MAPPING HUMAN-BEAR CONFLICT: THE URBAN-WILDLAND INTERFACE ON THE FLATHEAD INDIAN RESERVATION

by

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A professional paper submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Land Resources and Environmental Sciences

MONTANA STATE UNIVERSITY
Bozeman, Montana

December 2024

DEDICATION

There are no words that can describe the gratitude and debt that I owe to my lovely, smart, driven wife. Without her I would be living in a van down by the river. She is the wind in my sails, here's to her.

ACKNOWLEDGEMENTS

Many thanks are due to Montana State University's Land Resources and Environmental Science Master's Program. I am also thankful for my professors who guided me through this process. Most importantly, Dr. Robert Peterson for advising me through this analysis.

I owe a special thank you to the Confederated Salish and Kootenai Tribes (CSKT) and Kari Kingery, CSKT Wildlife Program Manager, for allowing me to conduct this analysis with data collected by the Wildlife Program. Finally, I would like to express my gratitude to my CSKT Wildlife Program colleagues, without whom I wouldn't have had the insight necessary into the factors and issues surrounding human-bear conflict to gain a deeper understanding of these data.

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ABSTRACT

As the human footprint expands across western Montana, the boundaries between people and wildlife blur, bringing grizzly (*Ursus arctos horribilis* Ord) and black (*Ursus americanus* Pallas) bears into closer contact with communities on the Flathead Indian Reservation. These interactions pose risks to both human safety and bear populations, highlighting the need for effective management strategies to mitigate human-bear conflicts. However, very little is known about the spatial and temporal frequency of these interactions. Therefore, I created a standardized, robust database to allow for better assessment of the risk factors and areas prone to human-bear conflict. By creating a map to highlight areas that are at higher risk of experiencing a conflict, education and outreach professionals can leverage these data for community-wide changes aimed at decreasing conflict. Between 2021 and 2024, more than 400 incidents of human-bear conflict were recorded, with improper waste storage and disposal identified as the leading causes. Garbage attracted bears in 57% of these incidents. Through the creation of a heat density map, I identified conflict hotspots, providing the Confederated Salish & Kootenai Tribes Wildlife Program with consistent visualization of data. for more targeted management. The greatest risks for conflict were in the areas of Polson and Saint Ignatius. The long-term availability of these data better facilitates more informed decisions. To reduce the risk of conflict, implementing bear-resistant trash ordinances and enhancing the use of electric fencing to secure attractants such as livestock and fruit trees should be prioritized in areas experiencing higher rates of conflict incidents. My findings provide a framework to reduce these conflicts and emphasize the significance of fostering coexistence between humans and bears, highlighting the importance of community outreach and engagement.

INTRODUCTION

Defining Human-Bear Conflict

Conflict between bears and humans involves complex interactions balancing the ecological needs of bears with human priorities. An issue of global concern, the increasing overlap between the home ranges of bears and human activity is unsurprisingly increasing the probability for interactions between the two (Venumière-Lefebvre et al., 2022). To prevent a mischaracterization of events, it is important to define what a conflict is, as not every interaction or sighting is a conflict. For my study, human-bear conflict, is defined as a situation where there are negative effects stemming from direct interactions between the two.

In western North America, two of the most notable large carnivores are the grizzly bear (*Ursus arctos horribilis*) and the black bear (*Ursus americanus*). These two bear species are commonly found in various habitats across the region, each with unique adaptations and behaviors. Humans and bears often compete for habitat and resources in the urban-wildlife interface, and the consequences of this competition can have significant impacts on both.

In a systematic review of more than 500 articles, Lozano et al. (2019) organized, analyzed, and synthesized global research, identifying a large increase in the number of studies on human-carnivore conflict since 2000. Highlighting the importance of assessing the factors as well as the drivers influencing and leading to the management of carnivores, especially bears. Global human-carnivore conflicts are framed by a world of increasing conflict between humans and carnivores (Khatoon et al., 2022) and decreasing carnivore populations (Dickman et al., 2011).

A majority of the studies produced about wildlife-human conflict since 2000 have been about bears and were conducted in North America (Lozano et al., 2019), both of which overlap extensively with the state of Montana. Four of the six grizzly bear demographic monitoring areas (DMA) (Cabinet-Yaak, Northern Continental Divide, Greater Yellowstone, and Bitterroot ecosystems) are located partially or entirely within Montana (Costello et al., 2022). Black bear distribution also occurs across the entire state, with a mean density of 12.8 bears per 100 km^2 (Mace & Chilton-Radandt, 2011). Montana also has a growing human population (Poulette et al., 2024) and with this there is increased pressure on bear habitat, increasing the chance of experiencing a human-bear conflict (Proctor, et al., 2018).

The Montana Department of Fish, Wildlife & Parks (FWP) manages the two species differently in many aspects, as grizzly bears in the lower 48 states are listed as threatened under the Endangered Species Act (ESA) (U.S. Fish & Wildlife Service, n.d.), and there is no shortage of black bears across most of the state (Mace & Chilton-Radandt, 2011). That being said, FWP also engages in many similar activities to prevent, mitigate, and manage conflicts for both bears, as their behavior can be very similar in connection to anthropogenic attractants, such as household garbage, bird feeders, and pet food to name a few (Proctor et al., 2018). If their habitats overlap, the same attractants could draw either species. Effective conflict prevention strategies for black bears are equally applicable to grizzly bears.

