UTAH STATE UNIVERSITY EXTENSION

CATEGORY 12

Vertebrate Animal Pest Control Study Guide

Extension
UtahStateUniversity

UDAF

Contents

Preface

This Category 12: Vertebrate Animal Pest Control Study Guide is designed for individuals preparing to take the Utah commercial and noncommercial Category 12: Vertebrate Animal Pest Control exams.

For more information regarding certification and licensing of pesticide applicators in Utah, see the Utah Department of Agriculture and Food website.

This edition of the Category 12 Study Guide is a major rewrite of the previous manual. It represents a close cooperation with leaders in the green industries of Utah, Utah State University (USU) Extension, and the Utah Department of Agriculture and Food (UDAF), as well as with the Pesticide Safety Education Program (PSEP) from other states. This cooperative effort expands our access to a broader array of expertise and resources.

This project is facilitated by the PSEP, part of the Utah State University Extension. USU PSEP neither endorses nor opposes the use of pesticides. USU PSEP's two primary goals include helping pest managers (1) determine when to use a pesticide, and (2) develop knowledge and skills to handle pesticides legally, safely, and responsibly.

The old study materials for this category should no longer be used and should be offered for paper recycling. We plan to revise and update this study guide in future years. Feedback from manual users is the most valuable source of information for improving the manual as a training, education, and reference tool. We welcome comments from users of this manual, both what you have found useful and suggestions for improvement.

Comments about this manual may be sent to:

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Major Sources

Pacific Northwest Wildlife Management Basics for Pesticide Applicator Licensing. Washington State University Extension. EM008

Study Guide for Vertebrate Pest Applications. Ohio State University Extension

CHAPTER 1

Introduction

FOREWORD

Category 12: “Vertebrate” is a diverse pesticide license category in Utah. This category covers pesticide applications in the control of vertebrate pests.

Whether you are a new or experienced applicator, you can take pride in your contributions to the quality of life enjoyed in Utah. Your efforts help protect our homes, institutions, restaurants, industrial establishments, and more from pests.

INTRODUCTION

Vertebrate pests cause damage to our food, health, and property, with management costs exceeding billions of dollars annually. Losses resulting from insect and rodent damage to stored food alone exceed $1 billion each year. Pests may also transmit diseases that cause human illnesses, such as bacteria and viruses. Lastly, some pests living in and around buildings can be a nuisance to people by their presence, detracting from their overall quality of life

Purpose of the Study Guide

Public concern over the use of pesticides continues to grow, and professionals who handle pesticides must prove themselves capable of using these chemicals responsibly. This study guide contains materials to help you prepare for the Category 12: Vertebrate Pesticide Applicator exam. To obtain a pesticide license, Utah requires you to demonstrate your competency by passing the exam. Occasionally, the materials presented in this study guide are also covered in the National Core Manual but is presented here as it applies to applicators in Category 12.

If this is your first license under Category 12, or you are retesting, you are expected to study available materials. Once you think you are ready:

1. Pay for your license.
2. Find a proctoring center and schedule your test time.
3. There will be a fee for testing.
4. Go to the testing location to take the exam. NOTE: You MUST bring your license receipt and a valid government ID (EPA requirement).
5. Pass the exam at 70% or better.

You must also pass a separate exam for the Core. All exams are closed book. Find testing center locations on the Utah Department of Agriculture and Food (UDAF) webpage at https://bit.ly/3wybBw8. If retesting is necessary due to not attaining 70% or better, you are limited to two attempts per day. Depending on the testing center, there may be a charge to retake the exam.

This study guide was adapted from the "Pacific Northwest Wildlife Management Basics for Pesticide Applicator Licensing" Washing State University Extension graciously granted copyright permission to use these materials. UDAF and Utah State University (USU) Extension experts modified the content to provide pesticide information relevant to Utah.

Because website links change, weblinks referred to in this study guide will be maintained online at https://bit.ly/3wybBw8

Study Guide Limitations

This study guide is not training for techniques and products used to control pests. It is intended to provide information so that pesticide applicators can use any product safely and legally. This study guide does not:

- Contain product-specific directions for use. Always read and follow the pesticide product label, which is a legally binding document. Note that some Utah laws may be more restrictive than label directions.

- Advocate pesticide use over other means of pest management. Rather, it focuses on the safe and proper use of pesticides by people who have already determined that pesticides are necessary for a given situation.

Study Tips

Everything in this study guide is considered testable. You will need to learn the study guide concepts to pass the closed-book, multiple-choice exam.

Everyone learns in different ways. If you remember things better by writing them down, take notes, review, and rewrite them. If you prefer visual learning, highlight the information. If you learn better by hearing things, read and repeat passages to yourself aloud. Repetition is key. Consider making flashcards of important information. Study with a coworker and test each other on key information and terms. There are several online options to

set up flashcards for studying. This website has some pre-made pesticide flashcards at:
https://bit.ly/3wybBw8

Once you've completed a chapter, go back and review the learning objectives and make sure you understand each concept.

CHAPTER 2

Managing Problem Wildlife

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Understand basic terminology and concepts related to vertebrate pest management.
2. Realize how different people assign different values to animals (or pests) based on situations and personal experience.
3. Understand the difference between native and non-native animals.
4. Understand the importance of professionalism.
5. Understand the legal definition of "take" and how that relates to vertebrate pest management.
6. Know the importance of complying with local, state, and federal regulations pertaining to vertebrate pest control.

This chapter introduces basic terminology and concepts important when managing problem wildlife because different people assign different values to different animals in different situations. Wildlife and pest managers must understand that when certain situations cause birds, snakes, deer, or other wildlife to become pests, management options may differ between native and non-native species. Proper identification of problem birds, mammals, and snakes is critical in both agricultural and urban settings.

VERTEBRATE PESTS

A vertebrate is an animal that has a backbone or spinal column. Birds, reptiles, amphibians, and mammals (including bats) are all vertebrates. In this study guide, we refer to vertebrate animals as vertebrates, wildlife, or animals.

Animals become pests when they are nuisances, pose human health risks, damage property, crops, forests, or natural resources. Wildlife damage to agriculture in the United States costs millions of dollars each year. Vertebrates may become pests in many different ways, including but not limited to burrowing into the ground, gnawing or pecking structures, feeding on trees and crops, preying on livestock, threatening humans or domestic animals, and contaminating human or livestock food supplies. Sometimes animals serve as reservoirs for human disease organisms. In rare instances, local outbreaks of rabies, hantavirus, or plague can be a managed by controlling problem wildlife. It is essential for wildlife managers to take precautions when handling animals to limit their exposures to disease organisms such as tularemia, roundworms, and campylobacteriosis.
In Utah and the Intermountain West, most vertebrate pest complaints involve birds and mammals. This study guide focuses on the most common birds and mammals and includes other vertebrates that pose human health risks or damage property, agriculture, and natural resources.

EXAMPLES OF PEST ANIMALS AND ASSOCIATED BEHAVIOR

- bird hazards to aircraft
- starling and blackbird contamination at feedlots
- bird damage to aquaculture
- pigeon, starling, and blackbird roosts
- rodent and bird feces contamination of food or feed
- Canada geese grazing, feces, and noise
- coyote predation of livestock or skunk predation of waterfowl
- beaver flooding roads and damaging timber
- gophers, raccoons or deer damaging orchards, crops, and ornamental landscaping
- bears destroying timber and beehives
- rodent fleas transmitting plague

THE GOVERNING PRINCIPLE OF VERTEBRATE PEST

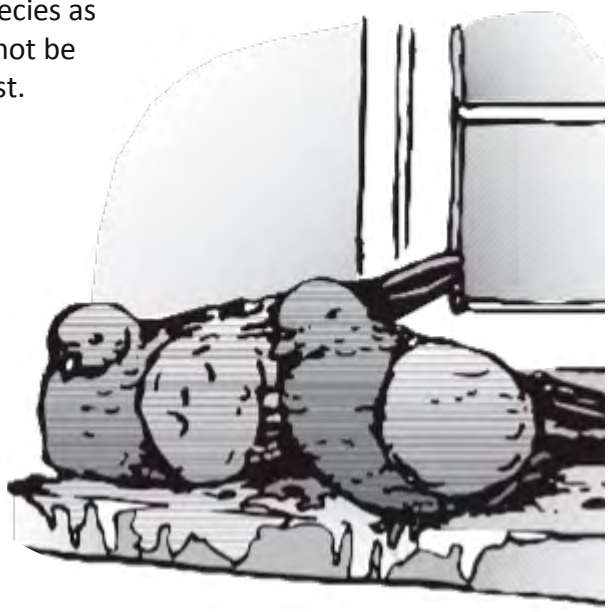
One basic principle governs any approach to vertebrate pest control: **try to eliminate the damage, not the animals.** When damage is controlled, people can usually tolerate or may welcome the animal(s) involved.

Vertebrate pest management professionals must recognize the positive values of all animal species and the need for humane treatment of managed animals. Many different strategies are used to prevent problems and control unwanted animals, including non-chemical and chemical approaches. If pesticides are used, heed all label precautions and instructions to ensure your safety as well as that of other people, pets, livestock, and non-pest wildlife.

THE VALUE OF ANIMALS

All animals have value to somebody, whether aesthetic, economic, or cultural. Sometimes, people value a species in one situation but not in another. When does an impressive, five-by-five buck or a round-eyed, adorable raccoon stop being an appreciated part of nature and turn into a pest? Clearly, the term "pest" depends on the values and experiences of the individuals affected. The mournful sound of a coyote howling in the distance may thrill stargazers, while a nearby shepherd may consider it a threat. Some adults and young children may enjoy feeding doves and pigeons in city parks, while building or railroad yard managers may loathe these species for the maintenance troubles they cause. Values also vary among individuals. Being sensitive to the different values that people assign to animals is an integral part of vertebrate pest management.

Many vertebrate animals, particularly those that co-exist with us in suburban and urban areas, can cause damage or endanger human health and safety and become a pest. Some species tend to be pests year-round (i.e., pigeons in a city park), while others may only cause problems seasonally (i.e., deer eating in an apple orchard). A good philosophy when one is managing vertebrate species is to consider that while the individual animal(s) causing the conflict may be a pest in that situation, the species as a whole should not be considered a pest.



NON-NATIVE ANIMAL SPECIES

Some pest problems stem from animals that are not native to the region they now inhabit. Many animals have been imported from other states, countries, or continents either purposefully or unintentionally. Unfortunately, these species can become a problem instead of a benefit. European starlings, house sparrows, Norway rats, roof rats, and nutria are non-native animals that have expanded their range to many parts of North America, where they compete with native species for resources. Often, their large numbers or destructive behavior cause them to be considered pests in their non-native environments. The impact of non-native vertebrate pests can have negative economic and ecological effects on agriculture, urban areas, and the natural environment.

PUBLIC RELATIONS AND PROFESSIONALISM

What is "take"?

To hunt, harass, shoot, harm, wound, kill, trap, capture, collect, or attempt to do any of these things.

At times it may be necessary to take or remove an animal to solve a damage problem. Legally, "take" means to hunt, harass, shoot, harm, wound, kill, trap, capture, collect, or attempt to do any of these things. Before choosing a control method, consider how the public might react and the opinion of your clients. Every management situation is unique, and differences in values may lead to different public responses, given the species and the situation. While some members of the public demand lethal control actions, others may question such management. When deciding if it is necessary to remove or kill an animal, always select the most humane and practical management method that is safe, effective, and considerate of the target animal. For example, place live-capture traps out of public view and provide trapped animals with shade and water. Always use humane practices when handling captured animals and discretion to ensure you do not upset others when handling animal carcasses. When in doubt, a good rule of thumb is to follow the American Veterinary Medical Association euthanasia guidelines, found at: https://bit.ly/3wybBw8.

Before starting any management actions, communicate your plans (what you are doing, techniques to be used, and future prevention strategies) with all people (homeowners, business owners, political entities) in the treatment area.

It is imperative that you comply with the various local, state, and federal regulations pertaining to vertebrate pest control. Typically, native species have greater protections than non-native species. Animals classified as "game" have another set of regulations overseeing their management versus those classified as "non-game animals." Other classifications are "furbearing," "prohibited species," "predatory animal," and "endangered or threatened species." Consult with the Utah Division of Wildlife Resources to make sure you understand the levels

of protection for certain species and inquire whether your control strategy is legal and feasible. Be sure to obtain the appropriate training, licenses, or permits before managing problem wildlife. Links to Federal and State regulatory agencies are discussed in Chapter 3, and links are at: https://bit.ly/3wybBw8

Lethal Control Considerations

- Consider how the public might react as well as the opinion of your clients.
- Every situation is unique, and public opinion or reaction can vary.
- Place live traps out of view.
- Provide shade and water for trapped animals.
- Always use humane practices when handling captured animals.

CHAPTER 3

Laws Regulating Vertebrate Pest Management

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Know state and federal laws that govern vertebrate pest control.
2. Know federal and state departments and services that oversee different vertebrate groups.
3. Know how federal regulations affect vertebrate pest management.
4. Know Utah Department of Agriculture License key points.
5. Understand requirements and recommendation associated with pesticide application records in Utah.

INTRODUCTION

Federal and state laws governing vertebrate pest control are in place to minimize concern for animal welfare and mitigate risks to people, pets, livestock, and the environment from rodenticides, avicides, and other pesticides used to control animals, as well as other management methods. Regulations at local and state levels can be more restrictive than federal laws. It is important for any wildlife manager to understand and keep current with all laws that affect methods used to control wildlife.

Review your state's pesticide laws and safety manual for federal and state pesticide laws, pesticide formulations, labeling, personal and environmental safety, and safe handling procedures. Remember that some pesticides used to manage vertebrate pests are classified as "restricted-use" and can only be applied or purchased by certified applicators or those working under their direct supervision.

This chapter introduces several federal and state wildlife and pesticide regulations that must be followed when managing wildlife. Links to agency websites and Acts listed below can be found at https://bit.ly/3wybBw8

Three Utah Pesticide Applicator Licenses

- Commercial
- Non-commercial
- Private

Non-commercial and Commercial applicators shall not supervise the application of any RUP by unlicensed individuals in Utah.

FEDERAL AGENCY OVERSIGHT

Four main federal agencies protect and help manage wild animals, birds, and fish and have different authorities for managing problem wildlife. These agencies work in collaboration with the Utah Division of Wildlife Resources.

United States Fish and Wildlife Service

The United States Fish and Wildlife Service (USFWS) is housed within the U.S. Department of Interior. The USFWS is responsible for the management and conservation of migratory birds, wildlife, and freshwater fish, including threatened and endangered species. You must obtain a permit from this agency to "take" migratory birds and threatened or endangered species.

United States Department of Agriculture Wildlife Services

Wildlife Services within the United States Department of Agriculture–Animal and Plant Health Inspection Service (USDA–APHIS/WS) responds to requests by the public and other agencies in need of help dealing with wildlife damage to agricultural property or natural resources and/or wildlife threats to human health and safety, private property, or threatened or endangered species. The costs associated with such solutions are shared among affected individuals. USDA Wildlife Services has the authority to use certain control strategies not allowed for commercial wildlife control specialists. USDA Wildlife Services also provides advice, recommendations, information, and materials to manage potential and existing wildlife damage problems. They will help identify the wildlife species responsible for specific damage and determine the extent of the damage.

United States Forest Service

The USFS, located within the Department of Agriculture, is responsible for the management and conservation of riverine amphibian and fish species and their habitat. Pest managers might need to work with this agency if their management of a pest animal could impact endangered or threatened fish species like Bonneville cutthroat trout or northern leopard frog.

Bureau of Land Management

The Bureau of Land Management, part of the Department of the Interior, is responsible for the management and conservation of rangelands that support endangered and threatened species of reptiles, birds and mammals. Pest managers might need to work with this agency if their management of a pest animal, such as a ground squirrel or pocket gopher, might impact an endangered or threatened species or its habitat.

FEDERAL REGULATIONS

Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) was enacted in 1947 to protect consumers from fraudulent pesticide products by requiring manufacturers to register their pesticide and provide label information about the contents, directions for use, and antidotes if the chemical is exposed to humans. Although herbicides are not included in the title, they are included under this regulation.

The United States Department of Agriculture (USDA) had responsibility for the implementation and enforcement of FIFRA until the Environmental Protection Agency (EPA) was formed in 1970. At that time, responsibility for FIFRA transferred to the Office of Pesticide Programs (OPP) at the EPA. Amended several times since first enacted, one of FIFRA's most important amendments passed in 1972, which led to more active regulation of product safety and an emphasis on the protection of public health and the environment. Today, registration decisions are based on data which demonstrates that the pesticide will not result in “unreasonable human health or environmental effects.”

Endangered Species Act of 1973

The Endangered Species Act and state laws specify what species are federally protected and state protected as endangered and threatened. Endangered species are those most likely to become extinct, while threatened species are documented as heading toward endangerment and possible extinction in the future. The federal Endangered Species Act is co-administered by the USFWS and National Marine Fisheries Services.

The ESA protects endangered species and their habitat. Under ESA, it is a violation of federal law to use a pesticide in any manner that may kill or otherwise harm an endangered species or adversely modify their habitat. Some pesticide labels now

KEY ELEMENTS OF FIFRA

- EPA reviews all pesticideand their uses, and approves the product label. All pesticides must be registered as "unclassified"/"general use" (GUP), or "restricted use" (RUP). A pesticide is classified as a RUP if it poses a risk to the environment and/or if it can harm the user even when used as directed. States may classifiy a federally registered general use pesticide as restricted use if additional concerns exist, especially to protect the environment. However, a RUP cannot be classified as a GUP by a state.
- FIFRA requires that anyone using RUPs must be certified as, or act under the direct supervision of a private applicator.
    - Utah has three types of pesticide applicator licenses: private, commercial, and non-commercial. One of these licenses must be obtained to purchase RUPs. Non-Commercial and commercial applicators shall not supervise the application of any RUP by unlicensed individuals.
- It is illegal to store or dispose of pesticides or containers in a manner other than described by regulations.
- There are penalties for "use inconsistent with the labeling" of the pesticicide and "Illegal handling of containers."
- FIFRA provides civil penalties when a violation of a regulation is unintentional, and criminal penalties for knowingly violating regulations.

include an "Endangered Species Restrictions" statement under the **ENVIRONMENTAL HAZARDS** section of the label.

The responsibility of protecting endangered species ultimately falls to the applicator. If the label contains an "Endangered Species Restrictions" statement, applicators must check the EPA Endangered Species Bulletins online to determine if the county (or counties) where the application will be made has any restrictions. These restrictions may be for a specific active ingredient, product, or time of application. Bulletins may be accessed online up to six months before the intended application. For example, when making an application in June, you can access Bulletins as far as six months before that application, or by January at the earliest. Access links for any state's Endangered Species Bulletin at https://bit.ly/3wybBw8

Pesticide applicators and their companies (if applicable) are responsible for checking bulletins and related information on endangered plants and animals prior to applications.

It is illegal to take or harass an endangered or threatened species without a permit. Contact the USFWS for information on federally listed endangered and threatened animals. The Division of Wildlife Resources can provide information for both federal and state listed threatened and endangered species in your state.

If indicated by the product label, pesticide applicators and their companies (if applicable) must check bulletins and related information on endangered plants and animals in the area where pesticides are applied. The USFWS website provides information on threatened and endangered species in Utah at https://bit.ly/3wybBw8. Consider EPA Bulletins to determine pesticide use limitations in the application area.

If an active Endangered Species Bulletin exists, applicators MUST print a copy and keep it as part of the application record, though they do not need to possess it during the application. Endangered Species Bulletins can be reviewed by UDAF during an inspection, and violations could result in federal investigation.

Pest control methods for protected species are either not allowed or are subject to very specific state or federal restrictions. Some pesticide labels have specific precautions for endangered and threatened species. However, even when the label does not address a specific concern, using a pesticide or any non-chemical strategy that negatively impacts a protected species or its habitat is considered a violation.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act is federal legislation that protects most resident non-game birds that are native to North America for nesting and raising young. The statute protects all listed migratory birds and their parts (including, but not limited to eggs, occupied nests, claws, and feathers). Most non-native pest birds are excluded from the Migratory Bird Treaty Act: in particular, rock pigeons, house sparrows, starlings, and the Eurasian collared dove. The Act does not protect upland game birds, but state regulations do. In this context, "migratory" is a legal term rather than definitive of migration patterns. The legal definition includes most resident native non-game birds,

though some may not migrate or only migrate short distances. Listed migratory birds include several species that can cause conflicts with people, such as: woodpeckers, American crows, Canada geese, and many others. The USFWS is responsible for protecting migratory birds under the authority of the Migratory Bird Treaty Act, which also covers the requirements for complying with depredation orders and obtaining depredation permits.

Migratory Bird Depredation Orders

A Migratory Bird Depredation Order (50 CFR 21.43) allows taking of specifically named migratory birds without a depredation permit if those named birds are "committing or are about to commit damage to ornamental or shade trees, agricultural crops, livestock, wildlife, or other property, or when large numbers cause a health hazard or other nuisance." Specifically in Utah, this order covers blackbirds, cowbirds, crows, grackles, and magpies. Therefore, to control these species when conflict arises, no federal permit is required. However, use caution when controlling crows; this species is easily confused with ravens, for which take is NOT allowed under this order. A section of the Depredation Order (50 CFR 21.50) allows for private landowners and managers to destroy resident Canada geese (i.e, those flocks that are present year-round) nests and their eggs. Prior to this action, one must register with the Resident Canada Goose system, a link to registration can be found at https://bit.ly/3wybBw8

Migratory Bird Depredation Permits

Migratory Bird Depredation Permits (50 CFR 21.41) are administered by the USFWS, which allows control of migratory birds to reduce damage or conflict. Wildlife managers and members of the public are required to obtain a federal depredation permit prior to taking control actions against migratory bird species that clearly cause or are about to cause damage to agriculture, horticulture, or aquacultures. The only species excluded from the permit system are those specified in state depredation orders.

***Note:** Check with the Utah Division of Wildlife Resources regarding the status of specific mammals, birds, and reptiles in Utah prior to conducting management that involves lethal control or take, because the protected status of a species may have changed.*

STATE REGULATORY AGENCIES AND REGULATIONS

Each state has one agency that administers wildlife conservation programs and another agency that regulates pesticide sales and use. In addition, each state has regulations governing the legal status of different animals and trapping/shooting requirements. Permits may be required for any game mammal or game bird, furbearing mammal, or non-game wildlife species. Control of furbearing animals usually requires a trapping permit, even if they are to be shot. Be familiar with all regulations, including local ordinances that affect management methods for problem wildlife.

The Utah Division of Wildlife Resources (UDWR) oversees wildlife management in the state of Utah. All native game species require a permit prior to take and may be limited by a harvest season. Additionally, UDWR has the authority to direct the control of protected wildlife and require identification of all traps and snares used on all species categorized as “furbearers,” coyote, and raccoons. Trapping seasons, rules and procedures vary with species, and one should review these regulations prior to conducting a management action.

Several native furbearers have special "depredation" rules. Badgers, red foxes, spotted skunks, striped skunks and weasels that are a nuisance or causing damage may be harvested at any time without a license as long as the animal is not sold or traded. Bobcats that are depredating livestock can be controlled by the livestock owner, but the animal must be surrendered to the UDWR within 72 hours. Nuisance beavers may be harvested outside of season with a permit from the UDWR.

Non-game species that are not listed as state sensitive, U.S. Endangered or Threatened, or protected by a federal law may be managed as needed by private residents or managers. These species in Utah include pocket gophers, Piute ground squirrels, and rock squirrels. Use caution, as the Utah prairie dog – a federally threatened species – looks similar to ground squirrels. Additionally, most non-native furbearers, such as raccoons and fox squirrels, are not managed under "furbearer" laws and may be lethally controlled as needed. No one may set out or use a drug, poison, explosive, or other deleterious substance that kills, injures, harms, or endangers fish or wildlife, except if the person is using the substance in compliance with federal and state laws and label instructions.

The Utah Department of Agriculture oversees pesticide sales, certification/licensing, and enforcement. A Professional Applicator license is required for any person to apply or supervise the application of pesticides on the land or property of another for compensation or offer or supply technical advice or recommendations regarding the use of agricultural pesticides.

The UDAF also regulates raccoons, and there is no permit required to harvest them during the course of damage management.

Rules and Policies for the Utah Pesticide Control Act

(Utah Code 4-14-101); (Utah Administrative Code R68-7-14)

The UDAF Pesticide Program administers the laws, rules, and policies associated with pesticides in Utah. UDAF issues four types of pesticide licenses: (1) private, (2) noncommercial, (3) commercial, and (4) commercial pesticide business. UDAF only issues new Utah commercial pesticide business licenses to businesses demonstrating that they employ a responsible individual who has maintained a valid Utah or out-of-state pesticide license for two years or that has an associate degree or higher in a related field. Some mowing businesses only spot treating with herbicides with the signal word "WARNING" or "CAUTION" may be exempt from this two-year rule. Conversely, individuals who apply for a Utah commercial pesticide applicator license must be associated with a commercial pesticide business. One reason to obtain a pesticide applicator license in Utah is to apply RUPs. Although not all pesticides used in Category 12 are restricted use, the predominant reason to obtain a license is to apply commercially (for hire or compensation) for management of pests in a wider variety of situations when RUPs may be required.

It is important that pesticide applicators understand the Unlawful Acts section of the Utah Pesticide Control Rule. UDAF requests applicators review the full document to understand how the rules concern their use of pesticides. For the complete list with comments on how unlawful acts may affect the Category 12: Vertebrate applicator, see https://bit.ly/3wybBw8

UDAF LICENSE KEY PONTS

1. UDAF will not issue a Utah commercial pesticide business license until at least one licensed Utah commercial pesticide applicator is assigned to that business.
2. No Utah commercial pesticide applicator will receive their license without first being associated with a licensed pesticide business.
3. As of 1/1/2019 no commercial pesticided business license will be issued until a new license has demonstrated that they have a qualifying party associated with the business who has been a certified licensee for at least to two years.

MAINTAIN PESTICIDE APPLICATION RECORDS FOR TWO YEARS

Applicators' records should contain the following:

- Reason for the application
- Customer and business identification
- Treatment site
- Time and date of application
- Product brand name and EPA registration number
- Application rate and total applied

A link to an example record form can be found at https://bit.ly/3wybBw8. Application records must be maintained and made available for inspection upon request by the commissioner's designee. A suggested business practice is to keep the application record where the applicator's license is located.

Individual commercial pesticide applicators must record all applications (GUP and RUP) within 24 hours of application and maintain the records for two years.

