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COEXISTING WITH AN ADAPTABLE AND RESILIENT CARNIVORE





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The Animal Protection Institute was founded in 1968 and united with Born Free USA in 2007, to strengthen the mission to keep wildlife in the wild.

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KEEP WILDLIFE IN THE WILD

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Executive Summary

FEW ANIMALS evoke as wide a range of feelings in humans as the coyote. To some, coyotes are icons of American culture, ecologically important, and worthy of respect and protection. To others, they are dangerous, despised vermin who are better dead than alive. Most people likely have a view somewhere in between.

The coyote is the most persecuted native carnivore in the United States. Hundreds of thousands of coyotes are killed each year by hunters, trappers, ranchers, and government agents.¹ Since 1916, the Federal Cooperative Animal Damage Control program alone has killed nearly six million coyotes, an average of more than 71,000 a year. In Fiscal Year 2003, the U.S. Department of Agriculture trapped, shot, and poisoned a reported 75,724 coyotes. While most coyotes are killed because they are considered a threat to livestock, they also have become increasingly targeted because of their activities in suburban and urban areas.

However, intense and widespread efforts to control coyotes have generally failed to produce long-lasting results. Rather, attempts to eradicate or suppress coyote populations have proven to be counterproductive.

It is widely held by the scientific community that predator eradication programs are futile and ecologically devastating. This publication charts a better course. It provides readers with information on the wide array of practical and proven techniques available to ranchers and suburbanites for coexisting with coyotes.

Coyotes in Our Midst looks first at coyote biology and ecology and considers the species' role in ecosystems. Following chapters examine traditional management of human-coyote conflicts and why such efforts have failed. The fact is, coyotes are here to stay. Moreover, with increased urbanization and development, conflict between humans and coyotes will undoubtedly continue. Many scientists and wildlife managers conclude that the only viable long-term solution to resolving conflicts with coyotes is educated coexistence and the implementation of effective, socially acceptable, and humane mitigation techniques. This publication responds to that need.

Outlining proactive measures for managing conflicts, *Coyotes in Our Midst* is a call to action for land and home owners, ranchers, policymakers, and communities. The pages within analyze a wide array of practical and proven techniques — from livestock guard dogs to motion-activated scare devices — that, when used correctly and especially in combination, can significantly reduce, if not eliminate, negative interactions between coyotes and humans. Whether the aim is to reduce livestock predation or keep companion animals safe, the approach outlined in this publication has the potential to change attitudes towards coyotes and to create effective and long-lasting solutions in communities.

The Animal Protection Institute (API) has taken a leading role in assisting communities with coyote conflicts. API advocates a multi-faceted approach to conflicts, including treating the source of the problem and not the symptoms, fostering collaboration among affected stakeholders, and educating the public through persistent outreach efforts. *Coyotes in Our Midst* is part of that effort and API hopes that everyone reading this publication will respond to the challenge it lays down. The advice and research here will help communities, agencies, public officials, and concerned individuals resolve conflicts with practical and humane solutions.

It is clear that lethal efforts to manage conflicts with coyotes have largely failed. The way forward is to implement a different approach — humane, practical solutions that have the real potential to prevent conflicts with coyotes wherever they occur.



Introduction

COYOTES are one of the most resilient and adaptable native carnivores in North America. By their nature, carnivores, including wolves, mountain lions, bears, foxes, bobcats, and lynx, prey on other animals to survive. Unfortunately, this trait has fostered widespread misunderstanding and prejudice, and has largely defined how humans treat predators.

A common sight to many indigenous cultures inhabiting North America prior to the arrival of Europeans, coyotes were generally respected for their intelligence, cunning, and adaptability. The name coyote is derived from the Aztec word coyotyl, which, loosely translated, means *trickster*. Native folklore credited coyotes with creating life and even endowed them with human traits. Some Native American cultures still refer to the animal as Old Man Coyote, Little Wolf, and Medicine Dog.

European settlers, however, sought to eradicate coyotes and other native carnivores, such as wolves, bears and mountain lions, because they viewed them as threats to livestock and as competition for the species they hunted. By the 1950s, mountain lions had been extirpated from much of their historic habitat in the 48 contiguous U.S. states and eastern Canada, and wolves and grizzly bears had been all but eradicated in most of the U.S. and in parts of Canada. Yet the coyote, a species of wild dog found only in North America, persevered.

Today, the coyote is the most persecuted native carnivore in the United States. Federal, state, and local governments and private individuals kill hundreds of thousands of coyotes annually, primarily for the benefit of livestock producers. Coyotes are also killed for their fur, for sport, and in body-count contests where prizes are awarded for killing the greatest number of animals. While the killing of most species is regulated by law in the form of designated hunting seasons and bag limits, many states still classify coyotes as "vermin," "predatory mammals," or "unprotected species," thereby providing no protection or regulatory oversight. Such classifications allow hunters, trappers, and ranchers to kill an unlimited number of coyotes year-round, often with any available method (see "Appendix: State Classification and Management of Coyotes" on p. 44).

Unlike wolves and grizzly bears, coyotes have thrived under persecution. There are now more coyotes in North America than ever before. Indiscriminate killing of coyotes has proven futile and even counterproductive. Nevertheless, many wildlife managers continue to promote lethal control as the best method to address conflicts. An increasing number of biologists and researchers, however, recognize the vital ecological role coyotes and other large carnivores play in maintaining the biodiversity, stability, and integrity of native ecosystems.





Coyote Biology and Ecology

Coyotes are native to North and Central America

and evolved into their present form approximately

10,000 years ago.

APPEARANCE

Coyotes are rather similar in appearance to a small, grizzled gray or reddish-gray German shepherd, with buff underparts, long rust or yellowish legs, a bushy tail, and pointed snout. Often mistaken for wolves, coyotes generally are smaller and more slender, with a relatively more narrow snout and larger ears. While running dogs and foxes usually carry their tails straight out from the

back, coyotes run with their tails hanging lower. The typical weight of a coyote ranges from 20 to 50 pounds, with a body length of 32-37 inches and a tail length of 11-16 inches. Coyotes living in northern regions and the mountains are substantially larger and more heavily furred than those living in the south and in deserts. The largest coyotes live in the northeast, in part the result of interbreeding with wolves and domestic dogs.

TAXONOMY

Coyotes, whose scientific

name is *Canis latrans* ("barking dog"), are native to North and Central America, ranging from Alaska to Costa Rica, having evolved into their present form some 10,000 years ago, during the Pleistocene age. Coyotes are closely related to the gray wolf (*Canis lupus*), red wolf (*Canis rufus*), Australian dingo (*Canis lupus dingo*), jackal (*Canis aureus*), and domestic dog (*Canis familiaris*). More distant relatives include the red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), and swift, or kit, fox (*Vulpes velox*).

DISTRIBUTION

The discovery of coyote fossils in Maryland and New Brunswick suggest that they may have once roamed much of North America during the Pleistocene. However, when Europeans first arrived, coyotes were limited mainly to the grasslands and prairies of southwestern Canada, the central United States, and north-central Mexico.² As white settlers pushed

westward in the 1800s, coyotes moved into new areas in response to human activity and changes in the landscape. Attracted by the garbage and clearings left by gold miners, coyotes expanded their range to the north and west into the Yukon and later into Nevada and California, and south as far as Panama. Deforestation of the eastern woodlands and the extirpation of the coyotes' competitors, such as the gray wolf, allowed coyotes to move eastward in the 1900s. They extended their range into the Great Lakes states by the 1930s,

and into New England a decade later. Introduction of coyotes for hunting and the release of captive animals aided the coyote's immigration into some southeastern states in the latter half of the twentieth century.

In all, coyotes have expanded their range threefold since the 1850s.³ At least nineteen subspecies of coyote now roam throughout North America, from California to Newfoundland and from Alaska to Panama. They occupy a broad range of habitats, including grasslands, deserts, eastern woodlands, boreal forests, agricultural



lands, urban parks, and the urban/suburban fringe.

DIET

Although classified as a carnivore, coyotes are omnivorous and highly opportunistic feeders, and share similar feeding traits with both wolves and foxes. Like wolves, coyotes can kill large prey such as deer and elk, especially when hunting in groups. Like foxes, they are expert mousers, and are skilled at catching ground squirrels and woodchucks, rats, and rabbits. The success of coyotes is a testament to their ability to survive and even thrive on whatever food is available. Ninety percent of their diet consists of small mammals (including relatively fresh carrion), but they also feed on fish, frogs, snakes, large insects, fruits, berries, and nuts.⁴ In northern climates, when snow makes it difficult to For decades it was believed that coyotes lived predominately solitary lives; however, coyotes have also been documented living as pairs and in extended family groups.⁵ The flexibility and social structure observed in coyotes is a response to numerous ecological parameters and, in many cases, human exploitation. Where ungulates such as deer are available, coyotes may readily form packs to kill together an animal that they could not kill alone. Where rodents, lagomorphs, or other small prey are abundant, coyotes often live solitary lives, since small animals are easy prey for a single coyote.

Another factor that is thought to influence coyote group size is the absence of wolves in the areas where their ranges once overlapped. In some areas, particularly Yellowstone National Park, coyotes may

find rodents in winter, coyotes may prey on large ungulates such as elk and deer. In agricultural areas, coyotes sometimes prey on domestic livestock such as sheep and poultry, especially when their natural prey has been reduced or eliminated by human activities. In suburban and urban areas, coyotes may prey on free-roaming and unattended



Coyotes are omnivorous, highly opportunistic feeders; approximately 90 percent of their diet consists of small mammals.

domestic cats and small dogs and feed on uncovered compost piles, overflowing bird feeders, and unsecured garbage.

SOCIAL ORGANIZATION

The demographics and dynamics of coyote populations have been strongly affected by human efforts to eradicate and otherwise control them. At present, nearly all coyote populations in North America are hunted, trapped, or otherwise exploited. In the United States, only three populations remain unexploited. Studies of these populations in Yellowstone National Park, Grand Teton National Park, and the adjacent National Elk Refuge in Wyoming, as well as in the Arid Lands Ecology Reserve at the Hanford nuclear facility in Washington, have produced remarkable insight into the natural history and ecology of coyotes. particularly in unexploited populations. In populations that are unexploited or lightly exploited by humans, 65–90% of coyotes may be members of a pack.⁶ Pack sizes generally ranges from a single pair to 10 animals, excluding pups. The pack is led by an *alpha* male and female pair, who control and maintain the territory and retain their position over the rest of the pack through dominance behavior. Under the alpha pair are the subordinate *beta* adults, who were generally born into the pack in previous years and remained. Betas who help rear pups are known as *helpers*, while those who share the territory and interact with the alpha pair but do not aid with feeding, rearing or guarding of pups are sometimes referred to as *slouches*.⁷

The pack's strong social hierarchy generally limits breeding to the alpha pair, who produces a single litter of four to eight pups each spring. In unexploited

have filled the niche of a top predator by hunting large prey such as deer. Because of the recent introduction of wolves back into this ecosystem, researchers are interested in documenting the wolves' influence on coyotes, their social structure, and their foraging behavior.

Like wolves, coyotes can live in highly developed, family-oriented societies, populations, roughly two-thirds of these pups will survive past five months and be recruited into the population.⁸ In rare instances, the alpha male will also breed with a beta female to produce a "double litter," although very few pups born to betas survive past their first year.⁹ Thus, even though females are capable of reproducing at one year of age, they must generally wait two to five years to breed.¹⁰ Adults have reproductive lives of roughly three to ten years,¹¹ although their reproductive capability generally begins diminishing at around age seven.¹²

Coyote populations also contain lone coyotes, who, as noted, may be more common in exploited populations. Lone coyotes who occupy but do not defend home ranges are called *solitary residents*, while those who range over large areas searching for a mate and territory are known as *nomads*.¹³

Coyotes are highly territorial, and packs occupy and defend on average a 10 square kilometer area.¹⁴ Coyote territories are generally larger in northern areas (e.g., 55–143 sq. km. in Washington) than in southern areas (e.g., 4–5 sq. km. in Texas).¹⁵ Coyote territories may be much smaller in urbanized areas (see p. 32). The territories of neighboring packs do not overlap greatly and may vary considerably in size due to differences in habitat quality and the abundance of prey.

The number of coyotes in a pack, and therefore in the larger population, is largely a function of the habitat's carrying capacity, specifically the availability of food. The abundance of food regulates coyote reproduction, survival, dispersal of yearlings out of the pack, delineation of territorial boundaries, and number of territories in an area.¹⁶

For example, in Yellowstone National Park, where coyotes are protected from exploitation, coyote pack size depends largely on the availability of large carrion in winter.¹⁷ More carcasses mean more members of the pack can feed, and thus the pack stays together. In times of scarcity, however, the alpha female may produce fewer pups, and yearling coyotes may be forced to leave the pack to find food, leading to smaller pack sizes.

Competition among neighboring packs for habitat and food also regulates the size of individual packs.¹⁸ Being a member of a pack and possessing a territory improves a coyote's access to food, chances for survival, and breeding opportunities over transient coyotes.¹⁹ Yellowstone coyotes with greater access to carrion in winter, generally those older and more dominant individuals, typically remain in packs and thus their packs remain large.²⁰ Older, more experienced coyotes are also better hunters of small and large prey.²¹



In unexploited coyote family groups, breeding is generally limited to the alpha pair, which produces a single litter of pups each spring.



The Role of Coyotes in Ecosystems

FOR DECADES, ecologists have understood that within a given habitat, every species connects to and depends upon other species, and therefore contributes to the overall integrity of the habitat. Biologists have identified as "keystone species" those whose absence would lead inexorably to the extinction of other forms of life. The disappearance of a keystone species triggers the loss of other resident species, unraveling the intricate connections among the remaining residents in a cascading effect.

Coyotes have been found to play an integral role in maintaining the health and integrity of a variety of native ecosystems, including chaparral, grasslands, and wetlands.²² Coyotes can have a "top-down" effect on ecosystems, primarily by regulating the numbers of smaller predators, such as foxes, raccoons, skunks, and feral cats through competitive exclusion and direct killing. Research in the fragmented urban habitats of coastal southern California indicates that the absence of coyotes allowed smaller predators to proliferate, leading to a sharp 5,000-hectare area caused a significant increase in the numbers of jackrabbits, badgers, gray foxes, and bobcats, and a severe decline in the diversity of rodent species.²⁵ Notably, they concluded that removing coyotes to protect livestock could actually be counterproductive: "Increased jackrabbit density caused by a lack of predation could cause increased competition for forage between jackrabbits and

reported that the killing of nearly all the coyotes in a



Coyotes play an integral role in maintaining the health and integrity of a variety of native ecosystems.

reduction in the number and diversity of scrub-nesting bird species.²³ Other studies have found that coyotes have similar indirect effects on songbirds and waterfowl.²⁴

Researchers at Texas Tech University have

disease that is carried by deer ticks.²⁸

In sum, coyotes can play an invaluable role in maintaining the health and integrity of a variety of native ecosystems. Conversely, their removal can lead to the unraveling of those same landscapes.

livestock...consequently, a reduced stocking rate [of livestock] may be required to offset competition, which may financially negate the number of livestock saved from predation."²⁶

In the northeastern U.S., researchers speculate that coyotes may help control overabundant white-tailed deer populations in suburban areas, thereby reducing the deer's impact on native vegetation and birds.²⁷ One researcher has even suggested that by reducing the number of deer in these areas, coyotes may further benefit humans by controlling the spread of Lyme deer version 28



Traditional Management of Coyote-Human Conflicts

HISTORY

The treatment of coyotes throughout American history parallels other North American large carnivores with one important difference: The coyote has prospered as others have been driven toward extinction.

Up until the mid-twentieth century, the dominant management strategy toward coyotes and other $% \left({{{\left({{{{\bf{n}}_{{\rm{s}}}}} \right)}_{{\rm{s}}}}} \right)$

land for domestic livestock and farming. Ranchers, bounty hunters, professional hunters, and trappers killed thousands of coyotes, wolves, bears, and mountain lions. Large-scale cattle grazing resulted in the widespread depletion of vegetation and the wildlife that consumed it. Without natural prey, the remaining coyotes, wolves, bears, and cougars were forced to prey on livestock to survive, which only bolstered

predators was that of eradication, with the goal of wholly eliminating the species from the American landscape. The European colonists who first settled North America encountered wolves and mountain lions along the eastern seaboard. They viewed these large carnivores as a threat to livestock, competition for game species, and a danger to public safety, and endeavored to exterminate them. Pushing westward in the early-tomid-1800s, settlers continued to kill native carnivores as well as bison, elk, and other large grazing animals to clear the



predator eradication campaigns.

In 1891, Congress passed a law setting aside federal forest reserves, a move that led to the establishment of the U.S. Forest Service in 1905. The newly implemented, albeit minimal, fees charged by the Forest Service to ranchers for grazing livestock on public land engendered the expectation that the federal government would also help protect livestock from predators.

In 1915, the U.S. federal government officially became involved in predator eradication efforts. Agricultural interests



Until relatively recently, coyote management in the U.S. focused on eradication, with the goal of eliminating the species from the American landscape.

pressured Congress to appropriate \$125,000 for the U.S. Department of Agriculture (USDA)'s Bureau of Biological Survey to conduct systematic strychnine poisoning campaigns targeting wolves, mountain lions, coyotes, foxes, bears, and eagles on the public domain lands of the West. The Bureau hired hundreds of hunters and trappers to kill predators. A biologist for the Bureau reflected official policy when he suggested that "large predatory mammals, destructive of livestock and game, no longer have a place in our advancing civilization."²⁹

In 1931, livestock operators and hunters lobbied Congress to pass the Animal Damage Control Act, which formalized and expanded predator eradication efforts. The Act, which remains nearly unchanged to this day, authorized the Secretary of Agriculture to "promulgate the best methods of *eradication [and] suppression [of] mountain lions, wolves, coyotes, bobcats, prairie dogs, [and] gophers... for the protection of stock* and other domestic animals . . . and to conduct campaigns for the destruction or control of such animals" (emphasis added).³⁰ Any uncertainty about the government's position vanished when the USDA stated in its 1934 yearbook that the government's goal was the "total extermination of the coyote in the United States."³¹

The principal methods for eradicating and otherwise controlling predator populations in the early half of the twentieth century were leghold traps, snares, shooting, denning, and strychnine-laced baits. The "coyotegetter," a cartridge-powered predecessor of today's spring-powered M-44 sodium cyanide ejector, was widely used after its introduction in the early 1940s. Compound 1080 (sodium fluoroacetate) and thallium sulfate, two highly toxic poisons, were used after World War II. Use of thallium sulfate was discontinued by the federal government in the early 1950s because of its impacts on non-target species, but Compound 1080, although it also kills non-target species and is a threat to human life, remained a favorite tool of the predator eradication program.

The widespread use of coyote-getters, strychnine baits, and Compound 1080 in the 1940s and 1950s had a significant impact on large carnivore populations. By the mid-1950s, grizzly bears, wolves, and mountain lions had been exterminated in all but a few areas of the lower 48 states.

Records indicate that from 1916 to 1999, nearly six million coyotes were killed by the Federal Cooperative Animal Damage Control; almost two million of these since 1976.³² The Federal Cooperative Animal Damage Control Program was also responsible for killing approximately 26,000 bears, 500,000 bobcats, 50,000 red wolves, 1,600 gray wolves, and 8,000 mountain lions between 1937 and 1983.³³ Today, the federal animal damage control program falls under the auspices of the USDA's Wildlife Services (WS) program, previously called Animal Damage Control. In Fiscal Year 2003 alone, Wildlife Services trapped, shot, and poisoned 75,724 coyotes (see Table 1). Hundreds of thousands more coyotes were killed by state and local governments and private individuals and hunt clubs. Since not all states require that hunters, trappers, and ranchers report the number of coyotes killed, no accurate total is available. In sum, from 1996 to 2004, Wildlife Services killed more than 14 million animals in the U.S. to benefit agricultural interests.³⁴

OPPOSITION TO PREDATOR CONTROL PROGRAMS

Predator eradication programs targeting coyotes and other predators have faced significant criticism and opposition over the years. In 1930, the American Society of Mammalogists referred to the federal animal damage control program, then under the auspices of the Bureau of Biological Survey, as "the most destructive organized agency that has ever menaced so many species of our native fauna."³⁵

In 1963, public outrage erupted after a young boy lost an eye to an M-44 set by federal predator control agents. To address increasing public interest in protecting wildlife and intense opposition to the widespread use of lethal predator control, Secretary of the Interior Stewart Udall commissioned Dr. Starker Leopold (son of famed American conservationist Aldo Leopold) to chair a committee to investigate and make recommendations on the Animal Damage Control program. The 1963 Leopold Report charged that the program practiced indiscriminate and excessive killing of predators and posed a significant threat to imperiled species. Yet the report was largely ignored by the government and no significant reforms were made to the Animal Damage Control program.

In 1966, Congressman John D. Dingell held hearings on the federal predator control program, which strongly condemned the government's efforts to eradicate native carnivores.

It is well known that over the years predator controls actually practiced by governmental and private organizations have been considerably in excess of the amount that can be justified, particularly when total public interest is considered. In fact, indiscriminate trapping, shooting, and poisoning programs against certain predators have been so effective that it has resulted in reducing their number to such an extent that their continued existence is now endangered. In some cases, methods of control, such as poisoning, are producing secondary killings of certain species that are already on the endangered list.³⁶

Several years later, in 1971, Secretary of the Interior Rogers Morton commissioned the Cain Report, named for Stanley Cain, Chairman of the six-person committee. Among other recommendations, the Cain Report called for an immediate prohibition of all existing toxic chemicals used for predator control. The Cain Report concluded that the predator control program:

... contains a high degree of built-in resistance to change . . . the substantial monetary contribution by the livestock industry serves as a gyroscope to keep the bureaucratic machinery pointed toward the familiar goal of general reduction of predator populations, with little attention to the effects of this on the native wildlife fauna.

Guidelines and good intentions will no longer suffice. The federal-state predator control program must be effectively changed. It must take full account of the whole spectrum of public interests and values, not only in predators but in all wildlife. This will require substantial, even drastic, changes in control personnel and control methods, supported by new legislation, administrative changes, and methods of financing.³⁷

Yet increased opposition to wide-scale predator control by the scientists and the public, as well as Congressional directives, has failed to reduce the prevalence of lethal control efforts. A 1995 Government Accounting Office (GAO) report concluded that "ADC personnel in western states use lethal methods to control livestock predators despite written USDA policies and procedures giving preference to the use of non-lethal control methods where practical and effective."³⁸ While the goal of coyote management has shifted in the past forty years from eradication to suppression of populations, there has been virtually no decline in the number of coyotes killed under the auspices of the federal animal damage control program.

