A RANCHER'S GUIDE

COEXISTENCE AMONG LIVESTOCK, PEOPLE & WOLVES

Prepared by
Sadie Parr and Jennifer Coleshill – 2013

Figure 1 Livestock guardian dogs and sheep in a temporary pasture. Photo courtesy of Grazerie Farms.

"When it is understood that one loses joy and happiness in the attempt to possess them, the essence of natural farming will be realized. The ultimate goal of farming is not the growing of crops, but the cultivation and perfection of human beings"

- *Masanobu Fukuoka, The One-Straw Revolution*

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Toolkit Goal: To Consolidate Information on Wolf Depredation for Livestock Producers and Policy Makers

The overall goal of this toolkit is to provide developmental assistance to livestock producers in Western Canada. This guide is designed to provide education, and enhance outreach and cooperation among livestock producers regarding ecosystem based management. This is an effort to facilitate coexistence among livestock and wolves. This guide will review methods of prevention, mitigation, compensation, and other forms of management used where the risk of wolf -livestock interactions exist. The overarching objective is an emphasis on recognizing the simplicity of more effective prevention practices, and the ability to adapt them to individual producers.

Figure 2 Family enjoying a walk through a natural forest together.

The health of our communities depends upon the health of the environment surrounding us.

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Coexistence among Livestock and Wolves

Wolves occur throughout the Northern Hemisphere from the Arctic to as far south as Mexico, Saudi Arabia and India. Once they were abundant over much of North America and Eurasia, although human encroachment and habitat loss have reduced their ranges to much smaller portions of their former habitat. In many such areas, people are livestock producers. However, wolves can kill livestock (i.e. wolf depredation) and this obviously creates conflict with people.

Biologists have spent decades learning about wolf depredations on livestock. Most research indicates that culling wolves does not reduce livestock deaths over time, unless wolves are exterminated (Wallache et al. 2009, Muhly et al. 2010, Harper et al. 2008). Indeed, there is no evidence to show that indiscriminately killing wolves works as a long-term solution; depredation still occurs in areas that have been practicing lethal control for decades.

Due to historical values and differing social and cultural views, (e.g. urban versus rural) a polarity of opinions exist around wolf management. The spectrum ranges from those who want to protect livestock to those who want to protect wolves. Both objectives could be met simultaneously through working together cooperatively. For example, a large amount of money has been invested within parts of North America to kill wolves in the name of livestock protection. **In areas where research has been done, increases in the numbers of wolves killed does not result in decreases of wolf livestock conflict but may actually increase depredations as found in the Eastern Slopes of the Rocky Mountains in southwest Alberta** (Muhly et al. 2010). However, when producers record livestock deaths results consistently show that prevention and protecting livestock from wolves reduces conflicts**.** Prevention of livestock conflict could therefore offer an effective tool for addressing the problem of livestock depredation on a local scale, while fostering nature conservation (Musiani et al. 2004).

Figure 3 Preventative husbandry practices workshop: fladry set-up - Wood River Project. Photo courtesy of Wolves of the Rockies.

According to a textbook about wolf behavior and ecology edited by renowned wolf experts D. Mech and L. Boitani in 2003, (*Wolves: Behavior, Ecology, and Conservation),* the most rational and effective approaches when dealing with depredation in areas where wolves and livestock overlap are:

1. Prevention by providing incentives to improve protection of livestock (fences, guard dogs, shepherds, range riders etc.)
2. Compensation of farmers for damage
3. Elimination of individual wolves causing damage (so-called 'problem wolves')

As conservation of biodiversity has become a global issue, efforts have been made to restore wolf and other predator populations which are understood to be critical in maintaining healthy ecosystems. Humans have been raising cattle in the Americas for 500 years. Wolves were present on the landscape long before this, but were extirpated in many areas of Alberta and BC through targeted killing during the 1950's. In recent times, wolves have been more accepted in returning to their former habitat as public perceptions have shifted and wildlife management practices have changed. Ranchers accustomed to living in predator-free landscapes must again learn how to effectively prevent depredation. It is imperative that livestock producers have all the necessary and available tools to effectively coexist with wolves.

Husbandry Practices May Reduce Depredation Risk

Husbandry methods used to avoid depredations are relatively inexpensive. Some of the more commonly used techniques discussed here include: removing dead livestock and attractants, confining or concentrating flocks and herds during periods of vulnerability, establishing a human presence using herders and range riders, livestock guardian dogs, synchronizing birthing to reduce the period of maximum vulnerability, and pasturing young animals in open areas and in close proximity to humans**.** The type of husbandry used has a large influence on predation when compared to the type of wolf management used or wolf population densities (Musiani, Boitani, & Paquet, 2009).

One of the easiest steps to take to prevent attracting predators to areas where livestock is being raised is to remove dead livestock immediately from pastures. If carcasses are not removed a predator WILL come in to feed (Wood River Wolf Project workshop, 2013).

If a producer can remain "unattractive to wolves" by promptly managing for dead and sick livestock, as well as maintaining a strong human presence, livestock depredation rates will decrease in most areas.

Figure 4 Fladry set up around cattle in the USA - Wood River Project. Photo courtesy of Wolves of the Rockies.

If the landscape is changing, are you?

Figure 5 Livestock Guardian Dogs standing with cattle in High Prairie, AB winter field. Photo courtesy of Grazerie Farms.

Compensation Programs for Livestock Losses

Compensation programs occur in various parts of North America and cover a wide range of expenses (see Appendix III for provincial regulations). Programs sometimes include costs associated with prevention measures. For example, USA-based Defenders of Wildlife compensates for all types of stock killed by predators including livestock guardian dogs. The amount of compensation for loss of an animal or product to a wolf varies from 100% full market value (even if depredation event occurs in spring) to a fraction of this. Sometimes there are general limits to the determined economic value of an animal; however there is seldom a maximum amount a producer can be compensated for.

Most compensation programs will only provide financial aid to producers proven to practice preventative and responsible husbandry methods. Some of these programs will also help to cover costs associated with prevention measures. Others will refund any veterinary costs associated with wolf-livestock conflicts.

It is imperative to determine whether a depredation event is due to predation or scavenging and this will be verified by the compensators at some level. Most provinces have science-based guidelines to help determine whether dead livestock has been killed or scavenged upon, and producers should learn to distinguish the differences themselves in order to protect the evidence needed to support a compensation claim.

Get there fast! Scavenging and local dogs can quickly obscure the scene. Protect the evidence by covering the carcass and preserving tracks. Use photographs and notes to document the scene. Using fladry (described later in this Toolkit) is another possible method for temporarily protecting a dead animal from scavengers.

Figure 6 Compensation programs reimburse livestock producers for financial losses associated with depredation events.

Methods to reduce risk of livestock depredation

The risk of depredation will vary between locations. Depending upon the location and individual situation of the producer, it will usually be necessary to change anti-predation devices and methods frequently as wolves and other predators might become habituated to one single method.

The key is to prevent wolves from being ATTRACTED to a livestock operation.

Surveillance and Monitoring: shepherds, herders, and range riders.

Shepherding a flock or herd of any domestic species is an age old tradition used around the globe where predators and livestock share habitat. It is one of the simplest and oldest methods for deterring predators. Human presence can help detect, determine, and alter behaviour patterns of wolves in an area.

Methods:

The overall approach might involve the following elements:

- Shepherds: individuals used to constantly monitor and care for domestics (typically sheep and goat). The approach is very effective against wolves as mere human presence deters most wildlife.

- Herders: individuals that work to keep the flock or herd together so they are easier to monitor and directed to appropriate areas.

- Range riders: individuals hired specifically for the summer-fall grazing season (typically cattle and horses).

