Evaluating the use of bear-resistant garbage cans to promote human-bear coexistence in Prince George, BC

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Introduction

Human-wildlife interactions are becoming more common as human populations continue to rise and encroach into natural habitats. Some species can adapt to and thrive in human-altered landscapes by using the resources that become available to them, such as food and shelter. The American black bear (*Ursus americanus*) is an example of a species that is commonly found in urbanized areas. The American black bear is a widely distributed member of the bear family found in North America. Black bears are a forest-adapted species with a generalist diet that can alter their foraging behaviour to access new food sources and are tolerant of human activities. As a result, black bears are the most encountered bear species in North America (Scheick and McCown, 2014). Human-black bear conflicts in urban areas have increased in North America where they have become a growing concern to many communities and residents.

Prince George, British Columbia is a city surrounded with rural and wild areas. Green belts within residential neighborhoods of Prince George provide corridors into the city for black bears; as a result, human-bear conflict is prevalent. Black bears in Prince George are commonly seen foraging on anthropogenic foods, primarily garbage, in urban areas. The city has the highest number of bear complaints and bears destroyed in all of British Columbia. For example, from 1994-2007, 624 bears were destroyed within Prince George and 134 (22%) of those bears were destroyed between 2004 and 2007 (Ciarniello, 2008). In 2008, the Northern Bear Awareness Society (NBAS) was established with the goals of promoting public awareness of bear behaviour and reducing human-bear conflict and the number of bears destroyed (Ciarniello, 2008). In 2019, the City of Prince George partnered with the NBAS to introduce bear-resistant garbage carts as a pilot project.

The objective of the pilot project was to determine if bear-resistant garbage carts would decrease attractants available to bears and help reduce overall bear-human conflicts in the community (CBC/Radio Canada, 2019). In April 2019, bear-resistant garbage carts were placed in the Croft Road neighbourhood of 285 residences. A different neighbourhood of 293 residences, adjacent to the trial area, used standard city garbage carts and served as a control area. The two neighborhoods were monitored for one year (Figure 1). The City of Prince George sent a public survey in 2019 to residents within the control and container areas to ask about their opinions on the bear-resistant garbage carts. A similar survey was sent out to the same neighbourhoods one year later. The surveys were used to determine the level of public support for future expansion of the bear-resistant garbage carts in other areas of Prince George. In addition to surveys, data on the number of bear observations in the two neighbourhoods was collected through the Conservation Officer Service and compiled by regional biologists from the Province of BC.

The overall goal of this project is to summarize data collected during the City of Prince George's pilot program and to assess if there was a spatial change in bear activity due to the bear-resistant garbage carts. Accordingly, I will analyze the data from the surveys of people's

perceptions of the bear-proof garbage cans to determine the overall feedback on the program. I will also compare the number of Problem Wildlife Occurrence Reports (PWOR) collected between 2019 and 2022 after implementation of the bear-resistant garbage carts compared with the previous eight years (2011-2018). In addition, I will compare the number of PWORs in the control and container areas. Finally, I will review reports and publications to find information about other bear-resistant garbage collection systems to learn about case studies where the containers have been applied elsewhere successfully. By replacing the original garbage cans with bear-resistant cans, we predicted that there would be fewer calls to the Conservation Officer in the container neighbourhood compared with the control neighbourhood. This report will help the NBAs and the City of Prince George understand the effectiveness of bear-resistant garbage cans in reducing human-bear conflicts.

