Part 1

Living with Our Wild Neighbors
HUMAN BEINGS MAY NEVER HAVE a better chance to live in harmony with wildlife than they do now. For most of the time we have spent on the North American continent, we have used (and often abused) the wild animals who live among us. Today, we no longer depend on them for food or fur, and the notion that they exist solely to provide recreation and diversionary pleasures for our kind is discredited. Once-decimated populations are recovering and on the move into what common sense would argue are the least likely places to offer hospitality—our cities and towns. To wild animals, an opportunity is an opportunity, and if we grow plants they like to eat or offer shelter in uncapped chimneys, that is fine by them. We now meet them again, after so many years of estrangement and unfamiliarity, hoping that it is with the understanding and the will to harmonize our lives with theirs.

Once we viewed wildlife as a “resource” there for the taking; now we see wild animals as members of living communities to which we also belong. These communities work in complex ways to form ecosystems, about whose well-being we have become urgently concerned. In acknowledging that concern, we are encouraged to reject an anthropocentric perspective (the idea that humans are the center of the living world) and accept a biocentric one (embracing the idea that we are a part of, not apart from, other living things). In turn, this leads us to give ever greater moral consideration to the animals and the environments that sustain us all.

Still, our lives are not likely ever to be free of conflicts with wild animals. In fact, as our population grows and expands, conflicts are likely to continue to arise. This does not mean, however, that we must choose lethal solutions in seeking to resolve them. It is not right to kill problem-causing wildlife simply because it is within our power to do so.

This book is about humane solutions to conflicts between humans and wild animals. It advocates humane solutions as morally and ethically correct concepts, grounded in logical, durable, and environmentally responsible tenets. The approach we advocate rests on three organizing principles:

- Respect for the environment
- Tolerance and understanding of living things
- Intent to resolve conflicts using nonlethal means.

The term “environment” means different things to different people. To us at The Humane Society of the United States, it means a community of living things and the processes that sustain it. Respect for the environment tends to encourage us to intervene less often with natural processes and practice more often the art of patience in allowing natural laws to resolve conflicts. There are great powers in natural systems that human beings cannot control at all, and lesser ones that we can, but should not. The foundation of the humane approach is in working with natural processes rather than against them.
Tolerance and understanding are necessary prerequisites to fostering respect for the environment. Respect is essential to fostering the intent needed to commit to nonlethal conflict resolution. People are insatiably curious about the world, and this curiosity can be used in many positive ways. A small start would be to reject irrational fear of wild animals. No life should ever be taken out of ignorance and misunderstanding.

For many reasons human beings cannot currently resolve every human-wildlife conflict using nonlethal means. It is possible, however, to address each conflict intending to do so. We really have only just begun to investigate and understand the considerable arsenal of ideas, tools, and techniques at our disposal to resolve conflicts with wild animals without causing them, us, or the environment harm. Voices ranging from Walt Whitman’s to Albert Einstein’s have spoken with concern that human beings’ technological capability seems to outstrip our ability to grasp the moral implications of its use. That is certainly true with respect to how easily, and how completely, we can use lethal methods against wild animals. The ease and expediency of lethal controls demand that a much greater effort be expended to advocate and adopt the nonlethal.

We have gathered the information in this book to help argue that point. Humane approaches to dealing with wildlife will not be created because we compose and publish books, brochures, or videos on the subject. They will only come about from the intent of a majority to adopt change. Some of the signs pointing toward this possibility are encouraging, others are not. It is our commitment to our wild neighbors to continue working to create a world in which we all can live in harmony.
CONFLICTS WITH WILDLIFE CAN occur in many different contexts and at many different levels. A homeowner may find a squirrel has taken up residence in the attic or that deer are eating plants in her garden. A neighborhood may find it has a shared conflict with crows using a winter roost or geese camped out on the local ball field. This book is primarily concerned with encounters between homeowners and the wild animals who find their way into our yards, gardens, and houses, but in the context of the larger issues that engage us as a society in our interactions with wild animals. Whether a problem is small or large, there is logic to approaching it in steps that begin before action is taken as well as after action occurs.

Common sense is really what wildlife problem solving is all about, but we can call upon concepts from the field of integrated pest management (IPM) to guide our thinking. IPM has evolved from a decision-making process that emphasizes the least harmful or environmentally damaging approaches to solving conflicts. It is focused primarily on insects and their control, a field in which the term “pest” is deemed more acceptable than when dealing with birds and mammals. If we change the term “pest” to “problem animal,” the IPM approach becomes a sensible and reasonable strategy for all situations. The following steps illustrate an integrated problem animal management approach.

Define the Problem

The first step for anyone who experiences a conflict situation with a wild animal in or around his home is to ask: Do I really have a problem? Many times, the “problem” is really a misunderstood natural behavior. A fox walks through a yard one afternoon. A bat flies overhead at dusk. Does the animal have rabies? Will the animal attack me or my pets? Flocks of starlings are landing on my lawn. Are they damaging it? A little knowledge of such animals’ benign behaviors can reassure an inexperienced homeowner that no threat exists.

Identify Damage

Suppose there is a problem and that it involves property damage or destruction. Where and when is the damage occurring? What species is causing it? How long has it been occurring? It is absolutely necessary to determine the species involved, the extent of damage, whether there are young animals present, and what environmental factors (such as available food or shelter) contribute to the intensity of a conflict with a particular species (Figure 1). Damage assessment is critical in determining the action to be taken or whether any action is needed at all (Figure 2).
Evaluate the Situation

How serious and/or extensive is the problem? Are there immediate safety or health risks to people or pets? Is the amount of damage insignificant? Real, but acceptable? Beyond acceptance? Likely to reoccur, or limited to a one-time occurrence? Noticeable damage often takes years to develop. Does discovery of damage necessitate trapping and relocating or killing animals? Even if an animal is causing some damage, is it enough to be classified as a problem or demand a solution? Timing is a key component of damage assessment: many problems with animals are of short duration or occur only during certain seasons.

Take Action

Only after the facts have been collected and evaluated should the need for action, the type of action necessary, and the timing of that action be considered. People often take direct action immediately after discovering a “problem,” leading, tragically, to the suffering or unnecessary death of animals whose crimes did not merit punishment. Taking action to resolve conflicts with wildlife does not mean the action has to be lethal. Exclusion, repellents, changing human cultural practices, and habitat modification are all examples of non-lethal actions described in this book. If lethal action has occurred, as it often does because

Figure 1 The typical dwelling and yard can provide abundant resources for wild animals. Backyard ponds (A) attract many species of birds and mammals to drink or search for food, while flower (B) and vegetable (C) gardens and fruit trees (D) often tempt animals with promises of meals. More tempting may be spilled seed from bird feeders (E) or unsecured trash cans (F).
people act before they stop to think, then nonlethal actions can still be crucial to prevent problems from reoccurring.

**Assess the Action Taken**

Has the action taken permanently resolved the problem? If not, how can the problem be prevented from reoccurring (Figure 3)? Frequently, whether or not action has been taken, the cause of the problem has remained untouched, making it necessary to deal with its symptoms time and time again. If lethal action has been taken, only evaluating the problem and taking steps to correct it can prevent reoccurrence (of both the lethal action and the problem itself).

These steps are not complex or difficult to understand or follow. With use they are no longer “steps” to remember but what they really are, a commonsense process. This common sense can lead to better resolution of human-wildlife conflicts, and it can prevent a great deal of suffering and unnecessary death.

**Figure 2** Is it raccoon, squirrel, or deer damage, or damage by some other species? Identifying the species causing a problem is an essential first step in wildlife conflict resolution.

**Figure 3** Humane wildlife conflict resolution begins with prevention. This unsecured vent cover is an obvious invitation to a wild animal to explore the space under this building and, logically, finding it safe and dry, consider denning there. Inspection and repair are crucial before problems occur.
Some knowledge of the law is critical when seeking to resolve conflicts with wildlife, not only because homeowners need to protect themselves from inadvertent violations, but because good laws can help protect animals as well. Even many non-lethal solutions emphasized in this book may have legal implications. For example, under state law it might be illegal for a homeowner to live-trap and relocate a problem animal. Even putting up a fence to exclude wildlife from a yard may be prohibited by a local ordinance, neighborhood covenant, or homeowners’ association rule.

We provide a brief overview of some of the laws in the United States concerning wildlife conflict resolution. The HSUS recommends that homeowners consult other sources, such as local wildlife rehabilitators or state wildlife agency personnel, for detailed information on statutes and regulations that may apply to wildlife. It is the homeowner’s responsibility to know applicable federal, state, and local law; unintentional violations of the law are violations nonetheless. If wildlife is treated in a manner that may be unlawful, the appropriate state agency or local animal-control department should be contacted immediately.

Although navigating through the legal maze may seem to be a daunting task, the process can be made somewhat easier by breaking down the laws by jurisdiction. At the top rung of the ladder are federal laws and regulations; state laws and regulations form the next rung. Both federal and state laws cover broad areas, and each state usually has a law closely related to the federal one on the same topic. Under state laws are local laws and ordinances of counties and municipalities. Finally (but still very important for those who live in certain neighborhoods) there are homeowner association’s rules, which can also play a big role in how members interact with wildlife.

A state law can never lessen the requirements in a federal law; it can only make them more stringent. This is an important point to remember, because even if you satisfy the requirements of a federal law, you still might be violating a related state law. The key to ensuring that you do not violate any law or regulation is knowledge.

Federal Law

Federal laws are codified in a publication called the United States Code (USC). If you see a reference to “USC” (e.g., 42 USC § 4332, which refers to part of the National Environmental Policy Act), you know you are dealing with federal law. Federal regulations are codified in a publication called the Code of Federal Regulation (CFR) (e.g., 40 CFR §§ 1500, et seq describes the regulations that implement the National Environmental Policy Act). Each state similarly codifies its laws and regulations in its own publications. These laws and regulations create requirements to be followed to ensure that a homeowner’s actions are legal. We mention specific examples here of important federal laws that affect urban and subur-
ban dwellers. Be aware that others, such as those covering endangered species and wetlands, for example, may have important implications for how people interact with wildlife in or near cities.

**The Migratory Bird Treaty Act (MBTA)**

Perhaps the easiest law to violate inadvertently when dealing with human-wildlife conflicts is the Migratory Bird Treaty Act (MBTA). The MBTA makes it unlawful to pursue, hunt, take, capture, or kill migratory birds or to destroy any migratory bird nest or egg, unless such action is specifically permitted. For example, it is technically a violation of the MBTA to capture (or remove) a chimney swift, or her nest, from a chimney unless authorized by the U.S. Fish and Wildlife Service (USFWS).

The MBTA protects hundreds of native bird species that nest in or migrate through the United States. Some, such as woodpeckers, do not migrate at all, but still are afforded full protection. Only a very few bird species, particularly house sparrows, pigeons, and starlings, are not protected by the MBTA. These birds may be protected by state laws, however.

A property owner has no constitutional right to kill or harm federally protected migratory birds (or other wildlife) to protect property. Instead, a property owner seeking relief from bird damage must apply to the USFWS for a federal permit, even for such nonlethal methods as relocation. A commercial animal-control company is also required to have a federal permit. If a homeowner plans to seek assistance from a commercial operator, she should make certain the operator has any necessary state licenses and any required federal and state permits.

**The Federal Insecticide, Fungicide, and Rodenticide Act**

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) regulates pesticide safety and use. It not only regulates pesticides that kill wildlife (products that The HSUS does not recommend), but also regulates repellents and some other nonlethal methods. Both the Environmental Protection Agency (EPA) and state agencies regulate the use of pesticides, requiring them to be registered in accordance with FIFRA. Although a pesticide might be in compliance with FIFRA requirements, a state may limit or ban that pesticide outright. People who use the pesticides, poisons, and even repellents must do so in strict adherence to the instructions on the product label. The use of any registered pesticide in a manner inconsistent with its labeling violates federal—and possibly state—laws.

**State and Local Law**

Although federal and state laws protect most birds, endangered species, and other select groups (marine mammals are one good example), an individual state law typically protects other resident wild animal species.

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**Laws versus Regulations**

Laws, also called statutes, are different in nature and form from regulations. The U.S. Congress or state legislatures pass broad laws that are applicable to the public at large. Laws very frequently state policy and general restrictions yet are not very specific in detail. That is where regulations come into play. Regulations implement laws by giving details and explaining how the laws apply to individuals. Government agencies, such as the U.S. Department of the Interior or a state’s Department of Natural Resources, which are part of the executive branches of federal and state governments, establish and enforce regulations. Federal regulations are codified and published in the Federal Register and state regulations in similar official state publications.
State laws can be a mixed bag, as many originate from the special protection and favor accorded to “game” species, protected at some times of the year so that they can be killed legally at others. Wildlife law is evolving rapidly, if somewhat painfully, for those who wish to see greater protection.

State Animal-Control Laws

Often several different state agencies are responsible for overseeing different aspects of human-wildlife conflicts. State fish and wildlife, health, and agricultural departments are the ones most commonly involved. Because no two states regulate interactions with wildlife in the same way, a necessary first step is contacting the proper agency—before taking any action—as a precaution against inadvertent violations of the law. The agency whose name includes “wildlife” or “natural resources” is most often the best place to start.

In recent years some states have passed laws and issued regulations concerning species thought to carry diseases such as rabies. Generally, these laws and regulations prohibit homeowners and licensed animal-control agents alike from live-trapping and relocating certain animals identified as belonging to rabies vector species (RVS). Some states require that any live-trapped RVS be euthanized but may offer the option of releasing the animal on site—which is our preferred approach. Some allow an animal to be moved a certain distance, but no farther, before release, while others demand a trapped RVS to be kept under quarantine for a specified number of days before allowing relocation. Some states prohibit unlicensed live-trapping altogether. If it seems these rules are all over the map and rely more on personal opinion than scientific guidance, we agree. These laws and regulations may also change frequently, so it pays to check often.

States may classify other wildlife species as protected nongame species. In many states, for example, bats are now protected and may not be harmed except under specified conditions. Unprotected animals, such as Norway and roof rats, mice, gophers, and moles, sometimes referred to as “vermin” or “pests,” can usually be killed, captured, or otherwise controlled without special authorization from the state wildlife department. But even though these species are unprotected, safe and humane methods are available and should be used when these animals cause problems for people.

State Hunting and Trapping Laws

State hunting and trapping laws may also determine how and when certain animals can be controlled. For example, in some states beaver are classified as a game animal that may be trapped or hunted only with a valid license during the state’s trapping and hunting seasons. At all other times, beaver and other furbearers, as well as game animals such as deer, may be protected and only be killed or removed under conditions set by the state wildlife agency. Because hunting and trapping laws vary from state to state, it is important to contact the state wildlife department to determine the legal status of a particular species before taking action.

State Anti-Cruelty Laws

State anti-cruelty statutes arguably give some protection to otherwise unprotected species, like rats and mice, depending on the statute. Generally, these laws make it unlawful to intentionally kill, mutilate, torment, torture, or cruelly beat any animal. All fifty states, and the District of Columbia, have anti-cruelty statutes. In most states, all animals, including wildlife, are protected; however, many wildlife-control operators have any training or even meet competency standards to obtain a license or practice wildlife control. Therefore, it is always the homeowner’s responsibility to ensure that the operator is knowledgeable and can offer a range of nonlethal, humane options for remedying the conflict.
statutes exempt certain activities from the definition of cruelty. For example, hunting, trapping, accepted animal husbandry practices, the use of animals in laboratory research, and even “pest” control are specifically exempted under anti-cruelty statutes in some states or are legal because other laws authorize them. If a wild animal is killed in a manner that does not fall within the definition of legal hunting or trapping, the act may be prosecuted as cruelty. For example, killing a deer with a neck snare or a skunk with a bow and arrow may warrant a cruelty charge even if state wildlife laws are silent on the matter.

State wildlife laws are changing, and anti-cruelty statutes are starting to be applied to wildlife “control” methods that courts and legislatures have found to constitute cruelty. Some common and, we believe, especially cruel methods of killing captured wildlife include drowning and injecting industrial solvents into animals’ bodies. While this area of law is still evolving, criminal prosecution of wild animal-control practices that involve cruelty are becoming more common.

**Local and Municipal Laws**

Local and municipal laws (often called ordinances) and neighborhood association rules (often called covenants or community restrictions) may further restrict the methods of animal control permitted in that location. For example, in many jurisdictions it is illegal to fire a gun in residential areas. Shooting troublesome raccoons in the backyard would not be legal in these locations regardless of state or federal law regulating interactions with animals. Some communities prohibit certain poisons and traps or strictly limit their use. Noise-making devices used to scare animals may be prohibited by local ordinance or a homeowner association covenant because they are just too noisy for neighbors to tolerate. Even putting up a fence may not be allowed in some locales or neighborhoods, or the types of fencing allowed may be limited or subject to review.

