University of British Columbia

Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Humane Rodent Control at UBC's In-Vessel Compost Facility

SEEDS project conducted as part of MSc Applied Animal Biology

Prepared by: Erin A. Ryan

Prepared for: Animal Welfare Program

Course Code: AANB 549A

University of British Columbia

Date: 14 May 2021

Erin A. Ryan, MSc Applied Animal Biology
May 2021 | Animal Welfare Program

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THE UNIVERSITY OF BRITISH COLUMBIA

Executive summary

UBC's Green Building Action Plan has made a commitment to biodiversity through two component goals: 1) UBC will develop highly functioning landscapes at the building and site scales to contribute to biodiversity and natural ecosystem processes, and 2) UBC will engage campus teaching and research opportunities to enhance biodiversity management capacity. The targets and indicators for achieving these goals both relate to biodiversity in birds – who are impacted by rodenticide and rodent control programs.

SEEDS staff connected with the researcher during the early phases of project development, and facilitated a collaboration with UBC Building Operations to identify a location on campus for this research project. The goal of the project was to evaluate the use of Goodnature A24 traps in a setting on campus, and for the research to provide recommendations for Building Operations to consider for rodent control.

The first study looked at potential impacts on non-target animals, and suggests that there are a high number of non-target species at this site that could potentially be exposed to rodent control devices. In general, the Goodnature A24 traps posed fairly low risks to non-target animals, and the use of blockers effectively removed the risks to non-target animals. At the same time, the use of a blocker did not inhibit the ability of rodents to access the trap.

The Goodnature A24 rat trap appears to be a relatively humane alternative to rodenticide poisons. However, the low number of kills relative to the high number of attractants at this site demonstrate a need for rodent exclusion and other preventive measures to effectively combat rodent activity.

As a result of observations during the project and researcher experience, the author recommends that UBC:

- Develop a campus-wide pest control policy; the District of North Vancouver's policy could serve as a model
- Prioritize contractors that have demonstrated exclusion and experience in Integrated Pest Management
- Develop guidelines or recommendations for sanitation and exclusion to prevent rodent activity
- Evaluate all current rodenticide and rodent control programs on campus
- If lethal control is required, consider using high-quality snap traps or Goodnature traps as an alternative to rodenticides
- Develop recommendations for appropriate bird attractants on campus
- Consider UBC's sustainability commitments and the values of the University community
- Seek opportunities to continually evaluate and improve pest control practices on campus

Introduction

Project overview

Commensal rodents such as the Norway rat, roof rat, and house mouse are among the most common targets of vertebrate pest control in North America, with countless numbers of animals trapped, poisoned, and/or killed each year. Controlling these species is important for wildlife, the environment and conservation, and human health and safety, but there are limited tools that are considered effective, environmentally friendly, and humane.

Rodenticides are currently the dominant method of rodent management, though they are non-discriminatory and have dramatic impacts on local raptors, predators, and non-target animals (Mason & Littin 2003, Brakes & Smith 2005, Albert et al. 2010, Huang et al. 2016). Although rodenticides are widely used, their effects and time-to-death vary widely, depending on the individual target and specific product used. The signs of poisoning indicate suffering, which can begin within a few hours and last several days before death (Mason & Littin 2003).

In addition to causing suffering in rodents, many of the most commonly used anticoagulant rodenticides are known to be high risk to birds and non-target mammals, and they may additionally have impacts on suspended particulate matter in water and fish (Erickson & Urban 2004, Kotthoff et al. 2019). Even when applied by professional pest control operators, the use of anticoagulant rodenticides can result in the secondary poisoning of raptors (Murray 2017, Wiens et al. 2019). Raptor deaths due to rodenticide may also be underestimated, as sub-lethal effects may be masked if they lead to lethal injuries such as electrocution or collision with vehicles (Hindmarch et al. 2019). Pest control operators may be unaware of the risks of anticoagulant rodenticides on non-target wildlife, and raptors are likely to be exposed to multiple rodenticides in areas where there are overlapping control areas (Memmott et al. 2017).

