
COYOTES

Integrated Pest Management for Home Gardeners and Landscape Professionals

Coyotes are medium-sized members of the dog family, larger than foxes but smaller than wolves (Fig. 1). Native to western North America, they are extremely adaptable. Coyotes have increased in numbers and have increased their geographical range during the past fifty years, due in part to human modification of the landscape. Coyotes now are found almost everywhere in North America.

IDENTIFICATION AND BIOLOGY

Males are larger and heavier than females, typically weighing 20 to 35 lbs when full-grown, while females are about 18 to 25 lbs. They stand approximately 18 inches high at the shoulders. Coloration is usually a blend of rust-colored to brown to gray. The coyote resembles a small German shepherd dog, but with a longer, narrower snout and a bushy black-tipped tail.

Breeding occurs once annually, typically in late January and in February, with pups born in March and April. Parents and offspring continue to remain in a family group for about six months. Before giving birth, the adults excavate one or more dens in the soil, occasionally expanding the burrows of other animals, but sometimes using hollow logs, rock piles, or culverts. Typically, even when denning in suburban areas, they choose sites where human activity is minimal. If disturbed, the parents may move the litter to an alternate den site. Litter size is normally 4 to 7 pups and may depend on the female's nutritional status, which is a function of food availability and coyote population density.

Pups emerge from the natal den at

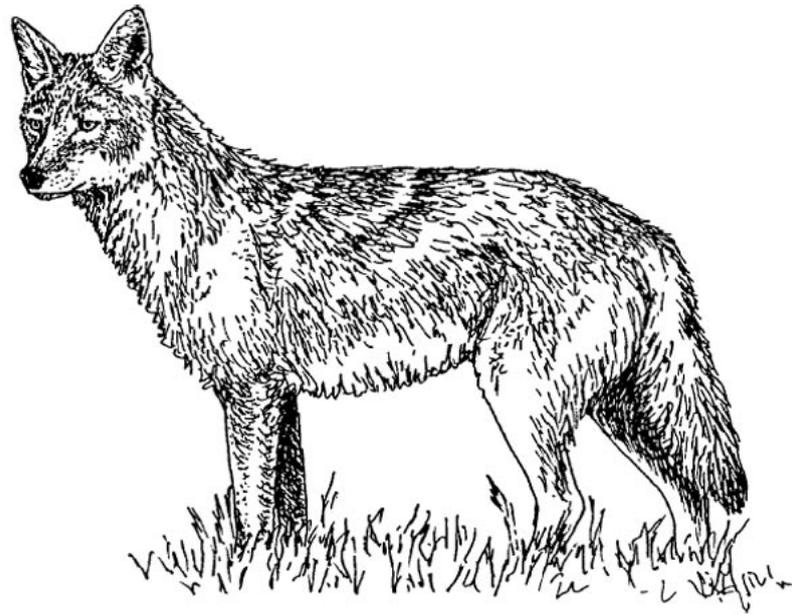


Figure 1. Coyote, *Canis latrans*.

about 3 weeks of age and grow quickly, relying primarily on their parents to provide them with food for the first few months. By late fall, juveniles may disperse to live independently, although if food resources are adequate, they can remain with their parents through the next year. Coyotes can be heard vocalizing (barking and howling) in the evening and night throughout most of the year, but they vocalize less when in the early stages of pup-rearing.

Space Use and Food Habits

Coyotes can live in almost any habitat in California, from arid deserts in the south to wet meadows and foggy coastal regions in the north. They are not as common in densely forested regions or in agricultural environments planted mainly to annual crops, because they find few food resources in these situations. In recent decades, they have become more numerous

in many suburban environments where an ample food supply is available. Some of the highest population densities on record occur in suburban Southern California.

While some coyotes may be nomadic or transient and travel over wide areas, others occupy distinct territories that they defend, particularly during breeding and pup rearing. Where food is abundant, territories are smaller than where food is scarce. Coyote territories can be greater than 15 square miles in arid areas where food is scarce, to 1 to 3 square miles in oak woodland livestock rangelands typical of California's Coast Range, to as small as one quarter of a square mile in the suburbs of Los Angeles. Dominant, territorial pairs may share their space with their juvenile offspring or other related coyotes when food resources are sufficient to support these expanded family groups. Coyotes are

generally regarded as less social with each other than are wolves. While they can live successfully as solitary individuals or pairs, and often do so, they can form packs of up to 10 individuals in environments where abundant food is present. Therefore, dense populations of suburban coyotes may not appear to be highly territorial.

