

EWC REPORT

Tools for coexisting with carnivores

A 2026 review of carnivore coexistence
tools and stewardship effectiveness

A NOTE FROM THE TEAM

An acknowledgement of language and place

Throughout this report, land titles such as the word Canada are used to describe the geographic context in which this review takes place, but it's important to note that **these colonial names are not the only way these lands have been, and continue to be, understood.**

For many Indigenous Peoples, parts of what are now called Canada are understood through teachings of Turtle Island. The term is rooted in distinct Indigenous cultures and creation stories, and its meaning is not singular. It speaks to relationships between people, land, water, animals, and responsibility in ways that do not always fit neatly within colonial concepts of geography, ownership, or conservation.

Even the name Canada has Indigenous roots, commonly understood to derive from kanata, a Huron-Iroquois word meaning “village” or “settlement.” The country that eventually came to carry that name, however, contains hundreds of Indigenous Nations, languages, territories, and knowledge systems.

We wanted to address these distinctions, as **the words we use shape the relationships we recognize. Wildlife, stewardship, conflict, and coexistence each come from particular ways of understanding the world, but none fully captures the diversity of relationships Indigenous Peoples have maintained with land and wildlife since time immemorial.**

We use Canada, North America, British Columbia and others throughout this report for clarity and consistency, while recognizing that the lands and waters these words describe hold many names, histories, and ways of knowing.

We acknowledge the Indigenous Peoples whose relationships, laws, languages, and knowledge of these lands continue to shape what stewardship and coexistence can mean today.

- The Team at Exposed Wildlife Conservancy

EXECUTIVE SUMMARY

Understanding the challenges of coexisting with carnivores.

This report combines evidence from 75 studies assessing the effectiveness of tools that enable coexistence between humans and apex predators.

The literature was categorized into ten topics; attractant management, deterrents, hazing, fencing, livestock management, translocation and lethal control, recreation management, education and outreach, stewardship, and community engagement.

Findings across various fields show that reactive tools like lethal control and translocation are commonly used and studied, yet have the weakest supporting evidence and may in some cases increase conflict. Meanwhile proactive interventions like managing attractants, fencing and livestock guardian animals have stronger evidence for effectiveness.

There is also a research gap in the assessment of interventions within agricultural landscapes where much of the conflict occurs, with research being focused on national parks. There is also a lack of research assessing interventions for cougar conflict.

This report summarizes the effectiveness of the carnivore coexistence tools that have been studied on Turtle Island/North America and shows that the most sustainable outcomes come from long-term Indigenous-led stewardship.

We emphasize the need for practical, scientific and community-based solutions using proactive management rather than reactive measures.

Report by Lindsay Wood
August 2026

Contents

EXECUTIVE SUMMARY	03
Introduction	05
Coexistence tools	08
Stewardship approaches	33
Effectiveness analysis	48
Research gaps	51
Conclusions & recommendations	58
References	62



Introduction

INTRODUCTION

Are the current coexistence tools working?

Human-carnivore conflict is a challenge across what is known today as Canada.

In British Columbia alone, there are roughly 9,000 bear complaints every year, with over 1,000 bears being destroyed annually, costing more than \$1 million CAD. But are the current tools working?

This report brings together findings from over 75 independent studies and reports to answer that question, focusing on coexistence tools and stewardship approaches relevant to cougar, grizzly bear, black bear, and wolf conflict in rural, remote, and agricultural contexts, as well as backcountry and wilderness recreation.

Included evidence is predominantly sourced from peer-reviewed scientific literature, and is supplemented by government and agency reports. US literature from similar landscapes is included where no comparable Canadian evidence exists for a tool, or when a US study provides the strongest evidence.

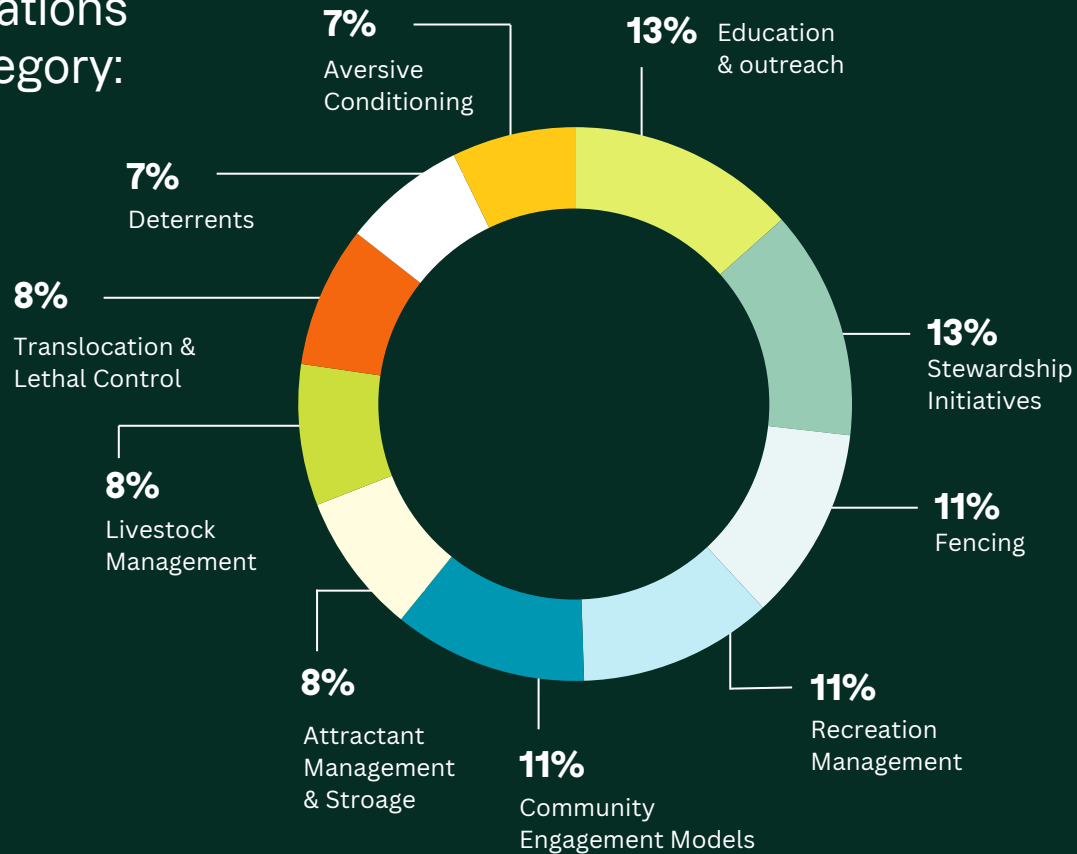
There is substantial research on the causes of human-carnivore conflict, but little on the solutions (Artelle et al., 2024). **This report is a solution-focused synthesis of what has been tested, what works, and where the research gaps are.**

