2021 NCF-Envirothon Nebraska
Wildlife Study Resources

Key Topic #1: Population Management

1. Identify major potential diseased threatening wildlife species and describe their characteristics.
2. Identify threatened and endangered species in Nebraska in Nebraska.
3. Make a habitat assessment and apply population management strategies to address and identified issues.
4. Explain the importance of indicator species in the field of conservation.

Study Resources

Study Resources begin on the next page! 

NEBRASKA ENDANGERED AND THREATENED SPECIES

	Common Name	Scientific Name	State Status	Federal Status
BIRDS	Eskimo Curlew*	*Numenius borealis*	Endangered	Endangered
	Whooping Crane	*Grus americana*	Endangered	Endangered
	Interior Least Tern	*Sternula antillarum athalassos*	Endangered	Endangered
	Piping Plover	*Charadrius melodus*	Threatened	Threatened
	Rufa Red Knot ^	*Calidris canutus rufa*	Threatened	Threatened
	Mountain Plover	*Charadrius montanus*	Threatened	
MAMMALS	Black-footed Ferret*	*Mustela nigripes*	Endangered	Endangered
	Gray Wolf ^	*Canis lupus*	Endangered	Endangered
	Swift Fox	*Vulpes velox*	Endangered	
	River Otter	*Lontra canadensis*	Threatened	
	Southern Flying Squirrel	*Glaucomys volans*	Threatened	
	Northern Long-eared Bat	*Myotis septentrionalis*	Threatened	Threatened 4(d) rule
FISH	Pallid Sturgeon	*Scaphirhynchus albus*	Endangered	Endangered
	Topeka Shiner	*Notropis topeka*	Endangered	Endangered
	Sturgeon Chub	*Macrhybopsis gelida*	Endangered	
	Blacknose Shiner	*Notropis heterolepis*	Endangered	
	Lake Sturgeon	*Acipenser fulvescens*	Threatened	
	Northern Redbelly Dace	*Chrosomus eos*	Threatened	
	Finescale Dace	*Chrosomus neogaeus*	Threatened	
INSECTS	American Burying Beetle	*Nicrophorus americanus*	Endangered	Endangered
	Salt Creek Tiger Beetle	*Cicindela nevadica lincolniana*	Endangered	Endangered
REPTILES	Western Massasauga	*Sistrurus tergeminus*	Threatened	
MUSSELS	Scaleshell Mussel	*Leptodea leptodon*	Endangered	Endangered
PLANTS	Blowout Penstemon	*Penstemon haydenii*	Endangered	Endangered
	Colorado Butterfly Plant	*Gaura neomexicana* ssp. *coloradensis*	Endangered	Threatened
	Saltwort	*Salicornia rubra*	Endangered	
	Western Prairie Fringed Orchid	*Platanthera praeclara*	Threatened	Threatened
	Ute Ladies'-tresses	*Spiranthes diluvialis*	Threatened	Threatened
	American Ginseng	*Panax quinquefolius*	Threatened	
	Small White Lady's Slipper	*Cypripedium candidum*	Threatened	

Although all the species in this table are state-listed, comments on Eskimo Curlew, Rufa Red Knot, Black Footed Ferret, and Grey Wolf are typically not included in environmental reviews due to the population status and/or rarity of these species in Nebraska.

* There are historical records of these species in Nebraska, but no known recent records or extant populations in Nebraska.

^ There are recent (not historical) records of these species in Nebraska. However, there are no known breeding populations and/or Nebraska does not provide an important stopover or migratory path for these species.

30 State-listed Species: 11 State & Federal Listed Endangered
4 State-listed Endangered
1 State-listed Endangered & Federal Listed Threatened
5 State & Federal Listed Threatened
9 State-listed Threatened

May 9, 2016

Carrying Capacity

There are only so many animals that can live in an area. The concept of carrying capacity is related to the number of animals that can exist in an area. Biological carrying capacity refers to the maximum number of animals, within a given species, an area can support before that species or another species is negatively affected. The quantity and quality of food, cover, water and space determines the carrying capacity. The requirement that is in shortest supply, called the limiting factor, determines carrying capacity. By increasing the requirement in shortest supply, a manager can increase the area's biological carrying capacity.

Biological carrying capacity varies from season to season and often from year to year. For most species, it is usually greatest from late spring through fall when food and cover are most abundant. This is when most young are born, which helps ensure adequate nutrition and cover are available for growth and survival. With the coming of winter or summer drought, food and cover gradually diminish.

More animals are produced each year than will survive. Surplus animals are lost to predation, starvation, competition or disease. Young wildlife and animals in poor health experience the highest mortality rates. Hunting and fishing remove some animals and help prevent overpopulation for some species.

In suburban areas, the biological carrying capacity may be able to support a given number of animals. However, humans may demand the density of certain wildlife be lower because of wildlife damage issues. For example, white-tailed deer populations can thrive in suburban areas where the biological carrying capacity is relatively high because deer have adapted to feed successfully on ornamental plants. However, homeowners have low tolerance for deer feeding on expensive landscape plants. Thus, the deer population must be reduced to limit damage. In this case, the cultural carrying capacity is lower than the biological carrying capacity.

Population Management Practices

Decrease Harvest

General description

Regulated hunting, trapping and fishing regulations are primary tools used to manage many wildlife and fish species. State and federal wildlife agencies set regulations for hunting, trapping, and fishing seasons and bag and creel limits. Landowners can choose to take the maximum allowed or less than that, depending on local populations and personal management objectives.

Gamebirds and mammals

Decreasing harvest may be necessary when data indicate populations are declining, especially in areas with good habitat. However, harvest through hunting and trapping is seldom the reason for declining wildlife populations. Rather, habitat quality is usually the reason for widespread low or declining populations. If food, cover, water, or space is limiting, populations may remain low or decline. Appropriate habitat management practices should enhance habitat and allow populations to stabilize or increase.

Disease and, less often, unsustainable mortality from predation are other reasons for low or declining populations. If populations are low or declining because of predation, it is likely related to habitat (poor-quality cover) or possibly an abnormally high predator population. In this scenario, habitat management and possibly a reduction in the predator population can address low or declining gamebird or mammal populations. Possible examples, though relatively rare, include abnormally high predation rates on deer fawns by coyotes or abnormally high predation rates on wild turkey eggs and poults from raccoons.

NOTE: ***Decrease Harvest*** is not an option for migratory species, such as waterfowl and mourning dove, because the U.S. Fish and Wildlife Service sets bag limits and individual landowners cannot influence population levels of migratory species.

Largemouth bass/bluegill

Balanced bass/bluegill populations

Documented via seine sampling: Young largemouth bass present. Many newly hatched bluegills and some intermediate (3-5 inches) bluegill present.

Documented via angler sampling: Proportional Size Distributions (PSDs) – Between 40 percent and 70 percent of 8 inch or larger largemouth bass caught are at least 12 inches long and 40 percent to 60 percent of 3 inch or larger bluegill caught are at least 6 inches long.

Decrease bass harvest when:

Seine sampling reveals young bass may or may not be present, many intermediate-sized bluegills in poor condition but no recent hatch of bluegills. If angling reveals few bass present but > 60 percent of the bass caught are at least 12 inches long while < 50 percent of bluegill are at least 6 inches long, return all bass. The lack of bluegill reproduction and poor condition of intermediate bluegill suggests the bluegill population may be too high and food is a limiting factor. Reduce bass harvest (catch and release is ok) to increase predation pressure on intermediate-sized bluegills.

Decrease bluegill harvest when:

Seine sampling reveals no young bass present and many recently hatched bluegills but few intermediate bluegills present. If angling reveals < 20 percent of bass caught are at least 12 inches long and > 80 percent of bluegill are at least 6 inches long, return all bluegill. Assess if other species of fish (such as green sunfish) may be competing with bluegill and if so, consider draining or renovating pond and restocking.

Channel catfish

As angler catch rates of channel catfish decline, impoundments are usually restocked with additional fingerlings (rather than reduce harvest) in order to maintain angling opportunities.

Coho salmon

A number of populations of Coho salmon in the southern portion of its range are in decline and have been listed as federally endangered or species of concern; therefore harvest is not allowed.

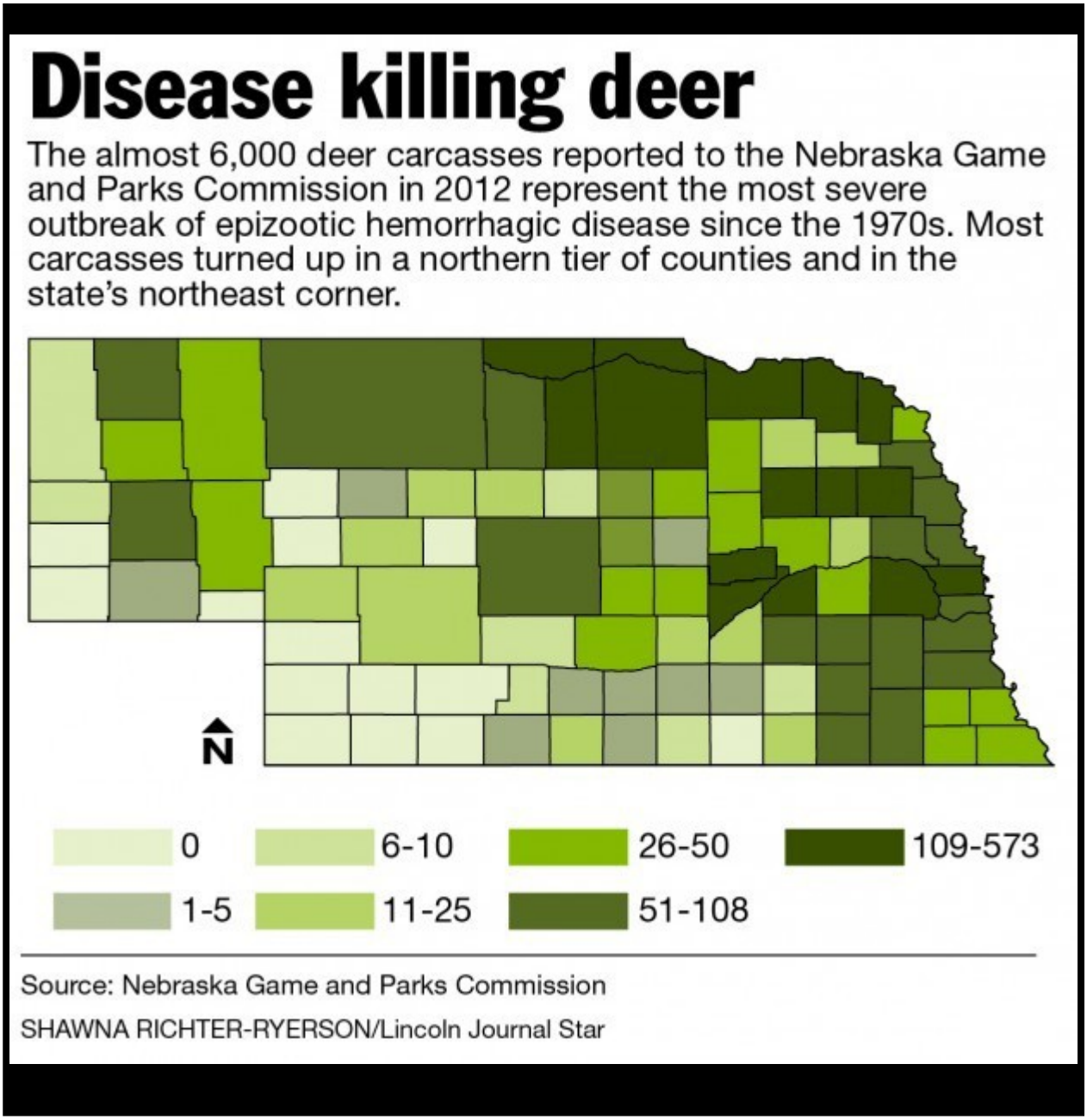
Cutthroat and Rainbow trout

Decrease trout harvest when seine and fishing records of a pond reveal that fish are in good condition and there are few medium and large fish and many small fish.

Deer population reeling from disease outbreak

1 of 2

A whitetail doe bounds through a restored grassland in Thayer County in 2011. A drought-related fever has killed around 6,000 deer in Nebraska this year, the most since 1976.



The almost 6,000 deer carcasses reported to the Nebraska Game and Parks Commission in 2012 represent the most severe outbreak of epizootic hemorrhagic disease since the 1970s.

"I think throughout the Midwest, there are states dealing with it," said Scott Taylor, wildlife division manager with Game and Parks. "But I think Nebraska is dealing with it to a greater degree than any other state, because the drought conditions are worse than any other state.

“Last year was maybe 10 or less,” Taylor said of reports from the public on an often fatal malady inflicted on deer by biting insects. “Within the last 10 years, the highest we’ve seen is maybe a few hundred.”

If the drought persists in 2013, the carcass count could rise rapidly again through the summer months.

What happened this year, what could happen next year, and what adjustments might be in order for hunting licenses are prominent topics in a series of big-game meetings across the state this month.

The closest meeting sites to Lincoln are at the Ak-Sar-Ben Aquarium near Gretna at 7 p.m. Tuesday and at the Kilgore Memorial Library in York at 6 p.m. Thursday.

Bruce Trindle, a Game and Parks wildlife biologist in Norfolk, attended a similar session there last week.

“We’ve had these deer meetings before,” Trindle said, “and they generally draw a crowd of about 25 people. And I think we had a little over 100 last Thursday -- which, to me, is amazing.”

Drought contributes in two ways, Taylor said.

“The receding water, the standing water leaves a sort of mud line. That mud line provides a habitat for the midge, the biting midge that causes the disease.”

Also, as water sources dry up entirely, more deer congregate around the remaining drinking spots, “and there’s sort of a recipe for a large outbreak.”

Along with causing hemorrhaging, the disease makes affected animals feverish. That's why they plunge into water to cool off and why their carcasses often are found in rivers and streams.

Damage to the deer population, mostly whitetails, ended abruptly in October with the freezing temperatures that killed the midges.

But in a two-week period in September, the report total reached 1,841.

"This year, because it was unusually hot and dry early, it seemed to start up in July," Trindle said. "And that's another reason this one was so bad."

The flare-up won't be viewed as bad news entirely by farmers angry over crop depredation, motorists who've hit deer and others who think the deer population is out of control.

The deer casualty count "comes on the heels of a couple of very liberal hunting seasons," Trindle said. "It's a situation where the level, the remaining level of deer or the population now is probably closer to what we were trying to reach."

Trindle said the most carcasses turned up in a northern tier of counties and in the state's northeast corner.

But veteran Kearney bow hunter Rich Walters said he noticed "a significant reduction in deer numbers" in his part of the state.

"I've been finding a fair number of dead ones along the riverbanks," he said.

Walters, 38, called it "the worst outbreak I've ever seen or heard about."

Bow hunting season began in mid-September. He's still trying to bag his second buck as the end of the season approaches this month.

"It definitely affects the number of deer that you see as a hunter," he said, "but there's nothing we can do about diseases. Hopefully, we can just be proactive and manage them in the future."

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WILDLIFE DISEASES

Like most living things, wildlife are susceptible to illness and disease. Wildlife that are sick or diseased may appear docile or exhibit unusual behavior. Outdoor enthusiasts should be alert to conditions and report any sick or dead animals to the Game and Parks Commission to ensure that proper procedures and testing will take place. As is so often the case, management of any species is greatly dependent upon the assistance and cooperation of our public and those efforts are greatly appreciated. Report sick or potentially sick animals to the Game and Parks office nearest you.
The following are diseases affecting that have been documented in Nebraska and are of concern to wildlife biologists:

Epizootic hemorrhagic disease (bluetongue)

Epizootic hemorrhagic disease *(EHD)* is a disease caused by viruses in the genus orbivirus. It is transmitted to deer by biting midges of the genus culicoides. Both white-tailed deer and mule deer are susceptible to EHD, but white-tailed deer seem to be more vulnerable. Cattle can be infected by the virus but rarely die from it. EHD is not known to infect humans.

This disease most commonly occurs in the late summer and early fall. The timing of this disease is most likely related to the abundance of the midge vectors, with the disease usually ending after the first frost. EHD can be acute, leading to death quickly with deer in good body condition and coat. It may also be chronic, with the deer becoming emaciated and lame. Clinical signs are therefore widely varied. They may include fever, hemorrhaging around the orifices and lack of fear of humans. Generally, high fevers lead deer to water before they die. However, this may not always be the case where die-offs occur over a large geographic region. A confirmed diagnosis requires fresh lymph nodes or blood from sick or freshly killed deer exhibiting clinical sings. For more information, visit the EHD page.

White-nose syndrome

White-nose syndrome *(WNS)* is an emergent disease of hibernating bats that has spread from the northeastern to the central United States at an alarming rate. Since the winter of 2007-2008, millions of insect-eating bats in 25 states and five Canadian provinces have died from this devastating disease.The disease is named for the white fungus, Pseudogymnoascus destructans, which infects skin of the muzzle, ears and wings of hibernating bats.

Current estimates of bat population declines in the northeastern United States since the emergence of WNS are approximately 80 percent. This sudden and widespread mortality associated with WNS is unprecedented in hibernating bats, among which disease outbreaks have not been previously documented. It is unlikely that species of bats affected by WNS will recover quickly because most are long-lived and have only a single pup per year. Consequently, even in the absence of disease, bat populations do not fluctuate widely in numbers over time.

Indicator Species

Lead Authors: Caitlin McDonough, David Jaffe
Contributing Author: Mary Watzin
Topic Editor: Mark McGinley
Source: Encyclopedia of Earth

An indicator species is an organism whose presence, absence or abundance reflects a specific environmental condition. Indicator species can signal a change in the biological condition of a particular ecosystem, and thus may be used as a proxy to diagnose the health of an ecosystem. For example, plants or lichens sensitive to heavy metals or acids in precipitation may be indicators of air pollution. Indicator species can also reflect a unique set of environmental qualities or characteristics found in a specific place, such as a unique microclimate. However, care must be exercised in using indicator species. Judging an ecosystem based on the response of a single indicator species might be like taking a pulse on a patient and immediately prescribing a treatment without a) further examination, b) other indicators such as blood pressure, or c) knowledge of the patient's past medical history.

Indicator species are an appealing research and monitoring tool. A conservation practitioner can use an indicator species as a surrogate for overall biodiversity, monitoring the outcomes of management practices by measuring the rise or fall of the population of the indicator species. One example of the use of indicator species is the spotted owl as an indicator of old growth habitat. However, this owl was at the heart of the timber industry v. environmentalist controversy over old growth forests in Oregon and Washington, USA. At the time it was believed that spotted owl habitat was limited to the big, tall trees and standing dead wood found only in very old and mature forests (though now it is clear that spotted owl habitat is much more widely distributed). River otters have been used as indicators of healthy, clean river systems. In the humid mountain forests of Mexico, many peaks harbor a distinct species of arboreal lizard. The health of these unique tree-dwelling lizard populations is used an indicator of the health and biodiversity of the natural communities in the region. Similarly, maidenhair ferns are known to grow in rich northern hardwoods throughout New England, but a subspecies of maidenhairs that are found only in sites with serpentine mineral soil is an indicator of a specific substrate.

Indicator species are a useful management tool, and can help us delineate an ecoregion, indicate the status of an environmental condition, find a disease outbreak, or monitor pollution or climate change. In one sense, they can be used as an “early warning system” by biologists and conservation managers. Indicator species must also be accompanied by a thorough study of what is being indicated, what is really correlated, and how this one species fits into the rest of ecosystem.

While the concept has excited international initiatives to identify indicator species, in practice, identifying potential indicator species is hard work. The organism’s presence, absence or abundance must be linked to an environmental condition in a scientifically-sound manner to justify its use as a conservation practitioner’s proxy. As the old adage goes, “correlation does not equal causation.” A case in point: it was widely believed (and highly publicized) that a worldwide decline in frogs was an indication of global climate change. The decline, however, seems to be the result of many factors that vary locally. Thus, it remains unclear what environmental or other changes are indicated by declines in frog populations.

References

1. Miller, Brian et al. (1998). Using Focal Species in the Design of Nature Reserve Networks. The Wildlands Project. Wild Earth Winter 1998/1999.
2. David B. Lindenmayer, Chris R. Margules, Daniel B. Botkin (2000). "Indicators of Biodiversity for Ecologically Sustainable Forest Management." Conservation Biology 14 (4), 941–950
3. McCallum, M. L. (2007). Amphibian Decline or Extinction? Current Declines Dwarf Background Extinction Rate. Journal of Herpetology. 41(3):483–491.

Citation
Caitlin McDonough, David Jaffe (Lead Author);Mary Watzin (Contributing Author);Mark McGinley (Topic Editor) "Indicator species". In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth December 18, 2009; Last revised Date June 11, 2012; Retrieved September 28, 2012 <http://www.eoearth.org/article/Indicator_species?topic=58074>

UNL professor, Henry Doorly Zoo work to sustain tiger salamander population

Kelsey Connelly | Courtesy photo

Four years ago, School of Natural Resources professor Dennis Ferraro noticed something was missing near Nebraska's ponds and streams.

