U.S. Department of Agriculture
Animal & Plant Health Inspection Service
Wildlife Services
November 2020

Wildlife Damage Management
Technical Series

Coyotes

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Figure 1. Coyote *(Canis latrans).*

Quick Links

Human-Wildlife Conflicts

The coyote (*Canis latrans;* Figure 1) is a medium-sized member of the canid family. Once primarily found in western deserts and grasslands, coyotes have expanded their range across North America and into diverse habitats, including urban areas. This expansion occurred during a time of extensive habitat change and efforts by people to suppress coyote populations to prevent damage.

Coyotes can cause a variety of conflicts related to agriculture, natural resources, property, and human health and safety. This document highlights a variety of methods for reducing those conflicts. Coyotes are a highly adaptable species and may become habituated to some management tools and techniques used to reduce or prevent damage.

Agriculture and Livestock

Coyotes are omnivores (i.e., eat plants and animals) and pose substantial threats to agricultural crops and livestock. They forage on agricultural crops, such as watermelons, sweet corn, and berries. Coyote depredation on poultry and livestock (e.g., sheep, cattle, goats), and non-traditional livestock and specialty breeds (e.g., miniature horses, donkeys, game birds, rabbits) is frequently a concern when both share the same environment. Furthermore, coyotes may spread the parasite *Neospora caninum* to livestock, causing abortion and neonatal mortality in cattle.

Human Health and Safety

Where coyotes occur near people, they sometimes become acclimated to human presence (Figure 2). Coyotes may attack and kill pets, other domestic animals, and sometimes threaten or attack people.

Additionally, coyotes pose aviation hazards when they occur on airports. In fact, coyotes are one of the terrestrial mammals most frequently struck by airplanes according to the Federal Aviation Administration's National Wildlife Strike Database, 1990-2018.

Figure 2. Coyotes in cities and suburban areas often become less wary of people.

Coyotes can carry transmissible diseases and parasites, such as rabies and *Echinococcus granulosus* tapeworms, which may threaten human health and safety.

Natural Resources

Coyote predation can impact the recovery of threatened and endangered species, such as black-footed ferrets *(Mustela nigripes)* and ground nesting birds (e.g., piping plovers *(Charadrius melodus)* and least terns *(Sternula antillarum))*.

Property and Nuisance Issues

Coyotes feed upon and scatter human garbage; eat unattended pet food or residual seed below feeders; and chew on rigging, straps or tie downs made of leather or treated with compounds containing sweet resin or sulphur.

Damage Identification

Agriculture and Livestock

Many animals can cause damage to agricultural crops and livestock. Therefore, it is important to accurately identify the species responsible to select the most appropriate methods and techniques to include in an effective integrated damage management program.

First, search for sign (e.g., tracks, scat, fur, carcass parts) by walking in ever expanding circles around the depredation site (it is also helpful to use a trained dog for this purpose). Check animal travel corridors for sign to aid in the investigation. Trail cameras may also be useful for monitoring a site. If ground conditions are suitable, rake a clear area in a suspected animal travel corridor and look for fresh tracks on future visits. In urban or suburban areas, scatter a thin layer of flour over dry hard surfaces (decks, sidewalks, driveways, or porches). Look for tracks in the following days to determine animal presence.

Next, examine the damaged resource. Coyotes eat smaller fruits and vegetables whole but can also cause extensive damage to larger fruits and plant parts. For example, coyotes will bite into and eat parts of watermelons. They will also knock down or rip out sweet corn plants by the roots and eat portions of a single ear before moving onto another plant. As generalist omnivores, coyotes may eat any type of food crop depending on local conditions and the availability of natural alternatives.

Regarding livestock depredation, examine the evidence to determine if the animal died of natural causes (and was later scavenged) or if it was killed by a predator. A timely evaluation of the depredation site is critical. Talk to the producer. If possible, ask them to cover the carcass to prevent scavengers from feeding and destroying evidence. Locate the attack, kill, and feeding sites and search for sign. Observe the remaining livestock in the vicinity to determine if additional stock are missing (e.g., an adult without young).

Begin a field necropsy by noting the position of the carcass. Predated animals are rarely lying in a natural position. Examine the carcass for wounds, hemorrhaging, broken bones, and feeding to determine the cause of death. Hemorrhaging around any bite mark would indicate the prey was alive at the time of the bite. Do not confuse bruising (localized and dark in color) with conditions caused by decomposition (body fluids collect and cause discoloration). Blood from wounds of injured animals is thick and easily clots; differing from the thin reddish fluids resulting from decomposition. Note the number, size, depth, and location of tooth puncture marks. Size and spacing between canine teeth is characteristic for each predator species. Detailed notes and photographs will help document and assist in the investigation.

Signs of coyote damage to livestock are diverse and may include the following:

- Eating the ears, noses, or tails of newborn calves;
- Killing of small ungulates like calves, lambs, and fawns which are easily overtaken by coyotes because of their size. For prey that is larger than a coyote, a rear leg may be damaged, or hamstring torn or rendered useless during an attack;
- Biting the throat (behind jaw hinge and below ear). There may be multiple bites in a location due to a lack of penetration or loss of grip. Calves or larger livestock are often attacked at the flank or hindquarters. Small livestock may be killed by a single bite through the head;
- Distinctive puncture wounds. Location and spacing of puncture wounds will aid in determining the species. There will be slight measurement variations with age and between eastern and western coyotes. Generally, an upper jaw canine tooth is ¼ inch (0.6 centimeters (cm)) in diameter and the puncture wound pattern of both upper canine teeth is 1¼ inches (3.1 cm) wide; and a lower jaw canine tooth is $^{3}/_{16}$ inch (0.4 cm) in diameter and the puncture wound pattern of both lower canine teeth is 1⅛ inches (2.8 cm) wide;
- Feeding on a carcass just behind the ribs. The heart, lungs, and liver or milk-filled stomach are often eaten first. In larger carcasses, feeding may begin on the hindquarters, near the anus or udder;
- Scattering remains (wool or hair, stomach contents, bones, etc.) or moving a carcass (small animals) or parts of a carcass to a safer or more protected area for feeding;
- Presence of coyote sign near the location of the damage or attack, as well as the feeding site; and
- Killing of multiple animals.

Human Health and Safety

In cities and towns across the U.S., coyotes are thriving. This increased contact with people sometimes leads to bolder and more aggressive behaviors towards people and pets. Factors which may lead to or allow for the continuation of these aggressive behaviors include:

- Lack of fear by some coyotes likely due to changes in interactions between coyotes and people (e.g., people more likely to tolerate coyote presence, coyotes are rarely hunted or trapped in urban areas);
- Intentional feeding of coyotes by people; and
- Reduction in management and animal control programs that selectively remove problem coyotes.

Many municipalities have developed urban coyote management plans that describe coyote actions and behaviors, and recommend management responses. A list of progressively bolder coyote behavior is described in Table 1. Many preventative actions (e.g., public education, stopping intentional and unintentional feeding, hazing) can be taken in the early stages to help curtail aggression.

Coyotes can carry a variety of diseases and parasites which are easily transferrable to pets and people. Spread can occur through direct or indirect contact with bodily fluids and scat. In some cases, people may have no direct contact with coyotes, but may be at risk through a pet's contact with coyotes or coyote scat. Pet vaccinations are an important tool for preventing the transfer of some diseases, such as rabies, canine distemper, and canine parvovirus.

Stage	Descriptive Behavior
1	An increase in observing coyotes on streets or property at night
2	An increase in coyotes approaching people or taking pets at night
3	Early morning and late afternoon daylight sightings of coyotes
4	Daylight sightings of coyotes pursuing or taking pets
5	Coyotes attacking pets on a leash or in close proximity to their owners
6	Midday sightings in areas where children congregate
7	Midday aggression towards people

Table 1. Progression of coyote aggression compiled by Timm, Coolahan, Baker and Beckerman (2007).

Management Methods

Responsible and professional reduction or elimination of wildlife damage is the goal of wildlife damage management practitioners. This is best accomplished through an integrated approach. No single method is effective in every situation, and success is optimized when damage management is initiated early, consistently, and adaptively using a variety of methods. Because the legality of different methods vary by state, consult local laws and regulations prior to the implementation of any method.

For a summary table of coyote management methods, please see Appendix I.

Animal Husbandry

Animal husbandry includes a variety of activities related to the care and attention given to livestock. Generally, when the frequency and intensity of livestock husbandry increases, so does the degree of protection from predators.

Altering animal husbandry to reduce wildlife damage can be effective but may have limitations. For example, confinement may not be possible when grazing conditions require livestock to scatter. Hiring extra people, building secure holding pens, and adjusting the timing of births is usually expensive. The expense associated with a change in husbandry practices may exceed the savings.

Flock and Herd Health

Poultry and livestock breeds with stronger flocking and herding behaviors may be less vulnerable to coyote depredation. Coyotes often take advantage of prey with compromised health conditions. Proper feeding and care of livestock helps ensure stronger young that are less vulnerable to coyote depredation.

Record Keeping

Good record keeping and animal identification systems are invaluable in a livestock operation. Records help producers identify loss patterns or trends related to coyote depredation, as well as determine what type and amount of coyote damage management is feasible. Records also identify critical problem areas that may require attention. For example, records may show that losses to coyotes are high in a particular pasture in early summer, requiring proactive preventive management. Owners who do not regularly count their livestock may suffer fairly substantial losses before realizing a problem exists. Such delays make it difficult to accurately determine if losses are due to coyotes.

Birthing and Raising Young

Both the season and location of birthing and raising young livestock can affect the severity of coyote depredation. Coyote related losses of young livestock are typically the highest from late spring through September when adult coyotes are feeding young. A fall birthing program is one option that avoids large numbers of young animals on the landscape during periods when coyote depredation is high.

Synchronized or group breeding helps shorten birthing periods and reduces exposure of small livestock to depredation. When birthing within a concentrated period, however, extra labor and facilities may be necessary. Some producers practice early weaning and do not allow young to go to large pastures, thus reducing coyote depredation. This also gives orphaned and weaker animals a greater chance of survival.

Where practical, sheds, pens, small pastures or paddocks for birthing or raising young livestock can increase survival. Increased human presence or activity around livestock also

Figure 3. Good animal husbandry practices, such as penning sheep at night and properly burying or disposing of livestock carcasses *(as shown),* can help prevent coyote depredation.

helps to reduce coyote depredation. Confining livestock entirely to buildings nearly eliminates coyote depredation, though may be impractical in many situations.

Carcass Removal

The proper removal and disposal of dead livestock is important since carcasses tend to attract coyotes and other predators, and may result in habituation to that food source (Figure 3). Coyotes are attracted to easily accessible carrion and, as a result, depredation losses to nearby livestock can be higher.

Pasture Selection

Habitat features often change with seasonal crop growth. Harvested or cultivated fields are often void of coyotes during winter but provide cover for them during the spring through fall growing season. This may lead to a corresponding increase in depredation on nearby livestock.

Livestock in remote or rugged pastures are usually more vulnerable to coyote depredation than those in closer, more open, and smaller pastures. A relatively small, open, tightly-fenced pasture that can be kept under close surveillance is generally a good choice for birthing livestock, if lambing sheds are unavailable. Also consider previous coyote presence in the area, as well as weather and disease issues.

At times, coyotes kill in one pasture and not in another. Changing pastures during these times of loss may reduce depredation. Pasture features, like slope, rough or broken terrain, brushy cover, and lack of human activity, provide ideal conditions for coyotes. Pastures adjacent to streams, creeks, or rivers may be more prone to coyote activity since water courses serve as coyote hunting and travel corridors.

Herders/Shepherds

Using herders or shepherds to watch over livestock in large pastures can help reduce coyote depredation. If herders are not used, daily or periodic checks on the livestock is a good animal husbandry practice.

Denning

Coyote depredation can be reduced by locating coyote dens (Figure 4) and lethally removing the adults and young of the year (known as denning). Denning is prohibited in some areas. Check local and state regulations and restrictions.

Denning may be warranted as a preventive control strategy if coyote depredation historically or consistently occurs in a particular area. Although denning requires special skills, training, and considerable time, the advantages can be significant.

Mated coyote pairs are extremely protective of their territory when raising young and will vigorously defend it from other coyotes. Coyotes often den year after year in the same general location. If a particular denning pair of coyotes has a history of existing with and not preying on livestock, it may be advantageous to leave them alone. Their removal will open up a territory that may become occupied with coyotes that could prey on livestock.

