Non-Lethal Methods to Mitigate Farmers-Large Carnivore Conflicts

Prepared for

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A. INTRODUCTION

The human-carnivore conflict between farmers and wild carnivores can be mitigated through several ways that also promote coexistence between human and wildlife. From extensive research through the Mendeley search engine and Google Scholar (using the keywords: human, carnivore, conflicts, mitigations, solution, management, and tools), it was found that electric fencing and the use of live guardian animals are the most efficient ways for farmers to coexist with predators. Moreover, Breitenmoser et al. (2011) found that the use of live guardian dogs (LGDs) and/or electric fences to protect livestock and beehives were rated effective by most producers.

B. TOOLS
   a. **BEARS**
      i. **ELECTRIC FENCE**

Research from peer reviewed paper, such as Breitenmoser (2011) and Karlsson and Johansson (2010) state that electric fence is one of the most effective non-lethal method to deter predators from livestock. According to Breitenmoser et al. (2011), electric fence has high effectiveness against bears at beehives. This is then more supported by a video made by a farmer who had not used electric fence before and then installed it (https://www.youtube.com/watch?v=lqIRMavnahE). In this video, the farmer had captured videos of bears trying to get to her beehives without any success and after the shock from the electric fence they instantly backed away. The minimum power for the electric fence to work is 1 joule and 7000 volts. Here is a short article on protecting beehives from bears: https://www.jandohner.com/single-post/2017/06/03/The-Bears-and-the-Bees-Protecting-Backyard-Hives .

Another example where electric fence had been really effective can be seen from this video (https://www.youtube.com/watch?v=Sv2G-aRDvyY), where an experiment was conducted by putting food in the middle of a pen surrounded by electric fence. In conclusion, the author believes that electric fencing is the most effective method to deter away bears from livestock.

More detailed information about electric fencing can be found here http://www.lwwf.org/index.php/resource-guides under electric fencing guide. Some sources on where to get electric fencing can be seen in Appendix A.

ii. LIVESTOCK GUARDIAN ANIMALS

Several animals have been mentioned in literature to be live guardian animals. They are dogs, llamas, and donkeys. The most effective one that the author has found is dogs. Livestock guardian dogs (LGDs) have been used around the world, especially Europe, for a long time (Stone 2016). According to Breitenmoser (2011), LGD has been rated most effective by producers in North America.

According to Jan Dohner, a writer, researcher, and a livestock guardian expert, (http://www.motherearthnews.com/biographies/jan-dohner-livestock-guardian-expert), livestock guardians are also a more sustainable solution to the problem of predation. They keep livestock safe 24-hours a day without farmers having to resort to poisons, lamb collars, rifles or other dangerous deterrents that have mixed results at best.

To know more about how livestock guardian animals work, the author provides some short videos introducing them and when they are in action:
- Dogs
    - https://www.facebook.com/caninenature/videos/848178431959292/
      LGD in action, chasing a brown bear.
    - https://youtu.be/dvOHVfWAbpc
    - https://vimeo.com/60354527
        - This is a film about a ranch in Saskatchewan, Canada, situated close to a Canadian National Park, where large carnivores are present. Though their ranching situation is different from the farming in the North Eastern United States, the film is an excellent introduction to different breeds of guardian dogs, and what their strengths are.
- Donkeys
    - https://www.youtube.com/watch?v=NlsNEUpxaRY

Unlike donkeys and llamas, there are different types of dogs to choose from. A guide on the different breed of LGD can be found here: http://www.canadasguidetodogs.com/dogjobs/lgd.htm For more information and resources on Livestock Guardian Animals, please see Appendix B.

iii. EDUCATION AND OUTREACH

According to Can et al. (2014) who reviewed 50 management plans from around the world regarding human-bear conflict management plans, education is the most mentioned approach worldwide; but its effectiveness still need to be evaluated. Moreover, Can et al. (2014) mentions that wildlife management agencies should assess and address the values of specific segments of society to tailor education initiative accordingly; then monitor and document its outcomes.

Marley et al. (2017) engages in the same problem, they created an agent-based modelling approach for education programs. The paper claims all human education types provide significant changes compared to no teaching. In the study where they explored 9 different type of education, they find that educating human in the areas that are directly adjacent to bear habitat is the most effective method. However, Baruch-Mordo et al. (2011) in their experiment of on-site education in communal dwellings, bear aware education in residential neighborhoods, and law enforcement at two levels in the core business area find that law enforcement works best. They found that education had little impact in changing human behavior and that proactive enforcement was more effective in altering human behavior.

