

Wetland Mammals

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Fish and Wildlife Habitat Management Leaflet

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National Oceanic and Atmospheric Administration

Wetlands provide a diversity of productive habitats for mammals, birds and other wildlife.

Wetland Basics

Wetlands are those lands between aquatic and terrestrial environments. The U.S. Fish and Wildlife Service (Cowardin et al. 1979) described five major systems of wetlands and deepwater habitats: marine, estuarine, lacustrine (lakes), riverine (rivers and streams), and palustrine (marshes, swamps, and bogs). Marine and estuarine systems include coastal habitats, while the other three systems include most inland

freshwater wetlands. At least 50% of the original wetland area in the continental United States has been lost to drainage, land-use development, and other human activities since colonial settlement.

Water is the most influential component of wetland ecosystems, controlling soil characteristics and associated plant and animal life. Wetland substrates are inundated or saturated near the surface long enough during the growing season to influence the vegetation community. Plants that are adapted to tolerate wet environments (generally referred to as hydrophytes) are more likely to inhabit wetland systems than plants that favor upland sites. Hydric soils develop in wetlands, largely due to the anaerobic conditions created by saturation at or near the surface during the growing season. Therefore, wetland hydrology, hydrophytic vegetation, and hydric soils are the three basic characteristics of wetland habitats.

Wetlands provide a variety of biological and socio-economic functions and are among the most productive ecosystems in the world. They provide diverse wildlife habitats and support complex food chains. At least 150 bird species and 200 fish species are wetland-dependent. About 900 terrestrial animal species use wetland habitats of the United States periodically throughout their lives for breeding, foraging, or other activities. The Prairie Pothole Region in the northern plains contains 10 percent of U.S. wetland area, but supports 50 percent of U.S. mallard, northern pintail, and green-winged teal production. The Great Basin area of the intermountain west also provides important wetland habitat for migrating birds.

Many species of mammals depend on wetland habitats for survival. Some mammals are herbivores, while others are omnivores or carnivores that rely on varying

Wetland Functions and Values

Hydrological

- ❖ Help control floodwater and lower flood and erosion potential.
- ❖ Contribute to aquifer and groundwater recharge.

Geochemical

- ❖ Filter pollutants and heavy metals from precipitation and point source and nonpoint source pollution (agricultural runoff, industrial discharge, etc.).

Biological

- ❖ Provide habitat for fish and wildlife.

Socio-economic

- ❖ Support timber production.
- ❖ Support shellfish production and aquaculture.
- ❖ Provide water sources for agriculture.
- ❖ Provide fuel source (peat) in some countries.
- ❖ Provide recreational opportunities such as hunting, trapping, canoeing, and bird watching.
- ❖ Provide educational opportunities.
- ❖ Aesthetic values.

combinations of aquatic invertebrates, amphibians, fish, and other prey. Many wetland mammals consume large numbers of insects, cultivate the soil, or modify habitat used by waterfowl and other wildlife.

This leaflet is designed as an introduction to wetland mammal identification and management, and is intended to assist landowners in their efforts to effectively manage wetland mammal habitats. The success of any management strategy depends on targeting the specific needs of the desired species and analyzing designated habitat areas to ensure all required habitat elements are present. Not all habitat management recommendations are suitable for all wetlands. Most successful plans use a combination of management methods that improve wetland biodiversity. Individual plans should take into account local climate, flora, and fauna. Landowners should be familiar with state and federally listed plant and animal species (see U.S. Fish and Wildlife Service Endangered Species Homepage, <http://engangered.fws.gov>) and are encouraged to consult natural resource professionals to achieve management objectives and identify future goals.

Wetland Mammals

Wetlands throughout North America are used by a wide variety of mammals. However, some species are more closely associated with wetland habitats than others. This leaflet focuses on species considered wetland mammals by Neiring (1992) and Burt and

Table 1. Species of wetland mammals in North America.

