



# Predation Management

with a Focus on Coyotes



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# 1. Introduction

Lamb producers in Alberta lose sheep to a number of predators, with coyotes responsible for the majority of predation losses. Losses occur to other predators including bears, cougars, wolves, eagles, ravens and magpies, although at considerably lower levels than to coyotes. Predation losses spread over an entire industry may be low, however for individual farmers predation of livestock can be a significant loss.

In most areas of Canada, managing predation must become an integral component of sheep management systems, similar to parasite management and flock nutrition, to ensure optimum production from the ewe flock. Predator species native to Canada have been re-establishing historic territories, and have increasingly become an accepted “part of the natural landscape.” There is increasing social pressure to learn to live with, rather than attempt to eliminate, wildlife including predator species. The general public may accept your need to remove a small number of problem predators to protect your sheep. They will not accept indiscriminate killing of predators because one **may** kill your sheep.

No one tool or single preventative measure will be equally effective in all flocks, or for all predators. No program will prevent predation 100 percent of the time. The goal of your predation management plan should be to keep predation at an acceptable level. Most producers will need to rely on a number of different deterrents to keep predation to a minimum.

The intent of this manual is to provide practical predation management options, along with pertinent background information on the primary predator species sheep producers in Alberta encounter. Although sheep are lost to a number of different predators, coyotes remain the number one predator of sheep and lambs in Canada and will be the primary focus of this manual.

## 2. Predation Management Planning

With other aspects of your lamb enterprise, you have been told “you need a Plan.” The same applies to dealing with predation. Because predator species are inhabitants of the same ecosystem in which we farm, it is inevitable that eventually we will have predation. Incorporating a predation management plan into your overall flock management helps to keep predation losses to a minimum.

Having a predation management plan is important in demonstrating that you are taking all practical steps possible to prevent predation. In the event of a predation incident, prompt corrective action on your part will help to prevent more from occurring.

Incorporate into your plan your production system, features of your local ecosystem, the predators your sheep are most likely to encounter, and the most effective preventative measures to deter them. “The Plan” should include what steps you will take if and when predation does occur as well as removal options for those individual problem predators that cannot be deterred with preventative measures.

### Know Your Flock

Frequent observation of your flock so you know how they behave enables you to recognize when they are being harassed. When predators are bothering the flock, the sheep will act more nervous, be more easily startled, not settle to graze, and be more vocal. If pups are involved in the attacks, clumps of wool pulled from the sheep may be evident in the pastures. Pups do not have the experience or strength to kill efficiently, so attacks are often to the ribs, flank and hind quarters.

### How Susceptible Are Your Sheep to Predation?

#### 1. What Predators Are Sharing the Same Land Base with You?

Learn to recognize the predators sharing your land base by the signs they leave, including tracks, scat, and hair caught on fence wire when they go through it.

Become familiar with their typical run-ways, scent-posts, and frequency of visits through your farm.

Each year, try to determine if they are raising young, as this increases their feed requirements, and the risk of them preying on your sheep. If an adult pair are in residence, chances are high that they will have a litter of pups. Check likely den sites for activity (tracks, bones, hair and scat).

Become familiar with the behaviour and killing style of different predators. Each predator species has characteristic killing behaviour. However, not every coyote, wolf, bear or cougar will kill in the same way, nor feed off the carcass in the same way. They are opportunistic in their hunt to survive.

Try to determine if your grazing area is part of a single predator territory or overlaps two or more territories. Coyotes scent-mark and ground scratch the periphery of their territory more frequently than they do inside the territory. If you are seeing lots of scent-marks (and scat) and ground scratches, your farm may be straddling more than one coyote territory.

## 2. What Predators Are Causing You Problems?

Close monitoring of your flock helps you recognize when predators are coming in contact with it. Signs of flock disturbance, such as increased flightiness, sheep that are more easily startled and increased vocalization, all point to possible harassment by predators. Injuries and pulled wool indicate that hunting attempts are occurring, and suggest pups may be involved.

Recording date and time of day of attack will help to identify your most vulnerable time of year. Recording the location of predation losses helps to identify particular pastures or areas that are more prone to predation.

Recording killing style (bite to throat, back of neck, etc.) not only helps to identify the predator species but can also indicate whether a new predator is on the scene.

Take pictures with date so you have something to work with when you go for help. Most cell phones have a camera with decent photo quality and time stamp.

Get help with correctly identifying the predator if you don't yet have the experience to do so.

## 3. Know Which of Your Sheep Are Most Vulnerable to Predation

Generally the younger the animal, the more vulnerable it is to coyote predation. Newborn and very young lambs are the most vulnerable to coyote predation.

- Coyotes tend to target newborn lambs over older lambs, lambs over ewes and ewes over rams.
- Sheep that are compromised (e.g., sick, lame, heavily pregnant) appear to be more vulnerable to coyote predation.
- Bears and wolves usually do not select for size or age with sheep.
- Eagles generally prey on young lambs, with documented cases of golden eagles killing 50 to 60 pound lambs<sup>1</sup>.

**Tip** – Three excellent resource booklets available from Alberta Agriculture:

*Rancher's Guide to Predator Attacks* is an excellent pictorial guide on typical injuries caused by the main predators in Alberta. Available through your nearest Fish and wildlife office of Alberta Sustainable Resource Development.

*Coyote Predation of Livestock* Agdex 684-19 order at [www.rtw.ca/b681](http://www.rtw.ca/b681)

*Methods of Investigating Predation of Livestock* Agdex684-14 order at [www.rtw.ca/b680](http://www.rtw.ca/b680)



- Ravens will target newborn lambs, and adult sheep that are compromised by, for example, pecking through the abdomen, at the udder and anus of ewes that are cast.

There does not appear to be any relationship between sheep behaviour and any predisposition to coyote predation. Gluesing et al (1980) found no behavioural differences between ewes whose lambs were killed and those whose lambs were not killed. In fact, coyote predation was more related to the chance of an animal being on the perimeter of the flock bedding-ground than to the animal's behavioural characteristics.

**Flocks lambing on pasture in the spring can expect high predation pressure from coyotes** during lambing, primarily because lambing in these flocks coincides with pup-rearing, which is one of the highest feed demand periods of breeding coyote pairs. The daily caloric demand of lactating coyotes is estimated to be 2.5 times greater than non-lactating female coyotes.<sup>2</sup> This should be no surprise, since we know that lactation is the peak nutritional demand period for the ewe compared to other stages of the production cycle.



*Newborn and very young lambs are most vulnerable to coyote predation  
Photo credit: A. O'Brien*

**The availability of lambs within a coyote territory appears to be an overriding factor in a flock's susceptibility to predation.** In a California study, coyotes whose territory included pastures with lambs killed substantially more sheep than coyotes whose territory included pastures with ewes without lambs. As well, following coyote removal, predation resumed sooner in territories that included pastures with lambs compared to those without lambs.<sup>3</sup>

#### **4. Know the Time(s) of Year when Predation Risk Is Highest for Your Flock**

Coyote predation on domestic livestock is generally highest during pup-rearing, which unfortunately coincides with the typical flock grazing season, with pups being born in April or May. They generally do not disperse from the home territory until late autumn or winter. However, within the grazing season, there may be periods when little or no predation occurs. Summary of your annual records will help identify the highest risk periods on your farm.

Generally, coyote predation is low during the winter months. It may be due to the flock being close to buildings and in feeding yards or it may be that coyotes do not yet associate sheep as a winter feed source.

In comparison, wolf predation tends to increase through the summer months and into the fall, while highest risk period for bear predation is often early spring when other food sources are scarce. In years of berry crop failures, bear predation on sheep can increase in late summer as well.

## **Incorporate Preventative Measures that Are Most Appropriate for Your Flock and Property**

Predation prevention measures can be very effective at keeping predation to a minimum. Livestock guarding animals, fencing, changes to flock management, and short-duration deterrents can all be used to discourage and minimize predation. Know that coyotes will be constantly challenging the prevention methods you use. It is always a good idea to have additional options ready for quick implementation if the current deterrents aren't working. Once coyotes discover a weakness in an existing prevention method and make a kill, predation will continue until changes are made. The current prevention method must either be improved or another method must be employed to prevent more killing. For example, predation often stops for a period of time when livestock guardian dogs are first used in a flock for predation control, or when a new predator control fence is erected. A final option is the problem coyote is removed.

## **What's Your Plan when Predation Occurs?**

If predation occurred today, what would you do? What strategy do you have in place to deal with the problem?

Suggested sequence of steps to consider:

- Can you move the flock to a "safe" pasture or enclosure? Is it practical? Or can you implement a short-term deterrent until the problem predator is removed?
- Determine which predator species is the culprit—examine the carcass for tooth punctures; match the kill evidence to typical kill and feeding pattern of typical predators.
- Scout the area and determine where the predator entered the pasture/corral (hair on the fence, digging under fence, trails through forages, tracks in soft dirt/mud)
- Determine why your prevention measures failed (e.g., dogs left flock unattended, sick dog, fence energizer turned off, persistent coyote breaching fully functioning prevention measures)
- Can you reinforce your current prevention measures?
- Does the predator need to be removed?

## Incorporate Selective Removal of Problem Predators

A number of research studies implicate breeding coyote pairs as being responsible for the majority of sheep and lamb predation.<sup>4,5</sup> The use of radio-tracking data and DNA analysis has since confirmed this.<sup>6,7</sup> Selectively removing breeding coyote pairs where predation is taking place effectively stops predation until a new alpha pair becomes established, which usually takes three to four months.<sup>8</sup> When only one of the alpha pair is removed, the average time to replace the mate is two months, which corresponds to the average time to resumption of killing.<sup>9</sup>

As well as being more effective at reducing predation, selective removal of the breeding pair results in fewer coyotes needing to be killed. In a five-year study in California, Blejwas et al. found that removing only those coyotes killing lambs or sheep resulted in approximately two-thirds fewer lambs being killed compared to non-selective removal strategy (attempting to remove as many coyotes as possible in the area), even though 75 percent fewer coyotes (6.2 versus 23.2 coyotes per year) were removed.<sup>10</sup>

Targeting only those coyotes that have killed livestock is also more socially acceptable, especially compared to non-selective population reduction.

**Tip** – when predation is occurring, selective removal of the breeding pair of coyotes results in fewer predation losses and fewer coyotes needing to be removed.

## Know the Programs and Regulations Pertaining to Predators in Your Area

How you deal with wild predators falls under the jurisdiction of the Fish and Wildlife Act, as well as the Agricultural Pests Act for coyotes.

- Management of coyote predation on livestock is regulated, in part, by the *Agricultural Pests Act*, and *The Pest and Nuisance Control Regulations* (184/2001).<sup>11</sup> [http://www.qp.alberta.ca/documents/regs/2001\\_184.pdf](http://www.qp.alberta.ca/documents/regs/2001_184.pdf).
- Coyotes are listed as nuisance animals under the Agricultural Pests Act. That means producers have more options in how they deal with problem coyotes but it also means that dealing with them is the landowner's/producer's responsibility.
- Hunting of wolves, black bears, coyotes and cougars is allowed on privately owned land by the owner or occupant of that land, or a resident who is authorized by the owner or occupant of that land to hunt on the land, or on public land by a person authorized to maintain livestock on that land, or a resident who is authorized in writing by the livestock owner to hunt on the land. <http://www.albertaregulations.ca/huntingregs/genregs.html#predation>.
- Grizzly bears and eagles are protected in Alberta and cannot be killed or harassed.<sup>12</sup>

## Whom to Contact when Predation Happens

- Predation by wolves, grizzly bears, black bears, cougars and eagles is to be reported to the nearest Fish and Wildlife office.
- Predation by coyotes should be reported to the local municipality office where the problem occurred.
- Predation by domestic or feral dogs should be directed to the local RCMP detachment office.

## What Assistance Programs Are Available?

- **Wildlife Predator Compensation Program** provides compensation for losses and damage caused by wolves, grizzly bears, black bears, cougars and eagle, but not coyotes. (see page 57 under Resource section). Full program details available on Alberta Agriculture website <http://esrd.alberta.ca/fish-wildlife/wildlife-damage-control-programs/wildlife-predator-compensation-program.aspx>.
- **Damage Control Licenses.** When certain species of wildlife are damaging private property, you can apply to a Fish and Wildlife Division district office for a damage control license. This license provides legal authority to hunt or trap the nuisance wildlife to attempt to minimize the damage. Contact your district Fish and Wildlife office to determine whether a damage control license is required (see page 60 under Resource section).
- **Coyote Predation Management Program.** The purpose of the Coyote Predation Management Program is to inform and assist landholders in managing coyote predation of their livestock. It is administered through a joint co-operative agreement between Alberta Agriculture and Development (ARD) and participating rural municipalities, with ARD supervising the program provincially and the municipality delivering the program within their jurisdiction (Alberta RSD. 2010). See page 61 under Resources for more details. Additional program details can be found at Alberta Agriculture's website <http://www1.agric.gov.ab.ca/general/progserv.nsf/all/pgmsrv403>.

### **Tip – Fish and Wildlife Area Office Contacts**

#### **Information Centre**

**Toll Free:** 1-877-944-0313

**Fax:** 1-780-427-4407

**Email:** [ESRD.Info-Centre@gov.ab.ca](mailto:ESRD.Info-Centre@gov.ab.ca)

**Web:** <http://esrd.alberta.ca/about-esrd/contact-esrd/fish-and-wildlife-area-office-contacts.aspx>

## References in this Chapter

References, pertaining to the endnotes listed below, can be found on page 65.

1. O’Gara 1978
2. Laundre and Hernandez 2003
3. Blejwas, Sacks, et al. 2002
4. Blejwas, Sacks, et al. 2002
5. Till and Knowlton 1983
6. Blejwas, Sacks, et al. 2002
7. Blejwas, Williams, et al. 2006
8. Jaeger 2004
9. Jaeger 2004
10. Blejwas, Sacks, et al. 2002
11. Alberta RSD. 2010
12. AlbertaESRD 2012

### 3. Primary Predators – Biology and Behaviour

#### Coyotes (*Canis latrans*)



*Coyotes are found in all terrestrial habitats in Alberta.*

*Photo credit: THagedorn, AARD*

According to Alberta Environment and Sustainable Resource Development, coyotes inhabit all parts of the province and are the most numerous member of the wild dog family in Alberta.<sup>1</sup>

#### Some Important Characteristics

- The coyote is highly adaptable, and can be found in all terrestrial habitats in Alberta, including many urban areas.
- In central Alberta, the home range of an adult coyote averages 12 square kilometres (1200 hectares/2965 acres), but can be two or three times larger.<sup>2</sup>
- Adult weight can range from 10 to 23 kilograms (22 to 50 pounds), with male coyotes being heavier than females.
- Coyotes are opportunists. Rodents and other small mammals constitute most of their food supply. Blueberries and other fruits are heavily used in season. During winter they readily scavenge livestock and other animal carcasses.<sup>3</sup>
- Coyotes are territorial, and this territoriality is maintained even in the presence of livestock.<sup>4</sup>
- A given area can have both resident coyotes and transient coyotes.
- Resident groups consist of a breeding pair and non-dispersed offspring. They tend to have small, mutually exclusive home ranges.<sup>5</sup>

**Tip** - a common error made in evaluating predator kills and feeding is the tendency to stereotype by species. Most predators do follow a general pattern, but individuals vary widely in food preferences, method of attack, and feeding behaviour. These behaviours may overlap extensively between different species; consequently, evidence other than the actual carcass is frequently essential to make accurate judgments on suspected kills. (Rollins n.d.)

- Transients, which are young, old or disabled coyotes, have larger and more overlapping home ranges than those of residents.<sup>6</sup>
- Home ranges of resident coyotes overlap only slightly.<sup>7</sup>
- Transient coyotes wander throughout the area, but tend to avoid resident coyotes.<sup>8</sup>
- Coyotes are often monogamous for life.<sup>9</sup>
- In Alberta mating generally occurs in February or March.<sup>10</sup>
- Gestation period is 63 days (same as domestic dog).
- Pups are born in April or May with an average litter size of five to seven.<sup>11</sup>
- For a den, the female often enlarges a rodent, rabbit or badger hole.<sup>12</sup>
- During pup rearing both parents tend the pups and defend the den. Additionally, nursing females rely on the male for provisioning and territory defense.<sup>13</sup>
- Generally coyote pups disperse through late autumn and winter.
- There is evidence that in some instances not all pups disperse, but rather some remain with the breeding pair into the following year or longer.<sup>14</sup>

### **Resident coyotes**

– those with an established territory in the area.

### **Transient coyotes**

– those that live in the area but do not have an established territory.

