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ALTERNATIVE METHODS OF PREDATOR CONTROL

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Abstract: Acceptable solutions to animal damage problems must consider the social and recreational values of wildlife, regulation of population levels, potential hazards of chemical use, human safety and disturbance to biotic communities. The objective should be to reduce harm and economic loss of livestock to an acceptable level. This paper reviews alternative, i.e. nonlethal, predator management methods. Alternative methods include guard animals, fencing, repellents, frightening devices and perhaps someday, immuno-contraception. The intent of animal damage control should be an integrated pest management approach tailored to fit the individual landowner's needs

Texas leads the U.S. in sheep production with 1.7 million head (Texas Agric. Statistics Serv. 1995). Another 1 95 million goats resided in Texas in 1995. This count includes Spanish, angora, Boer and a small number of dairy and cashmere goats. The Texas sheep and goat industry is located primarily in the Edwards Plateau region of the state. Rangelands used primarily for sheep and goat production are fairly rugged limestone hills with moderate to dense brush

Under such conditions, predation losses to coyotes (*Canis latrans*), domestic and feral dogs, bobcats (*Lynx rufus*), gray fox (*Urocyon cinereo-argenteus*), red fox (*Vulpes vulpes*), feral hogs (*Sus scrofa*), golden eagle (*Aquila chrysaetos*) and other predators were estimated to be 168,000 head in 1994 (Texas Agric Statistics Serv 1995). Coyote predation typically accounts for over 50% of predator losses Value of livestock losses from predators on sheep and lambs in Texas amounted to $1.2 million in 1994 Predation is considered as the primary problem of the sheep and goat industry by many producers

When toxicants were banned for predator control in the 1970s, many producers and researchers began to explore other methods of predator management. Considerable attention was focused on European and Eurasian breeds of livestock guarding dogs. While the use of dogs was gaining popularity, many Texas sheep and goat producers began to use donkeys and mules as guard animals (Walton and Feild 1989) Llamas have also been utilized as an effective means of predator deterrent (Franklin 1993), and other species (e g. ratites) are often promoted for guarding animals.

The goal of predator management should be to protect livestock and minimize losses due to predators, not necessarily maximizing the take of predators. Public opposition to coyote population reductions will likely become even more apparent in the future.

Livestock guarding animals

Dogs. Livestock guarding breeds originated in Europe and Asia, where they have been used for centuries to protect sheep from wolves and bears. American stockmen have used guarding dogs since the mid-1970s. Several breeds of dogs have been used for predator control; no particular breed has emerged as the most effective. The more common breeds include the Great Pyrenees of France, the Akbash and Anatolian Shepherd of Turkey, the Maremma of Italy, the Shar Planinetz of Yugoslavia and the Komondor of Hungary. Most of the breeds range from 75 to over 100 pounds and stand 25 inches or taller at the shoulder. However, smaller mongrel dogs have also been used successfully, especially when accompanied by herders (Black and Green 1985, Coppinger et al 1985).

Several research projects have been conducted to determine the effectiveness of the various breeds under field conditions. Dogs can be used effectively in farm flock pastures, on open range and in feedlots

Guard dogs have become a more widely recog-

nized form of predator control and therefore have increased in abundance and availability. In selecting a dog for guarding purposes, one should consider all characteristics of that particular breed. Such traits include behavior, rate of maturity, aggressiveness and self-confidence, along with gender-specific traits and the number of dogs needed for the area to be protected.

Buyers should also consider the bloodline of the guard dog and purchase or lease a dog based on a history of proven results. There are many guard dog breeders; the Texas Department of Agriculture maintains a current listing of breeders within Texas.

Guard dogs should be reared with a flock of sheep in order to secure a close bond between the dog(s) and the livestock. This act is called socialization and can be accomplished in various ways, depending on the dog and your situation. Dogs generally mature rather slowly, thus increasing the need to form a bond between the dog and the sheep before the dog is introduced to a specific flock of sheep. Guard dogs may be purchased as grown, mature adults ready to work, or as young puppies with little experience. In either case, there must be some interaction with the dog and sheep before the guard dog is asked to earn his keep.

Ideally, puppies should be placed with a flock of sheep in an enclosed environment so the pup is not allowed to leave his flock. Pen the newly-weaned pup with 6 or more sheep for 8 to 16 weeks (until the pup reaches 5 months of age) near water, bedding ground or other points, where the sheep gather (Lorenz and Coppinger 1986) After this time, evaluate the dog's capabilities to determine when it is best suited to be left alone with sheep.