A species of tiger salamander that once flourished in eastern Nebraska was nowhere to be found.

The University of Nebraska-Lincoln teamed up with Omaha's Henry Doorly Zoo and Aquarium in an attempt to find out where the amphibians had gone.

“There used to be hundreds of tiger salamanders throughout Douglas, Sarpy and Cass County,” Ferraro said. “We could find them without even trying.”

The disappearance of the western barred tiger salamander, named for the yellow vertical bar pattern along its black skin, concerned Ferraro and the Henry Doorly Zoo for two reasons:

With only two species of salamanders in Nebraska, the tiger salamander is important to the biodiversity of the wetlands and woodlands’ ecosystems.

“They’re a big part of the food chain,” said Sara Plesuk, supervisor of reptiles and amphibians at the Henry Doorly Zoo. “A lot of animals are tied to the amphibian population.”

Tiger salamanders — like all other amphibians — are an indicator species, meaning if their population declines it’s usually a sign of a larger issue.

“The decline could be because of habitat destruction, contamination or diseases, so we have been searching for them,” Ferraro said.

Ferraro and the zoo, along with members of the Nebraska Game and Parks Commission, 23 master naturalists and a local amphibian task force began their search for the missing tiger salamanders.

They set up 50 traps stretching from Washington County to Nemaha County, in places such as Pioneers Park Nature Center and Fontenelle Forest.

The zoo then set up the “Have you seen a tiger salamander?” program.

“We started a campaign with the members of communities throughout eastern Nebraska to help find these tiger salamanders,” Ferraro said. “If you found one of the salamanders you would call in and let us know.”

But after a year of campaigning, only one tiger salamander was spotted.

While the tiger salamander remained missing in eastern Nebraska, western counties had hundreds.

“The difficult thing is we don’t know why,” Plesuk said. “Many people just assumed we didn’t need to pay attention to them, but then we noticed they weren’t prevalent, so we are trying to fix a wrong.”

Ferraro and the team at the Henry Doorly Zoo began construction of an on-site ephemeral pond with their findings in western Nebraska in June 2014.

“The Henry Doorly Zoo is in the heart of the area where these salamanders are disappearing,” Ferraro said.

The pond will be monitored by Ferraro and a group of University of Nebraska-Lincoln students for the next two to three years as they try to establish a sustainable tiger salamander population.

“This project will continue until we solve the problem,” he said.

As the temporary pond gains publicity, Ferraro and members of the team at the Henry Doorly Zoo said they hope that the disappearance of the tiger salamander will raise awareness about the importance of environmental conservation.

“Species running close to extinction get a lot of press and money, but species like the tiger salamander aren’t getting enough attention,” Plesuk said. “People need to realize that conservation starts in our own backyard.”

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2021 NCF-Envirothon Nebraska
Wildlife Study Resources

Key Topic #2: Life History

5. Identify the taxonomic classifications of common Nebraska mammals, birds, herptiles, insects, and plants.
6. Describe the physical and behavioral adaptations of wildlife to different habitats and landscapes.
7. Differentiate between a food chain and a food web and describe how different types of animals play different roles as consumers in an ecosystem.
8. Identify common Nebraska wildlife species, including their niches, ranges, and food sources.

Study Resources

Nebraska Game and Parks Commission; Big Game Species, 2021. (*Pages 18 -20)*

Wildlife Habitat Evaluation Program Manual; Wildlife Management Concepts andTerms, p. 26, 27, 2019. (*Page 21*)

Recent Northern Records of the Nine-Banded Armadillo (Dasypodidae) in Nebraska:Digital Commons @Univerity of Nebraska-Lincoln, 1998. (*Pages 22-27*)

Armadillo Marches North; Lincoln Journal Star, 2015. (*Pages 28-30*)

Plains Hog-Nosed Snaked; Institute of Agriculture and Natural Resources, 2021. (*Page 31*)

Wildlife Habitat Evaluation Program Manual; Wildlife Species, p. 117, 2019. (*Page 32*)

Nebraska Game and Parks Commission; Mountain Lions in Nebraska, 2021. (*Pages 33-39*)

A Poison Ivy Primer; Smithsonian Insider, 2014. (*Pages 40-43*)

Bur Oak; Nebraska Forest Service, 2021. (*Pages 44-48*)

Wildlife Habitat Evaluation Program Manual; Regions, p. 25, 2019. (*Page 49*)

Penn Arts & Sciences: Digestive System, University of Pennsylvania, 2021. (*Page 50-51*)

Study Resources begin on the next page! ➡

NEBRASKA
GAME PARKS

BIG GAME SPECIES

Big game hunting and viewing opportunities in Nebraska are available for five species: white-tailed deer, mule deer, pronghorn, elk and bighorn sheep. Both species of deer provide annual hunting opportunities for most residents and nonresidents who wish to hunt. Pronghorn and elk populations in the northwest offer more limited, but consistent hunting opportunities. Bighorn sheep offer great viewing opportunities, and in some years, limited hunting.

BIG GAME SPECIES

Pronghorn - *Antilocapra americana*

Class: Mammalia

Order: Artiodactyla

Family: Anitocapridae

The pronghorn is North America's swiftest land mammal and one of the fastest in the world. Its speed, endurance and keen eyesight are well adapted to the short-grass prairies and gumbo badland of the western United States. Although commonly called an antelope, the pronghorn technically is not an antelope but the sole species in a family found only in North America. Pronghorn hunting is one of Nebraska's most challenging

big game experiences. Animals can be glassed and horn size determined at great distances. Herds were at the brink of extinction in Nebraska by 1907 when all hunting seasons were closed. Slow expansion occurred for the next 50 years, and hunting seasons have been held every year since 1958. Pronghorn occur primarily in Northwestern Nebraska and provide hunting opportunity to archers and firearm hunters annually.

Bighorn Sheep – *Ovis canadensis*

Class: Mammalia

Order: Artiodactyla

Family: Bovidae

Before 1900, Audubon bighorn sheep inhabited parts of western Nebraska including the Wildcat Hills, the Pine Ridge, along the North Platte River to eastern Lincoln County, and along the Niobrara River. It is thought that the Audubon bighorn probably became extinct in the early 1900s with its last stronghold being the South Dakota badlands.

In 1981, the Nebraska Game and Parks Commission released a dozen bighorn sheep in Fort Robinson State Park. Subsequent releases of bighorns in 1988, 2001, 2005, 2007 and 2012 have established bighorns in the Wildcat Hills and Pine Ridge of Nebraska's panhandle. Limited hunting opportunities have been available since 1998 through the issuance of auction and lottery permits. Approximately 350 bighorn sheep occupy the bluffs and buttes of western Nebraska.

Elk – *Cervis canadensis*

Class: Mammalia

Order: Artiodactyla

Family: Cervidae

Herds once common across all of Nebraska became extinct by 1900. In the 1960s a few elk returned to Nebraska, and in 1986 Nebraska had its first modern elk season. Since then, elk and have expanded into hills and rivers of western Nebraska, and the annual passage of young bulls through eastern Nebraska is a common occurrence. More than 1,600 elk have been harvested since the first season in 1986. Nebraska Game and Parks public lands and U.S. Forest Service lands in Ash Creek, Bordeaux and Hat Creek units provide public land hunting opportunities for some elk hunters. However, most elk are taken on private land. It is a good idea to make at least one pre-season trip to elk country before the hunting season to finalize access or to scout potential hunting areas.

Deer: White-tailed Deer - *Odocoileus virgianus,* Mule Deer – *Odocoileus hemionus*

Class: Mammalia

Order: Artiodactyla

Family: Cervidae

Deer were nearly extinct in Nebraska by 1900 due to unlimited hunting. In 1907 the Nebraska Legislature passed a law prohibiting the taking of deer, but recovery took decades. By the late 1930s, deer numbers were estimated at 2,500 in the Pine Ridge. In 1945 the first modern deer season began with a harvest of 275 mule deer and two white-tailed deer. White-tailed deer are now found statewide with higher densities in the east and in riparian corridors. Mule deer occupy the western two thirds of the state and are the dominant species in 20 counties. Hunters will find very good permit availability as archery, muzzleloader, youth and most firearm permit quotas do not sell out until October or when the season closes. Hunters may donate venison to Nebraskans in need through the Hunters Helping the Hungry program.

Food webs

Food chains are the step-by-step passage of material and energy (food) through an ecosystem. A network of interconnected food chains is called a food web. In terrestrial ecosystems, plants are primary producers in a food chain because they supply food at the lowest level of the food chain. In aquatic ecosystems, phytoplankton (microscopic algae) is the base of the food chain. It takes an enormous number of individual plants (or amount of phytoplankton) to support the other parts of a food web. At the next level of a food chain are primary consumers, plant-eating animals or herbivores. Primary consumers include rabbits, mice, deer, and certain other mammals; some insects and fish; and dabbling ducks, geese, and certain other birds. In aquatic ecosystems, zooplankton and aquatic insects feed on phytoplankton.

Alan Windham

Predators, such as this red-tailed hawk, are necessary to buffer populations of various prey species. For most predators, when one prey species begins to decline, other prey species become more prevalent in the diet.

Primary consumers are eaten by secondary consumers, or carnivores (meat-eaters). This group includes predators, such as birds of prey, snakes, foxes, cats, and people. In aquatic ecosystems, zooplankton and aquatic insects are eaten by small fish. Small fish are eaten by larger fish. Secondary consumers are eaten by tertiary consumers, which may be predators or scavengers, such as turkey vultures, crabs, and sometimes people. Note these categories are very broad and general. Many animals fit into more than one group, and there are more complex levels of a food web. An example is an omnivore, which is an animal that eats both plant and animal matter.

Any of the food web components mentioned above can be broken down by decomposers—organisms such as bacteria and fungi that reduce dead plant or animal matter into smaller particles. A decaying plant, for example, will be broken down into nutrients that enrich the soil. This process supports the growth of more plants and thus, more animals.

The following articles are included to give insight on why the species is expanding its range:

1. Recent Northern Records of the Nine-Banded Armadillo (Dasypodidae) in Nebraska: Digital Commons @Univerity of Nebraska-Lincoln, 1998. (*6 pages*)
2. Armadillo Marches North; Lincoln Journal Star, 2015. (*3 pages*)

December 1998

RECENT NORTHERN RECORDS OF THE NINE-BANDED ARMADILLO (DASYPODIDAE) IN NEBRASKA

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THE SOUTHWESTERN NATURALIST 43(4):491-504 DECEMBER 1998

NOTES

RECENT NORTHERN RECORDS OF THE NINE-BANDED ARMADILLO (DASYPODIDAE) IN NEBRASKA

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Northward dispersal of the nine-banded armadillo *(Dasypus novemcinctus)* has been well documented, beginning with Audubon and Bachman's (1854) report of the species in extreme southern Texas and culminating with the survey by Humphrey (1974) in 1972 (see also Kalmbach, 1943; Buchanan and Talmage, 1954; Buchanan, 1958; Galbreath, 1982; McBee and Baker, 1982). Humphrey (1974) stated that "distribution maps that do not distinguish between permanent armadillo populations and areas containing only pioneering individuals are misleadingly simple." He believed that the northern limit of the permanent population of armadillos as of 1972 was in northern Oklahoma Co., Oklahoma. Individuals beyond that area in northern Oklahoma and Kansas were considered to be only pioneers. Humphrey (1974) hypothesized that the northern limit of the permanent population of armadillos could be defined by two climatic conditions-a lower limit of 380 mm of annual precipitation and an approximate upper limit of 9 freeze-days a year.

In 1989, Caire et al. (1989) noted that a permanent population of armadillos was well-established in Payne Co., Oklahoma, in the vicinity of Stillwater, approximately 55 to 65 km north of the previous limit (Humphrey, 1974). Although the population was temporarily reduced, it had survived three successive extremely cold winters in the late 1970s. Caire et al. (1989) proposed that the breeding population had reached the northern limit of its geographic range, and future range expansions and contractions would depend on climatic changes.

Although the northward movement of permanent populations of the nine-banded armadillos has slowed in recent years and may have reached its northern limit (Caire et al., 1989), the pioneering zone for the species has continued to expand northward and westward on the central Great Plains. Hibbard (1944) reported the first Recent records of the armadillo from Kansas in Chase and Sumner counties. Subsequent authors (Cockrum, 1952; Hall, 1955; Getz, 1961) documented the northward expansion of this pioneering zone in eastern Kansas as far as Osage Co. The first records of the armadillo north of the Arkansas River in central and western Kansas were reported by Smith and Lawlor (1964) based on individuals taken in Sheridan Co. in 1958 and in Saline Co. in 1962. Choate and Fleharty (1975) reviewed the distribution of armadillos in western Kansas, including additional records (see also Bee et al., 1981; Sparks and Choate, 1995).

On 3 July 1963, the first armadillo was recorded in Colorado based on a subadult female taken in the Cimarron River valley in Baca Co. (Hahn, 1966; Armstrong, 1972). Two additional specimens of armadillo have been recorded in eastern Colorado both in association with river systems (Fitzgerald et al., 1994). The first was an adult male found on 26 June 1986 in Prowers Co. in the riparian corridor of the Arkansas River (Meaney et al., 1987) and the second specimen was found on 2July 1987 in Yuma Co. in northeastern Colorado at a locality near the South Fork of the Republican River (Choate and Pinkham, 1988). Humphrey (1974) noted that *Dasypus novemcinctus* was more numerous in semiarid regions along river valleys and associated riparian habitats, which could be used as dispersal routes. Based on this hypothesis, Choate and Pinkham (1988) proposed that the three records of armadillos from Colorado were the result of westward (upstream) rather than northward

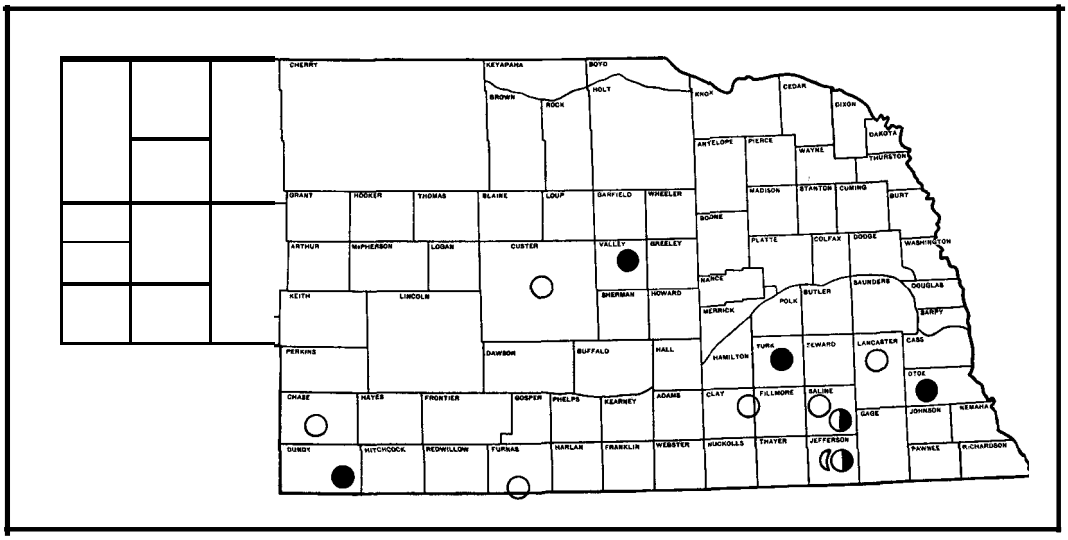

FIG. 1-Map of Nebraska showing records of the nine-banded armadillo, *Dasypus novemcinctus*. Closed circles represent records based upon museum specimens; half-open circles represent confirmed sightings; open circles represent other sightings.

dispersal along the valleys of the Cimarron, Arkansas, and Republican rivers from Kansas.

The pioneering zone of the nine-banded armadillo has continued to expand northward from Kansas and Colorado into Nebraska. Hoffmann and Jones (1970) reported a record of armadillo from south-central Nebraska without reference to a specific locality; Choate and Fleharty (1975) documented the first specimen taken in Nebraska from Benkelman, Dundy Co., in the extreme southwestern part of the state (now deposited in the University of Nebraska State Museum). This nine-banded armadillo also was taken along the valley of Republican River. The individual (Choate and Fleharty, 1975) was an adult (see Stangl et al., 1995 for relative age categories) for which the sex was not recorded. It was shot on the morning of 29 November 1972 as it was "rooting for grubs" in the lawn of Leon Baney, Sr. (Anonymous, 1972).

Currently, the northernmost point of the pioneering zone of the armadillo in North America (Fig. 1) is at 8 mi. W Ord, Valley Co. (41 °36'N, 98°56'W). The individual from this locality was an old adult male, which was captured on 26 December 1986. It was found in a haystack by members of the William P. Pierson family while they were hunting. It was held in captivity for two days before it died. This male had well developed testes that measured 19 mm by 12 mm. We compared the climatic conditions at Ord (freeze-days per year from recording site at Burwell, 27 km NW Ord) with those that Humphrey (1974) believed prevailed at the northern limit of the permanent population of nine-banded armadillos. Ord receives on average 550 mm of rainfall per year, which is well above the 380 mm minimum that Humphrey believed necessary, but there are 176 freeze-days (White, 1964; Baldwin, 1973) per year in this region of Nebraska, which is considerably above the 9 freeze-days maximum at the limit of the permanent population. This would seem to indicate that the number of days with temperatures below *0°C* is less of a limiting factor for populations of armadillos on the central Great Plains than is rainfall. As average temperatures in this region appear to be increasing and winter climate seems to be ameliorating, the northern limit of the pioneering zone for *Dasypus novemcinctus* may be expected to extent further to the north.

The adult male from south of York (see Specimens Examined) was found in the interchange area of U.S. Highway 81 and Interstate Highway 80. When the animal was found by Bruce Hulse in July 1987, it was alive, but it

seemed stunned as if it had been hit by a car. Inspection of the preserved skin does not show any evidence of major trauma. The animal died within a few hours of being captured. This adult male had well developed testes that measured 25 mm by 15 mm. The adult male from ½ mi. N Unadilla, Otoe Co., was found dead beside Nebraska State Highway 2 on 22 July 1996. This individual had well-developed testes that measured 39 mm by 18 mm and was noted by the preparator as being "very fat."

External measurements (in millimeters) of the specimens from Ord, York, and Unadilla, respectively, were as follows: total length, 712, 675, 732; length of tail, 299, 280, 300; length of hind foot, 103, 93, 96; length of ear, 42, 37, 41; weight, 4.27 kg, 5.80 kg, 5.55 kg. Cranial measurements (after Stangl et al., 1995) of these three individuals followed by those of the individual from Benkelman were as follows: greatest length of skull, 101.0, 97.8, -, 105.0; greatest width of nasals, 10.9, 10.4, 9.1, 10.7; rostral width, 19.1, 19.7, 20.0, 18.2; zygomatic breadth, 44.7, 42.3, 44.0, -, interorbital breadth, 25.7, 23.3, 25.4, 25.3; length of premaxillary, 9.6, 12.6, 11.5, 12.3; occipital breadth, 26.9, -, 27.7, 30.1; length of maxillary toothrow, 24.8, 25.0, -, 27.7; length of mandibular toothrow, 26.1, 24.6, 28.1, 29.2; length of palatine, 16.3, 17.8, 18.5, 14.6. The majority of these measurements fall within the range of samples reported by Stangl et al. (1995) from the Rolling Plains of Texas and Oklahoma, indicating that the material from Nebraska exhibits little to no morphological differentiation from this southern population. Given the rapidity with which the pioneering population of the nine-banded armadillo is expanding westward and northward on the central Great Plains, this result was not unexpected. Fifty percent of the 62 specimens examined by Stangl et al. (1995) were missing teeth so that individuals differed from the normal P 7/7, M 1/1 = 32 dental formula for the nine-banded armadillo. The specimen from near Ord possessed 31 teeth, evidently missing the left Pl, and the specimen from near Unadilla had only 30 teeth, missing a tooth in each maxillary toothrow, but it was not evident which of the teeth was missing.

The remaining records of the armadillo from Nebraska are based on sightings by the public or staff of the Nebraska Game and Parks Commission that were reported to the Commission or the Division of Zoology, University of Nebraska State Museum (see Confirmed Sightings and Sightings herein for precise localities). We feel confident that members of the public are able to identify specimens of armadillo (unlike most small mammals), especially those they are able to closely inspect. These sightings support records represented by preserved specimens, making the more northerly localities represented by preserved specimens not appear to be so isolated. In the case of two of these sightings, we have reviewed photographs and talked with local residents, and we consider these to be confirmed sightings. The armadillo from Wilber was found dead on State Highway 103 at the northern edge of town on 30 July 1989 by Whitey Schuerman. Apparently the animal had been "recently hit by a car or truck" (Anonymous, 1989; Jenson, 1989). The armadillo from east of Fairbury in Jefferson Co. was observed by Jeremy Bailey on llJanuary 1996 as it attempted to escape into a shallow burrow when it was disturbed from a hedgerow bordering an agricultural field. The burrow proved to be too shallow for the armadillo, which was captured and photographed before it was released at the capture site.