Non-commercial pesticide applicators must record RUP applications within 24 hours of application and maintain records for two years. It is HIGHLY recommended as the best business practice to record GUP applications also. Non-commercial pesticide applicators can choose to store application records anywhere, and all parties must know their location.

Private applicators must record RUP applications within 14 days and maintain the records for two years. Records can be stored as the applicator sees fit but must be accessible within 48 hours if requested.

Pesticide labels must also be stored with the application records. Note that some products have more than one label. The label version must match the product used. The EPA hosts a webpage of pesticide labeling questions and answers at https://bit.ly/3wybBw8.

CHAPTER 4

Integrated Pest Management (IPM)

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Know the four main steps of an IPM decision-making process.
2. Understand why knowledge about the pest animal and its habits are integral to an IPM plan.
3. Understand the importance of legal and environmental considerations and what questions you should ask when developing a management plan.
4. Understand how biological, physical, economic, and public environments can impact your work

INTRODUCTION

When dealing with problem wildlife, select legal, effective, and socially acceptable pest management methods. This is accomplished by assessing the problem and the biology of the pest species, evaluating all control options, and selecting the best management methods for the situation. Monitoring is a critical step in integrated wildlife management. This chapter introduces the concepts and steps for an integrated pest management decision-making process. Pest biology and different management strategies are discussed in later chapters. The Pesticide Environment Stewardship web page has an informative section on IPM and can be found at https://bit.ly/3wybBw8.

Good decision-making is critical in vertebrate pest management. Wildlife control professionals receive requests for assistance for a wide range of wildlife problems. Some requests are simple with straightforward solutions. Others may be more challenging. Some requests generate interest from outside groups, organizations, and agencies. Regardless of its complexity, each request for assistance is unique. This can make it difficult but critical to choose an appropriate management strategy.

All professions, including vertebrate pest managers, have a relatively similar approach to decision-making. To responsibly address a problem, whether it is damage being done by pest animals or health threats to humans, pets, or livestock, wildlife control specialists must proceed through a series of steps. To achieve success, vertebrate pest problems must be viewed and assessed on the larger community scale level. The focus should not solely be on the individual animals causing the problems. One must focus on the overlying environmental issues and the goal of reducing the damage caused by or the number of problem animals. This must include social and economic considerations.

We term this decision-making process "Integrated Pest Management" (IPM). IPM is an ecological and economical approach to pest control. It is based on the habits and life cycle of the pest. IPM programs consider all pest control methods and implement the most appropriate methods combined into a cohesive, strategic plan. IPM plans can include both non-chemical and chemical management methods.

The goal of an IPM program is to reduce pests and their damage to an acceptable level while causing the least amount of environmental disruption.

The IPM decision-making process for pest animals follows four major steps.

1. **Identify and Assess the Problem.** Identify the problem, the scope of concern, and the impacts of the problem. Consider whether you can legally and readily handle the problem.
2. **Evaluate Potential Management Methods.** Consider many potential approaches and their advantages and disadvantages.
3. **Choose and Implement a Management Plan.** Select and carry out the methods that are the most appropriate and effective. Follow all federal, state, and local regulations.
4. **Monitor the Results.** Assess the action for its timing and effectiveness. Decide if further action is required.

IDENTIFY AND ASSESS THE PROBLEM

When handling a request for assistance, go through an initial assessment process. Start by asking the following two questions:

1. Are you and your agency or business legally allowed to handle the problem?
2. Is your staff knowledgeable and capable of handling the request?

Most vertebrate pest control agencies and businesses can handle a variety of situations with problem animals. Common problems include wildlife damage to agriculture, facilities, structures, and natural resources. Less common are situations in which vertebrates pose a threat to public health and safety. If your agency or business cannot handle a request, refer the person to someone or an agency who can.

When a request has been received, assess it further. First, confirm that a vertebrate pest(s) is the cause of the damage. Identify the type of damage caused and the most likely culprits. Look for indications of animal presence such as odors, burrows, gnaw marks, fecal matter, tracks, and trails. Birds are easy to observe and identify; however, most wild mammals are secretive and the chance of seeing them causing the damage is slight. Do not forget to assess potential health risks and social outcomes. Next, note the extent of the damage. Estimate the financial loss if further damage occurs. Find out if there is a history of damage. Is it a recurring problem, or is this the first time the damage has occurred? What control actions, if any, have been attempted and when? What were the results? If no action is taken, is the damage likely to continue or recur?

Learn about the pest animal and its habits. Does it hibernate or estivate? When is its breeding season? Can you control it before the offspring are born? Can it be managed at its den, nest, roosting site, or where it feeds? Answers to these questions paint a clear picture of the problem. Make sure you target the correct species, such as deer damage to landscape plants, turkey feces contaminating hay, or rodent girdling of nursery trees.

TYPES OF DAMAGE OR CONCERN

- Agriculture production losses due to consumption by pest animals
- Urban nuisance from roosts
- Structural damage from gnawing, nesting, or burrowing in or around infrastructure
- Contamination of food or feed by rodents or birds
- Grazing damage or bird feces in turf areas
- Preying on invertebrates, small mammals, amphibians, reptiles, ground-nesting birds, or eggs
- Human health and safety via contact with animal feces or fluids (e.g, rabies, hantavirus)

EVALUATE POTENTIAL MANAGEMENT METHODS

Once identification and the problem assessments are complete, choose one or more methods to prevent damage or manage the pest animal. Understanding the species biology is needed to assess the best overall control strategy and timing. Several prevention and control methods are outlined in Chapters 5–7. Methods vary from species to species; some are associated with stringent regulations governing their control. Some pests require a multi-tactic approach. Several good reference materials provide details on selecting among different control methods for developing and implementing a management strategy.

Next, evaluate each option for prevention or control. Decide if it is legal, environmentally sound, publicly acceptable, cost-effective, and safe. Eliminate the prevention and control options that are inappropriate for the situation.

IS IT LEGAL …

- To control the damage
- For the site
- For the species
- At this time

Legal Considerations

Almost all wildlife damage control plans are subject to local, state, and federal laws. Some control methods may only be legal in certain areas, during certain times of the year, or for certain animals. For example, if a pest problem occurs in an urban area, shooting is not a legal option.
If children, pets, protected species, or non-target wildlife are present, toxic baiting may be too risky.
Before choosing a control method, ask if it is legal:

1. to control the specific type of damage?
2. at the specific site proposed?
3. on the specific species to be controlled?
4. during this season for this animal?

For each method considered, you must answer "yes" to all four questions.

BIRD MANAGEMENT TECHNIQUES

- Frightening devices
- Dispersal techniques
- Structural or habitat modifications to eliminate nesting and roost sites
- Selective removal

DEER MANAGEMENT TECHNIQUES

- Odor or taste repellents on plants
- Electric or improved fences
- Frightening devices

PREDATOR MANAGEMENT TECHNIQUES

- Changing livestock husbandry techniques
- Electric fences
- Electronic guard
- Guard dogs or llamas

There are also local, state, and federal rules about who may implement certain control methods, such as pesticides, trapping, or shooting. When in doubt, contact the local Utah Division of Wildlife Resources office or the Department of Agriculture and Food to clarify what is required. For example, certain pesticides can only be used by licensed employees of the USDA Wildlife Services. Always check local, state, and federal requirements before implementing any control method.

Environmental Considerations

Consider how each control method affects different environments. Four environments come into play: biological, physical, economic, and public. Control methods need to work in harmony with the biological and physical environments. These must also make financial sense and be publicly acceptable. If a control method is likely to disrupt any of these, weigh its effectiveness against the potential problems or conflicts it may cause.

Biological Environment

The biological environment consists of all the living parts of the outdoors. Pest control methods should not harm other living organisms. If a control method threatens non-target animals or other organisms, it may be illegal. Ask the following questions:

- What is the population status of the target pest species? Is it endangered or threatened? Is the population sparse or overpopulated? Are the animals concentrated or dispersed over a large area?

- Are there any threatened, endangered, or other non-target species in the area? Is there a chance that the control methods could affect these animals? Will the effect be direct or indirect? Will the effect be positive or negative?
- Does the target animal have special behaviors to consider? For example, does the animal migrate or hibernate, or does it roost away from feeding areas?
- What health and safety risks do the control methods pose to the applicator and the public?

Physical Environment

The physical environment includes the weather, soil, water, air, elevation, and other non-living parts of the outdoors. Physical factors can often reduce or increase the effectiveness of a given pest control method. Know how each method responds to the following:

- What effects will local weather have on use of the methods?
- What effects will physical environment features have on use of the methods?
- What effects will the methods have on soil, water, and air quality?

Economic Environment

Control methods must be cost-effective. Not all control methods are affordable for every client or cost-effective for every situation. Help the client answer the following questions:

- Will the control methods in this situation likely reduce damage and to what extent?
- Does the current level of damage warrant the cost of the control methods?
- If the control methods are not used, what will be the cost in damage?

Public Environment

When evaluating control methods, public opinion often presents the greatest challenge. People have different opinions about animals, damage, control methods, and the resources damaged by wildlife. Despite the difficulties, social values are important in decision-making. They deserve and demand careful consideration. Some important questions to ask include:

- Do the public and client consider the control methods humane and acceptable?
- Are the risks of the control methods acceptable to the client and public?
- What health and safety risks are posed to the public by not conducting control using the methods?
- What carcass disposal options are available?

At the end of the evaluation stage, one or more appropriate control methods should be clear. However, no practical methods may be available. This may result in no action being recommended or taken as the most appropriate course of action.

Killing an animal is considered euthanasia if it is quick, humane, and causes minimal pain, distress, or suffering. At times as a wildlife manager, you must take an animal's life after capturing it. The public has views on euthanasia that even differ according to species. For example, euthanasia applied to a mouse is not typically considered as objectionable as to a beaver. Euthanize animals in a location that the public cannot view. Remember that all animals have value to somebody; show suitable respect for the animal and its carcass. Respect the concerns of the public when making management decisions.

The most widely accepted—but still disputed— guidelines for euthanasia practices follow the American Veterinary Medical Association (AVMA) standards and fall within three major broad categories: physical methods, inhalants, and injectable drugs.

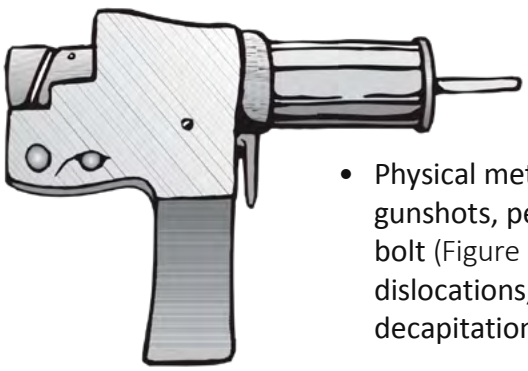


Figure 1 Captive Bolt Gun

- Physical methods include gunshots, penetrating captive bolt (Figure 1), cervical dislocations, stunning followed by decapitation, and quick-kill traps.

- Inhalants are gasses (carbon monoxide or carbon dioxide) that prevent oxygen from reaching body tissues when inhaled over time. A euthanasia chamber is required.

- The U.S. Drug Enforcement Agency regulates injectable drugs such as sodium pentobarbital. They can only be administered by veterinarians, their technicians, dog pound personnel, and certain government employees.

The American Association of Zoo Veterinarians has also published guidelines for non-domestic animals.

While drowning and freezing have long been considered a humane way to deal with problem wildlife, animal experts no longer accept these techniques. They are not considered humane by AVMA standards. You can find specific recommendations for euthanasia in other vertebrate management at https://bit.ly/3wybBw8.

Dispose of carcasses of all dead according to state and local regulations. If allowed, above-ground disposal or burial are preferred to incineration or landfill disposal. However, if the animal was sick or suspected of being sick, do not dispose of it above ground. Check with your state fish and wildlife agency regarding acceptable procedures for above or below-ground disposal. Seek out an incineration facility that is approved for burning pathological waste. If considering landfills, check with your refuse collector about local acceptability and handling (bagging) procedures. Consider secondary poisoning when disposing of carcasses; read the pesticide label.

CHOOSE AND IMPLEMENT AN APPROPRIATE MANAGEMENT PLAN

The goal of an IPM program is to reduce pests and their damage to an acceptable level while causing the least disruption to the environment. To accomplish this goal, consider all management strategies. Often, a combination of several different tactics provides the best control. Different methods may require different timing to reduce or eliminate damage. IPM plans include both non-chemical and chemical management methods. Total dependence on any single method is not likely to be effective with wildlife pest problems. Formulate a control strategy by considering all the appropriate control methods.

When deciding which methods to use, again consider the following:

- Which methods are the least invasive?
- Which methods are the most effective?
- Which methods are the most cost-effective?
- Which methods are the most publicly acceptable?

Even if each method is acceptable in these areas, ask which method or combination of methods is the best for a particular situation. Combining several methods often produces the most effective and lasting control.

Which Methods Are Least Invasive but Most Effective?

When developing an IPM plan, always give preference to the least invasive but long-term effective methods. Practical and effective non-lethal methods are preferred to lethal methods. However, this does not mean that non-lethal methods should always be the first response. Often the most appropriate choice is a combination of non-lethal and lethal methods. Sometimes a lethal method by itself is the most appropriate option. Every situation is different.

Which Methods Are Most Cost-effective?

Cost-effectiveness is critical when selecting the best methods for a management plan. Weigh the cost of applying the methods to the severity of the damage. Even when damage is extensive, a lack of money may constrain the choices.

Always consider two costs: the fees for a professional wildlife manager (technical assistance) and the total outlay of the materials needed (physical barriers, pyrotechnics, or chemicals). For relatively simple wildlife problems, such as excluding squirrels or raccoons from urban areas, technical assistance is usually sufficient and inexpensive. However, some vertebrate pest problems are not as easy to resolve. Added to the cost of technical assistance are the costs of materials and implementation. For example, a livestock producer using

WHEN CHOOSING A METHOD ASK WHICH METHOD …

- Is least invasive
- Is most effective
- Is most cost effective
- Is most publicly acceptable

state-of-the-art resource management and good fencing may also require professional assistance to remove coyotes that are killing livestock. If all such economic factors are known, better advice can be given on the most cost-effective control strategy.

Logistical costs may also be high. For example, the dispersal of a starling roost in a city needs the participation of many players. This effort requires coordination with city officials, police, and affected neighborhoods. It also takes time and money to explain the control program, coordinate the harassment effort, inform the media, and train volunteers to assist in the effort.

The short and long-term costs and benefits of wildlife management strategies are important as well. Methods such as using a propane cannon to scare away geese in a winter wheat field have substantially higher initial costs than pyrotechnics yet may be less expensive when labor is included in the budget.

Which Methods Are Most Publicly Acceptable?

Social concerns often affect the selected IPM methods. If all other factors are equally adequate, choose the option that is the most publicly acceptable. This may be more important than other factors in some cases. For example, in urban areas, the use of inexpensive pyrotechnics to reduce bird damage may be undesirable because of noise, visual impact, or other social concerns. Public acceptance can also prevent the use of the safest or most effective control methods. This is often the case with lethal methods. Despite these frustrations, public acceptance is critical. Weigh it heavily against all other factors.

Educate and inform clients about the control methods available to solve the wildlife problem. In this way, the client has a stake in the effectiveness and cost of the program. Ideally, a sound management strategy is cost-effective, socially acceptable, has few or no negative environmental impacts, and sufficiently reduces pest-related damage.

MONITOR THE RESULTS

Maintain a progress record during and after implementing a management strategy. This provides evidence the strategy is achieving the desired results. Progress records often require a site visit to note pest reduction effectiveness, economics, and social challenges and successes. For ongoing IPM programs, check the function of the equipment used. Record the number and species captured or killed, evidence of new pest activity or changes in activity, and possible access points. The more detailed records you make of what you did and its outcomes, the better you can refine your current and future IPM programs.
Depending on the management approach, either a state fish and wildlife agency or agriculture department requires recordkeeping and reporting. Know the requirements for your state.

Links to state agencies can be found at https://bit.ly/3wybBw8.

Monitoring a control strategy is an important step in determining if further assistance is required to address the pest problem. Monitoring also reveals when to discontinue control activities, which may reduce unnecessary environmental impacts and costly bills. Your professional role in an IPM program is complete when you have fulfilled your responsibilities to complete the most appropriate control activities for the identified problem.

NINE STEPS OF A GOOD IPM PROGRAM

1. Identify the pest and determine whether control is warranted.
2. Learn about the pest's life cycle and habits.
3. Assess the pest's population size and distribution.
4. Determine the pest control goal(s).
5. Find out what prevention or control methods are available, both non-chemical and chemical.
6. Observe local, state, and federal regulations that apply to the situation.
7. Evaluate the benefits and risks for each method or combination of methods.
8. Choose the strategy that is most effective and causes the least harm to people and the environment.
9. Develop long-term plans for the prevention or suppression of troublesome pest populations.

CHAPTER 5

General Principles of Wildlife Management

LEARNING OBJECTIVES

1. **Know the four main steps of an IPM decision-making process.**
2. **Understand why knowledge about the pest animal and its habits are integral to an IPM plan.**
3. **Understand the importance of legal and environmental considerations and what questions you should ask when developing a management plan.**
4. **Understand how biological, physical, economic, and public environments can impact your work**

INTRODUCTION

There are many ways to control problem wildlife. Wildlife management principles fall under three general groupings:

1) habitat modification,
2) behavior alteration, and
3) population reduction.

Habitat Modification

All animals need space, food, water, and shelter. Any habitat modification that limits access to these life requirements directly affects survivability or the desire to stay in a particular habitat. Modifying an animal's habitat sometimes provides lasting and cost-effective relief from damage caused by wildlife pests.

For example, to reduce rattlesnake encounters, consider reducing their food sources, shelter, and encouraging their natural predators. The reduction of shelter (rock piles, woodpiles, tall grass) not only limits hiding places, but also reduces the habitat used by mice and other rodents, which are a food source for snakes. Exclusion devices and methods, such as fencing and shields, are common modifications to prevent access to food and shelter. Sanitation reduces food sources, especially for pests like bears, skunks, and raccoons. If putting in new plantings, select plant species resistant to rodents or deer in areas known to have problem wildlife.

CONTROL METHODS

- Habitat Modification
- Behavior Alteration
- Population Reduction

Behavior Alteration

Using methods that change the behavior of an animal may lead to the reduction or elimination of a pest problem. Deterrents that frighten or annoy animals sometimes work, but usually only for a short time. Once they learn there is no real danger, damage resumes. For example, harassing geese with pyrotechnics causes them to disperse from turf in urban areas and agricultural crops. However, only repeated harassment keeps them from returning.

Population Reduction

Methods such as traps, fumigants, toxic baits, or shooting may be necessary to reduce pest numbers. Often a few animals survive such programs and continue to reproduce as long as they have abundant food, water, and shelter. It is important that sanitation, pest-proof construction, exclusion, and other techniques of habitat modification accompany reduction methods.

CONTROL METHODS

Within wildlife management principles, specific techniques may use biological, cultural, mechanical, or chemical controls. Chapter 6 discusses non-chemical methods and Chapter 7 covers chemical methods.

Each control strives to manage the pest in a different way. Some controls aim to modify the pest habitat or alter the pest's behavior, while others attempt to reduce the pest population.

Biological Control

Biological control involves using natural enemies (viruses, bacteria, or predators) to control individual pests and pest populations. Typically, biological control is not appropriate for vertebrate pest control because biological agents may also harm native wildlife, domestic animals, or humans. However, encouraging predators has been effectively used in both urban and agricultural areas, such as constructing perch poles for raptors.

Cultural Control

Cultural control involves implementing changes to create an uninviting or unfavorable environment for pests; for example, sanitation, work practices, cleaning, and garbage pickup schedules can all indirectly control wildlife. Cultural control methods may not eliminate pest populations, but they can reduce damage and nuisance effects caused by vertebrate pests. Cultural control methods are effective and compatible with most other pest control tactics and offer a good alternative. Two examples include burying garbage promptly at landfills to reduce bird problems or cleaning up dropped fruit to make orchards less attractive to scavengers.

Chemical Control

Chemical control involves pesticides that either repel or kill pests. This includes repellents, toxic baits, and fumigants. Any product sold that claims it repels or kills a pest animal must first be registered by

EPA (unless officially exempted). Pesticides must be registered for sale in each state. Make sure you only purchase pesticides that can legally be sold and used on your project site. See Chapter 7 for further details on chemical controls.

Mechanical Control

Mechanical control methods strive to repel, exclude, or remove pests. These methods include scare or harassment tools to repel wildlife, barriers and tactile (touch) repellents to exclude wildlife, and mechanical devices to capture wildlife. Similar to most pest management methods, each type of mechanical control has its benefits and drawbacks.

Successful harassment depends on the species, its previous exposure to the method, and the knowledge of the people doing the harassing. Barriers may provide long-term solutions to a wildlife conflict. The capture and removal of wildlife provides a range of short- to long-term relief from a wildlife conflict.

MANAGEMENT PRINCIPLES

- Biological
- Cultural
- Mechanical

Relocation of vertebrate pests is not recommended in most situations because it may move damage to new locations, spread animal disease, and result in high mortality of transported animals. When considering relocation, check with your state wildlife agency to find out if a permit is required for a particular pest species or if the agency must be directly involved. Some species, especially prohibited species, cannot be relocated for any reason. Utah prohibits relocation of any non-native species and most vertebrate species.

CHAPTER 6

Mechanical Pest Management Options

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Understand what mechanical controls strive to do.
2. Gain an introduction to numerous mechanical control methods used in vertebrate control.
3. Understand the major concerns when using live traps.

INTRODUCTION

As noted in the last chapter, mechanical control methods strive to repel, exclude, or remove pests. Mechanical methods are sometimes used in concert with cultural and chemical methods. The following sections describe some mechanical control options that are commonly used to manage problem wildlife.

SCARE AND HARASSMENT DEVICES

Scare and harassment devices repel animals by frightening them. These techniques are probably the oldest methods of combating wildlife damage or conflicts. Mechanical harassment and scare devices that rely on sound or sight include propane exploders, pyrotechnics, electronic calls and sirens, Mylar tape, and a variety of lights.

Noise-making devices are the most commonly used harassment methods. Simulated gunfire from propane cannons or a variety of other pyrotechnics like racket bombs, screamers, shellcrackers, and other noisemakers are commonly used. One recent innovation is a motion sensor combined with a sprinkler attached to a hose, commonly called water scarecrows.

MECHANICAL CONTROLS

- Repel,
- Exclude,
- Or Remove Pests.

The Migratory Bird Treaty Act does not prohibit harassing migratory birds as long as the harassment does not result in "take" of the occupied nest, eggs, young, or adults. For example, you can use hazing devices to scare birds away from crops but not away from active nests.

- Distress calls from various animals work alone or in conjunction with other noise devices to scare or harass pest animals (Figure 1). Many of these sounds are available on electronic units, CDs and downloadable for use with MP3 players. The effectiveness of distress calls is enhanced with propane cannons and pyrotechnics, although the latter may be regulated by state fire marshal offices. Also note that the use of distress calls should be adapted to the species and associated problem.

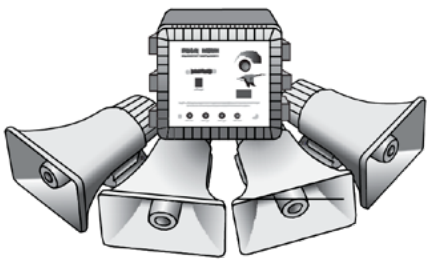


Figure 1 Sound Equipment

- Visual devices also harass or scare pests. A variety of lights, including strobe and revolving units, frighten birds and bats with mixed results. Extremely bright flashing lights have a blinding effect, causing confusion. Mylar tape (a reflective silver and red metallic tape), flagging, scarecrows or other human or predator effigies are often used. Placing any one or a combination of these items in the area may persuade animals to stay away.

- Unfortunately, control with sight repellents is often short-lived. As with other repellents, over time animals may get used to seeing the objects, reducing the frightening effect. These techniques tend to be most effective when used collectively in a varied pattern instead of individually. The continued success of sight repellents often requires reinforcement by periodically shooting at the pest, which serves to teach it that the objects are harmful.

- Lasers that produce relatively low-power, long wavelengths provide an effective means of dispersing geese, gulls, crows, and ravens under low light conditions, while presenting no threat to the animals or environment. The low power levels, directivity, accuracy over distance, and silence of laser devices make them safe and effective.

HAZING AND GUARDING

Animals, boats, planes, drones, and non-lethal shooting are used in hazing programs. For example, trained dogs will deter geese from large open areas such as golf courses, airports, parks, agricultural fields, and corporate parks. Dogs can be purchased already trained, be trained, or hired from a dog service company. Similarly, raptors can be used to disperse pigeons in urban areas.

Some dog breeds, llamas, donkeys and other animals are raised with sheep and other livestock to protect the

herd animals from predators. Common dog breeds used for hazing and guarding include Great Pyrenees, Akbash, and Komondor. Llamas respond by making an alarm call; walking to or running toward the predator; chasing, kicking, or pawing the predator; herding the livestock; or positioning themselves between the livestock and predator.

EXCLUSION BARRIERS

Exclusion barriers include fencing, sheathing, netting, wire grids, specialty wires, needle boards, and climbing guards. Some barriers physically prevent animals from accessing a particular area. Others work as touch or feel repellents. Touch barriers repel animals by making an area uncomfortable, such as keeping roosting birds away from buildings or climbing animals from crops. Selecting an effective barrier system depends on the animal, the expected duration of damage, what is to be protected, and the compatibility of the barrier with other operations. Considering all factors is critical to the long-term success of a barrier system.

- Flashing, hardware cloth, and caulking are used to seal entry holes for small animals like mice, rats, and bats. Make sure the products used to create barriers are durable and not likely to be chewed through (e.g., steel wool).

- Fences prevent or reduce damage to individual plants, yards, crops, and forests. Exclusion fences consist of woven wire, multiple strands of electrified wire, or a combination of both. They must be built to ensure animals cannot easily get over or under them. For example, to exclude coyotes, place a roller on the top of fence wire or posts so the animals cannot get leverage with their paws to hoist themselves over the fence. Some digging pests require buried fences or barriers.

- Sheathing protects individual seedlings or ornamental plants from rodents, beaver, deer, or other animals. Sheathing consists of hardware cloth (Figure 2), plastic mesh, seedling protectors, tubing (plastic, rubber, or cardboard), solid metal flashing (sheets of thin, flat metal), or other tough materials.

