

Ag Wildlife Damage



Category 1C

Kansas State University Agricultural Experiment Station and Cooperative Extension Service



Ag Wildlife Damage

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Directions for Using this Manual

This is a self-teaching manual. At the end of each major section is a list of study questions to check your understanding of the subject. These questions represent the type that are on the certification exam. By studying this manual and answering the questions, you should be able to gain sufficient knowledge to pass the Kansas Commercial Applicators Certification examination. Correct answers appear on page 82.

Introduction

In recent years, state and federal laws have been enacted to educate people about the safe use of pesticides for effective damage control. Wildlife damage control is an area that deals with animals with backbones (vertebrates), excluding humans or domestic animals. This is a complex topic. The goal is to alleviate problems, not to eliminate wildlife. Many

wildlife damage problems can be prevented with good livestock management and sanitation practices. The primary aim should be to prevent damage from occurring.

When it does occur, each problem should be studied individually. A pest manager should consider damage severity and the recreational and ecological value of the wildlife causing it. Species

and behavior; crop, season and duration of damage; biological characteristics of the nuisance animal; and legal status of wildlife will influence the choice of management technique.

Mere presence of an animal capable of causing damage does not dictate control. Control level must be balanced with cost, effort, and value of the goods preserved. Damage may be obvious, but it can be difficult to find objective data for a particular problem.

The pest manager should identify the damaging species, and then choose the appropriate control technique. For example, traps may be needed to control beaver damage, while a pesticide might be a better choice for rats or mice.

Often, the species can be identified from physical evidence at the damage site. Because most mammals are active at night, extensive damage may occur before animals are noticed. Rubs, hair, tooth marks, fecal matter, feathers, and tracks can provide evidence to help with accurate identification.

Wildlife requires food, cover, water, and space. Habitat must supply these needs. Negative habitat management or making the environment inhospitable by removing one of these essentials, generally produces a lasting effect. Environmental manipulation may take a long time and be expensive.

The economic threshold in wildlife damage control is the degree of damage that justifies control. Below this threshold, the cost of controlling a problem animal exceeds the probable loss, and control is not economically justified. When losses exceed this threshold, control provides an

economic benefit. A decision about when to control small rodent damage should be based on when the pest population is predicted to reach a level at which control becomes necessary to prevent economic loss.

Preventive procedures are most effective against species where damage can be predicted. Seasonal control is applied during the actual damage season and most commonly for species that are a problem at a specific time of year — coyotes at lambing time, for example.

This manual does not discuss all problems and species that conflict with agricultural production, or all known control methods. A species not covered in this manual is the beaver. Information about how to control beaver damage is available in the publication, *Beaver Damage Control*, <http://www.wildlife.ksu.edu/p.aspx?tabid=106>.

For more information, applicators are encouraged to obtain a copy of the handbook, *Prevention and Control of Wildlife Damage*, from the Cooperative Extension Service at University of Nebraska, 202 Natural Resources Hall, Lincoln, NE 68583-0819 or contact the nearest K-State Research and Extension office.

Wildlife Damage Management

The best wildlife damage management program is based on the following principles:

- Most of the damage is caused by relatively few individuals, not by all of them;
- When this individual(s) is removed, damage will stop; and
- The people who experience the problem are in the best position to locate the animal and reduce losses promptly.

Changes in management of the property being damaged may be needed to prevent further loss or a recurrence of loss at a later time.

Considerable damage from wild animals occurs directly to crops and livestock and as a health problem to man and domestic animals. Nearly all wild animals in Kansas are native, and they provide equilibrium to the environment. Managing only the species considered to be good or endangered is not recommended. Sometimes animals considered to be beneficial can be equally damaging, such as deer in an orchard, squirrels in a pecan grove, or muskrats in a pond dike. In reality, any animal can be either “good” or “bad” depending on the situation.

Populations fluctuate due to environmental influences. Animals change normal population parameters to recover from the loss of individuals. Because of these compensatory responses, control efforts will be less effective. In good habitat, animal populations respond to removal with increased birth rate, decreased mortality, and decreased emigration. Changes in mortality, birth, and dispersal rates

occur in response to decreased density. Species that reproduce seasonally exhibit an annual cycle. During the reproductive period, births normally exceed deaths, and the population increases. When reproduction ceases, mortality exceeds recruitment, and the population declines until the next breeding season. A population change of two- to fivefold is not uncommon during an average animal cycle. Factors that affect this pattern include immigration, emigration, adverse weather, and habitat disruption. The cycle is most pronounced in species that produce only one litter per year. Wildlife damage also fluctuates with cycles.

Damage is seldom a problem when populations are low. During peak years, damage may become severe and require frequent, intensive, control efforts. Disease is undoubtedly a contributing factor in the decline of populations under stress from other factors. Mammalian predators respond to an increase in prey with large litters and higher juvenile and adult pregnancy rates. Raptors respond with larger clutches.

Weather also affects wildlife damage. When populations are high, damage increases markedly during dry growing seasons. Crop damage is reduced during years when native forage is readily available. For example, jackrabbits may or may not increase in actual numbers during dry years, but they appear to be more numerous because they concentrate on croplands.

Seasonal movement of waterfowl and blackbirds often results in concentrations of these species

Wildlife Damage Management

on ripening crops in late summer and early fall. Problems associated with fall and winter concentrations include blackbird roosts in urban areas, and deer damage to haystacks, nursery stock, and woodland plantings during periods of heavy snow.

Duration and season of the damage determine the degree of control needed. Protecting tree seedlings from deer browsing may be necessary for six months of the year for a decade, while protecting corn from blackbirds is only needed for two or three weeks

in the summer. Management techniques are dictated by the time interval. A fence may be necessary for deer, while a repellent would be appropriate for blackbirds.

Wildlife cycles are important to damage control planning. Animal numbers normally reach their lowest levels in late winter. Population reduction at this time, before young have been produced or become self-sufficient, removes not only adults, but also the young those adults might have produced. This leaves fewer animals to cause damage later in the year.

Study Questions

These study questions are designed to help you learn the material on pages 4 through 6.

- The objective of wildlife damage control is to ____.*
 - alleviate a problem
 - preserve wildlife
 - a and b above
 - none of the above
- The first step in solving a wildlife damage problem is to ____.*
 - shoot all wildlife in the damage area
 - trap all wildlife in the damage area
 - poison all wildlife in the damaged area
 - identify the wildlife species involved
- Preventive techniques are most effective against ____.*
 - long-cycle species
 - medium-cycle species
 - short-cycle species
 - cycle length is of no concern
- To manage only species considered good or endangered is ____.*
 - recommended
 - not recommended
 - never a consideration
 - none of the above
- Factors that affect wildlife damage include ____.*
 - weather
 - seasonal movement
 - wildlife cycles
 - all of the above
- Wildlife cycles are important to damage control planning ____.*
 - T (true)
 - F (false)

Laws and Regulations

Wildlife is a publicly owned resource protected by federal and state laws. Before beginning a wildlife damage control program, determine the legal status of the animal. Laws will influence the selection of techniques to be used. Kansas Department of Wildlife, Parks and Tourism, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture-Wildlife Services are the state and federal regulatory agencies to contact about laws related to wildlife protection and wildlife damage control.

Anyone planning to solve a wildlife damage problem should understand federal, state, and city laws. For example, in dealing with bird problems in Kansas the applicator should know that only three birds are not protected: the English sparrow (*Passer domesticus*), the starling (*Sturnus vulgaris*), and the pigeon (*Columbia livia*).

Federal

United States Department of Agriculture

The U.S. Department of Agriculture-Animal and Plant Health Inspection Service-Wildlife Services (USDA-APHIS-WS) is the federal agency authorized and instructed to carry out predator, bird, and rodent control activities in cooperation with the various states. This authority is stated in the Act of March 2, 1931 (46 Stat. 1468), as well as in the Act of August 14, 1946 (60 Stat. 1080), and in Public Law 99-190 as enacted by the U.S. Congress on December 19, 1985.

United States Fish

and Wildlife Services

The U.S. Fish and Wildlife Service is responsible for the Endangered Species Act of 1973 (16 U.S.C.1531-1543; 87 Stat. 884) as amended, the Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742: 70 Stat. 1119) as amended, and the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703- 711; 40 Stat. 755) as amended, (Part 21, migratory bird permits and control of depredation birds).

State

Kansas Department of Wildlife, Parks and Tourism

The Kansas Legislature has developed a policy statement 32-702 “It shall be the policy of the state of Kansas to protect, provide, and improve outdoor recreation and natural resources in this state and to plan and provide for the wise management of use of the state’s natural resources, thus contributing to and benefiting the public’s health and its cultural, recreational and economic life.” (K.S.A. 32-703), states that the title of all wild animals (not held in private ownership, legally acquired) shall be in the state of Kansas. Primary legislative directions guiding the Kansas Department of Wildlife and Parks are: Statutes Annotated 32-807, which lists Powers of the Secretary and 32-1002 Taking or Dealing in Wildlife. KSA 32-1002 further states that this section shall not be construed to prevent “owners or legal occupants of land from killing any animals when found in or near buildings on their premises or when destroying property, subject to the following (A) The

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provisions of all federal laws and regulations governing protected species and the provisions of K.S.A. 32-957-32-963, and the rules and regulation adopted there under; (B) it is unlawful to use, or possess with intent to use, any such animal so killed unless authorized by rules and regulations of the secretary; and (C) such owners or legal occupants shall make reasonable efforts to alleviate their problems with any such animals before killing them.”

Further, the Kansas Department of Wildlife, Parks and Tourism has authority to issue permits for the use of 1080, sodium cyanide, and uses of poisonous gases (K.S.A. 32-1003).

Most of the other important laws governing wildlife through the Kansas Department of Wildlife, Parks and Tourism are found within K.S.A. 32-701 to 32-1312.

Kansas State University

The Kansas State University Cooperative Extension Service has been directed by and entrusted with the responsibility for wildlife damage control in Kansas by the Kansas legislature by the enactment of K.S.A. 76-459 through 76-464. This responsibility in part is to develop a statewide educational program for the control of damage caused by wildlife. This is to be accomplished, according to legislative mandate, by (1) instructing farmers and ranchers, (2) conducting studies, and (3) supplying materials at cost. The Kansas State University extension wildlife damage control specialist is also involved in parts of K.A.R. 115-16-2, which requires an extension wildlife damage

control specialist to evaluate and recommend certain toxicants for use in prairie dog control in Kansas.

Kansas Department of Health and Environment

The Kansas Department of Health and Environment is charged with general responsibility for protection of the public health (K.S.A. 65-101), specific responsibility for controlling water pollution detrimental to animal or aquatic life (K.S.A. 65-171a), and specific responsibility for maintaining levels of air quality that will protect human health and safety while, to the greatest degree practicable, preventing injury to plant and animal life (K.S.A. 65-3001).

Kansas Department of Agriculture

The Kansas Department of Agriculture is responsible for enforcing the Kansas Pesticide Law (K.S.A. 2-2438a et seq.), which regulates the safe and proper use of pesticides regarding wildlife damage control and the certification of applicators. Pesticide product labels are registered as required by the Kansas Agricultural Chemical Act (K.S.A. 2-2201).

County

Counties have some responsibility in wildlife damage control. K.S.A. 80-1201 et seq. imposes a duty on the township trustees of each Kansas township regarding the eradication of prairie dogs. The trustee of each township is empowered to purchase materials as needed for this task, including poison, with the cost met by an additional levy upon real property

Laws and Regulations

in the township. It is, however, within the home rule authority of a county to provide for the eradication of prairie dogs. A county may adopt by resolution those provisions of K.S.A. 80-1202, which are otherwise applicable only to townships in certain counties, cited herein: K.S.A. 1982 Supp, 19-101a(b), as amended by L. 1983, ch. 92, I, K.S.A. 80-1202, L. 1969, ch. 472, 1. (A.G. Op. No. 83-127, 8-30-83).

Domestic dog laws (K.S.A. 47-645 through 47-646) are as follows:

47-645. Dog owners' liability:

If any dog shall kill, wound, or worry any domestic animal, the owners of such dog shall be liable to the owner of such animal for all damages that may be sustained, thereby to be recovered by the parties so injured before any court having competent jurisdiction.

47-646. Lawful killing of dog:

It shall be lawful for any person at any time to kill any dog which may be found injuring or attempting to injure cattle, swine, sheep, goats, horses, mules, domesticated deer, all creatures of the ratite family that are not indigenous to this state, including but not limited to ostriches, emus and rheas, and any other animal as deemed necessary by the commissioner established through rules and regulations on cattle, hogs, or sheep.

Local

City ordinances may affect local urban wildlife damage control efforts. For instance, within city limits of one Kansas community it is (said to be) illegal to use any steel trap – subsequently poisons are used in place of the safer pocket gopher traps or mole traps.

In another town in Kansas, an ordinance prohibits killing any songbird or squirrel within the city limits. In most communities it is unlawful to discharge a firearm.

Landowner

State law (K.S.A. 32-1002) authorizes landowners and legal occupants of land (generally tenants) to kill animals found in or near buildings on their premises when those animals are destroying property (this would include trees and crops). Any agent engaged by the landowner or tenant would also be authorized to operate under that law provided they have a Nuisance Wildlife Damage Control Permit as authorized in K.A.R. 115-16-5 and issued according to K.A.R. 115-16-6. Animals killed cannot be taken into possession, sold, or utilized by the landowner. However, those operating under the provisions of K.A.R. 115-16-5 may sell parts of the wildlife except for the flesh. The raw fur, pelt, or skin of furbearers may be sold only to a licensed fur dealer and no part of a migratory bird or waterfowl shall be sold or used for any purpose.

This state law is not applicable to federally protected species which may only be killed as authorized by federal permit, nor to species of wildlife classified as threatened, endangered, or in need of conservation under the Kansas Nongame and Endangered Species Act. Those species may only be taken as provided by permit issued by the Kansas Department of Wildlife, Parks and Tourism (KDWP). Animals considered threatened, endangered, and in need of conservation are listed on pages 11–16.

Unless otherwise prohibited as described above, landowners, tenants, or those with wildlife control permits (agent) cannot be legally prohibited from killing animals for doing damage in and around buildings. It generally has been recognized through court cases that damage by wildlife must be substantial or excessive. Incidental or inconsequential damage does not constitute sufficient justification to warrant action by individuals. Obviously, considerable judgment is required by the Kansas Department of Wildlife, Parks and Tourism to determine if a landowner, tenant, or agent has exceeded authority to protect property.

Obtaining a Nuisance Wildlife Damage Control permit as required by regulation involves several steps. The applicant must take self-directed course work and complete a written test with a score greater than 80 percent. The test can be taken at local extension offices or KDWP regional offices. If the test is passed and a background check shows the applicant is not a habitual wildlife violator, a five-year permit is granted. There is no charge for the permit but an annual report must be made to KDWP. A copy of the rules and regulations governing the wildlife control permit is available at http://www.kdwp.state.ks.us/news/other_services/law_enforcement/regulations/wildlife_damage_control.

Threatened and Endangered Species K.A.R. 115-15-1

(A) The following are declared endangered species in Kansas.

(1) Invertebrates

- American burying beetle
Necrophorus americanus
- Elktoe mussel
Alasmidonta margnata
- Ellipse mussel
Venustaconcha ellipsiformis
- Flat floater mussel
Anodonta suborbiculata
- Mucket mussel
Actinonaias ligamentina
- Neosho mucket mussel
Lampsilis rafinesqueana
- Rabbitsfoot mussel
Quadrula cylindrical
- Scott optioservus riffle beetle
Optioservus phaeus
- Slender walker snail
Pomatiopsis lapidaria

- Western fanshell mussel
Cyprogenia aberti

(2) Fish

- Arkansas river shiner
Notropis girardi
- Arkansas river speckled chub
Macrhybopsis tetranema
- Pallid sturgeon
Scaphirhynchus albus
- Sicklefin chub
Hybopsis meekii
- Silver chub
Macrhybopsis storeriana

(3) Amphibians

- Cave salamander
Eurycea lucifuga
- Grotto salamander
Typhlotriton spelaeus
- Many-ribbed salamander
Eurycea multiplicata

continued

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(4) Birds

Black-capped vireo
Vireo atricapilla

Eskimo curlew
Numenius borealis

Least tern
Sterna antillarum

Whooping crane
Grus americana

(5) Mammals

Black-footed ferret
Mustela nigripes

Gray bat
Myotis grisescens

(B) The following are declared threatened species in Kansas.

(1) Invertebrates

Butterfly mussel
Ellipsaria lineolata

Delta hydrobe
Probythinella emarginata

Flutedshell mussel
Lasmigona costata

Ouachita kidneyshell mussel
Ptychobranhus occidentalis

Rock pocketbook mussel
Arcidens confragosus

Sharp hornsnail
Pleurocera acuta

(2) Fish

Arkansas darter
Etheostoma cragini

Blackside darter
Percina maculata

Chestnut lamprey
Ichthyomyzon castaneus

Flathead chub
Platygobio gracilis

Hornyhead chub
Nocomis biguttatus

Neosho madtom
Noturus placidus

Plains minnow
Hybognathus placitus

Redspot chub
Nocomis asper

Shoal chub
Macrhybopsis hyostoma

Silverband shiner
Notropis shumardi

Sturgeon chub
Macrhybopsis gelida

Topeka shiner
Notropis topeka

Western silvery minnow
Hybognathus argyritis

(3) Amphibians

Eastern narrowmouth toad
Gastrophryne carolinensis

Eastern newt
Notophthalmus viridescens

Green frog
Rana clamitans

Green toad
Bufo debilis

Longtail salamander
Eurycea longicauda

Spring peeper
Pseudacris crucifer

Strecker's chorus frog
Pseudacris streckeri

(4) Reptiles

Broadhead skink
Eumeces laticeps

Checkered garter snake
Thamnophis marcianus

Common map turtle
Graptemys geographica

Longnose snake
Rhinocheilus lecontei

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Redbelly snake
Storeria occipitomaculata

Smooth earth snake
Virginia valeriae elegans

Texas blind snake
Leptotyphlops dulcis

(5) Birds

Piping plover
Charadrius melodus

Snowy plover
Charadrius alexandrinus

(6) Mammals

Eastern spotted skunk
Spilogale putorius

(C) It shall be unlawful to take, attempt to take, possess, transport, export, deliver, carry, process, sell or offer for sale, or ship, alive or dead, any threatened or endangered species of wildlife except as authorized in K.A.R. 115-15-1 and K.A.R. 115-15-3.

(A) Definitions:

- (1) The definitions of terms in K.A.R.115-15-3 shall apply to this regulation.
- (2) “*Action*” means any activity resulting in a physical alteration or disturbance of aquatic or terrestrial wildlife or their habitats.
- (3) “*Habitat*” means the place of abode of an animal where it may generally be found and where all essentials for its survival and growth are present.
- (4) “*Critical habitat*” means the specific areas within Kansas that:
 - (a) are documented as currently providing the essential physical and biological features supporting a listed species
 - (b) are specific areas not documented as currently supporting a listed species but are determined as essential by the secretary of the Department of Wildlife Parks and Tourism

- (5) “*Publicly funded*” means any action wherein planning and implementation are wholly funded with monies from either federal, state, or local units of government.
- (6) “*State or federally assisted*” means any action receiving technical assistance or partial funding from any state or federal governmental agency.

(B) Persons undertaking or sponsoring publicly funded state or federally assisted action or any action requiring a state or federal permit, which is likely to destroy individuals of an endangered or threatened wildlife species or their critical habitats, shall obtain a permit from the secretary of the Department of Wildlife, Parks and Tourism prior to initiation of such action. It is the responsibility of the action sponsor to determine potential impacts of the proposed action on endangered or threatened species and their critical habitats.

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Nongame Species 115-15-2

(A) The following nongame species are declared species in need of conservation.