Although there are mixed reviews on the effectiveness of education, the author believes that people could still benefit from educational programs that deal specifically with the wildlife conflict in the area where they live. Aryal (2014) mentions that conservation education opportunities at the local level is one of the approaches used to mitigate conflict with snow leopard and other carnivores in the Himalaya. Similar approach is also used in the Sub-Saharan Africa for 10 years and it has improved coexistence of local communities with cheetahs (Marker and Boast 2015).

b. COUGAR

The author has not found any peer reviewed literature on non-lethal ways that are specific to deter cougars away from livestock. However, the author had contacted some farms in the US and one in Canada that have certified their farms with a predator friendly certification. Below is the list of the farms that the author contacted and their responses.

ACES at Rock Bottom Ranch
Certified Wildlife Friendly®
Basalt, Colorado
Tel: 970.927.6760
Email: aces@aspennature.org
DID NOT RESPOND

13 Mile Lamb & Wool
Certified Predator Friendly®
Belgrade, Montana
Tel: 406.388.4945
Email: becky@lambandwool.com
DID NOT RESPOND

Wild Echo Bison Reserve and Bison Quest
Certified Predator Friendly®

Townsend, Montana, USA
Email: pam@wildechobison.com
Tel: 406.202.2377
RESPONSE: HAS NEVER HAD A PROBLEM WITH PREDATORS. THOUGH THEIR PROPERTY HAS BEEN CROSSED BY COUGARS MANY TIMES

Grazerie
Certified Wildlife Friendly®
High Prairie, Alberta, Canada
Facebook
Email: info@grazerie.com
Tel: 780.523.9911
RESPONSE: LGD WORKS BUT IT'S NEVER 100%. MORE DETAILED INFO IS EXPLAINED IN SUBSECTION i. LIVESTOCK GUARDIAN DOGS (LGDs)

i. LIVESTOCK GUARDIAN DOGS (LGDs)

A farm in Alberta, Canada, named Grazerie responded to the author's email about non-lethal methods to deter cougars. The owner recommended LGD as a good deterrent for cougars. She said that "the dogs would play a big role in preventing/discouraging attack, particularly if you can haze them with hounds regularly." She also said that even though LGD is a great tool, it never provides 100% protection, as stealthy attacks from cougars are a possibility. It will have to be "a combination of human activity, LGD, hazing, protecting the weak and sick and overall animal husbandry".

ii. OTHERS

Even though there are not any specific literature to deter cougars away from livestock, there are some literature on how to deter cougars in general and how to coexist with them. According to Wainwright et al. (2010), some main strategies to conserve cougars are:

1. Solicit and draw on traditional knowledge and wisdom of aboriginal people and local people
2. Develop and maintain regular communication within local communities
3. Foster a change in public attitudes regarding the ecological importance of maintaining healthy predator-prey systems;
4. Implement non-lethal strategies, including education, to reduce cougar-human conflict and lethal control of cougars
5. Protect the remaining network of undisturbed and connected habitat for cougars and their prey
6. Eliminate cougar hunting.

Another source of possible ways to deter cougars can be found in this website: http://mountainlion.org/portalprotectfrighten.asp. According to the website, "installing motion or timer-activated outdoor lighting, sirens, or jets of water around your home and domestic animal enclosures may help keep predators away." It is mentioned that timed alarmed has been proved successfully to deter coyotes and wolves but has yet to be proven effective towards cougars.

The BC government recommends that farmers remove brush and trees within ¼ mile (.4 km) of buildings, barns, and livestock corrals which can result in reduced predation/harassment (http://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/wildlife/human-wildlife-conflict/staying-safe-around-wildlife/cougars). However, the website does not say that their recommended strategies will work. They said it may help reduce predation. Other suggestions included are livestock confinement, adding lighting to a pen or corral, store all feed in a secure location and ensure feeding areas are clean and free of attractants, etc.

c. WOLVES
i. ELECTRIC FENCE
The author has found that electric fencing and fladry work best to deter wolves away from livestock. In Livestock and Wolves: a guide to non lethal tools and methods to reduce conflicts by Defenders of the Wild (Stone 2016), electric fencing has been proved to work by a farmer who had not installed it before and had lost some sheeps to wolves. The farmer combined the electric fence with fladry and found that when the electric fencing was down, wolves still kept away from the livestock (p.12). However, according to Sowka (2013), it is not practical or cost-effective to fence an entire pasture or grazing allotment to exclude wolves; it is more successful to enclose a small or temporary paddocks, and bedding areas with electric fence.

