# Wildlife Services

**Protecting People**
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**Protecting Wildlife**

## National Wildlife Research Center

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# Ecology, Behavior, and Managment Methods for Predators to Protect Livestock and Wildlife

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**Major Cooperators**
- Utah State University
- The Berryman Institute
- U.S. Army
- U.S. Forest Service
- Utah Division of Wildlife Resources
- Wildlife Conservation Society
- Wyoming Department of Agriculture
- Wyoming Animal Damage Management Board
- Wyoming Department of Game and Fish

**Groups Affected By These Problems:**
- Livestock producers
- Wildlife managers
- Environmental organizations
- Land management agencies

## National Wildlife Research Center Scientists Study Predation Behavior and Ecology

Wildlife Services' (WS) National Wildlife Research Center (NWRC) is the only Federal research organization devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective, and acceptable methods, tools, and techniques. NWRC's field station in Logan, UT, is the leading coyote ecology research complex in the world.

Data on predator population dynamics, ecology, and behavior are necessary to understand predation patterns on livestock, game species, and threatened and endangered species. These data are also needed for effective depredation management, but significant gaps of knowledge exist with regard to predator-prey, predator-livestock, and predator-predator relationships.

NWRC is adopting a multi-disciplinary approach to study interactions among predators, and the impact of predators and predator removal on ecosystems and wildlife population dynamics. Current studies include investigating if sterilization of coyotes reduces predation on pronghorn fawns; determining the population ecology and evaluating survey methods for coyotes for large-scale monitoring; investigating the behavioral ecology of coyotes; determining interactions among cougars, wolves, coyotes, and mule deer and their influence in the abundances of these species; examining the interactions among coyotes, lynx and snowshoe hares; investigating the effects of prey cycles and nutrition on coyote population regulation; understanding the abilities of coyotes to avoid capture and other management techniques; documenting the effects of forest structure on snowshoe hare distribution and abundance; and investigating the predation patterns of jaguars on livestock and native prey species. Results from studies are fundamental to selective predator management. The information gathered will also be used to guide WS' operational programs, and to provide necessary information in the National Environmental Policy Act (NEPA) process.

## Applying Science & Expertise to Wildlife Challenges

**Wolves' Impacts on Coyote Distribution and Abundance**—Scientists at the NWRC Logan, UT field station investigated whether competition from wolves limits the distribution and abundance of coyotes, and whether the elimination of wolves from certain areas results in the expansion in coyote range throughout much of North America. Researchers gathered data on mortality and survival rates of coyotes captured at wolf-free and wolf-abundant sites in Wyoming, to determine whether mortality due to wolves is sufficient to reduce coyote densities. They also examined whether spatial segregation limits the local distribution of coyotes and determined whether coyotes are less abundant where wolves were common.

Although the number of coyotes was greater across the ecosystem, mean coyote densities were 33 percent lower where wolves were abundant, and densities declined 39 percent in some areas following wolf reintroduction. Overall, mortality of coyotes resulting from wolf predation was low, but wolves were responsible for 56 percent of transient coyote deaths. In addition, dispersal rates of transient coyotes were 117 percent higher where wolves were abundant. Scientists conclude that coyote abundance is limited by competition with wolves, and that differential effects on survival and dispersal rates of transient coyotes are important mechanisms by which wolves reduce coyote densities.

**Coyote Scavenging Ecology and Wolves**—Wolf recolonization of the Greater Yellowstone Ecosystem provides a rare opportunity for scientists to identify new behaviors facilitating coexistence between wolves and coyotes. NWRC scientists investigated behavioral interactions between coyotes and recolonizing wolves at ungulate carcasses in Montana's Madison Range. Socially dominant coyotes (alphas and betas) responded to

actual and simulated wolf presence by increasing the proportion of time spent being watchful while scavenging. Watchful behavior was more pronounced when scavenging closer to protective cover, where visual obstacles inhibited the ability of coyotes to scan for, and possibly escape from, returning wolves. Despite greater time being vigilant, alpha coyotes still consumed the greatest amount of carrion. Coyotes aggressively confronted wolves. The number of coyotes and stage of carcass consumption impacted whether coyotes were able to displace wolves from carcasses.