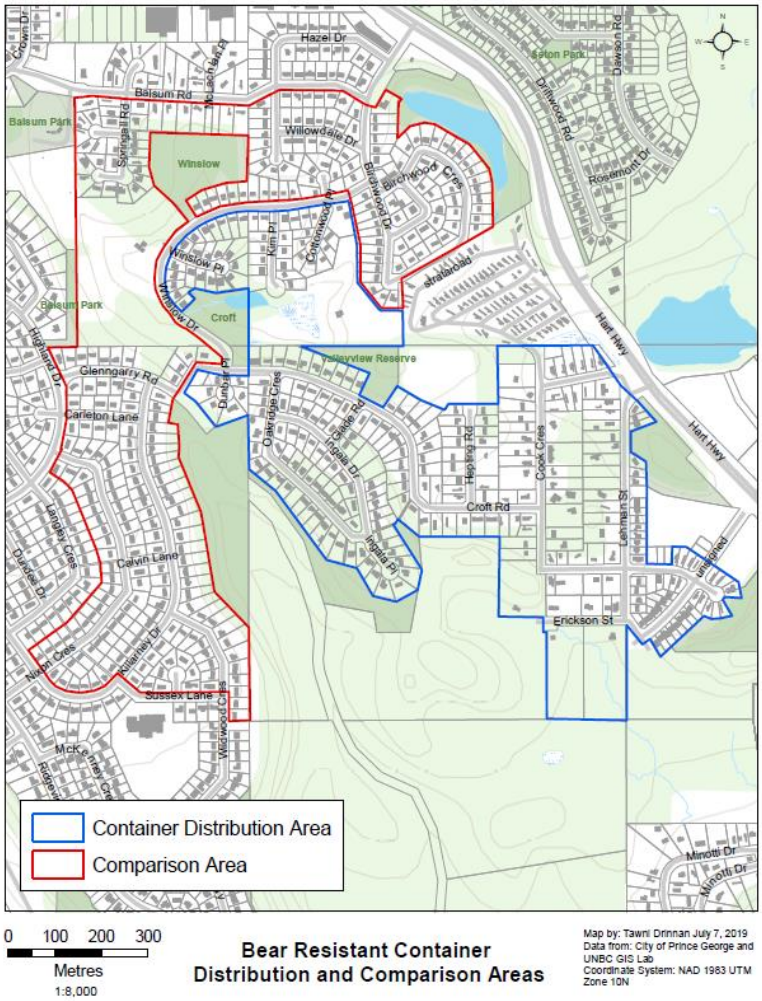

Figure 1. Map showing the container and comparison areas used in testing the effectiveness of the City of Prince George's Bear-resistant Garbage Cart Pilot Project.

Methods

Survey data

The City of Prince George organized a public survey that was sent to the residents in the container area and control areas to determine the level of public support for future expansion of the bear-resistant garbage carts in other areas of Prince George. A survey was sent out to residents in the container area in 2019 and 2020. The survey asked the following questions: (1) in your opinion, do you feel the bear-resistant cart has helped to reduce bear activity in your neighbourhood?; (2) did a bear try to get into your garbage cart (e.g., cart tipped over) this year?; (3) are the bear-resistant carts easy to use?; (4) would you be interested in downsizing to a smaller bear-resistant cart if this option were available?; and (5) would you recommend the use of bear-resistant carts in other neighbourhoods?

A separate survey was sent to the control area in 2019 and asked the following questions: (1) did you know that the adjacent Croft/Winslow neighbourhood has been using bear-resistant household garbage carts as a pilot project this year?; (2) did a bear try to get into your cart this year (e.g., cart tipped over)?; (3) do you feel the bear activity has increased in your neighbourhood in 2019 compared to the past 5 years?; (4) do you regularly lock your garbage cart in a shed or garage, or secure your cart with a tie-down strap to keep bears out of your cart?; and (5) would you be interested in using a bear-resistant cart if this option were available?

These two surveys asked questions with three answer choices: “yes”, “no”, and “don’t know”. I summarized the total responses and illustrated them in figures. I also examined the qualitative portion of the survey and summarized the key points.

PWOR data

To compare data on bear activity patterns before and after the implementation of bear-resistant garbage carts, I spatialized the addresses associated with the PWORs from 2011-2022 by inputting the geographic coordinates of each reported bear sighting into ArcGIS Pro. I created maps of the bear sightings in the container and control neighbourhoods to visually demonstrate the results. I also made bar graphs showing the total PWOR in both neighbourhoods to illustrate the overall trends.

Literature review

I performed a literature review to find information about other bear-proof garbage collection systems and to learn about case studies where bear-resistant garbage carts have been applied elsewhere successfully. Comparing the results of other case studies will offer greater insight into the overall effectiveness of bear-resistant garbage cans and will support my findings of the pilot project in Prince George, BC.