Evidence-based conservation assesses the effectiveness of wildlife management, guides policy and reduces conflict. More strategies for human-carnivore coexistence are urgently needed (Baruch-Mordo et al., 2011; Expósito-Granados et al., 2019).

Evidence is described for each tool that has been studied to inform decisions grounded in science, rather than just continuing what has been done.

THE RESEARCH

Publications
by category:



Where the
evidence
comes from:

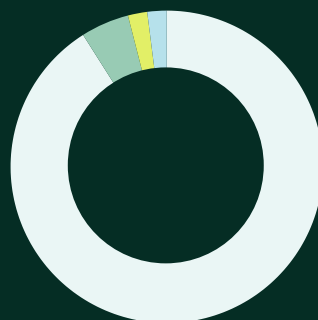
45%

American
Research

55%

Canadian
Research

Literature
type:



- Peer-reviewed: 88 (91%)
- Government reports: 5 (5%)
- Institutional reports: 2 (2%)
- Interagency technical guidance: 2 (2%)

Coexistence tools



Attractant management

Attractant management aims to reduce availability of anthropogenic food sources like garbage, bird feeders, fruit trees, compost, barbeques and the like.

COEXISTENCE TOOLS**ATTRACTANT MANAGEMENT**

Overview

Attractant management aims to reduce availability of anthropogenic food sources like garbage, bird feeders, fruit trees, compost, barbeques and the like.

In Canada, studies have focused on hotspots and seasonal attractants that draw grizzly bears to national parks, modelling black bear foraging, as well as Manitoba's Bear Smart program and BC's Bear Smart Community certification program.

Human-black bear conflict can often be attributed to unsecured attractants, residential garbage in particular being the biggest driver (Ciarniello & Davis, 2002; Johnson et al., 2018; Lamb et al., 2023).

Attractant management doesn't need to reach zero availability to reduce conflict, it just needs to cross a threshold. **Bears avoided human areas once attractants were reduced by 55%, and avoided urban parks once attractants were reduced by 70%.**

Attractants can include infrastructure that draws bears into contact with people. Roadside ditches and forestry areas contain more grizzly bear forage plants (like clover, dandelion, horsetail, sedges) than interior forests, making roads an additional attractant on their own (Roever et al., 2008).

Human-grizzly bear conflicts are typically not randomly distributed, but clustered into hotspots based on agricultural features like livestock boneyards and beehives (S. M. Wilson et al., 2005).

Overall, findings suggest that attractant management is not only a household problem, but also a landscape one.

COEXISTENCE TOOLS

ATTRACTANT MANAGEMENT

Key findings

Bear-resistant trash containers combined with education and enforcement led to a 60% decrease in trash-related conflicts (Baruch-Mordo et al., 2011).

Conflict is concentrated around certain attractants. Hotspot areas accounted for 75% of conflicts despite covering only 8% of the landscape (S. M. Wilson et al., 2005).

Human-bear conflicts decreased by 96% when hikers were provided with bear-resistant containers for food storage (Schirokauer & Boyd, 1998).

COEXISTENCE TOOLS**ATTRACTANT MANAGEMENT**

What works

Using bear-resistant steel bins reduced conflict in areas where food storage can be enforced (Johnson et al., 2018). **Managing attractants was only effective when applied as part of an multi-tool approach.**

Addressing garbage without also addressing fruit trees, birdfeeders, or livestock yields limited results, as bears will shift to whatever food source is available. Conflict declined significantly once garbage was stored in a bear-proof containers, locked garages or sheds. Effectiveness depended on compliance (Johnson et al., 2018) and enforcement affected compliance more than education alone (Baruch-Mordo et al., 2011).

Bear-resistant containers work best combined with education and enforcement.

Conflict tended to cluster around specific attractants (boneyards, beehives, roadside vegetation) and interventions focused on those hotspots yielded better results (Roever et al., 2008; S. M. Wilson et al., 2005).

