Guard Llamas

A part of integrated sheep protection

Coyote predation on sheep has been a problem for many years. Several methods are used to reduce this predation. Guard llamas offer a viable, non-lethal alternative for reducing predation, while requiring little specialized training and care.

Guard llama with sheep gathered at his side.

Coyote predation on sheep

Make no mistake about it: coyotes kill sheep. In fact, predation is a leading cause of sheep mortality and represents a serious problem for the sheep industry. Sheep losses due to all types of predation in the United States were more than $83 million in 1987, up from $72 million in 1986 and $69 million in 1985. The losses in 1987 represent 5 percent of the total sheep population in the United States. Lambs are particularly vulnerable. Lamb losses from predation average 9 percent and vary from 3 percent to 14 percent of the lambs. Sheep are found in every state of the union, and losses due to predation vary. In Iowa, the state with

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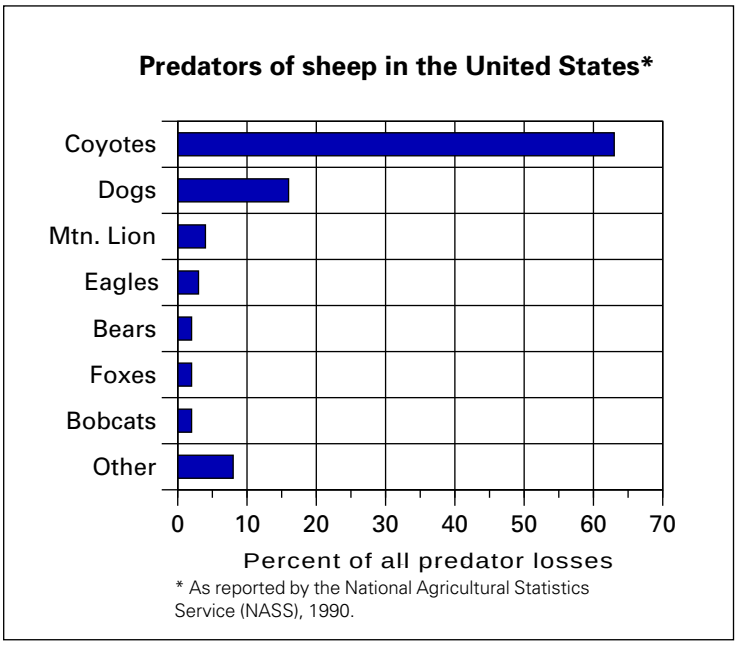


the largest number of sheep operations, intensive field studies revealed that 41 percent of all sheep losses were from canid predators (coyotes and dogs), 46 percent from non-predator causes (disease, starvation, etc.), and 13 percent from unknown causes. Retired U.S. Department of Agriculture sheep scientist, Clair Terrill, calculated economic losses due to predation. In Texas, the state with the largest number of sheep, predation was responsible for 14 percent to 69 percent of all sheep losses. Texas also led the nation in economic loss due to predation on sheep ($12 million), followed by California ($9 million), Wyoming ($7 million), Iowa ($6 million), Utah ($6 million), and Colorado ($5 million).

> ***"A guard animal is any animal that, when placed with a flock, represents a threat to predators."***

For an industry operating on a low profit margin, losses due to predation have resulted not only in reduced revenue for the producer, but also in higher prices paid by the consumer for meat and wool products. Predation is a real problem with a major impact on the sheep industry. It is a critical issue with both economic and ethical implications to wildlife management, the livestock industry, and the general public.

Reducing coyote predation

Integrated predation management

Over the last 150 years, many methods for reducing predation of sheep have been tried. In general, methods can be divided into a) preventive methods and b) control. Preventive methods are implemented prior to predation problems and are generally non-lethal to the predators. These include the use of fencing, guard animals, frightening devices, and sheep husbandry techniques, such as night penning and shed lambing.

Control methods usually are put into place after damage has occurred and are targeted at specific animals, usually being lethal to the predator. These methods include shooting, poisons, trapping and snaring, and fumigants. Local and state regulations regarding these regulations vary.