(1) Invertebrates

- Creepier mussel
Strophitus undulatus
- Cylindrical papershell mussel
Anodontooides ferusscianus
- Deertoe mussel
Truncilla truncata
- Delta hydrobe
Probythinella emarginata
- Fatmucket mussel
Lampsilis siliquoidea
- Fawnsfoot mussel
Truncilla donaciformis
- Gray petaltail dragonfly
Tachopteryx thoreyi
- Neosho midget crayfish
Orconectes macrus
- Ozark emerald dragonfly
Somatochlora ozarkensis
- Prairie mole cricket
Gryllotalpa major
- Round pigtoe mussel
Pleurobema sintoxia
- Snuffbox mussel
Epioblasma triquetra
- Spike mussel
Elliptio dilatata
- Wabash pigtoe mussel
Fusconaia flava
- Wartyback mussel
Quadrula nodulata
- Washboard mussel
Megaloniais nervosa
- Yellow sandshell mussel
Lampsilis teres

(2) Fishes

- Banded darter
Etheostoma zonale
- Banded sculpin
Cottus carolinae
- Bigeye shiner
Notropis boopsi
- Black redhorse
Moxostoma duquesnei
- Blacknose dace
Rhinichthys atratulus
- Blue sucker
Cycleptus elongatus
- Bluntnose darter
Etheostoma chlorosoma
- Brassy minnow
Hybognathus hankinsoni
- Brindled madtom
Noturus miurus
- Cardinal shiner
Luxilus cardinalis
- Common shiner
Luxilus cornutus
- Gravel chub
Erimystax x-punctatus
- Greenside darter
Etheostoma blennioides
- Highfin carpsucker
Carpiodes velifer
- Johnny darter
Etheostoma nigrum
- Lake sturgeon
Acipenser fulvescens
- Northern hog sucker
Hypentelium nigricans
- Ozark minnow
Notropis nubilus
- Plains minnow
Hybognathus placitus
- Redfin darter
Etheostoma whipplei

River darter
Percina shumardi

River redhorse
Moxostoma carinatum

River shiner
Notropis blennioides

Southern redbelly dace
Phoxinus erythrogaster

Slough darter
Etheostoma gracile

Speckled darter
Etheostoma stigmaeum

Spotfin shiner
Cyprinella spiloptera

Spotted sucker
Minytrema melanops

Stippled darter
Etheostoma punctulatum

Striped shiner
Luxilus chrysocephalus

(3) Amphibians

Crawfish frog
Rana areolata

Red-spotted toad
Bufo punctatus

(4) Reptiles

Alligator snapping turtle
Macrochelys temminckii

Eastern hognose snake
Heterodon platirhinos

Glossy snake
Arizona elegans

Night snake
Hypsiglena torquata

Rough earth snake
Virginia striatula

Timber rattlesnake
Crotalus horridus

Western hognose snake
Heterodon nasicus

(5) Birds

Black rail
Laterallus jamaicensis

Black tern
Chlidonias niger

Bobolink
Dolichonyx oryzivorus

Cerulean warbler
Dendroica cerulea

Chihuahuan raven
Corvus cryptoleucus

Curve-billed thrasher
Toxostoma curvirostre

Ferruginous hawk
Buteo regalis

Golden eagle
Aquila chrysaetos

Henslow's sparrow
Ammodramus henslowii

Ladder-backed woodpecker
Picoides scalaris

Long-billed curlew
Numenius americanus

Mountain plover
Charadrius montanus

Short-eared owl
Asio flammeus

Whip-poor-will
Caprimulgus vociferus

Yellow-throated warbler
Dendroica dominica

(6) Mammals

Franklin's ground squirrel
Spermophilus franklinii

Pallid bat
Antrozous pallidus

Southern bog lemming
Synaptomys cooperi

Southern flying squirrel
Glaucomys volans

continued

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Texas mouse

Peromyscus attwateri

Townsend's big-eared bat

Corynorhinus townsendii

(B) Except as may be provided by subsequent regulations or by permit issued by the Kansas Department of Wildlife, Parks and Tourism, it shall be unlawful to take, possess, transport, export, process, sell or offer for sale, or ship

any nongame species in need of conservation, except that such species taken during legal trapping seasons, commercial fishing operations, commercial mussel collecting operations, by hook and line or when legally seining for bait fish shall not be unlawfully taken if immediately released or returned to the water. (Authorized by and implementing K.A.R. 115-15-1)

If you have questions about conflicts with endangered, threatened, or need to conserve species in any wildlife damage control effort in which you are involved, please contact the state wildlife agency.

For further information contact: The Kansas Department of Wildlife, Parks and Tourism. 512 SE 25th Ave., Pratt, KS 67124-8174

Study Questions

These study questions are designed to help you learn the material on pages 8 through 16.

1. *Before beginning a wildlife damage control program you should _____.*
 - a. call the Department of Health and Environment
 - b. call your state senator
 - c. determine the legal status of the animal
 - d. determine the three-day weather forecast
2. *The Kansas Department of Agriculture is responsible for _____.*
 - a. regulating the safe and proper use of pesticides
 - b. installing fences for coyote control
 - c. installing sparrow proofing on farm buildings
 - d. applying prairie dog control chemicals
3. *Landowners can kill animals in and around buildings if the animals are _____.*
 - a. sleeping
 - b. running past
 - c. destroying the property
 - d. all of the above
4. *The following are declared endangered species in Kansas:*
 - a. mucket mussel
 - b. sicklefin chub
 - c. cave salamander
 - d. all of the above
5. *The following are declared threatened species in Kansas:*
 - a. Arkansas darter
 - b. green frog
 - c. eastern spotted skunk
 - d. all of the above
6. *The term, "Action," as used for endangered and threatened wildlife regulations (K.A.R. 115-15-3) means _____.*
 - a. the wildlife is actively moving around
 - b. any activity resulting in a physical alteration or disturbance of aquatic or terrestrial wildlife or their habitats
 - c. any action that results only in the death of the animal
 - d. any action that frightens the animal
7. *The term, "publicly funded," as used for endangered or threatened wildlife regulations (K.A.R. 115-15-3) means:*
 - a. any action where special grant funds from a private foundation are used for partial support of a wildlife program
 - b. any action receiving technical help or partial funding from any state or federal government agency
 - c. any action wherein planning and implementation are wholly funded with money from either federal, state, or local units of government
 - d. none of the above
8. *The following nongame species are declared in need of conservation:*
 - a. butterfly mussel
 - b. golden eagle
 - c. whooping crane
 - d. all of the above

Wildlife Diseases and Humans

Diseases of wild animals should be of concern to anyone who comes into contact with wildlife, either in damage control programs or through recreational pursuits. Many wildlife diseases have public health as well as agricultural economic significance. Some wildlife populations may be “reservoirs” of infection for transmissible diseases while others can serve as “vectors” for various diseases, providing a mechanism for transmission.

Wild animals are susceptible to a wide variety of infectious and parasitic organisms capable of causing disease. Many of these organisms are specific and of significance to only one or a few species of wild animals. Others may be generalized and capable of infecting a variety of wild and domestic animals or even humans. This section provides only a general survey of a few of the important wildlife diseases that may be commonly encountered in the field. Emphasis is placed on those wildlife diseases that may also be of significance to human health.

General Precautions

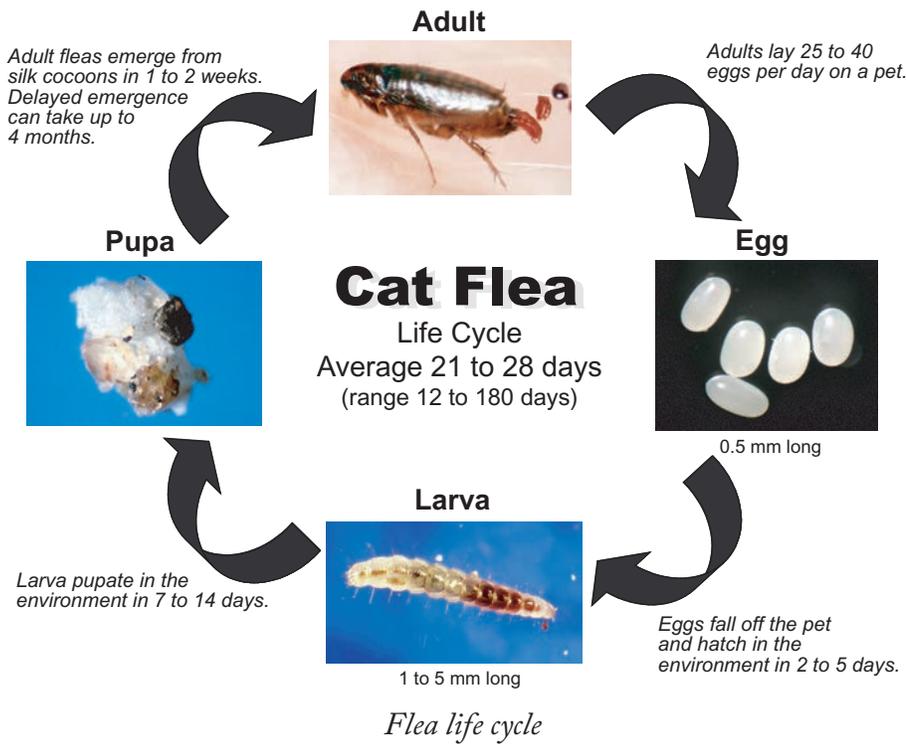
A few general precautions, if followed, will reduce the possibility of becoming infected or suffering serious illness from most wildlife diseases.

- Do not approach or handle any wild animal that appears sick or is acting in an abnormal manner, including animals that lack coordination, that show no fear of your approach, or that are active at unusual times of the day.
- Always wear rubber gloves when skinning or examining any wild animal.

- Practice cleanliness when working with wild animals. Do not eat or drink while handling or skinning animals and wash hands thoroughly when you are finished.
- If you become sick after working with wild animals, contact a physician and inform him of the contact occurring with wild animals and the possibility of flea or tick bites.

Plague

Plague is an acute infectious disease caused by bacteria. The disease causes fever and a painful, usually swollen, and often hot-to-the-touch lymph node, called a bubo. It is very serious. Transmitted by fleas, it primarily affects wild rodents and commensal rats. The disease can be transmitted to man through the bite of infected fleas and is known as bubonic or black plague. In the Great Plains, plague has been documented in wild rodents in New Mexico, Colorado, and the western portions of Texas, Oklahoma, and Kansas. Transmission of plague in the wild occurs when fleas feed on an infected animal, then later feed on an uninfected individual. Plague involves such diverse wildlife as ground squirrels, wood rats, prairie dogs, chipmunks, marmots, rabbits, deer mice, and voles. The most serious plague problem in recent years has been in prairie dog towns where it may occasionally lead to the rapid disappearance of entire colonies.



Rocky Mountain Spotted Fever

Rocky mountain spotted fever (RMSF) is a severe rickettsial disease caused by a tick bite. Typical symptoms include: fever, headache, abdominal pain, vomiting, and muscle pain. A rash might also develop but is often absent in the first few days, and in some never develops. The disease can be severe or even fatal if not treated in the first few days of symptoms. The organism causing the disease is transmitted only by certain species of ticks: the American dog tick (*Dermacentor variabilis*), Rocky Mountain wood tick (*Dermacentor andersoni*), and brown dog tick (*Rhipicephalus sanguineus*). Although it was first described as being from the Rocky Mountain region, the disease is found in nearly all the contiguous states and is now most frequently recognized outside the Rocky Mountain area. North Carolina, Oklahoma, Arkansas, Tennessee,

and Missouri account for more than 60 percent of cases. Numbers of reported cases in Kansas have been increasing in recent years.

The disease occurs most frequently in persons exposed to tick bites and especially among those for whom grooming facilities are limited. Thus hikers, campers, sheep herders, surveyors, explorers, soldiers on maneuvers, and forest workers are at risk of infection. Dog owners may become infected where suitable host ticks are abundant. Infection may be contracted from ticks by crushing them as well as by their bites. Rocky Mountain spotted fever can be treated effectively



American dog tick

Wildlife Diseases and Humans

by a physician, particularly if the disease is diagnosed early.

Tularemia

Tularemia is a bacterial, plague-like disease of rabbits and rodents. It can be transmitted by ectoparasites or direct contact with other mammals, including man. It is most commonly transmitted to man from infected rabbits, primarily cottontails. Jackrabbits may be an important source of infection locally, but overall are a minor factor. Transmission most often occurs through an open wound during the process of skinning the rabbit. It may also be contracted from incompletely cooked meat, through bites of ticks or flies, or breathing in the bacteria, *Francisella tularensis*. Some symptoms include sudden fever, chills, headaches, or diarrhea. Symptoms usually appear three to five days after exposure, but can take as long as 14 days. To prevent exposure, use insect repellent with DEET on your skin, treat clothing with repellent containing permethrin, wash hands often, and cook food thoroughly.

Rabbits with tularemia behave oddly, run slowly, and can often be captured easily. They often appear to be tame or in a stupor. Rodents, such as beaver, muskrats, and voles are also apparently highly susceptible to the disease under certain conditions.

Tularemia of rabbits and rodents cannot be eradicated. Attempts to reduce the numbers of susceptible wild hosts are generally ineffective at reducing the incidence of the disease. It has been reported from all the continental U.S. (except Vermont).

Trichinosis

Trichinosis is caused by a nematode parasite, which produces the disease in man and many other domestic and wild animals. Evidence indicates that nearly all mammals are susceptible to infection with this parasite which encysts in the muscle of the host and is then transmitted by eating the raw or undercooked meat. As would be expected, the disease is most common in wild carnivores and scavengers, but may also occur in domestic pigs.

If carnivorous wildlife such as bobcats, raccoons, or scavengers such as opossums are consumed by man, the meat should be properly prepared by cooking, freezing, or curing to destroy any viable trichinae.

The first symptoms include: nausea, diarrhea, vomiting, fatigue, fever, and abdominal discomfort.

Rabies

Rabies is one of the oldest diseases known to man. Despite this fact, little progress has been made for its elimination or eradication. Our knowledge of this disease and disease control has been greatly increased, but the high incidence stresses our inadequacies in solving this problem. There has not been an organized eradication program in the United States except for dogs and cats.

Rabies, a viral disease, affects the central nervous system and is often fatal. It occurs in all warm-blooded animals with the possible exception of opossums. Now more than 90 percent of the rabies cases come from wild carnivores and bats instead of domestic animals. It is considered fatal once symptoms have developed although there

Wildlife Diseases and Humans

have been reports of about 10 human survivors.

The losses caused by rabies are difficult to determine. The primary economic loss is from death of farm animals, pets, and the cost of vaccination. Its most serious effect is its transmission to humans and the fears associated with it.

Rabies is present in much of the United States. Rabies may be present during any season of the year. The incidence is usually highest in the spring and fall.

Most authorities agree that the main reservoir of infection is in wild animals. Skunks, foxes, bats, raccoons, coyotes, and others may be the source of this disease. Rodents are of no epidemiological significance.



Striped skunk

The skunk has the highest rate of infection. In Kansas more than 60 percent of the positive cases are from this animal. You should suspect rabies if a skunk is noticed wandering around without fear of dogs or humans. Be especially careful if the skunk chases dogs, cats, or humans near buildings during the daylight hours. Unfortunately, you

can't tell whether or not an animal is rabid just by its behavior.

Transmission: Rabid animals are the source of infection for other animals and humans. Transmission from the sick animal to a healthy animal or human is by infected saliva on broken skin or abrasions.

Prevention and Control:

Prevention should be based on (1) vaccination of pet animals, (2) control of stray dogs and cats, and (3) education of the public.

Commensal Rodent-Borne Diseases

Rats and mice are responsible for the spread of a number of diseases, either directly, as by the contamination of human food with their urine or feces, or indirectly, by way of rodent fleas and mites. Rats and mice have been implicated in more than thirty-five diseases.

Birds and Public Health

Large roosting concentrations of birds can lead to potential public health problems. Their droppings create an objectionable smell, and the droppings and the weight of the birds break tree limbs and destroy vegetation. The droppings, when allowed to accumulate over a 3- to 5-year time span, may form a medium for the growth of bacteria and fungi. In addition, birds may act directly as carriers or vectors for some diseases.



European starling

Wildlife Diseases and Humans

Histoplasmosis

Sources of Infestation

The fungus *Histoplasma capsulatum* is widely distributed throughout the world. It usually is in soil where droppings from bats, blackbirds, starlings, chickens, gulls, pigeons, or other birds have accumulated for three or more years. It may also be in or on buildings. The fungus normally grows in the upper two inches of the soil or accumulated droppings and, once established, can survive and propagate itself over a broad range of environmental conditions. Birds are not infected by the fungus and do not carry the disease. Bats are susceptible to infection and theoretically could infect new sites through their droppings, but this has never been demonstrated. Once established in the soil or on accumulated droppings the fungus persists for many years even though the source of the droppings is removed.

The fungus does not become established at all sites where droppings have accumulated. Surveys made in the 1960s of blackbird roosts in Arkansas and Missouri indicated that the fungus was growing in about a third of the roosts that had been active for three or more years. The fungus was not found, however, in some roosts that had been used by birds for 10 to 28 years. Therefore, age does not seem to be the only factor which influences whether the fungus will become established. Without sampling to determine the presence or absence of the fungus, discretion dictates that all bird or bat droppings that have been accumulating for three or more years be considered to be positive for *Histoplasma capsulatum*.

In humans, histoplasmosis infection can result from disturbing bird or bat droppings which have accumulated beneath tree roots, in attics and chicken houses, on buildings, lofts, or other sites. Most severe or symptomatic cases of histoplasmosis occur in persons who clean out silos, church towers, basements, or attics; demolish or clean out old chicken houses; explore caves; clear underbrush; or cut trees where birds or bats have habitually roosted. Infestation may also occur in persons who are near such activities. Most cases of histoplasmosis are acquired by persons who live in the vicinity of active or previously inhabited bird roosts in which the fungus is growing. Fortunately, if the roost is not disturbed, these cases are mild, producing no symptoms or causing a minor, transitory respiratory illness that elicits little or no concern.

Medical Information

Histoplasmosis affects man and domestic and wild animals. The disease occurs when the spores of this fungus enter the lungs where an infection begins, usually resulting in a primary lung lesion. The disease is not considered contagious since it is not transmitted from man to man or from animals to man. Many infections are overlooked since they produce no symptoms or cause a transitory respiratory illness with flu-like symptoms.

Histoplasmosis may occasionally become chronic and persist for years or, rarely, enter the bloodstream and infect organs other than the lungs. Minor cases require only supportive treatment.

Wildlife Diseases and Humans

The rare chronic or severe cases may require hospitalization. Persons who have recovered from histoplasmosis acquire some immunity to the disease, but reinfection may occur in a few individuals, especially if they inhale a massive dose of spores.

Control

A good way to prevent histoplasmosis is to avoid accumulations of soil mixed with bird or bat droppings or accumulations of these droppings. Unfortunately, this is not always possible. Because most cases of human histoplasmosis are associated with active or previously inhabited bird roosts, pay particular attention to the management of these areas to minimize their importance as a source of infection.

Avoid active or previously inhabited bird roosts if possible. Individuals or groups who are likely to come into close contact with roost soils should know about the possibility of contracting histoplasmosis if the soils are disturbed and should be encouraged to keep out of the roost site. If the roost site is being used often by the public or if the area will soon be developed, test the roost site for the presence of *Histoplasma capsulatum*. If the fungus is present, decontaminate the site. Decontamination is especially important if the roost site is located in an urban area.

Collecting soil samples in the roost site and forwarding specimens for fungal isolation should be performed under the direction of the State Health Department. Most states rely on the Division of Mycotic Diseases, Centers

for Disease Control, U.S. Public Health Service, Atlanta, Georgia, to determine the presence or absence of *Histoplasma capsulatum* in the samples.

Persons who must come in contact with soil mixed with bird or bat droppings should make every effort to avoid inhaling the spores of this fungus. If possible, only persons with positive histoplasmin skin tests should work in these sites, because they have acquired some immunity that others do not have. The National Institute for Occupational Safety and Health (NIOSH) recommends wearing a well-fitting part 84 particulate respirator certified by NIOSH. They should also wear coveralls, caps, rubber boots, and plastic or rubber gloves. When leaving the site, they should wash droppings off boots and remove clothing and place it in a plastic bag. Clothing can be decontaminated by drenching it with formaldehyde followed by washing it in detergent.

Moving bird or bat droppings that have accumulated in or on buildings is often necessary. Consider all such accumulations as positive for *Histoplasma capsulatum*. Workers should wear respirators and protective clothing. Dampen dry droppings with water containing a wetting agent (surfactant) to minimize spore dispersal. As they are removed, wet the droppings thoroughly with 3 percent formaldehyde solution, seal in heavy plastic bags, and dispose of in a landfill. In some situations disinfecting droppings with formalin before removal may be possible. Exercise extreme caution due to the hazardous nature of formalin. If the final cleanup

Wildlife Diseases and Humans

involves vacuuming, use only cleaners with a water filtration system to prevent spores from becoming airborne.

Prevention

The probability of contracting histoplasmosis can be minimized by preventing the accumulation of bird or bat droppings in or on buildings or in the vicinity of homes or populated areas. Bat and bird-proof the buildings to prevent them from entering. If they are already roosting in a building, begin a program to move them out then close all entrance points. Contact K-State Research and Extension or the Kansas Department of Health and Environment for help in developing a program to rid buildings of bats or birds.

