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Cattle and Carnivore Coexistence in Alberta: The Role of Compensation Programs

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On the Ground

- In Alberta, Canada beef producers share the landscape with large carnivores where interactions can lead to negative outcomes. We had 672 Alberta beef producers complete an online survey in spring 2014 to access the occurrence and outcomes of cattle-carnivore interactions.
- We found that a majority (64%) reported losses from carnivore depredation. The average rate of calf depredation was reported at 2%, but the rate was highly variable between producers (ranging from 0 to 25% calf loss annually). The direct annual economic loss to depredation for survey respondents was $2 million. This can be extrapolated with a number of assumptions provincially to $22 million.
- Albertas Wildlife Predator Compensation Program (WPCP) paid out an average of $220,584 annually from 2011-2013. The WPCP was under-utilized, 64% of producers did not report to the program, and did not adequately address financial burden experienced by producers from 2011 2013.
- Producers identified a series of challenges with the WPCP including the excessive burden of proof and the effort to value ratio being too low.
- We provide recommendations to improve the WPCP based on a literature review and our survey findings.

Keywords: large carnivores, livestock depredation, human wildlife interactions, beef producer, cattle producer, compensation.

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Alberta beef production is big business. The province produces nearly 40% of all beef cattle in Canada, contributes $5.87 billion to the national gross domestic product, and provides over 62,000 jobs. There are about 20,000 producers with 5.2 million cattle in Alberta.[1] Alberta is also home to numerous carnivore species, including wolf, coyote, cougar, black bear, and grizzly bear. Wildlife is an important component of Alberta's natural heritage, providing a wide array of values.

When large carnivores and cattle come into contact the resulting interactions can negatively impact ranchers, cattle, and/or the carnivore.[2] The loss of cattle to carnivore depredation (through kill or injury)[3] is a significant land-use issue. This problem is not unique to Alberta, it is global in nature—e.g., leopards in India, lions in Kenya, and wolves in China all prey on cattle. Carnivore depredation has been recognized as a significant source of economic loss for producers globally.[3] In Alberta, many individual beef producers endure economic losses due to carnivore interactions; however, the extent and impact of these losses at a provincial scale have not been adequately quantified and are not well understood.

Producers are aware that human–wildlife interactions are a risk when living in landscapes shared with carnivores.[4] Borgström noted that the Finnish government acknowledges the natural risks posed to producers by wildlife and recognizes an obligation to protect producers through compensation schemes.[5] The government of Alberta makes a similar recognition, albeit implicitly, in the establishment of the Wildlife Predator Compensation Program (WPCP). Despite a lack of clear articulation of the program objectives, the Alberta government accepts some obligation to mitigate economic losses due to carnivore depredation on livestock.

Compensation schemes and related conservation efforts are often developed in a top-down manner with limited consultation between wildlife managers and livestock producers.[5,6] As Boitani et al. assert, it is necessary for those most directly

Table 1. Average compensation payments (CAD dollars) per cattle type (2011-2013)				
Cattle type	**2010/2011**	**2011/2012**	**2012/2013**	**Average over 3 years**
Calf	$2,029	$826	$407	$1,088
Cow	$99,921	$126,541	$121,899	$115,787
Feeder/Yearling	$87,782	$107,357	$101,214	$98,784
Bull	$0	$5,165	$9,610	$4,925
Total payout	$189,732	$239,889	$233,130	$220,584

affected to have an active role in the policy and compensation program development process. In this paper, we focus on three issues that are important to improve beef producer and carnivore co-existence: 1) based on survey results we estimate the economic losses sustained by beef producers in Alberta through carnivore depredation on cattle; 2) we assess the ability of the current compensation program (WPCP) to alleviate costs associated with depredation; and 3) report on the opinions of beef producers regarding the efficacy of the established compensation program. Although our research focus is Alberta, Canada, potential solutions are transferable to other jurisdictions with similar carnivore and livestock management issues.