Order	Family name	Species name
Insectivora	Soricidae	Arctic shrew, masked shrew, Pacific shrew, Pacific water shrew, smoky shrew, water shrew
	Talpidae	Star-nosed mole
Rodentia	Zapodidae	Meadow jumping mouse
	Muridae*	Cotton mouse, golden mouse, marsh rice rat, meadow vole, southern red-backed vole, water vole muskrat, round-tailed muskrat, southern bog lemming
	Capromyidae	Nutria
	Castoridae	Beaver
Lagomorpha	Leporidae	Marsh rabbit, swamp rabbit
Carnivora	Mustelidae	Mink, river otter

*Incorporates and replaces *Cricetidae*



USDA Natural Resources Conservation Service

Tidal marshes provide numerous functions, including food chain support of coastal fisheries and habitat functions for mammals, birds, and other wildlife.

Grossenheider (1980).

Wetland mammals inhabit a variety of wetland habitats, and have diverse food and cover requirements. Below are general descriptions of wetland mammals, tracks, ranges, and habitat associations.

Shrews

Shrews are small, mouse-size insectivores with long, pointed noses and small eyes. They are found throughout most of North America and are active year-round. Shrews require an enormous amount of food to fuel their fast metabolisms. They feed on insects, slugs, and other invertebrates, and small vertebrates such as salamanders, frogs, and other mammals. Predators such as snakes, hawks, owls, weasels, and foxes often rely heavily on shrews as a major diet component. Prolific breeders, most shrews can produce up to three litters a year, each litter containing two to ten young. Six species of North American shrews are closely associated with wetlands: the Arctic shrew, smoky shrew, water shrew, Pacific water shrew, Pacific shrew, and masked shrew.

Moles

Moles dig shallow and deep tunnel systems below the ground surface. The low ridge of pushed-up soil on the ground surface is a sign that moles are below foraging for food. The more permanent, deeper tunnels are

Arctic shrew (*Sorex arcticus*)

Total length: 10.1–12.6 cm (4–5 in.)

Range: Most of Canada and Alaska south to North Dakota, northeast South Dakota, Minnesota, Wisconsin, and Michigan's Upper Peninsula.

Habitat: Swamps, bogs, marshes, and grass-sedge meadows.



Arctic shrew from Burt and Grossenheider (1980).

Smoky shrew (*Sorex fumeus*)

Total length: 11–12.7 cm (4¼–5 in.)

Range: Northeastern U.S. south through mountains to eastern Tennessee, north Georgia, and northern South Carolina; north to Ontario, Quebec, New Brunswick, and Nova Scotia.

Habitat: Various types of moist wooded areas, swamps, and along streams.

Comments: Uses tunnels made by red-backed voles, bog lemmings, northern short-tailed shrews, and star-nosed moles.



Water shrew (*Sorex palustris*)

Total length: 14.4–15.8 cm (5 5/8–6 1/4 in.)

Range: Most of Canada, south through northeastern California, Utah, and isolated populations in the White Mountains of Arizona; central states to northeastern South Dakota, northern Minnesota, Wisconsin, and Michigan; New England south through the Appalachians to North Carolina.

Habitat: Among boulders along mountain streams or in sphagnum moss around lakes.

Comments: Semiaquatic with large, broad hindfeet, slightly webbed between third and fourth toes; all toes have stiff hairs on the sides to increase swimming efficiency; fur traps air bubbles underwater for buoyancy.



Pacific shrew (*Sorex pacificus*)

Total length: 12.9–16 cm (5 1/8–6 1/4 in.)

Range: Pacific Coast from southern Oregon to northern California.

Habitat: Spruce and redwood forests; stands of alder skunk cabbage along the edges of streams.

Comments: Nocturnal.



Masked shrew (*Sorex cinereus*)

Total length: 7.5–11 cm (3–4 1/4 in.)

Range: Most of northern North America, south to Washington, Idaho, south-central Utah, north-central New Mexico, Nebraska, Iowa, Indiana, extreme northern Kentucky, Maryland and south through the Appalachians.

Habitat: Marshes, moist fields, bogs, moist or dry woods.

Comments: Primarily nocturnal, rarely seen.



Masked shrew from Burt and Grossenheider (1980).

Pacific water shrew (*Sorex bendirii*)

Total length: 14.7–17.4 cm (5 7/8–6 7/8 in.)