Dispersing birds from a roosting site is an obvious way to prevent the roost from becoming positive for *Histoplasma capsulatum*. Because roosts must be occupied for three or more years (rarely two) before favorable conditions develop for fungus growth, birds roosting at a site for the first winter should cause little concern. If birds return the following fall or winter, take steps to move them. In some instances the birds can be moved by altering the roosting site. Thinning the stand, removing thickets of understory shrubs, trimming hedges, or pruning the tree canopies often moves birds from an established roost and discourages them from selecting the site as a roosting area in the future.

Wildlife Diseases and Humans

Study Questions

These study questions are designed to help you learn the material on pages 18 through 24.

- General precautions to reduce the chance of getting wildlife diseases include _____.*
 - always wear rubber gloves when skinning or examining wild animals
 - practice cleanliness when working with wild animals
 - do not overcook wild animal meat
 - a and b above
- Plague is transmitted in wild animals by _____ feeding on infected animals.*
 - dogs
 - skunks
 - fleas
 - coyotes
- Most cases (60 percent) of Rocky Mountain spotted fever are reported in _____.*
 - North Carolina and Oklahoma
 - Arkansas, Tennessee, and Missouri
 - Virginia
 - a and b above
- In Kansas, more than 60 percent of the rabies cases are found in _____.*
 - foxes
 - skunks
 - coyotes
 - dogs
- Histoplasmosis should be suspected in all cases where bird or bat droppings have accumulated for _____.*
 - 1 to 6 months
 - 7 to 12 months
 - 1 to 2 years
 - 3 or more years
- To reduce the chance of getting histoplasmosis, individuals or groups should _____.*
 - avoid active or previously inhabited bird roosts
 - kill all birds in the area
 - decontaminate the roost site with alcohol
 - smoke a cigar when entering an infected bird roost site
- The probability of contracting histoplasmosis can be minimized by _____.*
 - preventing the accumulation of bird or bat droppings
 - bat- and bird-proof buildings
 - moving birds from roosting sites in less than three years
 - all the above

Public Relations and the Wildlife Damage Control Professional

Public Relations and the Wildlife Damage Control Professional

Even though Kansas is considered an agricultural state, more than 90 percent of Kansans live in urban centers, and many agricultural workers are not descendants of farm families. When regulations governing wildlife damage control are formulated on a national or even on a state level, urban-oriented values, emotions, and knowledge may dominate the wording of laws and regulations.

Almost all of the vertebrate animals in abundance now will probably remain relatively abundant until major land uses change or environmental disasters occur over wide areas. With control efforts limited to very few sites, slight reductions in local populations of nontarget animals will have no long-lasting adverse effects on total populations. Killing or injuring nontarget animals is of great concern to many people.

When settlers began to establish homes, they encountered many wild creatures. They had little choice but to kill offending animals. Attitudes developed that still exist in the rural population such as, "There are good animals, and bad animals. If bad animals (the ones not useful to people) harm something, kill them all if you can because they are not useful."

On the other side of the issue is the view is that all living species and each individual within each species should be preserved. Wildlife damage control professionals can help reconcile these differences by providing information. A lot is known about

animal populations and wildlife damage control, but people usually are not interested until they experience a problem. Then, with limited knowledge, myths and attitudes of early settlers may guide decisions.

Professionals should be aware of attitudes that affect acceptance and implementation of wildlife damage control programs. To minimize conflict, damage prevention should be emphasized. Minimal population reduction should be recommended only if necessary, using the safest methods. Wildlife damage control professionals should explain how animals compensate to resist population reduction attempts and why an effort to kill all animals in a favorable habitat might not succeed.

Coyotes

Coyotes are members of the dog family and resemble small German Shepherds. Both males and females are primarily brownish gray-colored, with variations from nearly white, to reddish-brown, to nearly black; the underbelly is a lighter color. Most have black guard hairs over their back and tails. Color variations seem somewhat related to the type of habitat in which they live. To be successful in using any control method, basic knowledge of coyote habits and behavior is necessary.

Coyotes are the principle predator of sheep and goats. Documented losses among all sheep raised in Kansas average from less than 1 percent to 3 percent per year. Coyote predation on other types of livestock has been documented and, although not of the magnitude of sheep losses, it can be serious in localized situations.

Coyotes tend to live in territories. Any device, tool, or control method that is used continually over several years, in a given area, will sooner or later decrease in effectiveness because coyotes adapt to control measures. Use only one or two methods of lethal removal at a time and use these sparingly. After removal of the coyote(s) responsible for causing losses, discontinue control measures.



Coyote

Reproductive Capacity of Coyotes

The percentage of female coyotes capable of breeding and successfully whelping is perhaps one of the most important variables in the reproductive capacity. To know litter size, age of maturity, and breeding capabilities of the animal is fundamental to wise management. In Kansas, 75 percent of the female coyotes are sexually active under good conditions, but less than 36 percent attempt mating when conditions are less favorable. Most of the variation appears to result from the frequency with which females become reproductively mature in the first year of life. The greatest influence in local population productivity results from significant changes in the percentage of females capable of bearing young. Some coyote control helps young females

grow into reproductive capacity at an earlier age and increases the number of pups per litter. These biological facts suggest that attempts to control the coyote population in some areas may be of help in keeping a population of coyotes healthy, abundant, and productive.

Coyotes usually breed in January and February and produce litters about 60 to 63 days later, in April and May. Average litter size is five to seven pups, although up to 13 in a litter have been reported. Coyotes crossbreed with dogs to produce the coy-dog hybrid. Hybrids are fertile, although their breeding seasons do not usually correspond to those of coyotes.

Distemper, parvovirus, and mange are the most common coyote diseases. Rabies and tularemia also occur and may be transmitted to other animals and humans. Some parasites of coyotes are mites, ticks, fleas, worms, and flukes.

Habits

Coyotes are found from Central America to the Arctic, including all the U.S., Canada, and Mexico. Kansas has maintained a high, relatively stable coyote population for many years. Timber, brush, open prairie, and desert areas are favored habitat types, but coyotes are highly adaptable and are also found in farming areas, suburbs, and cities.

Coyotes are most active at night in hot weather, and during early morning hours, especially where human activity occurs. With minimal human interference, or during cool, cloudy or foggy, rainy weather, they are active throughout the day. They bed in sheltered

Coyotes

areas, but they may seek temporary shelter underground in severe weather or when closely pursued.

Coyotes follow regular paths and crossways, and they prefer high hills or knolls from which they can view their terrain. They establish regular scent posts along their paths. They depend on their ears, noses, and eyes to sense danger.

Den Life

Coyotes do not normally utilize dens except when raising young. Dens are found in steep banks, rock crevices, sinkholes, and underbrush, as well as in open areas. Usually they are in areas selected for protective concealment. Coyote dens are often holes that have been used by badgers, skunks, foxes or other animals, with entrances enlarged to about 1 foot in diameter. Dens vary in depth from 4- to 5-feet to as deep as 50 feet. Dens usually have only one opening. They are usually less than 1 mile from water, but can be found much farther away.

Extensive travel is common in hunting, although coyotes hunt the same areas regularly if plenty of food is available. An adult coyote can hold up to 7 pounds of food in the stomach. Both parents hunt and bring food for the young. They usually regurgitate it for the pups until they are several weeks old. Pups begin coming out of the den by three weeks of age and are weaned by six weeks. Within two months, they follow adults on short hunting trips or to feed on large prey. The family usually remains together until late summer or fall. Some coyotes will leave overpopulated home ranges and travel to less populated areas.

Coyote physical abilities include good eyesight and hearing and an exceptionally keen sense of smell. They have been clocked at speeds up to 40 miles per hour and can sustain slower speeds for several miles.

Food

As carnivores, 98 percent of the average coyote winter diet is animal matter and 2 percent is vegetable matter. However, coyotes feed heavily on cedar berries, prickly pear fruits, wild plums, cantaloupes, and watermelons in the summertime.

Coyotes normally kill lambs by biting the head or neck, but on older lambs and adult sheep, kills are usually made by biting the throat just in back of the jaw and ear. The major cause of death is probably damage to the trachea and/or to nerves affecting respiration, blood pressure and heart rate, rather than the loss of blood. They usually feed on a carcass at the flanks or behind the ribs and first consume the liver, heart, lungs, and other viscera. The rumen and intestines may be removed and dragged away from the carcass. On very small lambs, the upper canine teeth may penetrate the top of the neck or the skull. Calf predation by coyotes is most common when calves are young. Calves attacked, but not killed, exhibit wounds in the flank, hindquarter, or front shoulders; often their tails are chewed off near the tip. They usually kill calves by eating into the anus or abdominal area. Mature deer are killed in a manner similar to that used on adult sheep. Large animals may be grabbed by the throat, but often are pulled down from

behind. Fawns usually are bitten through the neck or head. Deer carcasses often are completely dismembered and eaten.

Dogs usually kill by attacking the hindquarters, flanks, and head and rarely kill as cleanly as coyotes. Badly torn and slashed animals with damage to the head, ears, and sides are typical of dog predation. Domestic dogs are generally indiscriminate killers of livestock, attacking or harassing all age groups of any kind of livestock. Dogs eat small amounts of the kill, if any at all, and often kill or wound many individuals at once.

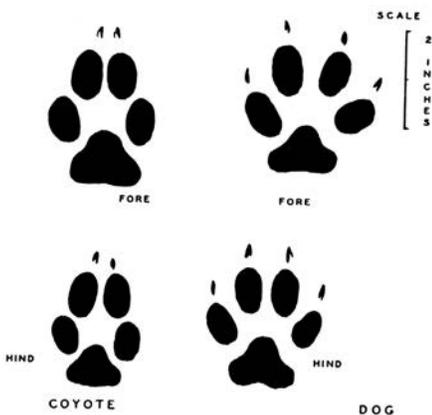
Red foxes kill and feed on small lambs much as coyotes do, but larger sheep often show many teeth marks in the throat. Occasionally, foxes pull wool loose from flanks and hindquarters or damage the head as dogs often do.

Skinning the hide away from the wound with a sharp knife and exposing the flesh is a reliable way to properly identify the extent of damage and locate places of hemorrhaging.

Coyote track comparison

Control

Coyote Damage Control



Alternatives

- ground shooting
- calling
- foot-hold traps
- snares
- guardian animals (dogs, donkeys, llamas, etc.)
- trail hounds
- sight hounds
- lighting
- parked vehicles
- propane exploders
- annoying sounds, and
- electrical fencing

All of these techniques have proven economical and practical in some situations but not all techniques are labeled in every state. For example, the M-44 device, livestock protection collars, and carbon monoxide cartridges are not registered in the state of Kansas, and therefore it is illegal to use them.

Specific knowledge of the field activity is important with predators and predator damage control.

Observe:

- tracks and droppings
- howling, barking
- times of day when seen
- places seen, travel routes direction
- number seen
- kind of livestock killed, age, sex, size, behavior of livestock
- frequency of killings, numbers killed/wounded in each attack
- date killing started
- loss record

Coyotes

For additional information regarding coyote damage control, refer to the following K-State Research and Extension publications:

How to Trap a Coyote, C660

How to Call a Coyote, C400 revised

Use of Snares for Capturing Coyotes, C698

Managing Predator Problems, C620

Understanding the Coyote, C578

Coyotes, and most other Kansas wild predators, kill with discrimination. Generally, one animal is killed per attack, and these attacks occur at regular intervals. Wild predators tend to attack smaller individuals: lambs, kids, calves. They will usually pick one kind of livestock animal and kill in one place, pen, or pasture.

Other information needed:

- type of wounds
- amount eaten, places carcasses eaten
- victim carried off or not, returns to carcasses the next day
- method of disposal of dead animals, place disposed of
- time of attacks, other predation in area
- travel routes used by predators in area of kills
- terrain where loss is occurring
- size of area
- use of adjacent land
- vegetative cover in area of loss and adjacent land
- trails of predator
- fence crossing used by predator
- temperature
- weather
- time of year
- expected weather conditions during time of control

Consider these factors to select the most effective control method:

- Traps work fine in dry weather and on dry soil.
- Snares are useful in trails under fence crossings, but not necessarily in pastures with livestock or in high use areas where deer are abundant.

- Level terrain lends itself to effective use of sight hounds during cooler months.

Livestock Management Factors

Management practices are equally important. Before a decision is made on control, consider:

- Were the attacked animals penned at the time of attack?
- If attacked at night, were there lights over penned animals?
- Were lambs in pasture?
- Does lambing occur in pastures?
- What is the condition of fencing?
- How long will the kind and size of animal being killed be present in the area of attacks?
- Where are dead livestock disposed of (location)?
- How long are dead livestock left in pastures or pens? Parasites and diseases may be wholly or partly responsible for losses.

Ask about recent efforts to control losses. What predator control methods were used and how successful were they? Individual coyotes can adapt to control methods and may become trap, snare, or predator-call shy. They may overcome their fear of killing in lighted pens and of scaring devices. In such cases careful consideration will allow the manager to choose the most appropriate methods. Broad knowledge of control methods is needed for effective control.

Public Relations and the Wildlife Damage Control Professional

Study Questions

These study questions are designed to help you learn the material on pages 26 through 30.

1. *Kansas is considered an agricultural state, but what percentage of Kansans live in urban centers, which affects their thoughts about wildlife.*
 - a. 60 percent
 - b. 70 percent
 - c. 80 percent
 - d. 90 percent
2. *Coyote control should use lethal methods _____ at a time.*
 - a. 1 or 2
 - b. 3 or 4
 - c. 5 or 6
 - d. 7 or 8
3. *One of the most important variables in coyote reproduction is:*
 - a. the number of males.
 - b. the number of females.
 - c. the percentage of females capable of breeding and successfully whelping
 - d. the presence of field mice for food.
4. *Coyote pups begin coming out of the den at _____ of age.*
 - a. 1 week
 - b. 3 weeks
 - c. 4 weeks
 - d. 6 weeks
5. *Domestic dogs generally:*
 - a. are indiscriminate killers.
 - b. attack all age groups of animals.
 - c. eat small amounts, if any, of the kill.
 - d. all the above.
6. *Knowledge of field activities of predators includes _____.*
 - a. howling and barking
 - b. places seen
 - c. behavior of livestock
 - d. all the above
7. *Some factors that influence the method of predator control include:*
 - a. dry weather and soil favor traps.
 - b. level terrain is best for sight hounds.
 - c. a and b.
 - d. the phase of the moon.
8. *Concerning previous predator control attempts, an important question is _____.*
 - a. What were the previous control methods?
 - b. Were owls present the night of the kill?
 - c. Were there flies found on the dead animal?
 - d. What happened two weeks after the attack by predators?

Deer, Elk, and Antelope



Pronghorn antelope



Whitetail deer



Elk

Deer, Elk, and Antelope

Overpopulations of deer, elk, and antelope can have adverse effects on agricultural production and maintenance of habitat for other wildlife. Damage to fences by deer often results in secondary damage by permitting livestock access to other areas.

When buck deer are rubbing the velvet from their antlers, they may scar saplings, break limbs, and bruise bark. Any of the antlered animals will leave this evidence of the approaching rutting season. The rub will be confined to the trunk area between 1½ feet and 3 feet above the ground. Small trees may be killed. This damage can be important economically when it occurs in orchards and the value of the individual trees is high.

Twigs or plants nipped by hooved animals do not show the neat, sharply cut edge left by rabbits and most rodents, but instead show a rough, shredded edge, and usually a square or ragged break. The stems browsed by deer and elk show no appreciable difference in appearance. Deer seldom browse higher than 6 feet from a standing position, but are able to reach 8 feet or more by rearing upon their hind legs. Deer rarely browse on branches more than an inch in diameter.

Control Methods

Hunting

Hunting seasons should be considered the best method to reduce or resolve deer, antelope, or elk damage problems caused by an overpopulation of animals in an area where existing populations of these animals are not compatible with existing

land uses. This includes areas where other techniques are not effective in reducing damage and an annual problem is anticipated unless numbers are reduced. Urban areas and areas of high human populations where wildlife damage is common are most difficult to resolve because hunters cannot effectively harvest the problem animals. As much hunting pressure as is tolerable by the residents should be applied annually to hold the problem animals at as low a level as possible.

Repellents

Specially formulated repellents have been effective in reducing or eliminating damage to gardens, flowers, ornamental shrubs, berries and fruit trees for varying lengths of time when used according to the instructions. Continuous application of repellents on large commercial orchards is expensive for the operator and a more permanent solution should be considered. Some repellents are not registered for use on edible plant parts, but may provide good protection during the dormant season when animals have adequate alternative foods.

Apply repellents at the first sign of damage to prevent deer from establishing a feeding pattern in fields.

Scare Devices

One of the keys to success with repellents or scare devices is to take action at the first sign of a problem. It is difficult to break a deer's behavior pattern once established.

Gas exploders (and possibly strobe lights with siren) set to detonate at irregular intervals are the most

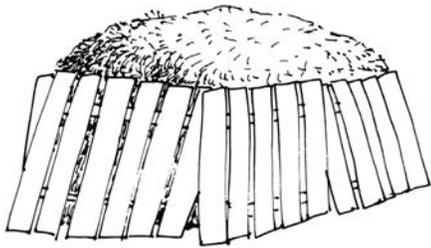
Deer, Elk, and Antelope

common scare devices. They are only effective for 1 to 2 weeks and should be used only for temporary control.

Propane cannons are another option. These noise-making devices may be used as a first attempt to frighten deer away from the damage area. These cannons allow the user the ability to place them and have timed explosions occurring for several hours.

Haystack Panels

Preconstructed 8- by 8-foot wood or 16-foot wire and wood snow fence haystack panels are useful to prevent deer, elk, and antelope from feeding on the hay. The panels are placed around the stack by the owner and wired together at the edges to create a solid wooden protective fence around the stack. When the stack is removed, the panels are stored to be used the following year.



Wooden panels

Tree Cages/Shelters

Tree cages can be used to protect young fruit trees from persistent damage by deer or elk in cases where repellents or a kill permit are ineffective. A cage consists of a 10- or 15-foot length of 47-inch woven wire with 10 gauge bottom and top wires and 12 ½ gauge filler wires with 6-inch stays. If a large acreage of newly planted fruit trees requires protection, a permanent fence around the entire orchard may be less expensive

and less troublesome to install and maintain than individual cages. Tree shelters are plastic or cardboard tubes that are placed over the tree at planting time and actually create a microclimate that enhances tree growth and survival.

Fencing

Simple, inexpensive electric fences are useful in protecting garden and field crops during snow-free periods. Deer are attracted to these fences by their appearance or smell, and are lured into contacting the fence with their noses. This causes an effective shock that trains them to avoid fenced areas.

Where a large number of deer annually cause damage to a high-value crop (fruit trees, irrigated alfalfa, and similar crops) and other preventative techniques are not effective, a permanent fence may be the only solution. The electric shocking power and unique fence designs present both psychological and physical barriers to deer. The disposition of public hunting on the land involved must be analyzed before any commitment.

An 84-inch high fence for repelling deer and a 96-inch fence for elk are recommended.



Deer exclusion fence

Trapping and Immobilizing

Trapping or immobilizing and moving animals to resolve damage complaints is not practical. Trapping is time consuming and

Deer, Elk, and Antelope

expensive. Individual deer, elk, or antelope with livestock, in towns, or accidentally driven into confined areas, can be removed by use of a tranquilizer gun. To tranquilize an animal, a trained person must be able to approach within 50 yards of the animal. Greater distance decreases the accuracy of the gun.

Permanent Stackyard Fence

A permanent stackyard where many stacks, bales, or loaves of hay are annually stored can be protected at minimum cost and manpower to all concerned by construction of permanent fence. The standard fence is 84-inches high.

Artificial Feeding

This technique can be implemented during the winter using a good grade of alfalfa hay to attract a herd of elk to a feeding site located at least ¼-mile from the damage site. Transporting the hay to the proper site is usually a major problem that discourages this activity. Deer cannot be effectively diverted from green hay or grain fields by this technique.

For additional information on deer damage control, refer to the following K-State Research and Extension publication:

Deer Damage Control Options, C728.

Study Questions

These study questions are designed to help you learn the material on pages 32 through 34.