- Netting excludes birds from structures or from eating valuable crops such as cherries and grapes. Netting comes as nylon, plastic, or metal mesh. Netting made of nylon 1-inch squares is best for protecting plants. However, small birds such as finches may become tangled in netting; thus nets should be checked multiple times a day to avoid non-target "take.' One-inch plastic netting also excludes domestic pigeons from the internal support structure of an airplane hangar. However, 1/2-inch–squared hardware cloth is needed to keep sparrows from nesting in garage eaves.

- Wire grids consist of stainless-steel wire, Kevlar line, or

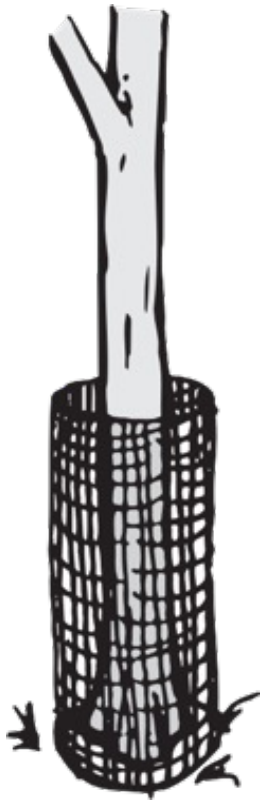


Figure 2 Hardware cloth sheathing protection.

monofilament line. Lay the line in a checkerboard pattern over water or across other areas to exclude pests. Wire grids work in a variety of ways. They most often keep birds from landing in ponds. Surrounding the perimeter of a pond with wire line or fencing prevents birds from walking in and out of the water. Another option is to completely enclose ponds with overhead wire grids. This prevents birds from landing on the water. Similarly, wire grids can exclude gulls from landfills.

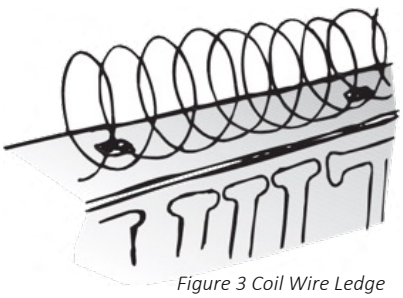


Figure 3 Coil Wire Ledge

Not all species can be legally relocated

- Wires and needle boards can repel birds from ledges and roosting spots. Wires may also exclude other animals from areas where they are undesirable. Place barriers on building ledges to exclude birds and other pests. Coil wire (Figure 3) is slinky-like, so it can be stretched across ledges or landing areas and tacked down. These devices make roosts less appealing and thus cause birds to avoid landing. In a similar fashion, electrically charged wire may successfully repel birds from ledges or other locations where they are not wanted.

- Cone guards keep pests from bothering bird feeders and nest boxes on poles. These barriers are round, flat sheets of metal with a hole in the center. To install a cone guard, place a metal sheet on top of a pole. The pole should go through the center hole in the metal sheet. Position the metal sheet between the ground and the bird feeder or nest box. When pests try to climb the pole, the metal sheet usually prevents them from reaching the feeder or nest box.

TRAPPING

Typically traps have one of two objectives: either live capture for ultimate death of the animal or live capture for relocation. Successful trapping requires knowledge of the animal's behavior, as well as proper trap selection, placement, and bait. This section will discuss different trap types, placement, and use. Be sure to check state regulations regarding trapping permits and licensing, trap styles, identification, and monitoring. Not all traps discussed in this section may be legally used in your state. Check with your local and state authorities before implementing a trapping program at https://bit.ly/3wybBw8.

Live-Capture Traps

Live-capture traps catch animals for relocation (not all species can be legally relocated) or euthanasia. The trap design varies depending on the target animal and the purpose of capture. Not all species can be legally relocated. Whenever possible, choose non-lethal traps over lethal traps when both offer effective control. Non-lethal traps allow the capture and release of target animals from inside buildings and have an added benefit of allowing the safe release of any non-target animals that accidentally get caught in the trap.

When live trapping with non-lethal capture devices, be sure to check traps

frequently. Animals caught alive can dehydrate and/or injure themselves. Wildlife managers have an ethical obligation to the humane treatment of animals, which includes not causing unnecessary suffering.

Proper trap location is essential to achieve good results. For bird traps, observe the problem area. Place traps in open areas where birds can easily see them in relation to flyways, feeding sites, and resting areas. Traps have been most effective where birds enter fields and orchards. They also work near resting and perching sites. When trapping mammals, scout the area for mammal signs such as trails, footprints, droppings, and the remains of dead animals. Be sure to place traps near the travel-ways of mammals. Most mammals do not travel far to get to a baited trap.

The following are examples of live-capture traps.

- Box traps (Figure 4) and cage traps have a rectangular, box-type design. Cage traps are made of wire, while box traps are made of wood, plastic, or other solid material. Cage traps are well-suited for use in suburban and urban areas because pets can be released unharmed. Both traps work best when baited specifically for the target animal. Unfortunately, cage traps can be harmful to wild animals such as river otters and raccoons that can break their teeth on the wire walls. Adding a small water source within the trap reduces mortality from dehydration and is especially important when non-target animals maybe caught.

- Cannon and rocket nets are large rectangular 40-foot by 60-foot nets used to capture large numbers of animals (primarily birds) alive and uninjured. Attract the animals to the net with bait in front of it. Allow animals to become accustomed to eating under the net for a few days before attempting to capture them with the net. Attach cannon projectile or rockets to the ends and middle of one side of the net. When a large group of target animals congregates in front of the net, ignite the cannons or rockets to capture them. Cannon and rocket nets allow accidentally-captured non-target animals to be released unharmed.

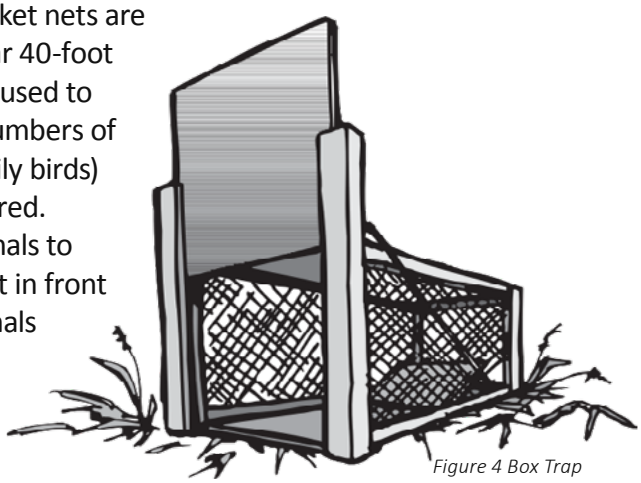


Figure 4 Box Trap

Humane treatment means "not causing unnecessary suffering"

- Australian crow traps (Figure 5) and decoy traps rely on decoy birds that come in for water or bait. Decoy traps are most effective when birds are flocking. Australian crow traps are constructed so birds sampling food on a ladder are attracted to a larger pile of bait through small openings into the trap. Once inside, the birds cannot figure out how to get back out. Simply leave food, water, and one or more live birds in a cage trap, funnel trap, or other bird trap. The feeding behavior and calls of the birds attract others. Place traps where target birds are likely to congregate. Trapped birds are euthanized.

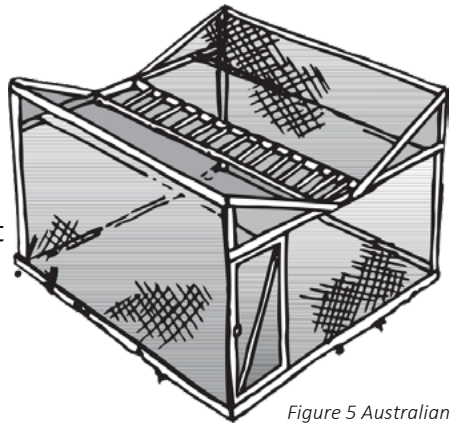


Figure 5 Australian Crow Trap

- Walk-in or funnel traps are cone-shaped traps with one or two narrow openings at one end. The funnel-shaped entrances lead to a larger holding area. Once the animal enters the holding area, it cannot figure out how to get back out. These traps are made with hardware cloth or similar mesh-type material. They are effective for bats and some birds; however, sparrows can escape from funnel traps with relative ease.

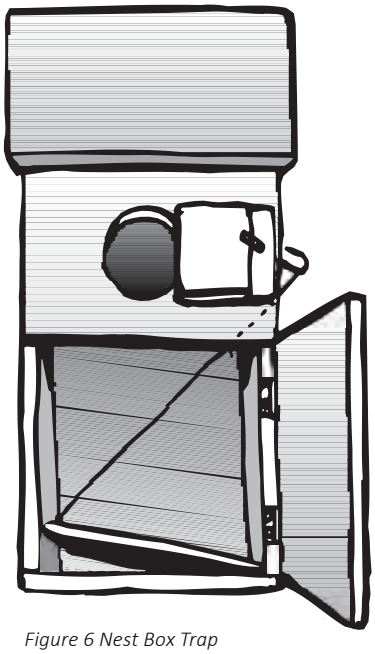


Figure 6 Nest Box Trap

- Foothold traps are commonly used to capture mammals such as coyote, bobcat, fox, mink, beaver, raccoon, skunk, and muskrats. However, these traps may also be used to capture predatory and scavenging birds such as eagles, hawks, and ravens. These traps are versatile and widely used on land and in shallow water. However, the traps must be checked regularly (non-lethal every 48 hours and lethal every 96 hours). Placing an animal attractant (odors or food) near a concealed foothold trap helps to capture animals. Choosing the right size and type of trap for the animal is the best way to prevent foot injuries. Pan tension devices prevent animals smaller than the target animals from springing the trap. For some animals, traps with padded or laminated jaws tend to reduce foot injuries. For other animals, these same traps may cause injury. Good trap placement, use of appropriate attractant, and trap selection contributes the most to capturing the right animal with minimal impact on other species. State laws governing trap checking intervals can be obtained from the Utah Division of Wildlife Resources at https://bit.ly/3wybBw8.

- Mist nets are lightweight nets with moderate to small-sized mesh or holes that snag birds in mid-flight. After observing the flight path of the pest birds, stretch nets across a large enough area to intercept several birds at a time. Because the net consists of thin line, it is virtually invisible to birds. Once birds have been caught, remove and relocate or euthanize them. Release non-target birds unharmed. Mist nets are useful in the rafters of buildings to trap birds living in the interior of a structure.

- Nest box traps (Figure 6) capture a variety of birds alive and unharmed, but are effective only during nesting season. A nest box trap is a wooden birdhouse with a large snap trap attached to the outside of the house above the entrance. When a bird enters the box and attempts to stand or nest on the bottom, it trips the trap, snapping the wooden flap over the entrance hole of the nest box. Non-target animals can be safely released on site.

- Panel traps are sections of fence temporarily assembled to form a corral for capturing waterfowl during their annual flightless molting period. Multiple panels consist of netting attached to a metal pipe frame are advanced on the flightless flock slowly until they encircle the birds forming a corral.

- Pit traps -drift fences successfully capture voles and other small rodents where they are abundant. Drive small, wooden posts a few inches into the ground and space about 10 feet apart in a line. Drift fences consist of a large piece of black ground cloth, burlap, or other solid cloth stretched across wooden post creating a barrier. The cloth should touch the ground and rise between 2 and 3 feet. Place empty containers (e.g., 3-pound coffee cans) recessed along the fence line with the fence straddling each container. As the small mammals encounter the edge of the cloth, they run along the cloth and fall into the first container they come to. The animals, with no jumping abilities, are trapped; therefore, pit traps must be checked regularly to avoid non-target "take." Safely release non-target animals.

- Snares (Figure7), made of twisted wire or cable with a locking mechanism, are among the oldest existing trapping tools. They effectively catch most mammals but are often used to capture bears, beaver, coyotes, foxes, and raccoons. Snares capture animals around the neck or the legs. Snares that seize animals around the body are passive because the animal pulls the device closed by passing through the snare. Snares that seize animals by the leg may be passive or powered. Powered leg snares close rapidly around the foot or leg when a spring-triggered pan is stepped on. Both passive and powered leg snares catch most species of wildlife alive and uninjured. Powered neck snares, which quickly and humanely kill the captured animal, are also available. Be very careful to place powered neck snares where they will not kill non-target animals. Because of their ability to kill non-target animals, snares must be checked regularly, particularly in areas where there may be threatened or endangered species.

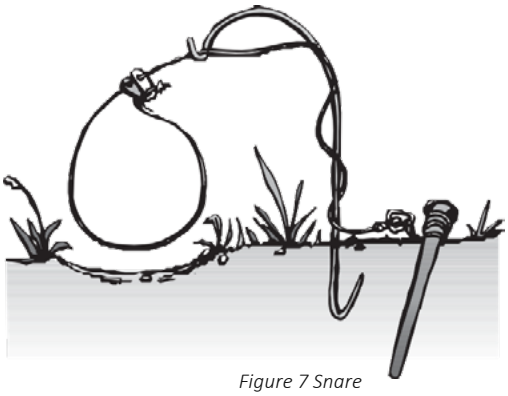


Figure 7 Snare

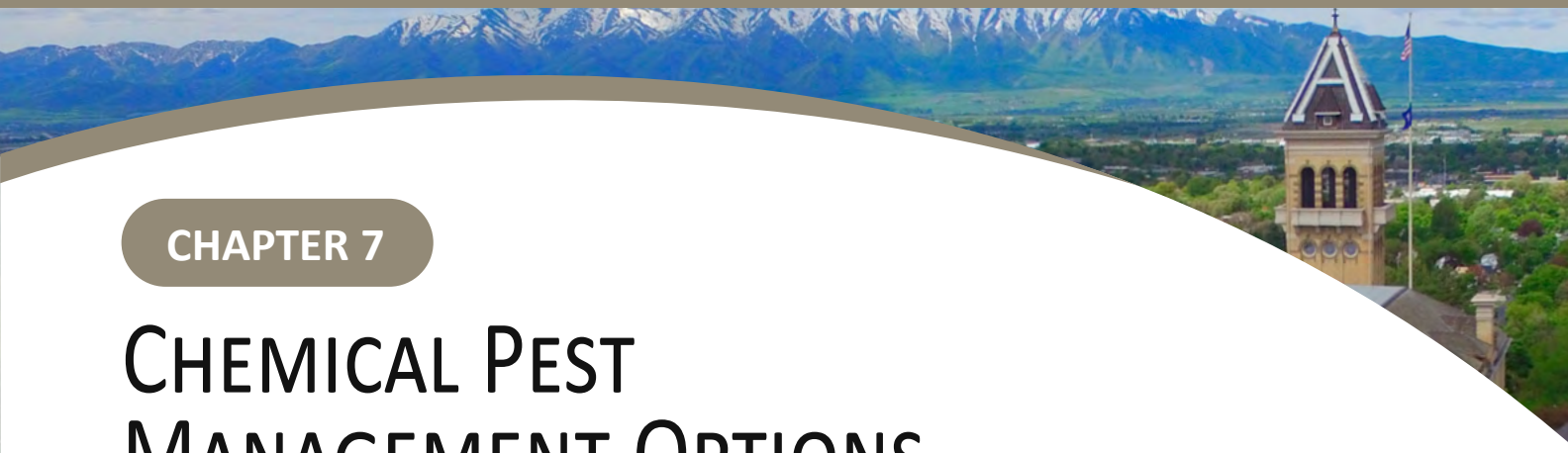
Quick-kill Traps

Quick-kill traps include body-gripping (e.g, Conibear), snap, choker loop, scissor, and harpoon traps. Body-gripping traps kill animals by administering a sharp blow to the back and chest or neck. The metal bar of a snap trap quickly crushes and kills the animal. Place spring-powered harpoon, choker loop, or scissor traps on top of surface runways. All these traps are designed to kill animals quickly and humanely.

SHOOTING

Shooting is sometimes warranted to manage vertebrate pests. Generally, shooting is illegal within city limits and restricted to rural areas where firearms can be safely discharged. Make sure you have appropriate hunting licenses and/or required permits and follow any game bird or game animal season limitations, including local regulations regarding transporting and discharging of firearms. To control some wildlife by shooting, actions must be coordinated with a state fish and wildlife agency. Firearm safety training is recommended.

BB and pellet guns may be used in some areas where firearms are prohibited. Because smaller bore pellet guns (.177) are usually insufficient to make humane kills, use a .22 caliber pellet gun.



CHAPTER 7

Chemical Pest Management Options

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Understand pesticides are used for controlling, repelling, managing, or killing of pest organisms.
2. Understand the difference between first and second generation anticoagulants.
3. Know which type of fumigants are general use and which are restricted use.
4. Understand the importance of a fumigant management plan.

INTRODUCTION

Pesticides are chemicals used to control, repel, manage or kill pest organisms. For managing vertebrate pests, repellents, frightening baits (agents), toxic baits, livestock collars, and fumigants are used. Wildlife managers need to understand how each pesticide works to control each pest species. To successfully and safely use a pesticide, managers must also have some understanding of the application principles and protections/precautions for non-target animals.

Chemical control relies on pesticides to manage vertebrate pests. Chemicals work best when used with other control methods in an IPM program. Pesticides may effectively reduce pest populations to levels where non-chemical control methods are adequate.

A pesticide may harass or scare an animal into leaving, alter its preferred food or habitat, prevent its reproduction (e.g., "birth control"), or kill it. The type of pesticide required depends on the target pest, type of damage, and location of the problem.

Read the product label prior to making a purchase and again before using the product.

Make sure the pesticide is registered for use in the state you plan to apply it. Follow all label directions and heed all label precautions. Labels may restrict use of the product to a specific site, against a specific pest, or even by a specific application method; if so, no deviation is allowed.

Pesticides are label restrictive in their direction of use, in both the application site and targeted pest. Always verify proper application with the label.

CHEMICAL REPELLENTS

TYPES OF REPELLENTS

- Oral
- Odor
- Touch

Pesticide repellents work in several ways to deter animal pests from a specific location or damaging activity. Repellents work through an animal's perception of taste, touch, or smell. These are termed oral, touch, or odor repellents, respectively. When used properly, repellents are not toxic to target animals. Typically, all repellents work some of the time, but no repellent works all of the time. Select a repellent that is labeled for the appropriate site (i.e, field, outbuilding, residential complex, etc.) of application and make sure it is effective against the target species.

Oral repellents are applied to vegetation, seeds, or fruit. The unpleasant taste of these chemicals may deter birds, deer, squirrels, and other pests. The effectiveness of oral repellents depends on the availability of food. When foods are scarce, repellents are less effective because the animal has few or no alternatives. Thiram and capsaicin are examples. It is important to know that thiram is also registered as a fungicide and seed treatment.
Odor repellents attempt to make mammals more cautious about approaching a particular location. Capsaicin, predator urine, soaps, dried blood, and rotten-egg solids sometimes have this effect. Napthalene, which is the active ingredient in mothballs, is also available to repel vertebrate pests. However, only napthalene-containing products specifically registered for vertebrate control may be used. As with other types of repellents, they work best if alternative foods and shelter are available to the pest. Bear repellent spray is a registered pesticide.

Touch repellents primarily repel roosting birds from structures by making the birds' feet uncomfortably sticky. Touch repellents are formulated as liquids, aerosols, nondrying films, gels, and pastes. They must be applied so birds cannot land in roost areas without contacting the repellent. Therefore, do not leave any part of a roost area untreated. Tactile repellents often lose their effectiveness over time, especially in dusty areas. Usually, these materials repel birds for less than one year before a second application is necessary.

RODENTICIDE BAITS

Rodenticide baits are pesticides used to control mice, rats, gophers, voles, squirrels, and other small rodents. Rodenticides are used in and around homes, structures, and rodent dens and burrows. They are toxic to birds, and mammals (including humans). The most effective rodenticide baits are pleasant-tasting yet highly toxic to the target pest. Baits used in areas with other sufficient food sources may be ineffective. Use tamperproof bait stations or place the bait into burrows and dens to protect non-target animals. Follow rodenticide label instructions carefully.

There are two major classes of rodenticides: anticoagulants and non-anticoagulants. Make sure the bait is available in sufficient quantities, enough locations, and for adequate periods to ensure access by the rodent colony. More bait stations with small quantities of bait provide for greater control than fewer stations with more bait.

Within the anticoagulant group, there are first and second-generation products. Anticoagulant rodenticides that require multiple feedings to cause death are termed first-generation anticoagulants. The rodents must feed over a period of 3–10 days, so the bait must be available during that entire time period. To control all individuals in a colony of rodents, a treatment period of 2–3 weeks may be required. Second-generation anticoagulants require only a single feeding, but several days may pass prior to the rodents dying.

Non-anticoagulant rodenticides cause death by heart paralysis, gastrointestinal and liver damage, or attacking the central nervous system. The target animal must consume a lethal dose for symptoms to develop. A sublethal dose may produce side effects that could make the rodent avoid the bait, commonly termed bait aversion or bait shyness. Using bait that tastes bad, smells bad, or is the wrong size increases the tendency for bait aversion. It is best to prebait with untreated bait before applying rodenticides to condition animals to eat the bait. When prebaiting, present untreated bait to the rodents until they feed regularly. Then replace it with the bait containing the pesticide.

RODENTCIDES

1. Are toxic to- birds and mammals (including humans)
2. Are most effective if they taste good but are highly toxic
3. Should always be placed in a tamper proof bait station
4. More bait stations with smaller quantities provide better control

Anticoagulant rodenticides are ingested during feeding or grooming. They interfere with the vitamin K-dependent blood clotting mechanism and destroy small blood vessels. With a sufficient dose, the rodent bleeds to death internally. Products are formulated as grain baits, pellets, weather-resistant bait blocks, liquid baits, and tracking powders. Typically, tracking powders are quite concentrated. They are ingested when the animal grooms after walking through the powder.

Rodenticides and bait stations must be placed in locations that are accessible to the pest animals, but out of sight and reach of children, pets, and domestic animals. Labels

provide specific instructions and restrictions on placement, such as only underground.

It is important to routinely check bait stations. This is true when prebaiting or using toxic bait. Frequent inspection indicates whether the target pests are using a station. It also helps with identifying signs of trouble. If the pest does not take the bait, switch to another brand of bait or remove competing food sources. If some bait stations are working and others are not, relocate the ones that are not being used. Liquid baits may be effective in areas where it is impossible to remove all food sources, but where water is scarce. Always look for signs of a non-target animal visiting the stations; if there are indications of non-target animals accessing the bait, relocate bait or bait stations to a less accessible place.

Anticoagulant Rodenticides

First generation—multiple dose

warfarin, diphacinone, chlorophacinone

Second generation—single dose

brodifacoum, bromadiolone, difethialone

Non-anticoagulant Rodenticides

strychnine, cholecalciferol, bromethalin, zinc phosphide

Additives are sometimes incorporated into bait by manufactures to improve performance. Attractants such as flavoring or oils can make the bait more appealing and enhance the taste or mask disagreeable odors. Preservatives and binders keep baits from deteriorating over time or in damp/wet conditions.

Additives can also provide a rodenticide with different safety features. For example, since some rodents cannot vomit, manufacturers may incorporate an emetic agent in rodenticides. The emetic agent causes non-rodent animals to vomit. This may protect some non-target animals from accidental poisoning.

Many rodenticides have safety features to limit exposure or hazard to non-target animals and humans. For example, some rodenticides are formulated into large, solid squares to prevent birds and small children from eating them. When possible, choose rodenticides with one or more safety features. Labels provide specific instructions on a product's proper handling, placement, use, and precautions (Figure 1).

Figure 1 Reading Pesticide Label

FUMIGANTS

Fumigants are an option when rodents, small mammals, or snakes do not respond to repellents, toxic baits, or powders. There are two types of fumigants: gas cartridges and moisture-activated fumigants. Gas cartridges are general-use pesticides, while moisture-activated fumigants are restricted-use pesticides. Both are used to kill pest animals that live in burrows or dens.

Gas cartridges are incendiary devices that produce carbon monoxide and smoke when ignited. They fumigate the burrows of certain rodents and other mammals. Gas cartridges are not bombs and do not explode when prepared and used properly. Because of a potential fire hazard, do not use gas cartridges in burrows under sheds, buildings, firewood, vegetative fuels, or near other combustible materials. Avoid breathing fumes. Review the label and wear a respirator if required. Never use indoors or in burrows that have openings within 15 feet of buildings.

Moisture-activated fumigants are tablets or pellets inserted into animal burrows or dens and activated by air or soil moisture. The most common active ingredient is aluminum phosphide. When activated by moisture, the fumigant tablets produce phosphine gas, which is very toxic to all animals (Note: Zinc phosphide is formulated as a bait rather than a fumigant, and is only activated after it is consumed.)

Moisture-activated fumigants are easy to use and very effective, but they pose significant concerns for humans and non-target animals. The phosphine gas they release, even in small concentrations, is odorless and extremely toxic to all mammals, including humans. Just a few breaths can be fatal. Take extreme caution when applying moisture activated fumigants. Do not treat if soil is extremely dry or if there are no signs of recent pest activity. Read and follow the pesticide label instructions carefully.

Following are some general guidelines for underground burrow treatment with fumigants:

1. Locate the main burrow opening (identified by a mound of excavated soil) and all secondary entrances associated with that burrow system. For closed-burrow systems, locate the main runway.

2. Do not use near structures inhabited by humans or non-target animals. Make sure the burrow system does not open into or under occupied buildings. If burrow systems are open, treat the burrow and seal all openings.

3. Follow the instructions on the label to determine how many tablets to use in each burrow opening or runway.

4. Open the canister only in fresh air or a well ventilated area.

5. For open burrows or dens, use a 4 to 5-foot length of PVC or ABS plastic pipe and insert tablets

deep into an active burrow entrance. Seal the openings with crumpled paper, cardboard, sod, or a cow chip, and then cover with dirt. Seal untreated entrances as well. For closed-burrow systems, use a probe to locate runways and apply tablets or pellets through the probe hole. Seal all probe holes.

6. Phosphine gas is heavier than air and sinks to the floor of the burrow, which means it is unable to escape through surface openings.

7. The length of time it takes for fumigants to be effective depends on the humidity of the burrow; it could be hours or days. The more moisture in the soil and humidity in the air within the burrow, the faster the phosphine gas is released. Once released, phosphine gas is quickly lethal.

8. Inspect treated areas 1- or 2-days following treatment for signs of residual activity of target species. Treat all burrows reopened by the pests in the same manner prescribed above.

9. Do not add water to burrow. This puts your health at great risk.

To use any fumigant (methyl bromide, aluminum phosphide, magnesium phosphide) safely and legally, read and review both the pesticide label and fumigation regulations.