Effective rodent management requires the use of preventive measures, long-term monitoring, and control methods to reduce populations. However, lethal control is still a valuable and necessary tool to help combat rodent populations and infestations, and institutions are seeking alternatives that are effective, target-specific, environmentally friendly, and humane. The Goodnature A24 rat trap is a self-resetting captive bolt trap powered by CO_2; field reports evaluating the humaneness, efficacy, and mechanical reliability of this trap show promising results, but to date there are no peer-reviewed field studies on non-target interactions or humane evaluations (Jansen & Grove 2011, Department of Conservation 2015a, 2015b). Because the trap is self-resetting, it offers greater rodent control efficacy, increased ability for control projects in remote sites, decreased damage to sensitive sites because they are visited less frequently, and rodent bodies that remain in the environment continue to be a safe food source for wildlife.

This UBC field study provides evidence demonstrating the trap is safe and humane, that it has the potential to be effective under certain circumstances, and that its use should be encouraged as an alternative to broadcast rodenticide programs consistent with biodiversity goals outlined in UBC's Green Building Action Plan (University of British Columbia 2018).

Current pest control programs

As a large institution with a variety of buildings that serve diverse functions, UBC's Vancouver campus functions much like a municipality. UBC's pest control programs have undergone some changes in recent years, but mostly on the administrative level. Before the start of the project, UBC staff provided an overview of their pest control process. Typically, the process is complaint-driven, resulting in deploying rodenticide programs, but UBC had expressed interest in options for more proactive and strategic approaches to rodent control. As part of this research collaboration through the SEEDS Sustainability Program, UBC requested recommendations and considerations for rodent management on campus.

Research

Study 1: Non-target interactions

Nine Goodnature A24 Rat Traps ("traps") were installed at selected locations at UBC's In-Vessel Composting Facility and monitored June through August. Traps were installed vertically and baited according to manufacturer recommendations (non-toxic chocolate lure). Each trap was continuously monitored 24/7 using a motion-activated video camera with no-glow night vision. Once the camera was activated, a 30-second video was captured, with a 5-second interval between subsequent recordings.

Three target species were identified: Norway rat (*Rattus norvegicus*), roof rat (*Rattus rattus*), and house mouse (*Mus musculus*). All other non-human animals were considered non-target species; these included deer mice, squirrels, voles, birds, raccoons, and skunks.

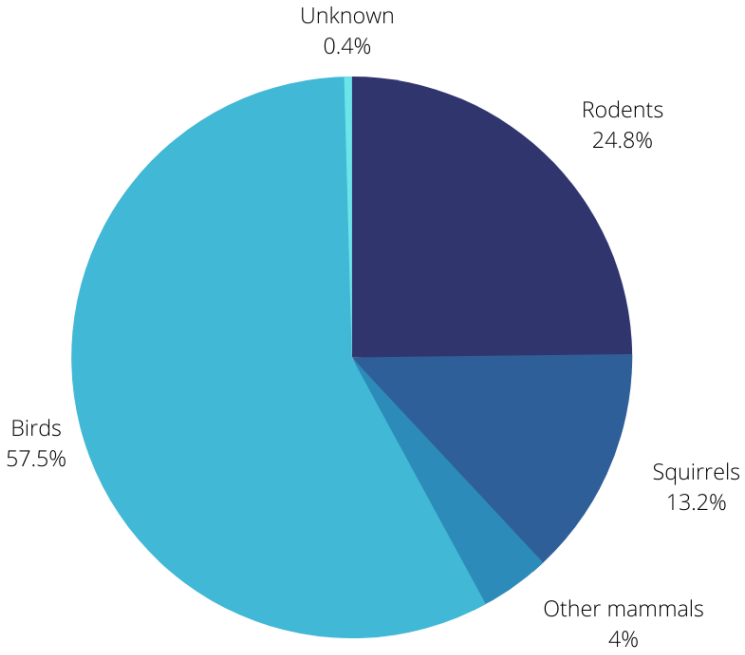
The Goodnature A24 trap includes an optional blocking device designed to prevent non-target animals from entering the trap. Blocking devices were used as a treatment in this study to determine how effective they are in excluding non-target animals. For this purpose, each trap was randomly assigned to the blocker or no blocker treatment during installation, and switched approximately half way through the data collection period in a crossover design.