Coyote diets are diverse and adaptable, varying according to local or seasonal availability of resources. Rodents or rabbits are often a major portion of their diet, when available. However, at times coyotes will rely on insects (such as grasshoppers), fruits, berries, songbirds, and carrion. They readily scavenge on carcasses of large wild or domestic animals and also are capable predators, able to attack and kill full-grown deer and other large prey. Because domestic animals such as poultry, sheep, goats, and calves lack effective natural defenses against wild predators, they are easy prey for coyotes. Some coyotes learn to kill livestock and pets and will do so repeatedly unless corrective action is taken. When preying on poultry and livestock, coyotes often kill more than they can consume.

Behavior Around Humans

Normally, coyotes are elusive animals that avoid contact with humans. Most active after dusk and before daylight, they are typically seen only at a distance. This trait may be a response to hunting, trapping, and other efforts to control coyote predation. Indeed, coyotes have been harassed and killed ever since settlers first arrived in western North America with their livestock. In most areas of California, coyotes continue to behave in ways that minimize their contact with humans.

In areas where predator control activities are practiced, coyotes are particularly wary of humans and of changes in their environment. Similarly, they are also wary of humans in places where sport hunters pursue or

shoot at coyotes. Their excellent sense of smell and their tendency to avoid new objects makes it very difficult to capture or even to study them, as they often recognize and evade traps, snares, and cameras.

Within urban and suburban areas in California, however, some coyotes have adapted to residential neighborhoods, parks, and open spaces, and seemingly have lost their fear of humans. This may be a result of behavioral changes that have occurred over several generations of coyotes, in localities where predator control is no longer practiced. Coyotes thrive in such areas because food, water, and shelter are abundant, and coyotes living in these environments may come to associate humans with food and protection. Once attracted to suburban areas, they prey on the abundant rodents, rabbits, birds, house cats, and small dogs that live in residential habitats. They also will feed on household garbage, pet food, and seeds and fruits of many garden and landscape plants. In some localities, this has resulted in the development of local coyote populations that seemingly ignore people, while a few coyotes have become increasingly aggressive toward humans. They will stalk and even attack children or adults, or attack pets being walked on a leash by their owners. More than 160 such attacks have occurred in California since the 1970s, and they are becoming more frequent, particularly in suburban areas of Southern California. While only one attack has been fatal (to a 3-year-old girl, attacked in her front yard in 1981), a number of attacks have resulted in serious injuries.

Recognizing Problem Coyote Behavior

As coyote numbers increase in cities, they become accustomed to the presence of people, especially if the people do not harass them. Studies of coyote attacks on pets and on humans have revealed a predictable

Table 1. Sequence of increasingly aggressive coyote behaviors.

Increasing Aggression 	1. Increase in coyotes on streets and in yards at night
	2. Increase in coyotes approaching adults and/or taking pets at night
	3. Coyotes on streets, and in parks and yards, in early morning/late afternoon
	4. Coyotes chasing or taking pets in daytime
	5. Coyotes attacking and taking pets on leash or near owners; chasing joggers, bicyclists, other adults
	6. Coyotes seen in and around children's play areas, school grounds, and parks in midday
	7. Coyotes acting aggressively toward adults in midday

pattern of change in coyote behavior in these environments (Table 1). This progression is accelerated when coyotes are provided abundant food, either unintentionally or intentionally, in residential areas. When it reaches the point where pets are being attacked or coyotes are seen in neighborhoods in early morning or late afternoon, area-wide corrective actions are recommended to prevent an escalation to attacks on humans. If coyotes are seen near your home, teach your children to identify them, recognize the potential for danger, and know what to do if they come in contact with a coyote. (See Responding to Coyote Aggression and Attack.)

IDENTIFYING COYOTE DAMAGE

Coyotes come into conflict with humans in a variety of ways, from

chasing and attacking pets in suburban areas, to chewing plastic drip irrigation systems in vineyards and orchards, killing livestock on rangelands, or killing other valued wild animals. The first step in solving any conflict with wildlife is to identify the wildlife species causing the problem. Because coyote damage often is not seen by humans as it is happening, heavy reliance must be placed on indirect evidence at the damage site. Inspect the area for "coyote sign" such as tracks, hair, droppings, or tooth marks on irrigation pipe.

