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Guardian Dog Research in the U.S.

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ABSTRACT: Research on the use and effectiveness of guardian dogs has been conducted since 1977 at 3 locations in the U.S.: the Livestock Dog Project (Amherst, MA), the U.S. Sheep Experiment Station (Dubois, ID), and Colorado State University (Ft. Collins). Their findings are quite consistent: dogs guard sheep and goats directly, i.e., they respond aggressively to predators, chasing them away when necessary, then returning to the flock. This aggressive response toward predators is apparently defense of personal space rather than territorial defense. The development of attentiveness toward sheep, beginning early in life, is probably the most important aspect of training a guardian dog. Between 60 and 80% of all dogs studied to date in the 3 projects were judged 'to have reduced predation to some extent. Purchase and annual maintenance costs for a dog can be recovered in most situations even if predation is not totally eliminated. In a hypothetical example, a dog which reduced predation on an Angora goat operation by 50% would increase its owner's return by about \$55 per animal unit. Dogs should not be thought of as a panacea for the predator problem, but rather as an important addition to the other lethal and non-lethal control measures available.

INTRODUCTION

In the early 1970's, largely unnoticed by the predator control community, a few American and Canadian livestock producers rediscovered an ancient, "low tech" method for controlling predation: the guardian dog (Canis familiaris). Most of those producers turned to dogs out of desperation: conventional control measures had failed, and predators (usually coyotes--Canis latrans) were driving them out of business. Unfortunately, the accounts of their experiences were published either in dog club newsletters (Adams 1978) or as feature articles with little objective data (Gerber 1974).

The first objective study of guardian dogs was conducted by the U.S. Fish and Wildlife Service in 1976. Linhart et al. (1979) trained 4 adult Hungarian Komondor dogs to attack coyotes and to stay with sheep in fenced pastures. The number of sheep killed by coyotes decreased significantly during and after introduction of the dogs, suggesting that the dogs were a deterrent to coyote predation. Linhart et al. (1979) were unable to determine how the dogs reduced predation, but they offered scent marking, barking, coyote neophobia, and coyote-dog interactions as possible explanations.

The Department of the Interior abandoned guardian dog research soon after the termination of this project, but in 1977 two other projects began independently to follow up the promising results. Ray Coppinger and his wife Lorna imported 10 puppies of 3 traditional European breeds and established the Livestock Dog Project (LDP) in Amherst, Massachusetts, to breed and study guardian dogs. Twenty-four hundred miles away, Dr. Norm Gates acquired several Hungarian Komondors for a long-term study of livestock guardian dogs at the U.S. Sheep Experiment Station (USSES) at Dubois, Idaho. To complement the in-house work at the USSES, Gates (and later Jeff Green) supported a **cooperative research agreement with Colorado**

State University. I wrote the proposal for this cooperative agreement and conducted the CSU research for 3.5 years.

From their inception, the three guardian dog projects had distinctly different methods and goals. The LDP bred a large number of dogs quickly and then leased them for a very nominal sum to cooperators around the U.S. Although they have collected data on the behavior and development of guardian dogs (see Coppinger and Coppinger 1982), most of their data come from questionnaires and interviews with their cooperators. The CSU study took the opposite approach: the number of dogs studied was limited to 9, but they were observed on a daily basis for 3.5 years, including one 3-week stint at guarding sheep in a 160-acre (65 ha) pasture (McGrew 1982). The USSES research combined aspects of the other 2 projects. Puppies were reared, trained, and observed on the station, often for 6 months or longer. The ability to guard sheep was then tested with flocks belonging to the USSES or with cooperator flocks. Thus, both pasture and range operations were available, and many dogs were tested in both.

In my presentation today I would like to quickly summarize the work done by the LDP, the USSES, and CSU. In particular I will outline what we have learned about the behavior, effectiveness, economics, advantages, and disadvantages of livestock guardian dogs.