Tracking a coyote from a kill site back to its den is one method for locating a den site. This can be done by patiently observing from a distant vantage point. A trained trailing hound also may be useful for this task. If the general area of the den is known, use a predator call to imitate a coyote howl. This usually solicits a response from any nearby coyote and helps determine the den's location.

Figure 4. Coyote den.

Aircraft can be used to locate coyote dens when depredations occur in spring or early summer. Dens are most easily located after young of the year begin venturing outside the burrows. Flattened vegetation around the den site can make it more visible from the air. If legal at the location, the coyotes can be lethally removed through aerial operations; otherwise, note the location and return on foot or by vehicle.

Once the den is located, approach the den unseen and downwind to within calling distance. A call that imitates the distress whine of a young coyote can draw out the adults, especially when used in conjunction with a specially-trained dog to act as a lure/decoy. The sound of a young coyote in distress, along with the sight of a dog near the den causes most coyotes to display highly aggressive behavior, frequently chasing the dog and coming out into the open where they can be lethally removed with a firearm. After the adults are removed, a trained applicator can fumigate the den with a large gas cartridge registered for this purpose (see *Fumigants*).

Exclusion

New materials and designs have made fences an effective and economically practical method for preventing coyote access to pastures, airport environments, backyards, and other areas. However, many factors, including the density, behavior and motivation of coyotes, terrain and vegetative conditions, availability of other prey, size of pastures, and time of year, as well as the fence design, construction, and maintenance, will impact the overall effectiveness of a fence.

It is unlikely that fences will totally exclude all coyotes from an area, especially large areas or ranges; however, fences can increase the effectiveness of other damage management methods, such as penning livestock, using guard animals, and trapping. For example, the combined use of livestock protection dogs (LPD) and fencing sometimes achieves a greater degree of success than either method alone. An electric fence may help keep an LPD in and coyotes out of a pasture. If an occasional coyote passes through the fence, the LPD can keep it away from the livestock and alert the producer by barking.

Fencing can concentrate coyote activity at specific locations, such as gateways or ravines, that coyotes use to easily gain access to livestock. Set foothold traps and cable devices at strategic locations along a fence to effectively capture coyotes.

While beneficial for livestock, fences can pose problems for wildlife. In particular, barrier fences may exclude not only coyotes, but also many other wildlife. Special attention should be made where fencing intersects wildlife travel or migration corridors.

Net-Wire Fencing

Well maintained net-wire or barrier fences deter many coyotes from entering a pasture. Horizontal spacing of the mesh wire should be less than 6 inches (15 cm), and vertical spacing less than 4 inches (10 cm). Digging under a fence can be discouraged by placing barbed wire at ground level or using a buried wire apron. A fence at least 5.5 feet (ft) (1.6 meters (m)) high will keep coyotes from jumping over it. Climbing can usually be prevented by adding an electrified wire at the top of the fence or installing a barbed wire overhang (Figure 5).

The construction and materials for such fencing can be expensive. Therefore, fences of this type are rarely used except around small pastures, corrals, feedlots, or areas used for temporary confinement.

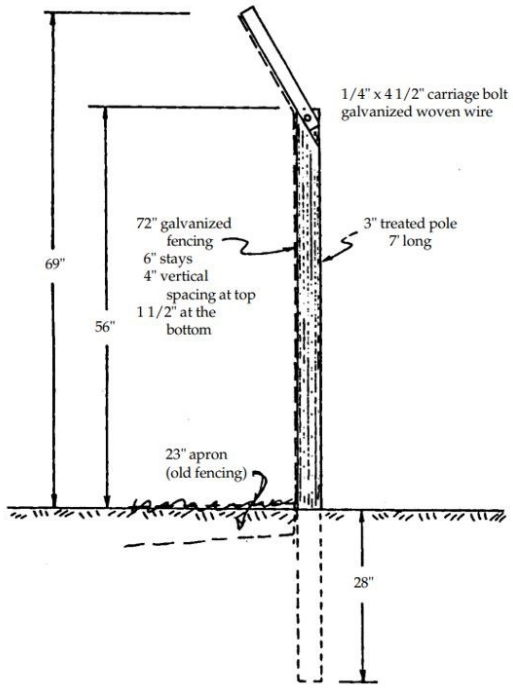

Figure 5. Barrier fence with wire overhang and buried apron.

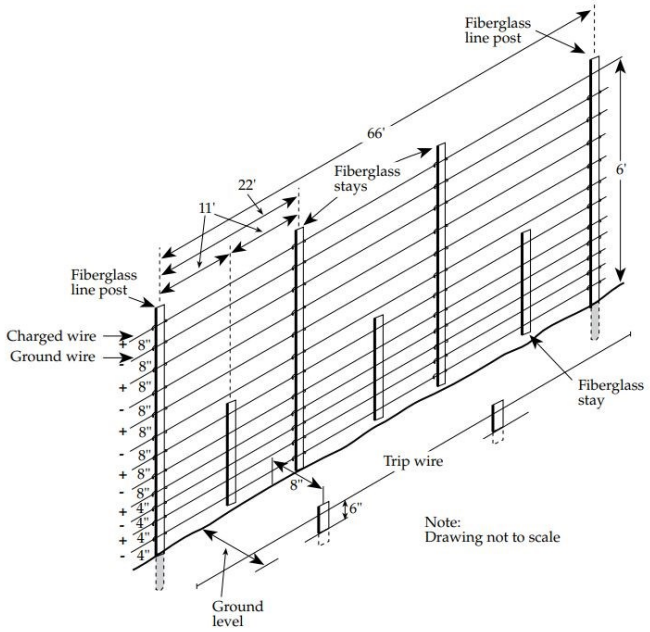

Figure 6. High-tensile electric fence.

Electric Fencing

Modern electric fencing for livestock containment and exclusion often is constructed of stretched, smooth, high-tensile steel wire and has chargers that maintain high output with low impedance which resists grounding and minimizes fire hazards.

Many electric fence designs charge every wire. A charged tripwire can also be installed just above the ground about 8 inches (20 cm) outside the main fence to discourage digging by animals (Figure 6).

Electric fencing is easiest to install on flat or even terrain. Labor to keep electric fencing functional can be significant and includes:

- Maintaining wire tension;
- Removing excessive vegetation under the fence to prevent grounding;
- Repairing damage from livestock or wildlife;
- Regularly checking the charger to ensure it is operational; and
- Checking for trapped animals inside the fence. These animals receive a shock as they enter the pasture and may subsequently avoid approaching the fence to escape.

In situations where conventional fencing is in good condition, adding 1 or 2 charged wires can significantly enhance predator deterrence. A charged wire placed 6 to 8 inches (15 to 23 cm) above the ground at 8 to 10 inches (20 to 25 cm) outside of the fence can help to prevent digging by animals. If coyotes are climbing or jumping a fence, add charged wires to the top or at horizontal levels above the ground. Wires should be offset and outside of the fence.

Portable Electric Fencing

The advent of safe, high-energy chargers (battery or solar-powered) has led to the development of portable electric fences. Electric fencing is created with thin strands of wire

running through polyethylene twine or ribbon, called poly-wire or poly-tape. The poly-material is available in single and multiple wire rolls or as a mesh fence of various heights. It can be quickly and easily installed to serve as a temporary corral to avoid depredation at places or periods of high risk (i.e., at night), to partition off pastures for controlled grazing, or to protect threatened or endangered species nesting sites (e.g., sea turtles, piping plovers) from depredation. Note that range livestock that are not accustomed to being fenced may be difficult to contain in a portable fence.

Corrals

Confining livestock in a corral at night helps to reduce depredation. Adding light, noise, and using an enclosure with good structural integrity also increases the effectiveness of corrals. Keeping livestock penned on foggy or cloudy days may be helpful, as coyotes seem to be more active under those conditions.

The potential downsides of using corrals include building costs and labor, herding, and feeding livestock. Additionally, confined livestock may increase parasite and disease problems within the flock or herd.

Fertility Control

No fertility control agent is currently available for use with coyotes. Past research on fertility control (e.g., sterilization, reproductive inhibitors, and chemical treatments) reveals some success in reducing coyote depredation, as treated territorial pairs no longer need to provide for young of the year. However, the costs may be limiting, and in some cases, annual treatment is required. These methods remain an area of research, but may not be practical nor effective on coyote populations.

Frightening Devices

Coyotes are often suspicious of novel stimuli and frightening devices are most useful for reducing coyote damage during short periods of time. Avoid acclimation by varying the position, appearance, duration, or frequency of the frightening stimuli, or using them in various combinations.

A variety of frightening devices and equipment exists, including animated scarecrows, fladry, lights and alarms, and propane cannons. Many are battery powered, motion-activated or programmable, and provide a variety of sounds or lights to frighten coyotes from the protected area.

Bells and Radios

Some livestock producers place bells on some or all of their livestock to discourage predators. Livestock are easily located, and the unnatural or unfamiliar sounds associated with them may discourage predators. A radio tuned and playing a 24-hour station may be a temporary deterrent in smaller penned areas or enclosures.

Fladry

Fladry consists of a line of brightly colored flags hung at regular intervals along the perimeter of a pasture. For extra protection, the line carrying the flags can be electrified, which is known as “turbofladry.”

Because carnivores are often wary of new items in their environment, like fluttering flags, they are cautious about crossing the fladry barrier—at least for 3 to 4 months. That

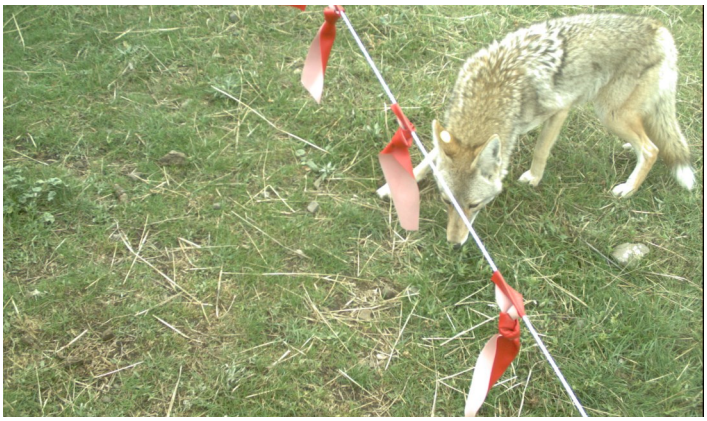

Figure 7. A 2019 USDA study showed fladry made with the top-knot design *(shown)* and with flags spaced 11 inches (27.9 cm) apart was the most effective at preventing coyotes from crossing a fladry barrier.

added time of protection may be enough to protect calves and lambs during critical periods. The effectiveness may be short-lived for coyotes as they are quite adaptable to this type of novel stimuli. A 2019 USDA Wildlife Services study showed fladry made with a top-knot design and with flags spaced 11 inches (27.9 cm) apart was the most effective at preventing coyotes from crossing a fladry barrier (Figure 7).

Lights

Lighting can act as a deterrent to coyotes, particularly in confined areas, such as corrals. Use daylight sensors or timers to activate the lights and reduce electricity costs. Revolving, flashing, or strobe lights with motion detectors may enhance their effectiveness.

Propane Cannons

Propane cannons produce loud discharges at timed intervals when a spark ignites a measured amount of propane gas. On most models, the time between discharges can vary from 1 to 55 minutes. Their effectiveness at frightening coyotes is usually temporary, but it can be increased by moving cannons to different locations every 3 to 4 days, varying the intervals between discharges, and using them in conjunction with other frightening devices. In pastures, propane cannons should be placed on rigid stands or T-posts. Elevated propane cannons reduce the potential for rodent infestations in the equipment that could cause malfunctions. Cannons can be fitted with timers to allow them to come on at predetermined times (e.g., before dark and at daybreak). Depending on location especially in relation to neighbors, noise may be a consideration.

Scarecrows

Scarecrows, air dancers or similar erect figurines may be effective predator frightening devices for short periods of time. Adding movement to the figurine increases its effectiveness. Air dancers with supplemental lighting may be useful as nocturnal frightening devices.