Montana's history with human-bear conflicts or incidents includes but is not limited to livestock depredations, destroying beehives, foraging for garbage in proximity to homes, breaking into homes and other buildings, or, in rare cases, injuring or killing humans. Problematic zones for conflict are often in valley bottoms and foothills adjacent to public lands,

especially where attractants coincide with bear habitat. There are multiple perspectives on what the conflict "problem" is in Montana. For example, Nesbitt et al. (2023) found that community members felt that there were too many grizzly bears as a result of over-repopulation, some people were excited about grizzly bear activity, and some viewed their presence as a risk to human safety; lastly, some viewed grizzly bears as a symbolic problem, linking the recolonization of bears to "an erosion of personal rights and freedoms exacerbated by the regulatory burden of the Endangered Species Act" (Clark et al., 2014). In 2011, there were 19 mortalities of grizzly bears due to human causes in the Northern Continental Divide Ecosystem, with 12 of those attributed to management removal, for actions such as killing chickens, accessing livestock feed, pet food, bird seed, fruit trees, and killing livestock (Mace & Roberts, 2012).

The Confederated Salish & Kootenai Tribes

In western Montana lies the Flathead Indian Reservation (FIR), where the Salish (Séliš), Pend d'Oreille (Q̓lispé), and Kootenai (Ksanka) tribes in western Montana, otherwise known as the Confederated Salish and Kootenai Tribes (CSKT) reside. A small fraction of their aboriginal lands of northern Idaho, Eastern Washington, and southern British Columbia, the reservation is approximately 533,000 hectares (1,317,000 acres). The reservation is framed by the Mission Mountain range and wilderness area on the eastern border, Flathead Lake on the north end, the Salish Mountains to the west, and the Reservation Divide and Rattlesnake Mountains to the south, with the Rattlesnake Wilderness being in the Rattlesnake Mountains (Madej, 2013). With all this habitat surrounding the Jocko and Mission Valleys and the Camas-Little Bitterroot areas

accompanied by a rising population and increasing levels of development, there are more interactions between bears and humans.

The establishment of the CSKT Natural Resources Department in 1981, coupled with the 1978 Supreme Court decision affirming tribal court jurisdiction over non-Indians in permitting, licensing, and environmental protection, laid the foundation for CSKT's management of wildlife on the FIR(Incashola, 2023). Over time, the tactics and objectives of wildlife management have evolved. However, the Wildlife and Conservation Programs within the Division of Fish, Wildlife, Recreation, and Conservation continue to dedicate significant effort and resources to addressing and mitigating human-carnivore conflicts within the reservation's boundaries (KPAX-TV, 2012).

Impacts on Humans

Although large carnivores can enhance tourism and make great mascots for conservation campaigns (Nesbitt et al., 2023), the presence of carnivores can impose financial costs on rural communities through competition with humans over crops, livestock, wild game, and other natural resources (Klees Van Bommel et al., 2020; Proctor, et al., 2018; Venumière-Lefebvre et al., 2022). With an increase in urbanization in western Montana (Hansen et al., 2024), there will be an increase in proximity to bear habitat.

Most of the human-bear conflict mitigation is typically focused on the economic impacts to property, livestock, and crops. Although negative feelings can still arise towards large carnivores, extending beyond economic loss and heightened by human perceptions of personal safety, fatal human-bear conflicts in Montana are rare, but such incidents typically receive significant media coverage and contribute to heightened public concern (Expósito-Granados et al., 2019).

Impacts on Bears

Urban encroachment is a common global issue, and as urban sprawl and modification of the environment dominate the landscape (Western, 2001), there will be more interaction between humans and bears, influencing their behavior. One example is black bears that live in the urban-wildlife interface and switch most of their activity to night, with later denning dates, and a decrease in the time spent in dens (Beckmann & Berger, 2003).

Tribal Viewpoint of Bears

All animal species on the landscape had their place and significance in the lives and cultures of all of the indigenous peoples of North America; the sentiment of the Salish, Kootenai, and Pend d'Orielle was no different, with the view that predators, wolves, and mountain lions were the custodians of our game herds, removing the sick and the injured from the populations, contributing to healthier herds and increased fitness. Bears were considered a relative, who used the landscape and foraged for food in many of the same ways the people themselves relied on the landscape for survival. Bears were present when they picked huckleberries (*Vaccinium* spp. Linnaeus), dug bitterroot (*Lewisia rediviva* Pursh) or camas (*Camassia quamash* (Pursh) Greene) roots, giving clues as to what plants might be edible, and where a person might find sources of food throughout most of the year. They were generally respected rather than feared (GOAL Tribal Coalition, 2016).

In today's management of wildlife, there has been considerable effort put into the preservation of wildlife corridors and directing habitat restoration at wildlife and fisheries mitigation properties. These properties serve as islands of undeveloped riparian and grazing habitats for all wildlife in pursuit of our directive of protection, enhancement, and management

of terrestrial wildlife species and habitats to provide for viable populations of all wildlife species on the FIR for use by present and future generations (Confederated Salish Kootenai, n.d.).

