2024 Wildlife

STUDY RESOURCES

2024 NCF-ENVIROTHON NEW YORK

Wildlife

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NCF-Envirothon 2024 New York

Wildlife Study Resources

Key Topic #1: Wildlife Biology

1. Identify New York wildlife species, including their niches, ranges, and food sources.
2. Describe the physical and behavioral adaptations (such as mimicry, camouflage, freeze response, hibernation, and special organs) of wildlife to different habitats and landscapes.
3. Identify anatomy of various wildlife species and describe the functions of anatomical parts.

Study Resources

Resource Title	Source	Located on
Mammals: White-tailed Deer, Beaver, Bear Muskrat, Fisher, Eastern Coyote, Northern Long-eared Bat, River Otter, New England Cottontail	*New York State Department of Environmental Conservation, 2023*	Page 4-21
Birds: Short-eared Owl, Golden-winged Warbler, Ruffed Grouse, Peregrine Falcon	*New York State Department of Environmental Conservation, 2023*	Page 22-28
Reptiles and Amphibians: Timber Rattlesnake, Eastern (Red-Spotted) Newt, Snapping Turtle	*New York State Department of Environmental Conservation, 2023*	Page 29-33
Animal Adaptation: Camouflage & Mimicry	*Johanna Katz – Naturalist Outreach Practicum, 2010*	Page 34-36

Study Resources begin on the next page! ➡

White-tailed Deer

Species Type: Mammal
Scientific Name: Odocoileus virginianus

Located throughout the state, the white-tailed deer (*Odocoileus virginianus*) is New York's most popular game animal. Residents and visitors to the state derive countless hours of enjoyment from the white-tailed deer resource. Each year, more than 500,000 deer hunters contribute nearly $1.5 billion to New York State's economy through hunting-related expenses. Through license purchases and federal excise taxes, hunters generate over $35 million to support management activities of NYSDEC. Hunters take some 220,000 deer annually, filling freezers with roughly 10.8 million pounds of high quality local venison. Largely due to efforts of more than 3,000 volunteer Hunter Education instructors, hunters continue to demonstrate exceptional safety records.

As a large herbivore, deer also play a role in shaping the landscape. Oftentimes, this can compete with human interests. Abundant deer populations can negatively affect plant communities and the other wildlife dependent on those communities. Deer can also cause problems for farmers, tree growers and homeowners. Additionally, they are a frequent hazard to motorists. Deer management seeks to maximize the benefits of this resource while being mindful of the human and ecological concerns associated with abundant deer populations.

Quick Facts About White-Tailed Deer

- Only male deer have antlers, which fall off every winter and regrow every summer. Developing antlers are covered with a soft skin called velvet, which is full of blood vessels.
- Deer can swim, run up to 35-40 miles per hour, and jump over an 8-foot-high fence!
- Deer communicate with scent and body language, in addition to vocalizations.

What to Watch for

- Size: 3 to 3.5 feet tall at the shoulder. 125-200 pounds, although males can weigh up to 300 pounds.
- Appearance
    - Adults: have reddish-brown coats in summer; grayish-brown in winter.
    - Fawns: are reddish-brown with white spots.
    -

Deer are often found on the edges of forests and in open areas by roadways, farm fields, or waterways. These wary animals are often quiet, but they make more sounds than most people realize. Fawns may bleat to get the attention of other deer. Adult deer may snort or stomp a front foot when they are disturbed or frightened. During mating season, bucks sometimes make a grunting noise.

Beaver

Species Type: Mammal
Scientific Name: Castor canadensis

Description

The beaver is New York State's official mammal. It is unmistakable due to its large body size (26-65 pounds, 25-35 inches) and broad flattened tail (9-10 inches long, 6 inches wide), not to mention the characteristically altered habitat in which it resides.

A unique feature of the beaver is a second set of eyelids. The secondary eyelids, known as a nictitating membrane, are white and form an inner eyelid. Additionally, their ears and nose can close while underwater! Beavers have lips that close behind the incisors which allow them to gnaw underwater. These large incisors are continuously growing and are kept at a manageable length by the gnawing action beaver use to gather food. The second hind toe has a split nail, which appears to aid in grooming.

The beaver's tail is flat, which helps them swim throughout aquatic habitats. It serves other purposes as well. The tissue beneath the scaly outer layer, which is actually compressed, grouped hairs, contains many blood vessels at its base. It serves as a thermoregulatory tool (helps them to maintain a consistent body temperature). Blood flows from the surface of the tail, thereby minimizing heat loss. It also assists in fat storage.

Habitat

Beavers rarely leave the water for long periods of time. They can be found in wooded streams; the margins of lakes, ponds, and reservoirs; swamps and marshes; and many other sources of year-round water. Ideally, waterways will be of low gradient with an abundance of aspen, willow, or alder, as well as a variety of aquatic vegetation.

Food and Feeding

The beaver's diet consists almost entirely of cellulose in the form of woody plant material. Beavers eat the leaves, bark and twigs of trees such as aspen, willow, and red maple and a variety of herbaceous plants. During summer months, their dietary preferences may shift to aquatic vegetation including water lilies and rhizomes from shoreline ferns.

As winter draws near, beaver may collect and store food items, called a raft or feed pile, underwater near the entrance to their lodge to use throughout the winter. This food store is imperative for survival when thick ice prevents access to fresh food during New York's long winters.

Behavior

Reproduction in beaver leads to the formation of their basic social unit, the family or colony. Beaver mate for life, but if one member of a pair dies, the remaining member will readily accept a new mate. These colonies usually consist of the parents, offspring, and infrequently an 'extra' adult will be found within a colony.. A typical number of beaver per colony is between four and six, but up to a dozen is possible.

Home ranges or colonial territories are established and passively defended by means of scent-mounding. This is where an adult beaver piles up muddy debris and marks the top with castoreum, which is washed out of the castor glands with urine.

Other forms of communication include vocalizations, postures, and tail-slapping. Tail-slapping is thought to be a means for one beaver in a colony to warn other beaver of a potential threat. Another function may be to frighten would-be predators away.

Ecology

Like most rodents, beaver construct an elaborate den or lodge with multiple entrances. Beaver differ from other rodents not only in size, but the fact that beaver alter their surroundings to suit their needs. Possessing the unique ability to fell trees, they use this talent to not only get food it is also a source of construction material. They are cued to begin construction at the sound and motion of running water. Beaver impound an area not only for a place to live and rear their young, but it also adds protection from certain predators.

Depending upon the type of habitat they colonize, they may create a home in a stream bank, or a lodge out in open water. These have two or more underwater entrances and the 'living quarters' of their lodge will be above the level of the surrounding water. In the wintertime, it will maintain a temperature significantly higher than that of the surrounding air.

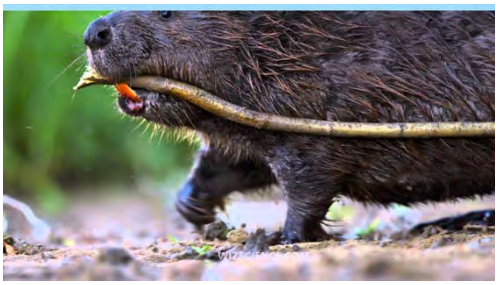
Beaver impound a variety of wetland types and streams with different forest types and gradients. This colonization converts the existing habitat to open water and provides a valuable resource for a variety of furbearer and waterfowl species. However, it can eliminate the existing natural diversity of certain groups of organisms, such as reptiles and some fish species, that may require cooler water than is provided by a beaver impoundment. Flooding of surrounding landscapes can prevent natural succession. It may destroy actual forest stands of trees not adapted for prolonged submersion of their roots.

Reproduction

Beaver reproduce once a year and form lifelong breeding pairs. Breeding occurs in January or February and young are born in May or June after an average gestation time of 107 days. Litter size may range from 2 to 7 kits. The number of offspring could be based on the quantity and quality of available food and habitat in any given year.

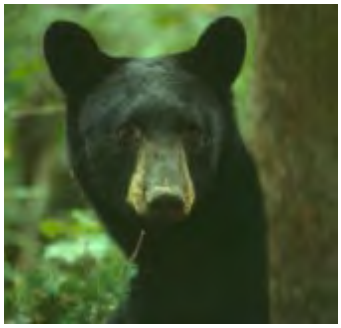
Externally, beaver can have multiple species of mite that dwell in their dense fur. There can be as many as 10 species of mite living on a single beaver. Each species is specialized for life in a distinct part of the animal's body. For instance, the mites living around the head are not the same species of mite that one would find in the hindquarters.

Quick Facts About Beaver



- A beaver can chew down hundreds of trees each year and a family of beavers can eat up to a ton of bark in a winter.
- With waterproof fur, webbed hind feet, and the ability to hold its breath for 15 minutes, the beaver is well adapted to life in the water.
- Beaver have prominent orange teeth, dark brown fur, and a flat, paddle-shaped tail

Black Bear

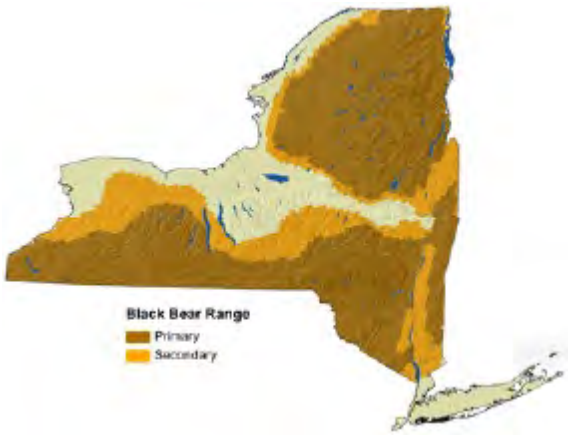


Species Type: Mammal
Scientific Name: Ursus americanus

Though rarely seen by most New Yorkers, black bears (*Ursus americanus*) are valued by hunters, photographers, and wildlife watchers. Many people enjoy just knowing that bears are present in New York. For many, black bears symbolize wilderness and wildness, but increasingly, bears can be found in semi-rural environments, agricultural areas, and occasionally in urban centers.

New York Black Bear Population Facts:

- Currently estimated at a minimum of 6,000-8,000 bears in areas open to hunting
- 50-60% inhabit the Adirondack region
- 30-35% inhabit the Catskill region
- 10-15% inhabit the central-western region.
- Bears are now well established in many other areas, including the Tug Hill, Hudson Valley, and across the Southern Tier.
- Transient bears are routinely encountered throughout the Lake Ontario Plains, Mohawk Valley, and St. Lawrence Valley.
- With the exception of Tug Hill, these other areas include a greater proportion of agriculture or have higher human densities, making them less suitable for bears due to the higher likelihood of human-bear conflicts.



Black bears are an important and natural component of New York's ecosystem. Whether you live or recreate in the bear country, please help maintain and protect the bear. At the same time, protect yourself and your property by not feeding bears and by reducing bear attractants.

If a bear den is located, please call the nearest wildlife office. Also, please do not visit the site or take other people to see the bear den. Female bears give birth in the den. Disturbances by humans may cause the bear to abandon the den and impact the survival of the cubs.

Black Bear Facts

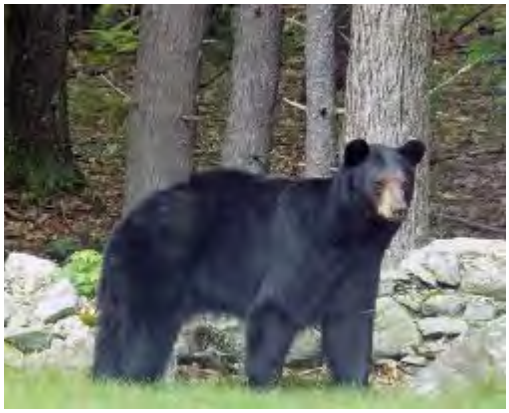
- **Black bears are large -** They have erect, rounded ears; a long, narrow, brown muzzle; and a short tail. An average adult male weighs about 300 pounds while females average about 170 pounds.
- **Black bears can remain dormant** for up to 5 months in winter.
- **Adult male and female bears** only tolerate each other during breeding season.
- **While breeding occurs in June and July**, the fertilized eggs of the female do not begin to develop until autumn. This delayed implantation occurs so that the cubs are born when their chances of survival are greatest, while in the den.
- **Bears eat nearly anything -** They are omnivorous; eating grasses, berries, fruit, nuts, seeds, insects, grubs, and carrion, as well as human sources of food like corn, honey, bird seed, trash, and pet food when available.
- **Bears are curious** - Black bears are omnivores, dieting on various and even unusual plant and animal materials. Bears are also opportunists, choosing the foods that are easiest to obtain in quantity. A

successful bear hunter recognizes that food availability changes from one year to the next, and also during the bear hunting season.

- **Bears are intelligent** - Bears learn from experience. If an activity results in food, they will repeat that activity. If an encounter with a human is negative, they learn to avoid humans. Also if an encounter with a human doesn't result in a reward (food), they will not have any reason to have contact with humans.
- **Black bears are aged by cutting a cross section of a small premolar tooth** and counting the cementum annuli (annual rings), similar to the technique used by foresters to determine the age of trees. The oldest wild bear ever aged in New York was 41¾ years.
- **Feeding bears creates human-bear conflicts** - When bears learn to obtain food from humans, they can become bold and aggressive. Deliberate and intentional feeding of bears is illegal in New York.

- **Feeding bears is bad for bears** - Bears' natural foraging habits and behavior can be changed. Usually solitary, bears can be concentrated in areas causing stress, injuries from physical conflicts, and the spread of diseases. Often when feeding on garbage or camper's supplies, bears will eat unhealthy materials such as soap, shaving cream, insect repellant, food packaging, etc.

Hunting Bear in New York



New York has between 6,000 to 7,000 black bears in the wild. In recent years, numbers have increased and become more widely distributed across the state. Hunting is the primary management tool to control the bear population. Bear hunting is permitted in the fall throughout portions of northern, southeastern, and central-western New York.

Watchable Wildlife

Black bears are the second largest mammal in New York State. (The moose is the largest.) Bears are excellent climbers and can run at speeds up to 25 mph or more. Look for claw marks or scars on trees and bark torn or ripped off. They are usually made to mark the tree or because they are climbing the tree in search of food.

- **Tracks**: Black bears have five toes on each foot, with the biggest toe being on the outside (in contrast to the location of a human's big toe). The position of the big toe is what gives the black bear its shuffling gait, with the tracks turning slightly inward. Look for five toes, claw marks, and a large heel pad. The hind tracks are longer and may reach 7 inches long by 5 inches wide. The front tracks are smaller, but often reach 5 inches long by 5 inches wide.
- **Scat**: Bear droppings may be over an inch thick and tubular. A pile of bear scat may be very large. The scat varies with diet and food availability, based on the season.

Muskrat

Species Type: Mammal
Scientific Name: Ondatra zibethicus

Description

Muskrats (*Ondatra zibethicus*) are easily recognized by their moderate size, their blunt head, and small non-descript ears and eyes. Adult muskrat weigh between 2.5 and 4 pounds, and total length may range from 23-26 inches, with a tail length of 8-11 inches. A scaly, laterally compressed tail with a fringe of coarse hair along the underside of the tail is a feature muskrats share with no other New York State mammal. They possess large hind feet with partial webbing in between their toes with a row of coarse hairs along the outer edge of each foot. Their fur can vary in shades of brown and in some cases black and consists of a soft, dense undercoat with an interspersion of longer, coarse guard hairs.

Habitat

Found throughout New York State, muskrats occupy a variety of aquatic habitats including ponds, lakes, marshes and streams, and can also occur in brackish habitats. They prefer marshlands, but are found to occupy wetlands and waterways that are heavily vegetated, particularly with cattails, bur-reeds, and bulrushes.

Food and Feeding

The roots and stems of aquatic vegetation are the muskrats' dietary staple. Animal matter is also consumed in times of vegetation shortages or peaks in abundance of invertebrate species. They have been known to eat mollusks, fish, various invertebrates and even turtles. Classic signs of the presence of muskrat are well-matted resting and feeding platforms such as the bare edges of stream banks, the tops of tussock grass clumps, or nestled within aquatic plants. These are often littered with piles of vegetative debris and occasionally crayfish or mussel remains, as well as droppings. Muskrat foods will vary with the type of habitat. Marsh dwellers may eat aquatic plants such as cattails almost exclusively, whereas animals in large bodies of water such as lakes and ponds may be more opportunistic, thus accounting for a more omnivorous diet.

Behavior

Primarily nocturnal, muskrats may also be active during daylight hours and remain active year round, as they do not hibernate. Muskrat will defend their territory vigorously from other muskrat and potential predators, especially prior to and during the breeding season. Territory holders are usually older adults, while younger animals remain subordinate and are more likely to fall victim to predators as they are forced into sub-optimal habitats by territorial adults.

Ecology

Den construction is dependent upon the type of habitat occupied. When in a stream habitat, muskrat burrow into the banks to create dens. One or more entrances are hidden underwater and lead to chambers located above the waterline. They excavate channels or runways in shallow water leading from den entrances for ease of mobility. In marshy habitats, a dome-shaped hut is constructed on a firm substrate using emergent vegetation in the immediate area. Regardless of den type, muskrat activity may be destructive to the banks of waterways and plant communities in the immediate area of a den site.

During winter months, another type of structure created by muskrats is referred to as 'push-ups' or 'breathers'. These are masses of vegetation collected from underwater and pushed up through cracks or holes in the ice. Ultimately, these freeze solid and serve as resting places and are maintained as breathing holes.

When muskrats manipulate vegetation during feeding or while constructing dens, they impact many other species that share these habitats. Some species, such as turtles, use muskrat houses as winter hibernacula. Canada geese and mallards will nest on top of muskrat huts. A unique ecological situation occurs in western New York that includes muskrat, bur-reed, and the state endangered black tern. As muskrat consume the bur-reed, a primary food item, they create open matted areas on the water surface that black terns can use as courtship and nesting areas, thereby increasing tern reproductive success.

Reproduction

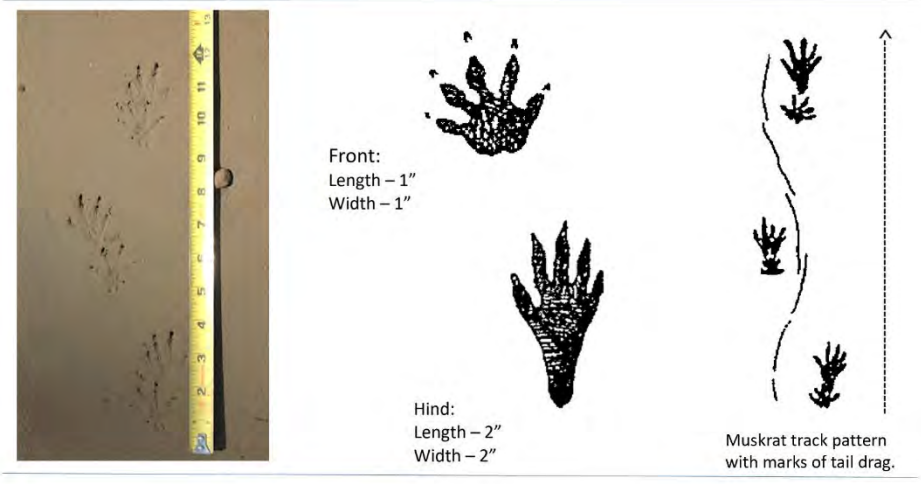
The breeding season starts in April, with the first litter born in early May. After a gestation period of 25-30 days, muskrats give birth to 4-8 young or kits, and can have up to three litters a year.

Nearly hairless at birth, kits are blind for about the first two weeks of their lives, after which they venture out of the den for their first swim. Females born in early spring may mate in autumn of the same year; however, muskrat in the northern parts of the species range do not reach sexual maturity or adulthood until the April following birth.

Predators, Parasites, and Diseases

Automobile collisions and trapping are two major sources of muskrat mortality. In addition, muskrats are a valuable food source for a wide variety of predatory wildlife. Raccoon and mink are their primary predators and other carnivores such as fox, coyote, red-tailed hawks and great horned owls readily prey on muskrat.

Historically, muskrat are susceptible to and have been ravaged by a variety of diseases such as tularemia, leptospira, salmonella, and hemorrhagic fever, but these diseases have not been extensively reported in New York State. As with most wildlife, muskrats can act as hosts to a wide variety of endoparasites such as intestinal roundworms and tapeworms that do not necessarily have a negative impact on the animal's overall condition. External parasites such as fleas, mites and ticks, which inhabit the soft underfur, also take up residence in the warm, dry interior of muskrat houses.



Fisher

Species Type: Mammal
Scientific Name: Martes pennant
New York Status: Not listed
Federal Status: Not listed

Description

The fisher is a large, dark, long-haired member of the weasel family. Their stature is relatively low to the ground, with short legs, small ears and a well-furred tail. The color of their fur varies from dark brown to nearly black. Females and juveniles usually have a more uniform color, and males will have a blonde or grizzled appearance due to multi colored guard hairs around the neck, upper back and shoulders.

There is considerable evidence of dimorphism between the sexes, with males weighing between 7 and 13 pounds, and females between 3 and 7 pounds. Total lengths for males range from 35-47 inches, and females, 30-37 inches.

Fisher have large, wide feet with five toes on each foot and semi-retractable claws. This makes them well adapted for walking on snow, climbing trees and grasping and killing prey. They are capable of rotating their hind feet nearly 180º, which allows for a headfirst descent from trees. As with all members of the weasel family, both sexes have large anal scent glands which may be used to mark territories or attract potential mates.

Distribution and Habitat

Found exclusively in North America, fisher inhabit a band of forested and semi-forested land from coast to coast, and prefer extensive closed canopy forests. In the east, they range from Virginia north to Quebec and the maritime provinces of Canada. They use deciduous, coniferous and mixed forests. Historically, their numbers experienced a severe decline during the late 1800s and early 1900s due to over-exploitation and loss of forested habitat due to unregulated logging and the clearing of land for farms. Reintroduction programs have proven to be effective in restoring populations, along with regulation of trapping opportunities and the initiation of reforestation programs.

In New York State, fisher can be found throughout approximately 26,000 square miles of forested habitat within the northern, eastern and southeastern parts of the state. Recently they have begun to return to the southern tier of central and western New York, as some sightings and road kills have been reported from that region.

Food and Feeding

Fisher are a dietary generalist. They eat a wide variety of small to medium sized mammals and birds, and a variety of hard and soft mast such as beechnuts, acorns, apples and berries. However, they have been considered a specialist in that they are the only known North American mammal that succeeds in killing and consuming porcupines. They will consume the entire animal, leaving nothing but a quilled hide and a few of the larger bones.

Other prey items include rabbits, squirrels, mice, shrews, and carrion from large mammals such as whitetailed deer. Carnivores such as bobcat, coyote, red and grey fox and some raptors serve as competition for prey items,

and fisher have been documented to travel over a hundred miles over the course of a few weeks in order to meet the demands of their dietary requirements.

Reproduction

Fisher reach sexual maturity in their first year of life, and females may be receptive at that time. Implantation of the fertilized embryo may be delayed until the following season, thus accounting for their first litter being born in their second year. Reproduction peaks in late March, and breeding may occur as late as May. Average litter size is 2-3 young, and kits are born partially furred with closed eyes and ears, essentially helpless at birth. Weaning occurs within 8-10 weeks, and dispersal of young may occur by their fifth month, as interfamilial aggression begins by the onset of autumn.

Behavior

Fisher use a variety of structures for year-round denning purposes such as the natural cavities found in older trees, hollow logs, cavities in rocky outcrops, brush piles and underground burrows. Dens used for birthing of young are usually found in hollow sections of trees, high above the ground.

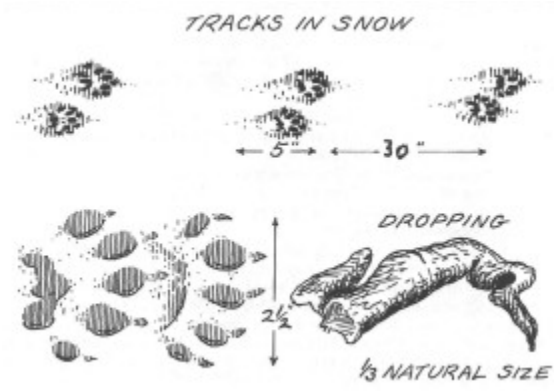
Fisher lead a solitary lifestyle except for brief periods during the breeding season. They have been found to be active at any time during the day or night. Males generally have larger home ranges than females, and their territories seldom overlap that of other males, suggesting territoriality between the sexes.

Predators and Disease

Fisher have no natural enemies, save humans, and natural mortality remains largely undocumented. Trapper harvest and automobile collisions likely account for the majority of fisher deaths across their range. A few species of tapeworm, intestinal roundworm, and flatworm have been identified in fisher, and their effects on health are minimal. Rabies and distemper have been described in fisher in New York State, but are a minor source of mortality in the wild.

Fisher Management Plan

The New York State Fisher Management Plan was completed in December 2015. The plan describes the goals, objectives, and strategies that will guide DEC's actions and decisions related to management of fisher populations in New York over the next ten years (2016-2025). The plan advances two primary goals for managing fisher populations in New York: (1) Maintain or enhance fisher populations in all areas of the state where suitable habitat exists; and (2) Provide for the sustainable use and enjoyment of fishers by the public.



Eastern Coyote

Species Type: Mammal
Scientific Name: Canis latrans

New York Status: Not Listed
Federal Status: Not Listed

Description

Eastern coyotes look similar to German shepherd dogs, yet are half the weight. They have long, thick fur and full bushy tails, usually carried pointing down. Ears are large, erect, and pointed.

Length: 4 to 5 feet (nose to tail)

Weight: 35 to 45 pounds (males usually larger than females)

Color: Variable, from blonde or reddish blonde to dark tan washed with black. Legs, ears and cheeks usually reddish. Many have a white chin and a dark spot just below the base of the tail when observed from behind.

Eastern coyotes have a mix of coyote, wolf, and dog ancestry and are larger in size (about 40 pounds, on average) than coyotes west of the Mississippi. Wolves are larger than both. Eastern coyotes can be distinguished from wolves by their smaller size; large, pointed ears; and pointed snout.

Life History

Coyotes are opportunistic omnivores, meaning a coyote's diet depends on what is easy to find, scavenge, or catch and kill. Coyote diets are diverse and vary throughout the year based on seasonal availability. Annually, their diet includes white-tailed deer, rabbits, small mammals such as mice and voles, raccoons, groundhogs, birds, insects, and plant materials. Deer killed by vehicles and other causes (carrion) can be an important food source for coyotes. Coyotes do not frequently kill healthy adult deer.

Coyotes are not strictly nocturnal. They may be observed moving about during the day, yet are more active after sunset and at night. Seeing a coyote during the day does not necessarily mean it is sick or unhealthy, but caution should be exercised. Coyotes do not migrate. They are year-long residents and typically inhabit an area known as a home range. They are territorial, and will firmly defend portions of their home range. Adult coyotes live in home ranges throughout the year in New York; however, they may shift their activity patterns during the four seasons.

Coyotes are monogamous and mate for life. In early spring, female coyotes use dens for raising pups and often stay close to these sites. Male coyotes may travel greater distances to hunt more intensively while seeking additional food to support the female and pups. Litters of 4-6 pups are born in ground dens, brush piles, or under downed trees or human structures, such as sheds and other buildings. Coyote pups grow rapidly and are weaned at 5 to 7 weeks of age and abandon den sites around this time. They are fully grown at 9 months and

eventually disperse after being driven from their parents' home ranges. These young coyotes often travel 50 to 100 miles in search of a vacant territory, find a mate, and enter adulthood as a breeding pair.

Distribution and Habitat

There are two hypotheses to explain the presence of Eastern coyotes in New York. The first explanation is that coyotes were here before Europeans settled North America. The clearing of the forest for farms and homes forced coyotes to retreat to unsettled areas of the Northeast. The return of forested habitats during the 20th century coincided with the return of the coyote.

The second and more widely accepted hypothesis is that Eastern coyotes are a relatively new species in New York. This explanation suggests that coyotes originally inhabited central North America and naturally extended their range throughout the continent in response to human changes to the land. Evidence indicates that coyotes reached New York and the Northeast in the early 1930s and 1940s, with coyote range expansion first reaching the state by passing north of the Great Lakes and into northern New York. Coyotes then spread rapidly across the state over the next 40-50 years. Regardless of how they arrived in the state, coyotes have been present in New York since the 1930s, and have been firmly established throughout the state since the 1970s. They are here to stay.

Coyotes, commonly believed to live only in the more rural or wild parts of New York, readily adapt to living close to people. Coyotes live throughout Upstate New York and commonly inhabit many suburban and urban areas. Occasionally, they are sighted in parts of New York City and Long Island. As unlikely as it may seem, human development makes surprisingly good coyote habitat. The abundant food supply for coyotes makes living close to people possible.

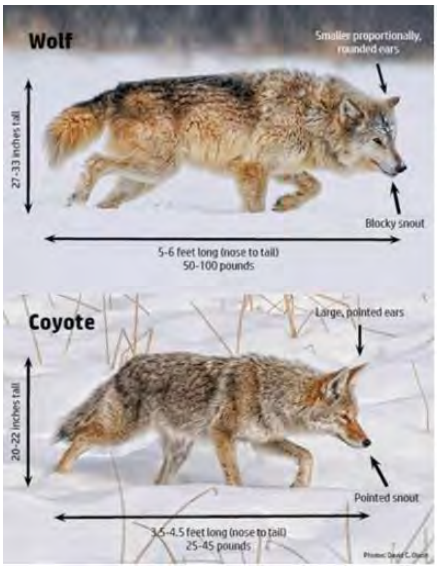
Status

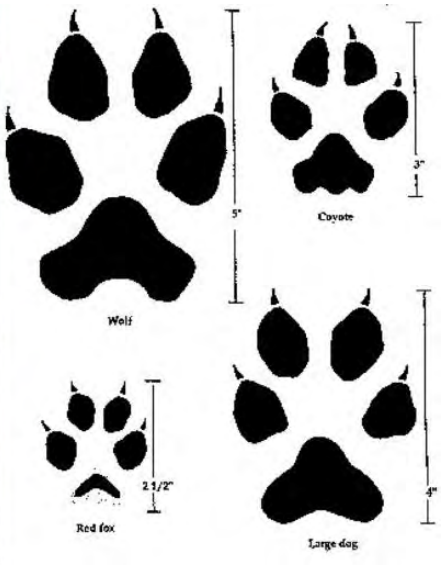
After hearing a family group of coyotes howl, it is easy to get the impression that the woods must be overflowing with coyotes. In reality there were probably five or six animals present (i.e., 2 adults and young of the year). A few coyotes make a tremendous amount of noise when they want to. The Eastern coyote does not form a true 'pack' with multiple adults living together like their relative the wolf. Instead, they are organized as a 'family unit'. Each family unit is made up of the adult pair and their pups from the current year. A family unit will defend a territory of 2 to 15 square miles against other coyotes. It is the territorial behavior of coyotes that limits their numbers in any one area.

Across New York, the most commonly reported issues with coyotes were incidents involving pets. Coyotes seldom approach or act aggressively towards people directly; however, dogs and cats attract coyotes. Coyotes approaching pets pose an immediate risk to the safety of pets and can jeopardize human safety, too. Overall, problems between people and coyotes are rare, yet the potential for conflicts to occur remains. Human behaviors may increase that potential if people feed coyotes (either directly or indirectly), or if they allow coyotes to approach people and pets. To minimize conflicts, it is important that people do their part to maintain the natural fear that coyotes have of humans.

Management

About 30,000 New Yorkers participate in coyote hunting each year and about 3,000 participate in coyote trapping. All of Upstate New York is open for coyote hunting, and a hunting license is required to hunt coyotes. All of Upstate New York is also open for coyote trapping and a trapping license is required.





The Environmental Conservation Law allows 'problem coyotes' to be killed at other times of the year. Section 11-0523 says coyotes that are "injuring private property may be taken by the owner, occupant or lessee... at any time in any manner."

Quick Facts About Coyote

Tracks

Similar to medium-sized dog tracks with four toes, claw marks, and a rear pad. Looking for coyote tracks in the winter is a good way to enjoy the outdoors. Look for coyote tracks moving alone or in pairs.

Scat

They leave a dropping similar to a dog, but look for parts of the animals they eat, such as hair and bones. Also look for bits of fruits or nuts.

When to Watch

Coyotes are most numerous at the end of summer and in the fall, when pups are almost fully grown. Watch an open field in late summer to see a coyote hunting for small mammals. Follow their tracks during the winter-you may catch a glimpse of a coyote in the distance as you track it.

What to Listen for

Chorus of howls and short, high-pitched yelps. Coyotes howl throughout the year, yet are highly vocal from late summer through early fall, and again during breeding season in winter. Listen for coyotes at dusk or after dark.

NEW YORK STATE | Department of Environmental Conservation

Northern Long-eared Bat

Scientific Name: ***Myotis septentrionalis***

New York Status: **Endangered***
Federal Status: **Endangered***

*On November 29, 2022, the United States Fish and Wildlife Service (USFWS) published a ruling reclassifying Northern Long-eared Bat from Threatened to Endangered under the federal Endangered Species Act. This rule is effective **March 31, 2023**. The change to Endangered in New York will take place at the same time as the Federal listing.

Distribution and Habitat

Northern long-eared bats (NLEB), also known as northern Myotis, are primarily forest-dependent insectivores. They utilize a diversity of forest habitats for roosting, foraging and raising young. In general, any tree large enough to have a cavity or that has loose bark may be utilized by NLEB for roosting or rearing young. Prior to 2006, NLEB were frequently detected in the forests of every county of New York State with the exception of the 5 counties of New York City. Since they feed predominantly on flying insects, they hibernate through the late fall and early spring to save energy when food is not available. Most known hibernation sites are caves or abandoned mines.

A northern long-eared bat in its hibernaculum.

A Species in Decline

NLEB were listed as "threatened" by the United States Fish and Wildlife Service (USFWS) under the federal Endangered Species Act on April 2, 2015. In New York, all federally threatened species that occur in the state are afforded threatened status under the New York Endangered Species Law and its implementing regulations. As recently as 2005, the NLEB was New York State's third most common bat species with populations estimated at or above 500,000 animals. The federal listing was the result of a dramatic population decline throughout most of the species' range. These declines have been caused by white-nose syndrome (WNS), a disease caused by an invasive fungus that ultimately causes affected hibernating bats to starve to death over the winter. Since WNS was first discovered in New York in 2006, a 98% decline in the abundance of NLEB has been observed. DEC is actively working with researchers from around North America to develop a management approach that will aid the recovery of this species. In the meantime, legal protections afforded by the listing status of the bat are focused on minimizing and avoiding direct loss of the remaining individuals by protecting the known hibernation sites and limiting forest management activities where NLEB are most likely to be present to certain times of the year.

General Recommendations for the Protection of Northern Long-eared Bats in New York

This section provides guidance regarding recommended measures to ensure that forest management activities are protective of the northern long-eared bat (NLEB) and do not result in an incidental take pursuant to 6NYCRR Part 182.