For more information on the different type of fencing for wolves, the cost and its lifespan, please see this rancher's guide for coexistence among ranchers, livestock, and wolves: http://wolfawarenessinc.org/wp-content/uploads/2016/07/Ranchers-Guide-to-prevent-livestock-losses-23-7-2014-final-press-quality.pdf

ii. LIVE GUARDIAN DOGS
Live guardian dogs are also effective against wolves. According to Treves et al.(2016), LGD is an effective non-lethal method that reduced livestock depredation by gray wolves and coyotes. Moreover, Rigg (2003) has also found that in Italy, wolf predation problems have been much less in areas where traditional husbandry and livestock guardian dogs are used.

C. PROGRAMS IN BC

a. GET BEAR SMART
ttp://www.bearsmart.com/

The get bear smart program is a certification program that promotes coexistence between human and bears and the mitigation of bears killed from human-caused problems. Communities have to met certain guidelines to attain the "bear smart" status. A background report containing bear smart guidelines can be found here : http://www.bearsmart.com/docs/BearsmartBkgdr.pdf.   So far, there are 7 communities in BC that have been certified as "bear smart". They are Whistler, Kamloops, Squamish, Lions Bay, Port Alberni, Naramata, New Denver. This program has successfully reduced the number of bears killed due to human-caused problems. They provide resources for communities such as education, videos, and guides for living, recreational activity, and ranching in bear country. This program has proved that education can lead to coexistence with wildlife, although success can only be achieved when all members of society, citizens and government, are involved and willing to do their part of the work.

b. WILDSAFE BC PROGRAMS
https://wildsafebc.com/

Wildsafe BC is a branch of a program called bear smart (mentioned above). It is a program designed to reduce human-wildlife conflict through education, innovation, and cooperation. From several of their annual reports in 2016 they have successfully educate people to secure their bins from bears (garbage management). Some areas that had little change in human behavior suggest the use of law enforcement to help implement the program.

D. PROGRAMS OUTSIDE OF BC
a. EDUCATION
i. LION GUARDIANS
http://lionguardians.org/

This organization works across Kenya and Tanzania. They trained East Africans to be lion guardians. They have been conserving lions and teaching communities how to live in coexistence with lions since 2007. There is a lot to learn here since their approach is to get the local people involved and interested in their surrounding environment and it has created incentive for them to live in coexistence with predators. They have designed a training program based on their experiences that can be found in their websites (http://lionguardians.org/the-training-program/).

b. OTHER PROGRAMS
i. ELECTRIC FENCE INCENTIVE PROGRAM (DEFENDERS OF WILDLIFE)

http://www.defenders.org/press-release/defenders-expands-grizzly-bear-fencing-incentive-program
https://www.defenders.org/publications/Got-Grizzlies-Brochure-2017.pdf

It has been previously discussed that electric fence is one of the most effective way to deter predators from livestock, therefore programs relating to the compensation of electric fence would give ranchers the initiative to install electric fence and in coexistence with predators. Program like this that has been ongoing and have received positive feedback is electric fence incentive program. The program offer to reimburse 50% of the cost of an electric fence (up to $500). It's been employed in the US the counties of Washington, Idaho, Montana, and Wyoming. For more details on how it works and the details on how to apply for one, please see the pdf link above.

ii. COMPENSATION PROGRAM (ALBERTA)

Alberta has a compensation program called Wildlife Predator Compensation Program (WPCP). However, there are some critiques about this program. According to Lee et al. (2016), 62% of their survey participant did not report depredation events to the Wildlife Predator Compensation Program (WPCP) because of these reasons: the excessive burden of proof to demonstrate depredation events, carcasses could be found too late, the agency not showing up on time, and the carcasses cannot be found. The producers were concerned with the inefficiency of the program. Lee et al. (2016) find that the current Alberta compensation program is not well utilized.

