REP 1994-062

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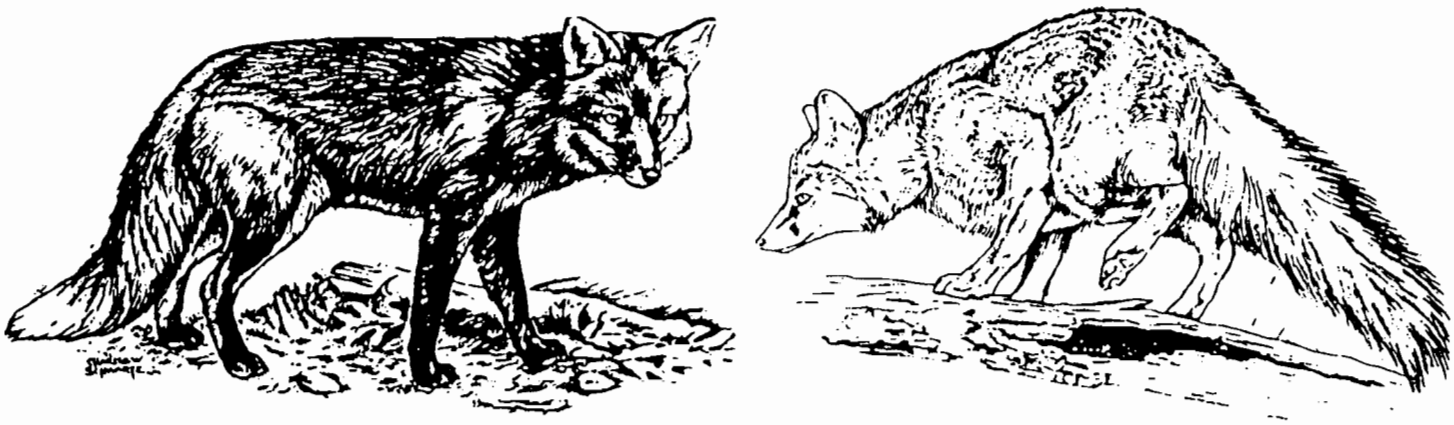
FOXES

Fig. 1. Red fox, *Vulpes vulpes* (left) and gray fox, *Urocyon cinereoargenteus* (right).



Damage Prevention and Control Methods

Exclusion

Net wire fence.

Electric fence.

Cultural Methods

Protect livestock and poultry during most vulnerable periods (for example, shed lambing, farrowing pigs in protective enclosures).

Frightening

Flashing lights and exploders may provide temporary protection.

Well-trained livestock guarding dogs may be effective in some situations.

Repellents

None are registered for livestock protection.

Toxicants

M-44® sodium cyanide mechanical ejection device, in states where registered.

Fumigants

Gas cartridges for den fumigation, where registered.

Trapping

Steel leghold traps.

Cage or box traps.

Snares.

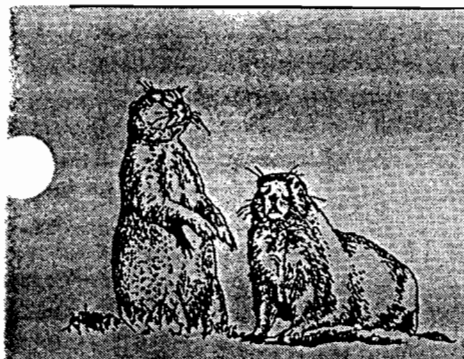
Shooting

Predator calling techniques.

Aerial hunting.

Other Methods

Den hunting. Remove young foxes from dens to reduce predation by adults.



PREVENTION AND CONTROL OF WILDLIFE DAMAGE — 1994

Cooperative Extension Division
Institute of Agriculture and Natural Resources
University of Nebraska - Lincoln

United States Department of Agriculture
Animal and Plant Health Inspection Service
Animal Damage Control

Great Plains Agricultural Council
Wildlife Committee

Identification

The red fox (*Vulpes vulpes*) is the most common of the foxes native to North America. Most depredation problems are associated with red foxes, although in some areas gray foxes (*Urocyon cinereoargenteus*) can cause problems. Few damage complaints have been associated with the swift fox (*V. velox*), kit fox (*V. macrotis*), or Arctic fox (*Alopex lagopus*).

