



A Farmer's Toolkit:

Managing bats on farms to help with natural pest control services



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South Coast Bat Conservation Society
2020

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Vancouver, BC

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Front cover: Overview of farmland pond that provides foraging and drinking habitat to bats. D. Dagenais

Title Page: Overview of a BC blueberry farm. D. Dagenais; A maternity colony of bats roosting inside a seven-chamber bat box. J. Sarembo

Back cover: Overview of a BC vegetable farm. P. Burke; Townsend's big-eared bat captured in southern BC. P. Burke

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Why are Bats Important to Farmers?

Farms are an important part of our lives. Farms supply residents with nourishment, open space, and even regular air temperature. Farmland also provide habitat for local wildlife. Unlike wildlife pests that consume crops or become nuisances to farm operators, there are several species, such as birds and bats, that pose little to no threats or damage to farms or farm operators. In fact, bats provide beneficial services to farmers in the form of free pest control. This Toolkit describes ways that bats help farmers and provide suggestions to farmers who attract, keep, and manage bats on their property.

Did You Know ?

BC is home to the greatest diversity of bats in Canada, with 15 species

All BC bats feed on insects. They can have an appetite 40 times greater than that of a human! For example, female bats raising young can eat their own body weight in insects each night. An average sized maternity colony in BC can consume up to 2 lbs of insects each night!

To understand the role that BC bats play in our agricultural sector, we conducted a research



D. Dagenais

Overview of a BC vegetable farm.



D. Dagenais

Cabbageworm butterfly; insect pest of BC vegetable farms and confirmed prey of BC bats

project to determine which insects bats eat in the Lower Fraser River Valley. Our research found eight species of bats over farmland crops. We analyzed bat droppings (guano) and discovered 129 different types of insects eaten by bats. This included 80 insect pest species of crops and humans!

Did You Know ?

Bats consume insect pests that damage crops and spread disease.

Our local bats are eating insect pests managed by our local farmers such as cabbageworm, cabbage looper, spotted winged-drosophila, cotton bollworm, black cutworm, aphids, and many more.

With such a healthy appetite for insects, farmers may benefit by encouraging bats to live and feed over farmland. This Toolkit will help farmers, attract, keep, and manage bats on their property. Farmland can be an ideal home for bats. Bats consume insects over crops, drink from water sources, and find roosts in trees and buildings on agricultural lands. The proximity of food, water, and shelter on farms reduces the energetic demand of bats, making these areas appealing to them.

There is a strong need to protect BC bats. Our bats face many *threats* and require habitat and protection. By helping local bat populations, farmers can ensure that bat services to farms remain for years to come.



J. Kazuta

Little brown bat, endangered in Canada due to white-nosed Syndrome.

Did You Know ?

Many populations of hibernating bats in North America are dying from a disease known as white-nose syndrome. The disease has killed over 7 million bats and has caused three Canadian bat species to become endangered. The disease spreads every year and is knocking on BC's door.

About this Guide

This toolkit is intended as a reference guide for farmers and indicates the importance of bats to farmland. It was designed to help with the enhancement of bat habitat on farm properties, identify threats and bat conservation needs, as well as to provide means for farmers to build valuable relationships with local bat biologists and bat organizations. The following objectives were set for this toolkit:

1. Provide means for farmers to identify features on their farm that may be used by bats.
2. Help farmers determine ways to enhance bat habitat on their farm to increase natural pest control in the area.
3. List potential threats of bats to farmers that may exist on farms.
4. Identify ways farmers can alleviate threats to protect bats on their property.
5. Outline actions farmers can take to help with local bat management and conservation.

Did You Know ?

Sustainable farm management practices used in BC are already contributing to bat management.

By helping bats, farmers help themselves.

Bats may provide both direct and indirect control of insect pest populations on farms. Any bat-farm management practices will provide environmental and economic benefits to farmers. This Toolkit contains practical measures to be implemented on farms and provides recommendations that can be applied by farmers to ensure healthy bat populations. The following seven sections identify management practices that can be applied on the farm to attract and/or protect bats. A list of resources is provided at the end of the document for further information.

We hope this Toolkit encourages farmers to engage with the management and conservation of bat species using farms in BC.



D. Dagenais

Overview of a BC vegetable farm.



G. Sirton

Bats foraging over trees

Managing Buildings for Bats

Farm buildings and outbuildings provide roosting habitat to bats, generally during the spring and summer months. Buildings provide protection from predators and the weather. They are also ideal location for females to raise young, as buildings provide stable warm temperatures needed to support growth. When conditions are favourable, bats will return to the same location year after year. When farmers allow bats to use farm buildings, bats will forage over crops and consume insect pests that damage crops.