1. *Deer damage includes _____.*
 - a. breaking branches and bruising bark by rubbing their antlers
 - b. eating tops of 15-foot trees
 - c. puncturing livestock watering tanks with their antlers
 - d. browsing on large branches (more than 3 inches in diameter)
2. *Frightening or scaring deer away from danger areas can be done by using _____.*
 - a. car horns
 - b. propane cannons
 - c. scarecrows
 - d. bright-colored paint
3. *Tree cages are effective for _____.*
 - a. controlling widespread damage from deer or elk
 - b. protecting entire orchards
 - c. protecting individual trees from deer or elk.
 - d. a and c above
4. *Permanent fences are effective in controlling deer or elk damage:*
 - a. to high value crops (commercial fruit and vegetables, etc)
 - b. when other preventative measures are not effective
 - c. a and b above
 - d. none of the above
5. *To artificially feed elk, the feeding site should be _____ mile from the damage site.*
 - a. ¼
 - b. ½
 - c. ¾
 - d. 1

A rodenticide is defined as a pesticide intended to kill rodents. They are often called poisons, toxicants or rat baits. The concept of using rodenticides is not a new approach. Aristotle reported using strychnine for rodents in 350 B.C. There are many rodenticides on the market but relatively few active ingredients involved. One task for the user is to select the rodenticide that is the best suited for the project.

EPA has published a document “Potential Risks of Nine Rodenticides to Birds and Nontarget Mammals: A Comparative Approach, 2004” (<http://www.fluoridealert.org/pesticides/EPA-HQ-OPP-2006-0955-0005.pdf>) that can guide producers in their selection of the proper rodenticide.

It is important to remember that no rodenticide is perfect. Rodenticides are products designed to kill small mammals, and they are not selective to the target species. They must be used in a manner that minimizes risk to children, pets and nontarget wildlife. There are advantages and disadvantages to using any of the products. By understanding differences between the first- and second- generation anticoagulants and the acute toxicants, a proper match between good efficacy and low risk to nontargets can be selected. Efficacy of any product depends somewhat on the attractiveness and palatability of the bait matrix. This may differ between species and even between individuals that are the target of the rodenticide program. No rodent bait is universally highly acceptable.

Anticoagulant rodenticides were first discovered in the 1940s and are now the most widely used

toxicants for rodent control. Rodents die from internal bleeding because of loss of the blood's clotting ability and capillary damage. Before death the animal is weak, but the appetite may remain. They have a slow action, so bait shyness may not occur. First-generation anticoagulants include warfarin, pindone, diphacinone and chlorophacinone. They are multiple feed rodenticides that are chronic in action. It requires multiple feedings for the rodent to consume a lethal dose, so the bait should be continuously available. First-generation anticoagulants pose secondary risks to birds and mammals.

Second-generation anticoagulants include brodifacoum, difethialone, difenacoum, and bromodiolone. Second-generation anticoagulants may be the most potent rodenticides currently available.

A lethal dose is obtained in a single feeding although death is delayed 4 to 5 days for some rodents. Second generation anticoagulants have secondary hazards to nontarget wildlife. Non-anticoagulants include bromethalin, cholecalciferol, and zinc phosphide. These rodenticides can provide a lethal dose in a single feeding and are much less likely than the anticoagulants to be retained in significant amounts in the body tissue of rodents that consumed the bait. Primary risks are high to nontargets that may consume those baits.

The EPA document concludes with a summary table for comparing overall risks to birds and mammals. The lower the number, the lower the risk.

Rodenticides

Rodenticide	mg ai/kg	Primary Risks	Primary Risks	Secondary Risks	Secondary Risks	Summary Values
		Birds	Mammals	Birds	Mammals	
Brodifacoum	50	5.58	1.25	8.60	6.76	5.55
Bromadiolone	50	0.10	0.71	3.03	4.40	2.06
Bromethalin	100	0.10	0.10	2.20	0.44	0.71
Chlorophacinone	50	0.07	0.08	0.03	7.62	1.95
Cholecalciferol	750	0.12	0.18	2.00	2.00	1.07
Difethialone	25	4.15	0.45	6.29	4.82	3.93
Diphacinone	50	0.01	0.22	3.18	8.42	2.96
Warfarin	250	0.04	0.83	1.72	1.32	0.98
Zinc phosphide	20000	7.81	10.00	0.00	0.69	4.63

Conclusions from the EPA document:

Brodifacoum and difethialone stand out as the two rodenticides posing the greatest potential overall risk to birds and nontarget mammals, followed by bromadiolone and diphacinone. Zinc phosphide also ranked high for overall risk based on the comparative analysis modeling, primarily because of high potential primary risks.

Brodifacoum, difethialone, and zinc phosphide pose the greatest potential primary risks to birds that eat bait. A single zinc phosphide or brodifacoum bait pellet provides more than an LD50 dose for a small bird. In contrast, a small bird would need to eat more than twice its body weight in bait pellets to ingest a comparable dose of a first-generation anticoagulant in a single feeding.

The available data indicates that the first-generation anticoagulants are less hazardous than the more

highly toxic and persistent second-generation anticoagulants.

Mammalian predators and scavengers are at risk from feeding on animals poisoned with anticoagulant baits.

Rodenticide users must follow label directions carefully. Some rodenticides, for example those that contain the active ingredients chlorphacinone and diphacinone, are legal to use in outdoor areas. These products can be used to control field rodents such as gophers, voles, and ground squirrels. Other rodent bait products, such as those that contain the active ingredients brodifacoum, bromodialone or difethialone, can only be used to control rodents found within structures, such as rats and mice. Read product labels carefully before using any pesticide, and follow directions exactly.

Check daily for dead rodents. Wearing gloves, collect the carcasses as soon as possible, place

in plastic bags, and dispose of them in garbage cans with tight lids that other animals cannot open. Wear protective gloves when handling dead animals.

Rodenticides can harm wildlife, pets, and children, and should be used carefully. The EPA has implemented steps to protect consumers and wildlife from exposure to rodenticides. Starting June 4, 2011, the agency banned the sale to residential consumers of the most toxic rat and mouse poisons, as well as most loose bait and pellet products. The EPA is also requiring that all newly registered rat and mouse poisons marketed to residential consumers be enclosed in bait stations that render the pesticide inaccessible to children and pets. Wildlife that consume bait or poisoned rodents will also be protected by EPA's actions.

EPA is strengthening protection of children, pets, and wildlife from rodenticides used in and around the home. As a result of EPA's May 2008 Risk Mitigation Decision for Ten Rodenticides, household rodenticide products must meet new risk-reduction goals.

Some changes include the requirement for use of bait stations. All rodenticide bait products marketed to residential consumers must be sold as a block or paste bait, packaged with an EPA-approved bait station. Products marketed to residential consumers may contain no more than 1 pound of rodenticide bait. While several pesticide active ingredients will still be allowed on the homeowner market, products marketed to residential consumers will no longer contain the most toxic and persistent pesticide active ingredients, that is, the

second-generation anticoagulants brodifacoum, bromadiolone, difenacoum, and difethialone. Products containing these active ingredients will only be available for commercial use and for residential use by professional pest control operators. Up-to-date information about these changes may be obtained from the EPA website at <http://www.epa.gov/pesticides/mice-and-rats/consumer-prod.html>.

Nonnative rodents

Norway rats and house mice consume millions of bushels of grain each year. They destroy it in the field, on the farm, in the elevator, mill, processing plant, store, home, and in transit. In addition, these rodents waste many more millions of bushels by contamination. Food may be severely contaminated because each rodent drops 25 to 150 pellets every 24 hours, voids 10 to 20 cc of urine, and constantly sheds fine hairs.

Rats are omnivorous. They eat nearly every kind of grain, fish, fruit, meat, milk products, and vegetables. These rodents can destroy hundreds of chicks in one night. They attack broilers and even adult hens, ducks, geese, and wild birds. They have been known to seriously injure newborn pigs, lambs, and calves and may kill caged chickens. Health departments, nationwide, annually report hundreds of human babies being bitten by rats. Many viral and bacterial diseases are transmitted to humans by rodent feces and urine, which contaminate food and water.

Rat gnawing causes considerable property damage. Fires are sometimes started by these rodents

Rodenticides

when they damage the insulation of electrical wiring. They may also use flammable materials such as oily rags and matches for building nests, which may cause fires from spontaneous combustion. Extensive damage is sometimes done when Norway rats burrow under buildings. Foundations and lower floors of buildings have been weakened and some have collapsed when rats burrowed under them. Concrete slabs crack when burrows undermine them. Burrows into dikes and outdoor embankments cause erosion and floods.



Norway rat

Norway Rats

Norway rats depend on humans for food and shelter. The most effective population reduction techniques are good sanitation and rodent-proofing.

Rat signs:

- greasy smear marks along travel routes and the edges of holes through which they enter structures
- oblong droppings 1¼ inch long or longer
- gnaw marks on surfaces
- spilled or partially eaten food
- burrows about 2 inches in diameter or larger

Young rats can be distinguished from mice by their blunt tails and smaller ears. The best way to control rats is by following the five-step method. While not every step applies to all situations, control will generally be most successful if multiple methods are applied simultaneously.

Step 1: Habitat Alteration:

Sanitation: Where rats have no place to hide or nest, they cannot thrive. Eliminate all accumulations of trash, debris, etc., inside and out. Clean up all spilled food and litter as soon as possible, but at least once daily. Do not allow pet food to be left where it can be eaten by rats.

Store all materials, lumber, boxes, pipe, etc., on stands at least 18 inches above the floor. Keep all foods in metal containers, which are tightly closed.

Place equipment, appliances, cabinets, etc., flush against the wall or out far enough to allow cleaning behind them.

Use metal garbage cans with tight-fitting lids.



Refuse containers with lids

Step 2: Acute toxicants (zinc phosphide, bromethalin, cholecalciferol) and single-dose anticoagulants (bromadiolone, brodifacoum, difethialone, and difenacoum): The best population reduction technique for large

numbers of rats in areas where food is abundant, such as feedlots, is the use of acute toxicants or single-dose anticoagulants on baits the rats will eat. Bait stations may be required. *Read and follow the label.*

To be sure the rats will eat the bait, pre-bait the area. If grain baits are suitable, the ready-to-use commercial poison baits can be used. Some poisons are available commercially in concentrated form. Fresh baits made of diced apples, sweet potatoes, ground meat, fish, or fish-flavored canned pet food can be used for mixing poisons in concentrated form. Combine toxicants directly with bait and stir until thoroughly mixed. Use immediately.

Do not breathe dust and always wear gloves when mixing or handling poisoned bait. Also wash hands, face, and all utensils immediately after use.

Single-dose acute poison baits should be placed in quantities specified on the label wherever evidence of rats is seen, especially down burrows, but where children and domestic animals cannot reach them and there is no danger of contaminating food or feed. Cover single-dose anticoagulant baits. If necessary, use bait stations. Most single-dose baiting will be more effective if pre-baiting with unpoisoned bait is done for three days. Use more than enough bait and collect all uneaten baits after three days. Dispose of all dead rats. Most single-dose poisons should not be used again in the same area for six months or one year. Single-dose anticoagulants may be left for a longer period of time.

Poison gases are effective fumigants for rats. The kind of area to be

fumigated and its size determine the concentration and amount to be used. Specific directions can be found on the label. Where rat burrows in the soil can be located, burrow fumigation is an effective and quick method to reduce rat numbers. It is also a useful follow-up to a poison bait application. For structures, fumigation is seldom recommended because of human hazard and high cost. The area to be fumigated must be made air-tight. The liquid concentrate can then be piped into the area or poured onto crumpled absorbent material that serves as a wick. Wear safety masks of the type specified on the label. After fumigation is completed, air out the area for several hours before use.

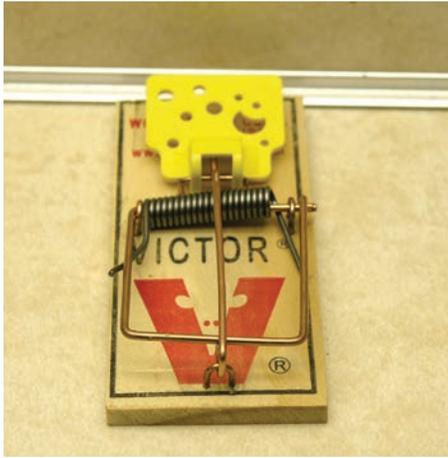
Step 3: Multi-dose anti-coagulants (chlorophacinone, diphacinone, warfarin, and pindone): Rats consume several doses of bait over several days before dying. Single doses of these poisons rarely kill. Keep away from children, pets, and food or feed. Read and follow all label directions.

Most commercial poison baits available are multiple-dose types. Be sure to choose good quality, fresh products that will compete well with the rat's existing food sources.

Multiple-dose poison food baits should be placed in 4 to 16 ounce quantities wherever evidence of rats is seen. If required by the label or to protect children, pets or nontarget wildlife, use bait stations. A bait station is a box with entrance holes large enough for rats, a tamper-proof lid secured by a latch and fastened tightly to the site. Label the box "**poison.**" Check all poisoned baits daily and replenish or replace

Rodenticides

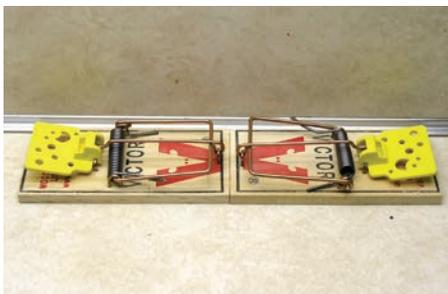
if moldy or rancid. Continue baiting for at least 10 days or until bait consumption ceases. Try alternative locations if no bait is consumed. Dispose of all dead rats.



Single Trap



Double set



Double set parallel

Water containing a multiple-dose poison may be an effective rat poison bait because rats have to drink water. All other water sources should be made unavailable to rats. Commercial concentrates are available to mix with water. Such baits must be exposed in non-metal containers or water fonts such as those used for chicks. Replace water baits if cloudy.

Step 4: Trapping: The most versatile and inexpensive rat traps are live traps, glue boards, rat-size wooden base snap traps, 110 conibear, or #0 leghold traps available in many stores. Always use several traps, but if rats are numerous, many more traps are necessary. Some excellent baits are raisins, nut meats, fresh crisp bacon, and a peanut butter-oatmeal mixture.

Snap traps can be made more effective by enlarging the trigger or pan with a square of thin, stiff cardboard cut slightly smaller than the snap-wire. Smear the cardboard with peanut butter for bait. Place traps where rats are seen, heard, and most likely to run: along walls, under appliances and cabinets, and if necessary, along rafters and pipes. Set traps perpendicular to rat travel routes. Use obstacles to force rats over the enlarged triggers of traps. If several traps are used at once, the rats can usually be eliminated before they become trap-shy.

Step 5: Exclusion: Rodent proofing: Close all openings $\frac{1}{2}$ inch in diameter or larger with concrete, sheet metal, or heavy screening.

Cover all edges of doors, window sashes, etc., with sheet metal or hardware cloth to prevent gnawing and subsequent entry. Extend rodent proofing to a height of 36 inches above the ground or 12 inches above the level of piled materials.

Where utilities enter concrete, stuff steel wool or hardware cloth in holes and fill with concrete, and where utilities enter wood, fit sheet metal tightly around the utility openings.

To rat-proof an isolated structure, such as feed storage sheds or corn crib, attach a skirt of $\frac{1}{2}$ inch wire mesh at least 3 feet wide to the structure. Bury the bottom edge 12 inches in the ground and cover the top edge with an 8-inch strip of sheet metal and fasten to the structure. Treat doors and windows as suggested above. Attached structures, such as feed storage rooms, will have to be completely lined with hardware cloth.

Concrete foundations should extend at least 18 inches below ground to prevent rat burrowing. Foundations less than 18 inches deep will require an L-shaped curtain extending outward from the foundation to prevent burrowing beneath the foundation.

Keep floor drains tightly covered with metal grill work to stop entry from sewers.

Study Questions

These study questions are designed to help you learn the material on pages 35 through 40.

- Efficacy of the anticoagulant products depends on the _____.*
 - attractiveness
 - timing
 - palatability
 - both a and c
- Which anticoagulant has the greatest primary risk to mammals?*
 - warfarin
 - zinc phosphide
 - brodifacoum
 - bromethalin
- Rats eat _____.*
 - grain and fish
 - fruit and meal
 - vegetables and milk products
 - all of the above
- In Norway rat control, the first step of the five-step program is _____.*
 - shooting the rats
 - poisoning the site
 - sanitizing (cleaning up)
 - using a big cat
- Most single-dose rat poisons should not be used again in the same area for:*
 - 1 to 4 months.
 - 6 to 12 months.
 - 18 to 24 months.
 - more than 2 years.
- The fifth step in a five-step rat control program is _____.*
 - trapping
 - using single-dose poison
 - exclusion
 - using multiple-dose poison
- _____ -inch wire mesh, 3 feet wide, can be used to rat-proof sheds and corn cribs.*
 - $\frac{1}{4}$
 - $\frac{1}{2}$
 - $\frac{3}{4}$
 - 1
- Concrete foundations should extend at least _____ inches below ground to prevent rat burrowing.*
 - 6
 - 16
 - 18
 - 24

House Mice

House Mice

House mice can consume and contaminate food, destroy property, and spread disease. They depend on humans for food and shelter. Population reduction techniques will be more effective when food and shelter are reduced first by good sanitation and rodent proofing.



House mouse

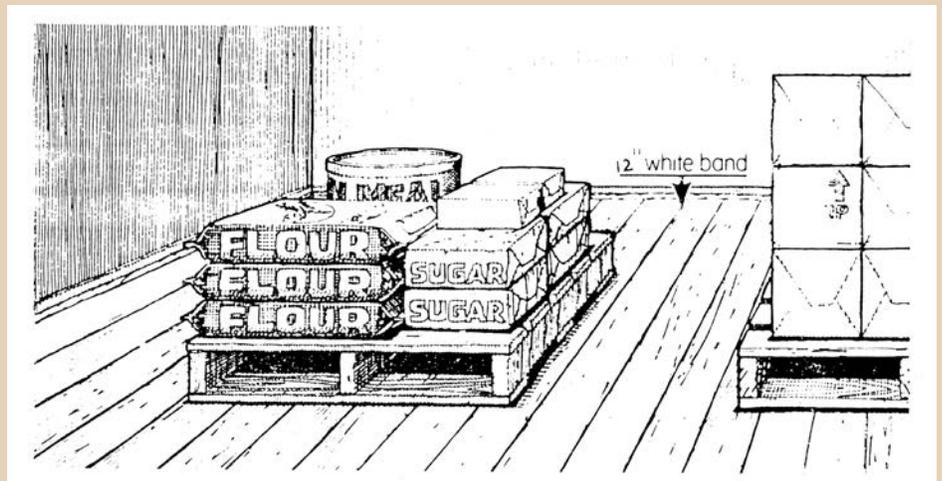
Mice leave greasy smears along their travel routes and at the edges of entry holes, small oblong droppings about $\frac{1}{8}$ inch long, gnaw marks on surfaces, and spilled or partially eaten food. House mice can be identified by grayish brown color, grayish belly, and uniformly gray, naked tail. The five steps previously described for Norway rat control also can be applied to house mice control with minor modifications. Control of house mice differs in

important ways from the control of Norway or roof rats. Mice are smaller and can enter narrower openings, making rodent-proofing more difficult. They have limited areas of movement (home range) and require little or no free water. Although they have greater reproductive capability than rats, house mice are usually less sensitive (often far less sensitive) to many rodenticides. Those who do not take these differences into account when attempting house mouse control can expect poor results.

Step 1: Habitat alteration:

Sanitation: Mice cannot thrive where they have no place to hide and nest. Eliminate accumulations of trash, debris, etc., inside and out. Clean up all spilled food and litter as soon as possible, but at least once daily.

- Store all materials, lumber, boxes, pipe, etc. on stands at least 18 inches above the ground or floor and 1 foot from walls.
- Store food and feed in metal, rodent-proof containers, if possible. Otherwise store on stands at least 18 inches above floor. Keep all food containers tightly closed.



A 12-inch (30.5-cm) white band painted on the floor next to the wall serves as a reminder to keep items away from walls. It also will allow you to detect rodent droppings or other signs more easily.

- Set equipment, appliances, cabinets, etc., flush against the wall or out far enough to allow cleaning behind them.
- Use metal garbage cans with tight-fitting lids.

Regular removal of debris and control of weeds from around structures will reduce the amount of shelter available to rodents. In some instances, a strip of heavy gravel placed adjacent to building foundations or other structures will reduce rodent burrowing at these locations. Keep the perimeter of buildings and other structures clean of weeds and debris (including stacked lumber, firewood, and other stored materials) to discourage rodent activity and to allow easier detection of rodent signs.

Step 2: Non-anticoagulant rodenticides and single-dose anticoagulants:

At present, three non-anticoagulant rodenticides are registered by EPA against house mice: bromethalin, cholecalciferol (vitamin D3), and zinc phosphide. All are potentially useful for controlling anticoagulant-resistant populations of house mice.