What doesn't work

Bear-resistant containers were ineffective without resident compliance (improper use). Effectiveness plateaus once 60% compliance is reached. Adoption of bear-resistant storage containers is influenced by the cost (USD\$500–2,000 per unit). This gap between effectiveness and uptake is why the BC Bear Smart program was originally created, a community certification program mainly addressed attractant management.

Deterrents

Deterrents are designed to prevent predators from accessing human food sources by scaring them off.

COEXISTENCE TOOLS

DETERRENTS

Overview

Deterrents are designed to prevent predators from accessing human food sources by scaring them off.

Fladry (flagged rope) and scare devices using flashing lights and noise cannons are the most commonly used types. A limitation of this method is that animals may return once the deterrent is removed.

In North America, deterrents have been studied by testing scare devices. **Results show that the devices reduce the likelihood of a bear accessing an attractant by 46%, and that each additional device reduces it by another 44%, with no evidence of habituation.** Bears showed increased vigilance and decreased feeding while devices were on.

Scare devices stopped bears from returning to roughly half of farms that were tested, and are relatively cost effective (~US\$15 per unit).

COEXISTENCE TOOLS

DETERRENTS

Key findings

Wolf barriers made of flags hanging from ropes (fladry) prevented access by wild wolves for 60 days, after which they habituate (Musiani et al., 2003).

Devices were most effective during peak natural food availability, suggesting they work better when alternative food is available. They were less effective on groups of bears, with each additional bear increasing the chances of accessing an attractant.

Electric shock devices prevented black bears from accessing and damaging bird feeders (Breck et al., 2006).

Deterrents varied in effectiveness (13.7–79.5% reduction in damage), a lower range than electric fencing (79.2–100%) (Khorozyan & Waltert, 2020).

COEXISTENCE TOOLS

DETERRENTS

What works

To be effective, scare devices need to be deployed in sufficient number (four or more is recommended). They work better on concentrated attractants than entire fields. This was effective when bears were risk-averse, and worked best in combination with other interventions like attractant removal and hazing.

Attractant type and season also influenced the success of deterrents (Sarmiento, 2024). Electric shock devices worked where bears repeatedly targeted a specific location like a bird feeder. Fladry is effective as a short-term, temporary barrier and is best used during calving season, not as a permanent solution. Since effectiveness declines over months, it requires monitoring.

What doesn't work

Reliance on a scare device without removing attractants is not sustainable. There is variability in the effectiveness of different deterrents, making it difficult to determine which device works in which context.

Hazing

Hazing is a learning-based intervention, distinct from deterrents as it doesn't block access to an attractant, but conditions a fear response in individual animals so that they avoid people, an area, or an attractant.

COEXISTENCE TOOLS**HAZING**

Overview

Hazing is a learning-based intervention, distinct from deterrents as it doesn't block access to an attractant, but conditions a fear response in individual animals so that they avoid people, an area, or an attractant. **This involves repeated association of a negative interaction with a behavior.**

Hazing usually means shooting rubber bullets and cracker shells, using hazing dogs and bear spray. The goal is to change the bear's behaviour instead of translocating it. This has been commonly used by conservation officers in Alberta and BC. 64% of North American agencies reported using rubber bullets and loud noises, while dogs were used more rarely (Spencer et al., 2007).

Hazing has been well researched on black bears (Beckmann et al., 2004; Breck et al., 2006; Mazur, 2010), showing that it can delay their return to an area. When used against bears who are not accustomed to human food, it can prevent conflict from developing. Hazing is not as effective once bears are food-conditioned.

The evidence for grizzly bears is limited (Gillin et al., 1994), and is likely not applicable to wolves and cougars (Musiani et al., 2010; Ohrens et al., 2024).

Overall, hazing has limited use in bear conflict management. At best, it drives bears away temporarily, providing a window to address the attractant.

COEXISTENCE TOOLS

HAZING

Key findings

Hazing prevented bears that were not food-conditioned from becoming food-conditioned. It was less successful on young bears than adults, and rubber slugs were more effective than lower-impact projectiles.

This method increased wariness in bears, but did not change overall habitat use; bears didn't stop using human-dominated spaces.

Hazing can create behavioral avoidance, but effectiveness decreased with repeated exposure in some cases (Gillin et al., 1994).

Hazing dogs delayed but did not prevent bears from returning to conflict areas (Beckmann et al., 2004).

COEXISTENCE TOOLS

HAZING

What works

Success depends on response time; hazing needs to start soon after the conflict event. Effectiveness is temporary and hazing works best when attractants are also removed.

What doesn't work

It doesn't work well on young bears. Relapse is common and can result in conflict escalation when hazing fails (Mazur, 2010). Additionally, this method requires training, rapid response, and is resource and labor intensive. Hazing dogs and high-intensity projectiles require specialized equipment and training.

Fencing

Barriers and fencing create boundaries between apex predators and attractants or livestock.

COEXISTENCE TOOLS**FENCING**

Overview

Barriers and fencing create boundaries between apex predators and attractants or livestock. There are electric fencing specifications and landfill case studies, along with field trials showing that electric fences reduce risk of black bears damaging bird feeders (Leeper & Tri, 2026). **There is evidence for the effectiveness of fencing on various predator species.** Night enclosures work best for cougar exclusion.

The Interagency Grizzly Bear Committee's bear-resistant product testing has used captive bears to evaluate various infrastructure. Products need to withstand 60 minutes of bear contact without being breached. [This is solid evidence for infrastructure selection.](#) Detailed technical guidance exists, including minimum voltage requirements of 6,000V, wire spacing specifications, grounding, gate design, and maintenance protocols. Electric fences alone are also not effective without addressing attractants.

