Managing Bats in Buildings

Alberta Guidelines

WCS CANADA

ALBERTA COMMUNITY
BAT PROGRAM

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Acknowledgements

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This guide may be regularly updated. Visit www.albertabats.ca/resources for the latest version. Please contact the Alberta Community Bat Program if you have identified errors or have other comments.

Why help building roosting bats?

Bats are among the top predators of night-flying insects, and are important for maintaining healthy ecosystems. Many pests of forests, crops, and people are among the favourite foods of bats. Their organic control of these pests is estimated to be worth billions of dollars annually to the North American economy (an estimated $23 billion to the U.S. agricultural industry alone).

Bats are unique among small mammals and aspects of their life-history make them a high conservation concern. Unlike mice and other rodents, bats reproduce slowly (usually giving birth to just one pup per year) and live long lives. Unfortunately, human activities have introduced new threats that are negatively affecting bat populations. Among the most serious of these is white-nose syndrome, a disease that has already killed millions of bats in eastern North America and is quickly advancing towards Alberta (see www.whitenosesyndrome.org for more information). Many bats are also being lost because of wind turbines, climate change, habitat loss and degradation, and extermination.

One important action for the conservation and recovery of our bats is to ensure that those occupying buildings can survive and successfully raise their offspring. For some bat species, buildings have potential to offer high quality sites for roosting and raising pups. Buildings may now be critical for supporting bat populations in highly-developed regions of the province where natural roosting habitat has been lost. The federally endangered Little Brown Myotis may be particularly affected because of its affinity for building-type roosts. The improper management of a single roost has potential to deplete the bat population several kilometres from the site.

Many people love bats and encourage them to use areas of their property where conflict can be avoided. However, in some cases, issues such as noise, smell, and guano accumulation can become major challenges for landowners. In many of these cases, the colony has remained unattended for many years, allowing it to become established and substantial amounts of guano to accumulate—regular inspection, maintenance and cleaning could have prevented these issues. Fortunately, bats do not chew through insulation or wiring and often regular cleaning and simple modifications can often allow bats to continue using a building with few problems for owners.

When building owners have reached the conclusion that keeping the bats is not an option, proper timing is key for planned exclusions and building repairs. In Alberta, most active colonies only occupy buildings in summer, although one species (Big Brown Bats) may use buildings for overwintering. Waiting until bats leave the site on their own greatly reduces the risk to bats and is often the easiest, lowest cost and most effective way to exclude bats.

In farmyards, urban areas or other places where habitats have been changed by people by constructing bridges, buildings or other features, there may be ways to alter sites to enhance them for bats. Removing hazards, providing well-designed bat houses, modifying unused buildings for bats, or simply finding a way to keep bats in buildings can benefit local bat populations.

What's in this guide?

Background

A great deal of misinformation exists about bats. Below are some basic bat facts:

- Bats are neither rodents nor pests, and extermination is not an appropriate management tool. Several bat species are conservation concerns, and disturbance or harm may be prohibited under federal or provincial laws.
- Bats are long-lived and have a low reproductive rate. A Little Brown Myotis in Alberta was known to be at least 39 years old the last time it was seen. Most bats in Alberta only produce one pup per year, and not until their second or third year. This slow reproductive rate makes it very difficult for bat populations to recover once a colony is eliminated.
- Of the nine species in Alberta, three are long-distance migrants and overwinter in warmer climates. The remaining species are believed to hibernate in the province during the winter, in places such as deep rock crevices, caves, mines, and occasionally buildings.
- Unlike rodents, bats do not build nests and they do not chew or claw their way into a structure. Instead, they take advantage of small openings or areas of disrepair on the outside of a building.
- Bats are important to our ecosystems and our economy. All bat species in Canada eat insects (and occasionally other arthropods), including pest species that impact agricultural and forestry resources, as well as disease-spreading pests such as mosquitoes.
- Bats are the only flying mammals. They hang upside down to allow them to drop head first to take flight quickly. Unlike birds, many bats have difficulty taking off from the ground to gain flight.
- White-nose syndrome (WNS) is a fungal disease that has killed millions of bats in North America since it was first discovered in 2006 in eastern North America. As of June 2019, WNS has been detected in 7 Canadian provinces and 33 US states, and has now spread to western North America. Entry restrictions for caves, proper decontamination of gear entering caves, and preventing the transportation of bats in RVs and other long-haul vehicles, is critical for slowing the spread of this disease.
- Over half of the nine species of bats in Alberta are of conservation concern due to factors such as wind turbines, habitat loss, and restricted ranges. The Little Brown Myotis and Northern Myotis are considered Endangered in Canada because of high levels of mortality caused by white-nose syndrome in affected regions.

Did you know?

During the summer, a bat may eat more than its weight in insects during a single night of feeding. A large building colony may eat millions of mosquito-sized insects per night.

Most bats only give birth to one pup per year but may live long lives. One bat in Alberta was known to be at least 39 years old the last time it was seen.

Visit the Alberta Community Bat Program website for free resources, including:

- *Information on bat houses, including blueprints for building your own bat house*
- *Guides for building bat-friendly communities*
- *Information on human health concerns and what to do if you find a dead or injured bat*

Bats and People

Never handle living or dead bats with your bare hands. If a bat must be moved, wear thick leather gloves and use another object, such as a pillow case, towel or box, to gently move the bat. If the bat must be temporarily contained prior to release, ensure the box or bag is tightly closed to ensure the bat will not escape once it becomes active.

Bats do not seek out and attack people, but will bite when handled or accidentally touched. Bites require immediate medical attention. When left alone, bats are not a threat to people. If you must move a bat, be sure to wear thick leather gloves to protect from bites.

Visit the provincial wildlife disease webpage for more information on wildlife health concerns in Alberta

Millions of bats live near people and provide tremendous benefits for controlling insect pests. The vast majority of these bats remain out of sight and do not pose a risk to people. However, as with all wildlife, there are important precautions that should be taken to ensure both you and bats remain safe.

Never touch bats with your bare hands. Like many wild animals, bats will defend themselves by biting if they feel threatened, such as when someone attempts to pick them up or reaches into a place they are hiding. Although very rare, there is potential to contract rabies from a bat bite. Rabies is a virus that occurs at very low levels in bat populations throughout Alberta. **Post-exposure shots must be administered as soon as possible after any exposure, or suspected exposure, because once rabies symptoms appear, the virus is almost always fatal.** Bites typically do not leave visible puncture wounds and rarely bleed, so it may be difficult to determine if someone was bitten—if in doubt, always seek medical treatment. Rabies can also be prevented through vaccinations delivered prior to exposure, but regular testing is needed to ensure continued immunity.

The best prevention is to never handle bats with bare hands. Bats do not seek out and attack people. Exposure is typically through accidental contact or deliberate handling of bats. Bats should not be allowed to enter the living quarters of a home, although they can quite often safely use portions of a building where human contact will not occur. Pets should always have up-to-date rabies vaccinations.

Photos in this guide may contain bats being held by hands covered by disposable latex or nitrile gloves. These are worn by bat researchers to prevent the spread of microbes from one bat to another. Most bats can bite through these gloves, and they **do not** provide adequate protection from bites. To protect yourself from bat bites, **leather gloves** must be worn.

Have you or your pet been bitten?

If you come into contact with a bat in Alberta, contact the Provincial Rabies Hotline at 1-844-427-6847 for instructions on receiving treatment (alternatively, contact Health Link at 811). It is important you receive prompt medical attention from a doctor or nurse, even if you are unsure whether you were bitten. Treatment will typically consist of post-exposure prophylaxis, a series of shots that helps your immune system destroy the virus during its early stages. These shots are small injections in the muscle of the arm or leg, much like other vaccinations we commonly receive. Check with your veterinarian to ensure your pet's vaccinations are up-to-date.

Bats and People

Bat guano and urine

Bat guano and urine are typically not health hazards. However, in rare cases, bat or bird feces have been associated with a fungal disease known as histoplasmosis. This disease has only been detected a few times in Alberta, and the risk is likely low in most areas of the province. However, beware that bats are often in areas where other health concerns, such as hanta virus (from exposure to the urine/feces of some rodents), dust, mould, and asbestos may also be an issue.