Characteristics of Livestock guardian Dogs

Livestock guardian dogs were once common throughout Europe, western Asia, and the Middle East (Coppinger and Coppinger 1978). Each national area had one or more distinctive breeds. Two devastating world wars, sweeping changes in agricultural systems, and a near elimination of predators have resulted in a reduction in the number of dogs presently in use, but most of the breeds can still be found working in remote regions of their former range. Few Americans have ever heard of most of the traditional Old World guardian dog breeds.

Despite the wide geographical distribution of these dogs, they have a number of physical traits in common. All are large--75 to 100 pounds (34 to 45 kg) and upward, 25 or more inches (63+ cm) at the shoulder. Most are white with long hair and shaggy appearance. Their ears tend to be flat and well-haired, muzzles relatively short and blunt, and tails long. When observed at a distance, they are often almost indistinguishable from the flocks they guard.

The various breeds also share similar behaviors. They can be left unattended with a flock, and they work independent of a shepherd. They are ordinarily placid and spend much of the daylight hours dozing. When the sheep move, the dogs plod along beside or in the midst of the flock. They exhibit only rudimentary interest and ability in herding, and they show little tendency toward stalking or chasing sheep (Coppinger and Coppinger 1982). Even naive sheep usually accept their presence after a short time. Despite their normally calm behavior, all of the breeds are fierce when provoked and wary of intruders, both animal and human.

RESULTS

Behaviour of Guardian Dogs

According to a LDP model, a successful guardian dog must exhibit 3 essential traits: it must be trustworthy (i.e., it must not harm sheep), attentive, and

protective of the flock ; coppinger aver' and coppingar 11 980; coppinger et al. 1983) . McGrew (1982) proposed a model of guardian dog behavior that could be tested and used to improve training and use of guardian dogs. Briefly stated, the model suggested that attentiveness to sheep and aggressiveness to coyotes are conflicting behaviors, in that they cause the dog to move in opposite directions. A successful dog must balance the 2 tendencies. The model also stated that attentiveness is the product of early exposure and socialization to **sheep** and that aggressiveness results from territorial behavior (McGrew 1982).

Six years of testing and observation by the USSES, the LDP, and CSU have confirmed the basic features of these 2 models. For instance, despite their normally lethargic behavior, most guardian dogs are naturally aggressive toward coyotes. They do not appear to require the early exposure and aggressiveness training used by Linhart et al. (1979). Also, the most successful dogs appear to balance their aggressiveness with attentiveness to sheep. In a typical encounter with a coyote, the dog first moves between the flock and the predator. If necessary it chases the coyote away, but the chase rarely goes beyond a few yards. The dog then stops, turns, and returns to the flock (McGrew and Blakesley 1982; Green and Woodruff 1983b).

The USSES and the LDP have stressed the importance of early exposure to sheep in developing successful guardian dogs (Green and Woodruff 1983x; Coppinger and Coppinger 1980; 1982). Their procedure is to place 6- to 8-week-old puppies with lambs in a small pen. The puppies are protected from physical contact and injury by a low fence, but they are allowed constant visual, auditory, and olfactory contact with the sheep. Later the pups mingle with the sheep and experience physical contact. This constant exposure at an early age is called "primary socialization" and is very effective for developing social bonds (Scott 1962).

McGrew (1982) and a few livestock producers (Adams 1978; Green and Woodruff 1980) have reported some success in training 6- to 12-month-old dogs to guard sheep. However, for the time being, there are sound reasons for continuing to urge dog owners to put their dogs with sheep as soon after 6 or 8 weeks of age as possible. Most of the successful working dogs in the U.S. and Canada were given extensive early exposure to sheep (Green and Woodruff 1980) and with reasonable care, this appears to be a safe and simple process. Socializing an adult dog to sheep, on the other hand, is difficult and time consuming, and few livestock producers have the skill or patience required. Also, other than the CSU study, there are few data to suggest that adult dogs can become successful guardians.