Bear-resistant infrastructure reduces access, but is not absolute protection. Electric fencing, physical deterrents, guarding animals, and calving control all reduce livestock depredation to varying degrees, but the ideal solutions are dependent on context.

Electric fencing requires financial investment and maintenance, making it more suited to economically developed areas (Khorozyan & Waltert, 2019). **Physical protections like night enclosures and fenced pastures have the most consistent support across studies.**

COEXISTENCE TOOLS

FENCING

Key findings

Electric fences provided a 79.2-100% reduction in damage by bears, the most consistent effectiveness of any intervention (Khorozyan & Waltert, 2020).

Larger pastures with more cattle, and pastures farther from residences were more likely to be depredated, regardless of fencing. Standard fencing alone does not prevent depredation. Risk is driven more by landscape and livestock practices (Bradley & Pletscher, 2005).

COEXISTENCE TOOLS

FENCING

What works

Electric fences show consistent effectiveness for sources like feeders and small crop plots.

What doesn't work

Standard livestock fencing doesn't prevent wolf depredation. Risk is affected by pasture size, density of cattle and distance from human development. Cost limits where electric barriers can be deployed, as there are high associated maintenance costs (electric fencing costs \$1.50–\$3.00 per foot).

Livestock management

Livestock management interventions include night penning, guard dogs, calving management, range riding and low-stress handling.

COEXISTENCE TOOLS**LIVESTOCK MANAGEMENT**

Overview

Livestock management interventions include night penning, guard dogs, calving management, range riding and low-stress handling. These interventions are designed to reduce depredation by making livestock harder to access. Similar tools are used for both bears and wolves, such as guard animals and electric fencing.

Effectiveness is species specific; calving control (shortening the calving season) was found to be 100% effective at reducing livestock losses from wolves, cougars and black bears, (Baruch-Mordo et al., 2011), while guard dogs were effective against black bears and grizzly bears but were less reliable for wolves, with cases of wolves killing dogs. Bears, wolves, and cougars can all habituate quickly to guarding animals.

The interventions that worked best limited physical access to livestock, like fencing and calving control, rather than guarding (Andelt & Hopper, 1997; Baruch-Mordo et al., 2011). The risk of cougar and black bear predation was also lower in herds accompanied by human herders, and guard dog use was found to be ineffective without proper training (Eklund et al., 2017; Khorozyan & Waltert, 2019).

COEXISTENCE TOOLS

LIVESTOCK MANAGEMENT

Key findings

Livestock protection dogs reduce both predation risk and disease transmission risk between wildlife and cattle (VerCauteren et al., 2012).

Guardian dogs are economically viable relative to depredation losses averted (Saitone & Bruno, 2020).

Guardian animals are some of the most effective non-lethal livestock protection tools studied, though effectiveness varies by context depending on herd size, terrain and predator composition (Andelt, n.d.; M. E. Smith et al., 2000).

COEXISTENCE TOOLS**LIVESTOCK MANAGEMENT**

What works

Guard dogs work best when they have bonded to livestock from a young age and in adequate numbers relative to herd size. Low-stress handling and range riding are most effective when combined with guardian animals. Cost-effectiveness improves at larger operation scales. Guard dog breed selection matters less than herd bonding, training, and adequate dog to herd ratios. **Combining guard animals with other practices like night penning produces better results than any method alone.**

What doesn't work

There are high costs associated with guardian dogs, and they may not be cost-effective for all operation types or sizes, and without proper bonding show reduced effects (Saitone & Bruno, 2020). Low-stress handling requires additional labour and training.

Translocation & lethal control

Lethal removal and translocation are reactive forms of conflict management that involve killing or relocating a problem animal after an incident.

COEXISTENCE TOOLS**TRANSLOCATION & LETHAL CONTROL**

Overview

Lethal removal and translocation are reactive forms of conflict management that involve killing or relocating a problem animal after an incident. **Lethal control is a well-studied intervention with the weakest evidence for effectiveness** (Artelle et al., 2024; Ohrens et al., 2024).

Cougar hunting has been tied to an increase in conflict reports, lethal removal of cougars had no effect on depredation complaints and reactive removals were not found to reduce conflict (Dellinger et al., 2021; Teichman et al., 2016; Wielgus & Peebles, 2014).

Non-lethal deterrents consistently outperform lethal removal across the carnivore conflict literature (Lorand et al., 2022). Carnivore conflict is a result of human mismanagement of attractants, not animal behavior on its own. Lethal control and translocation treat the symptom rather than the cause, at great expense and with little evidence of it solving the problem.

Bear translocation is common in Canada despite the mixed evidence. 75% of agencies in North America have translocated problem bears, while only 15% believed it was actually effective (Spencer et al., 2007).

Adult bears were more likely to survive translocations but were also more likely to return to the area where they were captured (Alldredge et al., 2015). Translocation success was dependent on the animal's history and the population at the release site. This tool can be a viable management option depending on these factors.

COEXISTENCE TOOLS

TRANSLOCATION & LETHAL CONTROL

Key findings

71% of experiments testing lethal predator control found no preventive effect or even a counter-productive effect of losing more livestock (Treves et al., 2016).

Conflict was driven by natural food scarcity rather than bear behavior or population size (Artelle et al., 2016).

21% of translocated bears returned to their capture site (Aldredge et al., 2015).