The red fox is dog-like in appearance, with an elongated pointed muzzle and large pointed ears that are usually erect and forward. It has moderately long legs and long, thick, soft body fur with a heavily furred, bushy tail (Fig. 1). Typically, red foxes are colored with a light orange-red coat, black legs, lighter-colored underfur and a white-tipped tail. Silver and cross foxes are color phases of the red fox. In North America the red fox weighs about 7.7 to 15.4 pounds (3.5 to 7.0 kg), with males on average 2.2 pounds (1 kg) heavier than females.

Gray foxes weigh 7 to 13 pounds (3.2 to 5.9 kg) and measure 32 to 45 inches (81 to 114 cm) from the nose to the tip of the tail (Fig. 1). The color pattern is generally salt-and-pepper gray with buffy underfur. The sides of the neck, back of the ears, legs, and feet are rusty yellow. The tail is long and bushy with a black tip.

Other species of foxes present in North America are the Arctic fox, swift fox, and kit fox. These animals are not usually associated with livestock and poultry depredation because they typically eat small rodents and lead a secretive life in remote habitats away from people, although they may cause site-specific damage problems.

Range

Red foxes occur over most of North America, north and east from southern California, Arizona, and central Texas. They are found throughout most of the United States with the exception of a few isolated areas (Fig. 2).

Gray foxes are found throughout the eastern, north central, and southwestern United States They are found throughout Mexico and most of the southwestern United States from California northward through western Oregon (Fig. 3).

Kit foxes are residents of arid habitats. They are found from extreme southern Oregon and Idaho south along the Baja Peninsula and eastward through southwestern Texas and northern Mexico (Fig. 4).

The present range of swift foxes is restricted to the central high plains. They are found in Kansas, the Oklahoma panhandle, New Mexico, Texas, Nebraska, South Dakota, Wyoming, and Colorado (Fig. 4).

As its name indicates, the Arctic fox occurs in the arctic regions of North America and was introduced on a number of islands in the Aleutian chain.

Habitat

The red fox is adaptable to most habitats within its range, but usually prefers open country with moderate cover. Some of the highest fox densities reported are in the north-central United States, where woodlands are interspersed with farmlands. The range of the red fox has expanded in recent years to fill habitats formerly occupied by coyotes (*Canis latrans*). The reduction of coyote numbers in many sagebrush/grassland areas of Montana and Wyoming has resulted in increased fox numbers. Red foxes have also demonstrated their adaptability by establishing breeding populations in many urban areas of the United States, Canada, and Europe. Gray foxes prefer more dense cover such as thickets, riparian areas, swamp land, or rocky pinyon-cedar ridges. In eastern North America, this species is closely associated with edges of deciduous forests. Gray foxes can also be found in urban areas where suitable habitat exists.

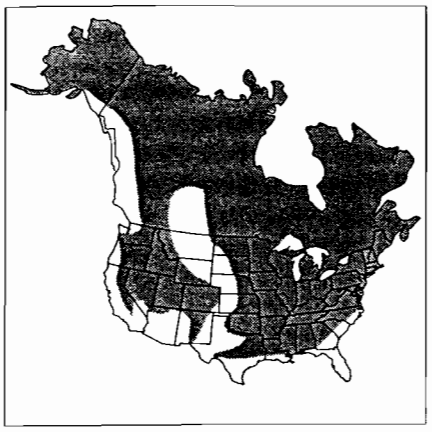


Fig. 2. Range of the red fox in North America.

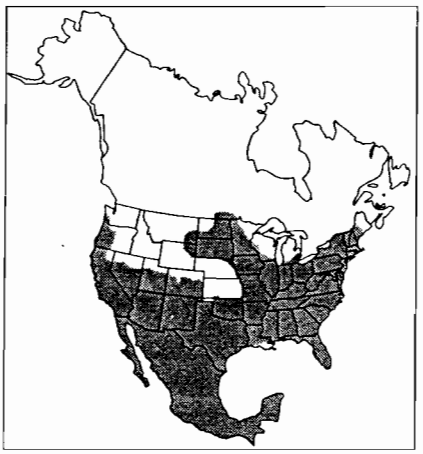


Fig. 3. Range of the gray fox in North America.

