



Procedures for Evaluating
PREDATION
on Livestock and Wildlife



Foreword

This bulletin briefly describes the evidence left by a variety of predatory mammals and birds of the United States when preying upon livestock and game animals. (The major North American carnivores are listed in Appendix A.) Their methods of attacking, killing and/or feeding on prey animals are reviewed, in addition to the type of wounds they cause, their tracks, and other evidence they may leave.

The bulletin is intended primarily for those who do not have experience with predator and livestock behavior, predation and other causes of livestock losses, and other factors that must be considered when determining the cause of injuries and death. Although predators injure and kill many domestic and game animals, malnutrition, exposure, parasites, poisonous plants and diseases often may be more important. Sound livestock management requires an accurate determination of the factors involved in animal losses.

The authors of this bulletin have extensive personal experience in predation and in identifying predator damage, but are not specialists in animal nutrition and disease. Only brief descriptions of nutrition and disease as causes of animal deaths are given. Where poisonous plants, malnutrition or disease may be responsible for loss, the help of specialists in these areas is recommended.

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Preface to the Revised Edition

While much has changed since Dale Wade and James Bowns* first authored this bulletin, one thing has definitely remained the same: predators consume prey. As long as predation exists, farmers and ranchers will want to know what is happening to their livestock, and smaller landowners and homeowners in suburbs and rural areas will want to know what has happened to wildlife and, sometimes, their pets. This publication focuses on interpreting evidence at livestock and wildlife depredation sites. It explains how to examine carcasses and how to determine the predators involved.

In the words of the original authors, this bulletin "...is intended primarily for those who do not have experience with predators" This population is growing every day. According to the Texas State Data Center and Office of the State Demographer (<http://txsdc.utsa.edu>), from 1980 to 2000 the suburban population in Texas grew by more than 100 percent, while the rural population grew by almost 18 percent (though less than 5 percent of rural residents lived on farms).

Although the number of traditional livestock ranchers has declined in Texas (and elsewhere), the number of ranchers involved in intensive wildlife management (including exotic wildlife) has increased dramatically. The effect of predators on threatened and endangered species is also of mounting concern. Depredation of livestock is still easier to document than depredation of wildlife, but new studies and new technologies have allowed us to learn a great deal about the patterns and effects of predation on wildlife populations. Additional information about evaluating predation on wildlife and interpreting evidence in the field is available in *Predator Control as a Tool in Wildlife Management* (B-6146, Texas AgriLife Extension Service). This publication also explains how to determine economic thresholds for predator management, as well as ways to integrate lethal and non-lethal control measures into an Integrated Pest Management (IPM) approach.

In many parts of Texas there has been a change in the distribution and abundance of predators since the early 1980s. Coyotes, once nearly extirpated from 24 million acres in Central Texas, have rebounded strongly (Nunley, 2004). So-called mesopredators (foxes, skunks, raccoons, etc.)

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have become more abundant in some counties and less so in others, but foxes and raccoons seem to have increased throughout the Central Texas region (Schwertner et al., 2006). Their numbers in suburban areas are unknown but not inconsequential, and they are sometimes swelled by feral cats and dogs. Feral hogs have expanded their range to cover almost the entire state (*Feral Hogs in Texas*, B-6149, Texas AgriLife Extension Service) and are found in at least 38 other states. Red imported fire ants are also found in most counties. Even mountain lions and black bears are increasing in some areas, while the reintroduction of wolves in the western United States and the natural recolonization of wolves in the Great Lakes states means that there is more wolf depredation than we have seen in generations.

While this publication focuses on traditional field techniques for evaluating evidence of predation, there is growing evidence that genetic analysis can help. Such analyses may be able to resolve ambiguous determinations of the species involved, and may even be able to identify the particular individual (or gender) involved. Genetic analyses may help us better understand livestock and wildlife depredation, confirm that management programs are targeting the predators responsible, and understand the effect of shifting prey availability and the roles of multiple predator species in the same system.

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Procedures for Evaluating Predation on Livestock and Wildlife

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Carnivores naturally prey on other species. Predation may be essential to controlling some wildlife populations, but may be harmful to other wildlife populations. It is detrimental to livestock production. Livestock and native and exotic wildlife are lost to predators on both public and private lands, including game ranches and preserves. The general criteria for evaluating predation on livestock may be applied to other species.

Where large animals are killed, there is normally evidence of predation, but small animals often leave no evidence or simply disappear without a trace. The presence of predators and predator sign in the area, in addition to hair, feathers and other remains in predator droppings (feces), even when simultaneous with the disappearance of livestock, is not sufficient evidence to confirm predation. Predators often scavenge animals that die of other causes and livestock can disappear in other ways.

It is easiest to confirm and evaluate predation if animals are examined soon after death or injury occurs. Examining wounded animals and fresh kills is relatively simple. Carcass decomposition, which happens rapidly during warm weather, obliterates evidence. Scavenging birds and mammals also can eliminate evidence, frequently in just a few hours.

Bear in mind the old dictum “common things occur commonly.” According to the United States Department of Agriculture National Agricultural Statistics Service (USDA NASS), predation accounts for 4.7 percent of all losses of cattle and calves (NASS, 2006) and 37.3

percent of all losses of sheep and goats (NASS, 2005). In separating predation from other causes of death, the following information may be required:

- Predator species present in the area
- Habits and signs of each predator species
- History of depredation problems in the area
- Normal and abnormal livestock appearance and behavior
- Common causes of livestock losses other than predators:
 - Starvation and/or exposure
 - Internal parasites
 - Bacterial and viral diseases
 - Pregnancy disease and other metabolic diseases
 - “Hardware” disease caused by ingestion of nails, wire or other metal objects that penetrate the walls of the digestive tract
 - Bloat
 - Suffocation
 - Poisonous plants and moldy feeds
 - Other poisons such as chemicals, lead-based paints or discarded batteries
 - Lightning
 - Snakebite
 - Theft

Sometimes the cause of death is obvious; in many cases it may be obscure. When the cause of livestock loss cannot be readily determined, assistance may be necessary. Veterinarians can identify and treat internal parasites and diseases that kill livestock. County Extension agents and range specialists can help identify poisonous plants and devise ways of managing them. Poisoned animals may require veterinary treatment.

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Animal Health

Carefully observing livestock and range conditions can help prevent death and may aid diagnosis when deaths do occur. When the cause of loss is unknown or uncertain, a veterinarian may ask about animal behavior or environmental conditions. Sometimes a veterinarian will send samples to a diagnostic laboratory to help determine the cause of death; these facilities are available in all states. Because some animal diseases can be transmitted to humans, always take precautions to prevent exposure when examining a carcass or taking tissue samples.

External Appearance of Animals and Carcasses

Although hair or fleece length and density vary with livestock breeds, healthy animals normally have coats that are glossy from natural oils and feel “live” to the touch; their skin is soft and flexible. In contrast, unhealthy animals have dry, dull coats that are harsh to the touch. Extended periods of poor health cause the skin to become dry and less flexible.

Coat condition is more difficult to evaluate in sheep because there is wide variation in fleece length, diameter and density among different breeds. Diet and nutrition also cause the amount of natural oils in the fleece to vary widely. Range type, vegetation and weather conditions also can cause marked differences in wool color and appearance. For example, extended wet periods, particularly in forested areas, cause fleece to darken. Unshorn sheep in late spring and summer may have a ragged appearance from some wool loss, particularly where they range in brush and lose wool on snags.

An alert appearance of the eyes and ears normally indicates a healthy animal. Sunken eyes and drooping ears indicate poor health. In fresh carcasses of healthy animals, the eyes fill the sockets and are not sunken from dehydration; however, carcasses dehydrate and decompose rapidly in temperatures above freezing.

Normally, livestock feces are relatively firm and dry. Exceptions include young animals receiving large amounts of milk and adult animals on lush, green forage. Large amounts of concentrates in the diet also will cause soft feces. This should not be confused with diarrhea, an unhealthy condition resulting from excessive quantities of concentrates, certain infectious diseases, or diseases caused by internal parasites.

Animals that die from natural causes normally die on their sides or chests with their legs folded under them. One exception is animals that lie on their backs and die of suffocation. This occurs most often in sheep attempting to scratch by rolling on their backs. Those with long, dense fleece may be unable to right themselves. In this position, gas cannot escape from the rumen, which distends and compresses the lungs, causing suffocation.

Another common cause of death is gas distention of the rumen (bloat), which may be caused by ingesting excessive amounts of grain or by feeding on alfalfa, clover and certain other

plants. Bloat should not be confused with the excessive carcass distention caused by gases formed during decomposition.

Carcasses should be examined for abnormal excretions (particularly pus or blood) from body openings (the eyes, ears, mouth, genitals and anus). Live animals and carcasses should be examined by a veterinarian if such abnormalities are observed or are suspected.

The carcass should be examined for skull fractures, broken bones and other wounds. The chest and stomach cavities should be opened to check for internal injuries and hemorrhage.

Internal Appearance of Carcasses

Body Fat

Animals with adequate nutrition normally have deposits of white or yellow fat around the kidneys, heart and intestines and in the bone marrow. Animals that are sick or malnourished normally metabolize this fat to meet body needs, leaving a gelatinous red deposit in the bone marrow. During starvation, internal fat is metabolized first and fat in the bone marrow is metabolized last. Breaking the large leg bones makes it possible to examine the bone marrow. Be cautious in evaluating the bone marrow fat deposits of healthy young animals that were growing rapidly. Their bone marrow may be red from extensive red blood cell production to meet body needs and may have little stored fat.

Intestinal Tract

The contents of the stomach and intestines are indicators of health. Normally, healthy ruminants (cattle, sheep, goats and other animals with multiple stomachs) older than weaning age will have a rumen (first compartment) that is one-third to one-half full of food. The rumen is not fully developed at birth, but the abomasum (fourth compartment) is fully functional in nursing young and should contain milk. A small, empty rumen is normal in nursing young for the first 2 to 3 weeks. A mixture of milk and vegetation in the rumen is normal from then until weaning age, when the rumen is fully functional.

In healthy animals, partially digested foods should be present through the rest of the gut and the feces (in the large intestine) should be relatively firm. Exceptions, as noted earlier, include animals on concentrates and lush green feeds.