Summary of the Alberta Wildlife Predator Compensation Program

The Alberta WPCP provides payments to ranchers for livestock killed or injured by wildlife. The program pays for cattle, sheep, bison, swine, or goats killed or injured by predators such as grizzly bears, black bears, wolves, cougars, or eagles. Coyote depredation is not eligible for compensation. Wildlife officials must verify that livestock were killed or injured by a predator before compensation is paid. If a claim is approved, producers can accept compensation at the time of loss or producers can wait until the end of October and receive compensation based on the average sale price of an animal based on a specific weight. The minimum amount paid out is $400 per confirmed kill. If a Fish and Wildlife Officer is not able to verify the depredation event as a predator kill it is labeled a "probable" kill, and the producer is paid 50% of the loss if a confirmed kill by the same species is found within 10 km and 90 days before or after the incident.

Table 1 summarizes WPCP data provided by the provincial government and presents the average value paid out over the 3-year period (2011-2013) for 272 claims. The mean annual compensation total was CAN $220,584.

The majority of these payouts were for confirmed depredation on cows or feeders/yearlings (97%), with minimal compensation paid for calves and bulls. Figure 1 shows the most common carnivore species reported to be responsible for confirmed depredation events for the 3-year period. Coyote depredation is not eligible for compensation and therefore is not recorded by the WPCP.

Surveying Beef Producers

To determine the extent of carnivore depredation, the economic losses suffered to beef producers and opinions of producers toward current compensation programming in Alberta, an online survey was developed in partnership with representatives from the Alberta Beef Producers (ABP).[i] The survey was tested for clarity by the ABP wildlife committee, a selection of beef producers, representatives from Agricultural Financial Services Corporation,[ii] and the Alberta Environment and Sustainable Resource Development,[iii] Operations Division. The survey consisted of 30 fixed-scale questions and one open-ended question to gather personal opinions about improving beef producer coexistence with carnivores. The survey was developed and delivered using online software (Survey Monkey) and shared broadly via a web link to ABP delegates, members, and municipal agricultural representatives. Hard copies of the surveys were also made available at municipal offices and upon request. Open-ended questions were coded into themes using qualitative data analysis software (Hyper Research).

A limitation resulting from the online survey approach is the possibility of selection bias in sampling due to the "word-of-mouth" promotion approach (compared to a random mail-out). In particular there is potential for voluntary response bias, which occurs when a majority of self-selected volunteers have strong opinions about the main topic of the survey, resulting in a sample that tends to overrepresent those individuals over the general population. We are confident that our relatively large sample size and the broad spatial distribution of respondents help reduce these concerns.

Analysis of Survey Data

The assessment of the impact carnivores have on beef producers was performed via the accumulated data collected by the online survey combined with a literature review. Survey respondents who reported cattle depredation were asked to

[i] Alberta Beef Producers are an organization representing the shared interests of beef producers in Alberta.

[ii] Agricultural Financial Services Corporation is a provincial crown corporation that provides financing and insurance options for agricultural related issues/endeavors.

[iii] Renamed Alberta Environment and Parks in 2015.

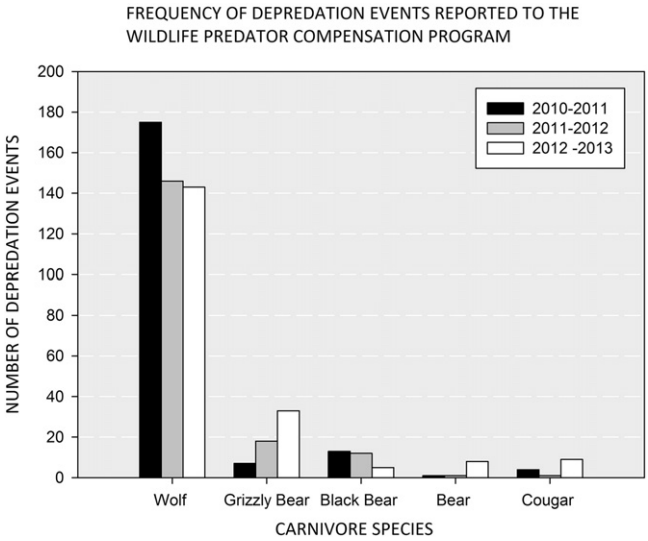

Figure 1. Carnivore species involved in depredation reported to the WPCP.

report the total number of cattle they owned by cattle type (calf, cow, feeder/yearling, and bull), as well as the number of each cattle type presumed lost due to carnivore depredation from 2011 to 2013. Survey responses that did not report cattle numbers were eliminated from the analysis. Data were analyzed to determine the average number of each cattle type owned and the mean annual loss by cattle type due to depredation.