To ensure that you are complying with all applicable laws and regulations, you may need to consult your humane society, university extension service, game warden, or state wildlife department.

**Resources**


Federal laws are available for all topics and agencies at [www.gpoaccess.gov](http://www.gpoaccess.gov). To find a specific state’s wildlife agency, visit this U.S. Fish and Wildlife Service webpage: [www.fws.gov/offices/statelinks.html](http://www.fws.gov/offices/statelinks.html).

The Center for Wildlife Law at the University of New Mexico Law School ([http://ipl.unm.edu/cwl/home.html](http://ipl.unm.edu/cwl/home.html)) is an important resource to consult for anyone interested in wildlife law, as is the Animal Legal Defense Fund ([http://www.aldf.org](http://www.aldf.org)).

A good example of animal-friendly community covenants and restrictions can be found at the website for Harmony, a planned community outside of Orlando, Florida: [http://www.weliveinharmonyfl.com/pdf/cahwc007.pdf](http://www.weliveinharmonyfl.com/pdf/cahwc007.pdf).
Health Concerns in Dealing with Wildlife

Wildlife diseases are becoming recognized more commonly as important issues when considering human health. West Nile Virus, monkey pox, severe acute respiratory syndrome (SARS), and raccoon rabies, for example, are newly recognized or reemerging wildlife diseases that potentially or actually affect humans in ways that cause concern. Many factors contribute to this trend, but one of the most notable is urban sprawl. As humans encroach on natural wildlife habitats, contact between wildlife and humans increases, which heightens the risk of exposure to diseases that can infect both wild animals and humans.

The ecological consequences of human-dominated landscapes have touched off a cascade of effects throughout natural communities. For example, the emergence of Lyme disease in suburban communities results in part from growing populations of host species where natural predators and competitors, more sensitive to landscape changes, may have been eliminated. High densities of white-footed mice, a key host for Lyme disease, increase the prevalence of the black-legged ticks, since the mice are a primary host for the larval and nymph (juvenile) life stages of this arthropod. Both nymph and adult ticks may potentially bite and spread Lyme disease to humans.

Animals and humans share more than 175 known communicable diseases. The term zoonosis identifies any disease transmitted from vertebrate animals to humans. Wild animals serve as reservoirs (the disease-causing agent lives and multiplies without damaging its host) for many zoonoses. Many diseases controlled by preventive health programs in domestic species (e.g., vaccinations for leptospirosis) go largely unchecked in wild animals.

Zoonotic diseases can be transmitted directly by contact with an animal or its blood, saliva, urine, or feces or indirectly by air, soil, and water contaminated with the infectious agent. Domestic animals may also be infected by contact with wildlife and subsequently expose human beings. Arthropod vectors, such as ticks and mosquitoes, also play an important role in transmitting diseases from wildlife to people.

Avoiding direct contact with wild animals is always advisable. When they must be handled, it should be by experienced and properly equipped individuals. For the average individual, indirect contact with wildlife disease agents or interactions with arthropod vectors (transmitters of pathogens) are likely to be much more frequent than actual direct exposure to infested animals. However, wildlife rehabilitators, researchers, veterinarians, and animal-control personnel are at increased risk of direct exposure to these diseases and should take additional precautions.

Most of our attention in this chapter focuses on awareness and prevention, the front line of defense against common wildlife-related diseases. Our intention is not to alarm or frighten but to cultivate an understanding of and respect for potential means of disease transmission and outline actions that can be
taken to avoid disease. With knowledge of zoonotic diseases, an individual can assist medical professionals in early diagnosis and treatment in the unlikely event of infection. Some uncommon but potentially life-threatening diseases are reviewed to emphasize the importance of preventing them. In any situation where a person or companion animal may have been exposed to a zoonotic disease, one should consult a private physician or veterinarian and public health officials.

**Infection from Physical Injuries**

When a wild animal is held against her will, she will use all available defenses to resist restraint. Without proper restraint techniques and equipment, the person restraining her is likely to be bitten, scratched, or otherwise injured.

If you are bitten or scratched, immediately clean the wound by scrubbing thoroughly with soap and water. Flush liberally with clean tap water if sterile solutions are unavailable. Proper early scrubbing and irrigation significantly reduces the chance that the wound will become infected. Wounds should be cleaned again with iodine or chlorhexidine-based solutions and irrigated liberally under medical supervision.

A physician or veterinarian should examine all wounds caused by a wild animal. Puncture wounds are often more serious than may appear at the skin surface and usually require antibiotic therapy. Discuss your tetanus immunization history with your health-care provider. The risk of infection from a penetrating animal bite ranges from 5 to 15 percent if expedient scrubbing and flushing take place.

The following section describes some of the major zoonotic diseases of concern for the species emphasized in this book.

**Wildlife Diseases**

**Bubonic (Sylvatic) Plague**

(Yersinia pestis)

**Hosts**

Primarily rodents; especially commensal mice and rats. Wild rodents, including prairie dogs and ground squirrels, are also highly susceptible.

**Background**

Plague is rarely reported in the United States. When host numbers are great and are accompanied by dense flea populations, periodic outbreaks occur. Ninety percent of cases originate in New Mexico, Arizona, California, and Colorado. These outbreaks kill many rodents, which subsequently can increase the possibility of exposure for pets and humans as fleas look for alternate hosts. Bubonic plague is primarily a flea-transmitted disease but can be acquired through direct contact with infected animals and their tissues, or by inhalation. Feral and free-roaming domestic cats in endemic areas (places where the disease is prevalent) have been sources of infected fleas that transmitted plague to humans.

**Clinical Disease and Symptoms**

After a two- to six-day incubation period, the infection starts at the site of the flea bite. Characteristic symptoms include fever, headache, chills, muscle pain, weakness, fatigue, and upset stomach. In bubonic plague lymph nodes enlarge, forming “buboes” (hence the disease’s name), especially near the first exposure. The same bacterium also causes the rarer yet much more dangerous pneumonic plague, which may be transmitted through airborne infectious droplets.

**Prevention**

It is important to educate the public in plague areas about the nature of the disease and its transmission. Rodent population control, by exclusion and habitat management, should begin before populations reach high levels. People should be aware that rodent die-offs
might signal the start of a period of special concern. They should protect themselves and their pets, especially by controlling fleas. Finally, people at high risk and people who live in plague-endemic areas should consider immunization.

**Chlamydiocosis (Psittacosis, ornithosis, parrot fever) (Chlamydophila psittaci)**

**Hosts**
More than 100 free-living bird species are potential reservoirs, especially pigeons and mallard ducks. This disease is most commonly spread to humans through pet birds and domestic poultry.

**Background**
Chlamydiocosis exists worldwide and has long been described as a bird-to-human zoonosis. Though the majority of reported cases are associated with captive parrots and their relatives or poultry, direct contact with birds of any origin can increase risk for contracting the disease. The primary mode of transmission is infected excretions (feces). When dry, *Chlamydophila psittaci* bacteria become aerosolized (disperse as a suspension of fine particles from the air) and easily inhaled. Only a few infectious particles can cause infection in the respiratory tract.

**Clinical Disease and Symptoms**
The incubation period varies but generally is five to nineteen days. The less severe form of chlamydiocosis can easily be discounted by sufferers as a mild respiratory virus. Headaches, fever, chills, and upper respiratory infections are found in 90 percent of cases.

**Prevention**
Education about potential exposure and mode of transmission is important, especially for those who frequently come into contact with or handle birds. Good personal hygiene, protective clothing, and minimal exposure to exudates and feces from birds are important means of prevention. Quaternary ammonium compounds are recommended for disinfection. Spraying contaminated areas with quaternary ammonium compounds limits aerosolization of infectious particles and minimizes risk of infection.

**Giardiasis (Giardia lamblia, aka G. intestinalis)**

**Hosts**
Giardiasis is widespread, especially among aquatic species, often associated with raccoons, beaver, and waterfowl.

**Background**
Giardiasis is caused by a one-celled flagellated organism (protozoan, *G. lamblia*) and is the most common human parasite in the United States, estimated at 4.8 percent overall prevalence in the general human population. Children, due to their common lack of good personal hygiene, are approximately three times more likely to be infected than are adults. Some debate remains over the significance of *Giardia*’s disease-causing abilities, even in the face of a number of reports implicating it as a cause of diarrhea.

*Giardia* of human origin can be transmitted to several wildlife species and vice versa. Infected humans, who pass millions of infective cysts per day, are the single most common reservoir. Humans become infected by accidental ingestion of the cysts through water or food contaminated with fecal material. Direct handling of infected wildlife or exposure to feces-contaminated surfaces (such as cages) or water predisposes individuals to becoming infected with this parasite.

**Clinical Disease and Symptoms**
After a week-long incubation period, *Giardia* often remains a subclinical infection causing no noticeable symptoms. When noticeable, it is characterized by a variety of intestinal symptoms such as recurrent chronic diarrhea, flatulence, and abdominal discomfort. In the majority of cases, symptoms disappear in two to six weeks.
**Prevention**

It is essential to practice good personal hygiene, including frequent hand washing. Gloves should be used when handling potential reservoir species. Never consume untreated or unprocessed water, even if the source is assumed to be pure. Carry water on camping trips or process groundwater through approved filtering devices that will remove *Giardia* cysts. Boiling water for at least one minute or more is one way to ensure that untreated water is free from *Giardia*.

**Hantaviruses**

*Sin Nombre* (Spanish for no-name) virus (SNV), *Black Creek Canal virus*, *New York virus*, *Bayou virus*, and several other serologically distinct viral types in the New World

**Hosts**

In the New World, rodent species in the subfamily *Sigmodontinae*, including deer mice (*Peromyscus maniculatus*), cotton rats (*Sigmodon hispidus*), white-footed mice (*Peromyscus leucopus*), and rice rats (*Oryzomys palustris*), are known carriers of hantavirus pulmonary syndrome (HPS). In the Old World, hantaviruses manifest themselves in the form of hemorrhagic fever with renal syndrome (HFRS).

**Background**

In the 1980s hantaviruses were found in rodents in the United States but were not associated with human disease. However, the first outbreak of human disease was diagnosed in 1994 in the Four Corners area of the southwestern United States. Rodents maintain hantavirus as a persistent infection, shedding the virus in urine, feces, or saliva, and do not exhibit overt signs of illness. Humans become infected by inhaling small particle aerosols (dust) of virus-contaminated feces, urine, or saliva. Rodent bites may be another avenue of virus transmission.

**Clinical Disease and Symptoms**

After initial exposure, hantavirus incubates for two to four weeks before disease ensues. Previously healthy individuals suddenly develop symptoms of headache, fever, muscle pain, and dry cough. The first symptoms mimic a typical upper respiratory virus; however, these flu-like symptoms rapidly progress to acute pulmonary insufficiency (reduced blood flow to the lungs), indistinguishable from adult respiratory distress syndrome. Within days of onset, the patient can die from respiratory failure.

**Prevention**

The first step in disease prevention is educating communities about hantavirus transmission and prevention. The goal is to modify rodent habitat by preventing access to human dwellings and reducing rodent shelter and food sources. Controlling rodent populations near buildings by trapping or poison will only address the problem temporarily; habitat modification and exclusion must be the principal line of defense.

If someone must work in a rodent-infested place, protective clothing, including thick rubber gloves and appropriate respiratory protection, should be worn. Disinfect working surfaces or old areas of contact with a solution of household bleach (one part bleach to forty parts water) or with any Environmental Protection Agency (EPA)-approved, hospital-grade disinfectant used according to manufacturer’s instructions.

**Histoplasmosis**

*Histoplasma capsulatum*

**Source**

This fungus grows in soil and material covered in bird and bat droppings.

**Background**

Histoplasmosis cannot technically be considered a true zoonosis but must be designated as a saprozoonosis (environmentally acquired disease). Soil enriched with bird or bat droppings that encourage the fungus’s growth is the primary reservoir; especially if the roost has been used at least three to five years. Histoplasmosis has frequently been linked to roosting sites of birds and bats.
Winter assemblages of blackbirds, nesting gull colonies, pigeon roosts, and bat-roosting areas such as caves, mines, or bridges have all been point sources of environmental histoplasmosis. In all of these instances, the animals’ excrement enriches the soil, promoting the growth of *Histoplasma capsulatum*. Birds display a remarkable resistance to infection but do transport the fungus. Bats can become ill and transport the fungus. Transmission is through inhalation of spores.

**Clinical Disease and Symptoms**

After inhalation of the spores, *H. capsulatum* usually causes disease that is not easily apparent. While infection is common in endemic areas, overt disease is not. In fact, in areas where this fungus is common, up to 80 percent of residents may test positive to a skin test. Children, the elderly, individuals with chronic lung disease, and people with compromised immune systems are most likely to exhibit severe clinical symptoms, which range from a mild hypersensitivity (such as an allergic reaction) to a disease-mimicking chronic pulmonary tuberculosis.

**Prevention**

The best line of defense in preventing exposure is to minimize potential contact by avoiding soil contaminated with either bird or bat droppings. If it is necessary to be in such areas, wear boots and use an appropriate mask or self-containing breathing apparatus.

**Leptospirosis (Spirochete bacteria of the genus Leptospira)**

**Hosts**

Skunks, raccoons, opossums, Norway rats, mice, and white-tailed deer are host species. Livestock and pets are also common carriers.

**Background**

Striped skunks, raccoons, and rodents are significant reservoirs for leptospirosis, with infection levels greater than 50 percent in some populations. In these species the bacteria commonly stay in the kidneys, where they cause slow, chronic pathologic changes and are shed for long periods of time. Transmission occurs by direct contamination of mucus membranes or broken skin by infected urine. Indirectly, leptospirosis can be acquired through contaminated soil and water. Leptospires can survive for three months in alkaline stagnant or slower-moving water.

**Clinical Disease and Symptoms**

The incubation period may range from two to twenty-nine days. Fever, headache, chills, weakness, vomiting, muscle pain, rash, and jaundice, or a combination of these, are noted early in the disease; in more severe infections, liver failure, kidney damage, blood disorders, meningitis, and respiratory distress may be present. Untreated severe cases can result in death.

**Prevention**

Avoid mucous membrane and skin exposure to the urine of wild animals while handling. Protect skin by wearing gloves, boots, and clothing that minimize contact with surfaces contaminated with urine. Use good personal hygiene following any potential exposure. Clean contaminated areas with common household disinfectant. Avoid swimming and recreational activities in bodies of water known to be contaminated. Vaccinate dogs for the prevalent type found in the wildlife of that geographic area.

**Lyme Disease (Borrelia burgdorferi)**

**Hosts**

In the United States, hosts are primarily white-footed mice (larvae, nymphal, and occasionally adult stages) and white-tailed deer (adult stage).

**Vectors**

Two species of Ixodid ticks are the primary vectors: *Ixodes scapularis* (formerly called *Ixodes dammini*) in the eastern and midwestern United States and *I. pacificus* in California.

**Background**

Lyme disease is a spirochete bacterial disease transmitted by the bite of a nymph or adult
tick, causing debilitating illness in humans. The disease is carried by small animals, most notably white-footed mice (*Peromyscus spp.*). Larvae or nymphs become infected with the bacteria when they feed on these mice and store the bacteria in their gut for life. It is these infected nymphs and adults that may spread this disease to humans and their pets.

In the United States, the disease was recognized in Lyme, Connecticut, in 1975, but it had been recognized in the Old World since the early 1900s. Lyme disease gained national attention in the 1980s when the infectious agent was first isolated and named and doctors were required to report cases. Throughout the 1980s, more cases were reported each year. Now more than twenty thousand cases are diagnosed annually. Lyme disease has quickly gained the distinction of being the most common tick-borne disease in the United States. The majority of cases occur in the northeastern Atlantic seaboard states and the upper Midwest (Minnesota and Wisconsin). Cases have been reported less commonly but regularly in the remaining states. Most cases of Lyme disease are acquired in June and July when nymphal ticks’ peak activity corresponds with increased human activity outdoors.

**Clinical Disease and Symptoms**

When a nymph or adult tick feeds on a human, it must be attached for at least twenty-four to eighty-eight hours before infection can occur. In 70–80 percent of cases, a characteristic bull’s eye rash, the erythema migrans, develops in four to forty days. This rash clears in the middle as it expands up to twelve inches in diameter over several days.