Some ranchers choose to leave the dog with the sheep during the day and pen them at night This allows the puppy to become accustomed to being alone with the sheep for extended periods of time in an open environment. A pup is usually ready to guard livestock at about 8 months of age A good indicator that you can leave your dog alone is that it stays with the sheep rather than following you as you leave the pasture (Lorenz 1986).

The cost of a livestock guarding dog varies among breeds and breeders, and depending on the level of maturity and training. Common costs associated with guardian dogs include feeding, veterinary care and maintenance. Costs associated with acquisition of the dog as well as the dog's longevity need to be figured in the overall cost to your operation. The average life span of a dog is 10-12 years. However, untimely deaths take their toll during the early years, primarily because of accidents

Effective use of dogs depends on their training, care and feeding. Factors to consider in the use of guard dogs include: severity of predation losses, pasture size, livestock habits (i.e., herding tendency, acceptance of dog), expense, the time involved in training the dog, compatibility with other predator control methods in practice, and also the predator control methods used by adjacent ranches

Donkeys and mules. Though livestock guarding dogs have received much attention in recent years, other animals (e g., donkeys) are also being used to deter predators. Donkeys and mules have been used with some success to reduce predation on sheep and goats from coyotes and dogs (Walton and Feild 1989). The effective use of guard donkeys capitalizes on the equines' herding instincts and natural dislike of, and aggressiveness towards, canines. Loud braying may also be helpful in discouraging some predators

Under proper conditions, guard donkeys can provide a high degree of around the clock protection against dogs and coyotes. They may also offer some protection against foxes and bobcats. However, larger predators such as mountain lions, gray wolves and black and grizzly bears (*Ursus* spp.) may prey on donkeys. Because individual differences in guarding abilities exist among donkeys, management practices may need to be tailored to capitalize on particular qualities of a donkey

Donkeys are compatible with most traditional methods of predator control and can be used in an integrated predator management program. Because they can forage with sheep or goats, are inexpensive to maintain, and they have an expected useful life of 10-15 years as guard animals.

Donkeys are easy to obtain and can be purchased from breeders or from auction barns. Most often, jennies are suitable for guard animals and cost

$75 to $150 (1995 prices) Jacks cost half as much as jennies, but should be neutered before use as a guard animal due to an intact jack's aggressive behavior to all animals. Proven guard donkeys may be more expensive. After initial acquisition of breeding stock, some guard donkey users produce their own stock. This practice allows selection for donkeys with good guarding tendencies.

Care and maintenance of donkeys is minimal. Annual health care such as worming and vaccination against common equine diseases is recommended Supplemental feeding during periods of poor range conditions may also be required. Donkeys should not be allowed access to feed containing ionophore feed additives (e.g. rumensin), urea or other products intended only for ruminants. Other veterinary care, e g , floating of teeth or hoof trimming may be needed periodically Average maintenance costs averaged less than $70 in 1989 (Walton and Feild 1989)

Guard donkeys require no special training However, bonding with the livestock to be protected is necessary in some instances to ensure that the donkey will stay with the flock. Halter-breaking and teaching a donkey to load in a trailer will increase ease of handling. Donkeys can be used with relative safety in conjunction with snares, traps, M-44 devices and Livestock Protection Collars.

Guard donkeys should be selected from medium- to large-sized stock Do not use extremely small or miniature donkeys Always select a donkey that can be sold or culled if it fails to perform properly (which may preclude animals from such programs as the Bureau of Land Management's Adopt-a-Burro program)

Donkeys ideally should be raised with the animals they will guard If possible, place the donkey with the sheep at birth or at time of weaning Jennies with newborn foals may be overly protective or too aggressive to sheep Further, guard donkeys should be monitored during lambing or kidding times as some donkeys may be aggressive or overly possessive of the newborn lambs/kids. The donkey(s) may be temporarily removed in these instances Guard donkeys should also be raised away from dogs, and the use of herding dogs around donkeys should be avoided

When placing a donkey into a pasture, isolate it from other equines Donkeys tend to socialize with other equines and will stray away from the flock if given the opportunity to mix with other equines. Donkeys tend to be most effective when used in small (less than 600 acres) open pastures with not more than 200 head of sheep or goats (Walton and Feild 1989). Large pastures, rough terrain , dense brush, too large a herd and sheep or goats that become scattered all lessen the effectiveness of guard donkeys.