Guidance from DEC

Because it is the disease (WNS) and not habitat that is currently limiting the population, removal of trees from the landscape is generally not considered harmful unless there are potentially bats within the trees during the time they are harvested or otherwise removed from the landscape. We do not have perfect information on where NLEB occur. To protect NLEB from unintentional harm, the Department encourages the voluntary implementation of all forest management activities during the hibernation period-**November 1 through March 31 throughout the state and December 1 through February 28 in Suffolk County**-when bats are not expected to be present. However, DEC imposes no restrictions on tree cutting unless a project is located within 5 miles of a known hibernation site or 1.5 miles of a documented summer occurrence. See the Protection of Northern Long-eared Bats page for a map and list of known NLEB occurrences by town. For all projects that require the removal of trees, the following voluntary actions are recommended:

- Leave snag and cavity trees uncut unless their removal is necessary for protection of human life and property. Snag and cavity trees are defined under DEC Program Policy ONR-DLF-2 Retention on State Forests.
- If any bats are observed flying from a tree, or on a tree that has been cut, tree management activities in the area should be suspended and DEC Wildlife staff notified as soon as possible. A permit may be required to continue work, or you may have to wait until November 1 to resume activities.

If your project is located within 5 miles of a known hibernation site or 1.5 miles of a documented summer occurrence, please see Protection of Northern Long-eared Bats for additional guidance.

For more information on other species of bats, visit Watchable Wildlife.

River Otter

Species Type: Mammal
Scientific Name: Lontra canadensis

Description

The North American river otter is a member of the mustelid or weasel family that can be easily identified by a stout body, short legs, noticeably tapered tail and dense, short, glossy fur. Their streamlined body, fully webbed feet, broad and flattened head and stout, muscular tail, and closeable nostrils and ears all serve to assist in swimming and foraging. Their eyes, ears, and nose are located on the top of the head so they can see, hear, and smell while most of their body remains in the water.

Distribution and Habitat

Historically, river otter could be found in all watersheds of New York, and declines were attributed to unregulated harvest, habitat destruction, and water pollution. As recent as the early 1990s, the river otter was only found in the eastern half of New York State, while the western regions were devoid of otter except for the occasional individual that happened to be passing through.

In the late 1990s, the New York River Otter Project aimed to restore river otter to the watersheds of western New York. From 1995 through 2000, 279 river otter were captured in eastern New York and released at 16 different sites across the western part of the state.

Life history studies have shown that otter are dependent upon permanent watersheds, and otter may be found in rivers, lakes ponds, small streams, marshes and other inland wetlands. Suitable habitat will exhibit a high percentage of emergent vegetation, or in the case of natural waterways, expansive riparian corridors.

Food and Feeding

River otter could be considered somewhat of an aquatic generalist, as they consume almost anything they encounter and can catch. Primarily visual predators, their eyes are shaped in a way that facilitates underwater vision and acuity. In situations where murky water occurs, they are further enabled to forage by 'motion sensitive' whiskers that help them cue in on prey location and movement.

Although fish comprise the majority of their diet, amphibians and crustaceans and other aquatic invertebrates are also taken when available. They may also eat small mammals and birds (e.g., muskrat and waterfowl), reptiles, and even fruit. Otters have been known to consume vast amounts of hibernating woods and snapping turtles. These instances have detrimental effects on local populations of turtles and could wipe out local turtle populations.

Since river otter are at the top of the food chain, they have a greater chance of being exposed to elevated levels of environmental contaminants such as PCBs, DDT and its associated metabolites, and heavy metals such as cadmium and mercury. This means of exposure is referred to as bio-magnification. As contaminants accumulate in the organic materials and sediments on the bottom of a waterway, they become ingested by aquatic invertebrates such as snails, mussels, and insects. These are in turn consumed by fish, which may then be eaten by larger fish, all of which are consumed by river otter. This accumulating effect results in elevated levels of pollutants in river otter due to the ingestion of contaminated food items. At such high levels, some of these contaminants can have negative impacts on otter ranging from poor survivorship to sterility or infertility.

Reproduction

Adult river otters breed with more than one mate in their lifetime, and the breeding season may span from December to May. Females delay implantation of sperm, and this may result in fertilization occurring from 10-12 months after initial copulation. Litters usually range from 1-3, but 5 kits may occur. Juvenile dispersal usually occurs between 12 - 13 months of age, and distances of over 100 miles may be traveled before a suitable home range is found.

Behavior

The main social unit is the family, or an adult female and her young. Otter do maintain home ranges, as family groups have been noted to avoid one another. One such method of maintaining a home range would be the classic latrine sites, or toilet areas that they will both defecate and urinate at repeatedly. They will choose almost any object or piece of land that protrudes from the water or the bank including large conifers, points of land, beaver lodges or exposed root systems.

Otters are nocturnal by nature, but they can be seen by day foraging or playing, and daytime activity increases during the winter months. There is no hibernation period -- they are active year-round. Prints are often paired, grouped, or laid out in angled strings. One key feature to look for is the tail drag marks. Due to their large, thick tail, it is often seen scraping over and between print sets, especially in snow. Another feature indicative of otter sign will be their slides. These slides can be found on flat ground with snow or grass cover, or snowy or muddy slopes into the water. This method of locomotion is used as a means of transport and play.

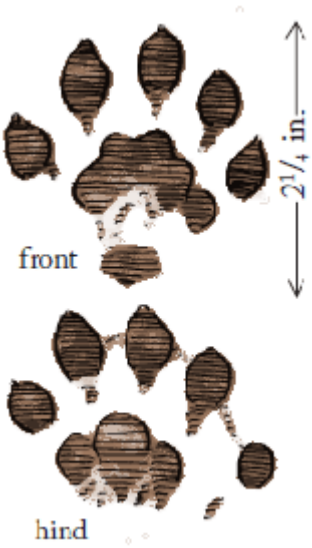
Ecology

Although the accepted, common name is the river otter, it might be suitable to rename it the swamp or inland wetland otter, due to its strong association with aquatic, emergent vegetation, and their affinity to freshwater wetlands. Beaver ponds are often home to both otter and beaver, and there have been reports of both species inhabiting the same lodges with little in the way of reported, negative encounters.

A diversity of structure along occupied water bodies appears to be of considerable importance, not just for foraging opportunities, but in regards to suitable den sites as well. Steep banks, with ample structure above and below the water allow for habitation of winter retreats, and ensure that unrestricted access to both terrestrial and submerged habitat are available.

Quick Facts About Otters

- Otters groom their fur with a "towel" made of moss or grass.
- The otter is a swift and agile swimmer, using its muscular tail to make sharp turns and steering with its neck and webbed feet.
- Size: 3-4' long including the tail which is about one third of the total length. 10-30 lbs.
- Appearance: Dark shiny brown fur.
- Tracks: 3' wide and round in shape. In the winter, look for 6" wide troughs formed when otters slide through the snow into the water.
- Scat: Otters choose a prominent location such as a rock or peninsula of land for their "toilet" and use it over and over. Look for large collections of scat in such areas.



New England Cottontail

Species Type: Mammal
Scientific Name: Sylvilagus transitionalis
Conservation Status: Special Concern

New York Status: **Special Concern**
Federal Status: Not Listed

Description

The New England cottontail (NEC) is a small mammal in the Leporidae family. Adults are 15-17 inches long and weigh about 2 pounds. NEC are very similar in appearance to the Eastern cottontail. However, NEC have shorter ears, a black spot between the ears, and a black line on the front edge of the ears, while Eastern cottontails have a white spot on the forehead. It can be very difficult to identify the two species just by their physical appearance alone, and researchers often analyze the DNA of fecal pellets for live rabbits or look at the skulls of museum specimens.

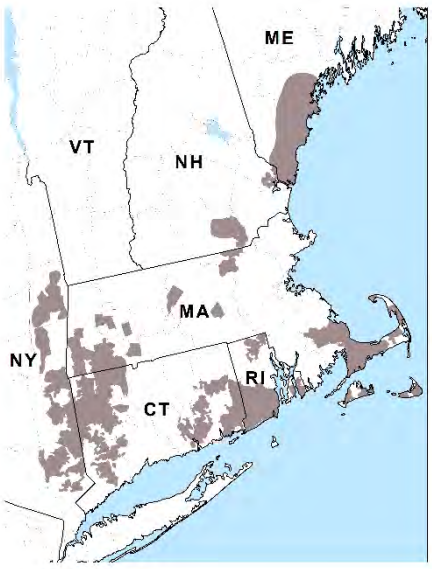
Life History

New England cottontails hide in dense cover during the day. They can be active at night, but are most active at dawn and dusk when they feed. Home ranges can be from half an acre to as many as eight acres. Males tend to have larger home ranges than females.

Mating begins in the spring and can run through September, so a female can produce several litters in a season. Gestation (pregnancy) is about four weeks and they tend to have four or five young (kits). The average lifespan of a NEC is about 15 months.

In summer, cottontails eat grasses and the shoots, stems, leaves, flowers, and seeds of many herbaceous plants. In autumn, rabbits switch to eating bark, twigs, and buds of woody plants, such as blackberry, raspberry, blueberry, and willow.

Distribution and Habitat



The New England cottontail is native to New England and eastern New York, whereas the well-known Eastern cottontail was introduced to the area in the early twentieth century to increase hunting opportunities. The state's New England cottontail populations are only found east of the Hudson River in Columbia, Dutchess, Putnam, and Westchester counties.

The NEC, which used to be known as the brush rabbit or woods rabbit, is a mid- to late-successional species, preferring shrubby areas, thickets, and wetlands with some canopy cover (tree cover). Areas with older shrubland with good understory are often favorable. However, ideal habitat should contain native shrubs as too many invasive shrubs, such as Japanese barberry, can have a negative impact. Areas with lots of barberry often contain a higher number of ticks, which can cause health problems due to excessive blood loss.

Status

Habitat loss and competition with Eastern cottontails have caused dramatic declines in populations across NEC's range. The New England cottontail is listed as a species of greatest conservation need, threatened, or endangered within every state in its current range.

New England cottontails were once common throughout New England and eastern New York, but due to natural forest succession (a change from fields/shrubs to forests over time) and loss of habitat to development, they now occupy less than 15% of their historic range.

Challenges to New England cottontails include:

- fragmented habitat-they need connected habitat patches, and roads can be significant barriers
- competition with non-native Eastern cottontails
- predation
- high tick load
- low genetic diversity due to population fragmentation and isolation

Management and Research Needs

Along with five other northeastern states, New York is part of an initiative to help the New England cottontail through research and habitat management. Researchers are attempting to create their preferred habitat in geographic focus areas where populations have been reduced, but are not yet eliminated. To conserve NEC effectively, more information on their population sizes and the distribution of suitable habitat in New York is needed. We also need to combat the loss of genetic diversity, evaluate the impacts of hunting on NEC populations, and try to keep Rabbit Hemorrhagic Disease out of the state.

Monitoring Populations and Captive Breeding Efforts

DEC staff have monitored NEC since 2005 by analyzing the DNA of rabbit fecal pellets. Staff analyzed hundreds of samples from about 50 sites, which provided accurate information on the distribution of NEC in New York. Population density and number of rabbits are estimated from this data, but are not measured directly at most locations.

DEC staff have captured a few NEC and provided these to the region-wide captive breeding effort, with their offspring being released at suitable locations in New England, but captive bred rabbits have not been released in New York.

How You Can Help

Consider these best management practices for NEC habitat management:

- If you have anything you consider a thicket, bramble or briar patch, consider leaving it for wildlife. If you can't walk through it, it's probably good for NEC!
- If you own forest land and you are removing trees, try to avoid clear-cutting. Leaving some larger trees as canopy closure may give NEC an advantage over Eastern cottontails.
- Minimize disturbance if possible by hand-cutting trees instead of using heavy machinery; protect seedlings and native shrubs during cutting.
- Provide additional cover such as brush piles or leaving cut trees on the ground.

NEW YORK STATE | Department of Environmental Conservation

Short-eared Owl

Scientific Name: ***Asio flammeus***

New York Status: **Endangered**
Federal Status: Not Listed

Description

Short-eared owls are medium size owls with small ear tufts on the top of the head. They have round, beige facial disks similar to those of barn owls. The underparts are white/buff (male) or tawny/rust (female), and streaked with brown, while the back is brown and mottled with white. When perched, the wings extend beyond the tail and in flight, the undersides of the wings show dark markings on the wrists and wing tips. The short-eared owl's flight is frequently described as "moth or bat-like" because it flies low over grasslands or marshes, moving back and forth with unhurried, irregular wing beats.

Short-eared owls are the most diurnal (active during the day) of all the northeastern owls. They are most often observed in the late afternoon and at dawn or dusk. These birds eat primarily small mammals, but they occasionally take small birds and the young sometimes eat insects. When hunting, they dive from perches or fly low over the ground and pounce on prey from above, sometimes hovering briefly before they drop.

Drawing by Jean Gawalt

Life History

Short-eared owls are birds of open country including grasslands and marshlands. They often opportunistically inhabit areas where small mammals, especially meadow voles (*Microtus pennsylvanicus*), are abundant. Their breeding sites, the number of wintering birds, the number of nesting pairs, and the number of eggs or young may change from year to year based on the food supply. Breeding occurs in March through June when both sexes begin defending territories and courting with elaborate flight displays that include wing-clapping, exaggerated wing-beats and skirmishing.

Nests are placed on the ground where the female creates a cup and lines it with grasses and down. Four to nine eggs are typical, but clutches as large as fourteen have been reported in years of peak small mammal abundance. Incubation, which is done by the female alone, lasts about a month. The eggs hatch asynchronously and fledging occurs about a month later.

In winter short-eared owls gather in open habitats that support large numbers of voles such as both fallow and cultivated grasslands, marshlands, and landfills. When food is abundant they may form large communal roosts of up to 200 birds in sheltered sites ranging from conifers to grassy tussocks and abandoned quarries.

Deep snow and ice may reduce the availability of prey locally and cause the owls to abandon wintering areas occupied earlier in the season. However, where food remains plentiful into the spring and summer, wintering areas may become breeding sites.

Distribution and Habitat

Short-eared owls are widely distributed breeding in marshes, grasslands, and tundras throughout North America and Eurasia, and on every continent except Australia and Antarctica. They are also found on islands such as Iceland, the Hawaiian Islands, the Greater Antilles, and the Galapagos. Within their extensive global range they occur in open areas where small mammals are abundant, favoring habitats such as prairies, coastal grasslands, heathlands, shrub-steppe, and tundra.

Although there are scattered breeding records in the east as far south as Virginia, New York is at the southern edge of this owl's breeding range. Northern populations are believed to be highly migratory, and there is a marked increase in the number of birds in New York in the fall and spring. Short-eared owls are more common as winter residents in New York State. As breeders they are very rare, being largely limited to the St. Lawrence and Lake Champlain Valleys, the Great Lakes plains and the marshes of Long Island's south shore.

*Short-eared owl range map from **Birds of the World**, maintained by the Cornell Lab of Ornithology.*

Status

Early in the twentieth century Eaton called the short-eared owl "one of our commonest owls" outnumbering all other owls in lowlands and marshy areas. By 1974 it was already considered a local breeder, declining in numbers. A comparison of historical and modern breeding records suggest that this species may have been lost as a breeder in many areas including eastern Suffolk County and the upper Hudson Valley. However, knowledge of their status and distribution may be incomplete because they occur in some parts of the state that are sparsely populated, breed early in the season, and hunt late in the day.

During the second New York State Breeding Bird Atlas, this species was found at a total of 24 survey blocks resulting in a 33% total decline from the first atlas. The most substantial losses occurred on Long Island with the species detected in only one survey block during the second atlas, as compared to nine blocks during the first.

Short-eared owls winter, sometimes in significant numbers, at concentration areas located throughout the state including the Finger Lakes region, the Lake Ontario lake plains, especially in Jefferson County, several sites in the Hudson Valley, and on the shores of Long Island. Historically, many winter concentration areas were also documented as breeding areas.

In the Northeast region, six of the thirteen states list short-eared owls as endangered while one other includes them on their state list at a lower level of conservation concern. Most biologists believe reforestation along with the loss of large, intact grasslands and other open habitats are largely responsible for this species decline.

Management and Research Needs

The conservation of short-eared owls in New York depends on protecting relatively large, open sites that support small rodents. Except for a few large marshes, most of the nest sites recorded in recent years have been found on farms, typically in active hayfields or pastures where the nests and young birds are sometimes mowed or plowed. Once abandoned, agricultural sites rapidly become unsuitable for owls because they succeed to woodlands or are replaced by development. In order to protect short-eared owls it will be necessary to identify suitable nesting sites that can be managed for small rodents and owls. Such management will likely have the added benefit of protecting other imperiled grassland birds with similar habitat requirements.

Recent efforts have been made to more closely monitor and identify wintering raptor concentration areas throughout New York State, with the short-eared owl included as a primary target species.

NEW YORK STATE | Department of Environmental Conservation

Golden-winged Warbler

Scientific name: ***Vermivora chrysoptera***

New York Status: **Special Concern**
Federal Status: Not Listed

©Jeff Nadler Photography

Description

This neotropical migrant is a small songbird (4.25 to 5.25 inches) of eastern shrub lands. The golden-winged song is a high and buzzy "zee zee zee zee." Adult males are gray above and white below with bright yellow fore crown and wing coverts (set of feathers that cover feathers beneath it). It has a black eye mask and throat patch suggestive of the black-capped chickadee (*Poecile atricapilla*). Females appear similar to males with smaller yellow wing patch and no black eye mask or throat patch. Likewise, juveniles are similar to adults.

Life History

Males arrive on breeding territory 2 to 7 days before females. Pairs form as soon as females arrive and nest building begins almost immediately after bond formation. Nest construction and incubation is done entirely by female. The nest is often an open cup of grasses with leaves forming the base and is typically located on the ground in a shrubby or forested edge. Females will desert nests during the construction phase if disturbed, but will tolerate a high level of disturbance while incubating. Nesting occurs between mid-May and late June with incubation beginning when the second to last egg is laid. Clutch size is 3 to 6 eggs. Re-nesting is known to occur after the loss of a clutch. After 10 to 11 days, the completely altricial (helpless) young will hatch. Both parents share in feeding the young which remain in the nest for 8 to 9 days. Diet consists mainly of insects and spiders gleaned from the peripheral branches of tree tops.

Distribution and Habitat

The golden-winged warbler breeds throughout the north central and northeastern United States into Ontario, Canada. Although its range is expanding westward, it is disappearing from much of its former range in the northeastern states. This pattern coincides with the loss of early successional habitat in the northeast, as well as, the expansion of the blue-winged warbler (*Vermivora pinus*) into the golden-winged warbler's range. The golden-winged warbler is a habitat specialist and prefers to nest in early successional fields with a combination of shrubby and open areas within the territory, with scattered overstory trees. In New York, this type of habitat is found in abandoned farmlands in the early stages of succession and in scrub/shrub wetlands.

Status

This species is becoming increasingly localized and uncommon throughout the state. Breeding Bird Atlas results for 2000 to 2005 showed a significant population decline across the state with the only remaining stronghold in the St. Lawrence Valley of northwestern New York.

Threats to golden-winged warbler populations in New York State include:

- habitat loss
- competition
- hybridization with blue-winged warblers (*Vermivora pinus*)

NEW YORK STATE | Department of Environmental Conservation

Ruffed Grouse

Scientific name: *Bonasa umbellus*

New York Status: Not Listed

Federal Status: Not Listed

Photo by John Major

Description

Round, plump birds a little larger than pigeons, ruffed grouse are a favorite of birders and hunters alike. Also known as "partridge", they are year-round residents of New York State. Though these birds go unseen by many, the familiar drumming performed by males, especially in spring, keys people into their presence.

Ruffed grouse come in two basic color phases. Gray phase birds tend to occur in colder northern areas, while brown phase birds occur in warmer southern areas. Some birds, however, exhibit a combination of both colors. Grouse feathers are mottled with white and black which helps them blend into the forest floor and hide from predators. Grouse have broad, flat, fan-shaped tails with a dark band near the tip. Similar in appearance, male grouse are slightly larger than females (hens) possessing long, shiny, black neck feathers. Males will puff up these feathers and fan out their tails to attract females or warn off other males.

Young grouse chicks eat insects and small invertebrates, gradually switching over to adult diets. Adult grouse eat a wide variety of fruits, seeds, leaves, buds, and insects. During winter when snow covers the ground, grouse rely on eating the buds and catkins (slender flower cluster) of trees and shrubs such as aspen, cherry, birch, ironwood, and apple.

Painting by Jean Gawalt

Quick fact about ruffed grouse:

- They spend most of their time on the ground.
- They seldom fly more than a couple hundred yards, but can hover and make complete turns in the air when flying through thick brush.
- Grouse do not migrate and spend their entire lives within a few acres.
- In fall, they grow fleshy bristles (called pectinations) along the sides of their toes which act like snowshoes to help them travel over snow. Pectinations are shed in spring.
- Males make drumming sounds with their wings to attract females and warn off males.

Life History

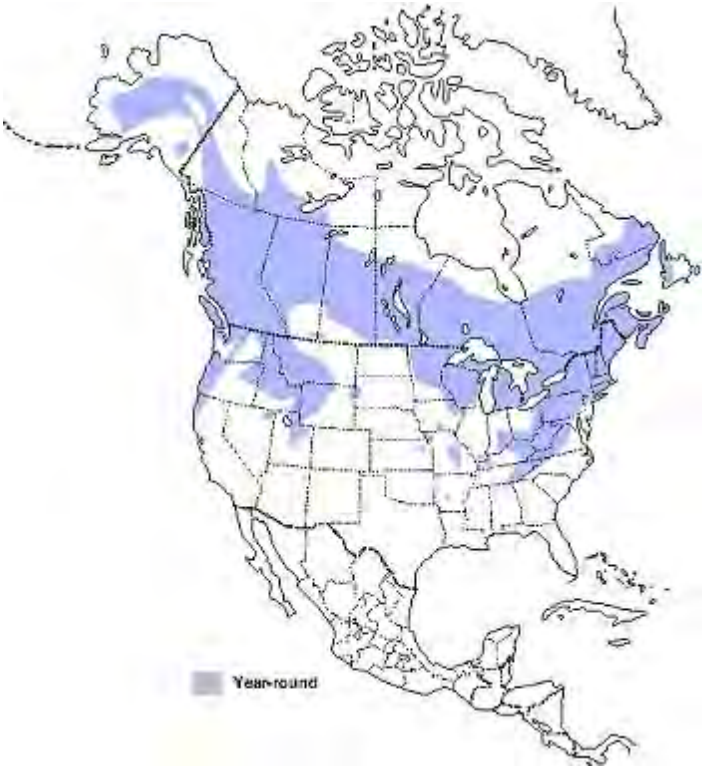
Each spring, male grouse ruffle their neck feathers, fan their tails and drum in an attempt to lure hens to their territory. Male grouse are aggressively territorial throughout their adult lives, defending a 5-20 acre patch of forest. Males claim their territory by standing on a log, rock, or mound and beating their wings against the air.

Called drumming, it sounds like a distant lawn mower engine slowly starting up and then increasing to a rapid beat. Drumming is most frequently heard during the spring mating season, but it can occur throughout the year. Generally solitary birds, ruffed grouse do not develop pair bonds, and one male may breed with several hens.

Following mating, hens construct nests and lay 8 to 14 cream-colored eggs. If the nest is destroyed, hens will often attempt to re-nest. Nests are shallow depressions in the leaf litter, often at the base of a tree, stump or bush, and normally located in second growth hardwoods. Eggs are incubated by the hens and hatch in 24-26 days. Chicks are precocial (highly independent from birth), and leave the nest soon after they hatch to follow the hen and start feeding. Hens stay with their broods until they are grown. During autumn, juvenile birds can disperse from natal habitats up to two miles or more.

Distribution and Habitat

Ruffed grouse spend most of their time on the ground and will often run and hide to avoid detection. When closely threatened, they explode from their hiding place in a powerful burst of flight. Many individuals have been startled by this loud unexpected flurry of wings. Though good fliers, grouse seldom fly more than a couple hundred yards before either landing in a tree or on the ground to run into a thicket to hide. Interestingly, sometimes when they land in a tree, they will back up, stretch out their necks, and flatten out against the tree trunk, appearing to camouflage themselves from predators.



*Ruffed grouse range map from **Birds of the World**, maintained by the Cornell Lab of Ornithology.*

During winter, grouse will burrow or dive into soft, powdery snow when available. This not only helps keep them warm, but also hides them from predators. In times of extreme cold, temperatures beneath the snow can be as much as 25 degrees warmer than the air.

A forest species, ruffed grouse prefer young forest habitats and are generally found in areas with active or recent forest cuts, recently abandoned agricultural areas that have reverted to early successional forest, or in areas affected by fire. Grouse can often be seen along the sides of gravel roads near these young forest thickets where they pick up grit (small stones) to aid in digestion.

Status

Despite declines in their numbers, ruffed grouse are still common, particularly in younger forests. Grouse attract thousands of hunters with their shotguns and bird dogs, anticipating the exciting flush of a grouse bursting from cover. Grouse are challenging quarry, rapidly flying and dodging through trees and thick cover.

In New York State, the reluctance to cut forests, and suppression of fires has greatly reduced the amount of early successional forest habitat available to ruffed grouse, as well as a host of other bird and wildlife species. In fact, 67% of the bird species that rely on this habitat are in serious long-term decline. While ruffed grouse are still a common bird in most forested areas of the state, their populations have declined more than 80% since the 1960s.

Short-lived, most ruffed grouse rarely live a full year, though a few will make it to three years. Mortality from the time the chicks hatch (early June) until they are fully grown (around mid-August) is often more than 50 percent. Most grouse succumb to predation, providing meals for a number of predators, including hawks, owls, fox, and coyotes. Some grouse die of disease or exposure to severe weather. Good habitat that provides adequate cover and food resources greatly increases the survival of ruffed grouse.

Peregrine Falcon

Species Type: Bird
Scientific Name: Falco peregrinus
Conservation Status: Endangered

Scientific Name: ***Falco peregrinus***

New York Status: **Endangered**
Federal Status: Not Listed

Description

This crow-sized falcon is admired for its incredible speeds which are seldom exceeded by any other bird. Plunging from tremendous heights, the peregrine falcon can reach up to 180 mph in pursuit of prey. It feeds primarily on birds, which it takes on the wing.

Adult peregrines are slate-grey above and pale below, with fine dark bars and spots on their underparts. Both adults and immatures have a wide, dark "moustache" mark below the eye. The tail is narrow and the wings long and pointed. Juveniles are brown overall, with dark streaking below. Airborne, this falcon can be recognized by characteristic rapid wingbeats mixed with long glides.

Life History

Peregrine falcons generally return to the same nesting territory annually and mate for life. The courtship flight is a spectacular sight. The pair climbs high in the air and performs a precise acrobatic act of whirling spirals and steep rapid dives, often touching in midair. The average clutch consists of three to four eggs which hatch after an incubation period of 29-32 days. The single brood fledges after 35-42 days. Both parents participate in incubation and brooding activities, but the female remains at the nest for the majority of the time while the male hunts and brings food to her and the young.

Young falcons may stay in the area for about six weeks after they fledge, developing their flying and hunting skills. Sexual maturity is generally reached at two years of age, but one-year-olds have been known to produce young. Individuals may live as long as 20 years.

Distribution and Habitat

The worldwide range of peregrine falcons is more extensive than any other bird. In addition to North America, they are found in southern South America, Eurasia, Africa and Australia. Natives of this continent formerly bred from Alaska and Greenland south to Georgia and Baja California. That range has been greatly reduced. Wintering occurs as far north as British Columbia and Massachusetts, as far south as Central America and the West Indies.

Within its range, this falcon prefers open country from tundra, savannah and seacoasts, to high mountains, as well as open forests and tall buildings. Nests are built on high ledges, 50 to 200 feet off the ground. The nest itself is a well-rounded scrape and is occasionally lined with grass.

Status

Like many other birds of prey, peregrine falcons have suffered from the use of pesticides. Exposure to DDT and other chemical contaminants has caused population declines since the 1940s. These pesticides cause eggshell thinning which drastically lowers breeding success.

At one time, there were approximately 350 breeding pairs in the eastern U. S., including 40-50 historic eyries (nest sites) in New York. By 1965, all were gone and populations in other parts of the country showed similar declines. Release programs initiated by the Peregrine Fund in the mid-1970s have resulted in peregrine falcons breeding in New York once again. In 1998, 38 pairs were present in New York, 36 bred, 31 were successful and 69 young fledged. New urban nests have been reported upstate for the first time in Albany. Gradual increases in the breeding population have been recorded throughout the east.

Management and Research Needs

Laws banning the use of DDT were passed by New York State in 1971 and by the federal government in 1972. Although DDT contamination has been reduced in this country, it continues to affect the peregrine and its prey outside our borders. Peregrine carcasses and unhatched eggs continue to be analyzed for DDT and other contaminants.

Hacking has proven to be a successful means of reestablishing a breeding population in the wild. Young raptors are placed at an artificial nest site and cared for until they are able to fly and hunt on their own. Through hacking, over 2,000 peregrines have been released in the U. S. and Canada. The number of breeding pairs in New York has grown steadily since 1983, when the first peregrines in decades returned to nest on bridges in New York City. This success has eliminated the need for hacking in most eastern states, including New York. Management has now shifted to locating, monitoring and protecting breeding pairs.

Watchable Wildlife

What to Listen for

Wailing call: a long-drawn-out scream Cacking call: cack-cack-cack

Peregrine's nesting boxes exist on most Hudson River bridges from Albany to New York City.

Peregrine Falcons also nest on Adirondack cliffs.

NEW YORK STATE | Department of Environmental Conservation

Timber Rattlesnake

Scientific Name: ***Crotalus horridus***

New York Status: Threatened
Federal Status: Not Listed

Description

A dark-phase timber rattlesnake.The color of the head determines whether it is dark or light phase. Photo by William Hoffman.

Measuring from 3 to 4 feet or more in length, the timber rattlesnake is the largest venomous snake in New York. The record length in New York is 60 inches. Despite their size, cryptic patterns and coloration allow them to easily conceal themselves by blending in with their surroundings.

The coloration of the species is incredibly variable but can be broken down into two distinct color phases, light and dark. This designation is determined by the color of the head.

This species has coloration that varies considerably between individuals and populations. Dark crossbands or chevrons overlay the base color and can range from yellows and shades of brown to black. Timber rattlesnakes also have a dorsal strip, which is often chestnut but can vary between tan, light orange, and yellow. In dark individuals, this is often broken up by the chevrons. Snakes will have the same pattern and coloration for the duration of their lives. The pattern generally fades into black towards the tail, which results in the antiquated name "old velvet tail".

A member of the pit-viper family, the timber rattlesnake has paired temperature-sensitive openings, or loreal pits situated below and in between the eye and nostril. The purpose of this sensory organ is to detect prey and potential predators. Timber rattlesnake have a broad, triangular head with many small scales on the crown, bordered by a few large scales over the eyes, the loreal pit and rostrum (nose). Scales have a center ridge or keel, giving this rattlesnake a somewhat rough-skinned appearance.

The key feature distinctive to rattlesnakes-providing their namesake-is the rattle, which is made of loosely attached segments made of keratin. A new segment is added to the base of the rattle each time the snake sheds. When vibrated, the segments make rapid contact with each other, resulting in the buzzing sound characteristic of a disturbed rattlesnake.

Life History

Timber rattlesnake have an active season that runs from late April until mid-October. In Northern New York, emergence is often delayed until mid-May. Upon emerging from the den, they are rather lethargic and spend most of their time under cover or basking under partly cloudy to sunny skies.

The species is considered migratory, meaning they originate from a central location and move out across the landscape. Gravid (pregnant) females migrate to gestating habitat- open, rocky ledges where temperatures are higher for embryo development. Overall, they generally migrate from 1.3 to 2.5 miles from their den each summer. Males move the greatest distances through their active season-up to 5 miles.

Mating season begins in the early summer and continues into early autumn. Males are especially active during this time and can be found using basking and gestating habitat and looking for receptive females. After mating, females store sperm through the winter until implantation of the embryos occurs during the following spring as temperatures increase.

A light-phase timber rattlesnake. Photo by William Hoffman.

Timber rattlesnakes are viviparous, meaning they give birth to live young. Following a gestation period of 4-5 months, females give birth to 4-14 (average 9) young every three to five years between late August to mid-September. Neonates (newborn) timber rattlesnakes are about 10-14 inches long at birth. Each neonate is born encased in a transparent membrane, or yolk sac, which is shed within a few minutes.

The young are miniature versions of adults, complete with hollow fangs, venom and a tiny rattle segment called a "pre-button". Shortly after birth, they shed their skin and drop their pre-button to reveal the button, or tip of a rattlesnake's rattle. They remain in the area with their mother for 1-2 weeks until they shed and disperse. In the fall the young follow their parent's scent trail back to the den for the winter.

Timber rattlesnakes are long-lived and reproduce at a low rate, making for slow populat n gr wth. Males may become sexually mature in as few as 5 years, whereas females take longer to reach sexual maturity, between 5 and 11 years. Juvenile mortality is very high, but once they reach maturity, the average life span may be between 15 and 20 years, with individuals being documented to have lived for more than 50 years in the wild.

Timber rattlesnakes shed their skin once and sometimes twice a year depending on the age of the animal and latitude of the population. A new segment is added to the base of the rattle each time shedding occurs. Snakes with a complete rattle are rarely seen-segments regularly break off during the year.

Rattlesnakes primarily fed on:

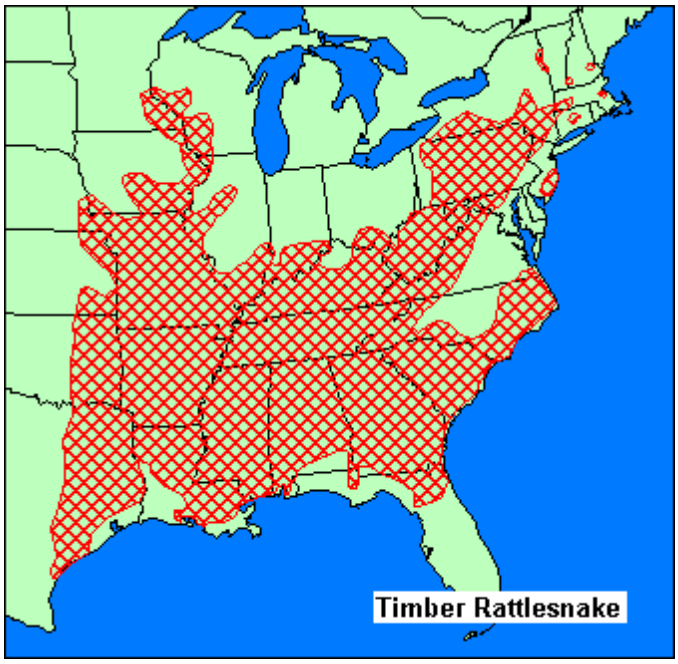
- squirrels
- chipmunks
- voles
- mice
- small birds
- amphibians

The venom, which is used primarily to immobilize prey, can be fatal to humans if the bite is untreated. However, in New York there have been no records of human deaths attributed to rattlesnakes in the wild during the last several decades. Less than 15% of the snake bites reported over a ten-year period were actually from a venomous snake. **Contrary to popular opinion, a rattlesnake will not pursue or attack a person unless threatened or provoked**. Such instances are likely a result of the observer being between the snake and it's point of cover. See if you encounter a timber rattlesnake below.