All target and non-target animal interactions with the traps were recorded, including the species, whether or not a blocker was used, and were coded according to the following definitions:

- No interactions (NI): An animal passes in and out of frame without sniffing, handling, or seeming to direct attention to the trap.
- Investigates trap (IT): An animal approaches trap and appears to smell trap or visually inspect trap.
- Touches trap (TT): An animal physically touches the external surfaces of the trap with paws, limbs, or other body parts. This includes apparent direct manipulation or apparently inadvertent touching.
- Limb in trap (LT): An animal's limb (other than head, nose) enters the trap body.
- Enters trap (ET): An animal inserts their nose, head, or whole body (small animals) inside the body of the trap.

Results

A total of 2,282 animals were observed during the course of the study, representing at least 34 different species (10 animals unidentified).



Species recorded during the research project (*n=2,282*)

Although the majority of interactions appear to be birds, all species of birds were largely non-interactive with the traps. Of the 1,312 bird interactions, most (1,087) did not involve interaction with the trap at all, 147 birds involved investigating the trap, 97 involved perching on top of the trap, and only 1 bird was observed entering the body of the trap.

Mammal species involved (8):

- Deer mouse
- House mouse
- Norway rat
- Grey squirrel
- Roof rat
- Raccoon
- Skunk
- Vagrant shrew

Bird species observed (23):

- American goldfinch
- American robin
- Anna's hummingbird
- Barn swallow
- Black-capped chickadee
- Brown-headed cowbird
- Bushtit
- Common raven
- Dark-eyed junco
- Downy woodpecker
- Fox sparrow
- Golden-crowned sparrow
- Hermit thrush
- House finch
- Northern flicker
- Orange-crowned warbler
- Pacific wren
- Purple finch
- Rufous hummingbird
- Song sparrow
- Spotted towhee
- White-crowned sparrow
- Wilson's warbler

Aside from birds, rodents were the most frequently observed animals interacting with the trap. Of concern, both squirrels and raccoons (non-target species) were able to enter the trap or insert limbs in the trap. The following trap interactions were observed:

Target and non-target species observed interacting with the non-baited Goodnature traps, with and without blockers

		No interaction	Investigated trap	Touched trap	Inserted limb	Entered trap
Rodent *(n=566)*	No blocker	223	77	12	0	4
	Blocker	177	90	27	2	10
Squirrel *(n=302)*	No blocker	90	63	61	2	25
	Blocker	87	38	31	0	0
Raccoon *(n=33)*	No blocker	4	13	11	8	1
	Blocker	6	7	6	0	0
Skunk *(n=54)*	No blocker	10	15	1	0	0
	Blocker	15	14	4	0	0
Unknown *(n=10)*	No blocker	3	0	0	0	0
	Blocker	7	0	0	0	0

Thankfully, the presence of a blocker significantly reduced the ability of non-target animals to enter the trap or insert limbs into the trap. With a blocker present, only rodents (target species) were able to do this.

Animals that were able to enter traps or insert limbs into traps, with and without blockers

	Bird	Raccoon	Squirrel	Rodent
No blocker	1	9	27	14
Blocker	0	0	0	12

Conclusions

The results of this study suggest that there are a high number of non-target species at this site that could potentially be exposed to rodent control devices. In general, the Goodnature A24 traps presented fairly low risks to non-target animals, and the use of blockers effectively removed the to risks non-target animals. At the same time, the use of a blocker did not inhibit the ability of rodents to access the trap.

Study 2: Humaneness Evaluation

Once we determined we could safely mitigate the risks to non-target species, the next phase of research was a humaneness evaluation of the traps once they were baited and set. For this phase, the same traps and cameras were used at the In-Vessel Compost facility, although the placement of two traps was adjusted due to low activity at these sites. All traps were fitted with blockers to prevent non-target access to the traps. The traps were activated and monitored from October through November.

Results

Although the traps were frequently visited by the target species, only nine kills were observed: 5 house mice, 3 deer mice, and 1 grey squirrel. Observations indicated immediate or near-immediate cessation of movement and apparent instantaneous death. After the bolt was triggered, the struck animals dropped from the trap to the ground and did not move again. After a 5-second interval between videos, the motion-activated cameras did not trigger a second interval, indicating no further movement. In some cases, the bodies were still visible in subsequent videos (triggered by other animals) or were available for collection the following day.