Strobe Lights and Sirens

The USDA Wildlife Services program developed a frightening device called the Electronic Guard (EG) (Figure 8). The EG consists of a strobe light and siren controlled by a variable interval timer that is activated at night with a photoelectric cell. In tests conducted in fenced pastures, EGs reduced depredation by approximately 89 percent. Most research on the effectiveness of EGs has been done with sheep operations. EG use differs for pastured versus ranged sheep operations. Although EGs are no longer manufactured by USDA Wildlife Services, similar devices are sold by private companies. Tips for using the EG and similar devices with fenced and pastured sheep include:

- Placing devices above the ground on fence posts, trees, or T-posts so they can be heard and seen at greater distances and to prevent livestock from damaging them;
- Positioning devices so that rainwater cannot enter the device and cause a malfunction;

Figure 8. Strobe lights and sirens, such as those used in an Electronic Guard *(shown)* and similar devices, reduce livestock depredation during short periods of time and have little to no negative impacts on livestock behavior.

- Positioning devices so that light can enter the photocell port or window. If positioned in deep shade, the device may not turn on or off at the desired times;

- Using at least 2 units in small (<30 acres/12 ha), level, short-grass pastures; 3 to 4 units in medium (<100 acres/40 ha), hilly, tall grass, or wooded pastures; and 4 to 8 units in larger pastures (>100 acres/40 ha) where livestock congregate or bed; and

- Placing devices on high spots, where depredation has occurred, at the edge of wooded areas, near or on bedding grounds, or near suspected coyote travel corridors. The devices should be moved to different locations every 10 to 14 days to reduce acclimation.

The number of devices used in open range situations depends on the number of livestock and size of their bedding grounds. Herders who bed their livestock tightly have better results than those who allow bedding over large areas. Tips for using the devices with open range or herded livestock include:

- Using 4 EGs in bedding areas to protect herds of 1,000 head and their young;

- When possible, placing an EG in the center of the bedding ground and others around the edge. Try to place the units in suspected coyote travel corridors; and

- Placing EGs on high points, ridge tops, edges of clearings, or on high rocks or outcroppings. Hang the devices on tree limbs 5 to 7 ft (1.5 to 2.1 m) above ground level. If used above timberline or in treeless areas, hang them from a tripod of poles.

Vehicles

Coyotes associate vehicles with human activity. Parking cars or pickups in areas where losses are occurring may temporarily reduce depredation. Effectiveness can be improved or extended by frequently moving the vehicles to new locations.

Figure 9. Livestock protection dogs (LPDs) have been used for centuries to protect livestock from predators.

Guarding Animals

The use of guarding animals, such as dogs and donkeys, to protect flocks and herds from predators is a common nonlethal predation damage management tool.

Livestock Protection Dogs

Livestock protection dogs (LPDs) have been used for centuries to protect livestock, primarily domestic sheep, from large carnivores (Figure 9). LPDs are raised and trained to stay with livestock without harming them. Their protective behaviors are largely instinctive, but proper rearing plays a part. LPDs should be acquired from a trained, reliable, and professional breeder.

Breeds commonly used as LPDs include the Great Pyrenees, Komondor, Anatolian Shepherd, and Akbash. Other Old-World breeds include Maremma, Sharplaninetz, and Kuvasz. LPDs typically live for about 10 years. Mixed breeds may be developed to provide for certain traits or needs.

USDA Wildlife Services research on the use of three larger European LPD breeds (Portuguese Transmontanos, Bulgarian Karackachans, and Turkish Kangals) to prevent depredation by predators larger than a coyote, such as grizzly bears and

wolves, determined that all the breeds successfully, protected sheep, but showed different guarding traits and behaviors. Producers may want to balance the traits of multiple dog breeds by having some that prefer to stand guard with the flock and some that seek out and investigate potential threats.

The characteristics of each livestock operation dictates the number of dogs required for effective guarding. If coyotes are scarce, one dog is sufficient for most fenced pasture operations. Range operations often use two dogs per herd of livestock. The performance of individual dogs differs based on age and experience.

Coyote density, as well as the size, topography, and habitat of the pasture or range must also be considered. Relatively flat, open areas can be adequately covered by one dog. When brush, timber, ravines and hills are in the pasture, several dogs may be needed, particularly if the livestock are scattered. Livestock that flock and form a cohesive unit, especially at night, can be protected by one dog more effectively than livestock that are scattered and bedded in a number of locations.

Donkeys

Donkeys or burros are generally docile to people but seem to have an inherent dislike for dogs and other canids. The typical response of a donkey to an intruding canid may include braying, bared teeth, a running attack, kicking, and biting. Pasturing a donkey with sheep, goats or other compatible livestock can help reduce coyote depredation.

Donkeys are less expensive to obtain and care for than LPDs, and may be less prone to accidental death and premature mortality. An average lifespan for a donkey is 33 years. Donkeys can be used with relative safety in conjunction with other damage management tools, such as cable devices, foothold traps, and toxicants.

For more information about donkeys, see Appendix II.

Llamas

Like donkeys, llamas have an inherent dislike of canids, and a growing number of producers are using llamas to protect their livestock. Llamas bond with sheep or goats within hours and offer advantages over guarding dogs similar to those described for donkeys. The average lifespan for a llama is 20 years.

Other Animals

Any animal that displays aggressive behavior toward intruding coyotes may offer some benefit in deterring depredation. Other animals reportedly used for reducing depredation include mules, ostriches, and larger breeds of goats.

The USDA Wildlife Services program tested whether the bonding and pasturing of sheep and goats with cattle helped to protect them from coyote depredation. Results showed the sheep and goats that remained near cattle did receive some protection. Whether this protection was the result of direct actions by the cattle or by the coyotes' response to the cattle is uncertain. Multi-species grazing allows for optimal foraging practices and may also help reduce coyote depredation.

Habitat Modification

Modify habitats to eliminate or reduce areas that provide cover, resting habitat, or travel corridors for predators. Prevent prey species, such as deer, pheasants, rabbits, or turkeys from gathering too close to human habitation or with livestock. Completely remove dead animal carcasses from pastures or bury them deep in place.

Hazing

Hazing (i.e., scaring) coyotes involves people yelling, throwing objects or aggressively approaching individual coyotes more frequently so that coyotes retain or gain more fear of people. It is commonly promoted as a nonlethal method to reduce urban coyote conflicts. USDA Wildlife Services' studies with captive coyotes suggest that hazed coyotes learn to avoid behaviors, such as getting too close to people, that might result in more hazing. Additionally, coyotes that were fed or followed by a dog were more likely to approach a person even if it resulted in hazing. Coyote hazing can work in certain situations, but researchers note a coyote's past experiences with people influences the technique's effectiveness.

Repellents

No effective chemical repellents are available to repel coyotes.

Relocation

Capturing and moving animals (also known as relocation) is rarely legal nor is it considered a viable solution by wildlife professionals for resolving certain wildlife damage problems. Reasons to avoid relocating wildlife include legal restrictions, disease concerns, liability issues associated with injuries or damages caused by a relocated animal, stress to the animal, homing behavior, and risk of death to the animal. Check state and local regulations before considering relocation.

Shooting

Shooting is a common method for lethally removing coyotes. Safety is a critical factor and may preclude the use of firearms due to local laws or human habitation. Consider all available management options and proceed accordingly.

The choice of firearm, caliber, and bullet will vary based on circumstances in the field. For instance, distance to target is important in the selection of the appropriate firearm (shotgun or rifle). The accuracy of firearms may be enhanced with accessories, such as night vision, illuminated or fiber optic sights, adjustable trigger assemblies and stocks, and tripods or shooting stands.

Predator Calling

Predator calling is used to locate coyotes or draw them close for shooting purposes. Common sounds used in predator calling replicate coyote howling, young coyote whining or distress sounds, and prey animal (cottontail, jackrabbit, bird, or young ungulates) distress sounds.

Predator calls can be hand-held and mouth-blown reed calls, or recorded sounds amplified through a battery-operated player and speaker. Advances in recording and player technology have allowed for remote use, and the opportunity to select from a variety of stored recordings that create realistic sounds.

Coyotes can be called at any time of the day, although shortly after dawn and just before dusk are usually best anywhere they are present. Night and thermal vision optics may extend predator calling opportunities after dark. Some coyotes come to a howl without howling back.

Night Operations

Shooting coyotes at night using thermal vision, night vision, or artificial light may be effective. This technology may also be useful for observing coyote behavior at night.

Review all local restrictions or regulations concerning discharging a firearm during hours of darkness and the use of thermal or night vision equipment. Seasonal restrictions or requirements may also exist if night operations are conducted during regulated harvest seasons.

For safety reasons, areas targeted for night operations should be scouted in advance during daylight. Create range maps with determined distances, locations of occupied or unoccupied structures, or terrain features that may hide an advancing coyote. Take special note of penned or pastured livestock, or the presence of domestic canines. Be familiar with the equipment and able to accurately identify coyotes during hours of darkness.

Aerial Operations

The use of aircraft for shooting coyotes is regulated by the Airborne Hunting Act and is allowed under special permit in states where legal. Aerial operations are very selective, allowing for the removal of targeted species. It is an effective alternative for removing coyotes that have evaded other methods, such as trapping.

Fixed-wing aerial operations is limited primarily to open areas with little vegetative cover. Due to their maneuverability, helicopters are more effective for shooting in areas of brush, scattered timber, and rugged terrain.

Although aerial operations can be conducted over bare ground, it is most effective with snow cover. Coyotes are more visible against a background of snow than green or brown vegetation. Their tracks are also more visible in the snow. Flying a grid pattern ensures areas are not missed.

Aerial crews generally fly the grid with the sun at their backs, allowing the sunlight to highlight coyotes and other ground features.

A ground crew assists with aerial operations. Before the aircraft arrives, the ground crew often works to locate coyotes in the area by eliciting howls. Two-way radio communication allows the ground crew to direct the aircraft toward the sound of the coyotes, thus reducing search times.

Aerial operations require special skills and training for both the pilot and gunner. Weather, terrain, and state or local laws limit the application of this method.

Toxicants

Pesticides are an important component in integrated wildlife damage management and their use is regulated by federal and state laws. All pesticides used in the United States must be registered by the U.S. Environmental Protection Agency (EPA) under the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act, as well as the appropriate state agency. Registered pesticides must be used in accordance with label directions. Some pesticides can only be applied by persons who have been specially trained and certified for their use. Each of the chemical methods listed below have specific requirements for their handling, transport, storage, application, and disposal.

Three toxicant active ingredients and eleven end-use products are registered with the EPA for use with coyotes to reduce predation.

Sodium Cyanide and the M-44

Sodium cyanide is used in the M-44 ejector device (EPA Reg. Nos. 56228-15, 35978-1, 35975-2, 39508-1, 33858-2, and 13808-8; products are all named M-44 Cyanide Capsules). EPA Reg. No. 56228-15 can only be used under the supervision of the USDA Animal and Plant Health Inspection Service (APHIS), and EPA Reg. Nos. 35978-1, 35975-2, 39508-1, 33858-2, 13808-8 can only be used under the supervision of the state's department of agriculture.

The M-44 is a spring-activated device that delivers a dose of sodium cyanide powder from the cyanide capsules to a coyote. All six M-44 cyanide capsule products are registered as Restricted Use Pesticides (RUP) by the EPA and can be used only by specially trained certified pesticide applicators who must comply with a number of product-specific use restrictions designed to protect people, domestic animals, and non-target wildlife.

The M-44 ejector device consists of four parts: a capsule holder wrapped with cloth, wool, or other soft material; a cyanide capsule (small plastic container holding less than 1 gram of sodium cyanide); a spring-activated ejector; and a 5- to 7-inch tubular stake. In the field, the stake is typically inserted with its top near the surface of the ground (Figure 10). In specialized circumstances, the top may be lower than the surrounding surface (i.e., the device is set in a hole or depression) so as not to be stepped upon, disturbed by large livestock, or seen by nontarget scavenging birds. The cyanide capsule is inserted into its holder and screwed onto the ejector. The ejector is placed into the stake and secured. Specially formulated bait or other attractant, which elicits a "bite and pull" response by coyotes, is smeared on the wrapped capsule holder.

The M-44 device is triggered when a coyote bites and pulls on the baited capsule holder, releasing the plunger and

Figure 10. The M-44 device is staked with its top placed near the surface of the ground.

ejecting sodium cyanide powder into the coyote's mouth. The sodium cyanide quickly reacts with moisture in the mouth, releasing hydrogen cyanide gas. Death is quick, normally within 1 to 5 minutes after the device is triggered.