The best flock protection is provided by an integrated management program that includes both preventive and selected control methods. No single method is 100 percent effective by itself. An integrated approach is the most ecologically and economically sound, yielding the best long-term protection.

Guard animals

Recently, the search for a simpler, non-lethal technique to reduce coyote predation has led to the experimental and field use of guard animals. A guard animal is any animal that, when placed with a flock, represents a threat to predators. The ideal guard animal should protect sheep against predation, while requiring minimal training, care, and maintenance. It should stay with and not disrupt or harm the flock, and be cost effective. A variety of guard animals currently in use includes dogs, donkeys (burros), and llamas. Of these, guard dogs are by far the most common.

During the past decade and a half with the birth and growth of the llama industry in North America, llamas were occasionally pastured with sheep. To the surprise of owners, they noticed fewer sheep were being lost to coyotes. Producers began experimenting with llamas as guard animals. Today, their use in North America is on the increase.

What is a llama?

Llamas are members of the South American camel family, where four camelids are found: the domesticated llama and alpaca, and the wild guanaco and vicuña. Surprisingly, llamas and their camel relatives were originally native to the grasslands and deserts of North America, but suddenly disappeared from here 10,000 to 15,000 years ago, about the time of the last glacial advance.

Today, llamas are used in the Andean Mountains as beasts of burden for carrying produce and trade goods. Alpacas come in a variety of natural colors, and their fine wool is made into soft sweaters and blankets. Guanacos have brown bodies and blackish faces and are found primarily on the Patagonia of southern Argentina, while the smaller vicuña dwells in the high altiplano grasslands of the Central Andes.

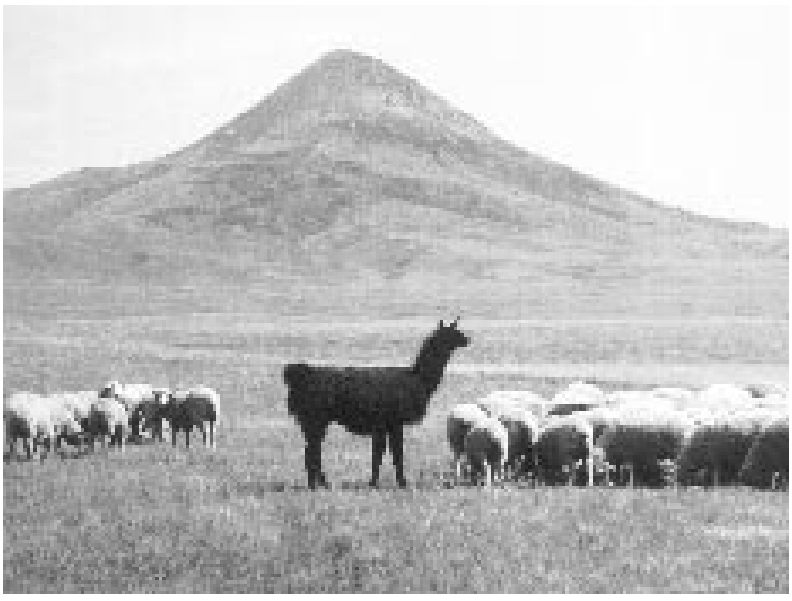
Because domesticated llamas originated from guanacos, the two have much in common. Llamas, guanacos, alpacas, and their hybrids are used as guard animals for sheep, but all are referred to in a generic sense as guard llamas.

Do guard llamas really work?

What is the llama's potential as a non-lethal alternative for reducing sheep losses to the 105,000 sheep producers of North America? While anecdotal articles and stories on guard llamas have been encouraging, there has been an absence of systematic studies on guard llamas to accurately assess their effectiveness. Many unknowns exist, including:

- 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 the best results?

Research on guard llamas at Iowa State University was initiated in 1990 to address the above questions. Telephone interviews were conducted with 145 sheep ranchers across the country using guard llamas. Questions dealt with specific sheep management practices and characteristics of guard llamas. In addition, researchers traveled to six midwestern and western states in the summer of 1991 for on-site visits to 29 sheep ranches



Llama with sheep flock in open rangeland near the Canadian border.