- Individuals in all cases will patrol the areas frequented by livestock at dawn and dusk when wolves are most active.
- Increase effectiveness by using dogs to send alert and cover more land area.
- Count stock regularly when possible. Especially in rugged terrain where dead livestock may go unnoticed.
- Monitor for the health of livestock.
- Ensure that deterrents are set.
- Monitor stock agitation as well as presence of wolves.
    - Lone mother (may be searching for lost calf)
    - Vocal
    - Tight bag
- Begin record keeping to identify patterns (problem areas, time of year, etc.)

Poor surveillance is a large factor associated with livestock losses.

Figure 7 A shepherd monitoring his stock in the Swiss Alps. Photo courtesy of Peter Dettling.

The keen senses of wolves enable them to recognise when otherwise healthy prey becomes disadvantaged, for example in deep snow. By noting past record keeping, monitoring your herd, and knowing what conditions might increase risk, patrol efforts may be increased during these times.

Costs:

Surveillance of livestock herds is the most common traditional non-lethal method used by livestock producers in many European countries. However, it is labor-intensive which can be expensive if the producer employs staff to watch over livestock (Musiani, Muhly, Callaghan, & Gates, 2004).

Two possible options to help offset costs if extra labour is employed are:

- Establish cooperatives in which sheep and other livestock can be grouped in bigger single herds to dilute the risk of predation by wolves on individuals (i.e. Communal husbandry) (Musiani et al. 2004)
- Increase surveillance only during times of known higher risk (eg. Calving and branding seasons; See section on Seasonal Patterns).

Range Riders:

Cost estimate $110/day for 2 months/year is $6,600. In some parts of the US tourists are **paying for** the opportunity to do this.

Figure 10 Dead livestock can go unnoticed without the use of monitoring. Livestock guardian dogs can also be used to help ensure that carcasses are found and removed. See section on livestock guardian dogs. Photo courtesy of Grazerie Farms.

Figure 8 A range-rider patrols his sheep and area - Wood River Project. Photo courtesy of Wolves of the Rockies.

Figure 9 A range rider with his shepherding dog patrolling their area Wood River Project. Photo courtesy of Wolves of the Rockies.

Management of Attractants

Remove carcasses immediately.

Managing attractants such as carcasses is critical to avoid attracting predators to an area. Failure to do so has been shown to increase chances of future depredations (Watersheds Messenger Newsletter, Vol. XVII, No. 2, Wood River Wolf Project Workshop 2013). Predators learn where they have received food rewards in the past and are more likely to return to that area.

Methods

- Haul away, burn, or bury body, body parts or bodily fluids.
- Carcass removal programs can be operated by government or private group (rendering facility/commercial landfill).
- A carcass pit dug on one`s own property may initially attract predators, but can be effective if not providing a reward (completely enclosed or electric fenced)

- Successful carcass pits are: :
  - Located away from stock
  - At least 8 feet deep
  - Regularly burned or carcasses regularly buried
  - Surrounded with fencing to provide more of a barrier

Figure 11 This compost pit requires a top fence and ideally a concrete base to prevent digging. Photo:www.ecan.govt.nzpublicationsGeneralInfosheet14StockDisposalJune09.pdf

If wolves become conditioned to livestock killing in one area all neighbouring farms may be at risk. Working together to ensure the larger area is attractant free is critical.

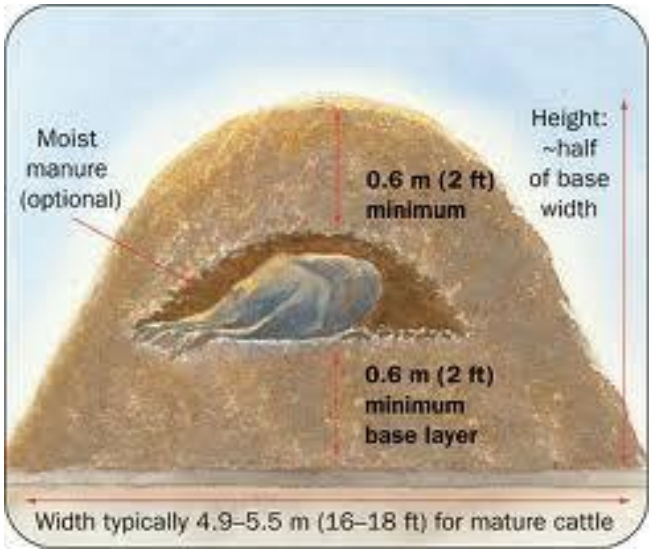

Figure 12 Burying carcasses is a good idea, however pits must be dug deep enough and well covered. Photo: www1.agric.gov.ab.ca$departmentdeptdocs.nsfallrsb10366

Costs:

The cost estimate for an individual using a carcass removal program is 9¢/lb for ruminants where programs occur in Alberta (2012), with a minimum $75 charge. In some parts of North America, government Fish and Wildlife Agencies will donate the truck and fuel costs.

Often funds for these programs are generated through rancher donations, conservation group donations, local taxes, and grants

Creating Barriers: Fencing and Fladry

Constructing a Predator Resistant Fence

In many areas fencing techniques are used effectively to deter predators such as wolves and bears. Electric fences, or combinations of wire mesh and electric fences have proven to be particularly effective (Musiani et al. 2004). However, permanent predator-proof fencing is of limited use when livestock are kept in large enclosures because such fences are costly to build and maintain (Musiani et al. 2004). In such circumstances, or when livestock is semi-nomadic, producers may consider portable electric fencing which can be set up temporarily and powered by solar energy. Another alternative to offset fencing costs would be to combine night penning, which would require only a portion of the pasture to be fenced.

Figure 13 Some materials for setting up a portable electric fence.

Fence Characteristics

One thing that should be considered when constructing a fence of any type is that it **should be visible to wildlife and livestock**. Wolves are most active at night and should see the fence before they try to pass through in order to associate the barrier with a visual cue. The visibility can be increased by increasing the thickness of the wire or adding flagging tape.

The bottom of the fence should be less than six inches from the ground. Woven fence can be buried, but it may be just as efficient to ensure that the ground is level. Holes should be filled in. Fences should be checked on a regular basis, because winter ground freezing and thawing can push the posts out of the ground increasing the space between fencing. Electric fencing needs to be maintained to be effective. .

Wolves have been known to jump heights of 5 feet, and thus **require a minimum fence height of 1.3 meters.**

TYPES OF FENCING:

Electric Fencing Designs

What You Need to Build an Electric Fence

- An Energizer to deliver power (solar, battery, or plug-in)
- Live wires of high tensile steel for permanent set-up (11-14 gauge wire with a minimum tensile strength of 200,000 psi and a minimum breaking of 1,800 pounds is recommended when also deterring bears) (Masterson 2006)
- Fencing posts (rebar, steel fibreglass, treated wood, cedar, etc)
- Fence charger
- Grounding system (rod or plate in the earth)

Simple Electric Fence

Wolves and cougars are jumpers so require a higher fence than bears to be kept out. Combining fladry with electric fencing will help to slow down a wolf to ensure they get a charge (see section on Fladry). Today there are portable electric fences that can be set up to work within 2 hours, and solar-powered systems that can be installed anywhere there is enough daylight to charge the batteries. Once properly installed, a permanent electric fence can be used for many years. Portable electric fences can be set up quickly and are useful when temporary protection is required, such as during lambing or calving season.

Five Strand Electric Fence

SET-UP

- Will require a minimum of 5 to 7 strands of wire if also deterring bears.
- Place posts 10 to 12 feet apart, bottom wire (or fence) 5 to 6 inches above ground.
- Galvanized wire is a better barrier than synthetic options (stronger but more expensive).
- Place wire outside of rebar (harder to dislodge).
- Need to maintain fence (no sagging/fraying, less likely to part hairs).
- Check volt meter regularly to ensure working (set up somewhere easy to check often).