While the use of traps or cable devices may present a hazard to livestock, M-44s can be used with relative safety in pastures where livestock are present. M-44s remain operational in adverse weather conditions like rain, snow, and freezing temperatures.

Sodium Fluoroacetate and the Livestock Protection Collar

Sodium fluoroacetate (also known as Compound 1080) is used in the Livestock Protection Collar (LPC) (EPA Reg. Nos. 56228-22, 39508-2, and 46779-1; products are all named Sodium Fluoroacetate (Compound 1080) Livestock Protection Collar). In Ohio, EPA Reg. No. 56228-22 can be used only by USDA Wildlife Services applicators. EPA Reg. No. 39508-2 can only be used in New Mexico and EPA Reg. No. 46779-1 can only be used in Texas.

LPCs are worn around the necks of sheep or goats in a group of animals experiencing predation. LPC products are one of the most selective methods available to manage coyote predation as only the coyote that attacks a sheep or goat fitted with an LPC is killed (Figure 11). A coyote must bite the prey animal on the neck and puncture one or both sodium fluoroacetate reservoir bladders attached to the collar to receive the toxicant. The sodium fluoroacetate is ingested by the coyote and results in its death.

Figure 11. The Livestock Protection Collar (LPC) is one of the most selective methods available to manage coyote predation on sheep and goats—only the coyote that attacks a sheep or goat fitted with an LPC is killed.

Typically, only operations with frequent or high depredations justify the use of LPCs given the cost of the collars, sacrificed livestock, and complying with use restrictions.

The LPC products are registered by the EPA as a RUP, and certified applicators must be specially trained in their use. Applicators must follow all label directions and Use Restrictions contained in the LPC product's accompanying Technical Bulletin.

Fumigants

Large gas cartridges (EPA Reg. Nos. 56228-21 and 56228-62) are products used for denning coyotes. The Large Gas Cartridge (EPA Reg. No. 56228-62) can be used by any person 16 years old or older. The APHIS-Only Large Gas Cartridge (EPA Reg. No. 56228-21) can only be used by trained USDA Wildlife Services applicators. Information on registration status and availability of these products in individual states may be obtained from the respective state's pesticide regulatory agency and from USDA Wildlife Services.

Large gas cartridges are registered, general use fumigant products which contain 53% sodium nitrate, 28% charcoal, and 19% inert ingredients to produce primarily carbon monoxide along with other lethal gases in minor quantities when ignited. A cartridge is lighted, placed as deep as possible within the coyote den, and the den opening is sealed. Death occurs when the lethal gasses are inhaled. Care should be taken to plug dens with nonflammable material, typically soil or rocks, to minimize the chance of nearby grasses and leaf litter from catching fire. Gas cartridges also may be used to euthanize coyotes that flee down a hole during aerial operations.

Trapping

Trapping describes foothold traps, cage traps, and cable devices commonly used to capture coyotes. Foothold and cage traps are designed to live-capture coyotes. Cable devices are designed to either live-capture or lethally remove coyotes.

Trapping rules and regulations vary by state. Consult local laws and regulations prior to using any traps or cable devices.

Trapper education programs exist in many states. This training may be required prior to receiving a trapper's license and actively trapping. Check with the local state agency for requirements and training opportunities. If none exist, the Association of Fish and Wildlife Agencies (AFWA) and some states offer online training.

Foothold Traps

For more information on the use of foothold traps, please see Appendix III.

Foothold traps should be purchased from reliable trap manufacturers or supply outlets. Foothold traps for coyotes vary in size and strength, allowing for use with different sized animals (e.g., eastern coyotes [larger] versus western coyotes) and environmental conditions (e.g., soil, moisture, and temperature).

Common foothold trap sizes for coyotes range from #1½ (small) to #4 (large) and use either coiled springs or double long springs. There are no manufacturing standards for correlating these numbered foothold traps with their dimensional measurements. Attributes like jaw spread, spring strength, and stock nomenclature vary between manufacturers. AFWA continues extensive research with foothold traps, using criteria to measure the effects on animal welfare, selectivity, efficiency, practicality, and safety. Refer to the guides Best Management Practices: Trapping Coyotes in the Eastern United States or Best Management Practices: Trapping Coyotes in Western United States for recommended sizes and measurements (Figure 12).

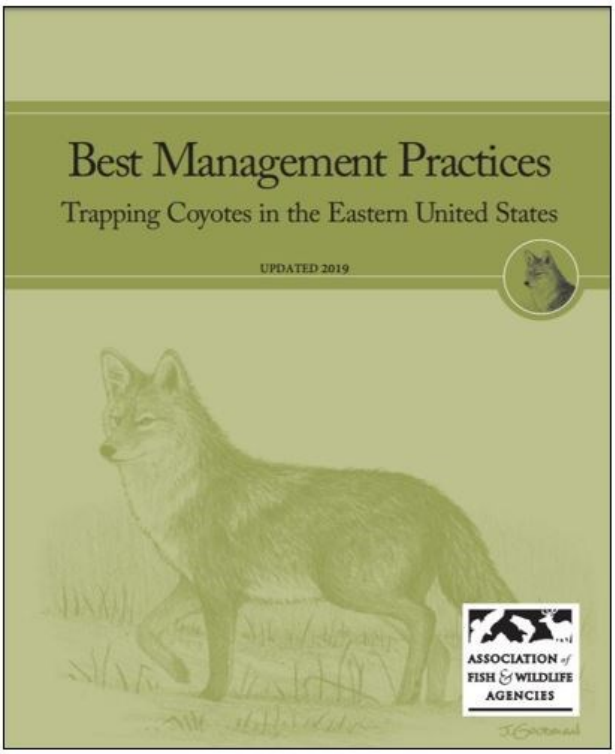

Figure 12. The Association of Fish and Wildlife Agencies provides online guides to best management practices for trapping.

Coyotes are very strong, long legged, and often lunge while restrained. Proper foothold traps for restraining coyotes include the following characteristics:

- Offset, laminated, or padded jaws (Figure 13): Offset jaws provide a space that allows for the mass of the coyote's foot. Offset and laminated jaws provide a wider contact surface, which displaces the closing pressure over a larger area. Padded jaws have a replaceable rubber surface;

- 4 lbs (1.8 kg) of pan tension: Pan tension is measured by applying a known weight to the trap pan to allow the trap jaws to close. Using 4 lbs of pan tension allows the foothold trap to be more selective for coyotes and prevents smaller animals from being captured. It increases the opportunity for a good foot pad catch and reduces the potential for injuries and accidental releases. Testing devices are commercially available

from reliable trapping supply dealers. Pan tension is typically increased or decreased by adjusting the nut and bolt that attach the trap pan to the trap base plate;

- An anchoring chain mounted to the center of the foothold trap baseplate: Any pulling pressure applied to the foothold trap is in direct line with the anchor. This direct line reduces the potential for injury by preventing the coyote's restrained foot from sliding between the foothold trap's jaws;

- An anchoring chain with multiple in-line swivels: Swivels allow the foothold trap to turn freely in any direction and prevents binding which may cause injury to the restrained foot; and

- An anchoring chain with a shock spring: A shock spring lessens the impact of a sudden stop if a coyote lunges while attempting to get free. Shock springs that can handle 50 to 100 lbs (22 to 45 kg) of pressure are typically used for coyotes.

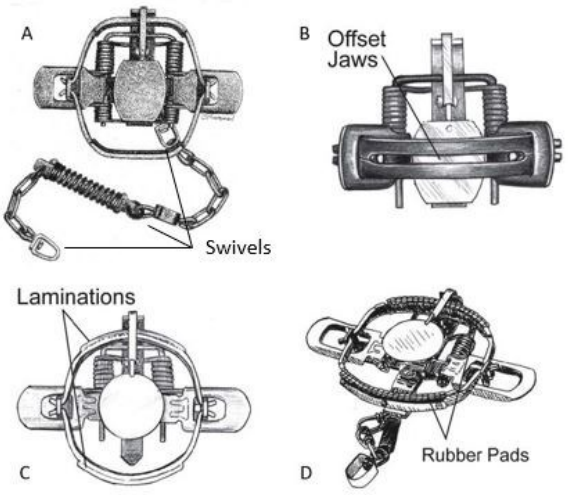

Figure 13. Foothold trap configurations: a) fully modified foothold trap with center mounted anchoring chain, multiple swivels, and an in-line shock spring; b) offset jaws; c) laminated jaws; and d) rubber padded jaws.

Foothold traps set for coyotes are secured with a single stake or double stake system; earth anchors; or drags (Figure 14). The soil conditions generally determine what anchoring system is used. Drags are typically used instead of in-ground anchors in sandy or loose soils or to allow the restrained coyote some movement to seek shelter.

Drags commonly use 6 to 10 ft (2 to 3 m) of chain between the foothold trap and the drag. The drag and chain are attached to the anchoring chain of the foothold trap. Drags should be designed to leave marks or a trail so the restrained coyote can easily be found.

Cage Traps

Cage traps used for coyotes should be at least 48 inches (1.2 m) long, 16 inches (40 cm) wide, and 23 inches (58 cm) high. Darken the cage trap's wire with paint or dye, use vegetation to break up the outline of the trap, and line the floor of the trap with dirt or vegetation to improve trapping success. Pre-baiting the cage trap with common food items which will be used during actual trapping may also help.

Encouraging a coyote into a cage trap is very difficult. Most coyotes are wary of novel objects. Cage traps may be more successful in urban or suburban environments where coyotes are more accustomed to human activity and human-made objects.

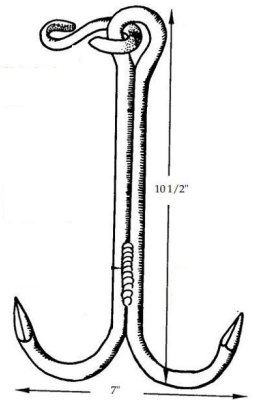

Figure 14. A drag is often used when loose soil conditions prevent the use of in-ground anchors.

Cable Devices

For more information on the use of cable devices, please see Appendix IV.

Cable devices (or snares) may be designed and set to either live-capture or lethally remove coyotes.

Cable devices are not legal in all states. Where legal, states may define the component requirements, measurements, setting restrictions, and training requirements. Consult local laws and regulations prior to using cable devices and acquire legal cable devices from a knowledgeable and reliable manufacturer. Carefully select sites where snares are set to avoid capturing nontarget animals, such as dogs.

Unlike other capture tools, cable devices cannot be reused. Once a capture is made, the stress applied to the cable makes it unusable. Some cable device components may be removed and re-used, but the cable itself cannot.

Cable devices are used to capture an unsuspecting coyote as it is traveling on its commonly used trails (known as "trailing"). Check the trail for recent tracks. If present, place the cable device set where the trail narrows. Approach the location from the side of the trail to prevent unnecessary disturbance to the site. Position the cable device's loop in the center of the trail, so the coyote places its head through it as it travels along the trail (Figure 15).

The support wire needs to hold the loop tightly and be sturdy and stiff enough to handle wind and other weather factors. Nine or 11 gauge wire is commonly used for support wire (Figure 16). A moving cable device can easily be detected by an animal or may cause the height and loop size to change. A cable loop that has fallen may catch a nontarget animal or may catch a coyote by the foot. Pay attention to conditions that may change or alter the cable devices and visit the sets regularly to check them.

Most cable devices are passive capture methods that are only activated by an animal moving through the loop and causing it to close. However, some systems are spring-loaded. When an animal trips the trigger, a compressed spring propels the cable loop around an animal's foot or neck (See Appendix IV). Spring-loaded foot cable devices are commonly used in lieu of foothold traps in states where foothold traps have been banned.

Figure 15. A properly suspended cable device loop with 9 gauge wire.

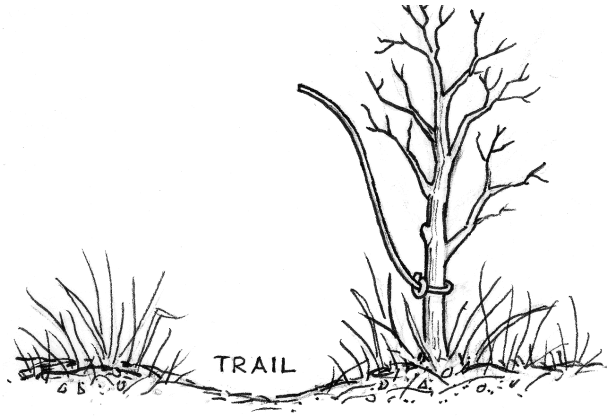

Figure 16. A cable device loop support wire made with 9 gauge wire. This set is for a lethal cable device because of the woody rooted vegetation that provides for entanglement.