Fumigation Management Plan

All fumigant product labels require a Fumigation Management Plan to ensure the safety of the applicators, site employees, surrounding community, and environment. This plan is a regulatory requirement and reviewed during pesticide use inspections and case reviews. It serves as a written record for legal purposes, providing specific logistical, performance, and contact information to help characterize the fumigation site. Fumigant management plans are meant to be somewhat prescriptive, yet flexible enough to allow the experience and expertise of the applicator to make changes based on circumstances that may exist in the field.

The required Fumigation Management Plan includes notification of local authorities and a written emergency response plan. It must detail use restrictions, site assessments, application and sealing procedures, and precautions for humans and non-target animals. For example, you are required to document any burrows that open under or into occupied buildings or any other source through which the gas may enter occupied buildings, and then specify that applications will not be made to those burrows. Prior to treating a rodent burrow on a property containing an inhabited structure, you must provide the customer (e.g., tenant, homeowner, or property manager) with a material safety data sheet (MSDS) or appropriate sections of the Fumigant Applicator's Manual.

Additional components of the Fumigation Management Plan are a compliance checklist for preparation, recordkeeping, who makes the application, notification of authorities, application and fumigation period, sealing procedures, post-application procedures, and pesticide storage.

AVICIDES

Avicides are pesticides used to control bird pests. These include repellents, toxicants, and frightening agents. Avicides differ in toxicity, dosage level, and mode of action.

Typically, avicide repellents are soft and sticky (Figure 2). They contain polybutenes, a non-toxic material that discourages birds from roosting on sites such as ledges, roof beams, or shopping center signs. They are available in the form of liquids, aerosols, non-drying films, and pastes. To increase effectiveness on porous surfaces and make removal easier, first put masking tape on the surface needing protection and then apply the repellent onto the tape. Retreatment is typically required.

Avicide baits are bird toxicants. Their taste and size contribute to their relative effectiveness. Be very careful when handling toxic baits since they can attract and kill non-target animals. Knowledge of the pest's behavior, location, habits, and life stages are some of the important factors that need to be considered when using these pesticides.

Most avicide baits are single dose oral pesticides that act on a bird's central nervous system or major organs to cause death. Both toxic and frightening baits are used to reduce pest bird populations. Prebaiting must be a part of the program to condition the birds to feed on the untreated bait (Figure 3). Select feeding sites carefully to protect non-target bird species.

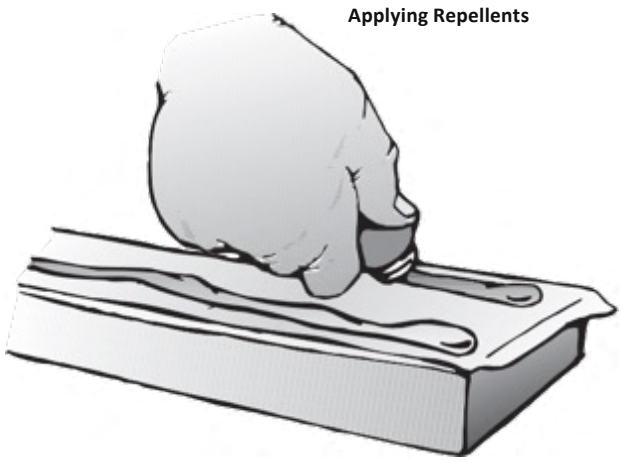


Figure 2 Application of a soft and sticky avicide on masking tape on a porous surface to increase effectiveness and simplify clean up.

Frightening baits are designed to repel birds from a specific location. These baits are central nervous system toxins and highly toxic to all bird species. However, instead of killing large numbers of birds, only a few birds need to eat the toxic grain bait and react violently. The dying birds fly erratically, emit distress and alarm cries and other visual displays that frighten the flock, causing the other birds to leave the area. The birds that

eat the bait quickly die. Symptoms often occur within 15 minutes and death within 20 minutes. Very little bait is required to produce the desired effects. Only a few birds must ingest the bait to frighten away the remainder of the flock.

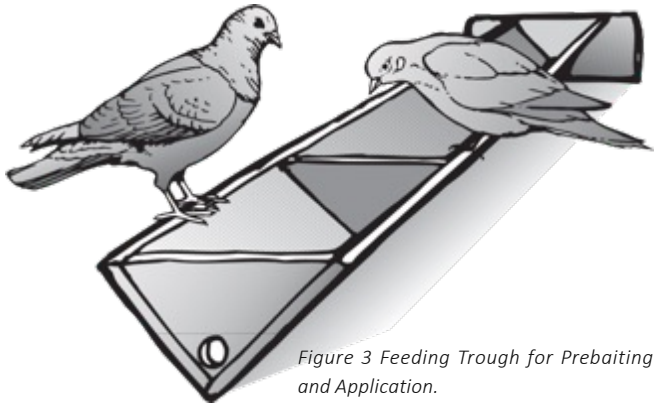


Figure 3 Feeding Trough for Prebaiting and Application.

Different dilution rates of the toxicant and grain yield differing results. In urban areas, lower toxicant doses are used to reduce the number of dead birds, but sufficient to deter birds from using an area. In agricultural areas, the higher labeled dose is used. Frightening baits are formulated with both treated and untreated grains and pellets. Prebaiting is required. Use great care to ensure impact on targeted species only. Follow all label directions.

Toxic baits are slow-acting, taking up to 3 days to non-violently kill pest birds. Toxic baits nearly eliminate the problem of bait shyness because the birds generally die at their roosting sites, not the feeding site. Collect and dispose of birds to reduce disease concerns.
The active ingredient (3-chloro-p-toluidine hydrochloride) causes irreversible kidney and heart damage. These toxic baits are registered for use around livestock and poultry operations. However, they are poisonous to chickens, turkeys, ducks, and some other birds. Never place bait where domestic animals, poultry, livestock, or non-target wildlife can feed on it.

Toxic and frightening baits present a threat to non-target animals. To minimize this hazard, be sure to:

- Prebait
- Place toxic bait knowledgeably and timely
- Remove and properly destroy any dead birds and uneaten bait

Baiting with avicides is a complex task that requires careful attention to detail. Because baits are rarely specific to a given species, there is always the danger for negative impacts on non-target animals. Safe placement of toxic bait and proper baiting procedures are critical, which requires reading and following all label directions carefully.

Before beginning any control measures, determine the daily movement patterns of the target birds. Observe how the birds travel between feeding, loafing, and roosting areas. Once the popular spots are identified, select several bait sites as prescribed by the label. The number of bait sites needed depends on the size of the area being treated and the number of birds involved. Normally, at least four baiting locations are used. Choose sites where birds are abundant, there are few disturbances, and access can be controlled at all times. As a rule, the closer the bait site is to the normal feeding site, the more successful it will be. Rooftops make

excellent bait sites. With persistence, nuisance birds— especially pigeons— can be taught to feed almost anywhere.

Prebait once you select the bait sites since the pest birds must learn to feed at the selected locations. Train the birds to eat particular bait and then replace it with toxic bait. This technique works well for all pest bird species except crows. The extremely varied feeding habits of crows makes prebaiting difficult.

Prebaiting is the single most important aspect of a successful baiting program. Since birds are suspicious of any change in their daily routine, be sure to prebait and replace this with toxic bait at the same time of day and in the same manner. Apply the prebait only on firm, smooth, and flat surfaces in wide, shallow, wooden, or metal trays. Avoid placing bait in bright-colored or shiny containers because they tend to cause birds to shy away. This type of placement helps maintain control of the prebait and toxic bait and eases the removal of any unused material at the end of the control program. Put out the prebait and toxic bait so that all birds can feed at one time. Never place the prebait or toxic bait in piles. Spread it out in a wide band or as directed by the label.

There is no set length for the prebaiting period. Each case is different. Usually, two weeks of prebaiting is necessary. The longer the prebaiting continues, the more successful the program will be. However, longer prebait periods increase the chance for attracting more non-target species to the site.

To further strengthen prebaiting at feeding sites, reduce or eliminate other food sources. This forces birds to rely solely on the prebait for their food source. Effectiveness increases with fresh snowfall since this makes other foods scarce. Birds usually feed most vigorously just after leaving their roost early in the morning. Therefore, place the prebait out before dawn or as early as possible. Put the bait out in late afternoon or just before dark when prebaiting birds at their roosts. Record the quantity of prebait placed and consumed each day to determine the correct amount of treated bait. A measurement is best if expressed in pounds but can be a simple volume measurement.

During the prebaiting period, carefully observe the prebait site to be sure it is not attracting non-target birds. If protected birds appear at a bait site, modify or abandon the site.

Always keep a constant supply of fresh prebait in front of the birds. There should always be prebait left over when the birds finish eating. No bird should ever go away hungry. It is difficult to train birds to feed at a site where they cannot get enough to eat.

Once all the target birds consistently feed on the prebait at the selected locations, apply the toxic bait. Apply the toxic bait at the same time of day and in the same manner as the prebait. Any variation in the established pattern reduces the acceptance of the toxic bait. The prebait should be as similar to the toxic bait as possible.

The amount of toxic bait put out usually does not need to be more than half the amount of prebait used each day. Pick up all prebait before applying the toxic bait. Once the toxic bait is set out, do not disturb the feeding birds. Observe them from a hidden location. Some birds may die at the bait site depending on the toxicant used; others die in flight or at their roosting areas. Consider whether dying birds could present problems in areas frequented by people. The longer it takes birds to die, the more likely they will leave the site and die over a broad area. This may increase the threat of secondary poisoning to scavengers with some avicides. It is important to pick up dead birds to the extent possible for proper disposal, or as directed by the pesticide label.

Sometimes, multiple applications of toxic bait are necessary. However, the birds remaining after the initial control period may have bait aversion and therefore require more effort to get them to accept prebait again. Typically, the same bait sites can be used, but if birds have bait aversion, establishing a new bait site may be necessary.

Remember, avicides are pesticides and all label precautions and instructions must be followed. Thoroughly understand the target bird's biology and habits, as well as those of non-target birds that may frequent the area. Keep in mind your desired results and use the minimum dosage (according to the label) to get those results. Know the avicide's mode of action. Do what is necessary to protect non-target animals and minimize the possibility of secondary poisoning.

PREDATOR TOXINS

Gas cartridges are registered by the EPA for coyote control (see fumigant section). In Utah sodium fluoroacetate (Compound 1080) is a registered predator toxin but can only be used in Livestock Protection Collars by trained USDA Wildlife Services employees

A Livestock Protection Collar contains a small quantity of Compound 1080 solution in small, paired rubber bladders attached around the neck of sheep or goats. A coyote attacking a collared sheep or goat often punctures the collar as it grabs the animal's throat, thereby ingesting enough of the toxicant to kill the coyote. EPA regulations for use of these collars are very restrictive.

The M-44 device, which uses sodium cyanide, can only be used by USDA Wildlife Services employees who have completed specific training for the chemical and the device.

CHAPTER 8

Human Disease Concerns

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Understand health risks you can encounter working near or handling vertebrate animals.
2. Understand ways diseases can be transmitted.
3. Become aware of the symptoms for diseases to which you could be exposed.

INTRODUCTION

You face a risk to your health when working near or handling wild animals. Some animals themselves, their feces or urine, or parasites living on or in animals carry disease pathogens that can be transferred to humans. Even though disease incidences are rare, wildlife managers must take certain precautions since some of these diseases pose serious health issues or death for humans. Be familiar with the disease risks, how they are transferred to humans, their symptoms, and techniques to avoid exposure.

DISEASE TRANSMISSION, SYMPTOMS, AND PROTECTIONS

Several diseases occur in problem wildlife populations that can impact humans. A wildlife manager must understand how different diseases move from infected animals to humans. Precautions vary according to the disease, geographical location, pest animal being managed, and control method. There are several major pathways by which disease organisms pass from animals to people.

Figure 1 Wash hands regularly and thoroughly to improve hygiene.

Fecal-oral Transmission

A diseased organism that lives in a wild animal may be passed in the animal's feces. If the contaminated feces are touched, or someone handles contaminated objects then touches their mouth or ingests contaminated water, disease transfer can occur.

To prevent disease transmission, wear disposable or washable gloves when handling animals or objects that may be contaminated with feces. Use caution if coming in contact with soil or nesting materials that could be contaminated. Practice good hygiene by washing your hands after handling animals or feces-contaminated objects (Figure 1). Wash hands before and after using the toilet and before eating, smoking, talking on cell phones, or handling food. Avoid food and water that might be contaminated. Disinfect cages, traps, bait stations, and other items potentially contaminated with animal feces.

Respiratory Transmission

Respiratory transmission occurs when disease organisms in urine, feces, or other animal material become airborne and are inhaled by humans. Work in a manner that limits disturbing areas to avoid contaminated particles becoming airborne. If working in an area with an accumulation of mice, bird, or bat droppings, wear disposable clothing and an appropriate National Institute for Occupational Safety and Health (NIOSH) respirator. Disinfect the area by spraying it with a 10% bleach solution. (A 10% solution corresponds to 1-1/2 cups of household bleach per gallon of water, or 1 part bleach to 9 parts water.) Let the bleach solution sit (a.k.a., dwell) on the area for 10-15 minutes before interacting. Wear clean rubber gloves and wash them at the end of each workday.
Regarding treatment, contact a medical provider if you experience any possible symptoms after handling live or dead animals or after working in areas with animal nests,

Transmission Pathways and Diseases

Ingestion:
Campylobacteriosis, Leptospirosis, Parasitic roundworms/ tapeworms, Cryptosporidiosis

Inhalation:
Hantavirus, Cryptococcosis

Wound Penetration (bites, cuts):
Rabies, Tetanus

Vector-borne (fleas, ticks):
Plague, Rocky Mountain Spotted Fever, West Nile Virus, Lyme Disease, Tularemia

urine, feces, or other contaminated surfaces. Inform the physician of your possible exposures to animals. Diseases contracted from wildlife or outdoor exposures are relatively rare, and most physicians do not readily recognize the symptoms. Be specific about the animal species handled, any other exposure to possible disease vectors, and characterize the environment in which you have been working. Early medical attention is critical for successful treatment.

Disinfect or replace all traps or other devices. Protect yourself when handling dead animals. For example, spray dead rodents with disinfectant solution and then place them in doubled bags (Figure 2). Contact your local health agency for the proper disposal method.

Direct-contact Transmission

Simply handling animals and contacting tissues and fluids that contain disease organisms can result in disease transmission. Wear rubber or plastic gloves for protection and keep any skin from coming into contact with live or dead animals or their nesting material. Practice good hygiene—especially hand-washing—for protection.

Wound Penetration

Some diseases require a break in the skin, such as an animal bite, scratch, puncture, or other injuries. Stay current on your tetanus immunization. If you know that your work will require you to encounter animals that host rabies, get a rabies shot 1 month before any possible exposure. If you make contact with any animal that is suspected to host rabies, seek medical advice immediately. Rabies is lethal and untreatable after the onset of symptoms.

Vector-borne Transmission

Sometimes another organism, like a flea, tick, or mosquito, transfers disease from an infected animal to humans. Insect and tick repellents may provide some personal protection. Spray animal carcasses with an insecticide, as appropriate, and double-bag if large numbers of fleas or ticks are present.

Figure 2 Gloves and Spray Bottle with Disinfectant for Cleaning Up Dead Rodents

TRANSMITTABLE DISEASES

The following diseases may be present in wild animals or areas where they live. Be aware of the symptoms for diseases to which you could be exposed and possible medical treatments. Identify ways to avoid or minimize exposure. Consult state and local health departments for specific disease concerns in your area. Links to specific disease pages from the Center for Disease Control and Utah Department of Health can be found at https://bit.ly/3wybBw8.

Cryptococcosis

Cryptococcosis is a fungal lung infection caused by *Cryptococcus neoformans.* This fungus is found in dust associated with pigeon or bat droppings. C. neoformans has been found in as many as 84% of samples taken from old roosting sites. The disease is acquired by inhaling the yeast-like vegetative cells of the fungus, which are easily airborne. Symptoms are not easy to characterize, but if the disease progresses untreated into meningitis (inflammation of the membranes of the brain and spinal cord), it can be fatal. It is extremely rare in people with normal immune systems.

Cryptosporidiosis

Cryptosporidiosis is an infection caused by a protozoan endoparasite called *Cryptosporidium parvum*. It lives in the digestive system of animals and humans. Eggs are passed in feces. Fecal-oral transmission is a concern for wildlife managers. However, drinking unfiltered water is a much more common mechanism for transmission. Stomach cramps and watery diarrhea are the most common symptoms. Vomiting and low-grade fever occur in some people. Generally, symptoms appear within 2–10 days and last two weeks. Not all people experience symptoms. There are no effective medications. Practice good hygiene for protection.

Hantavirus

The Sin Nombre virus, also known as hantavirus, is rare but causes extremely serious respiratory illness. The virus is primarily found in the urine, saliva, and droppings of deer mice (*Peromyscus spp*.). It is contracted by humans when they breathe contaminated dust particles. Transmission can also occur after handling deer mice and then touching your nose or mouth, or by a rodent bite. Symptoms include fever, muscle aches, and difficulty breathing. In addition, some people experience headaches, coughing, nausea, vomiting, diarrhea, and stomach pains. Symptoms typically start in 3 days to 6 weeks after exposure. There are no effective medications; however, early hospital care is critical to manage the symptoms.

Histoplasmosis

Histoplasmosis is a fungal lung infection caused by *Histoplasma capsulatum* that grows in soil or material contaminated with bat or bird droppings. Spores become airborne when contaminated soil is disturbed in areas such as bat or bird roosts in caves, barns, attics, belfries, and soil enriched with bat guano.

Breathing these spores can cause infection. Humans and numerous wild and domestic animals are susceptible, but bats are important animal carriers. Symptoms are quite variable from respiratory stress to severe illness. They appear 5–18 days after exposure. Mild cases of the disease recover without treatment; more severe cases require antifungal medications and can be fatal.

Intestinal Bacterial Diseases

Several organisms are classified as enteric bacteria when they reside in the intestines. *Campylobacter spp., Escherichia coli*, and *Salmonella spp.* are normal inhabitants in the intestines of many warm-blooded animals but can cause campylobacteriosis, E. coli infections, and salmonellosis in humans. Humans can contract these intestinal disorders after handling, eating, or drinking contaminated food or water, or not washing their hands or food after contact with animal feces. Raw poultry, milk, and vegetables are the more common routes of exposure. Symptoms include severe diarrhea, fever, and traces of blood in feces 2–5 days after exposure. Medical treatment is available. Practice good hygiene for protection.

Leptospirosis

This is a bacterial disease, also known as Weil's disease. The bacteria (*Leptospira spp.*) reside in soil or water or on vegetation contaminated with urine from infected animals. Humans become infected through contact with water, food, or soil containing urine from infected domestic or wild animals. Symptoms vary in severity and include sudden fever, chills, headache, body aches, and fatigue from 4 to 19 days after exposure. Leptospirosis may affect the liver, kidneys, or nervous system. Medical treatment is available. Practice good hygiene for protection.

Lyme Disease

Lyme disease is caused by the bacterium *Borrelia burgdorferi*, which resides in the midgut of ticks. It is transmitted through the bites of certain species of ticks, such as the western black-legged tick (Ixodes pacificus). These ticks commonly feed on mice, squirrels, and other small animals. The Intermountain West is a low-risk area for Lyme disease.

The first sign of Lyme disease is usually a circular rash that occurs at the tick bite location and gradually expands up to 12 inches across. People infected may also experience fatigue, chills, fever, headache, muscle and joint aches, and swollen lymph nodes. Other symptoms can develop with long-term effects. Protect yourself from tick bites by wearing appropriate clothing and using insect repellents. Also conduct daily tick checks of your body when working in tick habitat. Seek medical attention if experiencing symptoms since long-term disabilities can result from infection.

Parasitic Roundworms

Endoparasitic roundworms (*Baylisascaris procyonis*) are found primarily in raccoons. Raccoon roundworm eggs are deposited with feces onto soil, water, or other objects. Fecal-oral transmission to humans can occur when people have contaminated hands or ingest

contaminated water. Roundworm eggs are resistant to most environmental conditions and, with adequate moisture, can survive for years. Once infected, roundworms can move into virtually every tissue and organ (heart, liver, spleen, lungs, brain, eyes), making it extremely harmful and even deadly to humans. Medical treatment is available. Practice good hygiene for protection, including using extra care when working in raccoon latrine areas.

Parasitic Tapeworms

Echinococcus multilocularis is present in foxes (and to lesser extent coyotes, wolves, and other wild canids) and rodents (voles and deer mice). Fecal-oral transmission to humans can occur after contact with the tapeworm egg-infested feces of a fox that eats a rodent infected with the tapeworm. This endoparasite infects the liver of humans with fatality rates that approach 100% without medical treatment. Practice good hygiene for protection.

Plague

Humans get plague from being bitten by a rodent flea that carries the plague bacterium (*Yersinia pestis*) or by exposure to contaminated tissues and fluids when handling an infected animal. Millions of people in Europe died from plague in the Middle Ages when flea-infested rats inhabited human homes and places of work. Fleas seek another warm-blooded host when their host dies. Today, modern antibiotics are effective against plague, but if an infected person is not treated promptly, the disease is likely to cause illness or death. In the western United States, 1–40 cases are reported annually; most cases occur in New Mexico, Arizona, Colorado, and California. Be careful when handling live or dead ground squirrels, prairie dogs, and other burrowing rodents, which are the primary reservoirs for the disease. If working in an area with endemic plague, consider treating animals with an appropriate insecticide spray or dust and double-bagging the potential carriers before handling and disposing of them.

Rabies

Rabies is a viral disease of the nervous system of humans and other mammals, especially foxes, skunks, raccoons, and bats. Rodents and rabbits rarely carry the disease. It is present in the saliva and brain of infected animals and transmitted by a bite from an infected animal. The early signs of rabies can be fever or headache, but this changes quickly to nervous system symptoms such as confusion, sleepiness, or agitation. Once someone with a rabies infection starts exhibiting these symptoms, they usually do not survive. Utah is at low risk for rabies in any wildlife. However, it is very important to talk to your doctor or health care provider right away if any mammal bites you, especially a wild animal. Treatment is available but is only effective if administered immediately.

If an animal known to have rabies bites someone, that person must receive medication as soon as possible. If the biting wild animal can be caught, it is usually euthanized and immediately tested. Make special efforts to capture or collect an animal that has bitten a person

so it can be observed and tested for rabies. However, if the biting animal cannot be caught and observed, the bite victim should receive post-rabies exposure treatment as a precaution.

Pre-exposure rabies vaccines are administered for people at high risk for exposure in areas where immediate treatment is not available.

Rocky Mountain Spotted Fever

The bacteria *Rickettsia rickettsii* is vectored (transmitted) by the deer tick, wood tick, American dog tick, and many other tick species. These ticks are found on rodents, dogs, deer, and other animal species. The bacteria transmission can occur either from a tick bite (and attachment for several hours) or a crushed tick that is exposed to cuts in your skin. Symptoms include a sudden onset of moderate to high fever, accompanied by fatigue, deep muscle pain, severe headaches, chills, and eye infection. A rash appears on the wrists and ankles, and then spreads to the back, arms, legs, chest, and abdomen. Symptoms may last for 2–3 weeks. Early treatment with antibiotics is effective, but hospitalization may be required. Carefully remove ticks as soon as possible and remember to wash your hands and bite area promptly.

Recognize tick habitats, which are areas with rodents, deer, and any other host. Ticks only spread by physically grabbing another host species; thus, they primarily reside along game and rodent trails. When working in areas with host animals, inspect your body and remove any crawling or attached ticks. Wear light-colored clothing to spot them more easily. Wear long-sleeved shirts and long pants tucked into your sock legs to minimize exposed skin.

Tetanus

Tetanus is caused by the bacterium *Clostridium tentani*, which occurs in soil contaminated with manure. It affects the nervous system and causes painful tightening of the muscles all over the body. It is commonly called lockjaw. The greatest concern comes from exposure through a wound, such as those from contaminated barbed-wire or nail. There are reports of transmission by animal bites. Due to tetanus immunizations, this disease is rare. Wildlife managers must therefore stay current with their vaccinations.

Tularemia

Tularemia is a potentially serious illness that occurs naturally in the United States. It is caused by the bacterium *Francisella tularensis*, which is most commonly found in rodents and rabbits. Tularemia is fatal to animals and is transmitted by ticks, fleas, biting flies, direct contact with infected animals, and contaminated water. Animals with this disease may be sluggish, unable to run when disturbed or appear tame.

Tularemia can be transmitted to humans from the bite of an infected vector, breathing in bacteria, drinking contaminated water, eating undercooked contaminated meat, or allowing an open cut to contact an infected animal. The most common source of tularemia for humans is

to be cut or nicked by a knife when skinning or gutting an infected animal. Symptoms include a high temperature, headache, body ache, nausea, and sweats. The disease can be fatal if not treated with the right antibiotics. Use a multi-tactic approach to prevent exposure, including insect repellents, good hygiene, and wearing gloves and a respirator.

West Nile Virus

West Nile virus is most prevalent in bird populations; mosquitoes transmit it from birds to humans and other animals. Many people do not exhibit any symptoms. While 30% of infected humans have moderate symptoms, fewer than 1% contract full meningitis or encephalitis (spinal column or brain swelling). Human deaths do result in people who contract encephalitis or meningitis. Practice prevention by avoiding mosquito habitats or protecting yourself from mosquito bites. Recognize symptoms (i.e., high fever, severe headache, nausea, stiff neck, confusion) and seek medical attention at their earliest onset.

CHAPTER 9

Human, Non-target Animal, and Environmental Safety

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Understand the importance of personal and environmental safety concerns when choosing a management strategy.
2. Understand the importance of personal hygiene, personal protective equipment, and proper handling of pest to reduce oral and inhalation exposure to diseases.
3. Understand hazards associated with incendiary devices, fumigants, and non-chemical management strategies.
4. Understand the importance of avoiding non-target exposure.
5. Understand the importance and how to avoid rodenticide resistance.

INTRODUCTION

Wildlife managers must consider both personal and environmental concerns when assessing different pest management tactics. Management strategies can affect non-target organisms, including humans, especially when pesticides are used. It may also impact non-target animals. Pesticides in particular pose health concerns. Make sure you read and follow label instructions to protect yourself, non-target animals, and the environment.

Think about both personal and environmental impacts when assessing management tactics

HUMAN SAFETY CONCERNS

As noted in the previous chapter, it is important to be familiar with diseases that come from wild animal populations. This not only includes recognizing key symptoms of disease and pesticide exposures and seeking appropriate medical care when necessary, but also taking precautions to maintain a safe and healthy work environment.

