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Good fences make good neighbors: implementation of electric fencing for establishing effective livestock-protection dogs

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***Abstract*:** To be effective, livestock protection dogs (LPDs) must be carefully integrated with the livestock they will be protecting. Others have developed guidelines to assist producers in this training and assimilation process. In many areas fencing is necessary; however, guidelines for containing LPDs and their livestock behind electric fencing are lacking. We present results from larger projects involving LPDs where we encountered issues with fencing and preventing LPDs from roaming from their owner's property. We found that ranging and escaping from pastures was exhibited by LPDs that were not properly introduced and trained to electric fencing at an early age. LPDs that were trained strategically to respect electric fencing were effective guardians and did not leave livestock pastures.

***Key Words*:** *Canis lupus*, depredation, fencing, human–wildlife conflicts, livestock protection dog, Michigan, wildlife damage management, wolf

Livestock protection dogs (LPDs) have been used in Europe for centuries, but only since the 1970s in the United States (Coppinger and Coppinger 2001). LPDs are an effective method for reducing livestock losses from coyote (*Canis latrans*) predation (Green et al. 1984, Coppinger et al. 1988, Andelt 1992, Andelt and Hopper 2000) and may have application for additional human–wildlife conflict situations, such as predation by wolves (*Canis lupus*) and mitigation of disease transmission from wildlife to livestock (Gehring et al. 2010). Explicit guidelines for implementing LPDs on farms where it is necessary to contain livestock and LPDs behind fences are not readily available. General guidelines outline the basic principles of integrating an LPD into a working livestock operation (Lorenz and Coppinger 1988, Green and Woodruff 1999, Dawydiak and Sims 2004). Traits and behaviors (trustworthiness, attentiveness, and protectiveness) to look for in effective LPDs and the process of socializing dogs to livestock (mainly sheep) are established (Coppinger et al. 1983, 1987; Lorenz and Coppinger 1988). However, specific instructions on several aspects integral to the success of LPDs are missing. The exact process for using electric fencing for integrating LPDs into pasture systems is 1 such missing component.

The dearth of information on how to use electric fencing to manage LPDs could be due to several reasons, including that LPDs are a relatively new tool for U.S. livestock producers and have not received widespread attention. LPDs also have most commonly been used in the western United States where open-range grazing exists and containment is less integral than it is in other parts of the United States. As gray wolf populations continue to expand, small- and medium-sized farms prevalent in the Great Lakes region of the United States have a need to protect their livestock from predation using nonlethal methods, such as LPDs, which are more preferred by society (Gehring et al. 2010). To implement LPDs effectively, producers must be able to integrate them into their normal farming practices, which usually involve the use of fencing for containing livestock.

To be effective, LPDs must defend livestock from predators, and, to do so, they must stay with livestock. Current LPD guidelines stress the importance of bonding dogs with the livestock they are to protect (Lorenz and Coppinger 1988). Thus, most guidelines imply that roaming behavior by LPDs can be avoided by means of proper socialization with livestock. Although strong socialization is paramount for success, socialization alone may not prevent dogs from roaming. An LPD is not protecting livestock if it is roaming away from them. Roaming also could

lead to increased mortality of LPDs from such causes as vehicular accidents, shooting due to trespass, unintentional poisoning, or predation by wolves or other predators. Roaming might be more common in small or suburban-fringe farms where properties are smaller and there are more human-related distractions or activities to entice LPDs to leave their livestock or pasture (Green and Woodruff 1990, Gehring et al. 2010).

Using woven-wire fencing, chaining dogs, and using chain drags on dogs have been suggested as techniques to reduce roaming (Dawydiak and Sims 2004). VerCauteren et al. (2008) used invisible-fence systems to contain LPDs in 1.2 ha research pastures. Neutering or spaying LPDs may also limit roaming (Green and Woodruff 1990). Culling individual LPDs that roam may be necessary if a persistent problem exists (Lorenz and Coppinger 1988, Green and Woodruff 1990). Although many farms incorporate some type of fencing into their normal husbandry practices, fencing requirements for LPDs can be distinct from fencing needs of livestock. No current guidelines, however, specify fencing needs of LPDs. As part of a larger study of LPDs over a 5-year period, we found that effective fencing and training was a crucial link for successfully incorporating LPDs into working farms and preventing roaming. We provide observations and guidelines on fencing requirements and training needed to reliably contain LPDs and keep them within pastures and with their livestock.