Avoid using lure or urine close to a cable device set, with the exception of foot cable devices. Odors cause a coyote to investigate, become cautious, or behave differently. The coyote's head will not be in line with the body, they may stop or walk in circles to investigate, and depending on their status in the area or experiences, they may leave.

Set locations should be on straight runs in the trail, not curves or changes in direction. Look for a narrowing in the

trail. Avoid setting on uphill and downhill parts of a trail—regardless of which way the coyote is traveling, its head will not be in a good position to enter the cable device's loop. For trails that traverse side hills, anchor the cable device on the downhill side of the trail. A captured coyote will naturally work against the anchor downhill and provide little disturbance to the original set location. This becomes useful when another set may be needed.

Cable devices must be solidly anchored to an immovable object. This is imperative for a breakaway component to function properly, thus allowing the release of large, non-target animals. A breakaway component is any mechanism incorporated into a cable device that allows the loop to disassemble when a specified amount of pressure is applied. Do not use drags to anchor cable devices as there is no assurance that the drag will catch on an immovable object. Fence crossings make excellent set locations for cable devices, but fencing wire should not be used as an anchor as it moves when pulled.

Flag or record each set location with colored survey ribbon as cable devices easily blend in with the natural surroundings (Figure 17). Wind can move vegetation around, and snow can change the appearance of the landscape. If flagging is secured to vegetation, make sure it is removed when the set is removed. Place flagging adjacent to the set, not directly above it. In some areas, flagging can attract people who may disable or take the devices.

Restraining Cable Device: Restraining cable devices are excellent tools for live-capturing coyotes. This restraint system is a good choice for use in urban and suburban environments, or any location where domestic dogs may be captured. Live restraints have been used effectively for resolving wildlife conflicts and capturing animals for research.

Restraining cable devices incorporate a relaxing lock. The relaxing lock allows the cable's loop to tighten with tension, but it does not keep its place on the cable and will move slightly backward when tension stops. Relaxing locks are made so that when assembled, the cable passes through the lock to make the cable loop smaller or larger. The pass-through holes are slightly larger, allowing the lock to slide freely on the cable. Even though the lock can move slightly in either direction on the cable, an animal cannot shed the loop from its neck.

When setting a restraining cable device, choose set locations that are free of objects that could cause entanglement, such as trees, fences, machinery, and any woody, rooted vegetation larger than ½ inch (1.2 cm) in diameter.

Figure 17. Colored survey flagging threaded through the center of hinged clothespins works well for keeping cable devices organized and identifying set locations. Attach one to each coiled cable device when storing the cable; remove it and attach it to nearby vegetation or another structure to identify the set location once the cable device is set; and recover when the cable device is removed.

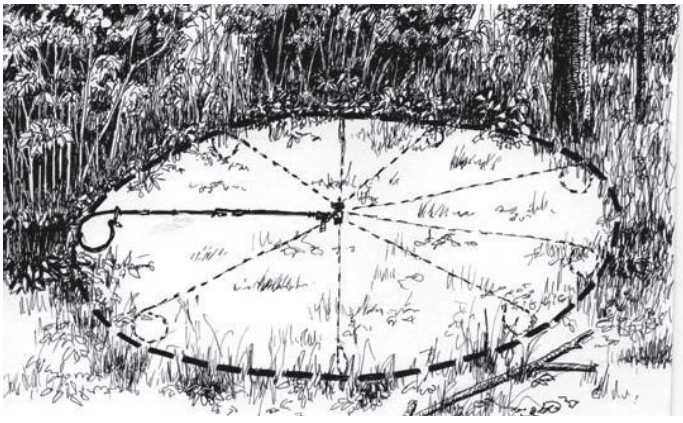

Figure 18. An example of a catch circle with a cable device.

Restraining cable devices are approximately 5 ft (1.5 m) in length and limit an animal's free reign when captured. If this "catch circle" (Figure 18) is not free of objects, an animal will be able to wrap the cable tight against them and become entangled. When this occurs, the lock cannot relax, and the animal will asphyxiate. Restraining cable devices should be checked daily as they are not designed to hold live coyotes for long periods of time.

Lethal Cable Device: Lethal cable devices include a non-relaxing lock. This lock allows the loop of the device to tighten with tension but prevents it from loosening when the tension stops.

Many modern cable devices incorporate a small compression or torsion spring that puts pressure on the lock to bind it more securely against the cable.

Set lethal cable devices in areas with natural objects that can cause entanglement and restrict movement, like small trees or brush, or add an entanglement object. An example of an entanglement object is a $^{5}/_{8}$-inch (1.2 cm) diameter or larger 4 ft (1.2 m) long re-rod stake. These are commonly called "tangle rods" and are used to support the cable loop and anchor the device. If a captured coyote is allowed free reign it may apply great stress to the cable device, causing a component to fail or providing time for the coyote to chew through the cable.

Draw Stations

Draw stations are locations that may already exist (e.g., carcass disposal sites) or are created by adding lure or bait to increase coyote interest and activity in an area. A draw station may be something as simple as lure on a piece of hide hung in a tree, a road-killed animal (legally possessed), or carcasses from previous trapping efforts. Moving dead livestock is generally restricted by state law. Landowner permission is required if wild animal carcasses are brought onto the property. Check state trapping regulations regarding the use of draw stations and certain baits.

The longer a draw station is in place, the more coyote activity it will receive. The draw station is a place for traveling coyotes to visit. Some may come to eat, smell identifiers (like urine or scat) left by other coyotes or leave scat or urine of their own.

Once coyote sign is found at a draw station, backtrack to the coyotes' entrance and exit trails and choose set locations as far from the draw station as possible (i.e., 100 to 500 yds (91 to 457 m) are recommended). Consider the following when making a draw station trap set:

- Making sets too close to the draw station may reduce their effectiveness. The closer a coyote gets to a draw station, the more alert it becomes. It is their intent not to surprise or be surprised by another coyote at the same location. An alert coyote behaves differently than a trailing coyote and may result in a poor catch or no catch.

- Setting traps or cable devices too close to a draw station increases the potential for catching non-target animals, such as raptors and scavengers that may visit the site. It is common for birds to land in the open and walk 10 to 50 yds (9 to 45 m) to reach a draw station.

Using Dogs

Trained dogs often assist in coyote damage management. A well-trained dog can help locate appropriate places to set capture devices by alerting their handlers to areas where target animals have traveled, urinated, or defecated. Trained dogs can also aid in the application of other methods by detecting individuals, dens, or attracting coyotes into shooting range. Properly trained and disciplined dogs should not make contact with coyotes and have minimal effect on non-target animals.

Handling and Euthanasia

Wear protective equipment (i.e., gloves, safety glasses) when handling live or dead coyotes. Avoid contact with claws, teeth, blood, saliva, urine, or feces.

Coyotes captured in restraining devices may need to be transported to a different location for euthanasia. A

catchpole and large cage trap will aid in the removal and transport of an animal from the device.

When working with a restrained coyote, move slowly and deliberately. Speak in a calm voice. Place a hood or towel over an anesthetized coyote's eyes to reduce stress. Keep a live coyote cool or in a shaded area to avoid heat-related injury.

The American Veterinary Medical Association provides guidelines for euthanizing animals with firearms. Captured coyotes are commonly euthanized with a well-placed shot to the brain using a hollow-point bullet from a .22 rimfire cartridge (or of equivalent or greater velocity and muzzle energy).

Euthanasia drugs, such as a solution of pentobarbital and phenytoin, can also be administered by trained specialists.

Disposal

Follow local and state regulations regarding carcass disposal. In some disease-related cases, deep burial or incineration may be warranted. When removing coyotes with restricted use pesticides, follow label instructions for proper carcass disposal. Care must also be taken with the disposal of carcasses that contain euthanasia drugs. Deep burial or incineration is required to avoid secondary hazards to animals that may feed on the carcass.

Economics

Coyotes cause considerable damage to livestock and natural resources in the United States. For example, even with coyote damage management programs in place, livestock producers lose in excess of $115 million in livestock annually to coyotes.

The value of livestock killed, or the reduced value of injured livestock represents a small fraction of the actual costs of predation. Other damage costs include looking for injured or dead livestock, disposing of dead livestock, caring for livestock injured or exhausted as a result of being pursued or attacked, and obtaining replacement animals.

Livestock Type	Percentage of predator-related losses due to coyotes	Use of Nonlethal Damage Management Tools
Cattle	40.5% cattle 53.1% calves	Producers spent an average of $3,000 and $300 on nonlethal and lethal tools, respectively
Goats	65% goats and kids (represents losses from coyotes and dogs)	Producers spent an average of $1,085 and $444 on nonlethal and lethal tools, respectively
Sheep	54.3% sheep 63.7% lambs	58% of producers used 1 or more nonlethal tools, such as fencing, guard dogs, lambing sheds, and night penning

Table 2. Coyote predation impacts and the use of nonlethal damage management tools by livestock type from USDA National Animal Health Monitoring System reports (2014 goat data, 2015 cattle and sheep data).

Coyote damage management implementation costs are additive to the direct damage costs. From 2000 to 2015, the percentage of U.S. cattle operations using nonlethal methods to control predators increased from approximately 3 to 19 percent. For an overview of coyote predation impacts and use of nonlethal damage management tools by livestock type, see Table 2.

Coyote predation or damage in urban and suburban settings is also expensive and includes costs associated with implementing management methods for aggressive or nuisance coyotes, protecting and/or replacing exotic or heritage livestock, and addressing disease related concerns.

Coyote predation can be costly when it impacts recovery efforts of highly valued endangered and threatened birds, mammals, reptiles, amphibians, and insects. Threatened or endangered species protection programs should consider coyote predation when these species share the same habitats, and budget for the necessary costs of prevention or removal.

Species Overview

Identification

Coyotes belong to the Order Carnivora in the Family Canidae, along with domestic dogs, wolves, foxes, and jackals (Figure 19).

Physical Description

Coyotes vary in size. Those from eastern regions of North America are larger and heavier (30 to 38 lbs /13.6–17.2 kg), than those from the west (20 to 35 lbs /9–15.8 kg). The genealogy of the eastern coyote includes a hybridization with wolves and dogs resulting in the slightly larger size. Adult male coyotes are generally larger than adult females. Pelt colorations range from near white to black. Some color phases include red and orange.

Figure 19. Coyotes are members of the canid family.

Coyotes have excellent hearing, sense of smell, and eyesight. They have pointed ear tips and a pointed nose. The distance from the top of a coyote's back to the bottom of its chest is equal distance from the bottom of its chest to the ground. Coyotes differ from wolves in that wolves have rounded ear tips and a square nose, and have proportionally much longer legs compared to a coyote. Coyotes have been measured running at speeds of up to 40 miles per hour (64 kilometers (km) per hour) and can sustain slower speeds for several miles.

Range

Coyotes occur across most of North America from the edge of the northern tundra to Central America. In the United States, all 48 contiguous states and Alaska have coyote populations, though densities vary with habitat quality.

Tracks

Coyote tracks contain four toes with claws and a heel pad. The track impression is longer than it is wide. Both front and rear feet have the same shape, but the rear track may appear slightly smaller than the front (Figure 20). Coyotes

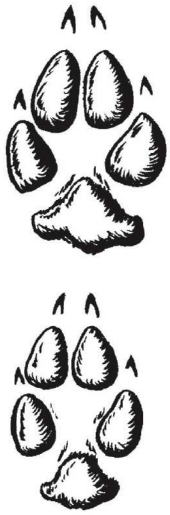

Figure 20. Coyote tracks. Note the front track *(top)* is larger than the rear *(bottom). Image not to scale.*

carry their weight forward, resulting in a larger front track.

Front foot tracks average 2 inches (5 cm) wide by 2.5 inches (6.3 cm) in length. The rear foot track averages 1.5 inches (3.8 cm) wide by 2 inches (5 cm) in length. Track impressions vary with animal weight and soil or substrate conditions. It is best to obtain several observations and measurements over a greater area to make an accurate identification.