**Interactions Among Wolves, Coyotes, and Pronghorn**—High coyote predation rates on pronghorn fawns are common throughout the western United States. NWRC scientists conducted a three-year study that provided strong evidence that wolf recovery in the Greater Yellowstone Ecosystem is decreasing the abundance of coyotes and subsequently increasing pronghorn fawn survival due to reduced coyote predation. Scientists documented a more than five-fold increase in pronghorn fawn survival at sites used by wolves during summer, and a nearly six-fold increase in fawn survival at sites used by wolves year round. Results indicate a negative relationship between coyote and wolf densities, suggesting that competition facilitated the increase in observed fawn survival. Scientists also noted the abundance of transient coyotes was lower in areas used by wolves.

The effects of wolves on solitary coyotes may be an important mechanism by which wolves limit coyote populations. Furthermore, results suggest that the extirpation of wolves throughout much of North American may contribute to high rates of coyote predation on pronghorn fawns.

**Effects of Coyote Population Reduction on Swift Fox**—The distribution and abundance of swift foxes has declined from historic levels. Causes for the decline include habitat loss and fragmentation, incidental poisoning, changing land use practices, trapping, and predation by other carnivores. Coyotes overlap the geographical distribution of swift foxes, compete for similar resources, and are a significant source of mortality in many swift fox populations.

Scientists at the NWRC Logan, UT field station evaluated whether controlling coyote populations decreases predation on declining or recovering fox populations. The scientists monitored 141 radio-collared swift foxes to compare swift fox population demographics (survival rates, dispersal rates, reproduction, density) between areas with and without coyote population reduction. Coyote predation was the main cause of juvenile and adult swift fox mortality in both areas, and juvenile survival increased where coyotes were removed. However, swift fox density remained similar between the areas. NWRC scientists concluded that in spite of increased swift fox survival, their population in the area was saturated, so additional animals had to disperse from the area.

**Influence of Landscape, Predators, and Prey on Swift Foxes**— NWRC researchers documented survival and density of swift foxes in a variety of landscapes and compared to prey availability, higher order predator abundance, and vegetation structure. The research found that predation by coyotes was responsible for the majority of swift fox mortalities, but concluded that the ultimate mechanism behind the mortalities was exposure to predation due to lack of adequate shrub cover and density.

**Natural Resources**—WS, the Rachel Carson National Wildlife Refuge, and Maine Department of Inland Fisheries and Wildlife are cooperating to protect nesting piping plovers and least terns from predation. Predation, as well as factors such as loss of habitat, weather events and human interference, brought piping plover populations to historic lows in the state. Over the past two nesting seasons, WS has helped increase piping plover reproductive success above the species recovery goal of 1.5 chicks per pair.

**Landscape Use and Movements of Wolves in Relation to Livestock**—With the recolonization of wolves into agricultural areas, there is increasing concern of wolf-livestock conflicts. To assess the risk wolves may pose to livestock, NWRC researchers are investigating the activity patterns, movements, habitat use, visitation to livestock pastures by wolves, and the occurrence of depredation events in agricultural-wildland areas in northwestern Minnesota.

Researchers captured, radio-collared, and monitored sixteen wolves. Movement of wolves showed that while they visited livestock pastures, they apparently were passing through these pastures with cattle and not preying on livestock. When compared to random simulations of movements, wolves appeared to randomly encounter livestock pastures. Wolves were more active at night than during the day. Visitation of livestock pastures was not related to any discernible characteristics of the pastures (i.e., pasture size, cattle density, distance to human habitation, percent forest cover, index of deer abundance). However, pastures in which livestock were killed by wolves often contained more cattle than pastures without depredations. While the risk of wolf predation on livestock was potentially high, few livestock were actually killed. During the 3-year study, only 8 animals (all young or vulnerable livestock) were depredated by wolves.