Training and integrating livestock protection dogs

During 2005, we placed a male (neutered) and a female (spayed) Great Pyrenees pup (7 to 8 weeks old) on each participating cattle farm in the Upper Peninsula of Michigan as part of a larger study examining effectiveness of LPDs to reduce livestock losses from predators and bovine tuberculosis. We purchased the pups from a reputable breeder of working LPDs to ensure consistent behavioral traits in dogs, and all pups were full- or half-siblings. Farms contained 19 to 50 head of cattle on 10- to 40-ha pastures. We provided producers with guidelines, and with our assistance, the providers were responsible for care and

Figure 1. Great Pyrenees pups at the time of delivery to study farms for training as livestock protection dogs.

training of pups. Pups were raised in 2 × 4-m pens (LPD pen) within an 8 × 8-m livestock pen with 2 ≤1-week-old calves. Under producer supervision, any negative behavior such as pulling tails or playing too rough was corrected. We provided food and water in the LPD pen where only the dogs had access. Human contact was minimized to ensure LPDs were bonded to cattle and not humans. To avoid injury to pups or any negative interaction between pups and adult cattle, pups remained with calves and had contact with adult cattle at 4 to 7 months of age under supervision by producers only. Pups were allowed to be loose inside cattle barns or for short periods of time in pastures where they would be guarding cattle. They were kept on leashes when away from cattle or their pastures.

We began integrating the pups into adult cattle herds when they were 7 months old. At this time, we housed pups and calves during daylight hours within outdoor pens (5 × 5 m) inside pastures. Pups were walked daily on leashes around the inside of pastures to familiarize them with pastures and to establish the fence as a boundary (Figure 2). Pups were encouraged to interact with adult cattle while exploring pastures. We maintained this schedule for 10 to 14 days, after which pups and calves were housed in outdoor pens continuously for 10 to 14 days. The dogs were then released into pastures. This slow-release program allowed pups to become accustomed to living in a new area while furthering bonding between them and adult cattle.

Before pups were released into pastures, we

Figure 2. Young livestock protection dogs on leashes are walked around the fence perimeter.

added strands of 12-gauge electric fence wire to existing fence at each farm to help contain pups and prevent them from roaming. We placed 1 electrified strand of wire approximately 0.25 m above the ground at each farm. Additional strands were added as needed to existing fences at each farm; a strand was added where gaps between fence strands were >0.33 m. We monitored LPDs and fencing regularly and maintained electric fencing current at 7,000 volts. If an LPD exited a pasture, we identified any escape points and added strands of electrified wire as needed. Also, we attempted to correct escape behavior by pushing LPDs into the electric fence to ensure that they had a negative association with it. If escape behavior could not be prevented with electrified fencing, we implemented an invisible fencing system (PetSafe Stubborn Dog System, Radio Systems Corp. Auburn, Ind.). We placed invisible fence wire outside livestock fencing (either lying on the ground or hung on fence posts), around the entire perimeter. We buried invisible fence wires at gates so that it was convenient for producers and vehicles would not damage the wire. We fitted dogs with an electronic shock collar that transmitted a corrective shock when LPDs were within 0.30 m of the fence. After an introduction to the invisible fence, dogs were again released into pastures following the same steps for electrified wire. The existing fences served as visible boundaries, so LPDs required little training once outfitted with electronic collars. Our research was approved by the Institutional Animal Care and Use Committee at Central Michigan University (IACUC #13-04).

Observations

Socialization

LPDs on all farms were well-socialized and bonded with cattle. As pups, they would sleep immediately next to their calves (i.e., trustworthy behavior). When pups were released from their pens to exercise or play in the barn, they would regularly be found greeting or interacting with calves that had once shared their pens (i.e., attentive behavior). Once adult cattle became accustomed to the presence of LPDs, they tended to greet LPDs or freely graze without being disturbed by them. Once released into pastures with adult cattle, LPDs would greet cattle in a submissive fashion, licking around the cattle's mouth. Cattle became equally interested in LPDs and would suck on their ears and collars without the LPDs exhibiting any aggressive or play behavior. Even in pastures, LPDs and cattle would be found resting and sleeping together. LPDs also exhibited protective behaviors by barking at and chasing deer, predators, and other wildlife from pastures.

Fencing and roaming behavior

The bond between LPDs and their livestock, along with the electric fencing, was sufficient to keep dogs within pastures on 3 of 6 study farms. Although well-bonded to cattle, LPDs on 3 farms habitually escaped from pastures. After these LPDs initially were released into pastures, they remained with cattle. After ≤2 weeks, these LPDs began testing the fence and escaping. When escape points in the fence were discovered, we modified the fence by adding wires to specific sections. Although fence modifications prevented LPDs from escaping at that specific point again, LPDs would find another exit from pastures. Adding additional lines of fencing to escapee farms prevented LPDs from roaming for ≤2 days. LPDs would find new escape points in the fence and continue to roam. On 2 farms, LPDs would roam but came back to the farm house or barn yard within 1 to 2 days. While this was commonly the case, on the third problem farm, LPDs went several km from their farm and were found by neighbors on several instances.

We abandoned use of electric fencing at these 3 farms and implemented invisible fence technology. Immediately, the invisible fencing

system was successful in correcting roaming behavior of LPDs. Within the first year of use of invisible fence on 1 farm, a break in the line caused the system to fail for 2 days. During this time, 1 LPD escaped after neighbors began shooting at birds near the pasture. This dog escaped through the fence and joined the neighbors. No LPDs escaped over the remaining 3 years of study after the invisible fence wire was fixed.