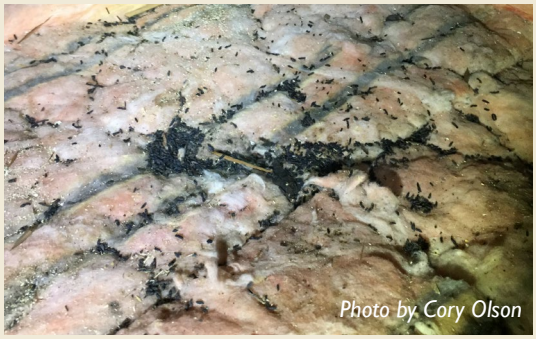
Histoplasmosis is a lung disease caused by the inhalation of the spores of *Histoplasma capsulatum*, which grows in humid conditions in areas with high concentrations of bat or bird droppings. Once the fungus dries, it can be inhaled, and people who inhale the spores may become sick. Most people recover on their own, and may not even be aware they were exposed. More serious health consequences may occur in some situations, especially for those with weak immune systems.

Appropriate respiratory protection, gloves, and coveralls should be worn if disturbing the feces of any wild animal, especially in confined areas such as attics. Wetting an area prior to cleaning (e.g., by using a spray bottle containing a 10% bleach solution) will help reduce the amount of dust generated. Respiratory protection should include at least an N-100 (high-efficiency) respirator for protection from histoplasmosis. **However, buildings with bats are often old and may have other health risks that require additional precautions, such as to prevent exposure to asbestos and rodent-associated diseases** (note that an N-100 respirator does not provide adequate protection from Asbestos). Professional services may be needed for high-risk situations.

Have you found a dead bat?

Do not touch bats, regardless of whether they are alive or dead. Bats may go into a state of 'torpor' during the day, and throughout winter hibernation, which involves lowering their body temperature so that they can conserve energy. This makes bats immobile, and they may appear dead. However, they will become active once they rewarm their body and may still bite.

In some cases, bat carcasses may be accepted by a Fish & Wildlife Office for inclusion in their routine disease monitoring program. Call the Alberta Environment and Parks information line at 1-877-944-0313 to locate your nearest office or visit their webpage. If you need additional advice or assistance regarding living or dead bats, contact the Alberta Community Bat Program.



Guano is often found on insulation in attics where bats are roosting. Protective measures may be required if cleaning, or otherwise disturbing materials in these areas.

Vermiculite used to insulate homes has potential to contain asbestos fibres (a potentially harmful material). Be careful not to disturb this material when cleaning; professional services may be required to prevent exposure.

Mice and other rodents may share buildings with bats. Hantavirus may be passed through the droppings of deer mice (shown above), requiring special health precautions during clean up.

Distressed Bats and Rehabilitation

Visit the Alberta Community Bat Program Website for a listing of wildlife rehabilitation centres that accept bats.

A pillow case can be a useful tool to pick up and contain bats prior to release (leather gloves must also be worn). The pillow case can be used like a glove to gently grab the bat and then inverted (and tightly tied) for containment. To release the bat, the pillow case can be tacked, open side up, to the side of a tree (at least 2 metres high to avoid predators). A healthy bat will likely wait until after sunset and then fly away. Bats can bite through fabric, so always wear leather gloves for protection, and make sure the bat is placed in a location where contact with people will not occur.

Have you found an injured or distressed bat?

Encounters with bats are most often reported during the late summer and fall, when young bats are learning to fly or large numbers of bats are undergoing long-distance movements to their winter habitat. During this period, bats may be found in highly unusual locations, such as the sides of building and under patio umbrellas. **In most of these cases, the best option is to leave the bat alone—it may simply be resting until it can take off again the following night.**

If the bat is on the ground, or in an inappropriate location, it may need to be moved. If the bat does not look sick or injured, it may be placed in an elevated location where it can take off into open flight space and where it is safe from predators such as magpies and cats. Suitable locations may include a decaying tree that can provide hiding spaces for bats (e.g., sloughing bark, cavities, holes, cracks, and breakage). A pillow case can be effectively used to help move and provide cover for the bat until it can be released (see image panel). Thick leather gloves should always be worn when moving a bat. Choose a location near a clearing so the bat doesn't crash once it attempts to fly. The bat will most likely seek shelter and rest until dark. If the bat is still there the following day, you may wish to contact a rehabilitation centre (see the Alberta Community Bat Program webpage for a listing).

Bats exhibiting unusual behaviour, such as flying during the day or lying on the ground, are more likely to be sick (possibly with rabies) and should be treated with care. On hot days, bats flying during the day may simply be getting water and are otherwise healthy. As a precaution, avoid the area where the bat is located and keep pets inside. If necessary, put on gloves, and use a stick, spade, or pillow-case to gently move the bat into an area away from humans and pets.

If you are confident the bat is injured or sick, contact the Alberta Community Bat Program or your local wildlife rehabilitation centre for advice and assistance. Remember to always use safe procedures when handling bats and wear thick leather gloves. Place the bat inside a cardboard box with SMALL air holes and ensure the box is tightly closed. Bats cannot chew through fabric or cardboard, but they are fantastic at finding their way out of loosely closed bags or boxes. Other than to deliver a bat to a wildlife rehabilitation centre or veterinarian, keeping bats in captivity is not recommended or legal—it requires appropriate permits, and is typically unsuccessful without extensive experience and knowledge of animal care. The best option is to contact a wildlife rehabilitation centre.

Bats in Buildings

Buildings and other human-made structures can offer warm, safe shelters for some bat species. Often the warm and dry conditions of buildings make them particularly suitable for female bats to birth and raise their offspring. In addition, buildings can serve as temporary night roosts (places they rest between night time foraging bouts) and migratory stop-overs.

Buildings have become an important resource for some bat species, especially in locations where natural roosting habitat has been lost. In the absence of buildings, most bats in Alberta would have roosted in trees—especially large trees with cracks, crevices, and sloughing bark in which bats can hide. However, in developed regions of the province, these trees are often cut down before suitable roost features develop, making buildings the best available roosting habitat. Although buildings can provide optimal conditions for roosting, bats occupying them are more vulnerable to human disturbance or injury, either by intentional or accidental means.

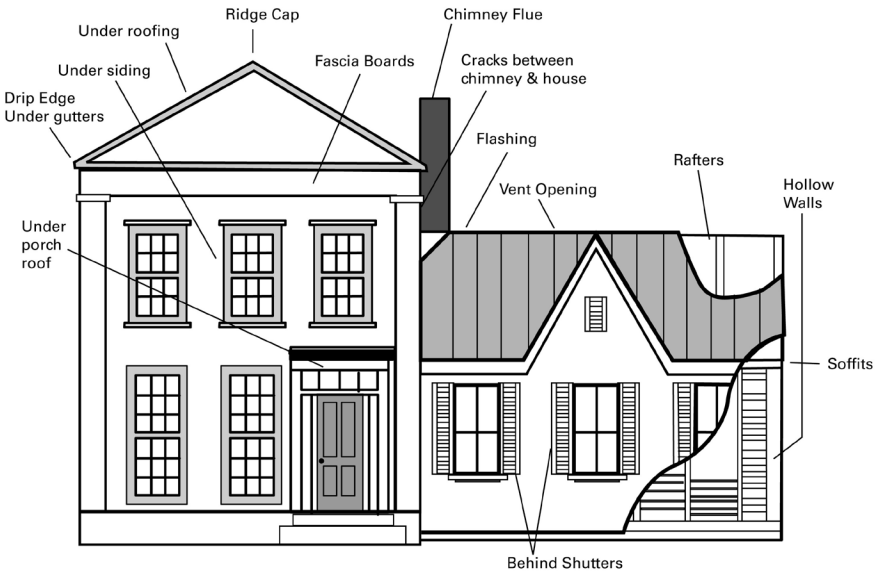


DIAGRAM OF A HOUSE SHOWING POSSIBLE ROOST SITES FOR BATS [1]

Bats may roost in many parts of a building structure including under roofing, siding, fascia boards, flashing and rafters, in cracks of the chimney or walls, behind shutters or under a porch roof. They often occupy tight crevices, and can squeeze into spaces with a diameter as small as 0.5" (1.3 cm). Sometimes bats appear to be roosting inside a house when in fact they are simply under roofing or fascia, and may not cause a problem for the homeowner. Bats don't chew to alter their environment like rodents do, and so they must rely on existing holes or gaps to gain entry.

Did you know?

Bats do not chew holes to access buildings and they do not build nests. They are entirely reliant on pre-existing openings to gain entry.

