

Pest Management for Museums

Written by:
Jane Dalley, Heritage Consulting

Introduction

Problems can arise if insects, birds, rodents, or small mammals move into museum buildings or take up residence in collections. In addition to the damage from their chewing and nesting habits, they can spread some truly nasty diseases through their bites, feces, urine, or saliva.

Traps or poison can be used to control undesired pests but there are several drawbacks in a museum setting. Dead rodents, mammals, or birds may be distressing to staff or visitors, and they may die someplace inaccessible where the bodies provide food for insects as well as an unpleasant smell. Pesticides can damage collections and pose health hazards to staff and visitors if not correctly applied. More importantly, neither trapping nor chemical control are effective if the conditions causing an infestation are not addressed.

An Integrated Pest Management (IPM) program can be effectively implemented in a single museum building or throughout a sprawling historic site, but must be applied consistently to every aspect of collection care from acquisition to storage and exhibition, and throughout the entire building – not just where collections are stored and exhibited. It requires support from maintenance and cleaning staff as well from staff and volunteers. Ideally, a pest management policy based on IPM is included with an institution's written policies.

This Tip Sheet presents a more in-depth look at Integrated Pest Management as outlined in the [Standards for Saskatchewan Museums \(2022\)](#).

Integrated Pest Management (IPM)

IPM is based on five steps of **Avoid**, **Block**, **Detect**, **Respond**, and **Recover** that are explained in detail in this document. The first three steps are the most detailed as the more effectively you can avoid, block, and detect pests, the easier it will be to respond and recover.

Avoid

Whether or not you have pests inside your building, begin by looking at its exterior to see how pests might be attracted and how they might find their way inside. Check the roof and eaves for birds' nests and remove them, as these are often inhabited by dermestids and clothes moths. You may also find bats nesting in tight spaces.



Check that water drains away from the outside walls of buildings. Not only will this prevent soil erosion that allows water into building foundations but it prevents damp wooden foundations that are attractive to wood boring insects.

Clean away leaves and debris from around buildings as these provide protection and habitat for pests. If possible, move bushes and plants away from the building and install an 18-inch wide pea gravel moat around the perimeter; rodents do not like to cross exposed areas. Cutting back tree branches that touch a building prevents pests from gaining access through a roof or window.

Locate exterior gaps, cracks, and holes by walking through a building at night with a strong light while someone on the outside uses chalk to mark the locations where the light shines through on the outside of the building, or else takes a picture. Shining a UV flashlight inside a darkened building can fluoresce rodent urine trails that lead to entry/exit points.

In general, turn off interior and exterior lights whenever safe and possible, to avoid attracting pests, and avoid mercury vapour bulbs for exterior fixtures as they attract pests. Fans can be used inside to discourage flying insects.

IPM relies heavily on good housekeeping. Use a HEPA vacuum inside a building to clean flat surfaces, wall/floor interfaces, cracks, crevices, behind radiators, under shelving units, and inside closets. The one exception to this practice is when a trail or pile of fine sawdust is seen on or at the base of a wall, as it indicates a potential wood-boring insect infestation. It is important that the location of the sawdust – insect frass – be documented on paper or by picture before a sample is gathered and the rest cleaned up.

Designate an eating area and keep it clean to avoid attracting pests to food in desk drawers or crumbs around desks. Store foodstuffs in sealed containers to prevent pest contamination, and wash dirty dishes right away to avoid attracting pests. Make sure that any foodstuffs coming into the building are free of insects, especially dry goods.

Rinse beverage cans before placing them in recycling bins to remove the residue. Keep dumpsters, garbage cans, and recycling bins tightly closed, both within and outside buildings, and empty them frequently.

Check the coils and insulation on fridges for pests that are attracted by the warmth. Keep cupboards underneath sinks clean and organized as they are close to a source of water and provide excellent hiding places.