Distribution and Habitat

The range of the timber rattlesnake extends from southern New Hampshire south through the Appalachian Mountains to northern Florida and west to southeastern Texas and southeastern Nebraska and Wisconsin. Populations are isolated in the Northeast. Historically, the species likely occurred in most mountainous and hilly areas of NYS, except in the higher elevations of the Adirondacks, Catskills, and Tug Hill region. They are now found in smaller numbers throughout the state with isolated populations in southeastern New York, the Southern Tier, and in the edges of the eastern Catskills and Adirondacks.

Timber rattlesnakes are generally found in deciduous hardwood forests in rugged terrain. They can also be found in lowlands, wetlands, or residential areas near dens. Crevices in rocky faces or talus with westerly to easterly southern exposures are used for denning or overwintering. Open areas with rocky surfaces are used for basking, shedding, and birthing. The surrounding forests provide foraging habitat.



Status

While abundant in some areas, the timber rattlesnake population has severely declined in numbers and distribution (about 50-75%) in New York State due to unregulated collection, indiscriminate killing, and habitat destruction. Until outlawed in 1971, there was a bounty in certain counties in Northern New York for the rattles of these snakes. Even in areas without bounties, the rattlesnake was severely persecuted by local residents. In 1983, timber rattlesnakes were designated as a threatened species.

Despite these conservation efforts, their slow population growth is further hindered by:

- development
- road mortality
- illegal collecting
- continual disturbance of habitat by recreational users

Collecting timber rattlesnakes from the wild is now prohibited by law under Environmental Conservation Law 11-0535 and 11-0103(2)(c). However, poachers are still actively supplying the black market pet trade.

Management and Research Needs

The DEC coordinates survey efforts for many of the remaining populations in New York State. These are designed to:

- verify the current status of known den sites;
- develop baseline estimates of population size;
- determine reproductive success; and
- document any threats to existing habitat.

New denning locations are currently being discovered in areas where the density of overwintering sites is high. Protection and management of habitat is now a primary concern.

Additional survey work is necessary to verify status in many populations. Long-term comparative measurements of rattlesnake populations has only been conducted in a single population in NYS. The recent discovery of Snake Fungal Disease (leaves DEC website) has been noted in several populations of rattlesnake in New York. Further research is necessary to determine the full extent of the impacts of such infections. The impact may be determined by comparing populations of infected versus non-infected snakes.

If you encounter a timber rattlesnake:

Do not panic! Keep a safe distance of 6ft or more away. Let them move along on their own. Do not kill or collect the individual. Timber rattlesnakes are not aggressive unless provoked.

Eastern (Red-Spotted) Newt

Species Type: Amphibian
Scientific Name: Notophthalmus v. viridescens

Did You Know?

- The Eastern (red-spotted) newt is a widespread, native salamander of New York State and eastern North America that can live for 12-15 years!
- Larvae live in water and use gills to breathe. However, juveniles (also known as "efts"), become land dwellers and develop lungs to breathe air. The adults also breathe air, but become aquatic once again.
- The Eastern (red-spotted) newt secretes poisonous toxins, and the eft's bright coloration serves as a warning to predators.
- Eastern newts use specialized chemicals to find food and attract mates.
- Newts help reduce mosquito populations by feeding on their larvae.

What to Watch for:

Size:
***Larvae*:** ¼ inch - 1 inch
***Eft*:** 1-3 inches
***Adult*:** 3-5 inches

Appearance:
Larvae: Olive-colored skin and feathery gills.
Eft (juvenile): Bright orange-red coloration with small black dots scattered on the back and a row of larger, black-bordered orange spots on each side of the back. The larger spots resemble an eye, which is the meaning of their scientific name "*Notophthalmus*". The skin is rough and dry compared to the moist and smooth skin of adults and larvae.
Adult (newt): Overall greenish coloration with small black dots scattered on the back and a row of several black-bordered reddish-orange spots on each side of the back. Males have black, rough patches on the inside of their thighs and on the bottom tip of their hind toes during the breeding season.

Other Signs to Look for:
Egg clusters of 200-400 attached to submerged aquatic vegetation or fallen leaves in the water.

Where to Watch:

Eft: moist forest floors and among leaf litter.
Adult: small bodies of fresh water such as ponds, lakes, marshes, and relatively slow-moving waters with a muddy substrate. They are commonly found in beaver ponds and man-made water bodies.

When to Watch:

Eft: late summer to autumn, usually at night, but also during the day if the ground is moist.
Adult: from spring through fall and sometimes in the winter, feeding under ice.

Snapping Turtle

Species Type: Reptile
Scientific Name: Chelydra serpentina

Did You Know?

- The snapping turtle is an omnivore (eats both plants and animals) and eats carrion (dead organisms) as well.
- It often buries itself in the mud with only its nostrils and eyes showing, waiting for unsuspecting prey.
- They seem aggressive, but often avoid confrontation and their behavior is actually defensive.
    - They will snap at anything they find threatening. Their snap is so powerful that it can easily shear fingers-so stay a safe distance away!
    - Snappers spend most of their lives in the water, where they will generally swim away from people when encountered.
- Snapping turtles live 30-40 years on average.
- It is one of the largest turtles in North America.
- The snapping turtle is New York's official state reptile.

What to Watch for:

Size:
8-20" shell length, average of 8-35 lbs.

Appearance:

- Upper shell is tan, brown, black or olive gray with three ridges, called keels.
- Tail is long with jagged saw-toothed ridges.

Where to Watch:

Lakes, ponds, rivers, streams, and marshes throughout New York, particularly in slow moving, shallow waters with a muddy bottom. One of the most adaptable reptiles in New York, they are even found in urban waterways. Females move to upland nesting locations predominantly in the early morning or early evening. The preferred nesting locations are within 100 feet of the water and typically occur in sandy or loamy soils, making backyard gardens a frequent nesting location. Where water temperatures are cooler, animals may sometimes be found perched atop rocks that provide easy access back into the water.

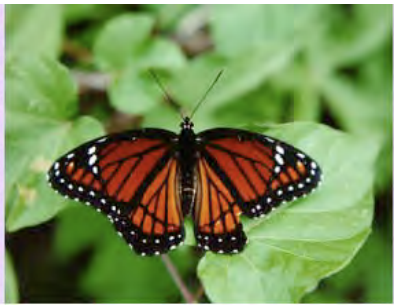
When to Watch:

Snapping turtle are most obvious when they are on land, basking or nesting. June is the best time of year to spot a snapping turtle. Snapping turtles overwinter under the muddy bottom of their watery home, so they are generally not seen from November to late March.

Animal Adaptation:
Camouflage & Mimicry

Johanna Katz – Naturalist Outreach Practicum, Fall 2010





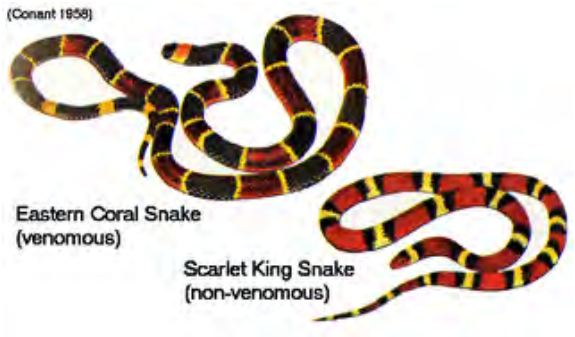
What is camouflage?

Camouflage or crypsis refers to an animal's ability to blend in with its surroundings. Its shape, color and patterns on its coat or exterior may help an animal to look similar to its environment. Some animals are camouflaged to look like tree bark or dead leaves, while others have patterning to look like rocks, sand and even bird droppings.

What is mimicry?

Mimicry describes the appearance of animal to look similar to another animal. There are two main types of mimicry: Batesian and Mullerian.

Batesian mimicry refers to two (or more) animals that appear similar, but just one of them is dangerous to predators. The dangerous animal, called a model, may have chemical toxins in its body, venomous secretions or other defenses making them undesirable prey for predator attacks. Animals that copy a model's appearance are called mimics. Mimics lack the defenses of the model, but because of their outward similarities, predators also avoid them.



Mullerian mimicry describes two (or more) animals that are similar in appearance, yet unlike in Batesian mimicry, all of the species in the relationship have predator defenses. Predators may avoid any of these similar looking animals after experiencing the bad affects of attacking with one of them.

Why are camouflage and mimicry important for animals?

Camouflage and mimicry are animal adaptations – ways that animals evolutionarily are better suited for their environments.

Camouflage aids an animal to blend in with its environment. Cryptic coloration can save an animal by avoiding detection by predators; protecting it from being attacked. It can also help an animal to not be seen by prey, so it can more easily obtain food.

Mimicry also influences an animal's predator-prey relationships. Batesian mimics are able to protect themselves by fooling predators into thinking they are dangerous. Mullerian mimics benefit by appearing like other animals with defenses, because predators are more likely to have experienced the bad effects of attacking one of these similar looking dangerous creatures, and will be more likely to avoid preying on them.

How else can animal appearance improve survival?

Some animals have patterns on their bodies that are meant to startle or scare a predator away. These markings can help to make the animal seem much larger, or can be confusing to a predator – decreasing success rate and timing of attack, and helping prey survival. This is often called automimicry or self-mimicry. Eye spots are one great example. Moths, butterflies and fish that exhibit automicry have patterns on their body that appear like large eyes. To a hungry predator, the eye spots may make a moth seem like a bigger animal, such as an owl and this will deter predators from attacking. Such patterns can also startle the predator, and give the prey enough time to escape.

Other animals have distinctive patterns that also improve their chances of survival. Most people wouldn't think that a zebra's coat would help it to camouflage. However, zebras travel in herds and when moving with the herd, their striped hides make it very difficult to distinguish one animal from another. This makes it much harder for a predator to attack a single zebra.

There are also animals that warn predators that they are very dangerous. This is called aposematism or warning coloration. Many toxic tree frogs have very bright colors on their skin – usually combinations of red, yellow and black. This coloring acts as a warning of their threat to predators, whether the prey stings, releases venom or is unpalatable. Predators are scared off by the warning colors, improving the aposematic animal's chances of survival.



Did you know that plants also adapt to use deceptive methods?

Some species of orchids have coloring that mimics the appearance of insects. A primary concern of flowers is to attract pollinators so that they can reproduce. Some kinds of orchids are adapted to look like female bees so that they attract male bees. The male bee comes to the flower (thinking that it is another bee) and tries to mate, in the process it pollinating the flower. Many of these flowers even release special chemicals called pheromones, which help them to smell like the female bee too. This way of deceiving insects helps the flower to breed, and thus improves its survival.

NCF-Envirothon 2024 New York

Wildlife Study Resources

Key Topic #2: Wildlife Ecology and Management

4. Identify the essential components of a habitat.

5. Evaluate different habitats for suitability for a variety of wildlife species.

6. Identify natural and human-caused factors that can alter habitats and how these can both positively and negatively influence the resources available to wildlife.

7. Describe different management practices for creating, maintaining, and improving a variety of wildlife habitats.

8. Describe various wildlife diseases, how they are monitored, and how they are affecting wildlife populations.

Study Resources

Resource Title	Source	Located on
Deer Overabundance	*New York State Department of Environmental Conservation, 2023*	Pages 38-40
Young Forest Initiative	*New York State Department of Environmental Conservation, 2015*	Pages 41
Creating and Maintaining Quality Forest Habitat	*Audubon-New York, 2019*	Pages 42-47
Managing Land for Wild Turkey Habitat	*New York State Department of Environmental Conservation, 2023*	Pages 48-51
Hayfield Management and Grassland Bird Conservation	*Cornell Cooperative Extension, 2006*	Pages 52-56
Wetland Habitat Management	*Vermont Fish & Wildlife Department, 2014*	Pages 57-62
NABS Factsheet-Getting Started with Bluebirds	*North American Bluebird Society, 2017*	Pages 63-64
Animal Diseases: Chronic Wasting Disease, White-Nose Syndrome, Rodenticide Toxicity, Lead Toxicosis and Chytriomycosis	*NYS Wildlife Health Program, NYS Dept. of Environmental Conservation and Cornell Wildlife Health Lab, 2018-2022*	Pages 65-74
Effects of Lead Exposure on Wildlife	*The Wildlife Society, 2017*	Pages 75-76

Study Resources begin on the next page! ➡

Deer Overabundance

Deer play vital roles in the natural and cultural environment of New York and are highly valued for their beauty and grace as well as the utilitarian benefits they provide. However, the abundance of deer in many parts of the state is causing increasing problems, particularly in suburban and urban areas.

Why There Are So Many Deer

Public Attitudes

After rampant deforestation and uncontrolled hunting wiped out over 95% of the country's deer in the 19th century, management in the first half of the 20th century was aimed at increasing deer numbers. New York was highly successful in this effort, as were other states in the Northeast. By mid-century wildlife managers across the country were recognizing that deer populations in many areas, including parts of New York, were outstripping their natural food supply. However, public awareness of the issues surrounding high-density populations has remained low. For the past twenty-five years, target population levels in New York have been set primarily through a public input process. Changes in those target levels have not adequately reflected deer impact on habitat or, in some cases, kept pace with population growth.

Reduced Predation

In fully functioning ecosystems, deer populations would be controlled by a combination of interacting factors, including food supply, predation, disease and weather. This doesn't mean that population density would be stable. It is normal for animal populations to fluctuate due to variable environmental conditions. High population densities, although they might occur in limited circumstances, would not be sustained across broad geographic areas. Mature forests don't provide enough suitable deer food to support such populations.

However, fully functional forest ecosystems don't exist in New York. Even deer in large wild areas such as the Adirondacks are not living in an intact ecosystem. Wolves and mountain lions, historically their principal predators, have been eliminated. Bears, bobcats and coyotes do prey on deer, particularly fawns, but hunting by humans is currently the primary predatory force acting to control population levels. The exception is in urban and suburban areas, where the majority of deer deaths are caused by collisions with vehicles.

Human Land Use Patterns

Deer normally find the most to eat in edges, or transition zones between forest and more open habitat types, where there is an abundance of low woody and herbaceous vegetation. The current pattern of human land use is ideal for creating and sustaining high-density deer populations. Open areas such as residential developments and agricultural fields are interspersed with forested areas, providing plentiful edge habitat as well as a variety of nutritious crops and ornamental plantings. This supplements the natural food available to deer.

Local laws and landowner opinions have severely constrained hunting in many developed areas. The resulting limited mortality combined with abundant food has allowed suburban and urban deer populations to reach extraordinarily high levels. Although better accessibility for hunters might have prevented such dramatic population growth, once populations reach high densities in developed areas it's very difficult to bring them down with recreational hunting in its traditional forms. Nor would the return of the state's full suite of natural predators be expected to significantly reduce deer populations in developed or agricultural areas. Wolves and mountain lions would avoid or not be tolerated in such areas.

Why Having So Many Deer is a Problem

Impacts on Human Activities

The principal deer-related problems recognized by most people are those that directly affect human activities. The most frequently mentioned concerns include:

- deer-vehicle collisions on roads;
- deer eating crops in agricultural areas and landscaping plants in residential areas; and
- the potential role of deer in the increase of tick-borne illnesses such as Lyme disease.

Deer-vehicle collisions

Based on insurance claims, State Farm estimates that there are over 70,000 deer-vehicle collisions annually in New York (data provided by State Farm Insurance®) and that nationally the average property-damage cost per collision is over $4,000. Losses are not limited to property; although the federal highway fatality database doesn't separate the statistics by species, hundreds of people were killed in the U.S. due to vehicles striking or attempting to avoid an animal, many of which were most likely deer.

Crop damage

New York farmers estimated their deer-related crop damages at $59 million, and about one quarter of farmers indicated deer damage was a significant factor affecting the profits of their farms.

Tick-borne disease

Many parts of New York are considered high-risk areas for human infection with Lyme disease, based on the density of infected ticks. Reducing deer populations to very low levels can reduce tick densities and infection rates because deer are the primary food source for adult female ticks. However, less drastic deer population reductions may not lower Lyme disease risk. Small mammals such as rodents and shrews, not deer, are the tick hosts that pass on the Lyme-causing bacteria. Evidence from New York and other states suggests that densities of various predator species may be more important than deer densities as determinants of Lyme disease prevalence, through their impacts on small mammal abundance.

Impacts on Forest Ecosystems

Plant diversity and forest structure

There is also a growing awareness that deer are altering forests across the state, perhaps permanently. Just as livestock can overgraze a range and reduce it to a barren wasteland, deer can over-browse a forest. Because mature canopy trees aren't affected, deer impacts on a forest may not be immediately obvious, but they are profound and long-lasting. Browsing by deer at high densities:

- reduces diversity in the forest understory;
- enables invasive species to out-compete natives; and
- prevents seedlings of many species from growing into the next generation of trees.

This ultimately leads to fewer mature trees in a more open plant community with a different and less diverse species composition. In other words, forests as they currently exist could disappear. In areas with long histories of high deer impacts, reducing deer population density or removing all deer may not be sufficient for plant diversity to recover, even as much as 20 years later. Some species are so thoroughly eliminated by deer that they may have to be planted if they are ever to be restored to such areas. Impacts on endemic species can be

devastating. For example, evidence suggests that current deer population densities in eastern North America will result in the extinction of ginseng, a valuable medicinal herb, within the next century.

Wildlife diversity

Furthermore, the ecological changes created by deer cascade through forest plant communities into wildlife communities, reducing the abundance and diversity of songbird species that use the intermediate levels of a forest. Ecosystem impacts may be magnified in urban and suburban parks and natural areas, which provide important habitat for migrating birds and other wildlife, but are often subjected to the highest deer densities.

Recovery from disturbance

High-density deer populations also interfere with habitat management efforts. Browsing by deer counteracts the regenerative effects of natural forest disturbances such as fire. Attempts to promote forest health through restoration of such disturbances and to increase populations of wildlife species that depend on young forest stands may fail unless deer populations are reduced. Regenerative processes are impaired throughout much of New York, particularly for tree species that are economically valuable. Even in the Adirondacks, where deer densities are lower than in much of the rest of the state, both direct and indirect impacts of deer browsing must be counteracted for regeneration (regrowth) of a diverse forest to occur.

Deer health

High-density populations can also harm the deer themselves by increasing competition for food and transmission of diseases and parasites. Deer in lower-density populations tend to be in better physical condition, all else being equal, because there is more food available to them. Because they don't come in contact with as many other deer, they are less likely to be infected with parasites or diseases.

The Right Deer Density

The density of deer that is desirable in a given area is one that maximizes the beneficial effects of deer while minimizing their negative impacts. Finding that balance requires understanding local deer-related impacts, both ecological and social, and evaluating the costs and benefits of changes in deer density. The balance point will vary from place to place according to differences in ecological sensitivity and productivity, as well as social values and goals.

Managing Deer Overabundance

Deer population levels in most areas are managed primarily through regulated recreational hunting. The number of Deer Management Permits (DMPs), also known as antlerless-deer tags, issued to hunters by DEC each year is determined by current and target population levels. In some parts of the state there has been virtually unlimited availability of DMPs in recent years. Even so, the desired harvest levels are not being achieved. DEC is working with stakeholders to find ways to increase the effectiveness of population management strategies in these areas.

WILDLIFE NEEDS OUR HELP!

NEW YORK STATE OF OPPORTUNITY | Division of Fish and Wildlife

NYSDEC's Young Forest Initiative

Why do we need to manage our forests?

Some of our most cherished birds are declining in numbers and abundance. American Woodcock, Ruffed Grouse, Golden-winged Warbler, and many migratory songbirds that depend on young forests for nesting and raising their young are becoming rare. Unfortunately, their populations are declining due in part to loss of habitat, in particular, the early-successional woodland habitat we call young forest. Young forest is also important for many wildlife species like deer, bear, turkeys, turtles and pollinators.

The American Woodcock has declined 68% since 1966.
© Larry Federman

What is young forest?

Young forest is generally 0-10 years old and has a dense understory of tree seedlings, saplings, woody vines, shrubs and herbaceous vegetation. Historically, young forest was created by natural disturbances such as fire or flooding, insect outbreaks, changes to the landscape by beavers and activities such as logging and farmland abandonment. These naturally occurring events and human actions have not kept pace to produce enough young forest habitat to meet the needs of the species named above. Although 63% of New York State's landscape is forested, it is shifting to predominantly mature trees which block out the sun and prevent the growth of critical vegetation. That's why we need to actively manage our land to maintain young forests throughout New York's landscape.

Golden-winged Warbler
© USFWS

How will we help?

Through DEC's Young Forest Initiative, we will restore young forest habitat on DEC Wildlife Management Areas (WMAs) by creating patches of young forest through timber cuts that meet target species' needs. We will manage 10% of the 120,000 forested acres on WMAs as young forest. DEC has a long history of habitat management on WMAs, and these actions will build on current efforts.

Dense shrubs and young trees grow after cuts.
© Beth Cooper

Benefits include:

- An increase in young forest habitat for at-risk wildlife
- Strong healthy forests and trees
- Abundant food and cover for the young of mature forest birds and mammals
- More opportunities for wildlife-dependent recreation, such as hunting and bird watching

Wood turtle basking in young forest
© William Hoffman

FOR MORE INFORMATION

and to see how you can help, go to
http://www.dec.ny.gov/outdoor/104218.html
or contact: yfwildlife@dec.ny.gov

WORKING LANDS

Audubon | NEW YORK

Creating and Maintaining Quality Forest Habitat
100% essential for birds.

By working together with private and public partners, Audubon aims to improve five millions of acres of forest habitat across Connecticut and New York for birds and people—in fact, we've already hit the million acre milestone. Here are a few more fun facts.

Golden-winged Warbler.
Photo: Arni Stinnissen/Audubon Photography Awards

63% of New York state is forested.

80% of forestland is privately owned in the Northeast (that means YOUR forestland can significantly influence bird populations).

45 priority bird species would benefit from forest management improvements.

5-10% young forest (0-10 years in age) represented in the surrounding landscape provides ample breeding habitat for forest birds.

American Woodcock. Photo: Deborah Rivel

Fan Favorite
How can you help the American Woodcock?

56% drop has occurred in the number of males heard singing on their breeding grounds due to loss of young forest over the last 40 years.

600,000 acres of young forest needs to be created annually to restore their population.

For more information or assistance improving forest habitat, visit ny.audubon.org/workinglands.

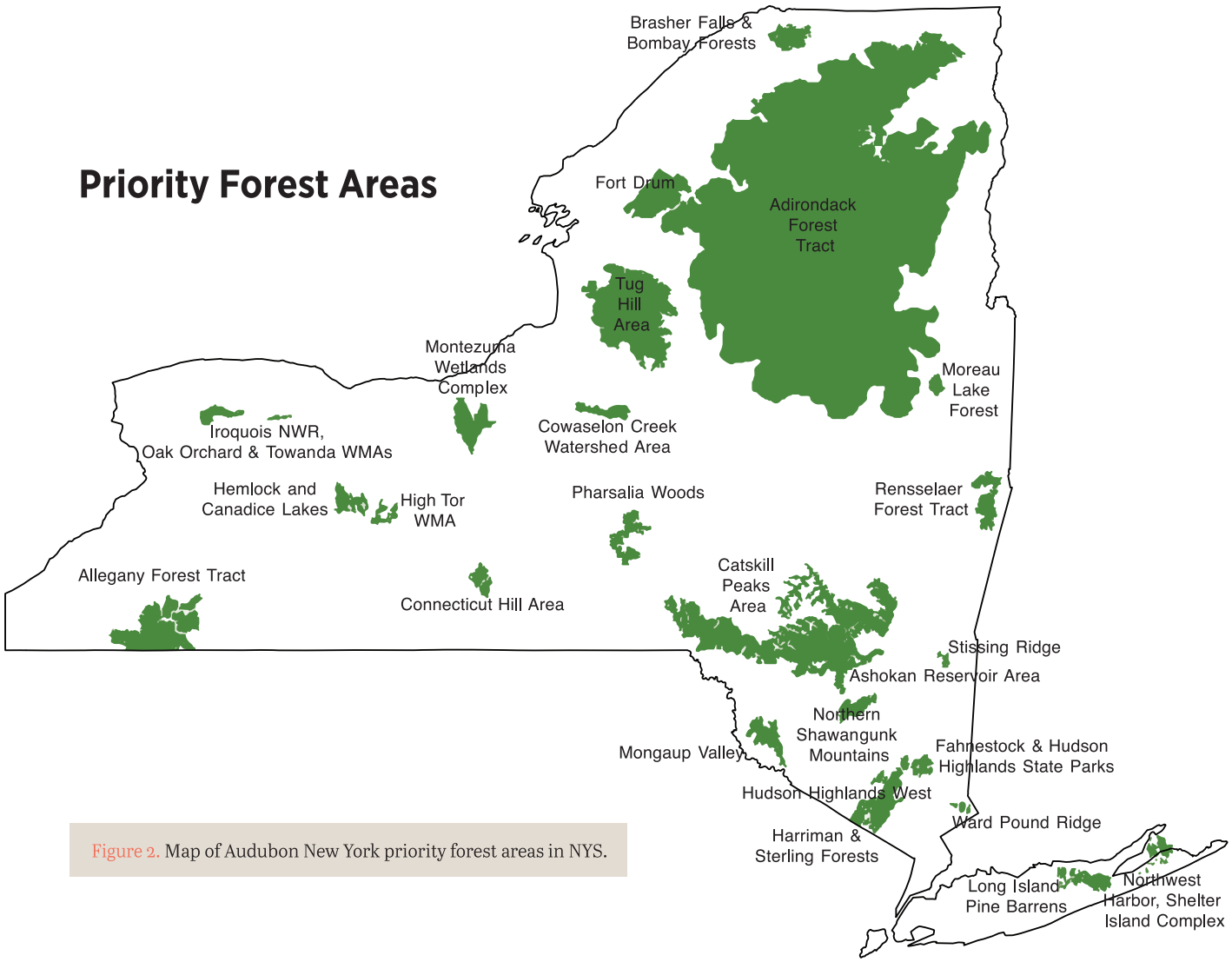
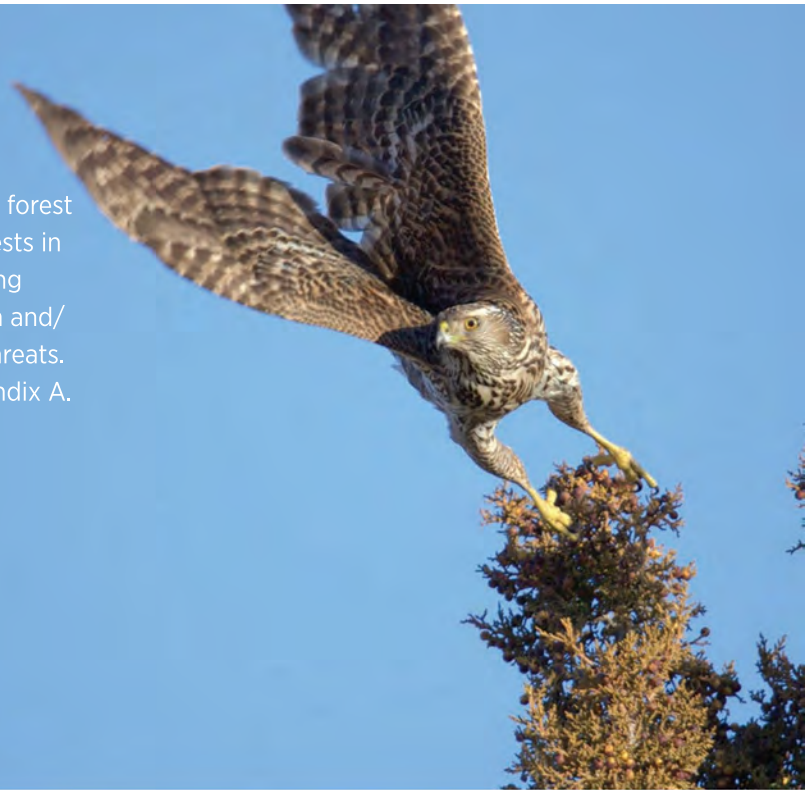


Figure 2. Map of Audubon New York priority forest areas in NYS.

New York Priority Forest Birds

Audubon New York has identified more than 45 priority forest bird species that would benefit from well-managed forests in New York (Table 1). A significant portion of their breeding populations use forests within the Eastern Forest region and/or are experiencing population declines or significant threats. Profiles of several priority species are included in Appendix A.



Cooper's Hawk
Photo: Beth Carpel/Audubon Photography Awards

Forest Habitat: Stand-level Conditions

The following section describes stand-level habitat components important to forest birds. All of these conditions apply to mature forest stands, and some also pertain to young forest stands. Many of the habitat features described in this section are similar to what you might find in late-successional Northern hardwood forests, but much of NYS lacks this forest age class. Depending on landowner goals, forest can be set aside from management to become late-successional forest in approximately 100–200 years, but the complex structure that is characteristic of older forests can be achieved by mimicking natural disturbances, such as wind throw and beaver flooding, through forest management. Foresters can enhance stand-level habitat features to increase forest birds' nesting success and rearing of fledglings.

Foresters and land managers can use the following descriptions of desired habitat features to compare against existing habitat conditions when performing timber cruises and forest inventories. The recommendations below (in bold face) can be integrated into silvicultural prescriptions to create or improve the key habitat features.

See Table 1 for information about forest habitat characteristics that are of particular importance to priority birds.

Vertical Structural Diversity

Vertical structural diversity refers to the layering of vegetation at multiple heights in a stand. Ones with high vertical structural diversity have overstory, midstory, and understory vegetation layers composed of some combination of trees, shrubs, herbaceous plants, and vines. This vertical structural diversity provides different birds with places to nest, perch, forage, seek cover, and raise young.

Structural complexity can be enhanced in mature forest by creating canopy gaps and stimulating the growth of understory vegetation (Newell and Rodewald 2011). Late successional forests (typically uneven-aged) tend to have high vertical structural diversity, exhibiting characteristics that include a tall overstory with small canopy openings (due to individual tree fall) that have allowed for several shorter canopy layers to develop, and substantial amounts of downed woody debris of larger logs and snags (DeGraaf et al. 2006, D'Amato and Catanzaro 2010). **In general, creating or maintaining vertical structural diversity within a mature forest stand is highly beneficial to many forest breeding birds.**

Forest with high structural diversity.

Photo: Nicholas A. Tonelli/Flickr (CC BY 2.0)

Species Diversity

Native vegetation provides the most habitat value to wildlife, and managing forests to provide a diversity of native trees, shrubs, vines, and herbaceous plants increases the suitable habitat potential for forest birds. However, some native species, such as American beech, can dominate a stand and reduce diversity. Native plants support all or part of the life cycles of our native insects, which are the primary food source for the majority of forest bird species during the breeding season. In addition, native trees and shrubs produce more nutritious mast (fruits, seeds, and nuts) when compared to non-natives.

Where interfering vegetation is prohibiting the growth of native tree and shrub species, apply control methods to the interfering vegetation to release the native species. Increase species diversity of native trees and shrubs by applying silviculture that allows varying amounts of sunlight throughout the area you are managing, thereby creating conditions that foster the growth of shade intolerant, tolerant, and intermediately tolerant species (e.g., a 5-acre patch cut in one stand and crop-tree release in another stand).

Photo: Jeff Nadler

Blue-winged Warbler.

Controlling Interfering Vegetation: **Interfering vegetation includes both native and non-native invasive plants that prohibit successful forest regeneration by shading seedlings and other plants. Species such as common buckthorn, Japanese barberry, hayscented and New York ferns, and American beech, can dominate the forest understory thereby suppressing forest regeneration, reducing diversity, and decreasing overall habitat value to wildlife. Management should control interfering vegetation so that tree regeneration and native, non-invasive understory plants regenerate.**

Photo: Eli Sagor/Flickr (CC BY-NC 2.0)

Japanese barberry in a forest understory.

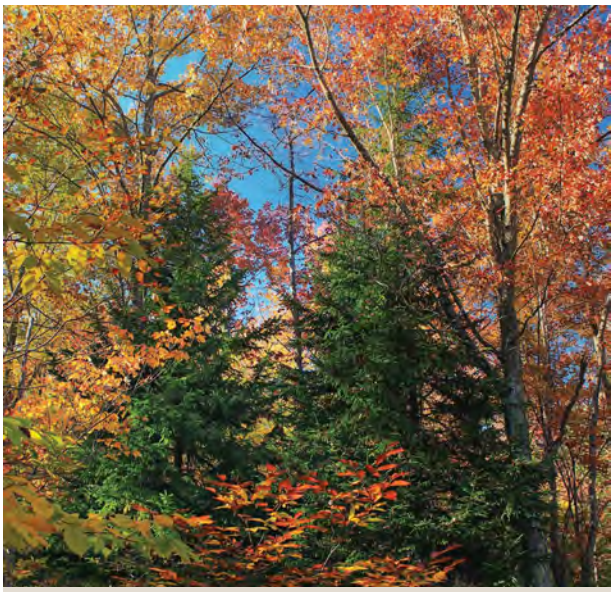
Managing for a diversity of native forest plants will ensure that birds have available food sources, including insects and mast, and having different species will increase the chances of having some mast production from one year to the next (DeGraaf et al. 2006).

Large Diameter Trees

Hardwood trees of at least 24 inches diameter at breast height (DBH) and softwood species of at least 20 inches DBH offer nest sites, perches, and places to forage for a number of forest birds, including Red-shouldered and Broad-winged Hawks. Large trees with cavities and large dead branches enhance the habitat for many forest birds **(see *Dead Standing Trees and Cavity Trees*). Where possible, retain a component of large diameter trees** (DeGraaf et al. 2006, Newell and Rodewald 2011). **If none are present, select some smaller ones to leave so they become large diameter wildlife trees in the future** (DeGraaf et al. 2006).

Large diameter trees.

Photo: Nicholas A. Tonelli/Flickr (CC BY 2.0)



Forest with a small group of softwoods.

Photo: Nicholas A. Tonelli/Flickr (CC BY 2.0)

Softwood Inclusions

Conifer, i.e. softwood, trees provide birds with cover and foraging habitat, and some birds preferentially select softwoods for nesting. In particular, there are a number of forest birds that are associated with eastern hemlocks, and some species, such as Blue-headed Vireos, Northern Saw-whet Owls, Hermit Thrushes, and Black-throated Green Warblers, are often found in areas with hemlocks (Yamasaki et al . 2000). To benefit forest birds, **retain and/or promote at least some softwoods where they occur, especially within predominantly hardwood stands** (DeGraaf et al. 2006). **Even a cluster of softwood trees of less than an acre in size has high habitat value to forest birds** (Yamasaki et al. 2000, DeGraaf et al. 2006).

Dead Standing Trees and Cavity Trees

Dead standing trees or "snags" provide locations for nesting, roosting, and foraging for insects. Cavity trees of all sizes provide nesting and roosting sites for birds. Keeping a range of size classes of snags and cavity trees (living or dead) is desirable, but the larger the better (Tubbs 1987, Yamasaki and Leak 2006). For snags, large diameter hardwood species (well over 18 inches DBH) will provide the best long-term habitat value as dead standing wood, and eventually as coarse downed woody material when they fall (Yamasaki and Leak 2006). **Where you can do so safely, retain at least six snags or cavity trees per acre, with one ≥ 18 inches DBH, and three ≥ 12 inches DBH** (Tubbs et al. 1987, Hagan and Grove 1999, DeGraaf et al. 2006, Bryan 2007, Bennett 2010, Hagenbuch et al. 2011). In areas of young forest, keep some cavity trees and snags (Hagan and Grove 1999, Bennett 2010).