Disease Contaminant Protection

Personal hygiene, personal protective equipment, and proper handling reduce oral and inhalation exposures to disease contaminants in the environment and to pesticides you handle. Make sure to wash your hands and face regularly. Wear gloves to protect from contaminants getting on your hands and transferred to your mouth. Consider eye protection as well.

When working in areas with surface contaminants, wear disposable protective gloves, a hat, coveralls, and boots. When finished in this environment, remove your protective clothing and place it in a plastic bag. If you wear washable coveralls, put them in a plastic bag after you are finished wearing them, and keep the bag tied until you are ready to wash them. Use hot water and detergent to wash the coveralls by themselves before wearing again.

If working in areas with ventilation concerns for contaminants such as deer mice or bird urine or feces, wear a full-face respirator with a high-efficiency particle air (HEPA) filter for screening particles down to 0.3 microns in size. Simple dust and particle masks may not provide adequate protection. Make sure the respirator is properly fit tested to you. Contact the manufacturer for specific information. Respirators are available for purchase in safety, hardware, paint, and home supply outlets.

Before cleaning areas contaminated with urine or feces, spray the area down with a 10% mixture of bleach and water to reduce airborne particulates. Keep the droppings damp for as long as you are working with them. Put droppings into sealed plastic garbage bags (disposal should be permissible through standard trash pickup). Wash or shower after removing your protective clothing.

Pesticide Exposures

Never store pesticides in an unmarked container, especially any food container. Read and follow all label directions and wear the appropriate personal protective equipment.

Some avicide and rodenticide baits are highly toxic to humans, depending on exposure and dose. Read the labels for precautions and emergency first aid. The following are a few examples of products that can be dangerous to humans. Avitrol, if ingested, causes a person to salivate, become excited and uncoordinated, have tremors and convulsions, and

then go into heart or respiratory arrest. Symptoms begin within 15 minutes to 4 hours after exposure. Induce vomiting if Avitrol is ingested and seek medical attention. Wash any area of the skin that might contact Avitrol.

Gas cartridges are incendiary devices that give off carbon monoxide and smoke when ignited. Because they pose a significant fire hazard, do not use gas cartridges in burrows under sheds, buildings, or near combustible materials. If using incendiary devices like gopher flares, do not inhale fumes, which are toxic to humans.

Moisture-activated fumigants are formulated as tablets to be inserted into an animal's burrow or den. Moisture in the air causes these fumigants to release phosphine gas, which is odorless and extremely toxic to all mammals, including humans. Just a few breaths can be fatal. Use extreme caution when handling fumigants. Make sure you open the pesticide container in fresh air or near a fan or ventilation system. Point the container away from your face when opening. Loosen the lid slowly. Additionally, these products are known to flash-ignite when the gasses escaping the container contact moist air. Follow all label directions carefully and exactly. Labels require applicators to develop a fumigation management plan (Appendix C). Store fumigants and other pesticides in a locked enclosure to prohibit access from unauthorized individuals.

Fumigant applications pose a significant health risk to you and others. Assess the locations of burrow or den openings to ensure gas cannot enter areas where people or non-target animals may be present (e.g., farm shop, livestock barn, pet boarding facility). Fumigants often have regulations restricting their use in proximity to homes, schools, etc. If fumigating a structure, adhere to ventilation requirements prior to reentry. Wear an appropriate respirator and use air sampling devices.

There are two predator control compounds with very restrictive use instructions. While sodium fluoroacetate (Compound 1080) and sodium cyanide (M44 devices) are registered in Utah, only USDA Wildlife Services employees can use these chemicals

- Wash your face and hands regularly.
- Wear PPE!

Concerns with Non-chemical Strategies

Several non-chemical pest management strategies also pose human health concerns. Firearms, pyrotechnics like racket bombs, screamers, or shellcrackers, and propane cannons or exploders (Figure 1) can cause severe injury or death if used incorrectly.

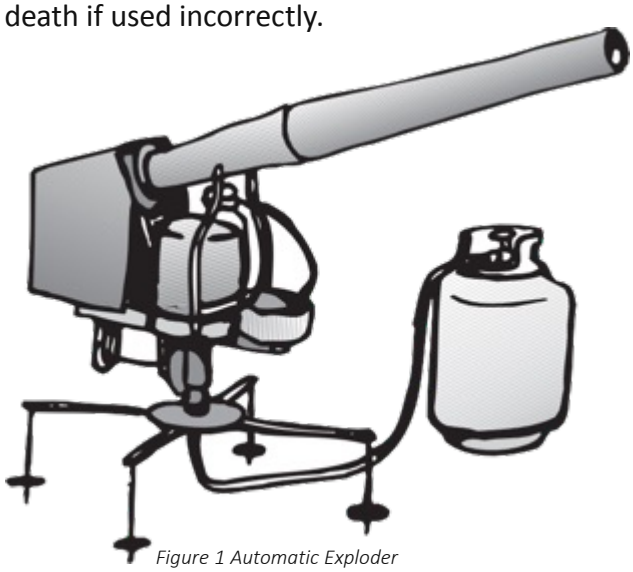


Figure 1 Automatic Exploder

Cannon and rocket nets are known to have caused human injury and death, as well as property damage from accidental discharges. Rockets may also start grass fires. Make sure you understand how to properly store, transport, and activate these devices; state regulations or local ordinances may govern their transport and use, including prohibition in some areas. Pyrotechnics may be regulated by state fire marshal offices.
Be familiar with the method for setting and releasing traps to prevent personal injury. Read instructions and make sure you clearly understand how to safely set and release animal trap devices.

NON-TARGET ANIMAL PROTECTIONS

One of the greatest risks in vertebrate pest control is injury or death of non-target species (Figure2). Non-chemical and chemical control strategies can impact pets, livestock, native wildlife, migratory birds, endangered or threatened species, or any other animal that is not causing damage. Even some non-toxic repellents can harm-nontarget animals by causing dispersal from home territories.

Due to public sensitivities regarding vertebrate pest control, take meticulous notes regarding what steps you followed for managing the pest as well as protecting humans and non-target animals. Recognize sensitive sites such as wetlands, public lands, urban/suburban areas, livestock and pet areas, and the habitats of federal or state threatened and endangered species. Pesticides used to manage vertebrate pests vary considerably in their toxicity and related exposure concerns. Prior to purchasing and then again before using any pesticide, read the label to understand the human and wildlife exposure concerns and required protective measures. Take every precaution noted on the pesticide label.

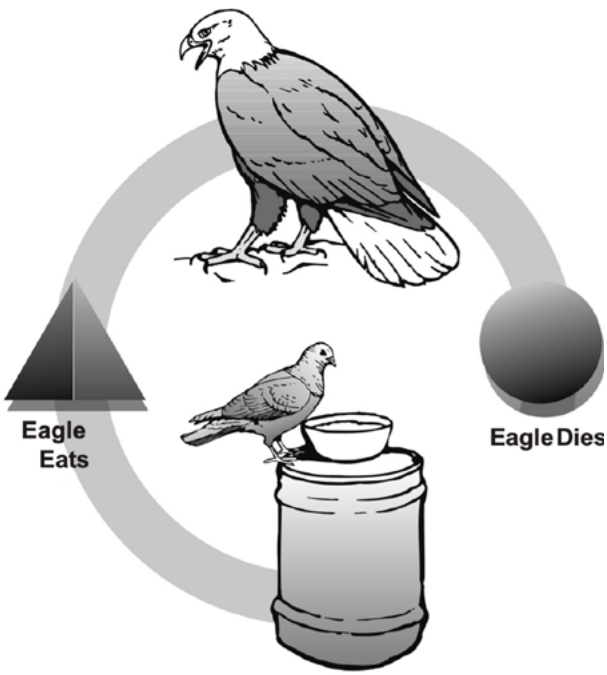


Figure 2: Secondary poisoning.

The pesticide label clearly states protective measures to protect against both primary and secondary non-target toxicity. Primary non-target exposure occurs when susceptible wildlife ingest or come into direct contact with a toxicant from improperly applied chemicals or intentional misuse. Secondary non-target exposure occurs when susceptible predators or scavengers feed on the carcass of a treated pest; for example, a hawk or owl feeding on a rodent that fed on a pesticide.

Bait Station

Bait boxes are a good protective measure when using baits above ground. Make sure they are tamper-resistant to both humans and wild animals (Figure 3). Label boxes with "Poison—Do not touch," the name of the active ingredient, and contact information for the person responsible for the bait station. Place out of sight of children. The entry hole must be appropriate for the target pest, but exclude other animals. Try to locate bait stations in areas not frequented by non-target animals. When the baiting program is over, dispose of all unused bait as specified on the product label. Ensure that any discarded product is inaccessible to non-target wildlife and humans.

Prebaiting increases concerns for non-target animals but may be necessary for some species and situations. During the prebaiting period, observe the bait stations to assess what species they are attracting. If non-targets frequent the bait station, consider another type of bait delivery method, or try a totally different management approach. Remember, if you are baiting birds, to place the bait out before dawn to attract the greatest number of birds when they leave the roost. However, this also can increase the area over which birds die and encourage more scavengers. Monitor the baiting site and watch where affected birds go. Collect any that drop in flight along the entire flight line and at the roost location. Take care not to disturb birds eating the bait. Dispose of bird carcasses according to the product label.

Rodenticide Resistance

Rodenticide resistance was first documented in North Carolina in 1971 when house mice and Norway rats were no longer controlled by first-generation anticoagulant rodenticides. This early evidence of resistance involved the first-generation anticoagulants warfarin and diphacinone. Resistance to other active ingredients has since been identified. Anticoagulant resistance is characterized by individuals within a rodent population successfully feeding on the anticoagulant bait over many weeks without being killed.

Select and manage control strategies to minimize the development of pesticide-resistant populations of vertebrate pests. First-generation anticoagulants require multiple feedings on a consistent basis for 10–15 days until control is achieved. Follow up with other rodenticides or strategies if needed. An IPM program can achieve satisfactory results if you stay alert for indications of rodent populations developing resistance and are prepared with alternate management tactics.

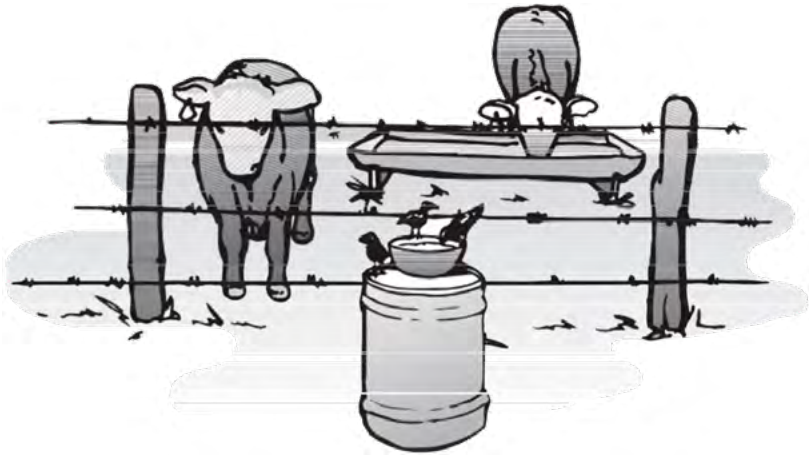


Figure 3 Bait station located out of reach of non-target organisms.

The alternative pesticide should not use the same mode of action, unless the alternate pesticide has a higher toxicity.

Avoid resistance development by using an IPM program with the following features:

- Monitor the pest population regularly.
- When using anticoagulant rodenticides, do not continue using on a permanent routine basis.
- Use alternative baits, baiting strategy, or alternative control techniques.
- Inspect bait stations weekly and replace old bait when necessary.
- Use control strategies until the pest population is under control enough that it is unlikely to return to damaging levels.
- Remove any unused bait.
- Know if the population is resident or immigrant.
- Remove alternative food and water sources and shelter.
- Use mechanical exclusion devices such as netting or hardware cloth, to prohibit pest entry.

CHAPTER 10

Problem Bird Species

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Understand that some protected bird species can be controlled if there is a concern about damage or conflict under the Migratory Bird Depredation Order.
2. Know common problem bird species.

INTRODUCTION

There are several bird species that cause damage to aquaculture, crops, and structures; pose hazards at airports; create unhealthy areas due to their droppings; and raise concerns due to their roosting locations. As described in Chapter 3, most native, non-game bird species are protected under the Migratory Bird Treaty Act. The Act excludes game birds such as quail, grouse, and turkey and non-native species, including European starlings, English or house sparrows, common pigeons, and Eurasian-collared doves. Federal and State permits are not required to take bird species that are not protected. Some protected species can be controlled if there is a concern about damage or conflict under the Migratory Bird Depredation Order. Birds protected under the Migratory Bird Depredation Order may or may not require a federal or state permit, so check with your state wildlife agency. Game birds and waterfowl causing damage or conflict require permits or coordination with your state wildlife agency.

Following is a list of common problem species, their general biology, and common control strategies. The first three groups (European starlings, common pigeons, and house or English sparrows) are not protected by the Migratory Bird Treaty Act. The remainder are protected and follow in alphabetical order.

EUROPEAN STARLINGS

European starlings (*Sturnus vulgaris*) were introduced from Europe into New York's Central Park in 1890 by a small group of people with a passion for introducing all of the animals mentioned in the works of William Shakespeare (Figure 1). These birds have since spread across the continental United States with an estimated population of 150 million.

Starlings are chunky, appear hump-backed, and have dark feathers with light speckles that do not generally show at a distance. The bill of both sexes is yellow during the reproductive cycle (January to June) and dark at other times. They have a short tail and their wings are shaped like a triangle when in flight. Starling flight is direct and swift, not rising and falling like the flight of many blackbirds, with which they are often confused.

Starlings can be problem birds for several different reasons. First, they compete with native cavity-nesting birds such as bluebirds, flickers, and other woodpeckers, purple martins, and wood ducks for nest sites. Second, starlings cause damage by consuming cultivated fruits such as grapes, peaches, blueberries, strawberries, apples, and cherries. In some areas, starlings pull sprouting grains—particularly winter wheat—and eat the planted seed. Third, the growing urbanization of wintering starling flocks seeking warmth and shelter for roosting may have serious consequences. Large roosts that occur in buildings, industrial structures, or trees near homes in rural and urban sites can cause health concerns, filth, noise, and odor. In addition, slippery accumulations of droppings pose safety hazards at industrial structures, and the acidity of droppings is corrosive.

Starlings forage on short grass such as lawns, pastures, golf courses, and turf farms. One of their very favorite foods is large crane-fly larvae. Starlings also eat fruit, seeds, suet at bird feeders, and food scraps. They have unique jaw muscles designed both to clamp shut and spring open, allowing them to use their bills to pry things open, including openings in the soil.

Starlings are found in various habitats, including cities, towns, farms, ranches, open woodlands, fields, and lawns. They nest in suitable holes and crevices in buildings, utility poles, decaying trees, and holes in cliff faces. The nest is an untidy collection of grasses, bark strips, twigs, rope, and other debris. Males are very aggressive when claiming nest sites, taking over nest boxes and other cavities even while they are in use by such native birds as bluebirds, woodpeckers, and swallows.

In late summer and fall, starlings form large flocks and roost in large deciduous trees. When trees lose their leaves in early winter, starlings roost in areas that protect them from wind and cold, including coniferous trees, areas under bridges, grain terminals, and barns.

Adult starlings have few predators, although hawks and falcons occasionally catch them in flight. Loss of young starlings results from starvation, adverse weather, and predation by owls, raccoons, rats, domestic cats, and other predators.

Legal Status

Starlings are not protected by federal or state laws, which means control can be conducted without permits.

Figure 1 European Starling

MANAGEMENT OPTIONS

Management relies on all three principles of vertebrate pest control: habitat modification, behavior alteration, and population reduction.

- ***Exclusion.*** Close all openings larger than 1 inch to exclude starlings from buildings or other structures. Heavy plastic (PVC) or rubber strips hung vertically in open doorways of farm buildings have been successful in some areas in excluding birds while allowing people, machinery, or livestock to enter. Where starlings are roosting or nesting on the ledge of a building, place a wooden, metal, or plexiglass covering over the ledge at a 45° angle to prevent use. Metal protectors or porcupine wires are also available for preventing roosting on ledges or roof beams. Netting is practical and cost-effective to protect fruit crops such as cherries and grapes.
- ***Remove food sources.*** Starlings are attracted to livestock operations by available food and water. Proper farm management is essential for long-term bird management. For example, store grain in bird-proof facilities, use bird-proof livestock feeders, and clean up spilled grain.
- ***Habitat modification.*** Thin out branches from the trees used by roosting starlings to disperse the population. In woodlots or groves, thinning the tree stand can help reduce starling numbers.
- ***Frightening devices*** are effective at dispersing starlings from roosts, small-scale fruit crops, and some other troublesome sites. Vary the location, intensity, and types of scare devices to increase their effectiveness.
- ***Avian repellent***s discourage starling from roosting. However, over time these materials lose their effectiveness and must be replaced.
- ***Chemical frightening baits.*** Birds that eat the treated portion of frightening bait behave erratically and/or give warning cries that frighten other birds from the area. Generally, birds that eat the treated bait die.
- ***Avicide toxic*** baits are slow-acting toxicants used around livestock and poultry operations. Always read and follow pesticide label instructions.
- ***Trapping*** and removing starlings can be successful at locations where a resident population is causing localized damage or conflicts or where other techniques cannot be used. Be sure to release all captured non-target birds immediately.

COMMON PIGEONS (ROCK DOVE)

The common pigeon (Columba livia; also called rock dove or city pigeon) was originally found in Europe, Northern Africa, and India and introduced into the eastern United States as a domestic bird in the 1600s (Figure 2). It can now be found throughout the United States, across southern Canada, and into South America.

Common pigeons originally lived in high places such as cliffs, ledges, and caves near the sea that provided them with safety. Over time they have adapted to roosting and nesting on windowsills, roofs, eaves, steeples, and other man-made structures.

Common pigeons typically have a gray body with iridescent feathers around their neck, a broad black band on their tail, and salmon-colored feet. Breeders have created color variations, so the body color may also be white, tan, black, or a combination of several colors. Common pigeons have a strutting walk and their call is a long, drawn-out coo that can be heard quite easily.

Common pigeon droppings deface and accelerate the deterioration of buildings and increase the cost of maintenance. Large amounts of droppings may kill vegetation and produce an objectionable odor. Pigeon manure deposited on park benches, statues, cars, and unwary pedestrians is aesthetically displeasing. Around grain handling facilities, common pigeons consume and contaminate large quantities of food destined for human or livestock consumption.

Two native birds sometimes confused with common pigeons are protected: the band-tailed pigeon (*Columba fasciata*) and the mourning dove (*Zenaida macroura*). Band-tailed pigeons are similar in size but have a purplish head and breast, a dark-tipped yellow bill, yellow feet, and a small white crescent on top of the neck. Mourning doves are smaller than common pigeons, have a long, pointed tail, large dark eyes, a dark bill, and a mournful who-ooh, who-whowho call.

Common pigeons are highly dependent on humans for food and roosting, loafing, and nesting sites. They are commonly found around farmyards, grain elevators, feed mills, parks, city buildings, bridges, and other man-made structures. Gregarious, they eat, roost, and nest in each other's company whenever possible. Their primary diet is seeds and grains, but they also eat insects, fruit, vegetation, and most any other food people provide for them. Common pigeons do not migrate, but they have a good homing ability and can return from long distances if removed from a nesting area.

Common pigeons may carry and spread diseases to people and livestock including ornithosis, encephalitis, Newcastle disease, cryptococcosis, toxoplasmosis, salmonella food poisoning, and several other diseases. Some of

these diseases are discussed in Chapter 8. Also, ectoparasites of common pigeons, including fleas, lice, mites, ticks, and other biting insects, can infect humans and/or poultry.

Domestic cats are the main urban predators of common pigeons, but opossums, raccoons, foxes, weasels, and rats all eat common pigeons nestlings or adults when accessible. Urban-dwelling common pigeons can also be an important food for peregrine falcons and Cooper's hawks. Crows sometimes eat juvenile common pigeons. As with starlings and house sparrows, there are several approaches to manage common pigeons.

Legal Status

Common pigeons are not protected and therefore do not require permits to control; however, it is important to distinguish these domestics from native band-tailed pigeons and mourning doves, which are protected. A pesticide applicator license is required if using restricted-use pesticides or applying to someone else's property.

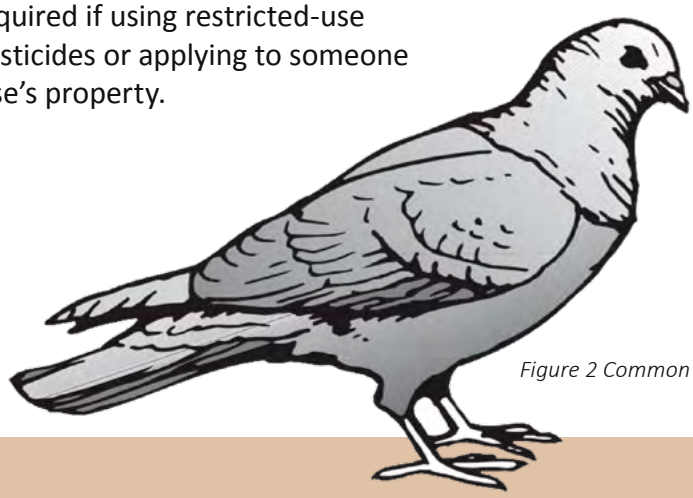


Figure 2 Common Pigeon

MANAGEMENT OPTIONS

- **Exclusion.** Exclude common pigeons from buildings by blocking access to indoor roosts and masonry with 1/4-inch rust-proofed wire mesh or plastic or nylon netting. Roosting on ledges can be discouraged by changing the angle to 45° or more. Sheet metal, wood, Styrofoam blocks, stone, and other materials can be fastened to ledges to accomplish the desired angle. In a tool or machinery shed, barn, hangar, or other similar building, roosting can be permanently prevented by screening the underside of the rafter area with netting or placing the appropriately sized "porcupine wires" along horizontal ledges. Electric shock bird control systems are available for repelling many species of birds, including common pigeons.
- **Habitat modification.** Eliminate feeding, watering, roosting, and nesting sites for long-term common pigeon control. Discourage people from feeding common pigeons in public areas and clean up spilled grain around elevators, feed mills, and railcar clean-out areas. Eliminate pools of standing water that common pigeons use for hydration and bathing. Modify structures, buildings, and architectural designs to prevent roosting sites.
- **Avian repellents** produce a sticky surface that common pigeons dislike, forcing them to find loafing or roosting sites elsewhere.
- **Chemical frightening baits.** Birds that eat chemical frightening bait behave erratically and/or give warning cries that frighten other birds from the area. Generally, birds that eat the treated particles die relatively quickly.
- **Avicide toxic baits.** Birds feed and then generally die at their roosting sites. Prebaiting is required. Most toxic baits require special permits and licenses to use.
- **Trapping** near roosting, loafing, or feeding sites can be quite effective.

HOUSE OR ENGLISH SPARROWS

The house sparrow (Passer domesticus; also known as the English sparrow), is native to Eurasia and Africa (Figure 3). It was deliberately introduced into the United States in 1854. This brown bird is about 53/4 inches long and is very common in human-made environments. The male has a distinctive black bib and white cheeks, while the female is plain, with a dingy-gray breast that is difficult to distinguish from native sparrows. A house sparrow's success lies in its ability to exploit new habitats, particularly those influenced by humans.

House sparrows primarily eat grain, fruit, and seeds. They can significantly damage crops and consume grain in fields and storage. In urban environments, sparrows live on human-sourced foods and refuse. They can be found in every habitat but prefer human-altered environments, particularly farm areas. Damage can be severe because the birds feed in large numbers in a small space. In addition, they can contaminate livestock and poultry feed with feces and feathers.

House sparrows are considered aggressive and social. Those living in urban areas do not migrate, finding year-round food and shelter among humans. Males select nest sites and build loose, haphazard nests.

Legal Status

House or English sparrows are a non-regulated species, and most control methods can be conducted without

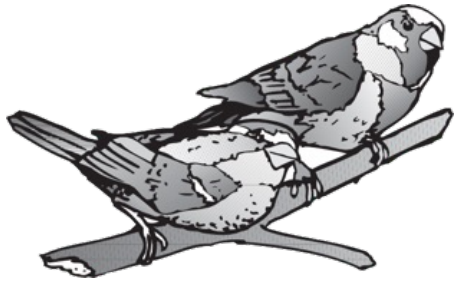


Figure 3 Sparrows

MANAGEMENT OPTIONS

- ***Exclusion.*** Close all openings with 3/4-inch mesh to exclude house sparrows from buildings. Attach signs flat against buildings to restrict roosting sites. Use plastic bird netting to protect high-value crops.
- ***Prevent nesting.*** Make sure openings to birdhouses are less than 1-1/8 inches wide to discourage house sparrows from nesting. Destroy roosting and nesting sites.
- ***Frightening*** using visual devices such as kites, balloons, flashers, and simulated bird of prey forms can be helpful in some areas.
- ***Tactile repellents*** can be used on ledges to prevent roosting. Sharp metal projections such as porcupine wires can also be used. Keep in mind that sparrows can roost on ledges 1-1/2 inches wide. When using porcupine wires, these must be small, thin wires. Otherwise, house sparrows can use the projections as a base for nests or perching.
- ***Trapping.*** There are many types of traps that can successfully help reduce sparrow populations in small areas. Be sure to release all non-target birds unharmed.

BLACKBIRDS

The term "blackbird" loosely refers to a diverse group of about ten species of North American birds that belong to the subfamily Icterinae. The various species of blackbirds (blackbirds, cowbirds, grackles) have several traits in common. The males are predominantly black or iridescent in color. All blackbirds are omnivorous, feeding primarily on grains, seeds (including those of weeds), fruits, and insects. Outside of the nesting season, blackbirds generally feed in flocks and roost at night in congregations varying from a few birds to over one million. These flocks and roosting congregations are sometimes comprised of a single species, but often several blackbird species mix together. Sometimes blackbirds are joined by non-blackbird species, notably European starlings and American robins (*Turdus migratorius*).

The various blackbird species have many important differences in their nesting biology, preferred foods, migration patterns, and their damage and benefits to agriculture.