Pests entering on infested acquisitions can spread throughout an entire collection. Examine new acquisitions from unknown or potentially infested locations for signs of pest activity, isolating them in a clear plastic bag for a week or so to safely view pest activity.¹

Block

To keep pests out of your building, remember that an adult mouse can squeeze through a 2-cm hole and a large adult beetle requires only 1.5 mm. Small gaps around windows, door frames, and overhead doors allow pests to enter buildings. Cracks in interior walls make it possible for them to move around within the walls. Seal cracks and holes, and cover vents or exterior holes larger than ¼" with fine copper mesh (rodents don't like to chew on it) or with cloth made of stainless steel with a polymer filling, sealed in place around the edges. Install good quality adjustable seals on doors and windows and repair damaged screens.

¹Do not put an artefact inside a plastic bag if it is wet or damp as it may become mouldy. In this case, contact a conservator for assistance.

Construction work or repairs in a building may disturb insect populations into visible activity, or create openings for pests to enter. At the same time, construction and renovations present an opportunity to include some pest-deterrent components such as:

- Placing diatomaceous earth in wall voids;
- Making closer fitting drywall joints (restaurant standard);
- Installing vapour barriers;
- Making improvements to building drainage.



Detect

In order to respond effectively, it is important to know what sort of pests you have, and how they got into your collection/building. Monitoring traps show the type and number of insects in your building. Cardboard traps with a sticky surface can be purchased with or without pheromones that attract a specific type of insect, such as a clothes moth. Record trap location and contents on a chart on a monthly basis.

If an unfamiliar insect requires identification, place it in a small jar and store it in the freezer for a few days. Once it is dead, examine it using a magnifying device and note the shape of its antennae, head, mouthparts, body, legs, feet, and wings. If it is a larva, is it hairy, furry, or horned and what colour, size, and shape is it? If an egg, what colour, size, and shape is it? Take pictures from as many angles as possible. It is best to use only those online apps and websites that are run by entomologists or trained staff. A list of recommended pest ID resources is found at the end of this Tip Sheet.

Beneficial insects such as centipedes, predatory mites, spiders, and ground beetles do not damage collections but indicate that there are other less beneficial insects to be preyed upon. Their dead bodies can be a food source for those insects that also damage your artefacts.

Small rodents are often attracted to sticky traps but usually pull free, leaving fur and feces and bitten edges. There are rodent traps with remote sensors that send an alert by text or email when activated. These are useful in seasonal museums or hard-to-access areas.

Respond

Food grade diatomaceous earth is a non-toxic, passive pest control product that can be poured inside wall cavities during construction and renovation. It can also be mixed with water and painted around the wall/floor interface in interior rooms, or inside storage cabinets. Soft-bodied insects that pass over it will be cut and desiccate and hard-bodied insects will groom themselves to remove it and die from internal haemorrhaging.

Snap traps are effective for rodents but require daily checking and may look out of place in historic settings, or be undesirable in public areas. Traps made from mason jars coated on the inside with Vaseline and with a Popsicle stick ramp are less noticeable in historic houses. Bread or peanut butter can be placed inside as bait, and the captured rodents disposed of in the manner of personal choice.

The rodent bait stations used by commercial pest control companies are effective but only for exterior use. If they are used inside a building, poisoned rodents may go off to die in an inaccessible place where they will decompose and attract undesirable insects.

Rodents can also be controlled with a kill trap that uses a CO2 hammer, mounted either on an exterior post or inside a building. When used outside, dead bodies are often scavenged by other animals, eliminating the need for body removal. Traps mounted inside buildings have to be checked daily for dead rodents.

Raccoon feces can contain roundworms, giardiasis, leptospirosis, and salmonella. A humane wildlife exterminator may be required to remove them. The clean up and removal of rodent, bat, and raccoon droppings must be done according to established health and safety procedures, such as those found for Hantavirus at the Centre for Disease Control website ([Hantavirus Prevention](#)) and Health Canada ([Prevention of a hantavirus infection](#)).

Bats are a protected species under the Saskatchewan Wildlife Act and cannot be killed or disturbed. Contact the Wildlife Rehabilitation Society of Saskatchewan for assistance.

Low temperature insect control has been common practice in the fur and food industries for many years, and freezing has been used to stop the spread of insect activity in museum artefacts since the 1990s. Most artefacts can be frozen, with the exception of glass, paintings on canvas, and rubber. The Canadian Conservation Institute has a series of Notes on vertebrate and invertebrate pest control, including instructions on freezing as an effective type of pest control.