"During the past decade and a half with the birth and growth of the llama industry in North America, llamas were occasionally pastured with sheep. To the surprise of owners, they noticed fewer sheep were being lost to coyotes."

using guard llamas. This bulletin summarizes that investigation and applies other studies conducted through Iowa State University.

"Nearly all llamas in this study had no prior experience with sheep before being introduced into the flock they were to protect."

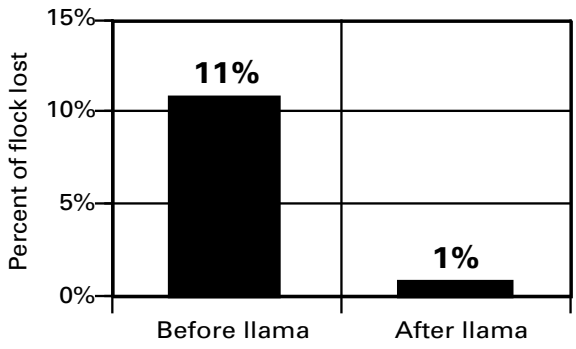
Current use of guard llamas

There are a great variety of settings where guard llamas are run with sheep: from the stubble wheat fields of the central plains, to the mountain meadows and open rangelands of the west. Guard llamas are found in many states, with the majority in the intermountain west (Montana, Wyoming, and Colorado) and far west (California and Oregon).

The average producer interviewed has raised sheep for 17 years and purchased a llama 3 years earlier from a llama breeder. The average producer had a similar breakdown of predator problems to the national study, with coyotes reported as the biggest problem. Nearly 70 percent of guard llamas are gelded males costing between $300 to $800; intact males are about $100 cheaper. A few ranchers own as many as six llamas but most have only one. One guard llama may be kept with as few as four sheep or as many as 2,100. Average flock size of those ranchers interviewed is 250 to 300 sheep maintained in a pasture of 250 to 300 acres. Since this is a fairly new management technique, producers have used guard llamas an average of 3 years, but some for as long as 12 years. The oldest llama reported was 18 years of age. Eleven of 204 guard llamas died of a variety of causes, including old age and disease, snake bite, guard dog, and lameness.

Llamas are often alert and inquisitive about any newcomers.

Reported average annual loss of sheep and lambs due to predation before and after obtaining a guard llama.



Introducing llamas to sheep

Nearly all llamas in this study had no experience with sheep before being introduced into the flock they were to protect. In other words, they had not been trained to guard sheep. Llamas averaged 2 years of age when introduced to sheep, with the most common llama age being 6 to 11 months at introduction.

The circumstances surrounding guard llama introduction to sheep vary greatly: small to large flocks, lambs to adults, indoors to outdoors, and small to large pastures. However, most are introduced to the whole flock, averaging 130 sheep. When first introduced, the llama usually is curious or neutral toward its new companions, while the sheep are either neutral or afraid. For the 201 introductions reported, the initial adjustment period lasted only a few hours for half the llamas, and nearly 80 percent were adjusted within a week. Many producers reported that guard llamas show intense interest and attachment to young lambs.

Did sheep losses decline?

Nearly three-fourths of the 145 sheep producers interviewed report that their worst predator is the coyote. Dogs are the leading predator in the remaining ranches, with only a few cases of mountain lions and bears. Before producers obtained their guard llamas, they had been losing an average of 26 sheep per year to predation, or about 11 percent of their flocks. After obtaining their llamas, the producers' losses dropped significantly to an average of 8 head per year, or about 1 percent; more than half of the producers had their losses reduced to zero. In their judgement, 80 percent of the producers rate their guard llama's ability to reduce predation losses of their sheep as "very effective" or "effective." All producers, however, reported continuing to use other preventive and control methods in addition to the llamas. (See Table 1.)

Table 1. Predator Control methods used by ranchers prior to and after obtaining a guard llama. Multiple responses possible.