Seven Strand Electric Fences

Dorrance and Bourne (Dorrance & Bourne, 1980) suggested a 7 strand electric fence design for preventing coyote depredation. The total height of the original fence was 130cm, but to deter jumping wolves the fence should be constructed to be no less than 2.3 m. Lower strands are placed closer together so that animals cannot get through between strands. Higher strands can be placed farther apart to increase the overall height that the animal has to jump over.

Figure 14 Using a low voltage charger may not be effective. Make sure that the charger is appropriate for predators, such as the one shown here. Photo courtesy of Gillian Sanders.

Extra Tips

- **Use chargers for predators**, NOT for livestock; 15,000 volts or more are required if also preventing bears (eg. "Super Energizer 4" 1900 volts, 50 mile range)
  - If the charge is not high enough a predator will go through the fence (nose shock is best learning experience).
- A plug-in unit has more power than a solar unit.
- A unit must be grounded (want wet earth) in order to deliver the needed voltage and shock.
- Less charge is transferred to an offender if the earth around the grounder is dry and gravely. Maintain moisture around the ground to increase the shock value (eg. placing directly under roof drip line can increase voltage by few thousand. Can also sprinkle water).
- Permanent fencing usually needs less maintenance and can handle harsh weather conditions (eg. snow-load) better than portable fences.
- Anything coming into contact with wires can create a closed circuit, making the electric fence powerless, eg. fallen branches or trees, therefore **walk the fence line every day to ensure circuit is kept open and maintained (tight wires).**
- Grass and vegetation growing up to touch bottom wire lessen the voltage; **keep grass cut low, cover or remove vegetation from beneath fence.**

- **Check daily that the fence charger is on** (place in convenient spot) and that batteries are charged if using solar.
- **Check voltage weekly with voltmeter.**
- **Keep battery and fence charger dry and corrosion-free.**

Human safety is not an issue as long as a fence charger is used. This allows for a pulsating charge which allows a person to let go of the wire. This will not do any permanent damage to pets, people, or wildlife but it is unpleasant. You may **put up warning signs** to alert people that the fence is electric.

Stucco Wire Fence

Stucco wire hung around rebar posts and electric wire top (eg.roll 100 feet $80, ¼ mile tensile steel) Better for coyotes because there are less gaps.

Recommended electric fence supplier
Margo Wildlife Supply www.margosupplies.com
See Appendix I for more details.

Suggested model SE-4 from Parmak for plug-in, Parmak Solar Magnum 12 for solar units.

Modified Stucco Wire or Woven Sheep Fence with 2 Strands Electric Wire

The Wildlife Damage Centre promotes a modified sheep fence design.

SET UP:

- Existing woven sheep fence can be made more resistant to predators by adding two electric wires to the system.
- One would be placed at the bottom of the fence, to prevent an animal from trying to dig under then fence.
- The other electric wire would be placed about 12 inches above the top of the woven fence to help prevent wolves from jumping over

Note that a battery powered solar fencer is made to be placed outside to recharge with solar rays, whereas a plug-in fencer must be stored out of the elements and requires a heavy duty extension cord and grounded electrical outlet.

Table 1. Cost Estimates for Electric Fencing Setups

Item	Quantity	Approximate Cost
Predator Charger Unit: "Super Energizer IV" 1900 volts, 50 mile range (plug - in) OR Parmak Magnum 6 or 12 - [solar]	1	$250 ($450 if off-grid)
Grounding plate or rod (rebar)	1	$17
Rebar posts every 10-12 feet	Many	$600 to $700 per ton
Tensile steel OR Stucco wire roll OR hot tape or electro plastic netting for temporary set-up	Depends on size of perimeter	$25 per 1/4 mile $80 per 100 feet $200 - $750 for 30 foot X 42 foot
Electric fence tester	1	$5 - $30
Fluorescent flagging and warning signs	2	$20

Table 2. A cost comparison of different fence designs and their effectiveness as barriers to wolves.

	Basic 4 strand Barbed Wire Cattle Fence	Basic 4 Strand Electric Cattle/Sheep Fence	Basic Woven Sheep Fence	5 Strand Electric Fence	7 Strand Electric Fence	Modified Electric Sheep Fence	Electrified Fladry (Turbofladry)
Wolf Barrier	Poor	Poor	Poor	Good	Good	Moderate	Good
Cost (per 1 mile)	$4,404.00	$2,101.28	$4,980.00	$2,496.60	$4,188.00	$5,371.84	$2,303 1st km., then $2,032/km
Labour	156 hours	60 hours	168 hours	72 hours	175 hours	200 hours	31.8 hours/km
Life Span	20 years	25 years	20 years	15-25 years	15-25 years		Indefinite

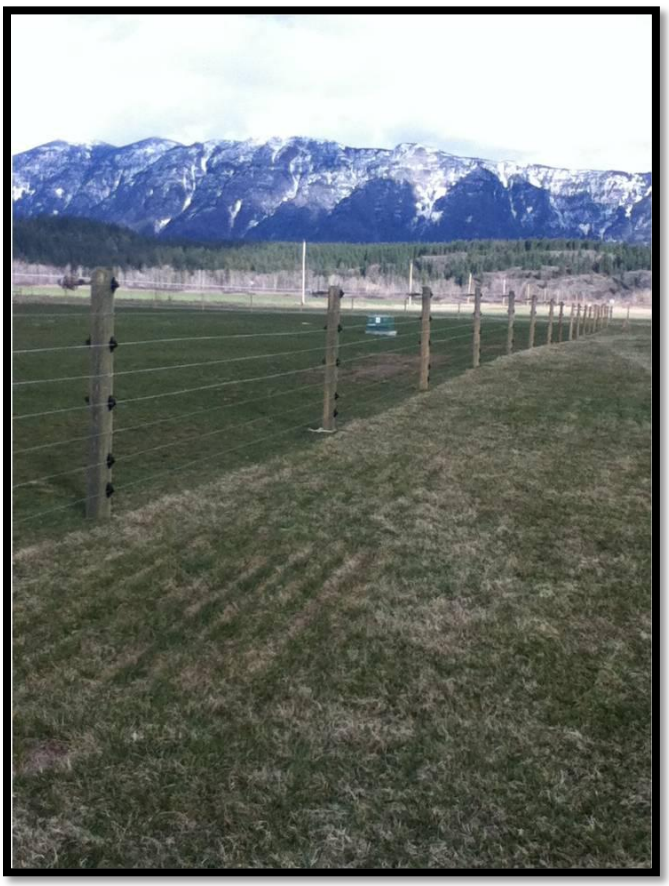

Figure 16 A five-strand permanent electric fence set-up, using a total of eight strands of wire .Photo courtesy of Gillian Sanders

Figure 15 Electrified fladry combines electric fencing with fladry. Photo courtesy of Nathan Lance

Figure 17 A five-strand portable electric fence set up to deter grizzly bears. Photo courtesy of Gillian Sanders

Fencing Considerations:
Fences will act as a barrier to other wildlife such as deer or elk.

Vegetation must be kept down under electric fences. Vegetation touching the bottom wire will help the wire lose its charge.

Set up electric fence before livestock enters the pasture. This gives wolves time to approach the fence and learn that it is electric, before the desire to penetrate the fence is established.

When fencing on slopes, one will need to consider a loss of height if an animal is approaching a pasture from upslope. Objects such as rocks and fallen logs should be removed from the fence because animals can use these as stepping stones to get over the fence.

Figure 18 Fladry provides a visible boundary around livestock. Photo courtesy of Nathan Lance

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Figure 19 Ensure that vegetation below electric fence is removed or kept below wires. This is a 5 strand electric fence modified to fit with an existing paige-wire fence. Photo courtesy of Gillian Sanders

Fladry

Fladry is a simple, inexpensive yet effective method for deterring wolves from entering a pasture.
It is a line of flags hung outside a pasture to deter wolves from crossing it and entering the area.
Fladry was found to be effective in deterring captive and wild wolves for up to 60 days (Musiani, et al., 2003). This research was done in smaller areas < 25 ha and humans were patrolling the fence every few days which may have increased its effectiveness.