## Coyotes as Livestock Predators

- Coyotes are opportunists. Rodents and other small mammals constitute most of their food supply. Saskatoons, chokecherries, blueberries and other fruits are heavily used in season. During winter they readily scavenge livestock and other animal carcasses.<sup>15</sup>
- Every coyote has the potential to kill livestock, but only some do.
- Although most livestock predation involves lambs, young calves and unconfined poultry<sup>16</sup>, coyotes are capable of killing, and do kill, adult livestock.
- In attacks on adult sheep and older lambs, coyotes bite and hold the throat a high percentage of the time. With very young lambs, bites are often to the top of the head, shoulders or back.<sup>17</sup>
- With very young lambs, multiple kills are more common but many carcasses are not eaten.<sup>18</sup>



*Newborn triplet lamb killed by coyote with bite to top of head. Photo credit: A. O'Brien.*

- Very young lambs can be carried away, leaving little or no physical evidence of the kill. However, a frantic ewe searching for her lambs with a milk-engorged udder suggests a missing lamb and possible predation.
- Young and inexperienced coyotes may not bite the throat when attacking sheep, but tear the flank or hindquarters,<sup>19</sup> often pulling clumps of wool from the hide. Resulting injuries are often not evident until the wounds become infested with maggots.
- Finding clumps of wool or numbers of scavenging birds, like magpies, in the pasture should be a flag for possible predation attacks and needs to be investigated.
- Recent research using DNA evidence has solidly shown that breeding pairs whose territory overlaps sheep grazing land are responsible for the majority of kills, with the alpha male, acting alone or with its mate, being responsible for 85 percent (21 of 25) of kills.<sup>20</sup>
- The same research showed that transient coyotes seldom kill sheep.
- While dominant adults have been implicated as primary killers, depredation is reduced when coyotes are without pups.<sup>21</sup>
- Removal of one or both of the breeding pair effectively stops predation, at least until a new alpha pair become established.<sup>22, 23</sup>

## Coyote Behaviour Pertinent to Preventative Methods

Coyotes are wary of novelty, and this caution also extends to food.<sup>24</sup> Anything new in their territory is avoided or approached with caution until they become used to it (habituation). Producers have used this reaction to temporarily stop predation prevention by employing such things as lights in corrals, leaving a radio playing, or parking a vehicle in the pasture. This is also why predation often stops when fences are newly erected.

**Habituation** – is an extremely simple form of learning, in which an animal, after a period of exposure to a stimulus, stops responding.

## Coyote Behaviour Pertinent to Successful Removal of Problem Coyotes

- Juvenile and yearling coyotes are more vulnerable than older coyotes to traps and snares,<sup>25</sup> but are the least likely to be the cause of the predation.
- Coyotes can learn to avoid traps and snares after exposure to their use.<sup>26</sup>
- The alpha pair more actively defends their territory than do other members of the pack, with territory defense increasing during breeding season and peaking with gestation and a second peak at den-emergence.<sup>27</sup>
- Howling and scent-marking are generally performed by the alpha pair and show a similar seasonal pattern to territory defense.<sup>28</sup>



- These responses can be used quite effectively to selectively remove problem coyotes whether by using traps or hunting with calls.

## Gray Wolves (*Canis lupus*)

- In Alberta, wolves are found in the mountain, foothill and boreal regions. They are not considered rare or endangered in the province.<sup>29</sup>
- Wolves are social animals that live in packs.
- Pack size tends to be largest in winter and can number over 20 animals.<sup>30</sup>
- Packs include a pair of breeding adults and their pups as well as yearling or extra adults.<sup>31</sup>
- Adult gray wolves can weigh up to 60 kilograms (130 pounds).
- Gray wolves are territorial with territories ranging from 250 to 750 square kilometers (97 to 282 square miles).<sup>32</sup>
- Breeding occurs in February or March with pups (five to seven) being born in May.<sup>33</sup>
- All pack members bring food to the young pups.
- Wolves prey on moose, deer, elk and caribou primarily, but their diet may also include beaver, hare, fish and plant material as well as livestock.

## Wolves as Livestock Predators

- Wolves prey on cattle more than they do on sheep in Alberta, in part because sheep are less common in wolf habitat. In one study,<sup>34</sup> of 1021 attacks on domestic livestock attributed to wolves during a 15 year period (1982 through 1996), 61 (6%) were attacks on sheep, while 756 (74%) were on cattle.
- At least in southwestern Alberta, where wolf predation on cattle herds is heavy, there is a seasonal shift in prey, from wild ungulates in the non-grazing season to cattle in the grazing season.<sup>35</sup> In the study area, cattle comprised 73.9 percent of the biomass consumed by wolves during the grazing season compared to 31% during the non-grazing season.
- Ranchers' boneyards can be a significant winter food source for wolves in Alberta. Morehouse and Boyce (2011) found that 85 percent of scavenging events in the non-grazing season were to ranchers' boneyards.
- Wolf predation on sheep occurs throughout the grazing season but shows a seasonal increase, with levels higher August through December than the rest of the year.<sup>37</sup>

**Biomass** – biological material used as a source of fuel or energy.<sup>36</sup>

- Wolves attack sheep in a similar manner as they do cattle, chasing and attacking from behind (Investigation and evaluation of predator kills and attacks.)
- Wolves do not usually select for size or age on sheep. Multiple kills often occur. Bites to the head, neck, back, flanks and hindquarters are common. Injuries may include a crushed skull, severed spine, disembowelment and massive tissue damage. Wolves will also kill sheep by attacking the throat, similar to the manner in which a coyote kills sheep. Wolves, however, will damage the underlying tissue much more.<sup>38</sup>
- Lambs may be bitten on top of the neck or back or carried away (Investigation and evaluation of predator kills and attacks.)
- Wolf attacks on sheep flocks can result in excessive damage. Several recent incidents highlight this.
  - In August 2013, 176 sheep (of 2400) died during a wolf attack near Fogg Hills, Idaho with only a few dying from bite wounds; the rest died due to trampling and suffocation caused by piling up during the attack.<sup>39</sup>
  - In May 2013, 31 sheep and lambs killed near Carey, Idaho over a two-day period were confirmed to be wolf kills by Idaho Wildlife Services.<sup>40</sup>

## **Black Bears (*Ursus americanus*)**

- Current range of black bears in Alberta encompasses about 74 percent of the province; they are primarily forest-dwelling, being common in open forests throughout the mixed-wood, foothill, and montane life zones.<sup>41</sup>
- Most adult female bears have well defined home ranges of 15 to 50 km<sup>2</sup> while the range of adult males will be several times larger.<sup>42</sup> Adult female black bears typically weigh 45 to 140 kilograms (100-310 pounds). Adult males are larger, weighing 100 to 200 kilograms (220- 440 pounds).<sup>43</sup>
- Colour varies from black to blond.<sup>44</sup>
- Breeding occurs in late June or early July.<sup>45</sup>
- In the female bear, the fertilized egg does not implant immediately after mating, but remains unattached in the uterus until fall.
- Females in good condition will usually produce two or three cubs that weigh seven to 12 ounces (198 to 340 g) at birth in late January and February while the sow is still in the den.
- Denning begins in October. Bears usually begin emerging from dens in early April.<sup>46</sup>
- On average bears will lose 16% of their bodyweight during the winter denning period. Lactating females will lose an additional 9%.<sup>47</sup>
- Lactating females do not come into estrus, so females generally breed only every other year.

- The female bear is the sole provider for the cubs. Males are known to kill cubs if they get the opportunity.
- Black bears are omnivorous, foraging on a wide variety of plants and animals. The foods they eat vary by season and include everything from insects to grass, berries, fruits, small animals, garbage and livestock.
- Habitat use coincides with the seasonal availability of preferred food sources: grasses and succulent forbs in the spring and early summer, and ripening fruits available from July (serviceberries, chokecherries, dogwood berries) through September (huckleberries, berries of mountain-ash, hawthorn apples).<sup>48</sup>
- When natural foods are scarce, bears will turn to whatever food resources are most available.<sup>49</sup> This is often when they become a problem for livestock owners.

## Black Bears as Livestock Predators

- As with other carnivores, not all black bears kill livestock. However, those that do learn often become persistent livestock predators.<sup>50</sup> Promptly solving the problem is essential as the bear will return frequently until stopped.
- Generally sheep tend to bunch up when approached by a bear, so multiple kills are common with sheep.<sup>51</sup>
- Kills are usually made with bites to the head or top of the shoulders.
- Black bears generally open up the body cavity of a kill and remove the internal organs. The liver and other vital organs are eaten first, followed by the hindquarters. Udders of lactating females are also preferred.<sup>52</sup>
- Hides are generally peeled back from the meat and often left intact.
- If an animal is killed in the open, the bear may drag it into the woods or brush and cover the remains with leaves, grass, soil, and forest debris.<sup>53</sup> The bear will periodically return to this cache site to feed on the decomposing carcass.
- When a bear makes a kill, it usually returns to the site at dusk.
- Black bears prefer to feed alone.
- Bear predation will generally be the result of a single adult bear. Because they often come back to either feed off a previous kill, or to kill again, problem bears are much easier to identify and target than are problem coyotes.
- Predation on livestock commonly occurs on farms that are close to forested areas.<sup>54</sup>
- Bears are very sensitive to electric shock, making electric fences an effective prevention method.

## Grizzly Bears (*Ursus arctos*)

- Grizzly bears prefer open or semi-open country, and are found in the foothill, mountain and boreal regions of the province.<sup>55</sup>
- Their current range includes areas in or near the Rocky Mountains and in some boreal forest areas of north-central and north-western Alberta.<sup>56</sup>
- Adult male (or boar) body weight average is 180 kilograms (400 pounds), but in better habitats, body weight can be 325 kilograms (716.5 pounds) or more. Adult female (or sow) weigh about two-thirds that of the male.<sup>57</sup>
- Adult forefoot print width is about 14 centimetres (5.5 inches). Adult rear foot print length is about 25 centimetres (9.75 inches).<sup>58</sup>
- Grizzlies can be distinguished from black bears by their dished face, distinct shoulder hump, and claw marks on their front footprint five to seven centimetres ahead of the toes.<sup>59</sup>
- Grizzlies are designated as a threatened species under Alberta's wildlife act, so it is illegal to hunt or kill them.<sup>60</sup>
- Grizzly bear-livestock problems are most common in June and July in Alberta,<sup>61</sup> but will likely increase during shortages of their normal food sources.
- Predation may increase during food shortages.
- Grizzly bears show a preference for adult sheep over lambs.

## Cougars (*Felis concolor*)

- The cougar is the largest of the North America's wild cats with average weight of adult males ranging from 60 to 70 kilograms (130 to 160 pounds). Average weight of adult females ranges from 40 to 50 kilograms (90 to 110 pounds).<sup>62</sup>
- Cougars live in the mountains and foothills of western Alberta;<sup>63</sup> occasional sightings have been reported along river valleys east of these zones.<sup>64</sup>
- A recent study that analyzed ENFOR (enforcement records) data of large carnivore incidents in southwestern Alberta found sightings expanded eastward over time, and that 87% of cougar incidents were livestock related (primarily sheep, alpacas, horses, and pets).<sup>65</sup>
- Adults weigh 35 to 90 kilograms (80 to 200 pounds).<sup>66</sup>
- Cougar's distinct three-lobed heel pad distinguishes its tracks from dog, wolf or coyote tracks.<sup>67</sup>
- They are elusive and solitary except when mating or when a female is accompanied by kittens.

- Although deer are their preferred prey and are a primary component of their diet, other prey will be taken when deer are unavailable.<sup>68</sup>

## Cougars as Livestock Predators

- Cougar predation of livestock usually occurs along the agricultural-forest fringe in Alberta.<sup>69</sup>
- Damage is often random and unpredictable, but when it occurs, it can consist of large numbers killed in a short period of time.<sup>70</sup>
- Cougars stalk their prey, sneaking up and then rushing it from a short distance away.
- Cougars normally kill their prey by biting the head and neck to crush the skull and neck bones, or by biting at the throat to crush the windpipe.<sup>71</sup> Broken necks are common.<sup>72</sup>
- Cougars feed on organ meats first.
- Before feeding, cougars pluck out the wool or hair from the hide.<sup>73</sup>
- They use their teeth to chew out a clean entryway rather than tear at the tissue.<sup>74</sup>
- Cougars tend to cover their kills with soil, leaves, grass, and other debris.<sup>75</sup>

## Eagles

- In Alberta, the bald eagle is most often seen in the mountain and northern regions of the province always near rivers and lakes, wintering in southern United States and on the Pacific coast.<sup>76</sup>
- The golden eagle nests in the Rocky Mountain and foothill natural regions as well as a portion of the boreal forest natural region of northern Alberta. In winter it is a frequent resident of the prairies.<sup>77</sup>
- Both the bald and golden eagles are scavengers as well as predators.
- The bald eagle and golden eagle are both classified as Sensitive in the general status of Alberta wild species report and are protected by the provincial Wildlife Act, and as such cannot be killed.<sup>78</sup>

## Eagles as Livestock Predators

- Golden eagles are more likely to prey on livestock than are bald eagles.
- Generally they prey on young livestock although they are capable of killing adults.
- Eagles generally take older lambs or kids that are running and playing some distance from flocks, not the younger ones, who usually stay close to their mother and within the flock. Predation is most severe on young that are at least two to four weeks of age. Predation by eagles is seldom a problem after lambs and kids have reached six weeks of age.<sup>79</sup>

- Eagles seize small lambs and kids anywhere on the head, neck, or body, frequently grasping from the front or side. They usually kill adult animals, or lambs and kids weighing 25 pounds (11 kg) or more, by multiple talon stabs into the upper ribs and back.<sup>80</sup>
- Most eagle predation occurs around sunrise.<sup>81</sup>
- Talon punctures are typically deeper than those caused by canine tooth punctures and are somewhat triangular and oblong.
- Eagles skin out carcasses, turning the hide inside out while leaving much of the skeleton intact, with the lower legs and skull still joined to the hide.<sup>82</sup>
- Ears, tendons, and other tissues are sheared off cleanly by the eagle's beak.<sup>83</sup> This compares to other carrion birds which pull the meat away from tendons leaving frilly white tufts on the bones.<sup>84</sup>

## Ravens (*Corvus corax*)

- Ravens are widely distributed throughout Canada, and occur in much of central Alberta.
- Ravens are larger than a crow, with a longer, heavier beak.
- Ravens are territorial and breeding pairs try to exclude all other adult ravens throughout the year.
- Ravens are well known for being scavengers, but are also predators.
- Ravens are among the smartest birds, with an amazing ability to learn, making them a significant predator threat.
- Most often ravens concentrate their attacks on newborn lambs, tearing out eyes and tongue.<sup>85</sup>
- In some instances, they have been known to attack larger, healthy lambs, usually around the head—pecking eyes or puncturing the skull.



*Although ravens more often attack newborn and very young lambs, they will attack older animals. A raven pecked the eye of this 10 month old ram lamb. Photo credits: Kaiser & O'Brien.*

- They will also prey on mature sheep that are cast, tearing through the abdomen, rectum and tearing out the eyes (personal observation).
- Livestock guarding dogs seem less effective at keeping ravens out of pastures compared to other birds (vultures, eagles, crows).
- Ravens can be hunted on private land by residents.<sup>86</sup>

There is limited research on raven predation on livestock or what methods may be effective to manage it. Because of the raven's amazing learning ability, prompt action when predation first begins is strongly recommended by wildlife biologists.

## References in this Chapter

References, pertaining to the endnotes listed below, can be found on page 65.

1. Alberta ESRD 2014
2. Acorn and Dorrance 1998
3. Acorn and Dorrance 1998
4. Jaeger 2004
5. Kamler and Gipson 2000
6. Kamler and Gipson 2000
7. Acorn and Dorrance 1998
8. Acorn and Dorrance 1998
9. Hennessy, Dubach and Gehrt 2012
10. Alberta ESRD 2014
11. Alberta ESRD 2014
12. Alberta ESRD 2014
13. Sacks and Neale 2001
14. Gese, Ruff and Crabtree 1996b
15. Acorn and Dorrance 1998
16. Acorn and Dorrance, Coyote Predation of Livestock 1998
17. Bowns 1995
18. Bowns 1995
19. Bowns 1995
20. Blejwas, Williams, et al. 2006
21. Carlson and Gese 2010
22. Jaeger 2004
23. Blejwas, Sacks, et al. 2002
24. Blejwas, Sacks, et al. 2002
25. Jaeger 2004
26. Jaeger 2004
27. E. Gese 2001
28. E. Gese 2001
29. Alberta ESRD 2014
30. Alberta ESRD 2014
31. Alberta ESRD 2014
32. Alberta ESRD 2014
33. Alberta ESRD 2014
34. Musiani, et al. 2005
35. Morehouse and Boyce 2011
36. Biology online dictionary 2014
37. Musiani, et al. 2005
38. Montanta State University Extension Services 2004
39. Levy 2013
40. Wutz 2013
41. Alberta ESRD 2014
42. Hygnstrom 1994
43. Alberta ESRD 2014
44. Alberta ESRD 2014
45. Alberta ESRD 2014
46. Tietje and Ruff 1980
47. Tietje and Ruff 1980
48. Jorgensen 1983
49. Parkhurst 1998
50. Hygnstrom 1994
51. Hygnstrom 1994
52. Hygnstrom 1994
53. Hygnstrom 1994
54. Acorn and Dorrance 1990
55. Alberta ESRD 2012
56. Alberta ESRD 2012
57. Alberta ESRD 2012
58. Alberta ESRD 2012
59. Alberta ESRD 2012
60. Alberta ESRD 2012
61. Acorn and Dorrance 1990
62. Alberta ESRD 2014
63. Acorn and Dorrance 1990
64. Alberta ESRD 2014
65. Urmson and Morehouse 2012
66. Knight 1994
67. Knight 1994
68. Knight 1994

69. Acorn and Dorrance 1990
70. Knight 1994
71. Alberta, Rancher's Guide to Predator Attacks on Livestock 2011
72. Knight 1994
73. Alberta, Rancher's Guide to Predator Attacks on Livestock 2011
74. Alberta, Rancher's Guide to Predator Attacks on Livestock 2011
75. Knight 1994
76. Alberta ESRD 2014
77. Alberta ESRD 2014
78. Alberta ESRD 2014
79. O'Gara 1994
80. O'Gara 1994
81. O'Gara 1994
82. O'Gara 1994
83. O'Gara 1994
84. O'Gara 1978
85. Personal observation
86. Alberta 2013



## 4. Predation Prevention - First Line of Defense

A number of management practices are effective at preventing or reducing predation. The two most commonly used are livestock guarding animals and predator deterring fences (both electric and woven wire options).