Tracks made by the front feet show the third toenail (counting from the inside to the outside of the foot) slightly longer than the others. The heel pad contains three lobes. The heel pads on the rear feet tend to have convex center lobes which cause the lobes on either side to disappear in the track. This knowledge may be useful in determining a front or rear foot impression.

Tracks in a single file represent a walking gait; tracks in a two-step (one track partially over another) represent a side trot; and a track pattern resembling a "T" (where the back feet surpass the front feet) represent a gallop. The walking and side trot gaits may measure 17 to 25 inches (43 to 63 cm) between the same foot-track in that pattern. When observed, the distance between the left and right tracks (straddle) is approximately 5 inches (12.7 cm). The track of eastern coyotes may be slightly larger and the distance between track impressions of a traveling coyote slightly longer.

Sign

Coyotes will urinate on elevated clumps of grass, dirt, old carcass parts, small waste grain piles, or other similar material as a method of communication. These locations are obvious when snow is present, less when surface conditions are dry or hard. Look for evidence of scratch-ups (i.e., surface scratching or kick-ups done by the rear feet) adjacent or close to where the urine was deposited. Similarly, scat (feces) may also be found on gravel roads or trails and at trail junctions. Visiting coyotes may also leave their urine and scat on top of or adjacent to previous deposits.

Figure 21. Coyote scat. Note red hair from feeding on a red Angus calf.

Scat segments (i.e., cords) vary in shape and size depending on diet and the size of the coyote (Figure 21). Segments are slightly tapered at the ends and may measure 2 to 5 inches (5 to 12.7 cm) in length. The cords may be folded and the last segment to be deposited will be pointed. Examine fresh segments to determine the diet. Items that may pass through the coyote's digestive system include hair, bone fragments, exoskeletal segments of insects, fruit pits or seeds, blades of grass, artificial materials (plastic) or other items. Scat containing unidentifiable dense black material and a disagreeable odor is heavy in animal protein, indicating a recent diet of meat.

Voice and Sounds

Coyotes communicate through a variety of vocalizations. In a relaxed and safe environment, coyotes will whine and growl in several low tones which have very different meanings. Some may serve to gain attention while others serve to create avoidance. Barking generally serves to gain attention or announce danger. Howling communicates location, which sometimes draws others to howl from their location. Howling can communicate a single coyote searching for others or may define an occupied home range. Howling sessions may include a series of barks, yips, whines, and howls. When this occurs, the listener may

be led to believe there are many more coyotes than are actually present. Two coyotes can easily sound like six. Pup distress whines and yelps are a typical vocalization for sub-dominant coyotes when being chased, injured, harassed, or attacked by others.

Reproduction

Coyotes usually breed in February and March, with gestation being 60 to 63 days. Females sometimes breed during the winter following their birth, particularly if food is plentiful. Females may have been bred by more than one male. Average litter size is 5 to 7 young. More than one litter may be found in a single den; at times these may be from females mated to a single male. Coyotes are capable of hybridizing with dogs and wolves, but breeding opportunities are rare and individual species' behaviors make it difficult.

Adult male and female coyotes provide food to their young for several weeks. Other adults associated with the denning pair may also provide food and care to the young.

Juveniles begin emerging from their den by three weeks of age, and within two months they follow adults to large prey or carrion. Juveniles are usually weaned by six weeks of age and will be moved to larger quarters with less structure than a den hole. The family group usually remains together until late summer or fall, when juveniles may disperse. Juveniles may be found in loose family groups until the following breeding season begins.

Dens

Coyotes prefer a below-ground cavity for a den site. If that is unavailable, they may resort to any protected area like brush or rock piles, under or in abandoned buildings, haystacks, or any similar object that will provide shelter from the weather and some level of security.

Coyotes may have several den sites, some interconnected. Coyotes will move to a different den, if circumstances occur that threaten the safety and security of the den or young (e.g., infestation of fleas, recent human activity in the area).

Rural den locations are generally located on an elevated piece of ground, facing south, with water nearby. An entrance is approximately 12 inches (30 cm) wide. The opening is generally taller than it is wide. The entrance may be larger if the den has been used for consecutive seasons. The depth and cavities within the den site vary based on the adult's experience and material in which the den is created. Den site openings may be littered with indigestible prey parts, bone fragments, small skulls, and wings or feathers.

Mortality

Mortality is highest during the first year of a coyote's life, and few survive for more than 12 years in the wild. Human activity is often the greatest single cause of coyote mortality.

Adult coyotes have few natural predators, but juveniles are killed or eaten by feral dogs, mountain lions, and golden eagles. Wolves prey upon coyotes to reduce competition in overlapping habitats. Coyotes may die from injuries by bears, lions, and wolverines while scavenging at kill sites, but are rarely preyed upon in those situations. Coyotes have been known to feed on other coyote carcasses during times of severe stress, such as extremely cold temperatures.

Coyote populations are also impacted by zoonotic diseases, such as rabies (*Lyssavirus*), canine parvovirus (*Parvovirinae*), heartworm (*Dirofilaria immitis*), and canine distemper (*Paramyxoviridae*). Rabies continues to be addressed in some regions of the United States by using treated baits to vaccinate coyotes.

Parasites

Tapeworms (*Echinococcosis granulosus*) and stomach roundworms (*Toxocara canis*) are common in coyotes. Coyotes host ectoparasites like chewing lice (*Trichodectes canis*), ticks (*Ixodes dammini, Dermacentor variabilis, Dermacentor andersoni, and Rhipicephalus sanguineus*), fleas (*Ctenocephalides canis*), and mites (*Sarcoptes scabiei*). Ticks transmit

Lyme's disease and Rocky Mountain spotted fever; fleas spread tapeworm (*Dipylidium caninum*); and mites inflict sarcoptic mange. Although parasites may not be the direct cause of death, the effect of parasites on the coyote's immune system and overall health or body condition may be fatal. Hyperthermia, hypothermia, and pneumonia are common causes of death related to compromised immune systems due to parasites.

Coyotes can be a definitive host for *Neospora caninum* which can cause abortion and neonatal mortality in cattle. Thick-walled spores called oocysts are passed in coyote scat and ingested by cattle feeding on infected materials (e.g., ground feed, hay, stored haylage, and pasture grasses). Neonatal infection occurs causing abortion or calf death within the womb. This parasite affects sheep and dogs in the same manner.

Population Status

Coyote populations vary across the country and are considered abundant. Coyote densities are highly variable depending on the time of year, habitat quality, and region.

Habitat

Originally an inhabitant of the open grasslands and prairies of the western United States and southern Canada, the coyote has adapted to a wide range of habitat conditions from southern swamps to northern spruce-fir forests. Coyotes occur in urban and suburban environments, including some of the largest cities in North America.

Behavior

Most coyotes are gregarious. When conditions and individual coyote behavior allows, family groups may loosely remain together and exhibit social structure. An alpha pair determines the context of the group and what individual behaviors are tolerated. The alpha pair mark their territory by defecating, urinating, or making scratch-ups, and are most aggressive to intruding coyotes. Other coyotes within the group may share these responsibilities and mimic this behavior.

Juvenile coyotes most often show gestures of submission, such as tucking their tail between their rear legs, turning their head, lowering eyes, skulking, showing their belly, and whining when in the company of adults. Aggressive gestures during adult coyote confrontations include pinned back ears, showing of teeth, arched back with a stiffened grotzen, and growling or snarling.

In the spring and summer, most coyotes limit their movements to a small area due to birthing and rearing of their young. Individual or unpaired coyotes are not restricted to such duties and continue roaming as needed during this time. Coyotes may roam over larger areas in late summer, fall, and winter. Coyotes follow regular travel corridors and trails and prefer slight elevations from which to view the surrounding area.

Primarily nocturnal, coyotes may be active during the day. They are most active during the hours near sunrise and sunset. This is especially true during hot summer months and where there is a lot of human activity. Where there is minimal human interference and during cool weather, coyotes may be active throughout the day. Coyotes bed in sheltered areas and do not generally use dens except when raising young. A bedded coyote usually has the wind at its back and observes the area downwind. They may seek shelter underground during severe weather or when closely pursued. Coyotes are excellent swimmers and have little difficulty crossing bodies of water or rivers.

The home range of a coyote is defined as the area it routinely visits during a 7-day period. Home range size is heavily dependent upon food and suitable habitat. Coyote densities are generally higher when food resources are abundant. Home ranges may be 4 to 15 square miles (6.4 to 16 km^2). Coyotes may explore and occupy much larger areas in search of food, water, new home ranges, or during the breeding season. Home ranges are fluid for most of the year. Under normal conditions, coyotes are tolerant of each other and many work to avoid direct confrontation with others.

A coyote's territory is defined as the area that is defended from other coyotes or other animals. Territories become

well defined when pairs are mated, den sites chosen, and when rearing young. During these times, the size of the territory is determined by the adult pair's tolerance for other coyotes. Offending coyotes are generally discouraged through vocalizations, body gestures, or being aggressively run off. The territory is smaller and more closely guarded when young of the year are within a den site, but becomes larger as the young grow and venture out with the adults. Territory size varies and is heavily dependent upon the available habitat (food, water, shelter, and space). Territory size may be as small as 0.25 to 0.56 square miles (0.4 to 0.9 km^2), and as large as 1.2 to 2.9 square miles (1.9 to 4.6 km^2) in more open areas.

Coyotes that occupy urban and suburban areas are often less wary of people and may kill and/or eat domestic pets, and attack people. Coyotes vary their activity based on human interactions and perceived threat levels. Coyotes learn from past events that were unpleasant or frightening, and often avoid such events in the future.

Food Habits

Coyotes are omnivores and opportunists, feeding on a variety of seasonal offerings—carrion, rodents, rabbits, birds, reptiles, ungulates (usually fawns), insects, feces, livestock, poultry, fruits, berries, and other plants and animals. Urban and suburban dwelling coyotes may also feed on human garbage, pets, domestic pet food, garden produce, and birdseed.

Coyotes are capable of catching and killing all ages of healthy domestic livestock but generally take prey that is the easiest to secure. Prey selection is based on opportunity and a myriad of behavioral cues. For example, strong, healthy lambs are often taken from a flock by a coyote even though smaller, weaker lambs are also present. Stronger lambs may spend more time on the periphery of the flock and are more active, making them more prone to attack than weaker lambs that are at the center of the flock and less active.

Legal Status

The legal status of coyotes varies from state to state. In some states, coyotes are protected except during the regulated hunting and trapping seasons. Provisions may exist for landowners or operators to remove coyotes to resolve predation. In other states, coyotes may be classified as a predator or as an unprotected species and may be taken year-round. Check local and state regulations for information on seasons, bag limits, and types of capture devices or methods that can be used.

Acknowledgements

Figure 1. Photo by Kevin Keirn
Figure 2. Photo by National Park Service
Figure 3. Photos by USDA-APHIS-Wildlife Services and USDA Jean Bonhotal
Figure 4, 15, 17, 21, 24, 25, 26, 28. Photos by Rick Tischaefer, USDA-APHIS-Wildlife Services
Figure 5, 6. Graphics from The Handbook: Prevention and Control of Wildlife Damage. Coyotes. By Jeffrey S. Green, F. Robert Henderson, and Mark D. Collinge. September 1994. University of Nebraska-Lincoln. Page C-55.
Figure 7, 8, 11. Photos by USDA-APHIS-Wildlife Services
Figure 9. Photo by Michael Marlow, USDA-APHIS-Wildlife Services
Figure 10. Photo by Gail Keirn, USDA-APHIS-Wildlife Services
Figure 12. Graphic by the Association of Fish and Wildlife Agencies
Figure 13, 20, 22, 23, 27. Graphics by Joe Goodman in concert with the Association of Fish and Wildlife Agencies
Figure 14. Graphics by Joe Goodman in concert with the Association of Fish and Wildlife Agencies and The Handbook: Prevention and Control of Wildlife Damage. Coyotes. By Jeffrey S. Green, F. Robert Henderson, and Mark D. Collinge. September 1994. University of Nebraska-Lincoln. Page C-55.
Figure 16. Graphic by Joe Goodman in concert with the North Dakota Cooperative Fur Harvester Education Program
Figure 18. Graphic by Natalene Cummings in concert with the Association of Fish and Wildlife Agencies
Figure 19. Photo by Tom Koerner, U.S. Fish and Wildlife Service

We thank Stewart Breck, Jeremy Duckwitz, Lauren Mastro, and Nathan Roberts for providing critical reviews of this manuscript.