The CSU study did demonstrate that aggressive behavior by the dogs toward coyotes is not territorial defense per se. Actually, although many owners had described their dogs as being "territorial", the accounts of the dogs' actions did not really agree with a canid territory model. For instance, many dogs were effective with range sheep which are constantly moving.

Instead of defending a geographical location, guardian dogs actually defend the space immediately around them (their "personal space"). The distance involved differs with the behavior of each individual dog. In the CSU study, the radius of the defended area varied from 15 to 200+ yards (14-183+ m) (McGrew 1982). Since the most effective dogs are also very attentive to sheep, the flock is included within this defended area whenever the dog is near or with the sheep. In essence, the flock becomes a moving or traveling territory, and the dog is equally protective anywhere it encounters a predator.

Another important finding of the CSU study concerned the behavior of the sheep being guarded. The sheep quickly learned to stay with or come to the dog when threatened by a coyote (McGrew 1982). Furthermore, they spent more time with or closer to the dogs which had the smallest defended areas, suggesting that they recognized the different abilities of individual dogs. Coppinger and Coppinger (1981) noted that breed-specific behaviors in sheep also affect their response to a guardian dog. European breeds (e.g., Rambouillet) are calm and tend to flock or bunch. Suffolks and other English breeds spread out over the range or pasture, presenting a much more difficult task for even an experienced guardian dog.

Effectiveness ~~iveness~~ of Guardian Dogs

From the point of view of the rancher, the principal measure of the effectiveness of his dog is reduction of predation. Exact data on effectiveness are impossible to obtain, since there is no way of knowing what the level of predation would have been without the dog once the dog has been added to the flock. However, results of surveys and questionnaires sent to dog owners are remarkably consistent. Ninety-three percent of respondents in an early USSES survey rated their dogs as either "excellent" or "good" in overall performance (Green and Woodruff 1980). Of 137 dogs included in a later, more detailed survey, 109 (80%) were characterized by their owners as effective guardians (Green et al. 1983).

Green and Woodruff (1983b; unpubl ms.) also have summarized 6 years of research with 63 USSES dogs, many of which were evaluated in both pasture and range operations. Overall, 42 of the 63 dogs (67%) markedly reduced predation in either or both settings (Green and Woodruff unpubl. ms.). Another 8 dogs (13%) reduced predation somewhat.

Cooperators with the LDP rated 59% of their dogs as excellent or good in overall effectiveness in 1981. In the 1982 annual survey, the number had risen to 70%. Sixty-three percent of the LDP cooperators reported a reduction in predation in this same survey (Lorenz and Coppinger 1983). Fifty-one of the 64 LDP cooperators (80%) who had previously reported greater than 6 kills/year experienced a reduction in predation after getting a dog.

Of the 9 CSU Komondor dogs, 6 (67%) were effective in reducing coyote predation on sheep in a large pasture (McGrew 1982). They accomplished this by direct confrontation of the coyote. Reports from herders and cooperators to the USSES and the LDP, although anecdotal in nature, agree with the observations recorded by McGrew and Blakesley (1982): the most successful working dogs are the most active and aggressive. Interactions with coyotes and other predators always involve the dog moving between the flock and the predator and actively confronting the latter.

Economics of Guardian Dogs

While guardian dogs are not inexpensive, they do not usually cost as much as a hunting dog of champion breeding. A Great Pyrenees or Komondor costs between \$250 and \$1,000 (mean = \$331 and \$458, respectively), plus about \$100 for shipping (Green et al. 1983). Purchase price has not risen appreciably in the last 5 years despite inflation and increased popularity of the traditional breeds.

Maintenance costs include food, veterinary care, and miscellaneous expenses (collars, leads, shelters, etc.). Green et al. (1980) estimated these annual costs would be about \$275 for a working Komondor dog. However, a recent survey of 70 owners of guardian dogs produced an average of about \$224 per dog per year (Green et al. in press). Thus, first year expenses for a Komondor average about \$760 with subsequent yearly expenses of about \$224. Additional costs (hours spent training, vehicle miles driven to check dogs) and benefits (no need to confine sheep at night, protection of house and family, finding lost lambs) are difficult to estimate accurately but appear to be roughly equivalent.