Careful observation of birds in the field and a little detective work may be necessary to correctly identify the damage and its source. Blackbird damage is sometimes confused with other forms of loss. For example, raccoon and squirrel corn depredation can be mistaken for blackbird damage. Also, seed shatter in sunflowers caused by wind may resemble bird damage; however, the difference can usually be detected by examining heads for the presence or absence of bird droppings and by looking on the ground for hulls or whole seeds. Similarly, starlings superficially resemble blackbirds and sometimes feed in cornfields, yet they usually concentrate on insects such as armyworms, doing little damage to corn. Red-winged blackbirds are also often attracted to cornfields, initially to feed on rootworm beetles and other insect pests. They do not damage the crop itself until the grain has reached the milk stage. Blackbirds often forage in newly planted grain fields such as winter wheat, feeding on previous crop residue, weed seeds, and insects without bothering the sprouting grain. So, in some of these cases, the birds are performing a beneficial ecosystem service rather than fulfilling a role as a pest.

Legal Status

Blackbirds are native migratory birds given federal protection under the jurisdiction of the Federal Migratory Bird Treaty Act. However, in Utah they fall under a Migratory Bird Depredation Order (50 CFR 21.43), so they can be taken at any time without a permit if they are committing or are about to commit damage to wildlife, ornamental or shade trees, agricultural crops, livestock, or other property, or when large numbers cause a health hazard or other nuisance. You may kill birds under this order only in a way that complies with all State, tribal, or territorial laws or regulations. The complete order can be found at https://bit.ly/3wybBw8.

MANAGEMENT OPTIONS

- ***Exclusion*** of blackbirds is only practical for small gardens and high-value fruit crops. Use lightweight netting to cover trees, bushes, or concentrated areas.
- ***Habitat modification.*** Plant crops that are not attractive to blackbirds such as wheat, potatoes, or hay in fields within a few miles of a roost. Consider planting and harvest times when bird concentrations are lowest to reduce crop damage.
- ***Frightening*** devices can be effective on blackbirds, but the persistence and innovation involved may require hard work and long hours. Devices need to be employed, especially in the early morning and late afternoon when the birds are most actively feeding. Mylar reflecting tape strung above susceptible vegetation can reduce blackbird feeding activity.
- ***Trapping.*** Certain species of blackbirds, particularly red-winged blackbirds and brown-headed cowbirds often can be easily captured in decoy traps. Consult a state wildlife official, such as a conservation officer or game warden, before putting a decoy trap into operation. Immediately release any non-target birds accidentally captured in a decoy trap.
- ***Avian and tactile repellents*** discourage blackbirds from roosting. Sharp metal projections such as porcupine wires can also be used.
- ***Chemical frightening baits.*** Birds that eat chemical frightening bait behave erratically and/or give warning cries that frighten other birds from the area. Generally, birds that eat the treated particles die relatively quickly.
- ***Avicide toxic baits.*** Birds feed and then generally die at their roosting sites. Prebaiting is required. In Utah, blackbirds may not be removed using bait or poisons unless afforded a special permit by the USFWS.
- ***Shooting*** blackbirds to kill with a shotgun is most effective when used occasionally to supplement or reinforce other scare devices. Follow state and local regulations for handling and discharging firearms. The State may require hunting licenses.

CANADA GEESE

Both migrating and non-migrating (often called resident) geese can be found in Utah. Resident Canada geese have dramatically increased over the past 25 years, particularly in urban areas where there are few predators, prohibitions on hunting, and a dependable year-round supply of food and water.

Canada geese are highly adaptable and particularly attracted to agricultural crops, mowed lawns around homes, golf courses, parks, and similar areas next to open water (Figure 4) . Because geese and people often occupy these spaces at the same time of the year, conflicts arise. Many citizens enjoy the presence of geese, but others do not.

Canada geese graze while walking on land and feed on submerged aquatic vegetation by reaching under the water with their long necks. Wild food plants include pondweed, bulrush, sedge, cattail, horsetail, clover, and grass; agricultural crops include alfalfa, corn, millet, rye, barley, oats, wheat, and grass grown for seed. Geese also eat some insects, snails, and tadpoles, probably incidentally.

Canada geese make nests that leave a bowl-shaped depression approximately 1-1/2 feet in diameter lined with grass, leaves, and goose down. Nest sites vary widely and include the shores of cattail and bulrush marshes, the bases of trees, the tops of muskrat lodges and haystacks, and unoccupied nests of eagles, herons, and ospreys, and human structures such as decks and patios.

The droppings of Canada geese can spread the parasite that causes swimmer's itch (schistosome or cercarial dermatitis). This parasite does not mature or reproduce in humans, but it does cause a red, itchy rash. A topical rash cream alleviates some of the itching, and the rash typically clears up within a week.

Predators of Canada geese and their eggs include humans, coyotes, raccoons, skunks, bobcats, foxes, gulls, eagles, crows, ravens, and magpies. Canada geese hatched in urban environments may have very low first-year mortalities due to the abundance of food and relative scarcity of natural predators.

Legal Status

Canada geese are protected by the Migratory Bird Treaty Act and do not fall under the provisions of a Migratory Bird Depredation Order. Under some circumstances, resident geese or their eggs may be taken for public safety or health issues. Coordinate control strategies with the state fish and wildlife agency or USDA Wildlife Services.

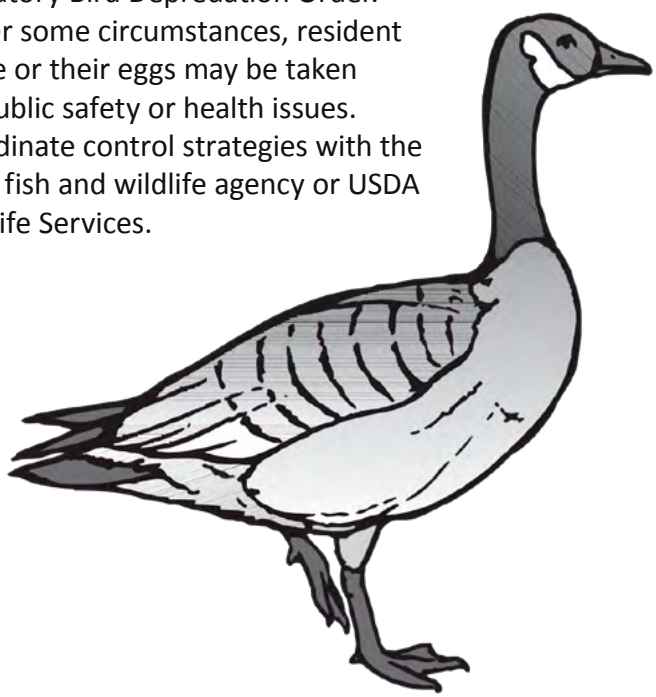


Figure 4 Canada Goose

MANAGEMENT OPTIONS

- ***Do not feed geese***. Encourage clients not to feed geese. Geese move on if there is inadequate food. Some localities may need to pass ordinances to regulate feeding and create authority to enforce such regulations.
- ***Habitat Modification***. Reduce lawn size to the point where geese no longer feel safe grazing. An open sight line (the distance from the geese to a place where a predator could hide) of less than 30 feet generally causes geese to move to a more comfortable grazing area. Also, any size lawn can be made less attractive to geese by increasing its growth height to 6 inches and reducing the number of tender new shoots it produces. Stopping fertilization and watering reduces both the palatability of the lawn and the time it takes to maintain it.
- ***Barriers*** are most effective when geese numbers are low, when geese are molting (not flying), and when the barrier is in place before geese begin using the area. Geese have a fear of confinement, so shrubs, aquatic plants, and closely-spaced groups of trees can be effective deterrents.
- ***Exclusion*** can be made from woven wire, poultry netting, plastic netting, plastic snow fencing, monofilament line, or electrified wire. Fences should be at least 3 feet tall, firmly constructed, and closed off at each end.
- ***Grids and netted areas***. A grid or network of multiple parallel lines of wire, stainless steel cable, twine, rope, or monofilament (50-pound test) stretched 1–2 feet above a water body or other area creates a flight hazard and deters geese. In places with large numbers of geese and where funding is available, enclose newly planted areas in netting for the first few growing seasons. Regularly monitor all grids, netting, and fencing material for holes, trapped wildlife, sagging, and overall effectiveness against geese.
- ***Harassment and scare tactics*** are used to frighten Canada geese away from feeding, loafing, and resting areas where they are unwanted. Geese learn that no actual physical danger is associated with harassment and scare devices and soon ignore such tactics. Because of this, and to take advantage of geese being fearful of novel objects, two important rules are never rely solely on one tactic and vary harassment techniques by altering the timing and location.
- ***Avian repellents***. Taste-aversion products and other chemical repellents are unobtrusive, may be applied directly to the problem area, and do not permanently harm geese. If geese have used the site in the past, apply repellent before they return. Carefully read and follow all labels and technical directions. Repeat applications may be required when using repellents on green, grassy areas that are regularly watered.
- ***Shooting***. It is illegal to hunt geese outside of open season and without the proper license or permit. Check with the Division of Wildlife Resources office for current regulations.

CROWS

Crows belong in the Corvid family (which includes ravens, jays, and magpies) and are considered among the most adaptable and intelligent birds. The American crow (*Corvus brachyrhynchos*) is large (17–21 inches long), has completely coal-black plumage, and a familiar caw-caw sound.

In spring and summer, crows are usually seen in family groups of 2–8 birds. During late summer, fall, and winter, crows gather from many miles to form communal night roosts. Large fall and winter crow roosts can cause serious problems, particularly in towns or other sites near people. Such roosts are objectionable because of the odor from bird droppings, health concerns, noise, and damage to trees.

Crows occupy almost any woodland, farmland, orchard, or residential neighborhood where sufficient shelter and enough trees suitable for nesting are available. Crows seem to prefer lower elevations and moist places, including creeks, streams, and lakeshores. In recent years, crow populations have expanded into urban and suburban areas. Their tameness becomes notable as they seek the plentiful food sources found on roadsides, parking lots, ferry landings, marinas, and other places where humans influence the landscape. Crows are omnivorous and eat whatever is available: insects, spiders, snails, fish, snakes, eggs, nestling birds, cultivated fruits, nuts, and vegetables. They also scavenge dead animals and garbage.

Crows build nests 15–60 feet above ground in tall coniferous or deciduous trees. The nests are solid, 1-1/2–2 feet in diameter, and in the crotch of a limb or near a tree trunk. In areas that lack tall trees, nests may be in hedgerows or shrubbery. In urban areas, crows may nest on window ledges or the sides of buildings.

Adult crow predators are primarily limited to eagles, hawks, owls, and human hunters. Mortality in the first year is about 50%, but adults can live 6–10 years. Agricultural areas and roosting sites may require management.

Legal Status

Crows are protected by the Migratory Bird Treaty Act but can be taken at any time without a permit if they are committing or are about to commit damage to ornamental or shade trees, agricultural crops, or livestock.

MANAGEMENT OPTIONS

- ***Exclusion*** is not practical for most crow problems but might be helpful in some situations. For example, nylon or plastic netting is known to exclude crows from high-value crops or small areas.
- ***Vegetation management***. Thinning branches from specific roost trees or thinning trees from dense groves reduces the availability of perch sites and opens the trees to weather effects. Such vegetation management has effectively dispersed starling/blackbird roosts, and the same biological concepts indicate probable effectiveness in dispersing crow roosts.
- ***Frightening devices***, including crow effigies, effectively disperse crows from roosts, some crops, and other troublesome sites. Be sure to vary the location, intensity, and types of scare devices to improve their effectiveness.
- ***Chemical frightening baits***. Birds that eat chemical frightening bait behave erratically and/or give warning cries that frighten other birds from the area. Generally, birds that eat the treated particles die relatively quickly.
- ***Avicide toxic baits***. Birds feed and then generally die at their roosting sites. Prebaiting is required. There may be restrictions for the use of these baits in certain environments. Read and follow all label instructions. Crows are protected under the Migratory Bird Depredation Act and may not be removed using baits or poisons without a special USFWS permit.
- ***Trapping*** is often less effective than other techniques because of the wide-ranging movements of crows, the time necessary to maintain and manage traps, and the number of crows that can be captured compared to the total number in the area. However, trapping and removing crows can be successful at locations where a small resident population is causing damage or where other techniques cannot be used.
- ***Shooting*** is more effective as a dispersal technique than as a way to reduce crow numbers. Crows are wary and thus difficult to shoot during daylight hours. Crow hunts are managed by the Utah Division of Wildlife and Resources. Check their site for specific hunting season dates at https://bit.ly/3wybBw8.

MAGPIES

Like crows, magpies are also in the Corvid family. These intelligent, social birds are bold and gregarious and adapt well to living around humans. The black-billed magpie, Pica hudsonia, is easily distinguished from other birds by its striking black-and-white color pattern. It has an unusually long tail (at least half its body length) and short, rounded wings that show flashes of white in flight. The feathers of the tail and wings are iridescent, reflecting a bronzy green to purple.

Magpies are typically found close to water in open areas near scattered trees and thickets. They are now common in rural and suburban areas, including city parks and gardens.

Magpies are omnivorous and opportunistic. The lifespan of a magpie in the wild is 4–6 years. Their diets primarily include insects, small mammals, and small wild birds and their hatchlings and eggs. Magpies also eat seeds, fruits, and nuts.

Magpies flip items over to look for food, follow predators to scavenge scraps, steal food from other birds, and pick insects and ticks from the backs of horses, cattle, and sheep. Another unusual bird trait that magpies display is using scent to find food. Magpies can cause substantial damage to crops such as cherries, corn, nuts, melons, grapes, peaches, and wheat.

Magpies form loose flocks throughout the year, with winter congregations up to several hundred individuals. Black-billed magpies nest once a year but re-nest if their first attempt fails. Nests are loose accumulations of branches, twigs, mud, grass, rootlets, bark strips, vines, needles, and other materials, with branches and twigs constituting the base and framework.

Adult magpies have few predators, although large hawks occasionally take some. Nestlings die from starvation, adverse weather, and attacks by raccoons, owls, and other animals.

Legal Status

Magpies are protected by the Migratory Bird Treaty Act. However, in Utah they fall under a Migratory Bird Depredation Order (50 CFR 21.43), so they can be taken at any time without a permit if they are committing or are about to commit damage to ornamental or shade trees, agricultural crops, livestock, other property, wildlife, or when large numbers cause a health hazard or other nuisance.

MANAGEMENT OPTIONS

- ***Exclusion*** is generally not feasible to protect crops from magpie depredation unless crops are of high value or the area to protect is relatively small. Nylon or plastic mesh netting can be used to cover crops, but the netting is expensive and labor-intensive, making it uneconomical to use in most situations.
- ***Habitat modification***. Clear low brush reduces nesting habitat in areas where several black-billed magpies are regularly concentrated and cause significant yearly damage. Removing or thinning roost trees forces magpies to find new roost sites.
- ***Frightening*** devices are effective for reducing magpie depredations to crops and livestock. A combination of human presence, scarecrows, pyrotechnics (fireworks), and propane cannons provide a good frightening or hazing program and can reduce depredations significantly. Frightening devices such as scarecrows and other effigies, eye-balloons, hawk kites, and Mylar tape are usually successful for only a short time, but moving them regularly can extend their effectiveness. The human scarecrow is still one of the most effective frightening devices for magpies.
- ***Trapping*** (Lethal removal) effectively reduces local magpie populations and damage where they have concentrated in high numbers because of food availability or winter conditions.
- ***Shooting*** can be an effective means to eliminate a few offending magpies or reduce a local population. Check with your local municipality for firearm regulations.

NORTHERN FLICKERS

The Northern flicker, *Colaptes auratus*, is a commonly seen and heard woodpecker. They have a white patch on their rump and salmon-colored wing undersides that are distinctly visible during a slow, bouncy flight. Flickers can also be identified by their loud call that sounds like wake-up, wakeup, wake-up.

Flickers eat a large number of insects, including ants and beetle larvae. They also eat berries, fruits, nuts, and seeds. When searching for insects, flickers tap on wooden surfaces and appear to look and listen for insect movements. If flickers see or hear an insect, they continue chiseling until the insects are caught. Hollow sounds also may indicate that insects are present, thus encouraging flickers to continue chiseling away.

Flickers excavate nest sites in dead or dying trees, aging utility poles, fence posts, and house siding. They also use specially-designed nest boxes. Individual flickers return to the same area to breed year after year.

Flickers drum to attract or otherwise communicate with a mate or proclaim territory. This typically happens during the breeding season. Drumming is the most common reason for flickers to use buildings, and while it may be annoying, the bird's activity usually does not penetrate entirely through the wood siding. They return year after year to the same house because it works for them; they attract a mate this way. Thus, a flicker that has been using the same location for several years is hard to move.

Legal Status

Flickers are a protected species. Permits are required but issued only after all non-lethal control techniques have proven unsuccessful. Permits must be obtained from the U.S. Fish and Wildlife Service.

MANAGEMENT OPTIONS

- ***Discourage*** drumming by hanging strips of Mylar scare tape or floating Mylar party balloons in front of the area of activity. Try hanging aluminum pie pans horizontally along a rope or section of twine.
- ***Frightening***. Scaring flickers by shouting and banging pans outside a nearby window may provide temporary relief. A squirt of water with a garden hose can have a similar effect. (Note: Scaring flickers away from a nest containing eggs or young is illegal.)
- ***Exclusion***. Create a barrier by covering or wrapping the gutter, downspout, or other drumming site with a sheet, tarp, burlap, or other material. A large area of siding can be protected by hanging a sheet, tarp, or bird netting from the roof gutter or eave. Be sure to cover any ledges or cracks the bird uses as a foothold while drumming.
- ***Avian repellents*** are commercially available. The repellent spray exudes an aromatic and taste deterrent when pecked, so apply this non-toxic coating spray where activity is taking place.

CHAPTER 11

Problem Rodent Species

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Understand common rodent pests of Utah.
2. Understand the damage caused by rodents.
3. Understand common management strategies for rodents.

INTRODUCTION

Rodents are a large group of mammals characterized by two continuously growing sharp incisors they use to gnaw wood, break into food, and bite predators. Most rodents eat seeds or plants, though some have more varied diets. Some species have historically been pests, eating human seed stores and spreading disease. This chapter presents information on some of the more common rodent species in alphabetical order. Pay close attention to the legal status of the animal.

BEAVERS

Beavers (*Castor canadensis*) are the largest living rodents in North America, with adults averaging 40 pounds and measuring more than 3 feet in length, including the tail. These semi-aquatic mammals have a broad, flat tail, webbed hind feet, large incisor teeth, valvular nose and ears which close underwater, and dense underfur with long, coarse guard hairs. Beavers are found where their preferred foods are in good supply—along rivers, small streams, lakes, marshes, and even roadside ditches containing adequate year-round water flow. Beavers use their large, sharp, upper and lower incisors to cut trees and peel bark while eating. The incisors grow their entire lives, but are worn down by grinding, tree cutting, and feeding. In areas where deep, calm water is not available, beavers that have enough building material create ponds by constructing dams across creeks or other watercourses and impounding water.

Like many rodents, beavers construct nesting dens for shelter and protection against predators. These may be burrows in a riverbank or the more familiar lodges built in the water or on the shore. However, the basic interior design varies little, consisting of one or more underwater entrances, a feeding area, a dry nest den, and a source of fresh air.

Dams are constructed and maintained with whatever materials are available, including wood, stones, mud, and plant parts. Beaver dams vary in size from a small accumulation of woody material to structures 10 feet high and over 165 feet wide. Beavers flood areas for protection from predators, access to their food supply, and underwater entrances to their den. Beavers living on water bodies that maintain a constant level do not build dams.

Beavers use lodges and bank dens for safety and a place to rest, stay warm, give birth, and raise young. Lodges consist of a mound of branches and logs plastered with mud. One or more underwater openings lead to tunnels that meet at the center of the mound, where a single chamber is created. One family can have several lodges or bank dens, but typically use only one den during winter. Beavers are very territorial.

Beavers eat the leaves, inner bark, and twigs of aspen (a favorite food), alder, birch, cottonwood, willow, and other deciduous trees. Beavers also eat shrubs, ferns, aquatic plants, grasses, and crops, including corn and beans.

Beavers live in colonies that may contain 2–12 individuals. The colony is usually made up of the adult breeding pair, the kits of the year, and kits of the previous year or years. Humans remain the major predator of beavers. Historically, beavers have been one of the most trapped furbearers.

Legal Status

The beaver is classified as a furbearing animal, and thus is protected from year-round lethal

control. A trapping license and open season are required to trap beavers. Contact your local Utah Division of Wildlife Office if beaver problems occur. The Utah Division of Wildlife Resources has a relocation program throughout Utah, designed to remove problem beavers and reintroduce them into headwaters where they can recreate ponds, provide habitat to aquatic animals, and recharge the ground water. Special permits are required to remove or modify a beaver dam. Work with your local UDWR any time a control method may use, obstruct, change, or divert the bed or flow of state waters.

MANAGEMENT OPTIONS

- ***Exclusion***. It is almost impossible as well as cost-prohibitive to exclude beavers from ponds, lakes, or impoundments. Protect culverts, drains, and valuable trees adjacent to waterways by encircling them with hardware cloth, woven wire, or other metal barriers. A trapezoidal fence that is narrow at the culvert and widens upstream works well where water flow is too great for pipe and cage systems.
- ***Habitat Modification***. Remove food and dam material sources. Where feasible, eliminate food, trees, and woody vegetation that beavers can use. Continual destruction of dams and daily removal of dam construction materials (depending on the supply) sometimes causes a colony or individual beavers to move to another site.A Clemson beaver pond leveler, locally called a 'beaver deceiver', can be used in a beaver pond to maintain a desired water level. The leveler consists of a pvc pipe that goes through the beaver dam, allowing water to flow. The ends of the pvc pipe should be enclosed in a wire mesh box, to exclude beavers from plugging the holes.
- ***Repellents:*** No chemical repellents are registered for beavers. However, a mixture of sand and paint, applied around the base of a tree, up to a height of at least 12” may serve to keep beavers from gnawing ornamental or shade trees.
- ***Pesticides.*** No chemical repellents, toxicants, or fumigants are registered for beavers.
- ***Trapping***. The use of traps in most situations where beavers are causing damage is the most effective, practical, and environmentally safe method of control. The effectiveness of any type of trap for beaver control is dependent on the trapper’s knowledge of beaver habits, food preferences, ability to read beaver signs, use of the proper trap, and trap placement. Check with your local UDWR office for current trapping regulations; as a furbearer there are regular trapping seasons. However, a permit may be required to remove beavers damaging private property.

DEER MICE

Peromyscus is a genus of mice collectively called "Deer Mice." There are many species of deer mice including the deer mouse, pinyon mouse, and canyon mouse. All these species have similar characteristics and are managed in the same way. Thus, we discuss them collectively, rather than discuss each species. Deer mice have white feet, usually white undersides, and brownish upper surfaces. Their tails are relatively long, sometimes as long as the head and body combined. They have a distinct separation between their brownish back and white belly and a sharply bi-colored furred tail. In comparison to house mice (*Mus musculus*), deer mice have larger eyes and ears, which most people consider to be more attractive. The tails of house mice are all one color and not furred. Deer mice also do not have the characteristic mousy odor of house mice.

Deer mice occupy nearly every type of habitat from forests to grasslands. They are primarily seed eaters, feeding on seeds, nuts, acorns, and other similar items. They also consume fruits, insects and insect larvae, fungi, and some green vegetation. Deer mice often store quantities of food near their nest sites, particularly in the fall when seeds, nuts, and acorns are abundant. They are mostly nocturnal, with a home range of 1/3 acre to 4 acres or larger.

Deer mice build their nests from stems, twigs, leaves, grass roots, and other fibrous materials, often with a lining of fur, feathers, or shredded cloth. The nests are usually underground in cavities beneath the roots of trees or shrubs, beneath a log or board, or in a burrow made by another rodent. Sometimes deer mice nest in above-ground sites such as a hollow log or fencepost, or in the cupboards and furniture of unoccupied buildings. Family groups commonly nest together through the winter. They do not hibernate but may become torpid for a few days when winter weather is severe.

Deer mice or related species serve as reservoirs of hantavirus (see Chapter 7). Mouse-infested areas should be disinfected by thorough spraying with a disinfectant or solution of diluted household bleach prior to any sweeping, vacuuming, or handling of surfaces or materials that mice have contacted.

Legal Status

Deer mice are native, non-game mammals that are not protected.

MANAGEMENT OPTIONS

- ***Exclusion.*** All openings larger than 1/4 inch should be modified to eliminate the opportunity for deer mice to gnaw and enlarge to gain entry.
- ***Habitat modification.*** Store foodstuffs such as dry pet food, grass seed, and groceries left in cabins in rodent-proof containers. Remove or limit nest-building materials from buildings that are used only occasionally.
- ***Encourage predators.*** Deer mice predators include raptors, snakes, cats, dogs, coyotes, long-tailed weasels, and skunks.
- ***Trapping.*** Mouse snap traps are effective in catching deer mice. Bait traps with peanut butter, sunflower seed, or moistened rolled oats. Set traps as you would for house mice: against walls, along likely travel routes, and behind objects. In areas with small pets or children, use snap traps that are housed in plastic containers. These devices are readily available in many hardware stores.
- ***Rodenticide baits.*** Both anticoagulant and non-anticoagulant baits are quite effective on deer mice. If baiting in and around structures, follow label directions and any rules related to bait station placement and labeling.
- ***Rodenticide fumigants.*** Some products are labeled for deer mice. Follow label directions and develop a fumigation management plan for moisture-activated fumigants.

PIUTE GROUND SQUIRRELS (FIGURE 1)

There are several species of ground squirrels in Utah that commonly may be considered pests, including the Piute ground squirrel (*Urocitellus mollis*), golden-mantled ground squirrel (*Callospermophilus lateralis*), and prairie dog (*Cynomys spp*). Prairie dogs will be discussed in a separate section. Golden-mantled ground squirrels are small animals that may be managed much like deer mice. Piute ground squirrels may occur in high densities, becoming an agricultural pest. Piute ground squirrels hibernate during the coldest part of the winter and breed immediately after emergence.

Ground squirrel population densities can range from 2 to 20 or more per acre, depending on the species. High populations of ground squirrels may pose a serious pest problem. They feed mostly on vegetation, preferring spring-time succulent greens like grasses and forbs and new shoots and buds in orchards. However, they switch to seeds and other dry foods later in the year. Most ground squirrels store large quantities of food in burrow caches. They compete with livestock for forage; destroy food crops, golf courses, and lawns; and can be reservoirs for diseases such as plague.

Ground squirrels construct and live in extensive underground burrows, sometimes up to 6 feet deep, with many entrances. They also use and improve on abandoned burrows of other mammals such as pocket gophers. Ground squirrel burrow systems have been known to weaken and collapse ditch banks and canals, undermine foundations, and alter irrigation systems. The mounds of soil excavated from their burrows not only cover and kill vegetation, but damage haying machinery.