Calculating the Loss to Beef Producers by Depredation and Cost/Value of Livestock

A market value approach was employed to calculate the economic loss incurred by producers as a result of carnivore depredations. To determine the value of each cattle type, average weights were used as generated by Canfax[iv] and multiplied by average market price per 100 pounds (Table 2).

The average market value of each cattle type was multiplied by the number of that cattle type lost to depredation as determined in the survey. The total cost of livestock lost in Alberta was estimated by extrapolating the percent loss generated in the survey to the total number of cattle type (Statistics Canada) for the same time period (Table 3).

In addition, estimated total loss was compared to the actual amount paid out in compensation to understand any discrepancy between beef producer losses and government payouts.

Results

A total of 672 beef producers satisfactorily completed the survey. Given a total population of 20,000 beef producers, 672 responses, and using a survey system calculator, we are confident that experiences of the surveyed population are representative of Alberta's beef producer population. In addition, Figure 2 highlights the distribution of survey responses and the total percentage of cattle per Alberta Beef Producer Zone within Alberta to highlight that producers from all of Alberta were represented in the survey.

Impacts From Carnivores and the Costs of Depredation

Seventy-four percent of respondents experienced impacts from carnivores. The species of most concern was coyote.

The most prominent impact carnivores have on beef producers is cattle depredation; 64% of producers reported losing at least one animal between 2011 and 2013. Depredation predominately occurs on calves, with 61% of producers reporting losses; 20% reporting losses of cows; 14% reporting losses of feeders/yearlings; and 4% reporting losses of bulls.

For the survey period, 2011 to 2013, the total economic costs were calculated for all survey respondents who provided adequate data (n = 381). The annual average number of calves reported for the entire survey group was 88,433. A total of 312 producers reported depredation on calves. The average rate of reported depredation for producers who experienced depredation events on calves was 2%; thus, approximately 1,769 calves were subjected to depredation. Given the unit price of $872 per calf (Table 2), the total economic loss of calves for survey respondents reporting depredation on calves was $1,543,134 annually. A similar calculation was done for each cattle type and the results are displayed in Table 3. This analysis indicates a direct annual loss of $2 million due to depredation events reported through survey responses (Table 3). The true value of loss is much greater, as these are reported losses only from survey participants (representing 3.36% of Alberta's beef producers).

Determining the impact of carnivore depredation from a provincial perspective is more challenging and less accurate than the numbers presented per individual producer because of reduced sample sizes in reporting and incompleteness in data collected (in the survey we did not collect information on the number of cattle owned by producers who had not experienced a depredation event). If, however, we make the assumption that cattle are distributed evenly among producers and that depredation rates are similar regardless of production system (feedlot vs. grazing system), then the percentage of producers who experience depredation per cattle type is the same as the percentage of cattle that may be subjected to a depredation event. Based on these assumptions, a best approximation of depredation during 2011 to 2013, from all carnivore species, was estimated to be $22 million in Alberta.

Cattle Losses are Uneven Among Producers

Survey results support the notion that depredation impacts are distributed unevenly among beef producers. For instance, the results show the distribution of percent loss of calves ranges from 0% to 25% loss for individual producers, with a mean of 2% losses annually. This means that 2.6% percent of

[iv] Canfax provides market analysis of the North American beef industry.

Table 2. Average market value (CAD dollars) per cattle type and number of cattle in Alberta averaged from 2011 to 2013 (Statistics Canada)

Cattle Type	Total population	Lbs	$/cwt	Estimated value per animal
Calf	1,626,000	550	$158.60	$872.32
Yearlings/Feeders	1,530,000	850	$130.74	$1,111
Cow	1,720,000	1400	$73.50	$1,029
Bulls	89,000	2400	$83.61	$2,006

producers report a high level of calf depredation events greater than 10% annually.

Do Beef Producers Use the Compensation Program?

Beef producers who reported experiencing negative interactions with carnivores (74%) were asked if they had reported depredation events to the WPCP. Of 374 responses, 62% had not reported, 24% had reported some depredation events, and 12% had reported all depredation events. Producers who participated in the survey were asked to explain why they did not report depredation events (Fig. 3).