Little Brown Myotis (*Myotis lucifugus*) maternity roost in a picnic shelter

[1] Diagram prepared by Julianne Leekie for the Kootenay Community Bat Project, based on original drawing by Dr. Stephen C. Frantz, Global Environmental Options, LLC.

Which Bats Use Buildings?

Bat or mouse droppings?

Bat guano is often concentrated in one place whereas mouse droppings are usually scattered. Bat droppings crumble when crushed whereas mouse droppings are hard and not easily crumbled. Bat droppings have shiny pieces (insect exoskeletons) whereas mouse droppings have vegetation. Bat droppings are often in difficult-to-reach locations, such as on top of leaves or stuck to siding.

Comparison of fecal pellet size between Big Brown Bats and Little Brown Myotis. Squares: 2 mm (small) / 1 cm (large).

Big Brown Bat (*Eptesicus fuscus*)

Most bats occupying building roosts in Alberta are either Little Brown Myotis or Big Brown Bats. Long-legged Myotis, Long-eared Myotis, and Silver-haired Bats may also use buildings but are rarely reported, possibly because they tend to roost in smaller groups and go unnoticed.

Identifying Species

Bats are difficult to tell apart without close examination and extensive training. Even experts can have difficulty with some species groups. Recent genetics techniques allow bats to be identified to species from a sample of guano (bat feces). The Alberta Community Bat Program may be able to assist with species identification using guano samples. See the web page or contact the program directly for more details.

Big Brown Bats can be separated from the smaller bats of the genus Myotis (e.g., Little Brown Myotis) based on the size of the fecal pellets. The adjacent diagram may be used as a guide. Bat guano looks superficially like rodent feces, but consists only of digested insects and is often deposited in different locations (see side panel).

Big Brown Bat

Big Brown Bat (*Eptesicus fuscus*) are one of the larger bats in the province, typically weighing between 15-20 g. They are common throughout the southern half of the province, but occur more sporadically in the boreal regions. Nonetheless, their range may extend close to the northern limits of the boreal forest. Big Brown Bats are a common resident of prairie river valleys, and a few have been confirmed to hibernate in deep rock crevices and erosion holes along these rivers. They are the only species in Alberta that appear to hibernate in buildings, although it is unknown how often this occurs. They are the most active bat in the province during warm winter nights, when individuals of this species can occasionally be detected flying outside their hibernaculum.

This species has a broad head and nose and long fur which varies from pale to dark brown. The swollen/puffy appearance of the sides of their nose can be used to distinguish from Little Brown Myotis. Big Brown Bats roost in buildings, as well as in trees, rock crevices, caves, and mines. Colonies tend to be smaller than the Little Brown Myotis, typically fewer than 100 individuals, but sometimes consisting of several hundred individuals. Larger colonies tend to occur in the southern portions of the province, where colonies up to 100 individuals may be common. The species has strong jaws that are well-adapted to eating beetles, but diets also consist of other types of insects, such as flies, midges, mayflies, and moths.

Which Bats Use Buildings?

Little Brown Myotis

Little Brown Myotis (*Myotis lucifugus)*, also called Little Brown Bats, are a common species found throughout Alberta. They commonly roost in buildings, in groups ranging anywhere from a couple individuals up to over a thousand individuals. Other common roost structures include old trees, rock-crevices, caves, mines, bridges, and bat houses. This bat is a medium-sized species weighing about 8 or 9 grams. Like many bats, their fur is a medium brown colour, although some individuals in southern Alberta may have very pale brown coloured fur. Little Brown Myotis appear similar to Big Brown Bats, but are much smaller and lack the swollen sides of the nose seen in Big Brown Bats.

Little Brown Myotis eat aquatic insects such as midges, caddisflies and mayflies as well as beetles, moths, mosquitoes, spiders, and various types of flies. They are a common occupant of cottages and other buildings that occur near water. The Little Brown Myotis has recently been listed as federally Endangered in Canada due to the devastating impacts of White-nose Syndrome in eastern North America.

Little Brown Myotis (*Myotis lucifugus*).

Long-legged Myotis

Long-legged Myotis (*Myotis volans)* are approximately the same size as the Little Brown Myotis and have a similar physical appearance. They may roost in mixed groups with Little Brown Myotis, and may be overlooked in many regions. Recent advances in DNA testing now make it possible to increase the number of reports for this species, but their use of buildings is still poorly understood. Multiple building roosts have been reported in the Rocky Mountains and foothills, suggesting the use of buildings may be common in some areas. The typical size of colonies is unknown, but a maternity roost in Jasper had over a hundred individuals. Long-legged Myotis appear less likely to target aquatic habitats than Little Brown Myotis, instead eating greater amounts of moths and foraging for insects farther from wetlands and lakes.

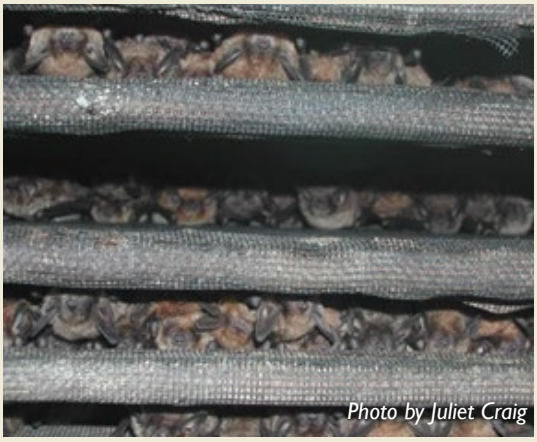
Long-Legged Myotis (*Myotis volans*)

Long-eared Myotis

Long-eared Myotis (*Myotis evotis*) are slightly smaller than Little Brown Myotis, but have substantially longer ears. They are highly manoeuvrable, capable of accessing difficult-to-reach roosts, and can easily glean insects from the surfaces of vegetation. They often roost in rock crevices, but also roost in trees (including stumps) and buildings. The species is not commonly reported, which may reflect their tendency to roost alone or in small groups, where they go unnoticed. In some areas of western Canada they may be common occupants of buildings.

Long-eared Myotis (*Myotis evotis*)

Types of Bat Roosts



Viewing a nursery bat house (maternity colony). Looking up from the bottom.

A night roost along the siding and under the eaves of a shower building in Alberta. Bats depart by morning, but their presence is given away by the guano left behind.

Many bats use the sides and overhangs of buildings as night roosts, and may never enter the building. Homeowners generally experience few problems with night roosts.

Day Roosts

Day roosts (including maternity roosts) are sites where bats gather to sleep and live during the day. They can be used by a lone bat (often a male or non-reproductive female) or a colony of females and their offspring (maternity roost). Usually these roost sites are enclosed spaces where they are protected from inclement weather and predators. Occasionally a bat will roost in the open (such as under the eaves of a building), especially during the fall when bats are migrating. Some day roosts are used intermittently for a few nights, while others may be used continuously.

Maternity Roosts

Maternity roosts are locations where multiple females gather to raise pups and may be used as both day and night roosts. Each female bat typically has only one pup per year but may roost in groups consisting of up to a thousand or more individuals. In most situations, large groups of bats seen in Alberta during the summer months are maternity colonies. Maternity colonies in buildings generally remain stable in number during the breeding season and roosts may be reused over several years or decades. Maternity roosts are usually easy to detect due to bats making audible noise, odour, or guano (i.e. feces), and may include places such as attics, barns, sheds, siding, and other enclosed spaces. Protection of maternity colonies is an essential component of bat conservation. New maternity colonies may form when bats have been disturbed from another site or an existing site is destroyed and its occupants are forced to relocate.

Night Roosts

Night roosts are places that bats use during the night to rest between feeding bouts. These are often in open spaces, such as under bridges, archways above doors, covered patios, and garages. Residents rarely see bats at night roosts but instead observe droppings, and possibly discarded insect parts, each morning where the bats were roosting the night before. The biggest nuisance with night roosts is cleaning up the guano—health risks are usually minor, but see Bats and People. A plant pot can often be placed to collect the guano to avoid having to clean up, or place a shelf or gutter along the wall below the night roost to catch guano before it falls to the floor.

The presence of a night roost does not necessarily indicate that bats are inside the building, and exclusion is typically not required. However, if exclusion is necessary, use can sometimes be discouraged by installing smooth materials (e.g., plexiglass or smooth plastic) in areas that bats are hanging to prevent them from gripping the surface.