Legal Status

Piute ground squirrels are not a protected species and may be managed as needed throughout the year.

Figure 1 Ground Squirrel

MANAGEMENT OPTIONS

- ***Habitat modification.*** Flood irrigation and frequent tillage somewhat discourages ground squirrels and destroys their tunnels.
- ***Trapping.*** Because of their extensive use of burrows, as well as their densities, trapping ground squirrels may not be an efficient management option. In low densities, tube traps (modified body-gripping traps) are effective at removing ground squirrels.
- ***Rodenticide baits.*** Zinc phosphide and anticoagulant baits are currently registered for ground squirrel control. Make sure the rodenticide is registered for use in Utah.
- ***Rodenticide fumigants.*** Gas cartridges are labeled for ground squirrels. Follow directions for incendiary device placement and sealing of burrows. Rodenticide fumigants may be successfully used on small acreages with light infestations. Make sure the rodenticide is registered for use in the state.
- ***Shooting.*** Although expensive and time-consuming, shooting may provide some relief from very small ground squirrel colonies that are under constant management pressure.

HOUSE MICE, NORWAY RATS, AND ROOF RATS

House mice and rats feed on foodstuffs, damage structures, and pose health concerns.

The house mouse (*Mus musculus*), is a small, slender, dusky gray rodent with a slightly pointed nose, small black protruding eyes, large scantily-haired ears, and a nearly hair less tail with obvious scale rings. House mice are troublesome and economically significant rodents. They live in and around homes, farms, and commercial establishments, as well as open fields and agricultural lands. They breed year-round.

House mice eat many types of food, including seeds and grain. However, they prefer foods high in fat, protein, or sugar. A single house mouse eats 8 pounds of food a year. In addition, they cause structural damage to buildings by gnawing and building nests.

House mice are mainly nocturnal. Seeing mice during daylight hours usually indicates a high population is present. To compensate for poor eyesight, house mice rely on their hearing, smell, touch, and taste. They construct nests by shredding fibrous materials such as paper, burlap, rags, bark, or similar items.

Norway rats (*Rattus norvegicus*) and roof rats (*Rattus rattus*) were accidentally introduced to North America from Europe. The Norway rat has spread throughout the United States, while the roof rat is mostly distributed among coastal states. The Norway rat has a blunt muzzle, short ears, small eyes, and weighs about 1 pound. Norway rats have coarse fur that is usually brownish on their backs and light gray on their bellies. Norway rats tend to inhabit the lower floors of multi-story buildings.

The roof rat (also known as black rat, ship rat), is slightly smaller than the Norway rat. Roof rats often live in trees, attics, walls, beams, or vine-covered fences since they are more agile climbers. They have a slender body, prominent ears, large eyes, and tend to be black or slate-gray.

Norway rats prefer meats and fish, while roof rats prefer cereals, grains, nuts, and fruits. Rats eat nearly anything but will select a nutritionally balanced diet if available. They also hoard food, which they may or may not eat later. Their poor eyesight forces them to rely on other senses to find food and travel in the dark.

Legal Status

House mice, Norway rats, and roof rats are not protected by law and can be controlled using a variety of methods. If using rodenticides, make sure you have the proper state pesticide applicator's license.

MANAGEMENT OPTIONS

- ***Exclusion.*** Seal all 1/2-inch square (for rats) or ¼ inch square (for mice) and larger holes with durable materials. Install metal guards on which mice and rats cannot crawl or climb to prevent them from climbing or traveling along a particular route. Mice and rats can gnaw through a wide variety of materials, including lead, aluminum sheeting, wood, rubber, and concrete.
- ***Habitat Modifiation***. Remove food sources. Store bulk foods, bird feed, and pet food in rodent-proof containers or rooms. Store garbage and rubbish in heavy duty rust and rodent-resistant containers equipped with tight-fitting lids. Remove debris and control weeds around structures to reduce the amount of shelter available for rodents.
- ***Frightening devices.*** Mice and rats can be frightened by unfamiliar sounds but quickly become accustomed to new sounds if heard repeatedly.
- ***Trapping.*** Body-gripping traps, commonly called snap traps, are often effective at controlling small populations of mice and rats. If using these traps in an area with small children or pets, use body-gripping traps that are housed in a plastic container. Bait traps with hotdogs, bacon, or peanut butter. Set traps close to walls, behind objects, in dark corners, and in places where rodent activity has been seen. Place traps so that the rodents pass over the trigger in their natural course of travel (Figure 2).
- ***Rodenticides.*** Toxic baits, tracking powders, and fumigants are available for mice and rat control. Always read and follow the label directions. Rats can build up an aversion or an immunity to rodenticides when they are not applied consistently and accurately.

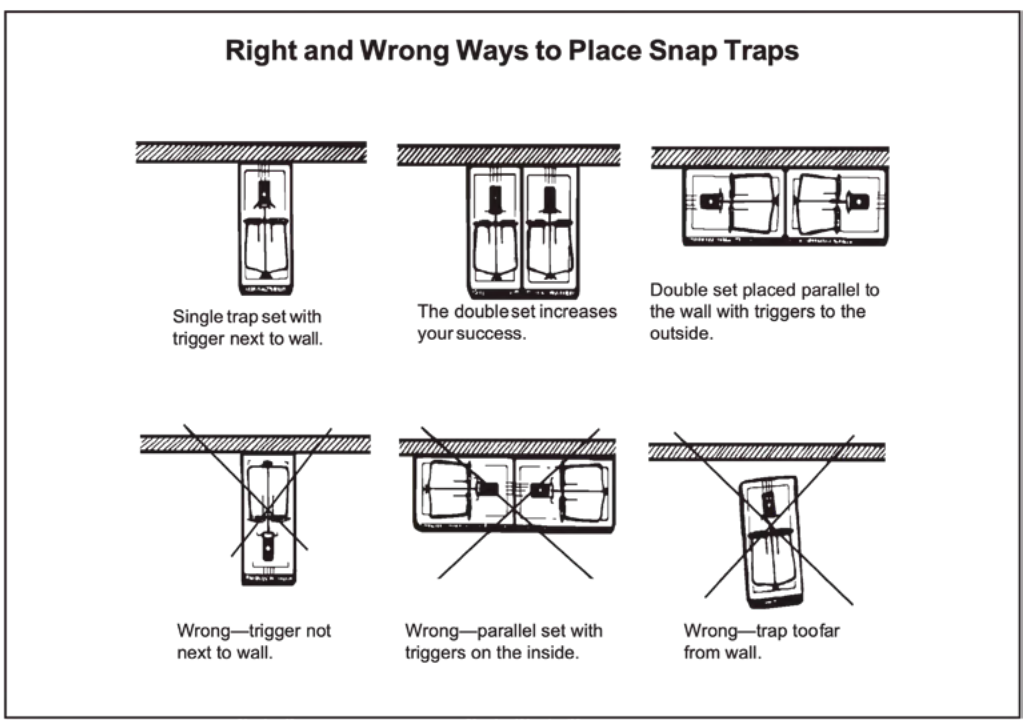


Figure 2 Proper Snap Trap Placement

POCKET GOPHERS

Pocket gophers (*Thomomys spp.*) are burrowing rodents with short fur, large front teeth, and fur-lined cheek pouches, or pockets. These pockets are used like a squirrel's for carrying food. However, the pockets on a gopher open outside of its mouth and turn inside out for emptying and cleaning.

Pocket gophers can be a problem by causing damage to vegetation, buried cables, dikes, and irrigation pipe. In areas with snowpack, pocket gophers gnaw on bark several feet up a tree or shrub. Because pocket gophers obtain sufficient moisture from their food, they do not need a source of open water. Pocket gophers live 1–2 years, so the majority of the population consists of young adults.

Pocket gophers are well-equipped for digging with large-clawed front paws, small eyes and ears, and long whiskers. Because of their pliable fur and sparsely haired tails, they can run backwards almost as fast as they can run forward. Pocket gophers are active year-round and at all hours of the day. In irrigated areas such as lawns, gardens, and pastures, digging conditions may be optimal year-round, and mounds can appear at any time.

Pocket gophers breed from early spring to early summer, resulting in 1 litter of 3–7 young per year. The nest chamber is located in the pocket gopher's burrow system. Pocket gophers are solitary except during the breeding season or when females have young with them.

Pocket gophers live in extensive burrow systems, which they use for locating food, rearing young, storing food and droppings, and escaping predators. Pocket gophers use their head and front feet to push out excavated material from the exit tunnel. The mounds they create have a fan or heart-shaped appearance. The tunnel exits are marked by a 1–3-inch circle of disturbed soil called a soil plug. Soil plugs occur where a pocket gopher emerged to forage or deposit soil, and then plugged up the hole on reentry. Plugs are found at mounds or along the course of the burrow system.

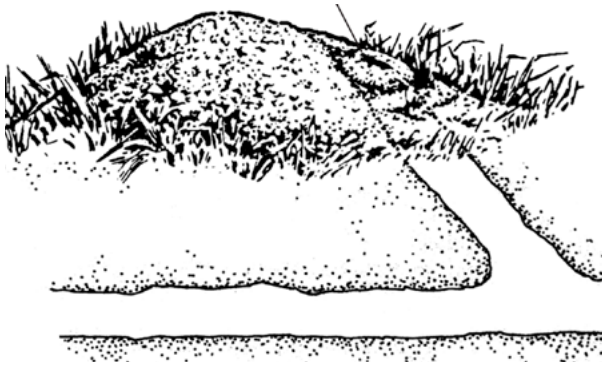


Figure 3 Pocket Gopher Soil Cast and Tunnel System

Soil casts are created because pocket gophers commonly backfill their previously excavated tunnels with excess soil when they dig new tunnels. Casts are the result of this excess soil being backfilled into snow tunnels. When the snow melts, these become apparent (Figure 3).

Legal Status

The northern pocket gopher (*Thomomys talpoides*) and Botta's pocket gopher (*Thomomys bottae*), are not protected and can be managed using a variety of options.

MANAGEMENT OPTIONS

- ***Exclusion.*** Constructing a barrier to keep pocket gophers from tunneling into an area can be labor-intensive and costly; however, this approach is recommended for small areas and areas containing valuable plants. Appropriately sized wire baskets made from hardware cloth can be placed around small tree and shrub root balls to protect them from being eaten by pocket gophers. Groups of bulbs and other plants needing long-term protection can be placed in baskets made from 1/2-inch mesh hardware cloth. Large areas such as vegetable gardens can be protected using an underground gopher fence or stone-filled trench. Several types of barriers (plastic tubes, 1-gallon plant containers) are effective at protecting above-ground parts of small plants such as newly planted conifers. Pocket gophers may be deterred from chewing underground sprinkler lines and utility cables by surrounding the wires with 6–8 inches of coarse gravel 1 inch or more in diameter.
- ***Flooding.*** To be effective, the entire tunnel system needs to be quickly and completely flooded. Flooding has the greatest chance of succeeding if pocket gophers are invading the property for the first time. For humane reasons, concentrate this effort in late winter and early spring before gophers give birth.
- Be careful when attempting to flood out a pocket gopher near a building; doing so could damage the foundation or flood the basement or crawl space.
- ***Encourage predators.*** Coyotes, domestic dogs and cats, foxes, and bobcats capture pocket gophers at their burrow entrances; badgers, long-tailed weasels, skunks, rattlesnakes, and gopher snakes corner pocket gophers in their burrows. Owls and hawks capture pocket gophers above ground and are especially effective on dispersed young gophers. Predators alone will not keep a gopher population below the levels that cause problems in gardens and landscaped areas; however, when combined with other management techniques, natural control can contribute to overall control.
- ***Trapping.*** There are several effective body-gripping and body-piercing pocket gopher traps available. Trapping is effective when pocket gophers are at low densities or in areas where rodenticides are not appropriate. However, at higher densities a combination of methods may need to be used.
- ***Rodenticide baits.*** Strychnine-treated baits are the most commonly used and are effective with 1 application. Make at least two bait sets per active burrow system. Locate the main burrow runway by probing. Use the probe hole to introduce bait into the main burrow. Follow all label directions. Take caution; even though bait is placed below ground, dogs and other animals can dig it up and be exposed. Pocket gophers are the only pest species listed on strychnine products. Several other anticoagulant and non-anticoagulant baits are also registered for use.
- ***Rodenticide fumigants***. Gas cartridges and moisture-activated fumigants are labeled for pocket gophers. Follow label directions and develop a fumigation management plan for moisture-activated fumigants.

TREE SQUIRRELS AND CHIPMUNKS

Utah has one native tree squirrel, the red squirrel (*Tamiasciurus hudsonicus*), that lives in coniferous forests, and occasionally may become a pest species. This species is 10-14" from head to tail. Conversely, fox squirrels (*Sciurus niger*) native to the Eastern United States have recently established themselves in Utah, primarily along the Wasatch Front. This species is much larger, 20-30" in length. Both have a characteristic bushy tail and spend most of their time in trees.

Utah has several species of chipmunks (*Neotamias spp., Tamias spp.*) that range in size from 3-6 inches from head to tail. They are identified by their pointy nose and (usually) white stripes on a chestnut colored body.

Tree squirrels and chipmunks feed mostly on plant material including seeds, nuts, acorns, berries, leaves, and twigs. Tree squirrels also store food in hollow trees, stumps, flower pots, exhaust pipes, and other places for later use. They become a problem when they attack fruit, nut, and vegetable crops; raid bird feeders; or clip twigs and strip bark from ornamental trees. In areas where nesting places are scarce, they gnaw into attics and wall voids. In trees, squirrels are relatively safe, except for an occasional owl or goshawk. On the ground, large hawks and owls, domestic cats and dogs, coyotes, and bobcats catch squirrels.

Legal Status

It is legal to remove tree squirrels and chipmunks that are harming your property.

MANAGEMENT OPTIONS

- ***Exclusion.*** Screen or block potential entrance sites to buildings with sheet metal or 1/4-inch square hardware cloth.
- ***Shield fruit and nut trees*** with 24-inch wide metal flashing on the trunks 6 feet off the ground. This method is only effective if the target tree is more than 6 feet away from any other tree, roof, or structure. Otherwise, squirrels can access the tree from above.
- ***Sanitation.*** In areas where squirrels may be a problem, clean up fallen fruits, nuts, and berries, and squirrel-proof bird feeders.
- ***Trapping*** can effectively reduce tree squirrel and chipmunk populations. The appropriate trap depends on the target species. Chipmunks may be trapped using body-gripping traps (i.e, snap traps) suitable for mice or rats. Tree squirrels require larger traps. Also, squirrel traps should be placed in trees, to eliminate non-target catch. Body-gripping (i.e, snap-trap) tube traps, such as those appropriate for ground squirrels, can be modified for use in trees. Additionally, there are specific tree-squirrel tube traps commercially available.
- ***Pesticides.*** Brodifacoum is registered for use with fox squirrels. However, because fox squirrels usually reside in urban areas, the use of rodenticides to control fox squirrels is not practical. There are several commercial repellants for tree squirrels. However, repellants have been shown to have limited effectiveness. Always read and follow label directions.

PRAIRIE DOGS

Prairie dogs are rodents within the squirrel family. There are several species of prairie dogs in Utah: The White-tailed prairie dog (*Cynomys leucurus*), the Gunnison's prairie dog (*C. gunnisoni*) and the Utah prairie dog (*C. parvidens*). Unlike black-tailed prairie dogs, prairie dogs in Utah have limited ranges; they each occur in separate parts of the state. Adults are 11-15 inches, and generally beige – light brown, although coloration differs slightly among species. The species are very similar to each other in color and size and are best identified by their range. White-tailed prairie dogs are found in eastern and central Utah. Gunnison's prairie dogs are found in Grand and San Juan counties. Utah prairie dogs can be found in Garfield, Iron, Kane, Piute, and Wayne counties.

All three species live in open rangeland with a mixture of shrubs and grasses. They prefer flat lands with low-lying shrubs so that they can see if predators are nearby. They prefer easily tillable soil that enables them to excavate their burrows.

Like most ground squirrels, prairie dogs hibernate during the coldest part of the winter and breed immediately after emergence. However, during mild winters, they may become active for a few days to feed, and then return to their nest.

Prairie dogs can pose a serious pest problem. They feed mostly on vegetation, preferring spring-time succulent greens like grasses and forbs and new shoots and buds in orchards. However, they switch to seeds and other dry foods later in the year. While they can compete with livestock for forage, most of the conflict arises from the extensive burrow systems that they create. These burrow systems destroy vegetation and pose a threat to livestock and farming machinery. Furthermore, all three species of prairie dog can contract sylvatic plague, which can be transmitted to pets and humans.

Legal Status

The Utah prairie dog is a federally threatened species that requires special permission to manage; Gunnison and White-tailed prairie dogs are a state sensitive species that can be lethally controlled. The three species look very similar. Additionally, young prairie dogs look similar in color and size to Piute ground squirrels. Therefore, correct identification is critical prior to any management

MANAGEMENT OPTIONS

- ***Habitat modification***. Prairie dogs require open, flat lands so that they can be aware of predators. Disrupting their line of sight will often cause prairie dogs to move to a new area. Creating visual barriers is permittable for each of the three species.
  - Encourage taller grasses or shrubs along property lines to discourage prairie dogs from moving onto property from an adjacent area.
  - Install flashing (metal barrier) or black silt fencing to create a consistent visual barrier. Flashing and fencing must be buried up to 6 inches below the soil to discourage digging under the barrier.
- ***Exclusion:*** Wire mesh fences can be installed but they are usually not practical or cost-effective.
- ***Frightening***: No methods are effective.
- ***Repellents:*** None are registered.
- ***Toxicants:*** Zinc phosphide is registered for use on prairie dogs by certified applicators. However, because of their special or protected status, a permit or consultation with the UDWR must be acquired before lethal take is allowed.
- ***Fumigants:*** Aluminum phosphide and gas cartridges are registered for use in prairie dog burrows. However, because of their special or protected status, a permit or consultation with the UDWR must be acquired before lethal take is allowed using toxicants. Additionally, many sensitive species such as burrowing owls and black foot ferrets use prairie dog burrows; therefore, a survey of the habitat by the UDWR may be necessary before using any fumigants.
- ***Trapping:*** Under certain permits, live trapping and relocation of prairie dogs is permitted. Usually, UDWR personnel will live trap and relocate problem Utah prairie dogs in agricultural settings or when human health and safety is at risk. Because there may be sensitive species using prairie dog burrows in Utah, one may need a survey of the habitat and a permit prior to using body gripping traps to remove prairie dogs.
- ***Shooting:*** Shooting with .22 rimfire or larger rifles is permitted for Gunnison and White-tailed prairie dogs where firearms are permitted. Shooting of Utah prairie dogs is not permitted.

YELLOW-BELLIED MARMOTS

The yellow-bellied marmot (*Marmota flaviventris*), is found in open habitats such as parks, levees, basalt steppes, alpine meadows, pastures, gravel-covered fields, and forest edges (Figure 4). They have distinct yellow speckles on the sides of their necks, white between their eyes, yellow to red-yellow bellies, and yellow-brown to tan straight hair with white tips. They are sometimes referred to as groundhogs, woodchucks, or rockchucks.

Yellow-bellied marmots eat the leaves and blossoms of a great variety of herbaceous plants and grasses. They also consume fruit, grains, legumes, and insects. Occasionally they damage crops, landscapes, and vehicle wiring. Also, their burrows may be a hazard to urban structures, farm machinery, and livestock.

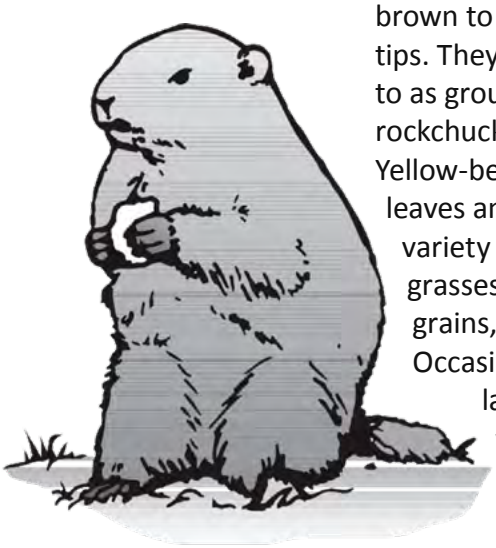


Figure 4 Marmot

Like all marmots, yellow-bellied marmots whistle or chirp when alarmed by a variety of predators, hence the common name “whistle pig.” Marmots typically alarm call when they see natural predators such as coyotes, foxes, badgers, and sometimes when they see eagles and other large birds.

Legal Status

Yellow-bellied marmots are native, non-game animals and not protected. Lethal control is allowed when this species is damaging personal property. Live trapping is not allowed without a permit.

MANAGEMENT OPTIONS

- ***Trapping***. Under administrative rule R657-19 marmots may not be lived-trapped without a collection permit.
- ***Shooting*** is effective, though may be difficult since marmots tend to be quite wary. Discharge of firearms is not allowed in urban areas. Check local ordinances.
- ***Rodenticide baits.*** Zinc phosphide is registered for marmots.
- ***Rodenticide fumigants.*** Gas cartridges and aluminum phosphide are labeled for woodchucks (marmots). Follow directions for incendiary device placement and sealing of dens. Make sure the rodenticide is registered for use in the state.
- ***Exclusion.*** The use of fencing where marmots are living adjacent to orchards, gardens, and agricultural fields (alfalfa) can help reduce damage. However, marmots are good climbers so any fencing needs to be used in conjunction with electric wire. Fencing needs to be a minimum of 3 feet high, 2 inch mesh wire. Since marmots burrow very well, fencing should be buried 10 to 12 inches with the bottom edge bent 1 to 2 inches in an "L" shape. The top edge of the fence should be bent outward at approximately 45 degrees to prevent climbing. Keep the area immediately close to the fence clear of vegetation to enhance inspection.

VOLES

Voles, also called meadow mice or field mice, belong to the genus *Microtus* (Figure 5). Voles are compact rodents with stocky bodies, short legs, and short tails. They range from 5 to 8.5 inches in length. Their eyes are small and their ears partially hidden. They usually are brown or gray, though many color variations exist. Voles occupy a wide variety of habitats. They prefer areas with a heavy ground cover of grasses, grass-like plants, or litter. Though voles evolved in natural habitats, they also use sites modified by humans such as orchards, windbreaks, and cultivated fields.

Voles eat a wide variety of plants, most frequently forbs and grasses, including grass grown for seed. In late summer and fall, they store seeds, tubers, bulbs, and rhizomes. They eat bark primarily in fall and winter, and crops when their populations are high. Voles may cause extensive damage to orchards, ornamentals, tree plantings, and field crops like alfalfa, clover, grain, potatoes, and sugar beets by girdling seedlings, roots, and mature trees. Girdling damage usually occurs in fall and winter. Vole girdling can be differentiated from girdling by other animals by the non-uniform gnaw marks at various angles and in irregular patches, about 1/8 inch wide, 3/8 inch long, and 1/16 inch or more deep. Voles also damage crops when they build extensive runway and tunnel systems.

Voles are active day and night, year-round. They do not hibernate. Their home range is usually 1/4 acre or less but varies with the season, population density, habitat, food supply, and other factors. They are semi-fossorial (living both under and above ground) and construct many tunnels and surface runways with numerous burrow entrances. The most easily identifiable sign of voles is an extensive surface runway system with numerous burrow openings. Runways are 1–2 inches wide with nearby vegetation clipped close to the ground and feces inside. Voles are prey for many predators, including cats, dogs, coyotes, snakes, hawks, owls, and weasels.

Legal Status

Voles are native, non-game mammals that are not protected and can be controlled when causing damage.

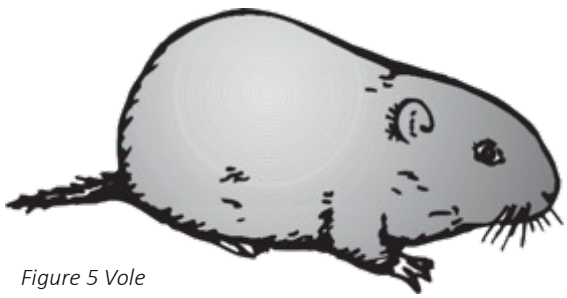


Figure 5 Vole

MANAGEMENT OPTIONS

- ***Trapping***. Exclusion. Hardware cloth with cylinders of 1/4-inch or less mesh excludes voles from seedlings and young trees. Bury the wire 6 inches to keep voles from burrowing under the cylinders. Large-scale fencing of areas is not cost-effective. Drift fences with pit traps may be used to monitor vole populations and can indicate when they are immigrating to crops, orchards, or other cultivated areas.
- ***Habitat Modification*** Dense cover such as grassy weeds and heavy mulch provides optimal habitat for voles. Eliminate weeds, ground cover, and litter in and around crops, lawns, and cultivated areas to reduce the capacity of these areas to support voles. Mow lawn and turf regularly. Soil tillage is effective in reducing vole damage as it removes cover, destroys existing runway-burrow systems, and kills some voles outright.
- ***Trapping*** is not effective in controlling large vole populations; however, it may be successful for very small populations. Place mouse snap traps perpendicular to vole runways. A peanut butter-oatmeal mixture or apple slices make good bait.
- ***Rodenticide baits.*** Zinc phosphide is the most commonly used toxicant for vole control. It is a single-dose toxicant available in pelleted and grain bait formulations and as a concentrate. Anticoagulant baits are also effective in controlling voles. Anticoagulants are slow-acting toxicants; depending on the type and dose, they usually take effect within 3–10 days. Vole baits are commonly administered within a bait box, or bait station, which keeps the bait from being consumed by non-target species. Place bait stations close to burrows opening, trails, and plants that are favored by voles. Read and follow all label instructions and local regulations.
- ***Rodenticide fumigants.*** Some products are labeled for voles. Follow label directions and develop a fumigation management plan for moisture-activated fumigants.

CHAPTER 12

Other Problem Mammals and Reptiles

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Gain an introduction to other mammal and reptile pests found in Utah.
2. Understand the legal status of these pests and how that can affect your work.
3. Understand management options for these pests.

INTRODUCTION

Common problem mammals and reptiles (snakes) are discussed in this chapter. They are presented alphabetically with a description of the pest animal, its biology, and common control strategies. Pay close attention to the legal status of the animal.

BATS

Common Bat Species

- Big free-tail bat, *Nuctinomops macrotis*
- Townsend's big-eared bat, *Corynorhinus townsendii*

Bats are the only true flying mammals (Figure 1). Although they do not usually cause any structural damage and are very beneficial insect eaters, many people do not like them around. People do not like bats because of the squeaking and scratching noise they make, the quantities of smelly guano (fecal matter) a large colony can produce, and the health risk they can present. Infected bats can sometimes transmit rabies. If roosting near windows or indoors, they can serve as a reservoir for bat bugs, a type of ectoparasitic insect related to bed bugs that can feed on humans.