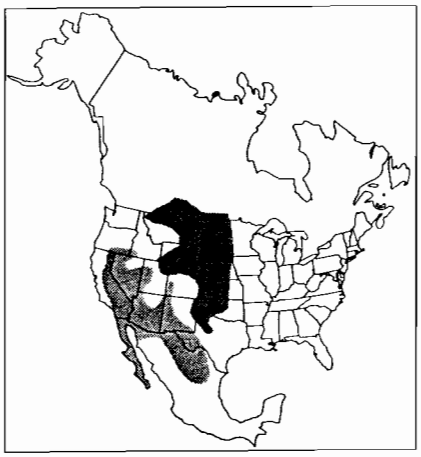


Fig 4. Range of the swift fox (dark) and the kit fox (light) in North America..

Food Habits

Foxes are opportunists, feeding mostly on rabbits, mice, bird eggs, insects, and native fruits. Foxes usually kill animals smaller than a rabbit, although fawns, pigs, kids, lambs, and poultry are sometimes taken. The fox's keen hearing, vision, and sense of smell aid in detecting prey. Foxes stalk even the smallest mice with skill and patience. The stalk usually ends with a sudden pounce onto the prey. Red foxes sometimes kill more than they can eat and bury food in caches for later use. All foxes feed on carrion (animal carcasses) at times.

General Biology, Reproduction, and Behavior

Foxes are crepuscular animals, being most active during the early hours of darkness and very early morning hours. They do move about during the day, however, especially when it is dark and overcast.

Foxes are solitary animals except from the winter breeding season through midsummer, when mates and their young associate closely. Foxes have a wide variety of calls. They may bark, scream, howl, yap, growl, or make sounds similar to a hiccup. During winter a male will often give a yelling bark, "wo-wo-wo," that seems to be important in warning other male foxes not to intrude on its territory. Red foxes may dig their own dens or use abandoned burrows of a woodchuck or badger. The same dens may be used for several generations. Gray foxes commonly use wood piles, rocky outcrops, hollow trees, or brush piles as den sites. Foxes use their urine and feces to mark their territories.

Mating in red foxes normally occurs from mid-January to early February. At higher latitudes (in the Arctic) mating occurs from late February to early March. Estrus in the vixen lasts 1 to 6 days, followed by a 51- to 53-day gestation period. Fox pups can be born from March in southern areas to May in the arctic zones. Red foxes generally produce 4 to 9 pups. Gray foxes usually have 3 to 7 pups per litter. Arctic foxes may have from 1 to 14 pups, but usually have 5 or 6. Foxes disperse from denning areas during the fall months and establish breeding areas in vacant territories, sometimes dispersing considerable distances.

Damage and Damage Identification

Foxes may cause serious problems for poultry producers. Turkeys raised in large range pens are subject to damage by foxes. Losses may be heavy in small farm flocks of chickens, ducks, and geese. Young pigs, lambs, and small pets are also killed by foxes. Damage can be difficult to detect because the prey is usually carried from the kill site to a den site, or uneaten parts are buried. Foxes usually attack the throat of young livestock, but some kill by inflicting multiple bites to the neck and back. Foxes do not have the size or strength to hold adult livestock or to crush the skull and large bones of their prey. They generally prefer the viscera and often begin feeding through an entry behind the ribs. Foxes will also scavenge carcasses, making the actual cause of death difficult to determine.

Pheasants, waterfowl, other game birds, and small game mammals are also preyed upon by foxes. At times, fox predation may be a significant mortality factor for upland and wetland birds, including some endangered species.