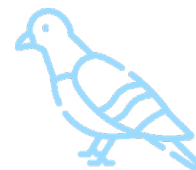
All insect life stages die at temperatures above 50°C and solar heat is a low-cost control option if freezer access is limited or if artefacts do not fit into a freezer. Natural history collections, carpets, textiles, wood (bare or painted), books, bolts of cloth, herbarium sheets, and bales of tobacco have all been treated with solar fumigation but some waxes, resins, and adhesives may soften at high temperatures and heat may not sufficiently penetrate thicker objects. Contact a conservator for advice and assistance if you are thinking of carrying out solar fumigation.

There are circumstances under which chemical control might be necessary. Obtain the services of a licenced pest control operator if considering chemical treatments, and consult with a conservator to understand the risks to your collections.

Recover

The type, number, and location of pests found in a building can indicate its condition as well as the level of housekeeping and maintenance. The presence of moisture-loving insects such as silverfish, booklice, or springtails can indicate water infiltration, leaky plumbing, or condensation. The presence of fungus-loving insects (fungus beetles, booklice, springtails) can indicate high relative humidity. If outdoor pests are found indoors, there may be inadequate door or window seals, or cracks in exterior walls. Carpenter ants or wood-boring insects could mean rotten wood in walls, beams, floors, or siding. Dermestids and clothes moths can indicate the presence of dead rodents or birds, or their nests.

An effective recovery requires that the conditions that gave rise to the infestation be identified and eliminated. Renovations and construction work and thorough cleaning may be required. Artefacts may require repair or removal from the collection. Programs can be affected. MAS is available to advise and assist members with their concerns.



Next Steps

A successful IPM program is not a stand-alone project with a beginning and an end. It is a continuous cycle that requires ongoing implementation to the five steps and a commitment by staff to become and remain informed. The Additional Resources section of this document can assist with this process.

Tools and Supplies

Microscope, digital or old-school.

Inexpensive UV flashlights are sold for building inspection in many hardware stores.

Sticky pest monitoring traps can often be purchased from local pest control companies or farm supply stores. JF Oakes LLC sells pheromone insect monitoring traps such as the XLure RTU Fabric Insect Trap that attracts both Casemaking & Webbing Clothes Moths, Black Carpet Beetles and Varied Carpet Beetles. <https://www.jfoakes.com/>. Accessed March 31, 2023.

Electronic remote monitoring (ERM) devices can detect rodents in hard-to-access interior locations such as attics and crawlspaces, or in seasonal museums closed for the winter: <https://www.activesense.com/electronic-remote-monitoring.html>. Accessed March 31, 2023.

The Frye Inspection Tool can quickly determine if a crack is large enough for a rodent to enter, and it also measures dropping size and chew patterns for identification purposes. Sold by Xcluder: <https://buyxcluder.com/frye-inspection-tool-f-i-t-10-pack.html>. Accessed March 31, 2023.

Xcluder fabric and wrap, made of stainless steel with a polymer filling, can be used to effectively fill any cracks larger than ¼". Information on use and application can be found at <https://buyxcluder.com/products/xcluder-kits.html>. Accessed March 31, 2023.

Food-grade diatomaceous Earth can be found in small quantities at health food stores and in larger quantities at farm supply stores.

Insect light traps used in commercial kitchens also work in museums. One source is <http://gilbertinc.com/index.html>. Accessed March 31, 2023.

The CO2 kill trap is effective inside and outside a building: <https://www.automatictrap.com/>. Accessed March 31, 2023.

Additional Resources

"Hantavirus Prevention." Centers for Disease Control and Prevention (CDC). 13 May 2024. Accessed 20 June 2024. <https://www.cdc.gov/hantavirus/prevention/index.html>

Public Health Agency of Canada. "Prevention of a hantavirus infection." Government of Canada. 29 June 2015. Accessed 31 March 2023. <https://www.canada.ca/en/public-health/services/diseases/hantaviruses/prevention-hantavirus-infection.html>.