Range: Coastal northern California, north to southeastern British Columbia.

Habitat: Marshes, along streams, occasionally moist forests.

Comments: Largest *Sorex* species; fringed hairs on toes give it buoyancy to run on top of the water's surface for several seconds; also dives.



used for resting, raising young, and food storage. Moles have broad, spade-like forefeet that are used for moving soil. The eyes are tiny and external ears are nonexistent. Moles eat a variety of insects and other invertebrates, and are typically important prey for raptors, snakes, owls, weasels, foxes, and other carnivores. Most moles live in well-drained upland areas. However, one species, the star-nosed mole, is adapted to living in the muddy soils of wetlands. The fleshy appendages on its nose enable it to recognize prey items by touch.



Dr. Ken Catania, Vanderbilt University

The fleshy, tentacle-like projections around the nose of the star-nosed mole are used for tactile detection of prey.

Mice, rats, lemmings, and voles

Mice, rats, lemmings, and voles are small to medium-size rodents. Most live on or under the ground, and some are semiaquatic. Lemmings and voles have short

tails and small ears and eyes in contrast with the longer, thinner tails and larger ears and eyes of mice and rats. These rodents are active year-round and are primarily nocturnal. They feed on a variety of foods from subterranean fungus, seeds, fruits and green vegetation, to terrestrial and aquatic invertebrates, to small bird eggs and young. Mice, rats, lemmings, and voles are important prey for many predators including owls, hawks, raccoons, foxes, mink, weasels, skunks, and others. The number of litters and the number of young per litter vary among species. Several species of mice, voles, and the southern bog lemming are considered wetland species in North America.

Star-nosed mole (*Condylura cristata*)

Total length: 15.2–21.1 cm (5 7/8–8¼ in.)

Range: Most of the northeastern U.S.; southeastern Labrador south through most of Minnesota, northeastern Indiana, northern Ohio, south through the Appalachians and along coastal Virginia; isolated populations along Georgia coast.

Habitat: Swamps, wet woods or fields, sometimes moist lawns.

Comments: The only semiaquatic mole; 22 tentacle-like, fleshy projections around tip of nose that act as tactile organs to probe/search out prey; waterproof fur, uses spade-like feet as paddles, tail as rudder; hunts stream bottoms for aquatic invertebrates, crustaceans, mollusks, even small fish; forages in tunnels for terrestrial invertebrates.



CVIOG/GeorgiaInfo

The cotton mouse is a strong swimmer that inhabits moist woodlands, swamps, and other wetland areas.

Cotton mouse (*Peromyscus gossypinus*)

Total length: 15.2–20.5 cm (6–8 1/8 in.)

Range: Southeastern U.S. from eastern Texas and southeastern Oklahoma east to southeastern Virginia, eastern North Carolina, eastern South Carolina, Georgia, and Florida.

Habitat: Swamps, moist woodlands, beaches, rocky areas and brushlands.

Comments: Strong swimmers and regularly climb trees; nocturnal.



Marsh rice rat (*Oryzomys palustris*)

Total length: 18.7–30.5 cm (7 3/8–12 in.)

Range: Mostly the southeastern U.S.; eastern Texas north to southeastern Kansas, southeastern Missouri, southern Illinois, southern Kentucky, eastern North Carolina, and north to southeastern Pennsylvania and southern New Jersey.

Habitat: Mostly marshes.

Comments: Semi-aquatic and swims underwater; water repellent fur; small internal cheek pouches; subterranean fungus *Endogone* is an important diet component.



Mansell 1998. CVIOG/GeorgiaInfo

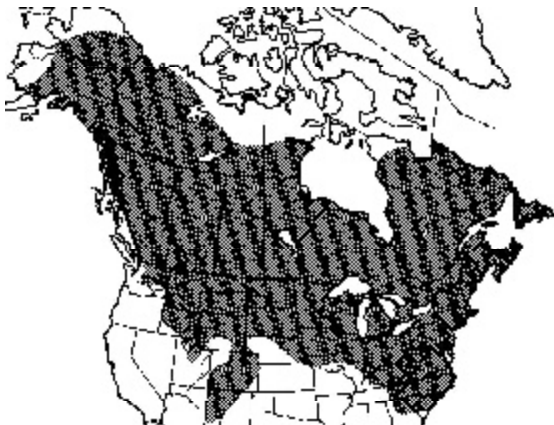
Meadow vole (*Microtus pennsylvanicus*)

Total length: 14–19.5 cm (5½–7 3/4 in.)