Tracks. Coyote tracks can often be distinguished from those of dogs by their shape and appearance (Fig. 2). Coyote tracks tend to be more oval-shaped and compact than those of common dog breeds. Nail marks of coyotes are less prominent, and the tracks tend to follow a straight line more closely than those of dogs. Tracks of large coyotes can be up to 3 x 1 3/4 inches.

Hair. Coyote hair may be found in fence wire, particularly at locations where coyotes have dug a "slide" to crawl under a chain-link or woven-wire fence. A close look at the hair will reveal bands of color on individual hairs (but many other animals also have hair with bands of color). Hairs from a coyote's back are often black-tipped.

Droppings. Coyote droppings or "scats" are typically about the diameter of a cigar, sometimes tapering at one end. Scats are deposited along trails and roadsides and will vary in appearance depending on the animal's diet and on the age of the scat. The scat may contain hair, feathers, bones or other animal parts, as well as plant materials such as grass or seeds. Scats are typically black to light gray in color, becoming bleached out as they remain exposed to sunlight and the elements.

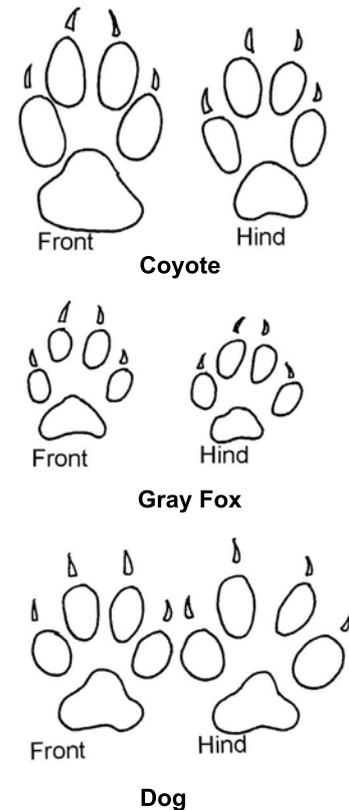
Tooth Marks. Drip irrigation pipe and other such materials, when chewed by coyotes, have the appearance of hav-

ing been compressed and shredded as if chewed by dogs. This is in contrast to chewing damage done by rodents or rabbits, where the pipe is scraped or gnawed repeatedly and often shows evidence of the presence of paired incisor tooth marks.

Prey Remains. When prey killed by coyotes is found and examined before it can be consumed or scavenged by other species, the appearance of the carcass may give clear evidence that coyotes were responsible. Coyotes usually kill small mammalian prey such as rabbits, young kid goats, and small lambs by biting them through the head or neck. The size and spacing of puncture wounds from the coyotes' canine teeth is sometimes apparent; the spacing between a coyote's canine teeth is typically 1 to 1 3/8 inches. A coyote's carnassial ("cheek") teeth are capable of making clean, knifelike cuts through carcasses, as coyotes sometimes dismember prey in order to transport portions to their den to feed pups. Municipal authorities and homeowners have sometimes found remains of dead house cats and mistakenly assumed they were mutilated by people practicing animal sacrifices, when in fact they were killed by coyotes.

Larger prey such as large lambs, large kid goats, and adult sheep and goats are usually attacked at the throat and may show puncture wounds on the side of the head or on the lower part of the neck. Skinning the neck may reveal substantial hemorrhaging in the area of the attack that is not visible externally. In contrast, dogs usually kill such prey by attacking the hindquarters, flanks, and head, often mutilating prey and leaving a "messy" kill. Because inexperienced or young coyotes sometimes do not make typical or "clean" kills, and some dogs may kill in a manner resembling coyotes, it is important to seek additional evidence at the site before reaching a conclusion.

Because coyotes will scavenge carcasses, it is important not to assume



Scale is 1 inch equals 3 inches.

Figure 2. A comparison of size and shape of footprints of the coyote, gray fox, and a large domestic dog. A gray fox footprint is similar to a small dog, but narrower.

coyotes have killed every animal they might feed on. Livestock and other prey can die from a variety of causes. However, the presence of hemorrhaging and bruising on the skin around tooth punctures or bites indicates the animal was alive when it was attacked by a predator.