	Percent of Ranches	
Predator Control Method	Prior to Guard Llama	After Guard Llama
Shooting	44	40
Traps/Snares	38	34
None	23	23
Guard Dog	15	17
Electric Fence	13	13
Aerial Shooting[a]	7	8
Poison[a]	6	1
Night Confinement of Flocks	4	6
Antipredator Fence	4	4
Herder/Camping	4	2
Scare Devices[b]	3	1

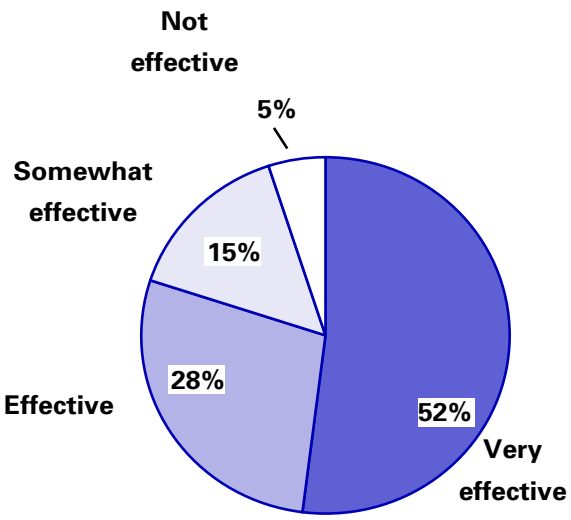
[a]Not legal in Iowa.

[b]Includes strobe lights, cannons, radios, etc

How and why do llamas protect sheep?

The highly social South American camelids are aggressive towards members of the canid family (coyotes, foxes, dogs etc.). Apparently, over time, canids have been important predators on the camelids, so that today, llamas are naturally wary of members of the dog family. In field studies in South America, guanacos and vicuñas often have been observed aggressively pursuing Andean and Patagonia foxes, but fleeing from mountain lions. Adult male guanacos are highly territorial, protecting their real estate and sounding alarms to their family group when predators are sighted.

Although not fully understood, 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. Even for the gelded llama, these innate behaviors remain. Guard llamas are not passive bystanders, but are active leaders and protectors of their flocks. During daily movements of a flock, llamas may take the front position to lead the sheep, walk and graze in their midst, or trail at their heels.



Owners' evaluation of 193 guard llamas.

> ***"Although not fully understood, once a guard llama becomes familiar with an area and is attached to the sheep, the pasture becomes his territory and the flock his family group."***

"The high cost of females, usually several thousand dollars, makes them an impractical choice unless they also are used as breeding stock."

It is not uncommon for the llama to separate from the flock and stand or rest on an adjacent hilltop or slope overlooking the sheep. While 70 percent of the producers interviewed said their llamas typically stay with their sheep, 25 percent reported that the llamas usually stay separate from the flock. Being separate is a behavior typical of wild, adult male guanacos, exhibited while overlooking both territory and family group for potential intruders and predators.

Table 2. Characteristics of guard llamas and of sheep husbandry compared to the number of sheep lost due to predation after the guard llama had been introduced.

Characteristics	Related to sheep losses
Gelding vs. intact males	No difference
Sheep guarded by one llama vs. guarded by several llamas	Yes, made a difference
Introduced to sheep with lambs vs. no lambs present	No difference
Introduced with sheep in corral vs. range	Yes, made a difference
Sheep ranged in open habitat vs. habitat with cover	No difference

About half of the people surveyed had seen their llamas interact with potential predators (coyote, dog, fox, or bear). Typical responses of a guard llama are alert attention (31 percent of the interactions, multiple responses possible), alarm call (32 percent), and walk to (25 percent) or run towards (62 percent) the predator, chase it (58 percent), kick or paw at it (21 percent), herd the sheep (34 percent), or position itself between the flock and predator (8 percent). In 3 percent of the cases it walked or ran away from the predator. Other times, ranchers reported their llamas killed a variety of intruders, including coyotes, woodchucks, and muskrats.