COEXISTENCE TOOLS

TRANSLOCATION & LETHAL CONTROL

What works

Translocation works best when there is adequate habitat at the release site and sufficient distance from the capture location, though even large distances don't necessarily stop bears from returning (Milligan et al., 2018). **A combination of multiple non-lethal tools is more effective for conservation outcomes** than lethal removal (Proctor et al., 2018).

What doesn't work

Lethal removal has no effect on reducing conflict, directly contradicting the assumption that underlies many management practices (Artelle et al. 2016). Removing a problem animal can leave space open for another individual to come in and repeat the same behavior. **Lethal control being used as the default response without further evaluation is inadvisable.** Public and political pressure often favors it as a visible, immediate response over slower non-lethal actions (Spencer et al., 2007).

A close-up photograph of a brown bear standing in a field of wildflowers. The bear is looking directly at the camera with a calm expression. Its fur is thick and brown, with some lighter patches around its eyes and muzzle. The background is a soft-focus green field of wildflowers.

Stewardship approaches.

Recreation management

Recreation management includes conflict associated with hiking, camping and other kinds of backcountry use.

STEWARDSHIP APPROACHES

RECREATION MANAGEMENT

Overview

This category includes conflict associated with hiking, camping and other kinds of backcountry use. In Jasper National Park, grizzly bears were found to reduce their use of sites with recreation, while black bears overlapped more with recreational activity than grizzlies, indicating that they respond differently to human presence (Ladle et al., 2018).

Testing of recreational restrictions to reduce human injury determined visitor precautions like hiking in groups, staying on trails and carrying bear spray reduce injuries more than seasonal closures (Gunther & Haroldson, 2020). Additionally, bear-watching ecotourism is likely not a driver of human-bear conflict (Field et al., 2025).

Key findings

Human presence shaped wolf behavior, indicating recreation is a variable wolves respond to, independent of management actions (Musiani et al., 2010).

STEWARDSHIP APPROACHES

RECREATION MANAGEMENT

What works

Targeted closures in identified high-injury hotspots are more advisable than park-wide restrictions given how concentrated injury risk is. **Effectiveness depends on matching restriction timing to bear resource use** (Gunther & Haroldson, 2020). Visitor behavior precautions may be more cost-effective and impactful than park closures and restrictions.

What doesn't work

Seasonal park or trail closures that don't align with bear feeding periods will not be effective for reducing risk to visitors. Black bears avoid recreational activity less than grizzlies do, meaning recreation management designed for grizzly bears may not adequately address black bears.

Restrictions tend to be unpopular with visitors which may result in reduced compliance. It may be difficult to predict risk for trails or seasons without monitoring with trail cameras or GPS collared bears. For this tool, coordination is required between the recreation sector, wildlife management, and tourism.

Education & outreach

Education and outreach affect human-carnivore interactions indirectly by changing human attitudes, knowledge and behavior, ideally to prevent conflict from developing.

STEWARDSHIP APPROACHES**RECREATION MANAGEMENT**

Overview

Education and outreach affect human-carnivore interactions indirectly by changing human attitudes, knowledge and behavior, ideally to prevent conflict from developing.

The perceived risk from bears often doesn't match the actual risk, and this misperception shapes people's attitudes toward wildlife management. Outreach has to confront these perceptions, not just fill the knowledge gaps.

Education programs are often only developed after conflict has reached a crisis level, making outreach reactive instead of proactive. Education programs that are designed for visibility may not be effective for actual behavior change. Lawn signs, billboards and magnets were some of the materials people remembered the most, but materials like fact sheets, articles, and brochures were considered the most effective by those who did change their behavior, including choosing to store garbage in a bear-proof container.

Enforcement in the form of daily patrolling did not result in behaviour change, while warning notices did have an effect (Baruch-Mordo et al., 2011). Overall, outreach on its own was insufficient. It was effective when combined with another intervention like implementing bear-resistant garbage containers and enforcing their use in communities.

STEWARDSHIP APPROACHES

RECREATION MANAGEMENT

Key findings

Despite educational and positive attitudes toward bear-smart behavior, people did not reduce their properties' attractiveness to bears. The education program changed people's beliefs but not their actions (Campbell, 2012).

Messages emphasizing the benefits of black bear presence increased acceptance of bears, while messages about personal risk management decreased acceptance, suggesting that not all educational content contributes towards tolerance (Slagle et al., 2013).

STEWARDSHIP APPROACHES

RECREATION MANAGEMENT

What works

Education is more likely to change behavior when paired with enforcement such as fines. Messages emphasizing the benefits of carnivore presence are more effective at increasing tolerance than messages about risk. Long-term community programs resulted in more behavior change than seasonal awareness campaigns.

What doesn't work

Education without enforcement failed to produce behavior change even when it successfully shifted attitudes; positive attitudes do not always relate to action. Education shows reduced effectiveness when it relies on voluntary compliance without any law enforcement for the desired action.

Stewardship initiatives

Stewardship initiatives are where communities take on active responsibility for conservation, rather than it being managed by wildlife agencies.

STEWARDSHIP APPROACHES

STEWARDSHIP INITIATIVES

Overview

Stewardship initiatives are where communities take on active responsibility for conservation, rather than it being managed by wildlife agencies.

Almost all of the research in this category is from national parks, coastal Indigenous territories or transboundary conservation programs, reflecting the fact that stewardship models tend to emerge in complex landscapes; across park boundaries, national borders, or Indigenous and provincial authority.