Figure 1 Bat

Bats are predators of night-flying insects, including moths, beetles, mosquitoes, termites, and flies. Bats locate flying insects primarily by using a radar system known as echolocation. The bat emits high-pitched sound waves that bounce back to the bat when they strike a flying insect. A bat locates prey by interpreting the reflected sounds. Bats may fly greater than 6 miles from their roost to a feeding site, using temporary roosts until returning to their main roost.

Most bats use a winter hibernation site called a hibernaculum. These include cavities in large trees, caves, mine shafts, tunnels, old wells, and attics. The hibernaculum protects the bats from predators, light, noise, and other disturbances. Temperatures in the hibernaculum must be cool enough to allow bats to maintain a low body temperature but not freeze; humidity must be high and constant enough to prevent bats from dehydrating. Bats hibernate alone or in groups starting in late September or October.

Many bats in Utah breed during late fall or winter at their hibernation site. Females store sperm until the following spring when fertilization takes place after the females rouse from hibernation. The young, called pups, are born and raised in nursery colonies occupied only by breeding females and their young.

Legal Status

Generally, bats cannot be hunted, trapped, or killed. Different species are quite difficult to distinguish, so one should assume that any bat they are dealing with is protected and permits are required. State wildlife agencies will help remove bats found in or immediately adjacent to a dwelling or other occupied building.

MANAGEMENT OPTIONS

- ***Exclusion*** is the best and safest way to manage bats—both for the bats and humans involved. However, it may be impossible to completely exclude bats from old buildings that offer many points of entry or from those with shake or cedar shingle roofs that have no underlayment. In some situations, bats are attracted to porches and decks during the night while hunting. Excluding access to these areas, by installing screening (even temporarily), may decrease the presence of bats and their droppings.
- ***Repellents.*** There are several ultrasonic repellants commercially available. These devices emit a sound that may interfere with bats' ability to use echolocation.
- ***Habitat Modification.*** Other than roosting in a house, bats can cause conflicts when they are attracted to a house for food. Modifying a home or yard to eliminate or decrease nighttime insects may decrease bat activity around a house. For example, installing motion-sensor lights rather than continuous outside lighting around doorways, will minimize the insects around the light, decreasing hunting opportunities in that area.

BEARS

In Utah, black bears (*Ursus americanus*), live in a diverse array of forested habitats, usually restricted to the foothills and mountains. In general, black bears are strongly associated with forest cover, but occasionally use relatively open country such as clearcuts, meadows, and the fringes of other open habitat. Fur color varies from cinnamon to black. Female black bears have the potential to live into their mid-20s. Male black bears do not typically live as long, rarely attaining 20 years of age.

Bears usually avoid people, but when such encounters do occur, the bear's strength and surprising speed make it potentially dangerous. Most confrontations with bears result from habituation to human food. Less common are surprise encounters at close range or when bears move into agricultural areas in search of food. Give bears plenty of respect and room to retreat without feeling threatened.

Black bears move in response to the seasonal availability of food, roaming constantly throughout their home range. They have adequate senses of sight and hearing, but their keen sense of smell and innate curiosity make them skilled scavengers. Black bears are omnivores, which means they eat both plants and animals; however, their diet consists mostly of vegetation. Carrion is eaten when it is found. Fall is a critical season for black bears, as they commonly acquire most of their fat at this time. Bears may forage up to 20 hours a day during fall, increasing their body weight by 35% in preparation for winter.

Generally, black bears hibernate in dens from mid-October into April. All pregnant females den to give birth to cubs. At 6 months, cubs are able to locate food, but generally remain with their mother for over a year, including hibernating with her during their second winter. Parental care is solely the responsibility of females.

Other than humans, black bears have few predators, but other black bears, cougars, bobcats, and coyotes will attack cubs if given the opportunity.

Legal Status

Bears are game animals and permits are required for lethal control or trapping.

MANAGEMENT OPTIONS

- ***Habitat Modification.*** Bears expend a great amount of time and energy digging under, breaking down, or crawling over barriers to get food, including garbage. Keep garbage cans with tight-fitting lids in a shed, garage, or fenced area. Keep fish parts and meat waste in your freezer until they can be disposed of properly. In areas with trash pickup service, put garbage out shortly before the truck arrives and not the night before. If bears are common in an area, consider investing in a commercially available bearproof garbage container. Remove bird feeders (suet and seed feeders), which allow residue to build up on the ground below them, from early March through November. Harvest tree fruit regularly; rotting fruit left on the ground is a powerful bear attractant. Consider removing fruit trees if they are not needed. Do not feed pets outside. Keep barbecue grills and outdoor refrigerators clean and store pet food inside.
- ***Frightening devices and deterrents.*** The extended use of night lights, strobe lights, loud music, pyrotechnics, exploder canons, scarecrows, and trained guard dogs can frighten black bears from an area (such as buildings, livestock corrals, and orchards). Make sure to frequently change the position of such frightening devices because over time, animals usually become used to scare devices. Bears often become tolerant of human activity, too. At this point, scare devices are ineffective and human safety becomes a concern. Black bears can also be deterred from landfills, occupied buildings, and other sites by using firearm projectiles operated by UDWR or Wildlife Services.
- ***Exclusion.*** Electric fencing can be used where bear raids on orchards, livestock, beehives, and other areas are frequent. Traditional wire fencing can also be used as a barrier. Use heavy chain-link or woven wire fencing at least 6 feet high. Install 24-inch-long wood or metal bar extensions at an outward angle to the top of the fence with two strands of barbed wire running on top.
- ***Repellents.*** Capsaicin or concentrated red pepper spray has been tested and used effectively on black bears. The spray range on most products is less than 30 feet (10 m), so capsaicin is only effective in close encounters. Capsaicin spray may become more popular where use of firearms is limited. Bear repellents must be registered by EPA and in each state where they are sold.
- ***Trapping.*** When a bear has become conditioned to humans and continues to forage in yards or campgrounds, the UDWR will first try using deterrents to move the bear. If deterrents are ineffective, the UDWR may trap and relocate the bear to a location away from human activity.
- ***Shooting.*** Once a bear has proven to be aggressive to humans, or if it cannot be trapped and relocated, a problem bear will be lethally controlled by UDWR or Wildlife Services

COYOTES

Historically, coyotes (*Canis latrans*) were restricted primarily to the sagebrush lands, brushy mountains, and open prairies of the American West. However, these intelligent and adaptable animals now occupy almost every conceivable habitat type, from open ranch country to densely forested areas to suburban and urban neighborhoods. Despite ever-increasing human encroachment and past efforts to eliminate coyotes, the species maintains its numbers and is increasing in some areas. Coyotes in captivity live as long as 18 years. In the wild, few coyotes live more than 4 years; the majority of pups die during their first year.

At first glance, the coyote resembles a small German shepherd dog with erect pointed ears, slender muzzle, and a bushy tail that they carry low to the ground. Coyotes are predominantly brownish gray in color with a light gray to cream-colored belly. However, shades include black, brown, gray, yellow, rust, and tan. Adult coyotes weigh 20–35 pounds, with males being slightly larger than females. At the shoulder, an adult male coyote is about 25 inches tall.

Coyotes are opportunists, both as hunters and scavengers. They eat any small animal they can capture, including mice, rats, gophers, mountain beavers, rabbits, squirrels, snakes, lizards, frogs, fish, birds, and carrion (animal carcasses). Given the opportunity, coyotes kill domestic cats and dogs. Coyotes also eat grass, fruits, berries, pet food, garbage, garden crops, livestock, and poultry. Pairs of coyotes or family groups using the relay method pursue small deer and antelope. Coyotes also kill to protect their territory and their young.

The female coyote digs her own den under an uprooted tree, log, or thicket; may use a cave, hollow log, or storm drain; or take over and enlarge another mammal's burrow. Coyotes usually have several dens and move from one to the other, minimizing the risk that a den containing young is detected. These moves also help to prevent an accumulation of fleas and other parasites, urine, droppings, and food refuse.

Legal Status

Coyotes are not a protected species and can be managed when there is a threat to pets or livestock. In Utah, they are legally classified as predatory animals when causing damage on private lands.

MANAGEMENT OPTIONS

- ***Exclusion*** may be impractical since coyotes eventually learn to either dig deeper or climb higher to defeat a fence. A coyote's response to a fence is influenced by various factors, including its experience and motivation for crossing the fence. However, good fences can be vital in reducing predation, as well as increasing the effectiveness of other control methods such as snares, traps, or guard animals.
- ***Habitat Modification.*** Keep garbage can lids on tight by securing them with rope, chain, bungee cords, or weights. Fence fruit trees or pick up fruit that falls to the ground. Keep compost piles within a fenced area or securely covered. Feed pets indoors. Confine livestock and small animals that live outdoors in secure pens during periods of vulnerability.
- ***Frightening Devices and Deterents***. Use a guard animal such as a specialty breed dog, donkey, or llama for a large property with livestock. Fladry, long strips of flagging placed at even intervals along a fenceline, is also effective at deterring coyotes from entering a paddock or pasture. Fladry is particularly effective when combined with other methods.
- ***Trapping Lethal Control.*** Utah has a bounty program that allows for the trapping and shooting of coyotes. Participants must complete training and registration to participate in this program. More information can be found at https://bit.ly/3wybBw8. Coyotes may be trapped and lethally controlled as needed to protect livestock and other resources from coyote depredation.
- ***Shooting*** is permitted as needed to protect livestock and other resources from coyote depredation.
- ***Fumigants.*** Gas cartridges are labeled for coyotes. Follow directions for incendiary device placement and sealing of dens. Predation can frequently be resolved by locating coyote dens and removing the pups and/or the adults responsible for depredations.

DEER AND ELK

Generally, deer and elk are among the most widely distributed and easily recognized large mammals in North America. They thrive at the interface of openings and cover patches. Their main food item is browse (growing tips of trees and shrubs), but they also eat fungi, lichens, grass, clover, grain, fruit, nuts, and acorns. Ideal elk habitat includes productive grasslands, meadows, or clear-cuts interspersed with closed canopy forests.

Deer and elk can cause significant damage in agriculture and pose conflicts in urban areas. Deer are responsible for many vehicle accidents each year.

Deer breed during a rutting season in November and December. A single mature buck (male) may breed with several females. Family groups usually consist of a doe (female) and her fawns, and sometimes her fawns from the previous year.

Rocky Mountain mule deer (*Odocoileus hemionus hemionus*) or simply referred to as mule deer, prefer open forests, big canyons, and sagebrush meadows. They have large, dark-edged ears and a 7–8-inch

white tail. Adult bucks weigh up to 250 pounds and adult does weigh 120–170 pounds.

White-tailed deer (*Odocoileus virginianus idahoensis*) very rarely occur in Utah. They are most easily distinguished by their 10–11-inch-long tail, which is raised like a flag when they run. White-tailed bucks weigh 150–200 pounds and adult does weigh 110–140 pounds.

Rocky Mountain Elk (*Cervus canadensis nelson*) range in color from light brown in winter to reddish tan in summer and have characteristic buff-colored rumps. In winter, a dark brown, shaggy mane hangs from the neck to the chest. Bull elk have large, spreading antlers. Elk are primarily active at dawn and dusk, but when temperatures soar or they are harassed, elk may become more active at night. They are social animals, living in herds for much of the year. They require large amounts of food and, depending on the time of year, eat grasses, sedges, flowering plants, sprouts, and branches of shrubs and trees.

Elk are common in most mountainous regions of Utah, where they can be found in mountain meadows and forests during the summer, and in foothills and valley grasslands during the winter. The seasonal changes in elevation allow elk to avoid deep snow and find food year-round. Male elk weigh 710-730 lbs and females weigh 500-530 lbs. Males stand 4.9 feet at the shoulder..

Dominant males gather and protect harems of females during the breeding season in the fall of each year. During this time, males emit loud vocalizations, called bugles, which keep the females in a group and warn other males to stay away from the harem. Females typically give birth to one (sometimes two) calves in the late spring. Elk are grazers, primarily eating grasses, but forbs, woody plants, and mushrooms may also be consumed. Elk are common in most mountainous regions of Utah, where they can be found in mountain meadows and forests during the summer, and in foothills and valley grasslands during the winter. The seasonal changes in elevation allow elk to avoid deep snow and find food year-round. Male elk way 710-730 lbs. Females weigh 500-530 lbs. Males stand 4.9ft at the shoulder.

Elk may be active during both day and night, but most activity occurs at dusk and dawn. Dominant males gather and protect harems of females during the breeding season, which occurs in the fall of each year. During this time, males emit loud vocalizations, called bugles, which keep the females in a group and warn other males to stay away from the harem. Females typically give birth to one (sometimes two) calves in the late spring.

Legal Status

Deer and elk are considered game species in Utah. Lethal control options are not permitted without a hunting license. Through coordination with the UDWR, special permits may be given to lethally control problem deer outside of the hunting season.

MANAGEMENT OPTIONS

- ***Exclusion*** with fencing provides some relief from deer and elk browse pressure. However, traditional deer fences are not always practical because of appearance, zoning restrictions, cost, or rugged terrain. Barriers to protect small areas, individual plants, or vulnerable parts of plants can be purchased or made at home. Barriers can also protect plants from male animals rubbing their antlers, which breaks branches and strips bark off trunks. To prevent deer and elk from pushing over or moving a mini-fence surrounding a tree or shrub, the fence should be 5 feet high and staked to the ground.
- ***Habitat Modification.*** Do not feed deer or elk. Remove bird feeders when deer or elk are present in a residential area. Select certain ornamental plant cultivars that deer and elk are known to avoid. Local nurseries and county Extension offices can be good resources for deer resistant plants and trees.
- ***Repellents*** are available in the marketplace. However, taste repellents have a short-term effectiveness.
- ***Frightening devices.*** Like most animals, deer and elk are fearful of novel objects, and many scare tactics take advantage of this behavior. Scare tactics can be visual (scarecrows, bright lights, spare blankets), auditory (noisemaking devices such as exploders, whistles, etc.), or olfactory (predator urine or droppings). However, deer and elk soon get accustomed to new things and damage resumes after they realize no actual harm will come to them.
- ***Shooting.*** Because legal status, hunting regulations, and other restrictions about deer and elk vary, contact your regional wildlife office to coordinate depredation efforts.

RABBITS AND HARES

Although rabbits are enjoyed by many people and are pets to others, they can be destructive pests in agriculture, gardens, and landscapes. Utah has both rabbits and hares. Rabbits differ from hares in that female rabbits give birth to blind, hairless young which require considerable attention for their first 2 weeks of life. Hares (snowshoes and jackrabbits) are born fully-furred with their eyes open, and can hop about within hours of their birth.

From spring to fall, rabbits and hares eat grass, clover, wildflowers, weeds, and farm and garden crops. In winter, their diet shifts to buds, twigs, bark, conifer needles, and practically any green plant. They re-ingest their droppings to further digest the material, a process called coprophagy. After returning to their shelters, they pass soft pellets containing undigested vegetation, and then eat these at a more leisurely pace, later passing hard pellets.

Nests and dens are located in or near brushy fencerows or field edges, brush piles, gullies containing shrubs, and landscaped areas with suitable cover.

Legal Status

In Utah, both cottontail rabbits and snowshoe hares are classified as game animals and require permits for control. The pygmy rabbit, which resembles a small cottontail, is a federally listed endangered species in Utah. Jackrabbits do not require a permit for hunting or lethal control in Utah. Identification is critical.

Common Utah Rabbits and Hares

- Mountain cottontail, *Sylvilagus nuttallii*
- Snowshoe hare, *Lepus americanus*
- Black-tailed jackrabbit, *Lepus californicus*
- White-tailed jackrabbit, *Lepus townsendii*

MANAGEMENT OPTIONS

- ***Exclusion***. To exclude rabbits and hares from small areas, such as a vegetable garden, use wire mesh with less than 1-1/2inch squares, 30–36 inches above ground and at least 6 inches buried below ground. To protect tree bark, form 1-inch mesh chicken wire or hardware cloth into cylinders and place around plants needing protection. Bury the bottom of the cylinders 3 inches below the soil line and brace them away from the plants so animals cannot press against the cylinders and nibble through the mesh. There are also a variety of commercially available protectors, including nylon mesh and plastic tubes; aluminum foil has been double-wrapped around small trees with effective results. Rabbits often eat bark primarily in winter. Therefore, consider the average snow depth of the area to determine the height of the tree trunk guard.
- ***Repellents.*** Several repellents are labeled for rabbits. Read and follow label directions.
- ***Encourage natural predators.*** Provide perches for owls and hawks in agricultural areas to control rabbits and hares.
- ***Habitat Modification.*** Use plants that are not palatable to rabbits. Keep in mind, however, if food sources become scarce, rabbits eat just about anything.
- ***Trapping*** is limited to lethal control and requires a permit from UDWR. Nuisance permits may be acquired through cooperation with UDWR, but lethal control must follow UDWR regulations.
- ***Shooting*** has traditionally been the primary form of controlling rabbits and is effective in eliminating small, isolated groups. Since cottontails are game animals, coordinate lethal control strategies with your state fish and wildlife agency. A hunting license is most likely required.

RACCOONS

Raccoons (*Procyon lotor*) have distinctive marks, with a prominent black mask over their eyes and a heavily-furred, ringed tail (Figure 2). These nocturnal, solitary animals measure about 3 feet long, which includes their 12-inch tail. They weigh from 15 to 40 pounds. Because their hind legs are longer than their front legs, raccoons have a hunched appearance when they walk or run. The average life span of a raccoon in the wild is 2–3 years.

Raccoons eat almost anything, including clams, crayfish, frogs, fish, snails, insects, slugs, dead animals, birds, bird eggs, fruits, vegetables, nuts, seeds, garbage, and pet food. They occasionally kill poultry and leave distinctive signs. Raccoons also can cause considerable damage to garden or truck crops, particularly sweet corn. In addition, they are known to roll up freshly laid sod in search of earthworms and grubs. They may also contaminate landscapes or gardens with their latrines or waste areas.

Raccoons prefer forest areas near a stream or water source, but have adapted to various environments, including urban areas. The size of a raccoon's home range as well as its nightly hunting area varies greatly depending on the habitat and food supply. Home range diameters of 1 mile are known to occur in urban areas.

Family groups of raccoons usually remain together for the first year and the young often den for the winter with the adult female. Den sites include abandoned burrows, areas in or under large rock and brush piles, hollow logs, holes in trees, wood duck nest-boxes, attics, crawl spaces, chimneys, and abandoned vehicles. However, raccoons generally move to a different den or daytime rest site every few days and do not follow a predictable pattern.

Legal Status

The raccoon is not considered native to Utah; one does not need a permit or license for lethal control.

Figure 2 Raccoon

MANAGEMENT OPTIONS

- ***Exclusion***. Protect orchards and gardens from raccoons with an electric fence. Rollers at the top of the fence or double fences can add to the efficiency of chicken wire-type fences. A cap or exclusion device keeps raccoons and other animals out of chimneys. Prevent poultry damage by excluding raccoons with tightly covered doors and windows on buildings or mesh-wire fences with an overhang surrounding poultry yards. Raccoons are excellent climbers, capable of gaining access by scaling conventional fences or using overhanging limbs to bypass fences.
- ***Habitat Modification.*** Store garbage in metal or tough plastic containers with tight-fitting lids to discourage raccoons from raiding garbage cans. Keep pet food and water inside at night.
- ***Trapping.*** Raccoons are relatively easy to catch in traps, but it takes a sturdy trap to hold one. Where possible, using "dog proof" paw traps reduce non-target catches over body-grip traps. Live traps should always include a water source as a humane measure and reduce issues with non-target catches such as cats that can be freed with little issue. However, any trapping must be followed by lethal control. Relocating raccoons is not permitted.
- ***Shooting.*** Shooting can be an effective means of controlling problem raccoons. Prior to shooting check regulations around discharging firearms in your area.

SKUNKS

Skunks are mild-tempered and mostly nocturnal. They defend themselves only when cornered or attacked. The striped skunk (*Mephitis mephitis*) has jet black fur except for two large white stripes running down its back. It is the size of a domestic cat, ranging in length from 22 to 32 inches, including its tail (Figure 3). The spotted skunk (*Spilogale gracilis*) has black or grayish-black fur, with white stripes on its shoulders and sides, and white spots on its forehead, cheeks, and rump (Figure 4). It is smaller measuring 14–18 inches long, including its tail.

Both striped and spotted skunks use similar types of habitat, although the spotted skunk is more likely to be seen in and around forests and woodlands, and is not as tolerant of human activity as the striped skunk. The musty odor of the striped skunk is noticeable in urban areas. Striped skunks live 3–4 years in the wild, while spotted skunks live half that long.

Skunks eat what they can find or catch, including mice, moles, voles, rats, birds, berries and other fruit, nuts, birdseed, pet food, and garbage. Skunks also have a fondness for eggs and are serious predators of ground-nesting birds.

Skunks use underground dens year-round for daytime resting, hiding, birthing, and rearing young. They locate dens under wood and rock piles, buildings, porches, concrete slabs, and in rock crevices, culverts, drainpipes, and standing or fallen hollow trees. Skunks may dig their own dens, but more often use the deserted burrows of other animals such as ground squirrels and marmots. Spotted skunks are excellent climbers and may use an attic or hayloft as a den. Skunks do not hibernate; instead, they lower their body temperature and stay inside their dens during extreme cold, plugging the entrance with leaves and grass to insulate them from the cold.

Figure 3 Striped Skunk

Legal Status

Both skunk species can be controlled lethally without a permit when they are creating a nuisance or causing damage. Lethally trapping spotted skunks (which are considered a game species) not actively creating a nuisance does require license while striped skunks do not. When skunks are live trapped to be relocated, coordinate your control measures with the UDWR.

MANAGEMENT OPTIONS

- ***Exclusion***. Prevent skunks access to den sites on private property. Close off these areas with 1/4-inch hardware cloth, boards, metal flashing, or other sturdy barriers. Bury the hardware cloth 6 inches below the soil surface to discourage skunks from digging under. Make sure you do not trap either adult or young skunks inside when sealing off a potential entry.
- ***Trapping or Shooting.*** Spotted skunks are considered furbearers and cannot be lethally controlled without a license if they are not actively causing damage and require following proper restrictions. Striped skunks can be lethally controlled as needed.
- ***Habitat Modification.*** Control lawn insects such as grubs. Practice good sanitation habits so food and garbage are not available to skunks. Remove pet food and water during the night. Clean under bird feeders to reduce seed waste accumulation.
- ***Repellents.*** Several repellents are labeled for skunks.

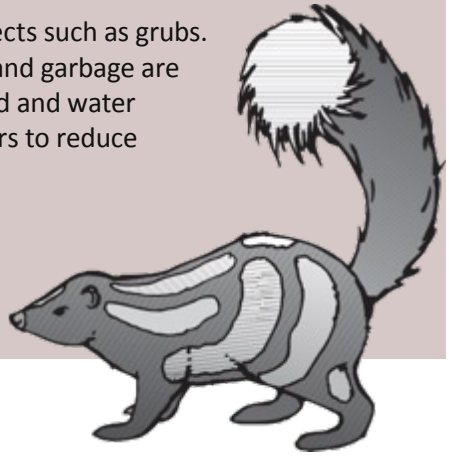


Figure 4 Spotted Skunk

SNAKES

Snakes, which are reptiles, are among the most misunderstood of all animals. As a result, many harmless, beneficial snakes have met untimely deaths at the hands of shovel-wielding humans. All snakes are an important part of the natural food chain, eating a variety of prey from mice and birds to frogs and insects. Leave snakes alone. Except for a rattlesnake that poses an immediate danger to people or pets, do not kill snakes. Besides their ecological value, snakes offer the careful wildlife viewer a chance to watch one of nature's most efficient predators. Observe snakes, like all wild animals, from a respectful distance. Do not attempt to capture them and do not keep wild ones as pets. The UDWR regulates the collection of wild reptiles.

Snakes are predators and eat many animals thought to be pests such as, mice, voles, snails, and slugs. Other prey include insects, bird eggs and nestlings, fish, frogs, and lizards.

Snakes have hinged jaws that allow them to consume food that is wider than their bodies. Even so, what a snake eats depends on its size; generally, larger snakes eat larger food items. Snakes have forked tongues that deposit air molecules on receptors in the mouth; thus, snakes taste the air, which helps them locate prey and sense their way in the dark.

Snakes in Utah hibernate during winter, either alone or in a group site called a hibernaculum or snake den. Snakes use the same hibernaculum year after year; several hundred snakes and different species may occupy the same hibernaculum. Snake dens include rodent burrows, spaces under logs and tree stumps, rock crevices, and lumber and rock piles. Emergence from hibernation can begin as early as March, depending on the species and location. Snakes may temporarily emerge from hibernation to feed and bask in the sun during warm periods in mild areas.

Courtship and mating occur shortly after snakes emerge from hibernation. Young are born from July through September, and fend for themselves after hatching. Young snakes grow rapidly, reaching sexual maturity in 2 or 3 years. Garter snakes, rubber boas, and rattlesnakes bear live young from eggs retained in the body until hatching. All other regional snakes lay eggs in protected areas where the eggs receive enough external heat to hatch.

Legal Status

Snakes are native, non-game wildlife. Check with the UDWR prior to using lethal control for snakes since all species are regulated. In particular, lethal control or relocation of rattlenakes is not permitted in Utah so the UDWR must be contacted in the rare situation where this is warranted.

MANAGEMENT OPTIONS

- ***Exclusion*** Exclusion. Prevent snakes from entering a building by sealing all ground-level and building foundation holes and cracks. Use 1/4-inch mesh hardware cloth, caulk, mortar, or a concrete patch to make the seal. Make sure all weather-stripping along the garage and other outside doors fits tightly.
- ***Habitat Modification.*** Reduce shelter sites such as rock piles, woodpiles, and tall grass. This also limits hiding places for rodents and other food sources.
- ***Exclusion.*** In areas where rattlesnakes are commonly encountered, fences have been used to keep them away from buildings and out of yards. A fence can be made from 1/4-inch mesh galvanized hardware cloth, 30 inches high, with the bottom edge buried 3–6 inches in the ground. Place support stakes inside the fence to prevent snakes from crawling up them. Regularly inspect the fence to be sure that holes are not open under it and items are not piled against the outside. Keep grass and weeds around the fence mowed.
- ***Trapping.*** As a last resort, a snake can be trapped and moved.

Extension

UtahStateUniversity