CSKT Wildlife Program - Past Management Efforts

As wildlife managers, the Confederated Salish and Kootenai Tribes (CSKT) biologists use the same tools to mitigate conflicts between humans and bears as Montana FWP. In bear management, there are lethal and non-lethal techniques and tools. The initial action emphasizes non-lethal methods such as attractant reduction and raising public awareness about how certain lifestyle habits can unintentionally attract bears to their residences. The Division of Fish, Wildlife, Recreation, and Conservation (DFWRC) has promoted more coexistence measures for many years, shifting more of the responsibility of reducing conflict onto landowners (KPAX-TV, 2012).

Conflict prevention on the FIR is characterized by increasing access to bear-resistant garbage cans for those who self-haul their garbage. With extensive education, information, and outreach efforts aimed at residents of all ages, our program focuses on the need to reduce the availability of anthropogenic attractants to bears on the reservation. A key component is the education of the incoming population about the best practices one can take to coexist with bears, with different messages for different audiences such as homeowners, short-term rental owners, and migrant workers with language limitations. Examples of this type of outreach material have been created by wildlife organizations such as People and Carnivores.

Another important form of conflict prevention involves consulting with residents on proper techniques for building electric fences to keep bears out as opposed to keeping livestock in. In some instances, there is collaboration with non-governmental organizations (NGO) to help

with the installation of permanent electric fence solutions in certain areas around attractants such as chicken coops, garbage collection sites, or fruit orchards. Strategically placed fences can prevent recurring conflicts, ensuring future generations of cubs are not educated as to the presence and availability of those anthropogenic sources of food (Mazur & Seher, 2008) and creating a lasting, positive impact on human-bear conflicts in small areas.

As every incident is unique, and there are often inescapable attractants, our first line of defense in preventing the reoccurrence of conflicts between humans and bears is to use electric fencing (Smith et al., 2018). Biologists for CSKT employ a variety of temporary systems of electric fences to remove bears' access to attractants such as garbage collection sites, chicken coops, and fruit trees. The success of these systems and their constant improvement has been one of the most effective tools, non-lethal or otherwise, available for conflict mitigation on the FIR. As our systems are temporary, we encourage permanent systems that are assembled and maintained by the landowner and will consult and assist with landowners in the development and deployment of permanent electric fencing systems.

Other non-lethal human-bear conflict mitigation techniques include the use of motion detection scare devices that produce a loud and disruptive noise, the use of battery-operated radios to create the noise of humans talking, and aversive conditioning techniques such as bear spray and air horns. Aversive conditioning can also be incorporated into release strategies during the relocation of bears involved in human-wildlife conflicts (Sarmento, 2024). Through a hard release approach, this technique aims to condition bears to avoid humans and anthropogenic attractants through the association of the use of those attractants to an unpleasant experience.

As a conflict scenario involving a bear progresses through stages of remediation, managers must determine whether relocation to an area with fewer anthropogenic attractants or lethal action is the most appropriate course of action to ensure both human safety and wildlife management objectives. Examining patterns and trends in human-bear conflict on the FIR can provide valuable insights for developing strategies to reduce such conflicts that end in total removal of the offending bear on the FIR.

There has been much effort spent in recent years to work to change the image of carnivores in the public eye with various levels of success. Many people are now aware that they share this landscape with these animals in our ecosystem (Nesbitt et al., 2023). With these same people taking steps to prevent unwanted interactions with carnivores such storing household garbage in your garage or shop until collection day, making use of bear-resistant containers, gleaning available fruits from your property, ensuring that pet and livestock feeds are properly contained. Other conflict reduction techniques are also available such as the use of livestock guard dogs and constructing electric fencing to prevent access of chicken coops, storage sheds with feed or garbage, and night penning areas (Smith et al., 2018; Titus & Jachowski, 2024; Young & Sarmento, 2024).

Although one landowner can be taking the necessary steps to prevent a conflict, if there are others in their area not taking these same steps, they could still be experiencing unwanted interactions with these carnivores, highlighting the need for community-wide paradigm changes in the way we manage our garbage, deceased livestock, excess fruit from trees, pet and livestock feed, as well as the livestock themselves.

Project Importance

The FIR encompasses 5,020 km^2 (1,938 mi^2), with two biologists primarily responsible for responding to incidences of human-carnivore conflict along with Tribal Game Wardens for black bear and mountain lion conflicts. In an area that has experienced a recent large influx of new residents (Poulette et al., 2024), the need for increased education and outreach on ways to coexist with carnivores in this landscape is even more prominent. With a chance to frame the discussion in a way that can help improve public perception of these carnivores to newcomers, we can continue to work towards positive outcomes such as changing whole community attitudes towards preventing interactions between carnivores and people.

Therefore, the goal of my research is to examine and identify primary contributors to human-bear conflicts on the reservation, identify high-risk zones for human-bear conflicts located within the reservation boundaries, examine spatial and temporal patterns, or clusters of conflict in specific areas, and examine ways that the identified conflict zones inform wildlife managers and conservation planning efforts by the CSKT Tribes Wildlife Program. This goal will be accomplished using four objectives: 1) creation of a robust database for the CSKT Wildlife Program, 2) assessment of human conflict risk factors, 3) creation of a map that highlights high-risk conflict zones, and 4) evaluation of communities and areas that would benefit from additional outreach and education promoting community-wide changes to reduce human-bear conflict.