The number of target animals observed on camera was reduced significantly as December approached, and this phase of the study was ultimately suspended due to low activity. Further data will continue to be collected at an alternative site.

Although blockers were effective at preventing squirrel entry during the first phase of the study, this lethal portion of the study did observe one squirrel entering the trap and being subsequently killed. This squirrel appeared to be younger and smaller than other adult squirrels, which may have contributed to their ability to pass the blocker. We expect this is an anomaly, as Study 1 demonstrated that of 302 occasions when a squirrel was seen at a trap with a blocker, none involved entering the trap.

Conclusions

The Goodnature A24 rat trap appears to be a relatively humane alternative to rodenticide poisons for mice in these circumstances. Further research is needed to evaluate the humaneness and efficacy in rats, perhaps in locations where there is a less abundant food source. However, the low number of kills, combined with the high number of attractants at this site, demonstrate a need for rodent exclusion and other preventive measures to effectively combat rodent activity.

Discussion & Recommendations

Principles of ethical wildlife control

In 2015, the UBC Animal Welfare Program and BC SPCA hosted an international expert forum to bring together a globally diverse group of academics, conservation and animal welfare organizations, and industry professionals to discuss humane wildlife control. One of the outcomes of the forum was a publication outlining seven principles for ethical wildlife control, determined by forum consensus (Dubois et al. 2017). The forum highlighted the importance of making wildlife control decisions based on the specifics of each human-wildlife conflict case, rather than a one-size-fits-all approach (Dubois et al. 2017). The seven principles, and seven questions adapted from Dubois et al. 2017, are:

1. Modifying human practices – can we change human behaviour to address the conflict?
2. Justification for control – is control really necessary? (i.e., causing a serious health and safety risk)
3. Clear and achievable outcome-based objectives – what is the goal, and how will it be monitored?
4. Animal welfare – are we using the most humane methods possible?
5. Social acceptability – have we considered community and stakeholder values?
6. Systematic planning – what is the long-term plan to address the conflict to prevent recurrence?
7. Decision making by specifics rather than labels – are we simply calling the animal a “pest” without consider steps 1-6?

These seven principles also formed the foundation of the AnimalKind accreditation program for wildlife and rodent control, another product of collaboration between the UBC Animal Welfare Program and the BC SPCA. These principles were also used in resources provided to municipalities seeking to reduce or eliminate the use of rodenticides (BC SPCA 2020a, 2020b).

These principles, as well as UBC’s Green Building Action Plan, will be used as a framework for discussing recommendations to UBC. The following recommendations are based on my observations during this project, literature reviews during my master’s thesis, years of experience attending pest control industry trainings and events, and years of experience developing organizational pest control policies for the BC SPCA.

ETHICAL WILDLIFE CONTROL

BEFORE CONTROLLING WILDLIFE, ASK THESE 7 QUESTIONS

1

CAN WE CHANGE OUR BEHAVIOUR? PUT AWAY GARBAGE SO IT DOESN'T ATTRACT WILDLIFE

2

IS CONTROL REALLY NECESSARY? IS THE ANIMAL CAUSING A SERIOUS HEALTH AND SAFETY RISK (OR JUST PASSING THROUGH)

3

WHAT IS OUR GOAL AND HOW WILL WE MONITOR IT? KNOW WHAT IS NEEDED TO ACTUALLY SOLVE THE CONFLICT

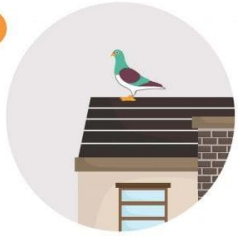
4

ARE WE USING THE MOST HUMANE METHOD POSSIBLE? SOMETIMES AN ANIMAL CAN BE EXCLUDED INSTEAD OF KILLED

5

HAVE WE CONSIDERED COMMUNITY VALUES? A PLAN WILL BE MORE SUCCESSFUL WITH A SOCIAL LICENSE

6



WHAT'S OUR LONG-TERM PLAN? TAKE ACTION TO PREVENT THE PROBLEM FROM HAPPENING AGAIN

7

ARE WE CALLING THE ANIMAL A "PEST" WITHOUT CONSIDERING STEPS 1-6? NEGATIVE LABELS CAN RESULT IN RUSHED DECISIONS THAT HURT WILDLIFE

BCSPCA

SPEAKING FOR ANIMALS

Based on **Dubois S et al. 2017** International consensus principles for ethical wildlife control. *Conservation Biology* 4: 753-760.