Cost-benefit Ratios

It is illustrative to compare the costs of owning a guardian dog with the additional income potentially realized from sheep or goats guarded by a dog (Green et al. 1980). Fig. 1a shows the increase in returns from a flock of 1,000 ewes and lambs accompanied by a dog working at various levels of effectiveness. In this hypothetical situation, a dog need only be about 65% effective to "earn its keep" (Fig. 1b), even at low (1%) levels of predation.

Hypothetical values aside, what can the real-world livestock producer expect from his dog? Keeping in mind that there can be sampling errors and biases in data obtained from producers without independent verification, the actual number of sheep or goats saved by guardian dogs can be significant. The 40 ranchers cited in Green et al. (1983) reported an average annual savings of 68 head. Only 2 respondents (5%) said that their dogs did not save any sheep, while 5 (12%) reported savings of 100 or more head per year. In perhaps the most optimistic published estimate of effectiveness, Pfeifer and Goos (1982) found that guardian dogs in North Dakota reduced predation from an average of 31 to 2 (93%) head lost per year on the 31 ranches surveyed.

In these days of depressed livestock prices, such reductions in losses can literally save a livestock operation from ruin (Green et al. 1983; Deterling 1981). Scrivner and Connor (1983) have calculated the costs and returns of raising Angora goats both with and without coyote predation. Using data obtained in a survey of 101 Texas goat producers, they considered not only the obvious costs, such as feed, livestock, and equipment, but also less obvious costs such as extra labor, fuel, and feed required to confine goats at night to reduce predation.

Average predation on Angora goat kids in nanny flocks was over 22%; 3.5% of adult nannies also were killed by coyotes (Scrivner and Connor, 1983). Production revenues decreased by 22.5%. At the same time, costs attributed to predator control increased production costs by 32.8%. The net result was startling: returns from nanny operations with heavy coyote predation amounted to -\$15.12 per animal unit, as opposed to an estimated return of \$194.36/AU in operations without a predator problem and without predator control expenses (Scrivner and Connor, 1983). Losses were even heavier with nanny/wether and wether flocks.

By coincidence, 2 Angora goat producers in the same part of Texas have had considerable success using guardian dogs. In fact, Adams (1978) and D. K. Kelley (cited in Deterling 1981) both reported almost total relief from coyote predation once their dogs (Komondor and Great Pyrenees, respectively) began working. Using the values from Scrivner and Connor (1983) where predator control costs were incurred, I have calculated the following increased returns for their flocks:

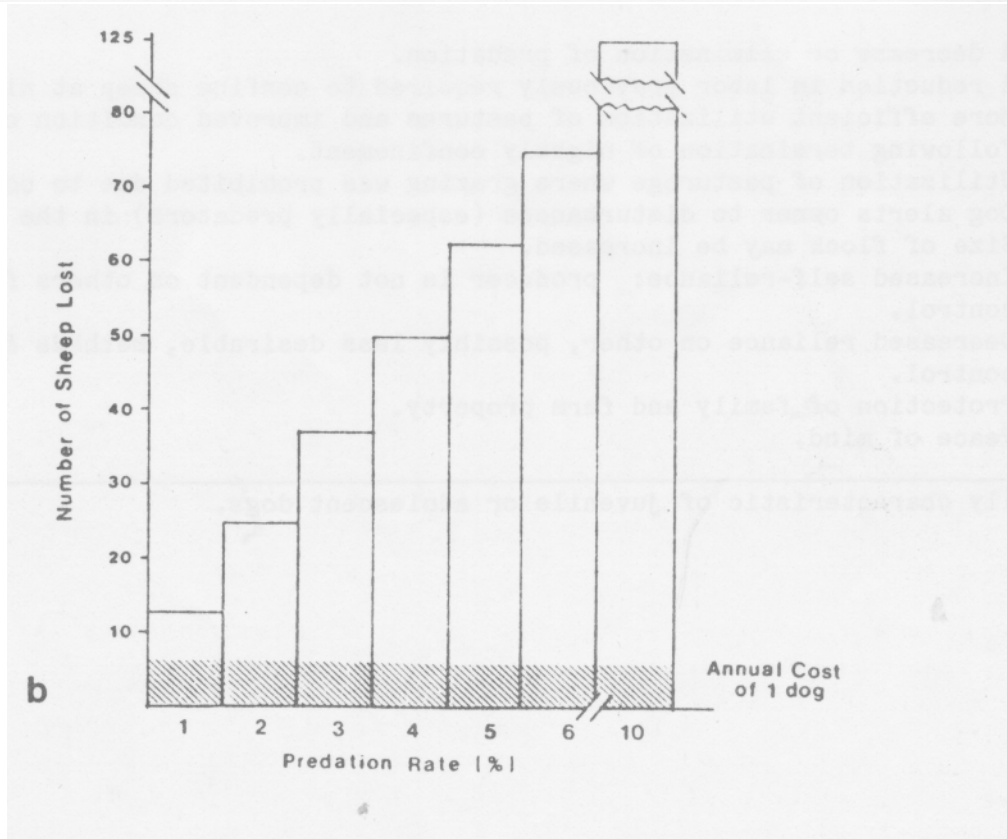
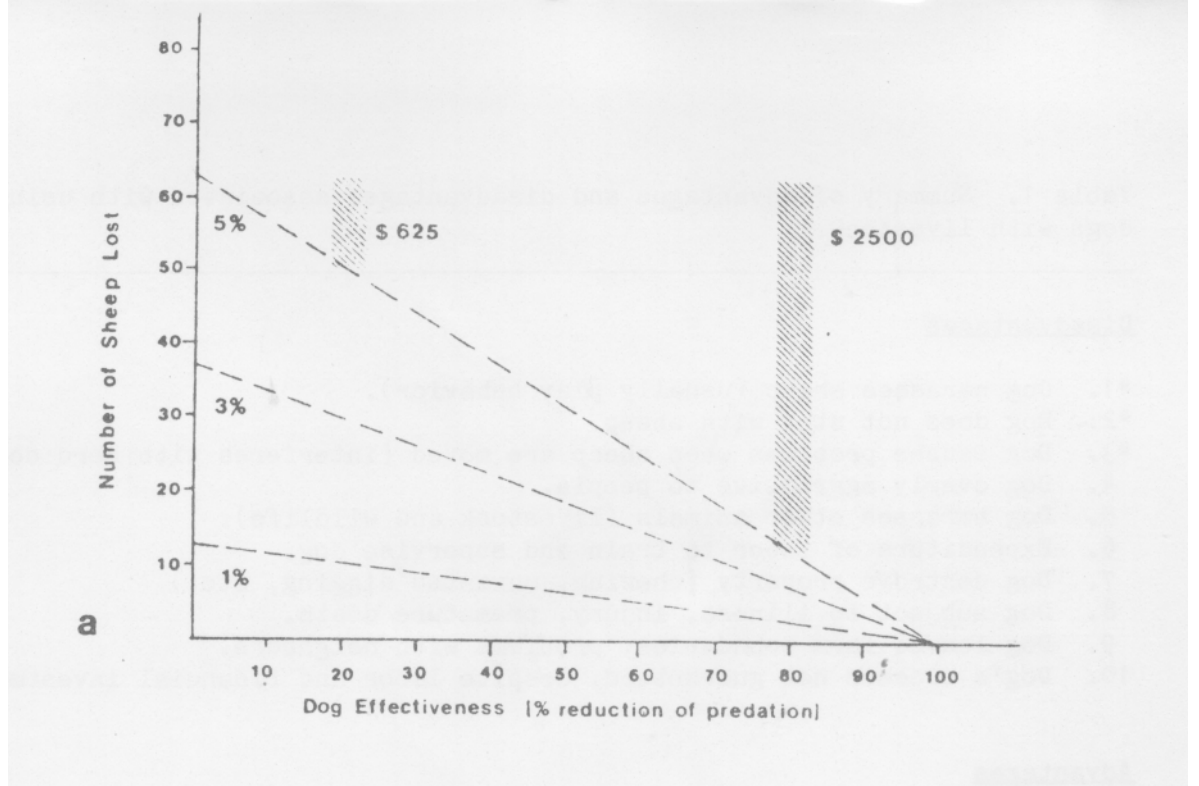