Results

The surveys sent to the container area had a total of 139 respondents, including the 2019 survey (n = 85) and the 2020 survey (n = 54). The survey sent to the control area in 2020 had a total of 66 respondents.

Container area

The survey sent to the container area in 2019 and 2020 revealed a strong level of support from the participants after a 1-year period for the use of bear-resistant garbage carts. The results showed positive feedback towards the use of bins, recommending them to other locations in Prince George, and stated that the bins greatly reduced bear activity. For example, 82.4% of residents in the first year voted that the bear-resistant garbage carts were easy to use and increased to 92.5% after 1-year of use. At the start of the pilot project, 91.8% (2019) of survey participants recommended the use of the bins in other neighbourhoods in Prince George and after a 1-year period, 90.6% (2020) of respondents recommended expanding the project to other areas in the city. There was positive feedback on the use of bins as 67.1% (2019) said that bear activity was greatly reduced after the implementation of the bear-resistant garbage carts, which increased to 81.5% (2020) after 1-year. Although there was strong level of support for future expansion of the bear-resistant garbage carts to other areas of Prince George, there was less interest in residents downsizing the garbage bins to a smaller size. For example, only 42.9 % (2019) of residents were interested in downsizing to a smaller cart size and decreased to 28.3% (2020) after 1-year of use.

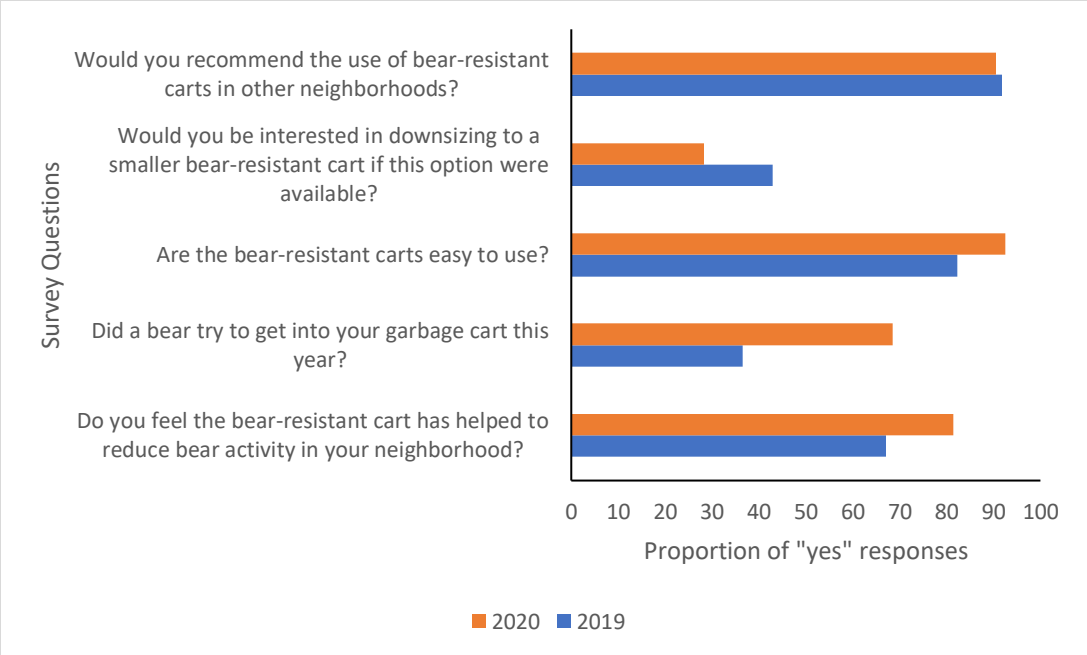

Figure 2. Proportion of “yes” responses to 5 survey questions from 85 participants in 2019 and 54 participants in 2020 in the container area.