Infographic of the 7 principles applied to urban wildlife control, available at spca.bc.ca/urban-wildlife

Principle 1 – Modifying human practices

The availability of food and shelter is the primary attractant for rodents. Because of the nature of the In-Vessel Compost facility, food and shelter is (and will continue to be) an attractant for rodents and other wild animals. However, a few simple actions can help minimize these attractants and the availability of shelter.

White-crowned sparrow with bird seed at In-Vessel Compost Facility, May 2020

The presence of bird seed on site is an immediate source of concern, and indeed the closest trap to the bird feeder (Site 1) saw relatively high rodent activity despite the furthest proximity from compost attractants. Bird seed is a major source of human-wildlife conflict, as the seed is meant to attract birds, but indiscriminately attracts all wild animals including mice and rats. UBC's Bird Friendly Design Guidelines for Buildings outlines best practices for feeders to avoid window collisions, but does not have guidelines on when bird feeders should or should not be available or considerations in design (University of British Columbia 2019). Because the In-Vessel Compost Facility has abundant natural food sources, removing the bird seed entirely is an ideal solution. However, given UBC's commitment to increase habitat for birds and pollinators (University of British Columbia 2018), staff could also consider a switch to a wildlife-resistant design to minimize speed spillage or switching to a nectar feeder for hummingbirds. Native plants and bird houses can also be appropriate attractants – allowing site staff to continue enjoying the presence of birds, without additional attractants for rodents.

The site also contains a small hobby garden, but based on informal observation and personal communication with staff, the garden is not a major source of attractants and is easily modified when it is. For example, a staff member shared that they stopped growing corn because it was a clear rodent attractant, where squash was apparently not. This hobby garden would also be an ideal opportunity to provide native plant attractants.

The effects of available shelter were also apparent throughout the study. For example, Sites 5 and 6 were initially chosen for their proximity to miscellaneous wood pallets, overgrown grasses, and various discarded objects that were observed as well-travelled by rodents during preliminary observations in April. In May 2020, the staff on site independently conducted a clean-up that removed all but one pallet, leaving a relatively bare area. These two trap sites subsequently had the fewest rodent visitors of all trap sites during Study 1.

Trap sites 5 and 6, before and after clean-up, May 2020

After this independent clean-up, trap site 6 was moved to an interior location within the facility where droppings were present. However, the presence of droppings (and other non-rodent mess) also prompted staff to arrange pressure-washing. After the pressure washing, this site saw zero rodents during Study 1.

Thus, staff actions (cleaning and debris removal) demonstrated a clear and predictable effect of reducing or eliminating rodent activity. These are both human actions that should be conducted regularly.

Recommendations:

- Develop a policy for bird attractants on campus – including if and when bird feeders are considered appropriate, considerations for wildlife-proof design, and/or providing a list of plants and other foliage to naturally attract birds and increase bird and pollinator habitat
- Develop guidelines or recommendations for sanitation and exclusion to prevent rodent activity, and include these in responses to complaints about rodent activity

Principle 2 – Justification for control

The need for wildlife control, including rodent pest control, should be justified with evidence of harm to people, property, ecosystems and/or other animals (Dubois et al. 2017). In all cases, this means considering the seriousness of the perceived problem and an evaluation of the effects if no control action is taken. The presence of rodents is

enough of a health and safety risk to justify control in place likes homes and restaurants, but this is not necessarily the case in the context of the In-Vessel Compost Facility where rodents are often burrowing in structures and bushes outside the facility, but are rarely present in areas where they may risk any interaction with staff. In this outdoor setting, proper sanitation and cleaning maintenance seems generally enough to discourage rodents in the operations areas. The trailer where staff have lockers, a fridge and breakroom, was relatively recently modified to prevent rodent access, which has been an effective measure.