Alberta beef producers identified seven reasons for not reporting depredation events to WPCP. The most common reason was the excessive burden of proof to demonstrate depredation events (34%). Under this theme, producers mentioned the primary concerns as the carcass being found too late; the agency not showing up on time; and/or the carcass not being found. Beef producers were also highly concerned with the inefficiency of the program (24%). Respondents identified the following programmatic issues: the claim and application process was too time consuming; the return was not worth the hassle of the process; and the program was not covering losses from coyote depredation.

Beef producers also perceived a certain level of inaction (18%) and complacency (11%) within the managing agency; there is a lack of trust between some producers and agency staff responsible for handling individual claims. Other producers feel agency staff is non-responsive and considered this an understaffing issue. Nine percent of producers were simply unaware of the existence of the compensation program.

Four percent of surveyed beef producers consider economic losses that result from depredation a 'cost of doing business' and therefore do not report. Finally, 4% of the surveyed beef producers found it sufficient to handle the issue themselves and did not consider contact with the agency necessary.

Discussion

A purpose of the survey was to support evidence-based decision-making in the realm of livestock depredation compensation. The results of the survey and the literature review provide guidance for improving the existing program in Alberta; however, the recommendations have application in similar ex post compensation programs in other jurisdictions. Here we discuss four key areas from the survey to help foster dialogue toward improving programming.

The Majority of Beef Producers Experience Carnivore Depredation

The survey results indicate a majority of beef producers in Alberta experience losses to carnivores; the most commonly reported loss was depredation on livestock, with calf depredation as the most frequent occurrence. These findings are consistent with other studies that identify depredation on livestock as the main economic impact from carnivores.[7]

Average reported depredation rates were consistent with other studies.[8] Survey results were also similar to findings in other research that found costs are borne unevenly among

Table 3. Total annual value of animals reported lost to depredation by survey respondents

Cattle type	Cost per unit	Total number lost to depredation	Total number of animals reported in survey	Average % loss to depredation from survey responses	Total value of animals reported by survey part. Lost to depredation
Calf	$872	1,769	88,433	2.0	$1,543,134
Cow	$111	275	18,330	1.5	$305,583
Feeder/Yearling	$1,029	151	30,216	0.5	$155,379
Bull	$2,006	16	320	5.0	$32,096
Total					$2,036,192

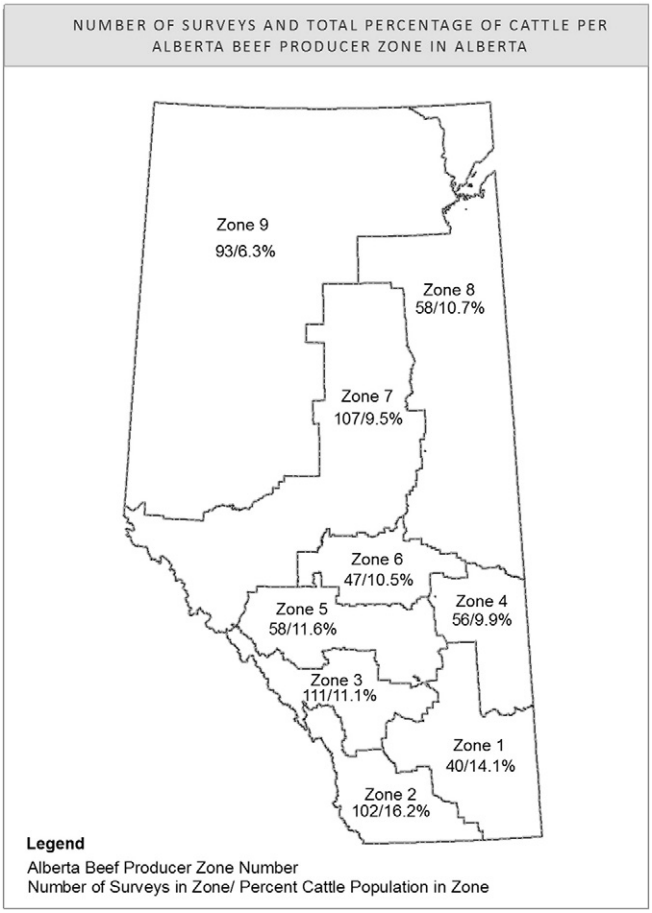

Figure 2. Distribution of survey responses and percent cattle by Alberta Beef Producers Zone in Alberta.

producers, with a small percentage of producers reporting higher rates of loss.[8] For example, in Alberta 2.6% of individuals reported experiencing calf depredation losses higher than 10% per year, while the average producer only experienced 2% annual losses. These producers experiencing extreme losses are important in the consideration of a compensation programs' ability to alleviate losses, helping maintain tolerance toward wildlife and support coexistence.

