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The Secret Lives of Livestock Guardian Dogs: Current Knowledge and Future Research

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ABSTRACT: Rangeland livestock operations in California and elsewhere are increasingly turning to livestock guardian dogs (LGD) to protect their herds from predators. LGD success depends on a variety of factors including social bonding, environmental and operational context, and individual behaviors. Observation and first-hand experience with LGD on foothill rangeland, Sacramento Valley cropland, and Sierra Nevada/Great Basin rangeland can provide practical evaluation of historic and current research regarding LGD efficacy, breed differences, and economic costs versus benefits. However, little is known about the relationship between LGD and livestock behavior and forage utilization. This article synthesizes current research, experiential knowledge from practitioners, and new frontiers for LGD research. An updated understanding of the principles of bonding LGD pups to livestock will improve LGD success rates and reduce costs for producers.

KEY WORDS: bonding, costs and benefits, depredation, livestock management, livestock protection tools, livestock guardian dogs, LGD, nonlethal control, wildlife interactions

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INTRODUCTION

Livestock guardian dogs (LGD) are increasingly used in a variety of commercial and non-commercial agricultural settings to protect all kinds of livestock from predators. Laws and regulations that protect predators, especially gray wolves (*Canis lupis*), mountain lions (*Puma concolor*), and grizzly bears (*Ursus arctos horribilis*), limit lethal control options for ranchers, in turn increasing reliance on non-lethal tools like LGD. This article evaluates over fifteen years of historic and current research of LGD at a small-scale commercial sheep operation in California's Sierra Nevada foothill rangelands, irrigated pastures, and cropland, and at large-scale targeted grazing and open range sheep and goat operations on both private and public lands throughout California (pers. observ.). Current knowledge and future research needs are discussed.

CURRENT KNOWLEDGE

Uses of LGD in Agricultural Settings

Since small domesticated ruminants (i.e., sheep and goats) are typically more vulnerable to depredation (CDFW 2019), producers have generally needed to use a variety of nonlethal livestock protection tools in addition to utilizing lethal control where permissible. Table 1 summarizes the use of selected nonlethal tools. Nearly a quarter of sheep producers and a third of goat producers reported using livestock guardian dogs as one of a suite of nonlethal tools (USDA 2015). Anecdotally, these numbers

may be much higher in the western United States due to the type of operation, type of predator, and regulations regarding lethal control. While cattle producers have been less likely to use LGD, they are showing increasing interest. Cattle producers in southern Europe and central Asia, where many LGD breeds were originally developed, have a long tradition of using LGD with cattle. Producers in the northern Rocky Mountains, where gray wolves may be of concern, are beginning to utilize LGD as well (Cat Urbigkit, Paradise Sheep Company, pers. commun.). In addition to these traditional uses, new production models, including pastured poultry and pastured pork production, are turning to LGD as well. Finally, homestead (or "hobby") livestock producers are utilizing LGD in suburban and semi-rural production systems; this may be problematic as LGD can be aggressive towards other domestic dogs. In addition, their first response to a perceived or actual threat is often barking, which can create conflict with neighboring homeowners (pers. observ.).

Are LGD Nonlethal?

LGD are considered to be nonlethal livestock protection tools, but wildlife managers and advocates have expressed concern that LGD may nevertheless impact non-target wildlife. Recent research from South Africa indicates that two-thirds of LGD in the study area had no interactions with wildlife (predators or otherwise) and that LGD were able to discriminate between target wildlife (predators) and non-target wildlife (Whitehouse-Tedd et.

Table 1. Selected Nonlethal Livestock Protection Tools by Livestock Species. Adapted from USDA-APHIS.

Nonlethal Method*	Beef Cattle Producers (2010)	Sheep Producers (2014)	Goat Producers (2014)
Livestock guardian dogs	4.7%	23.5%	33.0%
Llamas	(data not reported)	5.4%	4.2%
Donkeys	(data not reported)	8.2%	9.6%
Predator exclusion fencing	3.8%	31.8%	44.5%
Night penning	0.7%	19.5%	23.8%
Fright tactics/devices	0.3%	1.8%	2.1%
Other nonlethal methods	0.8%	3.9%	57.8%
Any nonlethal method	12.4%	58.0%	93.0%

*Note: many producers use more than one tool – totals may add up to more than 100%.

al. 2020). Predators that are protected under state or federal endangered species laws, however, may be more problematic because most protections include a prohibition against harassment of listed species. Barking at, pursuing, and (in limited cases) physical confrontation between LGD and listed predators could in theory constitute take under the California Endangered Species Act, in some circumstances (Kent Laudon, California Department of Fish and Wildlife, pers. commun.).

How Many Dogs are Needed?

Perhaps one of the most difficult questions to answer regarding LGD is how many dogs are necessary to successfully protect livestock; indeed, this question has not been thoroughly explored (Kinka 2019). As outlined above, the environmental context and production system (including other livestock protection tools used) can impact the number of dogs required. While Saitone and Bruno (2020) suggest a ratio of one dog per 100 sheep when evaluating LGD costs, commercial producers often vary the ratio of dogs to livestock depending on threat level and stage of production. For example, a producer grazing two bands of sheep (e.g., 1,100+ non-lactating ewes per band, with no lambs) in an open-range, herded system on the Tahoe National Forest in summer and early autumn successfully uses one to two dogs per band. The producer reports that additional dogs are required during lambing and lactation, when the flock is more vulnerable to predator losses (Emilio Huarte, Talbott Sheep Company, pers. commun.). Ultimately, from an economic perspective, producers want “just enough” dogs to do the job.