When diet (such as poisonous plants or excessive amounts of grain) is a possible cause of death, the contents of the stomach and intestines should be noted. Samples of the stomach contents should be taken for analysis if poisonous plants or other toxic agents are suspected.

Lungs and Respiratory Tract

Pneumonia, a relatively common cause of animal death, is evident from fluid accumulation and other lesions in lung tissue. Healthy lungs are pink, spongy and lightweight, with sharp, well-defined edges on the lobes. Infected lung tissue is dark and firmer and heavier than healthy lung tissue. Some diseases cause abscesses in lung tissue. These abscesses may be filled

with pus and often have a hard outer shell. Making incisions through sections of normal and infected lung tissue will demonstrate these differences.

The trachea and bronchi should be opened from above the larynx into the lungs to check for infection and other abnormalities. Animals killed by a bite in the throat frequently have physical injury to the larynx and trachea. These bites also may cause hemorrhage and foam in the trachea, which contribute to death by suffocation.

Animal Age and Health

Very old and very young animals are less likely than healthy adults to survive poor nutrition, adverse weather and exposure, and they are generally more susceptible to disease. Therefore, the age and apparent health of animals before death should be considered when evaluating losses.

Young animals, particularly newborn pigs, lambs and kids, are extremely vulnerable to exposure during cold, wet weather. If they do not receive adequate maternal care and do not nurse within the first few hours, they are not likely to survive. Birth weight also is important to survival; newborns that are small and weak are less likely to survive than healthy, vigorous young of average or larger size.

Diseases of pregnancy and difficult births may cause the death of either or both the mother and fetus. When a female dies giving birth, necropsy (examination and dissection of a body after death) should include attention to pregnancy diseases and to injuries sustained in giving birth. An unusually large fetus or one in an abnormal position may cause such injury.

When determining the cause of death of newborn and very young animals, consider the major characteristics of healthy young:

- Young born alive will have a distinct blood clot at the closed end of the navel (umbilical artery); stillborn young will not have this clot.
- If young animals breathe after birth, the lungs inflate, become light pink, and will float in water (complete lung inflation may take several hours); stillborn young have uninflated, dark, red-purple lungs that do not float.
- Firm, white fat deposits around the heart and kidneys indicate health; the lack of this fat indicates poor nutrition or starvation. As young, healthy animals grow, they also develop fat deposits around the stomach and intestines.
- Milk is normally present in the stomach and intestines of healthy young. The absence of milk during the first few weeks indicates poor nutrition; however, the milk content of the stomach decreases as the diet changes to solid foods and animals are weaned.
- Digestion of milk produces chyle, a white emulsion of milk fat and lymph. This is found in the lymphatic vessels, which drain the intestinal tract, and is present immediately after young animals suckle.
- The soft membrane on the hooves of newborn animals begins to wear as soon as they stand and begin walking. Hard, dry soil surfaces cause more rapid wear than soft, wet surfaces.

Missing Livestock

It is not unusual for livestock, especially young or small animals, to disappear from pastures and herds and there are many possible causes. When no trace of the animals can be found, particularly when they have been well tended and confined to pasture, predation or theft may be the cause.

Mothers and their young normally stay close enough that young animals can nurse several times daily, particularly for the first few weeks after birth. Therefore, a lactating female with engorged udder, searching for her young for a prolonged period, may be evidence that the young animal is missing or dead. This type of maternal behavior is less likely to occur where females have one remaining of two or more offspring. Because they behave differently and have large litters, hogs are less likely to respond in this fashion if several young remain.

Domestic animals are much less wary and nervous than wild species, particularly when they are herded or otherwise handled regularly. Their customary behavior is modified by weather, temperature, availability of feed and other factors. However, the behavior pattern is characteristic for each individual herd under a specific type of management.

Other livestock behavior is useful as indirect evidence of predation. When predators are near, cattle will be very alert. The presence of carnivores that appear threatening usually causes cows to bawl urgently and run to find their calves. They may even attempt to chase the carnivores. Sheep and goats respond in the same way but are much less aggressive than cattle. They do call urgently and attempt to find their young, but some may abandon their search and try to escape to protect themselves.



Livestock are gregarious and normally are not found alone, particularly young animals. This lamb was found by itself away from the herd and exhibits the gaunt appearance and low head carriage of an animal that is obviously sick.



A close-up view of this lamb's throat indicates the cause of its illness—a severe injury to the throat that was probably caused by a coyote attack.



This ewe, standing alone with her stillborn lambs, exhibits typical maternal behavior. Livestock commonly remain separated from the herd or flock to care for their young (even stillborn) for several hours or days after giving birth and until the young are able to follow. Therefore, animals found away from the herd may or may not be exhibiting abnormal behavior.



These two lambs exhibit the typical appearance of stillborn young or of those that have died very shortly after birth. There is no indication that they have made any strong attempt to rise and the fetal membrane is still present on the lamb on the left.



In examining the carcasses of young animals to determine cause of death, one factor is whether the animal has been able to rise and walk. The hooves on the left are those of a young goat that did not walk because it was dead at birth. The hooves on the right are those of a lamb that lived and walked for 18 hours after birth.

Livestock in herds that are raided repeatedly by predators almost always become more alert and defensive. They are frightened even by common management practices that do not normally disturb them, especially if carnivores have chased the herd while making a kill rather than stalking individual animals. Once this response has been established by repeated depredation, it may continue for days or weeks. With normal management, this unusual behavior will gradually disappear if predation stops. To the person versed in livestock production and familiar with the individual herd, abnormal behavior is readily apparent and indicates a reaction to an unusual disturbance.



It is quite common to find young animals alone for short periods of time while their mothers feed or go to water. Calves, kids or lambs are often found sleeping by themselves during such intervals. Although this lamb was found dead of exposure, it is common to find young livestock sleeping by themselves in a natural position.

Evaluation of Suspected Predator Kills

Because humans are susceptible to many diseases carried by animals, always take proper precautions to prevent exposure when examining animal carcasses. If you suspect an animal may have died of an infectious disease, be sure to use personal protective equipment and have the proper training to inspect the carcass. Even when it is apparent that injury or predation caused a death, take at least minimal precautions by wearing good-quality gloves and eye protection.

There is a logical, scientific procedure for evaluating predator kills and feeding to determine the species responsible, but there is no simple series of steps that lead to consistent and accurate determinations. Predators often feed on carrion (dead animals) and take carcasses killed by other predators. Several species may feed on the same carcass. Correctly identifying the predator species responsible for a kill requires much experience and intuitive judgment.

The tendency to stereotype evidence by predator species is a common error. Most predators do follow a general pattern, but individuals vary in food preferences, method of attack, and feeding behavior. These behaviors may overlap extensively between individuals of different species; consequently, evidence other than the carcass is frequently essential to making accurate judgments. The following procedure is suggested for determining whether a loss is from predation and for identifying the predator species.

1. Examine injured animals for the type and extent of wounds and feeding. If possible, determine whether wounds were made by mammals (canine teeth



These turkey vultures are circling above a livestock carcass. Scavenging birds such as vultures, magpies, ravens, crows and eagles can be very helpful in finding animal carcasses even though their feeding may destroy evidence of the cause of death.



The carcass of this ewe, although beginning to decompose, still retains evidence of injuries on the shoulder and neck area. Thus, there is evidence of an abnormal injury that suggests the need for further investigation.



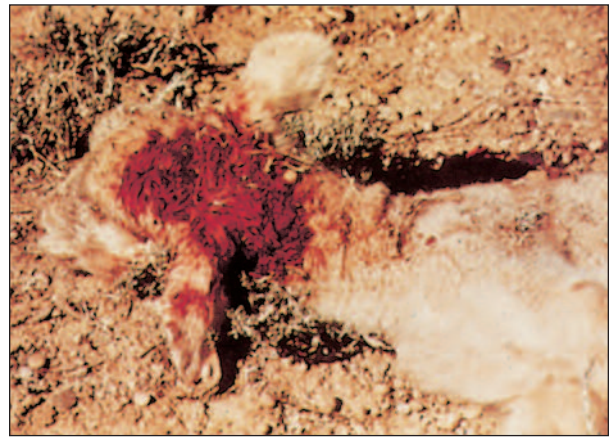
This white-tail fawn carcass has the appearance of an animal that has been fed upon by a carnivore. In this particular case, the fawn was killed and fed upon by a coyote.



This is the carcass of a lamb that was killed and fed upon by a raccoon.

and/or claws), by birds (talons and/or beaks), or by something else. Some animals are fed upon without being killed. Coyotes may bite off the tails and feed on the hindquarters of live calves. They may feed on newborn calves and on the genitals and hindquarters of cows giving birth. Black bears and coyotes occasionally feed on the udders of lactating females without killing them. At times, raccoons also feed on young or defenseless livestock without killing them. Vultures, magpies, ravens and gulls may attack and feed on young or defenseless livestock, peck out their eyes and kill them. Newborn young, females giving birth and other helpless animals are especially vulnerable. A high percentage of animals injured in predator attacks die later from shock, loss of blood or infections.

Dogs often cause extensive injuries to young and small livestock without killing them, but do not usually feed on them. However, some dogs learn to kill efficiently and feed like coyotes normally do. And, coyotes sometimes cause injuries that resemble those caused by dogs. This may be a result of inexperience in killing, two or more coyotes attacking the same animal, or a



The carcass of this lamb has injuries that are typical of some kinds of predators. In this case, the lamb was bitten in the skull by a coyote.



The carcass of this elk calf exhibits injuries typical of predation, in this case tooth punctures in the throat. This calf was killed and fed upon by coyotes.



This pronghorn antelope exhibits similar injuries—punctures in the throat—typical of predation. This pronghorn was killed by a coyote.

heavy fleece that prevents effective attack at the throat. A coyote that is injured may not kill in the normal way.

Animals with predator wounds and predator feeding patterns may have been weakened or even killed by injuries from thorns, nails, barbed wire, vehicles, or venomous snakebites. Carcasses must be examined very carefully to identify such injuries.

2. Where predation is suspected or confirmed, locate the attack, kill and feeding sites if possible. Be careful not to destroy evidence such as tracks and droppings at these sites and around the carcass. It is often necessary to have all available evidence to confirm the cause of death and/or the species responsible.