Initial symptoms include fever, muscle pain, lethargy, headache, joint aches, and swollen lymph nodes. Even if left untreated, many of these symptoms may clear up on their own. In about 60 percent of untreated cases, arthritis, swelling, and pain of the large joints, especially the knee, occur within months of infection. Bouts of subtle nervous system disease such as memory loss, drowsiness, or numbness and tingling of the hands and feet may occur in about 5 percent of untreated cases. A small percentage of people may continue to exhibit symptoms months or years after infection, even after treatment with antibiotics.

**Prevention**

To avoid exposure to Lyme disease, eliminate contact with ticks. One way to do this is simply to avoid tick-infested areas, especially between May and July. When this cannot be done, wear light-colored, long-sleeved shirts and pants, tuck pant legs into socks, and conduct frequent tick inspections of clothing and body (every three to four hours). Be sure to check the hairline and inconspicuous and hard-to-reach areas with special care. Tick repellents used on clothing may also be effective. Remove attached ticks without crushing them and scrub the wound thoroughly. Tick and flea preventive medications on companion animals can minimize the risk of exposure to ticks that first attach to those animals.

**Rabies (in the genus *Lyssavirus* along with a number of bat viruses)**

**Hosts**

Any mammal can carry rabies, but the primary carriers in North America are raccoons, striped skunks, bats, foxes, and coyotes.

**Background**

Rabies is a rapidly progressive and commonly fatal viral disease that produces incurable encephalitis in humans and other mammals. With rare exception, it is transmitted by the bite of an infected mammal. The rabies virus has seven distinct strains that affect mammals other than bats, as well as a number of distinct variants, each associated with a particular bat species. This helps explain why different species are primary carriers of the disease in different geographic areas. Other less commonly infected species such as woodchucks usually become infected with rabies as a result of a “spillover” from the dominant carrier who often serve as “dead-end” hosts not transmitting the virus. Rodents in general tend to be dead-end hosts in that they typically succumb to this disease before having the opportunity to spread it.
Table 1 — Quick Reference to Human Health Concerns in Dealing with Wildlife

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>WILDLIFE HOST(S)</th>
<th>PRIMARY MODE OF TRANSMISSION</th>
<th>PREVENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUBONIC PLAGUE</td>
<td>Prairie dogs, ground squirrels</td>
<td>Flea infestations, inhalation</td>
<td>Public education, rodent population control</td>
</tr>
<tr>
<td>CHLAMYDIOSIS</td>
<td>Birds (esp. pigeons, mallards)</td>
<td>Contact with feces, inhalation</td>
<td>Good hygiene, protective clothing</td>
</tr>
<tr>
<td>GIARDIASIS</td>
<td>Widespread, esp. aquatic</td>
<td>Ingestion</td>
<td>Good hygiene, especially hand washing</td>
</tr>
<tr>
<td>HANTA VIRUS</td>
<td>Rodents</td>
<td>Inhalation or bite</td>
<td>Public education, habitat modification/exclusion</td>
</tr>
<tr>
<td>HISTOPLASMOSIS</td>
<td>Soil (esp. roosting areas) exposed to birds, bats</td>
<td>Inhalation</td>
<td>Avoid known roosting areas</td>
</tr>
<tr>
<td>LEPTOSPIROSIS</td>
<td>Numerous mammals</td>
<td>Ingestion, broken skin</td>
<td>Avoid handling and exposure to urine, practice good hygiene</td>
</tr>
<tr>
<td>LYME DISEASE</td>
<td>White-footed mouse, white-tailed deer</td>
<td>Tick vector</td>
<td>Avoid tick-infested areas, wear protective clothing</td>
</tr>
<tr>
<td>RABIES</td>
<td>Primary carriers: raccoons, skunks, bats, foxes, coyotes</td>
<td>Animal bite</td>
<td>Avoid contact; treatment regimen if bitten</td>
</tr>
<tr>
<td>RACCOON ROUNDWORM</td>
<td>Raccoons</td>
<td>Exposure to feces or contaminated soil</td>
<td>Avoid exposure to feces or likely infected areas</td>
</tr>
<tr>
<td>ROCKY MOUNTAIN SPOTTED FEVER</td>
<td>Rabbits, rodents, opossums</td>
<td>Tick vector</td>
<td>Avoid tick-infested areas, wear protective clothing</td>
</tr>
<tr>
<td>SALMONELLOSIS</td>
<td>Widespread: reptiles, birds, mammals</td>
<td>Ingestion</td>
<td>Hygiene, disinfection</td>
</tr>
<tr>
<td>TULAREMIA</td>
<td>Rabbits, rodents</td>
<td>Tick, biting fly, or contaminated water</td>
<td>Good hygiene, avoid contaminated areas</td>
</tr>
<tr>
<td>WEST NILE VIRUS</td>
<td>Primary reservoirs: birds</td>
<td>Mosquito or arthropod vector, accidental human-to-human</td>
<td>Control mosquito breeding, wear protective clothing</td>
</tr>
</tbody>
</table>
Since 1960 rabies in the United States has been reported more frequently in wild animals than in domestic species due to the success of vaccination programs. Wildlife now accounts for more than 90 percent of all reported rabies cases. Humans are considered exposed to rabies only when the virus is introduced by a bite wound to the skin or when the virus contaminates cuts in the skin or mucous membranes. Any penetration of the skin by teeth, even one that leaves little damage, is a bite exposure, and all are a potential risk for rabies, regardless of the bite severity or location. Bites of some species, especially bats, who have small teeth, may inflict only minor injury and may frequently go undetected. Nonbite exposures are much less frequent but may be a sufficient risk to consider post-exposure prophylaxis (PEP) treatment to prevent the disease. Casual contact with a wild animal, such as touching or even contact with feces, urine, or blood, typically does not merit PEP.

Though overall numbers are small, the possibility of humans becoming infected by bats, even when they are not aware they have been bitten, is a real concern for the Centers for Disease Control and Prevention. Its advice is that treatment should be considered in any situation when a bat is physically present and the individual cannot rule out a possible bite (e.g., when the individual was asleep and awoke to find a bat in the room or when individuals such as young children may not be able to report a bite reliably), unless prompt testing of the bat results in a negative rabies test.

**Clinical Disease and Symptoms**

Humans are relatively resistant to rabies. Only 15 percent of humans become infected with rabies after being bitten by a known rabid animal if they receive timely wound care. Incubation periods range from fewer than ten days to more than six years. After clinical signs appear, the virus is almost always fatal.

**Responding to Exposure**

As with any other potential zoonotic disease exposure, prompt consultation with a physician is extremely important. *Immediate medical response to a bite from any wild animal is critical.* Scrub any bite wound immediately and aggressively with soap and water. If available, use an antiseptic soap such as betadine or Nolvasan®. Flush or irrigate the wound thoroughly with water to remove organisms. A medical professional evaluating the wound and considering the offending species can determine the potential for rabies infection. It should be assumed that all bites from known rabies vector species could have transmitted rabies unless laboratory testing proves the animal to be negative for this disease. If the bite-inflicting animal can be captured safely, he should be held until animal-control agents can submit him to the local health department for rabies testing.

**Prevention**

People at risk for rabies exposure (veterinarians, animal technicians, field researchers, animal health laboratory workers, wildlife rehabilitators, or others who handle rabies vector species directly) should be protected by pre-exposure vaccination by one of three approved human rabies vaccines. Subsequent exposure to rabies after pre-exposure vaccination does not eliminate the post-exposure treatment but simplifies treatment by eliminating the need for human rabies immunoglobulin (HRIG) administration and requires only two post-exposure vaccinations, as opposed to five.

In cases of potential or known human exposure, timely post-exposure prophylaxis (PEP) has been 100 percent effective in preventing human rabies in the United States. The treatment consists of HRIG infiltrations at the bite wound when possible, with the remaining volume being injected intramuscularly at a distance from the vaccination site. In addition, five vaccinations are given in the upper arm over one month.
Vaccinating companion animals such as dogs and cats is imperative. Even in areas without one of the dominant terrestrial carriers, the potential of exposure to bats always exists. Where rabies outbreaks are occurring or the disease is prevalent in animals such as skunks, local veterinarians may recommend vaccinating horses and other livestock.

**Raccoon Roundworm (Cutaneous, Visceral, Ocular, and Neural Larval Migrans) (Baylisascaris procyonis)**

**Hosts**
Raccoons (*Procyon lotor*) are the hosts, although closely related roundworms are found in other wild animals, such as skunks and bears.

**Background**
Larval migrans is a disease process started by ingesting the eggs of the raccoon roundworm, *Baylisascaris procyonis*. The larval parasite then begins prolonged migration through and persistence in internal organs and tissues. Different syndromes are named for the primary tissue invaded: cutaneous (skin), ocular (eyes), neural (brain, spinal cord), or visceral (organs) larval migrans.

*Baylisascaris* adults live in the small intestine of raccoons, rarely causing disease. The adult worms shed up to six million eggs per day in the feces. These become infective in three to four weeks under most environmental conditions. In the Midwest 44–85 percent of raccoons are infected. High population densities of raccoons, particularly in urban environments, the high incidence of *B. procyonis* among raccoons, and the persistence of eggs in the environment for months to years increase the potential for human exposure to eggs and, consequently, to infection. People in contact with raccoons and their feces have the highest risk of exposure.

**Clinical Disease and Symptoms**
The most common form of *Baylisascaris* in humans is minor tissue damage and encapsulation of the parasite in noncritical sites such as skeletal muscle. Large numbers of the parasite, however, can lead to more serious symptoms, including organ damage, loss of coordination, exhaustion, coma, blindness, and lung conditions similar to pneumonia. Central nervous system (CNS) disease is possible if *B. procyonis* invades the brain.

**Prevention**
The key to preventing exposure to raccoon roundworm is to avoid contact with feces or areas where feces have lain. The eggs are highly resistant to environmental and chemical disinfectants and can adhere to protected surfaces and remain in soil for long periods, even years. Old wood piles used by raccoons as latrines particularly should be recognized as sources of contamination and should be removed by individuals wearing protective clothing (coveralls and gloves) to handle logs and any other exposed material. Indoor cages where raccoons have been housed and areas contaminated by feces should be cleaned and disinfected with a household bleach solution (one part bleach to forty parts water). While it does not inactivate the eggs, bleach will help remove the sticky protein coat that makes eggs adhere to most surfaces so they can be removed mechanically by washing or flushing.

**Rocky Mountain Spotted Fever (Rickettsia rickettsii)**

**Hosts**
Hosts are primarily rabbits, rodents, and opossums, but nearly all mammals are potential hosts for the tick vectors of this disease.

**Vectors**
American dog tick (*Dermacentor variabilis*) and Rocky Mountain wood tick (*D. andersoni*) are the vectors.

**Background**
Rocky Mountain spotted fever (RMSF) is not confined to western mountain states, as its name suggests, but is in fact reported more commonly in south-Atlantic states, where more than half of all incidents occur. South
Carolina and Oklahoma have the highest infection rates. Ironically, this disease is not very common in the Rocky Mountain region. The American dog tick (Dermacentor variabilis) in the east and the Rocky Mountain wood tick (D. andersoni) in the west are the primary regional vectors. In the United States, most transmission occurs between April and September. The actual infective agent of this disease is the bacterium Rickettsia rickettsii. The risk of contracting this disease from a tick is actually very low, with only 1–4 percent of all ticks serving as carriers, even in areas with high rates of human infection.

Clinical Disease and Symptoms
In human infection, a five- to ten-day incubation period is followed by nonspecific signs of disease such as lethargy and weakness that rapidly progress to fever, chills, headaches, and muscle and joint pain. Fever is the most predictable and persistent sign. The telltale petechial (spotted) rash occurs only in 45–60 percent of all cases, while 85–90 percent of all cases exhibit some sort of rash over the course of their infection.

Prevention
Measures to avoid tick contact are strongly recommended. One way to do this is simply to avoid tick-infested areas, especially between May and July. When that cannot be done, wear light-colored, long-sleeved shirts and pants, tuck pant legs into socks, and conduct frequent inspections of clothing and body (every three to four hours). Tick repellents used on clothing may also be effective. Remove attached ticks without crushing them and scrub the wound thoroughly. Topical flea and tick products or pet-safe insecticides on companion animals can minimize the risk of exposure to ticks that first attach to those animals.

Salmonellosis (Rod-shaped bacteria of the genus Salmonella, including 2,400 serotypes. Half of all cases are from the Enteriditis [SE] and Typhimurium [ST] serotypes)

Hosts
A number of species of reptiles, birds, and mammals are potential carriers of this bacterium.

Background
Salmonellosis is possibly the world’s most common zoonotic disease. It is common in raw, processed meats, although proper cooking renders it inactive. Wild animals readily pick up Salmonella contamination from their immediate environment, especially from landfills, sewage treatment facilities, poultry processing plants, and livestock feedlots. Salmonellosis is also now recognized more commonly as an emerging disease of finches and other seed-eating birds who frequent backyard birdfeeders.

Clinical Disease and Symptoms
Salmonellosis is transmitted by accidental ingestion of Salmonella-contaminated feces, which includes indirect oral contact with contaminated surfaces. After a short incubation period of six to seventy-two hours, the disease commonly causes inflammation of the intestines with sudden onset of headache, abdominal pain, diarrhea, nausea, and vomiting. Symptoms usually last five to seven days. The signs can vary from barely discernible to very severe in young, old, and immunocompromised individuals. Resulting dehydration, especially in young children, can be life threatening.

Prevention
Good personal hygiene and proper environmental disinfection are important steps in preventing this disease. Currently, non-wildlife sources make up the majority of human exposures, but precautionary measures should be taken to minimize transmission when handling wildlife or coming in contact with feces.
Tularemia (Rabbit Fever) (the bacterium Francisella tularensis)

**Hosts**
Primarily lagomorphs (rabbits and hares; *Lepus* spp., *Sylvilagus* spp.) and rodents are the hosts.

**Background**
Ticks and biting flies are the primary arthropod vectors, but this disease can also be spread through inhaling airborne bacteria, consuming contaminated food or water, or handling infected animals. Inhalation transmission can include contact with airborne bacteria from the soil during such activities as lawn mowing or brush clearing, as was the case in one outbreak.

**Clinical Disease and Symptoms**
Symptoms of tularemia include skin ulcers, swollen and painful lymph glands, inflamed eyes, sore throat, mouth sores, diarrhea, or pneumonia. If the bacteria are inhaled, people exhibit flu–like symptoms. People with pneumonia can develop chest pain, difficulty breathing, bloody sputum, and respiratory failure. Tularemia can be fatal if not treated with appropriate antibiotics. In general the death rate in untreated cases is 5–7 percent. Infection with this bacterium results in similar symptoms in pets and livestock.

**Prevention**
In areas where tularemia is transmitted by ticks or insects, insecticides and repellents can help minimize bites. Anyone handling potentially infected animals, especially rabbits, should wear impervious gloves and practice good personal hygiene. Food should always be cooked thoroughly.

West Nile Virus (in the genus Flavivirus of the Japanese Encephalitis Antigenic Group)

**Hosts**
Hosts are primarily wild and domestic birds, the disease is incidental in mammals.

**Vectors**
Vectors are primarily mosquitoes in the genus *Culex*. In the United States, West Nile virus (WNV) has been linked only to mosquito transmission.

**Background**
WNV was first reported in the United States in August 1999 with the deaths of exotic birds at New York’s Bronx Zoo. American crows and blue jays were also found dead in the area before any evidence of human infection. Before the 1999 U.S. epidemic subsided, sixty-two people were stricken with severe neurological disease, and seven died. From this small probable point of entry, WNV spread rapidly in epidemic proportions across the United States. WNV has now expanded into Canada, Mexico, and the Caribbean islands. This annually occurring disease is now well established in North America, with its prevalence depending on environmental conditions and human susceptibility. WNV and similar viruses of the genus *Flavivirus* occur in temperate and tropical areas of the Old and New Worlds. It is absent from far northern and southern areas—most of Canada, Alaska, Scandinavia, Greenland, and Antarctica.

**Clinical Disease and Symptoms**
Although recent human outbreaks of WNV have been associated with severe neuro-invasive disease, this does not tend to be the typical pattern. (In a recent outbreak, 80 percent of victims did not exhibit any clinical symptoms.) Those who do show symptoms typically exhibit the flu-like symptoms of headache, fever, and fatigue, sometimes accompanied by swollen lymph nodes, eye pain, and a rash. Several studies show approximately 1 person in 150 infected people have clinical signs of encephalitis and/or meningitis, the types of cases most frequently needing hospitalization.

**Prevention**
The most important means of controlling the spread of WNV is to limit or reduce mosquito
breeding habitats. Mosquitoes lay their eggs in stagnant water, and their larvae need this medium to survive. Therefore, it is critical to drain standing water from all outdoor containers such as buckets, flowerpots, and kiddie pools. Use screens on windows, porches, and outside aviaries. Many municipalities are using a combination of insecticides and integrated pest management to reduce mosquito populations.