EXTENT OF LIVESTOCK LOSSES TO COYOTES

Livestock losses attributed to coyotes and other native carnivores are relatively low when compared to other causes. According to a National Agricultural Statistics Service (NASS) survey, "Predator losses accounted for just 2.2% of all cattle losses in 1995 . . . bad weather killed seven times more animals than did predators. So did calving problems. Illness killed 11 times as many and five times as many animals died from 'unknown' reasons . . . of nine categories for dead or missing cattle only poison and theft took a lower toll than predators."39 In 2000, NASS found that, considering all factors responsible for cattle deaths nationwide, including predation, weather, disease, injury, starvation, dehydration, and other factors, native carnivores were responsible for the loss of only 0.15% of the cattle/calf population nationwide.40

Table 1 The by the

The number of coyotes killed and the methods used in the U.S. by the USDA Wildlife Services program in fiscal year 2003 **(UPDATED)**

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AK	0	0	2	0	2	0	0	0	2	0	0	0	0	0	9
AL	0	0	15	0	0	0	0	0	0	0	0	0	0	0	15
AZ	0	0	175	З	6	502	5	35	45	0	0	0	0	0	774
CA	0	0	77	232	1,511	344	165	1,186	1,801	21	0	01	415	403	6,165
CO	0	0	25	0	23	1,664	2	256	123	28	0	0	21	266	2,408
FL	0	0	6	0	0	0	_	0	_	0	0	0	0	0	Π
GA	0	0	15	0	0	0	0	0	0	0	0	0	0	0	15
IA	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
Q	0	0	380	0	135	2,619	0	658	145	127	0	127	75	67	4,333
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МА	0	0	0	0	0	0	0	0	7	0	0	0	0	0	7
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75,724

1,686

1,691

13,275

3,652

6,871

28,255

12,927

6,691

Total

 $^{\dagger}Call = Using predator calls to lure and shoot an animal$ 

*Spot = Using spot lights to locate and shoot an animal

^tLPC = Livestock Protection Collar using Compound 1080/Sodium Fluoroacetate

Because sheep are small and relatively defenseless, sheep losses to native carnivores are significantly higher than losses of cattle. NASS reports that 7.03 million sheep are produced in the U.S., and of these, 273,000 lambs and sheep were lost to predators in 1999 (60.7% of this total was attributable to coyotes).⁴¹ In sum, coyotes accounted for the loss of 3.9% of the sheep/ lamb population nationwide in 1999; the vast majority of these losses were lambs.⁴² Predators caused 30% of all losses, while weather, disease, and other causes comprised 70%. In other words, significantly more sheep/lambs are lost to causes other than coyotes and other predators.⁴³ Moreover, ranchers are allowed to report their losses to the federal government without verification; thus these figures may be overstated. Predators are frequently blamed for livestock losses that actually result from disease, weather, etc. Therefore, the NASS statistics should be viewed with a certain degree of skepticism. Losses, however, can be significant for affected sheep ranchers. Factors influencing predation rates include habitat type, availability of the coyote's natural prey, livestock breeds, and the animal husbandry methods employed (or not employed) on the ranch.

#### **ECONOMICS**

### OF LIVESTOCK PROTECTION PROGRAMS

The American livestock industry traditionally has externalized the costs of managing conflicts with wildlife by demanding federally-sponsored control of predators. Agricultural interests argue that since wildlife falls under the public trust, the public should pay for damage to their operations. As a result, although they are the primary beneficiaries of Wildlife Services predator control operations, livestock producers in the 17 western states directly pay less than 1% of its total costs. Even when indirect payments are included, such as those made to livestock organizations and county governments (typically from a "head" tax on livestock), livestock producers pay less than 27% of the program's total costs. Federal taxpayers generally pay for nearly half of the program, with state taxpayers picking up the remaining 25%.44 Many ranchers benefiting from government predator control programs graze livestock on public land, where two-thirds of its "livestock protection" money is spent.

The annual cost of the Wildlife Services "livestock protection" program is approximately \$15–\$20 million.⁴⁵ As of 1994, for approximately every dollar of livestock lost to predators, three dollars were spent on predator control.⁴⁶ Considering both state and local contributions, it generally costs Wildlife Services more than \$100 to kill a single coyote, with costs sometimes exceeding \$2,000 per animal.⁴⁷

Until 1994, there had been virtually no

comprehensive cost-benefit analysis of the value of coyote control programs, despite their reliance on public funds and resources.⁴⁸ Then the Thoreau Institute released an economic audit of the USDA's Animal Damage Control Program (ADC), which in part found that:

- ADC's livestock-protection mission has apparently failed. In general, states with active ADC livestock programs experienced higher predator losses than states with minimal or no livestock programs. The starkest contrast: Farmers in Kansas who have no federal ADC livestock program suffer significantly lower predation rates than farmers in neighboring Nebraska and Oklahoma, each of which spends hundreds of thousands of dollars to kill thousands of predators each year.
- ADC's livestock protection program creates perverse incentives for ranchers to use submarginal land, overgraze public land, and rely on taxpayers rather than their own actions to protect their herds.
- Although ADC has expanded its scope of activities, western livestock protection, which mainly means killing coyotes, still accounts for most (53%) of its total operational budget.⁴⁹

The report concluded that there was "little legal or economic justification for continuing a federal animal damage control program. Few benefit from such a program and those who do ought to pay for the program themselves. In any case the federal government should not be involved in what are essentially state and local problems."⁵⁰

Ultimately, the current animal damage control program is maintained by creating incentives for ranchers to rely on taxpayer-funded assistance, to use land unsuitable for livestock, to overgraze public land, and to over-report losses from predation by coyotes and other predators. It appears that, despite public relations efforts to the contrary, the federal animal damage control program does not promote the longterm resolution of conflicts, but rather perpetuates an endless cycle of conflict and killing, subsidized by taxpayers.

### LETHAL METHODS USED TO ADDRESS CONFLICTS WITH LIVESTOCK

Today, Wildlife Services employs a variety of lethal methods to kill coyotes and other native carnivores, including such techniques as poisons, steel-jaw leghold traps, neck and leg snares, denning, hounding with dogs, shooting, and aerial gunning. In 2003, 75,724 coyotes were reported killed by Wildlife Services, mostly in the western states (Table I). This number should be considered only a minimum, since as late as 1990, Wildlife Services agents were reportedly pressured on a regular basis to underestimate the number of animals they killed and to disregard non-target kills.51

#### Aerial Gunning

The use of fixed-wing aircraft and helicopters to hunt coyote, wolves, foxes, badgers, ravens, and other species from the air began in the early 1920s.⁵²

Primarily employed as a preemptive control measure, aerial gunning operations are designed to reduce populations of coyotes and other predators in areas where livestock are to be grazed. Although Wildlife Services has argued that aerial hunting is selective for coyotes who prey on livestock,⁵³ one study referenced in support of this position found that only six of the eleven coyotes shot from a helicopter had recently attacked or fed on sheep.54 Moreover, Wildlife Services' former Colorado State Director (currently California State Director) admitted to the Rocky Mountain News in April 2000 that "we do the best job we can targeting coyotes [with aerial gunning] that are guilty of predation. But the only way I can guarantee I have the right one is if it's glommed onto the neck of the lamb when I shoot it."55

Given the difficulty in aiming at an animal from a moving aircraft, it is likely that many animals are shot and wounded. However, Wildlife Services has never analyzed wounding or crippling rates in its aerial gunning program.

Aerial gunning is also expensive, costing hundreds of dollars to kill each coyote.⁵⁶ Moreover, the cost in human lives has been high, as the dangerous mix of low-altitude, low-speed flying has resulted in at least 42 crashes during the past 20 years, with 39 injuries and 17 fatalities.⁵⁷

#### Traps

Body gripping traps, including steel-jaw leghold traps and neck and leg snares and have been widely used in coyote eradication campaigns and culling programs over the years.

Neck snares are generally set as killing devices and consist of a light wire cable looped through a locking device and are designed to tighten as the animal struggles. While small victims may become unconscious from strangulation in five to ten minutes, larger animals may suffer for hours or days. Trappers use the term "jellyhead" to refer to a neck-snared animal whose head and neck are swollen with thick, bloody lymph fluid.

Animals caught in leghold traps and leg snares can sustain severe injuries, including swelling, lacerations, joint dislocations, fractures, teeth and gum damage, selfmutilation, amputation, and death. Trapped animals are subject to dehydration, exposure to weather, and predation by other animals. Young may be orphaned as well if adults are trapped and killed. Coyotes are usually bludgeoned, strangled, or shot before they are removed from the trap.

Leghold traps and snares are notoriously indiscriminate. Non-target species, including lynx, red fox, porcupine, snowshoe hare, birds, and domestic cats and dogs,⁵⁸ comprise up to three-quarters of the animals captured in leghold traps.⁵⁹ Neck snares set for coyotes frequently capture and kill other wildlife, including mule deer and white-tailed deer.⁶⁰ After years of study, the Federal Provincial Committee on Humane Trapping in Canada concluded in 1981 that neck snares "do not have the potential to consistently produce a quick death."⁶¹

#### M-44 (Sodium Cyanide)

M-44s are designed to inject a lethal dose of sodium cyanide into the mouths of coyotes and other canids. These six-inch-long metal devices are driven into the ground and baited. When an animal pulls at the bait, a spring-loaded plunger is released and sodium cyanide granules spew into the mouth and nose of the victim. The force of the spray can project the granules up to five feet. Depending upon the size of the animal, death occurs in a period ranging from 30 seconds to approximately 5 minutes. Although registered by the U.S. Environmental Protection Agency (EPA) to kill coyotes, red and gray foxes, and feral dogs, sodium cyanide ejectors have killed numerous non-target species. Between 1997 and 2001, M-44s set for coyotes have killed at least three reintroduced wolves near Yellowstone National Park. Wildlife Services reported 20 human injuries from M-44s between 1983 and 1993.62

#### Calling and Shooting

In ground-shooting operations, coyotes are lured into shooting range using predator calls that simulate the sound of a distressed animal. Although Wildlife Services claims that this method is selective for coyotes who prey on livestock, it is almost impossible to determine whether a specific coyote is the culprit unless the shooter observes the act of predation.

#### Denning

Denning is the killing of coyote pups in their dens, generally by suffocation with poisonous gas (sodium nitrate) and/or by clubbing. In his book *Waste of the* West, Lynn Jacobs describes denning practices:

There are dozens of forms of denning, all of them gruesome. If possible, the denner simply digs back into the den and strangles the young barehanded, shoots them, or kills them with any implement at his disposal. In another form, a piece of barbed wire is shoved into the back of the den and rotated until it catches on a pup or kitten's



fur. Or a hook may be used.

The youngster is then fished out and shot or its head is bashed in. In another form of denning, the inside of the den is turned into a blazing inferno with a flamethrower, or filled with poison gas. One form involves smoking the animals out with a smoke bomb or fire and dispatching the choking, blinded pups or kittens with a club or shovel. In still another, dry brush is packed into the den and set on fire, and the entrance is covered with a rock.

In theory, the animals suffocate from the smoke, but as Dick Randall [a former Wildlife Services/ADC agent] related, "they'd often end up scrambling for the cracks of light at the entrance in desperation. You could hear them yowling when they hit the flames. They burned alive."⁶³

Responding to public outcry, U.S. Secretary of the Interior Cecil Andrus banned denning in 1979. Three years later the new Secretary, Reagan appointee James Watt, lifted the ban.

#### Compound 1080 (Livestock Protection Collars and Baits)

Compound 1080 (sodium fluoroacetate) is a highly toxic, slow-acting poison currently used as a predicide in Livestock Protection Collars (LPCs) that fit around the neck of domestic goats or sheep. The collars are designed to rupture when bitten by a predator, releasing the poison. Death from Compound 1080



results from cellular breakdown, progressive depression of the central nervous system, and/or cardiac arrest. It can take up to 10 hours for a coyote to die after ingesting Compound 1080. Less than 1/20th of an ounce can kill a 150-pound human adult, and each LPC contains enough poison to kill six healthy human adults.⁶⁴ There is



In 2003, the U.S. federal government killed more than 75,000 coyotes with traps, poisons, aerial gunning, and other lethal methods, primarily to protect livestock interests.

no antidote for Compound 1080.

Compound 1080 is virtually tasteless and odorless, making its presence in the environment extremely difficult to detect. Fewer than 10% of poisoned coyotes are recovered after they die, according to Wildlife Services. Compound 1080 does not deteriorate rapidly in the environment, and the bodies of poisoned coyotes may become a secondary hazard to other scavenging wildlife. A significant percentage of LPCs are punctured by vegetation or barbed wire and lost.⁶⁵

Developed during World War II as a rodenticide, Compound 1080 became popular for coyote control in the late 1940s, when biologists discovered it was highly toxic to canids. Over the next several decades, untold numbers of carnivores and other non-target animals died when they consumed 1080 pellets dropped from planes or inserted into dead sheep as bait. The practice of baiting sheep carcasses with poison likely selected against carrion-scavenging coyotes and for selected live-prey eating coyotes, with the net effect of encouraging livestock predation. After widespread misuse and abuse, and the death of 13 people who ingested the poison, the EPA banned Compound 1080 in 1972. EPA administrator William Ruckelshaus called Compound 1080 "one of the most dangerous [toxins] known to man."66 In 1985, the livestock industry convinced President Reagan to sanction Compound 1080 for use in LPCs.

A 1995 report by The Texas Center for Policy Studies titled TDA's Failed Enforcement for Predator Poisons: Texas Ranchers Betrayed concluded that the Texas Department of Agriculture had consistently failed to enforce use restrictions for LPCs and did not conduct mandatory inspections of LPC users. EPA reports indicate that more than twice as many collars have been lost or damaged than were punctured by coyotes in a number of states. As of 2000, LPCs were used in six states (Idaho, New Mexico, Texas, Virginia, West Virginia, and Wyoming), but have been banned in California and Washington by ballot initiatives and in Oregon by former Governor John Kitzhaber.

### THE EFFECT OF LETHAL CONTROL ON COYOTES AND CONFLICTS

More than a century of sustained lethal predator control has significantly affected the integrity and health of the native ecosystems of North America. Yet there has never been a comprehensive evaluation of the environmental effects of the federal animal damage control program.

Years of intense persecution have taught coyotes to be more wary of humans (provided coyotes do not directly associate humans with a food source; see "Conflicts with Coyotes at the Urban/Wildlands Interface" on p. 30). Coyotes have learned to spring traps without being caught, to avoid poison baits, to hide their dens from prying human eyes, to prey on livestock during times of little human activity, and to become more active during the night. In essence, our management of coyotes has selected individuals who are more successful, intelligent, adaptable, and resilient.

Efforts to reduce and even exterminate coyote populations have failed largely because of the coyotes' ability to adapt to changing circumstances and quickly replenish their numbers. While lethal control can create a short-term reduction of coyotes in an area, the vacuum will eventually be filled by coyotes emigrating from surrounding areas (e.g., colonizers), by shifts in the territories of neighboring packs, and by the increased reproduction of surviving coyotes.⁶⁷ The coyote's



Effects of human-related mortality on coyote family groups. Summarized from Crabtree and Sheldon (1999)

HUMAN-CAUSED MORTALITY	AVERAGE GROUP SIZE	AVERAGE ADULT AGE	GROUP STABILITY	BREEDING	PUP SURVIVAL
None to light (0–24%)	3–10	3–6	Stable– Fairly stable	Alphas breed. Few, if any, betas breed	20–60%
Moderate (25–49%)	3–9	2	Semi-colonization. Turnover of alpha pairs every 1–3 years.	Some yearling females breed.	50–90%
High (>50%)	2	1	Constant colonization, high immigration rates.	Many yearling females breed. Loose pair bonds and polygynous breeding possible.	70–100%

ability to flourish under intense persecution is likely the result of evolutionary adaptations developed while competing with other canids, such as the gray wolf.⁶⁸

Coyote populations that are minimally or not persecuted are able to maintain a stable pack (or family group) structure in which generally only alpha coyotes breed. Consequently, only about 30% of the females in the population breed (Table 2).⁶⁹ Alpha pairs often mate for life and may lead the pack for years. Since, starting at age six, alphas are less likely to reproduce, unpersecuted packs may produce fewer pups than persecuted packs, while still maintaining their home range. The survival of pups can also be quite low because of increased competition for available food resources in unexploited packs.

Alternately, coyote populations subjected to moderate or high levels of human persecution are characterized by unstable pack structures, semi- to constant immigration, and a high turnover of alpha pairs. This turnover causes a breakdown in the pack



"In essence, our management of coyotes has selected individuals who are more successful, intelligent, adaptable, and resilient."



structure, allowing more yearling and adult females to breed. As many as 90% of females may breed in these populations.⁷⁰ In addition, decreased competition for the available food resources resulting from anthropogenic caused population reductions means that more food is available to surviving adult coyotes and increases the likelihood that more pups will be born and survive past their first year.⁷¹

The lethal control of coyote populations can lead to the reduction of livestock losses, but only in the short term. The reason for this is that lethal control does not address the underlying cause of livestock predation, which is the presence of attractive prey (e.g., domestic sheep) in the habitat of an adaptable, opportunistic carnivore. The large size of livestock and their lack of anti-predator behavior provide a sizable meal for relatively little effort, particularly in the case of domestic sheep unaccompanied on open range far from human activity, a scenario that occurs on public lands throughout the West. Further, livestock consume and trample the vegetation that most of the coyotes' natural prey need to survive.⁷² The depletion of native prey may cause coyotes to prey increasingly on livestock, leading to the killing of more coyotes in an endless and ultimately futile cycle.⁷³

Moreover, indiscriminate lethal control may actually increase predation of livestock. Coyotes may select larger prey during the spring and summer to maximize their hunting efficiency while rearing their young.⁷⁴ Because coyote packs in moderate to highly exploited populations have relatively few adults, these packs may compensate for their reduced numbers by killing larger and more vulnerable prey, such as domestic sheep. As a result, coyotes may prey on domestic animals such as calves, sheep, and lambs, ⁷⁵ despite the increased risk of contact with humans.⁷⁶ Coyotes moving into areas cleared by lethal control may also have a greater propensity for attacking livestock than undisturbed resident coyotes, especially if they are juveniles inexperienced in killing native prey. Lethal control can further disrupt the transmission of hunting techniques and strategies from adults to pups.⁷⁷ Coyotes normally avoid new foods, but if these lessons are lost, the remaining coyotes may be forced to rely on novel prey such as livestock.

Importantly, lethal techniques often kill animals not involved in conflicts. A review of several studies concluded that 11–71% of the coyotes, bears and wolves killed to address conflicts were not responsible for attacks on livestock or crops.⁷⁸ This suggests that, in FY 2003, Wildlife Services killed between 8,300 and 53,800 coyotes who had not attacked or killed livestock.

Recent research in Northern California affirms that not all coyotes attack livestock, and that indiscriminate killing of coyotes was not effective in reducing depredation.79 Instead, the alpha pair, and particularly the alpha male, appears to be generally responsible for killing large prey such as livestock, especially when the coyotes are rearing young.80 (Other research suggests that the presence of unprotected lambs may be a more important factor affecting predation than the need to provision pups.)⁸¹

As a result, some wildlife managers and researchers recommend that lethal efforts be focused on breeding adult coyotes and their pups prior to the livestock lambing or calving season rather than on all coyotes in an area.82 While this approach would certainly result in fewer coyotes being killed than in typical control efforts, it still requires that coyotes be killed year after year, thus focusing resources on managing coyotes rather on implementing sound animal husbandry practices and other non-lethal techniques.

In reality, carnivore predation on sheep and calves may be unavoidable when livestock are left unguarded in large pastures or on open range.⁸³ According to a 1999 review, carnivores may not be able to see any difference between livestock and natural ungulate prey when livestock is left "free-ranging and unattended in natural carnivore habitat . . . apart from the sheep being easier to kill"; as a result, "most individuals of large carnivore species will at least occasionally kill accessible livestock that they encounter."⁸⁴ This suggests that in order to effectively reduce or prevent coyote predation on livestock over the long term, one of the following must happen: First, humans could continually remove every carnivore living in or venturing into areas where livestock are grazed. Or, alternatively, humans could practice and promote improved livestock husbandry.



A review of several studies concluded that many coyotes killed to address conflicts with livestock were not actually responsible for attacks on livestock.



## Alternative Strategies for Managing Livestock Conflicts with Coyotes

#### CHANGING PUBLIC ATTITUDES

Over the past several decades, the public has increasingly expressed opposition to lethal predator control programs and techniques and support for the use of non-lethal methods in managing conflicts with carnivores. Studies of public attitudes toward wildlife damage management and policy have concluded that the public largely favors the use of non-lethal methods while considering as inhumane those lethal methods most often used in predator control programs such as leghold traps, snares, poisons, and aerial shooting.⁸⁵

Livestock grazing on public land faces growing criticism because of its severe impact on the environment and the large subsidies that it requires. In an attempt to reduce their ecological impact, a number of sheep and cattle operations have opted to forego any lethal controls and to sell their products for a premium price under the label "predator friendly." These operations have capitalized on the public's willingness to pay more for products that help maintain predators in the ecosystem.

Largely as the result of public pressure, Wildlife Services has put considerable research into developing non-lethal methods, including several of those discussed below. Yet a 1995 report by the U.S. government's General Accounting Office (see p. 12) found that the agency still strongly favored lethal over non-lethal methods in the field.

### LIVESTOCK HUSBANDRY AND NON-LETHAL TECHNIQUES FOR REDUCING AND PREVENTING CONFLICTS

Conducting traditional animal husbandry practices

and implementing contemporary non-lethal methods can lead to significant reductions in livestock losses, thereby reducing or eliminating the demand for lethal methods.

Animal husbandry practices with a long history of successful use include livestock guard dogs, confining livestock at night and during the lambing season, employing herders to manage livestock on the range, removing livestock carcasses from pastures, mixing sheep and cattle, and synchronizing lambing in autumn in order to reduce the risk of overlapping the lambing season with coyote pup-rearing.