Many predators move their kills. Small animals are frequently carried away by foxes, bobcats and coyotes. Cougars, bobcats and black bears seem to prefer feeding in a secluded area and may drag or carry their kills to cover. These three species normally feed in a limited area without scattering carcass remains, and they often cover carcasses with dirt, grass, leaves or other debris. In contrast, coyotes tend to scatter carcass remains, wool and hair over much larger areas while feeding.

Predator sign is frequently found near kill sites. Trails, fencelines, creeks, waterholes and dry washes in the vicinity should be checked for tracks and droppings. Predators often crawl through or under net wire fences and it is common to find hair on the soil or clinging to wire where predators pass through or under these fences.



This newborn calf also exhibits the appearance of an animal fed upon by a predator. In this case, the calf was killed and fed upon by coyotes.



This Angora wether has injuries typical of predation, with tooth punctures and hemorrhage in the jaw and throat. This wether was killed and fed upon by coyotes.



This quail was killed by a mammal. Note the "puff of feathers" appearance.

3. Examine carcasses for wounds, hemorrhage, bruises, broken bones and feeding. If necessary, the entire carcass should be skinned and opened to identify internal wounds and other factors that help confirm the cause of death. For example, some animals are killed by a single grip at the throat that causes suffocation but leaves little external evidence. Bears and cougars may kill with blows from the front paws that break the neck or back and may cause extensive bruises, but these may not be apparent without necropsy. The claw marks of cougars and bobcats may be much more evident on the flesh side of the skin because of dense hair or wool.

Be careful not to confuse bruises, which are localized and a dark color from clotted blood, with the conditions caused by decomposition. At certain stages, decomposition may resemble extensive bruising. Also, body fluids collect on the lower side of the carcass during decomposition and cause extensive areas of discoloration. Discoloration caused by snakebite may also be obscured by decomposition; careful and complete examination may be necessary to find these wounds.

The position of the carcass may be important. Animals killed by predators are rarely found lying in a natural position. Scavengers that come along after the kill may move a carcass or turn it over while feeding. As a result, it can be difficult to reconstruct the circumstances of death because postmortem changes that developed with the body in one position may cause judgment errors when the body's position has been changed.



This quail was killed by a raptor. Note that the wings have been clipped off and the bones picked clean.



These eggs show signs of bobcat nest predation. The eggs have been bitten from the side.



A raccoon depredated this nest. Note that the eggs are broken in half.

General Characteristics of Predator Kills

The number, size, depth and location of tooth or talon punctures vary. Some animals are killed by a single bite at the throat or neck. Small animals are often killed by a bite over the head, neck, shoulders or back and a single bite is often sufficient to kill when the prey is much smaller than the predator. Since most predators find large animals harder to kill than small prey, they may bite repeatedly while shifting their grip to subdue prey animals.

As a rule, therefore, many tooth punctures and hemorrhages are found when predators are smaller than their prey. However, young, inexperienced predators are also likely to inflict multiple injuries by indiscriminate attacks without killing their prey. This is relatively common with foxes and coyotes and is particularly true of dogs.

Although the size of the canine teeth (responsible for most tooth punctures) and the spacing between them are characteristic for each species, tooth punctures in tissue are often difficult to assign to a particular species because there are close similarities in species of similar size. Also, punctures do not remain clear and distinct because of tissue pliancy and movement. Differences are further obscured by multiple bites and punctures. Therefore, additional information may be needed.

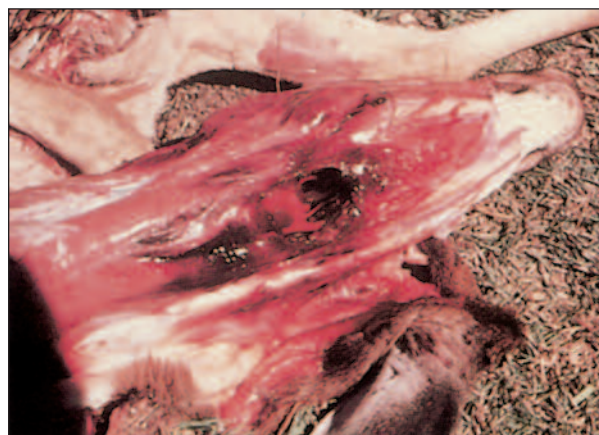
Foxes rarely crush the skull or spine of small livestock prey, but such injuries are relatively common on small lambs, goats and pigs killed by coyotes, bobcats and larger carnivores. Cougars and bears often cause similar massive injuries to adult sheep and goats, calves and other animals of similar size with bites over the



It is often necessary to skin animal carcasses to determine whether injuries have occurred. The lamb on the left was bitten in the throat and killed by coyotes, while the lamb on the right did not die from predation.



This lamb carcass exhibits injuries typical of predation—scratches, tooth punctures and hemorrhage. This lamb was killed by a bobcat.



The throat of this white-tail fawn shows injuries typical of several carnivore species, including lacerations in the area of the larynx and rear of the jaw. During necropsy of carcasses, the larynx and trachea should be opened and checked for the presence of foam, which indicates that the animal was alive and breathing when the injuries occurred. This fawn was killed by a coyote.



A second view of the same white-tail fawn shows the injuries to the skull caused by the coyote attack.

head, neck or shoulders. Broken bones are more common when the predator is relatively large compared to its prey.

Most predators tend to attack the head and neck, although eagles may grasp small prey anywhere. Eagles commonly leave talon wounds in the shoulders, ribs and back, and often in the brisket and abdomen of small animals such as lambs and kid goats. They often grasp small prey by the head or neck but the spacing between the talon wounds (1 to 3 inches between front talons and 4 to 6 inches between the middle front talon and the back talon), the triangular shape, and the depth of the wounds (up to 2 inches) are different from canine tooth punctures. Compression skull fractures in small prey such as lambs and kids may result from the eagle's grip. Internal bleeding is common in animals killed by eagles when their talons have entered the abdominal or thoracic cavities. Frequently, an eagle's talons puncture major internal veins and arteries, particularly the dorsal aorta, causing massive internal hemorrhage.

Bruises and extensive shoulder and back injuries are common in bear attacks on



Evidence of predation may persist for days or weeks after death, as long as certain portions of the carcass remain intact. This sheep had been killed by a coyote several days earlier but the tooth punctures and hemorrhage in the skin of the throat are still visible.



Evidence of predation often persists as long as certain portions of the skeleton are intact. The jaw bone on the left is from a goat killed by a coyote attack at the throat. The injuries to the rear of the jaw are typical of this kind of kill. The jaw bone on the right is that of a goat that did not die from predation.



This carcass exemplifies the need for caution in interpreting evidence. Although the blood on the lamb's nose and shoulder where it has been fed upon suggests that it died of predation, it was actually fed upon by scavenging birds several hours after death. The apparent bleeding resulted from a deficiency in blood clotting factors.



Caution is essential when interpreting injuries. This lamb died of injuries to the liver caused by trampling in a corral.

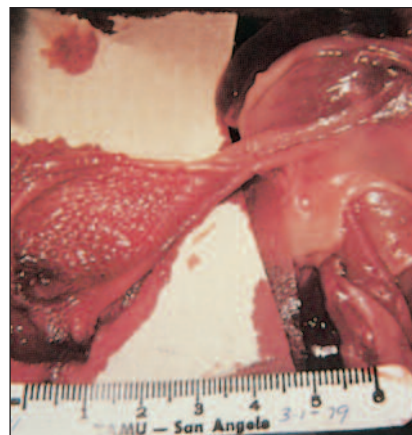


During necropsy, the carcass should be examined for evidence of adequate nutrition. This Angora kid's stomach was full of milk, indicating that it was well nourished when it was killed by an eagle.

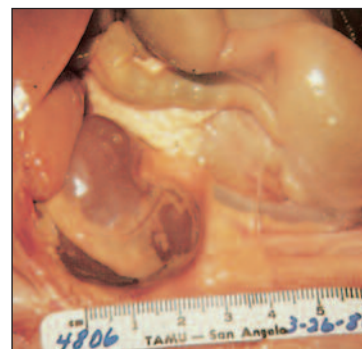
adult livestock but should not be confused with bruises caused by other livestock. For example, sheep may be injured by cattle and horses, particularly when livestock concentrate at the same locations. Bears may also claw and bruise the sides and abdomen while holding their prey. Bears may leave claw marks on the head, neck and shoulders, but these are more commonly found on cougar and bobcat kills.

Hemorrhages from arteries and veins differ. Arterial blood is normally bright red, while venous blood is dark. Blood pressure is much higher in arteries than in veins, and arterial blood is ejected in rapid spurts, often for several feet, as the heart contracts. In contrast, venous bleeding is steady and much slower because of low pressure. Blood from wounds or from the nose and mouth of injured animals is thick and clots readily. It is distinctly different from the thin, reddish fluids formed during decomposition.

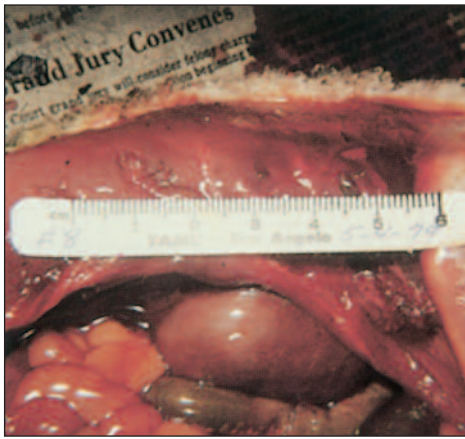
It is relatively rare to observe predators making kills. Therefore, when predators are removed it is hard to know whether the individual or predator group responsible was removed or whether those removed were simply scavengers. Occasionally a predator is observed in the act of killing and can be identified by unique tracks, particular killing methods, or other definitive factors. Sometimes a predator can be trailed from a carcass (by its tracks or with dogs) and removed. The stomach contents can be examined to determine if the captured predator has fed on a fresh kill. This alone is not sufficient to confirm responsibility for the kill, but it suggests involvement.



In contrast to the well-filled stomach of the Angora kid, this is the empty stomach of a young lamb fed upon by two red-tailed hawks. Thus, although the lamb was killed by hawks, it would not have survived.