METHODS

Objective 1: Create a Robust Conflict Database for the CSKT Wildlife Program

For collection of data, I determined that ESRI's Survey123 program would be the best fit to record new data. With the creation of a custom survey that can be filled out by Tribal Game

Wardens as well as Tribal Biologists, the data fields are selection forms, standardizing the data entry for sorting fields. The program also allows for longer form entry in the form of notes section, a field to upload photos, and the ability to designate some fields as required, such as location, type of attractant, species, and date collection. This permits the form to be flexible enough to account for the variability of conflict events, but rigid enough to keep data in a consistent format that is sortable for analysis. At the end of the year, the new data can be downloaded with historic data and analyzed in ways that fit the CSKT Wildlife Program objectives at that time.

Questions were determined during the process of standardizing the previous year's conflict data. Caller name and contact information are mandatory for follow-up actions and sending outreach and education materials to individuals. Date, species, and nature of event are all required fields, as the date helps to differentiate between similar events happening over a period, either in the same area or from the same caller. Species of the conflict animal are important as the response for a black bear is primarily under the preview of Tribal Game Wardens, whereas grizzly bear conflicts are required to be under the purview of Tribal Biologists. The "Nature of Event" field was added to differentiate between conflicts and sightings or detections. A bear simply walking through an area without any direct interaction with the caller does not constitute a conflict. Although this is a conflict database, it is not always as evident as to whether the event is a conflict, and being able to offer this option is important for data integrity as it ensures there is no over-reporting of conflicts.

Creating multiple selection fields for the attractant type and depredation species was important to keep responses consistent within the set options, allowing for better analysis of

responses and preventing typos and spelling errors from duplicating attractant types. Type of attractant is a required field because of the assumption that there is something bringing the bear into proximity of people, whether it is garbage, fruit trees, human food, bird feeders, centralized waste site for a business, pet or livestock feed, unsecured livestock, or other. The "other" selection opens a field to type in, which is important for unique attractants. Depredation type is not a required field, as not every conflict involves a depredation of pets or livestock. This field includes options such as chicken, sheep, goat, llama, cattle, pig, dog/cat, equine, and other. These were chosen as options because they are the most common responses for depredated animals in the four-year period represented by the data.

For capturing a location in conflict events, an address bar was added. Most callers have an address for their event, and often there are extra steps required to find reliable GPS coordinates when recording information from a call or voicemail. An address was required instead of coordinates because most past data used addresses as location identifiers. There is a separate "coordinates" field for rare occasions that have no address. Location is one of the most valuable aspects of this database, as there is no adding the data to a map without a location. Both addresses or latitude and longitude coordinates provide the necessary location data. Although the address was the most common location description, there can be conflicts that happen in areas with no address. Because not every record has a name or contact information from past incidents, I determined a location identification necessary to be included in the database.

Conflict description and corresponding action are documented in dedicated fields. Enabling the inclusion of notes provides context for each event. This allows for decisions to be made about the data in the case that there can be more data gleaned from these conflict events.

The form also allows for photographs to be collected to aid in the recording of events with as much useful data as possible. Keeping photos for records and reports is an important but not required capability for this system. Photos assist other biologists and game wardens in keeping informed of cases that extend beyond a single visit. Although these data are not shown, they are a part of the master file.

Survey123 is the ideal solution for gathering and storing data as it is kept in a cloud-based system, and it will continue to compile conflict data in a standardized form for years to come. The simplicity and accessibility of the form allows new biologists or game wardens to easily record and report on conflict events happening on the FIR.

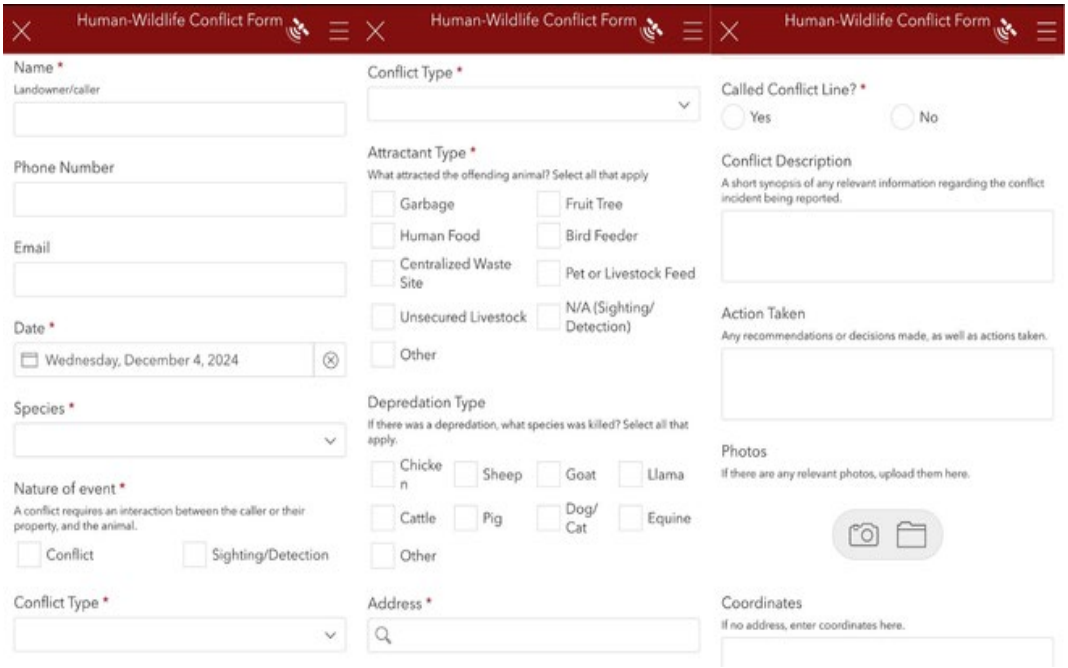

Figure 1. CSKT Human-Wildlife Conflict Form on the Survey123 app as seen on a mobile device.