Contemporary tools that have also proven to be successful in deterring predation include electric fencing, guard llamas and donkeys, and various scare tactics and frightening devices. The proper implementation of these methods, especially in combination, can significantly reduce, and potentially eliminate, predation by coyotes.

The benefits of non-lethal management techniques extend beyond their ability to protect domestic livestock from predators. These techniques allow coyotes to maintain their important role as keystone predators, keeping rodents and smaller predator populations in check.

Furthermore, coyotes whose territories overlap grazing areas may learn that preying on protected livestock is less efficient and more difficult than hunting natural prey. These "educated" coyotes will keep other coyotes, who may be more likely to prey on livestock, out of their respective territories, thus reducing predation on livestock overall. As John Shivik, a research wildlife biologist for Wildlife Services, and colleagues wrote in 2003: Nonlethal techniques that preserve stabilization of social and demographic structure may limit conflicts with humans and have additional benefits in management efficiency. That is, the removal of territorial predators [such as coyotes] results in a breakdown of territorial defense and allows access to livestock by predators that were formerly excluded. Nonlethal methods for managing predation allow continuance of territorial defense and may have longer-term effects by preventing other predators from intruding into an area containing livestock. Furthermore, efficiency of nonlethal techniques may be greater because they can last beyond the year of management.⁸⁶

Building fences, raising livestock guard dogs, and installing motion activated Electronic Guards does take time and money, but can be cost-effective in the long run. Adopting a primarily non-lethal approach can reduce conflicts, increase the acceptance of coyotes and other predators, and allows these animals to maintain their important ecological role.⁸⁷

The following non-lethal methods have proven to be effective in reducing predation on livestock. The applicability and effectiveness of each technique will vary from operation to operation depending upon a variety of factors, including habitat, topography, type of livestock, size of operation, climate, etc. Using two or more methods together, such as fencing and guard dogs, will generally prove more effective than use of any single method.

#### Herders/Shepherds

Historically, the use of herders or shepherds who remained with the sheep flock throughout the day and night greatly reduced predation and the presence of predators near livestock.⁸⁸ This practice declined as sheep ranchers came to rely on government-subsidized lethal predator control programs. Some sheep producers, however, continue to implement herding or shepherding in their livestock husbandry practices because of the technique's effectiveness in reducing or eliminating predation. In addition, an increasing number of farmers and ranchers are implementing communitybased shepherding systems in which neighbors take turns caring for and tending livestock.

#### Confinement

Confinement is one of the simplest, most effective ways to reduce predation by coyotes.⁸⁹ Studies show that ranchers who keep sheep in corrals day and night have significantly fewer losses than those who do not. However depending on the type of operation, it may be more practical to confine livestock in corrals at night, when coyotes are most active.⁹⁰ This method may not be convenient for large, open-range operations, but it may be economically beneficial if losses are concentrated in a specific area. Portable fencing (see below) can work well for protecting livestock in open-range operations.

#### Fencing

Properly constructed and maintained electric and non-electric predator-proof fencing has been shown to significantly reduce or prevent predation on livestock by coyotes,⁹¹ thus reducing the demand for lethal control.⁹² Fencing offers several advantages in addition to protecting livestock, including greater control of grazing and impact on vegetation, eliminating the need for herding, and re-

ducing parasitic infestations by minimizing contact with adjacent herds.⁹³

Usually predator fencing follows one of three general designs: netwire and barbed wire, electric fences of varying heights and numbers of strands, and combinations of these designs. Wellmaintained netwire fences can deter many coyotes from entering a pasture and preying on live-



A wide variety of animal husbandry practices can lead to significant reductions in livestock losses, thereby reducing or eliminating the demand for lethal control of coyotes and other predators.

stock. Spacing of the mesh should be less than 6" horizontal by 4" vertical. A buried wire apron that is bent outward beneath the ground or a barbed or electric wire placed at ground level can deter coyotes from digging under the fence. A wire overhang or single electric wire at the top of the fence can discourage climbing by coyotes.

Electric fences require more maintenance than netwire fencing, but can be more cost-effective. Constructed of smooth, high-tensile wires, electric fences have been built with both alternating charged





wires and grounded wires and with all charged wires. In tests at the USDA's U.S. Sheep Experiment Station, an electric fence with 13 strands completely excluded coyotes. Labor to construct and install an electric fence can be 40– 50% less than for conventional fencing.

Fences can be cost-effective.⁹⁴ Materials for a kilometer of seven-wire electrified fence in a straight run (no corners) costs about \$1,740 (excluding the cost of the energizer) while a similarly constructed high tensile netwire fence runs about \$2,200. These fences can last over 30 years, translating into a cost per year of roughly \$58 and \$73, respectively. Existing netwire fences can be supplemented with I-3 electrical wires outside the fence to limit coyote access.95

The effectiveness of fencing is influenced by factors such as density and behavior of coyotes, terrain and vegetative conditions, availability of prey, size of pastures, season

of the year, floods or deep snow, design of the fence, quality of construction, and maintenance.⁹⁶ The benefits can be maximized if used in conjunction with guard dogs or llamas. Most importantly, fencing can keep coyotes out of a pasture while keeping guard animals in. Any coyote that manages to bypass the fence can then be kept away from livestock by the guard animal.

While permanent fencing is an excellent option for use in small pastures, it is impractical on the vast semiarid public lands of the West, where high costs make it untenable for most ranchers. Its impact on movements of other wildlife species, including mule deer and pronghorn antelope, are also undesirable.⁹⁷ Fencing should not be constructed in a manner that blocks migration corridors or water routes for wildlife. Larger operations might consider fencing a smaller area in which to confine sheep at night or ewes and lambs for the first month or so after birth. Temporary or portable fencing can be used to keep livestock together so that they can be guarded more effectively. Portable electric fencing is easy to set up and allows herders and guard animals to monitor both livestock and intruders.

#### Suggested Resource:

deCalesta, David S. Building an Electric Antipredator Fence (PNW 225, 12 pp.). Oregon: Pacific Northwest Extension, 1983. (On the Internet at: <u>eesc.orst.edu/</u> <u>AgComWebFile/EdMat/PNW225.pdf</u>)

#### Shed Lambing

The practice of lambing, calving, and kidding in sheds has the benefit of protecting young livestock when they are most vulnerable from both predation and inclement weather.⁹⁸ Typically, ewes and lambs (or goats and kids) are confined to corrals next to the lambing shed for as long as two weeks after birth. In addition to protecting lambs or kids from predation, shed lambing can lead to higher survival rates because ranchers can care for sick and orphaned baby animals.

#### **Guard Dogs**

Despite only being used in the U.S. since the early 1970s, livestock guard dogs have a long and illustrious history of protecting domestic animals in Europe. In past decades, the use of dogs has been evaluated extensively and has proven highly successful in reducing predation on livestock in many situations.⁹⁹ Livestock guard dogs in the U.S. are used with small flocks of sheep (< 300 head) in fenced pastures, as well as with large flocks (> 1,000 head) on open range.

User surveys indicate that ranchers using guard dogs are largely pleased with the effectiveness of guard dogs at reducing predation. A ten-year study in the northeastern U.S. concluded that livestock guard dogs reduced predation on farms and ranches by 60% to 70% or more.¹⁰⁰ Livestock producers in Idaho, Oregon, Washington, and Wyoming reported that 90% of their dogs had reduced or maintained low predation rates.¹⁰¹ Thirty-six ranchers in North Dakota reported that guard dogs reduced predation on their flocks by 93%.¹⁰² A 1986 survey of U.S. and Canadian ranchers and farmers found that 92% of 399 polled considered their guard dogs to be effective.¹⁰³

Colorado ranchers taking part in a 1993 survey reported that losses of domestic sheep to coyotes were significantly reduced by the use of guard dogs, with many reporting increased reductions over several years of using dogs.¹⁰⁴ Guard dogs were rated as excellent or good by 84% of 160 ranchers polled and estimates provided by 125 of these ranchers indicated that their 392 guard dogs saved \$891,440 worth of sheep in 1993. On average, each guard dog in the study saved \$3,610 worth of open-range sheep. These savings were greater than the expenses associated with the dogs: \$240–690 for the purchase of the animal and \$350 for annual maintenance. (In 2004, the purchase price of a livestock guard dog ranged from \$800 to \$1,500.) Ninety-six percent of the surveyed ranchers said they would recommend guard dogs to other livestock producers.

The most popular dog breeds used as guard animals include Akbash, Great Pyrenees, and Komondor. No difference in performance among breeds was reported among livestock producers using only one breed.¹⁰⁵ However, reports from producers using multiple breeds suggest that Akbash dogs may be the most effective in deterring predation in fenced pastures and rangelands.¹⁰⁶

Guard dogs' most important behaviors are attentiveness, trustworthiness, protectiveness,¹⁰⁷ and aggressiveness.¹⁰⁸ Various factors can limit the effectiveness of guard dogs, including arid climates, scattered livestock, rough terrain, heavy vegetative cover, abundant carnivores, improper standards of dog-caring, and poor training.¹⁰⁹ It is important to use a sufficient number of guard dogs relative to the prevailing conditions. Using multiple dogs will garner better results because they can cover more ground, protect more sheep, and deter more coyotes. One dog can handle one or two coyotes at a time, but multiple dogs can handle an entire pack. Farmers suggest that problems with livestock guard dogs are generally the fault of poor training and not with the dogs.¹¹⁰

#### Points to consider:

- Purchase dogs from a reputable breeder who knows about the dogs he or she sells.
- Dogs should start working with livestock between 8–12 weeks of age. However, guard dogs may not

become completely effective until age two or three, so don't expect puppies to be able to ward off predators.

- Pups should be placed immediately in the area in which they will be working. Do not raise pups in the home or yard if you want them to stay with sheep.
- Basic obedience training is a necessity.
- While guarding is instinctive in certain breeds, be prepared to teach the dog what you expect of him or her, or to have a qualified individual provide adequate training.
- Use enough dogs for the situation; one or two dogs can protect up to 200 sheep or sheep grazed in fields smaller than 200 acres, while up to five dogs are needed for large operations (1,000 ewes and their lambs) on open range.

#### Suggested Resources:

Livestock Guard Dog Association — <u>www.lgd.org</u>
 Dog Owners Guide: Livestock Guard Dogs — <u>www.canismajor.com/dog/livestck.html</u>

#### Guard Donkeys

Donkeys can also reduce livestock losses to coyotes, although there is less scientific evidence of their effectiveness compared to guard dogs. Donkeys are easy to care for, do not require special foods, and generally remain with pastured sheep.¹¹¹ Donkeys exhibit an inherent dislike for coyotes and other canids,¹¹² and will bray, bare their teeth, run and chase and attempt to bite and kick an intruder.¹¹³ Results are



Guard animals, including special dog breeds, llamas, and donkeys, can be very effective at reducing or eliminating livestock predation by coyotes and other carnivores. promising: 50% of Texas ranchers participating in a survey rated donkeys as either good, fair, or excellent guards.  114 

#### Points to consider:

- Select donkeys of adequate size and conformation.
- Only use a jenny or a gelded jack. Intact jacks may kill livestock.
- Donkeys should be given about four to seven weeks to bond with sheep. Stronger bonds may form if donkeys are placed with sheep or goats at an early age (3–6 months).
- Raise donkeys away from dogs. Do not use dogs to gather sheep or goats in pastures with guard donkeys.
- Only use one donkey per pasture, as multiple donkeys might spend more time together than with sheep. Do not use donkeys in or adjacent to pastures with horses or other donkeys.
- The best results can be expected in small (600acre or less) pastures with no more than 200 sheep or goats. Donkeys cannot be expected to work well if sheep or goats are scattered.
- Jennies in heat may kill lambs or kids and may need to be temporarily removed.
- Do not allow donkeys access to feeds containing Bumensin or other addit

Rumensin or other additives intended only for ruminants (cattle, sheep, and goats).

- Do not use donkeys and guard dogs together.
- Donkeys are inexpensive and easy to keep. They can be used with most other carnivore management methods and are less likely to stray than dogs.

#### Guard Llamas

Llamas have been successfully used as sheep guards in North America since the early 1980s. Llamas are naturally aggressive toward canids, responding to their presence with alarm calls, approaching, chasing, pawing and kicking, herding sheep, or by positioning themselves between sheep and canids.¹¹⁵ No training or previous association with sheep or goats is required for a llama to be an effective guard animal. Most guard llamas remain continually with the flock and prevent it from dispersing widely, although some stay separated but near the flock. Many take complete control of the flock and keep the sheep together, herding them to feed, water or shelter. Llamas can live over 20 years and have a very low rate of mortality as guards.

A survey of 145 ranchers in the western U.S. concluded that the use of llamas had reduced the average loss of ewes and lambs to coyotes from 21% to 7%, and 87% of those surveyed rated their llamas as effective or very effective.¹¹⁶ Eighty-seven reported average annual savings of \$1,253 (1983 prices) by using llamas. Very few of the llamas had been raised with sheep and were not trained to guard them. However, most llamas adjusted to the sheep within a week. In 1993, nearly 80% of 145 lowa sheep producers using guard llamas reported that they were either "very satisfied" or "satisfied" with their guard llamas.¹¹⁷ The authors concluded that:

- Half of guard llama owners reported 100% reduction in predator losses.
- Sheep and lamb losses dropped from an average of 26 head per year (21% of the flock) before using

guard llamas to 8 head per year (7% of the flock) after their use.

• 85% of ranchers say they would recommend guard llamas to others.

• Most introductions require only a few days or less for the sheep and llama to adjust to each other.

• Llamas are introduced to and pastured with sheep under a variety of situations, few of which affect the number of sheep lost to predators.

- The average ranch uses one gelded male llama pastured with 250 to 300 sheep in 250 to 300 acres.
- Multiple guard llamas are not as effective as one llama.
- Protectiveness toward sheep and easy maintenance are the two most commonly cited advantages to using guard llamas.
- Problems encountered include aggressiveness, attempted breeding with ewes, overprotection of flock, and sheep interference with feeding llamas.

Overall, guard llamas require no training and minimal care and can be an effective method for reducing predation.

#### Suggested Resources:

Mountain Oaks Ranch — 29560 Valley Center Rd.,
 Valley Center, CA 92082; 760-751-2603 or 1-800-692 4636; MsLlama@aol.com; <u>www.mor-llama.com</u>

— Rocky Mountain Llama and Alpaca Association — Jill Knuckles, RMLA Secretary; 2970 A 1/2 Road; Grand Junction, CO 81503; 970-241-4112; <u>www.rmla.com</u>



#### Autumn Lambing

Adjusting the lambing or calving time of a rancher's animals can be an effective way to limit or eliminate predation. Livestock losses are typically highest from late spring through September, when coyote packs provide food for young pups. If livestock producers change their calving or lambing program to autumn,



Ranchers need to take responsibility for protecting their livestock from carnivores, particularly on the open range, where sheep and cattle are most vulnerable to predation.

when coyotes are less likely to be feeding pups, the opportunity and need for coyotes to prey on young livestock can be significantly reduced.

#### **Disposal of Livestock Carcasses**

Leaving the carcasses of dead livestock on the range encourages scavenging and may lead to predation by coyotes.¹¹⁸ Other carnivores that feed on carcasses learn that livestock is a source of food and that potential prey is in the area.¹¹⁹

In winter, coyotes can travel far to obtain food and may congregate in areas where livestock carrion is available. Additionally, carcasses increase the amount of food available to coyotes and may help raise their density.¹²⁰

#### **Multi-Species Stocking**

Raising sheep and cattle together in "flerds" is an effective way to deter coyote predation.

When coyotes approach such flerds, the cattle often encircle the more vulnerable sheep, discouraging attacks. Coyotes must balance need against risk, and if the threat of injury is high, such as from being kicked or gored by cattle, coyotes often will reconsider preying on livestock.

#### Selecting Appropriate Livestock

Before obtaining new livestock, ranchers should evaluate their grazing habitat and select appropriate breeds. Certain breeds have specific needs or weaknesses that must be considered in relation to habitat, terrain, and grazing conditions.

It is well known in the livestock community that Hereford cows tend to leave their calves with a few "sitters" while the majority goes off to feed or find water. These calves are more vulnerable to predation than Longhorn calves, who travel with, and are protected by, their mothers.

#### Frightening Devices

An assortment of devices designed to frighten or deter coyotes from attacking livestock are available. These devices are generally effective only when livestock are confined in small pastures.

Electronic frightening devices, which emit high bursts of sound and light, are shown to deter coyote predation.¹²¹ The USDAproduced "Electronic Guard" device consists of a blinking strobe light and warbling type siren that sounds for seven to ten seconds every six to seven minutes at night. In one field study, the Electronic Guard reduced sheep predation by about 60%, with savings of \$2,400 per sheep

flock.¹²² Eighty-four percent of ranchers who participated in the study reported decreased predation of lambs by coyotes.

A new motion-activated device called a MAG (movement activated radio guard), which uses a strobe light and recorded sound effects, has also shown promise in deterring coyote predation on livestock. A study conducted in 2002 found that the MAG successfully prevented a variety of predators from visiting livestock carcasses.¹²³ However, the long-term effectiveness of this device has not yet been ascertained. This device is not yet commercially available.

Propane gas exploders show some ability to temporarily deter coyotes from preying on domestic livestock.¹²⁴ Such devices are easy to operate, portable, and inexpensive (~\$200). Field studies on gas exploders found they deterred predation for 31 days¹²⁵ to six weeks.¹²⁶

While frightening devices maintained at the same location may produce only variable, short-lived benefits,¹²⁷ altering their placement, varying the frequency of sound and light bursts and utilizing larger numbers of devices could retard habituation of coyotes.¹²⁸ Because of their intrusive nature, these devices are more appropriate in lightly populated

areas.129

#### **Conditioned Taste Aversion**

Few methods are as controversial or disputed as conditioned taste aversion (CTA). CTA is the process through which animals associate the taste of a food with an illness that occurs after consumption. The original work on CTA took place during the 1970s and 1980s using lithium chloride, an emetic (a substance that simulates vomiting), to condition coyotes to avoid livestock. Several studies reported that coyotes who ingested baits laced with lithium chloride displayed reduced predation on livestock in the field and on live prey in pens.¹³⁰ Four field evaluations of lithium chloride in three widely separated geographic locations reported a 60% overall reduction in sheep losses to coyotes.¹³¹

Alternately, some researchers argue that CTA is ineffective in deterring predation,¹³² because coyotes may rely on vision more than other senses while locating prey¹³³ and few may actually ingest baits.¹³⁴ Still, proponents of CTA have maintained that federallysubsidized research of CTA carried out by the U.S. Department of Agriculture has been seriously flawed and unduly influenced by political agendas. Animal behaviorist Lowell K. Nicolaus, Ph.D., stated:

With the sole exception of the wildlife management hierarchy in the United States, there is now no serious controversy within the scientific community concerning whether or not CTA exists as a unique and most powerful form of learning, or whether CTA can quickly produce long-term changes in predatory behavior.¹³⁵

Researchers in other countries continue to investigate CTA's usefulness for reducing livestock predation.¹³⁶

#### Suggested Resource:

<u>www.conditionedtasteaversion.net</u>

#### **Reproductive Interference**

Reproductive interference or sterilization as a tool for controlling wildlife populations is used with whitetailed deer and several other species, and is currently being studied with coyotes.¹³⁷ Chemical sterilants were the first form of reproductive interference attempted with coyotes, under the premise that suppression of reproduction would produce fewer coyote pups and reduce predation by decreasing the population. Although initial trials appeared successful in reducing predation,¹³⁸ the method was impractical because of the need for both precise timing in application and an effective bait delivery system.¹³⁹

Wildlife Services is also currently studying surgical sterilization of coyotes for its effectiveness in reducing predation on livestock. Initial results suggest that sterilizing breeding coyotes can modify predatory behavior associated with the rearing of pups, thereby reducing, but not eliminating, livestock losses.140 Although research into sterilization has reported little or no impact on social and demographic instability within the coyote population, long-term studies are needed to determine whether inhibiting the reproductive potential of this keystone predator affects ecosystem dynamics.¹⁴¹ Moreover, there is more likely to be substantial opposition from conservationists and animal rights advocates if such invasive procedures are used on coyotes, when more humane methods of proven efficacy are available.

#### Shock Collars

Wildlife Services has studied the use of electric shock collars on coyotes and on reintroduced gray wolves to condition carnivores not to prey on livestock. The collars are placed around the neck of the predator and are designed to shock animals with a substantial charge of electricity when they approach livestock wearing a transmitter. In theory, shocked animals would develop a long-term aversion to livestock. In one study, shock collars deterred coyotes from predating on livestock,¹⁴² but a similar experiment with gray wolves failed.¹⁴³ The technical and logistical difficulties inherent in these devices makes them impractical for most ranching or farming operations.¹⁴⁴

### CREATING A RURAL COYOTE COEXISTENCE PROGRAM

Management of coyotes in the U.S. is traditionally implemented from the top down. The federal government carries out predator control programs at the state and local levels through cooperative agreements with local governments. Typically, counties that contract with Wildlife Services receive federal matching funds that help pay for salaries and equipment for trappers. The matching federal funds provide incentives for counties to contract with Wildlife Services.

Yet efforts to resolve human-carnivore conflicts from the bottom up, at the community level, have a greater potential for creating long-lasting results with broad public support. For example, community-based efforts to conserve cheetahs, lions, and tigers in Africa and snow leopards in Asia provide guidance for the successful resolution of conflicts with carnivores.

Public opposition to lethal control has led to greater demand for humane, socially acceptable, and ecologically sound methods for handling human-wildlife conflicts. Thus, collaboration among local government



agencies, wildlife and conservation organizations, animal protection groups, various affected constituents, and local communities is essential to the long-term success of any wildlife conflict mitigation program. Such collaborative efforts ensure that agencies, stakeholders, and the public are held accountable for their actions, and that animal welfare and ecological integrity are integral components of these efforts.

In the past several years, the creation of a community-based predator management program in California's Marin County provides an example of collaborative efforts to develop common ground among a wide array of stakeholders. As of 2004, more than 30 of the state's 58 counties contracted with Wildlife Services. Despite the enticement of matching federal funds, however, at least two counties in the state have ended their contracts with the agency. The decisions to cease contracting with Wildlife Services stemmed largely from public objection to the killing of native wildlife with public funds.