While local governments work to control the spread of WNV, individuals can decrease their risk of acquiring the disease by limiting outdoor activity at dusk, wearing long-sleeved shirts and pants, using an insect repellent with 45 percent DEET® on exposed skin, applying permethrin (Permanone®) to clothing, and even using mosquito netting headgear in higher-risk situations.

**Resources**

**Health Concerns**

The information in this field is highly technical and the works cited below are not light reading. They are comprehensive and informative if you are seeking more information.


A number of excellent websites can be found on this subject as well, and on updates on emerging issues. A sampling of these includes:

- General information: 800-311-3455.
- For information about zoonoses that affect pets, check: [www.cdc.gov/healthypets](http://www.cdc.gov/healthypets).

- Morbidity and Mortality Weekly Reports. [http://www.cdc.gov/mmwr](http://www.cdc.gov/mmwr)
- Emerging Infectious Diseases. [http://www.cdc.gov/ncidod/EID/index.htm](http://www.cdc.gov/ncidod/EID/index.htm)
- Zoonosis References. [http://medicine.bu.edu/dshapiro/zooref.htm](http://medicine.bu.edu/dshapiro/zooref.htm).

We are indebted to Donald Burton, D.V.M., of The Ohio Wildlife Center for this summary and discussion of wildlife diseases. Dr. Burton has been in the forefront of investigation on wildlife diseases for many years, seeing and treating thousands of wild animals annually in his wildlife rehabilitation center. He believes that people should not be overly concerned or dramatic when confronting the issue of wildlife disease, but rather knowledgeable, cautious, and prepared. Prevention is the key here, much as it is with keeping wild animals out of houses and yards.
5

Finding Help

The homeowner faced with a wildlife problem often has no idea where to turn and, in seeking help, all too frequently can find herself following an endless trail of referrals. If she is looking for immediate assistance in resolving her problem humanely, there may be nowhere to turn. Animal-control and local humane agencies are often not able—or even permitted—to respond to nonemergency calls involving wildlife. State game and wildlife departments may not have staff who can respond either and may be located many miles away from where problems might be occurring.

If, on the other hand, the homeowner is merely seeking advice, she may feel overwhelmed by the number of sources and the disparity among suggested solutions to her problem. Local, state, and federal agencies all deal with different aspects of wildlife control, as do private wildlife-control companies, university cooperative extension services, wildlife rehabilitators, local nonprofits, and national organizations such as The HSUS. Friends, neighbors, and relatives are ready to offer advice or to pass on secondhand remedies they have heard about somewhere. All will differ, sometimes significantly, in the advice they give. To anyone who has experienced this, we offer our sympathies. In a more helpful vein, we also offer some general guidelines to follow.

Local Agencies

When a person has been bitten by a wild animal, or in other true emergencies, the local animal-control or police department is the first place to call. It can help gain access to immediate medical attention if needed and address any need to capture or control a wild animal. In nonemergency situations, the local animal shelter can also be a good source of advice—even if it cannot or does not respond itself. Referrals from these sources may lead to wildlife specialists, rehabilitators, or wildlife-control companies that can render assistance when needed. However, it is still the homeowner’s responsibility to decide whose advice to take or whom to call upon for assistance.

State Agencies

The individual states are responsible for wildlife as a public asset and for enforcing laws and regulations, where these exist, concerning so-called nuisance wildlife. Contacting state agencies can be important if for no other reason than to determine what laws are applicable. Some states (and individuals) provide good advice and direction, others less so. State extension agents, usually working out of universities, may be a good source as well. (The extension services were originally created to assist agriculturalists and livestock producers and often still focus primarily on that mission.) State oversight for the use of pesticides used primarily to kill
rodents, moles, and some birds is typically vested in the agriculture agency.

**Federal Agencies**

The U.S. Fish and Wildlife Service (USFWS) is primarily responsible for the management of migratory birds and all federally endangered species. The U.S. Department of Agriculture’s Animal and Plant Health Inspection Service (APHIS) has a Wildlife Services (WS) division that specializes in animal damage. Other federal agencies, such as the National Park Service, may become involved when parks or other lands they manage are being held responsible for wildlife problems in neighboring communities. Still, no federal agency focuses any special attention or effort on urban wildlife as a part of its mission.

**Private Businesses**

Increasingly, homeowners are using the services of private companies to resolve wildlife conflicts. These wildlife-control operators (WCOs) are not government officials and do not have the legal authority that animal-control officers (ACOs) often do. It is easy to be confused about this, and it is not made simpler by the variety of other terms (such as wildlife cooperator, pest controller, or problem-animal-control operator) sometimes used to describe those who provide wildlife removal services. These companies are usually listed under “Pest Control” in the Yellow Pages, along with the traditional exterminating services that deal with termites and rodents—a most unfortunate association.

When wildlife problems cannot be resolved by the homeowner using the self-help tactics described here, a WCO may be the only available resource. The most difficult part of wildlife problem solving may be deciding when it is necessary to seek such services. Wildlife control is a fledgling industry, in which services, levels of expertise, and devotion to professional standards vary widely. As of 2007, there were few restrictions against businesses advertising themselves as “humane” while engaging in practices that are nothing of the sort, so we urge caution in choosing these services.

**Choosing a Wildlife-Control Company**

How do you, the homeowner, tell, then, what kind of WCO you are dealing with? The initial call and on-site inspection and interview are crucial to deciding if the company you choose to employ is professional and reliable.
and if it will use a humane approach. We recommend the following guidelines when seeking and contracting for services. (These are the suggestions of Brad Gates, president of AAA Wildlife Control in Toronto, Canada, a company whose business practices The HSUS feels should be used far more widely.) These guidelines cannot only help you determine whether a company will follow humane approaches, but they can also help to protect you as a customer from questionable business practices (Figure 4).

- Ensure that the company will provide an on-site inspection and a firm written quote; any fee for on-site inspection should apply to work contracted for if that becomes necessary.
- Ask for specific details about how the problem will be resolved and how the animal(s) will be treated. Will the animal be killed, and, if so, why?
- Ask if the company carries business liability insurance.
- Ask for assurance in writing that the company’s practices are in compliance with federal, state, provincial, and local laws and regulations.
- Never sign a contract with an open-ended clause that allows a WCO to charge for removal of any wild animal who can be captured on your property. This may be presented as a sort of preemptive measure to prevent other problems that could be caused by “nontarget” species. This is an unethical practice.
- For animals in buildings, insist on the use of exclusion strategies involving one-way doors or hands-on removal and reunion of families leading to release on-site as the preferred means of conflict resolution.
- Make sure that the company provides a full range of animal-proofing/exclusion services, along with at least a one-year guarantee against animal reentry.
- Get a reference for the company from a local wildlife rehabilitator, humane society, or animal-control agency. Ask the organization how it has determined that the company uses humane practices.
- Ask for references from previous customers.

All of this should only take a few minutes of your time. As with any other service you might contract for, it is up to you to make sure you are getting what you pay for. It is no secret that some wildlife-control operators deliberately mislead customers into thinking that an animal will be “taken care of” by releasing her in a “better place,” when in fact she will be killed, often by means that are far

Might there be young who will be orphaned or abandoned? Be highly suspicious of any advice that animals will “have” to be killed.

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Killing and Humaneness

Some people think that the humane approach we advocate means that wild animals never are, or never have to be, killed in wildlife-control work. Nothing could be more misleading. There is no way to know the actual number, but certainly tens of thousands of wild animals are killed annually because they cause conflicts. Many of these are animals’ whose only crime was to try to use a house as a secure place to give birth and raise their young. People may blame the agents responsible because many of their practices are inappropriate, but the public that condones these practices, or does not even acknowledge that they occur, must bear the ultimate responsibility for capturing and killing these animals.
from humane. If you do not ask for and receive direct assurances that these steps will be followed, you will not be protecting your interests and ensuring the animals will receive humane treatment.

**Humane Eviction and Removal Strategies**

Probably the most common conflict suburban homeowners have with wild animals is the uninvited guest living in the attic or chimney or under the deck. The two most frequently used “solutions” when this occurs are either to capture and relocate the problem animal or to kill her. Resolving the conflict by using humane eviction strategies is by far the more ethical and biologically appropriate approach.

Eviction strategies can range from completely passive, where the homeowner waits until the animal leaves of her own accord, to more active harassment, which attempts to compel an early move. These strategies do not involve any direct contact with animals and, when approached with careful thought, can be pursued by any motivated homeowner. Direct removal practices that involve capture and handling of wild animals are best undertaken by individuals who are professionally trained and equipped. The ideal solution is to prevent problems from occurring in the first place, but by the time the homeowner finds out about an animal problem, it is often too late for that.

Beyond the need for professional assistance in capture and handling is a need for an understanding of animal behavior and ecology that the homeowner often lacks. Among the most important considerations in evicting animals from a structure is whether dependent young are present. It is one thing to drive a raccoon out of an attic in Boston in November and another entirely to do so in April. There is a high likelihood (but still not a certainty) that no young will be present in November, and exactly the opposite likelihood in April. If you live in Florida and face a raccoon problem, you may want to presume that young are present year-round!

A professional, responsible, effective, and humane approach to dealing with wild animals who have occupied human structures comes from Brad Gates in the form of a program we call the three Rs: Removal, Reunion, and Release. Remembering that this is something best done by a trained and experienced professional, we outline below the steps and logic behind this approach.

**Removal.** The obvious first step in dealing with an animal in a structure is to get her out. Removal strategies can be simple or quite complex, but they all avoid actual physical handling of animals wherever possible. If capture should become necessary, handling time is kept to an absolute minimum to reduce stress. During the birthing season, the homeowner should always assume that animals living in a house have dependent offspring, unless determined otherwise. It can be difficult to ascertain whether offspring are present without previous field experience and an awareness of animal behavior and biology. Experienced professionals use cues acquired from many previous jobs to locate and retrieve litters safely.

**Reunion.** Ideally, encouraging a mother to move her litter on her own terms, even if mild harassment is needed to accomplish it, is the best approach. When that cannot happen, mothers and litters can still be reunited by a trained professional using a specially built...
“reunion box” that allows the young to be placed outside the entry hole but remain protected until the mother can retrieve them and move them to safety (Figure 5). Litters are often moved without any human pressure or involvement, for reasons we cannot be sure of. But it happens, and the objective in the approach described here is to mimic that process as closely as possible.

Release. The principal goal of humane removal strategies is not to remove the animal from her known home range (the area in which she has spent most of her life and therefore has an intimate knowledge of where to find food and shelter) (Figure 6). The goal is to get her out of the structure in which she has caused a problem and prevent her from returning. The strategy of “release on-site” allows mothers with litters to move them to another den while still being able to care for them as before. This can be nearly impossible if families are moved outside the mother’s home range, where finding shelter, food, and water could present an insurmountable challenge. Even healthy adults without young may be compromised by being moved.

The strategy behind the three Rs is to make the process of human intervention as natural and humane as possible. Although companies such as AAA Wildlife Control have been using and perfecting the three Rs for more than twenty years, the strategy is still “new” to traditional wildlife-control companies that come from a recreational fur-taking background. Some landowners question the idea of accommodating problem wildlife within the boundaries of their properties, and others argue that this approach simply moves a problem elsewhere. Here are some of the most frequently asked questions regarding this strategy:

• Won’t the animal just move back into my house?

No, not if the exclusion work is done correctly. Animals are opportunistic and will exploit structural weaknesses in buildings, and they do remember what worked for them in the past. To give an example, many raccoons in Toronto “know” that the base of a rooftop plumbing vent is only protected by a rubber membrane that, when torn open, gives them easy access to the attic. Once animal-proof screening is installed, the raccoon quickly learns that entry is no longer possible, although she might continue to test other houses for that weakness.

• Won’t the animal move into my neighbor’s house?

Perhaps, but only if a preexisting structural weakness exists, or if she has found refuge there before. Animals such as squirrels and raccoons have an intimate knowledge of the area in which they live (their home ranges) and know and remember useful foraging and denning sites. When pressured—as when evicted from a house, and especially when burdened with the care of young—they will go to a site they already know and have used before.

• What happens if the young are not retrieved?

If the eviction is done carefully and by someone with experience and the right equipment, only a small number of cases will result in the young being abandoned. In those few cases, local wildlife rehabilitators will usually accept these babies, knowing that a reputable wildlife-control company made sincere efforts to avoid this situation.

Figure 6 Live-trapping and relocation of “nuisance” wildlife is still commonly practiced, but it is increasingly recognized as ill-advised in all but special situations. It is far better to resolve conflicts without going to such extreme measures. New approaches make more humane options both practical and possible.
• Can I do this myself?
The three Rs is really not a do-it-yourself activity. Often, it involves direct capture and handling of adult animals, an undertaking we strongly discourage the average homeowner from attempting.

• Can I do the repairs?
Perhaps, depending on how skilled you are in that department. But we should note that the material and construction work to prevent the animal from reentering is often not a simple repair-to-original specification. Because animals have gained entry before, it may be necessary to adapt repair work. Often this means a strategy based on years of experience with different species and understanding what works best on each one. It may be difficult to find a professional who meets the standard for the humane approach as outlined here, but we encourage you to try to adhere to these principles. This approach should be the standard approach in urban wildlife control—not the exception.

Wildlife Rehabilitators

People who care for sick, injured, or orphaned wildlife are called wildlife rehabilitators. The goal of wildlife rehabilitation is to care for an orphaned or injured animal with the objective of returning the animal to the wild. A conscientious rehabilitator will want to release an animal who is completely wild, not one who is tame. In growing numbers, rehabilitators are becoming a valuable (and valued) resource in dealing with wildlife problems. Having once been almost exclusively a preoccupation of individuals who literally opened their homes to cage nesting birds, baby rabbits, and other temporary boarders, rehabilitators now are usually licensed by their state wildlife agencies, have separate caging and housing areas to care for animals, and in increasing numbers work out of professionally equipped and staffed centers that may handle thousands of animals annually.

Unfortunately, not every locality has a rehabilitator within a convenient distance. State wildlife agencies keep lists of licensed rehabilitators and can tell you which ones serve your area and what species they accept. Other sources of information are listed in appendix A. Rehabilitators can also provide guidance in finding humane animal-control services and companies in your local area. Because most rehabilitators are swamped with injured and orphaned animals during spring and summer months, they sometimes have to refuse to accept even perfectly healthy animals.

Homeowners with wildlife conflicts can do their part to prevent orphaning or injuring wildlife unnecessarily by consulting rehabilitators, delaying action if possible, and working toward a solution that does not necessitate handling the animal. One critical service most rehabilitators can provide is to advise people who think that a young animal they see has been orphaned. Well-intentioned and caring individuals often “rescue” fledgling birds, baby rabbits, or deer fawns who seem to have been abandoned by a neglectful parent, when in fact this is not the case. Because rehabilitators have experience with young animals and are motivated to avoid taking on otherwise healthy and cared-for young, they can be immensely helpful in such situations.

Wildlife Hotlines

Some local communities, usually though the volunteer services of wildlife rehabilitators, have access to telephone advice hotlines for people with wildlife problems. These services can be critical in providing immediate advice and referrals in situations involving orphaned and injured wildlife and in true emergencies as well. They can also provide information on how to resolve wildlife conflicts humanely.
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QUESTIONABLE PRACTICES AND INAPPROPRIATE PRODUCTS

THE HSUS BELIEVES IT IS IMPORTANT to draw attention to certain urban wildlife-control products and practices that we judge to be inappropriate and inhumane. It is not always easy, of course, to determine what is humane and what is not, and it can be very difficult to decide what is and what is not “necessary” (as opposed to convenient) in wildlife control. Sometimes the case against killing animals seems more difficult to argue, as when birds are killed at airports because of the potential hazard they might pose to the lives of people on aircraft. Often it is easy, as when we oppose a trap set to kill a squirrel for having done nothing more than think an attic might make a safe home.

Many situations can be cited in which animals may suffer or die as a result of human decisions and actions that, on critical examination, seem deeply flawed. Sometimes they go even beyond flaw into forms of tragic irony. For example, on at least one national wildlife refuge, “resident” Canada geese have been rounded up and killed in June so they do not eat the crops being raised for the migrant Canada geese who arrive there in the fall.