The sighting south of Arapahoe in Furnas Co. is based on a live individual that was captured by a Nebraska game warden at the junction of U.S. Highway 283 and the Kansas Stateline and was taken to Norton, Kansas. All of the remaining sightings listed herein, except the one from Custer Co. for which we have no data, were individuals that were found dead along highways. Although we have no indication of human involvement in the dispersal of armadillos into Nebraska, we question the sightings from Lancaster and Custer counties. These sightings are fairly far north in the state for the dates in the early 1970s when they were reported; the animal from Lancaster Co. was found dead on a street in Lincoln, which also seems unusual.

Examination of the distribution of nine-banded armadillo in Nebraska (Fig. 1) reveals that these animals may be entering the state from two directions. The animals in Chase, Dundy, and Furnas counties appear to be closely associated with the Republican River and its tributaries and probably reached the

state along these riparian habitats from northwestern Kansas and northeastern Colorado. Records in the central and eastern part of Nebraska are not closely tied to one river system. For the specimen from Ord to have followed watercourses, it would have needed to follow the Big or Little Blue rivers, crossed to the Platte River, and finally reached the North Loup River. Due to the moister climate and extensive center-pivot and ditch irrigation employed in eastern Nebraska, armadillos apparently are not confining their movements to riverine habitats. Nine-banded armadillos appear to be entering this part of Nebraska from north-central Kansas.

Resumen-Los datos de la disperci6n al norte desde hace casi 150 aiios desde el sur de Texas por el armadillo de nueve bandas *(Dasypus novemcinctus)* son revisados. El registro mas hacia al norte para esta especie esta ahora a 8 mi. 0. Ord, Valley Co., Nebraska. Otros tres espedmenes de armadillos son reportados en Nebraska. Se discuten nueve avistamientos adicionales de la especie. Dos de estos avistamientos fueron confirmados basandose en datos que no provinieron de especimenes de museos. La mayorfa de las medidas de los especimenes de Nebraska caen en el rango de las muestras reportadas de los Rolling Plains de Texas y de Oklahoma, indicando que el material de Nebraska exhibe poca o no diferenciaci6n morfol6gica con las poblaciones sureiias. Los armadillos de los condados de Chase, Dundy, y Furnas en el suroeste de Nebraska parecen estar cercanamente asociados con el Republican River y sus tributarios y probablemente llegaron al estado por medio de estos habitat rivereiios del noroeste de Kansas y del noreste de Colorado. Los registros del centro y del este de Nebraska no estan relacionados a un solo sistema de rios. Los movimientos de los armadillos no estan confinados a los habitat rivereiios en el este de Nebraska probablemente por el clima mas humedo y la irrigaci6n de pivote central y de acequia y los armadillos deben estar entrando a esta parte de Nebraska por la parte central norte de Kansas.

We would like to thank J. Springer for allowing us to examine the specimen deposited in the collections of the Department of Biology, University of Nebraska-Kearney (UNK). Specimens listed below as UNSM are deposited in the collections of the University of Nebraska State Museum, University of Nebraska-Lincoln. We would also like to thank the staff biologists of the Nebraska Game and Parks Commission for access to their sighting records and T. Labedz, who has prepared the specimens in UNSM.

Specimens examined (4)-Dundy Co.: Benkelman, 1 (UNSM 13398). Otoe Co.: ½ mi. NW Unadilla, 1 (UNSM 20908). Valley Co.: 8 mi. W Ord, 1 (UNSM 19014). York Co.: 3.5 mi. S York, 1 (UNK 4041).

Confirmed sighting.s,--Jefferson Co.: 3 to 4 mi. E Fairbury (11 January 1996). Saline Co.: Wilber (30 July 1989).

Sighting-Chase Co.: 1 mi. NE Champion (6 November 1986). Clay Co.: 12 mi. E, 1 mi. S Clay Center (21 June 1992). Custer Co.: no specific locality (early 1970s). Furnas Co.: 21 mi. S Arapahoe (1 September 1972). Jefferson Co.: 1 mi. W Fairbury (28 August 1989). Lancaster Co.: Lincoln (early December 1972). Saline Co.: Friend (early 1980s).

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Armadillo marches north

- By NICHOLAS BERGIN / Lincoln Journal Star
- Mar 18, 2015

Nine-banded armadillos have been seen in Nebraska in recent years, but the species' historic range has been farther south.
Nebraska Game and Parks Commission

Sasha Denton closed up the Runza in Crete and left the restaurant in the company of three coworkers Friday night.

As they walked toward her car, she noticed something the size of a small dog lying on the pavement bathed in yellow lamplight. It had a pig-like snout, a long tail and an oblong body covered in bands.

Armadillos are a rare sight in Nebraska, and Denton was shocked to see one.

“We poked it with a softball bat because we didn’t know whether it was still alive,” she said.

It wasn’t.

Mike Fritz, a natural heritage zoologist with Nebraska Game and Parks, said he gets fewer than a dozen reports of armadillos in Nebraska each year. The numbers vary and often depend on the severity of the prior winter.

Most are spotted along roadsides following an unfortunate run-in with a tire. The nine-banded armadillo, also known as Dasypus novemcinctus or the "nine-banded hairy-foot,” has a great sense of smell but poor eyesight and is terrible at dodging cars.

Armadillos have been marching steadily from South America north throughout recorded history, crossing the Rio Grande into Texas before 1854, according to the **Kansas Mammal Atlas**.

But winter generally stops their migration. They don’t regulate body temperature well, making cold weather fatal.

The most northern recorded finding of an armadillo in Nebraska was near Ord, said Professor Trish Freeman, a zoologist with the University of Nebraska-Lincoln’s School of Natural Resources.

Whether it fell off a hay wagon or wandered that far north on its own is a matter of speculation, but Freeman prefers to believe it walked on up from Kansas, where there is an established breeding population.

So far, the 9-banded pioneers recorded in Nebraska all have been male.

“That tells me they are not breeding here,” Freeman said.

Armadillos eat insects, worms, snails, small amphibians, bird eggs, berries and fruits. They have broad claws for digging and give birth to quadruplets.

While they can carry leprosy, instances of them transmitting the disease to humans are rare.

Denton, after contacting the Crete Police Department, scooped up the stiff and smelly immigrant with a snow shovel and put it to rest in the closest trash bin.

*Reach the writer at 402-473-7304 or **nbergin@journalstar.com**. Follow him on Twitter at **@ljsbergin**.*

Plains Hog-nosed Snake (FORMERLY WESTERN HOGNOSE SNAKE)

NONVENOMOUS

Other Names: Plains Hognose Snake
Scientific Name: *Heterodon nasicus*
Family: Xenodontidae

Life History

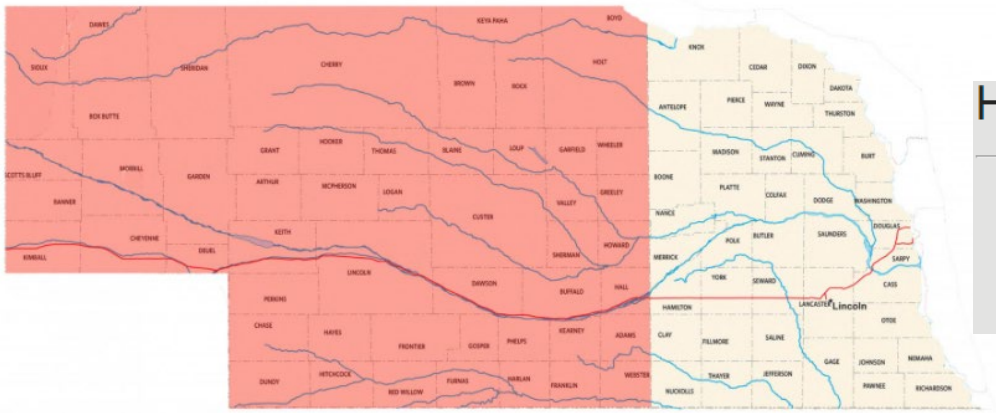
- Diurnal, rarely nocturnal
- Active season: April – October
- Breeding season: Late spring – early summer
- Lays eggs
- 4-25 eggs per female

Description & Size

- Legless
- No eyelids
- Lacks external ears
- Scales on the back have a prominent ridge in the middle (strongly keeled)
- Divided anal scale
- Upturned nose
- Total length: 38.0-100.6 cm (15.0-39.6 in)
- Back color: light brown to tan
- Belly color: usually black
- May have multiple dark blotches up and down the back

Diet

- Toads and frogs
- Lizards
- Small mammals
- Reptile and bird eggs and hatchlings



Habitat

- Dry short or mixed-grass prairie
- Sandy, loose soil
- Next to a body of water

Western hognose snake

General information

Western hognose snakes prefer scrubby flat or gently rolling prairies with sandy soil. Often these sandy sites are characterized by sparse vegetation in most years (Stages 2 through 4). Hognose snakes mimic rattlesnakes when threatened but are not dangerous. If their initial threat does not work, they will sometimes fake death by rolling over and exposing their undersides. Western hognose snakes burrow into loose soil to find food and spend the winter.

Habitat requirements

Diet: toads, frogs, reptiles, birds, mice and eggs
Cover: grasslands and shrubland
Water: necessary water obtained from diet

Wildlife management practices

Establish Native Grasses and Forbs: where native prairie has been converted to non-native grasses
Manipulate Succession: prescribed fire and chaining are recommended to reduce woody vegetation where needed and maintain native short grass prairie; grazing management should leave adequate herbaceous cover for prey populations

NEBRASKA GAME PARKS

MOUNTAIN LIONS IN NEBRASKA

Mountain lions (commonly called cougar or puma) vary in size and weight. Males (100 to 170 lbs.) are larger and heavier than females (60 to 100 lbs.). They are generally uniformly tan in color with a black tipped tail and dark fur on the back of the ears. Juveniles have dark spots and a dark-ringed tail until they are about 1 year of age.

Mountain lions occur in a variety of habitats, but prefer rougher, wooded areas. Cover for stalking and prey abundance are probably the most essential components of

mountain lion habitat. Mountain lions are most active from dusk to dawn, but will also move during the day. Deer are the choice prey but mountain lions will also prey on elk, bighorn sheep, small game, porcupines, and a variety of other species. After killing their prey, mountain lions often drag or carry the carcass under a bush or tree. After feeding, the carcass is often covered with litter to avoid detection by scavengers.

Mountain lions are commonly identified by trail camera photographs, tracks, and feces.

Although mountain lions were part of Nebraska's native fauna, they were extirpated by the end of the 19th century. Despite annual reports since the 1950s, no confirmed sighting was made in the state until the 1990s. In 1991 mountain lion tracks were found and shortly after, an adult mountain lion was shot by a hunter near Harrison, in Sioux County.

For information on mountain lion hunting in Nebraska, visit the mountain lion hunting page.

Facts about mountain lions in Nebraska

- The Commission's management goal is to maintain resilient, healthy, and socially acceptable mountain lion populations that are in balance with available habitat and other wildlife species over the long term.
- Nebraska has three documented mountain lion populations; the largest is in the Pine Ridge, where part of the state's inaugural mountain lion hunting season was held in 2014. The Niobrara Valley and Wildcat Hills also have populations, and those areas have remained closed to hunting. There are likely additional mountain lions elsewhere in the state.

- Mountain lions in Nebraska are part of the larger population that spans all Western states, and animals move freely between Nebraska and neighboring states, particularly South Dakota and Wyoming.
- Genetic surveys conducted between 2010 and 2017 indicate that the population in the Pine Ridge has increased, with estimates ranging from 22 – 33 between 2010-2015 and 59 total animals in 2017. As with all wildlife populations, the number in an area will fluctuate over time, so these estimates only apply to the years that the surveys were conducted.
- All populations continually change in size due to births and deaths as well as animals that enter or leave the area. It is not accurate to only subtract deaths from a population estimate without accounting for changes through births and animals entering or leaving the area over time.
- An in-depth feature published by NEBRASKAland Magazine sheds more light on Nebraska's mountain lion population.

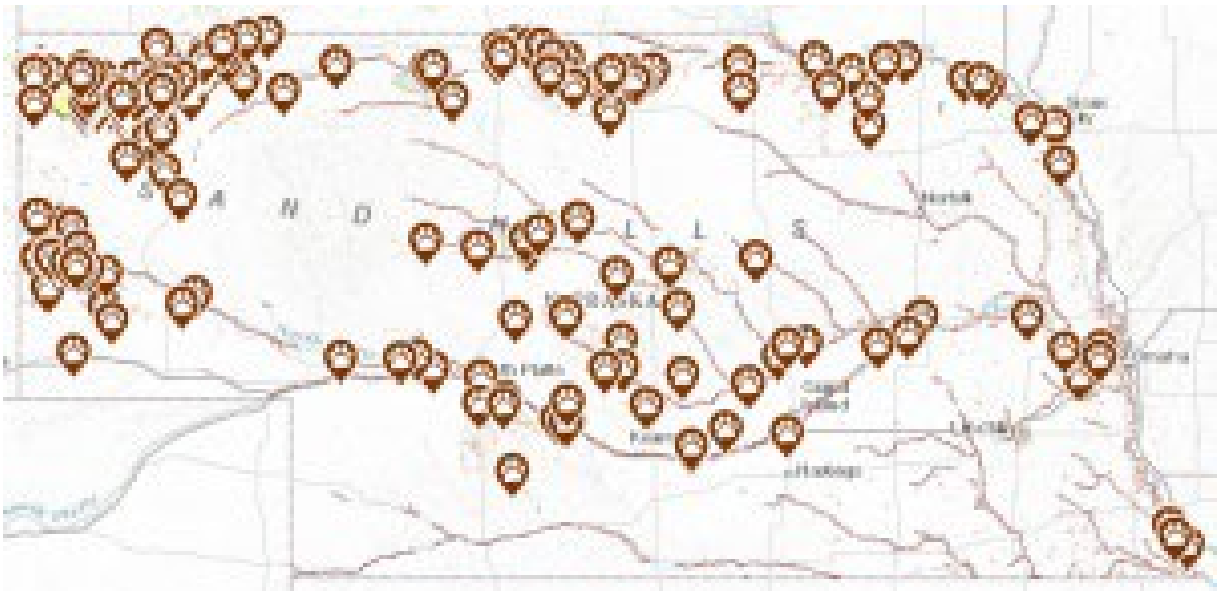
Mountain lion management plan

In 2017, the Nebraska Game and Parks Commission approved a mountain lion management plan intended to guide management decisions based on the agency's mission, as well as the management goals and guiding principles stated in the plan.

Mountain lion response plan

In 2003, the Nebraska Game and Parks Commission developed a plan to respond to various situations involving the state's growing mountain lion population.

Mountain lion sightings



The interactive map to the right lists only those observations that have been confirmed based on unambiguous evidence including fur, scat, tracks and trail camera photographs. The confirmations on the map do not necessarily represent individual mountain lions as a single mountain lion may be confirmed multiple times as it moves through the countryside. In addition, the map shows confirmations made over more than two decades.

Distribution and recent expansion of mountain lions

Arrows depict known or suspected interchange of animals among breeding populations.

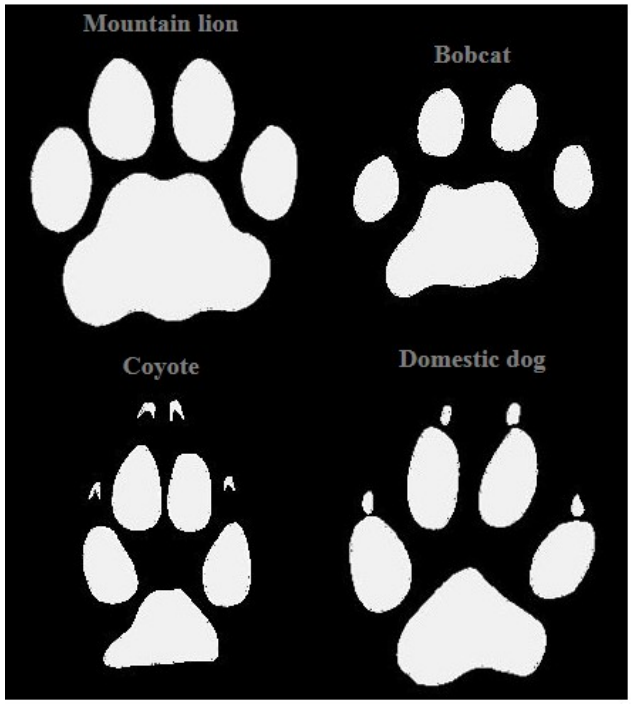
Mountain lions – particularly young animals – can travel long distances in search of new territory. This not only allows for healthy genetic interchange, but it can replenish populations through new immigration. Most mountain lions documented in the eastern part of the state have been young males, which typically travel farther than young females. Nebraska is presently conducting research using GPS collars and genetic surveys that may help detect local and regional movements of individual lions.

Reporting a mountain lion observation

The Nebraska Game and Parks Commission is interested in verifying mountain lion observations in Nebraska. If you have evidence of a mountain lion (such as a trail camera photo, video, tracks, feces, hair, etc.) please call your nearest Commission office and we will investigate the observation. If you are not certain if the tracks you found are from a mountain lion, please consult the track comparison shown below. Cover the tracks with buckets to prevent destruction and inform the Commission. If you take photos of sign, please include a ruler or pen in the picture for size reference and take photos of more than one track in the track line.

If you encounter a possible mountain lion kill (deer or livestock), please leave the kill site undisturbed and inform your nearest Commission office immediately. We will then attempt to record a possible re-visitation to identify the predator.

Track comparisons



The images to the right display tracks made by the front paws. Mountain lion front tracks are 3″ to 4 1/4″ long and 3 1/4″ to 4 3/4″ wide. Size alone cannot be used to distinguish mountain lion tracks as many dog tracks are as large, or larger, than mountain lion tracks. Claws usually do not register because they are retracted. Claw marks are usually (but not always) visible in coyote and dog tracks. The heal pad in cat tracks has two lobes in the front and three lobes in the back, while dog and coyote tracks show only one lobe in the front and two lobes in the back. The tracks from a small mountain lion and a large bobcat can be difficult to distinguish.

What to do in case of an encounter

Due to their secretive nature and low density, mountain lions rarely interact with humans. Occasional interactions may occur with increased human activities in natural areas and mountain lion immigration into populated areas with high deer densities.

- Do not approach a mountain lion.
- Leave the animal an avenue of escape.
- Stay calm, move slowly.

- Back away safely if you can. Do not turn your back to the lion or start running.
- Raise your arms or backpack to appear larger.
- Lift up your children to prevent them from running.
- If you are being attacked fight back. Mountain lion have been successfully driven off with bare hands. Use rocks, or whatever you can get your hands on. Try to remain on your feet or get back up if knocked down.

Future

Considering that mountain lions have established populations in three areas, and they are managed as a game animal with the goal of maintaining mountain lion populations in Nebraska over the long-term, it is likely that the future of mountain lions in the state is secure. State law is in place that allows for responses to individual animals that may threaten human safety or depredate on livestock. A management plan will continue to provide protocols for handling a variety of situations involving mountain lions in Nebraska.

A combination of understanding and tolerance will allow us to coexist with mountain lions and prevent us from repeating the mistake of extirpating this magnificent native animal from Nebraska once again.

A poison ivy primer

In Plants, Science & Nature / 12 August 2014

By John Barrat

Poison ivy climbing up a tree trunk. (Photo by Zen Sutherland)

Ahhh, the sensations of summer...ocean sand between your toes, a cool drink in the shade, and red itchy welts courtesy of that three-leaved miscreant: poison ivy (*Toxicodendron radicans*). If you've had a run-in with poison ivy this summer or in summers past, here are a few interesting facts about this woody vine offered up by

botanists Susan Pell, president of the Torrey Botanical Society, and Ken Wurdack, of the Botany Department at the Smithsonian's National Museum of Natural History.

- Poison ivy belongs to the same plant family, Anacardiaceae, as mangos and cashews. All three of these plants produce urushiol, the compound that causes the itchy rash. People who chew the mango flesh from mango skins frequently get a blister rash on their lips. Pistachios also belong to this family but do not cause a rash. Poison oak and poison sumac are in the same genus as poison ivy.

- Every part of the poison ivy plant—leaves, stems, roots—is poisonous, so don't burn it, Wurdack says. With burning, the urushiol becomes volatilized in the smoke and you can get it in your lungs, which is very dangerous and can even lead to death.

- Humans and possibly a few other primates are the only animals that get a rash from poison ivy. Your dog and cat don't get it, nor do birds, deer, squirrels, snakes and insects. However, be sure to wash your dog after a walk near poison ivy because the urushiol can be carried on dogs' fur and transferred to you!

- Scientists speculate urushiol evolved as an antimicrobial defense agent, says Susan Pell, protecting the poison ivy plant against infection....but not as a defense against people.