Hiring a Pest Management Operator

Information for Property Owners

Who you gonna call?

When you realize that you are sharing your home with a bat colony, there are several steps you can take and information to consider. First, are you willing and able to do the work of managing the situation yourself or are you going to hire someone to do it? If you are going to manage your bat colony on your own, then follow the suggestions offered in this guidebook (especially regarding timing of activities and safety precautions).

If you are going to hire someone to take care of managing your colony, then you should review the guide to ensure that whoever shows up on your doorstep to help does so in a humane and bat-friendly way. Providing them a copy of this guide is recommended.

There are Pest Management Operators (PMOs) who are knowledgeable on the topic of managing bats in buildings in a bat-friendly way, but there are also many who are not and may lack a basic understanding of bat biology. There are some historical methods of dealing with bats that are now considered unacceptable by most people. Be aware of what people are doing on your property and ask questions. Voice your expectation that the colony be managed in a bat-friendly way.

Be sure to consider these factors:

- Is your PMO planning to capture and remove bats? This is a red flag that they are excluding bats at the wrong time of year. Trapping and caging bats is typically only acceptable in situations where bats are distressed and require rescue, or if they need to be removed from human living spaces.
- Use of shop vacuums to suck bats out of spaces, pressurized air to blow into areas with roosting bats, and the use of pressure washers are all unacceptable, unethical, and in some cases illegal. These methods can lead to broken wings and other injuries; pregnant females may abort fetuses due to trauma and stress.
- Sticky traps are unacceptable for controlling bats. Even those intended for bugs or mice may inadvertently capture bats and should be avoided.
- Spray foam (or other sealants) should never be used to block exits, or sprayed into roost crevices, while bats are still present.
- Moving nursing bats and their babies from one site to another ("translocating") is strongly discouraged. Mother bats are very selective about their nursery sites, and translocations are likely to result in the death of the young bats. Many bat species are moving

Information on bats and health risks should be obtained from reliable sources–such as academic literature and government bulletins. Pest control websites often exaggerate danger and provide misleading or incorrect information. For example, diseases such as ebola, nipah, and hendra viruses are not associated with North American bats. Bats also do not create nests and do not chew holes through insulation or wiring.

Photo by Cory Olson

Cimicid bat bugs (shown above) are common parasites of bats ("bat bug" is inconsistently used to refer to a variety of different species). Bat bugs in Alberta are related to the bed bug (*Cimex lectularius*) but are a different species—they are not bed bugs. Bat bugs may occasionally migrate into the living quarters of homes that bats have inhabited, especially after bats have been evicted. These parasites are not known to be a health risk to people; bat bugs biting people have been purported but not verified. The application of insecticides to kill bat parasites may comfort nerves, but may not be warranted if their access into living quarters can be prevented. In the absence of bats, the bat bug (along with fleas and mites that also feed on bats) will eventually die out on their own.

Methods that include poisoning, trapping (e.g. cages, sticky traps), exterminating, moving, or in any other way harming, harassing, or killing bats should never be used.

Spray foam can be useful for preventing access by bats, but should never be used while bats are present. One-way exits are preferred if there is uncertainty whether bats are present inside the roost.

One-way exits are a great option to ensure any residual bats are not trapped inside a home and can provide a safeguard in case there are over-wintering bats. However, the preferred option is to wait until bats leave on their own. Bat pups cannot leave without their mother, so one-way exits are not effective during the maternity season (approximately June 1 to August 31). If bats must be removed during the spring or late fall, one-way exits should be used.

hundreds of kilometres from their winter hibernation site to the place where they raise their young. Relocating animals to new habitats is setting them up for failure, including the likely death of their pups for that year. In some situations this may be illegal. In addition, bats are likely to return to their original roost if access is not blocked, so be sceptical of proposed relocations.

- Poisons, chemical deterrents, and pesticides are strongly discouraged. Bats are mammals just like people. Any materials that are toxic to bats will likely be toxic to people. Bat roosts are most often located in the uppermost areas of buildings, which means any pesticides applied may eventually migrate down into the human living spaces. Bats that are weakened from toxic chemicals may also be more prone to illnesses, including rabies.

Timing is Everything

The most important feature of any plan to manage a bat colony is to wait until the appropriate timing window (when bats are absent) and then performing any actions (cleaning, replacing insulation, sealing up entry/exit spaces) after confirmation that all bats have left the roost space. If you are hiring someone to manage your bat colony, direct them to this guidebook and be clear that you expect them to use the guidance here as the "best practices" for managing bats in buildings.

After making your preferences clear, work with your Pest Management Professional to assess your situation. Where are the bats roosting in your building? How old and porous is your building? Can you successfully exclude the colony? Some buildings are almost impossible to seal completely (especially older buildings). Is it possible to set up the roost space so that it is easily cleaned and sealed completely from other parts of the house? Does the colony need to be excluded or will other options meet your objectives?

If exclusion is the only solution for your situation, it is usually preferable to offer alternate roosting habitat as soon as possible. Setting up bat houses well in advance of the exclusion can give bats the chance to "check out" their options for roosts outside the building. Be aware that in most situations your home will be a much better quality roost than a bat house, so bats may not choose to stay on your property even if bat houses are installed.

Ensure exclusions are done after bats have left for the year and are not in the building (see Timing an Eviction or Exclusion). The exclusion process sometimes requires multiple attempts, potentially occurring over a few years.

Options for Managing Bats

There is a wide range of public perceptions about bats. Some fear bats as potential vectors for disease, while others love bats for their important role in controlling biting insects and pests of gardens and crops. Most of the negative reaction towards bats is unfounded—bats are no more dangerous than other wildlife when properly managed. The US Centre for Disease Control (CDC) states that "some bats live in buildings, and there's no reason to evict them if there is little chance for contact with people". For basic precautions, see Bats and People.

The US Centre for Disease Control (CDC) states that "some bats live in buildings, and there's no reason to evict them if there is little chance for contact with people"

Many buildings are valuable as locations for bat maternity colonies. These locations may provide superior conditions for raising pups, resulting in faster growth and more time to prepare for winter. This may become particularly important if white-nose syndrome decimates Alberta's bat population, as has already occurred in the east. The best option for the bats is to allow them to continue using the building, provided there are no issues that cannot be mitigated.

Photo courtesy of Parks Canada / Palisades Centre

Bats such as these Long-legged Myotis rely on buildings as sites for raising their offspring. They typically return to the same site each year, potentially for many decades.

The problems that can be associated with bats in buildings are often a by-product of bats rather than the bats themselves. Although many homeowners have no problems, issues may include:

- guano – may accumulate in/on attics, crevices, decks, porches, etc.
- noise – typically in walls
- smell – urine accumulation, permeated insulation
- markings or stains – accumulation of oils, guano and urine
- health concerns – see the bats and people section

In many cases, concerns can be mitigated to the homeowner's satisfaction, such as by placing a plastic sheet or drop cloth to collect guano, or sealing off the entry points of bats into human living spaces. However, in some cases, bats may need to be excluded from a building, such as if guano accumulation cannot be controlled and is causing property damage, or if there are ongoing hazards to the bats. When exclusions are necessary, they should be appropriately timed to avoid stressing or trapping reproductive bats or their pups. Preventing entry into living spaces can be completed at any time of the year.

Capturing and relocating bats is not an appropriate option for managing bats in buildings. Bats are capable of travelling 100's of kilometres to return to their roost, and relocations may contribute to the spread of bat diseases (such as white-nose syndrome) to new areas. Forced eviction may result in reproductive failure and the death of any trapped bats.

Installing a bat house, or enhancing roosting habitat in a more appropriate building, can help reduce the negative effects of exclusions on a bat colony. Alternative accommodations should be installed well in advance (ideally 1 year or more) of exclusion to allow bats to become familiar with their location. Bat houses may help increase the success of exclusion programs by providing alternative roosting options for bats. However, buildings are often among the best available habitat, and bats rarely move out voluntarily (although most bats do not overwinter in buildings, and none overwinter in bat houses).

Option 1: Leave Bats Where They Are

Some bats, such as these Little Brown Myotis, are welcome occupants of old farmyard buildings.

Patio umbrellas are one of the most commonly reported roosts used by bats during fall migration. If left alone, these bats will often leave on their own within a few nights.

Bats occupying buildings may not need eviction if human living spaces can be protected.