Figure 21 Fladry fences are easy to produce, cheap and moveable, while being effective for reducing livestock predation on a local and short-term basis. Photo courtesy of Wolves of the Rockies.

SET UP:

- Plastic flags measure 50 X 10 cm.
- Attach every 50 cm on a 0.2 cm diameter nylon rope, suspended 50 cm above ground tied to rebar posts that are installed at 30 m intervals
- Fladry must be maintained and/or replaced if it gets warn (i.e. the removal/loss of just one flag was enough to allow wolf crossing in captivity)
- May be placed 2 m outside conventional fence to prevent cattle from damaging or eating flags
- Set up only AFTER a wolf denning site has moved outside of area

Figure 20 Setting up fladry is fairly simple, as seen in this image taken at a Wood River Project Workshop. Photo courtesy of Wolves of the Rockies.

Figure 22 Fladry can be set up around an existing fence. Photo courtesy of Nathan Lance

Fladry considerations:

- Most effective as a short term deterrent.
- Most useful for temporary prevention when livestock is kept in small pastures (calving, lambing, overnight holding, rotational grazing).
- Inexpensive, easily moved, quickly installed over a large area.

Figure 23 Setting up fladry at a workshop for livestock producers in the USA. Photo courtesy of Wolves of the Rockies.

COST:

- Cost of commercial fladry is approximately $0.19/m (US). (Musiani and Visalberghi 2001).
  - Fladry can sometimes be ordered through a general-contract sewing company. (See Appendix I for resources).

Turbofladry

Turbofladry combines an electric fence with fladry, and can be powered by solar energy. Although more expensive, this type of set up has proven very effective at keeping wolves out of a given area. Initial costs may appear high, but the effectiveness and longevity for preventing depredations should be considered. This is best suited for small pastures.

In the USA turbofladry successfully prevented any livestock losses within one month where 1,000 sheep were in close proximity to denning wolves (Wood River Wolf Project Workshop, 2013).

SET UP:

- Set up fladry as described earlier in this section in combination with an electric fence.
- Suggested use for **nighttime enclosures** – small night corrals; stock will head there come evening once they get into a rountine
- Some USA producers are successfully using electric night pens

COST:

- Cost estimate for electrified fladry is $2303 for the first kilometer, and $2032/km per addition (Lance, Breck, Sime, Callahan, & Shivik, 2010).
- This estimate includes all of the materials required to construct the complete fence system.
- To lower costs more fiberglass posts can be used instead of T-Bar posts (N. Lance personal comm.)
- Set-up requires approximately 31.8 person-hours per kilometer to install (Lance et al. 2010).

Figure 24 Setting up electrified fladry takes approximately 31.8 person hours per kilometer. Photo courtesy of Nathan Lance

Livestock Guardian Animals

This is one of the oldest methods used to protect livestock. It has been used in Eurasia for centuries and in some places documented to be used for thousands of years.

Livestock Guarding Dogs

Livestock Guardian Dogs (LGDs) must socialize with livestock and bond from a young age (6-8 week pups put in with stock, older than 8-10 weeks passed primary socialization stage The dogs must bond with livestock and not people.

These breeds of dogs are all working dogs. They should be treated with respect and watched cautiously with children and strangers. Training should all be done at a young age with a loving, determined, consistent, and encouraging approach from a dominant leader. They should not be family pets as they may prefer the family over the livestock. These dogs do not herd, only guard livestock. The following breeds are well-known guard dogs though they slightly differ in temperament which is an important factor in considering the best suited dog for your situation. Komondors have been known to bite more people than Pyrenees, Akbash, or Anatolians and Pyrenees have injured less livestock then Komondors, Akbash, or Anatolians (Green & Woodruff, 1988).

Figure 25 Newborn lamb with livestock guardian dog standing watch. Photo courtesy of Grazerie Farms.

Akbash

This is a primitive guard dog breed that is naturally aggressive, intelligent, courageous, and loyal. The Akbash is independent with strong protective instincts; a natural guardian that will strongly bond to livestock at a young age. Their behaviour is a combination of submissive posturing to livestock and dominance aggression to stand up against bears and wolves. This is a serious working breed and is best placed where it can have a job to do. It is devoted to its owner and any livestock in its charge. There is no difference in guarding ability between the male and female. Some of the animals the Akbash Dog has guarded include horses, cattle, sheep, goats, poultry and exotic birds, deer, alpacas and llamas. They will risk their own lives to protect livestock without hesitation. Recommended only for owners who want a serious guard dog.

Alentejo Shepherd Dog

This dog is self-confident, independent, very watchful, calm, brave, but not aggressive and can be stubborn and dominant. It is tough to strangers but docile with children. Important to socialize these dogs when they are young and the best training is motivational with a consistent and loving approach. This dog is known more for defence than attack with its low, deep tone of barking, which can be heard a long way off.

Anatolian Shepherd

A dog that is loyal, alert, possessive, calm, independent and brave though not aggressive. Possessive of its home and property and will not allow trespassers though is affectionate with its own family and patient and protective of its family's children. It is intelligent and easily trained. This dog does not need any additional protection training because of its very protective instincts. Often will find view point to watch over the livestock and they patrol their territory perimeter and check their protection zones. Will signal sheep to hide behind

him for protection and will only attack as a last resort. They are very protective at night and tend to bark.

Komondor

This dog is confident, alert, serious, and commanding. It is extremely territorial and protective over its family, property, and livestock. In minutes this dog can get the better of its strongest enemy and is ruthless against wolves and bears that attempt depredation.

Because of its fierce and aggressive nature it can even pose threat to other strange dogs and sometimes with people which requires early socialization at a young age. Due to their highly fierce nature are not recommended for most families but in the right situation would make a powerful livestock guarding dog.

Figure 26 Signs warning public about the use of Livestock Guardian Dogs should be used in some cases. Photo courtesy of Wolves of the Rockies.

Maremma

A stable and balanced livestock guardian. It is loyal, brave, alert, noble, and affectionate though not dependent. Without constant barking it makes an excellent guard-dog. Maremma's are social with other animals and more so than other guard breeds with strangers. Has excellent working abilities and is used effectively against wolves. This dog is also successful as a companion.

Great Pyrenees

This breed is courageous, very loyal and obedient. It is somewhat wary of strangers although devoted, gentle and affectionate to its family. A serious worker, but very independent and has potential to try and dominate a less secure owner. They may be difficult to train. Males can be aggressive towards other dogs but is good with non-canine animals. Some may be wonderers and they tend to bark a lot.

Process of Training Livestock Guarding Dogs

The goal of training for a livestock guardian dog is for it to learn that its place is with its flock. Instinct will basically do the rest. Most of the information available about livestock dogs pertains to sheep. Pups are integrated into the flock usually between 2-3 months. They can be kept in kennels or stalls next to the sheep when left unattended for the first while. Under supervision when the dog is loose amongst its flock, reinforcing the dog to stay with the flock and correcting any negative play behaviour is all of the training needed. This bonding time and the intensity of the bond will be dependent upon the situation. For a full time guard dog a tight bond needing early socialization will be

Figure 27 Young Livestock Guardian Dog bonding with its charges. Photo courtesy of Grazerie Farms.

wanted. Limited contact with people is also important to keep the dog bonded to the sheep so the dogs are not inclined to bond with humans. These dogs must be treated like a working dog not a pet. Once the dog is trusted with its flock it can be left alone unsupervised to do its job. This is usually by 6-8 months once the dog reaches maturity.