In 2000, the Marin County Board of Supervisors voted to phase out county funding for the Wildlife Services program. In place of subsidized lethal predator control, county officials implemented the "Strategic Plan for Protection of Livestock and Wildlife," an innovative, non-lethal program that has garnered national attention.

Prior to ending the county's contract, the Marin County Board of Supervisors attempted to reach a compromise with Wildlife Services. In 1999, the Supervisors renewed the county's contract with the agency but stipulated that neck snares and other lethal methods could only be used a last resort after nonlethal methods had been tried and proven unsuccessful. In addition, the Supervisors prohibited the killing of coyote pups in their dens — a practice known as "denning" (see p. 16).

Much to the surprise of the Supervisors, Marin residents, and the County Agricultural Commissioner's office, Wildlife Services refused to operate under the county's modest guidelines. In a report to the Marin County Board of Supervisors, the county agricultural commissioner noted, "The USDA has stated that local restrictions will set an unwanted precedent. They fear other counties may prohibit activities as a result of action taken by Marin County."

As a result, the Marin County Board of Supervisors decided it was in the county's best interest to cease contracting with the agency. The decision, however, did not prevent ranchers from shooting predators on their own land to protect their livestock.

The "Strategic Plan for Protection of Livestock and Wildlife" was developed at the local level by a coalition of wildlife advocacy organizations, led by the Animal Protection Institute, in conjunction with ranchers and the Marin County Agricultural Commissioner. The plan redirected the county's \$50,000 annual cost for Wildlife Services to assist qualified ranchers in implementing non-lethal techniques including livestock guard dogs, llamas, improved fencing and lambing sheds, and shepherding. At the request of local ranchers, a county cost-share indemnification program was added to the plan to compensate ranchers for verified livestock losses resulting from predation.

The reimbursement amount ranchers are eligible to receive for implementing non-lethal methods depends on the size of their herd. Ranchers with more than 200 head are eligible to receive up to \$2,000 (the program maximum), while ranchers with herds of between 25 and 200 head are eligible to receive up to \$500 annually. Operations with less than 25 head are not considered commercial and therefore are not eligible to participate in the program. Projects eligible for cost-share reimbursement include any material or property improvements that deter depredation, using methods such as fencing, barriers, and lambing sheds. Also reimbursable are animal husbandry strategies such as shepherding, penning, guard animals, noisemakers, and any other non-lethal predator protection/mitigation measures or animal husbandry.

To be eligible for reimbursement for verified livestock losses, a ranch must have an effective nonlethal program to manage livestock depredation in place, including at least two non-lethal depredation deterrents (such as guard dogs and electric fencing).

The County Agricultural Commissioner's office conducts an on-site ranch review to document and verify that the ranch qualifies. Once a ranch is deemed eligible for indemnification, the rancher can submit claims for losses. Claims are reimbursed at the market value of the loss. A County Inspector or the Livestock Advisor may make an on-site verification of the ranch and recommend ways to further deter depredation.

Marin County's non-lethal livestock and wildlife protection program offers a model that is effective, cost-efficient, and ecologically sound. The animal husbandry techniques that are supported and promoted through this community-based program allow native carnivores to remain on the land, thus ensuring their important role as keystone predators.



The Marin County non-lethal livestock and wildlife protection program supports humane solutions to conflicts and allows coyotes to remain on the land, thus ensuring their important role as keystone predators.



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## Conflicts with Coyotes at the Urban/Wildlands Interface

#### **OVERVIEW**

Interactions between humans and coyotes have become more commonplace in the expanding cities and suburbs of the U.S. and Canada. In 1999, a coyote was even observed roaming New York City's Central Park. While coyotes appear content to share habitat with humans, some people show little patience for coyotes in their neighborhoods and prefer that coyotes stay in national parks or other public lands. Many people who move to the outskirts of urban areas seem to forget that with wild land comes wildlife.

Humanized landscapes have actually worked to the coyote's advantage. The suburban patchwork of wooded and open areas offers an abundance of "edge" habitat, which the coyote is adept at exploiting. Here, coyotes and other wild animals find plentiful sources of food, water, and shelter. Unsecured garbage, pet food, free-roaming cats and small dogs, rodents, fruit trees, and koi ponds all attract coyotes, who can quickly adapt to the human-modified environment. This high density of food sources allows coyotes to fulfill their nutritional requirements within a much smaller area than in their natural habitat, thus increasing their overall population level per unit of land area.

With increased coyote activity in urbanized areas come increased numbers of interactions with people. The vast majority of these encounters are merely sightings. Most people are unaware that there are coyotes in their midst, as coyotes generally tend to keep a low profile and avoid humans. Coyotes may, however, prey on cats and small dogs, since these companion animals are similar in size to their natural prey. Yet often communities assume that a coyote that has killed neighborhood cats or dogs will work its way up to children. In some instances, particularly where coyotes have been fed, or where interaction with companion dogs has been encouraged, coyotes will become diurnal and quite bold, showing little fear of people.

Although very rare, attacks on people have occurred, primarily when coyotes begin to directly associate people with food. There is only one known human fatality from a coyote attack in U.S. history. In 1981, a coyote killed a three-year-old girl in the Los Angeles suburb of Glendale, California. Tragically, the girl's family and neighbors had been purposely feeding coyotes in their neighborhood, which led the coyotes to associate humans with food. Public panic prompted city and state officials to conduct a widespread trapping

effort that resulted in the killing of dozens of coyotes. Afterward, Glendale city officials initiated an extensive public education program to head off future incidents. In addition, recognizing the need to decrease habituation of coyotes to human food sources, in 1981 the Glendale City Council passed an ordinance prohibiting the feeding of animals out of doors after 10 PM. According to the Glen-



dale Police Department, however, not one citation has ever been issued by the city, even though it is common knowledge that people continue to feed coyotes and other animals, day and night.

The Glendale incident could likely have been avoided if people were aware of the possible consequences of their actions and refrained from habituating coyotes. Solutions will only be found when individuals, communities, and local and state governments change their own behavior to head off coyote incidents. A 10-year review of human-coyote conflicts in California conducted in 1998 concluded:

Human-caused changes in the environment, coupled with changes in human behavior toward coyotes, may result in the development of serious human-coyote conflicts...The general public's lack of concern and awareness is a serious problem and is the real root of coyote-human conflicts.¹⁴⁵



MICHAEL FRANCIS

As human encroachment into wild spaces increases, so do encounters between people and coyotes.

While most people welcome the opportunity to see a wild coyote, others respond to the presence of a wild predator in their midst with fear and panic. Such fears are often bolstered by alarmist media stories. In fact, coyotes are far less of a threat than the dog next door: Domestic pet dogs kill an average of about 20 people per year. Yet, most often, it is those who want coyotes out of their communities who are the most vocal, and thus the communities' initial response may be knee-jerk and short-sighted.

Although lethal approaches allow officials to tell the public that they are "doing something" about the situation, the effectiveness of these programs in reducing conflicts is short-lived at best. The reasons for this are largely attributable to the well-documented ability of coyote populations to rebound after heavy lethal control efforts. In addition, because public opposition to lethal control is increasing, particularly in urbanized landscapes, many wildlife managers and public officials are beginning to realize that broad-scale

> killing efforts may create an undesirable public relations nightmare, especially if the methods employed are viewed as nonselective and cruel.

### COYOTE BIOLOGY AND ECOLOGY IN URBAN/SUBURBAN AREAS

#### Diet

That coyotes are found in such a wide variety of landscapes is a testament to their ability to survive and even thrive on whatever food is available. One study found that coyotes living in the Chicago metropolitan area rarely exploit garbage or other human-related food.146 Small rodents (mice and voles), rabbits, and fruit were among the most common food sources. This can be a benefit to communities; coyotes help keep such species' populations in balance, offering free "pest" control services to farmers and suburban neighborhoods. Studies in southern California found that coyotes help regulate populations of smaller to mid-sized predators, known as mesocarnivores, who prey extensively on scrub nesting bird species (see "The Role of Coyotes in Ecosystems" on p. 9). Thus,

in addition to rodent control services, coyotes can help maintain healthy ecosystems and avian diversity by keeping bird-eating predators in check.

Coyotes in Chicago were also found to be consuming road-killed deer and preying on young fawns

born in the spring. Dr. Matt Gompper, who has studied coyotes in the Northeast, speculates that coyotes may help keep increasing white-tailed deer populations in check in urbanized areas and that the presence of coyotes "represents to wildlife managers a possible opportunity in some areas to reduce the need for controversial and expensive management decisions."¹⁴⁷

#### **Behavior**

To date, few studies have documented the dynamics of coyote populations in urban and suburban areas. Those studies that have been conducted have shed some light on how coyotes are able to adapt to densely populated human settlements.

Research has shown that coyotes living in urbanized areas tend to adjust behaviorally to habitat fragmentation and human activities.¹⁴⁸ This means that coyotes try to avoid human activities by hunting more at night and at dawn and dusk (although seeing coyotes in the day should not be cause for alarm as this, too, is perfectly normal behavior). Urban coyotes may favor residential habitats over commercial and vacant areas because of the diversity of vegetation, abundance of prey, and availability of cover in residential neighborhoods.¹⁴⁹

Coyotes generally live as solitary individuals or in pairs in urbanized areas, but research has shown that coyotes may also live in packs, especially if sufficient open space or natural areas are available that allow for less interaction with humans. Small family groups are common, and usually a pair with their most recent offspring accompanied by yearlings that have yet to strike out and find their own territories.

Food resources in urban and suburban areas may exceed those in the wild, allowing more coyotes to survive in relatively smaller areas. A study of coyotes in the Los Angeles found coyote home ranges to be as small as 0.5 square kilometers, compared to roughly 10 square kilometers in the wild.¹⁵⁰

One extensive, long-term study of coyotes in the Chicago metropolitan area determined that most, if not all, large patches of habitat in the area are occupied by groups of coyotes that form packs typical of rural coyotes. The researchers found a number of coyote packs living successfully in a relatively small forest preserve (8 square miles) just outside Chicago O'Hare International Airport.¹⁵¹ Although the Busse Woods preserve is surrounded by developments and roads, the coyotes were thriving and successfully using the fragmented communities surrounding the airport.

The home ranges of these Chicago coyote packs ranged from 2 to 9 square miles, with roads or





sidewalks often determining boundaries of territories in urbanized areas.¹⁵² The study found the packs tended to focus their activities in scattered, small patches of habitat, such as wetlands in city parks, golf courses, areas around retention ponds, and buffers between subdivisions and highways. To get from one patch to another, members of the pack must pass through neighborhoods, downtown areas, and use sidewalks and bridges, and often do so under the cover of night.¹⁵³

Living apart from established coyote packs, solitary coyotes — also called transients or nomads — in urban areas use much larger areas than do packs.¹⁵⁴ One yearling female coyote radio-collared in the Busse Woods preserve had a 25-square-mile home range that covered at least five municipalities and consisted of heavily developed areas and busy roads. Like other studied urban coyotes, this yearling female regularly traversed large interstates, shopping malls, and parking



Coyotes generally live as solitary individuals or in pairs in urbanized areas, but may also live in packs, particularly if sufficient open space or natural areas allow for less interaction with humans.

lots, as well as small and large patches of natural habitat. While some coyotes are savvy enough to survive the myriad dangers imposed by urbanization, mortality from automobile collisions is high and may account for up to 50% of coyote deaths in urbanized areas.¹⁵⁵

Since one coyote can make eleven different vocalizations, the howling of a few is often mistaken for that of many, particularly during mating season, from December through February. It is no surprise that there are often more reports of coyotes during this time at the urban wildlife interface. In addition, when pups are born, generally in April or May, the parents may become more mobile (in search of food to provision their young) and more aggressive toward people and dogs when defending their dens.

The results of these existing studies, along with further research into the behavior of coyotes in urbanized areas, have implications for community planning, transportation, development, and conservation/management efforts. Some of the key findings of Dr. Stanley Gehrt's urban coyote research in the Chicago metropolitan area bear repeating:

Two important points emerge from this aspect of the study: There is much coexistence

between people and coyotes occurring every day (yet coyotes only make the papers when a conflict occurs); and coyotes are using nearly every part of the metropolitan landscape, either as packs or solitary individuals.¹⁵⁶

First, if problem coyotes are removed they are likely to be replaced by solitary coyotes floating across the landscape, regardless of where the site is located. We have observed resident coyotes lost to mortality replaced by new coyotes within a few weeks. Thus is it important to determine why problems occurred, particularly if wildlife feeding is going on, and address these prior to removal. Otherwise, removal will only be a temporary solution.¹⁵⁷

Second, if coyotes are removed that are not really causing problems, such as in a general population reduction, they will be replaced with new coyotes that may, or may not, have a fear of people. Thus indiscriminate removal may exacerbate a conflict, if coyotes that have a healthy fear of people are replaced by new coyotes that have little or no fear of people. Therefore, removal should be discouraged if actual conflicts have not yet occurred, and management should focus on public education.

Over the last few years it has become clear to us that coyotes are now a permanent component of the Chicago Metropolitan landscape. Their ability to regularly move across the region and hunt prey in small patches of habitat, despite the intense development and heavy traffic volumes, is simply nothing short of amazing. Although conflicts will sometimes occur, public education and changing public attitudes may help keep such conflicts to a minimum.

As a top predator, coyotes are performing an important role in the Chicago region. Increasing evidence indicates coyotes assist with controlling deer and Canada Goose populations. This is important information for land managers and educators.¹⁵⁸

By increasing our knowledge and understanding of this intelligent species, we can help support the development of effective and humane approaches to human-coyote conflicts, and can shape a future in which humans and wild animals can live together more peacefully.

NON-LETHAL TECHNIQUES FOR REDUCING AND PREVENTING CONFLICTS Lethal control — whether in urbanized or agricultural areas — does not provide a long-term solution to conflicts with coyotes, for a variety of reasons. Coyote populations are able to rebound when their numbers are depleted and, given adequate habitat and prey, female coyotes can increase their litter sizes. In addition, transient coyotes from surrounding regions frequently move in to fill vacant territories. Research suggests that to suppress a coyote population in a given area over the long term, 70%–90% of the coyotes would need to be removed continually.¹⁵⁹ Wildlife managers have found this an untenable bar, and are increasingly realizing that widespread and indiscriminate lethal control simply does not work with a species as adaptable and resilient as the coyote.

So, what is the solution when coyotes become a "nuisance"?

It is critical that community leaders and residents examine the source of the problem. Oftentimes, human-coyote conflicts in urbanized areas result from people intentionally or unintentionally providing coyotes (and other wild animals) with food. Intentional feeding must be addressed immediately, as this is most often the source of aggressive coyote behavior, which almost infallibly leads to the destruction of that animal. If local ordinances or bylaws exist that restrict the feeding of wildlife, law enforcement officials must prosecute violators. If local ordinances prohibiting the feeding of wildlife do not exist, then concerned citizens and public officials should work to enact such legislation (see "New Laws" on p. 37).

Solutions can frequently be found in simple alterations of human behavior: securing garbage cans, putting garbage out the morning of scheduled pick-up instead of the night before, bringing in the dog and cat food — as well as the dogs and cats themselves — at night, picking up around fruit trees, cleaning up compost piles, and basically keeping a "clean house" and a clean neighborhood. Coyotes are smart, and they can become habituated easily to human environments. Therefore, in addition to removing coyote attractants, ingenuity is called for when trying to outsmart this intelligent and adaptable animal. For example, motionactivated sprinkler systems can help keep coyotes and other unwanted wildlife out of gardens, while beating coyotes at their ability to adapt to static deterrents.

Time and again, coyotes have proven themselves to be remarkably resilient animals; it's little wonder that the Navajo called this resourceful species "God's Dog," and the Aztec, "coyotyl," or "trickster." If we're smart, we'll recognize that coyotes have much to offer us, not only by keeping ecosystems healthy and diverse, but by providing inspiring examples of ingenuity and adaptability in an ever-changing world.

#### Keeping Coyotes at a Distance

Coyotes are drawn to urban and suburban neighborhoods for two reasons: human encroachment into the coyotes' habitat and the availability of food and water. The following steps can help prevent coyotes from being attracted to your home:

• Secure garbage cans by fastening the lid with rope, bungee cords, or chains,



Oftentimes, human-coyote conflicts in urbanized areas result from people intentionally or unintentionally providing coyotes (and other wild animals) with food.



and by tying the handle to a stake driven into the ground. Place trash bins inside sheds, garages, or other enclosed structures.

- Put garbage at curbside the morning of the scheduled pickup, not the night before.
- When composting, use enclosed bins rather than exposed piles. Avoid adding dog or cat waste, meat, milk, or eggs, as well as any food containing these products.
- Coyotes are fond of fruit, nuts, and seeds. If you have fruit trees, pick the ripe fruit and keep fallen fruit off the ground and keep bird feeders from overflowing.
- Vegetable gardens should be protected with heavy duty garden fences or be enclosed by a greenhouse. Check with your local nursery to see what deterrent products are available.
- Eliminate artificial water sources and koi ponds.
- Outdoor lighting triggered by motion sensors may keep coyotes from approaching too close to your house at night.
- Motion-activated sprinkler systems can help keep coyotes and other unwanted wildlife out of gardens.
- Fence your property or yard. The fence must be at least six feet tall with the bottom extending at least six inches below the ground and/or a foot outward. Fences can be made more effective by outwardly inverting the top of the fence or by using electric fencing along the top and bottom of your fence. Existing fences can be augmented with a Coyote Roller[™] system, which makes it difficult for coyotes and other animals to gain the foothold they need to pull themselves up and over the top of an enclosure.¹⁶⁰
- Clear away bushes and dense weeds near your home, where coyotes may find cover and small animals to feed upon.
- Close off crawl spaces under porches, decks, and sheds. Coyotes use such areas for denning and raising young.
- Consider "watering" the perimeter of your yard with your own urine; while not scientifically studied, some ranchers have reported success at keeping coyotes at bay from the ranches by "marking" their own territory.

Note: Trapping and relocating coyotes is not recommended (and is illegal in some states). Disruption of family units can cause orphaned juveniles to seek easy prey, such as small dogs and cats. Furthermore, other coyotes are likely to move into the vacated area.

#### Keeping Companion Animals Safe

Cats and small dogs may be seen as prey to the coyote, while larger dogs may be injured in a confrontation. To avoid these situations consider the

#### following:

- Install proper fencing (see above).
- Keep animals inside at night, as coyotes are primarily nocturnal.
- Do not allow companion animals to roam from home. API encourages cat guardians to keep their cats indoors where they are safe from cars and other animals.
- Do not leave dog or cat food outside.
- Walk your dog on a leash at all times. If your yard does not have a fence, use a leash while on your property to keep your dog close to you.
- Discuss an appropriate dog or cat vaccination program with your veterinarian.
- Spay or neuter your dogs. Coyotes are attracted to, and can mate with, unspayed or unneutered domestic dogs. Male coyotes will be attracted to unspayed female dogs or their urine, and unneutered male dogs may be lured away by an ovulating female coyote.

#### Safeguarding Other Animals

Coyotes are primarily rodent eaters and scavengers. However, they can harm or kill cats, dogs, chickens, rabbits, goats, sheep, and other animals kept outside. To reduce such risks, take the following precautions:

- Keep animals within a fenced area. The fence must be wire mesh and at least six feet tall with the bottom extending at least six inches below the ground and at least six inches outward. Existing fences can be augmented with a Coyote Roller[™] system.
- Electric fencing with five to nine strands is also very effective in deterring coyotes.
- Keep animals closed in a secure shelter at night.
- Frightening devices, such as sirens, sensor lights, and motion-activated sprinkler systems, may help deter coyotes from closely approaching animal housing areas.
- Use guard animals. Llamas, burros, and special guard dogs are proven effective in reducing or eliminating coyote predation of pastured animals (see "Livestock Husbandry and Non-lethal Techniques for Reducing and Preventing Conflicts" on p. 21).
- Provide rabbits a wire-covered enclosure with fencing buried below the ground. They should have an escape shelter with an opening just small enough for the rabbit to enter. Cages are not recommended because rabbits may be attacked through the cage or die of shock as they frantically try to find cover.

#### If You Encounter a Coyote

Coyotes are usually wary of humans and avoid people whenever possible. Aggressive behavior toward people is unusual and is most often a result of habituation due to feeding by humans. If you encounter a coyote, remember the following:

- Never attempt to "tame" a coyote.
- Never feed a coyote.
- Do not turn your back on or run from a coyote.
- Attempt to leave the area calmly.
- If followed by a coyote, make loud noises and make yourself look big by raising your hands above your head, or making a cape of your coat or shirttails and holding it up behind you.
- If this fails, throw clods of earth or sticks, first near the ground next to the coyote, then, if necessary, toward their body, but never at the head.
- Always keep yourself between a coyote and small children or companion animals.
- If walking on trails frequented by coyotes, carry a deterrent such as an air horn, whistle, walking stick, or cane.

Note: Coyotes are not considered a disease threat. Outbreaks of rabies in coyotes are rare and are not commonly implicated in the transmission of the disease to humans or domestic animals. In fact, coyotes often reduce the density of foxes, who are more likely to be infected with the rabies virus, and thus can serve as a buffer against the disease.

### CREATING AN URBAN COYOTE COEXISTENCE PROGRAM

In 1983, as a result of increasing

coyote conflicts in southern California, the mayor of South Pasadena appointed an advisory committee to produce a comprehensive report on coyote biology, ecology, and potential strategies for addressing conflicts. The report, titled *Investigative Report submitted by South Pasadena Mayor's Advisory Committee on Coyotes*, offers an excellent, comprehensive, and effective shortand long-term strategy for addressing urban coyote conflicts that, more than 20 years after its publication, still bears repeating:

Our studies have shown that elimination of the coyote from the city is not feasible or permanent; it is also not desirable because of the lost benefit of rodent control...the effort to manage the environment rather than the coyote through a continuous combination of education, enforcement and investigation, has been shown to bring the widest and longest lasting results. For this purpose, the committee recommends the following methods:

1. A highly publicized information campaign exposing the consequences of intentional or unintentional feeding of coyotes, which might include:

 Repeated distribution of a brochure outlining preventative measures for citizens to each household, by direct mail; inserts in local



newspapers, water bills, or civic-group mailings; handouts by scouts, civic, social, or other volunteer groups or police reserve units; welcome-wagon inclusion for newcomers. This could be the County brochure or a local modification of it.