As the argument over whether killing is right or wrong rages, we at The HSUS acknowledge the fact that killing is happening and will continue to occur into the foreseeable future. Where it cannot be stopped, we must strive to minimize the use of what we call least humane techniques. Consider mouse problems, probably the most common human-wildlife conflict in North America. We argue that the best way to deal with rodent problems is to prevent them in the first place. But what if mice are already in a building? Mice can be trapped and relocated with some (albeit small) confidence they will survive a move, but we believe most will not. Only a very small minority of people will be willing to take the time and effort to live-trap any mouse humanely before they resort to some means of lethal control. This mandates that we discuss the available killing techniques with an eye toward raising public awareness, not about those that are the most humane, but rather the least inhumane. The practices and products described below are ones we feel should always be questioned and, in many cases, opposed outright as inappropriate to our interaction with wild animals. Some are not available to homeowners but may be used by licensed commercial or government agents in local programs. These can affect you as a customer or community member, and we feel it is important that you know about them.

Moving Nuisance Wildlife

Too often people think the most humane way to solve a problem with the raccoon or squirrel that moves into the attic is to capture her in a cage trap and take her to the “country,” which often means a nearby park. There, the reasoning goes, she will be released into a more “natural” habitat, and the problem will
be solved. Too late, such people might realize that she was nursing a litter, which is now orphaned, and that this relocation (more commonly termed a translocation) was not a safe, benign, or humane procedure.

Wildlife professionals debate translocation, and most acknowledge that answers to many of the issues involved must await additional studies. It is clear that translocation sometimes works very well and at other times does not work at all. Trapping and moving the animal may harm or even kill her or her dependent young. It may also adversely affect the resident wild animals at the release site.

Often, state wildlife agencies restrict which species can be translocated and how far they can be moved. For this reason it is important that you be informed about what is and is not legal in your area. Common sense would argue that there are circumstances under which it would be cruel to translocate any animal, legal or not. Moving a gray squirrel in February, for example, would certainly be a death sentence in most northern states, and perhaps elsewhere as well. The majority of conflicts between people and wild animals can be resolved by the simpler, more humane means described in this book. Our advice is that translocation be considered only as the next-to-last option in solving a wildlife conflict (killing being the last). If you must consider translocation, we recommend seeking the advice of a wildlife rehabilitator on release strategy, since much of what he tries to do is successfully release wild animals who have been in his care. No one should translocate animals without making every effort to deal with the root cause of the conflict and ensuring that it will not reoccur.

We feel it appropriate to address the issue of live, or cage, trapping here as well, since the popular and readily available metal box or cage trap is used to capture wild animals for relocation. Cage traps, available in a wide variety of styles and designs, are usually sold in most large hardware and garden stores. Cage traps are also often available on loan from local animal-control agencies or humane societies. Once widely advocated as the best tool for “solving” wild animal problems, these devices are receiving more scrutiny. We have also seen too many instances in which poorly monitored or improperly designed traps resulted in animal deaths. For example, solid-sided metal traps are still marketed and sold for use with skunks, presumably because the chance of getting sprayed by the skunk is much smaller in a trap where the skunk cannot see and be threatened by an approaching person. Under even moderate extremes of heat and cold, these traps can become death chambers, causing horrific suffering. If a solid-sided trap must be used in a particular situation, it should be made of plastic, which does not compromise the trapped animal thermally as rapidly as does metal.

Live-trapping any wild animal is a risky business for animal and human both. We urge restraint and caution in any such attempt.

Wildlife as Pets

Wild animals should not be kept as pets. We say that knowing full well how popular some wild species are as pets, and that even our beloved cats and dogs were once wild. Untold generations of selective breeding, however, made the animals who share our homes as we know them today. Their wild relatives, such as wolves or bobcats, retain an independence and self-reliance that has never been altered by selective breeding.

Wild animals can be difficult or impossible to care for humanely; many are dangerous and unpredictable. They may appear tame, docile, and manageable as they grow up, but as they mature, and especially as they become sexually active, their docility typically ends. Ultimately, the animal becomes a problem to the owner. She is neglected, passed from owner to owner, or released—often illegally—either into unsuitable habitat harmful to her or so vulnerable that she may cause damage herself.

The practical reality of this fact is the tragedy of the pet trade in wild animals. No one has a good handle on the overall dollar value of this trade or the numbers of animals involved, but the industry includes both native and exotic species in significant num-
bers. In the United States, nine million native and exotic reptiles were kept as house-
hold pets in 2000. In a single year, imports of iguanas to the United States from Central
and South America have ranged from 600,000 to 800,000. Contrary to the assertions of pet dealers, commercial breeders, and hobbyists, the trade in wildlife can and does adversely affect conservation efforts to help animals in the wild.

There is no simple solution to the problem of wild animals as pets, but public aware-
ness campaigns are important, as are the growing number of local and state regulations that prohibit private ownership at least of obviously dangerous animals.

**Rodent Poisons**

Perhaps the most frequently used lethal prod-
ucts in all of wildlife control are the poisons we refer to as “rodenticides.” Rats and mice in many places have now become immune to the first generation of these products, developed largely in the 1940s. More powerful compounds are coming into use, to which we expect rodents to develop increasing levels of immunity as well. Most of the current generation of rodenticides are anticoagulants that depend on repeated ingestion over time to build up fatal dosages. These poisons take advantage of the fact that rats are samplers—when they encounter new food, they eat a little bit at a time to see if it is palatable. This habit increases the poison’s efficiency because the rat does not associate ingestion with pain or discomfort.

The slow deaths suffered by any animals who ingest these poisons (which may include pets, wild predators or scavengers and, rarely, even humans) raise such overwhelming concerns about pain, suffering, and safety that their use must be challenged. Vast quantities of rodenticides are used routinely by home-
owners who may be careless or unaware of the consequences of using these dangerous chemicals. Rodenticides are used far too widely in our society today.

**Bird Poisons**

Avitrol® (4-aminopyridine), a chemical used to control bird problems, is registered for use as a “flock repellent,” even though its action has lethal consequences. The label stipulates that the product be applied to only a small proportion of a bait that is set out for problem birds (typically pigeons, starlings, and house sparrows). Birds who ingest treated bait will experience acute distress and engage in behaviors (vocalizations, fluttering of wings, staggering, and struggling) that alarm other members of the flock, producing responses said to lead to flock dispersal. Any bird ingesting the chemical can consume a lethal dose. Thus, all birds who consume treated bait will be at risk, and unless extremely care-
ful bait placement and monitoring occurs, nontarget birds can also be exposed to the chemical and die. The HSUS does not sup-
port use of this product under any conditions or circumstances.

Another bird poison, DRC-1339 (3-chloro-4-methylbenzenamine hydrochloride), is often referred to by the popular name “starlicide,” as it is frequently used for killing starlings. Its use extends to other birds, including gulls, pigeons, magpies, crows, and ravens. It is a very dangerous tox-
icant whose application is restricted to certi-
fied personnel, usually agents of USDA Wild-
life Services. Once more common in agricul-
tural settings, DRC-139 is now used more frequently in urban bird “control,” such as for poisoning crows on winter roosts. Large birds, such as crows and gulls, may take several days to die after being poisoned. We believe that such deaths are expressly inhumane, but advocates of the poison do not. The HSUS opposes the use of this product in any form of animal control.

**Gas Cartridges and Concussion**

Several toxic gases, including sodium nitrate, sulfur, carbon monoxide, and red phospho-
rus, are packaged into cartridges that are
ignited or discharged in burrows in attempts to kill animals taking refuge there. Similarly, a device that combines oxygen and propane inside burrows is intended to kill the animals inside by explosive concussion. Aside from dangers to people from accidents or careless handling, the discharge from these devices indiscriminately kills, maims, or otherwise injures any animal in the burrows, whether targeted or not. Few, if any, studies have been conducted to establish the efficiency of these cartridges and exploders, such as the length of time until death, the rate of “sublethal dosing” (referring to animals that are subjected to and affected by toxic fumes but are not killed immediately), and injuries to animals trapped in burrows. We suspect there is a high incidence of extreme suffering and slow death in animals from these products and do not support them under any conditions or circumstances.

**Body-Gripping Traps and Snares**

Body-gripping traps cover any number of devices, including “leghold” traps, snares, and the body-crushing “conibear” traps (actually a brand name, but conibear is also a common name used to describe this general type of trap). Body-crushing traps theoretically are supposed to cause rapid death by breaking the spine of the captured animal, but even under ideal test conditions, they often do not. Leghold traps are intended to capture and hold the animal until he can be retrieved or dispatched, as are locking snares—wire loops which, when stepped through, tighten around an animal’s leg or neck. Other snares without locking devices simply tighten further as an animal struggles, causing massive injury or death. All of these devices can, and frequently do, cause intense suffering, pain, and injury. The HSUS and an ever increasing number of state and municipal governments and organizations have opposed the use of such traps for any purpose, leading, we feel appropriately, to an increasing number of outright bans as an educated public demands they be prohibited.

**Acetone and Other Solvents**

Some misguided entrepreneurs engaged in the business of wildlife control have experimented with the use of industrial solvents, such as acetone or denatured alcohol, as a means of killing wild animals. The typical procedure is to use a pole syringe, which allows the user to inject an animal in a cage trap from a distance, delivering the chemical directly into an animal’s lungs. Its action there is undocumented but certainly involves massive tissue destruction. Skunks, in particular, are often targeted for this procedure, since they die what is described as a “quiet” death and often do not spray as they succumb to the effects of the solvent. Whatever the appearance, there have been no studies on this practice to measure the suffering animals might experience. The HSUS considers this and any other practice that is used to kill wild animals, but has not been subjected to rigorous scientific study, to be inappropriate.

**Thoracic Compression and Bludgeoning**

Among the many disputed techniques that come from traditional trapping practices are thoracic compression, in which one stands on a trapped animal’s chest until the organs are crushed and the animal dies, and bludgeoning, where the animal is hit repeatedly on the head until dead. Some also use thoracic compression to dispatch small birds, by holding them in the hand and pressing on their chests with a thumb until they expire. We condemn these techniques, whether they are used by a recreational trapper or a professional wildlife biologist. We believe there are far more humane and acceptable ways of bringing death to wild animals.

**Drowning**

Recent scientific evidence suggests rather conclusively that drowning is an inhumane method of killing animals, wild or domest-
cated. Although commonly used by wildlife-control operators and long a standard practice for recreational and commercial fur takers, drowning is condemned by The HSUS as an inappropriate and inhumane method for killing any animal.

**Glue Boards**

These devices are simple cardboard squares coated with extremely sticky glues used to trap small mammals, then slowly kill them through a combination of stress, exhaustion, and eventual dehydration or suffocation. Nontarget animals encountering the traps and small enough to become mired in the glue will face the same fate. Glue boards are easy to use and inexpensive but probably cause more suffering than any other product used in wildlife control. One specially made form of glue board is advertised to capture snakes, with the recommendation that vegetable oil can be used to free the trapped victims if the user does not want them harmed. We seriously question this counsel, particularly given the variable success rates and extreme difficulty encountered by those who have tried to free animals from these sorts of traps. Glue boards are inappropriate for solving wildlife problems and inhumane under any circumstances or conditions of use.

**Polybutenes**

Polybutenes are highly dense, sticky substances (such as the commercial products Tanglefoot® and Eaton’s® 4 The Squirrel™) that are marketed in different formulations to discourage birds and squirrels from climbing, sitting, or roosting on treated surfaces. Manufacturers claim the substances only discourage animals by making them uncomfortable on the treated surface. However, as with glue traps, animals exposed to these materials have been treated in wildlife rehabilitation clinics, and deaths have been reported, notably in smaller species of birds. We recommend they not be used.

**Predator Urine**

One product that is appearing more and more frequently in garden supply and hardware stores is “predator urine,” which may be variously billed as “safe,” “organic,” and “humane.” Allegedly the by-product of coyotes, foxes, bobcats, and other animals, these products may be safe and organic, but they are likely not humane. Judging by the volumes sold, predator urines can only be generated by confining hundreds, perhaps thousands, of wild animals. If that is the case, we know of only one likely source: “fur farms,” which are facilities that raise wild animals for their pelts. These are often little more than a series of small wire cages in an open shed, and animals at these “farms” suffer extreme confinement and poor housing conditions and typically die inhumane deaths. Neck breaking, gassing, and anal electrocution are common killing techniques. Thus, in addition to the abject suffering and cruel treatment that they must endure, fur-farmed animals are also wrung dry for the small profits their urine may bring from unwitting gardeners, trying to do right by using “natural” products. We urge these products not be used and hope consumers will make their concerns known directly to any business enterprise that has them on the shelf.

**Resources**

**Euthanasia**

The American Veterinary Medical Association periodically publishes a report on euthanasia that contains guidance from a panel of experts about their best currently available recommendations. We agree with some parts of this and take exception to others, but it is the best published standard available at this time. [www.avma.org/resources/euthanasia.pdf](http://www.avma.org/resources/euthanasia.pdf).
WE SOMETIMES DON’T THINK about the unintended or indirect impact we have on wild animals, but human beings are responsible for many threats to animals’ survival beyond deliberate acts that harm them or cause injury. Today road mortality may be the most significant, or the loss of habitat from development, or the ever-growing number of buildings with reflective glass. Here we discuss a number of the threats we create for wild animals, most often unintentionally, but no less harmfully.

Wildlife Feeding

Wild animals should not be fed when the consequence of feeding could cause them harm. The possible impact on wild animals’ welfare from human feeding is truly complex and challenging. People’s actions, individually and collectively, reflect this complexity and are often contradictory. On the one hand, we support a multimillion-dollar industry devoted to feeding wild birds. On the other we pass local ordinances that prohibit feeding pigeons, ducks, and geese where they have been declared public nuisances. Sunflower growers in the Midwest, with assistance from federal agencies, kill thousands of blackbirds every year because they eat crops that will be harvested, processed, packaged, and sold—to feed backyard birds.

People feed wild animals for many reasons: to be kind, to see them close up, to have a personal relationship with particular animals, or to make amends for human preemption of animals’ habitat. When people feed some animals, especially those who may be viewed as nuisances or, worse, dangerous by other people, the consequences can be tragic. When an animal fed by one family loses his wariness of human beings and looks for a meal at the house down the street, he may receive an entirely different, and sometimes ultimately fatal, reception.

What species to feed, what and how much food to offer, and when to feed are all part of a complex calculus that must balance the potential for harm or good (Figure 7). Moderation is always a good idea, whether we are feeding wildlife or ourselves. Winter feeding of birds is widely justified as an educational, humane, and recreational experience for a child. Excessive feeding that creates dependency can lead to conflicts with tragic conclusions for animals, however, and it is imperative that we not feed wildlife whenever the consequences could lead to harm.
ence with animals who do not cause conflicts with people. But the person who goes on a three-week vacation in the depth of the winter and leaves empty feeders behind probably should have thought about the consequences before starting to feed that year. Long-term good is never likely to come from feeding animals who have the potential to cause conflicts, such as bears or even raccoons, but is much more likely to come from moderate feeding of others that rarely cause conflicts, such as songbirds.

**Birds and Windows**

Many people would be surprised that office buildings—and even their own homes—can be death traps for some wild animals. Human beings unwittingly kill millions of birds each year. Birds can fly into any variety of structures—TV towers, wires, wind-generating turbines—and be killed, but most die as a result of collisions with windows. By day window glass can reflect a scene that looks to a bird as if it were a perfectly unobstructed flyway; mirrored windows especially present this threat. By night lighted structures disorient them and draw them into fatal collisions, especially under certain weather conditions. Others, caught in the light “traps” created by buildings and outside lighting, will circle until exhausted and descend to ground, where predators or traffic may take them. At least a quarter of all bird species in the United States and Canada have been documented as striking windows, and upward of 900 million individual birds may be killed annually.

As frustrating as this situation is, the individual homeowner can take some simple steps to help reduce strikes. Window decals, available at most wild bird stores, have to be applied every few inches to a window to make a flyable path appear solid. Newer versions of decals are nearly invisible to humans, but birds can see them in the ultraviolet spectra that we do not perceive. Plastic mesh or a special screen can be placed in front of problem windows to act as a cushion for colliding birds. Feeding birds can contribute to window collisions: birds using a feeder can be startled into flight, then bolt into the air with enough momentum to strike a window lethally. Placing the feeder either directly next to the window or at a distance of more than thirty feet is recommended, with all feeders located near what is called “escape cover,” an evergreen tree or shrub that birds can flee into when panicked.

Programs in several major cities seek to address the issue of bird-window collisions via simple power-down protocols. These programs involve convincing building managers to reduce interior lighting at certain times of the year and under certain weather conditions. In the long run, though, we hope for technology that imbeds ultraviolet, light-reflecting particles within glass so the glass appears solid without obscuring the view—of the wildlife.