The surveys sent to the container and control areas had the option to leave a comment at the end of each question to allow residents to share their opinions and give feedback. Overall, many respondents who left comments on the survey questions felt that the bear-resistant garbage carts were very effective in reducing bear activity in their neighborhoods. Most responses indicated that bears were unsuccessful because the carts were difficult to get into, however, some stated that it is too soon to tell as the carts are new but are optimistic that it will help reduce bear activity over time. Although there was positive feedback, there were also some responses expressing concerns over the cart design, such as cold weather causing the lids to freeze shut or needing two hands to use the cart. Respondents from the control area were supportive of using the bins but only if there were no additional costs. Comments from the survey offer more insight into why people might feel positive or negative towards the bear-resistant garbage cans:

Container area

Question: "In your opinion, do you feel the bear-resistant cart has helped to reduce bear activity in your neighbourhood?"

Participants who voted "yes" commented:

"They work great. The bears come up my back yard to the street and they didn't get into my cart once."

"Perhaps not reduced activity at this time just given that the carts are new. It takes time for climatized bears to realize food is no longer available. However, although families of bears tried hard to get into the carts, they eventually gave up and moved along."

Participants who voted "no" commented:

"The bears were still around since the new cans were supplied to us, but we are not picking up our neighbor's garbage in our yard anymore since we received the cans. Maybe as time goes on bear sightings will go down."

Question: "Did a bear try to get into your garbage cart (e.g., cart tipped over) this year?"

Participants who voted "yes" commented:

"Yes ... but it couldn't."

"Only once and did not get to the garbage."

"Multiple times but as stated in #1 they were unsuccessful."

"Found it turned. One dragged our neighbors can 20 plus feet but couldn't get in."

"Had a bear drag the bear cart down the driveway. When he couldn't get it open, he ran off."

Question: "Are the bear-resistant carts easy to use?"

Participants who voted "yes" commented:

"Yes, but you need 2 hands to operate. Older people may have trouble opening the lock."

"Not difficult to use, but not as easy as other carts as you need two hands to open and put bag in."

"Lock freezes up when cold/raining, can't open when frozen."

"When it's cold the latch doesn't work properly and cannot open can at times."

Participants who voted "no" commented:

"They are too large & heavy - take up too much room in your shed or garage."

"Too big for us and you need two hands to open the lid."

General open-ended comments:

"The new carts have drastically reduced the bear presence in our neighbourhood. Bears were still around according to neighbour sightings/encounters (even a sow with 3 cubs) but over the next few years I believe their behaviours will change away from human food habitats."

"We had a bear tip ours over and try to get into it. The bear was unsuccessful. We even have teeth and claw marks on the cart, so the Bear was really trying. This is a great idea and I feel will reduce the amount of bear activity in the city."

"Thank you for the carts. It has made a huge difference in our neighborhood. I feel that my children are much safer this year."

"I 100% recommend the bear-resistant cart! Thank you for providing this update to our neighborhood."

Control area

The survey sent to the control area asked similar questions. For example, one of the questions asked was, "would you be interested in using a bear-resistant cart if this option were available?" Several of the comments from the respondents were people expressing their concerns on the pricing of the bear-resistant garbage bins. Some examples of the comments were as follows:

"Depends on if and how much additional cost to homeowners."

"Don't want to spend more money for garbage pick up."

"If its at no extra cost – absolutely."

Total PWORs per year from 2011-2022 in the container area and control area (Figure 3).

From 2011-2022, there were a total of 126 PWORs in the container area with an average of 10.8 reports per year (Table 1). Similarly, there were a total of 123 PWORs in the control area with an average of 11.3 reports per year (Table 1). The number of PWORs varied over time; the container area had the highest recorded number of PWORs in 2013 and the lowest recorded number in 2022. Consequently, the control area had the highest recorded number of PWORs in 2012 and had the lowest recorded PWORs in 2015 (Table 1). Between 2019-2022, there was a declining trajectory of PWORs in both the container and control neighbourhoods, with the container area having less reports than the control area (Figure 1).