PREDATOR DAMAGE MANAGEMENT, PAST AND PRESENT

During the twentieth century, livestock producers and government predator control agents often were able to control losses by suppressing coyote numbers, at least locally, through use of toxicants, traps, shooting, and other techniques. Population models reveal that to control coyote numbers

through removal, more than three-quarters of all coyotes must be killed annually, and even then, their elimination would take decades of effort. As regulations on predator control tools and materials increased and society's attitudes toward predators changed, it has become increasingly difficult to control coyote numbers or slow their range expansion into new areas. Today, toxicants are highly restricted for use in controlling coyotes, leghold traps are banned in some states including California, and shooting is not safe or legal in many situations, especially in suburban areas. Modern strategies to manage coyote damage integrate a number of nonlethal and preventive techniques, relying on lethal removal only when other techniques are ineffective or impractical.

While coyote removal often results in a void that is quickly filled by coyotes moving in from surrounding areas, this does not mean that coyote removal is ineffective in reducing or stopping damage. Coyotes moving in to fill a void may have different travel patterns and preferences for prey, thus reducing conflicts with humans, pets, or livestock. Recent research, as well as decades of practical field experience, suggests that removal of dominant coyote pairs at the beginning of breeding season may substantially reduce predation on livestock for up to a year. Removal of coyotes from a population may result in more resources being available to remaining coyotes, thus increasing litter sizes and pup survival. However, coyote removal does not result in higher coyote populations over the long term, as numbers are largely regulated by food availability.

Legal Status. Coyotes have no special protection in California and may be killed by any method that is not prohibited by federal, state, or local statutes. Since the passage of a state ballot initiative measure in November 1998, leghold traps cannot be used to capture coyotes except in situations where a human health and safety emer-

gency has been declared by designated officials, or in selected situations where the existence of an endangered species is threatened by predation. Toxicants or poisons used to control coyotes are illegal, with the exception of fumigant cartridges available only to predator control specialists to asphyxiate coyote pups in their dens. No chemical repellents are registered for use in repelling coyotes from property or from livestock.

The situations in which coyotes cause damage are quite variable, and therefore strategies and solutions to resolve these problems also must be tailored to individual situations. Professional wildlife damage management specialists who are employed by federal, state, or county agencies can be very helpful in evaluating coyote damage and in assisting landowners to develop appropriate management strategies for specific situations. Contact your county agricultural commissioner or county Cooperative Extension office to obtain information about professionals who can control coyotes, or telephone the United States Department of Agriculture, California Wildlife Services state office at 916-979-2675, or see the Wildlife Services Web site, <http://www.aphis.usda.gov/ws/ca>.

Exclusion. Coyotes have the physical ability to go under, through, or over many types of fences. While coyotes generally prefer to dig under fences or go through fence gaps at gates or washouts, some coyotes have the inclination to jump or climb fences, particularly at corners or where cross-braces provide a foothold.

While it is expensive and difficult to construct a completely coyote-proof fence, a fence that discourages coyotes will have the following design characteristics. Fence height should be a minimum of 5 ½ feet and should be built higher on sloping terrain. Net wire-mesh should be no larger than 6 inches between stays. To deter digging under, bury a galvanized wire-mesh

apron, attached securely to the bottom of the fence, 4 to 6 inches below the soil and extending outward at least 15 inches. An extra degree of protection against coyotes scaling a fence can be obtained by installing a wire-mesh overhang of at least 18 inches, slanted outward, or roller-type devices designed to be attached to the top of a fence, which prevent coyotes from getting a foothold in their attempts to climb or jump over. In general, truly coyote-proof fences are so expensive to build and maintain that they are economically viable only to protect very valuable commodities.

Electric fences of various designs have been effective in excluding coyotes. Retrofitting existing fences by adding electrified wires may provide an added degree of effectiveness. Electric fencing can be less expensive to construct than conventional woven-wire fence, but it requires substantially more maintenance to keep it in working condition. Additionally, electrical fencing may be inappropriate for use or illegal in residential or suburban areas.

Close off crawl spaces under mobile homes, porches, decks, and garden sheds, as coyotes can use these areas to rest and to rear their young. While quality fencing may not prevent all coyotes from entering an area, it will often result in coyotes leaving evidence of where and how they penetrated the fence, which will enable you to determine what other methods of management will be most effective to stop the damage.

Hazing and Behavior Modification.