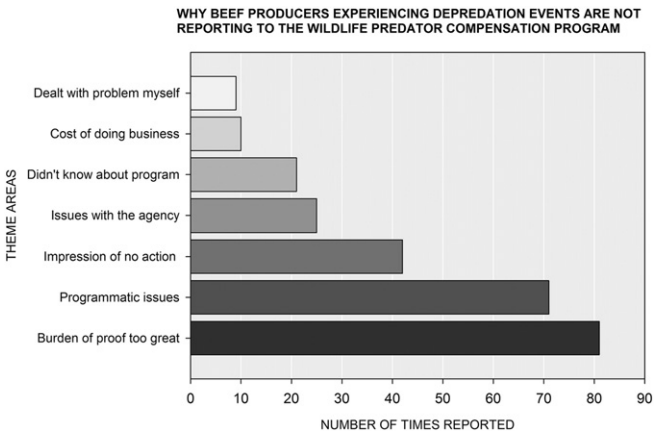

Figure 3. Reasons why beef producers are not reporting depredation events to the Wildlife Predator Compensation Program.

Although higher rates of losses only affected 2.6% of the producers who report experiencing depredation events, it can be a significant cause of negative feelings toward predators within the broader community.[9]

Economic Losses From Depredation are Not Fully Compensated

Depredation on individual livestock operations can have a significant monetary impact on beef producers.[2] Numerous studies have attempted to measure the impact of depredation to individuals[8,10] and on the beef industry in specific regions.[11]

Our results highlight that the current Alberta compensation program is not well utilized. The survey responses represent 3.36% of beef producers in Alberta with a direct financial loss of $2 million annually. The estimated losses incurred by beef producers presented are highly conservative and do not represent the total losses of cattle to depredation occurring in Alberta.

In comparison, the WPCP paid out an average $220,584 annually in the same time period of the survey (2011–2013). The discrepancy between actual compensation payout and the losses beef producers experience as a result of depredation can be partly attributed to the unwillingness of beef producers to participate in the compensation programs. In addition, it can be partly attributed to coyote not being eligible in the current compensation program even though they were identified as the most common species of concern.

Other costs borne by producers are not considered within the compensation program. Direct loss of livestock is compounded by indirect costs associated with depredation, such as reduced weight gain due to the stress caused by carnivores being present.[12] Our estimation of $2 million lost annually addresses only the market value of lost cattle reported by beef producers in the survey.

Researchers used the market value of cattle to estimate an annual loss of $2.5 million to beef producers in Colorado.[7] Using a multiplier this value was adjusted to $10 million to account for under-reporting and indirect losses. Alberta has approximately twice the cattle population of Colorado on a similar landscape. Applying similar multipliers suggests that the economic losses are far greater than the amounts currently paid out.

Can the Compensation Program Be Improved?

The WPCP is an ex post compensation program, meaning funds are paid out after a depredation event. A review of the literature highlighted a number of critiques of ex post compensation program many of which are supported by our survey findings. Compensation programs are compromised by a number of structural problems, including insufficient funding, excessive time gaps between depredation event and carnivore verification, overwhelming burden of proof for producers, and low reporting rates.[13] In addition, ex post compensation programs are often considered inadequate because they do not offer incentives to producers to take preventative measures against depredation events.[14,15] Here we highlight considerations when reviewing ex post compensation programs to guide discussions around improvements.

Establishing Clear Program Goals

Compensation programs are commonly developed to help ease the economic impact of carnivores while building human tolerance toward carnivore species.[16] It is important to outline the goals of a compensation program to enable evaluation of a program's success. Beeland[17] highlights some of the common goals of compensation programs:

- addressing the economic loss to local people;
- sharing the costs of conserving large carnivores more equitably;
- reducing producer motivation for removing carnivores;
- reducing mortality of livestock;
- increasing tolerance toward carnivores; and
- reducing attractants and promoting husbandry practices.