- Establishment of a regular column or monthly letter in local papers.

- Occasional publicity releases to local papers and on local cable T.V.

 Presentations to local civic and social clubs.
 Involvement of the schools through assemblies, classroom presentations; PTA programs, and home-room teacher cooperation; children should be taught proper recognition and treatment of all wildlife.

2. Active and continuous enforcement of existing ordinances concerning the sanitary disposal of garbage and the supervision of pets

and children, including periodic intensive crack-downs, especially in central city areas where coyotes tend to be least welcome (see "New Laws" on this page).

3. The establishment of the most complete possible resources file of books, articles, reports, accounts of experiences and research, made available to city residents at both City Hall and the public library and continually updated and expanded. It should also be made available to other cities and agencies, and their information and experiences actively solicited and included.

4. Prompt and direct investigation of any reports of coyote encounters, by telephone and written questionnaire, then: immediate follow-up and verification of actual coyote involvement and of the conditions under which it occurred; identification of problems that might be attracting coyotes and suggestions for changes or recommendations for individual yard fencing if appropriate. As a last resort, elimination of a specific and positively identified offending animal by a sharp-shooter.

5. The formation of a committee or organization of citizens, to deal with coyotes and other animals in the city on a long-term

basis by providing and receiving information, and by being an avenue for residents to handle concerns about animals before they become problems. It should be open to all interested residents, meeting regularly, either as a private group or with city affiliation. Such a group might also help carry out some of the recommendations made by the current Committee without committing much city money or manpower.

6. Cooperation should be set up with neighboring cities to encourage area-wide responsible management of the environment so that possible coyote problems can be minimized. A first step should be to send copies of these findings to the city authorities of all neighboring cities and to the County.

The report concludes:

The coyote is permanently with us; like human beings and automobiles. It [*sic*] can do much good and occasional harm. Urban residents can secure their properties through fences and common sense safety measures; they can learn of selfprotective strategies through schools, neighborhood groups, and the print and electronic media. The same cautionary attitudes and methods of



The goal of any community attempting to address increasing coyote encounters should be one of educated co-existence that fosters tolerance and appreciation of the role coyotes play in healthy ecosystems.

communication should apply to those who feel that the coyote poses a problem or threat; they need to avail themselves of the information on hand and strictly adhere to the guidelines offered....

The degree of success achieved by these

## NEW LAWS

One of the most effective ways to address coyote and other wildlife conflicts in urban areas is to restrict the intentional feeding of wildlife. People must learn that "a fed coyote is a dead coyote" and that irresponsible human behavior is most often the root cause of wildlife conflicts. Some communities have adopted or are creating new laws that make it illegal to leave or store any garbage, food product, pet food, or grain in a manner which would constitute an attractant to any wild animal. Penalties may include fines and a requirement to install coyote-proof garbage containers. Please contact API for model ordinance/bylaw language. recommendations depends in part on the cooperation of neighboring cities in also implementing such measures.

This committee strongly urges the immediate implementation of its recommendations to this end.

The goal of any community that is attempting to address increasing coyote encounters should be one of educated coexistence that fosters an understanding and appreciation of the role coyotes play in healthy ecosystems and the need to keep them wild. As the South Pasadena report emphasizes, this can only be achieved through proactive and sustained public education and outreach efforts. In addition, collaboration among government agencies and community involvement is essential. As Director of the California Department of Fish & Game Ryan Broddrick emphasized in an August 5, 2004 opinion editorial in the *San Diego Union-Tribune*: "The first step is to recognize that it's not a coyote problem. It's a people problem..... Every human encounter that ends with a meal is a lesson to the intelligent coyote: Humans equal food."¹⁶¹





## Conclusion

AS HUMAN CIVILIZATION continues to expand into wildlife habitat, and coyote populations adapt to our increasing presence, encounters with coyotes will inevitably continue. As a result, communities will be increasingly called upon to address conflicts and wildlife managers will face greater public pressure to use humane, non-lethal methods.

Solutions are not always simple or readily available. However, conflicts can be significantly reduced over the long term by redirecting the money and resources normally used to kill coyotes and other predators toward non-lethal, ecologically sound methods. It may even be possible to teach already habituated coyotes to avoid humans by developing aversive conditioning techniques. Because of the propensity of coyotes to reoccupy vacant habitat, it is beneficial to maintain stable coyote family units that are conditioned to avoid human interaction. Resident coyotes will prohibit transient coyotes, which may not have an aversion to humans, from entering their territories.

While trapping, aerial gunning, and poisoning are the primary methods used to address coyote conflicts to date, these methods are not humane, selective or effective. More importantly, indiscriminate killing does not place the responsibility for problems where it belongs — on humans.

The Animal Protection Institute advocates a multifaceted approach to conflicts that includes identifying the source of the problem, treating the source and not



the symptoms, and educating the public through consistent and persistent outreach efforts. Our hope is that this publication will help communities, agencies, public officials, and concerned individuals resolve such conflicts with the many scientifically proven, practical management techniques available for coexisting with coyotes.



## Notes

- Crabtree, R. L., and J. W. Sheldon. (1999). Coyotes and canid coexistence. In T. W. Clark, et al., (Eds.), *Carnivores in Ecosystems: The Yellowstone Experience*, (pp. 127–163). New Haven: Yale University Press.
- 2. Parker, G. (1995). Eastern coyote: The story of its success. Halifax: Nimbus.
- 3. Crabtree and Sheldon. "Coyotes and canid coexistence."
- 4. Bekoff, M. (1977). Canis latrans. Mammalian Species, 79, 1-9.
- Bekoff, M. and M. C. Wells. (1986). Social ecology and behavior of coyotes. Advances in the Study of Behavior, 16, 251–338; Crabtree and Sheldon. "Coyotes and canid coexistence."; Gehrt, S. (2004). Chicago coyotes. Wildlife Control Technology, 11(3), 24–26; Gehrt, S. (2004). Chicago coyotes part II. Wildlife Control Technology, 11(4), 20–21.
- 6. Crabtree and Sheldon. "Coyotes and canid coexistence."
- Sheldon, J. W. (1992). Wild dogs: The natural history of the nondomestic Canidae. New York: Academic Press.
- Gese, E. M. (2001). Territorial defense by coyotes (*Canis latrans*) in Yellowstone National Park, Wyoming: Who, how, where, when, and why. *Canadian Journal of Zoology*, 79, 980–987.
- 9. Ibid.
- 10. Crabtree and Sheldon. "Coyotes and canid coexistence."
- Knowlton, F. F., et al. (1999). Coyote depredation control: An interface between biology and management. *Journal of Range Management*, 52, 398–412.
- Crabtree, R. L. (1989). Social, spatial, and demographic characteristics of an unexploited coyote population. Ph.D. diss., University of Idaho, Moscow.
   Sheldon, Wild dogs.
- 14. Crabtree and Sheldon. "Coyotes and canid coexistence."
- Andelt, W. F. (1978). Behavioral ecology of coyotes in South Texas. Wildlife Monographs, 94, 1–45; Bowen, W. D. (1978). Social organization of the coyote in relation to prey size. Ph.D. diss., University of British Columbia, Vancouver.
- Knowlton, F. F. (1972). Preliminary interpretations of coyote population mechanics with some management implications. Journal of Wildlife Management, 36, 369–382; Todd, A. W., et al. (1981). Population ecology of coyotes during a fluctuation of snowshoe hares. Journal of Wildlife Management, 45, 629–640; Todd, A. W., and L. B. Keith. (1983). Coyote demography during a snowshoe hare decline in Alberta. Journal of Wildlife Management, 47, 394–404; Mills, L. S., and F. F. Knowlton. (1996). Coyote space use in relation to prey abundance. Canadian Journal of Zoology, 69, 1516–1521; Gese, E. M., et al. (1996). Social and nutritional factors influencing the dispersal of resident coyotes. Animal Behaviour, 52, 1025–1043.
- Gese, et al. "Social and nutritional factors"; Gese, E. M., et al. (1996). Foraging ecology of coyotes (*Canis latrans*): The influence of extrinsic factors and a dominance hierarchy. *Canadian Journal of Zoology*, 74, 769– 783.
- 18. Knowlton, et al. "Coyote depredation control."
- Andelt, "Behavioral ecology"; Bekoff and Wells. "Social ecology and behavior."; Gese, E. M., et al. (1989). Population dynamics of coyotes in southeastern Colorado. Journal of Wildlife Management, 53, 174–181;

Gese, et al. "Social and nutritional factors"; Gese, et al. "Foraging ecology of coyotes."

- 20. Gese, et al. "Social and nutritional factors."
- 21. Gese, E. M., and S. Grothe. (1995). Analysis of coyote predation on deer and elk during winter in Yellowstone National park, Wyoming. *American Midland Naturalist*, 133, 36–43; Gese, et al. "Foraging ecology of coyotes."
- Soulé, M. E., et al. (1988). Reconstructed dynamics of rapid extinctions of chaparral-requiring birds in urban habitat islands. *Conservation Biology*, 2, 75–82; Vickery, P. D., et al. (1992). Evidence of incidental nest predation and its effects on nests of threatened grassland birds. *Oikos*, 63, 1099–1104; Sovada, M. A., A. B. Sargeant, and J. W. Grier. (1995). Differential effects of coyotes and red foxes on duck nest success. *Journal of Wildlife Management*, 59, 1–9; Henke, S. E., and F. C. Bryant. (1999). Effects of coyote removal on the faunal community in western Texas. *Journal of Wildlife Management*, 63, 1066–1081.
- Crooks, K. R., and M. E. Soulé. (1999). Mesopredator release and avifaunal extinctions in a fragmented system. *Nature*, 400, 563–566.
- Sovada, et al. "Differential effects."; Rogers C. M. and M. J. Caro. (1998). Song sparrows, top carnivores and nest predation: A test of the mesopredator release hypothesis. *Oecologia*, *116*, 227–233.
- 25. Henke and Bryant. "Effects of coyote removal."
- 26. lbid., 1078–1079.
- Gompper, M. E. (2002). Top carnivores in the suburbs? Ecological and conservation issues raised by colonization of northeastern North America by coyotes. *Bioscience*, 52(2), 185–190.
- 28. Ibid.
- Dunlap, R.T. (1988). Saving America's wildlife. Princeton, NJ: Princeton University Press, 51.
- 30. 7 U.S.C. 426.
- 31. Jacobs, L. (1992). Waste of the west: Public lands ranching. Tucson: author.
- 32. Connolly, G. E. (1978). Predator control and coyote populations: A review of simulation models. In Bekoff, M. (Ed.), Coyotes: Biology, Behavior, and Management (pp. 327–345). New York: Academic Press; Statistics on the number of coyotes killed and the methods used in the U.S. by the USDA Wildlife Services program obtained from the USDA Wildlife Services online publication, "Number of Animals Taken and Methods Used by the WS Program" http://www.aphis.usda.gov/ws/ tables: through records obtained through the Freedom of Information Act, and from Predator Conservation Alliance, "Wildlife Services? A presentation and analysis of the USDA Wildlife Services Program's expenditures and kill figures for Fiscal Year 1999." (Bozeman, MT, June 2001).
- 33. Connolly. "Predator control"
- 34. Treves, A. and L. Naughton-Treves. (In press.) Evaluating lethal control in the management of human-wildlife conflict. In R. Woodroffe, S. Thirgood, and A. Rabinowitz. (Eds.), *People and Wildlife, Conflict or Coexistence?* Cambridge: Cambridge University Press.
- Edge, R. (1934). The United States Bureau of Destruction and Extermination. *Emergency Conservation Committee* Pamphlet. Denver:

Denver Public Library, Edge manuscript collection.

- 36. U.S. House of Representatives. (1966). Predatory mammals. Hearings before the Subcommittee on Fisheries and Wildlife Conservation of the Committee on Merchant Marine and Fisheries, 89th Congress, 2nd Session. Washington, DC: U.S. Government Printing Office.
- Cain, S., et al. (1971). Predator control 1971. Report to the Council on Environmental Quality and the Department of the Interior by the Advisory Committee on Predator Control. Ann Arbor: University of Michigan Press.
- General Accounting Office. (1995). Animal Damage Control Program — Efforts to protect livestock from predators. GAO Report B-261796.
- National Agricultural Statistics Service. Cattle predator loss. Washington, DC, 1996.
- 40. National Agricultural Statistics Service. Cattle predator loss. Washington, DC, 2001.
- National Agricultural Statistics Service. Sheep and goats predator loss. Washington, DC, 2000.
- 42. Ibid.
- Early, J. O., J. C. Roetherli, and O. R. Brewer. (1974). An economic study of predation in the Idaho range sheep industry, 1970–71 production cycle (Progress Report No. 182). Moscow, ID: Idaho Agricultural Research, University of Idaho, Moscow.
- O'Toole, R. (1994). Audit of the USDA Animal Damage Control Program. Cascade Holistic Economic Consultants Research Paper Number 31.
- 45. Predator Conservation Alliance. "Wildlife 'Services'?."
- 46. O'Toole. "Audit of the USDA."
- 47. Ibid.
- Harris, S. and G. Saunders. (1993). The control of canid populations. Symposium of the Zoological Society of London, 65, 441–464.
- 49. O'Toole. "Audit of the USDA."
- 50. Ibid., I.
- 51. Jacob. "Waste of the West."
- Wade, D. A. (1976). The use of aircraft in predator control. Proceedings of the Vertebrate Pest Conference, 7, 154–160.
- 53. Connolly, G. E. (1982). U.S. Fish and Wildlife Service coyote control research. Proceedings of the Great Plains Wildlife Damage Control Workshop, 5, 132–139; Connolly, G. E., and B. W. O'Gara. (1987). Aerial hunting takes sheep-killing coyotes in western Montana. Proceedings of the Great Plains Wildlife Damage Control Workshop, 8, 184– 188.
- 54. Connolly and O'Gara. "Aerial hunting."
- 55. Colleen Smith. The nature of Coyotes: Crafty canines shake off efforts at reduction. *Denver Post*, 21 March 1999.
- Wagner, K., and M. Conover. (1999). Effect of preventative coyote hunting on sheep losses to coyote predation. *Journal of Wildlife Management*, 63, 606–612.
- 57. Information obtained from the National Transportation Safety Board and the Federal Aviation Administration by Sinapu through the Freedom of Information Act. For further information, see <u>http://</u> www.goagro.org.
- Onderka, D. K., et al. (1990). Injuries to coyotes and other species caused by four models of footholding devices. Wildlife Society Bulletin, 18, 303–307; Skinner, D. L. and A. W. Todd. (1990). Evaluating efficiency of footholding devices for coyote capture. Wildlife Society Bulletin, 18, 166– 175.
- 59. Beasom, S. L. (1974). Selectivity of predator control techniques in south Texas. Journal of Wildlife Management, 38, 837–844.; Berchielli, L. T., and B. F. Tullar. (1980). Comparison of a leg snare with a standard leggripping trap. NY Fish and Game Journal, 27, 63–71; Novak, M. (1981). The foot-snare and the leg-hold traps: A comparison. Proceeding of the Worldwide Furbearer Conference, 3, 1671–1685.
- Phillips, R. L. (1996). Evaluation of 3 types of snares for capturing coyotes. Wildlife Society Bulletin, 24, 107–110.
- The Federal Provincial Committee on Humane Trapping. (1981). Findings and recommendations. Federal Provincial Wildlife Conference, Canada.
- 62. Wolff, P. (1995). Waste, fraud & abuse in the U.S. Animal Damage Control Program. A special report for Wildlife Damage Review.
- 63. Jacobs, "Waste of the West," 260.
- 64. U.S. Environmental Protection Agency. Registration Eligibility Decision (RED): Sodium Fluoroacetate. EPA 738-R-025, September 1995.

- 65. Information obtained from the U.S. Department of Agriculture, Animal and Plant Health Inspection Service in 1998 by the Animal Protection Institute through the Freedom of Information Act.
- 66. Jacobs, "Waste of the West," 259.
- 67. Crabtree and Sheldon. "Coyotes and canid coexistence."
- 68. Ibid.
- 69. Ibid.
  - Connolly, G. E., and W. M. Longhurst. (1975). The effects of control on coyote populations: A simulation model. *Division Agricultural Science*, University of California, Davis, Bulletin 1872.
  - 71. Crabtree and Sheldon. "Coyotes and canid coexistence."
  - 72. lbid.
  - Stoddart, L. C., R. E. Griffiths, and F. F. Knowlton. (2001). Coyote responses to changing jackrabbit abundance affect sheep predation. *Journal of Range Management*, 54, 15–20.
  - 74. Crabtree and Sheldon. "Coyotes and canid coexistence."; also see Pyke, G. H., H. R. Pulliam, and E. L. Charnov. (1977). Optimal foraging: A selective review of theory and tests. *Quarterly Review of Biology*, 52, 137– 154.
  - Till, J. A., and F. F. Knowlton. (1983). Efficacy of denning in alleviating coyote depredations upon domestic sheep. *Journal of Wildlife Management*, 47, 1018–1025.
  - 76. Crabtree, R. L. Open letter, 4 November 1997.
  - 77. lbid.
  - 78. Treves and Naughton-Treves. "Evaluating lethal control."
  - Jaeger, M. M, et al. (2001). Targeting alphas can make coyote control more effective and socially acceptable. *California Agriculture*, 55(6), 32– 36.
  - 80. Peterson, R. O. (1977). Wolf ecology and prey relationships on Isle Royale. U.S. National Park Service Scientific Monograph Series 11, 1–210; Mech, L. D. (1988). The Arctic wolf: Living with the pack. Stillwater, MNI: Voyageur Press; Gese and Grothe. "Analysis of coyote predation"; Sacks, B. N. (1996). Ecology and behavior of coyotes in relation to depredation and control on a California sheep ranch. Master's thesis, University of California, Berkeley; Sacks, B. N., et al. (1999). Territoriality and breeding status of coyotes relative to sheep predation. Journal of Wildlife Management, 63, 593–605.
  - Scrivner, J. H., et al. (1985). Sheep losses to predators on a California range, 1973–1983. Journal of Range Management, 38, 418–421; Conner, M. M. (1995). Identifying patterns of coyote predation on sheep on a northern California ranch. Master's thesis, University of California, Berkeley.
  - 82. See: Sacks, et al. "Territoriality and breeding status."
  - Treves and Naughton-Treves. "Evaluating lethal control."
     Linnell, J. D. C., et al. (1999). Large carnivores that kill livestock; do
  - 'problem individuals' really exist? Wildlife Society Bulletin, 27, 702.
  - Reiter, D. K., et al. (1999). Public attitudes toward wildlife damage management and policy. Wildlife Society Bulletin. 27, 746–758.
  - Shivik, J. A., A. Treves, and P. Callahan. (2003). Nonlethal techniques for managing predation: primary and secondary repellents. *Conservation Biology*, 17, 1541–1537.
  - 87. Shivik, et al. "Nonlethal techniques."
  - 88. Davenport, J. W., et al. (1977). Assessment of sheep losses to coyotes: A problem to Utah sheepman — concern to Utah researchers. Utah State University, Agric. Exp. Stn. Res. Rep., 7; Tigner, J. R., and G. E. Larson. (1977). Sheep losses on selected ranches in southern Wyoming. Journal of Range Management, 30, 244–252; Nass, R. D., et al. (1984). Circumstances associated with predation rates on sheep and goats. Journal of Range Management, 37, 423–426.
  - Wade, D. A. (1973). An assessment of the coyote problem in the Great Plains states. Proceedings Great Plains Wildlife Damage Control Workshop, *I*, 5–10; Robel, R. J., et al. (1981). Relationships between husbandry methods and sheep losses to canine predators. Journal of Wildlife Management, 45, 894–911.
  - 90. Andelt. "Carnivores."
  - deCalesta, D. S., and M. G. Cropsey. (1978). Field test of a coyote-proof fence. Wildlife Society Bulletin, 6, 256–259; Gates, N. L., et al. (1978). Development and evaluation of anticoyote electric fencing. Journal of Range Management, 31, 151–153; Thompson, B. C. (1979). Evaluation of wire fences for coyote control. Journal of Range Management, 32, 457– 461; Dorrance, M. J., and J. Bourne. (1980). An evaluation of anti-coyote electric fencing. Journal of Range Management, 33, 385–387; Linhart, S.

B., et al. (1982). Electric fencing reduces coyote predation on pastured sheep. *Journal of Range Management*, *35*, 276–281; Shelton, M. (1984). The use of conventional and electric fencing to reduce coyote predation on sheep and goats. *Texas Agric. Exp. Stn. Bull. MP-1556*; Shelton, M., and N. L. Gates. (1987). Antipredator fencing. In J. S. Green (Ed.), *Protecting Livestock from Coyotes* (pp. 30–37). Dubois, ID: U.S. Department of Agriculture, Agric. Res. Serv.; Nass, R. D. and J. Threade. (1988). Electric fences for reducing sheep losses to predators. *Journal of Range Management*, *41*, 251–252.