Downed Woody Material (DWM)

DWM or coarse woody debris includes logs, stumps, and large branches (Bennett 2010). DWM enhances habitat for forest birds by providing places to seek cover, perch, nest, and forage. Larger downed logs (> 18 inches diameter) provide especially important habitat structure for birds and other wildlife that forage or nest on or near the forest floor, and larger logs are used for drumming displays by Ruffed Grouse (Bennett 2010, Hagenbuch et al. 2011). In areas where deer densities are excessively high, leaving slash (tree material left from a harvest) may deter deer browsing and benefit forest regeneration, as it provides an obstacle that prevents deer from reaching seedlings and saplings. P**rotect existing DWM during harvest operations and increase DWM by leaving poor quality logs and cull material, tree tops, or other slash scattered throughout the stand rather than left in a large pile** (Hagan and Grove 1999). Providing DWM of different size classes and stages of decay is ideal (Hagan and Grove 1999, DeGraaf et al. 2006, Bennett 2010, Hagenbuch et al. 2011).

Downed woody material.

Photo: Suzanne Treyger/Audubon

Maple seedling in deciduous leaf litter.

Photo: Nicholas A. Tonelli/Flickr (CC BY 2.0)

Red-bellied Woodpecker in a dead cavity tree.

Photo: Matt MacGillivray/Flickr (CC BY 2.0)

Leaf Litter and Duff

Leaves, needles, and other decomposing vegetative materials offer foraging habitat for macroinvertebrates, such as worms and beetles. Moist leaf litter has high habitat value to Wood Thrushes, Ovenbirds, and other ground foragers and nesters. To protect the leaf litter layer, limit trails to no more than 10% of the total stand area, and confine skidding and vehicle traffic to these carefully located trails (R. Nyland personal communication). **When possible, avoid harvest operations during times with saturated soils, when rutting and soil compaction may compromise soil structure and drainage** (Leak et al. 2014).

Managing Land for Wild Turkey Habitat

Home Range

One of the first things you need to consider is how much area a turkey can normally be expected to cover, also known as its home range. A turkey can and does cover a lot of ground in its daily travels. Their home range varies by season and can range from 400 to 2,000 acres or more. Unless you own a large tract of land (at least several hundred acres), you do not need to provide for all of a turkey's annual needs on your land.

Look at your land and the surrounding area and determine what habitat component is in the shortest supply, then try to provide that habitat type. For instance, if your property is forested and surrounded by active agriculture, creating a small field will probably not be an effective method of attracting turkeys. Instead, maintaining it as a woodlot and managing for mature mast-producing trees would be a better choice.

Habitat Types

Turkeys thrive in areas with a wide variety of habitat types and plant species. One recent researcher has described the ideal turkey habitat as one-half wooded, one quarter abandoned fields, and one quarter active agriculture.

In the Northeast, turkeys have three critical habitat needs which may be in short supply:

- good nesting habitat
- good brood rearing habitat
- good winter food source

If those three needs are met, interspersed with mature woodland, you have greatly increased the probability of having wild turkeys in the area. The only other component you might want to add is a late summer/fall food source. The primary benefit of this would be to hold the birds for your enjoyment, as fall food is seldom lacking in the Northeast.

Supporting Local Dairy Farms

In most of the Northeast, some of the best wild turkey habitat is provided by small, family-owned, dairy farms. The woodlots, field-edges and hedgerows associated with small dairy farms provide ample nesting habitat. The hay fields and pastures provide high quality brood habitat. Waste grain from silage, corn, and small grain production provides late summer and fall food. Finally, manure spread on the fields provides a constant winter food source. One of the best things that you can do for the wild turkey is to actively support the small dairy industry in your community and state. Keep them in business-they are the key to your local turkey population and other wildlife.

Spring Habitat

For optimal reproduction turkeys require good nesting habitat. Wild turkey hens begin to nest before most of the new growth begins in the spring. Therefore, at least for initial nests, hens need some residual cover from the previous year to conceal their nest from predators. Generally, nesting habitat consists of low, horizontal cover such as low brush, standing raspberry canes from last year, or anything else that obstructs visibility between ground level and about 2 feet.

To aid in preventing increased predator involvement, be sure there are numerous patches of this type of cover in the vicinity. These patches of brushy cover will be used no matter where they are located, but it is better if nesting cover is close to brood habitat. Later in the spring, when new growth begins, hens will readily renest in areas where a nest may have failed earlier.

After the poults hatch, they require good brood habitat for survival and growth. Brood habitat consists of grasses and forbs (flowering groundcover) that will encourage insect populations that the poults need as a food supply. The ground cover needs to be dense enough to encourage insects, but not so dense as to inhibit the poults' movement. Brood habitat needs to be near or adjacent to brushy and wooded areas that provide escape cover and roosting trees. Orchards or groves of trees spaced widely enough to allow sunlight penetration and allow room for mowing provide ideal brood habitat when the grassy areas are mowed once or twice a year. The trees provide overhead cover, making the hens feel more secure.

Summer and Fall Habitat

Late summer and fall habitat is generally the least limiting of a wild turkey's needs in the Northeast. It is however, a time that many wild turkey enthusiasts want to see wild turkeys using their land. At this time of year a turkey needs wooded areas for concealment, roosting trees, and a good food supply to ensure they go into the winter in good physical condition.

Winter Habitat

In the Northeast, particularly northern New York, northern New England, and eastern Canada (and to a lesser extent southern New England, southern New York, and Pennsylvania) winter habitat is crucial for the survival of wild turkeys. In some parts of this area, turkeys now exist north of their historic range at the time of the arrival of European settlers. This is primarily because of habitat changes that have occurred, such as farming in the St. Lawrence and Champlain Valleys. During northern winters, wild turkeys need a dependable food source that is close to thermal roosting cover and protected travel corridors. In more southern parts of New York and at lower elevations, there is less difference between fall and winter habitat.

Creating Ideal Turkey Habitat

The following are suggestions for managing specific habitats for winter habitat. Remember that these are suggestions only. There are no hard and fast rules and you can decide what methods you wish to employ on your land. Assistance with soil testing or fertilizer and liming recommendations is available through your local Cooperative Extension Office.

Forested Areas

Logged areas, landings and roads: Leave some scattered treetops, but clear most of the tops and branches to allow natural regeneration.

If grassy openings are lacking in the vicinity you may decide to make some of the logged area into permanent openings by spreading lime and seeding grasses, sedges (nut grasses) and clovers. These areas generally need annual mowing to control weedy invasions and re-application of fertilizer/lime and over-seeding every few years. These treatments are known as "top-dressing". Clover mixes should not be mowed lower than six inches.

Woodlot edges: Thin (remove some of the trees to let sunlight reach the ground) up to 50 feet adjacent to open areas to encourage shrubs and brushy growth. Leave some scattered tree tops or branches for horizontal cover.

Hardwood timber and tall shrubs: Manage for dependable mast producing species (such as oak, beech, cherry, ash, black walnut, or hickory). Develop a timber management plan in consultation with a professional forester to manage for your goals (e.g., uninterrupted mast production and regeneration of those species.

Don't forget the mid-story mast producing species such as:

- hop hornbeam
- ironwood
- hazelnut
- serviceberry
- dogwoods
- viburnums

Thermal Cover: Conifer stands provide a wind break, protection from extreme cold, and limit snow depth under the stand allowing turkeys to be mobile. Provide several acres of conifer trees for every hundred acres of habitat. Hemlock or white pine are good, but most species of native conifers will help.

Travel Corridors: During deep snow conditions turkeys will use travel corridors created by conifer cover. By providing narrow strips of conifer cover between other habitat types, turkey will be able to move more freely.

Fields and Pastures

Hay fields and pastures: Many re-nesting hens will use hayfields. Delay mowing as long as possible (at least mid-July). Hay and pasture seed mixes should contain taller less dense grasses like timothy, orchard grass, perennial rye, and white clover. Avoid cool season grass mixtures that contain fescue as they can develop thick sod and stems which young turkeys may have difficulty traveling through. You might consider native warm season grasses like switch grasses or blue stem that mature later and can be cut for hay in late July.

Old fields: Maintain shrubby patches within the old field, cut brush and trees, and leave scattered piles of branches. Mow periodically to keep much of the field in grasses or other herbaceous cover. Encourage clumps of raspberry, blackberry, goldenrod, and aster (any heavy stem herbaceous cover) by brush-hogging every two to three years. Leave some trees (apple, black locust, crab apple, black hawthorn, wild raisin, ash, oaks, cherry, etc.) to create a savannah type habitat. In pastures grazing will maintain a short grass cover. In old fields encourage grasses and forbs by periodic mowing or spot herbicide application to discourage woody brush. If dense grasses exist, annual mowing may be necessary.

Food Plots

Test soil, lime and fertilize, as necessary, prior to planting. Occasionally top-dress area with lime and fertilizer in order to maintain grasses and legumes. If invasion of weeds are noticed, test the soil and add lime and fertilizer.

Annual food plots: Annual food plots should be small, roughly ½ to 5 acres unless planting corn in areas of high deer population. In which case, plant larger plots of 2-5 acres. Place food plots for winter use on south facing slopes to take advantage of the sun's radiant energy.

- Corn- Plant at normal time and leave standing to provide food into the winter.

- Sorghum/Millet/Sunflower- Plant in late spring and leave standing. Pure stands of sunflower should be at least ½ acre in size to protect from deer.
- Buckwheat- Plant later than normal (mid June to early July) for a fall food source. Leave standing.
- Rye/Wheat- Plant in September, over-seeding the buckwheat, for a fall and spring food source.

Perennial food plots, shrubs and openings: Plant clovers, native grasses, and lower lespedeza varieties. When necessary, mow very late fall or early spring. Clover mixes shouldn't be mowed less than 6 inches. Reseed only as necessary (every 5+ years). Discourage exotics like Russian olive, autumn olive, and multiflora rose.

Plant fruit/nut producing trees and shrubs such as:

- apple
- crab apple
- hazelnut
- serviceberry
- hawthorn
- dogwoods
- viburnums
- highbush cranberry
- staghorn sumac
- grapes

Shrubs may be planted in "hedgerow" type arrangements. Trees may be arranged on the edge of the plot that receives the most sun (preferably adjacent to the forest edge). Trees may also be planted orchard-style with 15 to 25 foot spacing.

Crop fields: Plant and harvest grain crops such as corn or oats in the normal manner, leaving some at the edges of the fields standing. Try to leave at least ten rows standing.

Miscellaneous Habitat

Power lines and other rights-of-way: Encourage regular maintenance by the power company to maintain grasses and forbs. Mid to late summer mowing is best. Some companies have vegetation management policies that allow establishment of low-growing shrubs and trees on their rights-of-way.

Spring Seeps: Spring seeps (spots where ground water comes to the surface) are found in old pastures, fields, and forests. The warmer ground water keeps snow melted around the seep. The plant and animal life found in and near spring seeps are important winter food sources for turkeys. All seeps can be useful but seeps on south-facing slopes are most valuable.

Seeps may be managed or simply left alone. Stimulate the growth of herbaceous plants in forested seeps by removing some of the forest canopy. However, leave about 70% canopy closure. Remove unproductive trees and leave mast producing trees near the seep. Seeps in open areas may be improved by keeping them from being invaded by varieties of woody stems that do not produce food items. Planting fruit-bearing shrubs near but not in the seeps can provide accessible winter food. If necessary, fence the seep to keep cattle out.

Hayfield Management and Grassland Bird Conservation

Grass hayfields of 10 – 12 acres or more present an attractive breeding area for grassland birds. The vast expanses of medium to tall grass stems, interspersed with legumes like clover, represent nearly ideal cover for the adults and nests of birds like Bobolinks, grassland sparrows, and Eastern Meadowlarks. Unfortunately, early hay mowing in May and June — meant to increase the nutritive value of hay for livestock — frequently destroys this habitat. In fact, research shows that intense hayfield mowing is one of several reasons for the decline of grassland birds in the Northeast (Mitchell et al., 2000).

Grassland birds are declining significantly in the Northeast and across most of North America. Just within the last 30 years, the populations of many of these birds have declined 70 to 90 percent. Farmers who have plowed under hayfields to plant corn or soybeans, converted grass hay to alfalfa stands, or who start the first cutting of grass hay in late May or June, have unknowingly contributed to the loss of grassland habitat when it is most crucial for the birds. In addition, farmland conversion into brush or development is reducing grassland habitat throughout the Northeast. In some areas, as much as 95 percent of hayfields present 50 years ago have disappeared (Herkert, 1997). Many farmers are aware of these losses and are striving to play a role in grassland bird conservation, hoping to bring the familiar sight of these birds back to their communities.

Bobolink

Grassland birds are species that require distinct grassland habitats during their breeding cycles, nesting, and feeding. Many other birds use grasslands during some portion of their life cycle, but the term "grassland birds" usually refers to birds constrained to grass-dominated ecosystems throughout their lives.

Grassland Birds of Management Concern in New York State

Northern Harrier *(Circus cyaneus)*
Upland Sandpiper *(Bartramia longicauda)*
Horned Lark *(Eremophila alpestris)*
Sedge Wren *(Cistothorus platensis)*
Eastern Bluebird *(Sialia sialis)*
Clay-colored Sparrow *(Spizella pallida)*
Vesper Sparrow *(Pooecetes gramineus)*
Savannah Sparrow *(Passerculus sandwichensis)*
Grasshopper Sparrow *(Ammodramus savannarum)*
Henslow's Sparrow *(Ammodramus henslowii)*
Dickcissel *(Spiza americana)*
Bobolink *(Dolichonyx oryzivorus)*
Eastern Meadowlark *(Sturnella magna)*

Managing hayfields for livestock nutrition as well as for grassland bird habitat will bring some tradeoffs, but perhaps not as severe as once thought. Farmers who would like to restore grassland bird habitat in their hayfields can adjust the timing of first cutting, use field rotation, modify mowing patterns, and take advantage of specific field characteristics to achieve this conservation goal. Excess hay acres, mulch and bedding hay harvests, and hay intended for mature livestock with good body condition (like beef, sheep, and horse), are compatible with grassland bird habitat preservation.

Before making firm decisions about managing hayfields for grassland birds, farmers should first consider how these decisions would affect overall farm operations. Hay tonnage yields are usually

Cornell University
Cooperative Extension

higher when cutting is delayed until just after the breeding season for grassland birds; however, later-harvested grass hay loses digestibility (due to higher fiber concentration) and nutritive value (due to lower protein). Supplements may be needed for livestock that cannot derive necessary nutrition from late harvested hay. On the other hand, the drying time for hay harvested after the grassland bird breeding season will likely be shorter due to more favorable weather conditions; thus it will retain any available dry matter and carbohydrates. Developing better grassland bird habitat on the farm begins by selecting the right fields for conservation and understanding how to balance habitat and grass hay nutrition.

Hayfields dominated by mixed grasses are also good habitat for grassland birds.

What good is grassland bird conservation for the farm?

Farmers aware of ecological relationships will appreciate how their hayfields can become home for even more diverse wildlife, especially habitat-sensitive grassland birds. These birds are known to reduce populations of potentially harmful insects like caterpillars, weevils, cutworms, beetles, and flies. Engaging in grassland bird conservation practices is convincing evidence for the public that farmers are good stewards of natural resources. Hay farmers who include appropriate bird conservation principles in their farm operations have gained an advantage when fighting to protect local farmland resources. Additionally, adoption of these practices can position farms better for the increasing availability of technical assistance and cost-share funds for grassland maintenance and habitat conservation.

Grassland bird breeding season in hayfields

To be considered good habitat for grassland birds, a grass hayfield needs to remain substantially unmown through the breeding season, which begins in early May and ends by mid-July across most of New York State. During this time, hayfields grow vigorously, providing shelter, nesting areas among the grass stems, and a source of insects that comprise bird diets. Any significant disturbance, like mowing or manure application, will cause most nests to fail. Alfalfa hay stands are generally unsuitable for grassland birds.

In New York, breeding grassland birds will begin identifying territories from late April through May. Nest building and egg laying occur through early June and young birds tend to hatch by mid- to late-June. The ability to fly for cover and feeding (called "fledging") develops by early July. Some birds have a faster breeding cycle and can produce two broods of young in one breeding season. Depending on location, these activities may take place a week or more earlier or later, as does hay crop development, contingent on the season's weather.

Hay farmers should monitor weather, bird behavior, and crop maturity to determine the best time to mow hay in fields pre-selected for grassland bird conservation. The earliest first cutting can take place

Hayfields best suited for grassland bird habitat

- Large (15 or more acres)
- Dominated by grasses (orchardgrass, timothy, bluegrass, smooth brome)
- Contain some legumes and other plants - up to 20%
- Located adjacent to pastures, idle fields, or other hayfields, extending the grassland habitat
- Field contains grass hay that heads later than usual due to damp soils, cooler climate, or late-maturing varieties

March

S	M	T	W	Th	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

April

S	M	T	W	Th	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24	25	26	27	28	29

May

S	M	T	W	Th	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

June

S	M	T	W	Th	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

July

S	M	T	W	Th	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24/31	25	26	27	28	29

August

S	M	T	W	Th	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

immediately after young birds have fledged. In many places, this will be in late June through early July. Birds will delay nesting and brood development in cooler or wetter seasons, so the first cutting should be delayed until mid-July. In any given year, a first cutting of grass hay in mid-July is sufficient to conserve grassland bird habitat. Subsequent cuttings should not have a detrimental effect on birds breeding in the current season. There is evidence that some birds, like Bobolinks, prefer a taller grass structure when selecting breeding sites early in the season. Thus, it is helpful to allow some hayfields to grow back in the autumn, letting the taller stems persist until the following spring (Nocera, J.J. pers. comm. 11-8-05).

Delaying hayfield mowing is a key element of grassland bird conservation.

Results of delayed hay cutting for grassland bird conservation

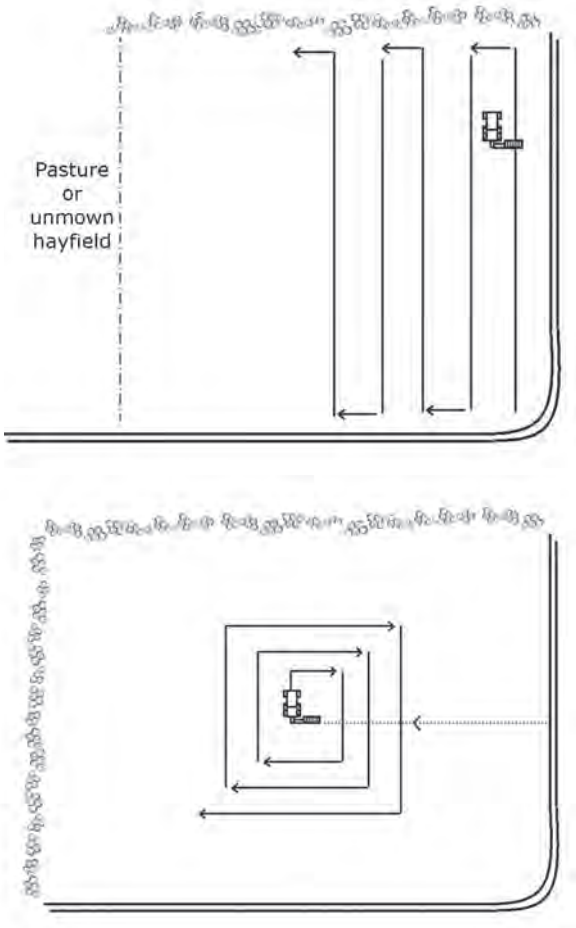
Delaying hay cutting for conservation or other reasons will compromise the optimal nutritional quality of hay. Later-cut hay has lower moisture content, lower digestibility, a higher rate of shattering, and lower protein. To maximize both yield and quality, grass hay should be cut at boot stage - just before or at head emergence; grass quality declines rapidly after heading. Delaying the cutting a week or two to allow for grassland birds to fledge will usually lead to hay that is essentially overmature, but potentially useful. Farms should make decisions about delaying cutting for conservation early in the growing season, based on expected herd nutrition needs. Nutrition loss from conservation cutting can be reduced by using late-maturing varieties of grasses when re-establishing a grass hay field.

New research shows that hay cut right after most young grassland birds have fledged in late June had lost only a small amount of crude protein (3.5% loss) but provided benefits of increased levels of calcium and phosphorous (Nocera et al., 2005). These losses will be unacceptable for livestock that require high-quality forage, such as calving dairy cows and

finishing beef cattle. Farms with animals that can tolerate moderately lower nutritive values - horse, sheep, dairy heifers, and mature beef - can often use this later-cut hay. Also, a coarse grade of hay can be beneficial to correct manure consistency problems for dairy cows on a rich feed ration.

Mowing patterns to conserve grassland birds

If an entire hayfield will be mown, the equipment operator can sometimes mow straight to the center of the hayfield and then gradually work toward the edges. This encourages grassland-nesting birds to scatter outward through cover, rather than into the open. If only part of a field will be cut, start with areas less conducive to grassland bird nesting, such as next to hedgerows or farm structures. If an unclipped pasture is adjacent to the hayfield, start farther from the pasture and work toward it, so birds can fly to the pasture as a refuge. Leave patches of standing grass in place, if possible.



Mow hay in a pattern that allows grass-nesting birds to escape to an adjacent field.

Most grassland birds will abandon hayfields that are mown during the breeding season, particularly Bobolink, Eastern Meadowlark, Henslow's Sparrow, Dickcissel, and Swamp Sparrow (Sample and Mossman, 1997). Some birds will remain in a mown hayfield to forage for insects, and some will attempt a second nest, depending on the season.

If hayfield mowing cannot be delayed or if a conservation mowing pattern is not be feasible, farmers should consider at least changing the mowing height. Raising the sicklebar or rotary blade height as much as possible (up to 5 – 6 inches) will reduce nest destruction, and provide some residual cover for birds. Also, a flushing bar is an increasingly common mower accessory used to reduce gamebird mortality in the Midwest (a flushing bar is a pipe extending horizontally over the uncut grass to the side of the hay mower; chains hang down to deter birds). They appear to be effective in deterring large gamebirds like pheasants, but probably have little conservation effect on small grassland birds; the loss of cover from mowing is mostly detrimental.

Rotating hayfields for grassland bird conservation

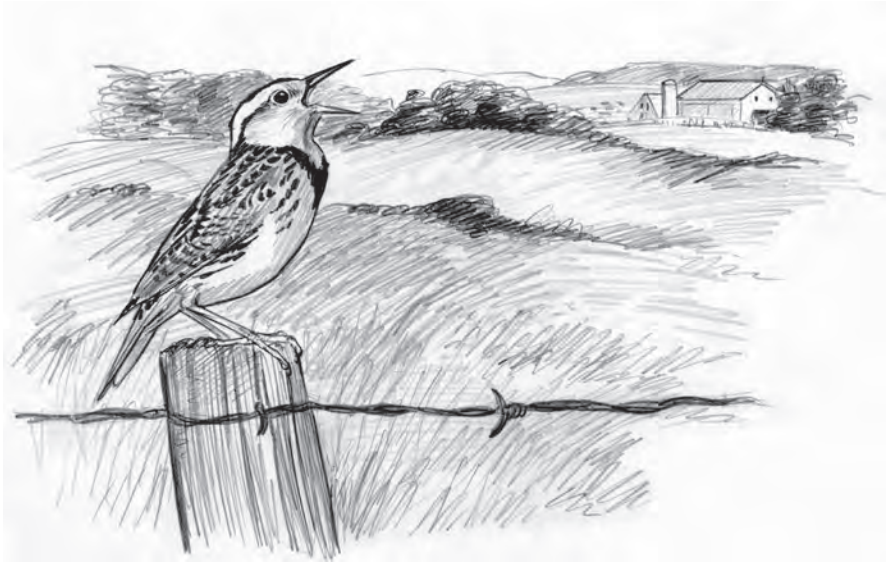
The concept of crop rotation usually means switching from annual corn or soybean crops to hay, back to annual crops in the same field on a 2 – 4 year cycle. Hayfield management rotation for grassland birds involves rotating which hayfields get cut earlier, later, or rested for a year or two. Whether or how a farm will rotate mowing in various hayfields will be particular to the goals of individual farmers, or controlled by rental agreements and easements in the NRCS Grassland Reserve Program. Such a hayfield management rotation plan for grassland bird conservation will usually restrict mowing during the breeding season for all fields, varying the timing annually. For example, an earlier mowing in one year (before grassland bird breeding) would rotate with later mowing (after grassland bird breeding) the following year.

When rotating hayfields for grassland birds, farmers should weigh the benefits (better grassy habitat, better drying conditions) with the disadvantages (hay quality loss). Hayfields cut late in the growing season produce

lower quality feed or mulch hay, but these do not have to result in economic loss. Late cut hay still has value for poultry, horse, sheep, dairy heifers, and beef fed with supplements. It can be used in some landscaping and conservation projects where weed seeds are acceptable. When grain prices are low, markets for late-cut hay are more flexible because there is less motivation to optimize nutritive value in the hay itself. Within a few years, this hay might be used for pelletized heating fuel. Farms that launch into grassland bird conservation in hayfields should also plan for long-term storage and alternative markets for their hay.

Grasshopper sparrow

Grassland bird conservation planning



Develop a plan for grassland bird conservation in your hayfields in cooperation with personnel from your county Soil and Water Conservation District, Cooperative Extension, and the regional Natural Resource Conservation Service.

here are new resources and research available to meet your production goals and provide space for specialized wildlife. he following steps will lead to this balance:

1. **Assess your current hayfield resources.**
2. Evaluate your hay and forage needs to meet current and long-term production goals.
3. Identify excess fields, fields that may not be critical for early hay mowing, and fields that are usually too wet for early mowing.

4) Observe the bird species that appear in hayfields. Farm operators curious to know which birds are already using their pastures should solicit the assistance of a knowledgeable birdwatcher, or obtain an audio guide to bird songs of the Eastern United States. In the spring and early summer, birds will be singing in the habitat daily. It is best to walk slowly around a hayfield in the morning, listening carefully and taking note of the different songs. Binoculars can help to observe field marks on some birds, but they should not be necessary in many cases.

5) Consult with conservation educators and technicians to develop a schedule of mowing and rotation to improve overall bird habitat.

12. WETLAND HABITAT MANAGEMENT

Wetlands are ecosystems characterized by hydric soils that support vegetation adapted to life in a wet environment. Wetland communities include the vegetated, shallow-water margins of lakes and ponds, the seasonally flooded borders of rivers and streams, and an amazing diversity of topographic settings across the landscape, including basins, seepage slopes, and wet flats. There are three characteristics shared by all wetlands. First, they are inundated by or saturated with water for varying periods during the growing season. Second, they contain wetland or hydric soils, which develop in saturated conditions. Finally, they are dominated by plant species that are adapted to life in saturated soils.

Wetlands can be grouped into the following general wetland types. *Swamps* are wetlands dominated by woody plants, either trees or shrubs. *Marshes* are wetlands dominated by herbaceous plants. *Fens* are peat-accumulating open wetlands that receive mineral rich groundwater. *Bogs* are also peat-accumulating wetlands but are isolated from mineral-rich water sources by deep peat accumulation and therefore receive most of their water and nutrients from precipitation.

WETLAND FUNCTIONS AND VALUES

Wetlands are some of the most biologically rich and diverse ecosystems that exist in Vermont, the United States and throughout the world. In Vermont, they represent a small percentage of the overall landscape (approximately five percent) and as such, must be protected for the many values they support. Generally speaking, wetlands provide a wide array of benefits including flood storage, water quality improvement, recreation, education and science, and habitat for many species of fish, wildlife, plants, and insects.

The following functions, although mentioned briefly, are important to consider when understanding the importance of wetlands on your property and help provide context for the values they may provide.

Hydrology

Frequency and duration of soil saturation are the primary factors determining the type of wetland that will develop or occur in a particular setting. For example, permanent standing water in deep-water marshes excludes most woody plants and is suitable habitat for only those herbaceous plants adapted to such a stressful environment that is created by this type of hydrology. Other wetlands are only seasonally wet or flooded, such as vernal pools or floodplain forests. These wetland habitats support a different set of plants and trees, and as a result, support different species of wildlife.

Nutrient Availability

The availability of nutrients in wetlands has a significant effect on the plants that will grow there. Fens occur in areas with calcium-rich bedrock. Many marshes receive surface water runoff, which provides a source of dissolved nutrients and minerals. In contrast, mineral poor wetlands

Wetlands provide a wide array of benefits including flood storage, water quality improvement, recreation, education and science, and habitat for many species of fish, wildlife, plants, and insects.

Wetlands also provide critical habitat for many animal groups that we know much less about, including dragonflies, butterflies, moths, beetles, and other insects.

have low nutrient availability. Bogs are especially low in nutrients. The effect on what plants occur in a wetland effects what food is available for some wildlife, or what brood-rearing habitat may be available for nesting waterfowl.

Attenuation of Flood Flows

Many wetlands, especially those that occur in basins with restricted stream outlets or in the floodplains of rivers, have the capacity to store large volumes of water generated by heavy rainfall, rapid snowmelt, or floods. These wetlands release stored water slowly back into rivers or streams or in some cases allow the water to percolate into the ground.

Surface Water Quality Protection and Groundwater Recharge

Wetlands are effective in trapping sediments and removing nutrients and pollutants from surface water runoff before that water reaches streams or lakes. The location of a wetland relative to sources of runoff and the receiving stream or lake is important in determining how effectively a wetland will protect the quality of surface waters. Groundwater discharge may be evident as seeps or springs where water comes to the surface. These wetlands have characteristic features such as stable water levels and soil saturation, defined outlet channels, and water chemistry and vegetation that reflect mineral-enriched conditions.

Fish Habitat

Certain freshwater fish species require wetlands as spawning grounds and as nursery areas for their young. Spring spawning by northern pike in the emergent wetlands adjacent to Lake Champlain is a particularly good example. Others, like black bullhead, yellow perch, pumpkinseed, and bluegill, leave open water to spawn in shallow water wetlands. Wetlands are also important for maintaining the quality of fish habitat by providing shade or discharging water from cold springs, both of which moderate surface water temperatures.

Wildlife Habitat

As previously mentioned, wetlands provide essential habitat for numerous species of wildlife. The dense vegetation found in most wetlands provides a variety of foods and also nesting sites that are relatively safe from predators. Many species, such as Canada goose, wood duck, great blue heron, muskrat, beaver, snapping turtle, and bullfrog are wetland dependent, meaning that they rely on wetlands for some or all of their life cycles. For others, such as black bear, moose, deer, wood frogs, and marsh hawks, wetlands are not primary habitat but are important for a part of their life cycle or during certain times of the year. Wetlands also provide critical habitat for many animal groups that we know much less about, including dragonflies, butterflies, moths, beetles, and other insects.

Habitat for Rare, Threatened, and Endangered Species

Wetlands occupy only five percent of the land area in Vermont, but they provide necessary habitats for the survival of a high percentage of the threatened and endangered species in the state. Examples of such wetland dependent species are Calypso orchid, Virginia chain fern, marsh valerian, common loon, spruce grouse, sedge wren, spotted turtle, and western chorus frog.

Shoreline Stabilization

Vegetated wetlands along the shores of lakes or the banks of rivers can protect against erosion caused by waves and strong currents. These wetlands dissipate wave and current energy, trap sediments, and bind and stabilize the wetland substrate. Wide wetlands with dense woody vegetation are most effective, but as can be observed in many locations along the shores of Lake Champlain, emergent wetlands such as deep bulrush marshes also contribute significantly to stabilizing the shoreline.

Beavers and Wetland Communities

Beaver alteration of wetlands is a form of natural disturbance and generally occurs in cycles that may span decades. Wetlands created and influenced by beavers are widespread and represent some dynamic and diverse wildlife habitats. These wetlands provide important habitat for a wide array of wildlife from wood ducks and Canada geese to mink, otter, and of course, beaver. Dam construction and creation of an impoundment typically kills all woody plants in the affected area and can drastically alter species composition. Over a period of years, however, beavers typically deplete their local food supply — woody species that grow near their pond — and move to other suitable habitat. Although the impoundment may persist for years, eventually the dam may fail and the pond drains. The resulting wet mud flats are colonized by annuals, then perennials, and finally woody plants after several years. All the successional wetland types created as part of this cycle are important habitats for numerous species of plants and animals.

FORESTED WETLANDS TYPES

Floodplain Forests are usually dominated by silver maple, red maple or sugar maple, with abundant ostrich fern or sensitive fern. They are closely associated with river and lake floodplains and have exposed mineral soils of alluvial origin.

Hardwood Swamps are dominated by broad-leaved deciduous trees, but may have lesser amounts of conifers. Dominant trees may be red maple, silver maple, black ash, green ash, or black gum. Soils are mineral or organic.

Softwood Swamps are dominated by conifers, including northern white cedar, red spruce, black spruce, balsam fir, tamarack, and hemlock. Broad-leaved deciduous trees may be present but are less abundant than conifers. Soils are mineral or organic.

Seeps and Vernal Pools typically are very small and occur in depressions or at the base of slopes in upland forests. Trees in the wetland may be scarce, but there is an overhanging canopy from the adjacent forest. Seeps have abundant groundwater discharging at their margins and usually a lush growth of herbs. Vernal pools are depressions that fill with water in the spring and fall and typically have little herbaceous cover.

OPEN WATER WETLANDS TYPES

Open Peatlands have stable water tables at or near the soil surface, generally lack seasonal flooding, and mosses and liverworts are consistently abundant. Trees are generally absent or sparse, except in black spruce woodland bogs and pitch pine woodland bogs.

Wetlands created and influenced by beavers are widespread and represent some dynamic and diverse wildlife habitats.

Marshes and Sedge Meadows have standing or slowly moving water with depths that may fluctuate seasonally. The soils are primarily mineral, with well-decomposed organic mucks in some cases. Herbaceous plants are dominant.

Wet Shores are sparsely vegetated wetland communities occur along the shores of rivers and lakes and are subject to seasonal flooding and scouring. The soils are mineral and include mud, sand, gravel, and cobble.

Shrub Swamps typically have significant seasonal flooding and variable soil types. Shrubs that typically dominate include speckled alder, willow, sweet gale, and buttonbush.

HOW TO PROTECT, ENHANCE, OR CREATE A WETLAND

Wetlands are one of the most sensitive and biologically rich habitats that occur in Vermont and the best way to manage wetlands is by protecting them from development or other disturbance. Establishing wide buffers around the perimeter of a wetland may be the best approach for managing to conserve the wildlife functions of the habitat. Natural wetlands, which developed across thousands of years, are hard to duplicate because of their complexity. Preserving those that are not currently altered by humans is often the best way to maintain existing functions, including wildlife habitat.