During necropsy, the carcass should also be examined for the presence of deposits that indicate the plane of nutrition. Fat deposits in the kidney area of this lamb indicate that it was well nourished.



The lack of fat deposits in the kidney area indicates a very low plane of nutrition. An example is this lamb, which was dying of starvation when killed by a red fox.



This is the carcass of a mule deer fawn that was fed upon by a bobcat, identified by tracks in the snow. Although some blood is present in the snow around the carcass, it is not sufficient to confirm predation as the cause of death, even though the fawn was partially covered by snow by the cat.

It is helpful to know that only specific animals live in an area or travel into an area to kill. But usually the only way to know for certain that the responsible animal(s) has been removed is that losses stop or are reduced when the predator(s) is removed.

Carnivore tracks and territorial marks are characteristic for each species, but they may be difficult to find. Tracks are seen most easily in mud, dust or snow but may not be clear on other surfaces. It takes experience to accurately identify predator tracks, feces and other marks.



The site where the fawn was killed by the bobcat does provide graphic evidence of predation through scattered hair and the blood on the snow.



It is often necessary to search for other evidence such as the tracks and hair that might be left at crossings under or through fences. In this case, a coyote has been using this crawl under a fence.



This hog hair on a fence indicates a hog crossing. Note the hair's dark color and coarse texture.



The coyote tracks and scat shown here are concrete evidence that coyotes are present in the area.



The spacing between puncture wounds can help determine the species responsible. This photo shows the canine spacing of (from left) a cougar, coyote, bobcat and fox.



By examining all the evidence it is sometimes possible to build a strong case for the cause of death even though no individual piece of evidence is sufficient. The cow shown here is a 3-year-old heifer that had given birth to her first calf some 12 hours earlier. Her udder provides evidence that her calf had nursed.



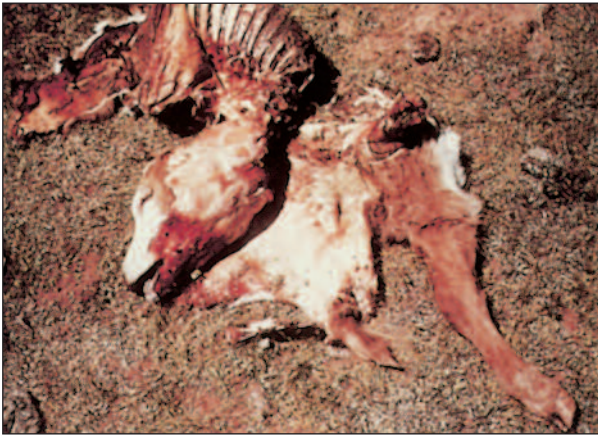
This is the carcass of her calf about 12 hours after birth. The carcass was almost entirely consumed by coyotes but no external evidence on the carcass was sufficient to determine the cause of death. However, the calf's nose was chapped and peeling, indicating that the calf had nursed; also, its skin had been cleaned of placental waste, which suggests good maternal care.



The coagulated blood indicates that the calf had bled extensively, not a normal circumstance for newborn animals. Coyote tracks in the immediate vicinity of the carcass indicate predation.



The calf's hooves indicate that it had been up and had walked extensively before death.



Skinning out the head and neck of the calf provided additional information.



Numerous small hemorrhages around the calf's jaws and nose are evidence of a difficult birth. Indirect evidence from the carcass and vicinity indicates that the calf was born alive and had walked, nursed and received good maternal care. Warm, dry weather ruled out exposure as the cause of death. Coyote tracks, coagulated blood and the cow's skidding tracks nearby indicate predation by coyotes.

Coyotes

Coyotes are the most common and the most serious predator of livestock in the western United States. They cause most of the predation losses of sheep, goats and cattle and, in some states, hogs and poultry. According to USDA reports, coyotes are responsible for 51 percent of predation losses of cattle and calves (NASS, 2006) and 60.5 percent of predation losses of sheep and goats (NASS, 2005).

In attacks on adult sheep and goats, coyotes typically bite the throat just behind the jaw and below the ear, although repeated bites made while shifting their hold may obscure the initial tooth punctures. Death commonly results from suffocation and shock; blood loss is usually a secondary cause of death. Coyotes may kill small prey such as young lambs and kids by biting the head, neck or back, causing massive tissue and bone damage. Young lambs, kids and pigs may be carried away by coyotes and disappear without a trace. Bloody soil and vegetation, missing animals, or females searching for their young may be the only evidence that a problem exists.

Some coyotes kill by attacking the flanks or hindquarters, causing shock and loss of blood. This is quite common on calves, but less common with sheep and goats. It seems to occur more often in sheep during winter months, possibly because of the heavy fleece during this period. Death of the calf and severe injuries to the genital organs and hindquarters of the cow are characteristic when a coyote attacks a cow giving birth. This is more common with heifers (young cows having their first calf) than with older cows. It is also quite common in some areas to see calves bobtailed by coyote attacks.

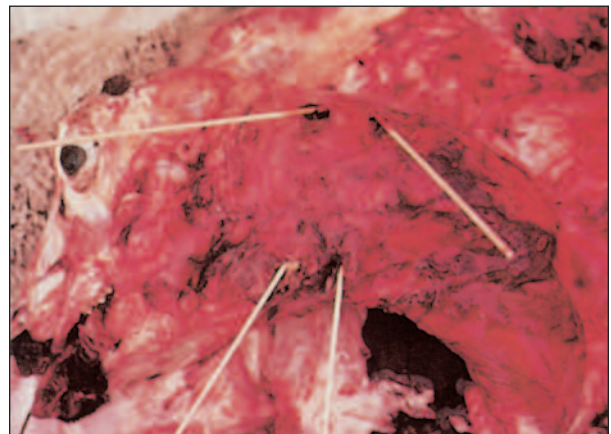
Young coyotes are more likely to kill in an atypical manner, but some coyotes consistently kill in a way that differs from the norm. Each



These two lambs exhibit the typical appearance of a coyote attack at the throat. The lamb at the right shows the most typical coyote feeding pattern.



This Angora goat carcass shows the typical coyote attack at the throat as well as coyote feeding in the ribcage and flank.



The neck of this lamb shows the typical tooth punctures and massive hemorrhage caused by a coyote attack at the throat. In this case the extensive hemorrhage occurred because the lamb lived for several hours after the attack.

individual may have unique food habits and behavior depending on its circumstances.

Some animals are attacked by coyotes without being killed but die later from injuries and infection. In these cases, sheep and goats are more likely to have throat injuries and cows and calves to have injuries to the hindquarters. Calves are often fed upon extensively at the hindquarters before they die. Even with prompt medical treatment, few of these animals survive because massive infections usually develop.

Coyotes normally begin feeding on kills in the flank or just behind the ribs, but there are exceptions. Some seem to choose the viscera (liver, heart, lungs, mesenteric fat, etc.) first. The milk-filled stomach is a preferred item. Feeding on the hindquarters is also common. Small animals may be entirely consumed.

When coyotes are involved there are often multiple kills, and many of these kills are not fed upon. Coyotes usually leave the hide and most of the skeleton of larger animals relatively intact; but when food is scarce, they may leave only the largest bones. Coyote feeding leaves ragged edges on muscle tissue and tendons and splintered and chewed ribs and other bones. Where coyotes feed extensively on larger carcasses there will be scattered wool, bits of skin and other parts.

The canine teeth of coyotes vary in size and spacing but on the average 20- to 30-pound coyote the normal spacing between the upper canine teeth is $1\frac{1}{8}$ to $1\frac{3}{8}$ inches, with 1 to $1\frac{1}{4}$ inches between the lower canine teeth. Because tissue is pliant and moves, and because there may be multiple bites, it may not be possible to identify paired punctures made by the canine teeth and accurately estimate the canine tooth size and spacing. But when these can be determined, it is very helpful in confirming the predator species responsible.



Matches are inserted into the tooth punctures in the skull and scalp of this young lamb killed by a coyote biting the head.



Tooth cuts on the throat and flank of this calf that escaped and survived were made by coyotes.



This calf, still living, was attacked by coyotes that fed extensively on its hindquarters.



This calf carcass exhibits the feeding on the nose that is relatively common when coyotes prey on young calves.



The calf in the center was attacked by coyotes, which bit off part of its tail. Bobtail calves are often seen in areas where coyote predation is common.

If not disturbed at a feeding site, coyotes often rub and roll after feeding, possibly to clean themselves. They may also urinate and defecate soon after feeding and usually scratch with their feet after defecation. These activities leave useful evidence if it can be found.

Some dog tracks may be easily confused with coyote tracks even when the tracks are well defined. The shape of tracks, the length of the stride, the prominence of nail marks, and the pattern of travel are important. Coyote tracks tend to be more oval and compact than those of dogs. Nail marks are less prominent and the tracks tend to follow a straight line more closely than those of dogs. Except for greyhounds and whippets, most dogs of the same weight as coyotes have a slightly shorter stride. The normal coyote track is about 2 inches wide and 2½ inches long, with the hind track slightly smaller than the front. The average coyote's stride at a trot is 16 to 18 inches, and the hind tracks tend to follow directly in line with or on top of front tracks.



Persistent attacks by coyotes may result in a calf losing its entire tail and the coyotes feeding into the rectal area. This calf is an example.



It is also relatively common for coyotes to feed on calves during birth, and also on the cow. This cow exhibits the results of such an attack.



This Angora nanny was attacked at the rear by a young, inexperienced coyote. The attack could have been interpreted as an attack by dogs had it not been for additional evidence, including coyote tracks and droppings in the immediate area.



This goat was attacked from the rear and fed upon by coyotes. The goat died of shock and loss of blood during the feeding. This type of attack could have been attributed to dogs, but in fact it is relatively typical of young, inexperienced coyotes. Also, it is less common for dogs to feed on their kills.



Injuries to the nose also might be considered atypical of coyote behavior. The result of such an attack is shown in the next photo.



Attacking and feeding on the nose is normally considered typical of dogs, but this lamb was killed and fed upon by coyotes.



This nanny was attacked and her udder was eaten by a coyote. This is considered an aberrant coyote attack and feeding pattern, one that is far more typical of black bear.



This coyote scat is composed almost entirely of mohair from an Angora goat. The appearance of scat differs a great deal depending on an animal's diet.