Livestock numbers - A guard dog can protect anywhere from 20-200 sheep in a flock,(i.e. use 3 – 5 dogs per herd as recommended by the Wood River Wolf Project, USA 2013).

The size of a pasture, number of paddocks, and the distances apart and how dispersed the animals are should be taken into account. Most dogs are used for small pasture rather than large range operations although producers grazing open ranges have also recommended dogs.

BENEFITS

- Reduced predation
- Reduced labour (in cases of needing to confine livestock at night)
- Pastures can be further utilized (livestock will roam further with protection)
- Larger area available for use leading to larger flock size
- Dog is alarm bell for disturbances on property
- Protection of family members and farm property
- Increased independence in predator management

COSTS

- A guard dog can cost anywhere from $250 to $1500
- Average cost of food and annual veterinary expenses is between $250 and $350
- May be more expenses in the first year with shipping, travel, and any damages caused by the puppy
- Biggest investment in the first year is the time needed in supervision of the dog with its flock in the first few months

Other potential concerns

- Dogs are not a guaranteed investment
- If not monitored for behavioural problems dogs may turn on the sheep; usually starts as a play behaviour
- Dog may be excessively aggressive towards other people
- Dog may harass other animals
- Too much of a time investment in first year training and supervision
- Cost of veterinary in cases of injury or illness
- May cause initial stress to livestock
- Timing: do not use LGD's in Spring. Dogs can be an attractant to wolves at this time of year, as wolves may defensively attack them if pups or a den-site are nearby (Wood River Wolf Project workshop 2013).

Figure 28 Livestock guardian dogs have been used for centuries to deter wolves in countries around the world, such as this one in the Swiss Alps. Photo courtesy of Peter Dettling

Factors affecting success

1. Number of dogs per head
2. Dog Training
3. Proximity of bedding ground to forest
4. Presence/Absence of shepherds

Figure 29. The number of livestock guardian dogs used for guarding is an important factor for its success. Photo Courtesy of Grazerie Farms.

Figure 30 Livestock guardian dog has bonded with both cattle and sheep and will remain in the pasture with its herd. Photo Courtesy of Grazier Farms.

Other Guardian Animals Used

Donkeys and llamas

Donkeys and llamas have a natural hate of canines. However, they can be susceptible to cougar attacks. They have shown to be effective in guarding livestock in some situations. It depends upon the predator species and temperament of the individual donkey or llama. There is not much work done on effectiveness against wolves. They should be placed in stalls beside their flock at first; especially during lambing so the lambs are not stepped on. With donkeys stallions are the most aggressive and may not be suitable as they could become aggressive towards the ewes/cows. Mares and geldings are recommended. Only a couple of donkeys/llamas should be used because they may herd by themselves ignoring the flock. One per flock recommended. Mostly used with small flocks of sheep.

BENEFITS

- No training is required.
- Around one week for integration; 4-6 weeks for bonding.
- Can be introduced to a herd or flock at any age (the younger the better).

COSTS

- Hay or pasture needed for feed.
- Some terrain that is suitable for sheep may be difficult for donkeys to navigate.
- Donkeys are noisy and will bray loudly which may pose noise problems with neighbours.
- May also fall prey themselves to certain predators.

Seasonal Attractants; Calving, Branding and Other "Attractive" Times

Calves and other newly born livestock are more susceptible to depredation. Afterbirth can be a strong attractant during the calving or lambing season further increasing risk. Livestock producers can plan timing, location, and ensure a human presence during birthing. During the calving/lambing season livestock herds are often more dense being kept in close proximity during these times, so when wolf depredations do occur more livestock may be killed at one time.

Figure 31 A cow calf pair bonds together in a pasture near Nicholson, BC. A calf will likely face a lower risk of depredation if a cow is around to help protect it.

Many ranchers will calve heifer groups separately from the main herd. These animals are inexperienced as yearlings and more likely to abandon calves, which are likely vulnerable to wolves. Keep cows and heifers together.

Some ranchers have reported success by keeping some bulls as part of the calving herd or introducing other animals with aggressive tendencies such as donkeys (see livestock guardians section). and other

METHODS: Seasonal Timing of Calving

Delay the release of newborns onto spring pastures until you can ensure surveillance is provided.

Schedule and manage for a condensed calving season so that human surveillance is easier to accomplish.

Monitor livestock more closely at this time to recognize livestock in vulnerable situations. Increasing human presence will also deter predators.

Remove any biological waste immediately.

Age and Type of Livestock

Some ranchers believe that yearlings are at a higher risk for depredations. , and There may indeed be behavioural characteristics of yearlings that make them less experienced and more vulnerable to wolves and other predators. Therefore, combining generations may possibly improve herd dynamic defences.

Herd Dynamic

aggressive animals to mingle (defend, teach, and toughen up).

Some domestic livestock breeds are more aggressive towards predators and have stronger maternal tendencies which leads a more defensive behaviour , leading to a more defensive response.

- Some ranchers will include a few longhorn steers, especially with yearlings. Aggressive breeds include Corrientes and Brahman.

Herefords have favourable characteristics and could be introduced into a herd to get a blend of aggression to predators, mothering skills, heartiness, beef value and reproductive success.

Mixing It Up

Some promising research shows that bonding sheep to cattle may decrease sheep predation (Breitenmoser, Angst, Landry, Breitenmoser-Wursten, Linnell, & Weber, 2005). This practice is most relevant for open range situations. It can also minimize stress during the weaning of sheep, and can help to control the spatial distribution of sheep without fencing.

Figure 32. A mixed age of cattle kept together may decrease risk of depredation. Photo courtesy of Malcolm Parr.

Seasonal Patterns

Figure 33 Seasonal changes in Canada are a natural part of cycles.

Understanding seasonal patterns can help improve planning and management, and potentially alleviate conflicts. By monitoring these patterns livestock producers will be more **prepared to predict risks and plan for increased prevention and investment of resources if required.**

Seasonal patterns reflect livestock calving and grazing practices, as well as seasonal variation in wolf pack energy requirements (Musiani, Muhly, Gates, & Callaghan, 2005). Most wolf-livestock conflict will occur at certain times of the year. For example, occurrences often increase around February to March during wolf breeding season. Some evidence suggests an increase in depredations between April-May when wolf pups are born and energy requirements increase (MacKay, 2005). July-August is another time when wolf-livestock interactions may increase, when pup growth results in more energy demand for the pack, and pups are learning to hunt (MacKay 2005). Biologist Dr. Marco Musiani identified a 3 season pattern in Canada (Alberta), as shown in the table below.

Table 3 Seasonal patterns of depredation seen in AB, Canada (Musiani et al. 2004).

Dates	Depredation Rates	Grazing Schedule	Calving
May - September	high *(Aug/Sept highest)	May-Oct	Yes
October - January	medium		No
February – April	Lowest	Feb – April	Some

Table 3 helps to show that seasonal patterns exist. Unless these patterns are taken into account, re-occurrences of depredation is likely to continue to occur regardless of wolf culling.

Being able to predict seasonal occurrences helps to plan prevention efficiently and effectively

- Wolf pups are born in **April-May** which increases wolf energy requirements.
- Depredations peak in **May** in Minnesota which corresponds with newborn calves (Harper et al 2008).
- During **late summer** wolves also have high energy requirements due to nurturing larger pups and packs before their numbers are reduced by fall and winter mortality. Pups are also learning to hunt at this time.
- In AB during **late winter-early spring** cold temperatures and deep snow often lead to supplementary feeding of livestock and this is also when most calving occurs. Snow accumulation in winter can add a disadvantage to healthy stock, which is picked up on by predators.

Figure 34 Keeping track of changes on your calendar can help to identify seasonal patterns.

Keep track of your own landscape and seasonal patterns. You may be surprised how much you learn.