Poison ivy and its fruits, called drupes. (Photo by Zen Sutherland)

- In humans, contact with poison ivy causes a reaction known as a cell-mediated immune response. Basically, as Pell explains, the urushiol binds to proteins in the membrane of your skin cells and interferes with their ability to communicate with other cells. It tricks your immune system into regarding your own skin cells as foreign. “Urushisol is not an irritant burning your skin,” Pell adds. “The rash is actually a result of your own immune system attacking your own skin cells.”

- Ten to 15 percent of people are immune to poison ivy and will never have a rash. Repeated contact however will not give you immunity, in fact just the opposite, Pell explains. “The rashes get worse and worse as your immune system gets better and better at recognizing urushiol.”

- Poison ivy fruits, called drupes, are an important food for birds. Deer and insects eat the leaves. People think of it as a weed but in an ecological sense it is an early successional plant that is mostly found in disturbed areas.

- Over time, individual botanists have named some 30 to 40

different species of poison ivy across North America. A recent and comprehensive study, however, has reduced that number to one species, *Toxicodendron radicans*, with 5 sub-species –*T. eximium*, *T. divaricatum*, *T. radicans*, *T. rydbergii* and *T. verrocosum*. "Poison ivy has a lot of structural diversity: I've seen a free-standing poison ivy plant with three-inch leaflets growing right next to a climbing poison ivy plant with six-inch leaflets. They may look different, but they are the same species," Pell adds. "Its morphological characteristics are very diverse and change in different habitats." Its many different physical variations appear to be different species but are not.

- What triggers a poison ivy plant to climb is a mystery. Some poison ivy plants climb right away from seedlings and others do not. Individual populations of these plants often contain a mix of climbing and non-climbing plants.

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NEBRASKA FOREST SERVICE

Oak, Bur DECIDUOUS

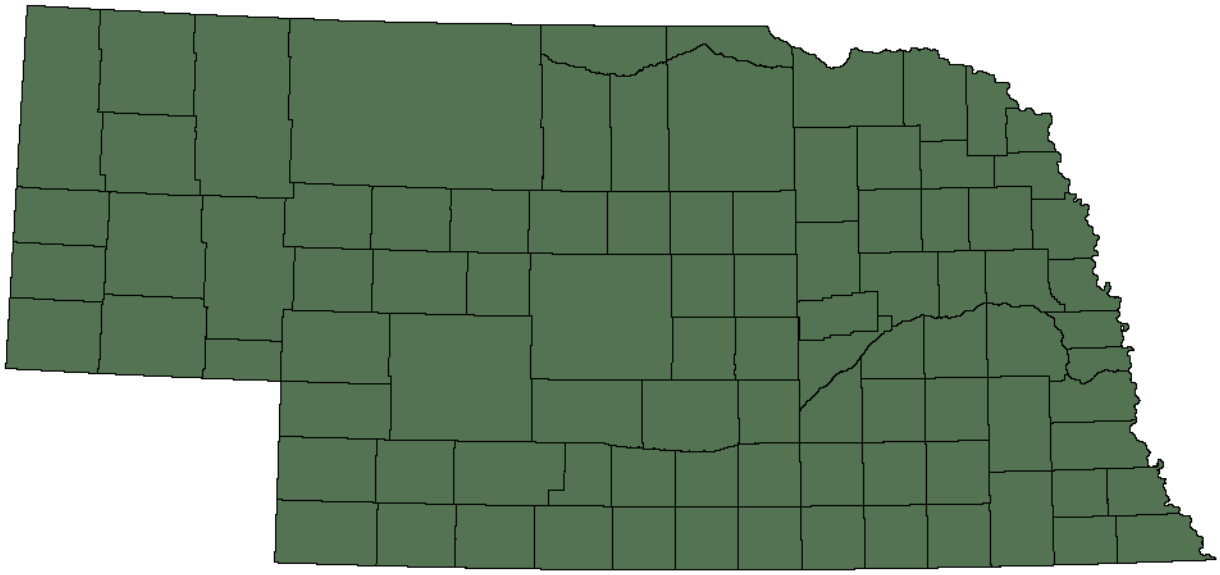
Quercus macrocarpa

Origin:

Bur oak is considered by many to be the king of Great Plains native hardwoods. It is the most common native oak in Nebraska occurring naturally along many rivers and streams in the eastern third of the state and can be found in pockets here and there as far west as Hitchcock and Dawes counties.

Where to Grow

Bur oak is tolerant of city smoke and other air pollutants and of soils that are compacted, sandy, and/or of high pH – it is commonly planted as a shade tree in many urban areas of the United States. The trees become large and are suited for lawns and other open areas, including golf courses, parks, large islands, and fields. They also are useful in rehabilitation of degraded sites and have been widely planted in windbreak and shelterbelt systems because of their drought tolerance.



Suitable to plant throughout the state.

Size at Maturity

Tree Height	Tree Spread
50-75'	50-75'

Tree Characteristics

The tree has distinguishable fan-shaped leaves that can vary greatly in size from tree to tree throughout the region. The leaves turn a rather non-descript tan-brown in the fall and fall relatively quickly from the tree. The tree's thick, corky bark allowed it to withstand wildfires better than most and thus became one of the dominant trees throughout much of the prairie region. The scientific name 'macrocarpa' means "large fruit" referring to the tree's large acorns enclosed in a distinguishable bur-lined cap that wraps most of the way around the nut.

Wildlife Benefits

The acorns are eaten by many birds and mammals, including squirrels, rabbits, ground squirrels, mice, deer, black bear, wild turkey, wood ducks, flickers, woodpeckers, and blue jays. They are dispersed by rodents and blue jays, which frequently cache the acorns for later use. Bur oak is browsed by deer, elk, and cattle. Red-tailed hawks, screech owls, fox squirrels, and flying squirrels' nest in large trees of bur oak.

Additional Considerations

Another hybrid cultivar tree enthusiasts could try is the bur-gambel oak.

Interesting Facts

Noteworthy bur oaks found in Nebraska include the outlying population in Bur Oak Canyon near Culbertson; the trees with the remarkably exposed root systems growing on pure sand north of Albion; the towering trees in Beatrice's Chautauqua Park; the nearly 500-year-old tree found at Ponca State Park; the canopy grove in the campground on the north edge of Fullerton.

Great Plains Grassland: Tallgrass-Mixed Prairie

	bluegill	blue-winged teal	coyote	dickcissel	Eastern cottontail	grasshopper sparrow	greater prairie-chicken	largemouth bass	mourning dove	Northern bobwhite	Northern harrier	ring-necked pheasant	Western hognose snake	white-tailed deer	wild turkey
Aquatic Plant		x													
Bark					x									x	
Birds			x												
Buds					x					x		x		x	x
Carrion			x												
Crayfish	x		x					x							
Earthworms	x							x							
Eggs	x		x					x					x		
Fish	x							x							
Forbs					x		x			x		x		x	
Frogs & Salamanders	x		x					x					x		
Fungi														x	
Grain		x		x	x		x		x	x		x		x	x
Grass					x		x					x		x	x
Hard Mast										x		x		x	x
Insects and Spiders	x	x	x	x		x	x	x	x	x		x	x		x
Leaves & Twigs					x		x					x		x	x
Lizards			x								x		x		
Mammals			x								x		x		x
Seeds		x		x	x	x	x		x	x		x			x
Snails		x						x							x
Snakes			x					x			x		x		x
Soft Mast			x		x	x	x			x		x		x	x

Digestive System

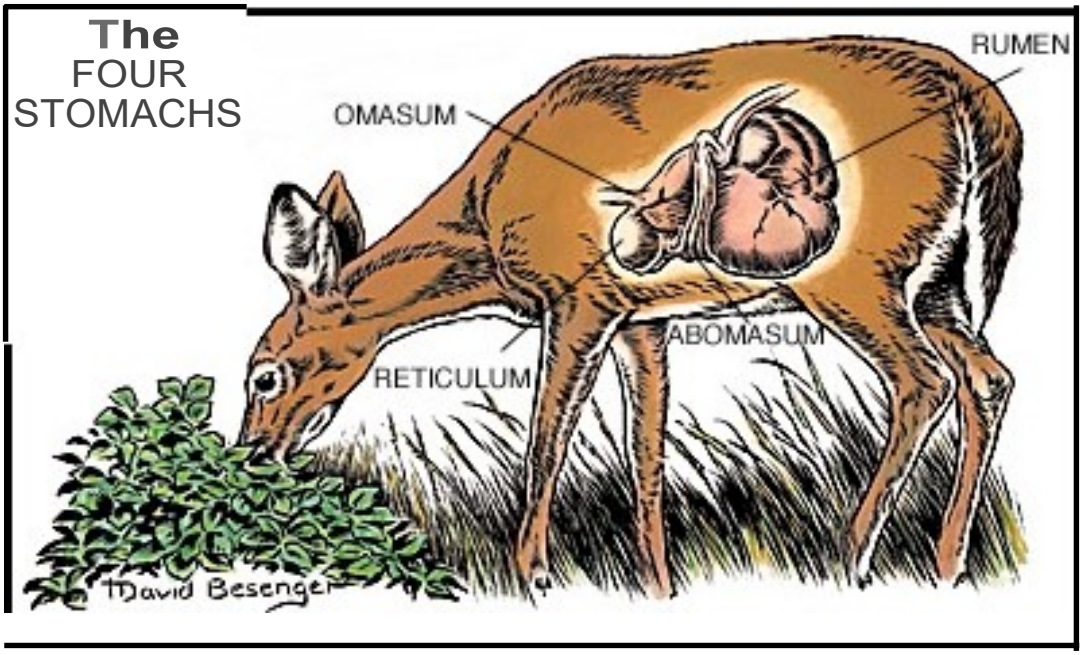
Deer are ruminants, meaning they are equipped with a four chambered stomach. They have a digestive system, which makes it necessary for them to chew, regurgitate and chew again their cud: they ruminate. The ruminant's four chambered stomach allows the deer to gather a lot of food at once and then chew and digest it later. They have the characteristic to be able to digest the cellulose of plants. To be able to break their foods down they have a stomach in four parts.

- Rumen
- Rectculum
- Omasum
- Abomassum

As deer begin to feed in the pasture, they chew very fast. Depending on the type and abundance of food, the deer can fill its stomach in about one or two hours. When a deer eats, food is chewed just enough to swallow. This is the first chewing. The food then passes down the esophagus into the stomach. The food goes into the first stomach. (the rumen) This area is used for storage. The soft round ball of chewed food is mixed in a bath of bacteria which attack the cellulose in the plants that the deer has eaten. Fermentation releases the acids amino contents in the cellulose, breaks it down into simpler substances and the substances can then be absorbed by the deer. Fermentation produces a gas (methane) which the deer must discharge very regularly.

Later, when the deer is at rest, the cud of regurgitation go for a second and longer chewing which makes it possible to break remaining cellulose fibers. This second process now repeats in the second stomach. (the reticulum) The finest particles pass in the third stomach,(the omasum) where water is absorbed.

Finally, resulting cud enters the last chamber, (the abomasums), where the gastric juices continue digestion. Last, it moves on to the small intestines. The food material then goes through the intestines and everything that isn't digested is passed off as waste droppings.


The
FOUR
STOMACHS
RUMEN
OMASUM
ABOMASUM
RETICULUM
David Besenger

2021 NCF-Envirothon Nebraska
Wildlife Study Resources

Key Topic #3: Habitat Management

9. Explain what components make up an ecological community.
10. Evaluate different habitats for suitability for a variety of wildlife species.
11. Describe and apply best management practices for threatened and endangered species.
12. Explain the impact of invasive species on local ecosystems, including native invasive species like the Eastern Red Cedar in Nebraska.
13. Describe and apply different management practices for controlling invasive species.

Study Resources

Kahn Academy; Community Ecology Review, 2020. (*Pages 53-57*)

Nebraska Game and Parks Commission; Southern Flying Squirrel, 2021. (*Pages 58-62*)

Xerces Society for Invertebrate Conservation; Managing Natural Lands for Pollinators, 2020. (*Pages 63-65*)

Wildlife Habitat Evaluation Program Manual; Wildlife Species, 2019. (*Page 66*)

The Nature Conservancy-Niobrara (Nebraska) Project Office, UNL Department of Agronomy and Horticulture, USDA-Agriculture Research Service; Integrated Management of Eastern Redcedar on Grasslands, 2007. (*Page 67-74*)

Study Resources begin on the next page! 

Community ecology review

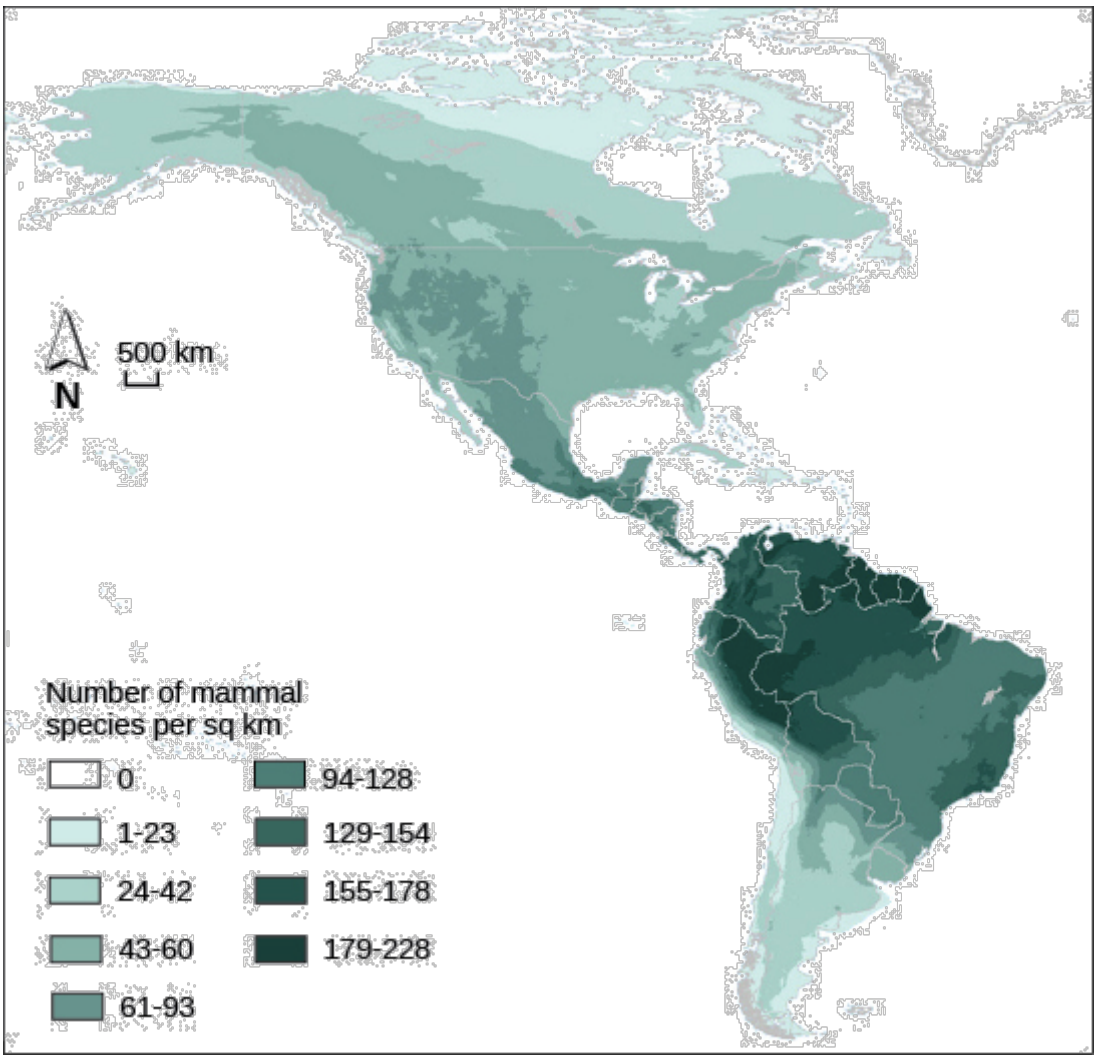
Key terms

Term	Meaning
Community	All the populations of all the different species that live together in a particular area
Species richness	The number of species present in a community
Species diversity	A measure of both species richness and relative number of species
Foundation species	Species that plays an essential role in creating and denning a community
Keystone species	Species that has a disproportionately large effect on community structure relative to their abundance
Invasive species	Non-native species whose introduction causes, or can cause harm in their new area
Ecological succession	A series of progressive changes in the composition of an ecological community over time
Pioneer species	The first species to popu late an area during succession
Climax community	Community which has reached a steady state after ecological succession

Community structure

Community structure describes the composition of a **community**, and includes the number of species in that community, along with their relative numbers. Different ecological communities can be pretty different in terms of the types and numbers of species they contain.

Communities with the highest **species richness** tend to be found in areas near the equator, and communities with the lowest species richness lie near the poles.



Global species richness as calculated for mammal species. Image credit:

"Community ecology: Figure 14," by OpenStax College, Biology, CC BY 4.0. Modification of work by NASA, CIESIN, Columbia University.

Larger numbers of species and more even abundances of species lead to higher **species diversity**. The higher species diversity in a community is, the more stable and able to recover from disturbances that community is.

Several factors that influence community structure include climate patterns, geography, disturbances, and interactions between organisms.

Foundation, keystone, and invasive species

Some species tend to have stronger effects on community structure than others.

Foundation species usually modify the environment so that it can support the other organisms that form the community.

Keystone species generally act in more diverse ways than foundation species, and are more likely to belong to higher trophic levels.

Invasive species may outcompete native species for resources or habitat, altering community structure and potentially leading to extinctions.

Ecological succession

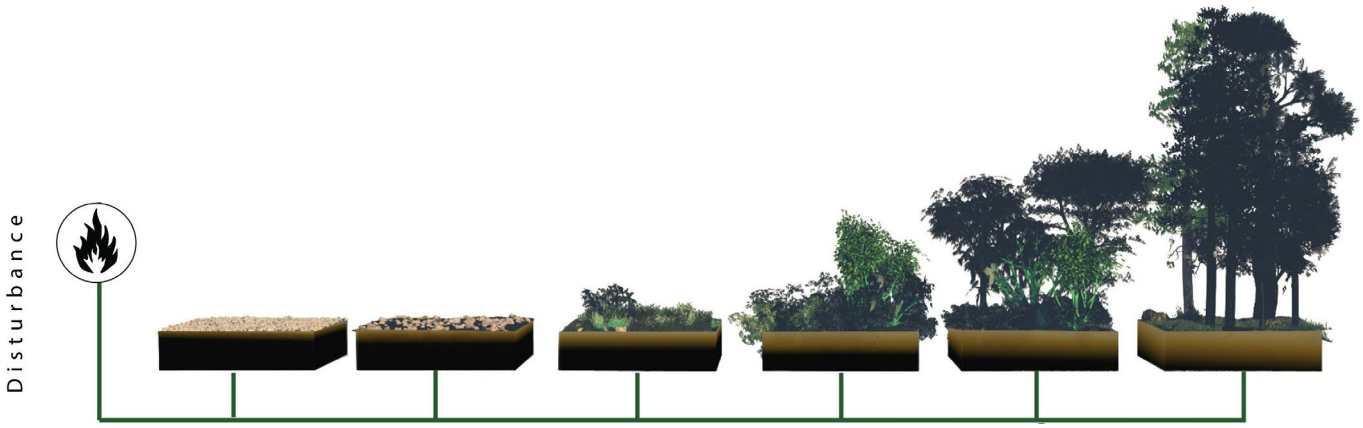
Succession can occur for many different reasons. In most cases, each species affects their environment in a way that allows other species to colonize. Over time, this increases the complexity of the environment, usually increasing species diversity as well.

There are two types of succession, which differ in their starting points:

- In *primary succession*, newly exposed or newly formed rock is colonized by living things for the first time. Certain hardy plants and lichens with few soil requirements, called **pioneer species**, colonize the area first.

During primary succession on lava in Maui, Hawaii, succulent plants are pioneer species. Image from OpenStax, CC BY 4.0.

- In *secondary succession*, an area that was previously occupied by living things is disturbed, then re-colonized following the disturbance.



Forest succession over time. Image modified from Wikimedia CC BY 3.0

Over a long period of time, and assuming no further disturbances, a **climax community** may form when a community reaches a steady, mature state.

Mistakes and misconceptions

- **Not all non-native species become invasive.** Invasive species are damaging, or have the potential to be damaging, to their new environment. They displace other species by competing with them, affecting their health, or destroying the habitat.

NEBRASKA
GAME PARKS

SOUTHERN FLYING SQUIRREL

GLAUCOMYS VOLANS

Description

Although common in many eastern states, the southern flying squirrel is considered threatened in Nebraska.

Flying squirrels have a white belly with a flattened tail used like a rudder. They are 7.8-10 inches long and weigh only 1.5-3 ounces. They are strictly nocturnal creatures known for their ability to “fly” among trees. They do not actually fly; they glide. Between each wrist of the front leg to the ankle of the hind leg there is a wing-like membrane, called a patagium. When the arms and legs are extended, the membrane forms a wing-like gliding surface.