Other management practices that offer short-term relief from predation include close supervision of the flock, scare devices, and novel items.

Several products marketed as predator deterrents, such as FoxLights®, Nite Guard® may be effective at discouraging predation during night time. However they offer no protection during daylight hours because they only activate at night.

A commonly held belief by wildlife biologists is that the coyote population we deal with during summer is determined by the available food during winter. In areas where coyotes had access to abundant carrion during the winter, more coyotes stayed in their social groups and pack size was greater. In contrast, in areas with low carrion available coyote pack size remained small, and the core social unit subsisted on small mammals.<sup>1,2</sup>

Alberta still allows “natural” disposal of livestock mortalities. Producers using this disposal method increase their risk of predation, not because coyotes eating livestock mortalities then turn to live sheep or lambs, but because the extra food source of the mortalities encourages more coyotes to stay in the area.

### Livestock Guarding Animals

Dogs, donkeys and llamas have all been used as guardians for sheep flocks. Increased interest in their use in North America occurred with the ban on use of toxicants for predator control in the 1970s in the United States. Both producers and researchers began exploring other predator control methods.

A number of studies have evaluated their effectiveness in preventing or reducing predation by coyotes. Unfortunately, none have evaluated their effectiveness against other predators such as wolves, bears and cougars.

Alberta Lamb Producers surveyed its members in 2012. Ninety-three percent of the producers completing the survey (54) used livestock guarding animals to protect against predation. Seventy-six percent (41) were using dogs, the remaining using donkeys/ponies, llamas or some combination. Two of the respondents used multi-species grazing (cattle) as an effective method of reducing/preventing losses.<sup>3</sup> Similar findings were also seen in a national survey conducted by Canadian Sheep Federation in 2010. At that time, eighty-two percent of Alberta producers who participated (72) indicated they used livestock guarding animals to protect against predation.<sup>4</sup> A comparison of the results of these two surveys with a 2011 survey of Ontario lamb producers shows that a higher percentage of Alberta lamb producers use guardian animals for flock protection compared to Ontario producers. According to the Ontario survey, seventy three percent

(132/181) of respondents indicated they were using livestock guarding animals, with only thirty seven percent (68/181) using guarding dogs, while 21 % (38/181) used llamas and 14% (26/181) used donkeys. Eighty-four respondents (46%) were using one guardian animal type, while only 15 (8.3%) used two types and four respondents (2.2%) used all three. Alternative guardian animals were listed as cattle and horses.<sup>5</sup> Unfortunately, none of the surveys attempted to determine relative effectiveness ratings of the various guarding animals used.

Generally, if more than one guard animal is needed, dogs often become the sole choice of guarding animal, or are added to the existing guarding donkeys and llamas. Effectiveness of dogs can actually increase with the addition of extra dogs. Donkeys and llamas, on the other hand, tend to work best as individual guardians with one group of sheep in relatively small areas where they have full view of the entire pasture. As such they are often the preferred choice for producers with small flocks.

Although less commonly used, individual horses, and cattle well-bonded to sheep have also been effective to prevent coyote predation.

## Livestock Guardian Dogs

Dogs have been used for more than 2000 years as guardians of sheep flocks in Europe, Asia and Africa against bears and wolves.<sup>6</sup> Their use in North America, however, like sheep themselves, is considerably more recent. Although individual producers had brought guarding dogs in from Europe, their use did not really catch on until Hampshire College (New England Farm Centre) in Massachusetts initiated a dog research project that eventually saw fourteen hundred livestock-guarding dogs placed on sheep farms and ranches across the United States and Canada between 1977 and 1990.<sup>7</sup> A similar project was initiated in the mid 1980s at the U.S. Sheep Experiment Station in Dubois, Idaho.<sup>8</sup> Researchers in Idaho worked with the Komondor (Hungary), the Great Pyrenees (France and Spain), and the Akbash (Turkey). The work at Hampshire College evaluated the Maremma (Italy), the Shar Planinetz (Yugoslavia), the Anatolian Shepherd (Turkey) and various crosses of these breeds.<sup>9</sup> Their efforts and those of the first farmers and ranchers participating in the experiments set the groundwork for the wide adoption of their use in predation prevention and what we know about the use of these dogs today.

Since that time more breeds have been imported (e.g., Tibetan Mastiff, Polish Tatra (Owczarek Podhalanski), Spanish Mastiff), most often by individual producers. Some of the importations have been in an effort to increase their own dogs' effectiveness against larger predators, in particular wolves and bears, suggesting that the dogs currently being used in North America do not measure up in effectiveness against wolves and bears. This is interesting, because in Europe, the primary use of these dogs is for protection against bears and wolves. Have we inadvertently been selecting dogs that are less effective against larger predators than their ancestors of only five decades ago? If nothing else, this highlights the importance of acquiring dogs from producers dealing with the same predators as you are.

In European countries where wolves are regularly encountered, anti-wolf spiked collars are worn on livestock guardian dogs. These collars have been used in Europe for centuries and are considered an essential survival tool in wolf country;<sup>10</sup> unfortunately the knowledge of their use is passed on verbally and through experience to the next generation, not in the written form. Their suitability to North American conditions needs to be fully explored before their use is broadly adopted.

Three hundred and ninety-nine producers ranked their 763 livestock guarding dogs' effectiveness as very effective (71%), somewhat effective (21%), and not effective (8%) in a 1986 survey.<sup>11</sup>

Dogs that were reared with livestock from two months old or younger had a higher success rate than those that were older than two months of age when placed with livestock ( $P > 0.01$ ).<sup>12</sup>

At the time of this survey the rate of success did not differ among the more common breeds—Great Pyrenees, Komondor, Akbash, Anatolians, Maremmas and hybrids.<sup>13</sup>

**Tip** – *If purchasing livestock guarding dogs acquire them from producers dealing with the same predators you are to help ensure they have the necessary protective traits needed.*

## Traits of an Effective Guarding Dog

To be effective at reducing predation livestock-guarding dogs:

- must stay with the sheep flock,
- must be attentive and react instinctively while protecting the flock,
- must be trustworthy and not harm the flock,
- must be aggressive toward the predator species you are dealing with,
- must be physically sound and have good conformation as these impact longevity,
- must be free from serious genetic defects such as hip dysplasia, poor bite and entropion.

Although these characteristics are critical for an effective livestock guarding dog, they are equally important for any livestock guarding animal, be it dog, donkey, llama, or cattle.

## Cautions and Problems with Using Guarding Dogs

- Dogs that don't stay with the sheep flock
- Dogs that stray and cause problems with neighbours, their dogs and or livestock
- Dogs that are aggressive to humans
- Dogs that maul or kill lambs and sheep
- Dogs that chase and/or kill non-predator wildlife
- Dogs that don't have the protective traits necessary to keep predators away

Dogs are host to several tapeworms that result in carcass condemnations (*Taenia ovis*, and *Echinococcus multilocularis*, a zoonotic causing alveolar echinococcus in humans). A dog deworming strategy must be part of a flock health scheme. A good resource factsheet is available on <http://www.ablamb.ca/documents/factsheets/C-ovis-factsheet.pdf>.

## Behaviour

Choosing a dog based on its behaviour is more important than choosing a dog based on breed. In fact, many producers are crossbreeding to take advantage of hybrid vigour and to increase longevity.

- Behaviour as a mature dog is a result of heredity (genetic factors) and how the dog was raised, with the experiences during the first few months of life being most important.<sup>14</sup>
- These breeds are predisposed to independent behaviour, making them relatively unresponsive to verbal commands; as a result it is important to focus on teaching them critical commands, such as “NO” and “COME” as young pups.
- Pups must be raised with sheep during the “critical period for social development” in order to be socially bonded with sheep as adults. This social learning window closes at approximately sixteen weeks of age. After this the dog has a very poor ability to develop or change its social skills.<sup>15</sup> This is one of the key reasons why dogs raised as household pets seldom make effective guarding dogs. They are socially attached to humans rather than sheep, and will seek out human company.
- When a pup is raised with sheep for its first sixteen weeks, for the rest of its life it treats sheep as its primary social companions.
- Another point on learned behaviour during these early months—if pups learn to crawl through gates and pen partitions, as adults they are more difficult to keep in fenced pastures or winter feeding yards. It is important to promptly stop undesirable behaviour before it becomes an ingrained habit. This includes aggressive play with sheep or lambs, chewing on ears, etc.
- The challenge in selecting a pup is trying to predict its behaviour as a mature dog from its behaviour as a pup. For a first dog, it is often better to purchase a dog that is already working effectively and has outgrown puppyhood problems. A number of breeders will offer to grow out a pup to five or six months of age (for an additional fee) before placing them. Generally these dogs have bonded well with sheep and have had the opportunity to work with and learn from an older dog.
- With the dogs placed through the project at US Sheep Experiment Station in Dubois Idaho, all successful dogs displayed positive traits within the first three to eight months of life.<sup>16</sup>
- Although both sexes are reported to be equally effective at preventing predation, some producers have found that intact females are more aggressive toward other guarding dogs and are often instigators of fights.
- A 1986 survey of 763 guarding dogs revealed no significant difference in success rates between intact versus neutered dogs.<sup>17</sup> Unless a producer is planning to breed dogs, it is strongly recommended that all dogs be neutered—females at approximately six months and males around nine months of age. An intact female in heat will attract other dogs

which may add to the predator problem. If she is kennelled during heat periods, late pregnancy, whelping and nursing, she is not protecting the flock.

## How Many Dogs?

The number of dogs needed to provide adequate protection against predation is dependent on a number of factors including:

- Performance and experience of individual dogs
- The type and number of predators and the intensity of predation
- The topography and amount of cover (brush, timber, ravines etc.)
- Whether the local predator population has become “acclimatized” to guarding dogs
- The size of area the sheep are grazing in and the number of paddocks used for grazing
- The flocking behaviour of the sheep
- The producer’s definition of adequate protection (minimum kills or zero)

Most young, inexperienced dogs and aged dogs will not be as effective at preventing predation as those in their prime. In areas where there are few predators, one dog may be sufficient. Where predation is occurring in the presence of guarding dog(s), adding more dogs, or changing dogs, may temporarily stop the predation.

More dogs may be required where wolf predation is a concern compared to areas where only coyote predation is a problem. Although most of the research has evaluated effectiveness against coyotes, these dogs protect sheep flocks primarily against wolves and bears in their home countries.

Pastures that are hilly, or have a lot of brush or ravines will be challenging for one dog to protect. Sheep that flock and form a cohesive unit, especially at night, can be protected by one dog more effectively than sheep that scatter and bed down in a number of locations.<sup>18</sup> A producer who wants to maintain zero predation may need to run more dogs than the producer who is willing to accept some losses.

Anecdotally, when dogs were first used in an area, one dog was effective. Ten years later, it required two dogs to do the same job. One study looked specifically at whether dogs lose their effectiveness over time. The study surveyed producers who participated in the Animal Damage Control (ADC) Livestock Guarding Dog Program. Data from 36 of the 100 dogs that began in the ADC dog program in 1987 were used for the report. Producers were asked whether their dogs’ recent performance when compared with the previous several years remained the same, was better, or was worse. 19 of the dogs were used on rangeland while 17 were used on pastures. Of those producers reporting worse performance (9), all of them were using rangeland. Those producers using dogs on pasture reported the performance of the dogs either stayed the same (88%) or improved (12%). The study concluded that the decrease in effectiveness of the dogs producers reported was presumed to be due to an increase in coyote density.<sup>19</sup> Has the ensuing twenty years given coyotes the time to become acclimatized to dogs? Have they learned to circumvent or lure the dogs away? Or is it simply a matter of increased coyote density, yet again?

Producers using multiple dogs have found that some dogs work better together than others. Where dogs are used in pairs, it can often be beneficial to switch one of the pair to increase their effectiveness, particularly when coyotes have been constantly challenging them. Paired dogs often show complementary behaviour,<sup>20</sup> with one dog being aggressive and patrolling a wide area around the flock while the second dog stayed with the sheep and responded aggressively only when directly confronted by a predator. A number of producers have observed similar behaviour in their dogs.



*Livestock guarding dogs are the preferred guardian for most lamb producers.  
Photo Credit: A. O'Brien.*

It is important to recognize there will be circumstances where guarding dogs alone are not sufficiently effective at stopping or preventing predation, the most obvious being when the territory to protect is too large for the number of dogs present.

### **What Are the Costs Associated with Using Dogs?**

- The purchase price of your dog and vet costs for neutering should be amortized over the dog's productive life (the expected number of years it is capable of protecting your sheep flock). Although individual dogs will work longer, expect most dogs to be fully functioning for five or six years (excluding first year of life and geriatric years). Some producers count yearling dogs and aged dogs as "half" dogs; i.e., expect them to look after half the number of sheep as a dog in the prime of its life.
- If feeding "middle of the road" dog kibble, expect a yearly feed bill of \$450 to \$500 per dog. Again, do not allow dogs to scavenge on dead sheep.
- Producers who feed farm butchered sheep need to ensure that the meat is either cooked to an internal temperature of 72°C or frozen below -18°C for a minimum of 10 days.<sup>21</sup>

- Annual vet costs (rabies, parvovirus vaccine, tapeworm medication) will be in the range of \$100 - \$200 per dog, excluding accidents and emergency procedures.

## Dogs Are Not Always the Best Choice

Producers living close to urban areas, or acreages, may want to evaluate whether dogs are the best choice for protecting your flock. The following issues need to be considered:

- Noise complaints because of barking
- Roaming dogs injuring or killing neighbours' pets
- Dogs chasing vehicles (in particular people on bicycles)
- Dog showing aggressive behaviour toward neighbours walking on municipal road

## Improving Effectiveness of Your Dogs

- If purchasing, do so from working stock only, and from producers dealing with the same predators as you are.
- Raise pups with sheep and your best adult dog that is tolerant of pups.
- In the ideal world, pups would be born in time to go out to pasture with the flock, so that they are "learning to stay with the sheep" during the critical 16 week social development period.
- Consider pairing up dogs that work well together. Also run your pup in training with your best adult dog.
- Change up dogs when predation pressure is high. This gives the challenged dogs a rest, and the fresh dogs a bit of action.
- Good fences generally keep most dogs where they belong—with the flock they are protecting.
- Feed a balanced ration to keep dogs fit, not fat. Body Condition Scoring is used for dogs too!
- Include dog health in your flock health scheme, such things as vaccines and tapeworm treatments.
- Do not keep dog(s) that don't measure up. Sometimes they may work better for someone else. Be up front with their faults/shortcomings.

## Donkeys

Donkeys can be effective at preventing coyote predation although their use is limited to relatively small flocks or where the sheep are only every managed as one flock. It is believed they have an inherent dislike of canines and this is the primary reason for their effectiveness.

The typical response of a donkey to an intruding canid is vocalization (braying), baring its teeth, and a running attack punctuated with attempts to kick and bite the intruder, particularly if it is

cornered. Donkeys are likely not acting directly to protect the sheep as much as acting out their aggression to the intruder.<sup>22</sup>

Although donkeys are not suited to as wide a variety of guarding situations (not effective against bear, wolf or cougar predation) as livestock guarding dogs, in some respects they may be easier to manage than guarding dogs.<sup>23</sup> Donkeys are also compatible with other livestock and share similar requirements for feed, water and shelter. They eat grass and hay and do not require special feed.<sup>24</sup>

One producer who has worked with many donkeys reported that they are afraid of bears and cougars and "will flee in terror whenever these animals are anywhere in the area".<sup>25</sup>

Not all donkeys will work at preventing predation. In a survey of sheep and goat producers in Texas, only 20 percent of respondents rated the effectiveness of their donkeys against coyotes as excellent or good while 20% rated their effectiveness as fair and 42% rated them as poor or failures.<sup>26</sup>

### Why Producers Like Donkeys

- Eat the same feed as the sheep flock.
- Easier to keep fenced in than dogs.
- Longevity—they usually live up to 20+ years.
- Relatively inexpensive to purchase, with low annual health and feed costs.

### Cautions and Problems with Donkeys as Guarding Animals

- May not be effective for preventing cougar, wolf or bear predation.
- Intact males show aggression to sheep, especially during breeding season.
- Some donkeys interfere with ewes at lambing, causing injury/death or mismothering of lambs. Temporary removal is advised.
- Some donkeys show aggression to sheep at feeders, biting and kicking ewes to get at the feeder.
- Some jennies in heat (estrus) can be aggressive toward sheep, needing to be removed temporarily.
- If more than one guard animal is required, donkeys will usually hang together and leave the flock unprotected.
- Frequent feet trimming required—at least every three to four months is recommended.
- Some feed ingredients are toxic to equine (Rumensin®, urea, and Bovatec®).