In the northwestern United States, compensation programs are designed and implemented to engender tolerance for large carnivore restoration programs, specifically wolves and grizzly bears, by offsetting costs of lost livestock and other property.[4] Outlining the goals is important for the Alberta program. In Alberta, the failure to include coyotes in the compensation program does not address the largest source of economic loss to carnivore predation. If the goal is to reduce economic burden, then the province may want to consider compensating coyote depredation. If, however, the program is more specifically focused on species of management concern, such as grizzly bears, then the program would be evaluated with this objective in mind.

Lessen the Burden of Proof

Survey respondents were dissatisfied with the burden of proof around verifying an eligible carnivore caused death. A number of issues can complicate the verification process, including consumption of the animal by the carnivore and scavengers leaving little or no evidence. This is further complicated by the need for the producer to find the kill in time and the officers responsible for verifying the kill to show up quickly enough to assess the cause of death.

Compensation program managers identify the verification process as important to create an audit trail accounting for compensation payouts. A balance is needed between the burden of proof and verification process. To achieve this balance, producers and program managers need to engage in discussions about program design and process. One suggestion to reduce the constraints of officers responding to depredation events on time is to implement a self-auditing process, where spot audits are carried out by officers to ensure compliance.

Consider a Multiplier

In our survey, producers indicated a low reporting rate partly because funds received are not a sufficient inducement. The costs of verifying the kill outweigh the benefits of receiving a payment. It is starting to be recognized that if one kill is confirmed likely there are other predations occurring. In addition, indirect costs (e.g., reduced poundage and weaning rates to cattle from stress of coexisting on landscape with carnivores) are not included in compensation programs. Given the challenges around burden of proof and indirect losses, other jurisdictions have started to consider a multiplier to account for the likely possibility that if one is confirmed more were likely lost to depredation.

To address these two shortcomings, some researchers have applied a multiplier of 3.8 for confirmed grizzly bear depredation kills while others have applied a 2.5 multiplier to all confirmed depredation events in Colorado due to underreporting and then added a 1.6 multiplier to address indirect costs from depredation.[7,10] In 2013, the Waterton Biosphere Reserve Association Carnivore Working Group, with the support of a graduate student, developed a series of recommendations to improve the existing compensation program in Alberta. After extensive meetings with landowners, a multiplier of 2.5 of the market value for all confirmed depredation events was suggested.[18] However, applying a multiplier also increases the payout associated with the program, in Colorado confirmed events resulted in a $2 million dollar payout but the addition of multiplier would have resulted in a $10 million dollar payout. A multiplier is only a possibility if it does not threaten program sustainability.

Lack of Incentives Toward Prevention

Prevention (e.g., removing cattle carcasses from the landscape, moving calving grounds closer to home, electric fencing calving grounds) has been identified as the best way to reduce the negative interactions occurring between producers and carnivores.[4] As with many ex post compensation programs, the WPCP is not directly linked to preventative measures; the current program is based solely on financial compensation for verified losses. This means an individual who has not taken steps to reduce attractants are entitled to the same compensation for losses as an individual whom has invested in changing management practices to reduce attractants. Nyrus et al. note that for compensation programs to be most effective they should be tied into best management practices as an incentive to reduce cattle and carnivore interactions.[16]

Compensation programming needs to be set in the context of broader carnivore management, as human carnivore interactions are a result of land use practices, prey density, and habitat loss.[14] The goals and specifics relating to compensation should be tied into broader carnivore management objectives. If the goal of compensation is mainly to offset financial burden to producers of coexisting with carnivores, other approaches could be considered. Incentive programs, whereby the producers are paid to support wildlife populations providing an incentive to reduce interactions and wildlife, are becoming more popular.

Conclusion

In this paper, we highlight that carnivore depredation on cattle has an economic impact on Alberta beef producers. The average calf loss per producer who reported experiencing losses is 2% annually, but 2.6% report experiencing greater than 10% loss, which characterizes a high level of loss to the

producer. The Alberta Government does offer compensation on verified kills, but the program is currently underutilized by producers and does not adequately address the economic losses caused by depredation. This is partly due to coyote not being included in the current program. Areas in which ex post compensation programs can improve include developing transparent program goals; improving the balance between verification and the need for an audit trail; considering a multiplier to verified kills to account for difficulty in verification process and to address indirect impacts of carnivore interactions; and tying compensation to best management practices aimed at reducing carnivore depredation events.