If the sheep ranch has a herding dog that typically chases, barks, and acts hostile towards the sheep during herding, the guard llama at first can be aggressive towards the dog. If there is a family dog on the premises that does not chase or bother the sheep, the llama usually will habituate to the dog and not attack it. However, some family dogs have been attacked and injured by guard llamas.

Llama and flock foraging together on a wheat stubble field in the central plains region.

What works best?

The characteristics of llamas and sheep husbandry practices were correlated with the relative effectiveness of guard llamas in

reducing predation after the llamas were introduced to the sheep (see Table 2). Although some intact males may attempt to mount ewes, there was no difference reported between geldings and intact males in their effectiveness in protecting sheep. There also was no reported difference between males and females, although the sample size of single female guard llamas was small. The high cost of females, usually several thousand dollars, makes them an impractical choice unless they also are used as breeding stock.

Intermountain guard llama leading a flock away.

It does make a difference whether single or multiple guard llamas are used. Multiple guard llamas work in some cases, but overall, predation in this study was higher in flocks with multiple llamas (7 percent of the flock) compared with flocks with one llama (1 percent loss).

Although llamas are introduced to sheep in a variety of ways, the situation made little difference in the llama's eventual effectiveness in protecting the sheep. Sheep first introduced to guard llamas on open range, however, experienced higher predation than those introduced into a corral. Although lambs affectionately interacting and playing with a llama is a striking and impressionable sight, llamas introduced to sheep with lambs ultimately are no more effective than llamas introduced to flocks without lambs.

Llama and sheep behavior toward each other does not influence the llama's guarding abilities. While there were no apparent differences in losses of sheep grazing with a guard llama in open rangeland versus rangeland with cover (forested, shrubby, gullies, etc.), this remains a question for study. We would expect a llama to be able to more easily detect a potential predator in open terrain. There may be, however, other complicating factors of which we are currently unaware.

From this study, researchers were unable to determine the ideal age to first introduce a guard llama to sheep. Actual age of the guard llama (excluding those less than 1 year old) is not related to its effectiveness. However, it appears that llamas do not reach their full protective potential until 1 to 2 years old. Similarly, the llama's wild counterpart, the guanaco, doesn't become territorial until 2 to 4 years of age.

Care and management of llamas

Llamas are easy to keep. More than 80 percent of the producers interviewed said the daily care for their guard llamas is the same as for their sheep, and no special feeds are given. Average annual expense for feed (not including pasture) is $90 and miscellaneous veterinary costs are approximately $16.

Llama breeders traditionally wean offspring at 6 to 8 months of age and castrate males at 6 to 24 months of age.

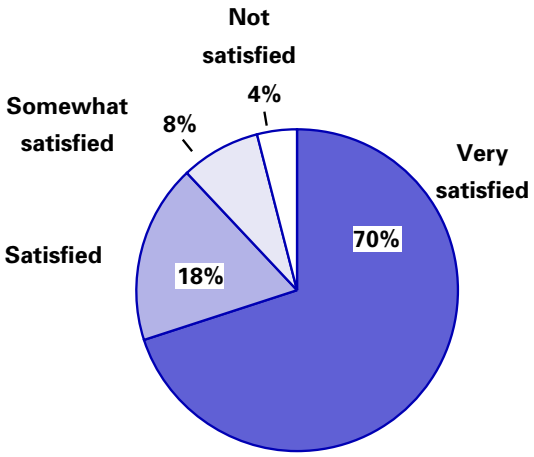
A 250-pound gelded llama typically consumes 7 to 10 pounds of good grass hay per day. Granular or block mineral supplement and access to fresh water should be available free choice, and grain is not necessary. Llamas typically don't bloat, even with a sudden change of pasture or hay.

> ***"Aggressiveness and breeding are the most commonly reported problems..."***

Illness in a llama can best be detected by making daily visual checks for subtle changes in behavior. If a llama is sick and won't get up, colic or heat stress should be suspected. Depending upon the area and the internal parasite load, llamas need to be dewormed 2 to 4 times a year. Annual vaccinations for Clostridial diseases, including tetanus, are recommended. Contact a llama association for information on llama care and management, and consult a veterinarian for specific health problems.