These coyote scats are composed almost entirely of pig hair.



This coyote scat is composed almost entirely of wild plums.

Dogs

Domestic dogs can be a serious problem where they are permitted to run at large, particularly near urban areas. True feral dogs and coydogs (coyote-dog hybrids) are also a problem but are far less common. According to USDA reports, dogs are responsible for 11.5 percent of predation losses of cattle and calves (NASS, 2006) and 13.3 percent of predation losses of sheep and goats (NASS, 2005).

Domestic dogs do not normally kill for food and their attacks usually show indiscriminate mutilation of prey. As a rule, domestic dogs feed very little on their prey. When they do feed, they tend to leave torn, ragged tissue and splintered bones much like coyotes do.

Some individual dogs, including pets, have the instinctive ability to kill effectively, whether or not they feed, and some become adept through repeated killing. True feral dogs are more likely to kill for food. Feral dogs and coydogs are also more likely to kill in a manner similar to coyotes, possibly as a result of experience in killing for food.

Both domestic and feral dogs often range in packs and can do extensive damage once they begin to attack livestock. Dog packs often harass livestock and persist in chasing injured animals, often for several hours. Careful searching where this occurs often reveals many attack sites with tracks and widely scattered bits of hair or wool and skin. When animals are chased by dogs, the consequences can include exhaustion, injuries, weight loss, loss of young, abortion, and fences damaged by livestock attempting to escape. Sheep and goats are especially vulnerable. They may drown in streams or reservoirs while trying to escape, or they may “pile up” and suffocate in fence corners, gullies and sheds. Many more may be injured or killed in this manner than by dog bites.



It is easy to misinterpret and confuse predator sign made by species that behave in similar ways and leave similar evidence, so it is important to be careful when examining sign. The front foot on the left is that of a 35-pound male collie dog. That on the right is of a 30-pound male coyote. Note the difference in the shape of the feet, toes, pads and nails.



Tracks made by dogs and coyotes of similar size are often easily confused. The tracks at the left were made by a collie dog weighing about 30 pounds, while those at the right were made by a male coyote of similar size. Note the difference in the nail marks and the shape of the tracks.



This Rambouillet wether show lamb was attacked by dogs.



Dogs frequently maul the muzzle and ears.



This ewe exhibits the type of injuries that often result from an attack by dogs.

Livestock proximity to urban areas, limited enforcement of leash laws and tagging regulations, and estrous female dogs at large are major factors that encourage dog damage problems. Because dogs vary in size and cause many kinds of injuries, the size and spacing of the canine teeth are less useful for confirming the species responsible. Tooth punctures often are not clear where skin and muscle tissues are torn.

Dog tracks are also highly variable because of size and weight differences. However, dog tracks are typically more round and show more prominent nail marks than coyote tracks. They are larger than fox tracks. Unlike coyote tracks, a dog's rear tracks normally are slightly to one side of the front tracks. If a site shows canine tracks made at the same time that vary widely in size, it is evidence of dog predation, especially near urban areas where stray dogs may range.



These ewes exhibit the indiscriminate mutilation that dogs often cause.



This ewe was mutilated and partially disemboweled by the dogs that killed it.



These Angora kids also exhibit the indiscriminate mutilation caused by dogs. Three were killed and two were badly injured. Multiple kills are quite common when dogs are the predators responsible.



Some dogs, through innate instinct or experience, learn to kill as efficiently as wild carnivores. This ewe was killed by a German shepherd that attacked at the throat.



After the ewe was killed, the dog began feeding in the flank area in a manner similar to that of coyotes.



This Rambouillet lamb was killed by a large dog, which attacked at the throat and fed on the hindquarters. This attack could have been confused with a coyote attack.



The feeding on the hindquarters is much more typical of coyotes, since pet dogs do not normally feed on animals they kill. However, this lamb was killed by pets in the backyard of a home.

Foxes

Although poultry are their usual domestic prey, both red and gray foxes may prey on livestock. This is generally less typical of gray foxes.

Foxes usually kill only young or small animals, particularly lambs and kids. However, red foxes may kill large lambs and kids, adult sheep and goats, and small calves, probably because their food is limited. According to the USDA, red foxes were responsible for 1 percent of sheep, 5 percent of lamb, 2 percent of goat and 9 percent of kid losses to predators in 1998.

Foxes usually attack the throat of lambs and kids, but sometimes kill with multiple bites to the neck and back. This may happen when young animals are caught lying down. Foxes do not have the size and strength to hold and immobilize adult sheep and goats or to crush the skull and large bones; therefore, they usually bite repeatedly to subdue prey, even smaller animals. Prey may show numerous injuries when attacked by young foxes that lack the experience to attack the throat or other vital areas.

Foxes generally prefer the viscera and begin feeding through an entry behind the ribs. However, some seem to prefer the nose and tongue and may consume the head of small prey. It has been noted in some areas that red foxes tend to feed on the carcasses of large prey and carrion on the side nearest the ground. Red foxes also are noted for carrying small carcasses back to their dens to feed their young, which may account for some poultry, lambs and kids that disappear and are never found.

Foxes have smaller canine teeth with narrower spacing than coyotes. The teeth are approximately $\frac{1}{2}$ to $\frac{3}{4}$ inch apart on gray foxes and $\frac{1}{16}$ to 1 inch apart on red foxes. Foxes rarely cause severe bone damage to livestock other than poultry. This helps to distinguish their kills from those made by coyotes and other larger carnivores.



These are the feet of a gray fox. The front foot is on the left and the hind foot is on the right.



These are the tracks of a gray fox in soft soil.



This is a gray fox track.

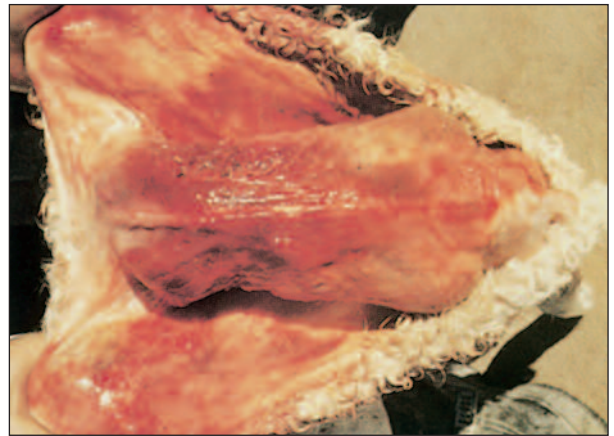


This 15-pound Angora kid was bitten in the throat and below the left ear by a gray fox. The size and spacing of the tooth punctures, as well as the history of gray fox attacks in this vicinity, helped determine the predator responsible.



This 25-pound Angora kid was also attacked at the throat by a gray fox.

Fox tracks resemble coyote tracks but are typically smaller. Foxes have a shorter stride. Red fox tracks are normally about $1\frac{3}{4}$ inches wide and $2\frac{1}{4}$ inches long; gray fox tracks are slightly smaller. A red fox's trotting stride is about 13 to 15 inches; a gray fox's stride is about 11 to 13 inches.



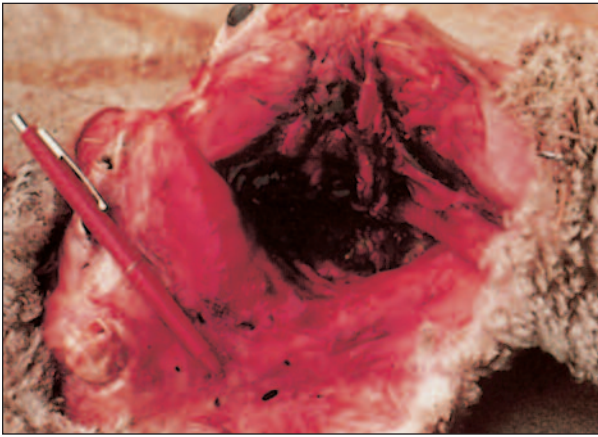
A gray fox killed this 8-pound Angora kid by repeatedly biting it in the back. The size and spacing of tooth punctures and the lack of any broken bones, in addition to the history of gray fox predation, were the determining factors in confirming this as a gray fox kill.



Examination of the Angora kid during necropsy confirmed that it was well nourished. Note the milk in the stomach.



This Angora kid was killed by a red fox that bit it at the throat and back of the skull. The size and spacing of the tooth punctures and the history of red fox predation in the vicinity were the determining factors.



This 20-pound lamb was killed by a red fox attack at the throat. Again, the size and spacing of the tooth punctures and the history of red fox predation confirmed the predator responsible.

Wolves

The reintroduction of wolves in the western United States, along with the natural recolonization of wolves in the Great Lakes states, has led to an increase in wolf depredations. Wolves usually prey on wildlife such as white-tailed deer or elk (depending on their location), but have also depredated cattle, sheep, horses, llamas and domestic dogs.

Wolves generally attack by chasing prey and biting at the fleeing animal. When they attack larger prey, wolves bite repeatedly at the flanks and “armpit” area of the animal, as well as at the throat. On smaller prey (calves and sheep), bites may be just to the head or neck. Wolves have large, powerful mouths. Bite marks on the outside of a carcass may just show tooth scrapes on the hide, but when the prey animal is skinned, a remarkable amount of hemorrhage is evident at the bite site. This is caused by the depth and strength of the bite. Because of this, all examinations of suspected wolf kills should include skinning the carcass completely to check for this typical damage.

Wolves may kill several sheep in a single event, especially on open range. They typically kill only one cow or calf at a time, but because several animals in the pack may be feeding on the same kill, the wolves may be returning to the same pasture and may kill several animals in a short period.

Established wolf packs are very territorial and do not tolerate other canines in their territories. Domestic dogs, especially hunting hounds and guard dogs, have been killed in encounters with wolves. This territorial behavior is most pronounced in the spring and early summer when wolves are near their dens and “rendezvous sites.”



This is a wolf track in snow.



Notice the pattern of these wolf tracks and the distance between tracks.



This goat was killed by a wolf.



These are the remains of a goat 1 day after it was killed by a wolf. Note the crushed bones.