Rabies outbreaks are most prevalent among red foxes in southeastern Canada and occasionally in the eastern United States. The incidence of rabies in foxes has declined substantially since the mid-1960s for unexplained reasons. In 1990, there were only 197 reported cases of fox rabies in the United States as compared to 1,821 for raccoons and 1,579 for skunks. Rabid foxes are a threat to humans, domestic animals, and wildlife.

Legal Status

Foxes in the United States are listed as furbearers or given some status as game animals by most state governments. Most states allow for the taking of foxes to protect private property. Check with your state wildlife agency for regulations before undertaking fox control measures.

Damage Prevention and Control Methods

Exclusion

Construct net wire fences with openings of 3 inches (8 cm) or less to exclude red foxes. Bury the bottom of the fence 1 to 2 feet (0.3 m to 0.9 m) with an apron of net wire extending at least 12 inches (30 cm) outward from the bottom. A top or roof of net wire may also be necessary to exclude all foxes, since some will readily climb a fence.

A 3-wire electric fence with wires spaced 6 inches, 12 inches, and 18 inches (15 cm, 31 cm, and 46 cm) above the ground can repel red foxes. Combination fences that incorporate net and electric wires are also effective.

Cultural Methods

The protection of livestock and poultry from fox depredation is most important during the spring denning period when adults are actively acquiring prey for their young. Watch for signs of depredation during the spring, especially if there is a history of fox depredation. Foxes, like other wild canids, will often return to established denning areas year after year. Foxes frequently den in close proximity to human habitation. Dens may be located close to farm buildings, under haystacks or patches of cover, or even inside hog lots or small pastures used for lambing. Because of the elusive habits of foxes, dens in these locations may not be noticed until excessive depredations have occurred.

The practice of shed lambing and farrowing in protected enclosures can be useful in preventing fox depredation on young livestock. Also, removal of

livestock carcasses from production areas can make these areas less attractive to predators.

Frightening

Foxes readily adapt to noise-making devices such as propane exploders, timed tape recordings, amplifiers, or radios, but such devices may temporarily reduce activity in an area.

Flashing lights, such as a rotating beacon or strobe light, may also provide temporary protection in relatively small areas or in livestock or poultry enclosures. Combinations of frightening devices used at irregular intervals should provide better protection than use of a single device because animals may have more difficulty in adapting to these disturbances.

When properly trained, some breeds of dog, such as Great Pyrenees and Akbash dogs, have been useful in preventing predation on sheep. The effectiveness of dogs, even the "guard dog" breeds, seems to depend entirely on training and the individual disposition of the dog.

Toxicants

The M-44®, a sodium cyanide mechanical ejection device, is registered for control of red and gray foxes nationwide by USDA-APHIS-ADC personnel, and in some states by certified pesticide applicators. Information on the safe, effective use of sodium cyanide is available from the appropriate state agency charged with the registration of pesticides. M-44s are generally set along trails and at crossings regularly used by foxes.

Fumigants

Gas cartridges made by USDA-APHIS-ADC are registered for fumigating the dens of coyotes, pocket gophers, ground squirrels, and other burrowing rodents. Special Local Needs permits 24(c) are available in North and South Dakota and Nebraska for gas cartridge fumigation of fox dens. State and local regulations should be consulted before using den fumigants.

Trapping

Trapping is a very effective and selective control method. A great deal of expertise is required to effectively trap foxes. Trapping by inexperienced people may serve to educate foxes, making them very difficult to catch, even by experienced trappers. Traps suitable for foxes are the Nos. 1 1/2, 1 3/4, and 2 double coilspring trap and the Nos. 2 and 3 double longspring trap. Traps with offset and padded jaws cause less injury to confined animals and facilitate the release of nontarget captures. State and provincial wildlife agencies regulate the traps and sets that can be used for trapping. Consult your local agency personnel for restrictions that pertain to your area.