Property Risk Assessment

It is possible to identify and determine high risk areas on a property and where prevention measures could be focused on (Muhly, Gates, Callaghan, & Musiani, 2010). Knowing and understanding the surrounding terrain also helps to recognize patterns of predation. For example, wolves and cougars often hunt from forested edges.

The relative importance of each factor in order to predicting depredation from highest to lowest:

1. Wild ungulate density
2. Slope
3. Distance to cover
   * Note that in the study done in Alberta (Muhly et al. 2010), ranches that practiced wolf culling and/or had yearling cattle herds also had had higher rates of depredations.

See Appendix II to assess your own property risk.

Figure 35. On large properties there may be some areas that pose more of a risk than others being influenced by factors such as distance to a forest edge or slope. Photo courtesy of Malcolm Parr.

Livestock Types

Sheep

Wolves kill more sheep than cattle when both are available.

- Depredation rates on sheep were 5-10 times higher than on cattle in AB, BC, Minnesota in 1992 (Fritts, 2003).
- Wolves seem to select adult sheep and goats (vs. calves for cattle)
- Very vulnerable to wolves, inadequate response to predation

Cattle

Wolves focus on calves mostly.

- In western Canada most calves are killed during mid-late summer (Fritts, 2003).
- Calves constituted 67 – 85% of all cattle killed by wolves in AB, BC, Minnesota & US Northern Rockies (Fritts, 2003).
- In AB wolves killed 3 times more cattle in heavily forested, less managed grazing leases than on pastures where most trees had been removed and cattle managed intensively (Fritts, 2003).

Relocation of Livestock

- **Diversionary feeding:** Defenders of Wildlife (USA) reimbursed ranchers in the Northern Rockies for hay to lure cattle away from wolf den (limited as wolves habituate)
- Funding for alternative pastures may be included in government stewardship or environmental incentive programs
- Design **livestock watering system** that draws cattle away from denning pack and forest
- Relocation of livestock is usually a last resort, can be temporary or permanent

Other Options

- **Volunteer program**: volunteers (wolf conservationists and cattlemen) serve as "wolf guardians" to help track wolf pack movements, install fladry and fencing, watch over livestock
- **Cooperatively work and plan** as a team with other livestock producers to share costs and efforts (a written agreement of expectations of roles and responsibilities recommended)
- **Cracker shells and other noise makers** are limited as wolves habituate to them, but initialy may be useful at discouraging wolves from remaining in an area.
- **Bean-bag shells and rubber bullets**, paintballs (learn how to use properly or serious injuries can occur)
- **Predator lights** or motion activated noise makers are also available and can be successful for a short amount of time.
- **Rag boxes** are activated by radio-collared wolves that come close; the box emits sounds and lights.
  - Can be very effective, mostly as temporary deterrent
  - Most effective for small pastures (60 acres or less), especially when lambing or calving
  - Works to deter wolves and alert range rider/herder
  - Limited use to radio-collared wolves
  - Powered by 12-volt car battery (recharge few weeks) or solar panel

Removal of Problem Wolves

The risk of depredation is influenced by many factors such as landscape and husbandry practices. Lethal control is a common reaction to a depredation event. However, removing the target individual is difficult and it is unlikely that targeted individuals will be selectively removed even by experts.

Treves (Treves, 2009) states that "even if the culprits are targeted selectively, property damage may increase if hunting disrupts carnivore social organization and promotes new individuals or new denser populations of different species of carnivores that, in turn, may have greater impacts on property".

Minnesota research indicated that the total number of wolves removed did not appear to affect the re-depredation rate (Harper, William, Mech, & Weisberg, 2008).

Finally, because **wolves are opportunistic hunters they may try to kill livestock whenever the chance presents itself** (eg. separated young animal, sick or injured animal, deep snow, etc). For this reason, **prevention is key even after a "problem wolf" has been removed from the landscape.**

Figure 36 Cattle grazing in BC's Columbia Shuswap.

Culling Wolves to Manage for Depredation

Killing wolves to help decrease livestock depredation rates is corrective, not preventative, (Musiani, Muhly, Gates, & Callaghan, 2005). In other words, people kill wolves as a reaction to depredation, but wolves do not kill less livestock in areas or times when they are hunted down.

Figure 37 Grey wolf (Canis lupus) in forest.

No evidence exists to show that indiscriminately killing wolves works as a long-term solution; depredations still occur in areas that have been practicing lethal control for decades.

In fact, in certain parts of North America, killing wolves indiscriminately through trapping may have lead to increased depredation rates on livestock the next year (Harper et al. 2008).

Neighbouring packs or dispersing wolves will recolonize the area that wolves were removed from. Killing an individual wolf may help reduce severe cases where the individual or pack offend repeatedly, as this may help rid genetic or behavioural traits conducive to depredation (Musiani et al 2005). However, this will not reduce the rate of occurrence if husbandry and environmental conditions are not changed.

There was no evidence found during 20 years of research to indicate that removal of wolves by trapping decreased the rate of depredation the next year at state or local levels in Minnesota for cattle and sheep (Harper et al 2008).

- Researching the correlations between trapping and depredations in the following years for all periods, areas, and livestock at both the individual scale and at a combined level showed either more depredations the next year or non-significant changes when wolves were killed by trapping (Harper et al 2008).

- Unsuccessful trapping reduced the rate of recurrence more than successful trapping or no trapping, indicating that human presence may have been the best deterrent with the possible exception of removing the breeding adult male (Harper et al 2008).

- Harper et al. (2008) showed that **"as more wolves were killed one year, the depredations increased the following year".**
  - There may be more wolves present in these areas or possibly wolves avoiding traps had learned to prey on livestock, and become more dependent as their pack mates were removed (killed off).
  - This study suggests that daily visits simulating trapping activities (human presence, foreign scents and objects) **may be more cost-effective** than trapping and killing wolves, especially where ranches are far from control personnel

Coyote bounties in the past have led to rodent problems. Reducing wolves or exploiting a population can lead to an increase in coyotes and ungulates, a decrease in beavers, and cascade effects from disrupting the ecological role of an apex predator and keystone species – (eg. Yellowstone National Park, Banff National Park).

Perspectives

Currently, there is no known place in North America where livestock is the majority of wolf prey (Musiani, Boitani, & Paquet, 2009). This is not always the case in other countries where wolf populations have been all but decimated, such as Europe and Asia. In many of these places, wolves now rely on livestock, small animals and/or garbage as predator prey systems have been lost.

Not all wolves predate on livestock.

In 2005, research done in Idaho, Montana, and Wyoming **indicated that LESS THAN 3% of all livestock mortality was due to wolves, grizzly bears, and black bears combined** (Muhly and Musiani 2009). Total livestock losses due to non-predators was at least 89%, with respiratory and digestive problems contributing the most (between 8 – 32%), (Muhly and Musiani 2009).

This study points out that total cattle losses due to wolf depredation in Idaho, Montana, and Wyoming are minor when compared to other causes of death (Muhly & Musiani, 2009).

Where wolves and livestock overlap there will be occasional losses. However, throughout the lifespan of a domestic animal; weather, genetics, feeding, birthing and transportation all pose much greater risks to survival, as indicated in the image to the right.

Issues of safety when wolves and other wild predators are nearby are unwarranted. The real **dangers** are poison on a landscape, more guns and traps. A larger issue at hand is tolerance.