Fig. 1. Additional income realized from a flock of ewes accompanied by a guardian dog. Calculations follow Green et al. (1980): 1,000 breeding ewes with a 125% lambing rate (1,250 lambs/year) and market lamb prices of \$50/cwt. (a) Number of lambs lost is shown for 3 levels of predation 1%, 3% and 5% and various levels of dog effectiveness. Savings of 12.5 and 50 lambs worth \$625 and \$2,500 (vertical bars) can be attributed to the guardian dog working at 20 and 80% effectiveness, respectively. (b) The cost of purchasing and owning a dog, depreciated over 5 years, is equivalent to the value of fewer than 7 lambs per year. At 3% predation rates, the annual cost of the dog is recovered if it reduces predation by 19% or more.

Table 1. Summary of advantages and disadvantages associated with using guardian dogs with livestock.

Disadvantages

- *1. Dog harasses sheep (usually play behavior).
- *2. Dog does not stay with sheep.
- *3. Dog causes problems when sheep are moved (interferes with herd dogs).
- 4. Dog overly aggressive to people.
- 5. Dog harasses other animals (livestock and wildlife).
- 6. Expenditure of labor to train and supervise dog.
- 7. Dog destroys property (chewing, unwanted digging, etc.)
- 8. Dog subject to illness, injury, premature death.
- 9. Dog leaves farm boundaries; problems with neighbors.
- 10. Dog's success not guaranteed, despite labor and financial investment.

Advantages

- 1. A decrease or elimination of predation.
- 2. A reduction in labor previously required to confine sheep at night.
- 3. More efficient utilization of pastures and improved condition of sheep following termination of nightly confinement.
- 4. Utilization of pasturage where grazing was prohibited due to coyote(s).
- 5. Dog alerts owner to disturbances (especially predators) in the flock.
- 6. Size of flock may be increased.
- 7. Increased self-reliance: producer is not dependent on others for predator control.
- 8. Decreased reliance on other, possibly less desirable, methods of predator control.
- 9. Protection of family and farm property.
- 10. Peace of mind.

*Usually characteristic of juvenile or adolescent dogs.

Dog Effectiveness	Return/AU
00%	-\$15.12
10%	- 4.08
14%	break even
50\$	\$40.07
75%	\$67.67
100%	\$95.26

SUMMARY AND CONCLUSIONS

Green and Woodruff (unpubl ms.) have summarized the advantages and disadvantages of using guardian dogs to reduce coyote predation (Table 1). They emphasize that no 1 owner has experienced all of the problems or all of the benefits listed. However, the majority of ranchers they have contacted feel strongly that the advantages outweigh the disadvantages, usually by a wide margin.

Guardian dogs appear to be highly beneficial in some situations. However, their effectiveness is influenced by a variety of factors, and their use requires a strong commitment on the part of their owner. The effectiveness of guardian dogs will probably increase with additional research and experience, but most livestock producers will continue to require other animal damage control measures in addition to their guardian dogs.

It is important to remember in our enthusiasm for guardian dogs that they are a panacea for the predator problem. Rather, they should be thought of as a valuable addition to the "toolbox" of lethal and non-lethal measures available to the livestock producer and the animal damage control specialist (Boggess et al. 1980).

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