Lee et al. (2016), then suggested several ways to improve the programs based on their findings. Their suggestions to improve the compensation programs:
- Establishing clear program goals
- Lessen the burden of proof
- Consider a multiplier
- Encourage best management practice as an incentive to reduce cattle and carnivore interaction

E. PREDATOR FRIENDLY CERTIFICATION
The author has found 4 predator friendly certification that relates to the conservation of wildlife. They are:
- Predator friendly certification and wildlife friendly certification (these organizations have merged into one)
    - http://www.predatorfriendly.org/
    - http://wildlifefriendly.org/
- Canadian wildlife federation certification (http://cwf-fcf.org/en/about-cwf/)
- Rainforest alliance certification
    - (http://www.rainforest-alliance.org/business/agriculture/certification/farm)

- Animal welfare approved. (**https://animalwelfareapproved.us/about/**)

However, according to Treves and Jones (2010), the verification and reliability of eco-label certification is hard to verify, thus hard to prove to consumers that they are actually making a change.

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APPENDIX A - electric fencing sources

Margo Supplies
https://www.margosupplies.com/canada?gclid=CNSckLKMp9QCFUtNfgodFPUCVA

Gallagher Group Limited
https://am.gallagher.com/ca-en/

R & S Powerfence
http://electricfence.homestead.com

APPENDIX B - Livestock Guardian Animals Resources

LGD farms and breeders

Company	Location	Delivery	Website
RLT farms	Alberta	yes	http://www.rltfarms.com/
Grazerie	Alberta	No information	www.grazerie.com
Disdero ranch	British Columbia	No information	http://disderoranch.ca/great-pyrenees-dogs/
Blacksbay farm	Ontario	yes	http://blacksbay.com/farm/LGD.html (offer training and rehabilitation of LGDs)

A table on livestock guardian animals' lifespan, cost, pros, and cons of each live guardian animals

Guardian animal	Life span	Initial cost	Subsequent costs	Comments	Pros	Cons
Dog	Working life= max 10 years (usually not effective guardians until 2 or 3 years old)	Purchase cost: $240 to $1000 1st year cost: $700 - $900	$250 - $300 a year	More successful and easier to choose from because they are already specially bred to guard livestocks	Reduce predation on livestock. -Reduce labor and lessening the need for night corralling. Alert the owners to disturbances in the flock. Allow for more efficient use of pastures and potential expansion of the flock	An investment with no guarantee of success. The dogs may become ill, injured, or die prematurely. They are potentially aggressive. May injure the stock or other animals, including pets. To reduce conflict, livestock

						producers should ensure that signs indicating the presence of LGDs are readily visible
Llama	10-15 years	$700 - $800	$90 a year	Can be tricky, not all llamas have guardian traits.	Naturally social creature. No need of extended training like some LGDs. Naturally aggressive towards foxes, coyotes, and dogs as well as some other predators. Has calm temperament and do not generally pose a threat to human beings	Llamas generally do not provide protection against feral hogs or small predators such as raccoons, opossums, large birds Do not provide protection for the family or the farm Less successful on pastures with dense vegetation, on large open range Not all llamas are peaceful flock companions If not trained or socialized, adult male llamas can be dangerous to humans

Donkey	10-25 years(they are most protective between 3-12 years)	$65 - $250	$0 - $300 a year	Can be tricky, not all donkeys have guardian traits..	Donkeys are especially alert grazing animal with very good hearing and a wider field of vision than horses. They are naturally aggressive to canines and this behavior will extend itself to their pasture mates. Donkeys can protect against a single fox, coyote, roaming dog and possibly a bobcat Generally have a calm temperament and pose little threat to neighbors or farm visitors.	Not all donkeys will confront canines, choosing to flee instead. Some donkeys will ignore threats to the other animals in their pasture and only react if they themselves are threatened. Donkeys cannot deal with multiple canine attackers or against wolves, bears, feral hogs, or mountain lions Donkeys don't typically protect against small predators, such as raccoons, or against large birds.

Compiled from different sources: Carmichael (2011), Dohner (http://www.motherearthnews.com/homesteading-and-livestock/guardian-llamas-zbcz1309), Dohner(http://www.motherearthnews.com/homesteading-and-livestock/guard-donkey-zbcz1310), and USDA (2011)