Llamas. Llamas (*Llama glama*), like donkeys, have a natural dislike for canines. This instinct allows llamas to work well as guard animals The use of llamas as guard animals is not as extensive as either guard dogs or donkeys at this time. However, llamas are becoming more common, less expensive and therefore being utilized as guard animals more frequently (Franklin 1993). Research on guard llamas has been underway at Iowa State University since 1981 with positive results.

Llamas are generally more expensive than guard dogs and considerably more expensive than donkeys. Most guard llamas are gelded males costing $700 to $800; intact males are about $100 cheaper (Franklin 1993). The average lifespan of a llama is 10-15 years. Llamas fit easily into a sheep herd, readily foraging on whatever the sheep are eating. They do not require special feed, except in times of drought or adverse conditions. Other veterinarian practices such as vaccinations and regular deworming are recommended. Guarding effectiveness of llamas may be adversely affected by hot weather, but proper shearing may help with this problem

Introduction of llamas to sheep has been accomplished at various ages. Llama breeders traditionally wean offspring at 6-8 months of age and castrate males at 6-24 months of age. In the study conducted at Iowa State University (Franklin 1993), nearly all llamas had no prior experience with sheep before being introduced to the herd they were to protect Average age of llamas used was 2 years but ranged from a few months to over 12 years. Most introductions of llamas to sheep required only a few days before bonding between species occurred. Many producers reported that guard llamas show intense interest and attachment to young lambs (Franklin 1993).

Repellents and frightening devices

Several devices or chemicals have been promoted as having utility for deterring predation. However, the use of devices to frighten and/or repel predators is almost always short-term, if any response is noted at all (Lehner 1987, Shelton and Thompson 1975). Experiences to date suggest they offer no real solution to predator problems.

Various repellents including capsaicin, cinnamaldehyde, undecenovannillylamie, coal-tar derivatives and other chemicals have been evaluated as either pour-ons or in collars that are attached to the target sheep (see summary in Lehner 1987). M. Shelton (Texas Agric. Exp. Sta., San Angelo, pers commun.) reported that short-term relief from predation is sometimes observed after treating goats with insecticides used to control lice

Predators tend to become accustomed to these devices/chemicals, therefore most authors suggest a diversity or combination of methods be used Linhart (1983) and Lehner (1987) summarized research studies involving gustatory and olfactory repellents and concluded that such repellents offer little potential for resolving coyote damage problems

Propane cannons, horns, sirens and radios are sometimes used in attempting to repel coyotes from lambing grounds These devices may also adversely affect the livestock to be protected. They may also result in disturbance to neighbors and non-target species. While sonic repellents usually have only short-term effects, they are generally compatible with other forms of predator management. The "Electronic Guard" emits periodic sirens and strobe lights and has been used successfully to curb predation losses on sheep bedding grounds (Linhart et al. 1984).

Aversive conditioning

Considerable research was undertaken during the 1970s and 1980s to evaluate the concept of aversive conditioning (Lehner 1987, Olsen and Lehner 1978). Aversive conditioning involves dosing a prey item with an emetic compound (e.g., lithium chloride) to produce an induced nausea in the coyote. Ideally, the coyote associates the illness with the novel food, and learns to avoid that food (prey). Although results in field trials varied, aversive conditioning is generally not considered as a viable damage control tool

Lithium chloride is a chemical that has been used in research studies conducted in the United States and Canada It is an emetic, and when consumed results in the animal experiencing short-term, severe gastrointestinal discomfort, usually accompanied by vomiting. Taste aversion has variable success in deterring predators from particular species of livestock. In order to be successful, predator must make the association between the illness produced and the taste of the species.

Baits injected with lithium chloride solution may be prepared and placed in strategic locations to encourage uptake by predators. Baits should be made out of hides and ground mutton from cull ewes or losses. Carcasses may also be injected with the solution Proponents of this technique maintain that coyotes with a conditioned taste aversion will avoid sheep and lambs and also will not teach offspring to use sheep as a food source These claims are speculative and have not been documented by other researchers.

Livestock husbandry and management practices

Several livestock management practices have proven to be effective in deterring predators. These methods should be practiced in conjunction with other forms of predator control.