The noticeably large eyes, an adaptation for its nocturnal habits, are surrounded by a black ring. Whiskers are prominent as are ears, which are more pronounced than in other tree squirrels. The eyes are surrounded by a black ring, and a black border extends along the edge of the gliding membrane. Their fur is soft, silky and moderately long. Fur on the wing-like membrane is shorter than on the rest of the squirrel’s body for better aerodynamics.

Flying squirrels produce several vocalizations including a high pitched “tseet” and other chirping sounds. Some vocalizations are above the frequency range of the human ear.

The “flying” or “glide” of the southern flying squirrel begin after the squirrel climbs to a lofty treetop perch and assesses the landing site by moving its head all around, apparently attempting to judge distance. It then launches itself with all four legs extended, stretching-out the gliding membrane.

With tremendous agility, flying squirrels can steer around branches or other obstacles. Most steering is done with the tail, but squirrels also vary the tension on the membrane to steer and to control speed. They usually land on the vertical trunk of another tree, invariably upright with the hind feet touching first. Upon landing, they scurry to the

opposite side of the tree to elude any pursuing predator. Glides occasionally extend for more than 50 yards, but are usually much shorter.

While southern flying squirrels do not hibernate, they may remain in their nests for several days during severe winter weather. They may also form groups in a common nest to conserve warmth. The number of animals in the winter congregations varies by latitude, with larger congregations found in northern climates.

Flying squirrels seldom live more than five years in the wild. Predators include owls, domestic cats, hawks, snakes, bobcats, raccoons, weasels and foxes.

Range

The southern flying squirrel's range extends from southeastern Canada throughout the entire eastern United States. In Nebraska, flying squirrels inhabit primarily hardwood forests along the southeastern edge of the state such as the Missouri River forests, Indian Cave Bluffs and Rulo Bluffs landscapes.

Diet

Flying squirrels are omnivores, although they eat mostly plant material. Tree nuts make up the bulk of their diet; they will also eat seeds, buds, fruit, sap, mushrooms, berries, tree bark, insects, bird eggs or nestlings, mice, and carrion. As winter approaches nuts are gathered and stored in caches.

Habitat

Flying squirrels are secondary cavity nesters, meaning they do not create their own cavities but rely on existing cavities such as old woodpecker nests and holes in trees. Flying squirrels readily use nest boxes placed for their benefit or for other species.

Cavities are typically lined with strips of inner bark and leaves, but lichens, moss, feathers and other materials have been used.

Reproduction

Southern flying squirrels show two periods of breeding activity. The first is in February and March, and the other is from late May through July. Females can produce two litters per year but only under favorable conditions. Litters, usually of three or four, but up to seven young, are born following a gestation period of 40 days.

Newborn young are hairless with eyes and ears closed. They are tiny, weighing less than a quarter-ounce each. The gliding membrane is visible as a transparent fold of skin. The ears open at about three weeks of age, and a week later the eyes open. The young are weaned at six to eight weeks and are capable of gliding soon thereafter. Young typically remain with the female until the next litter is born.

Adults are sometimes seen together as pairs, but males typically leave females before the young are born and do not assist in caring for the young. Females seldom leave the new-born young, defend them vigorously and will move the young to a new nest if disturbed or to eliminate parasites.

Flying squirrels reach sexual maturity at about one year. They do not form tight pair-bonds. Females often have different mates each breeding seasons.

Population Status

The primary reason the southern flying squirrel is threatened in Nebraska is the limited amount of mature, hardwood deciduous forest habitat.

Hardwood trees such as oaks and hickories produce acorns and nuts that squirrels require in large quantities to survive over the winter. Mature trees are also needed to provide the cavities or holes that squirrels need for nesting and protection. After the

area was settled, many of these large trees were cut for lumber. Timber harvest still occurs periodically as trees reach mature size. This harvest removes trees that produce acorns and nuts and that provide the greatest number of cavities.

The Southern Flying Squirrel is listed as a Nebraska Threatened Species.

Management and Outlook

The primary management tool used for conserving flying squirrels in Nebraska is maintaining mature forests and retaining dead trees, or trees with dead limbs, to offer roosting and nesting cavities.

Conservation Help

Homeowners in southeast Nebraska should consider minimizing tree removal, erect nest boxes, and keep pets, such as house cats, from roaming freely.

Donations to conservation organizations which help with research, land and habitat conservation and education is also critical to ensuring flying squirrel populations do not decline further.

Managing Natural Lands for Pollinators

(Photo: Bob Wick / Bureau of Land Management)

Approximately 85% of terrestrial plant species either require, or strongly benefit from, animal-assisted pollination. This includes many rare and at-risk plant species found in wilderness areas, federal and state lands, parks, nature reserves, and more. The role of pollinators in these landscapes is invaluable for the longevity of plant communities and for sustaining the wildlife that depend on those plants.

Native pollinators also support crop pollination. For agricultural areas that have lost native pollinators due to habitat modification or pesticide treatments, adjacent natural areas provide two valuable benefits: First, they are a source of pollinators for crop pollination. Second, they act as refugia for pollinators that can recolonize degraded agricultural areas.

Management tools such as grazing, fire, and mowing can be used in a manner that benefits pollinators, whereas we advise against using pesticides (including insecticides, herbicides, and fungicides) when possible. If pesticides must be used, there are a number of considerations to keep in mind in order to minimize their impact on pollinators.

Managing with Rare Species in Mind

In addition to the management considerations mentioned above, natural lands where rare or endangered pollinators may be present require additional care, with respect to the specific life history traits of these species. For instance, some species of butterflies do not respond well to fire. Meanwhile, practices like mowing can destroy nest sites of rare bumble bees. If a species of concern or a remnant-dependent species is thought to exist within the management unit, we advise conducting surveys to determine where they are located. Then management should be tailored to ensure the survival of imperiled species. Ultimately, the continued health of populations of all invertebrates in these natural areas will depend upon maintaining a diversity of habitats and refugia for specific species that need it.

Mowing

Mowing is a useful management practice to control the encroachment of weedy shrubs or invasive woody plants in prairies, wildflower meadows, and rangelands. However, mowing can cause direct insect mortality, especially for eggs and larvae—they can't avoid a mower! To reduce harm to insects, we advise mowing in the fall or winter when flowers are not in bloom. Mowing a mosaic of patches over several years, which no single area mowed more than once a year, also is helpful. We also recommend the use of a flushing bar and low mower speeds to protect wildlife.

Grazing

Management plans should be customized to the specific type of livestock to balance the needs of livestock and pollinators alike. Livestock like cattle will prefer to graze on grasses, switching to wildflowers only when grasses are depleted. Other livestock like goats have more diverse feeding habits and may feed on grasses and forbs equally. Herd sizes should be moderate to small, and grazing periods should be short to allow for adequate recovery of the habitat. A diverse pollinator population requires adequate nectar and pollen sources from early spring to early fall—making seasonal timing a key consideration for an effective grazing plan. Management should be adjusted to maintain the majority of the floral resources throughout the year, and to avoid harming active butterfly larvae or adults.

Fire

While prescribed burning has a role to play in the long-term maintenance of natural areas and pollinator habitat, it can also have catastrophic impacts on pollinators and other invertebrates. To minimize negative impacts, a program of rotational burning, in which small sections—30 percent of a site or less—are burned every few years will ensure adequate colonization potential and refugia for insects.

Pesticides

While herbicides can be an important management tool, they also can reduce important floral resources. To avoid herbicide damage to non-target plants and the pollinators that rely on them, avoid broadcast spraying or pellet dispersal. Each ot these may kill large numbers of larval host plants or adult forage plants. Instead, we recommend that you spot-treat specific plants or patches of weeds.

Insecticides used on forests, rangelands, and farms can also severely impact pollinator populations. In situations where insecticides must be used, it is best to avoid spraying when flowers are in bloom. It is also important to look for butterfly host plants in the management area, and avoid spraying them. In general, dusts and microencapsulated insecticides are the most dangerous formulations for bees, and aerial spraying is the most harmful method of application. Sprayed solutions and large granules tend to be less harmful to pollinators.

Eastern bluebird / Western bluebird

General information

Bluebirds are found in early successional habitat (Stages 2 and 3) interspersed with woods and shrubs (Stages 4, 5 and 6), which are used for perching and nesting (where cavities are available). Large open areas without interspersion of hedgerows, fencerows and woodlots may not receive as much use by bluebirds as those areas with more structural diversity. Bluebirds forage in open areas, but typically near trees, shrubs or a fence that provide perches.

Habitat requirements

Diet: insects, spiders and small amounts of soft mast
Water: obtain necessary water from diet but may use other water sources when available
Cover: nest in cavities of trees and fence posts; old woodpecker cavities are especially important; readily nest in nesting boxes, which have had a major impact in restoring bluebird populations in some areas

Wildlife management practices

Establish Field Buffers: to increase usable space around row crop fields
Establish Native Grasses and Forbs: when less than 75 percent of the area is composed of Stages 2 or 3
Forest Management Techniques: in large areas of Stage 6 where regeneration is needed, forest regeneration will create foraging habitat 1 year to 3 years postharvest; retaining some mature trees and snags may provide cavities for bluebirds
Manipulate Succession: prescribed fire, disking, herbicide application, mowing, chaining and roller beating can be used to maintain and rejuvenate areas of Stages 2 through 4 when habitat quality begins to decline; grazing management should prevent livestock from damaging trees and shrubs planted to benefit bluebirds
Mowing: can be used to maintain open areas in urban environments
Nesting Structures: should be erected where a scarcity of natural cavities may be limiting the population; nest boxes should be approximately 5 feet high with an entrance hole 1½ inches in diameter; nest boxes should be placed no closer than 80 yards apart to limit territorial fighting among males
Plant Shrubs: where needed to provide perches; hedgerows may be established across open fields larger than four acres
Plant Trees: to create potential nest sites where young trees are lacking
Retain/Create Snags: to provide potential nest sites and perching sites in open areas

Integrated Management of Eastern Redcedar on Grasslands

Reprinting and modification of this publication was paid for by the U.S. Fire Learning Network. The FLN is a joint project of The Nature Conservancy's Global Fire Initiative, the USDA Forest Service and the U.S. Department of the Interior.

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Eastern redcedar is a serious threat to grassland productivity and biodiversity. Some control measures may be too expensive to use on grasslands, but in many cases, an integrated approach combing fire with more intensive follow-up methods will provide reasonable control at an acceptable cost.

Eastern Redcedar in Nebraska

Eastern redcedar (*Juniperus virginiana* L.) is one of 13 juniper species native to the United States. It is the most widespread tree-sized conifer and is native to every state east of the 100th meridian. Throughout this vast range, eastern redcedar grows on many soils and under varying climatic conditions. This adaptability has enhanced the spread of eastern redcedar into areas where it was formerly rare or absent. Individual trees are either male or female. The small, berrylike cones produced by female trees are eaten by many birds and some small animals that then spread the seed in their droppings. Digestion actually improves germination. Most seeds move only a few feet from the tree. Only a very small percentage of seeds germinate and establish. A minority of years furnish conditions allowing significant establishment, leading to the widely recognized phenomenon of "cedar years."

First accounts of Nebraska vegetation mention eastern redcedar as a native tree species, primarily along the steep valley of the Niobrara River in northern Nebraska, as a minor component in deciduous forests in eastern Nebraska, and as a dominant species on canyon sides in the rugged Loess Hills of central Nebraska. Today, volunteer stands of eastern redcedar can be found on most eastern- and central-Nebraska grasslands. It is likely that most of the state's grasslands east of the 101st meridian, including the Sandhills, are infested or eventually will be. The more arid environment west of that line appears to be limiting expansion to the vicinity of sites with more favorable microclimates, such as the Dismal River Valley. The problem, particularly in the Sandhills, has been largely created by continued widespread windbreak planting of aggressive, selected cultivars in areas formerly without seed sources. Modern pasture weed trees are notably different in appearance from old-growth native junipers along the Niobrara River or in the Loess Hills. Since European settlement of the region, many factors other than planting have changed, allowing eastern redcedar to become a serious pest. Early records from the Loess Hills note that cedar was confined to the steepest canyons, usually on north-facing slopes where the microclimate was most favorable. The role of fire in confining the trees was obvious; trees near the edges of these stands displayed repeated fire damage.

The species' adaptability and hardiness made it a favorite of pioneer tree planters. Tens of millions of eastern redcedars have been planted in Nebraska for landscaping, windbreaks, and wildlife habitat. These plantings accelerated with the conservation programs of the 1930s.

Meanwhile, wildfire suppression became effective for the first time after World War II, when rural fire departments were organized and equipped with military-surplus vehicles. Thus, a maturing seed source from plantings and fire control converged in time to create an accidental weed.

Eastern redcedar invasion is an accelerating progression. The first trees colonize the most favorable sites, usually north-facing slopes. As these trees mature and begin to produce seed, more trees establish and add to the local seed rain. With more and more seed available, trees eventually appear on less favorable landscape positions. Once the progression begins, complete coverage by eastern redcedar eventually will occur, unless wildfire or human intervention reverses the process.

In addition to production losses, infestations fragment habitat for grassland animal species, reduce biodiversity, and create a fuel complex that makes wildfires more dangerous and difficult to control. Control measures should be initiated as soon as possible, both to improve effectiveness and reduce total cost.

Eastern Redcedar and Livestock Production

Many managers view eastern redcedar as a problem on grasslands primarily because it reduces forage production. Because trees alter the microclimate under and around them, they also encourage a shift from desirable warm-season native grasses to introduced cool-season grasses such as Kentucky bluegrass (*Poa pratensis* L). Heavy infestations make livestock handling more difficult. These adverse effects can be reflected in lower rental rates or sale prices for infested grasslands. Forage production essentially equals zero at about 80% canopy coverage. Recent Oklahoma research also shows that when canopy coverage reaches 80%, native herbaceous plants do not quickly recover if trees are removed by fire or cutting. Despite their amazing resilience, the native plants will disappear until they return through the slow process of ecological succession.

Eastern Redcedar and Wildlife Management

Eastern redcedar often is promoted as a wildlife-friendly tree. Millions have been planted and are still being planted with the goal of "improving" wildlife habitat. In fact, eastern redcedar's value to wildlife has been vastly overstated and its spread across the landscape is disastrous for many species.

Great Plains wildlife can be classified into three general groups; those that require woodland habitat, those that require grassland habitat, and "edge" species – those that do well on the boundary between woodland and grassland. Popular game species such as white-tailed deer and wild turkey do well on edges, driving the creation of this kind of habitat.

Cedar's primary contribution to wildlife habitat is to provide thermal and escape cover, a value that is maximized when only a small percentage of the landscape is in cedar. Beyond that, eastern redcedar degrades habitat for all species; it produces no food other than cones for wintering birds, primarily species like robins and starlings. The space eastern redcedar occupies is unavailable to grow other vegetation, which furnishes food for other species.

Eastern redcedar degrades habitat for pure grassland species, including many song birds, but also game species such as greater prairie chickens. This is because creating "edge" with a row of cedars actually constitutes habitat fragmentation, destroying habitat as thoroughly as building a residential subdivision. Cedar's adverse effects take many forms other than excluding other vegetation. For example, the trees provide hunting perches raptors use to locate nesting prairie birds. Creation of edge also encourages the spread of cowbirds, brood parasites that lay their eggs in other birds' nests.

Eastern Redcedar and Recreational Properties: Many cedar-infested properties are being purchased for recreational and hunting properties, under the misconception they are excellent wildlife habitat. Recreational landowners therefore often oppose controlling cedars. Expanding cedar infestations temporarily improve habitat for huntable edge species, but this stage will not last long.

Continued cedar expansion eventually will greatly reduce the value of these properties. Not only will they not support wildlife, but high densities will make such properties impenetrable. Finally, eastern redcedar creates an increasing wildfire threat that endangers home sites and other improvements.

Control of Eastern Redcedar

Many methods have been used to control eastern redcedar. These include prescribed fire, herbicides, and forms of cutting. All methods can have some drawbacks when used alone.

Prescribed fire: This method can be inexpensive and is most effective against smaller trees. However, its effectiveness declines as tree size increases, especially with the reduced fine fuel loads typical of heavily grazed and/or degraded grasslands. Adequate fine fuels (usually, last year's dead grass) is necessary for satisfactory results. Safety also is a concern since many managers lack experience with fire and the equipment required to conduct fires safely, especially the more intense fires required to kill larger trees.

Herbicides: Foliar sprays and broadcast soil applications of herbicides have been ineffective against eastern redcedar. The preferred treatment method is application of undiluted Tordon 22K[1] liquid to the soil under individual trees at a rate of three to four milliliters per three feet of tree height. This method minimizes the amount of herbicide used and the exposure of non-target species. However, it still is time consuming and expensive when used on dense infestations or large tracts. Effectiveness also is variable on larger trees and label directions recommend against use on trees more than 15 feet tall. (Always read and follow pesticide label directions).

Cutting: If done manually, this method is even more time consuming than herbicide application. It is effective because eastern redcedar is a non-sprouter. Trees cut below the lowest foliage will not regrow. Larger trees require a chain saw or machine-mounted shears, but trees less than three feet tall can be quickly cut with hand shears. Machine-mounted shears may not be able to safely operate on steep slopes. Sawing is potentially dangerous because all lower branches of larger trees must be removed before felling. Otherwise, the sawyer can be injured when the tree falls.

Cutting alone also fails to remove the entire problem because down trees continue to occupy space. Oklahoma research found that the durable skeletons on felled trees occupy 70% of the space of the living trees. This area is lost to production for years because livestock are reluctant to graze among the sharp branches. In addition, removing large trees often releases a flush of tree seedlings under the former canopy. Removal of one large tree can result in hundreds of small trees in its place that soon merge into a nearly impenetrable thicket.

Taking an Integrated Management Approach

As described, Nebraska's eastern redcedar infestations have developed over several decades due to multiple causes. Likewise, management of these infestations is best viewed as a long-term effort, both to reduce the existing infestation and to prevent them from redeveloping to economically damaging levels. It is best to begin treatment as soon as possible; once treatment has begun, considerable time is gained to continue long-term management. The emphasis should be on **management** of the infestation, rather than **eradication**. Eradication is not economical in a livestock-grazing context. Instead, it should be recognized that a few remaining larger trees, which are the most difficult and expensive to kill, do not reduce forage production significantly, nor will their effect increase much over time. Most important, long-term selective management is considerably less expensive than a more intensive, short-term approach.

On the other hand, eradication may be desirable on lands managed primarily for grassland wildlife species because of the trees' fragmenting effect. Here, decision making moves out of the realm of the strictly economic.

While single-method approaches all have drawbacks, recent research in Nebraska and elsewhere has shown that integrating prescribed burning with herbicides or cutting combines the strengths of each method while overcoming their disadvantages.

Prescribed fire: The controlled use of fire is a large subject in itself and beyond the scope of this publication. Other resources can provide more guidance. Particularly useful are Cooperative Extension publications from the Great Plains states. Many of these can be found on-line. In Nebraska, by law a fire plan must be prepared and a prescribed-burning permit obtained from the local fire jurisdiction. Specialize fire equipment can be purchased. Sources can be located on-line.

Prescribed fire should be used whenever possible to help manage eastern redcedar, both to initially reduce infestations and to maintain trees at economically tolerable levels. Research and experience indicate fires designed primarily to control eastern redcedar should be conducted in early spring. Many land managers are getting excellent results with fires conducted under warm, dry conditions in March. Foliage is drier before the growing season and ignition of large trees is more likely. Fires should be conducted under conditions that are as warm and dry as is consistent with safety. Lower windspeeds, in a range from 5 to 10 mph, increase duration of high temperatures around foliage and damage to larger trees, and help keep the fire manageable. In some cases, fire alone may be adequate. In other cases supplemental treatment may be necessary. Fortunately, a number of treatment options are available to fit different circumstances. These include selective treatment by height and/or sex and reducing herbicide rates for fire-damaged trees.

Several variables should be weighed when considering options. These include location within the state, difficulty of burning the area in question, age and density of trees, the density of surviving trees that can be tolerated, kind of grassland vegetation, availability of labor and capital, and use of the site after treatment, e.g. grazing, haying, wildlife, etc.

Location: Eastern Nebraska lies within the tallgrass prairie region, while central Nebraska, including the Loess Hills and Sandhills, is in the mixed-prairie region.

The **tallgrass** region potentially produces greater fine-fuel loads, and thus more intense fires and higher tree mortality. Fire can be used more frequently here with less risk of adverse effects to other vegetation, such as can occur when drought follows spring fire. The fragmented landscape reduces the risk of escape and can broaden weather prescriptions, allowing fire use under more intense conditions. All this means that fire alone on a shorter return interval may suffice in eastern Nebraska. However, higher population density may increase smoke-management difficulties and liability concerns.