Of these active ingredients, bromethalin and cholecalciferol are formulated to serve as chronic rodenticides, applied so that house mice will have the opportunity to feed on the baits one or more times over the period of one to several days. Bait acceptance is generally good when formulations appropriate for house mice are selected. Zinc phosphide differs from the other two compounds in that pre-baiting (offering mice similar but nontoxic bait before applying the zinc phosphide-treated bait) is recommended to

increase bait acceptance. Zinc phosphide baits are not designed to be left available to mice for more than a few days, because continued exposure is likely to result in bait shyness within the population. Be sure to follow label recommendations on any specific product to achieve best success.

Oatmeal, ground or rolled wheat, rolled barley, ground or rolled milo, and corn have been successfully used as chief ingredients of toxic baits for house mice. Grass seed, such as whole canary grass seed (*Phalaris canariensis*), is often highly accepted by house mice and can be very effective as a principal bait ingredient. In general, the fresher the bait, the better it will be accepted by mice. Rodent baits should always be made from high-quality food materials, and baits should be replaced or replenished regularly.

Place poison baits at 8 to 12 feet intervals in areas where evidence of mice is seen. It is best to use a bait station; check often and keep bait fresh. A bait station is a box with entrance holes large enough for mice and a tamper-proof lid secured by a latch. Fasten box securely so it cannot be moved. Label box "**poison.**" Use ¼ to ½ ounce of food bait per bait site.

All poisoned baits should be checked daily and replenished or replaced if cloudy, moldy, or rancid. Baiting should continue for at least 15 days or until bait consumption ceases. Try alternative locations if no bait is consumed. Dispose of all dead mice.

Step 3: Multi-feed anticoagulant rodenticides:

Anticoagulants (slow-acting, chronic toxicants). House mice are susceptible to

House Mice

all of the various anticoagulant rodenticides, but they are generally less sensitive (often far less sensitive) to the active ingredients than are Norway or roof rats.

It usually requires a few more feedings to produce death with the first-generation anticoagulants (such as warfarin, diphacinone, and chlorophacinone) than with the second-generation anticoagulants (such as brodifacoum and bromadiolone). All anticoagulants provide good to excellent house mouse control when prepared in acceptable baits.

Step 4: Trapping: *Snap Traps:*

The simple, inexpensive, wood-based snap trap is available in most hardware and farm supply stores. Traps should be baited with a small piece of nutmeat, chocolate candy, dried fruit, or bacon tied securely to the trigger. Peanut butter or marshmallows also may be used as bait. Because mice are always in search of nesting materials, a small cotton ball will also work as a bait when attached securely to the trigger. Food baits that become stale lose their effectiveness. Snap traps can be made more effective by enlarging the tripper or pan with a square of thin, stiff cardboard cut slightly smaller than the snap-wire. Smear the cardboard with peanut butter for bait. Set traps close to walls, behind objects, in dark places, and in locations where mouse activity is seen. Place the traps so that when mice follow their natural course of travel (usually close to a wall) they will pass directly over the trigger. Set traps so that the trigger is sensitive and will spring easily. Set traps perpendicular to mouse travel routes. Use obstacles to force mice over the enlarged trippers of traps. Use enough traps to make the campaign short and

decisive. Mice seldom venture far from their shelter and food supply, so traps should be spaced no more than about 6 feet (1.8 m) apart in areas where mice are active. If many traps are used at once, the mice can usually be eliminated before they become trap-shy. If mice become trap-shy, hide the trap except for the baited trigger, with a layer of flour, soil or sawdust, and use several different kinds of bait.

Multi-Capture Traps: Multiple-capture (automatic) mouse traps are available from some hardware and farm supply stores as well as from pest control equipment distributors. These traps work on the principle that mice enter small holes without hesitation. Such traps may catch many mice in a single setting, but should be checked and emptied periodically so that mice do not die of starvation or exposure in the traps.

Sticky Traps: An alternative to traps are glue boards, which catch and hold mice attempting to cross them, much the way flypaper catches flies. Place glue boards wherever mice travel—along walls or in established runways. Do not use glue boards where children, pets, or desirable wildlife can contact them. Glue boards lose their effectiveness in dusty areas unless covered, and temperature extremes may affect the tackiness of some glues. They are considered less effective for capturing rats than for mice. Glue boards can be purchased ready-to-use, or they can be made.

Step 5: Exclusion: Close all openings $\frac{1}{4}$ inch in diameter or larger with concrete, sheet metal, or screening to achieve rodent-proofing.

Cover all edges of doors, window sashes, etc., with sheet metal or hardware cloth to prevent gnawing and subsequent entry.

To prevent climbing, tightly fasten a 12-inch square of sheet metal in all corners at least 12 inches above the floor. The square should lie flat against both walls.

Where utilities enter concrete, stuff steel wool or hardware cloth in holes and fill with concrete and where utilities enter wood, fit sheet metal tightly around the utility.

To rodent-proof an isolated structure, such as feed storage sheds

or corn crib, attach a skirt of ¼-inch wire mesh at least 3 feet wide to the structure. Bury the bottom edge 12 inches in the ground and cover the top edge with an 8-inch strip of sheet metal and fasten to the structure. Treat doors and windows as suggested above. Attached structures, such as feed storage rooms, will have to be completely lined with hardware cloth.

For additional information, refer to the following K-State Research and Extension publication:

Controlling House Mice, MF1123.

Study Questions

These study questions are designed to help you learn the material on pages 42 through 45.

1. *House mice can be identified by their _____.*

- a. grayish brown color
- b. grayish belly
- c. naked tail
- d. all the above

2. *Multiple-dose mouse poison means the mice must consume _____.*

- a. 3 doses within 30 minutes
- b. 5 doses within 5 hours
- c. 2 doses within 2 hours
- d. several doses over several days

3. *The fourth step in a five-step house mouse control program is _____.*

- a. sanitation
- b. trapping
- c. exclusion
- d. using single-dose poison

4. *To mouse-proof a storage shed or corn crib, attach a ¼ inch wire mesh at least _____ feet (foot) wide to the structure.*

- a. 4
- b. 3
- c. 2
- d. 1

Native Rats

These rats include the wood rat, cotton rat, and kangaroo rat. They all live in different habitats and consume different foods and exhibit different behaviors, which are important in control methods.

Wood Rats

The native wood rat, also locally named pack rat, and brush rat, superficially resembles the common Norway rat.

Wood rats do not frequent towns or cities as often as do their cousins the Norway rats, but often live in the vicinity of farmhouses or summer homes. Occasionally they become a nuisance by invading dwellings and other buildings to construct nests or search for food.



Eastern woodrat

Though not often injurious to crops and agricultural enterprises, occasionally wood rats become numerous enough to do limited damage to crops in fields and gardens. In some regions they have been known to inflict injury to orchard trees. Valuable nut crops are sometimes carried off by these rodents. Wood rats occasionally strip bark from the crowns of trees for nest material. This type of injury generally occurs in dense, 15- to 30-year-old stands and is seldom widespread. They also cause problems in some buildings by fouling stored materials and creating unsightly messes.

These animals have a strong collecting habit and form bulky houses that are about 2-feet high, of sticks, cactus, cow dung, bones and other debris. Somewhere within the house or below ground, the wood rat makes a cup-shaped or ball-like nest of fibrous materials.

Controlling Wood Rat Damage

Troublesome wood rats may be discouraged through exclusion, destruction of dens, or the use of repellents. Population reduction, when necessary, is most often accomplished by trapping.

Exclusion involves primarily the proper construction and maintenance of buildings to prohibit their entrance. Pack rats may be permanently excluded from buildings and stored foods by the same methods directed toward the common Norway rat (described previously). Because several species of woodrats are agile climbers, all entrances to buildings, including those at the attic level, must be closed. Cracks and openings in building foundations, and any openings for water pipes, electric wires, sewer pipes, drain spouts, and vents must be sealed. Also check for openings in attic vents, broken roof shingles, or other gaps next to the eaves. No hole larger than ½ inch (1.3 cm) should be left unsealed. Make sure doors, windows, and screens fit tightly. If gnawing is a problem, edges can be covered with sheet metal. Coarse steel wool, wire screen, and lightweight sheet metal are excellent materials for plugging gaps and holes.

Some of the available commercial repellents used against rabbits and mice may, in some situations, prove effective in

reducing wood rat damage to young trees. Objectionable odors from substances like mothballs (naphthalene), or tacky substances, may make an enclosed area temporarily less desirable for wood rats, as for other mammals. Likewise, noxious tastes may make an item less palatable. No wood rat repellents, however, are registered by the EPA. In general, chemical repellents are not considered a practical solution to wood rat problems.

Anticoagulants are effective for wood rat control and are especially suited for use around structures because of their low hazard to pets and children. Most baits formulated for commensal rats and house mice give effective wood rat control. Anticoagulants work by interfering with the blood-clotting mechanism. Death usually occurs four to five days after feeding on bait begins. With most anticoagulants, such as chlorophacinone or diphacinone, feeding must occur daily for four to five days. Finely ground or meal-type anticoagulant baits are recommended. Because wood rats have a tendency to pack away items, pellet bait should be avoided as it is often cached at the nest site. Cached bait is probably not effective in minimizing reinvasions of the area, so it is essentially wasted and may present hazards to nontarget species. Anticoagulants are usually put out in bait boxes, but wood rats tend to fill boxes with sticks and other debris. Therefore, use open bait containers. Bait exposed in this manner must be placed so nontarget species, pets, and children do not have ready access to it. Access to the bait by pets

can be minimized by inverting a wooden crate over the bait tray. Baiting sites should be located near existing wood rat runways, feeding sites, or nests.

Wood rats that frequent buildings can be taken through the use of ordinary live traps, glue boards, or wooden snap-type traps. Wood rats are among the easiest animals to trap. Good baits include nut meats, bacon rind, peanut butter and oatmeal, prunes, raisins and other dried fruit, and biscuits. Seal all points of possible wood rat access to prevent re-entry. Many producers have good success catching wood rats in small cage traps baited with a small ball of aluminum foil.

In areas where wood rats are a particular menace, foresters and ranchers will sometimes burn their dens. This practice should be attempted with extreme caution to avoid accidental fires. Burning will prevent reoccupation by new rats and will lengthen the problem-free period.

Cotton Rats

Cotton rats resemble a half-grown Norway rat. Cotton rats are dependent upon a dense stand of vegetation for both food and protection from predators. Within their range, cotton rats occupy grassy fields and meadows, marshy areas, wastelands and roadsides, and ditch banks overgrown with weeds. On occasion they inhabit cropland.

Where cotton rats occur they may be detected by their well-defined runways and connecting burrows. Runways are about 3 inches across and burrows are correspondingly larger. Indications of active areas are runways with small piles of freshly clipped vegetation and

Native Rats

scattered or small piles of ½ inch-long droppings.

The amount of damage done by cotton rats depends on their abundance and the type of crop attacked. After a crop begins to grow, the rats move into various parts of the field and build up their runway and burrow systems, remaining as long as food and shelter are available or until appropriate control methods are administered. Cotton rats are known to damage a wide variety of field crops. These include grasses, alfalfa, grains, sugar beets, vegetables, fruits, squash, corn, sweet potatoes, and melons. The flesh and seeds of tomatoes are also eaten.



Cotton rat

Controlling Cotton Rat Damage

Control through natural means is of assistance when populations are at a low ebb. Cotton rat populations are affected by predators such as foxes, dogs, coyotes, raccoons, badgers, weasels, mink, domestic cats, owls, hawks, and snakes. Coccidiosis is common, and plague and murine typhus have been found occurring naturally in cotton rats. During times of high population, a fungus disease aided by wet weather, takes a great toll on the rats.

Exclusion: If the area is small or the crop to be protected is of

high value, a sheet metal barrier 18 inches (46 cm) tall may be used to exclude cotton rats. Bury the barrier about 6 inches (15 cm) to prevent cotton rats from burrowing under it.

Cultural Methods: Remove dense cover by burning, mowing, plowing, or using herbicides to reduce habitat and prevent large population increases. Habitat modification is best as a preventive measure, since this control method will have little effect on the ensuing damage once a population reaches its peak.

Trapping: Small rodent live traps or rat-sized snap traps are effective for catching a small number of animals. The traps should be baited with a mixture of peanut butter and oatmeal or a piece of fresh carrot or sweet potato. The trap should be set in the runway at a right angle to the direction of travel.

Cotton rat populations in Kansas have not reached a high enough peak to cause significant widespread damage since the mid-1950s, but isolated local population increases are not uncommon.

Kangaroo Rats

Kangaroo rats, also known as sand rats, are distinctive rodents with small front legs, long powerful hind legs, and long tufted tails. Brown or tan back, pure white under parts, and a pair of external, fur-lined cheek pouches like those of pocket gophers. The kangaroo rat occurs in most areas of sandy soil in central and western Kansas.

Kangaroo rats live in short, shallow burrows in sandy or soft ground. Occasionally they may be found in areas of harder soil. Kangaroo rats mainly eat seeds but may occasionally eat plant parts and insects. Kangaroo rats are nocturnal and never active during the day. They do not hibernate but will store large quantities of seeds for use in inclement weather.

Where farming is practiced in sandy areas, kangaroo rats may damage the outer rows of grain crops by digging up and eating the seeds. When present in high populations, kangaroo rats may be scattered in small colonies throughout the field. Kangaroo rats will also feed on the tops of young corn plants and may do considerable damage if large numbers of rats are present.



Kangaroo rat

Controlling Kangaroo Rat Damage

Exclusion: Exclusion is most often accomplished by the construction of rat-proof fences and gates around the area to be protected. Most kangaroo rats can be excluded by $\frac{1}{4}$ -inch (1.3-cm) mesh hardware cloth, 30 to 36 inches (75 to 90 cm) high. The bottom 6 inches (15 cm) should be turned outward and buried at least 12 inches (30 cm) in the ground. Exclusion may be

practical for small areas of high-value crops, such as gardens, but is impractical and too expensive for larger acreages.

Cultural Methods: Alfalfa, corn, sorghum, and other grains are the most likely crops to be damaged by kangaroo rats. When possible, planting should be done in early spring before kangaroo rats become active to prevent loss of seeds. Less palatable crops should be planted along field edges that are near areas infested with kangaroo rats.

High kangaroo rat numbers most often occur on rangelands that have been subjected to overuse by livestock. Kangaroo rats usually are not abundant where rangelands have a good grass cover, because many of the forbs that provide seeds for food are not abundant in dense stands of grass. Thus, changes in grazing practices accompanied by control programs may be necessary for substantial, long-term relief.

Trapping

Live Traps: Trapping with box-type (wire cage) traps can be successful in a small area when a small number of kangaroo rats are causing problems. These traps can be baited successfully with various grains, oatmeal, oatmeal and peanut butter, and other baits. One problem is the disposal of kangaroo rats after they have been trapped. They usually die from exposure if they remain in the trap for more than six hours. If the rats are released, they should be taken to an area more than 1 mile (1.6 km) from the problem site. The release site should provide suitable habitat and be acceptable

Native Rats

to everyone involved. Do not release kangaroo rats in areas where landowners do not want them.

Snap Traps: Trapping with snap traps is probably the most efficient and humane method for kangaroo rats. Mouse traps will suffice for the younger smaller animals, but rat traps are needed for larger kangaroo rats. Successful baits include whole kernel corn, peanut butter and oatmeal, and oatmeal paste, which are placed on the trigger mechanism. Place traps near, but not inside, the burrow entrances or along runways between mounds. Check traps each day to remove dead kangaroo rats. Reset tripped traps and replace baits that may have been removed by ants or other insects. Do not use whole kernel corn

when large numbers of seed-eating songbirds are in the area.

Other Methods: If kangaroo rats from only one or two mounds are causing the problems, and water is available, they may be flushed from their burrows and either killed or allowed to go elsewhere. Collapse the mounds after the kangaroo rats have been driven out. This not only levels the surface but also allows you to detect burrow reinvasion by other kangaroo rats. Use caution when flushing burrows with water or trapping kangaroo rats. The burrow entrances are sometimes used by rattlesnakes seeking to escape heat and direct sunlight during hot days. Even on warm days, rattlesnakes may be found near mounds because kangaroo rats are a source of food for them.

Study Questions

These study questions are designed to help you learn the material on pages 46 through 50.

- Wood rats are occasionally found living near _____.*
 - cities
 - towns
 - meadows
 - farmhouses
- _____ are among the easiest animals to trap.*
 - wood rats
 - kangaroo rats
 - house mice
 - Norway rats

3. *Cotton rats resemble _____.*

- house mice
- wood rats
- half-grown Norway rats
- kangaroo rats

4. *Predators of cotton rats include _____.*

- coyotes and foxes
- badgers and raccoons
- owls and hawks
- all the above

5. *The bait for kangaroo rats should be _____.*

- grain
- peanut butter
- crisp bacon
- cheese

This group includes white-footed mice, voles, pocket mice, jumping mice, harvest mice, and grasshopper mice. Definite identification should be made (by an expert, if necessary) because methods, materials, and necessity for control vary for the different mice species.



White-footed mouse

Voles

Meadow mice or voles, of the genus *Microtus*, are the most common species causing the damage to small trees and orchards. Other native mice are nearly always neutral or beneficial in their habits. All mice of the genus *Microtus* are much alike. Their common names are field mouse, meadow mouse, and meadow vole. They have short legs and tails, comparatively long and coarse fur, heavy bodies and short rounded ears. They are dark-colored and are sometimes mistaken for young moles. They prefer low-lying fertile lands, grassy meadows, prairies, and similar places. Breeding three to four times a year, they are very prolific, producing litters of two to six each.

Small rodents are characteristically short-lived and tend to fluctuate widely in numbers, a characteristic based on their ability to breed rapidly when conditions are right. At the peak of its cycle the prairie

vole may attain a population of 1,000 per acre.



Meadow vole

Controlling Damage

Field mice can cause damage to young trees in windbreaks, orchards, Christmas tree plantings, and nursery stock. Mice damage trees by girdling roots and stripping bark, usually in late winter when other food is scarce; however, green-barked young trees are preferred while older trees generally receive less damage.

Begin watching for signs of increased mouse populations in early autumn. Look for nests and runways in accumulated grass or duff covering the soil. Fresh grass clippings, chewed fruit, feces, and frequent sightings of mice are other indicators. A good way to detect the presence of mice in orchards is to place a fresh apple on the ground near the tree and examine it several days later to see if it has been chewed on. If uncertain about the species of mouse present, use a wooden-based snap trap baited with apple to capture one for identification.

Great numbers of mice are eaten by hawks, owls, foxes, coyotes, skunks, weasels, mink, and snakes. These enemies provide some natural control over the mouse population. Although predators seldom control rodent population cycles, they do reduce the extreme

Native Mice

peaks of rodent abundance that otherwise might occur. Harsh weather conditions, food shortages, and diseases may also reduce mouse populations.

When natural controls do not suffice, artificial methods must be used to control mouse outbreaks. These efforts should be applied in late fall because they are ineffective after snow has covered the ground.

One or more of the following methods should be effective in protecting trees and shrubs from damage by mice.

Control Options

Habitat management: Eliminate high grass cover through repeated mowing. Maintain a 3-foot radius grass-free area around the immediate base of trees and shrubs. This vegetation may be scalped by hand or with mechanical equipment, or may be killed with herbicides. Cultural practices have definite limitations, particularly in areas where snow provides winter cover for mice.

Mouse guards: Encircle the trunks of fruit and ornamental trees with ¼-inch mesh hardware cloth or hail screen. This should be set into the ground 8 inches at the base of the tree and should extend at least 20 inches above the soil surface. Higher guards should be constructed where deeper snow is expected.

Repellents: Use chemical repellents for home use or in orchards but do not rely on repellents alone. Under stress conditions mice may even feed on treated bark. For best results, combine with other procedures such as mouse guards or spot baiting.

Baits: Zinc phosphide is a commonly used toxicant for vole control. It is a single-dose toxicant available in pelleted and grain bait formulations and as a concentrate. Zinc phosphide baits generally are broadcast at rates of 6 to 10 pounds per acre (7 to 11 kg/ ha), or are placed by hand in runways and burrow openings. Although prebaiting (application of similar nontreated bait prior to applying toxic bait) is not usually needed to obtain good control, it may be required in some situations, such as when a population has been baited several times and bait shyness has developed. Zinc phosphide baits are potentially hazardous to ground-feeding birds, especially waterfowl. Placing bait into burrow openings may reduce this hazard.

Anticoagulant baits containing chlorophacinone or diphacinone are also effective in controlling mice. Anticoagulants are slow-acting toxicants requiring from 5 to 15 days to take effect. Multiple feedings are needed for most anticoagulants to be effective.

The most effective period for bait application is late fall after the grass cover has dried and just before snow cover is expected. Select a warm, clear, quiet day as voles are most active under these conditions.