**Wildlife and Roads**

Imagine hiring a contractor to build your new house. Due to an unfortunate miscommunication, he builds your kitchen on one side of a busy street and your bedroom on the other. Once the house is finished, it is otherwise lovely, so you decide to move in anyway. It isn’t long before you realize, though, that you risk your life just going from your bedroom to the kitchen and back again. This is exactly the situation wild animals regularly face. With nearly four million miles of public roads in the United States and uncounted miles of private roads, wildlife habitat is broken into pieces. Millions of animals are killed on roads every year, as is obvious to anyone who drives anywhere with any frequency. It is tragic that the closest and most continuous association that most members of the public have with wildlife is the sight of dead animals in the road.

What can be done to stop this destruction? The first and best line of defense is an informed public and educated, alert drivers. We offer these suggestions to anyone who drives:

- Expect to see wildlife in the road at dawn, dusk, and in the first few hours after darkness falls. Some animals, such
as deer, are more likely to be moving and crossing roads in certain seasons, such as fall, when they are mating. Be especially aware then (Figure 8).

- Drive with extra caution on roads bordered by woods or agricultural fields, where roads cross streams, and especially where posted signs warn of crossing animals.

- Lower your dashboard lights slightly, as this will enable you to better see the reflection of your headlights in the eyes of animals.

- Where there is one animal, there are often more. Assume they will not know to get out of your way.

- Most important, slow down! Most collisions could be prevented if drivers were not going too fast to avoid hitting an animal.

Despite taking these precautions, a collision may leave an animal alive and in need of help. By carrying a few simple items in your trunk (a towel, blanket, heavy gloves, cardboard box), you may be able to retrieve and confine the animal safely and get him to a veterinarian or wildlife rehabilitator.

- Do not put your own or other people’s safety at risk. Unless you can move the animal from the road in absolute safety, do not attempt to do so. Use your hazard lights or emergency flares to warn oncoming traffic. Never attempt to handle a large animal, like a deer, or one who could inflict a serious bite, like a raccoon.

- Call the nonemergency number of the local police department (it is a good idea to program this number into your cell phone) and describe the animal’s location. Emphasize that the animal is a traffic hazard and stay put until someone arrives.

- If you try to rescue a small animal yourself, remember the animal may bite or scratch in self-defense. Keep a pair of heavy gloves in your trunk, along with a sturdy cardboard box and an old towel. A paper bag makes an ideal carrier for small birds.

- Use the towel to pick up the animal gently or coax him into the box. Transport him as quickly and quietly as possible to a wildlife rehabilitator. A local veterinarian or animal-care and control agency may be able to direct you to a nearby rehabilitator, even if neither handles wildlife. If there is a delay in getting the animal to help,
keep him in a quiet, dark, warm place to minimize stress. Do not attempt to give him food or water.

- It is common to see turtles attempting to cross the road, especially during spring. If you can do so safely, help the turtle by moving him across the road in the direction he was headed. (Be careful of snapping turtles, who can deliver a serious bite.) Wearing gloves, hold him firmly on both sides of the shell above the rear legs. Never pick up or drag turtles by the tail, as their backs can be broken this way.

It is important to increase public awareness of the crisis of wildlife on roads. The HSUS’s Give Wildlife a Brake™ program seeks to focus attention on the impact roads have on wildlife habitat and on driving with wildlife in mind.

Wildlife and Development

Habitat loss and fragmentation and the impact on wildlife arising from land development are crucial issues that affect individual wild animals as well as entire populations. It is important to incorporate protection of habitat and wild animals into the land use planning process. This is not just the responsibility of developers and planning officials but also of citizens, who will live with the consequences long after the developers and officials are gone.

Advocates of wildlife and habitat protection should become familiar with existing comprehensive plans and get involved in local planning processes. Good planning can use a variety of strategies, resources, and design features to lessen the impact of development on wildlife. These include consensus planning, public education, developer incentives, conservation easements, conservation subdivision design, density transfers, transfer of development rights, changes in road standards, buffers, mitigation banking (primarily off-site to create larger, contiguous habitats), municipality or county fee waivers in exchange for equal contributions for conservation or wildlife purposes, and current-use taxation programs, which target wildlife habitat specifically. The more you know about these instruments, the better your ability to advocate on behalf of wildlife during the development process.

Successfully integrating wildlife concern into development decisions begins with community plans (sometimes called “master plans” or “comprehensive plans”). Become familiar with your community’s master plan and get involved when new plans are written or old ones are revised. Citizens are often invited to be part of planning efforts. You can use that opportunity to promote wildlife as an asset to be protected and encourage habitat conservation when land is developed. Be willing to participate in an open process from which all involved can benefit rather than merely try to block developers.
When a developer proposes a project, the specifics are expected to fit the general requirements of the local plan. But, with a little extra care and thought, that plan can incorporate provisions that can help wildlife. One example: removing trees and other vegetation at times of the year when the impact on nesting birds and mammals will be minimized. Where a partnership among state wildlife agencies, advocates, and developers allows for a removal and recovery plan that is biologically sound, some developers have allowed advocates to search for and remove especially vulnerable animals (box turtles are one good example).

People will continue to alter the landscape and affect the wildlife with which all share the land. People who care about wild animals cannot leave decisions solely to the development community and government land-use decision makers. Participate in the planning process and work cooperatively with other stakeholders to ensure that wildlife needs are recognized and accommodated when your community determines how, where, when, and what to build.

**Wildlife Sanctuary**

Resolving conflicts with wildlife is not always a homeowner’s first concern. More often than not, it is seeking out interactions and experiences with wild animals. Bird watching and feeding are popular pastimes, and gardening to attract wildlife, creating backyard ponds, and installing shelters to attract desirable species are gaining steadily in popularity.

The HSUS offers two programs to help property owners protect their land while offering safe and welcoming habitat for wildlife, the Urban Wildlife Sanctuary Program and the Wildlife Land Trust®. Some properties may qualify for both programs, and such combined participation is welcome. Both programs deliberately focus on protecting the homes of all wildlife in diverse settings.

The membership-based Urban Wildlife Sanctuary Program confers honorary certifications on properties whose owners commit to providing useful wildlife habitat and following humane stewardship principles in caring for their resident wildlife populations. In a world where viable wildlife habitat continues to be developed at alarming rates, the program’s goal is to encourage understanding and enjoyment of wildlife. Property size and location are unimportant; despite its name, the Sanctuary program is open to all comers, whether their properties are urban, suburban, or rural, whether they own several rustic acres or a city apartment balcony. The core requirements are a sincere desire to enhance habitat on the property and a willingness to commit to pursuing humane approaches to resolving conflicts with wildlife. Among other benefits, members may receive an attractive metal yard sign proclaiming their property an “Official Urban Wildlife Sanctuary” and a subscription to *Wild Neighbors*® News, The HSUS’s quarterly newsletter.

The HSUS Wildlife Land Trust provides protection to wildlife through a variety of legal mechanisms that seek to permanently preserve natural habitats. The Trust protects properties ranging from coastal wetlands to deserts, from plains to mountains to rainforests. Each shelters a diverse community of wildlife, and, on each, those animals are completely protected. The means by which the Trust protects property are as diverse as the sanctuaries themselves. In some cases the Trust owns the habitat outright and takes on all the responsibilities of that ownership. Other habitats are protected by conservation easements, agreements that set out permanent legal restrictions on the use of the property. For non-U.S. holdings where other legal tools are not available, the Trust relies on wildlife management agreements and partnerships with like-minded organizations.

Where property owners want to establish a permanent, legally enforceable wildlife sanctuary, The HSUS works with them and their advisors (such as accountants, lawyers, and appraisers) to craft legal restrictions that insure the property’s protection. Recreational and commercial hunting and trapping are prohibited; this prohibition is so central to the Trust’s mission that it is non-negotiable.

After taking the steps to insure that a
property has legal protection, The Wildlife Land Trust monitors and enforces that protection. Consistent with The HSUS’s abiding interest in the protection of all wildlife, the Trust staff work on large national and international projects and protect small properties. For Trust donors and the wildlife their lands protect, this offers the best of both worlds.

Resources

Birds and Windows
Editors Catherine Rich and Travis Longcore have brought together a number of expert contributions in Ecological Consequences of Artificial Night Lighting (Island Press, 2005). For those interested in more technical information, we recommend any of a series of articles by Daniel Klem, Ph.D., of Muhlenberg College, who has been recognized as a leader in the scientific study of bird-window collisions for many years. These include


Several programs focus on the issue of fatal collisions during migration and initiatives modeled after Toronto’s Fatal Light Awareness Program (FLAP). See www.flap.org for information on this program and www.birdsandbuildings.org for information on the innovative program in Chicago. The New York City Audubon Society is spearheading a birds and windows initiative that hopes to produce a major design change in glass that can help protect birds in flight. Visit its website at www.nycaudubon.org/home.

Bird Attacks Window!

Sometimes an ardent defender of a territory sees his reflection in a window and determinedly attacks his “rival” until both he and the homeowner are exhausted. Sheets of paper taped to the inside of the window may provide relief temporarily, but they defeat the purpose of having a window, and the bird often simply moves to the next window and resumes his defense. Mylar tape hanging in front of the window may work well enough to get through the season with the hope that maturation or just plain exhaustion will turn the bird’s attention elsewhere. This behavior is typically limited to the breeding season, so while annoying, it won’t last forever.

Specialty devices to deter birds from hitting windows are described at:

www.windowalert.com
800-773-2753
www.birdbusters.com
800-662-4737.

Finally, this company makes a screen to be mounted outside a window to prevent birds from flying into the glass:

www.birdscreen.com
717-445-9609.

Wildlife as Pets
Information about the issues of wild animals being captured, imported, traded, and kept as pets is available at www.hsus.org/wildlife-nopets. The HSUS manual Reptiles as Pets: An Examination of the Trade in Live Reptiles in the United

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States (Joseph Franke and Teresa Telecky, The Humane Society of the United States, 2001) thoroughly covers the issues for reptiles and can be ordered from the site above.

The Captive Wild Animal Protection Coalition (CWAPC), a consortium of zoo professionals, sanctuary operators, and animal protection groups founded in 2002, works to end exploitation and suffering of wild animals in captivity. By influencing public policy on possession, use, and trade, CWAPC seeks to improve animal welfare while working to end possession of wild animals as “pets.” Reach CWAPC in San Carlos, California, at 650-595-4692 and www.cwapc.org.

Wildlife and Roads
Richard Forman and his co-editors have brought together a wealth of information on roads as a conservation issue in Road Ecology: Science and Solutions (Island Press, 2003).

Information on the roadside reflectors in use in a number of communities throughout the country is available from the Strieter Corporation:

www.streiter-lite.com
309-794-9800.

Wildlife and Development
For an in-depth look at conservation subdivisions, including case studies and model zoning and ordinance language, consult Randall Arendt’s Growing Greener: Putting Conservation into Local Plans and Ordinances (Island Press, 1999).

Sanctuaries and Attracting Desired Wildlife
The Urban Wildlife Sanctuary program of The HSUS is on the Web at www.hsus.org/sanctuary, and the Wildlife Land Trust can be reached at www.wlt.org or by calling 1-800-729-SAVE.
Specific tools and tactics can be used to resolve wildlife conflicts without resorting to lethal means. They can be organized into three basic categories: (1) prevention, (2) eviction/exclusion, and (3) aversive conditioning. In practice, these often can merge and overlap, as when a single strand electric fence is used more for aversive conditioning than for exclusion purposes, but usually the use and meaning of a specific technique or product is clear.

Consider the perennial problem that many homeowners face: raccoons getting into the trash. Prevention, obviously, is the preferred strategy—putting the trash cans out at the curb the morning of collection, after the nocturnally active raccoons have finished their foraging, rather than the night before. Because weekday mornings are hectic or trash pick up starts at dawn, many homeowners can’t—or won’t—do this every week. The next best solution is to find the most secure trash can available and exclude raccoons from access. Tight-fitting lids on galvanized cans might do the trick, or bungee cords securing the lid, or, if available, one of the newer trash can designs with a screw-on lid that raccoons just can’t figure out. Problem solved. The raccoon, who is only trying to secure a meal, might even not come around any more at all, knowing that she is not going to be rewarded at this house.

But what if this isn’t an option for you? Perhaps you live in an apartment complex with large dumpsters that are always open and into which raccoons can easily climb. The problem truly gets harder now, and, unfortunately, this is where many people give up and hire a trapper to come and take the animals away, usually to be killed or released in unfamiliar territory where they may not survive. The logic behind such practices is flawed. New raccoons will move into the habitat as long as the trash problem has not been solved. This is a trash problem, not a raccoon problem. It should be solved by managing the trash, not the raccoons.

(A word of caution. As useful as the resources and procedures described here may be, they still might cause real harm if used inappropriately. Remember that the first rule of engagement with wild animals is that when they are not causing damage or harm they should be left alone.)

Prevention

Figure 9 illustrates some of the more common places around the house and yard where routine inspection and monitoring can pay big benefits in heading off potential wildlife problems. In virtually any house, structural breakdowns often invite wild animals to move in. Common points of entry need frequent checking.

Here are some of the places where wild animals might get into structures and where periodic inspections and repairs go a long way toward saving you future expenses (information for which we thank Brad Gates). A thorough inspection should be undertaken at least twice a year, and can be part of a routine...
Figure 9 A few simple and inexpensive fixes to the average house can go a long way toward preventing conflicts with wild animals. Biannual, if not more frequent, inspections are recommended.
fall and spring home repair and energy conservation plan. Table 2 (page 51) lists the dimensions of building openings that different wildlife species might use to gain entry. These should be kept in mind when performing a home inspection (Figures 10, 11).

**Roofs**

- Make sure the chimney is capped, and the cap is in good repair.
- Replace curled, worn, or missing shingles.
- Inspect all roof vents and secure perimeters with heavy screening if necessary.
- Remove debris (leaves, etc.) from gutters (or “eaves troughs,” if you live in Canada) to prevent water overflow that can lead to wood rot.
- Check downspouts for signs that animals have been using them to climb (muddy paw prints); check TV antennas as possible points of access, too.
- Check all attic vents for signs of entry and install heavy screening if necessary.

**Overhang**

- Cover with heavy screening any soffit vents located near gutters, downspouts, or other points of access animals could use.
- Trim back overhanging branches six to eight feet, if possible.

**Walls**

- Check stove and bathroom vents: install heavy screening on existing covers if bird problems are suspected.
- Screen any other existing gaps with hardware cloth or fill with copper mesh or foam insulation.

**Foundation**

- Screen or cover window wells; check existing covers to make sure they are in good repair.
- Check where plumbing and electrical leads enter the house for gaps.

Beyond fixing and maintaining structures, keeping up with yard chores can help minimize wildlife problems. Keeping yards clean, recognizing and removing plant foods or harborage that unwanted wild animals might use, trimming weeds or tall plant growth around building foundations, raking up apples or other fruit that fall onto the

*Figure 10* Sometimes an animal may gain entry at a point that cannot be seen from the ground. Here a raccoon family is in residence in a place the homeowner could only have found by thoroughly inspecting the home from above as well as below.

*Figure 11* Where it looks like an animal has worked to gain entry, especially where evidence of gnawing occurs, suspect squirrels. Be prepared for anything, since raccoons will take advantage of work done by others to move in as well.
ground, and relocating old wood piles can remove attractions and cover for wild animals if they are perceived as problems.

**Exclusion**

Many of the measures described above—a lid placed on a garbage can, a fence around a yard or garden—are forms of preventive exclusion. Exclusion can be a lasting and humane way to deal with wildlife conflicts, but it is also a difficult technique to apply when wild animals already present a problem.

There are some general considerations to keep in mind when attempting to exclude animals from any structure. These apply to do-it-yourself evictions as much as to professional removal. Wild animals will not willfully threaten or try to harm people or their property. They are simply interested in surviving and finding shelter, food, or a secure place to give birth and raise their young. Before you attempt any exclusionary activities, it is important to correctly identify the species involved. Misidentification is common and can lead to ineffective or injurious attempts at exclusion. If you observe the animal and can identify it, obviously, that is best. Tracks are also a good way to identify animal presence, but reading them takes some skill. On hard surfaces or in dry weather, flour, garden lime, or another suitable powder can be used to record prints. There are several excellent guides available to identify animal tracks, and a wealth of visual and written information is available on the Internet.

The best strategies take advantage of the natural behavior patterns of the species causing the problem. The more you know about the species involved, its daily and seasonal routines and biological requirements, the more likely you will be able to resolve conflicts humanely.

Exclusionary devices are both generally applicable and species-specific. To locate sources for products not easily found in your local hardware or home supply store, consult appendix B.

**Animal-Resistant Trash Containers**

In most cases simple latching or holding devices (bungee cords, rope tie-downs, or weights) will secure cans adequately (Figure 12). Newer trash can designs incorporate screw-on lids that are more effective at keeping animals such as raccoons out of the trash than are older designs. Commercial lockout systems especially designed to thwart large and powerful animals, such as bears, are also available.