In the **Loess Hills**, fine-fuel loads tend to be lower and control from fire alone may vary more by site, while arid post-fire conditions also are more likely. Large blocks of unfragmented grasslands exist, making escape a more serious issue. Thus, fire should be used more conservatively there, at longer intervals. Supplemental treatments likely will be necessary to achieve management goals.

In the **Sandhills** there is virtually no experience with prescribed fire-use on private lands in a commercial livestock industry context. There is a need for improved burning prescriptions that will be effective with the light fuel loads the Sandhills produce, and for appropriate holding and firebreak construction methods that will allow fire to be used with less risk. Unstable soils, greater aridity, and the risks and consequences of escape when burning in an enormous expanse of grass fuels with few natural or manmade firebreaks, suggests prescribed fire is a last resort for severe infestations, in the nature of radical surgery to save a terminal patient. Since most Sandhills infestations still are localized

and at lower densities than in the Loess Hills, and many areas remain locally cedar free, preventative measures and less radical control methods are better suited to maintaining economic and ecological health in the landscape at large.

However, many dense infestations that are uneconomical to treat intensively are near stream valleys. Fire use may be more feasible in these areas because fires can be conducted with the wind blowing toward the stream, so that the stream and associated valley vegetation help hold the fire on the downwind side.

Difficulty of burning individual units: Lighting a prescribed fire carries some risk of escape. Eastern Nebraska pastures more often are isolated by roads, cultivated lands, and other firebreaks that will help confine the fire and reduce escape risk. This means that fire may be safely used more often and under more favorable burning conditions. In central Nebraska, pastures often are located with large blocks of rangeland, making escape more likely and serious. This argues for a more sparing use of fire and reduces the chance that fire alone will suffice.

In some cases, the difficulty and risks of burning in areas of extensive grasslands can be greatly reduced by conducting "landscape-scale" fires, rather than burning pastures individually. This method is especially applicable to the highly dissected topography of the Loess Hills. Under the landscape-scale concept, the fire boundary is extended until adequate existing firebreaks are encountered. These may be roads, watercourses, cultivated lands, stands of broadleaf trees, relatively non-flammable valley bottoms, or areas of short or green vegetation. Such large areas may include property of more than one landowner, requiring that neighbors work together to develop multi-property burn plans.

Age and initial density of trees: Eastern Nebraska infestations tend to be younger and more dispersed. This will improve control levels achieved by fire alone. The rugged Loess Hills infestations include dense stands, usually on north-facing slopes, and many larger trees. These stands are less susceptible to fire and may require more supplemental treatment. Some managers have successfully attacked such stands by cutting trees along the bottoms of slopes and allowing foliage to dry before a broadcast fire is applied, when the added heat may help ignite trees on the slope. Or the resulting fuel complex can be ignited in the winter when the landscape has some snow cover to contain fires to the slopes being treated.

Density of surviving trees that can be tolerated. This factor depends on manager preference and management objectives. Low numbers of surviving trees will have little effect on future production because they will increase relatively little in size. Low numbers of such trees also can provide winter livestock shelter, and habitat for some wildlife, such as white-tailed deer and wild turkey. On the other hand, even a few surviving trees will be detrimental to pure grassland species such as greater prairie chickens. (See discussion of wildlife impacts below).

Kind of existing vegetation: Most research on grassland prescribed fire relates to warm-season native grasses, either on rangeland or planted pastures. Much less is known about the use of fire on cool-season grasslands. For planted cool-season pastures, fires would have to be conducted much earlier, probably no later than mid-March to avoid damaging grasses. Fortunately, this coincides closely with the optimum date to burn for cedar control.

The situation on degraded, cool-season dominated rangelands is more complex. Fires conducted in early spring will encourage cool-season grasses at the expense of remnant warm-season grasses. Fires conducted in late spring, at the optimum time to aid rejuvenation of warm-season grasses, will damage cool-season grasses. While that often is desirable, a manager may have come to depend on early production from cool-season rangeland. Much of this production will be lost during the year fire is used. Total production also may be temporarily reduced if the remnant warm-season grasses are too scarce or weakened to take advantage of the suppression of the cool-season component.

This illustrates the fact that it is often impossible to accomplish multiple management objectives with a single fire at a given time. Multiple fires over a number of years at the appropriate times will be needed both to control cedars and rehabilitate degraded rangelands. Which objective to start with is up to the individual manager based on what appears to be the most pressing problem, and if and how fire will be used in the future. If fire will become a regular management activity, it would be rational to address grass rehabilitation first. This will at least halt the spread of cedars, and later fires with higher fuel loads will eventually eliminate most trees. If it is expected that fire will be used only once to aid cedar removal, burning earlier to maximize tree kill would be more reasonable. Use of fire should be carefully considered on all lands. Ideally, fire should be incorporated into long-term pasture/grazing-management plans designed to both reduce eastern redcedar infestations and improve range condition.

Availability of labor vs. capital: Nebraska research indicates that the costs and effectiveness of cutting and herbicide application are similar for trees less than 10 feet tall. However, the sources of these costs are different. Labor accounts for most of chain-sawing costs. Power shearing costs include purchase or rental of equipment, or payment to a contractor. For herbicide application, the herbicide cost is the major component, with application time a minor cost. Cutting and herbicide application both are rational choices, but managers should choose based on their own circumstances.

Costs and Effectiveness of Eastern Redcedar Treatments

The cost of using prescribed fire can vary widely, depending on how it is applied and who does it. Probably the least expensive approach involves some form of collaboration among landowners, either informal or more formally through a prescribed burning association. These collaborations allow pooling of labor and equipment. The per-acre cost of prescribed fire also tends to decrease when larger units are burned, because fixed costs, such as equipment, are spread over more acres. Collaborative burning groups across the Great Plains report per-acre costs averaging about $10. At the other extreme, burn contractors charge upwards of $25 per acre regardless of unit size.

Nebraska research in the early 1990s provided detailed information on the results and costs that can be expected when a variety of eastern redcedar-control methods are applied under realistic conditions. The values in *Table 1* were generated on a site in the Loess Hills in Custer County. The site's cedar population had developed since about 1960 and had reached a density of about 250 trees per acre. Most trees were less than six feet tall, indicative of a still-expanding infestation, and were growing mostly as single trees or in small groups. The herbicide treatment used was Tordon 22K applied at a rate of 4 ml per 3 feet of tree height. It was apparent there were some misses and some trees were treated twice. Some form of marking can prevent this. Sprinkling a few kernels of popped corn by each tree as it is treated is fast and inexpensive. The cutting treatments were done with hand tools and chain saws. Supplemental treatments were applied one to two months after the fires. Actual costs and effectiveness achieved will depend on tree density and fire intensity.

The main points in *Table 1* are:

1. Total costs and effectiveness for trees less than 10 feet tall were about equal for fire plus Tordon 22K and fire plus cutting combinations.
2. Burning first reduced the time requirement by half for both Tordon 22K and cutting follow-up treatments.
3. Burning first reduced total costs by nearly half for both follow-up treatments. It should be noted that supplemental treatment is a one-time expense that can be spread over a number of years, if fire is used to prevent re-infestation.

Table 1. Effectiveness and costs of eastern redcedar control treatments as measured one year after treatment.

	Mortality by Height Class ----------%----------					To Apply Supplemental Treatments	
Tree size (ft)	0-3	3-6	6-10	> 10	Total[1]	Time (hours/acre)	Cost* ($/acre)
Treatment							
Fire alone	94	71	63	29	81	0.00	See text above
Fire+Tordon	98	95	93	60	95	0.25	24[2]
Fire+Cutting	95	99	100	94	96	1.25	19[2]
Tordon	82	83	60	66	79	0.50	50
Cutting	84	97	97	95	88	2.50	34

* Costs converted from 1994 to 2006 dollars and rounded to nearest whole dollar.
[1]Weighted means, based on different numbers of trees in each height class.
[2]Costs of supplemental treatments only, without fire costs.

These costs do not include charges for changes in grazing management. For example, if grazing is reduced by 0.50 animal unit month (AUM) per acre in the year before the fire to accumulate fine fuel, and an AUM's market value is $30, then an additional $15 per acre should be charged to the fire cost. However, much of this additional cost can be recovered in reduced supplemental-treatment costs if more effective fires are achieved.

Treatment options: The Nebraska research also indicated treatment strategies can be modified to further reduce costs. It was found that:

1. Some trees that initially appeared to survive the prescribed fire will die later.
2. Surviving large trees, which make up a small percentage of expanding populations, make a small contribution to future production losses.
3. For trees less than 10 feet tall that have been fire damaged, herbicide rates may be reduced to 2 ml per 3 feet of tree height without significantly reducing effectiveness. Reducing rates will, however, void the manufacturer's warranty. *Table II* shows estimated costs of fire plus herbicide application based on these findings.

Table II. Estimated cost per acre of fire followed by Tordon 22K applications under combinations of selective treatment of trees, reducing the herbicide rate by half, and delaying treatment after fire. Costs include estimated $3*/acre fire cost.

Trees Treated	Herbicide Rate (ml/3 ft height)	Treatment Date (time after fire)	Cost* ($/acre)
All	4	3 Weeks	24
All	4	1 Year	16
All	2	3 Weeks	13
All	2	1 Year	9
<10 feet	4	3 Weeks	15
<10 feet	4	1 Year	9
<10 feet	2	3 Weeks	9
<10 feet	2	1 Year	7

* Costs converted from 1994 to 2006 dollars and rounded to nearest whole dollar. Cost are for Tordon application only, without fire costs.

The assumptions regarding delaying follow-up treatment for one year after fire and selectively treating only smaller trees also can be made for cutting and could be expected to reduce these costs as well. A further refinement would be to focus supplemental control on seed-producing females of any size to reduce re-infestation rates.

Sandhills Windbreak Management

Because seeds from planted windbreaks are largely to blame for localized eastern redcedar infestations in the Sandhills, a good preventative strategy is to remove female trees from plantings. For newer windbreaks, this should be done as soon as trees start to bear seed and sex can be determined. The small trees can be easily and quickly removed. Removal of half of the trees from a multi-row windbreak will not significantly change its protective properties. The shrubby growth habit of windbreak trees will encourage lateral growth to fill in gaps.

Older windbreaks with larger trees can be treated over a number of years, by annually removing the minority of female trees that produce most of the seed crop in a given year. This slower removal strategy will allow remaining trees to fill gaps and retain protective properties.

General Suggestions

If at all possible, prescribed fire should be incorporated into long-term eastern redcedar management on grasslands. Periodic fire is required both to reduce the cost and improve effectiveness of treatments, and to prevent re-infestation. If necessary, grazing management should be changed to ensure adequate fine-fuel loads before the initial and subsequent fires. There are a number of ways to determine the necessary fire return interval. Based on growth rates, fires about every eight years in central Nebraska and every four years in eastern Nebraska will kill any young trees before they are large enough to survive fire. Alternately, fire can be applied whenever new trees are approaching 3 feet tall, the size above which significant numbers are likely to survive fire. Ideally, fire should be incorporated into overall pasture and grazing management, as part of a system of rest, rotation, and fuel building. This system also will promote increased wildlife diversity.

The need for supplemental treatment should be assessed after the initial fire, in light of the variables discussed in the "Integrated Management" section. Supplemental treatment should be delayed at least one year after the initial fire to take advantage of any delayed mortality. The supplemental methods used should be those best suited to individual circumstances. Selective treatment, based on sex and/or tree height, should be considered to reduce costs unless eradication is desired for wildlife-habitat needs.

These suggestions are based on the former University of Nebraska-Lincoln Cooperative Extension Publication "Management of Eastern Redcedar on Grasslands" (1996 version), which no longer is available. [1]Mention of trade names of commercial products is solely for the purpose of providing specific information, and does not imply recommendation or endorsement by the Nature Conservancy, the Fire Learning Network, the University of Nebraska, or the U.S. Department of Agriculture. (Printed March 2007)

2021 NCF-Envirothon Nebraska
Wildlife Study Resources

Key Topic #4: Specimen Identification

14. Identify common Nebraska turtle species and describe their characteristics.
15. Describe how the morphology of a skull can be used to determine the diet and eating strategies of an animal.
16. Identify common Nebraska wildlife species with and without a field guide.

Study Resources

University of Nebraska-Lincoln: A Field Guide to the Amphibians and Reptiles of Nebraska, 2010. *(Pages 76-85)*

NM Outdoor Classroom Program: Amazing Adaptations-Reading Skulls, 2010. *(Pages 86-90)*

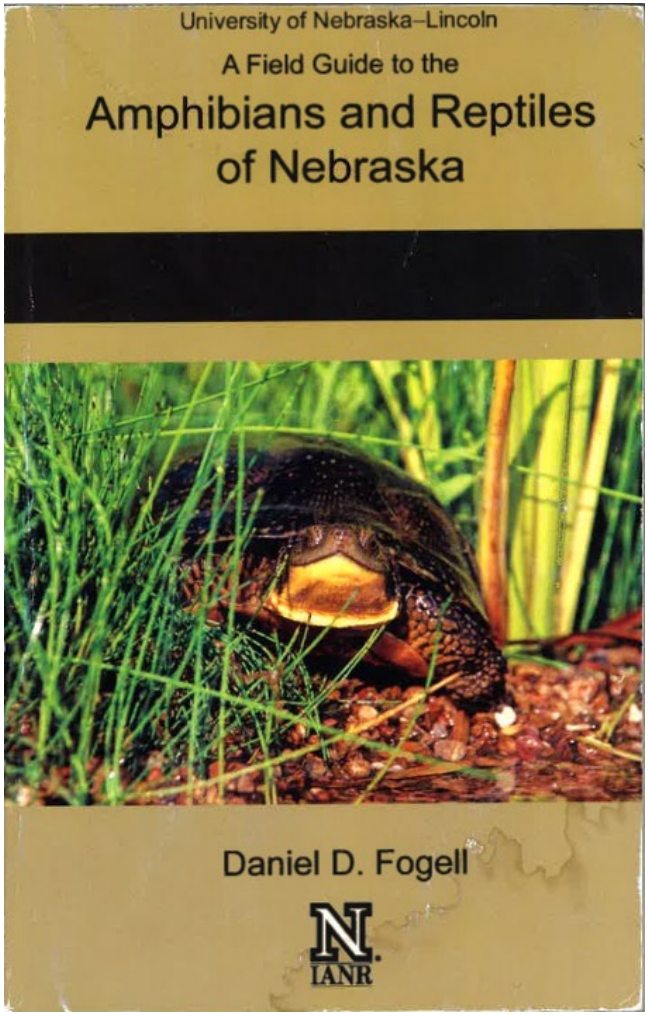
University of Nebraska-Lincoln: Differentiation of Mule Deer and White-Tailed Deer, 1989. *(Page 91-93)*

Nebraska Invasive Species Program: Eurasian Collared Dove, 2021. *(Page 94-95)*

Herpneb UNL: Western Tiger Salamander, 2021. *(Page 96)*

Study Resources begin on the next page! 

Turtles of Nebraska



Common Snapping Turtle

Chelydra serpentina

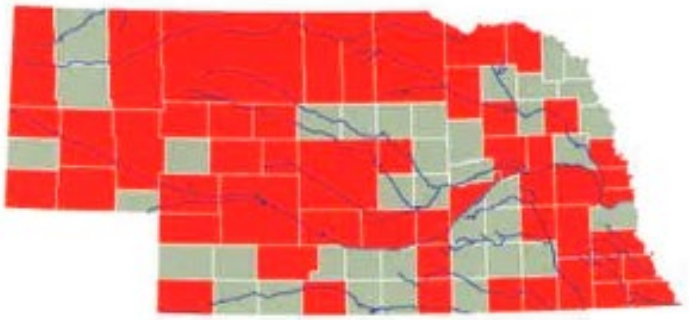
Description: Nebraska's largest turtle, the Common Snapping Turtle has a unique set of characteristics. The large head, remarkably long tail, and highly reduced plastron make it easy to identify. The carapace can be brown, gray, or nearly black, and there are three prominent longitudinal peaks or keels along its center as well as a series of "sawtooth" projections from the posterior marginal scales. Keels may be worn smooth in older individuals. Sometimes the carapace may appear green as a result of algae that take up residence there. Average carapace lengths in Nebraska are 9.0-10.0 inches (22.8-25.4 cm) with specimens up to 15.0 inches (38.1 cm) being reported. Weights up to 50.0 lbs (22.6 kg) are possible; however, most are much smaller in size.

Habitat: Snapping Turtles can be found using any body of water from the channelized Missouri River to small intermittent streams and ephemeral ponds. As water recedes from temporary streams and pools, these turtles migrate across grasslands, roads, and anything else in their way to find another body of water. They also have been known to climb fences.

Natural History: Common Snapping Turtles are predators that often use a "sit and wait" strategy to acquire food. They remain motionless under water or buried in mud with their heads above the mud surface and strike viciously and quickly at passing prey – which is nearly anything they can catch. Spring rains will often trigger migratory bursts, and Snapping Turtles can be found on land. Their name is given to them because of their aggressive behavior on land, but in the water they are much calmer. Usually they swim or walk slowly away when approached. Mating can occur throughout the active season. In ponds with high densities of turtles, males may fight each other for breeding privileges. Females nest in May and June and can migrate a fair distance from water to lay their eggs. Nesting activity is normally completed in the morning or evening. Eggs are round and leathery and look like ping pong balls. Young turtles hatch between August and October.

Distribution: Common Snapping Turtles are found throughout the United States, extreme southern Canada, and a small section of northern Mexico east of the Rocky Mountains. In Nebraska they are found statewide, are considered common, and are not specially protected. With the proper license, they may be hunted for their meat.

Common Snapping Turtles. Note dorsal keels on the long tail, and sawtooth projections on the posterior marginal scutes (above).



Northern Painted Turtle

Chrysemys picta

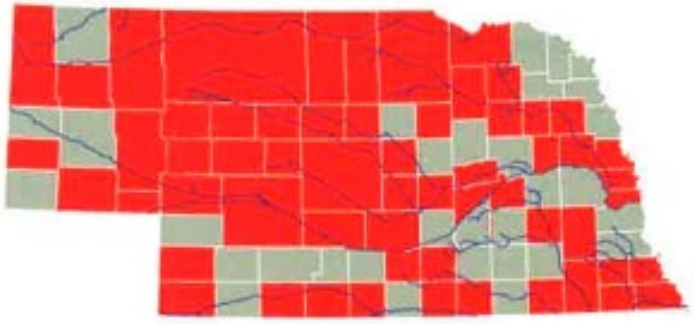
Description: The Northern Painted Turtle is the most commonly seen turtle in Nebraska. It has a smooth carapace with a ground color of olive, brown, or sometimes black in older individuals. An irregular pattern of light yellow lines is often present on the carapace as well, and subtle red patches may be present along the marginal scutes. The plastron is not hinged and is a reddish color with a large irregular dark figure that extends from the center of the plastron to nearly all edges. The head is an olive color with a pattern of broad and narrow yellow lines. Some adult males will become melanistic with age and appear completely dark and without pattern. Males have substantially longer front claws and tails than females. Average size is 5.0-7.0 inches (12.7-17.8 cm) with females usually larger than males.

Habitat: Any body of water in Nebraska can be considered habitat for the Northern Painted Turtle. Although they are more at home in permanent ponds and lakes with abundant aquatic vegetation, they are at home in slow-moving streams. They also inhabit Nebraska's larger rivers such as the Missouri, Niobrara, Platte, and Republican rivers. However, they are more commonly found in oxbow lakes and pools adjacent to these rivers.

Natural History: Often the first turtles to be seen basking in spring, Northern Painted Turtles are active from the first warm days of March through mid-October. They can usually be seen piled on logs, rocks, and even on top of each other as they warm up in the sun. Mating occurs in early spring and in fall. Females excavate egg chambers and deposit eggs by mid-summer. Eggs hatch by early fall, but hatchlings nearly always overwinter and do not emerge from the nest until the following spring. Eggs that do not hatch by fall cannot survive the winter. Northern Painted Turtles are omnivorous. They eat the roots and leaves of submerged vegetation, invertebrates, fish, and tadpoles. Females may be encountered on land while searching for a proper site for egg-laying. In some cases, it is far from water. Males will also traverse long distances over land.

Distribution: Northern Painted Turtles can be found throughout much of the northern two-thirds of the United States from coast to coast and south from the Midwestern states to the Gulf of Mexico. In Nebraska it can be found statewide in nearly any permanent aquatic habitat.

Northern Painted Turtles basking communally on a log (right) as they are often seen. Note the red plastron (above).