Certain baits may be hazardous to nontarget species. Sickness or death can result in other animals that eat the bait or consume bait-killed mice. Apply all baits in strict accordance with label directions.

For additional information, refer to the following K-State Research and Extension publications:

Controlling Voles in Lawns and Landscapes, MF2975

Study Questions

These study questions are designed to help you learn the material on pages 51 through 52.

1. *Native mice include _____.*
 - a. white-footed mice and voles
 - b. pocket mice and jumping mice
 - c. harvest mice and grasshopper mice
 - d. all the above
2. *Mice damage trees by _____.*
 - a. eating the seeds
 - b. eating the leaves
 - c. girdling the roots
 - d. nesting in the branches
3. *Cultural practices for mouse control are limited where _____.*
 - a. there is tall grass
 - b. snow provides winter cover
 - c. orchard trees are close together
 - d. children are present
4. *Mouse guards should be made of _____ inch mesh hardware cloth.*
 - a. $\frac{1}{4}$
 - b. $\frac{1}{2}$
 - c. $\frac{3}{4}$
 - d. 1
5. *For best results, repellents for mouse control should be used in combination with _____.*
 - a. mouse guards
 - b. no cultural practices
 - c. spot baiting
 - d. a and c above
6. *Mouse baits are most effective when applied in _____.*
 - a. late fall
 - b. mid-winter
 - c. early spring
 - d. summer

Black-Tailed Prairie Dogs

Black-Tailed Prairie Dogs

Prairie dogs are social mammals that live in colonies on short- and mixed-grass prairie. Of the four species native to the United States, black-tailed prairie dog is the one found in Kansas.

The black-tailed prairie dog is a thickset, burrowing squirrel with a black-tipped tail. The fur has a distinct reddish tan cast, the eyes are large, and the ears are inconspicuous. The legs are short with five toes on each foot and the head is broad and round. Adults vary from 10 to 12 inches in length and weigh between 1½ and 2½ pounds.

Prairie dog colonies, called towns, house from only a few to thousands of individuals. Within a town, prairie dogs form small social groups known as coterie. They are active only during the day and do not hibernate but may go into extended periods of torpor or stay below ground for extended periods during severe winter weather. Between four and five per litter are born each year in March or April. They are highly susceptible to plague, which kills many of them annually.

The population of dogs per acre is greatest during the spring after the young are born and lowest in late winter. The population density of black-tailed prairie dogs varies from five per acre in late winter to 15 or more per acre in the summer.

Effects on Soils and Range

These rodents increase the water holding capacity of soil. By bringing subsoil to the surface where it weathers, they accelerate natural soil formation. Their burrows are about 10 yards

apart with conspicuous mounds surrounding them. In a typical town with 25 holes per acre (this may vary from 10 to 120), the amount of bare soil exposed on the mound and the area around it is less than 4 percent of the total area. On the gently sloping short-grass range where most prairie dogs live, this amount of denudation probably does not cause severe soil washing but may increase wind erosion of soil; however, where cover is poor, prairie dogs lay bare a higher percentage of ground. In essence, where harmful erosion has started, prairie dogs may make it worse. Rarely are they a primary cause of erosion. Most prairie dog colonies thrive on short and mixed grass prairie that is in fair condition. On poor range, the colonies are common but sparsely inhabited. Prairie dogs thrive on short-grass range of any condition.



Prairie dog

Controlling Damage

In many cases, overgrazing by domestic animals on rangeland will encourage prairie dogs. Prairie dogs may disappear if the pasture is brought into a good range condition by normal or above normal rainfall or deferred grazing in the mixed grass prairie region of central Kansas. On short-grass range, direct control is usually necessary.

Black-Tailed Prairie Dogs

Use of toxicants, when done in accordance with product labels, does not pose a serious hazard to livestock or nontarget wildlife. Misuse of poison bait can create unnecessary dangers to both mammals and birds. Fumigating burrows kills all wildlife inside, including beneficial species such as cottontails, burrowing owls, and black-footed ferrets.

Black-Footed Ferrets

U.S. Fish and Wildlife Service issued a recovery permit to allow the reintroduction of the black-footed ferret into several locations in Kansas. These ferrets are not designated as “experimental” as allowed under section 10(j) of the Endangered Species Act, and therefore are fully endangered as defined. Because the black-footed ferret is an endangered species, signs of its existence should be explored thoroughly before undertaking a control program for prairie dogs. If a ferret is suspected of inhabiting the area, report its presence to state wildlife authorities before undertaking prairie dog control.

Ferrets are found exclusively in prairie dog towns because they prey upon the prairie dogs. Look for ferret ramps, long, narrow areas of overturned soil. In the snow, look for ferret tracks wandering all over prairie dog towns.



Black-footed ferret

Grazing Management: Proper range management can be used to control prairie dogs in areas with adequate rainfall. Use stocking rates that maintain sufficient stand density and height to reduce recolonization of previously controlled prairie dog towns or reduce occupation of new areas. The following general recommendations were developed with the assistance of extension range management specialists and research scientists.

Stocking Rate: Overgrazed pastures are favorable for prairie dog town establishment or expansion. If present, prairie dogs should be included in stocking rate calculations. At a high population density of 25 prairie dogs per acre (60/ha) and dietary overlap of 75 percent, it takes 6 acres (2.4 ha) of prairie dogs to equal 1 Animal Unit Month (AUM) (the amount of forage that one cow and calf ingest per month during summer [about 900 pounds; 485 kg]).

Rest/Rotation Grazing: Rest pastures for a period of time during the growing season to increase grass height and maintain desired grass species. Instead of season-long continuous grazing, use short duration or rapid rotation grazing systems, or even total deferment during the growing season. Livestock can be excluded from vacant prairie dog towns with temporary fencing to help vegetation regain vigor and productivity. Mid- to tallgrass species should be encouraged where they are a part of the natural vegetation. In semiarid and shortgrass prairie zones, grazing strategies may have little effect on prairie dog town expansion or establishment.

Black-tailed Prairie Dogs

Grazing Distribution: Prairie dogs often establish towns in areas where livestock congregate, such as at watering sites or old homesteads. Move watering facilities and place salt and minerals on areas that are underutilized by livestock to distribute livestock grazing pressure more evenly. Prescribed burns in spring may enhance regrowth of desirable grass species.

Cultivation: Prairie dog numbers can be reduced by plowing or disking towns and leaving the land fallow for 1 to 2 years where soil erosion is not a problem. Establish tall grain crops after the second year to further discourage prairie dogs. Burrows can be leveled and filled with a tractor-mounted blade to help slow reinvasion. Flood irrigation may discourage prairie dogs.

Poisoning

If population reduction is necessary, the most workable method now known is baiting with rodenticides. During the spring and summer when the prairie dogs feed almost entirely upon green food, they are very difficult to poison. After the grasses and roots have become dried, the prairie dogs will consume poisoned grain; therefore, late fall or early winter is the best time to use poison grain baits, when green food is no longer available. Many producers seem to prefer the use of chlorphacinone treated wheat (Rozol) to control prairie dogs. Efficacy is good and prebaiting is not required. Rozol is placed at least 6 inches down into the burrow so nontargets such as grainivorous birds are unlikely to consume the bait. Any carcasses found on top of the ground must be removed, so follow up is necessary and required by the label.

When using zinc phosphide, watch the weather forecast. On a day with calm, sunny weather, use the pre-bait to treat each burrow with clean, unpoisoned oats. Then in two or three days, when pre-bait is eaten, in sunny weather, thoroughly treat the entire colony. When scattering the oats, apply the amount indicated on the product label on the hard, clean ground around the burrow. Do not place the bait on the mound, or in the grass away from the mound. Do not put the grain in lumps or piles. Only treat pastures where livestock have been removed.

Delay treatment if rain is predicted. Usually a large percentage of the prairie dogs will be destroyed. Any animals that survive then can be destroyed by fumigation.

Results are better when the poison is scattered in the early morning. Wind and rain drastically reduce the effectiveness of the treatment. All burrows in a large colony must be treated. Grain can be scattered conveniently by walking or with the use of an all terrain vehicle (ATV), which can greatly increase the acreage treated. One person with an ATV and placing the bait in the burrow can treat 160 acres daily. A person on foot can cover about 80 acres daily. Wear gloves and after distributing the poison baits, stay away from the area for at least 24 hours.

Fumigating

Prairie dogs surviving the use of poison grain baits can be killed with a fumigant. A permit is required from the Kansas Department of Wildlife, Parks and Tourism (KDWPT) before using fumigant. A permit application

Black-Tailed Prairie Dogs

must be signed by the extension wildlife specialist at Kansas State University before being considered for issuance by KDWPT. On a small scale, fumigating is neither too expensive nor laborious.

Fumigate only burrows known or strongly suspected to be occupied. Mark all burrows to be treated with wooden stakes, turf paint, or soil conservation engineering flags. As the burrows are treated, the markers can be removed or pushed over.

The burrow should be tightly closed with soil after fumigation to make the gassing more effective. Frequently, one fumigation will kill all of the prairie dogs. If any burrows are reopened or activity is noted after treatment, the active burrows should be re-fumigated. Much labor is avoided and a better estimate of control can be made if retreatment is done the day after treatment.

There are some limitations on the use of fumigants. Fumigant tends not to be effective in dry soil. Fumigation fails sometimes because of configuration of the burrow system, length of the burrow system, absorption of gasses into ground cracks or interconnecting burrows. Fumigation, when carried out as the initial control method on large prairie dog colonies, is expensive, laborious, often disappointing, and therefore, not recommended.

Prairie dogs are much less abundant in late fall and winter than in the spring and summer; therefore, population reduction should be started in the fall or early winter. Prairie dog populations can be controlled, but persistence is important. Prairie dogs can repopulate an area rapidly.

Products used in prairie dog control may be hazardous to other wildlife. The user of any control method is responsible for following the label to minimize negative impacts to nontarget species. All poison grain and fumigant material used in controlling prairie dog damage must be registered by the Environmental Protection Agency and the state of Kansas. If you use these materials, follow instructions on the label. For additional information, refer to the K-State Research and Extension Publication: *Prairie Dog Management*, MF2702.

Black-Tailed Prairie Dogs

Study Questions

These study questions are designed to help you learn the material on pages 54 through 57.

1. *Prairie dog litters are born each year in _____.*
 - a. January–February
 - b. March–April
 - c. June–July
 - d. September–October
2. *The effect of prairie dogs on the soil is _____.*
 - a. to increase water holding capacity
 - b. to bring subsoil to the surface
 - c. a and b above
 - d. none of the above
3. *Fumigation for prairie dogs can also kill _____ in the burrow.*
 - a. cottontail rabbits
 - b. black-footed ferrets
 - c. burrowing owls
 - d. all the above
4. *An endangered species found in prairie dog towns is the _____.*
 - a. kangaroo rat
 - b. black-footed ferret
 - c. burrowing owl
 - d. red mink
5. *A permit for fumigating prairie dogs is required from the _____.*
 - a. U.S. EPA
 - b. U.S. Department of Agriculture
 - c. Kansas Department of Health and Environment
 - d. Kansas Department of Wildlife, Parks and Tourism
6. *Prairie dog poisons and fumigants must be registered by the _____.*
 - a. U.S. Environmental Protection Agency
 - b. State of Kansas
 - c. U.S. Food and Drug Administration
 - d. a and b above

Pocket Gophers

Pocket gophers get their name from their fur-lined (pocket-like) cheek pouches in which food is carried. An adult plains pocket gopher weighs about one pound and is 10 ½ to 12 inches long, of which the sparsely haired tail constitutes one-fourth. The two cheek pouches are used for carrying food to storage chambers but are not used in transporting soil.



Gopher mounds



Plains pocket gopher

For most of the year, pocket gophers are solitary. Only a few cases have been recorded of multiple inhabitants in one burrow. They occurred in the spring when a male and female would be expected to occupy the same burrow briefly for mating.

The burrow systems of the plains pocket gopher consist of both deep and subsurface runways. The subsurface runways, some of which are several hundred feet long, are the more extensive. Usually there is a single major subsurface runway with shorter runways branching off of it. Mounds on the surface of the ground are thrown out from short, lateral tunnels. These flat, fan-shaped mounds of soil are in contrast with the volcano-shaped mounds pushed up by moles.

Subsurface runways are 9 to 10 inches below the ground. Deep runs lead to nests or end blindly. They may reach a depth of 4½ to 5 feet and are not connected to the surface except for subsurface runs.

Beneficial Activities

In Kansas when pastures are overgrazed, the grasses are partly replaced by weeds with large roots which have special adaptations permitting the plants to live under adverse conditions. These large roots constitute an abundant food supply for pocket gophers which thrive and multiply. The action of the pocket gophers in “plowing” the soil and actually destroying the weeds hastens the return of grass if overgrazing is controlled. With the return of the grass, pocket gophers decrease in number.

Harmful Activities

Many complaints against pocket gophers stem from damage they do to alfalfa plants or the nuisance they constitute in those fields. Eating the roots of alfalfa can kill plants, and serious damage results from the gopher gnawing all the root crowns. The mounds of soil thrown onto the surface of the ground may kill alfalfa plants and create a nuisance by plugging and dulling mower sickle-bars and reducing the forage available to be harvested.

Pocket gophers can damage tree plantings. Infested roadways, power line rights-of-way, and meadows adjacent to plantings will ensure a much greater rate of infestation of the planting site.

Pocket Gophers

Root damaged trees are frequently unnoticed until crowns turn yellow and then brown in summer. Five- to 10-foot tall trees seem healthy until tilted at odd angles by the wind. Once discovered, they can be easily pulled up to reveal root cutting and barking.

Pocket gophers forage above ground and tunnel in snow to gnaw off tree branches. Coniferous trees have been found stripped of bark to a height of 11½ feet by pocket gophers working under the snow. Bark injuries caused by pocket gophers show small tooth marks. This differs from the distinct broader grooves left by porcupines and the finely gnawed surface inflicted by voles. Gophers also fill some of the snow passages with soil, thus forming long tubular “casts” which remain after the snow melts. When these casts are deposited on young trees 2 to 4 years old, severe deformity may occur.

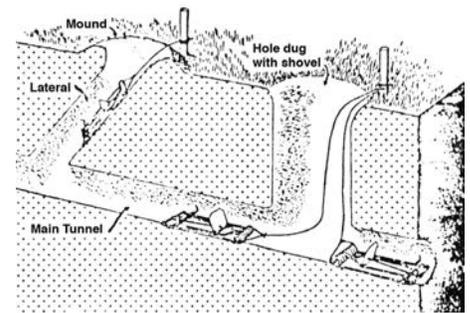
Orchards offer suitable habitat for pocket gophers in areas where weeds become established among the trees. The trees are damaged or killed by the gophers feeding on the roots.

Pocket gopher burrows have caused dams and roads to wash out as well as water loss from canals. Pocket gophers sometimes gnaw into underground cables and pipelines. Gophers create a nuisance and cause damage to lawns and gardens by destroying garden plants and creating mounds in lawns.

Control Methods

Control operations can best be conducted during seasons when the pocket gophers are most active near the surface. This usually is indicated by the presence of fresh mounds of dirt.

Trapping is the most effective way to control small numbers of gophers or gophers in lawns or gardens. In most areas autumn is the best season to trap because this is when gophers are most active in bringing soil to the surface of the mound and, as a result, can be located most easily. Traps should be set at sites with freshly worked soil. The next best season for trapping is spring.



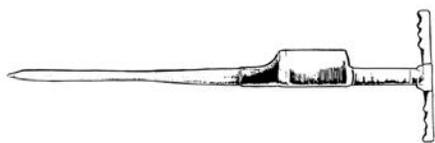
Pocket gopher trap placement

Over large and heavily infested areas, poison grain can be used. Poison placed underground is not likely to be picked up by other kinds of wildlife; however, it is possible for an animal to obtain a lethal dose of certain toxicants by eating poisoned gophers. Often a poisoned gopher will have some of the bait in its cheek pouches or undigested in its stomach. An animal eating these gophers may eat the poison bait also. Exposed bait should not be left lying around.

Poison bait can be placed in the burrows by hand or by using a tractor-drawn machine known as a “burrow-builder.” The burrow-builder makes an artificial burrow for the pocket gopher and at the same time places poison bait in this burrow.

The burrow-builder is most useful in alfalfa fields containing large

numbers of gophers. Follow-up applications with a hand-baiting probe or trapping can help prevent another buildup of the gopher population.



Pocket Gopher Bait Dispenser

Trapping: Trapping is extremely effective for pocket gopher control in small areas and for removal of remaining animals after a poisoning control program. For effective trapping, the first requisite is to find the tunnel.

It may be necessary to experiment with trap type and placement. Some trappers have success leaving tunnels completely open when they set traps; others, when they place traps in the main, close off the tunnel completely, and when trapping the lateral, close most of the tunnel with sod. Traps can be marked above ground with engineering flags and should be anchored with a stake and wire or chain so a predator does not carry off the catch and the trap.

Trapping is most effective when gophers are pushing up new mounds, generally in spring and fall. If a trap is not visited within 48 hours, move it to a new location. Leave traps set in a tunnel system even if you have trapped a gopher in spring and early summer, when gophers are most likely to share their quarters.

When burying underground cables or plastic pipelines, dig the ditch deeper than the intended depth of the line. Pocket gophers are thought to dig along the fill dirt at the bottom of the ditch.

By burying the line higher in the ditch, it may be possible to “hide” the cable from the gophers.

For additional information on controlling pocket gopher damage, refer to the following K-State publication:

Managing Pocket Gophers, MF770.

Rabbits

In Kansas, there are two major lagomorphs. Cottontail rabbits are represented primarily by the eastern cottontail; and the hares or so-called jackrabbits are represented by the black-tailed jackrabbit.

Rabbits and hares may damage or completely destroy a wide variety of tree plantings, gardens, ornamentals, agricultural crops, and rehabilitated rangeland. They can also strip bark from established fruit trees and conifers.



Black-tailed jackrabbit

Both rabbits and hares produce similar clipping injuries to tree seedlings. Clipped trees have a clean oblique knife-like cut on the stem. They usually clip stems off ¼ inch in diameter or less at a height not more than 20 inches above the ground. Repeated clipping will deform seedlings.

Quite often, rabbits or hares may be observed doing damage. Evidence of their presence are tracks and trails leading to and

Rabbits

from the damage area, as well as droppings at the base of the damaged area.

Natural enemies of rabbits and hares include hawks, owls, eagles, coyotes, bobcats, foxes, weasels, dogs, and domestic cats. Man hunts them for food and destroys many young in nests by mowing and by burning "waste" areas.



Eastern cottontail rabbit

Control Options

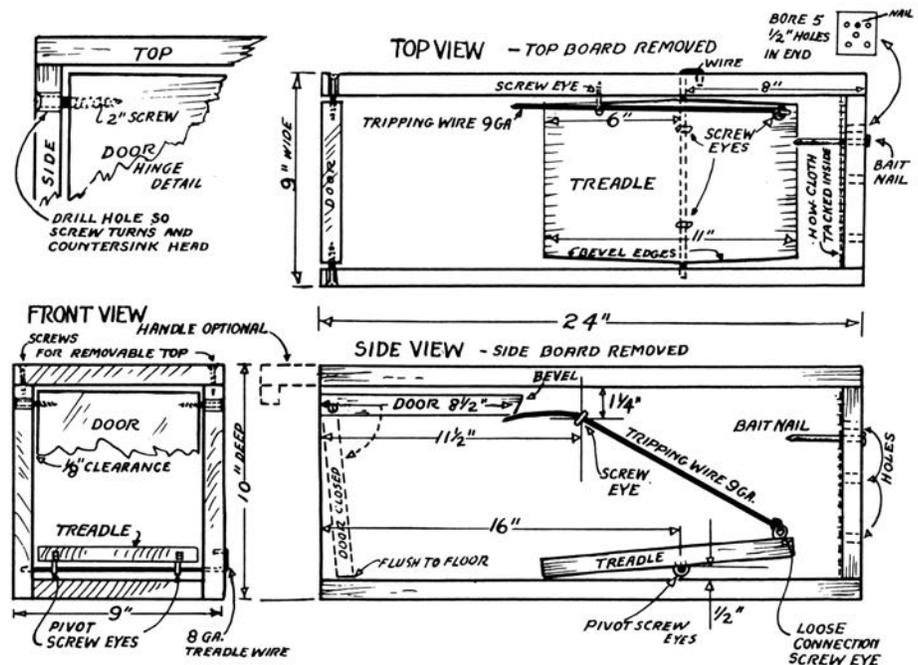
Removal

No poisons are currently registered for killing rabbits in Kansas. Damage can be controlled by using

the following techniques. Trapping with the box or similar type trap is often an effective control method for cottontails. It is not a successful method for controlling jackrabbits because of their reluctance to enter traps or dark enclosures; but they can sometimes be driven or herded into large traps.