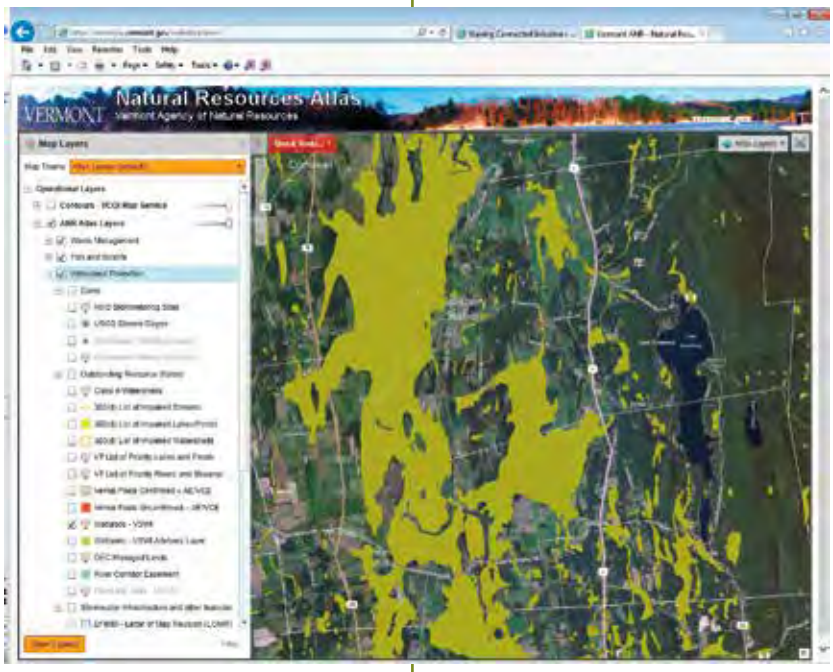


Figure 12.1
Map of wetlands as shown by the ANR Atlas

The Vermont Fish and Wildlife Department can provide detailed information on occurrences of significant wetland natural communities as well as technical assistance on wildlife habitats and use in wetlands. In addition, vernal pools are being mapped throughout the state and more information is available online or through the Vermont Fish and Wildlife Department (see Figure 12.1 and **Resources** for link).

Wetlands that have been dredged, drained, filled, or otherwise altered may offer an opportunity for restoration. Often, blocking a ditch or removing a portion of a field tile line may be all that is needed to restore water levels the support wetlands. Contact the Vermont Department of Environmental Conservation Wetlands Program or the U.S.D.A. Natural Resources Conservation Service for more information. Websites for both programs can be found in **Resources.**

"Enhancement" of an existing wetland can be difficult, and improving surrounding upland habitats is generally more effective. Enhancement efforts, however, may include removing nuisance plants and adding nest structures and other habitat improvements. To maintain and increase the size of naturally vegetated wetland buffers provides for wildlife travel corridors and screening for wildlife that are feeding and resting in wetlands. Refer to the chapters on waterfowl and beaver management for more information.

Other management options for enhancing the wildlife value of wetland habitats include:

- Install nesting structures to encourage ducks, geese or other waterfowl dependent birds to use the wetland for reproduction;
- Retain mature standing dead trees for nesting habitat for wood ducks and other cavity nesting birds and to serve as perches for raptors and other birds;
- If possible, control water levels. This is not typically the case and is not recommended without a qualified wildlife biologist. Draw advice from a biologist during the growing season to encourage prolific growth of smart weed and other native wetland plants that are of high food value to waterfowl and other wetland wildlife;
- Plant nut-producing trees, such as white oak, along the edge of the wetland to produce a valuable food resource;
- Where beavers occur, allow them to create wetlands, where appropriate — beaver influenced wetlands can become highly productive wildlife habitat;
- Retain shrub and herbaceous cover adjacent to within 1/2 mile of a wetland where it occurs — this serves as important nesting cover for mallards and other ground-nesting waterfowl that will use the wetland once their eggs hatch (delayed mowing or brush hogging is a useful approach);
- Carefully remove invasive plants such as phragmites and purple loosestrife. Follow proper protocols to prevent the seeds and roots from being dispersed to other locations.

Creating wetlands can also help wildlife, but this process may be both difficult and expensive depending on site characteristics. Wetland creation is most often done for mitigation of wetlands. Often created wetlands do not function correctly and result with failed projects due to incorrect soils, vegetation, and other factors. Wetland creation and restoration is a complicated science that involves engineering expertise and is not recommended without the guidance of an experienced wetland restoration expert. The U.S.D.A.'s Natural Resource Conservation Services and the U.S. Fish and Wildlife Service (links for which are provided in **Resources**) may provide guidance on opportunities for wetland restoration.

VERNAL POOLS

What Are Vernal Pools?

Vernal pools are small (generally less than 1 acre), ephemeral pools that occur in natural basins within upland forests. Vernal pools typically have no permanent inlet or outlet streams and have very small watersheds. These temporary pools generally last only a few months and then disappear by the end of summer, although some pools may persist in wet years.

During their dry period, vernal pool depressions may be recognized by the sparse vegetation and by stained leaves marked by seasonal high water. Vernal pools typically lack trees but are shaded by trees growing in the surrounding upland forest, with highly variable vegetation within the depression.

For vernal pools to be effective breeding habitats for amphibian populations, they must retain water for at least three months during the spring and summer breeding season in most years so that amphibians can complete their larval stage.

Why Are Vernal Pools Important?

Vernal pools are perhaps best known as breeding habitat for amphibians. Typical Vermont species that rely heavily on vernal pools for reproduction include the mole salamanders (spotted salamander, blue-spotted salamander, and Jefferson salamander), eastern four-toed salamander, and wood frog. For vernal pools to be effective breeding habitats for amphibian populations, they must retain water for at least three months during the spring and summer breeding season in most years so that amphibians can complete their larval stage.

The periodic drying of a vernal pool excludes populations of predatory fish and diving beetles that prey on amphibian larvae. Other animals use the pools as well, such as fairy shrimp, fingernail clams, snails, eastern newts, green frogs, American toads, spring peepers, and a diversity of aquatic insects. The amphibians and invertebrates found in vernal pools constitute a rich source of food for various species of mammals, reptiles, and birds such as wood ducks, mallards, black ducks, and great blue herons. Despite their small size and temporary nature, vernal pools are highly productive ecosystems. For more information on vernal pools, see the Natural Resource Conservation Service's website at the link in **Resources**.

THREATS TO VERNAL POOLS

Vernal pools and the species that depend on them are threatened by activities that alter the earth and water in and around the pool, as well as by significant alteration of the surrounding forest. Construction of roads and other development in the upland forests around vernal pools can block salamander migration. Poorly managed timber harvesting can have significant effects on vernal pools, including altering the vernal pool depression, changing the amount of sunlight and organic debris that reaches the pool, and disrupting amphibian migration routes by creating deep ruts. Even when the pool is dry, altering the depression may affect its ability to hold water and may disrupt the eggs of invertebrates that form the base of the vernal pool food chain.

MANAGEMENT RECOMMENDATIONS

Management of a vernal pool needs to include the surrounding upland habitat as well as the breeding pool. The area used by an amphibian population can be represented by three management zones: the breeding pool, a zone that extends to 100 feet around the pool, and a third zone that extends to 600 feet from the pool edge.

Breeding pool. This area includes the pool depression measured at spring high water. During dry periods, you can determine the high water mark using such evidence as watermarks on trees within the depression, water-stained, compressed or silted leaves, or an obvious change in topography at the pool edge.

Leave breeding pools undisturbed, with no cutting, heavy equipment, skidding, storage of slash or other woody debris, or sedimentation within these depressions during any season.

The 100-foot zone. Avoid land clearing, development including roads and driveways, use of pesticides, herbicides or fertilizers, and barriers to amphibian movement. Consider only light cutting or no cutting, such that at least an 80 percent canopy cover remains within this zone. Harvesting within this area should only occur on completely frozen ground in mid-winter.

NABS Factsheet

Getting Started with Bluebirds

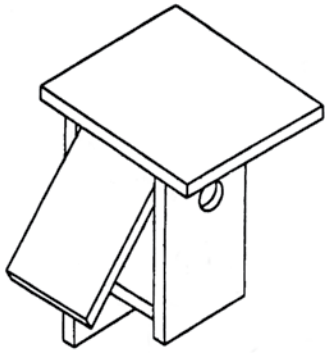
Over the years, land has been cleared for housing and commercial developments, highways and agriculture, and many old trees have been cut down. Wooden fence posts that provided nesting cavities have been replaced with metal posts. With modernization, the supply of natural nesting cavities for bluebirds and other native cavity nesters has been greatly reduced.

Dave Kinneer

Habitat loss was compounded by the introduction into North America of two imported species—the European Starling and the House Sparrow (not to be confused with sparrows that are native to North America, such as the Song Sparrow, Tree Sparrow, etc.). Both starlings and House Sparrows are cavity nesters. Both are very aggressive. House Sparrows are small enough to enter any hole that a bluebird can, and will chase away or kill bluebirds. Starlings can be excluded from entering nestboxes boxes by using the correct size entrance hole, but will out-compete bluebirds for woodpecker holes and other natural nesting cavities.

During the summer, bluebirds feed mainly on insects. In the winter, they depend on wild berries. However, the supply of wild berries has decreased over the years. The few that remain are often quickly stripped by large flocks of starlings.

Even though bluebird populations have decreased, their future can still be promising. The most important step we can take to help bring back the bluebird is to provide nesting sites by setting out a bluebird nestbox or starting a bluebird trail. A bluebird trail is a series of bluebird boxes placed along a prescribed route. In areas where nestboxes have been put up in suitable habitat, bluebird populations are increasing.

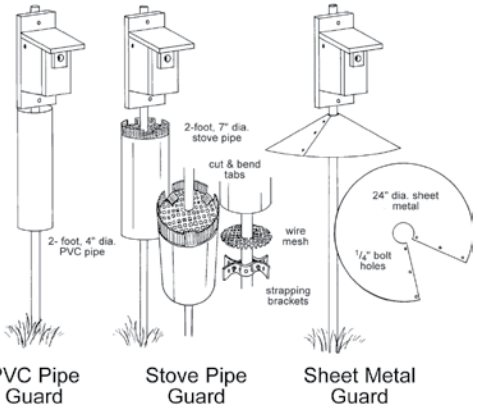


THE BLUEBIRD NESTBOX

- A good bluebird box should be well ventilated, watertight, and have drainage holes. It should be easy to open, monitor, and easy to clean.
- Solid, untreated wood is an ideal material, although exterior grade plywood can be used. The **outside** of boxes can be painted or stained if a light color is used.
- A bluebird box should not have a perch. Predatory House Sparrows and House Wrens are attracted to perches.
- Nestboxes for Eastern Bluebirds should have a round entrance hole measuring 1½" to 19/16" in diameter.
- Although bluebirds seem to prefer oval holes, smaller European Starlings may be able to enter them, especially if they are not **exactly** 1⅜" x 2¼". Nestboxes that are on the small to moderate side reduce the possibility of starling use.

MOUNTING THE BLUEBIRD BOX

- Smooth round pipe is probably the best and simplest mounting system to use
- Avoid mounting bluebird boxes on a fenceline or on trees where climbing mammals or snakes are present.
- Hardware cloth, or a wobbling stovepipe (Kingston) or PVC baffle placed on the pole directly underneath the box helps prevent access by climbing predators, including snakes



SETTING UP A BLUEBIRD TRAIL

- Habitat is the key factor to consider when setting up a bluebird trail. Open rural country with scattered trees and low or sparse ground cover is best. Suitable habitat should include a fence line, wires, tree branches, or other sites where bluebirds can perch to search for food. If bluebirds do not like the habitat, they probably will not use your nestboxes.
- Open pastureland, parks away from human traffic, and mowed areas such as cemeteries and golf courses are all good locations for a bluebird trail.
- Avoid areas of heavy pesticide use.
- Mount nestboxes at least 50–200 feet away from brushy and heavily wooded areas—this is the habitat of the House Wren, a native species that may destroy bluebird eggs and/or compete with bluebirds for nestboxes.


Susan Tartaglino

- Avoid areas where the House Sparrow is abundant, such as farmsteads and feedlots, or where people feed cheap birdseed containing millet and cracked corn. House Sparrows are vicious competitors. People who successfully raise bluebirds (and other native secondary cavity nesters) in House Sparrow territory generally trap and euthanize House Sparrows that invade nestboxes, but this may be too late to save young or adult bluebirds from House Sparrow attack.

Luc Viatour

- For convenience, mount nestboxes so the entrance hole is approximately five feet (eye level) above the ground.
- Face the nestbox away from prevailing winds, and if possible, face it toward a tree or shrub that is within 100 feet of the box to provide a landing spot for the young bluebirds when they first leave the box. This will keep them off the ground, away from predators.
- Nesting density is dependent on many factors. These factors include population density, habitat suitability, food supply, individual tolerance levels, visibility between boxes, the number of cavities available, weather, and the level of competition from other species (especially Tree Swallows or, in the West, Violet-green Swallows). It is therefore difficult to predetermine the optimal spacing for any given area. The following distances are given as general guidelines only;

  Eastern Bluebirds — 100 yards minimum — 125 to 150 yards apart may be better

- Nestboxes can be mounted in pairs in areas where Tree Swallows are abundant.
- Although bluebirds generally prefer rural areas, they will nest in golf courses, cemeteries, and along the outer edges of cities or in small towns.

Bluebirds usually begin to nest in late March or early April, depending on weather conditions. In southern states, where bluebirds reside year round, nesting may occur even earlier.

Bluebirds usually lay 4 or 5 light blue eggs, but may lay as many as 6 or 7. About 4–5% of bluebirds lay white eggs.

The typical incubation period for bluebird eggs is 12–14 days. A rule of thumb for Eastern Bluebirds is that eggs will hatch 17 days after the first egg is laid. Nestlings remain in the nest 17–21 days before they fledge.

Chronic Wasting Disease

Cornell University
College of Veterinary Medicine
Animal Health Diagnostic Center

BASICS

Chronic Wasting Disease (CWD) is a transmissible spongiform encephalopathy (TSE) causing **NEUROLOGIC DISEASE** in mule deer, white-tailed deer, elk, and moose. It is caused by an infectious prion, which is a misfolded protein.

CWD IS FATAL IN ALL CASES. Most animals will survive for a year or more, but death is inevitable.

CLINICAL SIGNS include decreased control of body movements and wide-based stances, head tremors, or carrying their head and ears lowered. Affected animals may walk in repetitive courses, sleep for excessively long periods of time, or be found near water sources or in riparian areas.

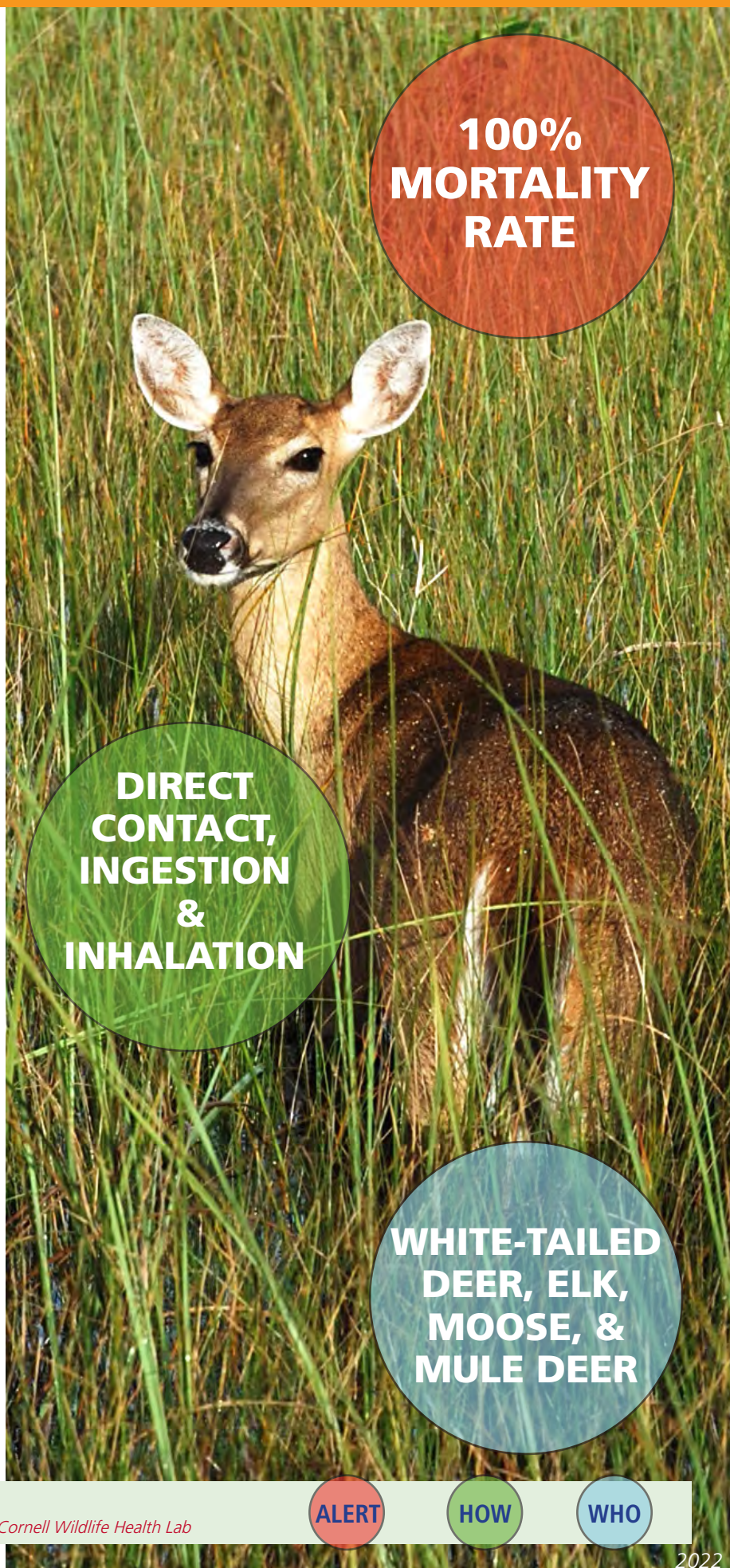
They will continue to eat but in decreasing amounts, which leads to a gradual **DECLINE IN BODY CONDITION.**

In the terminal stages, excessive drinking and urination are common as well as excessive salivation and drooling. Clinical signs are often more subtle and prolonged in elk.

TRANSMISSION occurs directly through contact with an infected animal or indirectly through contact with a contaminated environment. Live animals shed prions in saliva, feces, and urine, which can bind to soil and remain infectious.

DIAGNOSIS of CWD is most often done by testing the obex region of the brain or the retropharyngeal lymph nodes. Testing will determine if CWD prions are present or not detected.

There are **NO TREATMENTS** or vaccines available. Prevention is the most cost-effective control measure.



DETAILS

HISTORY CWD was discovered in captive mule deer in 1967 in Colorado, but wasn't identified in the wild until 1981 when Colorado found an affected elk. The origin of CWD is unknown, but may have originated from scrapie. Scrapie, CWD, and "mad cow" disease are in the same family of diseases known as "transmissible spongiform encephalopathies."

CWD has now been found in 27 states and 4 Canadian provinces. CWD has been identified in South Korea, Norway, Finland, and Sweden.

TRANSMISSION CWD prions can be spread directly from animal-to-animal contact or indirectly from infected carcasses, animal parts, product, or contaminated environments. Prions are found throughout the body and in saliva, feces, and urine. They are shed by live animals before they appear sick. Prions bind to soil and plants and remain infectious in the environment for years.

Species affected by CWD include white-tailed deer, mule deer, elk, red deer, reindeer/caribou, and moose, including subspecies. Carnivores and scavengers have not become infected although they have been shown to be able to pass infectious prions in their feces.

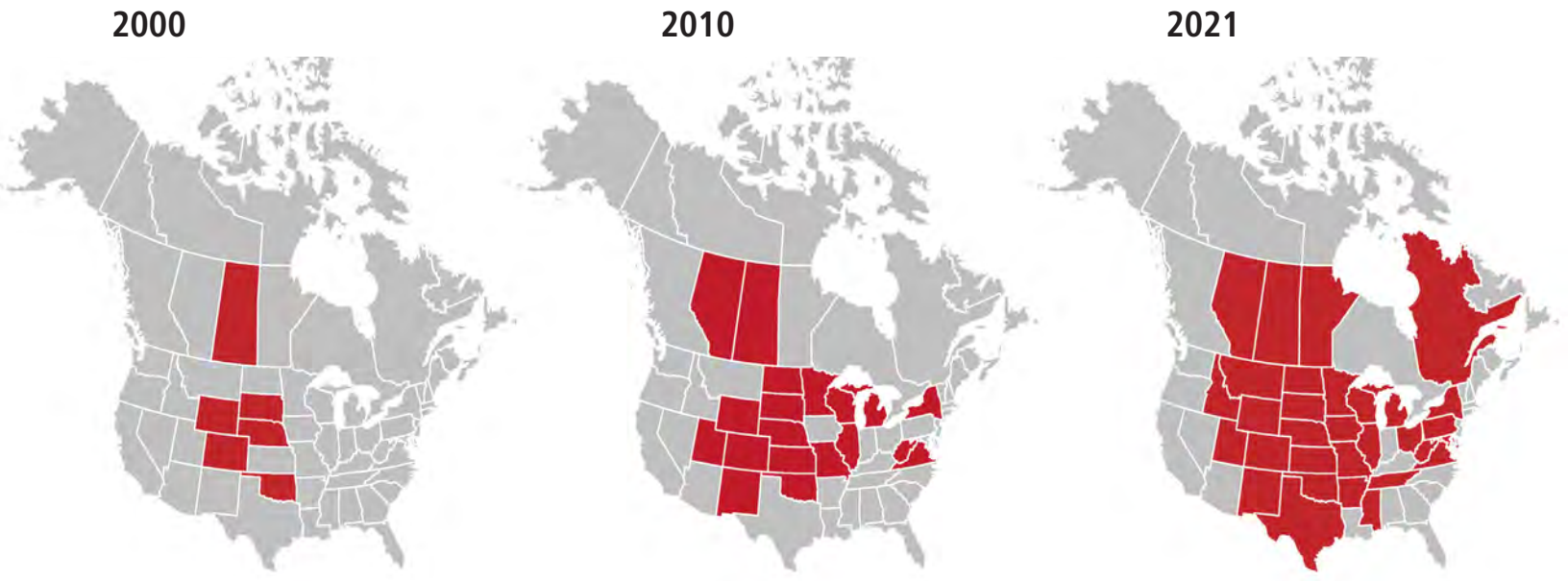
No human cases of CWD have been reported. However, the Centers for Disease Control and Prevention (CDC) recommends that no one knowingly consume CWD-positive animals. In CWD-positive areas, the CDC recommends that hunters consider testing harvested animals before eating the meat. Cooking the meat does not inactivate the CWD prion.


CWD infected deer

CWD can negatively impact deer and elk populations. Once the prevalence (% of animals infected) reaches critical points, populations may begin to decline. Deer infected with CWD do not live as long as unaffected deer. Males (bucks) are more likely to be infected than females (does).

Prions are resistant to normal disinfection procedures that kill most disease agents like bacteria or viruses.

Once CWD is established in a wild population, it has been nearly impossible to eliminate the disease. When CWD is found in captive deer and elk herds, those animals are often euthanized to prevent further spread of the disease to wildlife.



Progression of states and provinces where CWD has been detected, 2000-2021

White-Nose Syndrome

Cornell University
College of Veterinary Medicine
Animal Health Diagnostic Center

BASICS

White-nose syndrome (WNS) is caused by the **FUNGUS** *Pseudogymnoascus destructans*. The fungus thrives in the cold, humid conditions characteristic of hibernacula, underground caves or mines where bats overwinter. The fungus grows on the nose, wings, and ears of bats during **HIBERNATION** in the winter months. The mortality rate is often as high as 90-100%.

MILLIONS of bats have died from WNS since 2006. There are now 37 states and 7 Canadian provinces with confirmed cases of WNS in bats. The fungus has also been detected in three additional states and one more province.

CLINICAL SIGNS of the growth of *P. destructans* on hibernating bats is typically seen as a **WHITE FUZZ** on the bat's nose. The fungus may also be visible on the bat's wings, ears, or tail. Lesions and scarring found on bat wings may be the result of exposure to the fungus.

The fungus is **SPREAD** from bat-to-bat and from the environment to bats. The fungus can **SURVIVE** in cave sediment leaving the potential for new infections the following winters.

DIAGNOSIS of WNS involves laboratory identification of the white fungus and tissue lesions consistent with an infection. Methods to identify the fungus include fungal culture, histopathological examination (tissue analysis under a microscope), and PCR (testing for fungal DNA).

There is no practical **TREATMENT** for colonies affected with WNS.

DETAILS

White-nose syndrome was first documented in Scoharie County, New York in 2006. It almost exclusively affects **HIBERNATING BATS** and about half of the 47 bat species in North America hibernate during the winter.

White-nose syndrome has been **CONFIRMED** in 12 species of bats: big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), eastern small-footed bat (*Myotis leibii*), the threatened northern long-eared bat (*Myotis septentrionalis*), tri-colored bat (*Perimyotis subflavus*), cave bat (*Myotis velifer*), fringed bat (*Myotis thysanodes*), long-legged bat (*Myotis volans*), western long-eared bat (*Myotis evotis*), Yuma bat (*Myotis yumanensis*), the endangered gray bat (*Myotis grisescens*), and the Indiana bat (*Myotis sodalis*).

An additional six species, including the endangered Virginia big-eared bat (*Corynorhinus townsendii virginianus*) and Ozark big-eared bat (*Corynorhinus townsendii ingens*), have had *P. destructans* detected but did not have signs of WNS disease. In New York, little brown bats were the first to be affected and have sustained the most number of deaths, resulting in **POPULATION DECLINES** of 90-100% in caves. Half of the endangered Indiana bats that hibernate in New York are located in a former mine which is now contaminated with the fungus. The fungus is not known to affect humans.

CLINICAL SIGNS While bats hibernate, their body temperature drops and fat reserves are utilized during the winter. The wing membranes provide a particularly favorable cold and high humidity substrate for the growth of the fungus.

ABNORMAL BEHAVIOR during the winter is a sign of illness. Bats may fly outside during the day at below freezing temperatures or may be found clustered near entrances of hibernacula. Groups of dead or dying bats may be found at other locations.

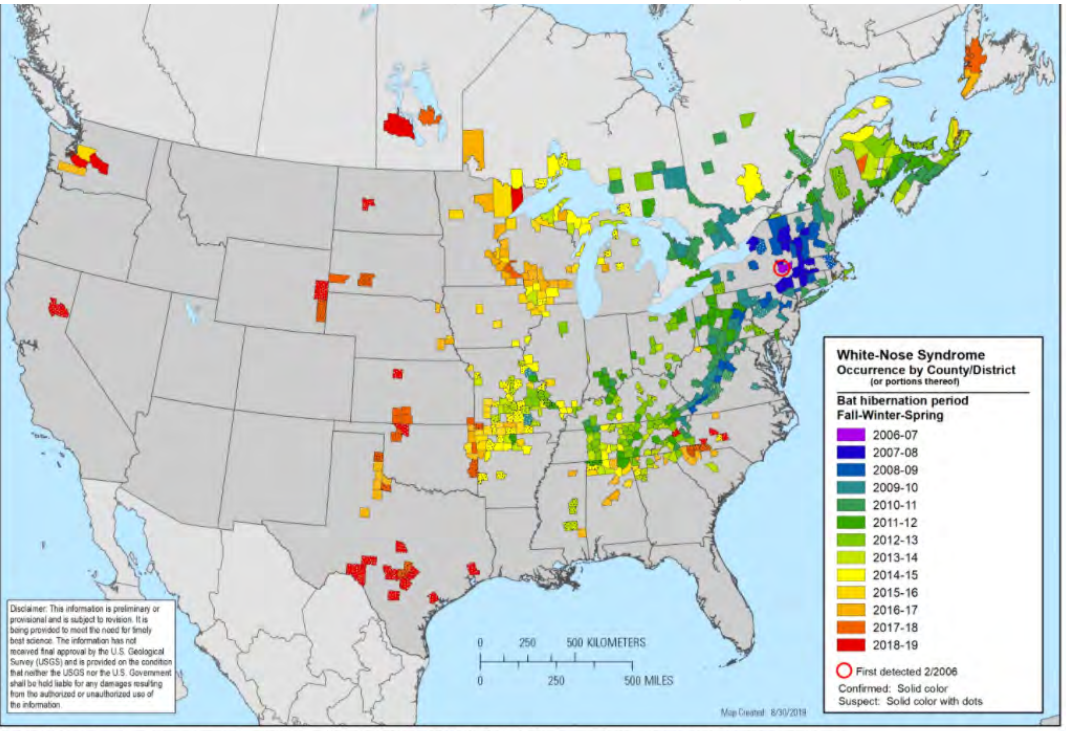
Bats are thought to die of WNS because of **STARVATION** and loss of fluids and electrolytes across damaged wing membranes. They arouse more often and earlier than normal while hibernating because of the fungus, which burns vital fat reserves. They may also leave their hibernacula during the winter in search of food. The insect-eating bats are **UNABLE TO FIND FOOD** to replenish their reserves and die. Although the majority of deaths occur during the winter, deaths can occur year round. Wing damage may contribute to deaths throughout the year.

TRANSMISSION In addition to bat-to-bat and environment-to-bat, **HUMANS** are believed to have contributed to the spread of the fungus from cave to cave by carrying fungal spores on their clothes and recreational caving and research equipment.

TREATMENT Research is underway involving vaccines, antifungal chemicals, and modifying hibernation habitats.

To **MINIMIZE SPREAD** of the fungus, people should not handle bats, avoid entering caves and mines with bat colonies, and should decontaminate all equipment and clothing between caves and bat roosts (see the National White-Nose Syndrome Decontamination Protocol).

A North American Bat Monitoring Program was started in 2015 to track changes in bat populations. For a live map, please visit https://www.whitenosesyndrome.org/where-is-wns.



Citation: White-nose syndrome occurrence map - by year (2019). Data Last Updated: 8/30/2019. Available at: https://www.whitenosesyndrome.org/static-page/wns-spread-maps.

Rodenticide Toxicity

Cornell University
College of Veterinary Medicine
Animal Health Diagnostic Center

BASICS

Rodenticide toxicity can be caused by any of several types of rodent poisons that fall into two general categories, anticoagulants and non-anticoagulants. **ANTICOAGULANT RODENTICIDES** work by interfering with the activation of Vitamin K, a critical component in the production of blood clotting factors in the liver. **NON-ANTICOAGULANT RODENTICIDES** vary in their mechanism of action and include bromethalin, strychnine, cholecalciferol, and zinc phosphide.

Rodenticides are **TOXIC** to many species of birds and mammals including pets, farm animals, and wildlife species. The time between **EXPOSURE AND DEVELOPMENT** of clinical signs is dependent upon the specific chemical and amount consumed.

Ingestion of a significant amount of **ANTICOAGULANT** rodenticides results in interference with blood coagulation and spontaneous bleeding. Specific **CLINICAL SIGNS** can include widespread bruising, bleeding into body cavities, and blood in the urine or feces; if the bleeding is sudden and significant, then cardiovascular shock and death can result. Bleeding can occur **INTERNALLY OR EXTERNALLY** and can affect any part of the body.

NON-ANTICOAGULANT rodenticide toxicity symptoms are more variable and are dependent on the chemical and dose. The **CLINICAL SIGNS** include rapid onset of seizures, muscle tremors, limb weakness, ataxia, neurologic signs, respiratory paralysis, anorexia, nausea, vomiting, diarrhea, and lethargy.

There are currently **NO BLOOD TESTS FOR BIRDS** for anticoagulant rodenticide exposure.

Diagnosis of non-anticoagulant rodenticide toxicity is based on detection of the chemical in the **DIGESTIVE SYSTEM OR TISSUES** of the animal.

Vitamin K is used to treat anticoagulant rodenticide intoxication and help restore normal coagulation. The treatment for non-anticoagulant rodenticide poisoning is typically only supportive care.

DETAILS

Over 40 cases of rodenticide poisonings in wildlife were identified by the New York State Wildlife Health Program between 2012 and 2014. Animals affected included several species of birds that prey on rodents, including red-tailed hawks and owls. In addition, squirrels, skunks, raccoons, and woodchucks died from rodenticide poisoning.

Lack of vitamin K prevents the liver from making blood clotting factors, and once the body stores run out, blood will **NOT CLOT** normally. Common anticoagulant rodenticides include warfarin, diphacinone, chlorphacinone, brodifacoum, difenacoum, and bromadiolone.

Anticoagulants vary in **TOXICITY** to nontarget species. The "first generation" chemicals such as warfarin require multiple ingestions of bait to result in toxicity, while anticoagulants like chlorophacinone and diphacinone are more toxic and require fewer feedings to result in intoxication. Chemicals considered "second generation" anticoagulants (SGARs) are highly toxic after a single feeding and include brodifacoum, difenacoum, and bromadiolone.

TRANSMISSION Although the targets of rodenticides are rodent pests, non-target animals can ingest the products from open bait containers or indirectly become exposed by consuming poisoned rodents. Pets and children are at risk of consuming rodenticides used in the household, and caution should be used when setting household baits to avoid accidental poisoning.

Because animals maintain body stores of blood clotting factors, there is typically a delay of 3-5 days between ingestion of the anticoagulant rodenticides and the onset of bleeding. In many cases of secondary poisoning (ingestion of poisoned rodents), smaller, non-lethal doses are consumed repeatedly. Because these compounds can last in the liver of the animal for months, these repeat exposures may have cumulative effects on coagulation.

BROMETHALIN can cause rapid onset of seizures when high doses are consumed along with clinical signs such as muscular hyperexcitability, muscle tremors, increased reflexes in the hind limbs, and hyperthermia (elevated body temperature). At lower doses animals may have hind limb weakness, ataxia (imbalance), and depression. There is no available antidote for bromethalin exposure.

STRYCHNINE inhibits the neurotransmitter glycine in the spinal cord. Poisoning occurs within one hour of ingestion and can lead to neurologic signs such as muscle twitching, stiffened neck, dilated pupils, seizures, and hypersensitivity. Animals can have severe muscle rigidity and seizures which increase in frequency. Eventually exhaustion or respiratory paralysis can lead to death.

CHOLECALCIFEROL (Vitamin D3) increases serum phosphate and calcium and may lead to kidney failure, cardiac abnormalities, and hypertension, as well as nonspecific clinical signs. Calcification of soft tissues because of the high calcium and phosphorus levels is possible.

ZINC PHOSPHIDE releases phosphine gas into the bloodstream following contact of the bait with stomach acid. Nonspecific clinical signs can include anorexia, nausea, vomiting with or without blood, diarrhea, and lethargy.

DIAGNOSIS Anticoagulant rodenticide toxicity is suspected when an animal has signs of spontaneous hemorrhage and rodenticide in the blood or liver. Because of the delay between ingestion and clinical signs, the bait or poisoned rodent is usually not present in the digestive tract by the time the animal is sick.

In **DOMESTIC ANIMALS,** a special blood test called a coagulation panel will show prolonged prothrombin time (PT), activated partial thromboplastin time (APTT), or thrombin time along with normal fibrinogen, fibrin degradation products, and platelet counts.

Laboratory detection of anticoagulant in the blood, liver, or kidney **DOES NOT NECESSARILY CONFIRM** rodenticide poisoning as cause of death in wild animals because many live wild animals have exposure to these compounds.