Objective 2: Assess Human-Bear Conflict Risk Factors

Using Microsoft's Excel program, I created a table with all the conflicts recorded for the period of years 2021 to 2024, "COUNTIFS" functions were used to create tables with the frequency of each attractant by year, town, conflict type, attractant type, and species.

The different types of conflict experienced are unnatural attractants, depredation, property/vehicle damage, entry or attempted entry, agricultural damage, human interaction, and non-target capture.

As stated above, the decision as to which attractants were important came from a combination of the most common attractants in past years, reducing redundancy by combining common attractants into a group such as all livestock including chickens being listed under unsecured livestock or pet and livestock feed being a single option.

Objective 3: Map Conflict Risk Zones

In defining the different areas on a 5,020 km^2 (1,938 mi^2) reservation, I decided that the best way to assign a general area to each conflict was to use the postal code already designated to the address associated with every conflict on the reservation. Requiring an address as a prerequisite for the use of past data. The different postal codes on the reservation in the data were for the Arlee, Big Arm, Charlo, Dayton, Dixon, Elmo, Hot Springs, Missoula, Pablo, Polson, Ronan, and Saint Ignatius areas. Of these 12 areas, only 8 were represented in the conflict data from 2021-2024. By using a familiar system, such as the postal code, the data are more understandable and accessible to the public as well as those not as familiar with the area. Using postal codes can also provide better context for new managers as they are recording conflict incidences.

By uploading the table of sorted conflicts by location into ArcGIS Online, a vector layer can be created. Using heat map tools on ArcGIS Online, the vector layer can be transformed into a layer with color denoting the number of conflicts that are near one another. I chose a yellow-to-red color range for this heatmap, with yellow denoting areas of highest conflict density (smallest distance between incidents) and red representing areas with lower intensity. This color choice aligns with intuitive visual cues—yellow typically signals urgency or intensity, while red indicates a lower but still notable presence, making the map easier to interpret for this context.

Objective 4: Evaluate Community Needs and Areas that Could Benefit from Increased Education and Information outreach

With the identification of areas experiencing the highest rates of reported human-bear conflict, education, information, and outreach, we can tailor outreach to those areas through community-wide programs such as the Interagency Grizzly Bear Committee's (IGBC) "Bear Smart" community program (Interagency Grizzly Bear Committee, 2021). As anthropogenic attractants can impact multiple properties simultaneously, there is a benefit to not just individual properties in reducing bears access to attractants. This highlights the need for coordinated and community-driven efforts with the overarching goal of reducing bear's access to anthropogenic attractants.

RESULTS

The creation of a data collection database inside of ESRI's Survey123 was the first step in understanding the issues around human and bear conflict on the FIR. Deciding the categories of conflict and attractant types and what information makes these data more mappable by

collecting the most relevant data in a predictable and consistent format over time. With better ability to map these data, we can better balance the societal needs of the residents of the FIR with its ecological functions in relation to bear management. Turning what one would think to be wildlife management into people management because in the act of removing and making anthropogenic attractants on the landscape unavailable to bears. The database also allows us better access to trends in conflicts over time, aiding in the adaptive management of bears on the FIR (Dressel et al., 2018).

The creation of a database along with the synthesis of the past data collection efforts provided insights into the factors driving human-bear conflicts on the FIR, highlighting which attractants are seen most often in conflicts (garbage), and which categories, if any, are redundant in their use. This is also an important step in framing the conversation around the handling of conflict incidents, as the questions asked can help new or less experienced tribal biologists or game wardens in their mitigation of conflict situations. In collecting the data in accordance with the form, they can most easily identify what may be the primary reason for experiencing the conflict as well as steps that can be taken to reduce the chances of it happening again.

Overall, the conflict type with the highest total conflicts attributed to it was that of unnatural attractants. For black bears, 285 of the total 399 conflict incidents were due to unnatural attractants. Entry or attempted entry was the next largest conflict reason for black bears followed by property or vehicle damage and depredation, with 45, 41, and 23 conflicts due to each type, respectively.

The largest conflict type for grizzly bears was depredation, with 15 of the 35 total conflicts attributed to the depredation of livestock, chickens, or pets. This was followed by

unnatural attractants, agricultural damage, and human interaction with 9, 5, and 3 conflicts since 2021.

Garbage was responsible for most conflicts. In 435 total conflicts between both black and grizzly bears for the four years, garbage was responsible for 255, or nearly 57% of total conflicts. Unsecured livestock, including chickens, was the next most common attractant for bear conflicts. With 51 total conflicts listing Unsecured Livestock as the sole attractant, followed by Unsecured Fruit Trees and Pet or Livestock feed with 26 and 16 total conflicts for each.

The data on conflicts over the years show significant variability without a discernible trend (Figure 1). Notably, the year 2022 recorded the highest number of incidents, with 227 reported conflicts. This was followed by 2021, 2024, and 2023. In 2023, the number of incidents dropped sharply to just 10, representing a nearly 96% reduction compared to 2022.