Glossary

Alpha: The highest-ranking individual in a social group. Other animals in the same social group may exhibit deference or other species-specific subordinate behavior towards the alpha or alphas.

Catch Circle: The disturbed area where a captured coyote is restrained.

Definitive Host: An organism in which a parasite reaches maturity and reproduces.

Denning: The practice of seeking out the dens of depredating coyotes and lethally removing the young and adults.

Drag: A type of anchoring system that allows a trapped animal to move a short distance and reach cover or shelter.

Fladry: A simple, nonlethal tool used to prevent livestock predation. It consists of a line of brightly colored flags hung at regular intervals along the perimeter of a pasture.

Grotzen: The long guard hairs of the mane and top of the shoulders.

Homing Behavior: An animal's ability to return to the location where it was originally captured following relocation or translocation.

Necropsy: An animal autopsy.

Novel Stimuli: An exposure to something never before seen or experienced.

Omnivore: Animal that eats both plants and animals.

Set: Where and how a trap or capture device is placed.

Set Location: The exact spot where a trap or capture device is placed.

Sign: Items indicating animal presence in an area; may include tracks, tufts of fur or hair, scat, teeth or claw marks, etc.

Keywords

Canids, *Canis latrans*, Coyote, Livestock, Predation

Disclaimer

Wildlife can threaten the health and safety of you and others in the area. Use of damage prevention and control methods also may pose risks to humans, pets, livestock, other non-target animals, and the environment. Be aware of the risks and take steps to reduce or eliminate those risks.

Some methods mentioned in this document may not be legal, permitted, or appropriate in your area. Read and follow all pesticide label recommendations and local requirements. Check with personnel from your state wildlife agency and local officials to determine if methods are acceptable and allowed.

Mention of any products, trademarks, or brand names does not constitute endorsement, nor does omission constitute criticism.

Citation

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Appendix I—Damage Management Methods for Coyotes

Type of Control	Available Management Options
Animal Husbandry	• Birthing schedules • Carcass removal and disposal • Herders/shepherds/range riders • Night penning • Pasture selection
Denning	Removal of adults and young at den sites
Exclusion	• Net wire and electric fencing • Corrals
Fertility Control	• No fertility control agents available • Sterilization of alpha pair
Frightening Devices	• Fladry • Propane cannons • Radios and other noise makers • Scarecrows and moveable human effigies • Strobe lights
Guarding Animals	Use of livestock protection dogs, donkeys, and other guarding animals
Habitat Modification	• Eliminate or reduce vegetation in areas that may provide cover or resting habitat for coyotes • Contain or bury garbage • Remove or bury dead livestock
Hazing	Shouting, shaking a tin can full of coins or rocks, stomping feet, waving arms, etc. to scare away an animal
Repellents	No effective chemical repellents available
Shooting	May include predator-calling, night operations or aerial operations; May require use of non-toxic/non-lead ammunition; Allowed with proper federal and state permits
Toxicants	• Sodium cyanide/M-44 (EPA Reg. Nos. 56228-15, 35978-1, 35975-2, 39508-1, 33858-2, and 13808-8; products are all named M-44 Cyanide Capsules); Restricted Use Pesticide • Sodium fluoroacetate/livestock protection collar (EPA Reg. Nos. 56228-22, 39508-2, and 46779-1; products are all named Sodium Fluoroacetate (Compound 1080) Livestock Protection Collar); Restricted Use Pesticide • Large gas cartridges (EPA Reg. Nos. 56228-21 and 56228-62) Registered pesticides must be used in accordance with label directions. Some pesticides can only be applied by persons who have been specially trained and certified for their use. Each of the chemical methods listed above have specific requirements for their handling, transport, storage, application, and disposal.
Trapping	Foothold and cage traps, cable devices; Allowed with proper federal and state permits

Appendix II—Donkeys as Guard Animals

Consider these key points when using a donkey to reduce depredation on sheep or goats:

- Donkeys should be acquired from a trained, reliable, and professional breeder;
- Choose a medium-sized female (jenny) or a gelded male (jack) compatible with the guarded livestock. Non-castrated jacks are too aggressive and may injure livestock;
- Use only one donkey per group of sheep or goats. The exception may be a jenny with a foal. When two or more adult donkeys are together or with a horse, they usually stay together, not necessarily near the sheep. Also avoid using donkeys in adjacent pastures since they may socialize across the fence and ignore the sheep;
- Allow 4 to 6 weeks for a naive donkey to bond with the sheep. Stronger bonding may occur when a donkey is raised from birth with sheep or goats;
- Avoid feed or supplements for sheep that contain monensin or lasolacid, as both are poisonous to donkeys;
- Remove the donkey during livestock birthing, particularly if birthing involves confinement. This avoids injuries to young livestock or disruption of the maternal bond;
- Test a new donkey's response to canids by challenging it with a dog in a pen or small pasture. Do not use a donkey that does not show overt aggression to an intruding dog; and
- Use donkeys in smaller (<600 acres/240 hectares), relatively open pastures with no more than 300 livestock. Large pastures with rough terrain and vegetation and widely scattered livestock decrease a donkey's effectiveness.

Appendix III—Foothold Traps

The following appendix highlights specific techniques related to the use of foothold traps.

Trap Preparation and Maintenance

It is important that foothold traps be clean and in good working condition. Oxidized/rusted foothold traps should be cleaned with a wire brush to ensure that all parts function properly. Properly tune the foothold trap with 4 lbs (1.8 kg) of pan tension and a level trap pan. Wash all foothold traps (new or used) in hot, soapy water and rinse clean.

Once dry, begin the process of protecting the steel from oxidation. This is done with commercially manufactured dips or dyes that not only darken the color of the steel, but retard oxidation. Plan ahead if using petroleum-based dips as these will need adequate warm weather and time to dry properly.

Once treated, foothold traps may be dipped in hot, melted wax. A properly waxed foothold trap will have a wet looking appearance. The wax creates a barrier between the treated steel and the dirt used for bedding. If left unwaxed, moisture can cause the dirt to adhere to the steel, lowering the performance of the foothold trap.

A foothold trap should be tuned, washed, and waxed after making a catch. The struggles of the restrained coyote will change the original tuning and wear off some, if not all, of the wax needed for a protective barrier. Reusing the same foothold trap without proper tuning, cleaning, and waxing will result in lower trap performance and success.

Store prepared foothold traps in covered containers to prevent contamination from unnatural materials or odors.

Set Location

Coyotes travel where walking is easy, such as along infrequently used roads or trails. Do not set foothold traps directly in a trail, but to one side where coyotes may stop, such as on a small rise, near a gate, or where the vegetation changes. Place the set upwind from the path (or site of coyote activity) so the prevailing wind will carry the scent across the area of expected coyote activity. Choose a level spot as close as possible to, but not directly on, the coyote's likely path. The coyote's approach should never be over dry leaves, tall grass, stones, sticks, weeds, or rough ground. Place each set where the coyote will have a clear view as it approaches.

Good locations for a set are often indicated by coyote tracks or scat. The following are good locations in most rural areas:

- side hills and saddles;
- near isolated land features like bale stacks, rock piles, or cut banks;
- trail junctions, fences, and stream crossings;
- pasture roads, livestock trails, waterways, game trails, and dry or shallow creek beds;
- near stock ponds and beaver dams, field borders or corners, tree groves, and eroded gullies;
- sites near animal carcasses, bone or brush piles; and
- below rim rock ledges or similar protected areas.

A Properly Bedded Trap

Foothold traps set for coyotes must be properly bedded and hidden (*See next page for step-by-step instructions*). Foothold traps should be level with or slightly below the level of the soil around it. Use a dedicated pair of gloves for this process and keep them protected from contamination.

Foothold traps also must be concealed to prevent detection. The most common method is to cover them with dry soil or waxed dirt. The open space underneath the trap pan must remain free of solids. This is achieved with an under pan material like fiberglass insulation or odorless foam material. These materials fill the void while still allowing the foothold trap pan to be depressed. An over-pan cover can be made with wax paper or window screen. Use a dirt sifter to remove small sticks and stones from the dirt used to cover the foothold trap.

Dirt used for covering can be mixed with shaved wax to create a freeze-proof and waterproof foothold trap bedding. This type of wax can be acquired from reputable trapping supply dealers. Mix dry-sifted dirt with wax pellets or shavings on sunny hot days. The wax will melt into the warm dirt and bond to the soil particles. Large quantities of waxed dirt are made using an electric or propane heat source. Wax dirt is stored in covered containers to prevent contamination until used.

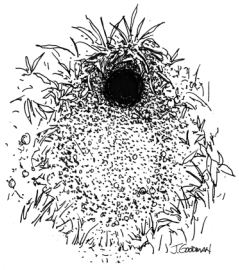
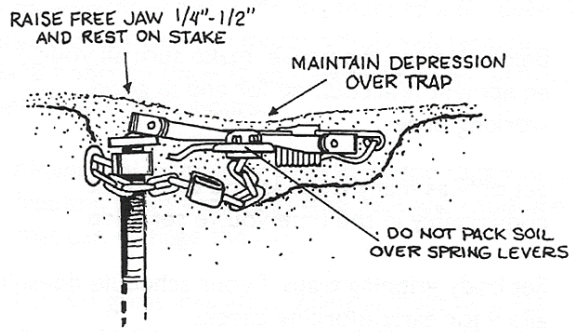
Other inclement weather options for foothold trap bedding and covering include sphagnum peat moss, dry manure, buckwheat hulls, or finely chopped hay. A disadvantage to these materials is they are attractive to small rodents. The rodents digging at these materials may cause the foothold trap to become exposed.

A mixture of one-part table salt or calcium chloride with three parts dry soil prevents the soil from freezing over the foothold trap. When using peat moss or other dry, fluffy material, cover the material with a thin layer of dry soil mixed with a teaspoon of table salt. This will blend the set with the surrounding soil and prevent the wind from blowing the light material away.

Appendix III—Foothold Traps *continued*

Instructions for bedding a foothold trap with waxed dirt during freezing conditions. For a standard set in non-freezing conditions, ignore waxed dirt references. *Graphics by Joe Goodman in concert with the Association of Fish and Wildlife Agencies.*

	Step 1 Dig a hole slightly larger than the outside profile of the trap. The depth will depend on the amount of chain to be concealed under the trap (i.e., the longer the chain, the deeper the hole). When the set is finished, the top of the trap should be covered by ⅛ to ½ inch of waxed dirt and the pan should sit slightly lower than the ground around it.
	Step 2 Test the hole to make sure the trap will fit and make adjustments if needed. Position and drive the stake at the front of the hole (the side nearest you) where the loose jaw of the trap can rest on it.
	Step 3 Pack the base of the hole with waxed dirt. Place the trap chain in the trap bed, cover it with waxed dirt and pack it with a hand or fist. If using an under-pan filler, apply it to the foothold trap at this time.
	Step 4 Place the trap in the trap bed with the loose jaw resting level on the top of the stake. Twist the trap slightly from side to side to settle it in the waxed dirt. Pack dirt tightly around the outside of the trap except for over the spring levers.
	Step 5 Use a finger to apply pressure to each jaw and spring lever (one at a time). If movement is detected, add some waxed dirt or a small dirt clod underneath to prevent movement.

	Step 6 If using a trap pan cover, apply it to the foothold trap at this time. Sift waxed dirt over the trap until it is nearly level with the surrounding area.
	Step 7 Locate the pan by brushing away some of the waxed dirt. When found, pack waxed dirt around the outside of the pan using the back of a hand.
	Step 8 If needed, brush or sift a fine layer of dirt over the set to blend it in with the surroundings.
	A side view of a properly bedded foothold trap.

Appendix III—Foothold Traps *continued*

Guiding a Coyote

Coyotes tend to avoid obstacles and place their feet in bare areas. Use a few strategically placed dirt clods, sticks, or small rocks at the set to guide the coyote's foot onto the foothold trap pan. Do not use this method to the extent that the set looks unnatural. Coyote scat may be strategically placed at a set as an attractant and foot guide.

Bait, Lure, and Urine

Bait, lure, and urine can be used alone or in combination to attract coyotes to the set and make them stay longer. The more time a coyote spends at the set, the more likely it will be caught. The choice of bait and its placement is based on the coyote's food source and eating habits. Bait can be chunks of meat or fish and may be fresh, tainted, or in liquid form. Bait must be used carefully to prevent catching non-target wildlife or domestic animals.