## Recommended Guidelines for Improving Success Rate of Donkeys<sup>27</sup>

- Guard donkeys should be selected from medium to large size stock. Do not use extremely small or miniature donkeys.
- Do not acquire a donkey which cannot be culled or sold if it fails to perform properly.
- Use jennies and geldings. Do not use jacks as guard animals.
- Test a new donkey's guarding response by challenging the donkey with a dog in a corral or small pasture.
- Use only one donkey or jenny and foal per pasture.
- Isolate guard donkeys from horses, mules, and other donkeys.
- To increase probability of bonding, donkeys should be raised from birth or placed at weaning with sheep or goats.
- Raise guard donkeys away from dogs.
- Avoid or limit the use of herding dogs around donkeys.
- Monitor the use of guard donkeys at lambing or kidding as some donkeys are aggressive or overly possessive to newborns. Remove donkeys temporarily if necessary.
- Use donkeys in small (<60 acres) open pastures with not more than 200 head of sheep or goats for best results. Large pastures, rough terrain, dense brush, too large a herd, and sheep or goats that are scattered all lessen effectiveness of guard donkeys.
- Trim feet regularly.
- Do not allow donkeys access to feed containing Rumensin®, urea, or Bovatec®.

### Costs Associated with Livestock Guarding Donkeys

- Purchase price and cost of gelding males should be amortized over the expected working life of the donkey. The literature suggests 15 years productive life (with a range of 10 to 20).
- Annual vet costs (vaccine and deworming medication).
- Hoof-trimming three times per year.
- Feed costs (additional to pasture).



*Good feet and regular trimming are essential if donkeys are to remain effective protectors. Photo Credit: A. O'Brien.*

## Llamas

Interest in using llamas as guardian animals for sheep flocks occurred around the same time as that for donkeys. Llamas are native to South America, and had been introduced into United States and Canada as an alternative livestock opportunity in the 1980s. Based on observations from some producers who ran their llamas with sheep and noticed lower predation levels, research at University of Iowa was initiated to address the following questions:

- How are North American sheep producers using guard llamas?
- Do llamas significantly reduce sheep losses caused by predation?
- What livestock and llama management practices give best results?

In 1990, they telephone interviewed 145 sheep producers across the United States known to be using guard llamas, as well as 29 on-site visits in six Midwestern and western states. Here are some of the key findings of their research:<sup>28</sup>

- The average producer interviewed had raised sheep for 17 years and purchased a llama three years earlier.
- Nearly 70% of guard llamas in use were gelded males.
- Most producers only had one llama, but a few owned as many as six.
- Average flock size of those ranchers interviewed was 250 to 300 sheep.
- Average pasture size of 250 to 300 acres.
- Most common llama age of six to eleven months at introduction to sheep, with the average age of two years when introduced to sheep.
- At introduction:
  - The llama was usually curious or neutral toward the sheep.
  - The sheep on the other hand were either neutral or afraid.
- There was an adjustment period of approximately one week for 80% of the llamas evaluated.
- Producers' losses dropped significantly to an average of eight head per year, or about 1% compared to 26 head (11%) prior to acquiring the llama. More than half the producers had their losses reduced to zero.
- 80% of producers rated their guard llama's ability to reduce predation losses of their sheep as "very effective" or "effective."

### How and Why Llamas Protect Sheep?

Llamas are aggressive toward members of the canid family (e.g., coyotes, foxes, dogs), and are also believed to be territorial. Once a guard llama becomes familiar with an area and is attached to the sheep, the pasture becomes the llama's territory and the flock becomes the llama's family group.

In field studies in South America, guanacos and vicunas (wild relatives of llamas and alpacas) have often been observed aggressively pursuing Andean and Patagonia foxes, but fleeing from mountain lions.

Typical responses of a guard llama to a potential predator reported by the producers in the Iowa study included:

- Alert attention (31% of the interactions)
- Alarm call (32%)
- Walking to (25%) or running towards (63%) the predator
- Chasing it (58%)
- Kicking or pawing at it (21%)
- Or, positioning itself between the flock and predator (8%)
- Other protective behaviour noted included:
  - llama taking either the lead front position, or trailing at their heels, when sheep were being moved;
  - staying separate from the flock, either standing or resting on an adjacent hilltop or slope overlooking the sheep.

## Other Important Findings

- Single guard llamas were more effective than multiple llamas at reducing predation (1% loss versus 7% loss).
- No reported difference in effectiveness between males and females, although the sample size of single female guard llamas was small (during 1990s the price of female llamas was approximately 10X that of a male).
- Expected working life of 10 to 15 years.
- Llamas did not reach their full protective potential until one or two years old, and generally did not become territorial until two to four years of age.
- Although there was no reported difference between intact and gelded males in their effectiveness at protecting sheep, it is recommended to use gelded males (25% of 61 intact males and 5% of 135 gelded llamas attempted to breed ewes, with some ewe deaths reported).
- Llamas did habituate to farm dogs that did not chase or bother the sheep (confirming that llamas and guard dogs can work together, but llamas will show aggression toward herding dogs).

## Cautions and Problems with Using Guard Llamas

- Likely will not provide protection against bears, wolves and cougars.
- Single llamas have been killed by a group of coyotes.

- Intact males attempting to breed ewes (25% of 61 in Iowa study). Use gelded males only.
- Male llamas being aggressive toward people.
- Overprotection of the flock creating difficulty working the sheep. Important to have the ability to separate llama from the flock (e.g., in a catch pen).
- Sheep crowding llamas away from feed. Recommended that llama feed be placed in a feeder high enough to be out of reach of the sheep.
- Llamas carry the same internal parasites as sheep and goats.<sup>29</sup> Ensure they are on a regular deworming program.

Since the Iowa study in the early 1990s, guard llamas have grown in popularity, both in the United States (11,000 guard llamas on 9,500 sheep operations in 2006<sup>30</sup> and Canada as a non-lethal alternative in the age-old problem of how to minimize predation on livestock. Unfortunately, research into their use and effectiveness has not kept pace. According to Franklin (2006) key questions remaining to be answered include:

- Is there improvement in guarding ability if a llama is raised with sheep?
- What is the best age for castrating a future guard llama?
- Can llamas be used in sheep management to regulate daily flock movement?
- Can llamas be selectively bred to improve guarding abilities?
- How do llamas respond to group-hunting coyotes or to high densities of coyotes?
- Do predators habituate to llamas? And if so, how long until llamas' efficacy is reduced?

### Costs Associated with Use of Guard Llamas

- Purchase price and cost of castrating males should be amortized over the expected productive life of the llama. The Iowa research suggested 10 to 15 years. According to the Canadian Llama and Alpaca Association price ranges from \$500 to \$1500 per animal. Individual producers however have indicated purchase price of \$150 to \$250.
- Annual vet costs (rabies vaccine, dewormer).
- Annual shearing.
- Annual feed costs (excluding pasture)—a 250 lb. gelded male will consume seven to 10 pounds average quality hay per day.

### Multi-Species Grazing (Flerds)

Multispecies grazing is not new, and in fact has been practised for centuries. What is relatively new is purposefully grazing multispecies together to provide protection against predation for small ruminants (sheep and goats). Its success is based on the premise that sheep (or goats) are bonded to the cattle, and so remain in close proximity to them while grazing. The cattle in turn provide some degree of protection against predation. Several studies in the 1980s in the United

States showed that lambs bonded to cattle were at lower risk to coyote predation compared to lambs that were not bonded to cattle.<sup>31</sup>

Unknown effectiveness in the following situations:

- Where predation on cattle is occurring, are flerds less effective or not effective at all?
- Do flerds provide protection against wolf and bear predation?

## Predator Detering Fence

In order for a fence design to be considered effective at stopping predation, it must be very effective at deterring coyotes. Such a fence must have the following features<sup>32</sup> so that:

- Coyotes cannot travel through the fence—ensure that openings in non-electric fences are no larger than 6 x 6 inches (and smaller if woven wire is not high tensile).
- Coyotes cannot crawl under the fence—place bottom wire of fence as close to the ground as practical with appropriate tension to prevent “pushing under.”
- Coyotes cannot jump, or climb over the fence—make height at least five feet six inches. Consider brace assembly designs to minimize toe-hold opportunities for coyotes.
- Coyotes cannot get through at gateways—ensure gates are as high as the fence and that bar or wire spacings prevent coyotes from squeezing through. Keep traffic ruts levelled out and clearance between gate and ground to a minimum.

Over the years, there have been a number of fence designs evaluated as to their effectiveness at keeping coyotes out of sheep pastures. Some were not effective at all, while others were cost prohibitive.<sup>33, 34, 35</sup> Thompson evaluated 34 electric and non-electric test fences, while Gates et al. and Dorrence and Bourne evaluated electric fences. Thompson and Gates et al. trials were conducted using captive wild-caught adult coyotes, while Dorrence and Bourne’s evaluation occurred on typical Alberta sheep farms. The results of these three trials provided proof that fences could be designed and built that effectively deterred coyotes most, if not all, of the time and also be cost-effective.

Two permanent fence designs have shown to be very effective at preventing coyote predation as well as economical to install as perimeter fences. One is a nine-wire electric fence while the other is a mesh (or woven) wire fence. Although neither was evaluated specifically for effectiveness with other predators, both designs should work as well for bears, and wolves, but not foxes.

Portable electric nets are a more recent development and some designs have been effective at keeping coyotes out. However, several recent reports of coyotes jumping over them raises the concern as to how much longer they will be effective.

An additional plus for all three of these fence types are that they are also very effective at keeping livestock guarding dogs in the pasture with the sheep! They may also enable one dog to effectively protect more sheep. One producer has gone so far as to suggest that at least with the mesh wire fence no livestock guarding dogs are needed at all!

Thompson's fence evaluations with captive wild-caught coyotes also provided some insight into coyote behaviour with respect to fences. Some of that insight included:

- Fence height matters. Thompson's work revealed that coyotes could climb over 183 cm high fences, and jump-over 152.4 cm high fences cleanly, with a height threshold of approximately 168 cm over which few coyotes could jump.
- Coyotes will use corner braces as toe-holds to jump fences.
- Coyotes appeared wary of anything hanging directly overhead; thus corner shields and overhangs tended to keep coyotes away from fences and reduced the probability of crossing.
- Fence overhangs can be effective at preventing coyotes from climbing over fences, the most effective being woven wire with no larger than six inch (15 cm) spacing between vertical wires and extending at least 15 inches (38 cm) from the vertical of the fence.
- Some coyotes were more motivated to cross a test fence than other coyotes. Even the best fence was unable to keep all coyotes from crossing all of the time. One coyote was able to cross the fence on three different occasions while the other coyotes it was with did not. This same coyote crawled through mesh wire where the openings were 15.2 x 10.2 cm! Openings in the lower 50 cm of the fence were smaller.

## Mesh (Woven) Wire Anti-coyote Fence

High tensile, galvanized mesh wire fence provides added anti-coyote features to a fence when compared to the fence designs tested by Thompson. This adaptation has been used successfully to prevent coyote predation in Ontario. One demonstration farm has had zero kills inside the 60 acre fenced pasture since the fence was erected in 2003. This demonstration project was made possible by funding through Ontario Soils and Crop Improvement Association's Wildlife Action Project 2002. It was a two-year initiative to test several wildlife damage prevention measures, evaluate their cost, and explore the question of who should contribute to the costs of prevention and compensation for severe losses.

Key features of this anti-coyote fence include:

- Mesh is high tensile wire, so maintains correct tension better than conventional mesh wire fence as it stretches less.
- Class3 galvanizing prevents rust from occurring for at least 30 years. Most standard farm fences, on the other hand, are showing rust within 15 years of installation.

*Well constructed mesh wire anti-coyote fence successfully prevents predation.*

*Photo credit: A. O'Brien.*



- Mesh wire height is 48 inches (120 cm).
- Preferred wire diameter is 12.5 gauge, not smaller than 14 gauge, as lighter wire is easier to bend, providing an opening for coyotes to enter.
- Spacing between wires is such that no opening is larger than six inches (15 centimetres) particularly in the bottom portion of the fence.
- Posts are spaced at 16.5 feet (five metres). Demonstration farm used steel t-bar posts.
- A smooth high tensile wire or barb wire is run at ground level to provide additional deterrent to coyotes trying to dig under.
- Mesh wire is strained sufficiently to manufacturer's recommended tension level.
- Two smooth high tensile wire 12.5 gauge added nine and 18 inches (15 to 22 centimetres) above the mesh wire to achieve a total fence height of 5.5 feet (160 cm). Consider electrifying one of the smooth wires.

In view of the fact that the demonstration pasture proved so effective at keeping coyotes out, the producer has since installed the same fence design around the entire home farm, providing 300 acres of "safe" pasture for lambing ewes in the spring and weaned lambs in the late summer/early fall.

## Important Construction Details

According to the producer, paying particular attention to the following details ensures fewer opportunities for coyotes to get through:

- Spend the time to have a clean, level fence line before construction.
- Ensure corner braces are proper size and depth.
- Install mesh wire with the bottom wire as close to the ground as possible to prevent entry under the bottom wire.
- Use galvanized staples to secure wire to wooden fence posts; otherwise they become the source of premature rusting on the fence.
- Use galvanized wire ties to secure wire to steel t-bars.
- Use gates that are the same height as the fence; otherwise they become entry points for coyotes.

*Gate showing anti-coyote features – coyotes cannot get through, over these gates.  
Photo credit: A. O'Brien.*

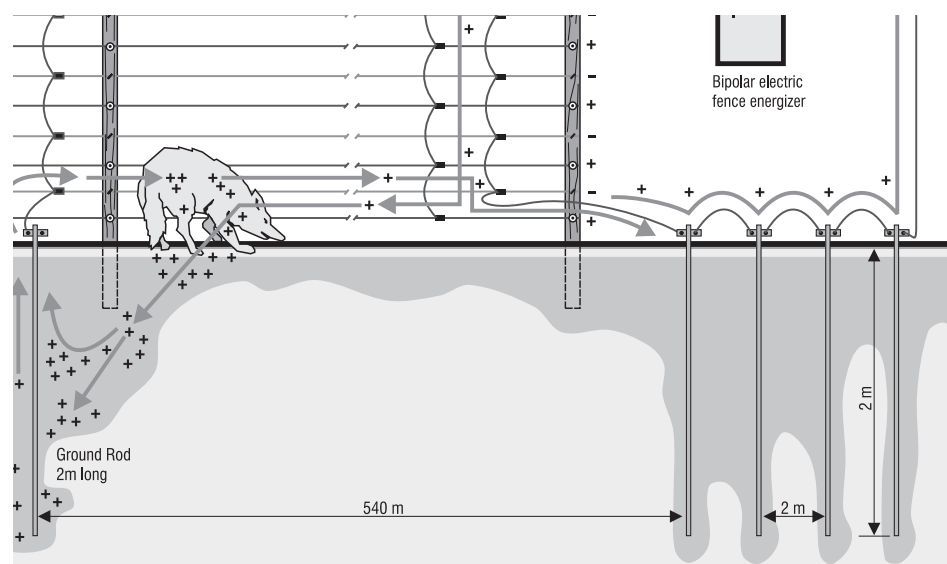


A similar fence design evaluated in Alberta in the early 1990s was rated very effective at preventing predation by the four farmers using it.<sup>36</sup> One difference with the Alberta fence design was a single electrified smooth wire placed on the outside of the fence, nine to 24 cm above ground level and about 15 cm from the mesh wire. Off-sets, particularly those on the outside of fences, are difficult to keep clear of vegetation, and will require either mechanical or chemical control to maintain effective electric shock ability.

## Nine-wire Anti-coyote Electric Fence

Early electric fence designs proved to be ineffective at preventing coyote predation. The lack of effectiveness was due to: reduced shock to the animal from poor grounding systems, the effect of vegetation reducing the electric charge, and the insulating effect of fur on the animal's body.<sup>37</sup> With the advent of modern-day low impedance fence energizers, high tensile smooth wire and good grounding systems, it is possible to maintain sufficient shocking power throughout the grazing season to discourage most if not all coyotes from entering sheep pastures.

Acorn and Dorrence (1994) interviewed 21 sheep farmers and evaluated their electric fences to identify problems and determine efficacy of electric fences to prevent coyote predation. Fence designs included 5-, 6-, 7-, 8- and 9-wire electric fences, as well as modified woven wire fences with one to three strands of wire above the woven wire and a single electrified offset wire on the outside of the fence. Fences had been in use from one to 18 years with an average of seven years. **The modified woven wire and nine smooth wire fences were judged to be very effective by farmers**—zero losses to coyotes during the 1990–1992 period. Alberta Agriculture has information on both of these designs as options for effective predator control fencing. Construction details are outlined in **Alberta Agriculture's Agri-Facts Protecting Livestock from Predation with Electric Fences Agdex 684-7**.