Proper set location is important when trapping foxes. Sets made along trails, at entrances to fields, and near carcasses are often most productive (Fig. 5). Many different sets are successful, and can minimize the risk of nontarget capture. One of the best is the dirt-hole set (Fig. 6). Dig a hole about 6 inches (15 cm) deep and 3 inches (8 cm) in diameter at a downward angle just behind the spot where the trap is to be placed. Four to five drops of scent should be placed in the back of the hole. Move back from the bait hole and dig a hole 2 inches (5 cm) deep that is large enough to accommodate the trap and chain. Fasten the trap chain to a trap stake with a chain swivel and drive the stake directly under the place where the trap is set. Fold and place the chain under or beside the trap. Set the trap about 1/2 inch (1.3 cm) below the ground. Adjust the tension device on the trap to eliminate the capture of lighter animals. When the set is completed, the pan of the trap should be approximately 5 inches (13 cm) from the entrance of the hole with the pan slightly offset from the center of the hole (Fig. 6). Cover

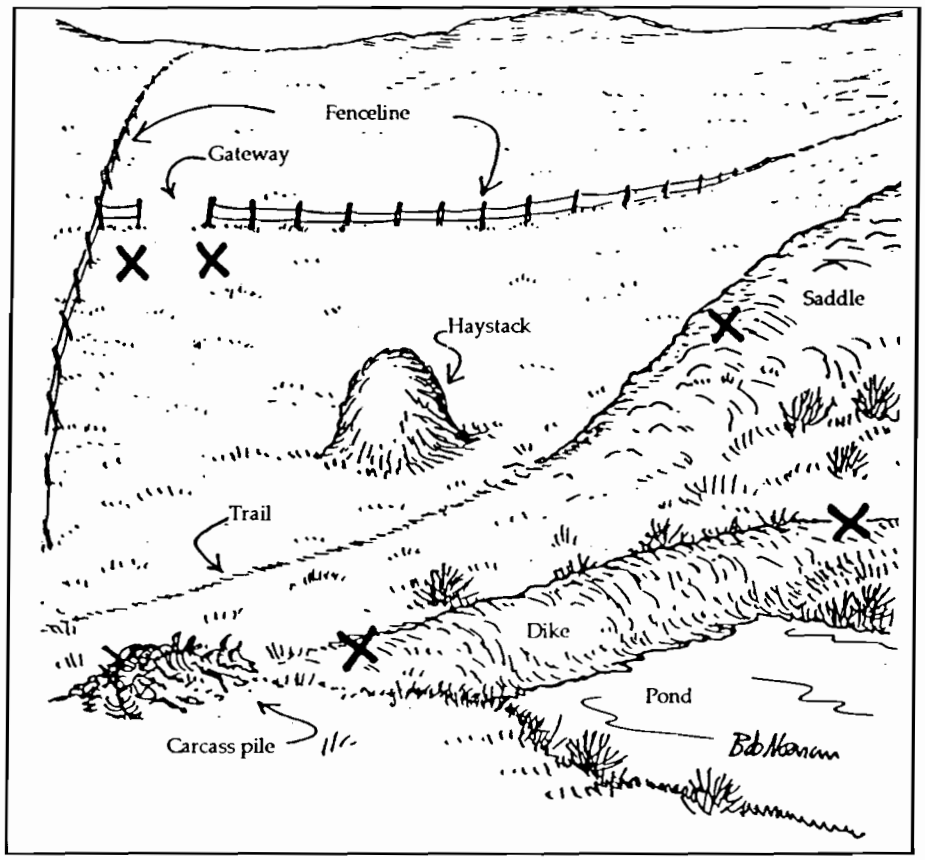


Fig. 5. Good locations for setting leghold traps for foxes.