Wolves can consume a large amount of meat in a single feeding; a pack may consume an entire calf or sheep in one feeding. Even large carcasses can be consumed in a few days if several wolves are feeding on the kill. Because of this, wolf kills are often not found or are found only when there is too little left of the carcass to determine the cause of death. In one study in a remote area of Idaho, ranchers and wildlife damage professionals were able to locate only one of every six kills.

Wolf depredations are handled differently in each area. Many states make compensation payments when it is confirmed that livestock have been killed by wolves. The protocol for contacting the appropriate agencies and for preserving the physical evidence varies from state to state. Livestock producers should familiarize themselves with the procedures for their particular area.



This calf was attacked by a wolf.



Note the canine scrape marks on this calf attacked by a wolf.



Bite marks to the hindquarters are evidence of a wolf attack on this calf.



Note the depth of the bite marks in this calf attacked by a wolf.



This herd guarding dog was killed by wolves.

Bobcats

Like cougars, bobcats prefer to stalk their prey and attack from cover. When attacking small prey such as lambs, kids and fawns, they bite into the skull or back of the neck and may leave claw marks on the back, sides and shoulders. Bobcats may also kill with a bite in the throat, usually just behind the jaws over the larynx. This could result from catching the prey after it falls, or it may be individual bobcat behavior.

Bobcats normally do not bite repeatedly in killing prey, but tend to secure a lethal hold on the neck or throat and hang on until the prey stops struggling. When bobcats secure a grip over the larynx, the animal often suffocates rapidly and there is virtually no bleeding from the injury. The adult bobcat's canine teeth are normally about $\frac{3}{4}$ to 1 inch apart. It is usually easier to estimate this spacing on bobcat kills than on fox and coyote kills.

As a rule, bobcats do not prey on adult sheep and goats or on calves, but they are known to kill adult deer and antelope. They attack larger prey by leaping on the back or shoulders and usually leave claw marks. On small prey, there may be claw marks on any part of the body, but they are usually concentrated on the neck, shoulders and ribs.

Bobcats generally begin feeding on the viscera by entering behind the ribs, but their feeding patterns vary. They may begin feeding on the neck, shoulders or hindquarters. Their feeding pattern is relatively neat, which is typical of the cat family. They may consume nearly the entire body of small animals, including the head, in a single feeding. Or they may carry the carcass away. Bobcats prefer to kill their own food but seem to feed more readily on carrion than cougars do.

Bobcats may cover a carcass and return several times to feed on it. Being smaller than cougars,



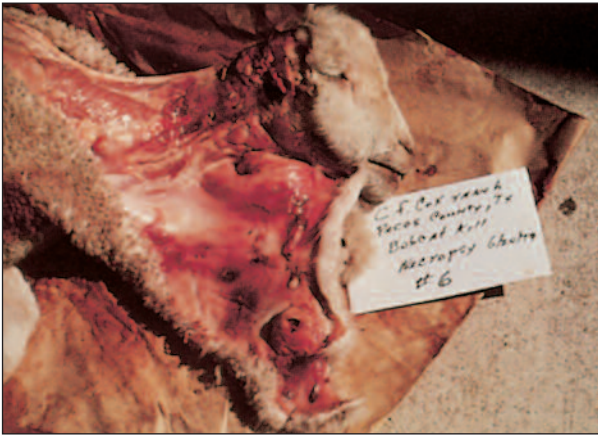
These are the feet of an adult male bobcat. The hind foot is at the left. The shape and spacing of the pads and the lack of claw marks are evident in bobcat tracks.



The characteristics of a bobcat's tracks are seen in these tracks made in snow.



This is a bobcat drag.



This 20-pound lamb was killed by a bobcat bite in the back of the head. The determination was made by the size and spacing of the tooth punctures and the claw marks on the skin.



After killing the lamb, the bobcat took a small feed from the flank area.

bobcats do not reach out as far in raking up debris, normally not much more than 15 inches. This, and much smaller tracks, helps distinguish between bobcat and cougar caches. Bobcats also may cover their urine and feces with a small mound of debris, typically much smaller than that made by cougars.

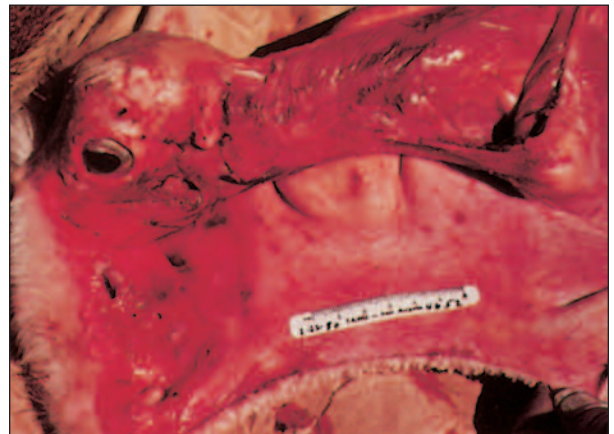
Like cougar tracks, bobcat tracks are round and lack claw marks, but they are much smaller—only 2 to 3 inches in diameter. The rear pad is shaped differently, being relatively straight in front with a three-lobed rear foot pad.



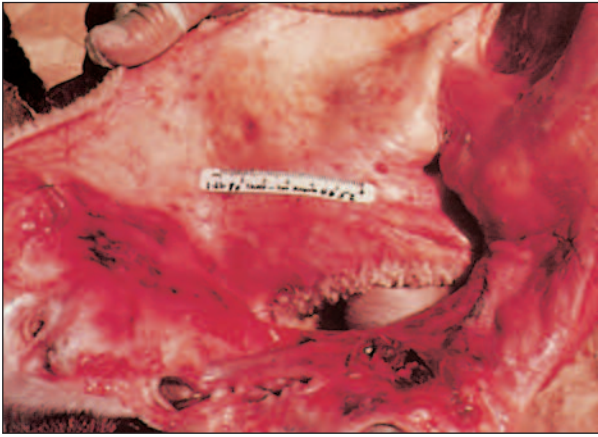
This mule deer fawn was killed by a bobcat attack at the throat. The bobcat ate a small amount from the hindquarters.



This is a small lamb (approximately 6 pounds) killed by a bobcat bite to the throat and jaws.



Skinning the lamb's neck and shoulders reveals massive injuries to the larynx, as well as claw punctures and scratches on the neck and shoulders.



The opposite side of the lamb also shows scratches and punctures in the skin. The hemorrhage indicates that these injuries occurred while the lamb was alive.



Note the canine punctures in the skull of this kid goat killed by a bobcat.



This lamb killed by a bobcat shows injury to the top of the skull.



This doe carcass shows the caching pattern of a bobcat.

Cougars

Cougars attempt to stalk their prey and attack from cover. They frequently kill sheep and goats by biting the top of the neck or head. Broken necks are common in these kills. This differs from the typical coyote bite in the throat and general mutilation caused by dogs. However, cougars also may kill sheep and goats by biting the throat. This may result from prey falling or being knocked down and caught, or it may simply be the method found effective by individual cougars and most convenient on some prey animals. Cougars may kill by grasping the head of prey such as sheep, goats and deer and pulling the head until the neck is broken. Animals killed in this way die quickly and may not have been bitten. Cougars kill calves much like they do sheep and goats. Multiple kills of sheep and goats by cougars are common; cases of a hundred or more animals killed in a single incident have been recorded. In such incidents usually very few animals, often only one or two, are fed upon by the cougar.

Cougars usually kill larger animals, such as deer, elk, horses and cattle, by leaping on their shoulders or back and biting the neck. Claw marks on the neck, back and shoulders are characteristic of cougar kills. The prey animal's neck may be broken by bites or by the animal falling. There may also be bites in the throat of larger prey. The size of the canine tooth punctures and the type of bone damage help distinguish cougar kills from those made by coyotes, dogs and foxes. An adult cougar's upper canine teeth are approximately $1\frac{1}{2}$ to $2\frac{1}{4}$ inches apart, with the lower teeth about $\frac{3}{8}$ to $\frac{1}{2}$ inch closer together. A cougar's teeth are massive compared to those of the average coyote or bobcat.

Except when prey is scarce, cougars do not normally feed on carrion other than their own kills or possibly those taken away from other predators. They usually carry or drag their kills



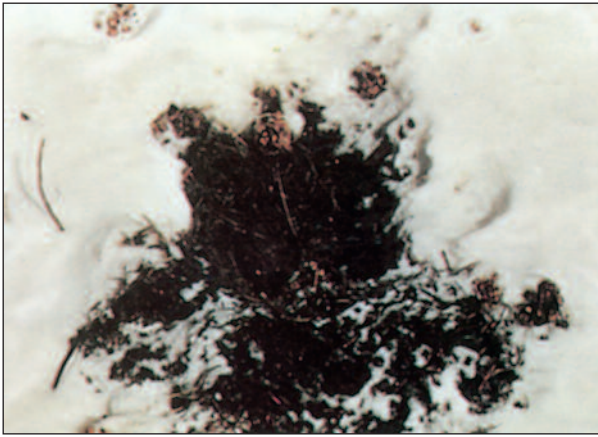
This is the front foot of a 125-pound male cougar. Note the distinctive characteristics of the toes and the rear pad.



This is a male cougar track in the mud. Note its distinctive characteristics.



In this cougar track, the rear track is on top of the front track.



This is a cougar scratch in snow, at which the cougar defecated and urinated. This appears to be a territorial behavior along cougar travelways, particularly by males.



The pile of leaves in the center was scratched up by a male cougar near a kill. This may be a territorial marker.

to a secluded area under cover to feed, so drag marks are often found at fresh kill sites. Cougars generally begin feeding on the viscera (liver, heart, lungs, etc.) through the abdomen or thorax, but like other carnivores, individuals differ. Some begin feeding on the neck or shoulder, while others prefer the hindquarters. Like other cats, cougars normally leave relatively clean-cut edges when they feed, compared to the ragged edges of tissue and bone left by coyotes. They also may break large bones when feeding.



The tracks in this photo, which straddle the drag marks, were made by the front feet of a male cougar as it dragged a deer carcass to cover for feeding. It is relatively common for cougars to drag their kills to secluded areas.

Cougars often try to cover their kills with soil, vegetation (leaves, grass, limbs) or snow. They may eviscerate prey and cover the viscera separately from the rest of the carcass. Even where little debris is available, bits of soil, rock, grass or sticks may be found on the carcass. However, where multiple kills are made at one time, there may be no effort to cover more than one or two of them.