The best option for bats is to remain where they are. Bats select roost sites that have suitable temperature, security, and other features for them. In some cases, bats use a building for many decades with no problem for landowners. Situations where bats can be left where they are may include:

- Bat roosts are in a location such as a shed or barn where guano accumulation is not a major concern
- Bats are using an external portion of a building where guano can be easily cleaned (e.g. behind shutters or external chimney)
- Issues of smell, noise or guano can be addressed while still maintaining bat colony
- Human living quarters are separated (or can be) from the roost
- Exclusion is too costly or otherwise not feasible
- The building is a night roost only

In many cases, such as bats in a barn, shed, or bat house, there are no issues with the bat colony and no action is required. Landowners are often happy to have bats on their property to assist with insect control or to promote backyard biodiversity. In other cases, landowners may wish to maintain the colony but need to deal with issues of noise, smell or guano or bats entering human living quarters. Exclusion may be required if there are hazards to bats or people that cannot be addressed.

Sealing Human Living Quarters

Bat-human contact can be prevented by ensuring that all openings between the bat roost site and human living quarters are properly sealed. Bats typically enter the building and go straight to their roost location. Bats do not go exploring through the house as mice do. Entry into human living quarters is typically the result of bats falling down a chimney or other chute and not being able to climb out (see Eliminating Hazards section) and/or pups getting into trouble when they are learning to fly (usually in late July or August). It is important to ensure the interior of the home is sealed so that all potential entries are blocked. Bat-proofing the human living space (i.e. providing "interior seals") can be carried out at any time of year.

The first step in this work consists of locating openings (typically areas where air flows) leading into the living space from attics, garages, walls, or any place that bats are roosting. Entry/exit points can be as small as 15 mm (5/8") round, or for oblong openings, 6 mm (1/4") wide and 19 mm (3/4") long.

Option 1: Leave Bats Where They Are

Likely openings may include:

- attic hatches and doors (including gaps around and under doors)
- fireplaces, furnaces, and chimneys
- around piping or plumbing
- open windows or loose windowsills
- openings around air conditioners. fans, and ducts
- screens in disrepair
- pet doors (possibly brought in by cats)

Seal gaps (e.g. with caulking, spray foam, weather stripping or screening) where bats and guano can enter living quarters, particularly around chimneys. Sealing off roost sites from living areas will reduce the entry of odours and guano and prevent bats from accessing the rest of the house. Once you are confident bats are no longer in the building, prevent access to chutes, ducts and vents by blocking their initial point of access into the building (e.g., use properly designed chimney caps, vent covers, sealant, etc.). Do not seal chutes and ducts at the bottom because bats may fall inside and become trapped, resulting in high bat mortality (see Eliminating Hazards section). Bats can only climb up rough surfaces and cannot fly straight up, thus bottom-sealed chutes can be death traps. If chutes or ducts cannot be screened off, then consider providing a rough surface ramp for bats to crawl up and out. Identifying bat entry and exit points will help ensure that modifications do not interrupt bat access to the roost. Although bats cannot chew through spray foam or other sealants, layering with steel wool may be required to control rodents.

Mitigating Guano and Smell

In situations where bats do not have contact with people, the primary issue is usually containment of guano. Containment can often be achieved at relatively low cost. It is also often the best option when exclusion from drafty buildings is virtually impossible. There are strategies to address these issues without excluding bats.

- Accumulated guano can be removed annually after the bats have left for the season. Use appropriate respiratory protection in dusty enclosed areas, especially if there is loose insulation or an unknown amount of mouse droppings. Guano can be used as a garden fertilizer since it is rich in nitrogen.
- Insulation stained by guano or urine can be replaced and plastic drop sheets and/or plywood can be inserted under roost(s) to catch guano and facilitate annual removal.

Ensure that any modifications to the home adheres to the Alberta Building Code and Alberta Fire Code. These codes ensure that homes meet minimum requirements for safety, health, accessibility, fire and structural protection of buildings, and energy and water efficiency.


Photo by Juliet Craig


Photo by Juliet Craig

Modifications for bat roost sites including plastic sheeting in attics to facilitate guano removal and reduce smell (top) and a tarp hung to prevent guano from falling on hay in a barn (bottom).

Option 1: Leave Bats Where They Are

Accidental bat traps, including an old paint tin (top), chimney with hatch closed (middle), and fly tape (bottom).

- Attic access for scheduled clean-up can be improved. Consider making a large entry hole, installing pull-down stairs, providing access from the outside of the house through the gable ends, or other such modifications to make it easy to get inside to clean when necessary. Install planks on the floor of the attic to provide a safe walking surface.
- Guano in conspicuous locations, such as on a front entrance or deck, can be deflected or caught by installing shelves, rain gutters or a planter below the roost site.
- Markings on walls can be regularly cleaned. After years of bats coming and going from a roost, the entry area to the roost often becomes stained and this can be cleaned annually (when the bats are absent) if it becomes unsightly.

Reducing Noise

Although the echolocation calls of bats are above the range of human hearing, bats also make vocalizations that are audible to humans. Often these high-pitch squeaks are made for communication between a mother and pup or other members of the colony. The noise level often peaks at dusk just prior to emergence and at dawn when foraging bats return to the roost. Bats roosting in attics are seldom heard unless the insulation is very thin. Improving insulation in an attic can reduce problems with noise. Bats in outside walls or around chimneys are often louder and noticed by homeowners. In both instances, remedial work is expensive or may be ineffective. If the sound is intolerable, then exclusion may be the only viable option.

Eliminating Hazards

Whether you are leaving bats where they are or planning to exclude them, preventing the accidental mortality of bats is critical. Some objects act as unintended bat traps—following these precautions can avoid the unnecessary death of large numbers of bats:

- **Do not place upright and open buckets, tubs, garbage pails, or other objects in or around the roost**. Bats that fall into these objects often cannot get out. Most bats cannot fly straight up and they cannot climb smooth, slippery surfaces—a bucket is a trap. Remove these objects within a bat roost. Where required, provide an exit route, such as a branch, board or other rough surfaced item that can act as a ramp for bats to climb to access open flight space.
- **Do not use sticky fly ribbon, glue traps, bird netting and tape** since bats can become entangled in them.

Option 1: Leave Bats Where They Are

- Control burdock (*Arctium lappa*), especially around known bat roosts. The bats can become entangled on the burrs of burdock and are often unable to escape. Trapped bats will attract more bats.
- Avoid suspended wires that bats may hit. Some bats are also prone to entanglement on barbed wire fences (especially the top strand)
- **Screen off chimneys and seal other chutes at the top** of the structure (e.g. ducts, laundry chutes) that lead below the roost site to prevent bats falling down—be sure bats are not inside when this is completed. Be particularly wary of chimneys that have been "cut off" within an attic space (which allows bats to easily go inside them) as well as other chutes that lead to the basement of the house. These chutes may provide access to the human living quarters. If the chutes are sealed at the bottom, bats that fall down them will become trapped. Extremely high bat mortality may occur because the calls of distressed bats will attract more bats.
- **Ensure there are exit points or coverings in garden ponds, water troughs and rain barrels.** Bats drink while in flight and are occasionally knocked into the water due to unforeseen obstacles. If there are no escape options, they may drown. Suitable escape options may include wood ramps, boards or logs (ideally at a 45 degree angle or less). Covering wood in mesh will ensure a good grip for bats to climb.
- **Keep your cats inside**, particularly at dawn and dusk. Domestic cats are very good hunters and regularly prey upon bats. Keeping your cat indoors can reduce unnecessary bat mortality. Bats did not evolve with predatory cats so it is not natural for bats to avoid these voracious hunters. Cats can hear the bat echolocation calls and are effective and efficient predators of bats. Although rabies is a low-risk, cats can become infected after contact with a bat so it is best to keep cats from preying on bats.

Burdock is an invasive exotic plant in Alberta that is capable of killing large numbers of bats. Once a bat becomes stuck on the burrs, it will call for help from other bats, which may also become trapped.

Rain barrels and other tanks should be covered to avoid trapping bats, which may unsuccessfully attempt to obtain drinking water.

For more details on designing bat friendly water sources, download Bat Conservation International's Water for Wildlife guide.

Option 2: Exclude Bats


Photo by Cory Olson

Most bats do not use buildings during the winter. However, Big Brown Bats (shown above) occasionally hibernate in the cooler parts of heated buildings. It is important to determine if this species is present, and if so, to determine whether it is a summer and/or winter occupant. Use of one-way exits is recommended if this species is found roosting in a heated building. Identifying exits during the summer months will help identify locations where one-way exits are required. Consultation with the Alberta Community Bat Program is recommended.