Another similar type of trapping operation is the construction of a small corral along a rabbit-tight fence surrounding a protected field. Another short strip of fence is constructed at a diagonal to the main fence, funneling the rabbits to a one-way gate into the corral. Daily inspection of the corral can then be made and trapped animals removed.

In some situations, rabbit damage can be suppressed or eliminated by selective shooting of the rabbits doing damage. Where feasible, the encouragement of sport hunting of problem rabbits provides a desirable solution to the problem.



Tom Butzen rabbit trap

Exclusion

Exclusion is most often accomplished by the construction of rabbit-proof fences and gates around the area to be protected. Exclusion by fencing is desirable to keep cottontail rabbits out of gardens.

Fencing is one of the most reliable ways of controlling jackrabbit damage. Rabbit-proof fences that are properly built and maintained greatly reduce the jackrabbit impact on crops for many years regardless of population densities. Standard 20-gauge, rust resistant poultry netting, for example, lasts about 10 years or more. A 17-gauge, stucco netting will last about 20 years or longer. Fencing for jackrabbit control is a good investment but may require annual maintenance.

The use of individual protectors to guard the trunks of young trees or vines may also be considered a form of exclusion. Among the best of these devices are cylinders made from woven wire netting.

Repellents

Various chemical repellents are offered as a means of reducing or preventing rabbit damage to trees, vines, or farm and garden crops. The purpose of rabbit repellent is to make the protected plants less desirable by treating with a material distasteful to the rabbit. Also a satisfactory repellent must be non-injurious to trees when applied at any time of the year. Repellents are most effective when alternative foods are available.

Garden crops: In all control operations that involve the use of powder repellents, the dusting of garden crops should take

place early in the morning when plants are covered with dew or immediately after a rain. Repeated applications may be necessary after rains have washed the powder from the foliage and as new plant growth takes place.

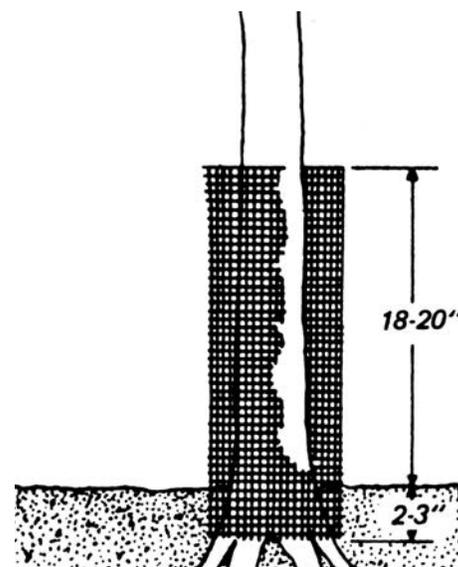
When a spray repellent is used against rabbits, the upper surfaces of the leaves should be thoroughly covered with the substance. A compressed air sprayer works well. Mild soap or some commercial spreader should be used with liquid repellents. As with dust repellents, liquid forms should be reapplied after a heavy rain and at 10-day intervals to make certain new plant growth is protected.

Some repellents applied to garden plants are not recommended for application to leaves, stems or fruit of plants to be harvested for table use. Check the label and as always follow the label.

Trees and shrubs: Several good commercial repellents are available for trees and are more effective than home concoctions. Treat all stems and low branches to a point above which rabbits cannot reach while standing on top of the estimated snow cover. One application made during a warm, dry day in late fall should suffice for the entire dormant season.

Lure Crops

With the use of a lure crop, such as ear corn, alfalfa hay, etc., placed away from the damage area, rabbits and hares may be drawn away from the area to be protected.



Hardware cloth or wire mesh

Rabbits

Study Questions

These study questions are designed to help you learn the material on pages 61 through 63.

- The two cheek pouches on pocket gophers are used for:*
 - carrying soil.
 - carrying food.
 - carrying keys to the burrows.
 - keeping their front feet warm in the winter months.
- The more extensive runways of the pocket gopher burrow systems are the:*
 - subsurface runways.
 - deep runways.
 - surface trail runways.
 - left turn runways.
- Harmful effects of pocket gophers include:*
 - damage to alfalfa roots and crowns.
 - damage to tree roots and plantings.
 - mower sickle-bars dulled by dirt in mounds.
 - all of the above.
- In most areas, _____ is the best season to trap gophers.*
 - summer
 - autumn
 - winter
 - spring
- The use of a "burrow builder" for pocket gopher baiting is most useful in:*
 - meadows.
 - small grain fields.
 - alfalfa fields.
 - home lawns.
- Hares are represented in Kansas by the:*
 - blacktailed jackrabbit.
 - whitetailed jackrabbit.
 - cottontail rabbit.
 - western jackalope.
- Rabbits and hares damage seedling trees by:*
 - eating the needles in the summer.
 - eating tree roots in their burrows
 - clipping off stems and twigs.
 - eating the leaves in August.
- In some situations, rabbit damage can be controlled by:*
 - scarecrows.
 - selective shooting.
 - complete vegetation control.
 - use of a tiny parasitic wasp.
- Rabbit repellents in gardens should be applied during the _____ to be most effective.*
 - evening
 - night time
 - early morning
 - mid-afternoon
- An example of a lure crop for rabbits is:*
 - dried lettuce.
 - alfalfa hay.
 - carrot tops.
 - bean leaves.

Ground Squirrels

Although three species of ground squirrels are native to Kansas, the thirteen-lined ground squirrel is the most widely distributed and the one most commonly seen. The adult's upper parts are striped with narrow bands of alternating dark on buffy white. Total length of the adult is about 11 inches, with no apparent differences in size or coloring between sexes. Seldom found far from their burrows, they give the appearance of being nervous and excitable. They frequently sit on their haunches to feed or observe an intruder. The thirteen-lined ground squirrel is found throughout the Great Plains region and its burrows consist of openings about the size of a silver dollar hidden in the grass with no conspicuous mound of dirt. Ground squirrels do little economic damage but are sometimes considered a nuisance in lawns, cemeteries, and golf courses. Where ground squirrels are abundant adjacent to cultivated fields, they can sometimes do considerable damage by digging up seed grains at planting time.

Life History

Ground squirrels hibernate in Kansas beginning with the onset of colder weather in late fall. The hibernating animals reappear in early spring, depending on the weather.

Though ground squirrels are mainly vegetarians, they are particularly fond of such insects as crickets, grasshoppers, caterpillars, and cutworms. The ground squirrel has a long list of natural enemies, especially hawks, weasels, badgers, and man.

Damage Control

Methods include trapping, shooting, poisoning and fumigation.

Trapping

Trapping is an effective control method in lawns, gardens, and around buildings. A rat-sized snap-trap is recommended. The trap can be set by inverting it over the burrow entrance or by baiting with peanut butter. To avoid catching nontarget animals, place traps inside boxes with 2-inch diameter holes drilled in two or more sides. Check all traps daily.

Shooting

Small numbers of ground squirrels in fields or other thinly populated open areas may be selectively destroyed with a day's shooting during the periods of greatest activity.

Poisoning

Approved poisons on grain baits can be used for controlling larger numbers of ground squirrels. Large grains such as oats are less likely to be taken by smaller, seed-eating birds than cracked wheat or grass seed. Commercial bait stations or those constructed of wood and homemade can often be used for placing the bait so it will be inaccessible to other species of wildlife.

Fumigating

In some cases it may be necessary to control ground squirrels by fumigation of burrows with an approved fumigant. After a fumigant has been applied, all burrow entrances should be plugged with soil.



Thirteen-lined ground squirrel

Ground Squirrels

Study Questions

These study questions are designed to help you learn the material on page 65.

1. *The thirteen-lined ground squirrel is found _____.*
 - a. throughout the Great Plains region
 - b. only in extreme northwestern Kansas
 - c. only in south central Kansas
 - d. only in southeastern Kansas
2. *Ground squirrels hibernate in Kansas beginning in _____.*
 - a. late fall
 - b. mid-winter
 - c. early spring
 - d. late summer
3. *A good bait for ground squirrel traps is _____.*
 - a. lettuce
 - b. chocolate
 - c. peanut butter
 - d. bacon
4. *Shooting ground squirrels can be done _____.*
 - a. only at dusk
 - b. only between 11 p.m. and 1 a.m.
 - c. only at sunrise
 - d. during periods of greatest activity
5. *After applying a fumigant to a ground squirrel burrow, you should _____.*
 - a. place some oat seeds in the entrance
 - b. place an apple slice in the entrance
 - c. plug the entrance with soil
 - d. wait for the animal to come out so you can shoot it

Many bird species have learned to take advantage of agricultural activities, particularly the growing of crops. In some cases, crops are a replacement for natural bird foods that enable these kinds of birds to winter in greater numbers than were formerly found in this country. Unfortunately for U.S. producers, most crops ripen in the postbreeding season of most birds. Bird numbers and food demands are near the annual peak because young have been added to the adult population.

The seriousness of bird damage is related to the stage of crop growth. If the preferred stage for a species is the sprouting or ripening crop, then serious damage often occurs, the period of vulnerability to damage will be long, and many plants will be destroyed or damaged as the birds satisfy their daily nutritional requirements. If the preferred stage is the mature crop, less damage usually occurs. A properly timed harvest ends the damage, and the birds are usually welcome to glean crop residuals. When a considerable monetary loss to birds is expected, producers should seek control methods to reduce damage.



Red-winged blackbird

Identification of Damage Factors

Before attempting bird control measures, one should make certain

that losses are actually being caused by birds. Because birds are fairly large and feed by day, they are usually conspicuous in crop fields, particularly when they occur in large flocks. Birds are often blamed for lower yields that may be attributable in part or in whole to plant diseases, insects, wind, and, quite commonly, to nocturnal mammals. In a few cases, bird control has been attempted where birds were not damaging crops, but were actually performing a service by feeding on harmful insects. Identification of the bird species causing damage and the proportion that each is contributing to the total is important because control methods often vary for bird species that may be damaging the same milo head or ear of corn.

Species Causing Loss

A necessary aid to better crop protection is a bird identification book. Most field guides have color illustrations not only of both sexes but also of immature and adult plumages. Many bird species that damage crops are small and quite wary, and field glasses or binoculars may be necessary for identification.

Amount of Losses

Determination of the amount of loss to birds is not an easy task even in an individual field. It requires effort, and it is expensive to derive countywide, statewide, or nationwide estimates. Yet loss determinations are essential for the development and use of specific methods for alleviating crop losses to birds, both for growers and for others concerned with the profitability of developing and

Birds

encouraging the use of bird control methods.

Three methods of estimating losses are available to the grower: (a) estimating bird numbers in a field at the time of damage and having information on the maximum potential of an individual bird to do damage to that crop, (b) checking the most severely damaged portions of the field, and (c) checking the proportion of the crop being lost in all areas of a field.

Available daily consumption estimates for some specific birds and crops are listed in Table 1. Observations of crop fields for damage and identification of the species responsible pay dividends for the time the grower invests and often guide selection of the best control method. A good use of the grower's time is to check portions

of the field where damage has been most severe in previous years. While making this check, birds are frequently encountered at close range in the act of damaging the crop.

Gathering information about a crop will be worth the time of the individual gathering it and, if pooled with that of other individuals, will help in developing suitable control methods to protect crops from bird damage.

Legal Status of Control of Problem Species

The proper federal and state permits, if needed, should be obtained before attempting to control birds damaging crops. K.A.R. 115-16-03 states, "a nuisance bird control permit shall be required to use any lethal method of control that involves

Table 1. Daily Consumption and Damage Estimates of Individuals of Selected Species of Birds to Specific Maturation Stages of Some Kansas Agricultural Crops

Crop	Species	Ounces Damaged
Corn, sprouting	Ring-necked pheasant, male	3.50
Corn, sprouting	Common grackle	.82
Corn, milk and dough stages	Red-winged blackbird, male	1.40
Corn, dented	Common grackle	.50
Grain sorghum, dough stage	Red-winged blackbird, male	.50
Grain sorghum, dough stage	House sparrow	.36
Feedlot feed ration	Starlings	.99
Sunflower, green bowls	Red-winged blackbird, male	1.42
Sunflower, yellow bowls	Red-winged blackbird, male	.89
Wheat, mature	Mallard, male	2.56
Wheat, mature	Blue-winged teal	.96
Wheat, mature	Canada goose	6.56

Table 2. Federal and Kansas Permit Requirements for Scaring or Killing Birds Damaging Kansas Agricultural Crops*

Scaring
Not required
All species except endangered or threatened species (see Sect. 17.11, Title 50, Code of Federal Regulations)
Killing
Not required
Pigeon, Domestic or Feral (Rock Dove)
Sparrow, House
Starling, European
Other undesirable exotics listed at Federal Register / Vol. 70, No. 49 / Tuesday, March 15, 2005 Notices
Not required when committing or about to commit depredations
Blackbird, Brewer's
Blackbird, red-winged
Blackbird, yellow-headed
Cowbird, shiny
Cowbird, brown-headed
Cowbird, bronzed
Crow, American
Crow, fish
Crow, northwestern
Grackle, boat-tailed
Grackle, common
Grackle, great-tailed
Grackle, greater Antillean
Magpie, black-billed
Magpie, yellow-billed
Required
Generally for all other species
NOTE: See Sections 21.44, 21.45. and 21.46, Title 50. Code of Federal Regulations for exceptions applicable to the horned lark, goldfinches, house finch, and meadowlark

* At the time of this writing, the Kansas Department of Wildlife, Parks and Tourism does require a permit before killing any birds other than feral pigeons, house sparrows or European Starlings.

poisons or chemicals for controlling nuisance birds other than feral pigeon, English sparrows, or starlings. A synopsis of the federal laws pertaining to individual species is given in Table 2.

Methods Available to Reduce Damage

Methods for reducing bird damage to agricultural crops can be placed in four broad categories: (a) ecological, (b) cultural, (c) mechanical, and (d) chemical. A variety of methods under each of these categories are listed in Table 3. Cultural and ecological methods should be considered first and are discussed in detail under specific crop headings. Mechanical and chemical methods are necessary when cultural and ecological methods fail to alleviate damage sufficiently or are not feasible.

The applicator should consider all methods available for a particular problem and choose one or more that are likely to be most effective. Methods available for consideration are heavily influenced by their costs in relation to damage levels and per acre crop values.

Table 3. Methods Available to Protect Kansas Agriculture Crops from Bird Damage

Methods

Ecological

1. Destruction of key habitat

- Nesting
- Loafing (including watering)
- Roosting

2. Supplemental feeding to reduce attractiveness of field

3. Management to increase specific predators

Cultural

1. Site selection

2. Crop selection

3. Variety selection for bird resistant characteristics

- Long husks or glumes
- Pendant ears
- Low plant height
- Thick or plastic seed coats
- Smaller or larger seeds than preferred by species causing damage
- Thick rinds (fruits)
- Preference by birds

4. Planting synchrony

5. Alteration of planting (and ripening) dates to avoid bird migration

- Early dates
- Late dates

6. Seeding depth

7. Wide-row planting

8. Provision of alternate bird foods

- Crop diversification
- Buffer plantings
- Delayed tillage

9. Ripening synchrony

10. Early harvest

11. Use of dryer

Mechanical

1. Exploders, acetylene, propane, carbide, sirens, and whistles

2. Pyrotechnics

- Shell-crackers
- Bird bombs
- Bird whistlers
- Whistle bombs
- Racket bombs
- Rope fire-crackers

3. Shooting

- .22 Rifle
- Large caliber rifle
- Shotgun

4. Patrol

- Walking
- Mobile

5. Amplified calls

- Alarm
- Distress
- Escape

6. Electronic noise production

- AV-Alarm

7. Traps

- Decoy
- Nest box

8. Protective netting

9. Predator models

- Stationary scarecrows
- Moving scarecrows

10. Revolving lights, balloons, flags

Chemical

1. Repellants

- Seed treatments
- Crop sprays

2. Frightening agents

- Feeding site baitings

3. Toxicants

- Feeding site baitings

4. Reproductive suppressants

- Feeding site baitings

5. Insecticides

- To reduce crop attractiveness to birds

6. Herbicides and dessicants

- To reduce crop attractiveness to birds
- To reduce period of crop vulnerability

Reducing Bird Damage to Specific Crops

Ripening Field Corn

Damage to corn in the milk, dough, dent, and mature stages is chiefly caused by members of the blackbird family. The red-winged blackbird is the most numerous species of blackbird in the country, with substantial populations in every state, and may be responsible for more damage to ripening corn than all other species combined. The red-wing prefers the milk and dough stages of ripening corn to dented corn. A minute portion of damage by red-wings occurs before ears reach the milk stage.

The common grackle is second in importance. The common grackle, and its close relative, the great-tailed grackle, with its much more restricted range, appear to prefer the dough, dent, and mature stages of corn.



Common grackle



Red-winged blackbird

The yellow-headed blackbird is a distant third in importance. Like red-wings, yellow-heads prefer the earlier stages of ripening corn. Other birds, with the possible exception of the house sparrow and common crow do relatively little damage to ripening corn. Some species, such as the starling, brown-headed cowbird, and Brewer's blackbird, sometimes associate with foraging flocks of red-wings, grackles, and yellow-heads, but feed mainly on the ground or on ears opened by other species.



Brown-headed cowbird male



Brown-headed cowbird female

Blackbird damage always starts at the tip of the ear, and usually on its upper surface. Damage by red-wings and yellow-heads in the milk stage is recognizable by the manner in which they open the ears, slitting the husk into $\frac{1}{8}$ to $\frac{1}{2}$ -inch strips and peeling these back over the remaining kernels. In the milk stage, kernels are punctured and the soft seed coats then quickly dry and are blackened by fungus. In the dough stages, birds also puncture the kernels and remove most of the contents, but leave the cellulose seed coats of the kernels adhering to the cob. Grackles also damage kernels in this manner in the dough stage, but more often remove the entire kernel in the mature and dent stage. Mature kernels are also taken by red-wings and yellow-heads but are not preferred. All three types of damage can be seen on some ears. Ears with severe damage resemble a peeled banana with the peel still attached.

The amount of damage an individual blackbird can cause daily is greatest in the milk and dough stages (Table 1, Page 68). Although they consume only about one third of the amount damaged, the grower still suffers this amount of yield reduction. As corn reaches maturity and kernels increase in weight, this level of damage decreases, approaching $\frac{1}{2}$ ounce daily or about 10 percent of the body weight of a large grackle.

Protection of Ripening Field

Corn: The cultural practice most likely to prevent severe bird damage at the various ripening stages is to time planting so the field ripens at about the same time as most other fields in the locality. Planting hybrid varieties with thicker husks that completely cover kernels or extend substantially beyond kernels is helpful in reducing bird damage if that variety ripens at the same time as others in the locality. Elimination of weeds or insects sometimes reduces bird damage in a particular field, but these are alternate foods for blackbirds during the period they feed on ripening corn. It is doubtful that weed control and insects by themselves will reduce damage in all fields within the range of a blackbird roost.

Nearly all corn farmers with blackbird problems are aware of the value of frightening birds from cornfields by patrolling them with rifles and shotguns, or by using exploders and pyrotechnics.

They also know this activity requires several hours each morning and evening, and occasionally all day. Corn is most vulnerable to birds for

approximately three weeks. The most severe damage by red-wings often takes place in about a one-week period in the early dough stage; therefore, protection of cornfields by mechanical means is especially profitable during the late milk-early dough stage of ripening.

Persevering farmers can nearly fully protect their crops by patrol. Birds can be moved effectively and economically by firing a round from a .22 caliber rifle above the feeding birds to flush them and then immediately firing a series of rounds behind the departing flock. Because rifle rounds can be hazardous up to 1 mile, good judgment must be used.

Use of a “shell-cracker,” which is a 12-gauge shotgun shell containing a powerful firecracker instead of a shot, is a second effective means for moving flocks of birds. A 12-gauge shotgun launches the firecracker, which explodes above the birds, about 100 yards from the gunner. Blackbirds, from their long association with hawks, instinctively pay attention to things above them. Shell crackers are far more effective than regular shells for moving birds, and greatly increase the range and versatility of a person patrolling the field. The cost of shell-crackers, however, is nearly double that of standard loads. Two or more gunners complement one another in protecting large fields with shell-crackers.

A gunner attempting to kill birds with a shotgun, where state laws permit them to be killed, is one of the least effective and most costly of all methods of patrolling.