Lures are classified as gland, food, or curiosity attractants. Gland lure appeals to a coyote's sexual attraction or territorial instincts. Food lure appeals to their desire to eat. Curiosity lure appeals to a coyote's instinct to investigate something unfamiliar. Generally, food lure is the most effective in the early fall; gland lure becomes more effective in mid-winter and during breeding season; and curiosity lure works well throughout the year.

Like all canines, coyotes mark their presence by urinating on various objects. Coyote urine is often used to attract coyotes and works year-round. The sight and smell of urine triggers a curiosity response that may cause a coyote to investigate the set.

Handle bait, lure, and urine containers with a dedicated pair of gloves. Lure containers and gloves used to apply them should be kept separate from other trapping equipment to avoid cross contamination.

Types of Foothold Sets

Most sets made with foothold traps are described as either a urine post, flat, or dirt hole set. Other versions may be a combination of these three basic sets. Regardless of which set type is used, all begin with a properly bedded foothold trap.

- **Urine Post Set:** When coyotes urinate, they lower the hind quarters, similar to squatting, or use a slightly raised leg posture. Urine is usually deposited on some sort of isolated structure, such as woody debris, a small pile of grain or hay chaff, a dirt mound, or a carcass bone. The urine post set imitates a location where a coyote has urinated. Begin with a properly bedded foothold trap. Utilize an existing structure (or add a structure) to serve as the urine post by applying a small amount of coyote urine. Place the urine post to help guide the coyote's foot placement.

- **Flat Set:** The flat set takes advantage of a coyote's curiosity and urge to investigate smells. Most items used in this type of set include coyote scat, a dried cow manure patty, a small to medium-sized rock, a bleached carcass bone or skull, or a small raised clod of dirt and vegetation. The flat set (Figure 22)

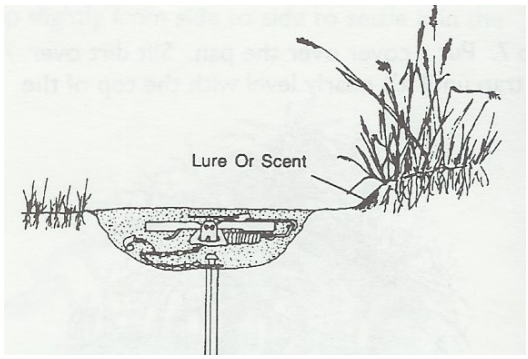


Figure 22. A side view of a flat set with a foothold trap.

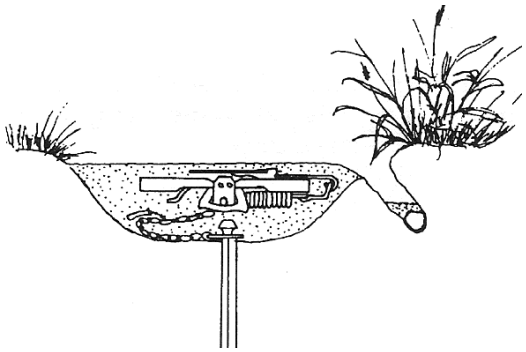


Figure 23. A side view of a dirt hole set with a foothold trap.

imitates a location where a coyote may linger in casual investigation. Begin with a properly bedded foothold trap. Move or add natural materials and apply small amounts of bait, lure, or urine to them. Add guides to help with foot placement.

- **Dirt Hole Set:** The dirt hole set (Figure 23) takes advantage of a coyote's need to investigate smells emanating from a hole in the ground. The dirt hole set imitates an existing small rodent burrow. Begin with a properly bedded foothold trap. Dig a hole resembling a burrow at a 45-degree angle down and 8 to 10 inches (20 to 25 cm) deep (if soil conditions allow). The diameter of the hole can be as small as ½ inch to as large as 4 inches (1.2 to 10 cm). Bait is placed in the bottom of the hole and a small wad of vegetation is added over the bait. Attractants are added outside of the hole to both appeal to the coyote's senses and guide its foot placement. The location of the foothold trap pan is placed in anticipation of where the visiting coyote will step. *Note: An existing small rodent burrow or hole may also be used.*

Resetting Traps within a Catch Circle

The disturbed area where a trapped coyote is restrained is referred to as the "catch circle." The odors and disturbance in a catch circle will often attract other coyotes. Thus, the foothold trap can be replaced, and a new set made within the catch circle. In some cases, cautious coyotes will approach, but not enter, the catch circle. If sign indicates that this occurred, make additional sets outside or adjacent to the catch circle.

Human Scent and Coyote Trapping

Coyotes quickly notice human scent. Practice bedding foothold traps frequently to reduce the amount of time spent making a set in the field. The longer it takes to make a set, the more human scent is left behind. Coyotes have been known to leave an area after encountering an unfamiliar human scent.

Wet or humid weather causes human scent to remain longer and may make coyotes more difficult to catch with foothold traps. Wear gloves, wax foothold traps, and take other precautionary measures when setting traps in areas where people or human activity are limited.

Appendix IV–Cable Devices

The following appendix highlights specific techniques related to the use of cable devices.

Cable Device Preparation and Maintenance

Cable devices should be cleaned and dulled prior to use (Figure 24). The majority of components are made of metal and the manufacturing process leaves oils and odors on the metal. Some components are galvanized, and others are bare metal. In either case, metal can shine and must be dulled to avoid detection.

To dull the metal, begin by coiling the cable devices individually and placing them in a kettle. Fill the kettle with water until the devices are covered. Estimate the amount of water and mix at a ratio of 1 cup baking soda per 1 gallon of water. Mix the baking soda in the water until it is completely dissolved and heat. Once boiling, reduce the temperature to a low roiling boil for 45 minutes to an hour. Pour off the dirty water and rinse the cable devices.

The baking soda boil turns the shiny metal a dull gray color. There is no need to color or dye the devices any further. Besides yellow and violet, a coyote sees the world only in shades of gray. If coloring is desired, match the color seen from the level of a coyote (24 inches [60 cm] from the ground), not from the height of a standing person.

Do not use lye, bleach, muriatic acid or other caustic cleaners with cable devices. The cable and aluminum components will quickly deteriorate with exposure to these chemicals.

Wear gloves when handling and cleaning cable devices. Store cable devices in covered buckets or plastic bags to avoid contamination. Cable devices do not have to be boiled or treated every season as long as they do not become contaminated. Inspect each cable device prior to use. The treating process removes any protection the steel and aluminum parts may have had, resulting in rust or deterioration from environmental conditions over time.

Figure 24. Cable devices can be cleaned and treated with minimal equipment.

Setting Cable Devices

Cable devices are built and include components for specific purposes (live-capture/restraint or lethal) in specific habitats. Match the device to how it is being used. Different designs include the following:

- Using shorter cables for cattails or tall grass areas, and adding a tangle rod if lethal results are desired;
- Using a lighter breakaway device in areas frequented by non-target animals, such as deer;
- Using medium to long cables in areas with good natural entanglement for lethal results; and
- Checking a device daily when used near people or domestic dogs.

To ensure cable device sets are selective for coyotes, consider the following items.

- **Location:** Scout, follow tracks, identify the variety of animals in the area, and learn where coyote trails exist. Avoid setting cable devices in areas with non-target animal traffic.

- **Loop size and shape:** Know the right size loop for coyotes and become proficient at suspending a loop that size. In some cases, it may be more appropriate to use a smaller diameter loop in narrower trail sets that go through heavy cover. The following loop sizes represent a top to bottom measurement, not side to side.

    - **Coyote cable loop for live-capture/restraint:** Use a 10- to 12-inch (25 to 30 cm) loop, with the bottom of the loop 10 inches (25 cm) from the ground.
    - **Coyote cable loop for lethal removal:** Use a 9- to 10-inch (22 to 25 cm) loop, with the bottom of the loop 10 inches (25 cm) from the ground.

    Note: Galvanized Aircraft Cable (GAC) is used to make cable devices. Most often, this cable will not provide a perfect circular loop. The loop more resembles a teardrop than a circle. A loop resembling a perfect circle is not required to catch coyotes, nor is a perfect circle naturally observed in the field. The measurement from a coyote's chin to the tip of its ears is greater than the measurement from one side of its head to the other. Teardrop-shaped loops are more appropriate than a perfect circle. It is critical to ensure the loop is the correct size and height from the ground and centered in the trail.

- **Loop height:** The loop height is the distance from the bottom of the suspended loop to the ground. As a coyote passes its head through the loop, the portion of its throat just under the chin should make initial contact with the bottom of the suspended loop. The coyote's forward progression will cause the loop to encircle its neck. When the loop is suspended properly, other smaller non-target animals can easily pass under the loop (Figure 25).

A Breakaway Component

A breakaway component is designed to fail under an established amount of pressure, causing the complete disassembly of the cable device loop. A breakaway component allows for the release of larger, non-target animals accidentally restrained with a cable device.

A breakaway component may be a j-hook, s-hook, or an aluminum release ferrule. Pull testing is done and weight ratings are established for each type of breakaway. Breakaway component ratings used for coyote cable devices range from 110 to 350 lbs (86 to 158 kg). These weight ratings correlate to the amount of pressure

Appendix IV–Cable Devices *continued*

required to cause the component to fail. In order to work, a cable device with a breakaway component must be solidly anchored to an immovable object.

Types of Cable Devices

- **RAM® Power Snare:** The RAM power snare is a torsion spring-powered lethal cable device (Figure 26). A short cable is used to attach the loop to the torsion spring. The torsion spring is set and anchored parallel to the coyote trail. As the coyote passes its head through the loop, its forward motion closes the loop around its neck. The continued forward motion allows the torsion spring arm to release and expand, keeping pressure on the loop around the coyote's neck and resulting in the animal's death.

- **Belisle® Foot Snare:** A Belisle foot snare is a torsion spring-powered restraining cable device that works similar to a foothold trap (Figure 27). When the coyote steps on the pan, the torsion spring arm throws the cable loop up onto the leg. The coyote is restrained by the cable loop around the foot.

- **Collarum®:** A Collarum is a coil and torsion spring-powered restraining cable device that works similar to the Belisle foot snare (Figure 28). With a Collarum, the coyote pulls on a baited trigger and the spring arm throws the cable loop around the head and onto the neck.

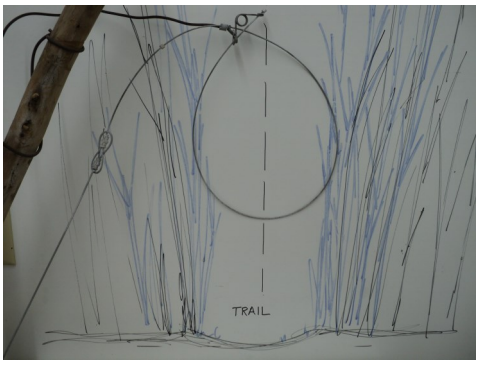


Figure 25. Center the bottom of the cable loop in the center of the trail. This set location is for a lethal cable device because the woody rooted vegetation provides entanglement.

Figure 26. An example of a RAM® Power Snare set.

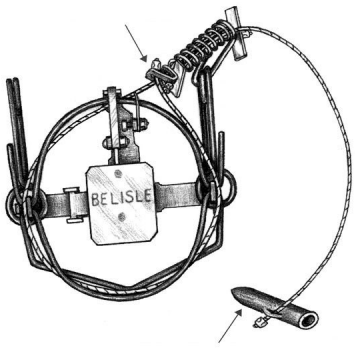


Figure 27. The Belisle® foot snare is a torsion spring-powered foothold restraining cable device.

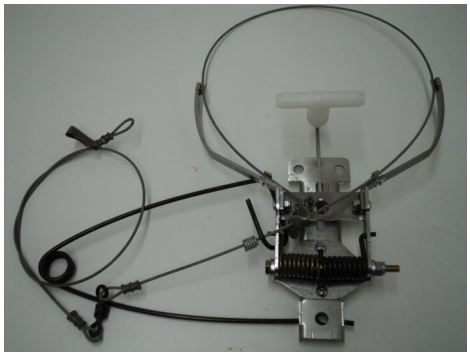


Figure 28. The Collarum® is a coil and torsion spring-powered restraining cable device.