Preventive maintenance and timely cleaning procedures will always be necessary to minimize rodent activity at this site, and it is unlikely that the rodents will ever be completely eliminated. The use of a rodenticide program at this site does not appear to match the corresponding risk to human health and safety.

Recommendations:

- Evaluate all current rodenticide programs on campus to determine if programs are based on real or perceived problems, and if rodent control actions are necessary

Principle 3 – Clear and achievable outcome-based objectives

Rodent bait station with "high" activity

Once the need for a control plan has been established, the plan should clearly outline the goals of the program and have sound evidence that the proposed control plan can meet those goals (Dubois et al. 2017). UBC is generally using a complaints-based approach to identify areas of concern, and does not yet have measurable goals associated with their pest control activities – i.e., "complete eradication", "reducing population by X%", or "reducing number of pest control complaints by ___".

Generally, reports from pest control operators define rodent "activity" in terms of how much rodenticide bait is consumed during weekly/monthly checks. While this does demonstrate that rodents have visited the bait station, it is not an indicator of the risk to people because it does not indicate actual rodent sightings, droppings, or interactions with people. Rodenticides comprise more than 90% of the baits used by pest control professionals, who generally apply them de facto with no intended end to their use (Almeida et al. 2013). Rodenticides are even commonly used as a "preventive measure", thus ensuring constant attraction of rodents and a constant supply of poisoned rodents into the environment (EBPF 2013, van den Brink et al. 2018).

In this instance, a compost facility will inevitably continue to be an attractant. However, the attractants can be managed through sanitation and structural exclusion (van den Brink et al. 2018).

Recommendations:

- Develop a campus-wide pest control policy that prioritizes proper sanitation and exclusion, and communicates that pest control contractors must use a rodent control plan that follows IPM protocol. The District of North Vancouver passed a pest control policy in 2020 that is publicly available, and could be used as a model (District of North Vancouver 2020)

Principle 4 – Animal welfare

This Principle states that control methods should cause the least animal welfare harms to the least number of animals (Dubois et al. 2017). Rodenticides are currently the dominant method of rodent management, but though they act indiscriminately on local raptors, predators, and non-target animals (Mason & Littin 2003, Brakes & Smith 2005, Albert et al. 2010, Huang et al. 2016). Rodenticides come in many different forms, including anticoagulant rodenticides (e.g., bromadiolone, brodifacoum), metal phosphides (e.g., zinc phosphide), Vitamin D (e.g., cholecalciferol/vitamin D_3), other chemical compounds, or combinations of these compounds. The In-Vessel compost facility, and other UBC sites that have rodenticide programs, are mostly using the anticoagulant rodenticide bromadiolone, which is approved for indoor and outdoor use.

Although rodenticides are widely used, their effects and time-to-death vary widely, depending on the individual target and specific product used. The signs of poisoning indicate suffering, and can begin within a few hours and last several days before death (Mason & Littin 2003). Many of the most commonly used anticoagulant rodenticides are known to be high risk to birds and non-target mammals, and recent evidence shows they may additionally have impacts on fish and suspended particulate matter (Erickson & Urban 2004, Kotthoff et al. 2019). Even when applied by professional pest control operators, the use of anticoagulant rodenticides can result in the secondary poisoning of raptors, and the illegal application of anticoagulant rodenticides can have significant effects on sensitive ecosystems (Memmott et al. 2017, Murray 2017, Wiens et al. 2019). Pest control operators exhibit a high dependence on rodenticides, but relatively low awareness of non-target impacts (Memmott et al. 2017). Operators also vary in the removal of excess bait or rodent carcasses (Memmott et al. 2017). Raptors are likely to be exposed to multiple rodenticides in areas where there are overlapping control areas (Memmott et al. 2017).

