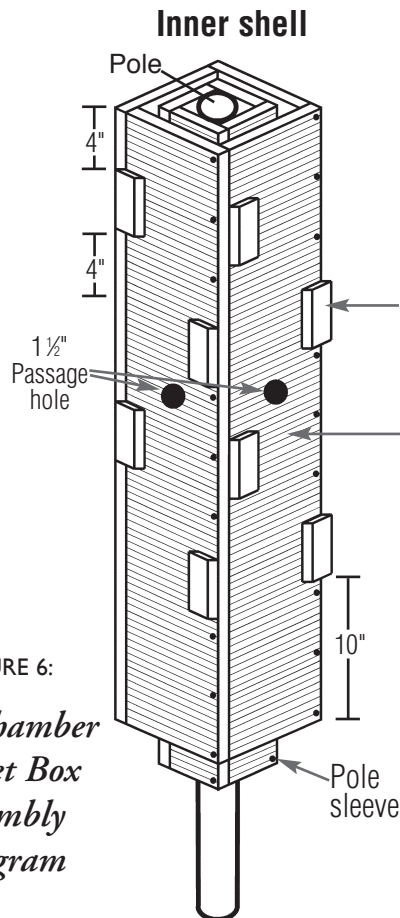


FIGURE 6:  
*Two-chamber Rocket Box Assembly Diagram*



### Construction

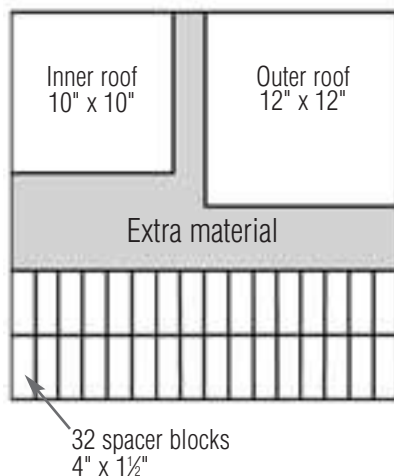
1. Measure, mark and cut out parts according to Figure 7. Dimensions must be exact for correct fit. Cut out two vent slots and four passage holes as shown.
2. Cut 1/6"-deep horizontal grooves 1/4" to 1/2" apart on one side of all 36" and 45" boards and on both sides of all 42" boards. Sand to remove splinters.
3. Drill two 1/8" holes through each 3/4" x 1 1/2" x 4" spacer block to prevent splitting.
4. Assemble four pole sleeve boards into a hollow, square box as shown using 1 1/2" screws and caulk. Pre-drill holes to prevent splitting. Countersinking holes may also help.

5. Attach spacer blocks to pole sleeve as shown (four per side) using two 1/4" screws per block. Bottom spacer blocks are 9" up from bottom of pole sleeve. Top spacer blocks are 5" from top. Alternate spacer blocks on left and right sides, 5" apart.
6. Assemble four inner shell boards into a hollow, square box as in step 4.
7. Slide pole sleeve into inner shell until top edges are flush. Bat passage holes will be towards the top. Mark location of spacer blocks. Secure inner shell to pole sleeve with 2" screws through the spacer blocks to ensure no screws protrude into roosting chambers. Pre-drill holes first to avoid splitting spacer blocks (countersinking holes may also help).
8. Attach spacer blocks (4 per side) to inner shell as shown, using two 1/4" screws per block. Bottom spacer blocks are 10" up from the bottom edge of the inner shell. Top spacers are 4" from top. Alternate spacers left and right sides, 4" apart.
9. Assemble four outer-shell boards into a hollow, square box as in step 4. Vent slots are on opposing sides and oriented towards the bottom.
10. Slide finished outer shell over inner shell, so that 6" of inner shell protrudes below outer shell. Mark locations of spacer blocks. Secure outer shell to inner shell as in step 7 (pre-drill holes first). Ensure that no screws protrude into the roosting chambers.
11. Caulking first, attach inner roof to box with 1/4" screws. Carefully drive screws into top edges of shells to prevent screws from entering roosting chambers.
12. Center and attach outer roof to inner roof with 1/4" screws, caulking first.
13. Paint or stain exterior three times (use primer for first coat). Cover roof with shingles or dark galvanized metal.
14. Slide completed rocket box over pole. One inch up from the bottom edge of pole sleeve, drill a 1/4" hole all the way through pole and sleeve. Rotate box and pole 90° and drill another 1/4" hole, 2 inches from the bottom, through pole and sleeve. Secure box to pole with two 4 1/2" bolts, washers and nuts. Orient vent slots north and south during installation.