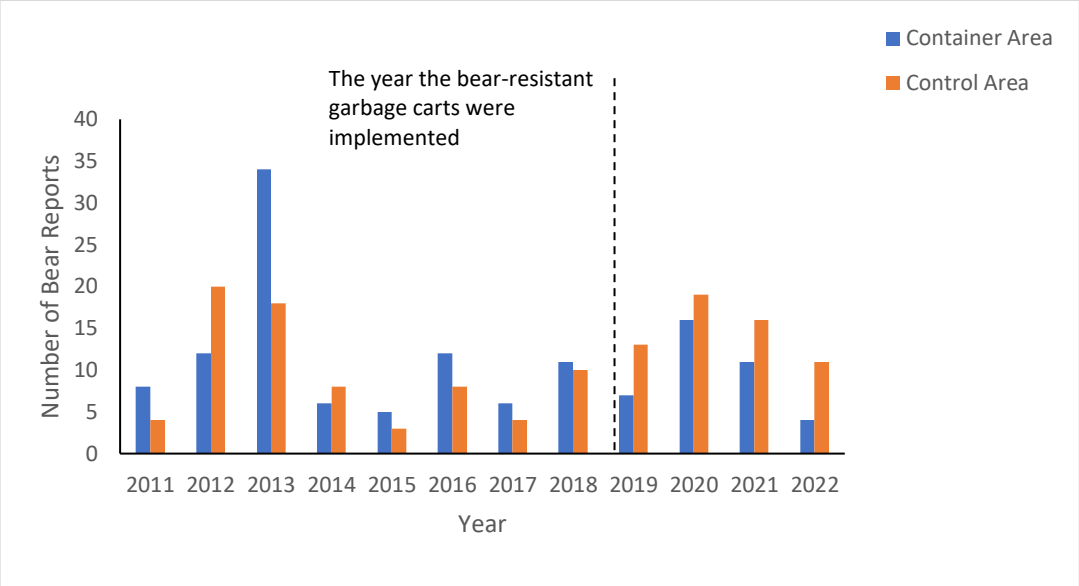

Figure 3. Numbers of Problem Wildlife Occurrence Reports in a neighbourhood where bear-resistant garbage containers were introduced in 2019 (Container Area) and in a nearby neighbourhood with regular garbage containers (Control Area). Data were collected between 2011 and 2022 in Prince George, BC. Dotted line illustrates the year the bear-resistant garbage carts were implemented.

Table 1. Number of bear reports in the city-wide area, container area, and control area between 2011 and 2022.

Year	Container Area	Control Area	PG City
2011	8	4	710
2012	12	20	928
2013	34	18	798
2014	6	8	549
2015	5	3	285
2016	12	8	497

2017	6	4	363
2018	11	10	699
2019	7	13	528
2020	16	19	1483
2021	11	16	1675
2022	4	11	1158
	128	123	8515

Total PWORs per year from 2011-2022 in the total city (Figure 4).

The trends in the study area parallel the trends for the total city-wide calls. For example, 2015 was the year that had the lowest recorded number of bear reports, which was reflected in both the study area and total city. The years prior to the implementation of the bear-proof garbage bins followed a similar trend in the number of bear reports for each year, however, the years after the bins were implemented did not show a comparable trend. For example, the total city-wide reports had the highest recorded number of bear reports in 2020-2022 (Figure 4), yet we see a declining trajectory in the number of bear reports in the study area with the container area having less bear sightings than the control area (Figure 3).