Using sound or visual stimuli to keep coyotes away from livestock or other resources will provide only temporary effectiveness, if any. Such efforts are likely to work best in localities where coyotes are wary as a result of continuing predator control efforts and where the stimuli can be frequently varied in type and location. In the absence of any real threat, coyotes quickly adapt or habituate to sounds,

flashing lights, propane cannons, scarecrows, and so on. A strobe-siren device, developed by researchers to keep coyotes away from sheep flocks at night, was effective only for several weeks to a few months at most locations where it was tested. Because of the disturbance such devices cause, they are impractical for use in suburban areas.

When coyotes first venture into a suburban area, they likely have some degree of wariness toward humans. In this situation, certain hazing techniques may, when combined with modifications to make the environment less attractive, reduce the chance that coyotes will lose their wariness of humans. Suburban residents who see a coyote in their neighborhood should attempt to frighten it away by shouting, throwing rocks, squirting it with a water hose, blowing portable air horns, or otherwise acting aggressively in order to reinforce its fear of people. Motion-sensitive lights on houses or outbuildings may deter coyotes from approaching.

Certain breeds of guard dogs, as well as llamas and donkeys, may effectively exclude coyotes from pastures. Livestock operators who have had the best success with guard animals typically place them in small, flat, fenced pastures where the guard animal can see and challenge any intruding coyotes. Guard animals are most effective when they are behaviorally bonded to the sheep or goats they are protecting. However, there are occasions when guard animals are of limited effectiveness, and multiple coyotes or mountain lions may even attack guard animals. In suburban areas, there have been instances of groups of coyotes attacking large dogs such as Labrador retrievers, even in the presence of their owners.

Habitat Management in Suburban Areas. Areas with lush landscaping provide ample food, water, and shelter for coyotes. Suburban coyotes can reach densities far greater than they do on rangeland or undeveloped wildlands. Homeowners can reduce the attractive-

ness of their property to coyotes by clearing or thinning thick vegetation and by removing brush and dense weeds from the landscape, thereby depriving coyotes and their prey of shelter and cover. In particular, prune back the lower limbs and branches of shrubs and small trees to a height of 2 feet, to deprive coyotes of cover where they can easily hide. Avoid using landscape plants that produce fruits and seeds, and pick fruit from trees before it falls to the ground to avoid attracting coyotes. Coyotes are attracted to ripening fruits of many kinds, and they will also readily consume the fruits of some plants commonly used for landscaping (Table 2). Install quality fencing around garden plots to exclude coyotes, as they will eat many common garden fruits and vegetables. Compost piles should be managed carefully so they will not encourage rodents or other prey attractive to coyotes, and they should be fenced or contained to exclude coyotes from foraging for grubs and worms. Eliminate available water sources for coyotes and other wildlife; for example, remove ponds or fountains, or install net wire fences around their perimeter. Manage bird feeders carefully to avoid spillage that attracts rodents and rabbits, which are attractive coyote prey.

Habitat Management in Semi-rural Areas. In areas where residential dwellings are on small acreages or where homeowners may keep livestock as hobby animals, consider installation of quality fencing to deter coyotes. Confine livestock and poultry from dusk to dawn, and use lights above corrals. Control rodents, especially any that are living in and around your livestock facilities or residence. Be particularly attentive when lambs or kid goats are present, as well as during the coyotes' pup rearing season (March through August), when their food needs are highest.

Pet Management. Cats and dogs should be fed indoors, or if fed outdoors, food dishes should be promptly emptied and removed after pets have eaten. Store pet food indoors or in

sealed heavy-duty containers. Use refuse containers that have tight-fitting lids to prevent raccoons, dogs, or coyotes from having access to household garbage. Keep small pets such as cats, rabbits, and small dogs, indoors, or if outdoors, keep them within enclosed kennels. Large dogs should be brought inside after dark. Never allow cats or dogs to run free at any time, as they are easy prey. Because coyotes that come in contact with domestic animals may transmit diseases, vaccinate all pets for rabies, distemper, parvovirus, and other diseases, as recommended by a veterinarian.

When exercising your dog, always use a leash, and walk only in populated areas of high pedestrian traffic. You may want to carry a walking stick or cane that you can use to fend off an attack. Try not to establish a regular routine in terms of route or time of day, as coyotes can learn your schedule and have been known to lie in wait to attack. Avoid walking pets at dawn or dusk, and avoid areas of dense vegetation or cover. Coyotes are more likely to attack dogs during the pup-rearing season, if dogs come too near the den site. If coyotes establish a den site near a residential area, attempts should be made to harass the coyotes so that they move their pups to an alternative, more remote den site.