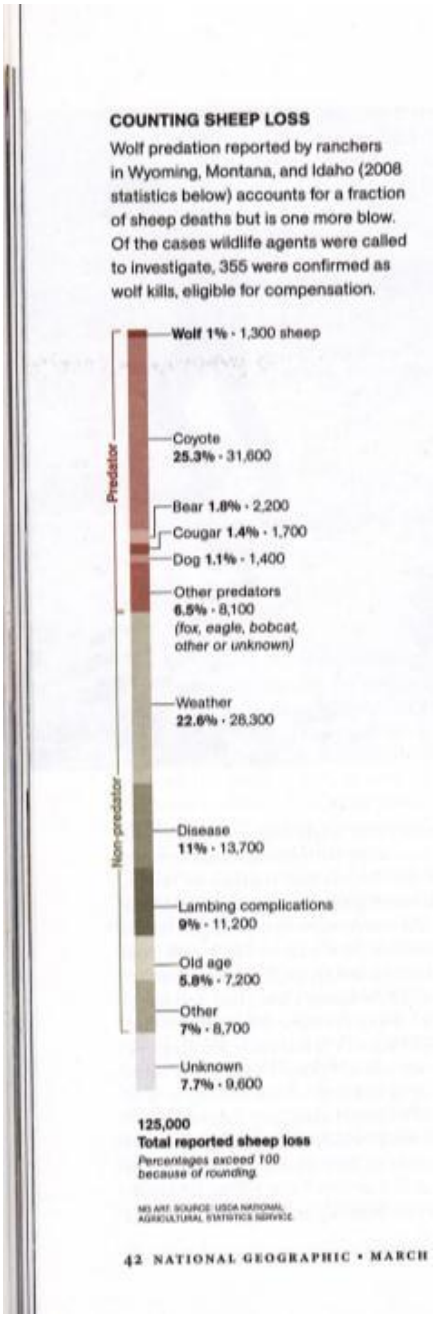

Figure 38 Bar graph showing causes of sheep losses taken from National Geographic, March 2010 issue.

Appendix I- Suppliers and Resources:

Electric Fence Suppliers:

Margo Supplies Ltd. – High River, Alberta
Website:www.margosupplies.com
Email: info@margosupplies.com
Phone: 403-652-1932

Kane Veterinary Supplies – Edmonton, Alberta
Website: www.kanevet.com
Toll-free: 1-800-252-7547

R & S Powerfence – Penticton, BC
Website: www.powerfence.ca
Email: rprs@vip.net

Score Construction Ltd. – Revelstoke, BC
Website: www.scorefencing.com
Email: score@telus.net

Gallagher Animal Management Systems Inc. – Owen Sound, Ontario
Website: www.gallagher.ca
Email: info@gallagher.ca

Fladry General Contract Sewers:

Jonco Industries, USA
Website: joncoind.com/sew.html
Email: info@joncoind.com
Phone: 414-449-2000
Address: 2501 West Hampton Ave. Milwaukee, Wisconsin USA 53209

Livestock Guardian Dog Breeders:

Louise Liebenberg and Erik Verstappen
Grazerie Farms – High Prairie, Alberta
Website: www.grazerie.com
Email: info@grazerie.com

Reports on different breeds of livestock guarding dogs:
Working Dog Web:
Website: www.workingdogweb.com/wdbreeds.htm

A lot of information on guarding dogs with links to other web-pages

Backyard Deterrents:
Margo Supplies Ltd. – High River, Alberta
Website: www.margosupplies.com
Email: info@margosupplies.com
Phone: 403-652-1932

Kodiak Security Products –
Website: www.kodiakcanada.com

Useful Website Resources:

Defenders' of Wildlife is a USA-based group that has come up with an organized and comprehensive program to reduce livestock losses to wolves by working with various sectors. Defenders' has published a guide to non-lethal tools and methods to reduce conflicts through addressing root causes: www.defenders.org/resources/publications/programs_and_policy/wildlife_conservation/solutions/livestock_and_wolves.pdf

Also www.Defenders.org

More information and links available at www.defenders.org/programs_and_policy/wildlife_conservation/solutions/coexisting_with_carnivores/on_your_ranch/index.php

Defenders has also helped reduce tension between **Canadian** ranchers and wolves.
http://www.defenders.org/programs_and_policy/wildlife_conservation/imperiled_species/wolves/wolf_recovery_efforts/canada_wolves/in_the_field.php

Others:

An international accredited organization
www.predatorfriendly.com

A Large Carnivore Initiative for Europe:
http://www.lcie.org/

Carnivore Damage Prevention News
http://www.kora.unibe.ch/en/proj/cdpnews/

Flock & Family Guardian Network
www.flockguard.org

Government Contacts:

Alberta
Ministry in charge: Alberta Environmental Sustainable Resource Development
Email: ESRD.Info-Centre@gov.ab.ca
Phone: 1-877-944-0313 or toll-free Alberta 310-ESRD (3773)
http://www3.gov.ab.ca/srd/fw/wolves/prob.html

British Columbia
Ministry in charge: BC Ministry of Forests, Lands and Natural Resource Operations
Email: FLNR.minister@gov.bc.ca
Phone: 1-800-663-7867, BC 250-387-6240
http://www.env.gov.bc.ca/cos/info/wildlife_human_interaction/index.html

BC Environmental Farm Plan Program in conjunction with BC Agricultural Research & Development Corportaion (ARDCorp)
Phone: 604-854-4483
Email: efpinfo@ardcorp.ca
www.bcefp.ca

BC Ecological Goods and Services Initiative
Email: dzehnder@telus.net
www.bcesi.ca

Ontario
Visit
http://www.ontariosheep.org/PREDATOR.html for perspectives, prevention and compensation programs in Ontario. Note that coyotes, wolves, and dogs are all grouped into one category for losses, and there are no stats indicating changes in livestock numbers or values over the years.

Also see:
http://www.omafra.gov.on.ca/english/livestock/sheep/predator.html

Appendix II - Risk Assessment:

Assess your risk by circling the category that best describes your situation and then tallying results.

Risk			Low	Med	High	Score
Ranch Characteristics		Pasture Size	Small	Medium	Large	
		Distance to Human Dwellings	Small	Medium	Large	
		Vegetation	Open	Partly Forested	> 50% Forested	
		Terrain	Flat	Rolling Hills	Rugged	
Livestock	Sheep/Goats	Sheep		Rams	Ewes and Lambs	
		Number of Sheep	Small	Medium	High	
		Season			Lambing Season	
	Bovine	Bovine	Bulls	Cow/Calf Pairs	Yearlings	
		Number of Bovine	Small	Medium	High	
		Season	Feb - April	Oct - Jan	May - Sept (calving & grazing)	
Natural Prey					Abundant or Reduced Quickly	
Wolf Pack Characteristics		Season	No pups		Late Summer with Pups	
Total Score						

Appendix III -
Livestock Producers Best Management Practices Checklist

Adopted from "Wild Predator Loss Prevention Best Management Practices for Cattle" as prepared for the BC Cattleman's Association

General Husbandry Practices

- Pasture and areas surrounding fence are clear of vegetation where predators can hide
- Old farm equipment and other items are stored in a defined location away from where cattle are kept
- Breeding seasons are defined
- Afterbirth from calving is removed
- Calves are given enough time to heal from branding and castration before being put to pasture/rangeland
- Dead livestock are removed quickly
- Dead livestock are buried deep enough so that the carcass is covered by at least 1 metre of soil
- Record keeping is done frequently and is up to date
- Herd is inspected regularly
- Watering locations are safe
- Herd is grouped

Predator Deterrents/Scare Devices

- Bells
- Radios
- Lights

Guardian Animals

- Livestock Guardian Dogs
- Longhorn Steers

Predator Resistant Fencing

- Permanent
- Portable
- Electric: ample voltage
- Taught wires
- Fladry: maintained

Appendix IV -
Summary of Some Provincial Regulations

British Columbia

- Government Provincial Compensation programs are in effect where producers are compensated 70% of current market value.
- BC also has an Ecological Goods and Services Initiative program which helps finance producers to maintain ecologically healthy landscapes. www.bcesi.ca

Alberta

- Government Provincial Compensation programs for losses of cattle, sheep, hogs, goats, bison
- Compensated 100%
- Some parts of Alberta are practicing carcass removal programs where livestock depredations have been occurring due to grizzly bears, a threatened species listed federally through SARA (Species at Risk Act).