Blanding's Turtle

Emydoidea blandingii

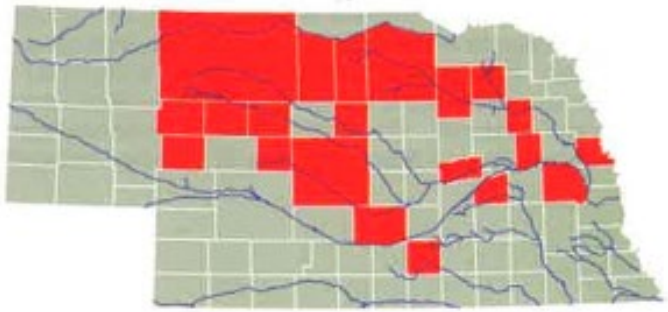
Description: A moderately-sized turtle, Blanding's Turtle has a dark carapace with light yellow spots and streaks radiating on it as well as on the top of the neck and head. The upper jaw is notched at the front of the mouth. The plastron has a single hinge that allows the body to be withdrawn partially into the shell. The most identifying feature, however, is the bright yellow pigment on the chin and throat. No other turtle in Nebraska will have this characteristic. The plastron is yellow with black "smudge marks" along outer edges of scutes. The carapace is high-domed when compared to other aquatic turtles, and the tail is noticeably long though not as long as that of Snapping Turtles. Lengths are between 5.0 and 8.0 inches (12.7-20.3 cm) with females larger than males.

Habitat: Though Blanding's Turtles are predominantly aquatic turtles, they often traverse great distances over land during summer months. They even have been found using shallow puddles of water formed from overflowing cattle tanks in grazing pastures. More commonly, however, Blanding's Turtles are found in marshes, permanent pools, and small streams with sandy substrates and abundant vegetation.

Natural History: This turtle is active from late March through mid-October, mates in early spring, and nests from May through June. Eggs are elongate in shape and leathery in consistency. Blanding's Turtles are omnivorous, but the bulk of their food is animal matter – snails, earthworms, fish, and frogs. They will eat both on land and submerged under water.

Distribution: Basically a turtle of the southern Great Lakes region, Blanding's Turtles can be found from northwestern New York west across the southern Great Lakes to Minnesota and southwest into Nebraska. They extend south through the northern portions of Ohio, Indiana, Illinois, and Iowa. There are isolated populations in South Dakota, southeastern New York, eastern New England, and Nova Scotia, and in extreme northwestern Missouri where they have been discovered recently. Blanding's Turtles are particularly abundant in lakes and sandy streams of Nebraska's unique Sand Hills region. They are present but uncommon in northeastern and eastern Nebraska. They are absent from the panhandle region and most counties south of the Platte River.

Blanding's Turtles showing the high-domed carapace, the bright yellow chin, and the notch in the front of the upper jaw that are indicative of the species.



False Map Turtle

Graptemys pseudogeographica

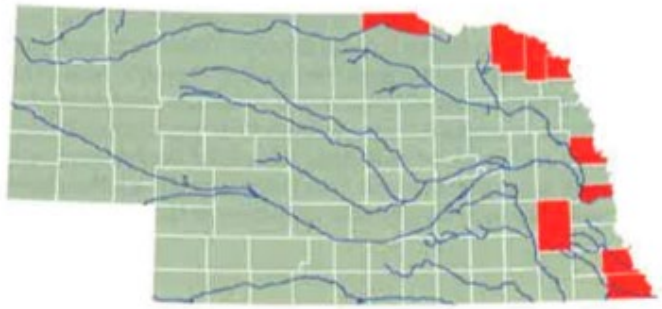
Description: This is a relatively large river-dwelling turtle with large, paddle-like hind feet that help it swim through fast-moving water. The carapace is olive green to brown in color and has a distinct medial keel with low-profile spines. The plastron is generally unmarked and is yellow or cream colored. Size ranges from 6.0-11.0 inches (15.2-27.8 cm) with females significantly larger than males. The posterior marginal scutes are serrated, and the head and neck are heavily streaked with yellow stripes. Two varieties have been found in Nebraska: the False Map Turtle (*G. p. pseudogeographica*) and the Mississippi Map Turtle (*G. p. kohnii*). They differ in three respects: The Mississippi Map Turtle has a large curved stripe posterior to the eye that prevents any neck stripes from reaching the eye; it has a very light, almost white iris with no horizontal line through it; and the plastron normally has a pattern or remnants of a pattern. False Map Turtles lack all these features.

Habitat: Large rivers and associated backwater ponds are the primary habitats for False Map Turtles; however, they can also be found in large lakes near large streams and smaller streams that are tributaries to large rivers. River banks with adequate basking sites such as fallen trees, stumps, sandy shores, and sand bars are preferred basking areas.

Natural History: False Map Turtles are active from early April through late October although their season may be slightly shorter in the northern portion of their range. Mating occurs early in the season but in some areas may occur again in the fall. Females will leave the water to nest in open sandy areas in late May through July. They often lay multiple clutches of oval-shaped eggs throughout summer, and they will often exhibit nest-site fidelity from year to year. Eggs begin hatching in August, and young turtles occupy backwater areas where they feed until hibernation begins. False Map Turtles are omnivorous but mainly eat insects, insect larvae, mollusks, and occasionally fish or dead fish.

Distribution: Large rivers and their tributaries within the Missouri and Mississippi River drainages from North Dakota south into eastern Texas, and from eastern Minnesota/western Wisconsin south to Gulf coastal Mississippi and extreme western Florida. Isolated populations exist in Indiana and Ohio. In Nebraska this is almost strictly a Missouri River turtle but it also can be found in some tributaries and nearly all of the associated oxbow lakes and reservoirs. The Mississippi Map Turtle has been found only in the Missouri River in Nemaha County in extreme southeastern Nebraska.

False Map Turtles. Note the low profile spines on the median keel (top). The Mississippi Map Turtle (left and above) has a large curved stripe behind the eye and a light iris with no horizontal line through it.



Ornate Box Turtle

Terrapene ornata

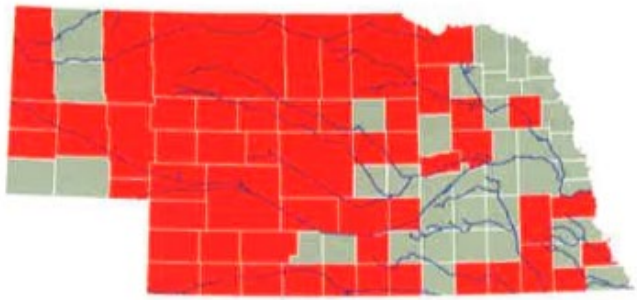
Description: The Ornate Box Turtle is Nebraska's only native terrestrial turtle. A small turtle, it can be recognized easily by its intricate carapace and plastron pattern with bright yellow lines radiating on a brown to black background. The plastron has a single hinge that allows the turtle to withdraw its body almost completely into its shell for protection. Yellow stripes may be present on the tail and stripes or spots may occur on the legs, neck, and head. The sexually dimorphic males usually have eyes with red irises, while females have maroon, yellow, or green. Males may also have more brightly colored red markings on the forelimbs but not always. Size is rarely larger than 6.0 inches (15.2 cm).

Habitat: This is a grassland turtle occupying short, mixed, and tallgrass prairies throughout its range. Although it is more common in areas with sandy soils, it also uses grasslands with loamy soil and even areas with dense limestone layers just beneath the surface. In Nebraska it is most commonly encountered in the short and mixed grass prairies in the western part of the state as well as the Sand Hills. It can be found in some of the eastern counties, but it is rare with conversion of tallgrass prairies to row-crop agricultural fields.

Natural History: At northern extremes of their range, Ornate Box Turtles are active from April through October. In warmer regions they may be active throughout most of the year. They feed daily and forage several times throughout the day. When temperatures become extreme they find shelter until favorable conditions return. The greatest amount of activity seems to be associated with rainfall. Ornate Box Turtles are often found on sand and gravel roads shortly after rain storms. They are omnivorous and eat succulent plants, arthropods, worms, small vertebrates, and even carrion. However, their primary prey is dung beetles. Breeding occurs in May and can continue through September. Females may lay eggs during the summer or may retain sperm and lay eggs the following season. As with most long-lived species, sexual maturity is not reached until later in life – usually around age ten.

Distribution: Ornate Box Turtles range throughout the Great Plains region from extreme southern South Dakota through Texas and west into southeastern Arizona. To the east they extend through most of Missouri and southern Illinois, parts of Indiana and Arkansas, and along the Mississippi River of eastern Iowa, western Wisconsin, and Illinois. In Nebraska they can be found statewide except for northeastern counties. Their densities are greatest in the Sand Hills and the southwestern counties. They are protected from commercial collection in Nebraska.

Ornate Box Turtles. Males (top and above left) are identified by the red pigmented eyes and forelimbs, and a female (above right) with brownish green eyes.



Slider

Trachemys scripta

Description: Generally a pond turtle, the Slider has a green to olive carapace with occasional yellow bars. It has serrated posterior marginal scutes, and the plastron is generally yellow and may have a dark blotch within each scute. The skin is green to brown with yellow stripes on the head, neck, and feet. Often called the Red Eared Slider, the variety found in Nebraska may have a red bar just posterior to the eye and one that can fade with age. Adults range from 7.0-11.0 inches (17.8-27.9 cm) in carapace length.

Habitat: Sliders prefer permanent ponds or marshes with abundant aquatic vegetation. While natural ponds are rare in eastern Nebraska, small man-made ponds are relatively abundant. City parks, large reservoirs, and canals are all potential habitats for Sliders in Nebraska, and all non-natural populations occupy just such habitats. Known localities for naturally occurring Sliders in Nebraska are all natural oxbow/backwater ponds adjacent to the Missouri River.

Natural History: Sliders may be seen basking on logs and other structures as early as March and as late as November in the northern tier of their range. Breeding occurs in late May-early June, and females may migrate long distances to find suitable nesting areas before depositing eggs in the ground. Eggs hatch later in summer or in fall, although in northern populations hatchlings may remain in the nest over winter and emerge the following spring. As with most pond turtles males have exceptionally long claws on front feet that they use during courtship rituals. Sliders eat nearly anything from vegetation and algae to insects and other arthropods, mollusks, and several kinds of vertebrates.

Distribution: Sliders can be found from south central and southeastern United States south through Mexico and Central America. In the United States, they occur naturally from southeastern Virginia south to the panhandle of Florida and west through most of Texas with small fingers of distribution in New Mexico. To the north they continue to eastern Kansas and then east to occupy most of the southeastern states with the exception of peninsular Florida. Their introduced range is substantially larger, as they have been established in every one of the contiguous 48 states, Australia, Asia, Europe, Africa, and South America. In Nebraska they occur naturally in Richardson County but are often found in ponds and reservoirs throughout the state as released pets.

Sliders, also known as Red-eared Sliders. Note the serrated posterior marginal scutes (right) and the red mark behind the eye.

Yellow Mud Turtle

Kinosternon flavescens

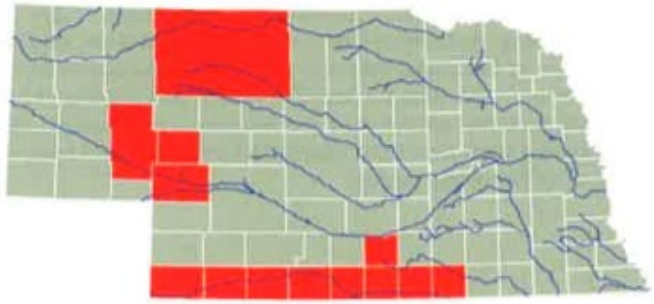
Description: The Yellow Mud Turtle is the only turtle in Nebraska that has two hinges on its plastron rather than one or no hinge. Its unpatterned carapace is smooth and uniformly an olive to yellowish-brown color. Often times the dorsal portion of the carapace is flattened. The double-hinged plastron is yellow and unmarked. There are no markings on the yellow to green to gray skin and there are pronounced tubercles on the chin. The anterior margin of the upper jaw is hooked. Size ranges from 5.0-7.0 inches (12.7-17.8 cm).

Habitat: This turtle is a resident of short and mixed-grass prairies. Nearly any body of standing or slow moving water – permanent or temporary – within these grasslands can be considered suitable habitat for the Yellow Mud Turtle. However true to its name, those with muddy or sandy substrates are preferred.

Natural History: Yellow Mud Turtles are active from April through October with a brief mid-summer aestivation period during July and August, at which time they leave their aquatic habitats and migrate to upland areas and bury themselves underground. Courtship and mating activities normally take place shortly after emergence from winter hibernation. During May, females migrate fair distances to south-facing, sparsely-vegetated hillsides to nest, and this is the only species in the world that nests while completely underground. Eggs are elliptical and hard-shelled, and they hatch between August and October. Western Hognose Snakes (*Heterodon nasicus*) are the primary predators of Yellow Mud Turtle eggs and hatchlings. Yellow Mud Turtles are mainly carnivorous and feed on snails, crustaceans, earthworms, amphibian larvae, fish, and carrion. Some vegetable material may be eaten as well.

Distribution: The Yellow Mud Turtle is primarily a short to mixed-grass prairie species found in the southwestern Great Plains with several isolated populations far from the general range. The primary range extends from southwestern Nebraska south through the western two-thirds of Texas and into northern Mexico and west into eastern and extreme southern New Mexico and southeastern Arizona as well as adjacent areas in Mexico. Isolated populations occur in the northwestern Sand Hills of Nebraska, the four-state area where Kansas, Missouri, Arkansas, and Oklahoma converge, western Illinois and eastern Iowa, and a small area in east Texas. In Nebraska, aside from the Sand Hills wetlands, this species is restricted to the Republican River and its tributaries in the southwestern part of the state. It is protected from commercial collection and only three individuals may be collected by any person in the state.

Yellow Mud Turtles. Note the double-hinged plastron (above left).



Smooth Softshell

Apalone mutica

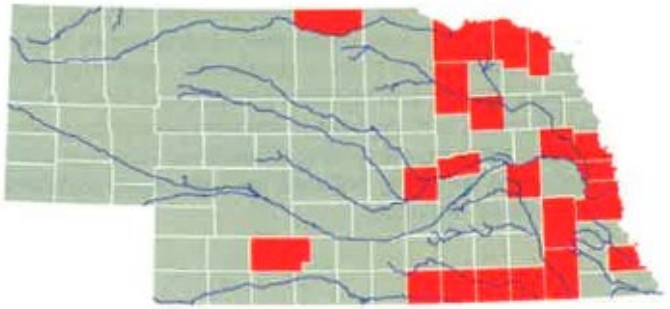
Description: As the name implies the Smooth Softshell is one of two turtles found in Nebraska that lacks the plated carapace found on other turtles. The soft, leathery carapace is normally olive green to brown and without spines or tubercles. Young animals and some adults may have a series of black dots and dashes randomly scattered over the carapace. Most adults will have a more blotched pattern that looks somewhat like greenish-brown galvanized metal. Part of the skeleton is often visible through the carapace. The plastron is solid white or gray. A single, dark-bordered light stripe extends posteriorly from the eye. The head, neck, and limbs are often patternless and uniform in color with the carapace. There are no projections extending from the nasal septum. Length ranges from 6.5-14.0 inches (16.5-35.6 cm).

Habitat: Smooth Softshells are a large river-dwelling species preferring sandy substrates rather than silt. They also can be found in large lakes and reservoirs. Sandy shores and sandbars are preferred basking spots rather than fallen logs, stumps, or other emergent structures. With the exception of females looking for nesting sites, these turtles rarely leave the water.

Natural History: Smooth Softshells may be found basking in early April but usually are not active until late April or later at the northern edge of their range. Basking, foraging for food, and resting within the substrate are the most common daily activities. All softshell turtles are strong swimmers and can easily swim across or against strong currents. Mating activity begins early in the season, and nesting occurs shortly afterwards in May. Females leave the water and migrate across sandbars or sandy shores to find suitable nesting habitat. Once the brittle, ovoid to round eggs are laid, females will often bury themselves near the nest for a short time. Smooth Softshells feed on invertebrates – mostly insects, mollusks, and worms. Fish and other vertebrate matter is also eaten. They are rarely herbivorous, but they may eat a fair amount of seed and fruit material.

Distribution: This large river species can be found in the Missouri, Mississippi, and Ohio River systems as well as their larger tributaries in Kansas, Oklahoma, Arkansas, Louisiana and east Texas. They can also be found in similar river systems in west Tennessee, Alabama, and extreme western Florida. In Nebraska they are primarily a Missouri River species but are also found in the Elkhorn, eastern Platte, and Big Blue Rivers. Anecdotal evidence has shown they are becoming increasingly rare. Presently they are protected from interstate commerce and have a collection limit of three per person.

Smooth Softshells. The nasal septum lacks projections (right) and a distinctive light stripe is behind the eye.



Spiny Softshell

Apalone spinifera

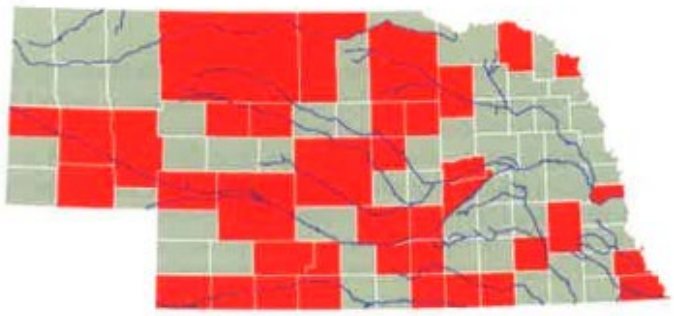
Description: The carapace is leathery and similar to the Smooth Softshell; however, the anterior edge of the carapace on the Spiny Softshell is covered with rough spiny projections or tubercles. Carapace color is similar as well – olive green to light brown. In males, however, the pattern consists only of larger rounded dots, or ocelli, and no dashes – a pattern that persists throughout life. Females have weakly defined ocelli as hatchlings that become hidden within a more blotched pattern as adults. A pair of separate black-bordered yellow lines can be found on each side of the head – one extending posteriorly from the eyes and one extending from the corner of the mouth. The head, neck, and limbs are often patterned with light stripes and dark blotches. A unique feature is two projections extending out from either side of the nasal septum and is distinctly in contrast to the Smooth Softshell, which lacks the projections. This species, ranging from 8.0-20.0 inches (20.3-50.8 cm), is larger than the Smooth Softshell. Sexual size dimorphism is strong among softshell turtles where females are substantially larger than males of both species.

Habitat: Although the Spiny Softshell is also a stream-dwelling species, it is not as selective as the Smooth Softshell and is common in ponds, marshes, lakes, reservoirs, and small streams – including those that regularly dry up during summer months. In Nebraska nearly any body of water is suitable habitat for this species.

Natural History: April through October make up the active season for Spiny Softshells, and their reproductive activity and season are similar to those of the Smooth Softshell. Female Spiny Softshells generally produce two clutches of spherical, hard-shelled eggs each season and may traverse great distances from water to find appropriate nesting habitat. Females nest in June, and eggs hatch from late summer through October. Like other softshell turtle species, sex is determined genetically rather than by incubation temperature. Spiny Softshells are carnivores that feed mostly on insects and other invertebrates, but they are also known to scavenge dead fish.

Distribution: Much more widely distributed than the Smooth Softshell, this species is found throughout most of the east-central United States from western New York south to the Florida panhandle, west through most of Texas parts of New Mexico and northern Mexico, and north to southern North Dakota, Colorado, and Wyoming. Isolated populations occur in Montana, southern Nevada, extreme southeastern California and parts of Arizona. In Nebraska the Spiny Softshell is found nearly statewide and within every major river drainage.

Spiny Softshells. Female (top), and male (above right). The nasal septum has medial projections (above left).



4. Amazing Adaptations
(2) Reading Skulls

Background

Animal skulls are great tools for teaching about the diversity of wildlife and the special role each animal plays in its natural environment at Bottomless Lakes.

Many interesting relationships between animals are revealed by studying their skulls. Skulls also give us clues about how the animal is adapted for survival in its environment.

Teeth, eye sockets, nasal passages, auditory bones, horns/antlers, and the individual plates of the skull tell us what it eats, when it is most active, how it sees and smells, whether it's predator or prey, its age and sometimes even its sex.

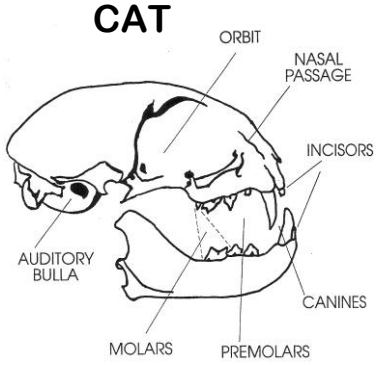
The following diagrams and explanations will help you become better-acquainted with the different characteristics of skulls.

Christopher Leinonen

Reading Skulls Background Information

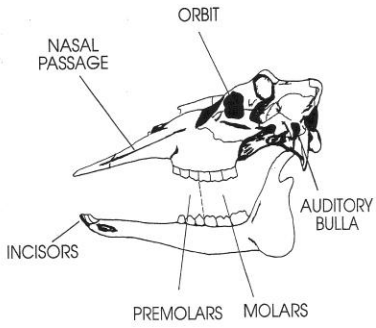
Teeth
The teeth in an animal skull can tell us whether the animal was a *carnivore, herbivore* or an *omnivore*.