Are there bat deterrents?

Various non-lethal deterrents have been used in an attempt to exclude bats, often with limited or no success. Ultrasonic deterrents are typically ineffective, and may even attract bats. Artificial lighting may cause bats to move to more shaded areas, but they often resist leaving once they are established. Adding structural clutter (e.g., streamers dangling from the roof) may persuade bats to move, but not necessarily to a different building.

Exclusion involves blocking the entry and exit points of a roost (while bats are not present) to prevent future use of the building. The disadvantage of excluding bats is the reduction of insect control. Excluded bats may have reduced reproductive success because they are forced into lower quality roosts.

Proper timing of exclusions, combined with the installation of bat houses, can help minimize the harm to bat populations when exclusions are necessary. Exclusion may be the best option if:

- Bat issues cannot be addressed (e.g. guano is inaccessible)
- There are too many gaps into the human living quarters to prevent bat-human contact
- A major renovation or demolition is planned
- Bat hazards cannot be addressed and/or bats are regularly dying

Assessing Feasibility of Exclusion

It is important to assess whether an exclusion is feasible before trying to carry it out. How 'tight' is the building? Are there lots of cracks and crevices allowing entrance to the building space or just a few? In some cases, such as cedar shake roofs, corrugated metal roofs, log houses, and A-frame houses, exclusion is extremely difficult or costly. It may be more realistic to exclude bats from a certain portion of the building and let them remain in another section.

Seven Steps to Exclusion

Bat exclusion must be carefully timed so that bats are not present in the roost. Simply waiting until bats fly out at dusk and blocking the holes is not appropriate. Adults and young bats that cannot fly may still be present in the roost site at all times of the day or night.

Excluding bats from buildings requires the following 7 steps:

Step 1: Know the Basics

Misconceptions about bats can lead to unnecessary or poorly managed exclusions of bats from property. Bats are important components of healthy ecosystems, and provide tremendous benefits to people. Their slow reproductive rate makes bat populations slow to recover from human caused mortality. Bats in buildings typically pose little threat to the safety of people or animals provided they are not allowed to enter living spaces and are not handled. In some cases, harming bats may be illegal.

Option 2: Exclude Bats

Step 2: Assess the Situation

Before excluding bats, you should know where bats are roosting, the species, and whether it is a day roost, night roost or winter hibernation site. This will help determine if eviction is necessary, whether other options exist, and the best way to go about the eviction.

Step 3: Protect Human Living Space

Protect human health by preventing bats from entering human living spaces. Seal gaps (e.g. with caulking, aerosol foam, weather stripping or screening) where guano and bats can enter living quarters, particularly around chimneys. Entry/exit points can be as small as 15 mm (5/8") round or 6 mm (1/4") wide and 19 mm (3/4") long. Sealing living spaces can be done at any time of year, but ensure bats are able to leave the building through exterior exits.

Step 4: Identify Entry and Exit Points

Identify any space large enough for a bat to enter walls or the roof of the house. Look for areas of disrepair, such as where siding or flashing leaves gaps in walls or attics. Inspect your attic during the daytime to see if any daylight is visible through the roof. Watch your house for an hour, starting at sunset, to see where bats are exiting the building.

Step 5: Install Bat Houses Prior to Exclusion

Bat houses can help mitigate the effect of exclusion on bats. More than one bat house is recommended, with units mounted in both sunny and shaded locations. Warm bat houses in spring can jump-start the development of the bat fetus, but these sunny roosts may be detrimental later in the season when bats may over heat. Bats in bat houses that get a lot of sun on hot summer days can move to cooler (shaded) boxes if available nearby. Large multi-chambered designs are recommended. See www.albertabats.ca/bathouses for more details.

Step 6: Install One-way Exit Devices

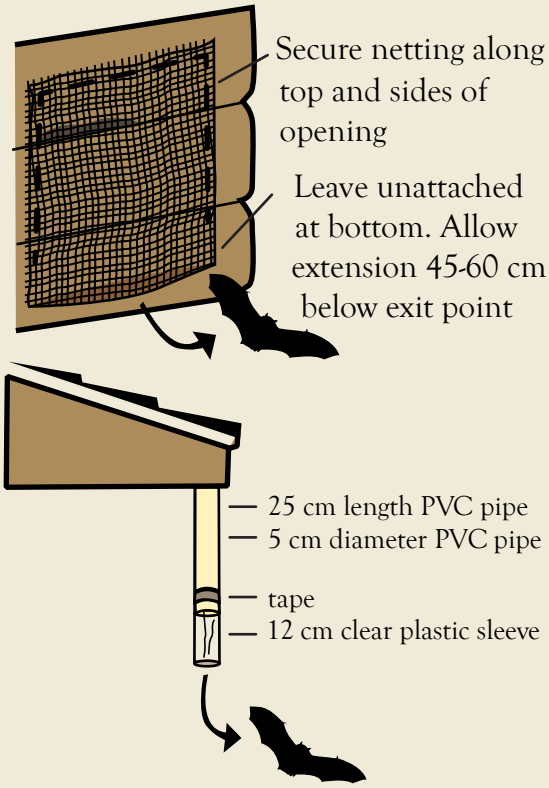
If you cannot confirm whether all bats have left the building, then one-way exits are recommended (see side diagram). These exits allow bats to exit, but not re-enter a roost. One-way exits should only be used outside the maternity season because dependent pups cannot leave a roost on their own. In Alberta, Big Brown Bats may hibernate in heated buildings during the winter. If this species roosts in your building, providing one-way exits until the following year is recommended.

Step 7: Seal Roost to Exclude Bats from the Building

Once bats have left for the winter (see timing), seal any potential entry points for bats into the building, such as by using caulking, aerosol foam, weather stripping or screening. If required, clean up bat guano after exclusion (wearing respiratory protection), and inspect the following year to make sure exclusion was successful.

Photo courtesy of Parks Canada / Palisades Centre

Bat pups, such as those of the Long-legged Myotis shown Above, are unable to fly, and stay behind in the roost while the mothers forage for insects. Improperly timed evictions may result in the entrapment and death of pups, or delayed development, leading to reduced overwinter survival.



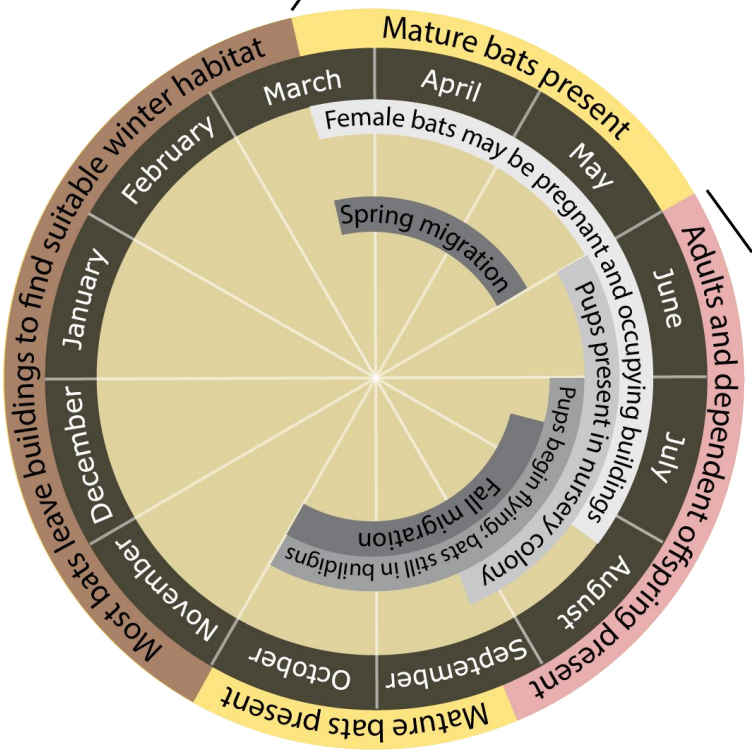
Two options for creating one-way exits for bat exclusion. Upper: fibreglass screen mesh with bottom detached. Lower: tube with mesh bottom to allow bats to exit.