*Alberta Agriculture's Agri-Facts Protecting Livestock from Predation with Electric Fences Agdex 684-7, page 4.*



Electric fences are often promoted as being easier, less expensive and faster to install and maintain than traditional woven wire fences. Although the first three points are usually true, an electric fence that is not installed correctly or regularly maintained very quickly becomes ineffective at preventing predation. Acorn and Dorrence (1994) identified a number of problems with the construction of some of the electric fences evaluated in their research that impacted the fence's ability to deter coyotes. Problems seen most frequently included:

- **Bottom charged wire too high from ground.**
  - Eight of 21 (38%) fences had the bottom charged wire more than 20 cm (8 inches) above ground level. This, along with **wires spaced too far apart** was considered one of the primary reasons coyotes were able to penetrate fences.
  - Recommended height from ground for first wire is currently 7.5 cm (3 inches).
- **Inadequate vegetation control** reduced the effectiveness of six of the 21 (28.6%) fences by grounding charged wires and reducing voltage.
  - Recommended that either herbicide or mechanical control be used, recognizing that mechanical methods must be repeated throughout the grazing season and are time consuming. Topography also can present challenges in vegetation control.
- **Posts too far apart.** Where fence posts are spaced more than five to nine metres apart, fence stays (droppers) need to be used to maintain correct wire spacing and prevent wires from sagging, or being pulled down by snow load or drifting snow.
- **Uneven fence line** proved challenging to maintain proper wire spacing between ground level and the first charged wire on seven (33%) of the 21 fences.
- **Height of fence and gates too low.** Forty three percent (nine of 21) of fences were less than 120 cm high, while twenty-four percent (five of 21) had gates less than 120 cm high. Many coyotes have no problem jumping this height of fence.
- **Grounding system insufficiencies.** 50% of the fences had grounding system deficiencies that reduced their effectiveness during unfavourable conditions (e.g., low soil moisture):
  - Common wires not connected and negative wires not grounded along fence lines. Charged wires need to be joined to each other. Ground (negative) wires need to be joined to each other as well.
  - Negative wires not connected to negative terminal of fence energizers.
  - Only one ground rod used to ground energizers.

***Tip - effectiveness of electric fence can be improved by designating bottom wire as a negative (ground) wire and positioning it close to the ground. This enables the first charged wire to be eight or nine inches from the ground, reducing drain from vegetation.***

- It is important to follow energizer manufacturer's instructions on ensuring sufficient grounding system for fence and energizer.
- **Corner braces inadequate or giving way.** 50% of the fences had problems with braces. Some of these problems included poorly designed braces, braces that were too short, improperly secured or rotted away braces, all of which increase fence maintenance and shorten the life span of the fences.
- **Wire tension (inadequate or too much).** 28.6% of the fences had well constructed brace assemblies but fence wires were too tight, resulting in corner braces raising out of ground.
- **Wire connections inadequate.** 33% of fences showed poor wire connecting techniques, resulting in wires pulling apart and corrosion at joins reducing electricity flow through the wire join.
- **Alberta Agriculture's Fencing with Electricity Agdex 724-6 order at [www.rtw.ca/b720](http://www.rtw.ca/b720)** is an excellent resource guide for erecting electric fence that work effectively.

***Tip** – gates left open for easy access to pastures also provide easy access for coyotes.*

## Comments on Permanent Fences

New fence construction should be a serious consideration when a producer has high, persistent predation, or when existing fences are being replaced, for the following reasons:

- It can be designed to deter all methods of crossing (i.e., through, over, and under fences, and at gateways).
- It eliminates the initial familiarity to coyotes that is present when existing fences are modified.
- Greater flexibility exists with new construction because existing fences are not incorporated.

There is wide variation in construction costs of new fence relative to geographic area, purchase quantities and amount of labour needed, and the cost is considerably higher than the cost of modifying existing fences. Modifications of existing fences, however, do not guarantee that predation will stop.

## Portable Electric Netting

Electric netting is being used successfully as predator deterrent fence for sheep. It comes in a number of designs and heights with built-in posts that are either single or double spiked. At least one company offers a "semi-permanent" design that is intended to be left in place for the entire grazing season.

**Electric netting offers the following advantages:**

- Portability enables it to be used in locations where no permanent fences exist (e.g., rented land, grazing crop land) while offering considerably more security than temporary fences made from electric string/poly wire.
- Easy and quick to erect. A single person can enclose a ten acre pasture using 16 nets in just over two hours.
- Mesh design of horizontal electric wires and vertical plastic stays/struts ensures no predator gets through the fence—they either have to jump it, or go under the bottom non-electrified strand.
- It is effective at keeping most coyotes away from sheep, most probably due to coyotes being leery of all things new. With electric netting, not only are the sheep moved to a new location, but the fence moves too. This frequent change may delay habituation to it, and therefore offer some degree of protection.

**Some of the challenges with electric netting:**

- It is relatively expensive and has a shorter life-span than permanent fences. Nets that are only used during summer months, and well-maintained, will last for up to 10 years. However, as the polywire ages, and wires become frayed and broken, the fence is less able to deliver high energy levels required to keep predators out.
- Entanglement most often leads to electrocution. Initial training to the fence is important. Manufacturers recommend not ever using the netting without it being connected to the energizer.
- Can be flattened with heavy wet snow and ice. In open, windy areas it can blow down. Deer can be a problem.
- Poor visibility, particularly as the colour fades with age in some styles of netting, makes them more difficult for animals, particularly young lambs, to see, thus increasing the risk of entanglement.
- There is a high labour requirement as nets are picked up, moved and re-installed multiple times over the grazing season.
- Recent reports of coyotes killing inside the nets with no apparent digging under and with good voltage levels suggest that some coyotes have learned to jump over them. Fence height of 34 inch (85cm) to 48 inch (120cm) is well below the recommended minimum to prevent coyotes from jumping over.

**Tips on using electric nets effectively**

- Knock down vegetation where nets are to go with ATV or tractor. Erect fence on the tire track.

- Do not leave slack in the fence as sagging nets lose power on vegetation, and provide opportunities for coyotes to jump where the net sags low between posts.
- Ensure the bottom string is taut when erecting the fence. It is simpler to achieve this when net is being put up in a relatively straight line. It is easiest is to use your foot against the bottom of post to pull the string tight before setting the picket.
- Ensure that electrified wires are not wrapped around spike of picket.
- Use your newest fences closest to the power source, as older fences with broken wires do not maintain voltage as well.
- Make a habit of checking the voltage level either daily or at least when nets are moved and re-installed.
- Visibility of faded nets can be increased by running two strips of poly tape the full length of the net.
- Visibility of fence is important for the animals you are trying to contain as well as those you want to keep out. White nets are easier to see against the green or yellowish backgrounds of pasture plants.
- Double spiked nets offer better stand ability in soils that are soft (e.g., water-saturated or cultivated) and in windy conditions.
- Nets with vertical struts sag less between posts than nets with vertical string or stays. (Fibreglass or step-in posts can be used to improve how the nets stand upright, particularly in windy areas).
- Moving ewes with very young lambs to new pasture can pose a very high risk of entanglement, as lambs run back to where they lost contact with their dam. Rather than force lambs through, remove (at least) one complete net between grazed and ungrazed area, and leave power turned off. Usually in a matter of a couple of hours, most ewes and lambs will have matched up and the fence can be erected and power reconnected.



*White nets are more visible to the sheep and predators alike.*

*Photo credit: A. O'Brien*

## Notes on Energizers

Along with good fence construction and adequate grounding systems, an electric fence is only as good as the energizer used to power it. For predator control, you need to be using energizers that deliver a big enough shock to discourage predators from going through the fence. Don't skimp on the energizer you buy. From a predation perspective, it is better to have an energizer that is bigger than needed for the job than one that is not going to do the job at all.

Most manufactures rate their energizers using voltage and joules. The joule rating is a better indicator of the effectiveness of the energizer than the voltage rating. Joules measure the total amount of energy released per pulse and so is a good indication of the shocking power of the energizer. The higher the joules, the greater the shock delivered. Doubling the joules will double the shock delivered by the fence. Some manufacturers also rate the energizers on stored joules, so be sure you are comparing like to like when evaluating which energizer to buy.

The minimum number of joules needed depends on the length of the fence, the number of electrified wires and the severity of conditions.<sup>38</sup> Pratt recommends an energizer with a rating of one joule for every six miles of wire you want to electrify. For example if you install four miles of fence with five of the nine wires electrified that is equivalent to 20 miles of electrified wire, therefore needing an energizer with a minimum rating of at least 3.3 joules. (20 miles @ 6 joules per mile = 3.3 joules). If there will be heavy vegetation pressure on the fence, then a higher joule rating should be considered.

Some present day energizers are designed to be used either with electricity or battery. They offer versatility for producers who use both battery and electricity based energizers.

## Fence Construction

Alberta Agriculture has an excellent fence construction manual - ***Fencing with Electricity*** **Agdex 724-6** order at [www.rtw.ca/b720](http://www.rtw.ca/b720) detailing the materials and procedures used to construct a proper livestock fence.

## Shed/Confinement Production

Some producers opt to forego pasturing their sheep entirely as a means of dealing with predation. Although very effective, the higher costs of confinement production require that producers also change flock management and the genetic make-up of their flock in order to produce enough marketable lambs to offset the added costs.

Producers need to factor in the following in their decision:

- Balance the cost of predation losses with the cost of confinement. On a purely economic comparison, one study reported that losses would have to be over 0.2 to 0.5 lambs per ewe to justify going total confinement.<sup>39</sup>
- For some producers there is also a high psychological cost with predation that cannot be quantified with economics.

- Confinement flocks must have prolific genetics (e.g., Romanov, Romanov crosses, Rideau, or Outouais Arcott) which also require intensive management to meet their genetic potential.
- Flock management must be top-notch to maintain flock productivity, minimize lamb mortality, and maximize conception rates and lamb growth rates while managing feed costs.
- Investment will be in high capital cost buildings and machinery rather than in predation control and pasture fencing and watering systems.
- In any flock health management program the focus will shift to managing diseases that have the opportunity to spread through close animal proximity in confinement operations: mastitis, pneumonias, coccidiosis, caseous lymphadenitis, etc.
- Additionally, there are risks in higher investment operations. How well can you weather low lamb prices with this system? It becomes critical to know the costs in producing every marketable lamb!

## Confinement Lambing

Delaying turn-out until lambs are older may lower the risk of predation by some predators but not all, and comes with increased production costs of feed, health and extra labour, and often times only delays when predation starts.

Some producers have taken confinement, corral, or lot lambing one step further in that ewes and lambs remain in corrals until weaning. Lambs are kept in the corrals and fed until marketing, with only the ewe flock going out to pasture.

Accurate tracking of lamb mortality and what percent is due to predation, along with a partial budget, will help determine whether the risk to predation loss outweighs the extra production costs.

## Night Confinement

Night penning can be an effective method of preventing predation, depending on the predator, and if portable, how long the corral remains in one location. It is more suitable to small operations, small- to medium-sized flocks that can be moved more easily. It is also more suitable for dry ewes than it is for ewes and lambs. Night corralling of large flocks is used as one way to reduce predation in vegetation management in British Columbia forestry blocks. However, with larger flocks, unless night corrals are moved regularly, corralling sheep nightly can lead to localized damage in range situations.<sup>40</sup>

Night penning can increase disease and parasite transmission and stress, reduce growth rates, and in some instances increase mortality rates (e.g., mismothering of newborn lambs) of the livestock.

Effectiveness of night penning may also only be short-term, in particular with coyotes. A specific example: on one particular farm where coyote predation was particularly heavy, night penning of the sheep flock was initiated in an effort to reduce losses. A corral large enough to hold 1200 ewes and their lambs was built, using electrified wire. Ewes and lambs were herded into the pen in late afternoon and early evening, and turned out very early in the mornings. Predation was effectively stopped. Within ten days the producer was finding lambs killed during the late afternoon, just prior to the time when the flock was brought into the night pen.<sup>41</sup>

Predation can also occur in night corrals, as coyotes are opportunists, and routinely confined sheep may be easier prey.

In order to minimize predation, the same principles used in erecting coyote deterrent perimeter fences need to be used in the design and construction of night corrals—make it difficult for coyotes to go under, through or over the fence.

## Consider Leaving Resident Predators Undisturbed

There may be merit in leaving predators (e.g., coyotes) alone if they are not killing your sheep, especially those that are territorial. As long as they maintain their territory, and don't start preying on the sheep, their presence can discourage other "sheep-eating" coyotes from establishing in the area. Recognize that it is likely the resident pack will eventually kill sheep, as was observed by Blejwas et al (2002).

## Other Deterrents that Provide Short-term Protection

A number of techniques can stop predation but their effectiveness is short lived. These include fladry, lights, noise, light and noise combinations, and scare-crows. Generally the effectiveness of these techniques lasts less than 60 days, with some being effective for considerably shorter periods.

Most of these deterrents rely on the predator's innate fear (**neophobia**) of all things new (novel) in their environment, and produce a flight or startle response that disrupts predatory behaviour.<sup>42</sup> Unfortunately, over time predators do habituate to these deterrents, with time to habituation varying by predator species as well as by individual predator.

Situations when a producer may want to use a prevention technique, knowing that it only offers protection for a short period of time, include:

- immediately after a predation event,
- in a pasture known to be consistently high risk for predation, or
- during times when highly vulnerable groups such as ewes lambing on pasture, or newly weaned lambs, are present.

**Neophobia** – the fear of novelty and tendency to avoid or retreat from an unfamiliar object or situation. Neophobia is typified by hesitation, avoidance, or caution.

**Habituation** – when a predator has overcome its fear of the novel object placed in its environment.

## Fladry

Fladry is basically flags hanging from a rope that is stretched at a short distance (mostly 50 centimetres) above the ground. It was used in Eastern Europe to “funnel” wolves to areas where they could be captured or killed. For the purposes of protecting sheep from predation, fladry is erected around the pasture (or farm) being protected

Effectiveness of fladry appears to last up to 60 days with wolves. It shows little effectiveness against coyotes.

Cost and labour required for regular maintenance are the two largest limiting factors for wide-spread use of fladry. Protection of smaller pastures or highly valued animals may justify the cost.

Studies over the past ten plus years have evaluated the effectiveness of this old-world technique. Fladry barriers were used to effectively keep wolves out of cattle wintering yards in Alberta, and stopped predation for up to 60 days.<sup>43</sup> More recently, field trials over two grazing seasons in Michigan showed fladry to be effective at keeping wolves out of pastures, but it had no significant effect on coyotes.<sup>44</sup> Wolves only crossed the fladry barrier twice, once when calves had escaped from the pasture and knocked down the fladry and once when the fladry at a gate crossing was not reconnected. Coyotes crossed the fladry 47 days after it was first installed.

Under controlled conditions, Lance et al, (2010) found that electrified fladry (flags hung from electrified wire instead of rope) was two to 10 times more effective than regular fladry. Under field conditions, although the electrified fladry kept wolves out of test pastures, failures (electrified system stopped working) occurred 18 times over 394 day test period, indicating the necessity of regular monitoring and maintenance of fladry.

Davidson-Nelson and Gehring’s (2010) also tracked labour requirements and material costs.

	Per km per year <sup>1</sup>	Materials needed for a ½ section (4.8 km)	Cost of Fladry for ½ section (4.8 km) with labour @ \$10/hr
Setup time	8.5 hours	40.8 hrs	\$ 408
Maintenance time	1.6 hours /week	7.7 hrs/wk	
(107.5 hrs/14 wk)	\$1075		
Cost of fladry "	\$ 588	\$2822.20	\$2822.20
(est. 3 yr lifespan)			
Rebar posts	\$ 40	\$ 192	\$ 192
(est. 6 yr lifespan)			
insulators	\$ 40	\$ 192	\$ 192
<b>TOTAL COST</b>			<b>\$4689.20</b>

<sup>1</sup>Labour requirements and material costs are taken from (Davidson-Nelson and Gehring 2010)

Based on their figures, the table above shows the relative costs of using fladry to protect a half-section (320 acres) pasture. The cost of fladry alone would purchase 50% of the wire needed



*Fladry being evaluated on Ontario sheep farm. Photo Credit: Kaiti Nixon.*



to erect a nine-wire electric fence or 34% of the wire needed to erect a high tensile woven wire coyote fence.<sup>45</sup>

Predation losses would have to be very significant to justify the cost and maintenance of fladry barrier.

If fladry is to be used, it is important that it be carefully constructed (or purchased).

- Plastic flags 10 centimetres wide by 50 centimetres long are securely attached to a rope at 50 cm intervals. They should not be able to slide back and forth on the rope.
- The rope is suspended 50 cm above ground level.
- The rope is supported with posts at 30 metre intervals.
- Fladry can be erected outside an existing fence or on an existing fence as long as the flags are able to flap freely and not become entangled or torn from the rope.
- Electric fladry was made using electric rope-style wire such as that used for horse pastures or heavy duty polywire.

## Noise, Lights and Combination Light Strobes

**Sound** can be used to frighten or startle a predator and limit access to an area. Radios playing loudly at night have long been used in an attempt to keep coyotes away from pasture areas or night pens. Unfortunately their effective duration time is only a matter of days.<sup>46</sup> More recently, recordings of distress calls have been used, more often to deter birds rather than carnivores. Combining the birds' distress calls with that of their natural predator can keep them out of an area and help to delay habituation, compared to using their distress calls on their own. This technology is used to reduce bird problems at airports, and has also been used to effectively keep ravens off power transformers in Alaska.