Bromethalin poisoning can be diagnosed based on history, clinical signs, and the presence of the chemical in liver, kidney, brain, or fat. Zinc phosphide poisoning is difficult to diagnose because phosphine gas doesn't remain long in the stomach.

TREATMENT Because the second generation anti-coagulant rodenticides can be very long acting, treatment may be required for weeks to months.

When ingestion is recent, stomach flushing or induction of vomiting followed by activated charcoal administration can help prevent more absorption. Cholecalciferol treatment may include medications to increase calcium excretion in the urine and help prevent absorption from the digestive tract.

Lead Toxicosis

Cornell University
College of Veterinary Medicine
Animal Health Diagnostic Center

BASICS

Lead is a heavy metal found in mineral deposits around the world. It has been widely used in many industries including ammunition and fishing tackle. Lead has no biological function and is toxic to all animals.

ALL ANIMALS are susceptible to lead toxicosis, although the effects are most often seen in birds, especially loons and swans, condors, vultures, and eagles. Other bird species, including crows, robins, mourning doves, upland game birds, and domestic poultry, have also been seen with lead toxicosis.

CLINICAL SIGNS of lead toxicosis in birds include incoordination, weakness, drooped wings, anorexia, reduced activity, and green watery diarrhea. Toxic effects may cause birds to be more vulnerable to predation, trauma, and other diseases. Birds may become emaciated and die within 2-4 weeks of ingesting lead.

The most common route of **EXPOSURE** to lead for birds is through ingestion of spent lead ammunition fragments and fishing tackle.

In live birds, **DIAGNOSIS** of lead toxicosis is made by assessing clinical signs and measuring lead levels in blood. In dead birds, lead levels in liver and kidney can be measured. Radiographs can be used to detect lead fragments in the gastrointestinal tract or tissues of affected animals.

Lead toxicosis can be **TREATED** with lead chelating agents and supportive care, although many birds are too severely affected for treatment to be successful. Removal of lead particles in the gastro-intestinal tract or tissues of wild species is necessary to prevent continued exposure to lead.

State wildlife agencies, including NYSDEC, and conservation groups encourage the use of **NON-LEAD** ammunition and fishing tackle to reduce lead exposure for wildlife. Because lead ammunition fragments upon impact, lead particles can be found in meat processed from hunter-killed animals posing a risk to people eating those meats.

DETAILS

The toxic effects of lead have been known for thousands of years. Regulations prohibiting the use of lead in paint, plumbing, and gasoline have acted to reduce the risk of lead toxicosis in humans. However, lead continues to be used in ammunition and fishing tackle leading to **LEAD TOXICOSIS IN WILDLIFE**, especially bird species.

SPECIES AFFECTED The incidence of lead toxicosis in bird species is related to their diet and digestive anatomy and physiology. Waterfowl have very muscular gizzards for grinding plants in their diet and ingest small rocks to facilitate this grinding. Any lead that is ingested is also subject to grinding, leading to its absorption in the gastrointestinal tract and bloodstream.

Although raptors have less muscular gizzards because of their meat diets, they have highly acidic stomach fluids. Ingested food and lead particles spend more time in the stomach than in other birds. Both of these features favor increased digestion and absorption of any ingested lead compared to other species of birds.

MAMMALS, such as bears, coyotes, and raccoons, that scavenge gut piles of game animals killed with lead ammunition are at risk of lead toxicosis. Domestic ruminants have been seen with lead toxicosis after ingesting lead batteries.

TRANSMISSION Lead can be taken up by animals through ingestion, inhalation, or skin absorption.

Common loons have been **SEVERELY AFFECTED** by lead toxicosis related to ingestion of lead fishing tackle. Loons strike at fish or tackle as they are being reeled in. The birds may also prey upon fish that have ingested fishing tackle and are impeded by trailing lines. Lost tackle may be ingested as grit or mistaken as a prey item.

SCAVENGING RAPTORS, such as California condors and eagles, may ingest spent lead ammunition fragments in carcasses or offal piles.

LEAD ACCUMULATES in the environment and is taken up by plants. For decades, mining waste containing lead was discharged into the Coeur d'Alene river system in Idaho. As a result, tundra swans have been severely affected by lead toxicosis as they burrow into the contaminated mud to feed on roots and tubers.

CLINICAL SIGNS Lead competes with calcium in the body and inhibits enzymes leading to toxic effects in all body systems. Competition of calcium by lead results in neurologic and reproductive effects. Inhibition of the enzyme used in the synthesis of hemoglobin causes anemia in affected animals.

DIAGNOSIS Although there are no safe levels of lead in blood and tissues, suggested diagnostic guidelines for lead concentrations in tissues and blood are typically published by testing laboratories.

TREATMENT Chelation therapy is used to remove lead from the body. A chelating agent, such as EDTA, binds to lead in the body and both are excreted in urine.

PRECAUTION AND PREVENTION The waterfowl lead shot ban in 1991 effectively reduced lead exposure in waterfowl in the US although the use of lead in fishing tackle continues to put waterfowl, especially loons, at risk of lead toxicosis. In addition, spent lead shot still remains in the environment and may be ingested by waterfowl, wading birds, and upland game birds.

Some states, including New York, ban the use of some lead fishing tackle based on size and weight.

LEAD AMMUNITION is commonly used for deer hunting and other activities. Solid copper bullets are an alternative, non-toxic ammunition for hunters. If lead ammunition is used, proper disposal of gut piles when field dressing carcasses is important to limit access by scavenging animals. Covering, burying, or removing gut piles is recommended. Covering offal with snow is not effective, because the gut pile will be exposed as the snow melts.

IMPACT Each year in the US, **10-20 MILLION** animals die from lead toxicosis. In addition to these individual deaths, lead has negatively affected populations of birds, most notably California condors, bald eagles, and common loons. These birds are long-lived with longer times to sexual maturity making them particularly susceptible to the population effects associated with the loss of breeding adults due to lead toxicosis.

Spent lead shot in the environment is a hazard to birds and other animals.

Chytridiomycosis

Cornell University
College of Veterinary Medicine
Animal Health Diagnostic Center

BASICS

Chytridiomycosis is an infectious disease of amphibians caused by the fungus *Batrachochytrium dendrobatidis* (*Bd*). It an emerging disease that is significantly impacting amphibian populations across the globe. The disease has caused the **DECLINE OR COMPLETE EXTINCTION** of over 200 species of frogs and other amphibians.

Chytrid disease is known to affect **OVER 350 SPECIES** of amphibians, though it appears to be impacting frog species most severely. However, the disease does not have an effect on all frog species.

Bd infects the **KERATIN LAYER** of the skin, where it multiplies by producing zoospores, which are shed into the environment. The zoospores can live for weeks in **WATER** depending on the temperature.

CLINICAL SIGNS vary by species. The earliest signs of chytrid disease tend to be anorexia and lethargy. Most frogs experience **EXCESSIVE SHEDDING** of skin, which appears opaque and gray-white or tan in color.

Other **COMMON SIGNS** include red skin, convulsions, lack of the righting reflex (a reflex that corrects the orientation of the body after it has been taken out of its normal upright position), abnormal feeding behavior, and discoloration near the mouth.

Bd is a waterborne fungus that disperses into the environment in order to search for a new host. The fungus travels through **WATER SOURCES** until it finds a new host, and enters through the skin.

DIAGNOSING true chytridiomycosis (disease, not just infection) requires histopathologic examination of tissues from dead animals.

It is impractical to **TREAT** amphibians in the wild, and the zoospores can be widespread in the environment. There is **NO VACCINE.**

Chytridiomycosis is easily spread by human activity. Boots, clothes, and equipment should be cleaned. Wild amphibians **SHOULD NOT BE MOVED** between habitats.

DETAILS

Chytrid was first discovered in 1993 in Australia after a **MASSIVE MORTALITY** event involving several species of frog. Further studies conducted on preserved amphibian specimens have shown that *Bd* has been present in Australia since 1978 and that the disease may have originated in Africa in as early as 1938.

Chytrid disease is believed to be responsible for one of the **MOST SIGNIFICANT LOSSES OF BIODIVERSITY FROM DISEASE** in recorded history.

Currently, the American bullfrog and the African clawed frog appear to be **RESISTANT** to the disease, but may still act as carriers. The disease is not known to affect humans.

Chytridiomycosis is present on **EVERY CONTINENT** except for Antarctica, though the disease is having the biggest impact in South and Central America, Australia, and North America. In the United States, chytrid disease has been confirmed in 46 out of the 50 states.

In Canada, infection with *Bd* has been found in various species of frogs from at least 7 provinces and the Northwest territory. The **HIGHEST INCIDENCE** of disease is occurring in the Western part of the United States.

CLINICAL SIGNS Many frogs experience a thickening of the skin, which may **PREVENT OXYGEN EXCHANGE**, and impair thermoregulation, nutrient intake, and hydration. Secondary skin infections with bacteria can occur.

TRANSMISSION Once the host is infected with *Bd*, chytridiomycosis may or may not develop. The disease is transmitted through contact with zoospores in the environment, and possibly through **DIRECT CONTACT** with diseased amphibians, though this has not yet been confirmed. Research has shown that *Bd* grows best in water that is between 17-25°C (62-77°F) and that in the wild, most disease outbreaks occur at higher elevations during **COOLER MONTHS.**

DIAGNOSIS Laboratory tests detect the DNA of *Bd* from skin samples or a skin swab of infected animals. Chytrid can also be seen in tissue sections from infected animals.

TREATMENT Captive animals may be treated for chytridiomycosis with antifungal medications and heat therapy.

PREVENTION Captive amphibians should not be released into the environment or used as fishing bait. All newly acquired captive amphibians should be initially quarantined from other amphibians until it has been confirmed that they are disease free. Chytridiomycosis is a **REPORTABLE DISEASE** and any detection of the disease should be reported to the appropriate wildlife authorities.

Content provided in part by The Northeast Wildlife Cooperative

THE WILDLIFE SOCIETY
Leaders in Wildlife Science, Management and Conservation
FACT SHEET

Effects of Lead (Pb) Exposure on Wildlife

Lead (Pb) is one of the world's most widely used industrial metals due to its unique physical properties and widespread availability. Though naturally occurring, lead has no known functional or beneficial role in biological systems and is recognized as a **potent, broad-spectrum toxicant** to both humans and wildlife.[1] Lead's adverse toxicological consequences vary depending on the species, health, and age of an individual, but even at trace levels of exposure, can have a variety of sub-lethal, and potentially irreversible, health effects.[2]

How Lead Exposure Effects Wildlife[3]

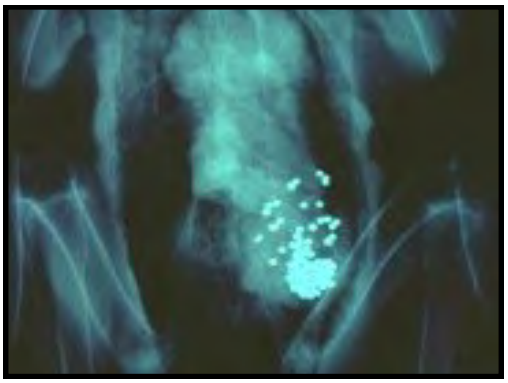
- **Toxic Level Lead Exposure Can Cause:**
  - Damage to nervous system
  - Paralysis
  - Death
- **Low-Level Lead Exposure Can Cause:**
  - Damage to organs & tissues
  - Damage to immune system
  - Reproductive impairment
  - Neurological impairment
  - High blood pressure

For some species, like the federally endangered California condor, lead exposure has population-level effects that threaten the long-term viability of the species[4] (Credit: USFWS).

Lead in Ammunition & Fishing Tackle

Despite well-documented adverse effects to humans and wildlife, **lead use in ammunition and fishing tackle remains widespread**.[5] While lead in this form provides only a small fraction of total anthropogenic releases, it can have significant effects on some wildlife species.[6] Under some circumstances, elemental lead from spent ammunition and lost fishing tackle can leech into water and sediment, becoming bioavailable for plants and animals and creating environmental contaminant problems.[3] The most significant hazard to wildlife, however, results from the direct ingestion of lead through the consumption of prey containing **fragmented lead ammunition or abandoned fishing tackle**.[3]

Over **130 species in North America** are affected by lead ingestion, with lead-caused mortality in some species reaching **tens of thousands of individuals per year**.[7] For most of these species, however, there is little to no assessment of the effect of this lead-caused mortality on population levels.[7] To better understand the magnitude and extent of this problem, more targeted, broad-scale monitoring of lead poisoning incidents are needed; but in many settings, current science sufficiently indicates that minimizing or restricting the use of lead ammunition and fishing tackle will benefit a variety of wildlife species, including waterbirds, scavenging birds, upland birds, and possibly other species.[3]



Lead ammunition ingested by a bald eagle scavenging on wildlife shot with lead ammunition (Credit: USGS).

Alternatives to Lead

Several **effective, nontoxic alternatives** to lead ammunition are now available in North America.[8] Nontoxic ammunition exists for all gauges of modern shotguns, as well as nontoxic rifle bullets for hunting large game.[9]

Removal of lead from hunting, fishing, and shooting, however, will require **collaboration and cooperative management** among all affected stakeholders and must recognize the crucial role that hunters and anglers play in wildlife management/conservation.[10] This will likely require a **phased-in approach**, that focuses on targeted education and the removal of potential barriers to adoption, including the costs and availability of nontoxic alternatives.[10]

Historical Perspective of Lead Regulations in North America

- **Late 1800's:** Lead poisoning documented in waterfowl at hunting sites in TX and NC
- **Mid-1900's:** Lead recognized as a widespread hazard and mortality factor in waterfowl populations
- **1970:** Hazards of lead fishing sinkers to waterfowl documented.
- **1970–1980:** Regulation of lead begins in some jurisdictions within the U.S. & Canada
- **1983–1985:** USFWS* begins monitoring impacts of lead exposure on waterfowl
- **1986:** U.S. begins 5-year phase-out of lead ammunition in hunting waterfowl and coots
- **1991:** Use of lead ammunition in waterfowl hunting officially prohibited in U.S.
- **1997:** Parks Canada bans use of small lead sinkers in all national parks and wildlife areas
- **1999:** Canada prohibits use of lead ammunition for hunting all migratory game birds
- **2010:** U.S. Military begins phasing out lead ammunition—will fully replace lead by 2018
- **2013:** California adopts plan to ban the use of lead ammunition statewide by 2019

*U.S. Fish and Wildlife Service

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Updated: March 2017

NCF-Envirothon 2024 New York

Wildlife Study Resources

Key Topic #3: Wildlife, Conservation and Society

9. Describe how public lands are managed for wildlife and people.
10. Identify major legislation pertaining to wildlife and explain how these laws and regulations support conservation.
11. Describe threats to habitats and wildlife populations, including contaminants, land development, and invasive species.
12. Explain how to prevent and control wildlife issues on private property.

Study Resources

Resource Title	Source	Located on
Endangered Species Act	*The Wildlife Society, 2017*	Pages 78-79
Migratory Bird Hunting and Conservation Stamp Act	*The Wildlife Society, 2017*	Pages 80-81
Federal Aid in Wildlife Restoration Act / Pittman-Robertson Act	*The Wildlife Society, 2017*	Pages 82-83
State and Tribal Wildlife Grant Program	*The Wildlife Society, 2022*	Pages 84-85
North American Wetlands Conservation Act	*The Wildlife Society, 2017*	Pages 86-87
Effects of an Invasive Species: Domestic Cats	*The Wildlife Society, 2017*	Pages 88-89
Effects of an Invasive Species: Feral Swine	*The Wildlife Society, 2017*	Pages 90-91
Invasive Species: Plants-Common Reed, Japanese Knotweed, Japanese Stiltgrass	*Finger Lakes Institute, 2017*	Pages 92-94
Habitat Loss & Fragmentation	*The Wildlife Society, 2017*	Pages 95-96
Tips to Eliminate Wildlife Conflicts	*New York State Department of Environmental Conservation, 2023*	Page 97
Bear Wise: Avoiding Conflicts with Bears	*BearWise.org, 2023*	Pages 98-100

Study Resources begin on the next page! ➡

THE WILDLIFE SOCIETY
Leaders in Wildlife Science, Management and Conservation
POLICY BRIEF

Endangered Species Act

Congress passed the Endangered Species Act (ESA) of 1973 to replace the Endangered Species Conservation Act of 1969 and in direct response to the 1973 signing of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).[1] ESA provides a federal program for the conservation of threatened and endangered plants and animals and the ecosystems upon which they depend. Since 1973, Congress has enacted significant amendments to ESA—1978, 1982, 1988, and 2004—but the law's overarching goal of reversing trends towards species extinction has remained unchanged.[1]

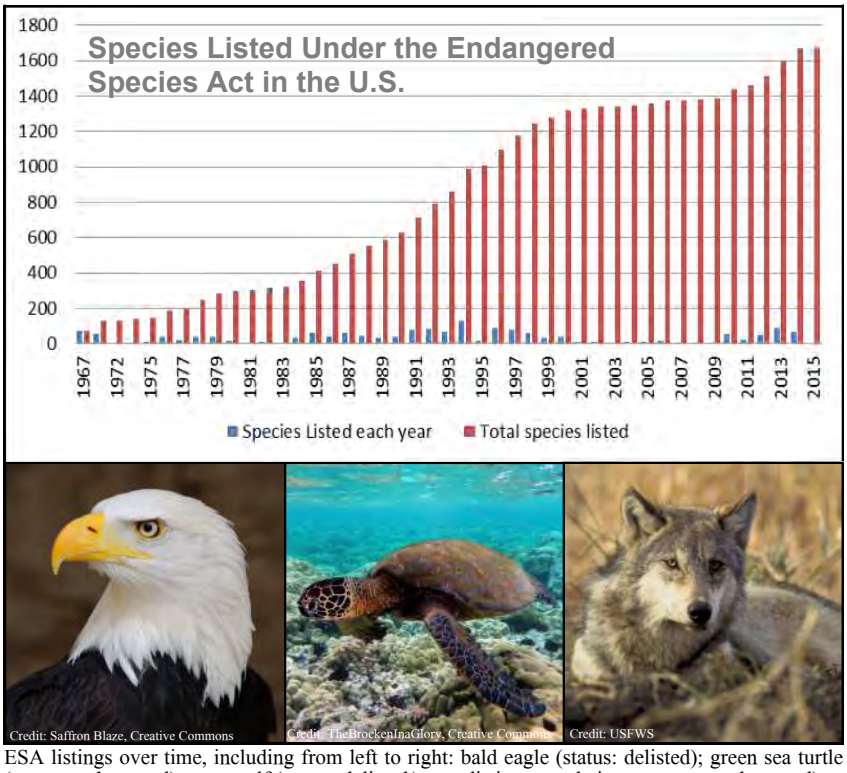
Methods

The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) administer ESA. Under ESA, species, subspecies, and distinct population segments may be federally listed—by regulation—as endangered or threatened based on the "best scientific and commercial data available."[1] An *endangered* listing indicates that the species is in danger of extinction throughout all or a significant portion of it's range. A *threatened* listing means that the species is likely to become endangered within the foreseeable future.[1]

Five factors are considered when listing a species: [1]

1) Damage to or destruction of a species' habitat;
2) Overutilization of the species for commercial, recreational, scientific, or educational purposes;
3) Disease or predation;
4) Inadequacy of existing protection; and/or
5) Other natural or manmade factors affecting its continued existence.

If a species is listed, USFWS/NMFS must create an Endangered Species Recovery plan that outlines: actions needed to return the species to a healthy state; criteria for achieving this healthy state; estimates for how long the recovery will take; and how much recovery will cost. Recovery plans are not regulatory documents; rather they provide implementation guidelines to ensure successful recovery of the listed species. The agencies then enlist the help of states and local governments to implement the plans until the species is considered "recovered," and no longer warrants ESA listing.[1]



ESA listings over time, including from left to right: bald eagle (status: delisted); green sea turtle (status: endangered); gray wolf (status: delisted/some distinct population segments endangered)

Results

Since 1973, over 2,300 plant and animal species, in the U.S. and internationally, have been listed as threatened or endangered under ESA. Of these listed species, only 10 have gone extinct and 12 have been reclassified from threatened to endangered.[2] Comparatively, 38 species have been downgraded from endangered to threatened and an additional 49 species have been completely delisted due to recovery.[3] As of April 2017, the U.S. and it's surrounding waters, have 1,603 (1,228 endangered/375 threatened) of the total 2,390 ESA listed species.

Discussion

ESA has effectively prevented the extinction of over 99.5 percent of all listed species, thereby achieving its primary goal of preventing species extinctions. However, only about 2 percent of listed species have been removed from ESA as a result of recovery. This is likely a result of the fact that most species are listed at critically low population levels and because of threats—like habitat loss—which require significant time, funding, and commitment to reverse through restoration, enhancement, management, and protection. Historically, insufficient funding levels have largely constrained recovery efforts, but improvements in the status of listed species is still overall positively correlated with ESA listing.

Implications for Wildlife Professionals

ESA is a vital tool in the U.S. effort to conserve biological diversity. Listing a species under ESA enables wildlife professionals to prioritize management of that species and its habitat based on recovery need and through firm statutory duties on both public and private lands. In addition to the ESA Section 9 prohibition against "take" (*harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect*) of a listed species, the law also requires Interagency Cooperation (Section 7) for any federal action that may affect a listed species; and Habitat Conservation Plans (HCP) and incidental take permits (Section 10) for any non-federal activities—including those conducted by states or private entities—that will result in the take of a listed species. HCPs ensure that any negative effects of an authorized incidental take will be adequately minimized and mitigated. While ESA has served as an essential tool in preventing extinctions, its effectiveness at recovering species can be improved through a greater commitment of resources and focus on proactive measures to conserve at-risk species.

Endangered Species Act: Features

Critical Habitat[4]

Section 4 of ESA states that USFWS must designate a species' critical habitat at the same time that the Agency lists the species. Critical habitat is defined as a specific geographic area that contains biological or physical features that are essential to the recovery of a threatened or endangered species. Critical habitat can also include any area that is not currently occupied by a threatened or endangered species, but will likely be needed for its recovery. Designations have to take into account not only the benefits of critical habitat for the species, but also its potential impacts on the economy and national security. Critical habitat designations do not restrict development. However, they do provide a reminder to agencies to protect the physical or biological features which are necessary for threatened or endangered species recovery. USFWS does not always choose to designate critical habitat at the same time as a species listing due to inadequate resources and difficulty in gathering information about a species' habitat within a timeline that is beneficial for the species' recovery.

Ash Meadows National Wildlife Refuge provides critical habitat for 8 ESA-listed species (Credit: USFWS)

Petition Process[5]

Members of the public can issue petitions—or formal requests to list a species—that are subject to review by the applicable agency. Within 90 days of receiving a petition, USFWS or NMFS must make a finding as to whether or not substantial information exists to warrant listing. If the initial review finds that listing may be warranted, a 12-month status review is conducted. The 12-month status review will determine if listing is: not warranted, warranted, or warranted but precluded. "Warranted but precluded" findings require a status review every year until a formal decision can be made about the status of the species. If the data supports listing, a proposed rule to list the species is published in the Federal Register. The applicable agency then solicits the expert opinion of three species specialists in a peer review and opens the proposal to public comment for 60 days. After the public comment period closes, the agency will either announce the decision not to list or will publish a final rule to list the species in the Federal Register. ESA protections become effective 30 days after a final rule is published.

Florida black bear: Petitioned for listing in 2016 but USFWS determined that listing was not warranted (Credit: FWC)

Candidate Conservation Agreements[6,7]

Candidate Conservation Agreements (CCA) are voluntary agreements between USFWS and public and private entities to determine threats to candidate species. These entities work together to design and implement conservation measures for effective recovery. USFWS also implements Candidate Conservation Agreements with Assurances (CCAA), which provide non-federal landowners with additional incentives for engaging in conservation activities on their lands. USFWS developed the CCAA program to address landowner concerns about potential regulations due to having candidate species on their lands. According to USFWS, implementing collaborative conservation efforts before a species becomes listed increases the likelihood that more cost-effective conservation tools are available if the species becomes listed in the future. In southeast Oregon, an agreement between landowners and state and federal agencies to reduce threats to greater sage-grouse (*Centrocercus urophasianus*) aided in the USFWS' decision not to list the species in 2015.

Greater sage-grouse: USFWS found that the sage-grouse did not warrant listing in 2015 (Credit: USFWS)

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Updated: July 2017

THE WILDLIFE SOCIETY
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POLICY BRIEF

Migratory Bird Hunting and Conservation Stamp Act

North America experienced unprecedented declines in waterfowl populations in the early 1900s. In response, Congress passed The Migratory Bird Hunting Stamp Act of 1934 to provide "funds for the acquisition of areas for use as migratory-bird sanctuaries, refuges, and breeding grounds...for the protection of certain migratory birds." The Act, later amended in 1976 to the Migratory Bird Hunting and Conservation Stamp Act, is more commonly known as the Duck Stamp Act.

Methods

The Act requires any person, age 16 or older, who hunts waterfowl to buy a Duck Stamp each year—though anyone can purchase one or more of these stamps, including outdoor enthusiasts, birders, and/or stamp collectors. The money raised by the sale of these stamps is placed in the Migratory Bird Conservation Fund (MBCF) and is used primarily by the U.S. Fish and Wildlife Service (USFWS) to acquire migratory bird habitat.[1] Any new habitat bought or leased by USFWS using MBCF money must be approved by the Migratory Bird Conservation Commission (MBCC). MBCC is comprised of two U.S. Senators, two U.S. Representatives, the EPA Administrator, the Chief of the Division of Realty within USFWS, and the Secretaries of the Departments of the Interior and Agriculture.

Periodically, Congress passes amendments to the Act that increase the price of the Duck Stamp to offset inflation or changes in land value.[2] The first Duck Stamp sold for $1 in 1934. Since then, the price has increased to $2 in 1949, $3 in 1959, $5 in 1972, $7.50 in 1979, $10 in 1987, $12.50 in 1989, $15 in 1991, and finally to the current price of $25 in 2015.[3] The Postal Service prints, issues, and sells the stamp and is reimbursed for its expenses from MBCF.

Results

Over $800 million have been raised through the Duck Stamp, which has contributed to the protection of over 6 million acres of wetland habitat.[4] By law, 98 percent of the purchase price of Duck Stamps goes directly to wetlands and associated habitats.[3] More than 300 national wildlife refuges were created or have been expanded utilizing revenue generated through the Duck Stamp. Since the implementation of the Duck Stamp, duck populations have nearly doubled and now exceed 48 million individuals.[5]

Discussion

Wetland habitats conserved through Duck Stamp revenues benefit waterfowl, all wetland-dependent wildlife, hunters, and other wildlife enthusiasts; and local communities benefit through ecotourism and ecological services provided by wetlands. The conserved wetlands mitigate floods, improve water quality, and provide critical habitat for game, fish, and endangered species.[6]

Implications for Wildlife Professionals

Habitat purchased through Duck Stamp revenues is restored and managed by wildlife professionals, thereby enabling and enhancing the ability of wildlife professionals to conserve wildlife populations and habitats through science-based management practices and regulated use of public trust resources.

Various Duck Stamp designs over the years, beginning at the top with the first Duck Stamp issued in 1934 and designed by legendary cartoonist and conservationist, Ding Darling (Credit: USFWS)

Migratory Bird Hunting and Conservation Stamp Act: Features

Winning entries from a Federal Duck Stamp Competition (Credit: USFWS)

The Federal Duck Stamp Competition[2]

The artwork for each year's stamp has been an important artistic symbol of wildlife conservation. The first Duck Stamp was designed by legendary cartoonist and conservationist, Ding Darling, in 1934. In 1949, the stamp artwork became a contest judged by a panel of art and waterfowl professionals. Hundreds of artists compete each year to have their art on the official stamp. Anyone who is 18 or older may submit artwork to be considered for the design for the Federal Duck Stamp. This is the only art competition sponsored by the federal government.

Overflow National Wildlife Refuge[8]

Duck Stamp revenue provided 100 percent of the funds needed to purchase the 13,973 acre Overflow National Wildlife Refuge located in Ashley County, Arkansas, in 1980. This refuge protects 12,000 acres of bottomland hardwood forests that provide essential habitat for wintering waterfowl and other wildlife, including black bears, bald eagles, and migrating shorebirds. In addition to the more than 12,000 acres of bottomland hardwoods, the refuge also has approximately 1,600 acres of wetlands and moist soil impoundments managed for waterfowl and 289 acres of upland habitats. The refuge attracts about 10,000 visitors annually.

Mallards at Overflow National Wildlife Refuge (Credit: USFWS)

2016-2017 Junior Duck Stamp featuring Ross's geese by Stacy Shen, age 16 (Credit: USFWS)

Junior Duck Stamp Program[9]

The Federal Junior Duck Stamp Conservation and Design Program was created by USFWS in 1989 as a conservation education initiative. The art and science-based curriculum helps to teach students from kindergarten through high school about wetlands and waterfowl conservation. Revenue generated by the program goes towards environmental education programs throughout the U.S. Each year, students may submit artwork for the opportunity to be featured as the design for the next year's Junior Duck Stamp. Congress recognized the program in 1994 with the enactment of the Junior Duck Stamp Conservation and Design Program Act.

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Updated: July 2017

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POLICY BRIEF

Federal Aid in Wildlife Restoration Act / Pittman-Robertson Act

In the early 1900s, sportsmen's organizations and state wildlife agencies—concerned with unprecedented declines of wildlife populations in the United States—urged Congress to pass the Federal Aid in Wildlife Restoration Act. The Act, passed in 1937, designates an excise tax on firearms, ammunition, and archery equipment to be used by states to fund wildlife restoration. Today, the Act is often referred to as the Pittman-Robertson Act (P-R Act) after its two key champions: Senator Key Pittman of Nevada and Congressman Willis Robertson of Virginia.

Methods

The P-R Act generates funds through an 11 percent excise tax on long guns, ammunition, and archery equipment and a 10 percent excise tax on handguns. The revenue from this tax goes into the Wildlife Restoration Account administered by the U. S. Fish and Wildlife Service (USFWS).

Funds are then apportioned annually to state wildlife agencies for wildlife restoration programs and hunter education. An additional $3 million is also allocated to projects that involve cooperation among states through the Multistate Conservation Grant Program[1] (Figure 1). State wildlife agencies use P-R funds to cover up to 75 percent of a project's cost. The remaining 25 percent of a P-R funded project generally comes from state hunting license revenues: P-R Act requires that all state hunting license revenues go to administering state wildlife agencies.

Results

Since 1939, the Wildlife Restoration Account has generated over $10 billion, leading to the purchase of approximately 4 million acres of land to support wildlife.[1] Moreover, an additional 40 million acres are being managed for wildlife under agreements with land owners through the use of P-R funds.[2] P-R funds have also been used to support wildlife research, thereby building scientific capacity and understanding within state agencies.

Discussion

The original purpose of the P-R Act was to provide funding for restoring wildlife populations and to acquire, develop, and manage their habitats.[3] The Act was amended in 1970, to include funding for hunter education programs and the development, operation, and maintenance of public shooting ranges.[3]

The P-R Act is fully funded by sportsmen, but benefits hunters and non-hunters alike. Nearly all lands purchased with P-R money are managed for wildlife production and other public uses like hiking and bird watching. Recent estimates indicate that 70 percent of people using areas conserved by the P-R Act are not hunting.[2]

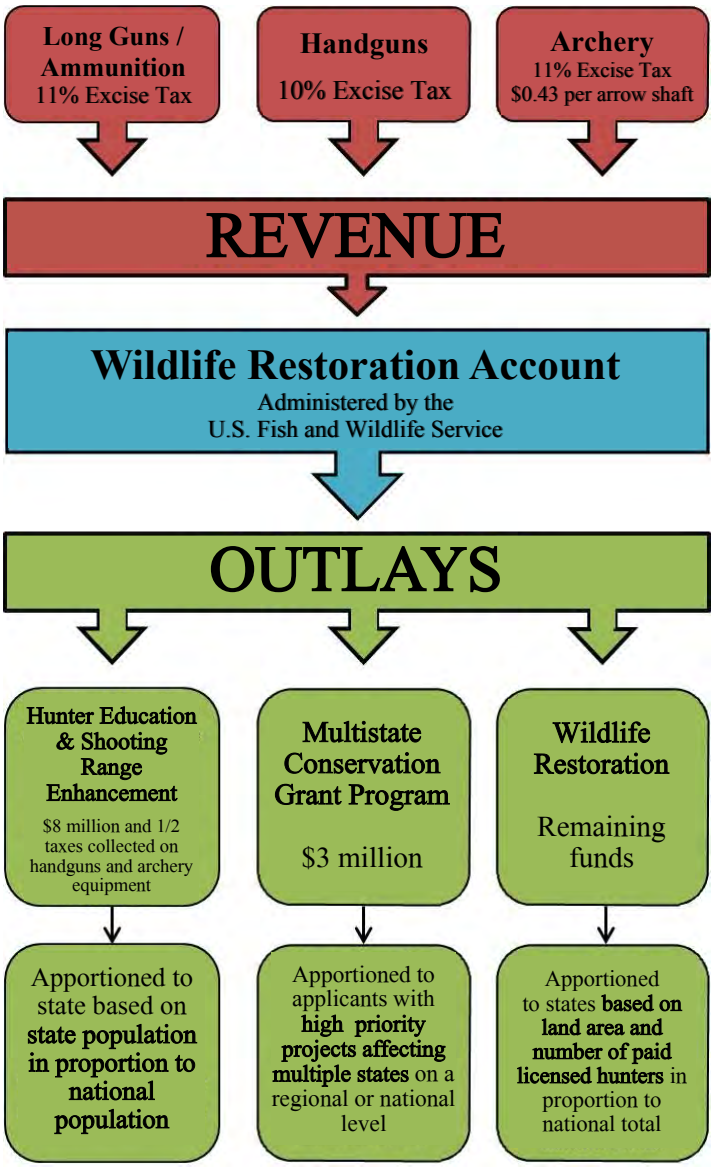

Figure 1. The funding process for excise taxes being apportioned to state wildlife agencies through the Federal Aid in Wildlife Restoration Act

Implications for Wildlife Professionals

Funding from the P-R Act provides state wildlife agencies with a continuous, secure, and substantial source of funding. This benefits wildlife professionals working in or with state agencies, by ensuring that they have adequate resources to implement important projects to research, manage, and conserve public trust wildlife for the benefit of society.

Federal Aid in Wildlife Restoration Act: Features

Male and female northern bobwhite (Credit: Steve Maslowski, USFWS)

Bobwhite Research[4,5]

The National Bobwhite Conservation Initiative (NBCI) began in 2002 as a unified strategic effort across numerous U.S. states to restore wild populations of northern bobwhite (*Colinus virginianus*), also known as bobwhite quail. The bobwhite has become a symbol of the need for conservation for a myriad of grassland species facing similar declines due to habitat loss at the continental scale. In 2006, the Tennessee Wildlife Resources Agency (TWRA) was awarded $240,000 through the Multistate Conservation Grant Program to further develop and expand NBCI. With this funding, TWRA effectively developed landscape-level, step-down plans for bobwhite habitat conservation that take into account the needs of other priority grassland species. These plans have proved essential to facilitating the development and implementation of NBCI programs.