Maintaining healthy wild prey populations, removing offending wolves that kill livestock, and encouraging effective and proper husbandry practices (e.g., disposal of carcasses) among livestock producers, should allow for the persistence of wolves in northwestern Minnesota while minimizing their impact to farmers.

**Habitat Influence on Cougar and Wolf Predation**—Numerous studies have documented how animals use specific anti-predator strategies to mitigate risk of predation from a single predator. However, when a recolonizing predator enters an already complex predator-prey system, the avoidance of one predator can enhance vulnerability to another.

In Montana, NWRC researchers studied the patterns of prey selection by recolonizing wolves and cougars in response to changes in prey habitat preferences. Elk were the primary prey for wolves, and mule deer were the primary prey for cougars, but elk made up an increasingly greater proportion of yearly cougar kills. While both predators preyed disproportionately on bull elk, wolves were most likely to prey on bulls in poor physical condition. Scientists concluded that habitat shifts in prey (from open landscapes to more wooded areas) were attempts by formerly naïve prey to lessen predation risk from wolves. However, shifting to more structurally complex habitats might have made prey more vulnerable to cougars. Habitat shifts may represent a compromise to minimize overall risk, following a change in predator exposure.

## Selected Publications:

Arjo, W. M., E. M. Gese, T. J. Bennett, and A. J. Kozlowski. 2007. Changes in kit fox-coyote-prey relationships in the Great Basin Desert, Utah. Western North American Naturalist 67:389-401.

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Atwood, T. C., E. M. Gese, and K. E. Kunkel. 2007. Comparative patterns of predation by cougars and recolonizing wolves. Journal of Wildlife Management 71:1098-1106.

Atwood, T. C., and E. M. Gese. 2008. Coyotes and recolonizing wolves: social rank mediates risk-conditional behaviour at ungulate carcasses. Animal Behaviour 75:753-762.

Berger, K. M., and E. M. Gese. 2007. Does interference competition with wolves limit the distribution and abundance of coyotes? Journal of Animal Ecology 76:1075-1085.

Berger, K. M., E. M. Gese, and J. Berger. 2008. Indirect effects and traditional trophic cascades: a test involving wolves, coyotes, and pronghorn. Ecology 89:818-828.

Carlson, D. A., and E. M. Gese. 2007. Relaxin as a diagnostic tool for pregnancy in the coyote (Canis latrans). Animal Reproduction Science 101:304-312.

Carlson, D. A., and E. M. Gese. 2008. Reproductive biology of the coyote (Canis latrans): integration of mating behavior, reproductive hormones, and vaginal cytology. Journal of Mammalogy 89:654-664.

Karki, S. M., E. M. Gese, and M. L. Klavetter. 2007. Effects of coyote population reduction on swift fox demographics in southeastern Colorado. Journal of Wildlife Management 71:2707-2718.

Kozlowski, A. J., E. M. Gese, and W. M. Arjo. 2008. Niche overlap and resource partitioning between sympatric kit foxes and coyotes in the Great Basin Desert of western Utah. American Midland Naturalist 160:191-208.

Larrucea-Sequin, E. S., P. F. Brussard, M. M. Jaeger, and R. H. Barrett. 2007. Cameras, coyotes, and the assumption of equal detectability. Journal of Wildlife Management 71:1682-1689.

Morey, P. S., E. M. Gese, and S. Gehrt. 2007. Spatial and temporal variation in the diet of coyotes in the Chicago metropolitan area. American Midland Naturalist 158:147-161.

Thompson, C. M., and E. M. Gese. 2007. Food webs and intraguild predation: community interactions of a native mesocarnivore. Ecology 88:334-346.

**Major Research Accomplishments:**

- WS demonstrated that coyotes can exert significant negative impacts on swift fox and may limit populations under appropriate conditions.
- WS examined the impacts not only of predators on livestock, but of predators on other predators and native prey.
- WS reported that wolves limited coyotes which were beneficial to increasing pronghorn fawn survival.