Temporary roosts:



- Occupied by one or a few bats
- Used for a few days
- Consists of exposed locations such as: above doorways, under trim, or simply on the wall.
- Require little to no maintenance

Permanent roosts:



- Occupied by colonies of female bats (ten to thousands of bats)
- Used for several weeks or months
- Occupied from April to August
- Consists of well-hidden and secured locations such as: inside attics, under corrugated roofs, under siding or fascia boards, in or alongside chimneys
- Requires a maintenance plan to deal with guano and urine

Did You Know ?

Bat babies are called pups. Most bat species in BC only have 1 pup each year!



D. Dagenais

BC barn that provides a permanent roost for bats every summer.

One of the main issues with bats in buildings is the management of guano. Containment measures, such as tarps and sheeting are commonly used. Sheeting must not sag and be securely fastened to prevent pup entrapment. Once a system is established, little effort may be required each year to clean up and dispose of the guano.

Bats keep to themselves and rarely cause conflicts. Farmers are encouraged to maintain roost sites where possible and minimize disturbances to bats. Roost locations should be discussed with workers and farm residents to minimize human-bat

interactions. These interactions can be further reduced by sealing off living spaces and keep doors and windows closed between sunset and sunrise.

Farmers are encouraged to reach out to the [Community Bat Programs of BC](#) to report roosts and obtain guidance on co-existence with bats. Their website contains many resources such as living with bats,

managing bats in buildings, creating and enhancing bat habitat, and information to connect with regional coordinators. Understanding how to manage roosts will allow farmers and bats to live in unison and benefit from each other.

Did You Know ?

Guano makes an excellent fertilizer and can be used on the farm to help grow crops.



Did You Know ?

Bats also commonly roost on fences, in patio umbrellas, awnings, and in wood piles. Use caution. Special attention to bat signs such as guano in these areas will minimize human-bat interactions.



M. Fisher

Constructing Artificial Bat Roosts

Did You Know ?
One of the greatest threats to bats is loss of maternal roosting habitat.

When farm buildings with bat roosts are scheduled to be torn down or relocated, farmers can compensate for loss of bat habitat by providing artificial roosts. A common practice across BC is to install bat boxes on the property. Bat boxes are specifically designed as a place for female bats to have their pup. As females require specific temperature regimes to raise their young, they will switch between

two or more boxes throughout the summer. We therefore recommend that more than one bat box be installed at multiple locations on a single farm to encourages bats to remain on the property and to provide continued insect pest management. We also recommend installing bat boxes 1 to 2 years before a building is removed.

Did You Know ?
A farm in Oregon eliminated all pesticide applications for corn earworms by attracting bats and birds to the farm using boxes for roosting bats and nesting birds.

In addition to habitat loss, bat boxes can also be used to support growing colonies or attract bats to live and stay on a farm, when no maternity colonies are present.

Bat boxes come in various styles and sizes. They are commonly built of wood; however, can also built of wood-concrete material (woodcrete) or insulated plastics. Bat boxes must meet specific criteria in order to be used by bats and must be hung in suitable locations to attract maternity colonies. Once installed, they requires little maintenance.

Three common bat boxes used in BC include: [*Four-chamber Nursery House*](#), [*Rocket box*](#), [*Bat mini-condo*](#)



D. Dagenais

Four-chamber Nursery House



J. Cardno

Rocket box



D. Dagenais

Bat mini-condo

Four-chamber bat houses are very common in BC and can provide habitat for 200 bats. They are most successful with little brown bats and Yuma myotis. Rocket boxes provide habitat for 100 bats and in BC are most successful with California myotis. While bat mini-condo are most successful when excluding large colonies from buildings. These can house 1000s of bats.

Farmers are encouraged to [register](#) their artificial bat roost with the Community Bat Programs of BC to allow for monitoring. Monitoring bat box condition and use, as well as collecting data on bat populations, provides valuable information to biologists. With multiple bat boxes and designs on a farm, farmers may attract a multitude of bats and a variety of species to help reduce pesticide applications and farm costs.

Farmers can also compensate for loss of trees by providing artificial tree roosting habitat. Power poles or telephone poles can be wrapped with an artificial bark material. The small gap between the pole and the artificial material provides roosting habitat. Farmers can use cedar shakes or purchase an off-the-shelf product such as [BrandenBark](#).



Bat emerging from a bat box installed on the side of a building

Did You Know ?

Artificial bark, such as BrandenBark, provides habitat for tree roosting bat species.