Cautions and problems

While 75 percent of the 145 ranchers interviewed reported that their llamas did not negatively affect their sheep, and 90 percent reported that the sheep did not negatively affect the llama, there are some potential problems. Aggressiveness and breeding are the most commonly reported problems among the 25 percent of respondents that said "yes." No problems were reported for the 10 female llamas in this study. Twenty-five percent of 61 intact males and 5 percent of 135 gelded llamas attempted to breed ewes. Some producers lost sheep due to this breeding behavior. In one instance, a single male killed 100 ewes before the problem was determined. If an intact, sexually mature male is used, he should be closely watched during the breeding season. Castration can modify this behavior, but not necessarily in all cases.



Reported owner satisfaction of 145 sheep producers who own guard llamas.

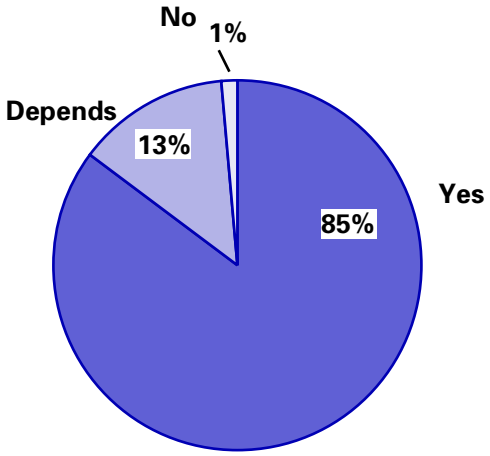
Five percent of the producers report their guard llamas are overprotective, so much so that the producer sometimes has difficulty working with the sheep. A producer's ability to separate the llama from the flock, in a catch pen, for example, can help overcome this problem.

Nine out of 10 of the sheep ranchers said that their sheep do not negatively affect the llama. When problems arise, it is often because the sheep are crowding the llama away from food. To overcome this problem, food for the llama should be put in a feeder high enough to be out of reach of the sheep.

Owner satisfaction, costs and savings

Nearly 80 percent of the sheep producers reported that they are either "very satisfied" or "satisfied" with their guard llamas. Predator control and easy maintenance are cited as the top benefits. Two-thirds of the producers report no disadvantages about their guard llamas, and 85 percent indicate they would recommend guard llamas to others.

An average annual savings of $1,034 was reported by 86 producers who had owned a llama for three years. Llamas commonly live for 10 to 15 years. When the initial investment ($300-800) and annual expenses ($105) are factored out, the long-term savings of a guard llama could be substantial. Fiftyeight producers could not estimate savings or losses by having a guard llama, while one purebred producer saves an average of $20,000 per year.



Would you recommend guard llamas?

Guard llamas vs. guard dogs

How does this new information on guard llamas compare with previous findings about guard dogs? The majority of guard dogs originated in eastern Europe and show a mixture of juvenile, maternal, and protective behaviors towards sheep, compared with the predator-like stalking and chasing behaviors of herding dogs that originated in the British Isles.

While guard dogs have been shown to be effective in reducing coyote predation on sheep, as with llamas, there have been problems. A significant concern is the short life span and premature death of guard dogs due to accidents, culling, and disease: 50 percent die before 3 years of age.

Beginning as small pups, guard dogs must be raised exclusively with sheep and with minimal human contact. Many are not as effective during their first year of life. Over-attachment to people and aggressiveness towards sheep also have been observed. Another disadvantage is that dogs must be fed daily.

Table 3. Comparison of characteristics of guard llamas and guard dogs.

	Guard animals	
	Dogs	Llamas
Initial cost	$100-400	$300-700
Bonding/adjustment	1 year	Few days
Feed	Daily dog food	Pasture
Annual expense*	$286	$103
Longevity	On farms 50% lived 3 years	10–15 year
Purchase price per year of use**	$100	$70

* Annual expense included feed and veterinary costs.
** Dogs: assumed 4 years average use ($400 ÷ 4 = $100).
Llamas: allowed 10 years average use ($700 ÷ 10 = $70).