One example is the decolonial model of environmental management from Indigenous-led grizzly bear stewardship in the Great Bear Rainforest, in which shifting decision making by the territories of, the Haíłzaqv, Kitasoo/Xai'xais, Nuxalk, and Wuikinuxv First Nations reshaped the process and outcomes of carnivore conservation (Artelle et al., 2021).

Stewardship operates on two levels, ecological (addressing causes of conflict) and governance (relationship between people and carnivores). Stewardship is about habitat management and governance.

STEWARDSHIP APPROACHES

STEWARDSHIP INITIATIVES

Key findings

Switching decision-making to Indigenous Nations (Haíłzaqv, Kitasoo/Xai'xais, Nuxalk, and Wuikinuxv First Nations) achieved conflict-management outcomes (Artelle et al., 2021).

Trans-border grizzly bear conservation success was connected to long-term conflict-reduction programs which combined multiple different interventions (Proctor et al., 2018).

STEWARDSHIP APPROACHES

STEWARDSHIP INITIATIVES

What works

Managing ecological drivers of conflict such as natural food scarcity is more effective for reducing conflict than lethal control. Indigenous-led models succeeded when authority, cultural values, and long-term relationships to the land were centered.

Programs that were carried out over the course of decades that combined habitat protection with conflict-prevention infrastructure were more successful. **Projects that genuinely shared authority with Indigenous Nations were more successful than those that only consulted.**

What doesn't work

Management models that don't center Indigenous authority or long-term relationships to the land do not create sustainable stewardship. **Treating conflict as an animal behaviour problem while ignoring ecological drivers like food scarcity is not effective.**

Failing to account for the cultural dimensions of stewardship can undermine community participation. Governance reform toward Indigenous-led models requires institutional and political change, as well as financial commitment.

Community engagement

Community engagement models consider how stakeholders like farmers, hunters, communities and tourism are brought into decision-making for carnivore management.

STEWARDSHIP APPROACHES**COMMUNITY ENGAGEMENT**

Overview

Community engagement models consider how stakeholders like farmers, hunters, communities and tourism are brought into decision-making for carnivore management. The current literature is focused on wolf conservation in National Parks (Doney, 2024; Musiani et al., 2010; J. Smith, 2007). The most detailed assessment of community engagement process is from the Blackfoot Challenge in Montana, which used an existing grizzly bear conflict-mitigation program to create a similar community-based plan for coexisting with wolves (S. Wilson et al., 2017). This program engaged with the community through meetings, workshops and field tours, along with participatory data collection and projects. They also combined their community engagement with conflict-reduction measures, including electric fencing of calving areas.

Key findings

Alberta residents overestimated risk from cougars. More than half believed that cougars posed the same or greater risk as driving a car, even though only one Albertan has been killed by a cougar in the last century. Engagement programs need to target perceived risks (Knopff et al., 2016).

STEWARDSHIP APPROACHES

COMMUNITY ENGAGEMENT

What works

Combining relationship-building with conflict reduction measures is more effective than engagement or education alone. Building on trusted community relationships gives credibility to programs.

Since perceived risk is not proportionate to actual risk, misperceptions must be addressed. Success for engagement is higher for long-term projects rather than single events.

Trust and relationships with wildlife officials seem to matter as much as the engagement content. **Combining engagement with conflict reducing infrastructure gives participants evidence and encourages continued participation.**

What doesn't work

Risk misperception is a barrier and no studies test whether a specific community engagement intervention actually changes misperceptions (Knopff et al., 2016).

Building community relationships takes years and requires consistent staffing and funding.

Effectiveness analysis



EFFECTIVENESS ANALYSIS

Understanding effectiveness across methods.

Effectiveness varies across tool categories.

Attractant reduction and bear-resistant infrastructure have some of the strongest evidence, but success is conditional. Overall, single approaches without attractant management are not effective.

Scare devices and hazing provide short-term deterrence and standard fencing doesn't prevent depredation, whereas electric fences, fladry, night penning, and calving control are more consistent. For cougars specifically, guard dogs and physical barriers have the best supporting evidence, while lethal control has the weakest (also across species). Guardian dogs work well against bears and cougars, but are unreliable on wolves. Evidence for low-stress livestock handling and range riding is mixed. Lethal control and translocation are expensive and mostly ineffective at reducing conflict, and in some cases have been correlated with increased conflict.

Attractant management is a more feasible long-term solution. Seasonal closures and recreational precautions reduce injury risk when timed properly to bear activity patterns, and visitor precautions are more effective than park closures.

Education and outreach need to be combined with other interventions in order to be effective. **Indigenous-led stewardship and collaborative community are some of the most promising approaches in this literature, especially when combined with other conflict reduction measures.**

EFFECTIVENESS ANALYSIS

Understanding effectiveness across methods.