Total confinement offers the highest degree of protection, but has it's drawbacks These include increased cost of feed, disease control, quality of wool and mohair production, increased labor costs, etc. Thus, total confinement is impractical for range operations Shed birthing of lambs and kids provides protection at the most vulnerable age This method requires increased capital investment and costs associated with labor and disease control, but these costs may be offset by an increase in lamb and kid crops

Predators often respond to the most abundant and available food source, therefore, alternating lambing and kidding seasons to prevent a build-up of predators dependent on this food source may

result in a decrease in predation. Coyotes typically whelp in the early summer (April-May) and food demands of the parents are highest during early-summer (Till and Knowlton 1983). Fall-lambing may avoid the period of greatest demand for food by these predators

Penning of sheep at night may be another option. Predation by coyotes, foxes and bobcats most often occurs primarily between dusk and dawn; therefore, night penning provides protection during the period of greatest vulnerability This method does involve increased labor as a result of movement of livestock and maintenance of facilities.

Removal and proper disposal of dead livestock and other sources of carrion may be helpful in reducing incidence of predation by reducing the attraction of predators to areas used by livestock. It also reduces the artificial food supply available to predators, with predators becoming less likely to develop a taste for livestock.

Selective use of pastures is a technique relatively easy to implement, given alternate grazing lands are available. Some pastures, due to vegetative and physiographic features or proximity to preferred habitat, lend themselves to higher predation rates. Changes in seasonal use or class of livestock used in such pastures may provide some relief.

Fencing

The use of conventional and electric fencing has increased as a predator management method because of restrictions on alternate methods Various types of fencing exists that may be utilized as predator deterrents (Shelton and Gates 1987, Linhart et al. 1981). Fencing is most successful if it is implemented before a pattern of movement has been established by a predator. If coyotes have been feeding on animals within a given pasture, the construction of a fence will probably not deter them, as they recognize these animals as a food source.

Cost effectiveness of fences is related to the type and density of predators, along with acreage involved and land productivity. Other factors that contribute to the cost effectiveness of fences are construction and maintenance cost, stocking density, terrain and soil type Fencing to ward off predators has been proven to be most useful and cost effective on small, level, open pastures with a minimum of brush (Shelton 1984, .

There are many types of fencing used to manage predators; however, the most common types are net wire and electric fencing. A fence should be at least 5.5 feet tall to discourage predators from attempting to jump the fence. An overhang on the outside of the fence prevents climbing. Digging under the fence can be prevented by a buried barb wire or mesh apron The mesh size of the fence should be a maximum of 4 inches by 6 inches, but preferably smaller to ensure that coyotes won't attempt to crawl through the fence.

Netwire may be fatal to livestock and deer after feeding through the wire or attempting to jump over and becoming entangled This option is also very expensive. By using information on stocking rate, fencing costs, size and shape of area fenced and estimated life of the fence, producers can calculate relatively easily the annual per-head costs to determine if this approach is feasible (Shelton 1984)

Electric fencing may be suitable as temporary or permanent fencing This type of fencing will provide a physical barrier as well as, a psychological barrier to predators. This type of fencing is less expensive than net-wire fencing but it requires a higher degree of maintenance.

Modifying existing net-wire fences by adding one or more electric wires have proven effective at deterring coyotes (Shelton 1984, Rollins 1991). This may include adding a trip wire to the bottom, middle or top of the fence. When adding a wire to the bottom of the fence, it is necessary to place it in the proper position. Placing the wire too high or too far away form the fence may prove to be ineffective. Generally, the electrified trip wire should be located about 8-10 inches outside the fence and about 6 inches off the ground. Brush in fencelines may be a chronic problem with placing and servicing such trip wires. Adding an electrified wire to the top of a fence will give added height to the fence and discourage climbing by predators

It should be noted that fencing is not a cure-all for predator problems; however, with proper use fencing can be very effective in a predator management program

Conclusion

Predator management continues to be a problem that livestock producers must address. With ever-increasing pressure against the use of lethal methods of control, producers increasing have adopted alternative, non-lethal control methods. The use of guard animals, including donkeys, dogs and llamas has provided some relief from predation. Other forms of control and/or deterrents are the repellents and frightening devices, along with proper use of fencing. An alternative that is currently under product registration review is the use of lithium chloride as a taste aversion product.

At any rate, an effective predator management program must incorporate the use of several methods of control into an integrated pest management philosophy. This approach should combine the ranchers' concerns over predator- related livestock losses with the equally valid need to protect wildlife, the environment and the public.

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