- 92. Dorrance and Bourne. "An evaluation."
- Jones, 1938 cited in D. A. Wade. (1982). The use of fences for predator damage control. Proceedings Vertebrate Pest Conference, 10, 24–33.
- 94. Dorrance and Bourne. "An evaluation"; Linhart, et al. "Electric fencing."
- deCalesta, D. S. (1983). Building an electric antipredator fence. Pacific Northwest Cooperative Extension Bulletin, 225 ; Shelton. "Conventional and electric fencing."
- 96. United States Department of Agriculture. (1994). Animal Damage Control Program: Final environmental impact statement. Washington, DC: U.S. Department of Agriculture, Animal and Plant Health Inspection Service.
   97. Howard. "Effects of electric predator-excluding fences."
- Wade. "An assessment"; Boggess, E. K., et al. (1980). Managing predator problems: Practices and procedures for preventing and reducing livestock losses. *Cooperative Extension Service Bulletin, C-620, Kansas State University.*
- 99. Linhart, S. B., et al. (1979). Komondor guard dogs reduce sheep losses to coyotes: A preliminary evaluation. Journal of Range Management, 32, 238–241; Coppinger, R. L., et al. (1983). Introducing livestock guarding dogs to sheep and goat producers. Proceedings of the Eastern Wildlife Damage Control Conference, 1, 129–132; Coppinger, R. L., et al. (1988). A decade of use of livestock guarding dogs. Proceedings of the Vertebrate Pest Council, 13, 209-214; Black, H. L., and J. S. Green. (1985). Navajo use of mixed-breed dogs for management of predators. Journal of Range Management, 38, 483–487; Green, J. S., et al. (1984). Livestock guarding dogs for predator control: Costs, benefits, and practicality. Wildlife Society Bulletin, 12, 44-50; Green, J. S., and R. A. Woodruff. (1983). The use of three breeds of dog to protect rangeland sheep from predators. Applied Animal Ethology, 11, 141-161; Green, J. S., and R. A. Woodruff. (1987). Livestock-guarding dogs for predator control. In J. S. Green (Ed.), Protecting Livestock from Coyotes (pp. 62-68). Dubois, ID: U.S. Department of Agriculture, Agric. Res. Serv.; Andelt. "Behaviorial ecology"; Andelt, W. F. (1992). Effectiveness of livestock guarding dogs for reducing predation on domestic sheep. Wildlife Society Bulletin, 20, 55-62; Andelt, W. F. (1999). Relative effectiveness of guarding dogbreeds to deter predation on domestic sheep in Colorado. Wildlife Society Bulletin, 27, 706-714.
- 100. Coppinger, et al. "A decade of use."
- 101. Green, J. S., and R. A. Woodruff. (1990). ADC guarding dog program update: A focus on managing dogs. Proceedings of the Vertebrate Pest Conference, 14, 233-236.
- 102. Pfeifer, W. K., and M. W. Goos. (1982). Guard dogs and gas exploders as coyote depredation control tools in North Dakota. Proceedings of the Vertebrate Pest Conference, 10, 55–61.
- 103. Green, J. S., and R. A. Woodruff. (1988). Breed comparisons and characteristics of use of livestock guarding dogs. *Journal of Range Management*, 41, 249–251.
- Andelt, W. F., and S. N. Hopper. (2000). Livestock guarding dogs reduce predation on domestic sheep in Colorado. *Journal of Range Management*, 53, 259–267.
- 105. Green and Woodruff. "Breed comparisons"; Andelt. "Relative effectiveness."
- 106. Andelt. "Relative effectiveness."
- 107. Coppinger, et al. "Introducing livestock guarding dogs"; Andelt. "Relative effectiveness."
- 108. McGrew, J. C., and C. S. Blakesley. (1982). How Komondor dogs reduce sheep losses to coyotes. *Journal of Range Management*, 35, 693– 696; Andelt. "Relative effectiveness."
- 109. Green, J. S., and R. A. Woodruff. (1983). The use of Eurasian dogs to protect sheep from carnivores in North America: A summary of research at the U.S. Sheep Experiment Station. *Proceedings Eastern Wildlife Damage Conference*, 1, 119–124.
- 110. Duckworth, B. "Guard dogs on patrol." The Western Producer (January

13, 2000).

- 111. Andelt, W. F. "Carnivores." In P. R. Krausman (Ed.), Rangeland Wildlife (pp.133–155). Denver: Society of Range Management.
- 112. Ibid.
- 113. Green, J. S. (1989). Donkeys for predation control. Proceedings of the Eastern Wildlife Damage Control Conference, 4, 83–86.
- 114. Walton, M. T., and C. A. Feild. (1989). Use of donkeys to guard sheep and goats in Texas. Proceedings of the Eastern Wildlife Damage Control Conference, 4, 87–94.
- 115. Andelt, W. F. (1999). Livestock Guard Dogs, Llamas and Donkeys. Colorado State University Cooperative Extension No. 1.218. Retrieved on the World Wide Web: <u>http://www.ext.colostate.edu/pubs/livestk/01218.html</u>
- 116. Franklin, W. L., and K. J. Powell. (1983). Guard llamas. Iowa State University Extension Bulletin.
- 117. lbid.
- 118. Lehner, P. N. (1976). Coyote behavior: Implications for management. Wildlife Society Bulletin, 4, 120–126.
- 119. Ibid.; Fritts, S. H. (1982). Wolf depredation on livestock in Minnesota. U.S. Department of the Interior, Fish and Wildlife Service Res. Publication 145.
- 120. Todd, A. W., and L. B. Keith. (1976). Responses of coyotes to winter reductions in agricultural carrion. Alberta Wildlife Technology Bulletin, 5.
- Linhart, S. B., et al. (1984). Efficacy of light and sound stimuli for reducing coyote predation upon pastured sheep. *Protection Ecology*, 6, 75–84.
- 122. Linhart, S. B., et al. (1992). Electronic frightening devices for reducing coyote predation on domestic sheep: Efficacy under range conditions and operational use. Proceedings of the Vertebrate Pest Conference, 15, 386–392.
- 123. Shivik, et al. "Nonlethal techniques."
- 124. Andelt. "Carnivores."
- 125. Pfeiffer and Goos. "Guard dogs and gas exploders."
- 126. Andelt. "Carnivores."
- 127. Bomford, M., and P. H. O'Brien. (1990). Sonic deterrents in animal damage control: A review of device tests and effectiveness. Wildlife Society Bulletin, 18, 411–422.
- 128. Linhart, et al. "Electronic frightening devices."
- 129. Knowlton, et al. "Coyote depredation control."
- 130. Gustavson, C. R., et al. (1974). Coyote predation control by aversive conditioning. Science, 184, 581–583; Gustavson, C. R., et al. (1982). A 3year evaluation of taste aversion coyote control in Saskatchewan. Journal of Range Management, 35, 57–59; Ellins, S. R., and S. M. Catalano. (1980). Field application of the conditioned taste aversion paradigm to the control of coyote predation on sheep and turkeys. Behavioral and Neural Biology, 29, 532–536.
- 131. Gustavson, C. R., et al. (1976). Prey-lithium aversions I: Coyotes and wolves. Behavioral Biology, 17, 61–72; Gustavson, C. R., et al. Taste aversion control of coyote predation in Washington, California, and Saskatchewan. Paper presented at the annual meeting of the Western Psychological Association, Seattle, April 1977; Ellins, S. R., et al. (1977). Conditioned taste aversion: A field application to coyote predation on sheep. Behavior Biology, 20, 91–95; Jelinski, D. E., et al. (1983). Coyote predation on sheep, and control by aversive conditioning in Saskatchewan. Journal of Range Management, 36, 16–19.
- 132. Conover, M. R., et al. (1977). An experimental evaluation of aversive conditioning for controlling coyote predation. *Journal of Wildlife Management*, 41, 775–779; Burns, R. J., and G. E. Connolly. (1980). Lithium chloride bait aversion did not influence prey killing by coyotes. *Proceedings of the Vertebrate Pest Conference*, 13, 200–204; Burns, R. J. (1980). Evaluation of conditioned predation aversion for controlling coyote predation. *Journal of Wildlife Management*, 44, 938–942; Bourne, J., and M. J. Dorrance. (1982). A field test of lithium chloride aversion to reduce coyote predation on domestic sheep. *Journal of Wildlife Management*, 46, 235–239; Burns, R. J. (1983). Microencapsulated lithium chloride bait aversion did not stop coyote predation on sheep. *Journal of Wildlife Management*, 47, 1010–1017.
- Wells, M. C., and P. N. Lehner. (1978). The relative importance of the distance senses in coyote predatory behavior. *Animal Behavior*, 26, 251– 258.
- 134. Linhart, S. B., et al. (1968). Field evaluation of an antifertility agent, stilbestrol, for inhibiting coyote reproduction. *Transactions of the North*

American Wildlife and Natural Resource Conference, 33, 316-327. 135. http://www.conditionedtasteaversion.net

- 136. Gill, E. L., et al. (1999). A comparative assessment of potential conditioned taste aversion agents for vertebrate management. Applied Animal Behaviour Science, 67, 229-240; Cowan, D. P., et al. (2000). Reducing predation through conditioned taste aversion. In L. M. Gosling and W. T. Sotherland (Eds.), Behaviour and conservation (pp. 281-299). Cambridge: Cambridge University Press.
- 137. Miller, L. A. (1995). Immunocontraception as a tool for controlling reproduction in coyotes. In D. Rollins (Ed.), Proceedings of the Symposium on Coyotes in the Southwest: A Compendium of our Knowledge (pp.172-176). Austin: Texas Parks and Wildlife Department.; DeLiberto, T. J. (1998). Fertility control in coyotes: Is it a potential management tool? Proceedings of the Vertebrate Pest Conference, 18, 144-149.
- 138. Balser, D. S. (1964). Management of predator populations with antifertility agents. Journal of Wildlife Management, 28, 352-358; Linhart, et al. "Field evaluation."
- 139. Turner, J. W. and J. F. Kirkpatrick. (1991). New developments in feral horse contraception and their potential application to wildlife. Wildlife Society Bulletin, 19, 350-359.
- 140. Bromley, C., and E. M. Gese. (2001). Sterilization as a method of reducing coyote predation on domestic sheep. Journal of Wildlife Management, 65, 510-519.
- 141. Bromley, C., and E. M. Gese. (2001). Effects of sterilization on territory fidelity and maintenance, pair bonds, and survival rates of free-ranging coyotes. Canadian Journal of Zoology, 79, 386–392.
- 142. Andelt, W. F., et al. (1999). Coyote predation on domestic sheep deterred with electronic dog-training collar. Wildlife Society Bulletin, 27, 12-18.
- 143. Shivik, J., Wildlife Services. Personal communication.

- 144. Shargo, E. S. (1988). Home range, movements, and activity patterns of coyotes (Canis latrans) in Los Angeles suburbs. Ph.D. diss., University of California, Los Angeles.
- 145. Shivik, et al. "Nonlethal techniques."
- 146. Gehrt. "Chicago coyotes."
- 147. Gompper. "Top carnivores."
- 148. Tigas, A. L., D. H. Van Vuren, and R. M. Sauvajot. (2002). Behavioral responses of bobcats and coyotes to habitat fragmentation and corridors in an urban environment. Biological Conservation, 108(3), 299-306.
- 149. Grinder, M. I., and P. R. Krausman. (1998). Ecology and management of coyotes in Tucson, Arizona. Proceedings of the 18th Vertebrate Pest Conference, 293-298.
- 150. Charge. Home range.
- 151. Gehrt. "Chicago coyotes."152. Gehrt. "Chicago coyotes part II."
- 153. Ibid.
- 154. Quinn, T. (1991). Distribution and habitat associations of coyotes in Seattle, Washington. Wildlife Conservation. Metropolitan Environments Symposium Series, 2, 48-51; Grinder and Krausman. "Ecology and management."; Gerht. "Chicago Coyotes Part II."
- 155. Tigas, et al. "Behavioral responses."
- 156. Gehrt. "Chicago coyotes part II."
- 157. Ibid.
- 158. Gehrt. "Chicago coyotes."
- 159. Connolly. "Predator control and coyote populations."
- 160. For information see http://www.coyoteroller.com. API has not endorsed this product.
- 161. Broddrick, R. How not to have to kill coyotes: Keep them wild. The San Diego Union-Tribune, 5 August 2004.



Appendix State Classification and Management of Coyotes

of the various states' statutes and implementing regulations. Only when no state statute or regulation was found were the various states' wildlife agency websites reviewed. Please note that other methods of hunting and/or trapping of coyotes may be allowed; what is included in this summary is what was stated within the statutes and implementing regulations, as well as in the state wildlife agencies' websites, where applicable. Laws related to specific restrictions for Wildlife Management Areas or Nuisance Animal Control Operators were not included in this summary. This summary is intended to be an overview of the U.S. state laws pertaining to how coyotes are classified, hunted, trapped, and killed by a landowner on his or her property. The summary is based on research