Cougar “scrapes” or “scratches,” composed of mounds of soil, grass, leaves or snow, are probably a means of communicating with other cougars. These scrapes are generally 6 to 8 inches high. Male cougars appear to make scrapes as territorial markers around their kills and near trails and deposit urine and feces on them; these markers may be considerably larger



Note the tracks on either side of this cougar drag.



This lamb carcass shows the abnormal position in which it was dropped while being dragged by a cougar.



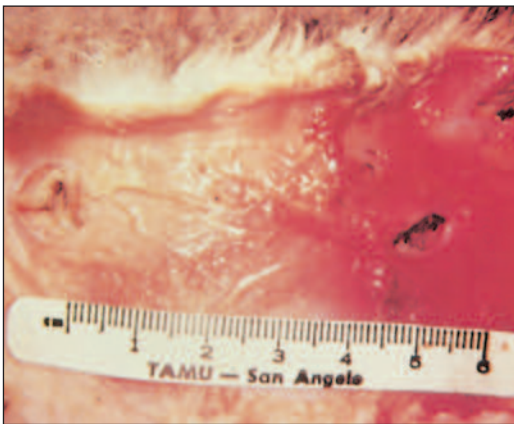
This is the carcass of a male mule deer that was killed, fed upon, and partially covered by a cougar. Cougars often cache larger prey.

than others—up to 2 feet long, 12 inches wide, and 6 to 8 inches high.

Cougar tracks are relatively round and rarely show any claw marks since the claws are normally retracted. Tracks of large adult males' front feet may be 4 inches or more long and about the same or slightly less in width. The hind tracks are slightly smaller. The rear pads of the feet are distinctively different from those of other carnivores. Typically, there are two lobes in front and three on the rear of the rear pads, although there are variations. With extensive experience, some hunters can recognize individual cougars by their tracks, even without distinctive features such as missing toes or other deformities.



This sheep was killed by a cougar, which bit the top of the neck behind the head.



The size and spacing of the tooth punctures in this kill demonstrate that they were made by a large animal. The tooth punctures are nearly $\frac{3}{8}$ inch in diameter and $2\frac{1}{4}$ inches apart.



A rancher and technician are examining one of numerous kills made by a cougar during one night at a sheep bed ground.

Bears

Grizzly Bears

Grizzly bears are common in parts of Canada and Alaska but occur only in limited areas of the west in the lower 48 states, primarily in the Greater Yellowstone ecosystem. They are omnivores and consume large amounts of vegetation and wild fruits in addition to carrion and prey. They will take nearly any domestic animal species, but cattle and sheep are their most common livestock prey, primarily because these are the most common species available. Grizzly bears are large and powerful and generally have little trouble killing adult livestock. They kill with bites and blows to the head or neck and often break bones of the skull, neck or shoulders. They may leave claw marks and tooth punctures on the head, neck and back.

Grizzlies typically drag their kills into cover before feeding. They skin out the carcass, leaving skin and skeleton relatively intact. They do not chew and scatter bones as canids do. They usually cover their kills with soil and vegetation and feed repeatedly as long as flesh remains. They readily feed on carrion and leave extensive sign (matted vegetation, tracks and feces) around a carcass.

Black Bears

Predation by black bears on livestock is most common in spring and summer. Limited food sources in early spring and failures of wild berry and nut crops during summer are probably major contributing factors. Black bears are also omnivorous and vegetation is a significant part of their diet. They do extensive damage in some areas of the northwestern states by stripping the bark from trees and feeding on the cambium. Black bears raid bee yards for honey and orchards for fruit. They also feed readily on carrion.



These are the tracks of a black bear made in soft soil. Note the distinctive pattern of the toes and rear pads in the tracks.



This rather formless pile of scat was deposited by a black bear that had been feeding on huckleberries.



The black bear claw marks on this tree may be a territorial marker.

Black bears will attack adult cattle and horses but seem to prefer sheep, goats, calves and pigs. They may break the neck or back of prey with blows from the paws, but normally they kill by biting the neck (often immediately behind the ear) and shoulders. Claw marks are frequently found on the neck, back and shoulders of these larger animals. Multiple kills of sheep and goats are relatively common, possibly because they are easy prey. Whether by accident or design, bears have been known to frighten livestock herds over cliffs, injuring and killing many animals.

Black bears prefer to feed in seclusion and often drag their prey to cover. They frequently begin feeding on the udder of lactating females. They may consume the liver and other vital organs, but generally prefer meat to the viscera. Some begin feeding at the neck or shoulders where the initial attack occurs. Where most of the prey is consumed, the skin of large prey is stripped back and turned inside out. The skin and skeleton are usually left largely intact. Black bears rarely scatter a carcass, although this may be done by coyotes or other animals that scavenge the remains. Vegetation around the carcass is usually matted down by black bears, and their droppings are frequently found nearby.

Black bears may attempt to cover remains of larger carcasses but seem somewhat less inclined to do so than cougars and grizzly bears. Bear tracks have distinct characteristics. The front foot has five toes with a broad, short pad; the rear foot has five toes with a triangular pad. The rear foot oversteps the front foot in normal travel.



This ewe was attacked and her udder eaten by a black bear. The ewe escaped and survived for a short time.



This ewe was killed and fed upon by a black bear. It is relatively common for black bears to feed on the udders of lactating ewes.



These are the remains of a 70-pound lamb that was killed and almost entirely consumed by a black bear. The skinning of the carcass and almost total consumption indicates an adult bear's huge appetite, as well as its feeding behavior.



After killing and eating the lamb shown in the previous photo, the bear then killed this ewe and fed heavily on the neck and shoulders. Note the distinct difference in the feeding pattern as compared to that of other carnivores.



This calf was attacked by a black bear, which began feeding at the shoulders while the calf was still alive. The bear was shot at the site and the calf had to be destroyed.



Note the bear bite marks across the shoulder of this carcass.



This calf was killed by a grizzly bear. Note the bites across the shoulder.



These shoulder bites are under the hide of a calf killed by a grizzly bear.

Hogs

In some areas, domestic or wild hogs (Russian boars, domestic hogs gone wild, and their crosses) prey on poultry and livestock. This occurs more often during droughts or when mast (acorns, etc.) and other foods are scarce. Hogs will also feed readily on carrion. Some hogs become highly efficient predators. Hog predation on livestock usually occurs on lambing or calving grounds, perhaps partially because of the prevalence of afterbirth. Occasionally, adult animals giving birth are fed upon and killed by hogs.

Young and small animals are often entirely consumed by hogs, leaving only tracks and blood as evidence where feeding occurred. Missing young and their mothers with full udders may indicate such predation, particularly where this is frequent and no other causes for loss can be found.

Hogs feed on carcasses much like bears do, although they are not as proficient in skinning them out. They may consume some parts that bears do not, such as the rumen and its contents. Since hogs commonly root up soil and vegetation, their presence is usually evident and their tracks are distinctive.

When the opportunity presents itself, hogs also prey on arthropods (especially beetles), amphibians, reptiles, eggs, deer, ground-nesting birds, and small mammals. Their diet can put them in direct competition with native wildlife species. In certain areas, wild hogs may cause significant losses to endangered or threatened wildlife species through both predation and competition.



In these hog tracks, note the blunt and rounded shape and the location of the first and fourth toes outside the impression of the other toes.



This scat was deposited by a feral hog.



These are the remains of a lamb that was killed and fed upon by a wild domestic hog.

Eagles

Both bald and golden eagles may prey on livestock, but golden eagles do so more often. Both species readily consume livestock carrion and carcasses of foxes and coyotes, although some individuals may prefer live prey to carrion. Eagles are efficient predators and can cause severe losses of young livestock, particularly where there are concentrations of eagles. They usually prey on young sheep and goats but are capable of killing adults. Golden eagles also take young deer and antelope, as well as some adults.

Eagles have three front toes opposing the hind toe, or hallux, on each foot. The front talons normally leave wounds 1 to 3 inches apart, with the wound from the hallux 4 to 6 inches from the wound made by the middle front talon. On animals the size of small lambs and kids, fewer than four talon wounds may be found, one made by the hallux and one or two by the opposing talons. Talon punctures are typically deeper than those caused by canine teeth and somewhat triangular or oblong. Crushing between the wounds is not usually found, although an eagle's grip may cause compression fractures of the skulls of small animals. Bruises from their grip are relatively common on eagle kills.

Eagles seize small lambs and kids anywhere on the head, neck or body; lambs are frequently grasped from the front or side. Eagles usually kill adult animals and lambs and kids weighing 25 pounds or more with multiple talon stabs into the upper ribs and back. Their feet and talons are well adapted to closing around the backbone, with the talons puncturing large internal arteries, frequently the aorta in front of the kidneys. Massive internal hemorrhaging from punctured arteries, and/or collapse of the lungs when the thorax (ribcage) is punctured,



This eagle nest near lambing grounds contains an eaglet and lamb remains.



The back of this lamb exhibits the talon punctures made by an eagle.

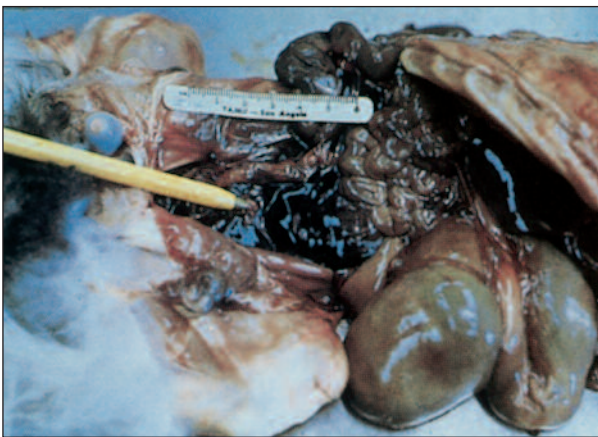


This skull of a lamb killed by an eagle shows the talon punctures made by the bird.