**Bafflers**

A baffler is any device that physically keeps an animal away from something you want to protect, such as a birdfeeder or birdhouse. Cones and tubes that attach to poles supporting bird feeders are bafflers. So are the small tubes designed to fit over the openings to birdhouses and prevent predators from reaching in to snatch baby birds. The term also is used sometimes to refer to piping systems that control the height of water behind a beaver dam, but we prefer to call these flow devices (adopting wildlife biologist Skip Lisle’s terminology).

**Bird Wires or Roost Inhibitors**

Various wire devices are used to keep birds away from buildings or other structures. Single strands of galvanized or stainless steel wire (18- to 20-gauge) strung three to four inches above a railing or ledge can be highly effective in preventing pigeons, house sparrows, and starlings from landing. The lines are anchored to eyelet screws (or the like).
They are kept taut by support posts placed every few feet, as well as by hooking the wire onto small springs, which help to maintain tension. As an alternative, a wire coil that looks a lot like the popular Slinky® toy can be wound around or attached to railings or ledges to keep birds from landing.

Products known as “porcupine wire” or “bird spikes” are glued or fastened to ledges and other areas where birds perch to prevent them from landing. In commercial applications, these are generally reserved for difficult sites where problems have been long-standing. There have been claims that porcupine wires caused occasional serious injury to birds, but documentation of this has not been conclusive. Newer versions of this wire, with blunted ends can, we hope, prevent even accidental injury. Porcupine wire may require some upkeep; wind-blown debris can accumulate on it and must be removed.

The “Daddi LongLegs,” another wire device designed to protect rooftops and light poles from nesting or perching birds, has long stainless wire “legs” that project out from a fixed base and bend back down in a gentle curve. The legs move and flex in the breeze and swivel around the base. The larger models are intended for use on rooftops, while smaller versions are for the tops of streetlights or poles. A specialty device adopting similar principles is made for keeping gulls off boats.

In any application of bird exclusion devices, you may need a professional to install the product, especially on high-rise buildings.

**Excluding Wild Animals from Structures**

It is critical to determine whether young are present before conducting any exclusion. Always assume young are present when you consider harassing, excluding, or physically removing wild animals from homes unless demonstrated otherwise.

**Bulb Cages and Gopher Baskets**

Flower bulbs and plant roots can be protected from burrowing animals by wire cages and baskets, which can be purchased or simply homemade from sturdy flexible wire. Mesh size may vary, depending on the species causing problems and the effect on the plant of having to force growth through sometimes very small areas. Start with one-inch-square galvanized hardware cloth, if you can find it. (You can use one-half-inch square, but monitor the effect it has on plant growth.) The cage or basket is set into the planting hole, and the bulbs or plant placed inside before backfilling the hole. If squirrels are the problem, as they often are, you may get by with a cover only, and it would easier to try this first. In general, we prefer plantings that are naturally resistant to animal tampering, such as daffodils, as any buried hardware cloth will deteriorate over time and may be a nuisance to remove.

**Plant Covers**

Cloche, French for “bell,” describes a bell-shaped glass cover used to protect young plants from frost. These covers can also be used to keep hungry wildlife at bay when plants are most vulnerable (during the first couple of weeks of the growing season). Many people reuse a plastic jug with the bottom cut out—cheaper but less aesthetically pleasing—for the same purpose. (The jug is anchored by partly burying the bottom in the soil.) Row crops can be protected by fabric plant covers and tents or row covers. Both covers and cloches are especially useful where protection is only needed during the early spring. This is the time before natural foods are readily available, and damage from deer, rabbits, or woodchucks can be intense but temporary.

**Wire Mesh, Caulking, and Foam Sealants**

Caulking materials range from silicone-based fillers to common expanding-foam products. These are used to fill in around wire mesh or to fill entry holes up to several inches in diameter. Pliable wire mesh can be used to fill
holes, which are then sealed off with caulking or foam. The best material is made of copper: it is basically the copper mesh dish cleaners you see in the grocery store, just sold in larger quantities. It will not rust or deteriorate, and it may inhibit rodent gnawing. It can also be pushed into all sorts of small and oddly shaped openings.

**Chimney Caps**

Commercial chimney caps are made of painted heavy-gauge or stainless steel. They generally will withstand many seasons of exposure. Both commercial and homemade caps must comply with fire codes and can be deadly if installed incorrectly, so here, as elsewhere, obtain professional installation if in doubt.

**Fencing**

Fencing is one of the most effective and permanent ways of excluding wild animals from outside areas. Although initially costly, fencing may be the most cost-effective solution over time where damage is likely to recur (Figure 13). The trick is in figuring what kind of fence is needed for a specific situation. Fence height, material, design, and installation can all vary, depending on the species the fence is meant to exclude and other factors, so you should usually seek professional advice. Good local sources might include farm supply stores, fencing companies, or university cooperative extension agents. Some fencing supply companies also include advice and useful information in their catalogues. Community covenants and local ordinances may restrict the type, size, and design of fencing you can install. (Since animals react to electric fencing more as aversive conditioning than as exclusion, it is discussed in the following section).

Animals who take up residence under a deck or crawl space often are capable diggers, and fencing to exclude them should be extended in an L shape to prevent reentry. Ideally such footers are buried a foot deep and extend at a 90 degree angle for up to 24 inches to present a horizontal front. If this is not possible—where foundation plants, roots, or rocky soil are found, for example—the L-footer can lie on the surface instead, covered with soil or mulch. Landscaping “pins” from garden supply outlets will hold these surface footers down securely.

L-footers can be homemade from fencing material or purchased from the sources listed in appendix B (Figure 14). When animals are evicted from under decks and similar locations, this fencing is used with a one-way door that allows the animal to leave but

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**Figure 13** This fence permanently excludes deer, because of its height, and smaller animals such as rabbits, because of the narrow lower bars, from access to this yard. The homeowners can, and do, grow any plants they want.

**Figure 14** The L-footer can be used to protect any area where a burrowing animal has started to excavate a potential home. L-footers are also used preemptively to protect raised decks. When installing an L-footer, it is necessary to make sure that no animals, especially dependent young, are prevented from getting out.
Table 2 — Minimum Access Area Needed by Common Wild Animal Species Found Around Homes

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>OPENING (IN INCHES)</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BATS (MOST SPECIES)</td>
<td>1/4 x 1/2</td>
<td>Usually gain access through gaps where materials join, such as siding and soffit.</td>
</tr>
<tr>
<td>FOXES (RED AND GRAY)</td>
<td>4 x 4</td>
<td>Gray foxes are good climbers.</td>
</tr>
<tr>
<td>HOUSE SPARROWS</td>
<td>3/4 x 3/4</td>
<td>Adept at gaining access to clothes dryer, range, and bathroom vents.</td>
</tr>
<tr>
<td>MICE</td>
<td>1/4 x 1/2</td>
<td>Can fit through openings the size of a dime.</td>
</tr>
<tr>
<td>RACCOONS</td>
<td>2 1/2 x 4</td>
<td>Can fit through surprisingly small openings; heavier material required to exclude because of greater strength.</td>
</tr>
<tr>
<td>RATS</td>
<td>1/4 x 1/2</td>
<td>Can fit through openings the size of a quarter.</td>
</tr>
<tr>
<td>SNAKES</td>
<td>1/4 x 1/2</td>
<td>Some snakes fit through smaller openings; if the snake can get his head into the opening, he can get his body in.</td>
</tr>
<tr>
<td>STARLINGS</td>
<td>1 x 1</td>
<td>Clothes dryer and exhaust fan vents are a favorite; starlings can lift flaps and get in.</td>
</tr>
<tr>
<td>TREE SQUIRRELS</td>
<td>2 x 2</td>
<td>Entry often occurs through screening behind attic vents and deteriorated louvers; may require very heavy exclusion materials because of gnawing ability.</td>
</tr>
<tr>
<td>WHITE-TAILED DEER</td>
<td>12 x 24</td>
<td>Deer prefer to crawl under obstructions rather than jump over; a 9-inch or lower wire is recommended on either electric or nonelectric fencing because the animals may crawl under higher wires.</td>
</tr>
<tr>
<td>WOODCHUCKS</td>
<td>3 x 4</td>
<td>Under decks and porches; the characteristic mound of earth in front of a hole is an indicator of woodchucks.</td>
</tr>
</tbody>
</table>
not return. (Later chapters dealing with individual species have more specific information on this use). Any such repaired or modified denning area should be examined daily after the animal is excluded to make sure she has not tried to get back in or that others are not trapped inside.

**Hardware Cloth and Welded Wire**

These workhorses of most exclusion jobs are available in many different sizes at virtually any hardware outlet. Hardware cloth is used to make or repair window screening and is available in fiberglass and galvanized metal with mesh (hole) sizes that range from very fine (1/32 inch) to large (1 inch) and come in various gauges (wire thicknesses). The professional standard is one-inch, 16-gauge mesh that is galvanized after being welded. Mesh this size may be difficult to find, and, if other sizes must be used, we caution against going much larger, since small animals might be able to gain entry. Larger animals may have to be excluded with heavier mesh, which usually comes in larger sizes. When it is installed over window screening, welded wire keeps larger animals at bay, while the finer mesh keeps small animals and insects out.

**Ultrasonic Devices**

Numerous products that emit sounds inaudible to humans are claimed to be highly aversive to wildlife species. Often heavily advertised in garden and home improvement catalogues, these products, in our opinion, remain completely unproven. In the future these devices may prove to be effective and reliable, since they have that obvious potential. For the present The HSUS does not recommend ultrasonic devices for wildlife control until properly conducted scientific research can validate the manufacturers’ claims of their effectiveness in real-life situations.

**Netting**

Netting is being used increasingly to solve many wildlife problems—from unwanted sparrows and pigeons perching on buildings to deer browsing on ornamental plants. Netting is sometimes used in large-scale commercial operations, for example, to protect vineyards from depredating birds. It’s also used to make “check valves” to exclude bats from buildings.

The growing popularity of the “invisible” netting material used to protect shrubs from deer raises a potential concern. There are anecdotal reports that birds, snakes, and other animals may blunder into this fine mesh and not be able to get out. We had little documentation of this phenomenon as of 2007 but wanted to offer it as a possibility.

**One-Way Doors (Animal Excluders)**

These devices will let an animal out of a den or burrow but not back in. Not too long ago, one-way doors had to be homemade; now they are sold in several different sizes. One-way doors can be used above ground on buildings, where squirrels or raccoons are in attics, or at ground level, where woodchucks, skunks, foxes, raccoons, or other animals are getting under decks or patios (Figure 15). Very simple one-way doors for snakes are described in chapter 35. One-way doors

![Figure 15 This one-way door will let the woodchuck who has taken up residence leave but not return.](image)
should be used only when the homeowner can be sure that no young animals will be trapped inside after the adults are excluded. When used correctly the doors offer a practical and humane method for evicting animals living in or under a house.

**Vent Covers**

Birds nesting in dryer and oven vents can be excluded by installing either commercially available or homemade wire or plastic covers. The caution here, as with any exclusion strategy, is not to modify the area so much that it impedes the original function—chimneys must vent gases, dryer vents must allow the flow of air without becoming clogged, even the vents that passively allow air into attics or crawl spaces and are working to meet a specific purpose cannot be entirely sealed off. When in doubt, consult a professional.

**Tree Protectors**

Tree protectors, which are wrapped around tree trunks, are made of wire fencing. Larger mesh is used as protection from animals such as beaver, and finer mesh wrapping, sold at many nurseries, protects younger trees from small animals, such as voles. Their uses are further explained in the chapters devoted to individual species.

**Window Well Covers**

These simple, inexpensive plastic covers prevent wild animals from falling into window wells (Figure 16). Skunks and snakes are common victims and often cannot get out without assistance. The covers double as insulation and protection from the elements and ought to be used everywhere.

**Aversive Conditioning**

Aversive conditioning refers to any active effort to “teach” a wild animal to stay out of a given area. It is the same principle as teaching your dog to stay off the sofa or your cat to stay off the kitchen countertop. It can be as simple as stepping out onto the back porch and yelling or as sophisticated as high-tech electronics that broadcast species-specific distress calls. It has the same chances of success as do the many devices and strategies you may have tried with your cat or dog. (Sometimes life is simple, sometimes difficult, but it should always be humane.)

Common sense tells us there is a limit beyond which frightening or scaring techniques should not be used on wild animals. It is clearly inhumane to harass a wild animal in a way that creates excessive stress—but what is “excessive”? For migratory birds and some species of special concern, federal and state law authorities tell you exactly what is or is not acceptable as a harassment technique. For other species limits, if any, are set by anti-cruelty statutes. As a general rule, it is inappropriate to harass or frighten a wild animal when he cannot escape from the stimulus or to pursue and use scaring or frightening stimuli persistently. Fright and harassment are not ends or solutions to problems in and of themselves and must always be coupled with other strategies that strive to eliminate the circumstances that caused the problem in the first place.

Creativity has its place in devising aversive strategies, and you may have some tools in your house in the form of simple children’s toys or household castoffs that might prove effective. Here are some strategies and devices used for aversive conditioning.
Acoustical Alarms

Commercially manufactured alarms rely on loud noises (sometimes combined with bright lights) to frighten both birds and mammals away from areas where they are not wanted. Hand-sized motion detectors and alarms, intended mainly for indoor use, can be used in attics or crawl spaces or, with proper protection from the weather, in some outdoor situations. Triggered by motion, they set off a loud alarm to frighten intruding animals. These alarms might also frighten or waken nearby humans, so they should only be used where they are not likely to alarm or bother people.

Bird Distress Calls

Tape recordings of the distress calls of individual bird species have been used for a long time to frighten away birds of the same species. More recently, they have taken the form of digital recordings in devices made to work on specific species. Used properly, these can help disperse birds such as starlings and crows from roosts and geese from parks and other public areas. Distress calls should not be used where people could be bothered or inconvenienced. They are most likely to be effective when used in combination with other techniques.

Effigies, Scarecrows, and Kites

Scarecrows are one of the oldest, simplest, and most effective methods of frightening birds; they even work on some mammals. Scarecrows can be as simple as plastic garbage bags or strips of lightweight material tied to a stake in the ground, or as complex as a robotic model that randomly inflates itself to appear as if a human were rising from the earth. Movement is an important element in any scarecrow design, and those that can catch breezes, or are motorized, are generally more effective than stationary ones.

Lifelike replicas of hawks, snakes, and owls are widely marketed as bird-frightening deterrents. The effectiveness of these devices varies with the target species, the type of model, its placement, and the extent to which the device resembles a real predator. Moving effigies are likely to be more effective than stationary ones. Hawk and eagle effigies used as kites can have a real impact on geese, gulls, and other birds in open areas. Regardless of movement or appearance, however, birds can become acclimated to these devices and cease to fear them. The trick to increasing the effectiveness of effigies lies in innovative human use and presentation of the stimulus, as much as in the nature of the stimulus itself.

Electric Shock

Farmers have long used electric fencing to protect crops. It even has proven effective in keeping large animals, such as bears, from valuable and enticing resources such as beehives. The principle involves delivering a high-voltage but low-amperage jolt that does not physically harm the animal but delivers a shock unpleasant enough to create a strong negative conditioning response. Because of the great differences in size and susceptibility to shock among species (deer, for example, can be quite resistant to shock because their hooves are relatively good insulators), the exact requirements for effective electric fencing vary greatly.
These fences are potentially dangerous to both people and animals, and they must be used in accordance with any local restrictions or ordinances and common sense. Electric fences should not be used in places where small children or pets could be shocked and must always be well marked with cautionary signs. All electric fences require frequent inspection and maintenance; it is important to keep surrounding areas clear to prevent plants from growing into the wires and shorting them out.

Single-strand electric fences set at an appropriate height can deter species ranging from woodchucks and raccoons to deer and bear. Sometimes the fences work best by attracting the animal rather than by repelling him. The theory is that, by luring the animal in to investigate the fence, he is much more likely to be shocked in a way that conditions him effectively to avoid the general area. For deer or raccoons, affix tinfoil strips to hold a lure (peanut butter for deer, jelly or licorice paste for raccoons) that draws the animal to investigate the wire (Figure 17). Individual battery-charged posts, similarly baited, can attract deer and deliver a lesson. For smaller animals, such as raccoons and woodchucks, single-strand electric fences can be installed in front of nonelectrified fences or other obstacles. The shock is then delivered before the animal is able to climb the larger fence. All-in-one kits offer small gardens and backyard ponds an easy electric fence option.