Conflicts by town/area show the Polson area had the highest total number of conflicts over the four-year period as well as each individual year, followed by Saint Ignatius and then Ronan. Despite the difference in the population sizes of Ronan and Saint Ignatius, Saint Ignatius experienced multiple years with higher levels of conflict than the larger Ronan (Table 4).

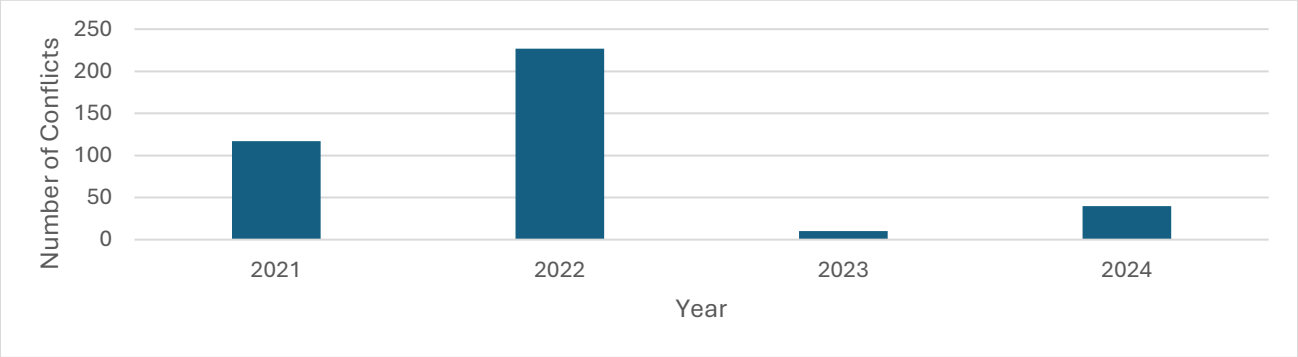

Figure 2. Total number of conflicts per year on the FIR.

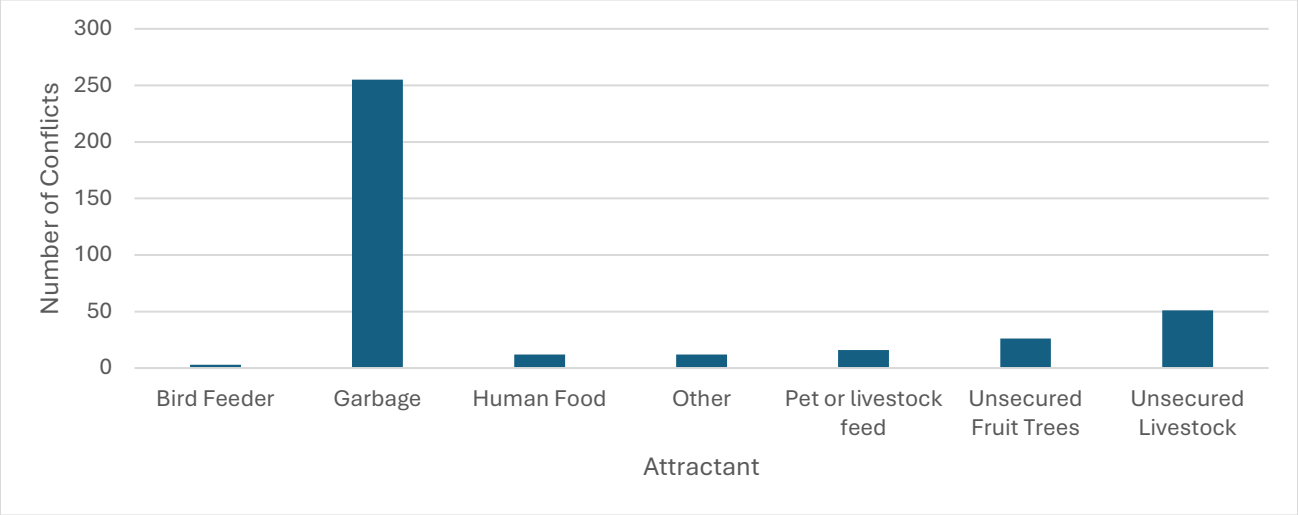

Figure 3. Number of conflicts associated with each type of anthropogenic attractant.

Table 1. Attractants responsible for human-bear conflicts by year.

Attractant	2021	2022	2023	2024
Bird Feeder	1	2	0	0
Garbage	83	147	1	24
Human Food	1	10	0	1
Other	4	6	0	2
Pet or Livestock Feed	5	10	0	1
Unsecured Fruit Trees	2	19	0	5
Unsecured	9	27	9	7
Total	105	221	10	40

Table 2. Total human-bear conflicts attributed to each attractant by area.