Tool	Species	Eff.	Evid.	Cost	Works When...	Fails When...
Reduce Attractants	 			\$\$\$	Remove 55-70% of attractant	–
Bear-Resistant Trash Containers	 			\$\$\$	Combine with education & enforcement	• Low compliance • Improper use
Steel Bear-Resistant Food Containers	 			\$\$\$	Combine with reducing attractants	• Low compliance • Improper use
Scare Devices	 			\$\$\$	• Install 4+ devices together • Natural food also available • Combine with attractant removal & hazing	Predators may return once removed
Fladry				\$\$\$	Short-term use (e.g. calving season)	Habituation over time (-60 days)
Hazing / Aversive Conditioning	 			\$\$\$	• Adult black bears • Rubber bullets, dogs • Combine with attractant removal • Short-term use	• Food-conditioned bears • Young bears • Behaviour reoccurs after intervention stops
Standard Livestock Fencing	  			\$\$\$	–	• Larger farms • Farther from human development
Electric Fencing	  			\$\$\$	• Combine with reducing attractants • Point-source attractants • Minimum 6,000V • Economically developed areas • Requires monitoring	–
Night Penning	  			\$\$\$	• Combined with guardian animals • Used consistently during peak-risk hours	Used inconsistently or as a sole measure
Calving Control	  			\$\$\$	Shortened / controlled calving season, applied consistently	–
Guardian Dogs	  			\$\$\$	• Small herds • Dogs bonded to herd from a young age • Combine with night penning	• Ineffective without training • Less reliable against wolves
Low-Stress Handling / Range Riding	  			\$\$\$	Combine with guardian dogs	–
Lethal Control	 			\$\$\$	–	• No preventative effect in most cases • May increase further conflict
Translocation	 			\$\$\$	• Release-site habitat quality • Adequate distance from capture site	May return to capture site

Species:  : Grizzly Bear  : Black Bear  : Cougar  : Grey Wolf

Effectiveness / Evidence:  High / Strong  Medium / Moderate  Low / Limited

Research gaps



RESEARCH GAPS

Where existing research is missing the mark.

Across the studies and reports reviewed, evidence for human-carnivore coexistence tools in this part of the world is somewhat limited. This section outlines the research gaps by species.

Much of Canadian peer-reviewed literature is from national park contexts (Banff, Kootenay, Jasper, Pacific Rim, and Elk Island). The research doesn't always cover where conflict happens, which is more often in rural farming and ranching communities. For community engagement and stewardship research, most Canadian studies are drawn from national parks, Indigenous stewardship projects and wolf reintroduction scenarios. This leaves a gap in research on engagement models with communities that live alongside carnivores.

There are some gaps across all four target species. Warning systems have little evidence globally and hazing studies are lacking locally despite being used regularly. Livestock guardian animals have not been evaluated in this part of the world, despite their widespread use. Some tools have strong evidence internationally, but have not been tested in applicable contexts, such as electric fencing, bear-resistant infrastructure and livestock management practices.

“ **There is a gap in research on engagement models with communities that live alongside carnivores.** ”

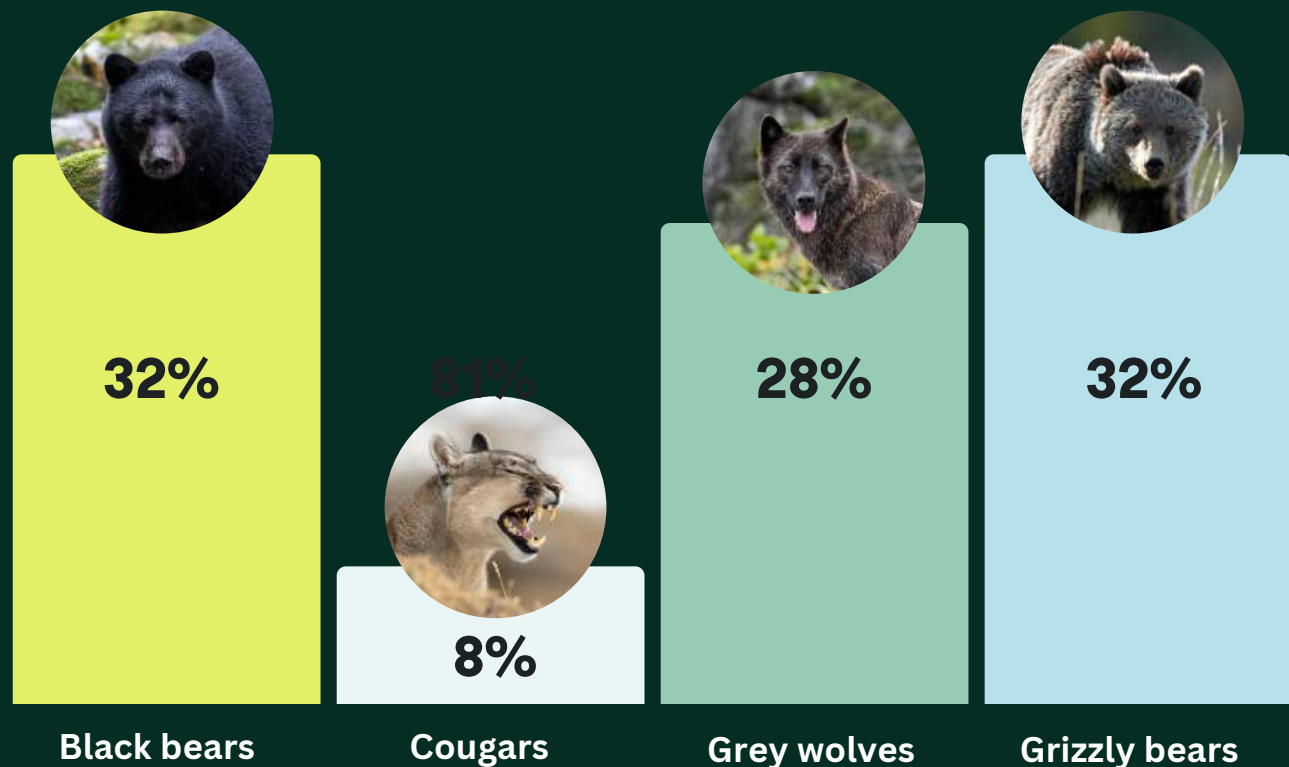
Recreation management studies tend to document how recreation affects wildlife rather than whether interventions reduce conflict. Community engagement research similarly tends to document processes, not outcomes. Stewardship research is strong in BC across the traditional territories of the Ktunaxa, Secwépemc and Sinixt, but focuses on the ecological dimensions of conflict, not effectiveness.