Not a panacea

These results indicate that guard llamas offer a viable non-lethal alternative to the problem of coyote predation on sheep. However, no matter what the approach when dealing with the adaptive coyote, the concept of "protection against" coyote predation is an overstatement. A more realistic expectation is a reduction of coyote predation.

> ***"While the results of this research are encouraging, the guard llama should not be seen as a cure-all."***

While the results of this research are encouraging, the guard llama should not be seen as a cure-all. Some

ranchers continue to have problems with predation, but the average rancher experiences a substantial reduction in losses with the use of a guard llama.

However, don't count out the opportunistic coyote. This predator is well-known for adapting to new situations. It hunts alone, in pairs, and in small groups. How guard llamas respond to group-hunting coyotes or to high densities of coyotes is not known. One rancher reported that a 7-month-old llama was killed by a group of coyotes. Guard llamas can be an effective part of a rancher's overall predator prevention and control program. As stated earlier, no single approach used alone should be relied upon. It must be integrated with other preventive and control options.

"...guard llamas are a viable non-lethal alternative for reducing predation, requiring no special training, and minimal care."

Unanswered questions

Guard llamas may have application to other species. This study found that a number of ranches and farms successfully use llamas to protect ducks, geese, goats, deer, and even cattle. Such expanded use of guard llamas is intriguing and deserves further assessment.

While this study has answered some questions, many remain to be addressed, including:

Summary

Coyote predation is a serious problem for the sheep industry. The traditional approach to controlling predator losses has been to trap and shoot coyotes. During this study, 145 sheep producers using guard llamas were interviewed to determine characteristics of the guard llamas and husbandry practices. Some of the results include:

- Most introductions require only a few days or less for the sheep and llama to adjust to each other.
- The average ranch uses one gelded male llama pastured with 250 to 300 sheep on 250 to 300 acres.
- Sheep and lamb losses average 26 head per year (11 percent of the flock) before using guard llamas and eight head per year (1 percent of flock) after.
- More than half of guard llama owners report 100 percent reduction in predator losses.
- Llamas are introduced to sheep and pastured with sheep under a variety of situations.
- Multiple guard llamas are not as effective as one llama.
- Ranchers estimate an average annual savings of $1,034 and 85 percent say they would recommend guard llamas to others.
- Protectiveness of sheep and easy maintenance are the two most commonly cited advantages.
- Problems encountered include aggressiveness and attempted breeding of ewes, overprotection of flock, and sheep interference with feeding llamas.
- Overall, llamas are effective guards with high sheep producer satisfaction. Although questions remain to be answered, guard llamas are a viable non-lethal alternative for reducing predation, requiring little specialized training and care.

- 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 llama breeders selectively breed for improved guarding abilities?
- If a guard llama reduces predation on the premises, do the coyotes leave the area, change food habits, or move over to the neighbors and eat their sheep?
- Can llamas be used to regulate daily flock movement?
- Can a guard llama be used for the next 10 years, or will producers need to plan on rotating to another guard animal species?

"Protectiveness of sheep and easy maintenance are the two most commonly cited advantages of guard llamas."

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Information about llamas

If you are interested in learning more about llama management, care, health, housing, nutrition and reproduction, or for the llama association, chapter and owners in your area, contact one or more of the following organizations.

International Llama Association (ILA)
P.O. Box 370505
Denver, Colo. 80237
(303) 756-9004

Rocky Mountain Llama and Alpaca Association (RMLA)
593 19-3/4 Road
Grand Junction, Colo. 81503
(303) 241-7921

Llama Association of North America (LANA)
P.O. Box 1882
Minden, Nev. 89423
(702) 265-3177

Greater Appalachian Llama Association (GALA)
P.O. Box 6992
Harrisburg, Penn. 17112-0992
(410) 592-7050

Canadian Llama Association (CLA)
P.O. Box 476
Bragg Creek
Alberta, Canada T0L 0K0
(403) 949-2955

> ***"In fact, predation is a leading cause of sheep mortality and represents a serious problem for the sheep industry."***

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