	Arlee	Big Arm	Charlo	Hot Springs	Missoula	Polson	Ronan	St. Ignatius
Bird Feeder	0	0	0	0	0	2	0	1
Garbage	14	13	6	23	6	93	33	32
Human Food	2	1	1	0	0	5	1	0
Other	0	1	2	0	0	3	3	2
Pet or Livestock Feed	1	1	1	0	1	7	1	1
Unsecured Fruit Trees	3	6	1	0	0	11	1	3
Unsecured Livestock	3	2	7	3	0	12	11	10

I created a heat map for all bear conflicts reported between the years of 2021 and 2024 (Figure 3). The “hottest” or brightest yellow areas on this map of the FIR shows the regions most populated are the areas with the highest frequency of conflict, with Saint Ignatius having the highest frequency in a small area. Hot Springs, Ronan, Pablo, Ravalli, and Polson also show high frequencies of conflicts. The area around the southern shore of Flathead Lake is another, more spread-out hotspot, but this area experienced the most calls on the reservation for all four years. As a postal area, it is very large, extending to Pablo city limits to the south, as well as nearly to Big Arm on the southwest shore of the lake and to the reservation border on the southeast shore of Flathead Lake. With Polson, Saint Ignatius, and Ronan experiencing the highest rates of human-bear conflict, respectively, we now have a much better idea of where the greatest focus in education, information, and outreach efforts should be directed.

Table 3. Total conflicts in each area by year.

	2021	**2022**	**2023**	**2024**	**Total**
Arlee	11	21	0	2	34
Big Arm	6	19	0	2	27
Charlo	1	12	0	6	19
Hot Springs	16	11	0	1	28
Missoula	1	10	0	1	12
Polson	48	86	4	19	157
Ronan	21	29	3	3	56
St. Ignatius	13	39	3	6	61

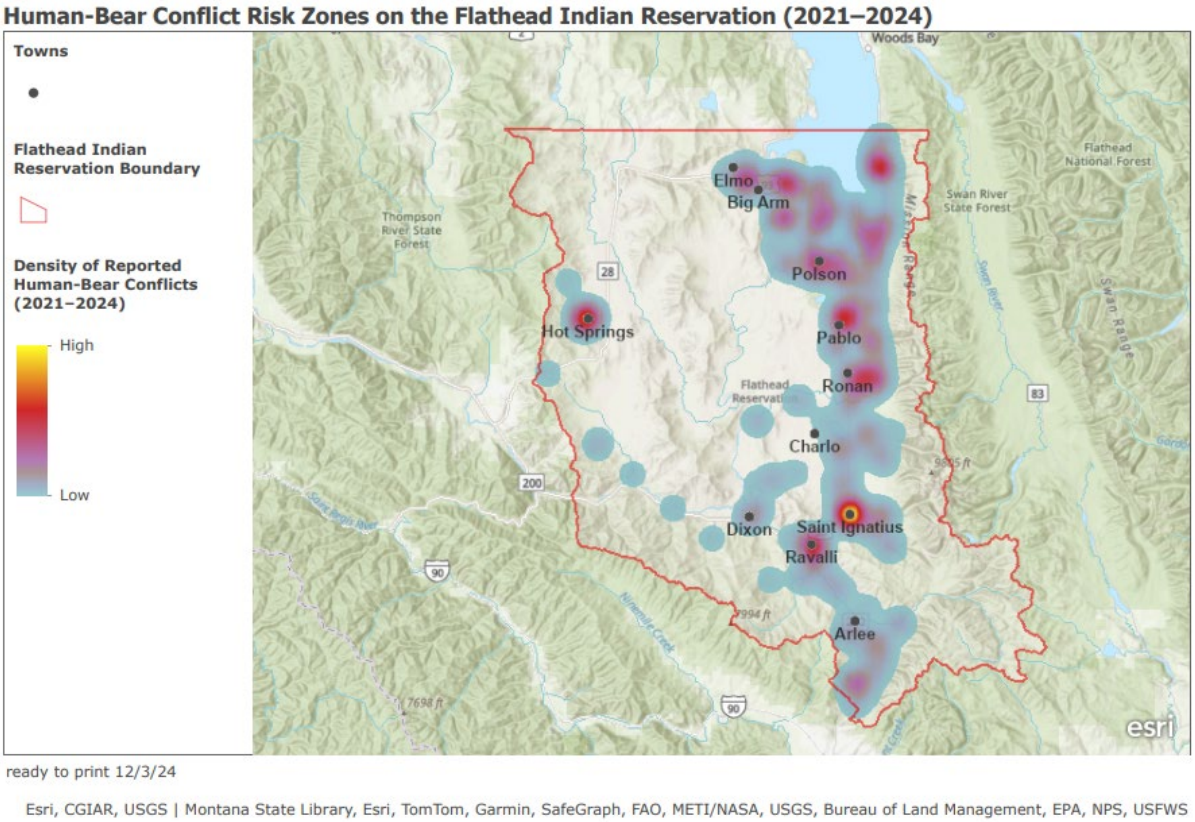

Figure 4. Human-bear conflict risk zones for both species of bears on the Flathead Indian Reservation from the years 2021 to 2024.

DISCUSSION

The creation of my database and the synthesis of the past data collection efforts provided insights into the factors that drive human-bear conflicts on the FIR, especially providing evidence of the attractants most involved in conflicts. Building the database also provided insight into redundant categories, offering an opportunity to simplify them. My database is also an important step in framing the conversation around the handling of conflict incidents, as the questions asked in the form can help new or less experienced wildlife managers direct the mitigation of conflict situations. In collecting the data in accordance with the form, the data

might be able to pinpoint the biggest reason for experiencing the conflict with the attractant type, as well as an appropriate course of mitigation action based on the conflict type.