Summer Lake Wildlife Area[6,7]

The Summer Lake Wildlife Area in Oregon was established in 1944 to protect and improve waterfowl habitat and provide a public hunting area. Acquisition of the land, in addition to various habitat development and infrastructure projects, were partially financed through P-R funds. Today, Summer Lake Wildlife Area is a popular destination not just for hunting, but also wildlife viewing and environmental education. Through the use of P-R funds wildlife biologists and land managers have been able to restore and maintain over 3,000 acres in the wildlife area, which is home to more than 250 species of birds and at least 40 species of mammals, fish, reptiles, and amphibians.

Habitat improvement project at Summer Lake Wildlife Area (Credit: ODFW)

Wildlife Restoration Program[8]

The Wildlife Restoration Program, authorized under the P-R Act, provides grant funds to state fish and wildlife agencies to develop projects that restore, conserve, manage, and enhance wild birds and mammals and their habitats. The Wildlife Restoration Program symbol (*see reverse*) is used to identify those projects and properties that have utilized P-R funds. Variations of this symbol may also be used by businesses that manufacture or sell guns, ammunition, and archery equipment that contribute excise taxes to the Wildlife Restoration Account. For example, the symbol to the left is often used by businesses associated with the manufacture or sale of products that contribute to wildlife restoration through the P-R Act and sport fish restoration through the Federal Aid in Sport Fish Restoration Act (also known as the Dingell-Johnson Act).

Sport Fish & Wildlife Restoration Program Symbol (Credit: USFWS)

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Updated: July 2017

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POLICY BRIEF

State and Tribal Wildlife Grant Program

Congress created the **State and Tribal Wildlife Grant (STWG) Program** in 2000 to assist state fish and wildlife agencies and their partners with the conservation of public-trust species.[1] STWG is the only federal program that directly supports states in keeping common species common and thus preventing wildlife from becoming threatened or endangered. It is the primary program supporting the development and implementation of State Wildlife Action Plans (SWAPs), which identify the species of greatest conservation need (SGCN) in each state and detail the on-the-ground conservation actions needed to conserve those species.[1]

Methods

STWG funds are administered by the U.S. Fish and Wildlife Service (USFWS). Congress appropriates funds for STWG on an annual basis. USFWS apportions a majority of those funds to states, commonwealths, and U.S. territories based on a formula that considers each state's population and total geographic size (Figure 1). Tribal funds, and some state funds, are also attained through a STWG competitive grants subprogram.[1]

As a condition for receiving STWG funding, each state and territory must develop a SWAP. These plans are approved by USFWS and are implemented—in part—using the federal funds provided through STWG. SWAPs are updated at least every ten years. STWG funds may be used to address a variety of conservation needs as identified within a SWAP, including research, habitat management, fish and wildlife surveys, and species restoration. Funds may also be used to update, revise, or modify a SWAP.[1]

To access STWG funds; states, the District of Columbia, and the Commonwealth of Puerto Rico must provide a minimum 25 percent match for SWAP planning-related activities and a 35 percent match for all other types of eligible activities, like implementation of SWAP projects.[1] Tribes and territories are exempt from this matching funds requirement.

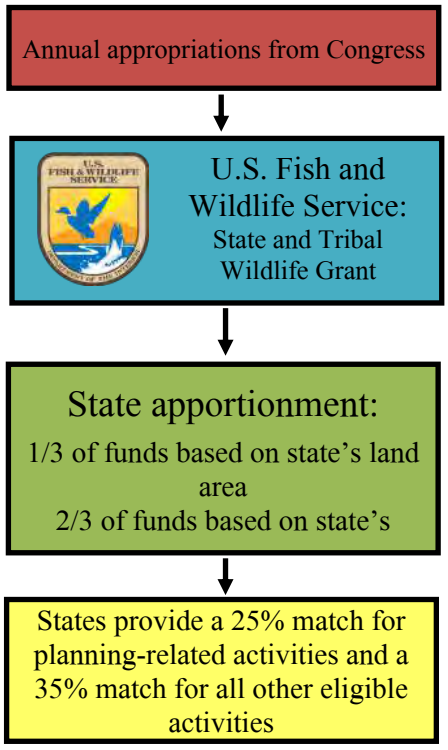

Figure 1. The process of appropriating funds to states and territories through the State and Tribal Wildlife Grant Program

Results

All 50 states and five territories have created a SWAP in response to STWG. Almost $1.5 billion has been appropriated to STWG as of fiscal year (FY) 2022.[2] Collectively, STWG funds aid in the conservation of more than 12,000 SGCN, as identified by states and territories.

Discussion

STWG funds provide an ongoing basis for conserving the nation's fish and wildlife and are vital for the protection of all public-trust species. In 2016, the Blue Ribbon Panel on Sustaining America's Diverse Fish & Wildlife Resources recommended that Congress dedicate up to $1.3 billion in new funding annually to effectively implement all SWAPs.[3] In 2018, this proposal was updated to address much-needed funding for tribal conservation efforts. Past appropriations for STWG range from $90 million in FY 2010 down to $50 million in FY 2001 (Figure 2).[2]

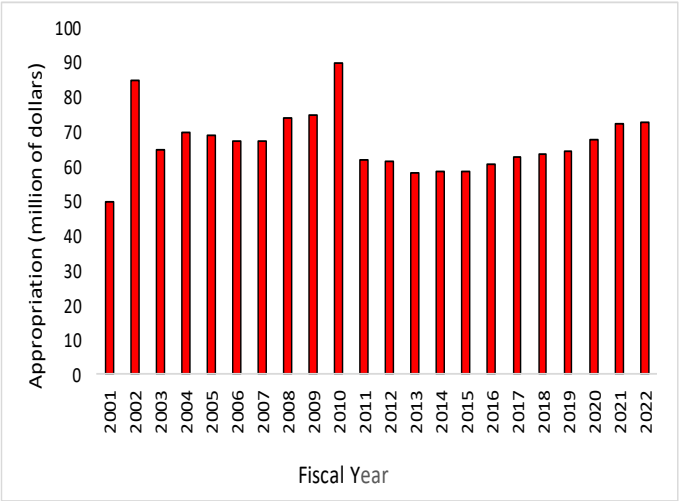

Figure 2. Annual appropriations for the STWG (Credit: Adapted from USFWS)[2]

Implications for Wildlife Professionals

STWG supports strong partnerships between federal, state, tribal, private, and nonprofit entities that enable wildlife professionals to implement conservation activities that conserve SGCN. Any reductions in STWG funding would constrict the ability of wildlife professionals to prevent further declines in these at-risk species.

State and Tribal Wildlife Grant Program: Success Stories

Swift fox (Credit: Tony Ifland, USFWS)

Swift Fox Recovery[4,5,6]

STWG funds aided the successful recovery of the swift fox (*Vulpes velox*). Through broad cooperation between state, federal, tribal, and private entities in six western states receiving STWG funds, the swift fox was effectively removed from the federal endangered species candidate list in 2001. STWG funds now support the continued conservation of this species. From 2006 to 2009, a partnership involving Montana Fish, Wildlife, and Parks; the World Wildlife Fund; and the Fort Peck Indian Reservation, reintroduced 40 swift foxes in the Fort Peck Indian Reservation. The reservation now has a stable swift fox population, thus helping to ensure the long-term viability of this species.

Survey of Mountain Plovers in Nebraska[4,5]

STWG funds can be used for a variety of conservation activities. In Nebraska, biologists used STWG funding to survey the range of the mountain plover (*Charadrius montanus*). Prior to the survey, the biologists knew of only two nesting pairs of the species in Nebraska. Throughout the survey hundreds more of the birds were discovered. The survey also increased the biologists' knowledge of habitats where the birds nest, indicating the common use of fallow farm lands. With that information, biologists were able to encourage farmers to till around the nests, thus increasing the survival rate of chicks. Nebraska now has a thriving mountain plover population, which helped contribute to the USFWS decision to not list the mountain plover as threatened or endangered in 2011.

Mountain plover (Credit: Seabamirum, Flickr)

Columbia spotted frog (Credit: Kristin Lohr, USFWS)

Columbia Spotted Frog Listing Prevention[5,7]

The Columbia spotted frog (*Rana luteiventris*) was designated as a candidate species for ESA listing in 1993. STWG funds were utilized in Utah to repatriate and successfully establish two populations of the frog in areas where they have been extirpated for over 30 years, thus helping to prevent the species from becoming endangered. STWG funds also provided the resources necessary to conduct the research used by USFWS in 2015 to determine that the species did not warrant federal listing. Through collaborative efforts—including clarifying objectives, utilizing sustainable grazing practices, creating ponds, and implementing effective conservation strategies—the frog population has rebounded across its range.

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Updated: May 2022

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POLICY BRIEF

North American Wetlands Conservation Act

Waterfowl populations in North America reached historic lows in the 1980s due in part to decreasing wetland habitat in the U.S. and Canada.[1] The two countries acknowledged this decline and signed the North American Waterfowl Management Plan (NAWMP) in 1986 to restore waterfowl populations through habitat protection, restoration, and enhancement.[1] The North American Wetlands Conservation Act (NAWCA) was passed by Congress in 1989 to support activities in NAWMP.[2] Mexico signed on to NAWMP when the plan was updated in 1994.[1]

Methods

NAWCA receives annual appropriations from Congress in addition to funding from provisions in the Migratory Bird Treaty Act, Federal Aid in Sport Fish Restoration Act, and the Federal Aid in Wildlife Restoration Act (Figure 1).[3]

NAWCA provides grants for wetland conservation projects in the U.S., Canada, and Mexico. Eligible proposals are reviewed and ranked by The North American Wetlands Conservation Council—a nine member council appointed by the Secretary of Interior—which then recommends projects to the Migratory Bird Conservation Commission for final approval. The U.S. Fish and Wildlife Service's Division of Bird Habitat Conservation awards and administers the approved grant projects.

NAWCA requires that projects match at least $1 in non-federal funds for every $1 received in grant funds.[4] The standard grants program is open to projects in Canada, Mexico, and the U.S. The small grants program is only open to projects in the U.S. with grant funds limited to $75,000 per project; which allows smaller partners and projects to successfully compete for NAWCA funds.

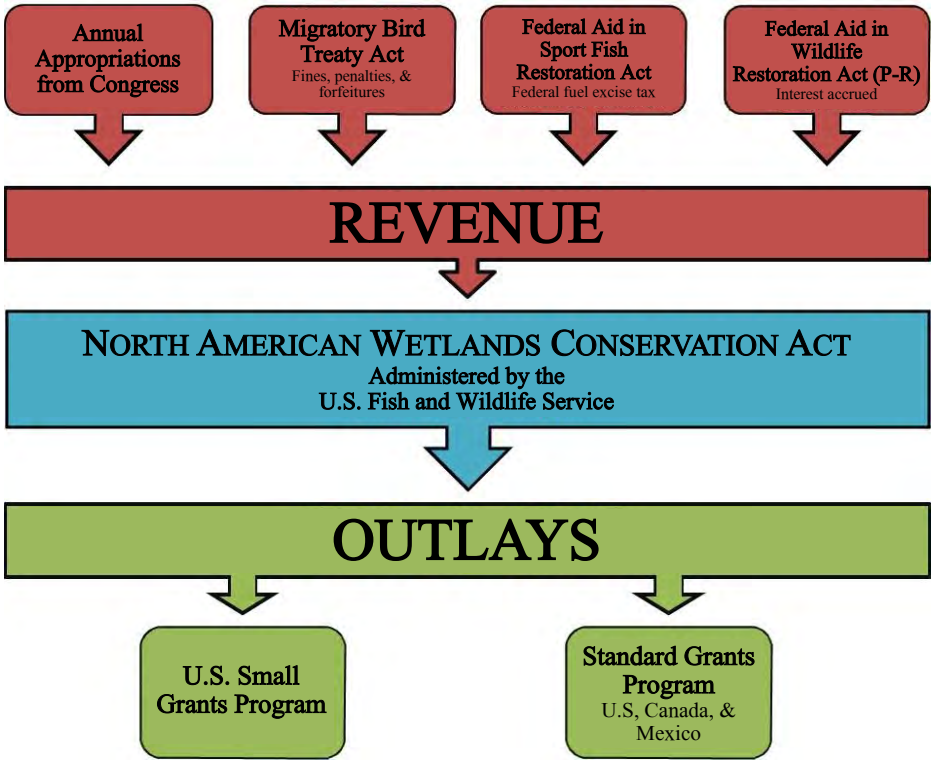

Figure 1. The funding process for the North American Wetlands Conservation Act

Results

NAWCA grants have supported protection, restoration, and enhancement of wetlands in all 50 U.S. states, Puerto Rico, and the U.S. Virgin Islands; all 13 Canadian provinces and territories; and all 31 Mexican states.[2] Through fiscal year (FY) 2015, over 2,500 projects have received nearly $1.4 billion in NAWCA grants with partners contributing an additional $2.8 billion in non-federal matching funds—thus providing greater than $2 in eligible match for every standard NAWCA dollar awarded (Small Grants leverage almost $4 for every NAWCA dollar awarded).[3] Through these funds, more than 5,000 different partners have helped conserve over 28 million acres of wetland and associated upland habitats.[3]

Discussion

NAWCA has expanded its scope from covering projects in NAWMP to the conservation of wetland migratory birds listed in the U.S. Shorebird Conservation Plan, the North American Wetland Conservation Plan, and the Partners In Flight Conservation Plan.[2]

While NAWCA continues to receive annual appropriations, the act's authorization expired in October 2012, putting the program at risk of being discontinued. Though last authorized at $75 million for each of the years FY 2008–2012, the program currently receives approximately $35 million per year. Reauthorization of NAWCA would enable Congress to continue this cooperative, non-regulatory, incentive-based program that has shown unprecedented success in maintaining and restoring wetlands, waterfowl, and other migratory bird populations.

Implications for Wildlife Professionals

NAWCA provides funding for public-private partnerships carrying out wetlands conservation projects that benefit wetlands-associated migratory birds and other wildlife. NAWCA grants generate approximately 7,500 new jobs annually in the U.S.[4] Wildlife professionals are needed on grant projects to assess appropriate restoration requirements, evaluate habitat management needs, and propose project criteria that will benefit wildlife.

North American Wetlands Conservation Act: Features

Cackling geese (Credit: Nathan Graff, USFWS)

Small Grants Program[5]

The Small Grants Program was created in 1996 by the North American Wetlands Conservation Council to fund smaller-scale, long-term wetlands conservation projects that might not be able to compete in the Standard Grants Program. Projects are eligible to receive up to $75,000 in funding. Through April 2016, over 1,600 partners in 750 projects have been involved in the Small Grants Program, benefitting over 359,000 acres of wetland habitats. Furthermore, over $43.2 million in NAWCA grants have resulted in partners contributing an additional $155 million in matching funds.

NAWCA in Canada[6]

Since 1991, NAWCA Standard Grants have contributed over $500 million dollars to 547 projects on more than 19 million acres across all 13 provinces and territories in Canada. Moreover, these funds were matched on a one-to-one basis by over 160 partners, thereby doubling the impact of the NAWCA grants. In 2016, NAWCA grants contributed $20 million to 9 projects, including $5 million to Ducks Unlimited Canada to help secure and enhance 8,809 acres in the prairie potholes region. The prairie potholes region serves as a breeding ground for about 50 to 70 percent of North America's waterfowl population.

Dabbling ducks (Credit: Ducks Unlimited)

Protecting the Acadia Archipelago[7]

The Maine Coast Heritage Trust received a $1 million grant in 2010 from NAWCA to conserve parts of the Acadia Archipelago. The archipelago provides habitat for waterfowl, seabirds, and shorebirds. The grant, along with $4.45 million in matching funds from partners, was used to permanently protect interior wetlands on Mount Desert Island, in addition to five entire islands. Many migratory birds have benefited from these improved coastal wetlands, including the American black duck (*Anas rubripes*), yellow rail (*Coturnicops noveboracensis*), American woodcock (*Scolopax minor*), and olive-sided flycatcher (*Contopus cooperi*).

Wetlands in Acadia National Park, Maine (Credit: Petr Kratochvil, PublicDomainPictures)

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Updated: July 2017

THE WILDLIFE SOCIETY
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Effects of an Invasive Species: Domestic Cats

Though originally bred from wild cats, the domestic cat (*Felis catus*) has no native range and is listed among the **100 worst non-native invasive species in the world** by the International Union for Conservation of Nature (IUCN).[1]

What is a domestic cat?

Domestic cats are one of the most popular pets in North America and can be categorized into three management groups:

Indoor cats: Owned pets that spend all of their time within the home—house cats.

Free-ranging cats: Owned pets that are habituated to humans but spend all or a portion of their time roaming outdoors.

Feral cats: Unowned animals that live entirely outdoors. These cats are not socialized to humans but descended from domesticated individuals.

Disease Transmission

Domestic cats can serve as vectors for multiple diseases, including **zoonotic diseases**—diseases that can spread to humans.[2] Threats to human and wildlife health from domestic cat disease include:

- **Rabies**: A potentially fatal viral disease transmitted through bite wounds. In 2014, cats accounted for 61% of rabid domestic animals recorded in the U.S.[3]
- **Toxoplasmosis**: Caused by a microscopic parasite in cat feces. Can result in birth defects, behavioral disorders, or illness in people with weakened immune systems.[4] Can also cause death or other severe negative effects to wildlife.

Domestic cats are highly skilled, instinctive predators that kill billions of animals each year[7] (Credit: Wikimedia Commons User Alex T./Lxowle/Mark Marek).

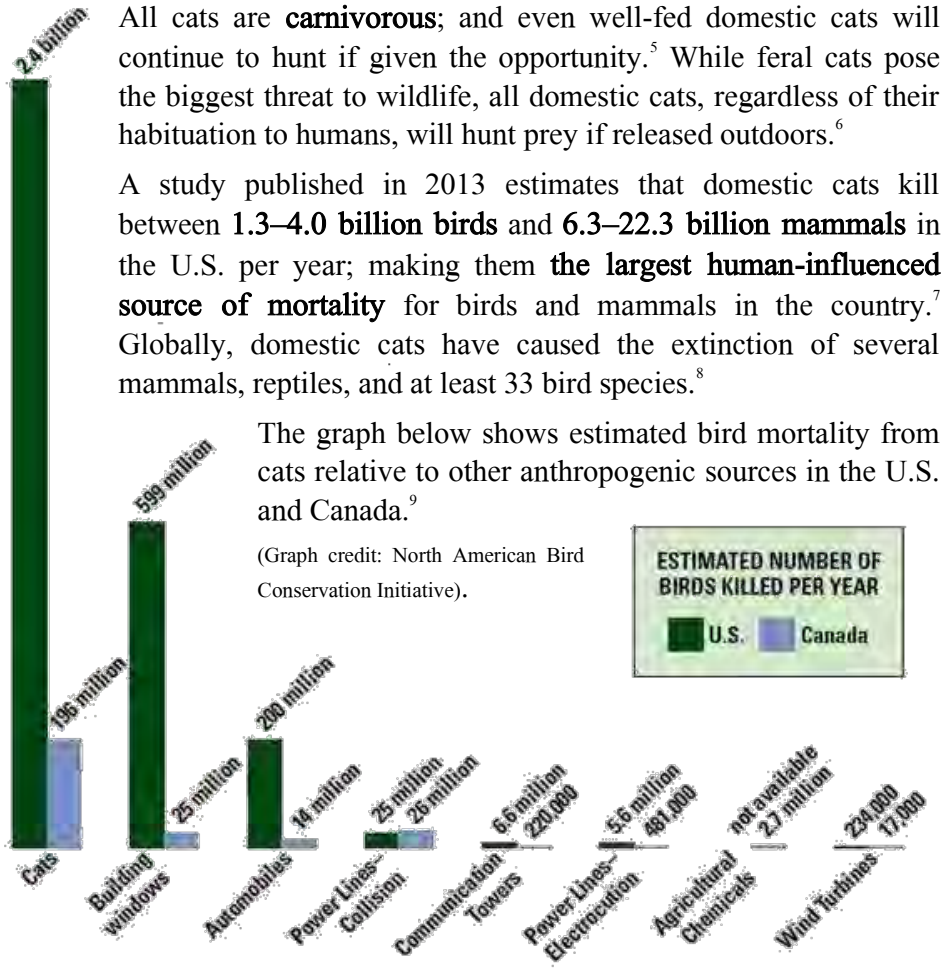
Predatory and Behavior Effects

All cats are **carnivorous**; and even well-fed domestic cats will continue to hunt if given the opportunity.[5] While feral cats pose the biggest threat to wildlife, all domestic cats, regardless of their habituation to humans, will hunt prey if released outdoors.[6]

A study published in 2013 estimates that domestic cats kill between **1.3–4.0 billion birds** and **6.3–22.3 billion mammals** in the U.S. per year; making them **the largest human-influenced source of mortality** for birds and mammals in the country.[7] Globally, domestic cats have caused the extinction of several mammals, reptiles, and at least 33 bird species.[8]

The graph below shows estimated bird mortality from cats relative to other anthropogenic sources in the U.S. and Canada.[9]

(Graph credit: North American Bird Conservation Initiative).

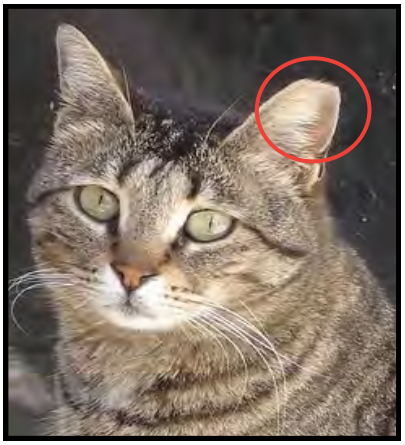


Domestic Cat Reproduction

Domestic cats are prolific breeders. A single female cat can reach sexual maturity at just six months of age and produce up to **three litters per year with two to four kittens per litter** (Up two 12 cats per year).[10]

Limited empirical data exists for the total number of feral cats in the U.S., but estimates range from **30 to 80 million cats**—not including the roughly **40 million** pet cats with outdoor access.[7] The size of feral cat populations, combined with their high reproductive potential, exacerbates concerns over **animal welfare, wildlife predation, and disease**.

Feral cat "colony" (Credit: Wikimedia Commons User Kushi)



TNR programs use eartipping to mark a sterilized cat. (Credit: Rachel Jaskow).

Problems with Trap-Neuter-Release

Trap-neuter-release (TNR) is often considered as a humane solution to reducing feral cat overpopulation, and involves catching, vaccinating, sterilizing, and then releasing feral cats. With a long-term commitment of resources—and the sterilization of approximately **71-94% of a population**—this type of high-intensity management can theoretically reduce feral cat colonies.[11]

However, numerous long-term scientific studies have shown TNR programs to be **ineffective** or even **counterproductive** because they enable the abandonment of owned cats, thus resulting in the indefinite maintenance of feral cat colonies.[11] This compounds the problems caused by feral cats and justifies the continued presence of an invasive species in North America. As a result, **TNR undermines the work of wildlife professionals and severely jeopardizes the integrity of native biodiversity**.

Domestic Cats: Things to Consider

Keep Cats Indoors	Keeping cats indoors protects wildlife and the cats themselves. Cats that live or are allowed outside are exposed to cars, wild animal attacks, and diseases.
Don't Feed Outdoor Cats	Providing food for outdoor cats, even over-feeding, does not stop natural hunting behavior. It can also lead to larger feral cat colonies, thus compounding the problem.[5]
Spay and Neuter Pets	Educate cat owners to spay or neuter their cats and keep them indoors. TNR does not reduce overpopulation or prevent wildlife deaths.[11]
Raise Awareness	Encourage researchers to develop and disseminate information on the impacts of feral cats on native wildlife, relative to predation, competition, and diseases.

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Updated: March 2017

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Effects of an Invasive Species: Feral Swine

Domestic swine are **not native** to North America, but have been used on the continent for agriculture and other purposes since early European settlers.[1] The intentional release and/or escape of these domesticated swine have led to established populations of **feral swine**—also known as wild pigs, wild boar, or wild hogs (*Sus scrofa*).[1] Feral swine should not be confused with North America's only native pig-like animal, the collared peccary (*Pecari tajacu*).[2]

What is a Feral Animal?	An animal living in the wild but **descended from domesticated** individuals.[3]

In the past decade, the range and abundance of feral swine has increased markedly. Feral swine now exist in parts of Canada, Mexico, and at least **35 U.S. states**—where current population estimates exceed **5 million** individuals.[4] Due to their detrimental effects on ecosystems, property, and agriculture; controlling feral swine populations is critical to natural resource management.

Feral swine: One of the IUCN's 100 worst non-native invasive species in the world[5] (Credit: USDA– APHIS).

Feral swine use their tusks and snouts to root in search of food, damaging plants and crops (Credit: USDA).

Economic Impacts of Feral Swine

Feral swine cause at least **$1.5 billion in economic damages per year**.[6] This includes control costs, agricultural production losses, and non-production losses like damage to infrastructure.[2]

Moreover, this dollar estimate is likely conservative given the difficulty of documenting and assigning a monetary value to environmental degradation, disease outbreaks, and other effects to ecosystem services like clean water.[7]

Effects on Native Wildlife and Habitats

Feral swine are **extreme habitat generalists**, capable of surviving and thriving in both natural and suburban areas.[4] As **omnivores**, feral swine feed on both plants and animals; changing food preferences based on availability.[1] In some areas, the diet of feral swine can include sea turtles, ground nesting birds, endemic reptiles, and macro-invertebrates, resulting in the direct loss of wildlife through predation.[8]

Feral swine also modify plant communities, and can quickly decimate an area of native vegetation—or agricultural fields and lawns—through their **wallowing, tree-rubbing, and rooting** behaviors.[4] In Hawaii, more than 80% of soil is bare in areas inhabited by feral swine.[6] This intensifies soil erosion, negatively effects water quality/availability, increases invasive plant colonization, alters vegetative ground cover, and disrupts natural ecosystem processes.[6]

Disease

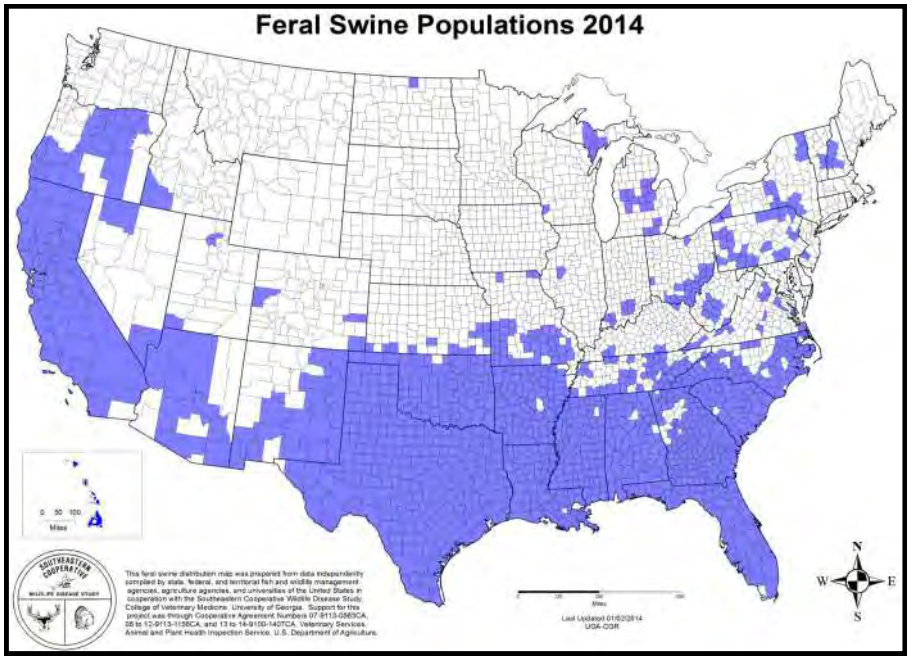
Feral swine can carry and transmit over **30 diseases and 37 parasites**[4] to wildlife, pets, livestock, and humans, including:

- **Zoonotic diseases**, like brucellosis, salmonellosis, and swine influenza, which can be transmitted to humans and wildlife;[9] and
- **Other infectious animal diseases**, like bovine tuberculosis and Aujeszky's disease (**pseudorabies**), which can affect some pets and have devastating effects to the livestock industry.[9]

Feral swine can also potentially facilitate the reemergence of **foot-and-mouth disease (FMD)**; one of the most economically damaging animal diseases in the world. Feral swine act as amplifiers of FMD because they can excrete large quantities of the disease as an aerosol virus, thus exacerbating its spread.[9]

FMD was last detected in the U.S. in 1929, Canada in 1952, and Mexico in 1953.[10]

Feral swine trap in Florida (Credit: Wikimedia User Rusty Clark).



Feral swine populations are expanding northward at a rate of 12.6 km per year. At this rate, the entire continental U.S. could be inhabited within the next 3–5 decades[11] (Credit: Southern Cooperative Wildlife Diseases Study 2014).

Management of Feral Swine

Management of feral swine is a challenging task. Swine are difficult to trap, highly mobile, and exhibit high reproductive capacity.[11] Where populations are well established, multiple methods of control are required to reduce or eradicate populations, including trapping, snaring, shooting, use of trained dogs, and aerial gunning.[2] **Hunting alone will not keep populations from growing**.[12]

Both federal and state agencies, with the assistance of non-governmental organizations, work to control feral swine, but **variability in regulations** across political boundaries further complicates management. Some states manage feral swine as a **game species**, while other states have little or no regulations concerning their control.[1] In recent years, this has led to the intentional, and illegal, release of swine to establish new populations for hunting. **Delayed implementation of control efforts for these newly established populations will result in the need for increased effort at higher cost and/or more years needed to achieve elimination**.[2]

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PLANTS

COMMON REED

Phragmites australis ssp. australis

Origin: Europe & Middle East

Common reed is a tall, herbaceous, perennial plant that grows 1-6 m tall from rhizomes or stolons (horizontal stems). The stems are hollow and ribbed. Leaves are linear, flat, drooping, smooth, and blue-green in color. The flowers grow in an oblong panicle inflorescence and progress from purple to straw-colored when mature. The non-native subspecies can be distinguished from the native using leaf color (blue-green vs yellow-green), persistent leaf sheaths, and rougher texture on the stem. Common reed mostly reproduces clonally through rhizomes but will also grow from viable seeds.

INVASIVE RANKING, NYS

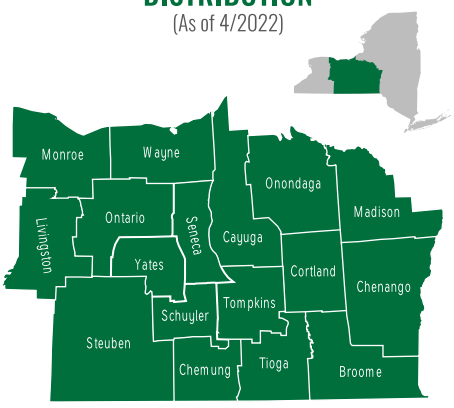
Very High

MANAGEMENT STRATEGY

Chemical
Physical
Prevention

DISTRIBUTION

(As of 4/2022)



HABITAT

Common reed grows on shorelines, wetlands, ditches, and disturbed sites. It can tolerate saline habitats and a wide range of environmental conditions.

THREAT

Common reed forms dense monocultures, displaces native species, and degrades wetland habitat. It also alters habitat structure and hydrology. The leaves and stems are of poor nutritional value to wildlife. Dense stands impede shoreline access and can block important signage, as well as pose a fire hazard during its dormant season.

MANAGEMENT

Prescribed burning following herbicide treatment can help manage common reed populations. Mechanical control can slow the spread but will not eradicate established stands. Soil disruption should be kept to a minimum since it encourages re-sprouting. Cut material should be raked, bagged, and disposed of to prevent seed dispersal. Large stands are best managed using herbicides.

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PLANTS

JAPANESE KNOTWEED

Reynoutria japonica
var. *japonica*
Origin: Eastern Asia (Japan, China, Korea)

INVASIVE RANKING, NYS

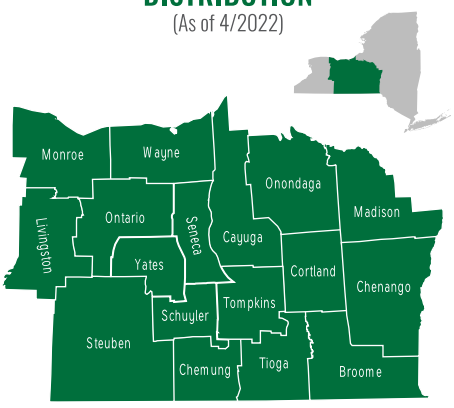
Very High

MANAGEMENT STRATEGY

Chemical
Physical
Prevention

DISTRIBUTION

(As of 4/2022)



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Japanese knotweed is a tall, shrubby, herbaceous perennial that forms dense patches up to 3 m tall. Stems are hollow and 'bamboo-like', with purple speckles. Leaves are broadly triangular in shape, about 15 cm long and 7-12 cm wide, coming to a sharply pointed tip. They emerge alternately from the swollen internodes, producing a 'zig-zag' appearance. In late summer, Japanese knotweed produces small, creamy white flowers in spikes up to 10 cm in length.

HABITAT

This species can tolerate a wide range of light conditions, temperatures, nutrients, and other environmental conditions. It is commonly found along streams and rivers, in low-lying areas, and in disturbed areas.

THREAT

This species spreads rapidly, forming dense populations that crowd and shade out native vegetation resulting in reduced species diversity, altered ecosystems, and negatively impacted wildlife habitat. Japanese knotweed grows aggressively in riparian and previously disturbed areas and can have detrimental effects on infrastructure.

MANAGEMENT

Rhizomes must be controlled in order to manage Japanese knotweed populations. Manual removal of established plants is usually ineffective due to the easily fragmented rhizomes. A range of chemical control methods, used alone or in conjunction with cutting, have been proven effective on smaller infestations, including foliar spray, cut-and-wipe, and stem injection. If plant materials are to be removed from the site, they should be bagged and disposed of; any root fragment or stem fragment containing an internode can start a new plant. Treatment of large infestations rarely results in the eradication of knotweed from the site, but can suppress the population and prevent spread.

REFERENCE - Japanese Knotweed. Michigan Department of Natural Resources. http://www.michigan.gov/documents/dnr/knotweed_BCP_372280_7.pdf November 10, 2017

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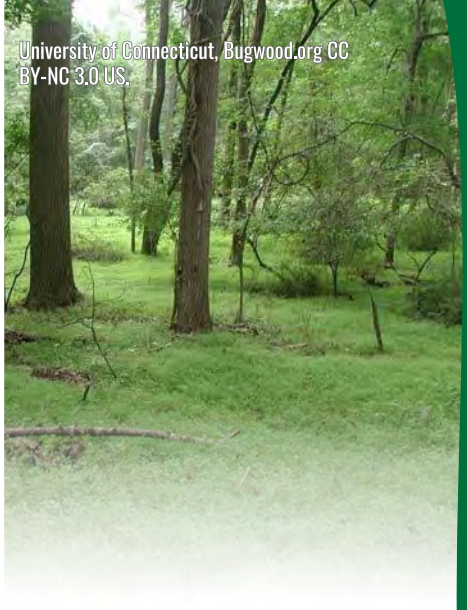


PLANTS

JAPANESE STILTGRASS

Microstegium vimineum
Origin: Asia

Japanese stiltgrass is an annual grass that is adapted to low light levels. It grows in a sprawling habit up to 1 m in height. The leaves are 3-13 cm long, asymmetrical with an off-center mid-rib, and are alternately arranged on the stalk. The leaves feel smooth, although each leaf has a line of silvery hairs on the upper surface. Japanese stiltgrass blooms in the late summer and early fall. Flowers are arranged in one or two delicate spikes at the top of each stem. Roots are weak, but can form at stem nodes.