Bat Box Criteria



Maternity colony of bats roosting in a six-chamber bat house, showing the narrow spacing of 3/4" preferred by bats

Design criteria:

Successful bat boxes have the following design parameters:

- Internal chambers height \geq 14 inches (36 cm), preferably \geq 24 inches (61 cm)
- Internal chamber width \geq 6 inches (15 cm), preferably \geq 12 inches (31 cm)
- Multi-chamber box (\geq 3),
- Chamber spacing between $\frac{3}{4}$ inch and 1 inch (1.9 cm – 2.5 cm)
- Chamber connected internally via small access holes
- Internal surfaces untreated
- All internal surfaces horizontally roughened/scoured the full length and width of the box
- Roughened landing strip with height \geq 5 inches (13 cm)
- Ventilation holes at sides and front
- Properly sealed and watertight
- Bat box colour appropriate for regional summer temperatures

Installation criteria:

- Install 10 ft -12 ft (3 m – 3.7 m) above the ground
- Install 15 ft - 20 ft (4.6 m – 6.1 m) from obstacles (tree branches, wires)
- Install ≥ 2 at each location on the property either adjacent or back to back
- Install multiple boxes to receive varying sun exposure at each site
- Install multiple boxes with various styles, sizes, and depths
- Install on or in a building to minimize internal temperature fluctuations
- Can install multiple boxes on posts or trees. (Best to use trees with high canopies and no lower branches)
- Provide predator guard where needed to prevent predation on bats.
- Use a guano catcher to check for occupancy to minimize disturbances of flashlights on bats.



D. Dagenais

Bat emerging from bat box.

Annual maintenance:

- Check exterior for damage
- Repair any holes
- Caulk or paint outside as needed
- Clean out wasp nests
- Clean out guano as needed
- Install, repair or replace animal guard as needed
- Empty, repair, or replace guano catchers as needed
- Check for signs of overheating (bats crowding at the bottom of the box) during hot summer days and modify as required
- Modify box or change location if unoccupied after 5 years.



J. Soremba

Guano from 165 bats accumulated in guano catchers after one season.

Small and/or a single chamber bat houses do not provide ideal roosting habitat for maternity colonies but may provide roosting habitat for males and non-reproductive females in the summer.

Managing Vegetation for Bats

Farms may be bordered by trees, contain isolated trees, snags, hedgerows, and/or vegetative ground cover amongst the crops. These features provide both benefits to farmers and bats. Live trees provide windbreaks, privacy, sediment and erosion control, and shade for livestock. Trees and snags provide important roosting habitat for bats. Hedgerows act as a wind barrier for crop protection and provide foraging opportunities for bats using the areas. Trees and hedgerows also create travel corridors for bats.

Did You Know ?

The sustainable farm management practice of retaining natural vegetation between crop rows is already helping bats.

Stanley Park
Ecology Society



Silver-haired bat roosting on a tree.



D. Dagenais

Ground cover between rows of grapes in a BC vineyard.

Wherever possible, farmers should maintain natural vegetation and ground cover on farms. Retaining native trees, shrubs, and ground cover encourages insect biodiversity on farms, which in turns helps to increase bat diversity on farms. Greater bat diversity on farms leads to greater variety of insect pests consumed over crops. To maintain insect biodiversity throughout the growing season, vegetative ground cover should be mowed on a rotating schedule. Leaving patches of ground cover will provide refuge areas for beneficial insects during farm maintenance.



D. Dagenais

Overview of a BC hop and vegetable farm with natural vegetation throughout.

Managing Water Resources for Bats

Water is essential to any farm. Bats require open water sources for drinking and seek freshwater every night. Any water used by farmers may be important drinking habitat for bats. Water sources also produce insects and provide foraging habitat for bats. Farmers are encouraged to assess water sources on their property, as pollution, turbidity, and poor flight access would deter bats from using water features on farms.

Ensure water sources used by livestock remain clean and uncontaminated from wildlife carcasses. Prevent drowning with lids or wildlife escape ramps

- Extend ramp to the bottom of the trough
- Ensure sides extend downward so animal will encounter it
- Fasten ramp tightly at the top
- Provide grip for animals on the top and sides of the ramp
- Monitored ramp often
- Repair, modify, and/or replace ramp as needed

Troughs with wire or fencing are dangerous to bats. Prevent trough injuries with simple modifications.

- Allow access points
- Remove wires/fencing
- Provide one trough per pasture
- Support trough with internal braces

When water and food is provided to bats, bats may remain in the area throughout the night to feed. Greater bat activity over farmland can lead to more natural pest control services provided by bats to the farmers.