CAT



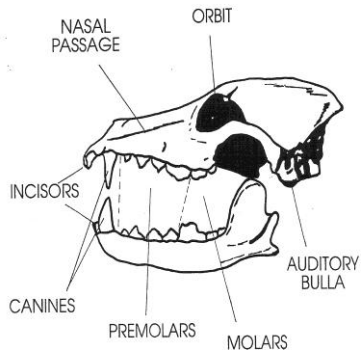
Carnivore: (meat eater – bobcat, mountain lion)
Carnivores have comparatively small, less developed *incisors*. *Incisors* play a minor role for carnivores, such as for grooming. The *canines* are large, long and pointed for piercing and holding prey. Cheek teeth (*pre-molars* and *molars*) are sharp and pointed for cutting and tearing flesh. Some of these upper teeth overlap lower teeth, providing a scissor-like shearing action to cut meat. These teeth are referred to as *carnassials.* With overlapping cheek teeth and long canines, carnivores do not have the ability to move the lower jaw from side to side in a chewing motion. Carnivores are predators (they kill and eat other animals) and tend to bite, tear and gulp food without any chewing action. The meat-eater's teeth tend to be clean and white because they are not stained by chemicals in plant material.

DEER



Herbivore: (plant eater - mule deer, jackrabbit)
*Herbivore*s have large, well developed *incisors* for cutting plant material. Their *canines* resemble *incisors* in form and function. Most ruminant (cud chewing) *herbivores* (deer, sheep, cattle, etc.) do not have upper *incisors* or *canines*. Instead, they have a hard upper *palate* that serves as a "cutting board" for the lower *incisors* to cut through plant stems. This arrangement permits the rapid ingestion of large amounts of plant material. Ruminant animals often seek cover after eating to regurgitate and chew their cud while watching for predators. *Herbivore* cheek teeth are large and wide with high, sharp crowns for grinding and chewing plant material. Instead of overlapping, the cheek teeth make surface contact to create a grinding action. Unlike predators, *herbivores* have side-to-side movement of the lower jaw and are able to chew food. This chewing, grinding action causes their teeth to wear with age. *Herbivore* teeth are often stained from substances in plants.

COYOTE



Omnivore: (plant and meat eater – coyote, gray fox, raccoon)
As might be expected, *omnivores* have a combination of *carnivore* and *herbivore* teeth characteristics. *Omnivores* have fairly large and well developed *incisors* for cutting plant material. The *canine teeth* are long and pointed for catching and killing prey. Cheek teeth are a combination of sharp, scissor-like *carnassials* for shearing meat, and teeth with more rounded *cusps* for grinding and crushing plant material. There is surface contact between some upper and lower *molars.* *Omnivores* (except some primates) do not have side to side lower jaw movement. Rather than chewing, their cheek teeth perform both shearing and crushing actions. Many *omnivores* are either predominately meat-eaters or predominately plant-eaters. The cheek teeth of these animals can usually tell us their predominant feeding strategy. For example, the coyote is an *omnivore* that is predominately a meat eater and has cheek teeth very similar to a *carnivore.* However, the coyote's most *posterior molars* have rounded *cusps* for grinding and crushing plant material.

Reading Skulls Background Information

Nasal Passage	Eyes
The relative size of the *nasal passage* on a skull is an indication of the animal's sense of smell. The thin bony structures inside the *nasal passage* (nasal turbinates) provide the framework for membranes which sense odor. The greater the size of these structures the greater the sense of smell. The short *nasal passages* of cat skulls tell us that cats do not have a very good sense of smell compared to many other animals and rely more on other senses to locate prey. Conversely, the long *nasal passage* of a coyote indicates that coyotes have a very keen sense of smell and that this sense is important to the coyote's survival.	The size of the *orbits* (eye sockets) in relation to the overall size of the skull, is generally proportional to the sharpness of the animal's eyesight. The larger the *orbits*, the better the eyesight of the animal. As an example, mountain lions (and most cats) have very large *orbits* and hence, very acute vision. The large eyes of cats, and many other *nocturnal* animals, play a role in their keen night vision.

Auditory Bullae

The *auditory bullae* ("bully") are the bony portions of a skull that encase structures of the inner and middle ear. In general, the larger, more inflated, this structure the greater the sense of hearing. Cats have comparatively large, inflated *auditory bullae* and very acute hearing. Although their hearing is much better than a human's, deer and elk have a relatively poor sense of hearing as compared to that of a cat.

Characteristics for Survival

All of the characteristics discussed here are elements of survival. The particular combination of characteristics that an animal has determines how that animal survives. Ruminant *herbivores*, such as deer and elk, are able to ingest large amounts of food and retreat to cover to regurgitate and chew this food (chew their "cud") while hiding from predators. These *herbivores* are equipped to detect predators with keen senses of hearing and smell along with *monocular vision* which provides for a wide field of vision. When predators attack, the *herbivores* best defense is their fleetness of foot.

Carnivores that would prey upon these *herbivores* are equipped with large *canine teeth* to capture and kill them. These predators have *orbits* forward on their skulls and thus *binocular vision,* which permits better depth perception. *Omnivores,* with the ability to eat both meat and plants, have a wider choice of food sources than strict *carnivores* or *herbivores.*

An example of one of the most successful animal survivors is the coyote. Coyotes are currently found in all the contiguous United States, throughout Canada, north to near the Arctic Circle and south to the Panama Canal. Within this extensive range of climates, this animal is found in remote wilderness and in large urban areas. Because it is an *omnivore* and can eat almost anything, coyotes are highly adaptable to just about any setting. Their excellent senses of sight, hearing and smell help them find food and avoid danger (coyotes living in mountain lion country are often preyed upon by these big cats).

Bobcat

Mule deer

Coyote

Photos by Robert Shantz

Predator and Prey Characteristics

Predators are animals that eat other animals and prey are animals that are eaten by other animals. Predators can also become prey. Predators are always *carnivores* or *omnivores*, whereas prey may be *carnivores*, *herbivores* or *omnivores*. When examining skulls to determine predators, we look for the teeth characteristics of a *carnivore* or an *omnivore*. If the teeth characteristics of a skull are strictly those of an *herbivore*, we consider the animal to be a prey species.

There is another skull characteristic that is very useful in determining predator/prey classification. This is the location of the *orbits* (eye sockets.) Most all predators have the eyes located in a forward position on the skull. Forward eye placement provides the animal with a greater degree of *binocular vision*. *Binocular vision* means that both eyes focus on an object providing the animal with a greater ability to judge distance (depth perception).

Binocular vision is an advantage when attacking prey and an important element of a predator's survival. *Herbivores* are strictly prey and most have *orbits* located on the side of the skull. This placement limits *binocular vision*, but enhances the animal's field of view or peripheral vision. These *herbivores* have *monocular vision* which means that they can see an object with only one eye. With *monocular vision*, each eye has a field of view of almost 180 degrees. Therefore, by using both eyes, these animals almost have a 360 degree field of view.

This field of vision provides the animal with a greater ability to locate predators and is an important element of their survival. In some *herbivores,* there is some overlap in the field of view and these animals may have partial *binocular vision*.

AMAZING ADAPTATIONS / Reading Skulls
Vocabulary

Carnivores: any animal with a diet consisting mainly of meat, whether it comes from animals living (predation) or dead (scavenging).

Diurnal: active during the daytime and sleep at night.

Habitats: an ecological or environmental area that is inhabited by a particular animal or plant species. It is the natural environment in which an organism lives, or the physical environment that surrounds a species population.

Herbivores: an animal that is adapted to eat plants and not meat. Herbivores form an important link in the food chain as they transform the sun's energy stored in the plants to food that can be consumable by carnivores and omnivores up the food chain. As such, they are termed the primary consumers in the food cycle (chain).

Nocturnal: active at night and sleep during the daytime.

Omnivores: an animal that eats both plants and animals as its primary food source. They are opportunistic, general feeders not specifically adapted to eat and digest either meat or plant material exclusively.

Predator: an animal that hunts, feeding on its prey.

Prey: an animal taken by a predator as food.

Skull: the bony skeleton of the head of vertebrates

January 1989

DIFFERENTIATION OF MULE DEER AND WHITE-TAILED DEER

David W. Oates

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2200 No. 33rd St./P.O. Box 30370/Lincoln, NE 68503

DIFFERENTIATION OF MULE DEER AND WHITE-TAILED DEER

by David W. Oates

The mule deer was so named because of the appearance of its ears. Compared to the whitetail's, the mule deer's ears are noticeably oversized, measuring fully one-fourth larger.

The whitetail is also well named, for its most distinctive feature is the large tail or "flag." The upper surface of the underside is pure white and is often exposed when the deer is fleeing. Instead of a "white flag," the mule deer's tail can be more likened to a black-tipped rope.

Antlers, too, serve to differentiate the species. In the whitetail, the points on each antler arise from a single main beam, much as the points on a garden rake arise from the iron crosspiece. On the other hand, the mule deer's antlers are basically in the form of the letter "Y" and the upper ends fork to form two smaller **"Y"'s.** The ends of these may fork also.

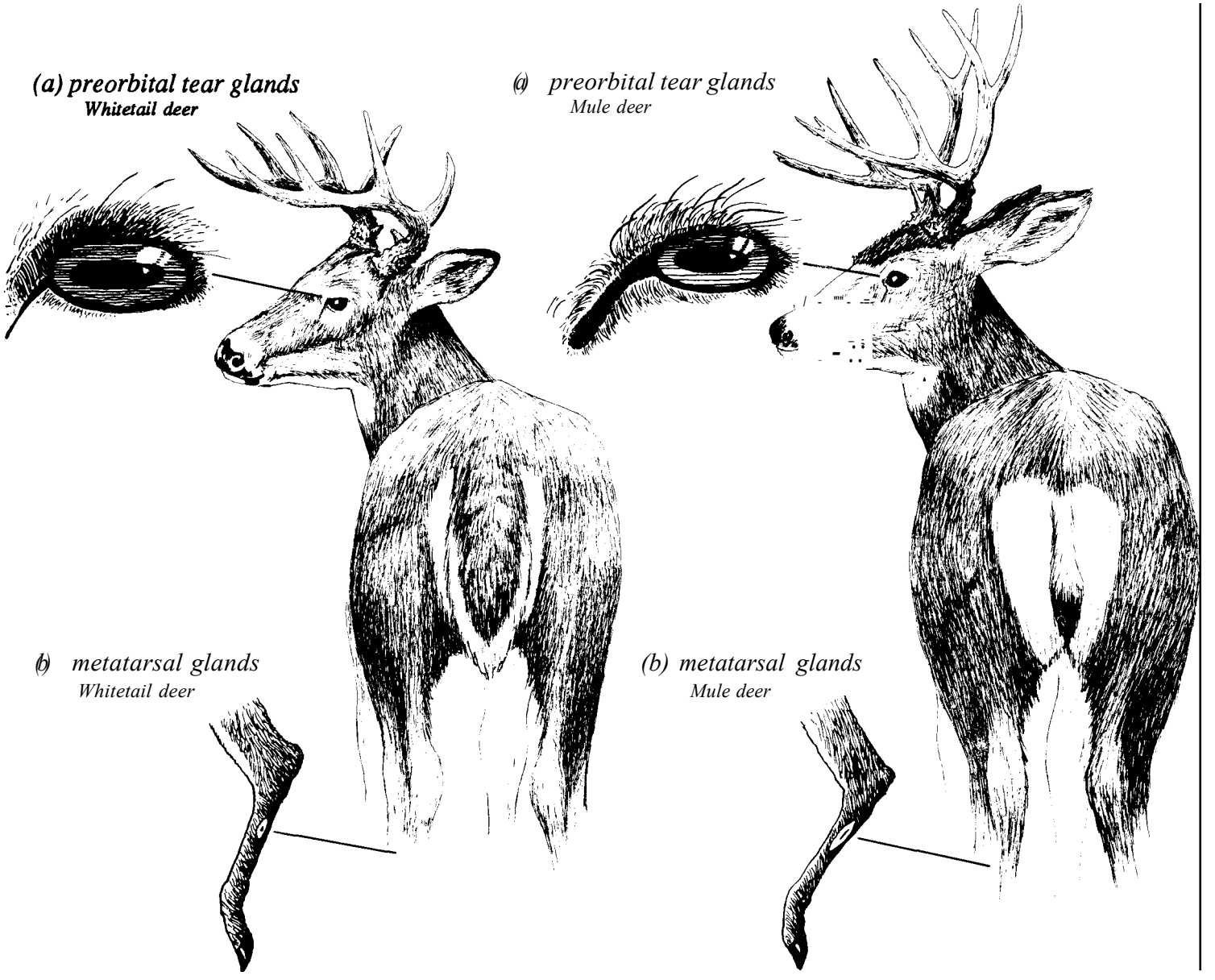
The whitetail's winter coat has a buff cast while the mule deer's is a plain gray. Both have white bellies; however, the mule deer's brisket is a rich brown. Also, the mule deer's brow has a distinct, dark gray patch.

But regardless of physical appearances, the mule deer proclaims its identity in no uncertain terms when he bounds away. Unlike the loping gait characteristic of the whitetail, he bounces along stiff-leggedly, striking all four hoofs at once, reminding you of a boy on a pogo stick.

a) An interesting feature of both species is the two sets of specialized skin glands. The preorbital tear glands, which lie just in front of the eyes, lubricate and clean the eyes. Longer and wider than a whitetail's this gland sometimes measures more than an inch in the mule deer.

b) The metatarsal glands occupy an elongated area on the outside of the hocks. This area, which shows as a "part" in the hair, is four to five inches long in mule deer, but scarcely an inch long in whitetails.

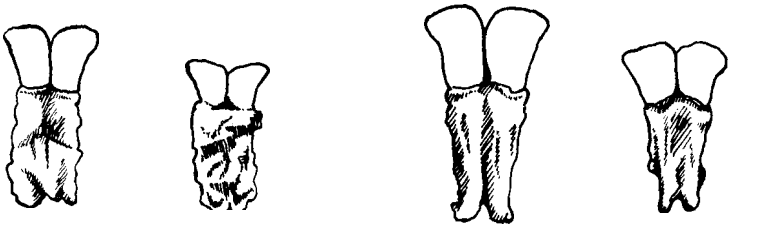
c) Another characteristic that can be used to differentiate normal (non-hybrid or old specimens) individuals is their "two front teeth." The two incisors of mule deer are longer and narrower than a whitetail's both in fawns and adults.



(c) two front teeth

Temporary teeth found in fawns

Permanent teeth found in adults

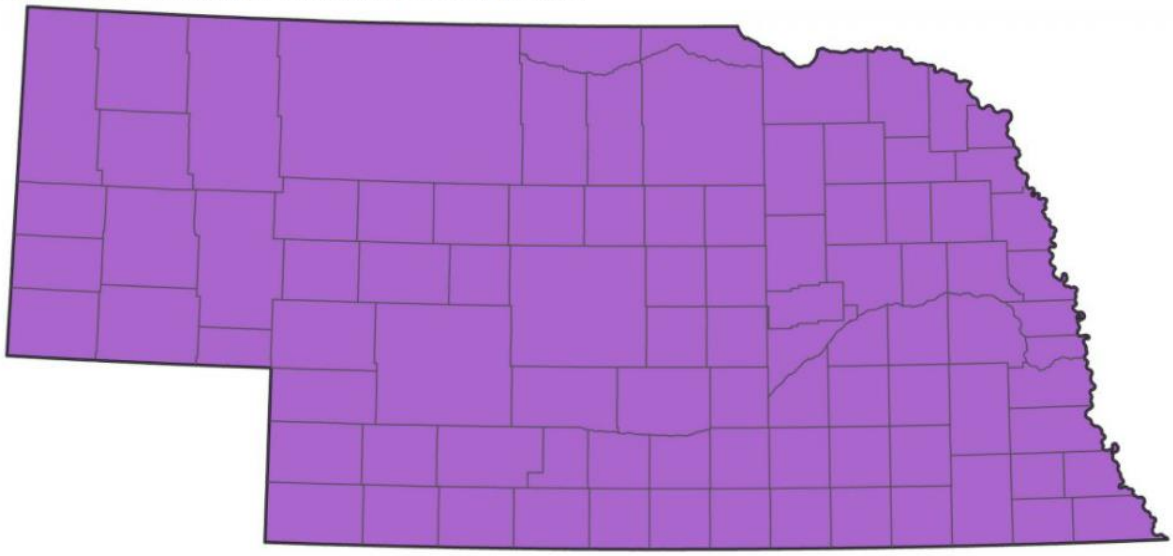


Mule deer Whitetail deer Mule deer Whitetail deer

EURASIAN COLLARED-DOVE

Streptopelia decaocto

Status: Common, locally abundant, regular **resident** statewide.



Documentation: Specimens: ZM-18428 (female) and 18429 (male), 29 Nov 2005 "found dead one day after blizzard" in Bassett, Rock Co.

Taxonomy: There are two subspecies in the native range of this species: *decaocto* from Europe to western China and Korea, and *xanthocyla* in Burma and eastern China (Clements et al 2016).

Numbers of wild birds may be augmented on occasion by released Ringed Turtle-Doves (see that species).

See hybrid account for Mourning X Eurasian Collared-Dove for discussion on putative hybrids between these two species.

Changes Since 2000: This species has expanded its range and numbers have increased dramatically in Nebraska since 2000 with largest increases occurring in western Nebraska (Figures 1 & 2 in Appendix).

Resident: Arrival, range expansion and increase in numbers by this species in Nebraska was discussed by Brogie and Silcock (2004). As of Mar 2001, it was "now residing in many of the larger towns in the Panhandle" (Stephen J. Dinsmore, personal communication), and occurred in numbers in and near Kearney, Buffalo Co. By spring 2004, it had been reported in 77 counties (Brogie and Silcock 2004), the main exceptions being in the Sandhills; the final county to record the species was Keya Paha, on 18 Feb 2007. In 2008 it was considered "common", even in the Sandhills, although as of spring 2017 there are still few reports from Cherry Co. It is by far most common in rural towns in western Nebraska and has only become noticeable in Omaha and Lincoln neighborhoods since about 2006.

The first state record was of one at a feeder in Shelton, Buffalo Co 29 Nov 1997 (Brogie and Silcock 2004). The second state record and first breeding record was of a pair in Kearney, Buffalo Co 22 Apr 1998. These birds fledged two young by 19 May and then re-nested, and by 24 Sep as many as nine birds were present in the neighborhood. Nesting was attempted in Oct and Dec but was unsuccessful. Eight birds were still present Dec 1998-Feb 1999, and "lots" were reported into spring 2000.

Since these initial records, numbers have increased dramatically, most notably in the west; CBCs in winter 2016-2017 reflect this distribution, with Scottsbluff reporting 1359 on 29 Dec 2017, a new count high, while across the state totals were North Platte 166, Harlan County Reservoir 50, and Omaha 33, the latter a new count high.

High non-CBC counts are 1500 at Kearney, Buffalo Co 2 Jan 2019 and 1000 there 26 Dec 2017, and in the east high counts are 243 in Lincoln, Lancaster Co 18 Oct 2019 and 231 at a grain elevator there 28 Sep 2018.

Breeding Phenology:

Nest-building: 30 Jan-24 May
Copulation: late Feb-9 Apr
Eggs: 21 Mar-4 Jun
Nestlings: 29 Mar-27 Aug

This species, like Rock Pigeon, may attempt to nest almost year-round, but mostly in Feb-Oct (Romagosa 2020). Four broods were raised in a Sidney, Cheyenne Co yard in 2006.

Comments: Escaped and released birds of the nominate subspecies *decaocto* (Romagosa 2020) on New Providence, Bahama Islands, in 1974 spread rapidly thereafter in the northern Caribbean and to Florida by the late 1970s (Smith 1987). Subsequently it has spread northwestward on the Great Plains and was first discovered in Nebraska at a feeder in Shelton, Buffalo Co 29 Nov 1997 (Brogie and Silcock 2004).

A specimen shot by a hunter in Stanton Co 16 Sep 2000 and mentioned in Brogie and Silcock (2004) cannot now be located.

Images

Acknowledgement

Photograph (top) of an Eurasian Collared-Dove at Papillion, Sarpy Co on 11 Apr 2011 by Phil Swanson.

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Western Tiger Salamander (FORMERLY BARRED TIGER SALAMANDER)

Other Names: Blotched Tiger Salamander
Scientific Name: *Ambystoma mavortium* (Formerly: *Ambystoma trigrinum*)
Family: Amybstomatidae

Description & Size

- Smooth, slimy skin
- Short fore and hind limbs
- Total Length: 15.2-21.5 cm (6.0-8.5 inches)
- Vertical bars that extend down the body or numerous blotches
- Bars: bright yellow, Blotches: olive green to pale-yellow
- Base color: Black or dark brown or green

Habitat

- Fishless, permanent or semi-permanent bodies of water (Larvae)
- Moist woodlands
- Prairie dog towns
- Other small mammal burrows

Diet

- Aquatic invertebrates (Larvae)
- Worms
- Terrestrial arthropods

Life History

- Nocturnal, rarely diurnal
- Active Season: Early spring – Late fall
- Breeding Season: Early spring – Early summer
- Lays gelatinous eggs
- Variable (50-200 per female)