Ontario

Although Ontario is an eastern province, earlier development has forced similar issues that needed addressing sooner.

Ontario has 3 wildlife Damage Programs administered by the Farm Finance Branch of the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA**)**

- Compensation programs are administered by the Livestock, Poultry and Honeybee Protection Act
  - compensates losses of livestock including cattle, fur-bearing animals, goats, horses, rabbits, sheep, swine, poultry over 25kg attributable to attacks by wolves, coyotes, dogs

    maximum amounts:
  - $200 per sheep/goat/swine
  - $1,000 per head of cattle
  - $500 per horse
  - $1,000 per year for poultry of one owner
  - $20 per rabbit, maximum of $1,000 per year
  - $100 per fur bearing animal
  - $35 for bees, $75 for hive equipment

Appendix VI - Social Factors

Various sectors and individuals must work to recognize wolves as an important part of an ecosystem, not something to be liked or disliked. This is essential in order for people to improve their tolerance of wolves.

Note that a deep-rooted social identity often influences tolerances more than actual encounters with wolves and other predators. Many people also view large carnivores as a threat to private property rights and a symbol of government interference. Perceived risk can be as important as actual experience in shaping attitudes….therefore education is critical for creating a foundation for coexistence. Misperceptions about wolves are not uncommon.

The USA is currently striving to be proactive towards fostering coexistence among livestock producers and wild predators such as wolves by forming partnerships between Defenders of Wildlife, the US Fish and Wildlife Service, the National Wildlife Research Centre, Native American tribes, community conservation groups, and the Livestock Producers Advisory Group.

Figure 39 Social identity often influences tolerance of wolves more than actual encounters. Listening to others and sharing knowledge and forming cooperative partnerships will help reach common goals to reduce unnecessary domestic and wildlife deaths.

Appendix VII- Cost Comparison for Wolf Bounty in Big Lakes 2010 – 2012 with Prevention

The following cost comparisons have been made using information gathered by John A Shivik of the US Department of Agriculture in his journal article in BioScience, March 2006 ("Tools for the Edge: What's New for Conserving Carnivores?"), and through personal communication with wolf biologists, ranchers, and individuals providing electric fence workshops

Cost Comparisons at $87,000 spent in 3 years on Wolf Bounty

Figure 40 Preventative husbandry practices can save you money and livestock losses in the long

Livestock Guardian Dogs: Cost estimate $300 - $1000 initial cost, then $500 per year. Could purchase 108 guardian dogs (at $800 each). Duration of effectiveness is approximately the lifespan of guard animal, typically years.

Carcass Removal Programs: Cost estimate 9¢/lb for ruminants where programs occur, with a minimum $75 charge. If the average calf weighs 525 pounds at weaning 1160 calves could have been removed (at $75). If the average cow weighs 1800 lbs, then 537 cows could have been removed. In some parts of North America Fish and Wildlife will donate the truck and fuel costs.

Fladry: Cost estimate $781/km. Could purchase 111.4 km. Duration 60 days

***Electric Fencing*:** Cost estimate -$250 for Super Energizer IV voltmeter- 50 mile range (if off grid $450)
- Grounding plates $17 or rods (rebar)
-rebar posts every 10-12 feet ($600 to $700 per ton)
-stucco wire roll 100 feet $80, or ¼ mile tensile steel $25

Could purchase -348 voltmeters or 5118 grounding plates or 134 tons of rebar posts or 108,750 feet of stucco wire or 870 miles of tensile steel.

Duration of effectiveness would be unlimited as long as fence was properly constructed and maintained.

***Turbofladry*:** Cost estimate $2303 1st km, then $2032/km. Could purchase 40 km. Duration of effectiveness is unlimited as long as fence was properly constructed and maintained.

Range Riders: Cost estimate $110/day for 2 months/year is $6,600. In some parts of the US tourists are **paying for** the opportunity to do this. Could provide range riders for 13 ranches. Duration of effectiveness is ongoing.

NOTE: As of August 2013, a total of 378 wolves have been killed and turned in to the regional district of Big Lakes, costing local taxpayers a total of $113,400.

Works Cited

_. (2003). *Wolves; Bahaviour, Ecology, and Conservation. .* (L. D. Mech, & L. Boitani, Eds.) Chicago, USA: University of Chicago Press.

Breitenmoser, U., Angst, C., Landry, J. M., Breitenmoser-Wursten, C., Linnell, D. C., & Weber, J. M. (2005). Non-lethal techniques for reducing depredation. In R. Woodroffe, S. Thirgood, & A. Rabinowitz (Eds.), *People and Wildlife, Conflict or Coexistence?* The Zoological Society of London: Cambridge University Press.

Dorrance, M. J., & Bourne, J. (1980). An evaluation of anti-coyote electric fencing. *Journal of Range Management* (33), 385-387.

Fritts, S. H.-3. (2003). *Wolves: Behavior, Ecology, and Conservation.* University of Chicago Press.

Green, J. S., & Woodruff, R. A. (1988). Breed Comparisons and characteristics of use of livestock guarding dogs. *Journal of Range Management* , 249-251.

Harper, E., William, P. J., Mech, L. D., & Weisberg, S. (2008). Effectiveness of Lethal, Directed Wolf-Depredation Control in Minnesota. . *The Journal of Wildlife Management , 72* (3), 778-783.

Lance, N. J., Breck, S. W., Sime, C., Callahan, P., & Shivik, J. A. (2010). Biological, technical, and social aspects of applying electrified fladry for livestock protection from wolves (Canis lupus). *Wildlife Research , 37*, 708-714.

MacKay, A. (2005). *Mitigating Cattle Losses Caused by Wild Predators in British Columbia, A Field Guide for Ranchers. .* Agriculture and Agri-Food Canada, [British Columbia Cattleman's Association], British Columbia Ministry of Agriculture & Lands.

Muhly, T., & Musiani, M. (2009). Livestock depredation by wolves and the ranching economy in the Northwestern US. *Ecological Economics* .

Muhly, T., Gates, C. C., Callaghan, C., & Musiani, M. (2010). In Musiani, Boitani, & Paquet (Eds.), *The World of Wolves: new perspectives on ecology, behaviour and management.* (pp. 242-273). Calgary: University of Calgary Press.

Musiani, M., Boitani, L., & Paquet, P. (Eds.). (2009). *A New Era for Wolves and People. Wolf Recovery, Human Attitudes, and Policy.* Calgary: University of Calgary Press.

Musiani, M., Mamo, C., Boitani, L., Callghan, C., Cormack, G., Mattei, L., et al. (2003). Wolf Depredation Trends and the Use of Fladry Barriers to Protect Livestock in Western North Americ. *Conservation Biology* , 1538-1547.

Musiani, M., Muhly, T., Callaghan, C., & Gates, C. (2004). Recovery, conservation, conflicts and legal status of wolves in western North America. in N. Fascione. In A. Delach, & M. Smith (Eds.), *Predators and People: From Conflict to Conservation* (pp. 51-75). Washington, D.C., USA: Island Press.

Musiani, M., Muhly, T., Gates, C. C., & Callaghan, C. (2005). Seasonality and reoccurrence of depredation and wolf control in western North America. *Wildlife Society Bulletin , 33* (3), 876-887.

Shivik, J. A. (2006). "Tools for the Edge: What's New for Conserving Carnivores?". *BioScience* .

Treves, A. (2009). Hunting for large carnivore conservation. *Journal of Applied Ecology , 46*, 1350-1356.

Wallach A.D., E. R. (2009). More than Mere Numbers: The Impact of Lethal Control on the Social Stability of a Top-Order Predator. *PloS ONE* , 4 (9): 1-7.

Let's think and talk about "How can we?"