Standards for Saskatchewan Museums. Museums Association of Saskatchewan. 2022. Accessed 31 March 2023. https://saskmuseums.org/wp-content/uploads/2023/02/Standards_for_Saskatchewan_Museums_-_Sixth_Edition_-_2022_-_WEB.pdf

"A Common Sense Pest Control" by William Olkowski, Sheila Daar and Helga Olkowski (1991) is a comprehensive manual based on prevention. ISBN: 0942391632, 9780942391633

The Canadian Conservation Institute (CCI) publishes a series of free downloadable Notes and Technical Bulletins on IPM: Strang, Thomas J. K. CCI Notes Series 3 (The Museum Environment: Biological Factors). Ottawa: Canadian Conservation Institute:

- "Preventing Infestations: Control Strategies and Detections Methods." CCI Notes 3/1. 1996. <https://www.canada.ca/en/conservation-institute/services/conservation-preservation-publications/canadian-conservation-institute-notes/preventing-infestations.html>. Last modified February 22, 2019.
- "Detecting Infestations: Facility Inspection Procedure and Checklist." CCI Notes 3/2. 1996. <https://www.canada.ca/en/conservation-institute/services/conservation-preservation-publications/canadian-conservation-institute-notes/detecting-infestations.html>. Last modified February 22, 2019.
- "Controlling Insect Pest with Low Temperature." CCI Notes 3/3. 1997. <https://www.canada.ca/en/>

Dawson, John E. *Solving Museum Insect Problems: Chemical Control*. Technical Bulletin, No. 15. Ottawa: Canadian Conservation Institute, 1992. https://publications.gc.ca/collections/collection_2016/pch/NM95-55-15-1992-eng.pdf. Accessed March 31, 2023.

Strang, Tom and Kigawa, Rika. *Combatting Pests of Cultural Property*. Technical Bulletin, No. 29. Ottawa: Canadian Conservation Institute, 2009. https://publications.gc.ca/collections/collection_2015/pc-ch/CH57-3-1-29-2009-eng.pdf. Accessed March 31, 2023.

“FUNdamentals of Museum Integrated Pest Management” by Christa Deacy-Quinn is a publication available for free download and an informative introductory video to the basic principles of IMP:

- FUNdamentals of Museum IMP Download form: <https://forms.illinois.edu/sec/6828287>. Accessed March 31, 2023.
- Collections Stewardship of AAM. “FUNdamentals of Museum Integrated Pest Management.” YouTube, November 6th, 2020. <https://www.youtube.com/watch?v=SNucs0BN47w>. Accessed March 31, 2023.

Museum Pests is an excellent online resource for heritage staff that offers information on all aspects of integrated pest management including identification tips, videos, and fact sheets: www.museumpests.net and <https://museumpests.net/identification/identification-pest-fact-sheets>. Accessed March 31, 2023.

Insects Limited provides monitoring, treatment programs and consultations for museums as well as publications, YouTube videos, and free webinars: <http://www.insectslimited.com>. Accessed March 31, 2023.

BugGuide.net is an online knowledge base of naturalists who share images of insects, spiders and other related species, and offer identification services: <https://bugguide.net/node/view/6/bgimage>. Accessed March 31, 2023.

The Wildlife Rehabilitation Society of Saskatchewan can offer advice on bats as well as rehouse and/or overwinter them. Their phone number is (306) 242-7177 and website: <https://www.wrsos.org/>. Accessed March 31, 2023.

The Alberta Community Bat Program has produced a guide to managing bats in buildings: “Alberta and Saskatchewan Bats: Beneficial Management Guidelines for Pest Control Operators” (2022): <https://www.albertabats.ca/wp-content/uploads/Pest-Control-Brochure.pdf>. Accessed March 31, 2023.

BugFinder is an online identification tool that uses location, species and/or characteristics to identify insects: <https://www.insectidentification.org/bugfinder-start.php>. Accessed March 31, 2023.

The Entomological Society of Saskatchewan will answer questions about insects, and provides identification services: <https://www.entsocsask.ca/>. Accessed March 31, 2023.

We gratefully acknowledge
the support of...