Several products currently being marketed use **intermittent flashing light** (that turn on at dusk and turn off at sunrise) as a deterrent (e.g., Foxlights®, Nite Guard®). Although they are relatively low cost, their effectiveness is limited, as they only function during night hours, and do not provide protection during daylight hours. Recent field trials in Ontario were unable to demonstrate effectiveness of either device for preventing coyote predation on sheep. There was no difference in predation between protected pastures and unprotected pastures, whether these devices were used alone, or in combination with fladry.<sup>47</sup>

Devices that use randomly activated combinations of **noise and light** (e.g., Electronic Guard) provided longer period of effectiveness compared to either on its own. In a trial using the Electronic Guard, it took 91 days before coyotes habituated to them.<sup>48</sup> When multiple units were used, and their locations altered, they provided significant protection (8–103 days) to sheep from coyotes. The area protected was comparatively small, and recommendations were to use two Electronic guards per small pasture or one per 10 acres in larger pastures.<sup>49</sup> The Electronic Guard was developed and sold by U.S Wildlife Services. Unfortunately, it is no longer manufactured. A similar

device manufactured in Canada (Phoenix Wailer, Phoenix Agritech) showed some promise when trialed on sheep farms experiencing predation in Ontario during the mid to late 1990s.<sup>50</sup> Its relatively small protection zone limits its use to small to mid-sized flocks, or where the sheep are managed as one unit and intensively pastured in small paddocks (under nine hectares (22 acres)).

These devices might work better if their activation were triggered by predator behaviour instead of randomly. When a device fires randomly, coyotes may learn that activation has nothing to do with them. If the device activates only when the coyote approaches a particular pasture or engages in a certain behaviour, the coyote is more likely to associate activation of the device with its own action.<sup>51</sup>

Probably the largest disadvantage with these combination devices is that the noise and lights can annoy your neighbours, and their dogs, and your dogs as well.

## Scare Crows

One of the most ancient of primary repellents is the scare crow. Scarecrows were used to effectively keep eagles out of sheep pastures for up to three weeks.<sup>52</sup> Several sheep producers have also used scarecrows and claim they can deter coyotes, at least for short periods of time.<sup>53</sup> One Ontario producer has had success using scarecrows to effectively stop heavy coyote predation—he has erected eight in his 25 acre sheep pasture.<sup>54</sup>

Their effectiveness can be increased by using chicken wire, or hinges to join the 2x4 arms and legs so that they swing freely in the breeze.

Another suggestion is to connect the moving parts of the scarecrow to small 12 volt motors such as those used to operate car windscreen wipers, so that your scarecrow can move automatically. Periodically moving the scarecrows to other locations in the pasture may help to delay habituation.

Shivik (2004) notes that this concept can be extended to almost anything out of the ordinary that is placed in a pasture or area and startles or frightens predators away. Some producers have left yard lights on over a night pen, or a vehicle parked in the pasture, to discourage predation attempts. Other producers have relied on hanging aluminum pie plates and obsolete CD discs



*Scarecrows can help keep coyotes out of sheep pastures  
Photo Credit: Dennis Yellowlees*

from fence and trees, which move freely in a breeze, to discourage coyotes from entering sheep pastures.

## Bells on Sheep Collars

Placing bells on a number of sheep has also been claimed to deter predators. Their effectiveness has not been evaluated in controlled field trials however. If they work, their effectiveness will likely be short-term as predators become used to the ringing. Bells with a loud ringing tone (e.g., Swiss sheep bells) do alert the producer to unusual activity in the flock.

## Comments on Using Short-term Deterrents

Although predators quickly become habituated<sup>55</sup> to these “passive disruptive stimuli” they can provide short term relief from predation until other longer term solutions are found and put in place.

Several tactics can be used to increase their effectiveness:

**Delay habituation.** Moving the deterring device periodically and randomly may slow the habituation process.

**Match device effectiveness with protection time needed.** If protection is needed for more than a couple of days, then radio or lights on their own are just not going to cut it.

**Limit their use to specific time periods.** Habituation occurs the longer the predator is exposed to the device. If short-term protection is needed for only two weeks after weaning, then prompt removal and storage of the device until it is needed again should extend its usefulness.

**Recognize their effective coverage limitations.** Many of these devices are more effective at protecting smaller areas than they are at larger areas. Expect failures wherever you push their limits.

**Recognize their effectiveness varies with predator species.** Fladry provides a longer period of protection against wolves than it does against coyotes, and has no apparent effect against black bears.

## Deterrents that Offer Little or No Protection

### Conditioned Taste Aversion

Probably one of the most widely recognized taste aversion examples was the work using lithium chloride (LiCl) laced lamb meat baits to induce illness in coyotes that ate them. The working principle was that coyotes would associate the illness with the lamb meat and therefore avoid killing sheep and lambs. A number of trials were done in Saskatchewan<sup>56</sup> that showed promise. Other trials, however, were not able to demonstrate any effectiveness in preventing coyote predation (Burn and Connolly 1980) including one in Alberta which used LiCl laced baits. The Saskatchewan government initiated a program whereby baits were provided to producers at no cost. However, in an evaluation of the program 15 years after it was initiated, Conover (1994) found that produ-

cers were not using the program and postulated that if it were effective, producer participation would not have declined.

Conditioned taste aversion is excellent for deterring eating behaviours, but is not especially effective at modifying killing behaviours. A strong aversion to tainted meat baits does not necessarily translate to a strong aversion to killing live prey.<sup>58</sup>

## Plastic (King) Collars

Another example of a deterrent not proving effective at stopping predation is plastic collars. Plastic collars were patented in 1998 in South Africa as a control device for stopping jackal and lynx predation of sheep. The collars cover the prey animal's cheek and underside of the neck. The collar prevents predation by predators that attack the throat (which most do) by denying them access (Award for Eastern Cape sheep collar 2002) It has proven to protect the throat area, but eventually predators tend to return to killing, by attacking other areas of the body rather than the neck.<sup>59</sup>

## Other Non-lethal Tools

### Game Cameras

When predation occurs, it is sometimes difficult to determine which predator is involved. In other instances, you may want to determine whether the damage is caused by adults or pups, or monitor coyote activity at trap sets. Strategically placed game cameras can be useful for these purposes. Realize that you cannot expect to capture images of the predation kill itself, but you most likely will capture images of the predator entering or leaving the area of the kill.

Game cameras are activated by movement, work 24/7 as long as batteries have sufficient charge, and are becoming cheaper while also becoming more advanced. Many are now equipped with "black light" flashes so wildlife is not startled when the camera is activated. Researchers in Calgary parks are using cameras to monitor coyote traps, to ensure quick response times to apply radio-collars and prompt release of the coyotes.<sup>60</sup>

Probably the biggest challenge in using cameras successfully in predation management will be identifying the best location(s) to set up the camera.

#### **Tips on using game cameras effectively**

- Select camera locations to monitor predators where there is evidence of regular entry to the pasture or monitored area.
- Clear limbs and small brush that may activate camera during windy conditions. The only thing triggering the camera should be the predator.
- Locate so that sheep are not triggering the camera too often.
- Minimize visits to check for pictures—human activity and scent will discourage visits by predators.

- Consider models that enable remote downloading of photos to keep disturbances to a minimum.
- Setting up more than one camera location will increase the odds of capturing images of the predators.

## References in this Chapter

References, pertaining to the endnotes listed below, can be found on page 65.

1. Gese, Ruff and Crabtree 1996a
2. Gese, Ruff and Crabtree 1996b
3. Alberta Lamb Producers 2012
4. Canadian Sheep Federation 2010
5. Nixon 2013
6. Coppinger and Coppinger 2001
7. Coppinger and Coppinger 2001
8. Green and Woodruff, Livestock Guarding Dogs - Protecting Sheep from Predators 1999
9. Green and Woodruff, Livestock Guarding Dogs - Protecting Sheep from Predators 1999
10. Urbigit and Urbigit 2010
11. Green and Woodruff 1988
12. Green and Woodruff 1988
13. Green and Woodruff 1988
14. Green and Woodruff 1999
15. Coppinger and Coppinger 2001
16. Green and Woodruff 1999
17. Green and Woodruff 1999
18. Green and Woodruff 1999
19. Green, Woodruff and Andelt 1994
20. Green and Woodruff 1999
21. Wenger 2005
22. Green 1989
23. Green 1989
24. J. Bourne 1994
25. Green 1989
26. Walton and Field 1989
27. Walton and Field 1989
28. Franklin and Powell 1994
29. Schoenian No Date
30. Franklin and Powell 2006
31. Hulet, et al. 1987
32. O'Brien 2011
33. Thompson 1979
34. Gates, et al. 1978
35. Dorrence and Bourne 1980
36. Acorn and Dorrence 1994
37. Gates, et al. 1978
38. Pratt 1991
39. McAdoo and Glimp 2000
40. J. Shivik 2004
41. Kennedy personal communications
42. J. Shivik 2006
43. Musiani, et al. 2003
44. Davidson-Nelson and Gehring 2010
45. A. B. O'Brien 2012
46. J. Shivik 2006
47. Nixon 2013
48. Linhart, et al. 1984
49. J. Shivik 2004
50. Martin and O'Brien unpublished
51. Mitchell, Jaeger and Barrett 2004
52. O'Gara 1994
53. Bryson 2008
54. Pascual 2012
55. J. Shivik 2004
56. Gustavson, et al. 1974
57. Burn and Connolly 1980
58. J. Shivik 2004
59. J. Shivik 2004
60. Kessler 2013

## 5. Removal Options for Problem Predators

When preventative measures fail, and predation cannot be stopped, lethal control measures most often need to be implemented. The following is a summary of those most effective at removing problem coyotes. In Alberta, some of these tools are only available through the Coyote Predation Management Program.

### Livestock Protection Collar (Toxic Neck Collar)

This is the most selective tool for targeting coyotes that are killing sheep or lambs. Only coyotes attacking collared sheep and lambs are killed. It is also considered the safest way to use poisons for coyote control and most useful when other lethal control methods are inappropriate or ineffective.<sup>2</sup>

It works by exploiting the coyote's habit of killing sheep and older lambs with a bite to the throat area.

The livestock protection collar comes in two sizes, one for adult sheep and the other for smaller sheep and lambs less than 22 kilograms (50 pounds).<sup>3</sup> Each collar consists of two rubber reservoirs firmly attached to two Velcro straps. Each bladder contains a solution of water and Compound 1080. The collar is fitted to the sheep so that the rubber reservoirs are on each side of the throat. The Velcro straps are secured over the top of the head, one in front of the ears and the other behind the ears to ensure the reservoirs stay approximately close to the point of the jaw. Usually a small group of sheep are collared and placed in the pasture where killing occurred, with the rest of the flock pastured elsewhere. If lambs and ewes are still pastured together, usually only lambs are collared, relying on most coyotes' preference to kill lambs over adult sheep.

### Advantages of Livestock Protection Collars

- Selective, only killing coyotes that attack collared sheep and lambs.
- The risk to non-target species is extremely low.<sup>4</sup>
- Compound 1080 (sodium monofluoroacetate) is most toxic to canines, with primates and birds being least sensitive.<sup>5</sup>
- Low risk of secondary poisoning (feeding off of the coyote carcass) since sodium monofluoroacetate does not accumulate in tissues at toxicologically significant level.<sup>6</sup>

**Tip** – the purpose of the Coyote Predation Management Program is to inform and assist landholders in managing coyote predation of their livestock. It is administered through a joint co-operative agreement between Alberta Agriculture and Development (ARD) and participating rural municipalities, with ARD supervising the program provincially and the municipality delivering the program within their jurisdiction.<sup>1</sup> For full details of the program and how it is delivered in your municipality, contact your Agricultural Services Board.

Use of toxic collars is more involved and has more disadvantages than other lethal control measures. In Alberta, they are generally used only where other lethal control measures have failed or are inappropriate for the situation.

## Disadvantages of Livestock Protection Collars

- Loss of collared animals that are attacked. Compound 1080 does not immediately kill the coyote, so most attacked animals are usually killed.
- Extra labour to capture, collar, monitor and manage the target flock.
- Extra management where the main flock is separated from the collared animals.
- Work best where coyotes kill regularly.
- Only effective on coyotes that attack the throat during attacks. Not effective with other killing styles.
- Guardian dogs must be removed from collared sheep to prevent accidental poisoning and also to encourage coyotes to attack.

Because Livestock Protection Collars contain a poison, their use is strictly regulated. People using poisons for coyote control must be trained, able to demonstrate responsible use of the poison and agree to use the poison in strict accordance with the regulations.

The use of poison to kill wildlife is extremely controversial and under close scrutiny by the Federal government. The continued availability of poisons highly depends upon the safe and responsible use of these valuable tools for livestock predation management.<sup>7</sup>

Livestock Protection Collars are only available for use through the Coyote Predation Management Program.<sup>8</sup>

## Shooting (Using Coyote Calls)

Shooting predating coyotes is probably next in line when ranked according to selectivity in targeting problem coyotes. Hunting over the carcass of a freshly killed sheep, or in a pasture where predation has occurred, assumes that any coyote returning is the one responsible for the killing. We know that the adult breeding pair are most often the coyotes preying on sheep and therefore should be targeted to stop predation.

The probability of successfully removing the coyote doing the killing can be increased by using a coyote call. Coyote calling can elicit an approach response from the alpha pair and in particular the alpha male,<sup>9</sup> especially during the first half of the year (breeding and whelping season). Approach response was higher for group howl playbacks and human vocalizations than for solo howl playbacks.<sup>10</sup>

Alberta Regulations allow landowners (residents only) to take immediate action to control some problem wildlife, including wolves and coyotes.

**Wolves** may be hunted (but not trapped) without a license during all seasons of the year as follows:

- a.** on privately owned land by the owner or occupant of the land, or by a resident with permission from the owner or occupant;
- b.** on public land by a person authorized to keep livestock on that land, or by a resident who has written permission from that authorized person.

The above authorities to hunt wolves extend to lands within eight kilometres (five miles) of the land described above, provided the authorized person or resident has right of access.

**Coyotes** may be hunted (but not trapped), without a license, at all times of the year throughout the province:

- a.** by a resident who has right of access to hunt on lands that are not public lands within the Green Area;
- b.** by the owner or occupant of privately owned land, on the privately owned land;
- c.** by a person maintain livestock on public land, on that public land; or
- d.** \*on lands described in c) that are in the Green Area, by a resident who is authorized in writing by the person described.  
\*these pelts must be salvaged.

Contact your district Fish and Wildlife office to confirm whether a damage control license may be necessary for other problem wildlife. A listing of area office contact numbers is included on page 55 in the Resource section.

## Challenges with Shooting as a Removal Tool

- Requires a significant investment of time if it is to be successful, particularly if there is a long interval between attempted predation events.
- Hunter is usually not attending the flock 24/7, resulting in missed opportunities to kill the problem coyote as well as the likelihood of repeat kills until the coyote is successfully removed.
- Hunter must have the experience and skill to not only shoot the coyote, but do so humanely.

## Neck Snares

Neck snare are a very effective tool in targeting problem coyotes, particularly where coyotes have dug under or crawled through a fence (look for hairs caught in fence) to access the pasture. In these instances, coyotes can be taken by setting the snare so that the coyote must (attempt to) go through it to gain entry into the pasture.

Neck snares are fairly easy to learn how to use, are relatively inexpensive, and are effective 24/7. They are considered harmless to birds, but can capture deer, other wildlife and farm animals if not set properly. It is important that livestock guarding dogs that cannot be tied are removed from the pasture where snares are placed. Snares that are checked daily pose less risk to dogs that are



used to being tied as they don't fight the snare and are usually released with no harm. Chance of catching non-target animals is increased when snares are set on game trails, so this should be avoided.<sup>11</sup>

Neck snares are available for use for coyote control in Alberta under permit and are one of the tools available through the Coyote Predation Management Program administered by your local Agricultural Services Board. Snares are individually numbered, marked for accountability and must be used under standards provided by Regulatory Services Division (RSD) of Alberta Agriculture and Rural Development.<sup>12</sup>

## Trapping

Compared to neck snares, foothold (restraining) traps require slightly more training and a higher skill level to use effectively, but are an effective tool in targeted removal of problem coyotes. They also require a bigger up-front financial investment, but function for years as long as they are well maintained.

It is not the intent of the author to provide an instructional guide to coyote trapping, but rather to outline the basic components, to give some appreciation to what is involved. Many books have been written, videos made, and instructional courses offered on coyote trapping and effective trap sets for the producers interested in doing their own coyote trapping.

Both the dirt-hole set and flat set are commonly used for coyotes. The dirt-hole set is intended to mimic the burrow of a ground rodent (e.g., prairie dog or ground squirrel). Flat sets are either used as a scent station—where the intended primary focus is for the coyote to attempt to mark (urinate) the station, thereby stepping into the trap set where his weight-bearing foot lands, or a trail set—where the trap is set in a livestock or wildlife trail bed.

Lures (food and gland) and scents (including coyote urine) are important components of successful coyote trapping.

As with snaring, traps generally work 24/7.

In order to trap in Alberta, even on your own land, you must obtain a Resident Fur Management License. Contact your district Fish and Wildlife office as to what is entailed.

Trapping regulations dictate the type and size of traps that can be used. As well, Canada is a signatory to the Agreement on International Humane Trapping Standards (AIHTS). The intent is that eventually all traps will be required to meet these standards in order to be used. A number of coyote traps have undergone testing and have been certified as meeting the AIHTS standards. Certified status of traps is published annually in *Alberta Guide to Trapping Regulations* and can also be found on the Fur Institute of Canada website [www.fur.ca](http://www.fur.ca).