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References

1. Kulshreshtha, S., O. Modongo, and A. Florizone. 2012. Economic impacts of livestock production in Canada - a regional multiplier analysis. Canfax Research Service. Saskatoon, SK, Canada: University of Saskatchewan.
2. Naughton-Treves, L., R. Grossberg, and A. Treves. 2003. Paying for tolerance: rural citizens' attitudes toward wolf depredation and compensation. *Conservation Biology* 17:1500-1511.
3. Berger, K.M. 2006. Carnivore-livestock conflicts: effects of subsidized predator control and economic correlates on the sheep industry. *Conservation Biology* 20:751-761.
4. Treves, A., and K.U. Karanth. 2003. Human-carnivore conflict and perspectives on carnivore management worldwide. *Conservation Biology* 17:1491-1499.
5. Borgström, S. 2012. Legitimacy issues in Finnish wolf conservation. *Journal of Environmental Law* 24:451-476.
6. Boitani, L., P. Ciucci, and E. Raganella-Pelliccioni. 2010. Ex-post compensation payments for wolf predation on livestock in Italy: a tool for conservation? *Wildlife Research* 37:722-730.
7. Hoag, D.L.K., R.B. Boone, and C.M.H. Keske. 2011. The cost for agriculture to coexist with wildlife in Colorado. *Human Dimensions of Wildlife* 16:318-329.
8. Muhly, T.B., and M. Musiani. 2009. Livestock depredation by wolves and the ranching economy in the Northwestern U.S. *Ecological Economics* 68:2439-2450.
9. Gangas, K.E. 2014. Attitudes towards large carnivores and acceptance of illegal hunting [thesis]. Elverum, Norway: Hedmark University College.
10. Sommers, A.P., C.C. Price, C.D. Urbigkit, and E.M. Peterson. 2010. Quantifying economic impacts of large-carnivore depredation on bovine calves. *Journal of Wildlife Management* 74:1425-1434.
11. Pacific Analysis Inc. & Risk Reduction Strategies, 2011. An economic assessment of wildlife predation in British Columbia. B.C. Agriculture Research & Development Corporation. Wild Predator Loss Prevention Pilot Project. Accessed May 2016: https://www.bcac.bc.ca/sites/bcac.localhost/files/An%20Economic%20Assessment%20of%20Predation%20in%20BC.pdf.
12. Ramler, J.P., M. Hebblewhite, D. Kellenberg, and C. Sime. 2014. Crying wolf a spatial analysis of wolf location and depredations on calf weight. *American Journal of Agricultural Economics* 96:631-656.
13. Maheshwari, A., N. Midha, and A. Cherukupalli. 2014. Participatory rural appraisal and compensation intervention: challenges and protocols while managing large carnivore–human conflict. *Human Dimensions of Wildlife* 19:62-71.
14. Pettigrew, M., Y. Xie, A. Kang, M. Rao, J. Goodrich, T. Liu, and J. Berger. 2012. Human-carnivore conflict in China: a review of current approaches with recommendations for improved management. *Integrative Zoology* 7:210-226.
15. Agarwala, M., S. Kumar, A. Treves, and L. Naughton-Treves. 2010. Paying for wolves in Solapur, India and Wisconsin, USA: comparing compensation rules and practice to understand the goals and politics of wolf conservation. *Biological Conservation* 143:2945-2955.
16. Nyhus, P.J., H. Fischer, F. Madden, and S. Osofsky. 2003. Taking the bite out of wildlife damage: the challenges of wildlife compensation schemes. *Conservation in Practice* 4:37-40.
17. Beeland, T.D. 2008. Information sources, beliefs and values of key stakeholder groups in Mexican Gray Wolf reintroduction [thesis]. Gainesville, FL, USA: University of Florida.
18. Morrison, C. 2013. Proposed amendment to Alberta wildlife compensation programs. Wateron Biosphere Reserve. Burnaby, BC, Canada: Simon Fraser University. Report 2.

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