Never intentionally feed or provide water to coyotes, as this causes them to quickly lose their fear of people and become aggressive. Anyone who intentionally feeds coyotes is putting the entire neighborhood's pets and children at risk of coyote attack and serious injury.

In addition, ask your neighbors to also follow the described methods in order to reduce the potential for conflicts with coyotes.

Responding to Coyote Aggression and Attack. If you or your pets are approached by an aggressive or fearless coyote, try to frighten it away by shouting in a deep voice, waving your

arms, throwing objects at the animal, and looking it directly in the eyes. Stand up if you are seated. If you are wearing a coat or vest, spread it open like a cape so that you appear larger. Retreat from the situation by walking slowly backward so that you do not turn your back on the coyote.

If you are bitten or scratched by a coyote, wash the affected area thoroughly with soap and water and then seek immediate medical attention. Although most problem coyotes are healthy, the risk of rabies is always present. Rabies can occur from a bite or scrape from an infected coyote, or if you handle your pet after it has been attacked and the coyote's saliva comes into contact with broken skin or mucous membranes. Because rabies infections in humans are nearly always fatal, medical authorities typically recommend post-exposure immunization whenever a person comes into contact with a wild coyote during an attack.

Report any incidents of coyote aggression or attack to local authorities including your local animal control agency and the California Department of Fish & Game. Report any attacks on livestock to your county agricultural commissioner.

Coyote Removal in Suburban Areas.

Once coyotes have lost their fear of humans or have started behaving aggressively, a health and safety hazard exists. Usually it can be remedied only by removal of one or more of the coyotes. Typically, coyote removal in urban or suburban areas is conducted by predator control professionals who shoot coyotes or capture them in padded leghold traps or snares. Captured coyotes must be destroyed, as relocating problem coyotes would incur unacceptable liability and risk on the part of the agency involved, and relocation is illegal without prior approval of the California Department of Fish & Game. Management experience has shown that removal of only a few problem coyotes from a popula-

Table 2. Landscape plants having fruits or seeds often preferred by coyotes.

Common name	Scientific name
Indian laurel fig	<i>Ficus microcarpa</i> var. <i>nitida</i>
Ornamental strawberry	<i>Fragaria chiloensis</i>
Date palm	<i>Phoenix dactylifera</i>
Passion fruit, Passion vine	<i>Passiflora</i> spp.
Lychee	<i>Litchi chinensis</i>
Sugar bush	<i>Rhus ovata</i>
Strawberry bush	<i>Euonymus americanus</i>
Strawberry tree	<i>Arbutus unedo</i>
Jujube, or Chinese date	<i>Ziziphus jujuba</i>
Brush cherries	<i>Eugenia</i> spp.
Elderberry	<i>Sambucus</i> spp.
Avocado	<i>Persea americana</i>
Fig	<i>Ficus carica</i>
Guava	<i>Psidium guajava</i>
Loquat	<i>Eriobotrya japonica</i>

tion will reinstall fear of humans in the remaining population, often solving coyote problems in that locality for months or even years. Because other coyotes quickly move in to occupy vacant territories, removal of several animals has no long-term impact on coyote numbers.

Following coyote removal, local agencies or authorities should evaluate the entire neighborhood and recommend preventive measures that homeowners should take in order to make the area less attractive to coyotes, thus preventing recurrence of the problem.

Coyote Removal in Rural Areas. In semi-rural settings or in agricultural lands, coyote damage to livestock, drip irrigation systems, and other resources often cannot be solved by habitat management or livestock management efforts alone. Professional assistance is usually required to remove the responsible coyotes as selectively and as efficiently as possible.

Wildlife management specialists employed by United States Department of Agriculture Wildlife Services or by individual counties are available to assist landowners in most areas within California. Contact your county agricultural commissioner to obtain

a referral, telephone the United States Department of Agriculture, California branch of Wildlife Services at 916-979-2675, or see their Web site, <http://www.aphis.usda.gov/ws/ca>. Wildlife Services professionals have experience in dealing with problem coyotes, which can be wary and difficult to capture. They can also use certain tools and methods that are not generally available to the public. There are also private "nuisance" wildlife control firms in some areas that specialize in dealing with suburban wildlife problems.

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Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, lakes, and rivers. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down sink or toilet. Either use the pesticide according to the label or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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