After extensive interviews with all producers in our study, we learned additional information about variability in producer training of LPD pups and deviation from our guidelines. On all 3 farms where LPDs escaped from pastures, producers allowed dogs as pups to move in and out of pastures under an electric fence near their barns (i.e., before we added lines of electric fencing for release of LPDs into pastures). Because fencing at all 6 farms was designed for cattle, none had an electric wire ≤0.3 m from the ground. Pups could easily crawl under and even between fence lines without consequence. Although all producers knew LPD pups should not be allowed to breach the fence when in pastures, 3 producers were careless regarding this guideline. They allowed the pups to roam unattended, often for hours at a time. We observed 1 producer calling his pups to come to him when he was outside the fence. Initially, the LPDs stopped when they reached the fence line. However, after being called and coaxed by the producer, the pups breached the fence to get to their owner. Allowing and encouraging this type of behavior led to LPDs not respecting the fence as a boundary. Despite our immediate actions to correct producers when they did not follow our protocol, it is likely that some producers continued to not follow our guidelines.

On 3 farms where LPDs did not escape from pastures, we found that producers had always supervised LPDs until they were integrated into pastures with adult cattle. LPDs were allowed to play inside barns and in small pens. One farm allowed their dogs to be loose outside with supervision in the barnyard. None of these farms, however, allowed their dogs to cross a fence or go into pastures unless entering through a gate on a leash. Because LPDs were not exposed to the fence until extra lines were added, their first experience with fencing was negative. On these farms, we did not observe dogs testing fences after initial exposure to it. Further evidence that these LPDs recognized the fence as a boundary and did not test it occurred at multiple times throughout the study. For example, two of the farms had their fence lines broken and one had a gate down for ≥3 days, but LPDs never left their pastures.

Management recommendations

Fencing that prevents LPDs from leaving livestock that they are protecting is a critical component in establishing effective LPDs. We found that proper socialization alone was not enough to ensure that LPDs remained with their livestock. However, LPDs that begin roaming may still become excellent guardians if they can be properly re-conditioned and contained. We found that invisible-fence was effective in containing LPDs that previously had roamed. Both electric fencing and invisible fencing have advantages and disadvantages associated with them. The type of fence used depends on existing infrastructure and the needs of each individual producer. Both fence types can be labor intensive, requiring proper maintenance (e.g., monitoring downed wires, mowing or herbicide treatment for weed growth, and addition of extra wire). However, electric fencing maintained for livestock (particularly sheep) may require only slight modifications for preventing LPDs from escaping. We found that the lowest electric wire (preferably ≤0.25 m from the ground) was the most critical. Invisible-fence technology is limited to approximately 40 ha that can be fenced. Invisible fencing also requires regular monitoring to fix line breaks that may occur during freeze and thaw periods, replacement of batteries in shock collars, and monitoring of LPDs to be sure that their necks are not being abraded from shock collar probes. However, invisible fencing or 1.2-m-tall electrified woven wire may be the only viable option if producers are not completely invested into training their LPDs. We found that a 610-m section of electric or invisible fence in our study cost $0.11/m and $0.63/m, respectively. Our farms required ≤3 additional strands of electric fencing at an estimated cost of $0.33/m.

Regardless of the type of fence used, training LPDs as pups to respect electric fences is critical to establishing the fence as a physical

and psychological boundary and reducing the likelihood of roaming behavior. We suggest that this initial training can be even more critical than the choice of fencing itself. Establishing a fence as a boundary by walking LPDs on a leash around a pasture's perimeter and, most importantly, not allowing them to pass through a fence is a crucial component of LPD training. Making an LPD's first experience with the fence a negative one is important in keeping them in pastures. During a LPD's first exposure to electric fencing, we recommend leashed LPDs be allowed to investigate fencing and receive a shock, followed by continued walking of fence and shocking. To reinforce aversion to fencing, producers should walk LPDs daily around pastures for several weeks, with corrective shocking, before releasing LPDs into pastures.

Fencing and training guidelines

1. Assess existing fencing on livestock farm. Add additional electric wire, if needed, and ensure bottom wire is ≤0.25 m from the ground. Alternatively, use an invisible-fence system, woven wire or woven-electric net fencing. Electric fencing or invisible fencing is most desirable to prevent LPDs from digging under fences and escaping.
2. Socialize and bond LPDs with livestock starting at 7 to 8 weeks of age. Ensure that LPD pups are not allowed to breach electric fence and that first experience with fencing is negative.
3. Integrate LPDs into pastures at approximately 7 months of age. Ensure that this integration is a formal process of walking dogs on leashes around the pasture perimeter and forcing dogs into electric or invisible fencing. When LPDs demonstrate great resistance to being forced near fencing, they are conditioned properly.
4. If roaming problems are exhibited by LPDs, producers can use invisible-fence, in lieu of immediately considering culling to correct this behavior.
5. Regardless of fencing considerations, producers must be genuinely interested in using LPDs and be full participants in training and maintaining dogs. If a producer lacks these attributes, LPDs should not be used.

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