Depredation	Allows taking of animals in defense of life or property as long as: (1) the animal was not harassed or proveked; (2) there was no improper disposal of garbage or other attractive means to protect are exhausted. Property is defined as: permanent or temporary dwelling, aircraft, beat, automobile, or other conveyance, domesticated animal or other property of substantial value necessary for the livelihood or survival of the owner. A person killing an animal under this section shall notify the about the circumstances surrounding killing the animal. (ALASKA ADMIN. CODE tit. 5, § 84.270)	Prohibits killing wildlife causing crop or property damage without procuring a permit from Department of Conservation and Natural Resources. A permit will be issued if after investigation it has been determined that the protected wildlife should be removed to protect agricultural crops or other property from excessive damage. (ALA ADMIN. CODE r. 220-2.27)
R I I I I I I I I I I I I I I I I I I I	Unlimited. (Alaska Admin. CODE tit. 5, § 84.270)	۶ Z
pping	Varying seasons for 11 different groups of units. (ALASKA ADMIN. CODE tit. 5, § 84.270) 84.270)	Season runs from I I/15/03 to 2/20/04 (this may change each year). (Au. Apmin. CoDE r. 220- 229) No closed season on private land with owner's permission. (Au.A.Abmin. CoDE r. 220-229)
Trap Methods of Table	May be taken by any trapping method except for the following: a conventional steel trap with an inside jaw spread over 9 inches with exceptions: with a snare with exceptions. (ALASKA ADMIN. CODE tit. 5, § 92.095)	No land set leghold trap having a jaw width exceeding 6 inches, leghold trap having teeth or serrated edges along the inside of one or both jaws, or Conibear trap or kill-type trap with jaw width exceeding 5 inches or snares (except powered foot snare with a maximum loop of 5 1/2
, initial init	In Units 1-5, 18, 22, 23 and 26(A) limit is 2. (Auster Apmin. Cope. tit. 5, § 85.060) In Units 6-17, 19- 21, 24, 25, 26(B), and 26(C) limit is 10. (Auster Apmin. Cobe, tit. 5, § 85.060)	Guns with no dogs: Unlimited. (ALA. ADMIN. CODE r. 220-201.01) Guns with Dogs: NS. Bow/arrow with no dogs: Unlimited. (ALA. ADMIN. CODE r. 220-201.01)
Hunting	Units I-5, I8, 22, 23 and 26(A) season runs from 9/1 to 4/30. (ALASKA ADMIN. CODE tit. 5, § 85.060) Units 6-17, 19-21, 24, 25, 26(B), and 26(C) season runs from 8/10 to 4/30. (ALASKA ADMIN. CODE tit. 5, § 85.060)	Guns with no dogs: Allowed during daylight hours only, vear-round. (ALA. ADMIN. CODE r. 220- 2-01.01) Guns with dogs: Allowed in daylight during, and in areas of, dog deer season. (ALA. ADMIN. CODE r.
Mathods of Talva	May be taken by any hunting method except for the following: shooting from, on, or across a highway: use of any poison except with the written consent of the board; motor driven boat with exceptions; use or aid of a machine gun, set gun, or a shorgun larger than 10 gauge; aid of artificial light, radio communication, artificial alt lick, explosive, expanding gas arrow, bomb, smoke, chemical (excluding scent lures); etc. (ALASKA ADMIN. CODE tit. 5, § 92.075 & §	Guns: Rifles of any caliber; handguns or pistols; shorguns, 10 gauge or smaller (with slugs or single round ball only during stalk gun deer season) are permitted. (ALv. ADMIN. CODE r. 220-202 & 220-309) Bow/arrow: Long bows
Class	Furbearer. (ALaska ADMN. Cobe tit. 5, § 2.990)	Game.(ALA. ADMIN. CODE r. 220-206) Furbearer. (ALA. ADMIN. CODE r. 220-230)
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epredation		r the taking of animals amage to crops or (1) during an open nd the species ng the damage or (2) bermit issued by the ion. (Code Ark. R 10.04	continued on following bage
Ď		Allows fr causing d property season our under a F commissi & 18.09) & 18.09)	
		Unlimited (CODE ARK. R. 2.12) R. 2.12)	
ping		Season runs from 8/1/04 to 3/31/05 (will change each year). (CODE ARK. R. 2.07)	
Trap	inches) can be used to trap coyotes on land.Any person trapping coyote must carry a choke stick while running traps. (ALA. ADMIN. CODE r. 220-2-30) It shall be illegal to set a trap on top of a post or stake elevated above ground level. (ALA. ADMIN. CODE r. 220-2-30)	Restricts use of snares, steel trap, and Conibear by type. Prohibits leg snares and only non- locking snares may be used on land. The use of any form of sight bait composed of animal matter within 20 feet of a trap is prohibited. (CODE ARK. R. 10.02)	
	Bow/arrow with Dogs: NS. Dogs: NS.	Limit 2 per day. (CobE Ark. R. 2.12)	
Hunting	220-2-01.01) Bow/arrow with no dogs: Allowed during daylight hours only, year-round. (ALA. ADMIN. CODE r. 220- 2-01.01) Bow/arrow with dogs: Allowed in daylight during, and in areas of, dog deer season. (ALA. ADMIN. CODE r. 220-2-01.01) Dogs: Allowed anytime year- round except during and daytime or after daytime or after daytime or after daytime or after daytime or after daytime or after daytim	Season runs from 9/1/04 to 2/28/05. (Code Ank. R. 2.09)	
	or compound bows may be used. (ALA. Abmin. Code r. 220-2- .02 & 220-309) Dogs (ALA. Admin. Code r. 220-201.01)	Allows use of specified archery equipment. (CODE ARK. R. 8.04) Allows use of specified types of crossbows. (CODE ARK. R. 8.06) Allows use of dogs with exceptions. (CODE ARK. R. 9.01) Prohibits use of artificial light (CODE ARK. R. 18.02-A) Prohibits use of deadfalls, drugs,	
Class		Furbearer & Game. (CODE Akx. R. 01.00- C)	
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	Depredation		Any person suffering property damage from wildlife may exercise all reasonable measures to alleviate the damage, except for killing species protected by federal law or regulation unless otherwise authorized. Any person suffering such property damage, after resorting to seeking their own relief may file a written report with the Director, and the Director shall immediately order an investigation and report by an employee trained in the handling of wild animal depredation measures recommended in the necessary anti-depredation measures recommended in the report, including trapping. (AKL REV. STAT. § 17-239) The Department may issue a nonfee small game to the landowner, lessee, livestock	continued on following bage
	Bag Limit		Unlimited. (Commis- sion Order 23)	
	ping Seasons		Sason runs from 11/1/04 to 2/28/05. (Commission Order 23)	
	<b>Trap</b> Methods of Take		Prohibits the use of leghold trap, instant kill body-gripping design trap, or poison or snare on any public land. (ARIZ. REV. Srar. § 17-301)	
	Bag Limit		Unlimited. (Commission Order 13)	
revious þage	Hunting Seasons		Saason is year-round. (Commission Order 13)	
<b>diff</b> continued from <b>p</b>	Methods of Take	poisons, chemicals, explosives, or any device designed to take wildlife by the activation of a trip wire, electronic actions of a switch, or other means that do not require the attendance of an individual to) activate said device. (CODE ARV. R. 18.07)	Allows use of firearms with exceptions, bow/ arrow and crossbow. (AR.Z. ADMIN. Core R 12-4-303 & R 12-304) Prohibits use of light. (AR.Z. REV. STAT. § 17-30)	
nad	Class		Predator. (Ariz. Rev. Star. § 17- 101)	
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uo	ity suffering artment ier ihausted all game e the Astz. 3)	ng i at any ish and mer or or at. F5H & s. 4180)	e ices STAT. § 33- STAT. § 33- STAT. § 33- cor ice ethal stfective. 33-6-207) stv. STAT. §
Depredati	operator, or municipal damage when the Dep determines that all oth remedies have been ex and the take of such si is necessary to alleviat damage being caused. ( ADMIN. CODE R12-4-11	Nongame and furbeari mammals that are injuu property may be taken time or in any manner accordance with the F Game Code by the ow tenant of the premises employees thereof. (C GAME CODE § 4152 and	Permits persons to us, prohibited trapping de outlined in CoLo. Rev. 6-203 to protect owne that is primarily used f agriculture or livestocl landowner can prove c methods have been ine Person is permitted to devices for a 30-day p vear. (CoLo. Rev. STAT. § Provides a \$1 bounty f coyote killed. (CoLo. R 35-40-107)
		Unlimited. (CAL CODE RES. tit. 14, § 472)	Unlimited. (2 CoLo. CoDe Reds. § 406-3, #301 and § #324) #324)
ping	CIOCODA	Season is year- round. (Ca Coe Recs. tit. 14, § 472)	Season is year- round: day or night. (2 Coto. Code Recs. § 406-3, #324) 406-3, #324)
Trap Methods of Table		Prohibits use of any body- gripping trap, including Conibear traps, and snares for the purposes of recreation or commerce in fur. (CAL. FISH & GAME COE § 3003.1 and CAL. COE REGS. tit. 14, §465.5)	Prohibits the use of a leghold trap, instant kill body-gripping design trap, poison or snare. (Colo. Rev. Start § 33-6-203)
B and T invite	8	Unlimited. (CAL Cope Ress. tit. 14, § 472)	Unlimited. (2 CoLo. Cobe Ress.§ 406-3, #301 and § 406-3, #324)
Hunting		Season is year-round. (Cal. Cope Recs. tit. 14, § 472)	Season is year-round; hunting hours are from 1/2 hour before sunrise to 1/5 hour after sunset. Also, coyotes may be hunted at night. (2 CoLo. CoDE REGS. § 406-3, #324) 406-3, #324)
Mothoda of Tolo		May be taken in any manner except poisons may not be used; no feed, bait or other material capable of attracting a coyote may be placed or used in conjunction with dogs for the purpose of taking the animal. (CAL. CODE REGS. tit. 14, §	Allows the use of any rifle: handgun: shotgun; handheld bows and crossbows: electric call devices; motor vehicles with permit; aircraft with permits in and artificial light on public lands with permit. (2 Couo. Cobe Ress. § 406-3, #302) Allows use of dogs as an aid to pursue, flush, or point. (2 Couo. Cobe Ress. § 406-0, #004) Prohibits use of poisons. (Couo. Rev.
Class		Nongame. (CAl. Fish & Game Code § 4150)	Furbearer. (Couo. Rev. STAT. § 33-1-102 and 2 Couo. Code Ress. § 406-3, #300)
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	Depredation		Allows any landowner or lessee of land used for agricultural or game-raising purposes to take furbearing animals injuring any property. (CONN. GEN. STAT. § 26- 72)	NS	Allows persons to kill destructive mammals on their own property within the immediate locality where damage is occurring by means other than gun and artificial light, steel traps, or poison (unless those methods are allowed by a permit issued by the commission executive director). (FLA. ADMIN. CODE ANN. r. 68A-12.009)	The department may issue wildlife control permits authorizing the permitee to trap, transport and release or kill continued on following poge
	Bag Limit		Unlimited. (Conn. Agencies Reds. § 26- 66-7)	NS	Unlimited. Hunting Handbook p. 19)	SZ
	ping ^{Seasons}		Season begins the Sunday following the first Saturday in November through March 15°. (Conn. Acencis Recs. § 26- 66-7)	NS	Prohibits steel or leghold traps. (Hunting Handbook, p. 19) Season is year-round. (FLA. ADMIN. COFE ANN. r. 68A-24.002)	Season is year-round. (GA. Come, R. & Ress. r. 391-4-2-12)
	<b>Trap</b> Methods of Take		Allows use of deadfall, box traps, and live traps; allows use of unpadded metal traps in water, metal traps with specified dimensions. (Conn. AGENCIES REGS § 26-66-5) Prohibits the use of snares. (Conn. GEN. STAT. § 26-72)	NS	Allows use of live traps and snares; prohibits steel traps.(FLA. ADMIN. CODE ANN. r. 68A-24.002)	May be taken by any method except those specifically prohibited by law. (GA. CODE ANN. § 27-
	Bag Limit		Unlimited. (Conn. Agencies Regs. § 26-66-3)	SN	Unlimited. (Hunting Handbook, p. 19)	S
revious þage	Hunting Seasons		Season is year-round, except for the 25- day turkey season. (ConN.AGENCES REGS. § 26-66-3) No hunting from ½ hour after sunset to ½ hour before sunrise.(CoNN. AGENCES REGS. § 26- 66-1)	NS	Season is year-round. (FLA, Admin, Code Ann r, 68A-24.002)	S
Continued from #	Methods of Take	Stat. § 33-6-130)	Allows the use of firearms; high velocity air guns using a single ball or pellet type projectile; and compound, Iong, or recurved bow. (CoNN. AGENCIES REGS. § 26-66- 1) No person while in a motor vehicle, snowmobile, or all- terrain vehicle or by aid or use of any light or lights carried on the vehicle may hunt a quadruped. (CONN. GEN.STAT. § 26-74)	NS	Allows use of guns and dogs. (F.A. Apmin. Cope Ann. r. 68A-12.002)	May be taken by any method except those specifically prohibited by law. (GA. CODE ANN.
nad	Class		Quadrupeds. (Conn. Gen. STAT. § 26-1)	SN	Furbearer: (FLA. Admin. CODE ANN. r. 684- 1.004)	Nongame.(Ga. Cope Ann. § 27-1-28)
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Depredation		wildlife where such action is otherwise prohibited by law when there is a substantial likelihood that the wildlife damaged the property. (G.A. CODE ANN. § 27-2-31)	N/A	Any conservation officer or wildlife biologist may authorize a landowner, tenant, or designee to trap coyotes causing damage outside the established trapping season dates. (Iowa ADMIN. CODE r. 571-108.5) Allows persons to take fur- bearers outside of open seasons to protect person or property with prior permission from a commission representative unless getting prior permission is impractical. (Iowa CODE § 481A.87)	continued on following bage
	Bag Limit		N/A	Unlimited. (Iowa ADMN. CODE r. 571-108.5)	
ping	Seasons		N/A	Season is from first Saturday in Novem- ber through 1/31. (Iowa Abmin. Cobe r. 571-108.)	
Trap	<ul> <li>Methods of Take</li> </ul>	1-28) Prohibits setting on land any leghold or body- gripping traps exceeding specified dimensions. (GA. CopE ANN. § 27-3-63)	NA	Prohibits use of leghold traps with teeth and leghold traps exceeding specified dimensions. (lowa Apwin, Cope r. 571- 110.4) Prohibits snares when set with a loop larger than eight inches in horizontal measurement except for a snare set with at least one-half of the loop under water. (lowa Cope § 481A.92)	
	Bag Limit		N/A	Unlimited. (Iowa Abmu. Cope r. 571-108.5)	
Hunting	Seasons		N/A	Sasson is year-round. (Iowa Admin. Code r. 571-108.5)	
	Methods of Take	§ 27-1-28) No firearms restrictions. (GA. CODE ANN. § 27-3-4) Prohibits destroying of dens, holes, or homes of any wildlife, use of lights to blind wildlife; or use of explosives, chemicals, electrical or mechanical devices, or smokers of any kind in order to drive wildlife out of habitat. (GA. CODE ANN. § 27-1-30)	N/A	Allows persons to train dogs on coyotes. (IowA CODE § 481A.56) Prohibits the use of artificial light, except when furbearing animals have been treed by dogs. (IowA CODE § 481A.93) Prohibits disturbing any den, lodge, or house of a furbearing animal except by written permission of an officer appointed by the director or to protect one's property. (IowA CODE § 481A.90)	
Class			No coyotes in state.	Furbearer: (Iowa CoDE § 481A.1)	
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Depredation	Predators may be killed by live- stock owners, their employees, agents, and animal damage control personnel when the animals are molesting livestock; no permit is necessary Livestock owners may take steps they deem necessary to protect their livestock. (IDAHO CODE § 36- 11017)	The Department may authorize owners/tenants or their agents to remove or destroy any wild bird or wild mammal when animal is known to be destroying property or causing a risk to human health or safety upon his or her land. Owner/tenant shall notify department of damage and after investigation and finding that damage can be abated only be removing or killing the animal, a permit shall be issued for no more than 90 days. (520 lu. Com. STAT. 5/2.37)	Allows the director to issue a permit to property owners, lessees or WCOs to control animals threatening property or persons. (IND.ADMIN. CODE tit. 312, 9-10-11)	continued on following page
Bag Limit	Unlimited. (IDAHO ADMIN. CODE 10. 01.06.300)	Unlimited. (ILL ADMIN. CODE tit. 17 § 570.30)	Unlimited. (Hunting Guide, p.10)	
ping ^{Seasons}	Season is year-round. (IDAHO ADMIN, CODE 10.01.06.300)	Season runs fro 11/10 to 1/20. (ILL. ADMN. CODE tit. 17, § 570.20)	Season runs from 10/15 to 2/28; allows one who possesses land or a person designated in writing by that person to take coyots any time. (IND. ADMIN	
<b>Trap</b> Methods of Take	May be taken in any manner not prohibited by state or federal law, by holders of the appropriate valid state hunting, trapping, or combination hunting and fishing licenses, provided such taking is not in violation of state, county, or city laws, ordinances, or regulations. (IDAHO ADMIN. CODE 10.01.06. 300)	Allows restricted use of specified types of snares in water. (520 ILL. Com. 5TAT. 5/2.33) Prohibits using certain leghold and body-gripping traps exceeding specified dimensions on land and dimensions on land and timn water: prohibits any trap with saw-toothed, spiked, or toothed jaws. (IL Hunting Handbook, p. 21)	Prohibits use of specified types of leghold traps, including those possessing saw-teeth or spiked jaws; prohibits setting on land Conibear traps exceeding specified dimensions; prohibits use	
Bag Limit	Unlimited. (IDAHO ADMN. CODE 10.01.06.300)	Unlimited. (IL Admin Code tit. I7, § 550.20)	SZ	
Hunting Seasons	Season is year-round. (IbAHO ADMIN. CODE 10.01.06.300)	Season is year-round except as noted in Section 550.10(a); ½ hour before sunrise to ½ hour after sunset with limited exceptions. (ILL ADMIN CODE tit. 17, § 550.2)	Season runs from 10/15 to 2/28; allows one who possesses land or a person designated in writing by that person to take coyctes any time. (IND. ADMIN	
Methods of Take	May be taken in any manner not prohibited by state or federal law, by holders of the appropriate valid state hunting, trapping, or combination hunting and fishing licenses, provided such taking is not in violation of state, county, or city laws, ordinances, or regulations. (IDAHO ADMIN. CODE 10.01.06.300)	Prohibits poison, specified types of shotguns, and crossbows. (520 ltu. Comp. STAT. 5/2.33)	Prohibits removal of wild animals from any cavity or den: restrictions on disturbing dens; allows use of dogs from 11/8 to 1/31. (Hunting Guide, p. 11)	
Class	Predator: (IDAHO CODE § 36-201 and IDAHO ADMIN. CODE 13.01.16.010)	Furbearer. (520 ILL ComP. STAT. 5/1.2g)	Furbearer. (I∧D. CoDE § 14-8-2- 108)	
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Depredation		S	Allows resident homeowners and family members to kill or trap without a license wildlife causing damage to their land. (K.Y. REV. STAT.ANN. § 150.170)	Coyotes proven to be causing a nuisance or causing damage to property can be taken by the land owner year-round without permit continued on following page
	Bag Limit	sz	Unlimited. (Hunting Handbook, p. 35)	SZ
ping	Seasons Code tit. 312, 9-3- 12)	Season is year- round, except for season for the taking of deer by firearm. (Kan. Star. Ann. § 32-1006)	Season is year- round. (Hunting Handbook, p. 35)	Season runs from 11/20/03 to 3/31/04 (changes each year). (Trapping
Trap	Methods of Take of snares (unless written permission is granted by the landowner; with dimension limitations). (IND.ADMIN. CODE tit. 312, 9-3-18)	Allows use of foothold traps.body.gripping traps, box traps. live traps, snares, and dead falls. (Kan.ADmin. Recs. 115-5- 1)	A person trapping on dry land shall not: set traps closer than 10 feet apart; use a trap except a: use a trap except a: use a trap with a jaw smaller foor-hold trap; padded trap with a jaw spread of six inches or less; number 220 or smaller Conibear-type trap; or nonlocking snare. No restrictions on a trap used as a water set used as a water set except during he extended beaver season. (301 KY.ADMIN. REGS. 2:251S	May be taken only during the open trapping season and only by means of a trap or snare. (Hunting
	Bag Limit	S	Unlimited.(Hunting Handbook, p. 35)	Z
Hunting	Seasons CopE tit. 312, 9-3- 12)	Season is year-round, except for season for the taking of deer by firearm. (Kan. Stat. Ann. § 32- 1006)	Season is year-round. (301 Kr.ADmin REGS. 3:030 and Hunting Handbook, p. 35)	Season is year-round: during daylight shooting hours. (Hunting Handbook
	Methods of Take	Allows use of firearms, except fully automatic firearms; archery equipment; and crossbows. (KaN. ADMN. REGS. I 15-5-1) Prohibits use of artificial light. (Hunting Handbook, p. 16)	Allows use of arrow, bow & arrow, dogs, and restricted use of guns. (K.v. Rev. Star. § 150.360) Prohibits the use of artificial light. (K.v. Rev. Star. Ann. § 150.395) Prohibits killing wildlife with the aid of fire, smoke, explosives, or gas. (K.v. Rev. Star. Ann. § 150.365) Prohibits use of artificial light. (K.v. Rev. Star. Ann. § 150.395, 360)	Prohibits the use of artificial light. (56 LA. Rev. Stat. ANN. § 116.1)
Class		SZ	Furbearer. (Hunting Handbook, p. 35)	Furbearer & Nongame Quadruped. (56 La. REV. STAT.
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Appendix 51

ook – website) its use of traps seth. (56 La. Rev. NN. § 121.1)
wes box and cage s.s. (Mass. Recs. CODI 321, § 3.02) all, schoke traps, told traps, Conibear nets for coyotes. s.s. Gen. LAws ANN. c § 80A and Mass. § 80A and Mass.
ws box and cage so in all upland and land areas;allows u eghold and body- ping traps with cfifed dimensions. (N s. Cope tit. 8, §. 03)
hibits setting on lar old traps with illary teeth; prohibit sons; prohibits use ( res. (ME. Rev. STAT.AI. 12, § 12252) wws cage-type traps; ws use of colony an

Appendix continued from previous page

Depredation	mortgagee of specified crops to kill animals day or night when the animal is found in the crop where the damage is occurring. (ME. REV. STAT.ANN. tit. 12, § 12402) The commissioner may cause department personnel to take coyctes at any time and in any may prescribe. (ME. REV. STAT.ANN. tit. 12, § 12404) Requires the commissioner to	maintain a "coyote control program" by employing persons to serve as agents of the department for the purposes of coyote control. (ME. REV. 5TAT. ANN. tit. 12, § 10108)	Coyotes causing damage on private property may be hunted or trapped by the property owner or designee any time without a license. (MI Dept. of Natural Resources website)	g	continued on following page
: : ,			۲	Unlimited. (Hunting Handbook, p. 41)	
ping	Early Fox and Coyote Trapping Season: extends the regular season by moving the opening day up two weeks; prohibits killer traps and traps set in water during this time. (Cope ME. R § 4.01)		Season runs from 10/15/2004 to 3/1/ 2005. (MI Dept. of Natural Resources website)	Season is year- round. (Hunting Handbook, p. 41)	
Trap	kill-type traps with specified dimensions. (Cobe Me. R. § 4.01)		Prohibits use of traps other than live traps and bodygripping Conibear, and foothold traps with specified dimensions; allows restricted use of specified types of snares from 1/1 to 3/1 to trap coyotes. (MI Dept. of Natural Resources website)	Mammals that are unprotected wild animals may be taken at any time and in any manner, except with artificial lights or by using a motor vehicle in violation of § 97B.091. Poison may not be used to take unprotected mammals or unprotected	
:	200 200 20		۶۶ Z	Unlimited. (Hunting Handbook, p. 41)	
Hunting	SUCCEDE		Season runs from 7/ 15/2005 and from 10/15 to 3/1 with game or predator call only. (MI Dept. of Natural Resources website)	Season is year-round. (Hunting Handbook, p. 41)	
			Allows restricted use of guns and bow & arrow: prohibits use of artificial light. (MI Dept. of Natural Resources website)	Mammals that are unprotected wild animals may be taken at any time and in any manner, except with artificial lights or by using a motor vehicle in violation of § 978.091. Poison may not be	
Class			Furbearer. (MICH. Come. Laws § 324.43503)Game. (MICH. Come. Laws § 324.40103)	Predator & Unprotected WildAnimal. (MINN. STAT. ANN. §97A.015)	
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	Depredation		Allows a property owner to kill wildlife causing damage to said property without permit by shooting or trapping; other methods not allowed except by written authorization of the director. (Mo. Copt REGS. ANN. tit. 3, § 10-4.130)	Allows landowners, agricultural lease holders, or their designated agents to take predatory animals year-round on lands owned by them. (Miss. CODE ANN. § 49-7-31)	continued on following page
	Bag Limit		Unlimited. (Mo. Code Res. Ann. tit. 3, § 10- 8.515)	sz	
	ping ^{Seasons}		Season runs from 11/15 to 2/15. (Mo. C DDE REGS ANN. tit. 3, § 10-8.515)	The taking of any animal or animals other than beavers or coyote by the use of a trap or traps is unlawful except during the time the season is open for the taking of fur- bearing animals.	
	<b>Trap</b> Methods of Take	birds unless the safety of humans and domestic livestock is ensured. (MINN. STAT. ANN. § 97B.651 and Hunting Handbook, p. 28)	Traps shall have smooth or rubber jaws only and may include foot-hold traps. Conibear-type traps with specified restrictions, foot- enclosing-type traps, cage-type traps, cage-type traps, cable restraint devices with prescribed permit. Use of pitals, deadfalls, snares set in a dry land set, and nets are prohibited. (Mo. CODE REGS.ANN. tit. 3, § 10- 8.510)	It is illegal to trap with the aid of bait, recordings of bird or animal calls, or electrically amplified imitations of calls of any kind. (MS Wildlife Fisheries & Parks website)	
	Bag Limit		Unlimited. (Mo. Cope Ress ANN. tit. 3, § 10-7.450)	SZ	
orevious þage	Hunting Seasons		Season is year-round, except from 4/1 through the end of the spring turkey hunting season and during the firearms deer hunting season. (Mo. CODE REGS.ANN. tit. 3, § 10-7.450)	Season is restricted to the open hunting seasons of any game animal or bird. (Mis. COE ANN. § 49-7- 31)	
<b>ALL</b> continued from 1	Methods of Take	used to take unprotected mammals or unprotected birds unless the safety of humans and domestic livestock is ensured. (MiNN. STAT. ANN. § 978.651 and Hunting Handbook, p. 28)	Allows use of guns, slingshots, longbows, and crossbows; allows restricted use of poisons and artificial light, except when furbearing animals have been treed by hounds. (Mo. Coore Recs, ANN. tit. 3, § 10-7.410)	Allows firearms, ammunition, primitive weapons, or archery equipment legal for use during that open season. Coyote may be run, chased, or pursued with dogs except as provided in § 49-7-32 year-round by licensed	
nad	Class		Furbearer: (Mo. Cope Recs. Ann. tit. 3, § 10- 20.805)	Predatory animals. (Miss. Cope Ann. § 49-7-1)	
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uo			nt to pay atory ed by the vT. CoDE	to issue a to take more his/her Cope tit.	tenant to rbearing edations % ops. (N.D.	owning or tch may yed any estock or sr 1 on land v him or sued by tev. STAT. §
Depredati			Requires the departme bounty claims for pred- animals that are approv board of livestock. (Moi ANN. § 87-11-206)	Allows the commission permit to a landholder wildlife that has caused than \$50 in damage to property. (N.C. ADMN. ( 15A, r. 10B.0106)	Allows a landowner or catch or kill any wild fu animal committing depi on that person's poultr domestic animals, or c CENT. Code § 20.1-01-0	Any farmer or rancher operating a farm or ran destroy or have destroy predator preying on liv predator preving oth agricultural depredation owned or controlled b her without a permit is the commission. (Nei. F 37-559)
	Bag Limit		S	Unlimited. (N.C. ADMIN. CODE tit. 15A,r 10B.0303)	sz	sz
ping	Seasons (Miss. Cope Ann. §	49-7-31)	SZ	Season varies: dates between 1 I/1 and 3/31, depending on the county. (N.C. Aomin. Core tit. 15A, r. 108.0302)	Season is year- round: allows restricted use of snares from 11/22 to 3/14. (N.D. 2003 Furbearer Guide)	ž
Trap	Methods of Take		No trapping license is required for residents. (Trapping Handbook, p. 2)	Prohibits use of steel-jaw, leghold, and Conibear traps unless they are smooth edged, within have been set in a specified manner. (N.C. GEN. STAT. § 113-291.6) Prohibits use of snare. (N.C. GEN.STAT. § 113- 291.61)	Establishes a coyote snaring season. (N.D. CENT. CODE § 20.1-07- 03.1) Leghold, Conibear, and snare restrictions with respect to size and placement. (N.D. Furbearer Guide)	SZ
	Bag Limit		SZ	Unlimited. (N.C. Apmin, Cobe tit. 15A, r. 108.0219)	SZ	SZ
Hunting	Seasons		ŝ	Season is year-round. (N.C. ADMI. CODE tit. I5A. r. 108.0219) ½ hour before sunrise to ½ hour after sunset. (N.C. Gen. STAT. § 113- 291.1)	Season is year-round; and may be hunted at any hour from 11/22 to 3/20 (dates may change each may change each Year). (N.D. Furbearer Guide)	sz
	Methods of Take hunters. (Miss. Code	ANN. § 49-7-31)	SZ	Allows restricted use of guns, bow & arrow, and dogs; prohibits use of artificial light. (N.C. GeN. STAT. § 113-291.1)	Allows restricted use of guns and archery equipment; prohibits use of artificial light. (N.D. 2003 Small Game & Furbearer Guide)	SZ
Class			Predator: (Mont. Code Ann. § 87-2- 101)	SZ	Furbearer: (N.D. CENT. CODE § 20.1- 01-02)	ž
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	Depredation	Allows commercial growers whose crops are being damaged to submit an application for a wildlife depredation permit to the executive director; disallows the granting of a permit if the department will supply non-lethal methods, and unless there is substantial damages; requires that the executive director establish the dates, times, and methods for the taking. (N.H. CODE ADMIN. R. ANN. Fis. 304.04)	Farmers or their agents may trap coyote by lawful procedures at any time when found destroying poultry, crops, or property subject to state law and local ordinances. (N.J. ADMIN. CODE tit. 7, § 25-5.11) Allows property owners and farmers to control coyotes causing damage by lawful procedures at any time. (N.J. ADMIN. CODE tit. 7, § 25-5-21)
	Bag Limit	Unlimited. (N.H. Fish & Game website)	Unlimited. (N.J. ADMN. CODE tit. 7, § 25-5.11)
	ping Seasons	Season is year-round. (N.H. Code Admin. R. Ann. Fis 303.09)	Sason runs from 11/15 to 3/15. (NJ). Admin. Code tit, 7, § 25-5.11) 25-5.11)
	<b>Trap</b> Methods of Take	Prohibits use of snares. (N.H. Rev. STAT.ANN. § 207.10) Allows use of any legal method. (N.H. Code Admin. R.ANN. Fis 303.09) Restrictions on use of Conibear traps. (N.H. COde Admin. R.ANN. Fis 303.16)	Prohibits setting on land of Conibear or kill-type traps; prohibits use of steel jaw leghold traps; sets forth restrictions for the use of snares. (N.J. ADMN. CODE tit. 7, § 25- 5.12)
	Bag Limit	Unlimited.(N.H. Fish & Game website)	Limit is 2. (N.J. Admin. Code tit. 7, § 25-5.19)
previous page	Hunting Seasons	Season is ½ hour before sunrise to ½ hour after sunset, year-round; allows night hunting with the landowner's permission from 1/1- 3/1 (N.H. Cope ADMN. R. ANN. Fis 303.09)	<ul> <li>½ hour before sunrise to ½ hour after sunset. (N.J. Apwin. Cope tit. 7, § 25-5,19)</li> <li>Bow &amp; Arrow only: Saason runs 10/1/05 saason runs 10/1/05 (varies each year). (N.J. Apwin. Cope tit. 7, § 25-5,19)</li> <li>Firearm or Bow &amp; Arrow &amp; Arrow Season runs 11/13/04 to 221/05 &amp; 11/12/05 to 2/2/06 (alters each year). (N.J. Apwin. Cope tit. 7, § 25-5,19)</li> </ul>
Continued from A	Methods of Take	Allows use of any legal method, including artificial light, except from a motor vehicle; bow & arrow; and restricted use of guns. (N.H. COE ADMIN. R. ANN. Fis 303.09)	Allows use of dogs, firearm, or bow & arrow (dogs ok during firearm deer season only); prohibits use of dogs, allows use of artificial light, bow & arrow and restricted arrow and restricted use of guns during special eastern coyote season. (NJ, ADMIN. CODE tit. 7, § 25-5.19)
nad	Class	S	Game. (N.J. Admin. Code tit. 7, § 25-10.6) Furbearer. (N.J. 7, § 25-5.11) 7, § 25-5.11)
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Special eastern coyote season runs 2/1/05 to 2/21/05 and 2/1/06 to 2/20/06 (varies each year).