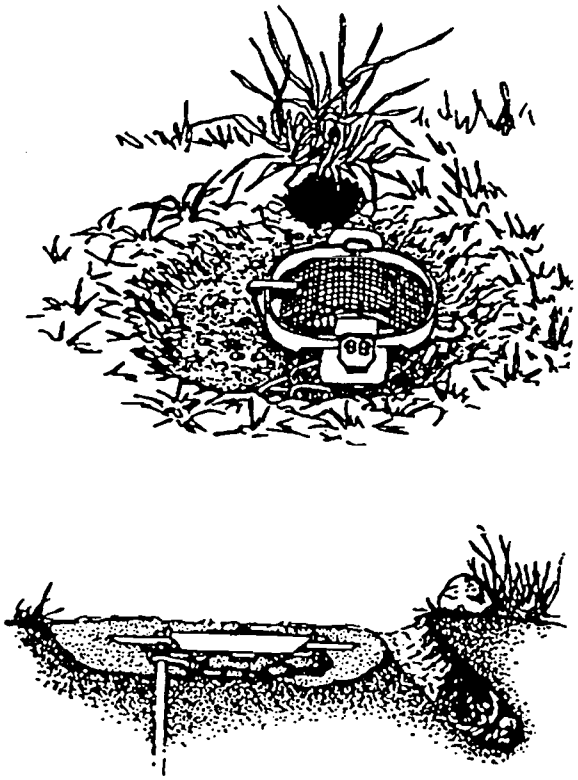


Fig. 6. A dirt-hole set showing proper trap placement.

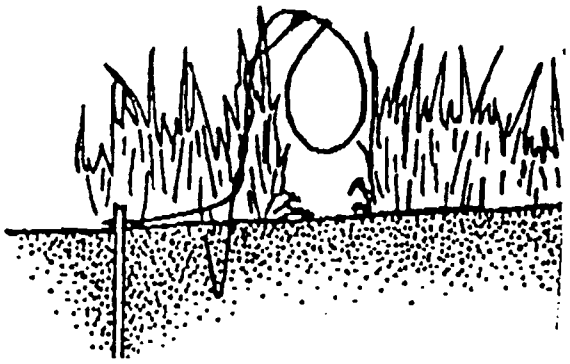


Fig. 7. Properly set neck snare for foxes.

the area between the jaws and over the trap pan with a piece of waxed paper, light canvas, or light screen wire. The trap must be firmly placed so that it does not move or wobble. The entire trap should be covered lightly with sifted soil up to the original ground level.

Fox scents and lures can be home-made, but this requires some knowledge of scent making as described in various trapping books. Commercial trap scents can be purchased from most trapping suppliers (see **Supplies and Materials**). Experiment with various baits and scents to discover the combination of odors that will be most appropriate for your area.

Equipment needed for trapping foxes includes traps, a sifter with a 3/16- or 1/2-inch screen (0.5 or 1.3 cm), trap stakes, trowel, gloves (which should be used only for trapping), a 16- to 20-ounce (448- to 560-g) carpenter's hammer with straight claws, and a bottle of scent. Remove the factory oil finish on the traps by boiling the traps in water and vinegar or by burying the traps in moist soil for one to two weeks until lightly rusted. The traps should then be dyed with commercially available trap dye to prevent further corrosion. Do not allow the traps and other trapping equipment to come in contact with gasoline, oil, or other strong-smelling and contaminating materials. Cleanliness of equipment is absolutely necessary for consistent trapping success.

Cage traps are sometimes effective for capturing juvenile red foxes living in urban areas. It is uncommon to trap an adult red fox in a cage or a box trap; however, kit and swift foxes can be readily captured using this method.

Snares made from 1/16-inch, 5/64-inch, and 3/32-inch (0.15 cm, 0.2 cm, and 0.25 cm) cable can be very effective for capturing both red and gray foxes. Snares are generally set in trails or in crawl holes (under fences) that are frequented by foxes. The standard loop size for foxes is about 6 inches (15 cm) with the bottom of the loop about 10 to 12 inches (25 to 30 cm) above ground level (Fig. 7). Trails leading to

and from den sites and to carcasses being fed on by foxes make excellent locations for snares.

Shooting

Harvest of foxes by sport hunters and fur trappers is another method of reducing fox populations in areas where damage is occurring. Livestock and poultry producers who have predation problems during the late fall and winter can sometimes find private fur trappers willing to hunt or trap foxes around loss sites. Depredations are usually most severe, however, during the spring when furs are not saleable, and it is difficult to interest private trappers at that time.

Artificial rabbit distress calls can be used to decoy foxes to within rifle or shotgun range. Select a spot that faces into the wind, at the edge of a clearing or under a bush on a slight rise where visibility is good. Blow the call at 1/2- to 1-minute intervals, with each call lasting 5 to 10 seconds. If a fox appears, remain motionless and do not move the rifle or shotgun until ready to shoot. If a fox does not appear in about 20 minutes, move to a new spot and call again.