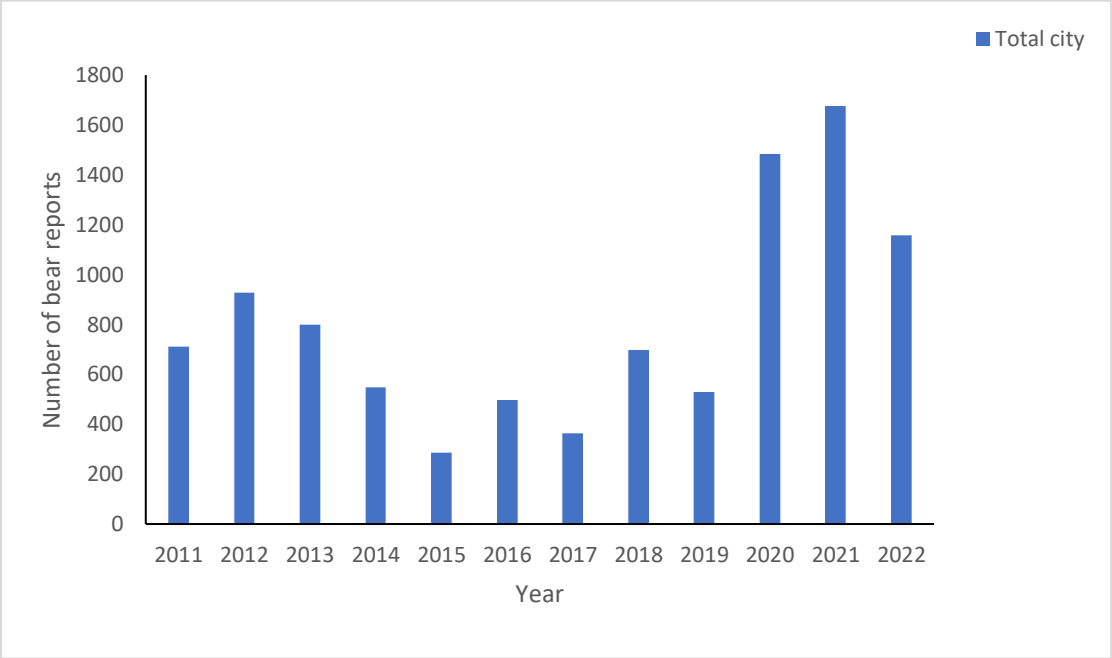

Figure 4. Numbers of city-wide Problem Wildlife Occurrence Reports. Data were collected between 2011 and 2022 in Prince George, BC.

Discussion

The prevalence of black bears in urban areas is a growing concern in Prince George, BC, a city surrounded by bear habitat. The proximity to the forest combined with attractants such as

compost, garbage, and fruit trees, often brings bears into people's neighbourhoods. Prince George has experienced an increase in bear activity over the last two decades, increasing the human-bear conflict and number of bears destroyed within the city each year (Ciarniello, 2019). The bear-resistant garbage cart pilot project was initiated as an attempt to reduce these issues and to determine if these carts were successful or not.

Surveys revealed that residents perceived a reduction in the number of bears consuming garbage over a 1-year period. Residents also commented positively on using the trash cans. While the results from both surveys were not large enough to be definitive or model the entire city, they are strongly suggestive that residents are supportive of bear-resistant garbage carts. The residents of the container neighbourhood gave positive feedback towards the usage and effectiveness of the bear-resistant garbage carts. For example, after using the bear-resistant garbage cans for one year, 92.5% of residents said that the bear-resistant garbage cans were easy to use and 90.6% recommended the use of the bins in other neighbourhoods. The number of bears attempting to get into the garbage can increased from 36.5% (2019) to 68.5% (2020), however, there were 955 more bear sightings across the city which may have influenced this increase. Although the number of bears attempting to access garbage increased, the comment sections on the surveys revealed that most of these attempts were done unsuccessfully and that bears could not get into the bins. The bear-resistant garbage cans have shown to be successful in reducing bear activity in these neighbourhoods as 81.5% of the users voted that they did not witness as many sightings as previous years.

The PWOR calls fluctuated from 2011-2022 (Figure 3) with bear activity rising and falling. However, the total city-wide reports had the highest recorded number of bear reports in 2020-2022 after the bins were implemented (Figure 4), yet our results showed a declining trajectory in PWORs in the control and container area from 2019-2022, with the container area having slightly fewer PWORs than the control area (Figure 3). These numbers support our prediction that there would be fewer calls to the Conservation Officer in the container neighbourhood compared with the control neighbourhood. However, it is not fully understood yet if the bear-resistant garbage carts are the main cause for the declining trajectory in PWORs in the study area.

While the bear-resistant garbage carts are likely helping reduce the number of PWORs in these neighbourhoods, there may be other factors involved that are contributing to the rising and falling of PWORs that should be considered. For example, drier weather conditions may limit the amount of natural food in the wild due to poor growing conditions, resulting in bears utilizing anthropogenic foods (e.g., garbage, fruit trees, birdfeeders) which can significantly increase human-wildlife conflict (Johnson et al., 2017). Human garbage is one of the highest-calorie food sources available to black bears and is easily accessible in residential areas. It is easier for black bears to acquire its daily calorie requirement from eating garbage compared to scavenging for food in the wild, resulting in bears congregating where there is garbage available (Noel et al., 2017). Thus, bears are more likely to search for garbage and other unnatural foods in residential

areas which increases human-wildlife conflict. In a study done by Barrett et al. (2014) to evaluate the effectiveness of using 2 types of bear-resistant garbage bins found that 70% of calls received in 2010 were related to bears accessing garbage and other unnatural food sources in residential areas. Despite the increase in bears accessing anthropogenic foods, the bear-resistant garbage carts are helping to reduce the number of bears accessing the garbage successfully.