Depredation		A landowner, lessee, or employee may take or kill an animal on private land in which they have an ownership or leasehold interest that presents an immediate threat to human life or an immediate threat of damage to property, including crops, provided that the killing is reported to the killing is reported to the Department of Game and Fish within 24 hours and before the removal of the carcass of the animal killed. (N.M. STAT. ANN. § 17-2-7.2)	Allows the director to issue a permit to frighten, herd, or kill wildlife if it is proved that property is being damaged or destroyed or is in danger of being damaged or destroyed, and the damage caused by the animal is substantial and can be abated . (Nev. Admin. CODE ch. 503, § 710)	Allows an owner, occupant, lessee, or a family member or employee of such owner, occupant, or lessee to take a coyote damaging private property at any time in any manner, (N.Y. CONSERV. LAW § 11-0523)	continued on following bage
	Bag Limit	Unlimited. (Hunting Handbook, p. 54)	sz	Unlimited. (N.Y. Comp. Copes R. & Ress. tit. 6, § 6.2)	
ping	Seasons	SZ	Season is year- round. (Nev Abmın. Cope ch. 503, § 090)	Season is either from the last Saturday in October to the Sunday closest to 2/15 or the next to last Saturday in October to the Sunday closest to 2/15, depending on the wildlife management unit. (N.Y. Comp. CODEs R. & REGS. tit. 6, § 6.2)	
Trap	Methods of Take	May be taken with traps and snares; leghold and snare restrictions with respect to size and placement. (N.M.ADMIN. CODE tit. 19, § 19:32.2 and Hunting Handbook, p. 54)	Allows use of steel leghold traps with specified dimensions. (Nev. ADMN. CODE ch. 503, § 155)	Prohibits use of leg- gripping traps with teeth; leg-gripping traps with specified dimensions; specified dimensions; snares; and poisons. (N.Y. CONSERV. LAW § 11-1101)	
	Bag Limit	Unlimited. (Hunting Handbook, p. 54)	SZ	Unlimited. (N.Y. Conserv. Law § 11- 0905)	
Hunting	Seasons (N.J.ADMIN. CODE tit. 7, § 25-5.19)	S	Sason is year-round. (Nev Aprin, Cope ch. 503, § 090)	Season runs 10/1 through the last Sunday in March; year-round in wildlife management units. (N.T. Conte. Cones R. & REGS. tit. 6, § 2.20) Allows the taking of coyotes at any hour; day or night. (N.T. CONSERY. Law § 11- 0909)	
	Methods of Take	May be taken with dogs, firearms, and bow & arrow (N.M. Abwin. Cobe tit. 19, § 19.32.2)	A person is not required to obtain a hunting license or permit to hunt unprotected wild birds or mammals. (NEv. ADMIN. CODE ch. 503. § [93]	May be taken by longbow, gun, use of raptors, and any other legal method. (N.Y. Conserv. Law § 11- 0901) Prohibits the use of artificial light from a vehicle. (N.Y. CONSERV. Law § 11-0901)	
Class		Predator. (N.M. ADMN. CODE tit. 19, § 30.6.7) Unprotected Furbearer. (Hunting Handbook, p. 54))	Unprotected. (Nev.Apmı. Cope ch. 503, § 035)	Small game. (N.Y. Conserv. Law § 11-0103)	
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	Depredation		Allows any person to trap an animal, except white-tailed deer, black bear, or wild turkey, that has become a nuisance. (ΟΗΙΟ ΑDΜΙΝ. CODE § 1501:31-15-030	Allows persons to "control" coyotes with or without a nuisance wildlife control permit. (OkLA.ADMIN. CODE § 800:25-37- 5)	Exempts landowners from having to mark traps or snares set on their land. (OR. ADMIN. R. 635- 050-0045) Exempts landowners and lessees killing predators on their land from a prohibition disallowing bage
		Bag Limit	Unlimited. (Оню Арми. Сор€§ 1501: 31- 15-09)	Unlimited. (OK Furbearer Guide)	sz
	ping	Seasons Allows the taking of coyotes at any hour, day or night (N.Y. Conserv. Law § 11- 0909)	Season is year-round. (OHIO ADMIN. CODE § 1501: 31-15-11)	Season is year-round. (Oku, Apmir, Cobe § 800:25-7-60)	Season is year-round. (Or. ADMIN. R. 635- 050-0165)
	Trap	Methods of Take	Prohibits use of any trap other than specified live traps, body-gripping traps, leghold traps, and snares; sets forth size restrictions on all these methods. (OHIO ADMIN. CODE § I 501: 31-15-09)	Allows restricted use of box traps and specified rypes of leghold traps; prohibits use of snares and deadfils. (OKIA, STAT. ANN. tit. 29, § 5-502)	Prohibits use of leghold and instant-kill traps with teeth or exceeding specified dimensions; allows use of snares. (Or. Admin. R. 635-050-0045)
		Bag Limit	Unlimited. (Оню Арми. Соре § 1501: 31-15-09)	Unlimited. (Okla. Abmin. Code § 800:25-7-61)	SZ
	Hunting	Seasons	Season is year-round. (OHIO ADMIN. CODE § 1501: 31-15-17)	Season is year-round. (OkuA. Admin. Code § 800:25-7-600	Season is year-round. (Or. ADMIN. R. 635- 050-0165)
-		Methods of Take	Allows use of guns, bow & arrow, and dogs. (OHIO REV. CODE ANN. § 1533.16) Allows use of crossbow. (OHIO ADMIN. CODE § 1501: 31-15-02)	Allows use of specified shorguns and longbows. (Oku.A. Star. Ann. tit. 29, § 5-203.10 Allows restricted use of poisons. (Oku.A. Star. Ann. tit. 29, § 5-3010 Prohibits use of artificial light or any sight dog to take coyotes within the period of dark to daylight. (Oku.A. ADMIN. Cobe § 800:25-7-30	Allows use of dogs. (Or. ADMIN. R. 635-050- 0045) Prohibits use of artificial light. (Or. ADMIN. R. 635-065- 0745)
	Class		Furbearer & Game & Wild Quadrupeds. (OHIO ADMIN. CODE § 1501: 31-1-02)	Predator. (Ok.I.A. Srar. Ann. tit. 29, § 2-1320	Predatory and Unprotected. (Or. Admin. R. 635-050-0050) Predatory. (Or. Admin. R. 635- 045-0002)
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Depredation	use of center fire and muzzle loading rifles. (OR. ADMIN. R. 635- 065-0740)	Any person may kill any game or wildlife that has actually engaged in the material destruction of cultivated crops, fruit trees, vegetables, livestock, poultry, or beehives. (PA. STAT.ANN. tit. 34, § 2121) A person is authorized to use pesticide products registered and labeled as approved for wildlife control by the Department of Agriculture, to control wildlife destroying or damaging crops. (58 PA. CODE § 141.2)	Allows landowners, lessees or employees of landowners or lesses to kill on the person's premises any furbearer that is worrying, wounding, or killing domestic animals or livestock, or destroying crops, or causing clear and immediate economic damage to any property belonging to that person. (R.I. GEN. LAWS § 20-16-2)	Allows a landowner or lessee with an enclosure for running rabbits with dogs to trap a coyote with a cage trap within the enclosure. (S.C. CODE ANN. § 50-11-1145) When it appears that coyotes are destroying birds, poultry, pigs,
	Bag Limit	Unlimited. (58 P.A. Cope § 139.4)	SZ Z	SZ
ping	Seasons	Season runs from 10/19 to 2/21. (58 P.A. CODE § 139.4) May be taken any hour, day or night. (58 P.A. CODE § 141.4)	Season is year- round. (R.I. Cope R. 12 080 005)	Season runs 1/1 to 3/1. (S.C.Trapping Handbook, p. 2)
Trap	Methods of lake	Prohibits setting snares on land; prohibits body- gripping traps exceeding specified dimensions: and cage or box traps capable of catching more than one furbearer at a time. (58 P.A. Code § 141.6)	Prohibits use of snares and poison. (R.I. GEN. Laws § 20-16-6) Prohibits use of steel-jaw leghold traps unless special permit is granted to a landowner to use against an animal nuisance. (R.I. GEN. Laws §20-16-8) Allows use of Conibear traps with specified dimensions. (R.I. CODE R. 12 080 005)	Allows use of foothold traps with restrictions; Conibear traps in water; and live traps may be used statewide. All other traps are unlawful. (S.C. CODE ANN. § 50-11- 2460)
	Bag Limit	Unlimited. (58 PA. Cope § 139.4)	SZ	SZ
Hunting	Seasons	Season is year-round. (58 P.A. Cope § 139.4) May be taken any hour, day or night. (58 P.A. Cope § 141.4)	Season is ½ hour before sunrise to ½ hour after sunset, year-round.(R.I. CODE R. 12 080 005)	Season is year-round. (S.C. Hunting Handbook, p. 30) Allows hunting of coyotes at night. (S.C. CODE ANN. § 50-11-710)
	Methods of lake	Prohibits use of specified shotguns. (58 P.A. Code § 141.6) Prohibits use of artificial light, other than that ordinarily carried on the person. (58 P.A. Code § 141.6 and § 141.7)	Prohibits specified shotguns and rifles. (R.I. Gen. Laws § 20-13-13)	Coyotes may be hunted at night; however, they may not be hunted with artificial lights except when treed or cornered with dogs; or with buckshot or any shot larger than
Class		Furbearer. (58 P.a. Code § 133.5)	Furbearer. (R.I. GEN. LAws § 20- 16-1)	Predatory Animal. (S.C. Cope ANN. § 50-11-1145, by implication)
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Depredation	lambs, or other property in any county or there is an apparent epidemic of rabies in any county, the Department, upon written request of the legislative delegation of any such county, shall declare an open season on coyotes, with the use of firearms for a designated period of time. (S.C. CODE ANN. § 50-11-1080) Depredation permits are available for killing coyotes year-round. (S.C. Dept. of Natural Resources website)	Allows bounties to be paid for each coyote killed. (S.D. CODIFIED Laws § 41-36-15 and § 41-36-37) Allows the department to issue a depredation permit to landowners who are experiencing documented depredation by coyotes and who are operating agricultural or grazing land. (S.D. ADMIN. R. 41:06:46:06)	Allows owners of land to destroy any wild animals that are destroying property upon such lands. (TENN. COE ANN. § 70-4- 115)	continued on following have
а 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Unlimited. (SD Game, Fish and Parks website)	Unlimited. (2004 TN Hunting & Trapping Guide)	
ping	C100000	Season is year-round. (S.D. Codified Laws § 41-8-20)	Saason is year-round. (2004 TN Hunting & Trapping Guide)	
Trap Motion of The		Allows restricted use of specified snares. (S.D. Admin. R. 41:08:02:05) Prohibits setting on land body-gripping or kill-type traps exceeding specified dimensions. (S.D. Admin. R. 1:08:02:06)	Prohibits use of snares in specified counties. (TENN. CODE ANN. § 70-1-120) Allows use of live traps, steel-jaw leghold, instant- kill, snares, and cushion hold with restrictions. (2004 TN Hunting & Trapping Guide)	
and the second se		Unlimited. (SD Game, Fish and Parks website)	Unlimited. (2004 TN Hunting & Trapping Guide)	
Hunting	cinceph	Season is year-round. (S.D. CoDIFIED LAWS § 41-8-20)	Season is year-round. (2004 TN Hunting & Trapping Guide)	
Mothods of Tho	number four or any rifle ammunition larger than a twenty-two rimfire. (S.C. CODE ANIN. § 50-11-710) There are no weapons restrictions for hunting coyotes on private lands statewide with exceptions in wildlife management areas and during certain hunting seasons. (S.C. Hunting fandbook, p. 30)	Prohibits use of artificial light except that landowners or occupants may use artificial light on their own land to hunt coyotes during the hunting season. (S.D. CODIRED LAWS § 41-8- 17)	Allows use of dogs; restricted use of guns; prohibits use of poisonous arrows; artificial light; and crossbows (during archery-only season). (2004 TN Hunting & Trapping Guide)	
Class		Furbearer & Predator: (S.D. Codified Laws § 41-1-1)	Furbearen: (Tenn. Code Ann. § 70-1- 101)	
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Depredation	States that a coyote that is attacking, about to attack or has recently attacked livestock or domestic animals may be killed by any person witnessing the attack or the person whose animals have been attacked; allows persons who find such a coyote on his/her property to catch and deliver the coyote to local animal control. (TEX. Parks & WLD. CODE ANN. § 822.013) Allows specific counties to pay bounties for coyotes. (TEX. Parks & WLD. CODE ANN. § 825.033) Allows the commissioner's court of any given county to purchase poison and furnish it to citizens of the county to kill coyotes. (TEX. HEALTH & SAFETY CODE ANN. § 825.021)	The Agricultural and Wildlife Prevention Board may specify bounties on designated predatory animals and recommend procedures for the payment of bounty claims, recommend bounty districts, and recommend persons not authorized to receive bounty. (UTAH CODE ANN. § 4-23-5)	Allows counties to pay bounties for coyotes. (Va. CODE ANN. § 15.2-926.1) rontinued on following have
	Rag Limit NS	sz	ž
ping	Seasons	SZ	Season is year- round. (VA Dept. of Game & Inland Fisheries website)
Trap	Methods of Take	S	Nuisance wildlife "can be killed at any time and in any manner that is legal under state and local laws." (vA Dept. of Game & Inland Fisheries website) Prohibits use of body-
	Bag Limit NS	N	SZ
Hunting	Seasons Season is year-round. (2004-2005 Outdoor Annual, p. 69)	SZ	Season is year-round on private land; may be restrictions on some public lands – refer to National- Forest-Game Department Regulations. (VA Dept. of Game &
	Methods of Take Allows restricted use of specified crossbows and use of specified archery equipment; prohibits use of prohibits use of firearms with restrictions. (31 TEx. ADMIN. CODE § 65.11) Coyotes may be hunted by any lawful means or methods on private property. Public hunting lands may have restrictions. (2004- 2005 Outdoor Annual, p. 69)	S	Nuisance species "can be killed at any time and in any manner that is legal under state and local laws." (VA Dept. of Gane & Inland Fisheries website) Prohibits use of
Class	Nongame. (Tex. Parks & WILD. Cope ANN. § 67.001)	Predator. (UTAH Code ANN. § 4- 23-3)	Nuisance Species. (4 V.A. ADMIN. CODE § 15-20-160)
ST	×	5	\$

	Depredation		Exempts a landowner and the landowner's employees, tenants, and caretakers from laws governing furbearers when they are acting to protect their property from damage. (VT. STAT. ANN. tit. 10, § 4828)	Allows any landowner or immediate family member to trap or kill without a license wild animals that are damaging crops, domestic animals, or fowl. (WAsH. continued on following page
	Bag Limit		Unlimited. (Yr. Srar. ANN. tit. 10A. § 41)	SZ
	ping Seasons		Saason runs from fourth Saturday in October 0 12/31. (VT. STAT. ANN. tit. 10A. § 41)	Season is from 10/1 to 3/15. (WA Fish and Wildlife website)
	<b>Trap</b> Methods of Take	gripping traps with jaw spread in excess of 7½ inches except in water. (4 V.A. ADMIN. CODE § 15-40- 190) Prohibits setting above ground any steel-jaw leghold trap with teeth or with a jaw spread exceeding 6½ inches. (4 V.A. ADMIN. CODE § 15-40- 210) Prohibits deadfalls; allows use of snares not exceeding specified dimensions with written permission from the landowner. (4 V.A. ADMIN. CODE § 15-40-220)	Prohibits use of snares. (VT. STAT. ANN. tit. 10, § 4706) Prohibits setting on land traps with teeth and body-gripping traps exceeding specified dimensions. (VT. STAT. ANN. tit. 10A, § 44)	Prohibits use of steel-jaw leghold traps, neck snares, or other body-gripping traps, allows the director of the department to
	Bag Limit		Unlimited. (VT. STAT. ANN. tit. 10A, § 41)	Unlimited. (Wash. Admin. Code § 232-28-341:
srevious page	Hunting Seasons	Inland Fisheries website)	Season is year-round. (V.T. STar. Ann. tit. 10A, § 41)	Season is year-round - closed 9/15 to 11/30 in specified wilderness areas. (WASH, ADMIN. CODE
Continued from f	Methods of Take	poisonous or explosive arrows. (4 V.A.AbmiN. Code § 15-40-50) Prohibits use of poison. (4 V.A.AbmiN. Code § 15-40-50)Allows use of dogs. (VA Dept. of Game & Inland Fisheries website)	Allows use of firearms with restrictions and dogs.(Yr. 5TAT.ANN. tit. 10, § 4701) Prohibits use of artificial light.(Yr. 5TAT. ANN. tit. 10, § 4702) Prohibits use of poisons.(Yr. 5TAT.ANN. tit. 10A, § 43)	Allows restricted use of archery equipment; prohibits use of crossbows. (WAsH. ADMN. CODE § 232-12-
nad	Class		Furbearer: (VT. STAT.ANN. tit. 10, § 4001)	ž
A	ST		5	Υ.Υ.

Depredation	Rev. Code § 77.36.030)	Allows the owner or occupant of any land, or any member of the family, to trap or hunt coyotes on the land without a license with limited restrictions. (WIs. STAT. ANN. § 29.337)	Declares that when a wild animal is damaging cultivated crops, fruit trees, commercial nurseries, homeowner's trees, shrubbery, or vegetable gardens, the landowner or lessee can submit a report to the department and the director may issue a permit authorizing the submitee to kill the animal. (W.VA. CODE ANN. § 20-2-15)	Each predatory animal district board may adopt rules and regulations necessary for the purpose of controlling predatory
	Bag Limit	Unlimited. (Wis. ADMIN. CODE NR § 10.01)	Unlimited. (W.V.A. CODE ST. R § 58-45- 10)	SZ
ping	Seasons	Various periods starting the Saturday nearest 10/17 or 10/28 to 2/ 15, (Wis, ADMN. CODE NR § 10,01) May trap from 4 AM to 8 PM. (Wis. ADMN. CODE NR § 10,13)	Season is from the first Saturday in November through the last day in February, (WV.A. Code Sr. R. § 58-45- 9)	Season is year- round. (Wro. Star. Ann. § 23-3-103)
Trap	Methods of Take authorize use of padded leghold traps and non- strangling snares. (WASH. Rev. CODE § 77.15.194)	Prohibits use of traps with teeth unless under water, and Conibear and steel jawed traps esceeding specified dimensions; allows restricted use of snares and cable restraints. (WIs. ADMIN. CODE NR § 10.13)	Prohibits use of Conibear traps on land: traps with teeth; deadfalls; and various traps exceeding specified dimensions; allows foot snares with maximum loop of 6/5 inches; allows snares in water; prohibits neck/ body snares on land. (W. V.A. CODE ST. R. § 58-53-3)	Allows predatory animals to be taken in any manner except that use of snares is restricted. (WYO. STAT.
	Bag Limit	Unlimited. (WIs. Admin. Code NR § 10.01)	Unlimited. (W.V.A. Cope ST. R.§ 58-45- 8)	sz
Hunting	Seasons § 232-28-341)	Yaar-round (some closed periods in specified areas). (WIS.ADMIN. CODE NR § 10.01)	Season is year-round. (W.V.A. Cobe Sr. R.§ 58-45-7) 58-45-7)	Season is year-round. (WYo. STAT ANN. § 23-3-103)
	Methods of Take 054) Allows use of dogs during specified periods. (WASH. ADMIN. CODE § 232-28-341)	Prohibits hunting with any means other than specified guns and bow & arrow. (WIS.ADMIN. CODE NR § 10.09)	Allows use of amber colored artificial light when hunting coyote. (W.V.A. CODE ANN. § 20- 2-5) Prohibits use of poisons and automatic firearms. (W.V.A. CODE 57. R. § 58-47-3) Allows restricted use of archery equipment; prohibits use of automatic firearms and crossbows. (WV Dept. of Natural Resources website)	Allows predatory animals to be taken in any manner except that use of automatic
Class		Furbearer. (Wis. Stat. Ann. § 29.001)	2 Z	Predatory animal. (WYco. STAT. ANN. § 23- I - I01)
ST		ž	~	X





Whether cruising down Main Street or perusing the open range, coyotes have expanded their range threefold since the mid-nineteenth century and are increasingly crossing paths with human society. To some, coyotes are icons of American culture, ecologically important, and worthy of respect and protection. To others, they are dangerous, despised vermin that are better dead than alive. Most people likely have a view somewhere in between.

Far too often, the traditional response to conflicts between humans and coyotes has been indiscriminate lethal control. However, intense and widespread efforts to control coyotes have generally failed to produce long-lasting results. It is widely held by the scientific community that predator eradication programs are futile and ecologically devastating. *Coyotes in Our Midst* charts a better course. It provides readers with information on the wide array of practical and proven techniques available to ranchers and suburbanites for coexisting with coyotes.

Outlining methods of managing conflict that have a long, successful track record, this publication is a call to action for land and home owners, ranchers, policymakers, and communities. From livestock guard dogs to motion-activated scare devices, the pages within analyze a range of practical solutions and non-lethal techniques which, when used correctly and especially in combination, can significantly reduce, if not eliminate, negative interactions between coyotes and humans.

Also covered in Coyotes in Our Midst:

- Coyote Biology and Ecology
- Traditional Management of Coyote/Human Conflicts
- Alternative Strategies for Managing Livestock Conflicts with Coyotes
- Community Approaches to Conflicts
- Conflicts with Coyotes at the Urban/Wildlands Interface
- How to Create an Urban Coyote Coexistence Program
- State Classification and Management of Coyotes



Whether the alm is to reduce livestock predation or keep companion animals safe, the approach outlined in this publication has the potential to change attitudes towards coyotes, foster coexistence, and create effective and longlasting solutions in communities.

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#### **KEEP WILDLIFE IN THE WILD**