INVASIVE RANKING, NYS

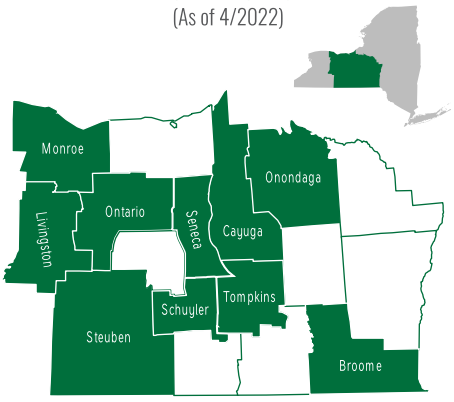
Very High

MANAGEMENT STRATEGY

Chemical
Mechanical
Physical
Prevention

DISTRIBUTION

(As of 4/2022)



HABITAT

Japanese stiltgrass grows in a wide range of habitats, from roadsides to undisturbed forest understory. It is most often associated with moist, acidic to neutral soils that are high in nitrogen. Japanese stiltgrass readily takes advantage of disturbed areas.

THREAT

Japanese stiltgrass grows densely, crowding out native vegetation. This results in decreased biodiversity and wildlife value, as well as disrupted ecosystem functioning.

MANAGEMENT

Prevent infestations by limiting disturbance and quickly remediating disturbed areas. Hand pulling, mowing, and soil tilling of small infestations can be effective before the seeds set in late summer. Herbicides can be used to control larger Japanese stiltgrass infestations.

REFERENCE - Japanese Stiltgrass. New York Invasive Speacies Information. Cornell University Cooperative Extension. http://www.nyis.info/index.php?action=invasive_detail&id=32

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Habitat Loss & Fragmentation

The term **habitat** refers to an area with the resources and conditions present to produce occupancy by a given organism.[1] These resources and conditions include **food, water, cover, and any special factors needed by a species for survival and reproductive success.**[2] Since habitat is organism-specific, the appropriate mix of abiotic and biotic components necessary for successful reproduction and survival varies by species.[1]

Habitat fragmentation occurs when a large expanse of habitat is transformed into a number of smaller patches of smaller total area, isolated from each other by a matrix of habitats unlike the original.[3] Habitat fragmentation describes changes in habitat configuration and can be independent of or in addition to the effects of **habitat loss**—a reduction in habitat abundance.[4]

Habitat fragmentation and loss affect wildlife in a variety of ways. Though changes in habitat quality and composition occur naturally, human manipulation of landscapes has increasingly served as a source of habitat changes—**some with overall negative effects to wildlife**. Fortunately, there are numerous techniques biologists can use to mitigate these effects and manage habitats to benefit a diverse array of wildlife species.

Collared peccary: Border fences can fragment habitat, prevent migration, and limit access to vital resources[8] (Credit: Matt Clark).

Effects of Habitat Loss & Fragmentation on Wildlife

Patch-Size Effects

When fragmentation occurs, it **reduces the total area of continuous habitat** and creates barriers for movement between habitats. This can negatively effect many species, particularly those species that have large territories or home ranges.[5]

Edge Effects

By breaking habitat up into smaller parts, this increases the amount of **edge**—perimeter area surrounding a patch. This increased edge can change both the biotic and abiotic aspects of the interior habitat and could **potentially reduce habitat quality** for some species.[6] However, given the organism-specific nature of habitat, landscape changes that are detrimental to the habitat of one species may benefit the habitats of others and thus have a positive effect on biodiversity.[4]

Isolation Effects

Fragmentation often isolates habitat and **prevents wildlife from moving** back and forth between patches. This can cause inbreeding, limit access to resources, and increase mortality for organisms unable to cross the non-habitat portion of land between patches.[4]

Sources of Human-Caused Habitat Loss & Fragmentation

Food Production | *Urban Development* | *Roads & Railways* | *Energy Development*




Photo Credit, from left to right: Pam Brophy, Simon Mortimer, Ken Kistler, Tim Evanson

Humans contribute to habitat loss and fragmentation in a variety of ways. As the worldwide human population and demand for **food production** continue to grow, the intensity of our land-use increases.[9] Whether for **economic productivity** or **urban development**, humans alter the landscape matrix in ways that effect the spatial density, diversity, and quality of wildlife habitat.[10] As habitat patches become smaller and more isolated, this affects the ability of wildlife to disperse—a factor further compounded by physical barriers like **fences and roadways** that bisect the landscape.[11] However, with knowledge of the habitat requirements for a particular species of interest (or group of species), land managers can make informed decisions as to how landscape alterations will influence ecological communities and then take appropriate steps to manage those habitats in a way that provides benefits to wildlife.[12]

Techniques to Prevent/Mitigate the Negative Effects of Habitat Fragmentation and Loss[13]

Wildlife Corridors:
A narrow strip of natural habitat that connects at least two significant habitat areas.

Land Acquisitions:
Local, state, federal, and private entities purchase land for habitat preservation.

Conservation Easements:
Agreements between private landowners and government agencies to prevent or limit commercial or residential development of critical habitat.

Restoration:
Converting once developed land to a natural state.

Mitigation:
Developers create or preserve lands of similar quality and size to that which they impact.

Zoning:
Adding wildlife and habitat conservation considerations into local development plans.

Buffer Zones:
Areas around targeted habitat that reduce the impacts of edge disturbances on species that require continuous habitat.

Wildlife Crossings:
A physical structure that facilitates the safe passage of animals over or under linear infrastructure like roads and railways.

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Updated: March 2017

NEW YORK STATE | Department of Environmental Conservation

Tips to Eliminate Wildlife Conflicts

Prevent and Control Wildlife Issues on Your Property

Below are general tips intended to help landowners ***REPEL*** or prevent and control problems with wild animals. The best way to reduce common wildlife issues is by eliminating access to food, water, and shelter, which is what all animals need to survive.

R emove food sources

- Clean up food around bird feeders and remove all feeders and suet in the spring and summer
- Secure or remove garbage immediately and wait until the day of trash pick-up to bring outside
- Feed pets indoors
- Use fencing to cover gardens and plants
- Pick up dropped fruit on the ground
- Use landscaping plants that do not attract problem animals

E liminate cover and shelter

- Get rid of piles of brush, logs, junk, etc., and stash firewood away from your house or other buildings.
- Mow tall grass near houses or other buildings. Wait until November to mow tall grass to ensure that nesting birds have left the area and that turtles near waterbodies have become fully inactive.

P ut up barriers

- Use chimney covers and soffit vents
- Fence in areas such as gardens and underneath decks
- Seal entry holes that lead into the house. Ensure there are no animals inside as this can lead to worse problems.

E xcite or agitate

- Use visual repellents such as scarecrows or lights
- Create noise (i.e. yelling, noisemakers) - be sure to check noise ordinances in your area
- Haze (i.e. chase away with dogs, remote control cars and planes, etc.). Do not haze a migratory bird that is nesting, as this is a violation of the Migratory Bird Treaty Act.

L egally remove or "take"

- Contact a Nuisance Wildlife Control Operator - hire a professional to remove problem wildlife from your property.
- Remove or "take" nuisance animals on your own in accordance to New York State laws and regulations.

Other Helpful Resources

DEC provides other helpful resources on handling problems with wildlife. Find out more on the Nuisance Species page.

Be BearWise AT HOME

Six At-Home BearWise Basics

Never Feed or Approach Bears

Intentionally feeding bears or allowing them to find anything that smells or tastes like food teaches bears to approach homes and people looking for more. Bears will defend themselves if a person gets too close, so don't risk your safety and theirs!

Secure Food, Garbage and Recycling

Food and food odors attract bears, so don't reward them with easily available food, liquids or garbage.

Remove Bird Feeders When Bears Are Active

Birdseed and grains have lots of calories, so they're very attractive to bears. Removing feeders is the best way to avoid creating conflicts with bears.

Never Leave Pet Food Outdoors

Feed pets indoors when possible. If you must feed pets outside, feed in single portions and remove food and bowls after feeding. Store pet food where bears can't see or smell it.

Clean & Store Grills

Clean grills after each use and make sure that all grease, fat and food particles are removed. Store clean grills and smokers in a secure area that keeps bears out.

Alert Neighbors to Bear Activity

See bears in the area or evidence of bear activity? Tell your neighbors and share information on how to avoid bear conflicts. Bears have adapted to living near people; now it's up to us to adapt to living near bears.

Black bear is a species; common colors include black, brown and cinnamon.

Learn More:
BearWise.org
Helping People Live Responsibly with Black Bears

BearWise®

Be BearWise® AT HOME CHECKLIST

How BearWise® Are You?

Bears are curious and will follow their powerful noses to just about anything with an odor (it doesn't have to be a good odor). Bears may also investigate anything they've learned can yield a food reward: garbage, birdseed, pet food, chickens, beehives…you get the idea.

Use our **Be BearWise Checklist** to learn what attracts bears and how you can keep bears away from your home and property.

BBQ Grills, Smokers

- ❍ Grill and/or smoker is stored inside when not in use. ***If not:***
  - ❍ Drip pans and grates are cleaned after every use.
  - ❍ Grill/smoker is kept covered.
- ❍ Utensils are stored indoors.
- ❍ Food is not left unattended when cooking or eating outdoors.

Be BearWise:
Keep a look-out when you cook-out. Thoroughly clean grills and smokers.

Trash, Recycling

- ❍ All trash containers are cleaned often to reduce odors.
- ❍ Recycling is rinsed out and clean.
- ❍ Bear-resistant trash containers are always closed and latched.

If containers are not bear-resistant:

- ❍ Regular trash cans are stored inside a sturdy locked building or bear-resistant enclosure.
- ❍ Garbage is put out the morning of pick up (not the night before).

Be BearWise:
For certified bear-resistant containers and ways to modify your standard trash cans, visit BearWise.org.

Vehicles Parked Outside

- ❍ No food or anything with a fragrance is left in vehicles, car trunks or truck beds, including pet food, birdseed, food, beverages, scented air fresheners and trash.
- ❍ Vehicle windows are kept fully closed and doors locked.

Be BearWise:
Keep a small trash bag in your vehicle and empty daily. Use an odor-removing spray. Roll up and lock up.

Feeding Birds

- ❍ Birds/hummingbirds are not fed when bears are active in your area.
- ❍ Bird food is stored in bear-resistant containers or inside a sturdy, locked building.

If you feed birds when bears are active:

- ❍ Bird food and feeders are brought in nightly.
- ❍ Fallen birdseed and leftover food is picked up daily before dark.

Be BearWise:
Download our bulletin: *Attract Birds, Not Bears* for feeder-free options.

Feeding Pets, Strays

- ❍ Food is not put outside for stray animals or wildlife.
- ❍ Pets are fed indoors.

If you must feed pets outside:

- ❍ Pets are fed in single portions; bowls are removed and feeding area cleaned as soon as pets have eaten.
- ❍ Pet food is stored in a sturdy locked building or bear-resistant containers.

Be BearWise:
Download our bulletin: *Dogs + Bears = Problems* for more safety tips.

continued >

Fruit Trees, Gardens

- ❍ Fallen fruit is picked up daily OR fruit is picked before it ripens.
- ❍ Fertilizers are free of blood-meal and bone-meal.
- ❍ Electric fencing protects the fruit trees, edible gardens, berry bushes, and ornamental fruit-bearing trees (such as flowering crabapples).

Be BearWise:
Avoid planting and consider removing ornamental fruit-bearing trees and bushes.

Compost

- ❍ Meat, bones, fish, oil, grease, dairy products, eggshells, garbage or large amounts of fruit are not put in the compost.
- ❍ Compost is protected with a bear-resistant enclosure or electric fence.

Be BearWise:
Follow USDA composting guidelines. Consider using an indoor composter.

Unexpected Attractants

Be aware that some outdoor features that can't be removed or easily protected can attract bears, such as:

- ◆ Swimming pool, hot tub, pond, stream, water features.
- ◆ Nearby woods, dense bushes, conservation areas.
- ◆ Natural foods (i.e. berries, acorns).

Be BearWise:
Don't give naturally curious bears **any other reasons** to stick around and look for people-provided 'food'.

If properly installed for your soil conditions and maintained, electric fencing is an effective deterrent for keeping bears out.

Chickens, Farm Animals

Bear-resistant buildings, enclosures, containers and/or electric fences protect:

- ❍ Animals at night
- ❍ Newborns, always
- ❍ Livestock feed

- ❍ Dead animals are not buried near homes, buildings, livestock areas.

Be BearWise:
Take extra steps to keep your animals safe and their feed away from bears.

Bears may dig up buried carcasses. Consult your county for other options.

Beehives

- ❍ Permanent or portable electric fencing protects the beehives.
- ❍ Beehives are at least 3 feet away from the electric fencing.
- ❍ Beehives are at least 300 feet from dense bushes, trees or other places bears could hide.

Be BearWise:
Wisely locate and protect beehives. Spread the word to your fellow beekeepers.

Homes, Outbuildings

- ❍ **Doors and windows** in houses and outbuildings are kept closed and locked, especially at night or when people are not home. Pay special attention to sliding glass doors, inward-swinging doors, French doors and doors with lever handles.
- ❍ **Crawl spaces and small openings** under home and other buildings are barricaded before hibernation.
- ❍ **Refrigerators and freezers** are kept inside sturdy, locked buildings.
- ❍ Attractants are not stored on **upper-level balconies/decks** that bears can reach by climbing stairs, trees or deck posts.
- ❍ **Garage doors** are kept closed to keep bears away from stored attractants (i.e. pet food, birdseed, trash, food in fridge/freezer).
- ❍ **Coolers** with food/drinks are not stored on the porch, patio, deck or in a vehicle.
- ❍ **Pet doors** are locked at night.

Be BearWise:
Screens don't keep out bears. Visit **BearWise.org** to learn how to use bear unwelcome mats and get other practical tips for keeping bears out.

Bears are smart, quick learners and may be active at any time of day.

Check with your state wildlife agency to find out when bears are most active in your area and what solutions are most effective (state and local regulations may vary).

Thanks for helping to keep people, pets and property safe and bears wild.

Learn More:
BearWise.org

NCF-Envirothon 2024 New York

Wildlife Study Resources

Key Topic #4: Field Skills

13. Identify common New York wildlife species from preserved specimens, skulls, skeletons, pelts, tracks, scat, photos, drawings, and other animal signs without the use of a key.

14. Describe how the morphology of a skull can be used to determine the diet and eating strategies of an animal.

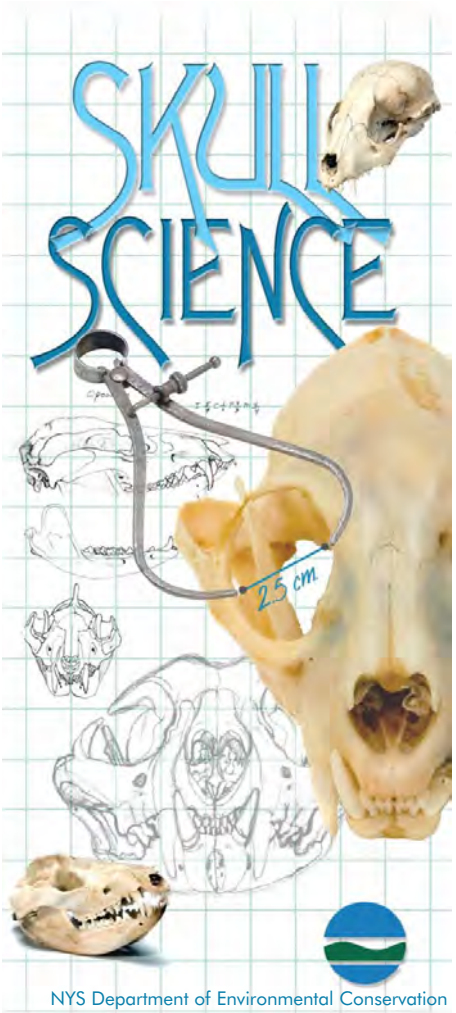
15. Describe how to age white-tailed deer using the tooth replacement and wear technique.

Study Resources

Resource Title	Source	Located on
Skull Science	*New York State Department of Environmental Conservation, 2017*	Pages 102-103
Aging White-tailed Deer	*New York State Department of Environmental Conservation, 2023*	Page 104-105

Study Resources begin on the next page! ➡

SKULL SCIENCE



NYS Department of Environmental Conservation

Did you ever find a bone while exploring the woods and wonder what animal it belonged to? Bones, especially mammal skulls and jaws, can tell you a lot about the animal they came from. Whether it's just a partial jaw or a full skull, the bone's size, shape and structure provides you with clues to the mammal's identity and habits.

If you're lucky enough to find an entire mammal skull, the first thing you should look at is its general size and shape. Is it large like a deer, or small like a rabbit? Is the skull streamlined and narrow like an opossum, or broader and rounder like a raccoon? Are there teeth, and if so, how many and what do they look like?

Teeth are great visual clues to an animal's identity. They indicate what and how an animal eats. In many mammals, the teeth are quite distinctive. By examining the dentition (number and form of the teeth), you can tell whether the animal is a meat-eater (carnivore), plant-eater (herbivore) or both (omnivore). Sharp, pointed teeth such as canines and carnassials (last upper premolar and first lower molar that meet with a scissorslike action) are used for tearing and shearing meat, indicating a carnivore. Broad, somewhat flat teeth are used for crushing and grinding vegetation, indicating an herbivore. Since omnivores, such as raccoons and humans, eat both plants and meat, they have sharp teeth in the front to rip and cut, and flattened teeth in the back to mash their food.

The condition of teeth (and bones) can provide you with information about the animal's history. For instance, heavily worn, damaged and cracked teeth may indicate that an animal is old. Likewise, chipped, broken or missing teeth, or broken bones could mean the animal was in an accident or fight.

In addition to teeth, other skull structures can tell you whether an animal is a meat-or plant-eater. For example, there are numerous sites on the skull for muscle attachment, which vary from species to species. In carnivores and omnivores, there is a ridge on top of the skull called a sagittal crest. The site of muscle attachment for the strong muscle that controls the crushing lower jaw, the sagittal crest is quite pronounced on opossum and fisher, and less pronounced on coyote, raccoon and otter. Since herbivores typically have smaller jaw muscles, they lack an obvious crest.

Another interesting feature on a skull is the position and size of the eye sockets. Predators, such as coyote and otter, generally have forward-facing eyes. This provides them with 3-D vision, enabling them to more accurately locate and follow prey. In contrast, prey species, such as rabbits, have relatively large eyes located on the sides of their head. This gives them great peripheral vision, aiding them in locating predators and warning them about sneak attacks.

While all mammal species have specific traits and adaptations, keep in mind that animals can also be highly variable within a species, adjusting to available conditions. For example, coyotes are generally meat eaters, but will also eat fruit. Raccoons and opossums are considered omnivores, but they may be entirely carnivorous or vegetarian depending on food availability. And while deer are herbivores, they have been observed to eat fish on occasion.

So next time you're in the woods, or even in your own backyard, look around and see if you can spot any mammal bones. While finding a complete skull is rare, you'll be amazed at what you can find, and surprised at the amount of information those bones reveal.

The following are a few mammals whose bones you might find in New York's outdoors.

Text by Eileen Stegemann
Artwork - Jean Gawalt / Layout & design - Frank Herec

Reprinted from the New York State Conservationist, April 2006
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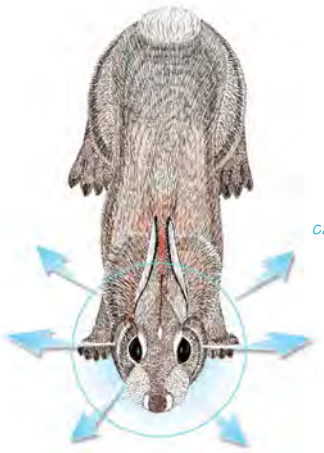
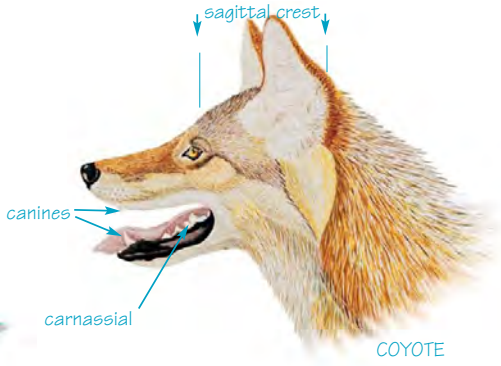
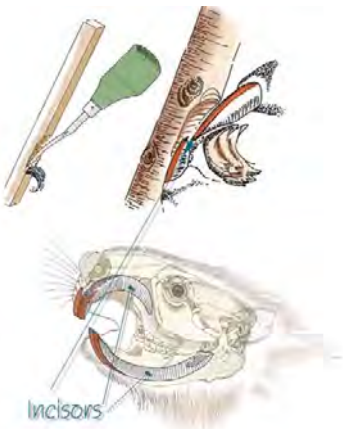


Rabbit's peripheral vision

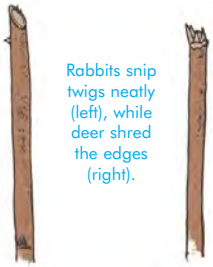


Skulls and teeth reveal a lot about an animal's habits. This coyote has forward-facing eyes for binocular vision, canines for puncturing flesh, and a heavy carnassial pair for crushing bones. In contrast, a rabbit has eyes on the side of its head to see danger approaching from almost any direction.

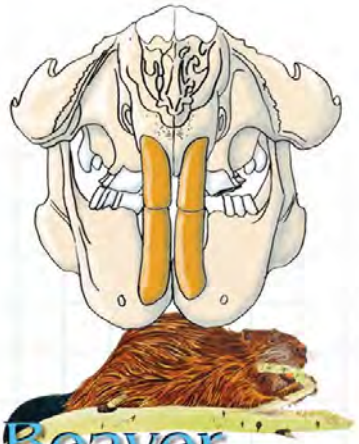
A dog-like animal, the coyote's skull is rather long with a large braincase and an elongated snout. Like other predators, the eyes are located on the front of the head, giving the coyote binocular vision and better depth perception. Though largely a meat eater, a coyote's diet consists of a wide range of available foods, including deer, rabbits, rodents, carrion, fruit, birds and insects. The coyote's teeth are specially adapted for eating meat. It has large, round, pointed canines for grabbing and stabbing prey, and blade-like premolars and molars for both shearing and crushing bones. The skull has a low sagittal crest for muscle attachment to the crushing lower jaw.



Beaver's incisors remove wood like a chisel.

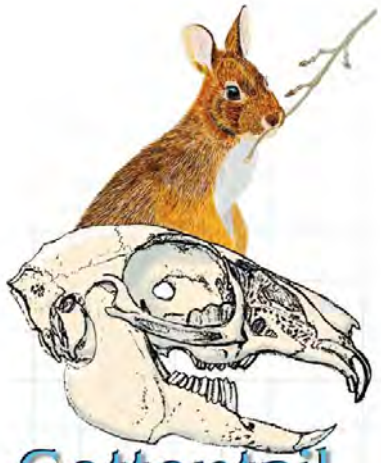


Rabbits snip twigs neatly (left), while deer shred the edges (right).



Beaver

The continent's largest rodent, the beaver has a thickly muscled body supported by large bones. Its skull and jaws are heavy to support the four large bright-orange incisor teeth (two on top, two on bottom). Like all rodents, the beaver's chisel-like incisors are deeply rooted in the skull and continue to grow throughout the animal's life. They use these sharp teeth to fell trees for both food and building material. The incisors automatically sharpen one another when the uppers meet the lowers. Constant gnawing keeps the teeth from growing too long. The beaver's molar teeth function much like a wood rasp, shredding and grating woody plant fibers. Eye sockets and ear openings are located high on the beaver's skull, enabling this animal to see and hear while floating on the water's surface.



Cottontail

Closely related to rodents, the eastern cottontail rabbit is an herbivore, eating a variety of plants, including tender green vegetation, garden produce, bark and buds of trees, vines and shrubs. Its jaw contains both upper and lower front incisors which enable it to neatly snip off plants. Unlike rodents, the cottontail has two pairs of upper incisors—a small incisor lies behind each large, deeply-grooved upper incisor. Popular prey for a number of predator species, the cottontail's skull has very large eyes sockets located on its sides. This eye placement provides a wide field of vision, enabling the cottontail to more effectively spot predators. You can test this: try to sneak up on a rabbit, even one that is facing away from you! In addition, the cottontail has very thin, light bones, which help the animal to run more quickly.

Raccoon

Its "masked" face familiar to many, the raccoon is a mischievous creature often known for getting into people's garbage. An omnivore, it will eat vertebrates, invertebrates, fruits, nuts, berries, mice, young birds, crayfish, frogs and turtle and bird eggs. It has a broad, rounded skull with a large brain case, and with eye sockets that face forward like a predator's. The jaw contains canines and ripping teeth as well as grinding teeth, but like a bear, the raccoon has broad, low-crowned molars shaped for crushing rather than cutting. The raccoon's scientific name, *lotor*, refers to its habit of washing food before eating it.

Deer

An herbivore, the white-tailed deer is considered a browser or grazer, eating leaves, stems, buds of woody plants, fruits, vines, mushrooms, grasses and acorns. The white-tail's broad molar teeth are high-crested and quite sharp for cutting, slicing and grinding. Like all mammals, the teeth wear down progressively as the deer grows older. Because a white-tail lacks upper incisors, it tears, shreds or roughly shears off vegetation when eating, rather than neatly snipping it like a rabbit. One distinguishing feature of a deer's elongated skull is the large gap on the lower jaw between the front incisors and back teeth. A prey species, the deer's eyes are set somewhat to the side for better peripheral vision.

River Otter

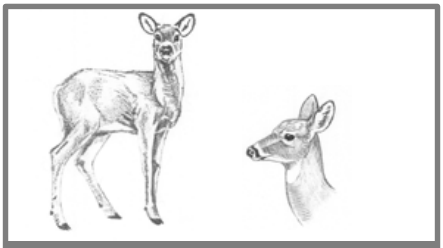
A large, mostly aquatic weasel, the river otter's streamlined body is perfectly shaped for moving quickly through water. Its skull is slightly flattened with an elongated braincase, and its eye sockets are set high on the head, close to the nose. This eye placement enables this predator to accurately view the surroundings while floating on the surface. The river otter eats fish and crustaceans, amphibians (particularly frogs), insects, birds and mammals. It has large, sharp canines for grasping prey, and its other teeth are adapted for slicing and crushing. Otters range over wide territories, and their high metabolic rates make them voracious eaters.

Opossum

The opossum is North America's only marsupial. Recognized by its long, bare, prehensile tail used during climbing, it is a primitive animal with a very small braincase. Opportunistic, the opossum is an omnivore, eating whatever is available, such as fruits, berries, insects, reptiles, amphibians, smaller mammals, carrion and garbage. Its skull can be distinguished from other mammals' by the large number of teeth—a total of 50 in an adult, including 10 upper and 8 lower incisors, large canine teeth, and a number of grinding teeth. The opossum's skull contains a number of strong muscle attachment sites, including a tall, well-defined, blade-like sagittal crest.

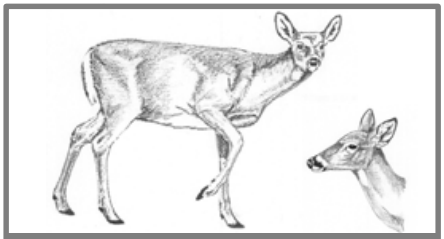
Aging White-tailed Deer

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation



Fawn

- Body about as long as tall (square)
- Short neck and compact nose
- Buck fawns' heads may have visible antler nubs or "buttons"



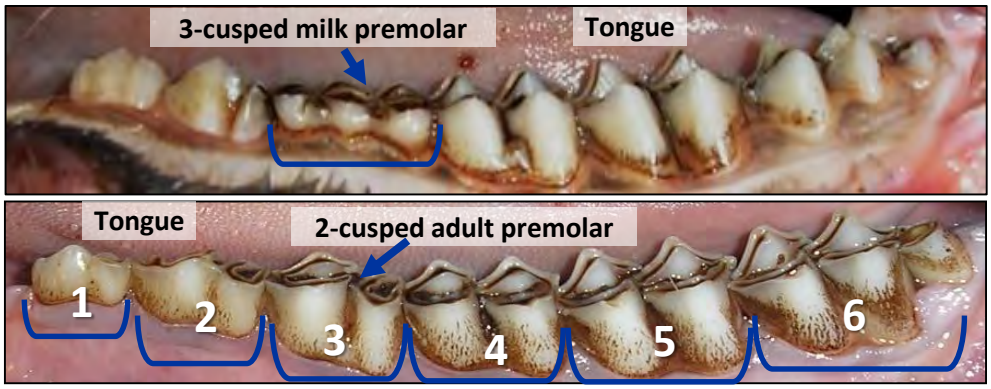
Adult Doe

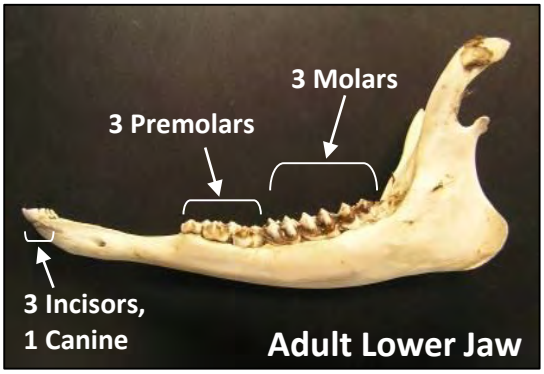
- Body longer than tall (rectangle)
- Long neck and elongated nose

These bucks from Washington County, New York demonstrate typical differences in body and antler size between yearlings and 2.5 and 3.5 year old bucks. Photos courtesy of QDMA.

	Yearling Buck	Older Buck
Body Size	similar to adult doe	larger than adult doe
Legs	appear long and skinny	thicker chest makes leg appear stocky
Muscles	often not clearly defined	well defined in shoulders and thighs
Body Shape	slender, belly tucks up	belly flat or even sagging
Antlers	thin, spread narrower than ear tips	spread as wide or wider than ear tips

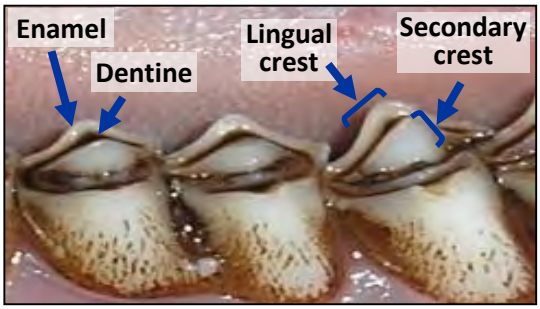
Tooth & Jaw Anatomy



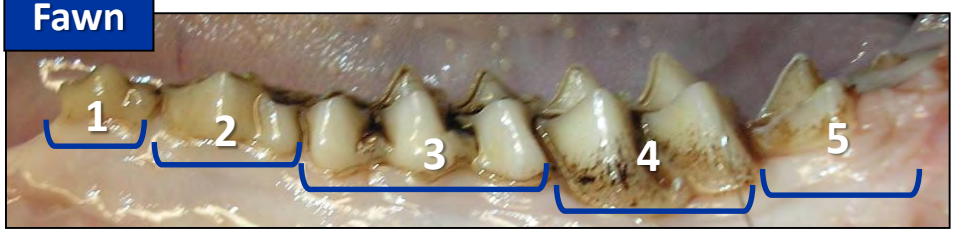


Definitions:

- Cusps – The points or projections on the surface of a tooth.
- Dentine – The soft dark brown inner core of the tooth.
- Enamel – The hard, white, outer coating of the tooth.
- Lingual Crests – The tooth ridges adjacent to the tongue.
- Secondary Crests – Crests in the interior of the tooth.
- Milk Teeth – Deciduous, primary teeth; will be replaced by adult teeth.



Fawn



Fawns have a noticeably shorter jaw than adults and do not have a full set of teeth. Fawns have less than 6 teeth along the side of their jaw (premolars and molars).

At 1½ years old, yearling deer have 6 teeth along the side of their jaw and may be at any one of three stages of replacing the 3 milk teeth (premolars). The 3rd molar is not fully erupted and shows no dentine. These three examples illustrate what you may see among yearling deer.

1½ years (yearlings)

STAGE 1

In the first yearling stage, all milk premolars are present, showing substantial dentine from wear. The 3rd premolar is 3-cusped. This yearling stage may be mistaken for an older deer.

STAGE 2

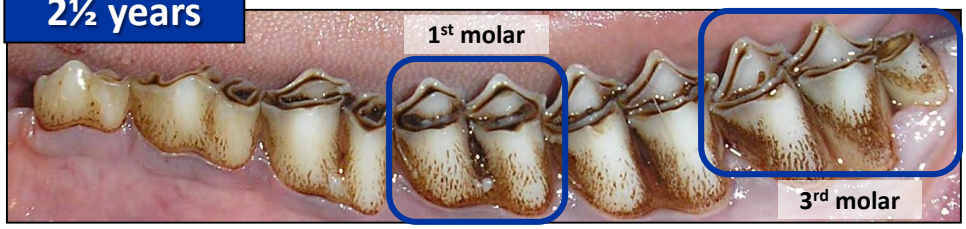
In the second yearling stage, milk premolars are being replaced by adult premolars. In this photo, the 3rd premolar is now a partially erupted, 2-cusped adult tooth.

STAGE 3

In the last stage, all adult premolars are fully erupted with very little or no wear showing on crests. The 3rd premolar is 2-cusped. The 3rd molar is not fully erupted and has no dentine showing from wear.

Deer that are 2½ years old or older have 6 adult teeth along the side of their jaw. Generally, as deer age, the tooth enamel wears down exposing more dentine, and the lingual crests become more blunt. Aging by wear patterns becomes less precise for deer above 3½ years old.

2½ years



Slight wear on 2nd and 3rd premolars. 1st molar dentine of lingual crest is not wider than enamel on either side of it and lingual crests are sharp. 3rd molar is fully erupted and shows dentine from wear.

3½ years

1st molar dentine of lingual crest is wider than enamel on either side and lingual crests are moderately blunt. 2nd molar dentine of lingual crest is not wider than its enamel and lingual crests still sharp.

4½ years

Both 1st and 2nd molars have wider dentine than enamel on lingual crests and lingual crests of both are blunted. 3rd molar dentine of lingual crest is not wider than its enamel. More wear on premolars and overall height of teeth is diminishing.

> 5½ years

Dentine of lingual crests of all three molars is wider than their enamel. Secondary crests on molars are becoming progressively worn until teeth are cup-shaped.