Studies have shown bear-resistant garbage carts to be successful in other communities. For example, Barrett et al. (2014) performed an experiment in 2 residential communities in Florida using 95-gallon bear-resistant garbage cans and 95-gallon regular garbage cans; the goal of their project was to reduce the human-bear conflicts. The study areas, a neighborhood in DeLand, Florida, USA and Fort Walton Beach, Florida, USA, are located approximately 638km apart and consisted of more than 400 residents in each neighborhood. They used a bear-resistant garbage cart (approximately $200) in the DeLand neighborhood, and a modified residential trash can (approximately $70) in the Fort Walton Beach neighborhood. They performed a survey that revealed that the bear-resistant bins significantly reduced the number of bears getting into garbage cans and the overall bear-human interactions. The authors concluded that the dramatic decrease in the number of bear sightings in both study areas strongly suggest the long-term efficacy of the bear-resistant garbage carts. Another study in Colorado (Johnson et al., 2018) performed a similar comparison where they distributed bear-resistant garbage cans to 2 treatment areas and 2 container areas. Observations of bear sightings and bears getting into garbage cans were significantly reduced by 60% in treatment areas than control areas. There was also increased public support for using the bear-proof bins for bear management, encouraging the municipalities to implement more in other neighbourhoods.

Limitations

Although positive results were found in our current study, we acknowledge some limitations in our study. Limited resources allowed for only one type of bear-resistant garbage can to be tested in one neighborhood of Prince George and so the data reflects only a small portion of Prince George. The sample size in the container neighborhood had 285 residents and the control neighborhood had 293 residents, however, Prince George has a population of approximately 84,000 people (Varcoe et al., 2015). Therefore, the sample size is small in relation to the population of the city.

Another limitation is the distance between the control and container area. These two neighbourhoods are adjacent to each other, and so it is possible that a bear sighting in both neighborhoods is from the same bear; a bear in the control neighbourhood does not have to walk far to reach the container neighbourhood. If there are a higher number of bear sightings in the control neighborhood who are accessing garbage successfully does not suggest that they are successful with acquiring garbage in the container neighborhood.

Recommendations

I strongly recommend that the City of Prince George expands the bear-resistant garbage cart pilot project to other areas of Prince George, specifically, areas with high bear activity such as the Hart Highlands, College Heights, and Charella Gardens (yellow dashed lines) (Figure 5). This recommendation is based on the results of residents' perceptions which revealed that bears were less likely to acquire garbage from locked garbage bins and reduced human-bear conflict.

Since there was feedback of residents expressing concern over the costs of the bins, another survey should be sent to the neighbourhoods to ask if residents would be willing to contribute to that extra cost or if there is a percentage or total amount that they would be willing to pay. If there is little interest in paying additional costs, then two options are (1) the NBAS could apply for a grant from the BC government to cover costs of bear-resistant garbage bins for neighborhoods in Prince George that have high bear activity (Figure 5) or (2) modifying residential trash cans with hardware attached to make it more bear-resistant (Figure 6). The second option would allow more garbage bins across the city to be more resistant to black bears which may help reduce bears accessing the garbage, therefore, reducing human-bear conflict.

There was feedback stating that the carts were problematic in cold weather. For example, some residents commented on the surveys stating that the locks freeze when it is cold and raining and that the latch does not operate properly, causing issues for residents and garbage truck operators. Thus, it will be necessary to explore other bear-resistant options that might be better suited for the climate in Prince George.

I also recommend monitoring the study area and the city-wide bear reports to collect more data over the coming years to build a stronger case study to help evaluate the overall feedback of using the bear-resistant garbage bins.