An irrigation pond well-designed for bat use. Bats require an unobstructed flight access to water.

Did You Know ?

Did you know? Bats can swim but cannot grip onto smooth surfaces and can easily drown

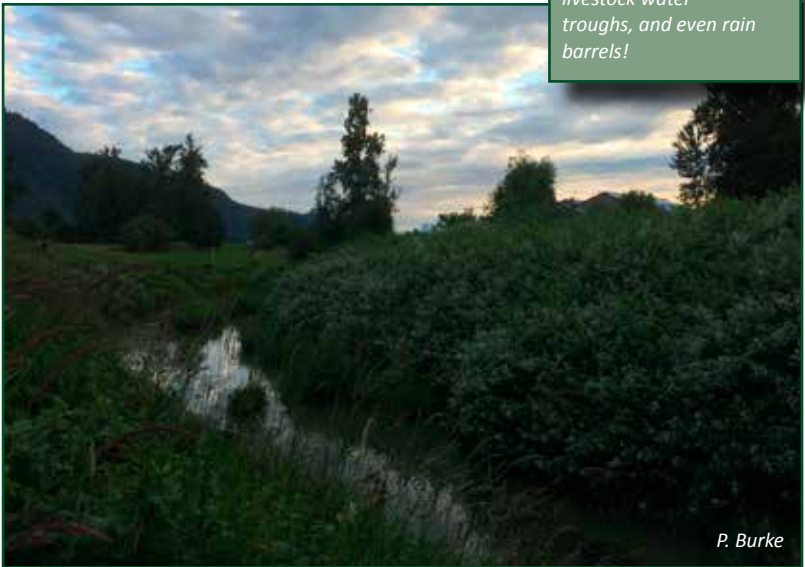


D. Dagenais

Vegetative growth on a pond reduces bat access to the water source.

Did You Know ?

Did you know? Bats drink by lapping water with their tongue while in flight. They may drink from streams, lakes, irrigation ponds, livestock water troughs, and even rain barrels!



P. Burke

An irrigation ditch can provide drinking and foraging opportunities for bats.

Improving Lighting for Bats

Bats do see, despite the myth that they are blind. In fact, bats are sensitive to bright lights, which interfere with their navigation. Artificial night lighting for equipment sheds, barns, roads, and residences can adversely impact bat activity over farms. Furthermore, many bat species will avoid lit areas when foraging or drinking and may avoid crossing lit areas to assess habitat.

Consider changing farm lighting practices to minimize the impact of lights on bats:

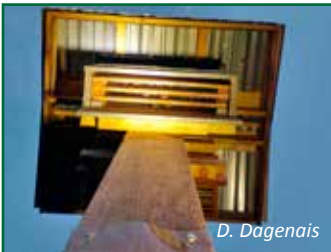
- Eliminate any light source that is unnecessary to decrease light pollution over the farm.
- Keep lights away from roost exits/entry points and artificial maternity roost structures.
- Eliminate lights shining on fresh water sources, trees, and hedge rows to keep key bat habitat features dark.
- Minimize lighting duration with use of timers.
- Reduce light intensity with dimmers or by replacing lights with a lower intensity light.
- Lower the height of the lights to minimize the area being lit.
- Use lighting shields to focus light where it is needed.
- Replace lights that shine upwards with lights that shine downwards.

Did You Know ?

Avoiding lit areas can impact a bat's health. Bats that avoid lights may use more energy to find resources, may feed during times of reduced insect activity, or may feed in lower quality habitat.



Light pollution over a small city farm.



Reduce disturbances to bats. Avoid shining bright lights up into bat boxes for more than 10 seconds or use guano catchers to confirm occupancy.

Managing Pesticide Use for Bats

Farmers can reduce pesticide applications by encouraging natural pest control by bats. Bats switch diets throughout the crop growing season and have been known to target insects when their populations increase. However, bats do not just save farmers money by reducing pesticide applications, bats also help farmers by reducing the proportion of crops loss to insect pests. Bats can prevent certain moth species from laying eggs on crops when they hear bats feeding in the area.

Did You Know ?

A colony of 150 big-brown bats living adjacent to farmland consumed 600,000 cucumber beetles, 194,000 scarabacids, 158,000 leafhoppers, and 335,000 stinkbugs in a single growing season! What a great amount of free pest control services for local farmers.