Polytape electric fencing is also single-strand, but this much wider and more highly visible tape strip is meant to work as a visual repellent as well as a shocking device. Once an animal has been shocked by a polytape fence, he is likely to remember and recognize the highly visible tape and avoid going near it again. The brightly colored tape is also more visible to people. There is probably less maintenance required for a polytape than for single-strand fences simply because the greater visibility of the tape prevents it from being knocked down as often.

Multistrand, high-tensile electric fences are used mostly to protect highly valued resources such as orchards or agricultural crops. These, more than other types of electric fencing, require expertise to install, and we recommend local sources or consultation with the fencing companies listed in appendix B before considering their use and application. Specialty products are made to repel birds, primarily pigeons, from buildings and are sourced in appendix B.

**Scare Balloons**

Eye-spot balloons have been used for a number of years to frighten birds from fields and open lawn areas and may work well depending on the setting and context. The balloons rely on what is called a “supernormal” stimulus—in this case a highly enhanced “eye” that menacingly occupies the center of the balloon. We’re not currently as enthusiastic about the potential of these devices as we used to be, having experienced firsthand some failures in the field. Movement of the balloons (as with effigies) and repositioning them seem to be important factors. Less expensive and readily available Mylar® party balloons with bright silvery finishes may be equally effective deterrents on a short-term basis. These might be used to frighten any of the variety of birds causing conflicts (waterfowl, starlings, and pigeons being the most

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**Mothballs**

Naphthalene, a chemical used in moth balls, is registered with the EPA as a bird repellent. Paradichlorobenzene, another commonly used ingredient in mothballs, is registered for use in the form of Varpel Rope, but not for use outdoors in mothball form. Besides most likely being ineffective in such a context for any species, these white “candies” could be a danger to any children putting them in their mouths. Consider all of the implications of using a product as well as what the label says you can and can’t do with it.
common) and deer, skunk, foxes, and (perhaps) raccoons. For a dollar or two of investment, a party balloon maybe worth a try.

**Scare Tape**

Mylar® tape is a strong laminated metal and plastic material that was originally developed for use in the NASA space program. It is highly reflective and can create a dazzling pattern of light when in motion (Figure 18). A holographically imprinted version has even greater light-reflecting properties. Cut into strips of varying lengths and widths, this tape can be hung in streamers from posts, wires, house gutters, or anywhere else the homeowner wishes to repel animals. It can be twisted and strung to make a temporary fence that, while not sturdy enough to keep animals out, can frighten them away. As with other harassment tools, it may be most effective when used in combination with other strategies. It is less effective on cloudy days and at night; however, whenever it can be set up to catch occasional flashes of light it should work.

Mylar® tape has been incorporated into a number of variants on the basic concept, including devices that rotate or flap in the wind and combine the signal properties of motion and brightness. Unpredictability and motion are key requirements for any visual frightening device.

**Sprinklers**

The ordinary garden hose with a power nozzle attachment has long been used to scare away unwelcome animals. The difficulty has been that the homeowner has to see the animal, and the animal has to be fairly close. A second-generation device combines a motion sensor with an oscillating sprinkler (Figure 19). This sentinel can sit quietly in a yard or garden for hours waiting for an offending creature to draw near before coming to life with an energized blast of water. The main drawback may be its somewhat hefty price tag, as well as the possibility that homeowners given to forgetfulness may be its victims as often as the intended target species.

**Lights and Lasers**

More and more high-tech devices are coming onto the market every year, including such sophisticated electronic devices as motion-sensitive lights, strobes, and lasers that find use in wildlife-control work. Motion-sensitive outdoor lights are probably the most economical, as well as practical, aid, since they can scare animals as well as alert the homeowner to the possibility of deer, raccoons, or other animals in the yard. An added benefit could be in the exercise the homeowner gets while going back and forth to the window to see what has set the light off “this time.”

High-powered lasers are used often now to deter birds, such as geese, from occupying sites where they are unwanted. The focused light is not directed at the birds but at the ground or water they are resting on; as it scatters and diffuses, it creates a stimulus that causes high alarm. Strobe lights have more limited application and use, but research to determine if they can repel birds from airplanes’ flight paths is encouraging, and the information that might come from such studies eventually could be applied elsewhere.
Chemical Repellents

The use of a chemical compound to deter wild animals humanely is appealing to many people, and it is difficult to disentangle this appeal from an objective assessment of the compounds’ effectiveness. (We thank Russell Mason, Ph.D., a leading expert on repellents, for contributing the following technical summary.)

Chemical repellents have been used to protect crops and gardens for centuries. Formal scientific investigations of these substances, sought as rodent and deer deterrents, started in the first half of the twentieth century. Generically, chemical repellents are irritants or odors that wildlife avoid or tastes that wildlife refuse to consume. A variety of deer, rodent, canine, and bird repellents are commercially available. Others can be concocted at home, following recipes and application instructions widely available in gardening manuals. Examples of home remedies include soap (particularly those advertised as having a “fresh scent”), human hair, household ammonia, and “hot sauce.” Commercial repellents typically incorporate capsaicin (the active chemical in hot sauce), various higher fatty acids (cheese- or fish-like odors), bone tar oils (decay odors), bitrex (denatonium salts or acids that taste bitter to humans), or urines.

With the exception of hot sauce, few home remedies actually work. Soap and human hair sometimes confer limited (weak) short-term protection but otherwise are of little use. Among commercial repellents, those containing capsaicin, bone tar oil, or higher fatty acids can prevent animals from eating the treated plants.

No repellent currently available will always prevent animals from entering, crossing, or living in treated locations. Despite marketing claims to the contrary, there is no such thing as an area repellent. In many cases, the principle benefit of chemical repellents may be psychological; they give users greater peace of mind. Perhaps for this reason, repellents’ marketing strategies often feature anecdotes and testimonials, rather than science. Products marketed this way should be viewed with suspicion. The lack of dependable information reflects the fact that the Environmental Protection Agency (EPA) often does not require repellent manufacturers to prove they actually work. Instead, the agency requires evidence that repellents are environmentally benign.

In situations where repellents might work, following a few guidelines greatly increases chances for success.

- Apply repellents at the first signs of damage or before expected damage is observed.

Figure 19
This oscillating sprinkler is activated by a motion-sensing device to send a blast of water in the direction of any moving object triggering its sensor. It can help keep a variety of wild animals, not to mention the occasional cat, dog, or person who violates its protective radius, away from protected plants.
• Reapply repellents regularly, especially after rain or snow.
• Apply repellents directly to the items that need protection and not to entire areas.
• Apply repellents when it is clear that wildlife have other foods available to them (e.g., other plants to browse, fruit to consume, etc.). If no other food is available, hungry animals will eat whatever they find, even plants treated with a repellent that would deter them under other conditions.
• Recognize that season of the year is important; repellents are unlikely to work in late winter or early spring when little alternative food is available, unless they are combined with other strategies such as physical barriers.

In general, repellents fall into two broad classes: those that are physically irritating and those that alter palatability (taste). Both classes are most effective when used to prevent animals from eating or chewing treated items such as food or electrical wiring. Contact with the animal’s mouth and nasal passages is key.

**Pain (Irritation)**

Among chemical repellents, substances that cause pain have the most immediate effect. This is because pain elicits immediate avoidance independent of learning and because repellency does not diminish as long as the repellent chemical is present. Irritants are not simply “bad” tastes or smells; they stimulate specialized pain receptors in the exposed mucous membranes of the eyes, mouth, nose, and gut. For mammals, including humans, capsaicin, capsicum oleo resins, and volatile chemicals such as mustard oil and ammonia are strong irritants. These are the active ingredients in commercial hot sauce products and many deer and rabbit repellents.

Bitter and acidic substances are rarely, if ever, effective feeding deterrents. While they can reduce the consumption of treated materials slightly, wildlife acclimate to them within a short period. Products that claim to work because of a bad taste are doing so largely (if not solely) in the absence of evidence.

For birds, methyl anthranilate (a chemical in Concord grapes) is an effective irritant at concentrations that are inoffensive to most mammals. This chemical has a fruity or floral odor to humans (and presumably to other mammals) but is highly irritating to birds, highlighting a fundamental difference in how these groups’ nervous systems perceive irritants. In general, substances that irritate mammals are inoffensive to birds and vice versa. Capsaicin, for example, is an extremely effective irritant for mammals and works even in concentrations as low as 1–10 parts per million (ppm). Birds, on the other hand, tolerate capsaicin concentrations as high as...
20,000 ppm in drinking water. Likewise, mustard oil (allyl isothiocyanate, the active ingredient in tear gas) is extremely irritating to mammals, provoking intense short-term tearing and difficulty breathing. However, when open vials of mustard oil are placed in starling nest boxes, birds build more nests, lay more eggs, and hatch more nestlings. This surprising effect likely is because mustard oil is an insecticide and fumigant against pathogens and parasites in the nest boxes but is not a bird repellent.

The great disadvantages of irritants as wildlife repellents are that animals do not learn to avoid treated materials and, at least for mammals, irritants affect all species at about the same concentration (i.e., if the irritant concentration is too low to affect humans, it is unlikely to affect wildlife and vice versa). For reasons that remain unclear, wildlife continually “test” treated materials and resume feeding once irritant concentrations diminish. Also, the effectiveness of irritant repellents varies depending on the context (where and when) and crop where they are used. Although several brands and formulations are sold to repel a variety of birds (starlings, blackbirds, cowbirds, gulls, Canada geese, mallards) from a number of crops (apples, grapes, cherries, blueberries, corn, sunflower, rice, turf, ornamentals) and settings (e.g., lawns, ponds, indoor areas), there is still a need to show how effective these different applications are under different conditions. For substances such as methyl anthranilate and capsaicin, there is also the possibility treated food crops will taste off-flavor to people.

**Palatability**

Animals usually avoid tastes that are followed by sickness, at least temporarily, an effect called conditioned avoidance. Conditioned avoidance can occur after a single negative experience, particularly when sickness is great and the taste or food is new. It is much harder to condition wild animals to avoid a taste or a food they are already familiar with.

Conditioned avoidance protects crops. It is the mechanism that makes methiocarb (Mesurol) work as a bird repellent and disulfiram (Thiram) as a bird and mammal repellent. It has also been tried on coyotes to control preying on livestock and on bears to teach them to avoid garbage dumps. Neither of these attempts has been especially successful, although the latter has not been researched as thoroughly. (It may be possible to train bears to avoid specific garbage cans.) At present, there are few conditioned avoidance products on the market, although disulfiram (Thiram) is still sold as a deer repellent. This reflects the expense and difficulty of registering and maintaining the registration of vertebrate pesticide chemicals with the EPA. Disulfiram is chemically similar to Antabuse (a drug used to help alcoholics stop drinking) and can be absorbed through the skin. People who drink alcohol soon after applying disulfiram have become ill as a result.

**Combinations**

Repellent combinations may be more effective than repellents with single modes of action. It makes sense intuitively that irritation and gastrointestinal malaise would provoke stronger avoidance than either alone. For example, a mixture of capsaicin (pain), disulfiram (sickness), and Big Game Repellent (carnivore diet) might be considerably more effective as a deer repellent than any one of these substances would be alone. For birds, anthraquinone is a commercial repellent that probably has negative sensory (visual, as it is perceived by birds in ultraviolet spectra) and post-ingestive (causing malaise) effects.

The caveat on combination repellent products is that each of the components needs to be present in biologically significant concentrations. This is frequently not the case. For example, some deer repellents contain egg solids and capsaicin. While both ingredients are repellent to herbivores at appropriate concentrations, the capsaicin concentration in these mixtures is very low. For this reason, the mixture may be no more effective than egg solids alone.
The Bottom Line on Repellents

Irritation is a more effective repellent principle than conditioned avoidance, and conditioned avoidance is probably a more effective repellent principle than predator avoidance. Regardless, the effectiveness of any repellent is affected by (1) the number and density of animals causing problems, (2) the alternative food available, (3) the desirability (to the animals) of the treated material, (4) weather conditions, and (5) the concentration of active ingredients the target animals experience. Because of these factors, chemical repellency is always relative and thus always susceptible to failure. Given sufficiently high numbers of animals and sufficiently few food alternatives, repellents will fail. Repellents are not a stand-alone tactic to resolve wildlife conflicts; they can be most effective when combined with other methods such as those described in the earlier sections of this chapter.

Population Control

Often, conflicts with wild animals in urban and suburban environments are attributed to “overpopulation” of a given species, such as white-tailed deer and Canada geese. These and other animal generalists who thrive in towns and cities often do so well that their populations grow rapidly enough to appear explosive. But “overpopulation” is a relative concept, and wildlife biologists today are quick to distinguish between the numbers of animals that can be supported physically on a given piece of land (the biological carrying capacity) and the numbers that people are willing to tolerate (the social or cultural carrying capacity). Conflicts between people and wildlife start when animal numbers cross the social carrying capacity threshold, which often is far lower than the threshold for biological carrying capacity.

One of the most controversial issues with wildlife today surrounds “controlling” populations labeled “overpopulated” or “overabundant.” The HSUS has led national and international efforts in developing approaches for humane population control. Currently, these fall into two broad categories: contraception, used in mammals to prevent pregnancy, and egg addling, used with birds to prevent hatching. Others are developing reproductive controls as well. In particular, a drug (nicarbazin) to prevent birds’ eggs from hatching has been registered by the EPA for Canada geese and pigeons and should be available soon for other species as well.

By whatever method, limiting population growth requires a long-term effort to make significant inroads in population size. It can also show results in the short term when fewer animals are using a problem site to raise their young the season after the method was applied.

Contraception

The idea of using contraception to limit the growth of animal populations has been around for more than a half-century, but rarely championed outside the animal welfare and protection community. Since the 1980s, The HSUS has focused on developing immunocontraception, a vaccine-based birth control method that uses the body’s immune response to prevent pregnancy. The HSUS’s immunocontraception programs now encompass a range of research projects around the world, with free-ranging white-tailed deer, wild horses, elephants, water buffalo, domestic animals, such as dogs, and more than 150 species of zoo animals.

Virtually all of The HSUS’s immunocontraception studies use the PZP (porcine zona pellucida) vaccine administered by dart or hand injection. PZP is a protein in pig ovaries (the small amount of protein used in this research is collected from pigs already destined for slaughter; no pigs are killed for the sole purpose of making PZP). In field studies the vaccine has proven highly effective and reversible; it does not pass through the food chain or negatively affect the health or behavior of treated animals. The HSUS is also strongly advocating for and funding the development and humane testing of synthetic contraceptives so a safe, economical immunocontraception option can be available for large-scale use.
Public attention has turned to contraception as the solution to deer-human conflicts in recent years as word gets out about our successes. The HSUS receives numerous inquiries annually from interested parties who hope for a cure for deer-human conflicts. While immuncontraception holds promise for the future, this tool is still in its developmental stages, and it is only one tool. Immuncontraception can ultimately be one of several management alternatives, but it is not a “magic bullet” to control every problematic free-ranging wildlife population. Political and bureaucratic obstacles must be overcome, including the long process of testing and approval for the vaccine and resistance to using contraception as a management tool from some state wildlife agencies. (They may be concerned that revenues derived from deer hunting in particular will fall.) Still, we remain optimistic about the future of wildlife contraception.

**Egg Addling**

Addling, which means “loss of development,” is commonly used to refer to any process that makes an egg unviable. Addling can occur naturally when incubation is interrupted for long enough that the egg cools and the embryo stops developing. People addle eggs to limit reproduction of species causing conflicts. Older methods of shaking or piercing eggs to physically destroy egg contents have been replaced by oiling eggs or simply removing them from the nest and allowing them to cool. Addling has been used to limit reproduction of a variety of bird species: gulls, to protect eggs and chicks of endangered terns; mute swans, to limit their claimed impact on aquatic plants; and, most extensively, Canada geese, to limit the growth of flocks in urban and suburban areas.

To be humane, it is imperative to addle eggs in the earliest stages of development. When an air sac develops inside the egg, the embryo is typically too developed for addling. The HSUS has a written protocol for Canada geese that details how to addle eggs of this species humanely. Other species have different nesting chronologies and incubation periods, so an addling protocol must be developed for each species.

**Addling Permits**

Egg addling for any species except those exempt from the Migratory Bird Treaty Act is regulated by federal and state wildlife agencies; be sure to check any regulations that might be applicable in your state before even considering use of this technique.

**Resources**

**Repellents**

Because the brand names and even formulations of repellents change frequently, we recommend web-based searches for current information, or a visit to your local household supply store or plant nursery. Often a conversation with a local nursery manager or salesperson can provide the best advice and direction about what products are working in your area. More information on the science of repellents can be found at this site: <www.aphis.usda.gov/ws/nwrc> and we mention a couple of specialty products as well in appendix B.