RESEARCH GAPS

Species specific coexistence research is limited.

Publications by focal species:

Only 8% of research on coexistence tools in Canada and the US focuses on contexts and applications specific to cougars.



The causes of human-carnivore conflict are well-documented, but overall, what's missing is evaluation of interventions for specific species and contexts.

Grizzly bears

There are no experimental studies evaluating attractant management interventions for grizzly bears in Canada. Livestock guardian animals are widely used across Alberta and BC, but there is only one Canadian research paper on it (Louchouart & Treves, 2023), and no local studies evaluate guardian dogs against grizzly bears.

Canadian literature on husbandry practices (night penning, calving management and range riding) is lacking, although they are common practice. Hazing is also often used by conservation officers, but lacks research. BC and Alberta translocation records have not been analyzed. An evaluation comparable to the American NeighBEARhood Watch program does not exist yet for grizzly bears in Canada (Gore et al., 2006).

Black bears

Black bear coexistence research is the strongest for attractant management. Evidence for effectiveness of visitor education and hazing are from American sources. A lot of black bear research comes from eastern Canada (Ontario, Manitoba, New Brunswick and Nova Scotia). Black bear depredation of livestock and beehives is understudied in BC/territories of the Ktunaxa, Secwépemc and Sinixt, and Alberta.



Grey wolves

There is relevant research on fladry, electric fencing, guardian animals, community engagement, and lethal management for wolves. Much of the wolf-specific coexistence research is drawn from similar landscapes in the US (Idaho, Montana, Wyoming, Washington). No experimental studies on livestock management for wolves exist in Canada. Guardian animals are used in Alberta but have not been evaluated there.

Cougars

Cougar research is the largest gap. Most cougar coexistence literature is from the US, Chile and Argentina, and may not be applicable in all cases. The relevant literature in Western Canadian contexts is focused on translocation, lethal removal and husbandry. Flashing light deterrents have potential, but they have only been tested in Chile on alpaca and llama operation (Ohrens et al., 2024).

Conclusions & Recommendations



CONCLUSIONS & RECOMMENDATIONS

Coexistence is achievable with the right tools.

Evidence for effectiveness of lethal removal is weak to absent, and lethal removal may actually increase conflict. Non-lethal alternatives outperform lethal approaches for cougars and grizzly bears (Artelle et al., 2024; Teichman et al., 2016). Guardian animals, fences and night penning were more effective for protecting livestock and allowed carnivore social structures to remain intact (Treves et al., 2016).

This report shows that coexistence is achievable, but that the most effective tools are not always the ones being used. Lethal control and translocation have been commonly used despite weak evidence for their success. This is supported by peer-reviewed literature spanning multiple species and countries, including BC-based research showing that hunting cougars can increase conflict (Teichman et al., 2016).

Analysis of 35 years of grizzly bear conflict-kills in BC/territories of the Ktunaxa, Secwépemc and Sinixt found that lethal removal had no measurable effect on conflict, while ecological drivers did (Artelle et al., 2016). Given this evidence, agencies and communities should treat lethal control and translocation as a last resort rather than a default.

In agricultural operations, electric fencing, guardian animals and husbandry practices have the strongest evidence for effectiveness. For cougars, guardian dogs are among the best supported tools, depending on factors including early bonding with livestock. Evidence shows that reactive management is expensive and largely ineffective, while proactive attractant management addresses the root cause rather than the symptoms.

CONCLUSIONS & RECOMMENDATIONS

Moving toward proactive evidence-based approaches.

Bear conflict monitoring, bear-activity rating signage modelled on existing fire-danger signage, and annual public progress reporting would give communities real-time, legible information about risk while also creating accountability and visibility for whether efforts are actually working.

Awareness alone rarely changes behavior at the scale needed to reduce conflict. Structural interventions like enforceable bear-resistant infrastructure need to accompany community outreach for results.

Education should be understood as a necessary complement to other interventions.

Some of the most longstanding and successful examples of human-carnivore coexistence in this literature involved local and Indigenous Peoples. This is an evidence-supported pathway for improving human-carnivore relationships in Canada through respectful, sustained cross-cultural collaboration and meaningful recognition of Indigenous governance authority over land and wildlife decisions.

There are major gaps in peer-reviewed evidence for coexistence tools in rural and agricultural contexts, and research has been disproportionately clustered in national parks.

Taken together, the findings of this review point to shifting practices away from reactive measures and toward proactive, evidence-based approaches like attractant management, electric fencing, guardian animals, education paired with structural enforcement, as well as community and Indigenous partnership.

CONCLUSIONS & RECOMMENDATIONS

“We emphasize the need for practical, scientific and community-based solutions using proactive management rather than reactive measures.”

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A close-up photograph of a brown bear sitting on a large, moss-covered rock. The bear is looking directly at the camera with a calm expression. Its fur is a mix of light and dark brown. The background is a soft, out-of-focus green, suggesting a forest or natural habitat. The overall mood is serene and majestic.

Thank you