Factors Influencing LGD Success

Most research suggests that there are few differences between common U.S. LGD breeds (e.g., “whitedogs,” Great Pyrenees, Akbash, Anatolian Shepherd, and Maremma) with regards to successful guarding behavior (Kinka and Young 2018). Kinka and Young (2018), however, did note some differences between several European and Asian breeds that have been newly imported to North America. Genetics and proper bonding/socialization seem to have a greater influence than breed on LGD success (Coppinger et al. 1988). In selecting an LGD pup, producers should prioritize pups from working parents to ensure their genetic potential (pers. observ.).

Successful LGD will display a combination of attentiveness (e.g., they should be alert to their surroundings); trustworthiness (e.g., submissive to livestock); and protectiveness (e.g., they should display escalating levels of aggressiveness appropriate to the level of threat from predators) (Coppinger et al. 1988). Environmental and production contexts are also critical. Environmental context includes the suite of predators present on the landscape, as well as habitat and other attributes that may facilitate or discourage livestock depredation. Production context includes an individual operation’s production calendar (e.g., does lambing or kidding occur when there are few other prey options for predators?) and the class of animal present (e.g., non-lactating females versus pairs) (pers. observ.).

Once an LGD with appropriate genetic potential is selected, the process of socializing (or bonding) a pup with

livestock and with the specific attributes of the ranch becomes crucial. Canines form strong social bonds between eight and 20 weeks of age (Coppinger et al. 1988); LGD pups are no different. Experience suggests that the pre-bonding period, from birth to eight weeks of age, is also important: pups should be whelped and raised where they can smell and hear livestock before their eyes have opened (pers. observ.). Once the bonding process has been initiated, pups should be housed with livestock that will not injure the pup and tolerate rough play behavior: many producers use non-lactating ewes or does for this initial bonding phase. Leash training, transport training, and human bonding can occur once the livestock-LGD bond has been established (Coppinger et al. 1988).

Finally, the perspective of an individual producer may influence the success (or failure) of LGD generally. A producer who believes the dogs will work will usually be able to work through problems when they arise. A producer who believes the dogs create too many problems or cause too much liability will usually stop using dogs when problems occur (pers. observ.).

Costs Versus Benefits

The producer costs associated LGD include capital costs (for acquisition and pup development) and operating costs (including dog food, veterinary care, possibility of early death loss, and depreciation). Pup development costs include feeding and veterinary care from puppyhood until a dog is ready to work on its own (i.e., at 12-18 months of age) (pers. observ.).

The benefits of using LGD can be more difficult to measure. Certainly, the major benefit is the value of livestock saved from depredation (Saitone and Bruno 2020). At the operational level, however, this value is difficult to quantify: how do we know how many animals were saved? Other benefits include the value of future production from breeding animals, increased reproductive success and weight gain in the absence of predator-induced stress, more efficient use of rangeland forage resources (Webber et al. 2015), and producer peace of mind.

Research conducted at the University of California Hopland Research and Extension Center (Saitone and Bruno 2020) suggests that:

- “...producers who are considering the purchase of LGD, or those who already have LGD and are interested in their return on investment, need a few pieces of data to make this determination. Market lamb and ewe prices are typically well known to producers and can be used, in conjunction with efficacy rates from this study, to estimate the benefits of LGD.”
- “On the cost side, producers would need to make some logical forecasts about the time required to maintain LGD, given their operation specifics.... Also, using guidance from the literature included herein, producers could calculate the likely dog cull and mortality costs of the LGD’s useful life.”

FUTURE RESEARCH NEEDS

While LGD have been used in Europe and Asia for thousands of years (Sillero-Zubri and Laurenson 2001), North American producers have generally only used LGD

for the last 40-50 years. Consequently, there are a number of research gaps related to LGD use in North American landscapes and livestock operations. Classical research design (treatment versus control) presents challenges to understanding the efficacy of LGD: after all, who would want to be in the unprotected “control” group? Some researchers have been critical of the lack of classical experiment-based research regarding livestock protection tools (Eklund et al. 2017), and the environmental and production variables noted above further compound these challenges. As a result, future research efforts should focus on the mechanisms of protective behavior rather than efficacy.

An evaluation of the spatial and temporal relationships and behaviors of LGD, livestock, and predators using GPS or other remote sensing technology, may increase understanding of the protective mechanisms that contribute to LGD success. This type of research may also increase our understanding of predator displacement versus disruption in the presence of LGD, as well as our understanding of the relationships between grazing efficiency and LGD use. The question of disruption versus displacement is especially relevant to producers who worry that LGD may simply push problem predators onto another ranch, as well as to wildlife managers concerned with habitat impacts. This line of inquiry may also help address perceived conflicts between LGD and recreational uses of public lands. Finally, understanding the relationship of LGD to other livestock protection tools (e.g., human presence, electric fencing and/or fladry, and lethal control) will help producers address their operation-specific needs.

Turning to the success or failure of individual LGD, surveys and observational evaluation of pup behavioral attributes and bonding/socialization techniques may increase the probability of success. Objective case studies, rather than classic control versus treatment experiments, may be useful in identifying specific relationships between behaviors, environment, and operational context. Similarly, demonstration projects (for instance, demonstrating techniques for bonding LGD with cattle) may help producers understand where LGD may be useful in non-traditional (at least in North America) settings.

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