Patrol by aircraft has not been effective. Birds often take refuge



Frightening birds

from the plane in the crop instead of leaving the field, and they are extremely difficult to move from loafing cover, such as shelterbelts, with a plane. In addition, the cost of flying has increased much faster than crop value, making this approach steadily less attractive.

Gas-powered (propane or acetylene) exploders probably have saved more ripening corn from birds to date than any other means. The exploder produces a sound about nine times louder than a shotgun blast. Some exploders have solar cells that turn them on at daylight and off at dark, thus reducing maintenance time. For best results, however, exploders should be moved frequently so birds do not habituate to them quickly. Cannons and alarm and distress broadcast systems are available with motion detectors that trigger the devices when birds enter the field. Because the frightening devices are not operating continually, the birds are more likely to be frightened away and the devices should be more effective for longer periods of time. One exploder can nearly fully protect about 10 acres of crop, and has beneficial effects over a larger area. Mounting the exploder

on a stand above the crop gives the best deterrent effect. A small, thin steel drum, with the ends removed, mounted just beyond the barrel of the exploder, will serve as an amplifier and increases the effectiveness of the exploder.

Rope firecrackers are effective for small acreages and short damage periods. Flash-salute firecrackers, known popularly as bulldogs, cannon crackers, cherry bombs, or salutes, are used in a firecracker rope. Fuses of the firecrackers are inserted at intervals between strands of a loosely twisted cotton rope, one end of which is tied to the apex or a tripod made of wooden stakes. The free end of the rope is ignited, and as it slowly burns, the ignited firecrackers drop from the rope and explode. Timing of explosions is regulated by spacing the firecrackers along the rope. A metal container such as a wash tub should be placed below the smoldering rope, to avoid fires in dry fields and to amplify the sound. Approximately 10 acres of standing corn can be protected with one rope firecracker assembly.

As of May 1, 2011, the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) requires a Federal Explosives Permit for the use of Explosive Pest Control Devices (EPCDs). The application is the same for a license and a permit. ATF requires a permit. Go to <http://www.atf.gov/explosives/how-to/explosive-pest-control-device-requirements.html> for additional information or to download forms.

You will need a Type 4 storage magazine and must maintain records of removal from the magazine. You must know local zoning and state requirements for

an interview with ATF. You must notify your local fire authority immediately upon possession of the pyrotechnics. Federal, state, and local agencies are not required to possess a permit or license, but must maintain proper storage and record-keeping in accordance with ATF regulations. Some screamer siren devices do not require an ATF permit.

Amplification of recorded distress, alarm, and escape calls of blackbirds as well as calls of their natural enemies, such as hawks, have been used to protect corn crops. Electronically generated amplified sounds also have been used by some growers. Use two speakers per 5 to 10 acres or use mobile speakers. Broadcast alarm and distress cries are more effective if used only when birds are in the corn and if broadcast from mobile speakers. Alternate the broadcast of alarm and distress cries with the broadcast of the sound of static, steam locomotives, urban traffic, etc.

A variety of other bird-frightening devices, including helium-filled balloons tethered in fields, radio-controlled model planes, reflecting tapes made of mylar, and various types of scarecrows, are also occasionally used to rid fields of blackbirds. The effectiveness of these devices is highly variable, depending on the persistence of the operator, the skill used in employing a device, the attractiveness of the crop, the number of birds, and the availability of alternate feeding sites. As mentioned with regard to propane exploders, birds tend to adjust or adapt to frightening devices. It is usually best to use two or more devices than to rely on a single device.

In recent years, mechanical frightening methods have sometimes been replaced by chemical frightening methods. Avitrol is an example chemical. When applied to the corn field, Avitrol will kill a small number of crows or blackbirds in such a way as to frighten the rest of the flock from the field. Avitrol treated grain bait may be applied from aircraft or from high clearance ground equipment. Apply at the recommended rate, but for best results, apply in three separate swaths that cover $\frac{1}{3}$ of the field. If another treatment is necessary within 5 to 7 days, reapply in three separate swaths to another $\frac{1}{3}$ of the field.

Grain Sorghum (Milo Maize)

Bird damage to ripening grain sorghum in the U.S. is caused chiefly by the red-winged blackbird, house sparrow, common grackle and brown-headed cowbird.



House sparrow

Bird damage to ripening grain sorghum is readily identifiable. Most species begin feeding on the uppermost kernels or the head leaving the empty glumes attached. Damage becomes progressively greater as lower kernels are removed. Early removal of kernels from glumes is often followed by

fungal invasion and these empty glumes quickly blacken.

Like corn, the amount of damage per day that an individual blackbird can cause is greater in the dough stage than when mature. At this stage, red-wings often feed on the embryos (seed germs) only and drop the remainder of the kernel, leaving the soil littered with partially eaten seeds. A considerable portion of very early damage is compensated by the plant if damage does not exceed 25 percent.

Protection of Grain Sorghum:

The cultural practice most likely to prevent bird damage to mature seeds is to harvest them as soon as practical. Dryers are especially recommended. Bird-resistant varieties have found more favor with grain sorghum growers than growers of other crops, but most of these varieties, known as brown sorghums, contain enough tannins at harvest to reduce their palatability, digestibility, and nutritional quality to livestock. Some varieties, however, are resistant to birds in the early stages of kernel development. They have been well accepted by grain growers and have good nutritional qualities for livestock.

Much of the discussion of mechanical means for protecting ripening corn is appropriate for grain sorghum also. Patrol of ripening grain sorghum fields is more productive than patrol of cornfields because feeding birds are seldom obscured by crop foliage. Shooting with a .22 caliber rifle from the field border is the most cost-efficient mechanical means. Patrolling is largely ineffective for house sparrows causing damage.

Birds

Large numbers of sparrows can be taken in small decoy traps and then destroyed. The method may be effective in fields near isolated farm buildings; however, traps do not provide effective protection from sparrow damage when fields are located near towns and cities where a reservoir of newly hatched young regularly appear to replace trapped birds.

Chemical means for protecting ripening grain sorghum appear to hold the most promise for eventually relieving the most severe damage to this crop. Repellent sprays and chemical-frightening agents both have the potential to satisfactorily reduce severe damage.

Sunflowers

Wild sunflower has been found in the diets of many species of birds in numerous food habit studies. Cultivated sunflower is an acceptable food in the diet of many species of birds.

Blackbirds are the principal family of birds that damage ripening sunflowers. The red-winged blackbird probably damages more sunflowers than all other species of blackbirds combined. Other important species of blackbirds damaging sunflower are the Common grackle and the yellow-headed blackbird. Many other species, including the house sparrow, blue jay, brown thrasher, and common crow, take seed from standing heads, but none, other than house sparrows, cause noteworthy damage.

Damage to sunflowers sometimes begins even before ray petals fall, and continues until harvest. The most severe damage often

takes place within two weeks after ray petals begin to wither. Sometimes within a week and occasionally within three days, red-wings discontinue attacking a field in favor of finding one where the outer whorl of seeds is just beginning to fill. Yellow-heads and grackles often feed in fields that have the seeds filled, and grackles may actually prefer the more advanced stages of sunflower ripeness, as they do in corn.

Blackbird damage in sunflower fields is greater in the soft seed stage (green or yellow-green bowls) than later. Bird damage can be differentiated from wind shattering by noting that seeds on the soil surface will be split and the kernel extracted if damage is caused by birds. Birds deposit many empty hulls in the bowl formed by the inverted head, but wind soon removes many of these. If feeding on heads occurs early and is light, this feeding is sometimes missed because outer bracts of the heads slump to cover the areas where seed has been removed. Often the plant compensates for this early damage by increased weight in undamaged seeds.



American crow

Protection of Sunflowers: Growers should avoid planting sunflower

adjacent to shelterbelts, groves, or other woody areas regularly used by blackbirds for loafing cover. Within 100 yards of such cover, a grower should substitute a crop that blackbirds do not harm, such as wheat, flax, sugar beets, potatoes, soybeans, or pinto beans. If farmers cannot select an alternate crop or designate a site to grow sunflower far enough from trees to provide a degree of bird protection, they should plant at a lower rate to produce large heads that are less susceptible to bird damage.

The cultural practice most likely to reduce bird loss is an early harvest. In some years, harvest can be accomplished before the peak of blackbird migration, if blackbird breeding seasons have been delayed. Use of dessicants and driers is especially recommended.

Early varieties sometimes mature before the peak of blackbird migrations. Birds prefer certain varieties of cultivated sunflower. Surprisingly, the oilseed cultivars are preferred by most birds over confectionery varieties or even those cultivars specifically planted for the bird feed market. Growers suffering high bird losses of oilseed sunflowers might consider growing non-oilseed sunflower to lower losses.

The most underrated cultural practice for relieving bird damage is both effective and simple. A major portion of harvested cropland near blackbird roosts should not be plowed or tilled until most or all sunflower fields have been harvested. Delaying tillage of nearby cropland is practiced by many of the wiser farmers and is recommended to reduce damage to sunflower. Birds, especially blackbirds, consume great quantities of weed seeds

and some insects from crop stubbles. The probable benefit of blackbirds reducing weeds and insect numbers while feeding in grain stubbles is not well established, but leaving grain stubbles near blackbird roosts reduces crop damage. After harvesting sunflower, the stubble with its shattered seed should be left as alternate feeding areas until all sunflowers in the area are harvested.

Most applicators are aware of the value of frightening birds from sunflower fields by patrol with rifles and shotguns, or using exploders and pyrotechnics. Pyrotechnics include whistle bombs, shell crackers and 15 mm rockets. Use of these devices requires several hours each morning and evening and occasionally all day. Because sunflowers are vulnerable to birds for approximately six weeks – longer than any other crop – protection of sunflower fields by mechanical means is an especially formidable task. Nevertheless, persevering applicators can nearly fully protect the crop by patrol. Methods for using mechanical means to protect sunflowers from blackbirds are nearly identical to those used in ripening field corn.

Chemical frightening methods are replacing mechanical frightening methods. The discovery of chemical frightening agents that cause some species of birds to emit cries during distress-display flights has led to a new method of protecting sunflowers. As in corn, using chemical frightening agents is more promising than attempting to reduce populations of blackbirds by poisons. Ripening sunflower seeds are preferred by blackbirds

Birds

over all baits tried and getting a majority of blackbirds to accept a poison bait in a ripening sunflower field is even more difficult than in a ripening cornfield.

Other chemical methods to protect sunflowers also have many disadvantages. Repellent sprays appear to have little use in sunflowers because most of the repellent sprayed on heads in the soft seed stage falls on the florets which are sloughed off as heads ripen. Heads turn downward at later stages of maturity, effectively preventing the repellent from reaching the seed coat which birds must open to feed on the seeds.

Feed Grains

Bird damage to the grain does not stop when the grain is harvested. These grains, along with protein supplements are fed to cattle, hogs, and poultry in livestock feeding areas where wintering congregations of granivorous birds sometimes cause serious losses and foul livestock feed. Damage has been particularly severe at cattle feedlots where rations are continuously available to beef animals in open troughs. Natural, preferred bird foods are scarce for several months during winter, especially when the ground is frozen or snow covers it, making livestock feeding operations quite attractive to hungry birds. Damage is less at hog feeding areas where feed is usually supplied in flip-top self-feeders and feed is available to birds only when a hog is feeding or when the feeder is in disrepair.



European starling

The European starling is responsible for most losses of livestock feed from troughs and often selects the more costly high protein supplements or starch components from rations. Starlings may take up to 1 pound of grain per month directly from the feed bunk. All species of wintering blackbirds, principally the common grackle, red-winged blackbird and brown-headed cowbird also feed at livestock feeding areas in large numbers, but they obtain much of their food from grains spilled or wasted by livestock feeders or their animals, or from undigested grain in cattle manure. The house sparrow and the rock dove are present at many feeding areas and also take some food from troughs.

Protection of Feed Grains:

Prevention of loss of livestock rations to birds for small producers can sometimes be easily accomplished. Pulling feed wagons into buildings or covering them with tarpaulins denies birds access to ration stocks and averts one source of loss. Repair of self-feeder covers at hog lots is another.

The following methods might be of value in reducing starling feeding:

- making feed available later in the day, following prime feeding time for starlings,

- feeding under sheltered areas (roofs or overhangs),
- increasing particle size of feeds so they are too large for starlings to eat, and
- elimination of water sources at feedlots, and making water less available by lowering the water level in the waterers.

One study done at Kansas State University showed that the amount of feed delivered increased by 36 percent for cattle that were fed a traditional meal type ration compared to cattle that were fed a total diet in an extruded ration. The extruded ration was too large a pellet for the birds to consume.

Electronically-generated noise has been effective at cattle feedlots where starlings were the principal species causing losses. Exploders also frighten other birds for short periods, but these and other noisemaking devices often lose effectiveness during the long period.

Chemical agents are the preferred method of control for the most serious problems at livestock feedlots. Because of the long period that starlings visit lots, an acceptable bait for this species can usually be found. For stable populations in December and

January, baiting with starling poison has been very effective.

Baiting effectiveness increases over the broadcast method to exposing baits in containers such as rubber pans or small troughs. Placing these atop cattle self-feeders and buildings where starlings are loafing. Baiting large concentrations of starlings in pre-roosting or staging areas is effective for reducing losses of livestock rations and far easier than baiting the many individual lots within range of a roost (up to 30 miles). Roost movement may break birds into smaller flocks and reduce concentrations of birds at feeding sites if new roosts are formed beyond the range of the daily movement of the birds.

Chemical frightening agents are particularly useful against migrating starlings or migrating or wintering blackbirds in feedlots. In late fall or late winter, starlings may be present in livestock feeding areas for only a few days or weeks and it is much easier to obtain quick relief for a problem by affecting a small percentage of starlings with a chemical frightening agent than to attempt to poison a larger percentage of these populations.

Birds

Study Questions

These study questions are designed to help you learn the material on pages 67 through 79.

1. *Bird damage is high for U.S. producers because _____.*
 - a. all birds will damage all crops
 - b. most crops ripen in the post-breeding season of most birds
 - c. there is no way to control damage
 - d. birds do not eat anything but crops
2. *Bird identification often requires _____.*
 - a. field glasses (binoculars)
 - b. a bird handbook on identification
 - c. two people to frighten the birds so you can see the color of the wings
 - d. a and b above
3. *Estimating bird loss in fields can be done by _____.*
 - a. estimating the number of birds in the field and knowing how much damage each individual bird does
 - b. checking the most severely damaged portion of the fields
 - c. checking the proportion being lost in all areas of the field
 - d. all the above
4. *The red-winged blackbird can damage _____ ounces of sunflowers in the green bowl stage per day.*
 - a. 50
 - b. 1.42
 - c. 2.11
 - d. 3.00
5. *No permits are ever required to kill _____.*
 - a. pigeons and sparrows
 - b. blackbirds and cowbirds
 - c. crows and grackles.
 - d. magpies and meadowlarks
6. *_____ methods should be used first in bird control.*
 - a. Mechanical and chemical
 - b. Cultural and ecological
 - c. Frightening and netting
 - d. Shooting and chemical
7. *Ecological methods to reduce bird damage include _____.*
 - a. destruction of habitat (nests, roosts etc)
 - b. crop selection
 - c. use of repellents
 - d. use of amplified calls
8. *Mechanical methods to reduce bird damage include _____.*
 - a. supplemental feeding of birds
 - b. early crop harvesting
 - c. use of reproductive suppressants
 - d. use of exploders, patrols, traps, and revolving lights
9. *The second most damaging bird species to field corn is the _____.*
 - a. red-winged blackbird
 - b. common crow.
 - c. common grackle
 - d. starling
10. *Birds actually consume only about _____ of the amount damaged.*
 - a. $\frac{1}{4}$
 - b. $\frac{1}{3}$
 - c. $\frac{1}{2}$
 - d. $\frac{2}{3}$

11. *The best cultural method to use to reduce blackbird damage to ripening field corn is _____.*
- early harvest
 - seeding depth
 - planting date
 - site selection
12. *_____ have probably saved more ripening corn than any other method.*
- Using .22 rifles
 - “Shell-crackers”
 - Repellants
 - Gas-powered (propane or acetylene) exploders
13. *An example of a chemical frightening agent for some bird species is _____.*
- Counter.
 - Furadan.
 - Diazinon.
 - Avitrol
14. *The cultural practice most likely to prevent bird damage to sorghum is _____.*
- site selection
 - planting date
 - early harvest
 - wide-row planting
15. *The bird species which does the most damage to sunflowers is _____.*
- common crow
 - blue jay
 - red-winged blackbird
 - starlings
16. *The most underrated cultural practice in sunflower bird damage control is _____.*
- variety selection
 - seeding depth
 - wide-row planting
 - delayed tillage or plowing of harvested cropland near blackbird roosting areas
17. *Bird damage to cattle feedlot rations is particularly severe during the _____.*
- fall
 - winter
 - spring
 - summer
18. *_____ are the preferred method of control for the most serious problems in livestock feedlots.*
- Ecological methods
 - Mechanical methods
 - Chemical agents
 - Cultural methods

Answers to Study Questions

Answers to Study Questions

Pages 4–6 (Introduction and Wildlife Damage Management)

1. c, 2. d, 3. a, 4. b, 5. d, 6. a

Pages 8–16 (Laws and Regulations)

1. c, 2. a, 3. c, 4. d, 5. d, 6. b, 7. c, 8. b

Pages 18–24 (Wildlife Diseases and Man)

1. d, 2. c, 3. d, 4. b, 5. b, 6. d, 7. a, 8. d

Pages 26–30 (Public Relations and Coyotes)

1. d, 2. a, 3. c, 4. b, 5. d, 6. d, 7. c, 8. a

Pages 32–34 (Deer, Elk, and Antelope)

1. a, 2. b, 3. c, 4. c, 5. a

Pages 35–40 (Rodenticides)

1. d, 2. b, 3. d, 4. c, 5. b, 6. c, 7. b, 8. c

Pages 42–45 (House Mice)

1. d, 2. d, 3. b, 4. b

Pages 46–50 (Native Rats)

1. d, 2. a, 3. c, 4. d, 5. a

Pages 51–52 (Native Mice)

1. d, 2. c, 3. b, 4. a, 5. d, 6. a

Pages 54–57 (Black-tailed Prairie Dogs)

1. b, 2. c, 3. d, 4. b, 5. d, 6. d

Pages 61–63 (Pocket Gophers and Rabbits)

1. b, 2. a, 3. d, 4. b, 5. c, 6. a, 7. c, 8. b, 9. c, 10. b

Page 65 (Ground Squirrels)

1. a, 2. a, 3. c, 4. d, 5. c

Pages 67–79 (Birds)

1. b, 2. d, 3. d, 4. b, 5. a, 6. b, 7. a, 8. d, 9. c, 10. b, 11. c, 12. d, 13. d, 14. c, 15. c, 16. d, 17. b, 18. c

Credits for Photographs and Illustrations

Bob Gress, *BirdsInFocus.com*, brown-headed cowbird male and female, European starling 1 and 2, red-winged blackbird 1 and 2, cowbird cover

Bob Gress, Great Plains Nature Center, *gpnc.org*, eastern woodrat, prairie vole and prairie vole 1, plains pocket gopher, plains pocket gopher 1

Centers for Disease Control and Prevention, Rodents, Images of Rodents, www.cdc.gov/rodents/resources/images.html, cotton rat, white-footed mouse; Orkin, Inc., Norway rat

University of Georgia, Bugwood Network, *Bugwood.org*

Deena Chadi, William Paterson University, *Bugwood.org*, house sparrow

Ken Hackman, *Bugwood.org*, kangaroo rat

R. L. Hamblen, *Bugwood.org*, deer exclusion

Terry L. Spivey, Terry Spivey Photography, *Bugwood.org*, American crow

Matt Pound, USDA Agricultural Research Service, *Bugwood.org*, American dog tick

Alfred Viola, Northeastern University, *Bugwood.org*, thirteen-lined ground squirrel

USDA Forest Service, Northeastern Area Archive, gopher mound

U.S. Fish and Wildlife Service Archive, black-tail jackrabbit

University of Michigan, Animal Diversity Web, <http://animaldiversity.ummz.umich.edu/>

Susan Hoffman, Miami University, Department of Zoology, Oxford, Ohio, house mouse

Phil Myers, University of Michigan, Museum of Zoology, meadow vole

U.S. Fish and Wildlife Service, National Digital Library, <http://digitalmedia.fws.gov/cdm/>

John Collins, striped skunk

Ryan Hagerty, black-footed ferret

Thomas G. Barnes, common grackle

Steve Thompson, coyote

Lewis Gorman, eastern cottontail rabbit

Gary Zahm, elk

Gary M. Stolz, black-tailed prairie dog

James C. Leupold, pronghorn antelope

Steve Hillebrand, white-tailed deer

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