In collecting basic information about the location, nature of the alleged conflict incident, spatial and temporal data, and mitigation steps, we can better focus policy efforts such as the implementation of trash ordinances. Conflict data provides further evidence to support community-wide changes in trash management for areas experiencing high rates of conflict. Other policy measures could include increased use of electric fencing to protect livestock, chicken coops, and other seasonal attractants. In the creation of a consistent database, there is a more consistent and comprehensive record of conflict incidents, better communication for events that often span weeks or months, with multiple biologists or officers assisting in mitigation/management efforts, and better record of requests made of landowners so that mitigation efforts are more effective, such as disposing of trash stockpiled in trailers or picking the ripe apples in the tree in your yard.

By organizing historic data into a uniform database, we are better able to compare changes across years, as rates of conflict are dependent on factors such as natural food source availability due to variability in weather patterns. Years with better berry crops of native fruits such as huckleberry (*Vaccinium* spp.), saskatoon serviceberry (*Amelanchier alnifolia* (Nutt.) Nutt. Es M. Roem), chokecherry (*Prunus virginiana* Linnaeus), elderberry (*Sambucus* spp. Linnaeus), thimbleberry (*Rubus parviflorus* Nutt.), and many others. As some seasonal patterns include years with late freezes that kill off early buds of fruit bearing trees and bushes or drought years that have significantly less precipitation than normal, there can be substantial effects on the

rates of conflict due to a reduction of native fruits available for consumption on the landscape (Bradford, 2024; Proctor et al., 2023).

Unnatural attractants, especially in the form of garbage, were the largest cause of human-black bear conflicts on the FIR. Unexpectedly, depredations emerged as the primary type of conflict for grizzly bears instead of garbage, with chickens the biggest cause of depredation. Pointing to the further need for increased information and education about electric fencing around chicken coops.

The data surprisingly revealed there were more conflicts associated with Saint Ignatius than the town of Ronan and the surrounding area, which has a larger population base. Mission Creek, which flows through the middle of Saint Ignatius and is a prominent corridor of travel (Jensen et al., 2022; Titus & Jachowski, 2024) from the Mission Mountain Range to the Flathead River may transport more bears directly into the proximity of more commercial attractants from businesses such as restaurant waste and trash from elderly living facilities.

There were substantial differences in the data between the years 2022 and 2023, possibly due to the yearly variability of seasonal food sources such as the “berry crop” (Lewis et al., 2015; Proctor et al., 2023), highlighting one of the limiting factors in the extent of the data used for this project, as there were only four years of accessible data available. With the growth of available data, these differences could be used to estimate potential rates of conflict due to weather conditions that affect the growth of natural food sources of bears (Davis et al., 2006; Klees Van Bommel et al., 2020).

Although the heat map shows that Saint Ignatius and Hot Springs communities had the greatest risk of experiencing a human-bear conflict, it does not necessarily capture the whole picture. The heat map was intended to highlight areas that had a higher rate of conflict, or possibly illuminate areas with greater access to bear habitat. As such, the heat map highlights areas with more conflict, also considering the proximity of those conflicts.

The Polson area is an area that the heat map does not effectively represent because it is an area containing the largest town on the FIR by population as well as the southern and eastern shore of Flathead Lake. With a larger human population and many dispersed properties situated along most of the shoreline is, this area experiences the largest number of conflicts. The heat map shows this area as experiencing conflict, but it does not show the intensity that is displayed for the towns of Saint Ignatius and Hot Springs, as these conflict incidences are more widely distributed throughout the valley (Figure 3).

My analysis of these data further emphasizes the need to continue to focus on certain areas such as Saint Ignatius in efforts to reduce anthropogenic attractants on the landscape. Continuing the collection of these data will provide further evidence for the need to direct policies that impact whole communities such as garbage ordinances requiring all businesses in a community to use bear-resistant containers to store waste, or encouraging the Lake County Solid Waste District to make better arrangements with the only solid waste company that operates in Lake County, Republic Services, so that they offer more bear-resistant garbage container options for business or commercial use. The results also reinforce the need to continue our other efforts such as encouraging fruit gleaning and providing a way to use this fruit, such as with cider presses.

CONCLUSION

The development of a comprehensive database for conflict reporting and analysis aims to enhance the understanding and mitigation of human-bear interactions by driving policy, community perception and efforts, and trash collection on the Flathead Indian Reservation to reduce incidences of human-carnivore conflict. By identifying areas that experience higher rates of conflict, sources of conflict can be addressed. Because the improper storage of trash and garbage is the largest source of conflict, the importance of effective garbage ordinances is highlighted.

Outreach can be improved in areas experiencing the highest rate of conflict through partnering with NGOs to facilitate permanent electric fencing solutions for properties with the highest risk. These data are also crucial for applying to funding opportunities aimed at reducing human-bear conflicts. For instance, it could support the creation of seasonal employment positions dedicated to mitigating and managing such conflicts. These positions would focus on implementing best conflict-management practices, such as reducing the accessibility of anthropogenic attractants to bears, deploying temporary electric fencing or sound devices, and conducting trapping and relocation efforts in a consistent and effective manner.

Other long-term benefits in building a database with uniform data spanning long periods of time are the ability to analyze and assess special, temporal, and climatic patterns that may be influencing the chances of experiencing a human-carnivore conflict. Balancing simplicity in

reporting with sufficient data points to give meaningful analysis is one of the challenges faced in creating a consistent, long-running database that provides added insight into patterns of human-bear conflict over time.

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