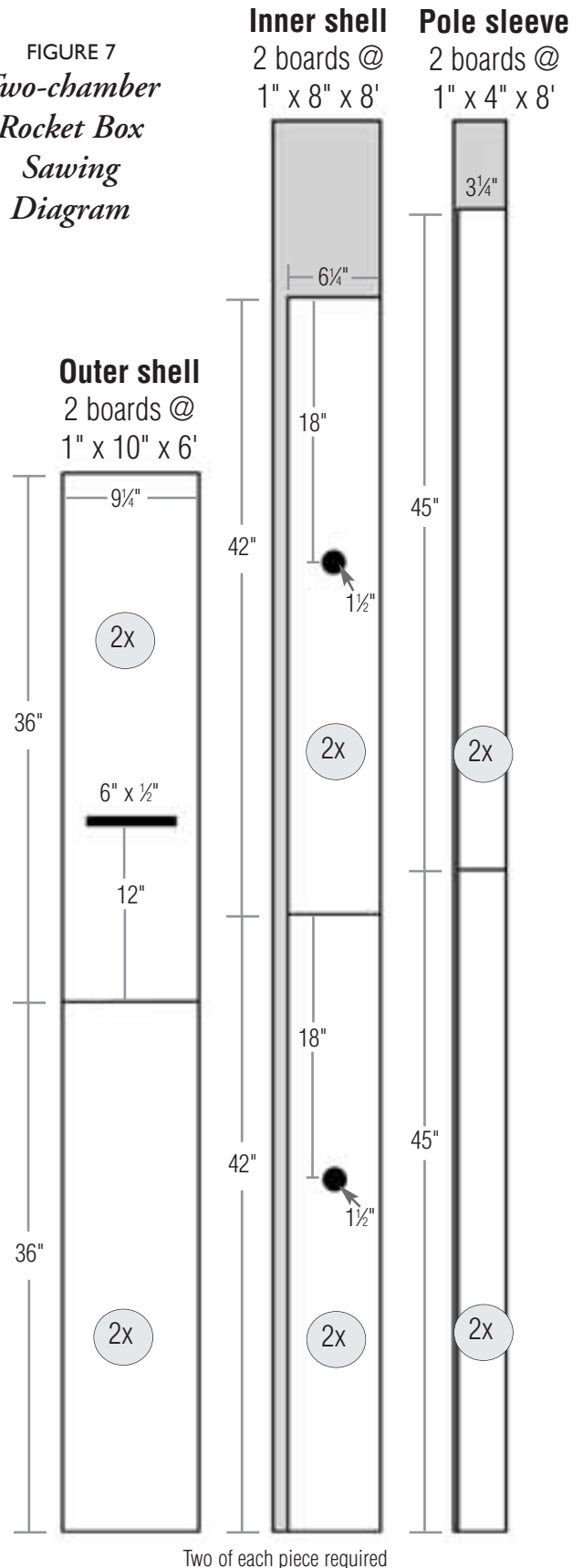
**Optional modifications to the rocket box**

1. For extra mounting height, insert a 4 1/2" bolt and nut about halfway up through pole sleeve after completing step 5.
2. For extra heat-holding capacity, create a compartment in upper half of pole sleeve with a 2 1/2"-square piece of leftover plywood. Fill upper half of sleeve with sand, gravel or dirt, and seal with another piece of plywood flush with top.
3. In warmer climates, a larger outer roof with more overhang can be used for additional shading.

**2' x 2' x 3/4" AC plywood**



**FIGURE 7**  
**Two-chamber**  
**Rocket Box**  
**Sawing**  
**Diagram**



## Single-chamber Bat House (wall mounted)

### 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 to 10 roofing nails, ¾" (if using shingles or metal roofing)

### Recommended tools

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

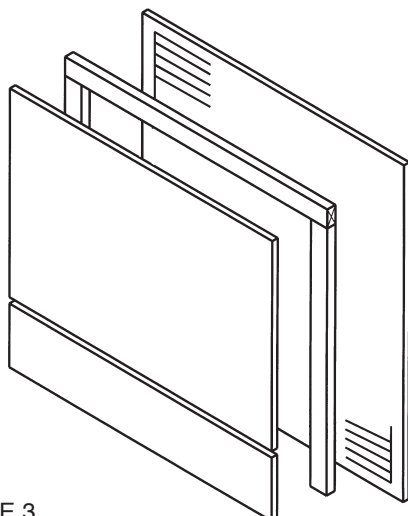
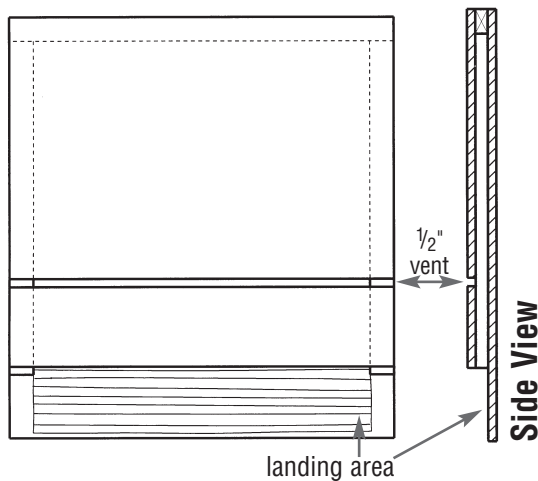


FIGURE 3

### 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 ½" to ⅞" 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 ¼" 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. Details on page 11.