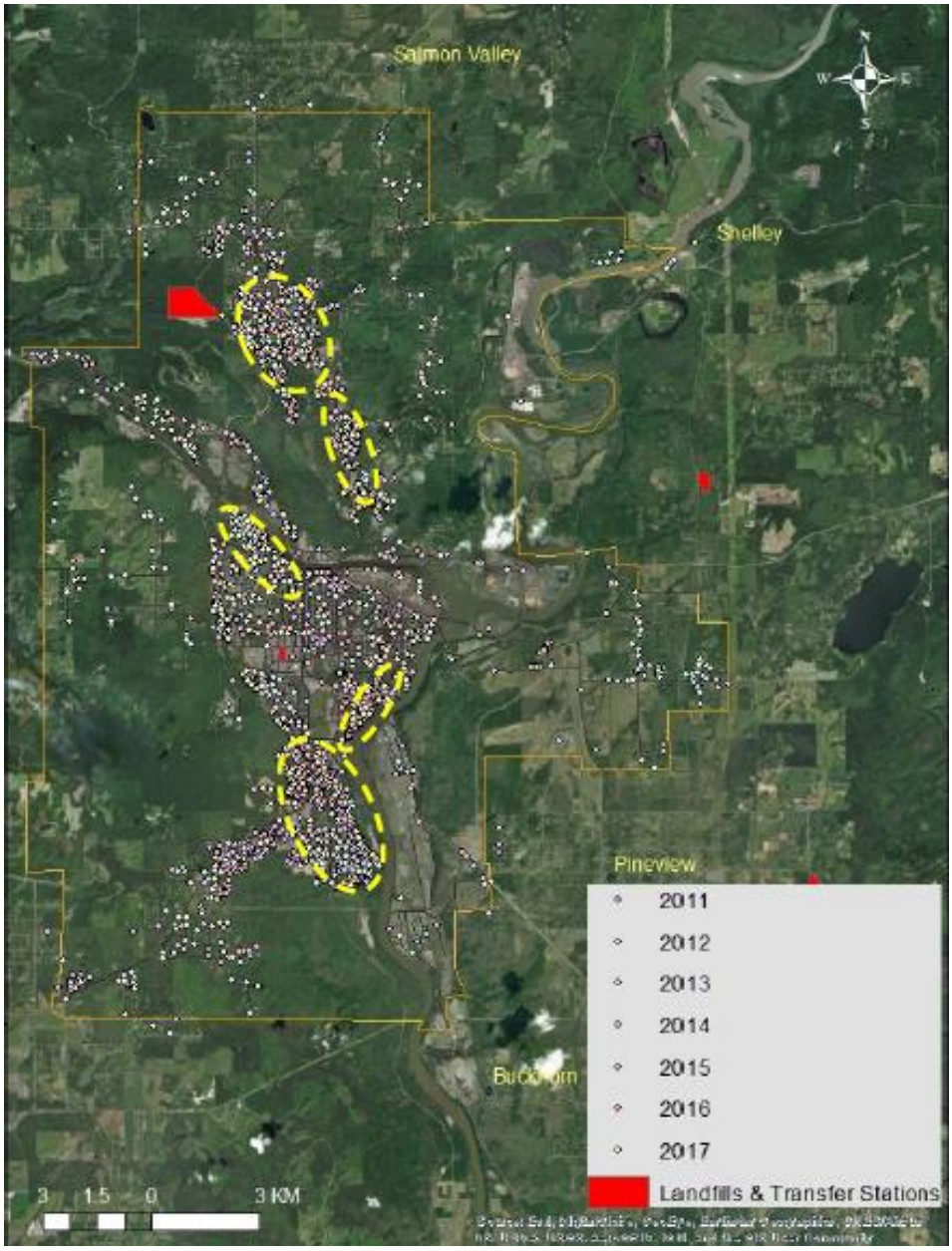

Figure 5. Location of Bear Reports for the city of Prince George BC. Areas with high bear activity are outlined in yellow dashed lines (Ciarniello, 2019).

Figure 6. A residential trash can with hardware attached to make it more bear-resistant. Inset: close-up of hardware on residential trash can (Barrett et al. 2014).

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