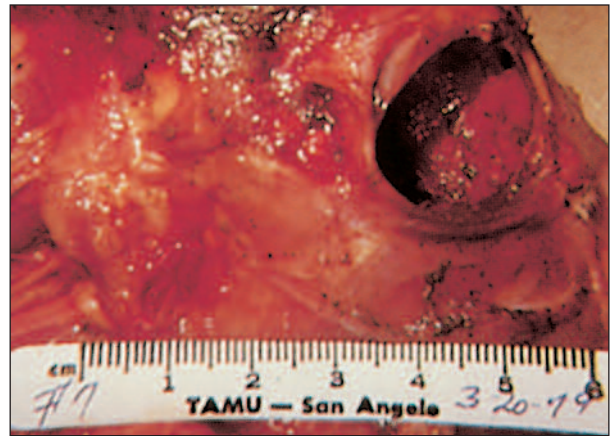
contribute to shock as the major cause of death. Eagles may also simply seize young lambs, kids or fawns and begin feeding, causing the prey to die from shock and loss of blood as they are eviscerated.

Eagles skin out carcasses, turning the hide inside out and leaving much of the skeleton intact with the lower legs and skull attached to the hide. However, on very young animals, the ribs are often clipped off neatly close to the backbone and eaten, although eagles frequently do not eat the sternum (breast bone). Some eagles clip off and eat the mandible (lower jaw), nose and ears. Quite often they remove the palate and floor pan of the skull and eat the brain. They may clean all major hemorrhages off the skin, leaving very little evidence of the cause of death except for many talon punctures in the skin. Ears, tendons and other tissues are sheared off cleanly by the eagle's beak.

Larger carcasses heavily fed on by eagles may have the skin turned inside out with the skull, backbone, ribs and leg bones intact, but with nearly all flesh and viscera missing (except for the rumen, which is not normally eaten). Eagles may defecate around a carcass, leaving characteristic white streaks of feces on the soil, and their tracks may be visible in soft or dusty soil.



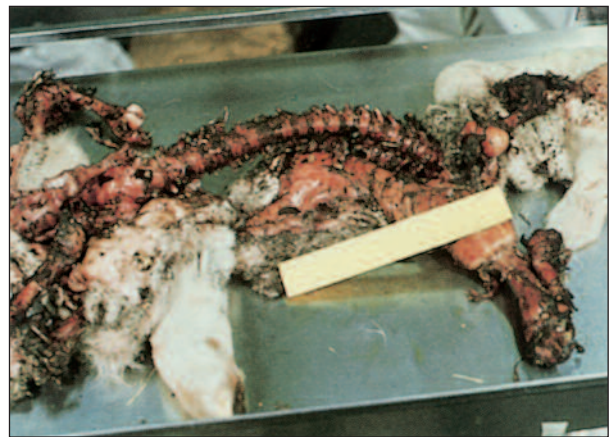
During necropsy it was found that the eagle's talons had penetrated through the ribs into the dorsal aorta and caused the massive hemorrhage shown at the tip of the pencil.



The skull of this lamb shows the massive injuries and hemorrhage caused by an eagle, which opened the skull and fed on the brain.



The head and neck of this lamb show the characteristics of an eagle attack. Pencils are inserted into the talon punctures. The fracture in the right side of the skull was caused by the eagle's grip.



This carcass exhibits the characteristics of extensive eagle feeding, with the carcass skinned out and the ribs clipped off close to the spine.



This Angora kid carcass was almost entirely skinned out by an eagle. The carcass, including the small bones, was consumed.

Scavenging Birds

Vultures, caracaras, ravens, crows, magpies and some gulls commonly scavenge carcasses. They sometimes attack live animals and kill those that are unable to escape or defend themselves. Initial attacks by these birds are usually at the eyes, nose, navel and anal area. They usually blind the animals by pecking out the eyes even if they do not kill them.

Magpies may attack the anal area and back as well as wound sites on healthy adult livestock under certain conditions. Unhealed brands and other wounds, such as saddle sores on horses, are preferred sites for attack. This is not a common occurrence, except possibly in northern states during severe winters when food for magpies is scarce.

Some hawk species also scavenge carcasses and may attack small animals that are not able to defend themselves. Hawks generally seem to attack and begin feeding in the shoulder or ribs.



This is the carcass of a lamb that was killed and had its intestines stripped out by ravens.



This ewe survived an attack by gulls.



This lamb died from shock and blood loss when fed upon by two red-tailed hawks.



This first-calf heifer had trouble calving and was fed upon by vultures while unable to rise. The heifer had to be destroyed.



This photo shows caracara predation on a lamb. Note the damage to the eye.

Snakes

Venomous snakes, particularly rattlesnakes, occur on nearly all livestock ranges of the southern and western United States and in many other areas; thus, it is inevitable that substantial numbers of livestock are bitten. Because young animals (colts, calves, lambs and kids) are curious and far less cautious than adults, they are more often victims of snakebite. Many of them are bitten on the nose or head as they attempt to investigate snakes.

During summer months, livestock concentrate around streams and ponds for water during the hot, midday hours. This frequently leads to crowding, particularly of sheep, into shady areas during the time snakes must have shade. As a consequence, sheep are frequently bitten on the legs or lower body when they are pushed close to snakes.

Typical snakebite injuries include swollen, discolored tissue, lethargy and fever. Animals bitten on the head may have severe swelling of the head and neck. A large percentage of young animals die, though some survive, possibly because of greater resistance and/or smaller doses of venom.

Fang punctures and tissue discoloration that follows the major arteries and veins from the bite area are generally evident at necropsy.



This is the carcass of a lamb that died from a rattlesnake bite. The discolored tissue is evident at the point of the arrow.

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Appendix A

Some North American carnivore species that prey on livestock, poultry and game animals and that may also scavenge carcasses.

Mammals

Kodiak bear, *Ursus arctos middendorfi*
Grizzly bear, *Ursus arctos horribilis*
Black bear, *Ursus americanus*
Cougar, *Puma concolor*
Jaguar, *Panthera onca*
Bobcat, *Lynx rufus*
Lynx, *Lynx canadensis*
Ocelot, *Leopardus pardalis*
Jaguarundi, *Puma yagouarundi*
Gray wolf, *Canis lupus*
Red wolf, *Canis rufus*
Coyote, *Canis latrans*
Dog, *Canis familiaris*
Coydog, primarily coyote-dog crosses
(*Canis latrans x familiaris*)

Red fox, *Vulpes vulpes*
Gray fox, *Urocyon cinereoargenteus*
Arctic fox, *Alopex lagopus*
Wolverine, *Gulo gulo*
Badger, *Taxidea taxus*
Striped skunk, *Mephitis mephitis*
Hooded skunk, *Mephitis macroura*
Hognosed skunk, *Conepatus leuconotus*
Spotted skunk, *Spilogale putorius*
Mink, *Mustela (Neovison) vison*
Weasels, *Mustela frenata*, *M. erminea*,
M. nivalis
Raccoon, *Procyon lotor*
Opossum, *Didelphis virginiana*
Hogs (domestic, feral and wild), *Sus scrofa*

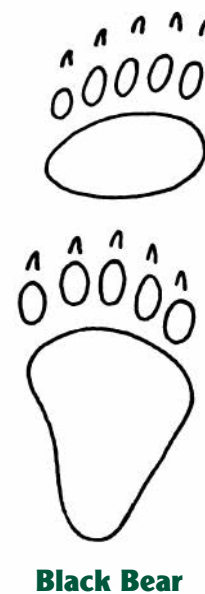
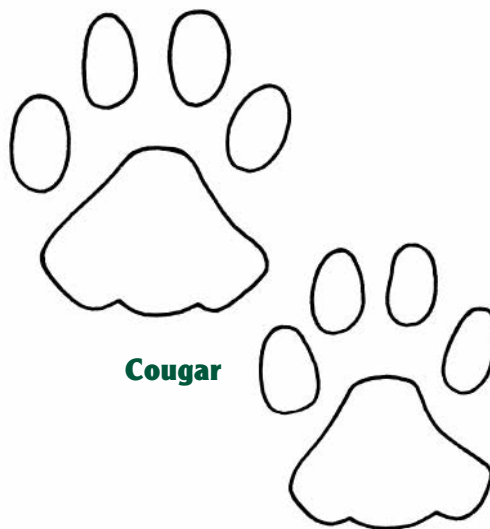
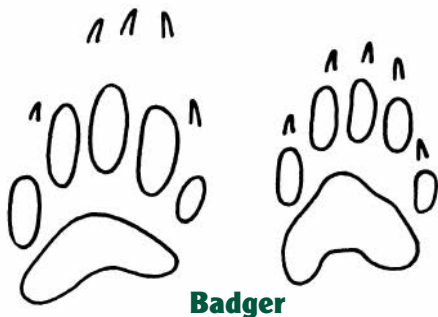
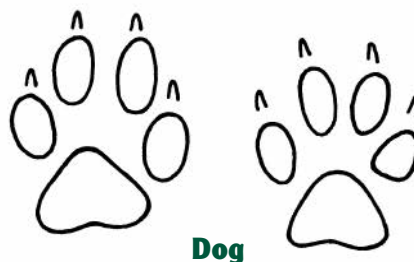
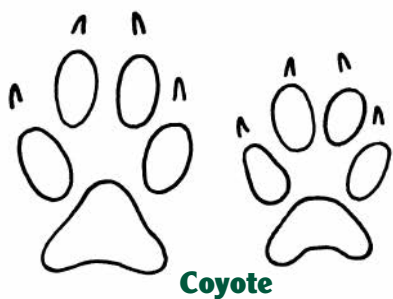
Birds

Golden eagle, *Aquila chrysaetos*
Bald eagle, *Haliaeetus leucocephalus*
Red-tailed hawk, *Buteo jamaicensis*
Great horned owl, *Bubo virginianus*
Crested caracara, *Carcara plancus*
Black vulture, *Coragyps atratus*
Turkey vulture, *Cathartes aura*
Chihuahuan raven, *Corvus cryptoleucus*

Common raven, *Corvus corax*
Common crow, *Corvus brachyrhynchos*
Black-billed magpie, *Pica hudsonia*
Yellow-billed magpie, *Pica nuttalli*
Various gull species, e.g.,
California gull, *Larus californicus*
Herring gull, *Larus argentatus*

Appendix B

General Appearance of Animal Tracks



Illustrations show general appearance and are not necessarily drawn to scale.

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