The animal welfare issues associated with anticoagulant rodenticides are clear, as are the risks to non-target animals like hawks, owls, coyotes, raccoons, and skunks. Our results from Study 1 demonstrate this is a site with high biodiversity and an attractive habitat for a wide variety of birds and other animals. In staying aligned with UBC's goal to contribute to biodiversity and natural ecosystem processes, UBC should consider removing rodenticides from this site (University of British Columbia 2018). Our results from Study 2 suggest that the Goodnature trap could be a viable, more humane alternative to broadcast rodenticides for mice, but further study is needed to evaluate the humaneness and efficacy for rats.

Recommendations:

- If lethal control is required, consider using high-quality snap traps or Goodnature traps as an alternative to rodenticides

Principle 5 – Social acceptability

Decisions surrounding wildlife and pest control often involve dilemmas of balancing harms and benefits. In addition to scientific, technical, and practical information, these decisions should also be informed by community values, as this will ensure more realistic goals and successful implementation (Dubois et al. 2017). Many municipalities in BC have recently made motions to ban use of rodenticides in their owned facilities, with a high level of public support for this change in policy (BC SPCA 2021). In just the Lower Mainland as of February 2021, this list of municipalities includes the District of North Vancouver, City of North Vancouver, City of Port Moody, City of Richmond (1-year trial for 2021), District of West Vancouver, City of New Westminster, City of Victoria, and nine other cities and districts in BC (BC SPCA 2021).

UBC has outlined many ambitious sustainability commitments, through initiatives including LEED, REAP, and the Green Building Action Plan which envisions net positive contributions to human and natural systems by 2035. There is therefore a case that UBC and the broader community would support rodent control programs that are considered humane and environmentally friendly.

Recommendations:

- In developing a campus-wide rodent control policy, consider UBC's sustainability commitments and the values of the University community. A policy or program can be expected to be more successful with social support.

Principle 6 – Systematic planning

Pest control programs should be designed with long-term thinking and a systematic management plan (Dubois et al. 2017). The benefits of reactive, ad hoc control programs are more likely to be short-lived and not achieve a sustainable solution (Clayton & Cowan 2010). In the case of rodent problems, relatively low-effort population control can amount to senseless killing if the populations rebound quickly or are never fully reduced.

UBC should look towards developing a systematic rodent control plan, to avoid entering a state of perpetual monthly bait management with no end in sight. The control plan should outline specific actions to reduce food and habitat availability, increase sanitation and structural exclusion opportunities, and reduced rodenticide use.

Recommendations:

- Prioritize contractors that have demonstrated exclusion and IPM experience. This could be accomplished by amending RFPs with a policy as outlined above, and/or indicating a preference for AnimalKind companies or standards similar to the City of Delta (BC SPCA 2020a)

Principle 7 – Decision making by specifics rather than labels

The final principle is truly an integration of the previous 6 – asking decision-makers to consider all angles of a wildlife control problem based on the specifics of the scenario. This seventh principle serves as one final check that decisions are based on comprehensive analysis of the concerns and outcomes, rather than simply because a "pest" is present at all (Dubois et al. 2017). Unfortunately, when animals are given labels like "pests" or a "nuisance", this is often used as justification for inhumane treatment (Dubois et al. 2017).

Recommendations:

- Seek opportunities to continually evaluate and improve pest control practices on campus. Continue engaging with students and researchers exploring novel pest control tools, techniques, and monitoring.
    - For example, one APBI 415 student could be recruited annually as part of their final research project – these students are required to engage in 12-15 hours of data collection and analysis. Students could potentially set up cameras at bait stations on campus and observe rodent activity.

Acknowledgements

Many thanks to the SEEDS team for enabling this collaboration, and the support of the UBC Building Operations staff in this research project.

This research project was funded by an Aboriginal Graduate Fellowship (British Columbia Graduate Scholarship) and the Okanagan Indian Band.

Respectfully acknowledging that this research was conducted on the unceded traditional territory of the downriver hən̓q̓əmin̓əm̓ speaking peoples - ,xʷməθkʷəy̓əm (Musqueam), and səl̓ilwətaʔɬ (Tsleil-Waututh) Nations, and the Skwxwú7mesh-ulh Sníchim speaking peoples - Skwxwú7mesh Uxwumixw (Squamish) Nation whose historical relationships with the land continue to this day.

Appendix

Appendix A – District of North Vancouver Rodent Control Policy

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