Timing an Eviction or Exclusion

The timing of exclusion is critical to ensure that bats are not inadvertently trapped inside the roost. Evictions and **exclusions should be avoided while bats are present, and should never occur while dependent pups are present** (See Calendar below). Bat pups (young-of-the-year) are typically born in June or July. Pups nurse for about four weeks, ending after they learn to fly and feed on their own. Young bats may not be weaned and able to feed on their own until August, and even later in poor years. Bat pups cannot fly and are left behind in the roost while mothers forage for insects. Attempts to evict or exclude bats while they are still using the roost can result in the death of flightless young, as well as an increase in the number of bats that enter the living space looking for an exit or searching for their mother or young. This may increase the risk of human-bat contact and, rarely, rabies exposure. Exclusion or eviction of pregnant bats may increase reproductive failure, even if no bats are trapped. Bats should not be allowed to enter living quarters at any time of the year.

Even when pups can fly, they may continue to use the roost as a safe place to spend their days, so sealing the roost could still trap bats inside. Waiting until November can reduce this risk, but one species in Alberta (Big Brown Bats) may use the roost throughout the winter. Sealing the roost before bats have left may cause homeowners considerable grief. The trapped bats may attempt to find a new way out of the roost, following wiring and piping ports. Some meet dead ends until they finally die of dehydration and the carcasses begin to putrefy, causing foul odours in the home. Others find their way into the living quarters and then fly around searching for a way out. Neither scenario is welcomed by homeowners.

Bat Activity Calendar



Note: overlapping time frames reflects natural variation and uncertainty in the timing of life-history events

Bats start to become active soon after the snow melts; as early as the last half of March. They arrive already pregnant. Activity increases substantially by mid-April. Exclusion after March 15th risks causing reproductive failure, even if no bats are directly harmed. Exclusion using one-way exits (before June 1) may be suitable if there is concern that bats hibernate in the building.

Pups may be born as early as the first week of June. Pups cannot leave the roost on their own, so one-way exit devices will not be effective. Exclusion should not occur while pups are present in the roost.

Maternity colonies begin to break apart soon after the pups begin flying, but some bats continue occupying buildings until the end of October. Few bats occupy buildings from November 1st to March 15th, making it the ideal time to complete exclusions. However, beware that Big Brown Bats occasionally hibernate in buildings. One-way exits can help ensure these bats are not trapped. If winter use is confirmed, a spring/fall exclusion using one-way exits may be the preferred option.

Option 3: Enhance Bat Habitat

Enhancing Buildings Roosts

Many bats in Alberta are conservation concerns and rely on human buildings to survive and successfully reproduce. Landowners with bats on their property can play an important role in their stewardship and management. Enhancing bat habitat should be considered if:

- Bats do not create issues for owners, or issues can be addressed
- Landowners have an interest in environmental stewardship
- Landowners would like increased insect control or other benefits of a healthy bat colony
- The enhanced habitat will be available for the long-term and be safe from threats such as vandalism, cats, and human disturbance

Bat roosting habitat may be enhanced within an existing roost site or by adding features to the property.

Within building roosts

Enhance crevices

Bat species that roost in buildings in Alberta prefer small (about 1" or 2.5 cm) crevices. Increasing the number of crevices will provide increased roosting habitat. For example, attaching plywood to rafters (to create a gap between the two) will provide additional crevice space.

Enhance grip

Bats require a rough surface for landing and hanging within the roost. Roughening surfaces where bats could potentially roost may allow access to spaces that were previously unusable. For example, where wood is slick, roughen the surface with sandpaper or by cutting grooves.

Increase darkness

Some roost sites become unsuitable when too much light is present. Increasing darkness may create a more favourable site. Fixing roofs that are in disrepair, screening or blocking windows, or creating smaller "rooms" within an attic of a house, barn or shed may create darker roost areas. Keeping the gable ends partially open can help attract bats into outbuildings as some species appear to prefer the larger opening.

Installation of a four-chambered bat house on the side of the building prior to sealing the roost.

Roosting structures installed in the attic of an old barn that are used by a colony of more than 1,000 Little Brown Myotis.

Option 3: Enhance Bat Habitat

Backyard Biodiversity and Bat Houses

Rocket boxes (left) and back-to-back four chambered bat houses (right) are excellent bat house designs and can be located in areas where guano will not cause problems

> *Not all commercially available bat houses are suitable for bats in Alberta. Before you purchase a bat house, or build your own, ensure it meets minimum design requirements. See www.albertabats.ca/bathouses for more details.*

Outside the building

Backyard Biodiversity

Bat habitat can be enhanced in the backyard for all bats, not just building-roosting bats, by maintaining or increasing trees, other plant species, and water features. Trees are important resources for roosting, and many types of vegetation are needed to provide habitat for their insect prey. Trees that are older and larger (tall and/or large diameter) tend to be preferred, especially those with peeling bark, cracks and crevices suitable for roosting. Because suitable roost trees are often beginning to decay, managing tree roosts usually entails trying to balance the needs of bats with the safety of people.

Bats drink from the water's surface while in flight. Drinking habitat includes any calm waterbody (small or large) with clean water, open space above and an open flight path. Bats often attempt to use water troughs, rain barrels, and other water receptacles, but the small size and smooth surfaces of these features frequently results in bats becoming trapped. These features should be equipped with a log or ramp that extends into the water and reaching into open flight space, so bats can climb out if they accidentally drop into the water. Avoid the use of fencing directly above the trough, especially wire fencing, which bats have a hard time detecting.

See the "Building Bat Friendly Communities Guide" for more details on enhancing habitat and managing hazards around buildings.

Bat houses

A bat house (or bat box) is a human-made structure designed to provide bats with a warm, dry and safe roost site. Similar to birdhouses, they are often wooden "boxes" that can be installed in a garden, on a building, on a tall post in an agricultural field, or in other openings.

Bat houses are a good option in areas where human developments have degraded natural roosting habitat, such as locations where forests can no longer establish, or where decaying living trees and snags have to be cut down for safety or aesthetic reasons. Bat houses can also help mitigate the effects of excluding bats from building roosts, provided they are installed well in advance of the exclusion. An alternative option is to enhance bat habitat in certain buildings where the presence of bats will not cause concerns for property owners (see Enhancing Building Roosts).

Although bat houses can be an effective addition to conservation plans, and provide a focal point for education and outreach, there is currently no evidence that bat houses provide the same high-quality roosting conditions that building roosts and natural roosts provide. There are

concerns that small or single-chambered bat houses may expose bats to more extreme temperature fluctuations than other roosting options, which could lower reproductive success. Heat extremes can lead to the death of non-flying pups who cannot escape hot bat houses. Furthermore, many of our bat species will not use bat houses, and may experience increased competition for resources from bats attracted to these structures.

Before you install a bat house, try to ensure your bat house will provide a net benefit for bats by considering whether the planned location meets **one or more** of the following criteria:

- ❑ The bat house is installed to help manage bats in buildings, such as to mitigate the effects of a required exclusion. Note that it is preferable to retain bats in buildings, separated from human space.
- ❑ The bat house is intended to compensate for roosting habitat that has been degraded and is unlikely to be restored, such as often occurs in urban areas, farmland, acreages, and industrial lands.
- ❑ The bat house is installed in conjunction with restoration of natural roosting habitat and will help bridge the time until tree roosting habitat becomes available.

Consider location, colour, and incidence of the sun when planning a bat house project. Multiple bat houses are strongly recommended, with each designed to provide different conditions. For large projects, a 'bat condo' may provide more effective mitigation for the loss of a building colony (see panel image). These are large structures that better approximate the high-quality conditions of building roosts. However, bat condos can be complex and expensive to build and install, and many of the same benefits can be provided by multiple large multi-chambered bat houses strategically placed around a yard.

Bats typically use roosting areas over many years or decades. Therefore, bat house projects are most suited to situations where bat houses will be maintained and made available to bats for several years.

How do we plan for a successful bat house project?

- **Use an approved design and size for the species of interest.** Although there are several designs of bat houses that are effective in Alberta, many of those sold commercially do not meet minimum guidelines. Large bat houses are recommended because they not only provide added roosting space (Table 2), but also give bats the opportunity to select more appropriate temperatures by moving among the chambers of the bat house, lowering the risk of pups being exposed to extreme hot or cold temperatures. Refer to the Alberta Bat House Guidelines document for detailed information on choosing suitable designs.

Rocket boxes (left) and back-to-back four chamber houses (right) are two commonly used bat house designs.