Aerial hunting can be used in some western states to remove problem foxes. This activity is closely regulated and is usually limited to USDA-APHIS-ADC personnel or individuals with special permits from the state regulatory agency.

Den Hunting

Fox depredations often increase during the spring whelping season. Damage may be reduced or even eliminated by locating and removing the young foxes from the den. Locate fox dens by observing signs of fox activity and by careful observation during the early and late hours of the day when adult foxes are moving about in search of food. Preferred denning sites are usually on a low rise facing a southerly direction. When fox pups are several weeks old, they will spend time outside the den in the early morning and evening hours. They leave abundant signs of their presence, such as matted vegetation and remnants of food, including bits of bone, feathers, and hair. Frequently used den sites have a distinctive odor.

Fox pups may be removed by trapping or by fumigating the den with gas cartridges if they are registered for your area. In some situations it may be desirable to remove the pups without killing them. The mechanical wire ferret has proved to be effective in chasing the pups from the den without harming them. This device consists of a long piece of smooth spring steel wire with a spring and wooden plug at one end and a handle at the other. This wire is twisted through the den passageways, chasing foxes out of other den openings where they can be captured by hand or with dip nets. Small dogs are sometimes trained to retrieve pups unharmed from dens. Wire-cage box traps placed in the entrance of the den can also be useful for capturing young foxes.

Acknowledgments

We thank Norman C. Johnson, whose chapter "Foxes" in the 1983 edition of this manual provided much of the information used in this section. F. Sherman Blom, Ronald A. Thompson, and Judy Loven (USDA-APHIS-ADC) provided useful comments.

Figure 1 from Schwartz and Schwartz (1981) adapted by Jill Sack Johnson.

Figures 2, 3, and 4 courtesy of Pam Tinnin.

Figure 5 courtesy of Bob Noonan.

Figures 6 and 7 courtesy of Tom Krause.

For Additional Information

Burt, W. H., and R. P. Grossenheider. 1976. A field guide to mammals, 3d ed. Houghton Mifflin Co., Boston. 289 pp.

Foreyt, W. J. 1980. A live trap for multiple capture of coyote pups from dens. J. Wildl. Manage. 44:487-88.

Fritzell, E. K., and K. J. Haroldson. 1982. *Urocyon cinereoargenteus*. Mammal. Sp. 189:1-8.

Dolbeer, R. A., N. R. Holler, and D. W. Hawthorne. 1994. Identification and control of wildlife damage. Pages 474-506 *in* T. A. Bookhout ed. Research and management techniques for wildlife and habitats. The Wildl. Soc., Bethesda, Maryland.

Krause, T. 1982. NTA trapping handbook — a guide for better trapping. Spearman Publ. and Printing Co., Sutton, Nebraska. 206 pp.

Samuel, D. E., and B. B. Nelson. 1982. Foxes. Pages 475-90 *in* J. A. Chapman and G. A Feldhamer eds., Wild mammals of North America: biology, management, and economics. The Johns Hopkins Univ. Press, Baltimore, Maryland.

Schwartz, C. W., and E. R. Schwartz. 1981. The wild mammals of Missouri, rev. ed. Univ. Missouri Press, Columbia. 356 pp.

Storm, G. L., R. D. Andrews, R. L. Phillips, R. A. Bishop, D. B. Siniff, and J. R. Tester. 1976. Morphology, reproduction, dispersal and mortality of midwestern red fox populations. Wildl. Mono. No. 49. The Wildl. Soc., Inc., Washington, DC. 82 pp.

Storm, G. L., and K. P. Dauphin. 1965. A wire ferret for use in studies of foxes and skunks. J. Wildl. Manage. 29:625-26.

Voigt, D. R. 1987. Red fox. Pages 379-93 *in* M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch eds., Wildlife Furbearer Management and Conservation in North America. Ontario Ministry of Nat. Resour.

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