## M-44s

The M-44 is a mechanical device designed to eject sodium cyanide powder into the mouth and throat of a coyote. The M-44 device is positioned in the ground and fitted with a baited cyanide cartridge. When a coyote bites and pulls on the cartridge, an ejector on the M-44 propels cyanide powder into the coyote's mouth and throat, and the coyote is killed quickly.

Sodium cyanide reacts with carbon dioxide or acids to form hydrogen cyanide gas, which is extremely toxic. Hydrogen cyanide is produced when the animal ingests sodium cyanide and it prevents cells of the body from using oxygen. Unconsciousness occurs quickly, followed by convulsions and death within five minutes.<sup>13</sup>

Some of the same techniques used to set foothold traps are employed to set M-44s with respect to placement of device to improve the likelihood of a coyote finding it, and the use of lure to attract coyotes to the M-44 device and to elicit a biting response.

Because M-44s contain a poison, their use is strictly regulated. People using poisons for coyote control must be trained, able to demonstrate responsible use of the poison and agree to use the poison in strict accordance with the regulations.

The use of poison to kill wildlife is extremely controversial and under close scrutiny by the Federal government. The continued availability of poisons highly depends upon the safe and responsible use of these valuable tools for livestock predation management.<sup>14</sup>

The use of the M-44 device is authorized by the Alberta Agricultural Pest Act. The sodium cyanide used in M-44s is registered under the federal Pest Control Products Act. M-44 devices must be used in accordance with the PCP label for sodium cyanide.<sup>15</sup>

M-44 devices are only available through the Coyote Predation Management Program.<sup>16</sup>

## References in this Chapter

References, pertaining to the endnotes listed below, can be found on page 65.

1. Alberta RSD. 2010
2. Alberta RSD. 2010
3. USDA 2010
4. USDA 2010
5. USDA 2010
6. USDA 2010
7. Alberta RSD. 2010
8. Alberta RSD. 2010
9. Mitchell 2004
10. Mitchell 2004
11. Alberta RSD. 2010
12. Alberta RSD. 2010
13. Alberta RSD. 2010
14. Alberta RSD. 2010
15. Alberta RSD. 2010
16. Alberta RSD. 2010

## 6. Managing Mortalities

Under Alberta's Destruction and Disposal of Dead Animals Regulation of the Animal Health Act, Appendix A, the owner of a dead animal shall dispose of the animal within 48 hours of its death. Mortalities can be composted, incinerated, buried, rendered, or naturally disposed.

Today, animal agriculture is challenged to discover innovative ways to dispose of livestock mortalities. It is a particular problem for small acreage flocks where close proximity to neighbours means the dead livestock must be dealt with quickly. Natural disposal is coming under scrutiny by both the cattle and lamb sectors. In isolated areas for operations with a large land base it is less of an issue for the neighbours and more of an issue of bringing in unwanted predators.

Prompt removal of deadstock ensures predators are not artificially attracted to staying in your locale. As well, it plays a significant role in breaking the *Taenia ovis* / *C. ovis* parasite cycle. If dogs and coyotes do not have access to infected sheep carcasses, they do not become infected with the canine tapeworm, and therefore no longer perpetuate the economic losses this disease causes to the sheep industry each year. (See [www.ablamb.ca](http://www.ablamb.ca), SheepSmart series: "C. ovis fact sheet.")

## 7. Resources

### Contacts and Information

#### Agricultural Service Boards Homepage

[www.agriculture.alberta.ca/asb](http://www.agriculture.alberta.ca/asb)

#### Association of Alberta Agricultural Fieldmen Website

[www.aaaf.ab.ca](http://www.aaaf.ab.ca)

Contact information for Agricultural Fieldmen can be found under the Directory tab, by clicking on Complete AAAF Members Directory link.

#### Fish and Wildlife Area Offices Contacts

##### Information Centre

##### Alberta Environment and Sustainable Resource Development

Main Floor, Great West Life Building  
9920 - 108 Street  
Edmonton, Alberta, Canada T5K 2M4

##### Hours of Operation:

8:15 a.m. - 4:30 p.m. Monday - Friday  
Closed: Weekends and Statutory Holidays

**Call Toll Free Alberta:** 310-ESRD (3773)

Toll Free: 1-877-944-0313

**Fax:** 1-780 427-4407

**Email:** [ESRD.Info-Centre@gov.ab.ca](mailto:ESRD.Info-Centre@gov.ab.ca)

##### Call Toll free in Alberta - Dial 310-0000

These services allow you to access the province-wide toll free service without paying long distance or airtime charges. Dial 310-0000, prior to the area code and telephone number.

Office Location	Telephone Number		
Athabasca	780-675-2419	Cardston	403-653-5158
Barrhead	780-674-8236	Claresholm	403-625-1450
Blairmore	403-562-3289	Cochrane	403-932-2388
Bonnyville	780-826-3142	Cold Lake	780-594-7876
Brooks	403-362-1232	Coronation	403-578-3223
Calgary	403-297-6423	Drayton Valley	780-542-6616
Camrose	780-679-1225	Drumheller	403-823-1670
Canmore	403-678-2373	Edmonton	780-427-3574

Edson	780-723-8244	Peace River	780-624-6405
Evansburg	780-727-3635	Pincher Creek	403-627-1116
Fairview	780-835-2737	Ponoka	403-783-7093
Foremost	403-867-3826	Provost	780-753-2433
Fort McMurray	780-743-7200	Red Deer	403-340-5142
Fort Vermillion	780-927-4488	Red Earth	780-649-3853
Fox Creek	780-622-3421	Rocky Mountain House	403-845-8230
Grande Cache	780-827-3356	Slave Lake	780-849-7123
Grande Prairie	780-538-5265	Smoky Lake	780-656-3556
Hanna	403-854-5540	Spirit River	780-864-4101
High Level	780-926-2238	Stettler	403-742-7510
High Prairie	780-523-6521	St. Paul	780-645-6313
High River	403-652-8330	Stony Plain / Spruce Grove	780-960-8190
Hinton	780-865-8264	Strathmore	403-934-3422
Lac La Biche	780-623-5247	Sundre	403-638-3805
Lethbridge	403-381-5266	Swan Hills	780-333-2229
Lloydminster	780-871-6495	Valleyview	780-524-3605
Manning	780-836-3065	Vegreville	780-632-5410
Medicine Hat	403-529-3680	Vermilion	780-853-8137
Nordegg	403-721-3965	Vulcan	403-485-6971
Oyen	403-664-3614	Wetaskiwin	780-361-1250
Olds	403-556-4215	Whitecourt	780-778-7112

<http://esrd.alberta.ca/about-esrd/contact-esrd/fish-and-wildlife-area-office-contacts.aspx>

## Coyote Predation of Livestock Agdex 684-19

order at [www.rtw.ca/b681](http://www.rtw.ca/b681)

## Fencing with Electricity Agdex 724-6

order at [www.rtw.ca/b720](http://www.rtw.ca/b720)

## Methods of Investigating Predation of Livestock Agdex 684-14

order at [www.rtw.ca/b680](http://www.rtw.ca/b680)

## Rancher's Guide to Predator Attacks

Available through your nearest Fish and Wildlife office of Alberta Sustainable Environment and Resource Development.

## Wildlife Predator Compensation

### Wildlife Act Regulation 143/1993 up to and including Regulation 69/2014

**14(1)** A person whose livestock is killed or injured through predation by wolves, grizzly bears, black bears, cougars or eagles may claim from the Minister wildlife predator compensation for the death of or injury to the livestock.

**(2)** A claim under subsection (1) respecting an injured livestock animal is to consist only of fees paid for the medical treatment of the injured animal.

**(3)** The claimant must,

- (a) within three days of learning of the death of or injury to the livestock, report the death or injury to the Service, and
- (b) apply to the Minister for the compensation on a form provided by the Minister.

**(4)** A person may claim compensation for livestock whose death is confirmed as probably resulting from predation described in subsection (1) if

- (a) the livestock is confirmed as probably having died within 90 days of a confirmed death of or injury to other livestock that has been attributed to such predation, and
- (b) the location where the first-mentioned dead livestock was discovered is not more than 10 kilometres from the location of that confirmed death or injury.

**(5)** An investigation of the death of or injury to livestock for which an application for wildlife predator compensation is made may be conducted by an appointed officer, a veterinarian or, if such an officer is not readily available, a problem wildlife specialist employed by the Department of Agriculture and Rural Development.

AR 143/97 s14;172/98;35/2007;68/2008

### Compensation Committee

**15 (1)** The Minister shall ensure that a committee exists to determine the amount of shot livestock and wildlife predator compensation payable.

**(2)** The compensation committee shall perform its functions in accordance with this Part.

**(3)** The Minister shall determine whether an application is eligible to be considered as

- (a) A confirmed death of or injury to livestock in the circumstances described in section 13(1), for the purposes of shot livestock compensation, or
- (b) A confirmed death of or injury to livestock resulting, or a death probably resulting, from predation described in section 14(1), for the purposes of wildlife predator compensation.

**(4)** The compensation committee shall determine the value of a livestock animal based on the commercial market value of the class of livestock to which it belongs.

- (5)** The maximum amount of compensation payable for an animal whose value has been determined under subsection (4) is,
- (a) For shot livestock compensation for dead livestock, 100% of the value of the animal to a maximum, in the case of a horse, of \$2000, and
  - (b) For wildlife predator compensation for dead livestock, 100% of the value of the animal for a confirmed death and 50% of the value of an animal whose death has been determined to be the probable result of predation.
- (6)** The maximum amount of shot livestock or wildlife predator compensation payable to the owner of livestock for the medical treatment of an injured livestock animal is not to exceed the lesser of
- (a) The amount paid by the applicant for the veterinarian's bills and drugs and medication for the injured animal, and
  - (b) The maximum amount that could have been payable under subsection (5)(a) or (b) if the injured animal had died.

AR 143/97 s15;105/2002

## Compensation Generally

- 16 (1)** The Minister shall consider a claim for compensation in accordance with this Part and may accept or reject the claim.
- (2)** The amount of compensation to be paid for a claim respecting veterinary fees is to be determined by the compensation committee.
- (3)** If an injured livestock animal dies after receiving medical treatment, the amount of compensation payable for the dead animal is to be reduced by the amount paid under any claim for that medical treatment.
- (4)** The amount of compensation payable under this section is to be reduced by the amount or value realized by an applicant on a sale or salvage of the dead or injured livestock animal or any part of the animal.
- (5)** The Minister shall notify the claimant of the result of a decision under subsection (1).
- (6)** A decision made by the Minister under subsection (1) is final.

## Coyote Predation Management Program

The purpose of the Coyote Predation Management Program is to inform and assist landholders in managing coyote predation of their livestock. It is administered through a joint co-operative agreement between Alberta Agriculture and Development (ARD) and participating rural municipalities, with ARD supervising the program provincially and the municipality delivering the program within their jurisdiction (Alberta RSD. 2010).

Included in the written municipal policy on coyote predation management will be the list of coyote control materials and devices approved by council (or Agricultural Service Boards [ASB]) for use within their jurisdiction for the purposes of the program.

Municipal personnel are trained and authorized by ARD as inspectors under the Alberta Agricultural Pests Act (APA) to carry out the CPMP.

Authorized municipal inspectors respond to landholder complaints of coyote predation and provide advice and, where needed, direct assistance to landholders in managing coyote predation on their property.

## **Agricultural Pests Act (Alberta)**

Management of coyote predation on livestock is regulated, in part, by the Agricultural Pests Act (APA) and the Pest and Nuisance Control Regulations (406/86); pertinent sections are included below. The regulation declares the coyote to be 'nuisance' which allows authorized municipal inspectors to set out or issue coyote control devices and materials to landholders at the discretion of municipal policy and in accordance with provincial and federal legislation. Authority is also granted under the regulations to permit landholders to use coyote control materials issued to them by an authorized inspector to control coyotes.

In addition, the Pest and Nuisance Control Regulations of the APA allow a landholder and others authorized by him, to destroy coyotes on land which the landholder owns or controls by:

- Shooting coyotes
- Destroying coyote dens
- Using of authorized poisons under the requirement of the APA and Pest Control Products
- Act Canada (PCP Act) (mentioned above)
- Using ARD approved neck snares in compliance with the APA.

ARD does not use or supply leg-hold traps for coyote predation management. Landholders who wish to trap coyotes or authorize someone else to trap coyotes on their property should inquire at the local Fish and Wildlife office for further information.

For full details of the Coyote Predation Management Program and how it is delivered in your municipality, contact your Agricultural Services Board. Not all municipalities participate in the Coyote Predation Management Program.

[http://www1.agric.gov.ab.ca/general/progserv.nsf/all/pgmsrv403/\\$FILE/manual-study-guide.pdf](http://www1.agric.gov.ab.ca/general/progserv.nsf/all/pgmsrv403/$FILE/manual-study-guide.pdf)



# AGRICULTURAL PESTS ACT © Alberta Queen's Printer, 2010

Current as of November 1, 2010

## Duty of Individual

**5 (1)** An owner or occupant of land may prevent the establishment of, control or destroy a nuisance on land the owner owns or occupier occupies.

**(2)** An owner or occupant of land or property or the owner or person in control of livestock shall take active measures to

- (a) prevent the establishment of pests on or in the land, property or livestock unless otherwise authorized by the Minister,
- (b) control or destroy all pests on or in the land, property or livestock unless otherwise authorized by the Minister, and
- (c) destroy any crop, vegetation or other matter that contributes or may contribute to the maintenance or spread of a pest on or in the land, property or livestock.

1984 cA-8.1 s5

## Duty of Local Authority

**6** A local authority of a municipality shall take active measures

- (a) to prevent the establishment of, or
- (b) to control or destroy, pests in the municipality.

1984 cA-8.1 s6

## Inspectors

**9 (1)** Inspectors may be appointed by a local authority or by the Minister to carry out this Act and the regulations.

**(2)** An agricultural fieldman under the Agricultural Service Board Act is by virtue of that office an inspector under this Act.

1984 cA-8.1 s9

Pest and Nuisance Control Regulation 184/2001 up to and including Regulation 101/2011

## Nuisances

**3 (1)** The following continue to be declared nuisances throughout Alberta:

- (a) Coyote (*Canis latrans*);
- (b) Skunk (*Mephitis mephitis*);

- (c) Richardson's ground squirrel (*Spermophilus richardsonii*);
- (d) Franklin's ground squirrel (*Spermophilus franklinii*);
- (e) Thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*);
- (f) Columbian ground squirrel (*Spermophilus columbianus*);
- (g) Northern pocket gopher (*Thomomys talpoides*);
- (h) Deer mouse (*Peromyscus maniculatus*);
- (i) Meadow vole (*Microtus pennsylvanicus*);
- (j) House mouse (*Mus musculus*);
- (k) Bushy-tailed wood rat (*Neotoma cinerea*);
- (l) English sparrow (*Passer domesticus*);
- (m) Rock dove (*Columba livia*);
- (n) European starling (*Sturnus vulgaris*);
- (o) Magpie (*Pica pica*).

**(2)** A horse (*Equus caballus*) is declared to be a nuisance where it is at large in any of the following wildlife management units, as described in Schedule 9 to the Wildlife Regulation (AR 143/97):

- Wolf River Wildlife Management Unit (340);
- McLeod River Wildlife Management Unit (342);
- Wildhay Wildlife Management Unit (344);
- Shiningbank Wildlife Management Unit (346);
- Coalspur Wildlife Management Unit (438);
- Solomon Wildlife Management Unit (439);
- Adams Creek Wildlife Management Unit (440).

AR 184/2001 s3;325/2009

## Coyote and Skunk Control

**14 (1)** In this section and in Forms 7 and 8,

- (a) "device" means a device that can be used to control coyotes or skunks;
- (b) "poisonous material" means any substance or equipment, or a combination of both, that can be used to poison a coyote or skunk;
- (c) "use" includes set.

- (2)** A person so authorized by the Minister may issue a Form 7 permit to a person who has been trained by the Department in the use, storage and handling of devices and poisonous material in respect of which the permit is issued.
- (3)** A person who holds a Form 7 permit may issue Form 8 permits.
- (4)** A person shall not use any device or poisonous material with a view to controlling coyotes or skunks unless the person holds
- (a) a Form 7 permit authorizing the use of such a device or material, if the use is to be on land belonging to another person, or
  - (b) a Form 8 permit authorizing the use of such a device or material, if the use is to be on the permit holder's own land (and whether or not the holder holds a Form 7 permit).
- (5)** A person shall not remove or alter a written warning issued by the Department concerning the use or storage of any device or poisonous material unless the person holds
- (a) a Form 7 permit authorizing that removal or alteration, if the use or storage is to be on land belonging to another person, or
  - (b) a Form 8 permit authorizing that removal or alteration, if the use or storage is to be on the permit holder's own land.
- (6)** The holder of a Form 7 permit may issue the devices and poisonous material listed in the permit to the holder of a Form 8 permit for the control of coyotes or skunks.
- (7)** The holder of a Form 7 permit shall not use any device or poisonous material with a view to controlling coyotes or skunks on land belonging to another person without first obtaining the permission to do so contained in a Form 8 permit from its owner or occupant.
- (8)** Subsection (7) does not apply to the use of a device or poisonous material for rabies control on land that is unoccupied in an area designated in Schedule 2 as a rabies control zone.
- (9)** A person shall not use a device or poisonous material with a view to controlling coyotes unless it has letters, numbers or a chemical marker indicating its approval by the Minister.
- (10)** Subsections (4), (6) and (9) do not apply to an activity specifically authorized by or under the Wildlife Act or the Environmental Protection and Enhancement Act.
- (11)** A person shall not shoot coyotes or skunks or destroy dens of coyotes or skunks unless that person
- (a) holds a Form 7 permit and, if the shooting is to take place on another person's land, has the written permission of its owner or occupant, and
  - (b) is acting in compliance with all other applicable laws.
- (12)** A person who does not hold a Form 7 permit shall not issue a device or poisonous material knowing or believing that it is to be used to control coyotes or skunks.