Bats crowding near the ventilated areas of a bat house in British Columbia to escape intense heat. Pink bodies are bat pups, which are more susceptible to heat stress because of their small size.

> *Not all commercially available bat houses are suitable for bats in Alberta. Before you purchase a bat house, or build your own, ensure it meets minimum design requirements. See Building Homes for Bats: Alberta Bat House Guidelines for more details and installation advice.*

Option 3: Enhance Bat Habitat

Backyard Biodiversity and Bat Houses

Quiet Hills Ranch Bat Condo located southeast of Edmonton.

Visit the Alberta Community Bat Program webpage for more information on region-specific bat house recommendations, blueprints for bat house designs, and guidelines for installing bat houses in Alberta.

www.albertabats.ca/bathouses

- **Follow recommended installation guidelines specific to Alberta.** All bat houses and condos need to be installed correctly to effectively provide bat habitat. Refer to the Alberta Bat House Guidelines for information on suitable installation methods.
- **Install a diversity of different bat house options.** In natural environments, bats may use dozens of roosts over the summer, each with different conditions—bat houses should be no different. Ensure multiple options are available. Face them different directions to provide a range of sun exposures (e.g., full sun, partial sun, and full shade). The bat houses should be within a small area so bats can become familiar with their location (e.g. 100 metre radius).
- **Maintain and monitor.** Bat houses and condos should be maintained and monitored for use, and data on characteristics of the structure and its occupancy by bats can be contributed to the Alberta Community Bat Program. This information will advance our understanding of bat roost preferences, and help improve recommendations in the future. See the Citizen Science section for more information on monitoring and submitting count information.

How many bat houses are needed for my bat colony?

The below table can be used to determine the minimum number of bat houses needed to provide potential alternative locations for building colonies. If combined with exclusion, be sure to provide more than the minimum number needed (base this on counts of emerging bats). Regardless of the purpose, multiple bat houses should be installed to provide a range of different conditions for roosting bats—these should include bat houses in both sunny and shaded locations.

TABLE 2. CAPACITIES OF BAT HOUSE DESIGNS

Bat House Design	Capacity[1]	Potential Roost Quality[2]
Small Multi or Single Chamber[3]	< ~25	Very Low
Single-Chamber[4]	< 100	Low to Very Low
Four Chamber Nursery-House[4]	>300 (328[5])	Moderate
Two-Chamber Rocket Box [4]	300 (<10)	Moderate (or Low[6])
Mini-Condo[7]	1,000+	High
Full Condo[8]	3,000+	High to Very High

[1] Numbers in parentheses are maximum reported occupancy in Alberta
[2] Higher quality bat houses are those that have more variation in internal conditions and are more likely to provide suitable roosting conditions regardless of prevailing weather
[3] Refers to designs below minimum size guidelines (< 61 cm [24"] tall and 43 cm [17"] wide)
[4] Based on designs in The Bat House Builder's Handbook (2013) by M.D. Tuttle, M. Kiser, and S. Kiser
[5] Maximum count at a bat house at the Ellis Bird Farm; similar size to BCI 4-Chambered Nursery House, but wider chamber spacing
[6] Reports of Rocket Boxes in Alberta suggest low to negligible use by bats; more reports are needed
[7] See the Wisconsin DNR (mini) Bat Condo design for an example
[8] Based on the Bat Condo installed in Creston, BC (this condo was found to support 3,078 bats)

Citizen Science

Interested in getting involved with the study of bats?

There is a great deal we do not know about basic aspects of bats in Alberta. The last large-scale examination of building roosts in Alberta was the 1970's, and since that time, there has been major changes in research techniques, building methods, and the conservation status of bats. Bat houses continue to become more common, with better designs being used, yet there have been no comprehensive studies of their effectiveness for promoting bat conservation in Canada.

Many bats in Alberta use buildings, and for two species, buildings may have become the dominant roost type used in developed regions of the province. Most buildings and bat houses are on private land, so public participation in research and monitoring is essential.

As a greater number of observations are reported, we can begin to develop more comprehensive studies, and answer questions such as:

- What species of bats use buildings and bat houses in Alberta and how does this vary by region?
- What are the geographic ranges of building-roosting bats?
- What structures are bats using for roosting, and will they continue to be available as building methods are changed?
- What bat house designs and spatial implementation are effective for bat conservation? How many bat houses are generally needed to promote successful rearing of pups?
- How does reproductive success differ among bats roosting in buildings, bat houses, and natural roost cavities?
- How does the average size of roosting colonies, and the proportion of each species being reported, change through time (especially if white-nose syndrome reaches Alberta)?

The Alberta Community Bat Program has a citizen science project where people with roosting bats can submit findings about their roost for inclusion in a provincial database. These data are used to address research and monitoring priorities in Alberta. Knowing locations where bats roost may be critical if treatments for white-nose syndrome become available.

If you do not have any roosting bats, consider putting up a bat house and reporting whether it is being used. Individual bat sightings (e.g., those seen flying at campgrounds, around street lights, etc.) can also be reported to Neighbourhood Bat Watch (batwatch.ca). If you find signs of roosting bats in public areas (e.g., buildings and picnic shelters in parks), let us know and we may be able to work with park staff or facility managers to monitor the roost.

Unlike mice droppings, most bat guano is concentrated in a localized area. Look up and you may see roosting bats.

Most bat species can be identified to species using a relatively inexpensive genetic test. The Alberta Community Bat Program may be able to have your sample tested free of charge if a roost report is submitted to the citizen science program.

Email info@albertabats.ca or visit www.albertabats.ca/citizenscience to learn more about the citizen science project

Other Resources

Photo by Juliet Craig

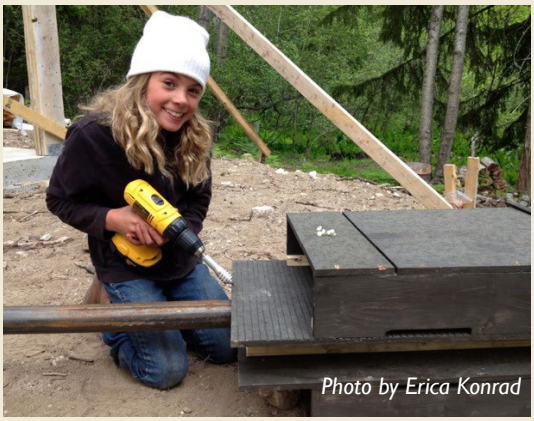


Photo by Erica Konrad

RESOURCES

Community bat programs

- Alberta Community Bat Program: www.albertabats.ca
  - o Documents, posters, and other resources: www.albertabats.ca/resources
  - o Bat house recommendations: www.albertabats.ca/bathouses
  - o Events: www.albertabats.ca/events
  - o Finding a bat: www. albertabats.ca/foundabat
  - o Bats in buildings: www.albertabats.ca/gotbats
  - o Facebook: www.facebook.com/albertabats
  - o Twitter: twitter.com/albertabats
  - o Instagram: www.instagram.com/abcommunitybatprogram
- WCS Canada's BatCaver Program: www.batcaver.org
- Community Bat Programs of BC: www.bcbats.ca
- Neighbourhood Batwatch: batwatch.ca

Removing a single bat from the living space

- Bat Conservation International - There's a bat in my house: www.batcon.org/index.php/resources/for-specific-issues/bats-in-buildings/there-s-a-bat-in-my-house

Information about white-nose syndrome

- Alberta Environment and Parks: www.alberta.ca/white-nose-syndrome.aspxf.ca/wns_regional_outlook.php
- US White-nose Syndrome website: whitenosesyndrome.org

Rabies and other health concerns

- Alberta Environment and Parks - Wildlife Diseases: www.alberta.ca/bats-and-rabies-in-alberta.aspx

Other guides on managing bats in buildings

- Got Bats? A BC Guide for Managing Bats in Buildings: https://www.bcbats.ca/attachments/GOTbats.pdf

Other Bat House Recommendations

- Building Homes for Bats: A Guide for Bat houses in BC: http://www.bcbats.ca/attachments/Bat_houses_in_BC_2015.pdf
- BCI Installing Your Bat House: https://www.batcon.org/pdfs/bathouses/InstallingYourBatHouseWoodenPostSteel%20Pole.pdf

WCS CANADA

ALBERTA COMMUNITY
BAT PROGRAM

email: info@albertabats.ca | web: www.albertabats.ca