D. Burles



Chemicals found in pesticides impact humans, soil, water, vegetation, and local wildlife in the area, including bats. Pesticides decrease habitat quality by reducing prey availability to bat and contaminates their drinking sources. Furthermore, any insect exposed to pesticides and subsequently consumed

by bats, exposes bats to accumulated toxins. Toxins may buildup within a bat's body, affect its health, can negatively impact a bat's weight gain, and can be passed on to nursing pups. Any direct or indirect contact with pesticides can also result in bat mortality.

Did You Know ?

Did you know? Leaving patches of crops pesticide free can help with the management of bats and insect pests.

Did You Know ?

Did you know? Research in the US indicates that bats save farmers billions of dollars in pesticide application every year. In 2011, the average annual economic benefit of bats was estimated to be 22.9 billion USD per year!

Where possible, pesticide applications should be minimized to allow bats to provide natural pest control services to farmers. Reducing pesticide applications on farms is not only economically beneficial to farmers but will also reduce the farm's environmental footprint and help to maintain healthy bat populations.

D. Dagenais



Did You Know ?

Did you know? Bats may live to be 30 years old, providing many years of pest control services to farmers.

top: Cutworm moth, an insect pest of BC vineyards and prey of bats.

right: Stinkbug, an insect pest of BC vegetable farms and prey of bats.



D. Dagenais

Future Research Needs

One of the simplest, yet greatest way farmers can help bats is to open their farm up to research. Any farm-bat research would form partnerships between farmers and bat researchers, and help each party better understand each other's needs and operation.

Farms that contain bat roosts are invaluable to bat biologists. Bats are difficult to study due to their nocturnal behaviour, small size, and fast flight. Farms reduce researcher's efforts to locate and capture bats. Much information on bat physiology, behaviour, preferences, and threats can be acquired.

Did You Know ?

Researchers still have so much to learn about BC bats.

Bat-farm research can be designed to minimize disturbance to farm operations. Many studies are conducted outside of farm operating hours. Long-term monitoring equipment have small footprints and would not interfere with farm operations or production. Passive monitoring devices allow researchers to install equipment and leave over extended periods of time reducing the farm access required.

As farm-bat research expands across BC, there will be a better understanding of natural pest control services provided by bats to farmers. Farm-bat research will also help to understand how ecosystem services vary with different crops and regions and will also help us understand the consequences of future bat population losses to farmers.

Common research that may be conducted on farms include:

- Diet analysis to determine insect prey consumed by bats
- Acoustic surveys to assess relative activity and species diversity of bats over farmland
- Bat box research to understand regional preferences of bats
- Bat box research to minimize bat box mortalities
- Roost assessment to understand preferences and level of roost switching throughout a season
- Pup studies to assess survival and development during the summer



Acoustic bat detector placed within a BC farm to detect bat activity and species diversity over the crops. This passive monitoring device has a small footprint and can be left for months to record continuous bat activity.

Conclusion

Farms play an important role in BC's economy. The province contains diverse farmland and the most bat species of any province in Canada. Bats are important wildlife that play a key role in managing insect populations. Resident bat populations pose little threat to farmers. Farmland is ideal habitat for bats as it provides roosting, feeding and drinking habitat to bats. Encouraging bats to use farm habitats provides benefits to both farmers and bats. Farmers can apply the management practices and conservation measures described in this Toolkit to provide improved habitat to bats and natural reductions in insect pest populations on their farms. Many actions required by farmers to maintain healthy local bat population require minimal efforts. By working with local bat organizations, bat biologists, and researchers, farmers and bats will be able to co-exist in harmony for many years.



D. Dagenais

Overview of a BC vineyard.



D. Dagenais

Juvenile bat roosting in a birch tree.

Resources

The following websites provide more information on bats, contain links to download documents and guidebooks about bat habitat features and managing bats on properties, as well as provide contact information to reach out to a bat expert to answer questions.

- [South Coast Bat Conservation Society](#)
- [Community Bat Programs of BC](#)
- [Bat Conservation International \(BCI\)](#)
- [Alberta Community Bat Program](#)
- [Copperhead Environmental Consulting: BrandenBark](#)
- [White-nose Syndrome Response Team](#)
- [Wildlife Rehabilitators' Network of British Columbia](#)

Specific documents that may be of interest include:

- [Best Management Practices for Bats, BC Ministry of Environment](#)
- [Got bats? A BC guide of managing bats in building, CBP of BC](#)
- [Building homes for bats: a guide for bat houses in British Columbia, CBP of BC](#)
- [Water for wildlife: a handbook for ranchers and range managers, BCI](#)
- [Best management practices for bats and artificial lighting, BCI](#)



Yuma myotis; a common bat species that roosts in buildings and bat boxes in BC.