**(13)** A Form 8 permit is not valid for more than 30 days.

**(14)** All devices and poisonous material issued under subsection (6) remain the property of the Government (represented by the Department) and may be recalled by it at any time.

**(15)** A person so authorized by the Minister may issue a Form 9 permit to the owner or occupant of land authorizing the use of dogs to control coyote on that land, and such a permit is not valid for more than 30 days.

**(16)** Notwithstanding section 8, an owner or occupant of land may control a coyote on that land by destroying, or giving prior authorization to a resident of Alberta to destroy, the coyote with the use of dogs where

- (a) livestock predation caused by a coyote has occurred within the period of 30 days before the confirmation under clause (b),
- (b) that predation has been confirmed in writing by an inspector,
- (c) a Form 9 permit has been issued by an inspector in respect of that predation and is still valid and the terms and conditions of the permit are adhered to, and
- (d) if the destruction is to be effected by a resident of Alberta who is not that owner or occupant, that resident has been specifically authorized by that owner or occupant in writing on the permit to do so.

AR 184/2001 s14;201/2001

## Damage Control Licenses and Permits

### Damage Control Licenses

When certain species of wildlife are damaging private property, you can apply to a Fish and Wildlife Division district office for a damage control license. This license provides legal authority to hunt or trap the nuisance wildlife to attempt to minimize the damage.

#### Conditions and Restrictions

The damage control license is issued by a Fish and Wildlife officer and specifies:

- Type of animal that can be taken under the license
- Method for taking the animal
- Period of time the license is valid

The conditions of the license must be followed exactly.

Some restrictions of the damage control license:

- On privately-owned land, an applicant must be the owner or occupant of the privately-owned land listed on the damage control license, and the license must be issued in that person's name.

- License holders can designate someone else to control the wildlife for them who, if approved, will be issued a separate authorization form.
- A damage control license cannot be issued to manage migratory birds if a federal migratory bird damage permit has already been issued.
- A damage control license cannot be issued to control ungulates that are causing damage to crops or stored feed.
- A report stating the number and species of animals taken must be submitted no later than 10 days after the expiry of the license. <http://esrd.alberta.ca/fish-wildlife/wildlife-damage-control-programs/damage-control-licences-permits.aspx#>.

## 8. References

- Acorn, R.C., and M.J. Dorrence. "An evaluation of anti-coyote electric fences." *Proceedings of the Sixteenth Vertebrate Pest Conference* (1994). Davis: University of California, Davis, 1994. 45-50.
- Acorn, Robert C., and Michael J. Dorrance. *Coyote Predation of Livestock*. Edmonton: Alberta Agriculture, Food and Rural Development, 1998.
- . *Methods of investigating predation of livestock*. Edmonton: Alberta Agriculture, 1990.
- Alberta ESRD. January 8, 2014. <http://esrd.alberta.ca/fish-wildlife/wild-species/mammals/> (accessed April 25, 2014).
- Alberta Lamb Producers. *ALP Coyote Predation Survey Analysis*. Survey, Alberta Lamb Producers, 2012.
- Alberta RSD. *Coyote Predation Control Manual and Study Guide*. Government of Alberta, 2010.
- "2013 Alberta Guide to Hunting Regulations." Government of Alberta. 2013.
- . *Rancher's Guide to Predator Attacks on Livestock*. Government of Alberta, 2011.
- AlbertaESRD. Grizzly Bears. 04 30, 2012. <http://esrd.alberta.ca/fish-wildlife/wild-species/mammals/bears/grizzly-bear.aspx> (accessed 07 25, 2014).
- "Award for Eastern Cape sheep collar." *East Cape Business News*. June 14, 2002. [http://www.ecdc.co.za/ecdc/news\\_article/1093/Award\\_for\\_Eastern\\_Cape\\_sheep\\_collar/14\\_June\\_2002](http://www.ecdc.co.za/ecdc/news_article/1093/Award_for_Eastern_Cape_sheep_collar/14_June_2002) (accessed 07 27, 2014).
- Biology online dictionary*. 2014. [www.biology-online.org/dictionary/biomass](http://www.biology-online.org/dictionary/biomass) (accessed 05 29, 2014).
- Blejwas, K.M., B.N. Sacks, M.M. Jaeger, and D.R. McCullough. "The effectiveness of selective removal of breeding coyotes in reducing sheep predation." *The Journal of Wildlife Management*, 2002: 451-462.
- Blejwas, K.M., C.L. Williams, G.T. Shin, D.R. McCullough, and M.M. Jaeger. "Salivary DNA evidence convicts breeding male coyotes of killing sheep." *Journal of Wildlife Management*, 2006: 1087-1093.
- Bourne, and Dorrence. 1982.
- Bourne, John. *Protecting Livestock with Guard Donkeys*. Factsheet, Alberta Agriculture, 1994.
- Bowns, J.E. "Interpreting physical evidence of coyote predation." *Coyotes in the Southwest: A compendium of our knowledge*. 1995. 79-84.
- Bryson, G. "Electronic scarecrows haze ravens from utility equipment." September 2, 2008.
- Burn, R.J., and G.E, Connolly. "Lithium Chloride Bait aversion did not influence prey killing by coyotes." *Proceedings of the 9th Vertebrate Pest Conference*. 1980. 200-204.
- Canadian Sheep Federation. *National Predation Survey*. on-line survey, unpublished, 2010.

- Carlson, D.A., and E.M. Gese. "Integrity of mating behaviors and seasonal reproduction in coyotes (*Canis latrans*) following treatment with estradiol benzoate." *Animal Reproduction Science*, 2010: 322-330.
- Conover, M.R., and K.K. Kessler. "Diminished producer participation in an aversive conditioning program to reduce coyote predation on sheep." *Wildlife Society Bulletin*, 1994: 229-233.
- Coppinger, R., and L. Coppinger. *Dogs: a new understanding of canine origin, behavior, and evolution*. Chicago: The University of Chicago Press, 2001.
- Davidson-Nelson, S.J., and T.M. Gehring. "Testing fladry as a nonlethal management tool for wolves and coyotes in Michigan." *Human-Wildlife Interactions*, 2010: 87-94.
- Dorrence, M.J., and J. Bourne. "An evaluation of anti-coyote electric fencing." *Journal of Range Management*, 1980 : 385-387.
- Dorrence, Robert C. Acorn and Michael J. *Coyote Predation of Livestock*. Edmonton, 1998.
- Franklin, W.L., and K.J. Powell. *Guard Llamas- a part of integrated sheep protection*. Extension publication, Iowa State University Cooperative Extension Services, 1994.
- . "Guard Llamas - a part pf Integrated Sheep Protection." *The Camelid Quarterly*, March 2006: 1-7.
- Gates, N.L., J.E. Rich, C.V. Hulet, and D.D. Godtel. "Development and evaluation of anti-coyote electric fence." *Journal of Range Management*, 1978: 151-153.
- Gese, E.M. "Territorial defense by coyotes (*Canis latrans*) in Yellowstone National Park, Wyoming: who, how, where, when, and why." *Candian Journal of Zoology*, 2001: 980-987.
- Gese, E.M., R.L. Ruff, and R.L. Crabtree. "Foraging ecology of coyotes (*Canis latrans*): The influence of extrinsic factors and a dominance hierarchy." *Canadian Journal of Zoology*, 1996a: 769-783.
- Gese, Eric M., Robert L. Ruff, and Robert L. Crabtree. "Social and nutritional factors influencing the dispersal of resident coyotes." *Animal Behavior*, 1996b: 1025-1043.
- Gluesing, E.A., D.F. Balph, and F.F. Knowlton. "Behavioral Patterns of domestic sheep and their relationship to coyote predation." *Applied Animal Ethology*, 1980: 315-330.
- Green, J.S. "Donkeys for Predation Control." *Fourth Eastern Wildlife Damage Control Conference, 1989*. Lincoln: University of Nebraska, 1989. 83-86.
- Green, J.S., and R.A. Woodruff. "Breed comparisons and characteristics of use of livestock guarding dogs." *Journal of Range Management*, 1988: 249-251.
- Green, J.S., and R.A. Woodruff. *Livestock Guarding Dogs - Protecting Sheep from Predators*. Agriculture Information Bulletin, United States Department of Agriculutre, 1999.

Green, J.S., R.A. Woodruff, and W.F. Andelt. "Do livestock guarding dogs lose their effectiveness over time?" *Proceedings of the Sixteenth Vertebrate Pest Conference (1994)*. Lincoln: University of Nebraska, 1994. 41-44.

Gustavson, C.R., J. Garcia, W.G. Hankins, and K.W. Rusiniak. "Coyote predation control by aversive conditioning." *Science*, 1974: 581-583.

Hennessey, Cecelia A., Jean Dubach, and Stanley D. Gehrt. "Long-term pair bonding and genetic evidence for monogamy among." *Journal of Mammology*, 2012: 732-742.

Hulet, C.V., D.M. Anderson, J.N. Smith, and W.L. Shupe. "Bonding of Cattle to Sheep as an Effective Technique for Predator Control." *Applied Animal Behavior Science*, 1987: 19-25.

Hygnstrom, S.E. "Black Bears." In *Damage Prevention and Control Methods*, C5-C16. Cooperative Extension Division University of Nebraska - Lincoln, 1994.

Jaeger, M.M. "Selective targeting alpha coyotes to stop sheep predation." *Sheep & Goat Research Journal*, 2004: 80-84.

Jorgensen, C.J. "Bear-sheep interactions, Targhee National Forest." *Bears: their biology and management*. International Association for Bear Research and Management, 1983. 191-200.

Kamler, and Philip S. Gipson. "Space and Habitat use by Resident and Transient Coyotes." *Canadian Journal of Zoology*, 2000: 2106 - 2111.

Kennedy, C. personal communications.

Kessler, Janet. "Traps back in Calgary parks to catch coyotes for study." *CBC News*. February 15, 2013. <http://www.cbc.ca/news/canada/calgary/traps-back-in-calgary-parks-to-catch-coyotes-for-study-1.1308295> (accessed 07 28, 2014).

Knight, James E. "Mountain Lions." In *Prevention and Control of Wildlife Damage*, by Scott E. Hygnstrom, Robert M. Timm and Gary E. Larson, C93-100. 1994.

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

Laundre, J.W., and J. Hernandez. "Total energy budget and prey requirements of free-ranging coyotes in the Great Basin desert of the western United States." *Journal of Arid Environments*, 2003: 675-689.

Lay, A. *Investigation and evaluation of predator kills and attacks*. Bulletin, B.C. Conservation Officer Service, no date.

Levy, K. "Wolves cause death of 176 sheep near Foff Hill; Forest Service says stay out of area." *Tenton Valley News*. 08 19, 2013. [tentonvalleynews.net/news/wolves-cause-death-of-sheep-near-fogg-hill-forest-service/article\\_f79754fc-08eb-11e3-82d9-001a4bcf887a.html?mode=jqm](http://tentonvalleynews.net/news/wolves-cause-death-of-sheep-near-fogg-hill-forest-service/article_f79754fc-08eb-11e3-82d9-001a4bcf887a.html?mode=jqm) (accessed May 30, 2014).



- Linhart, S.B., R.T. Sterner, G.J. Dasch, and J.W. Theade. "Efficacy of light and sound stimuli for reducing coyote predation upon pastured sheep." *Protection Ecology*, 1984: 75-84.
- Martin, J.S., and A.B. O'Brien. "Field Trial - Effectiveness of Phoenix Wailer in Preventing Coyote Predation of Sheep." unpublished.
- McAdoo, J.K., and H.A. Glimp. "Sheep Management As a Deterrent to Predation." *Rangelands*, 2000: 21-24.
- Mitchell, B.R. *Coyote Vocal Communication and Its Application to the Selective Management of Problem Individuals*. PhD thesis, Berkeley: University of California, 2004.
- Mitchell, B.R., M.M. Jaeger, and R.H. Barrett. "Coyote depredation management: current methods and research needs." *Wildlife Society Bulletin*, 2004: 1209-1218.
- Montana State University Extension Services. *Rancher's Guide to Wolf Depredation*. Extension brochure, Montana State University Extension Services, 2004.
- Morehouse, A.T., and M.S. Boyce. "From venison to beef: seasonal changes in wolf diet composition in a livestock grazing landscape." *Frontiers in Ecological Environment*, 2011: 440–445.
- Musiani, M, et al. "Wolf Depredation Trends and the Use of Fladry Barriers to Protect Livestock in Western North America." *Conservation Biology*, 2003: 1538-1547.
- Musiani, M., T. Mluly, C.C. Gates, C. Callaghan, M.E. Smith, and E. Tosoni. "Seasonality and reoccurrence of wolf depredation and wolf control in Western North America." *Wildlife Society Bulletin*, 2005: 876-887.
- Nixon, K. "Livestock Predation Study 2011- 2013." *OSMA Predation Project Report*, 2013.
- O'Brien, A B. "Pature Breakpoint - can you afford to stop using pasture?" *Ontario Sheep Seminars Proceedings*. OMAF, 2012.
- O'Brien, A.B. "Fencing and Predators: Coyote Deterrent Fences." *Ontario Sheep News*, 2011.
- O'Gara, B. W. "Eagles." In the Handbook: *Prevention and Control of Wildlife Damage*, E41-E48, 1994.
- . "Sheep depredation by golden eagles in Montana." *Proceedings of the 8th Vertebrate Pest Conference*, 1978. 206-213.
- Parkhurst, J. *Managing Wildlife Damage....Black Bears*. Extension note, Blacksburg: Virginia Cooperative Extension, 1998.
- Pascual, James. "Return of the scarecrow - because nothing else could save his sheep." *Farmers' Forum Newspaper*, October 2012. <http://www.farmersforum.com/OCT2012/p28.htm> (accessed 07 27, 2014).
- Pratt, D.W. *Electric Fence Energizers*. Livestock and Range Report No 913, University of California, 1991.

Rollins, D. *Evaluation of Suspected Predator Kills*. <http://texnat.tamu.edu/about/procedures-for-evaluation/evaluation-of-suspected-predator-kills/> (accessed 04 29, 2014).

Sacks, B. N., and J. C. C. Neale. "Does paternal care of pups benefit breeding female coyotes?" *Southwestern Naturalist*, 2001: 121-126.

Schoenian, Susan. "Livestock Parasitology 101." *Infosheet*, No Date.

Shivik. 2003.

Shivik, J.A. "Tools for the edge: what's new for conserving carnivores." *BioScience*, March 2006: 253-259.

Shivik, J.A. "Non-lethal alternatives for Predation Management." *Sheep and Goat Research Journal*, 2004: 64-71.

Thompson, B.C. "Evaluation of wire fences for coyote control." *Journal of Range Management*, 1979: 457-461.

Tietje, W.D., and R.L. Ruff. "Denning behavior of black bears in boreal forest of Alberta (abstract)." *Journal of Wildlife Management*, 1980: Abstract.

Till, J.A., and F.F. Knowlton. "efficacy of denning in alleviating coyote depredation upon domestic sheep." *Journal of Wildlife Management*, 1983: 1018-1025.

Urbigkit, C., and J. Urbigkit. "A Review: the use of livestock protection dogs in association with large carnivores in the rocky mountains." *Sheep and Goat Journal*, 2010: 1-8.

Urmson, M.B., and A.T. Morehouse. "Carnivore Conflicts in southwestern Alberta." 2012.

USDA, Wildlife Services. *The Livestock Protection Collar*. Factsheet, United States Department of Agriculture, 2010.

Walton, M.T., and C.A. Feild. "Use of Donkeys to Guard Sheep and Goats in Texas." *Fourth Eastern Wildlife Damage Control Conference 1989*. Lincoln: University of Nebraska, 1989. 87-94.

Walton, Murray T., and C. Andy Field. "Use of Donkeys to Guard Sheep and Goats in Texas." *Fourth Eastern Wildlife Damage Control Conference*. Eastern Wildlife Damage Control Conferences, 1989. 87-94.

Wenger, Ileana. *Guide to Parasites in Sheep*. Alberta Sheep and Wool Commission, 2005.

Wutz, K. "Rancher: wolves kill 31 sheep; Agency issues kill order for predators near Carey." *Idaho Mountain Express*. May 17, 2013. [www.mtexpress.com/index2.php?ID=2005147366#.U4pNN4IZTqA](http://www.mtexpress.com/index2.php?ID=2005147366#.U4pNN4IZTqA) (accessed May 30, 2014).