Range: Canada and Alaska (except northern most portions) south and east to northern Washington, Idaho, Utah, New Mexico, Wyoming, Nebraska, northern Missouri, northern Illinois, Kentucky, northeastern Georgia, and South Carolina.

Habitat: Marshes, swamps, woodland glades, mountaintops, fields.

Comments: Active day or night; good swimmer, nests above or below ground.



Meadow jumping mouse (*Zapus hudsonius*)

Total length: 18.7–25.5 cm (7 1/4–10 in.)

Range: Southern Alaska and most southern portions of Canadian provinces; northeastern U.S. west to eastern Wyoming and south to northeastern Oklahoma and northeastern Georgia.

Habitat: Moist fields, marshes, brushy fields, woodlands with thick vegetation.

Comments: Belongs to the family of jumping mice, Zapodidae; primarily nocturnal; hibernates in winter nest two to three feet below ground surface, October or November; emerges from hibernation in April or May; can take jumps three to four feet long on large hindfeet; feeds mostly on invertebrates in spring, seeds and green plants, and the subterranean fungus *Endogone* in summer and fall.

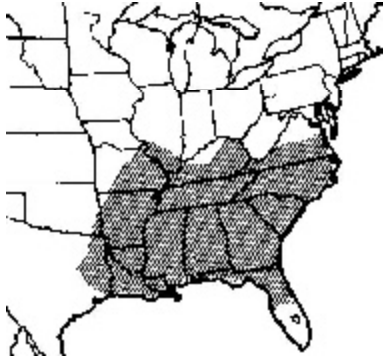
Golden mouse (*Ochrotomys nuttalli*)

Total length: 15–19 cm (5 7/8–7½ in.)

Range: Eastern Texas and Oklahoma, southern Missouri and southern Illinois to the East Coast; southern Virginia south to central Florida.

Habitat: Swamps, greenbrier thickets, rocky hemlock slopes.

Comments: Arboreal mouse, uses long tail for balance; bright golden-cinnamon color with white belly.



Mansell 1998. CVIOG/GeorgiaInfo

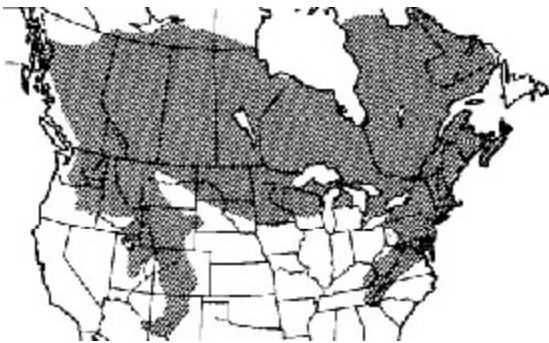
Southern red-backed vole (*Clethrionomys gapperi*)

Total length: 12–15.8 cm (4 3/4–6 1/4 in.)

Range: Southern portion of most Canadian provinces south into Oregon; Rocky Mountain system to Arizona and New Mexico; North and South Dakota, Minnesota, Wisconsin, northern Michigan; Allegheny Mountain system to North Carolina, New England south to Maryland.

Habitat: Cool, damp forests; swamps and bogs.

Comments: Active day and night; usually uses natural runways along fallen logs, tree roots, along rocks or tunnels of other animals; climbs trees.



Water vole (*Arvicola richardsoni*)

Total length: 19.8–26.1 cm (7 3/4–10 1/4 in.)

Range: Southeastern and southwestern British Columbia and southwestern Alberta south through central and eastern Washington; central and eastern Oregon, northern Idaho, north-central Utah and western Wyoming.

Habitat: Upland creek- and streambanks and marshes; often above timberline.

Comments: Large, semi-aquatic vole; burrows along streambanks and lives in colonies.

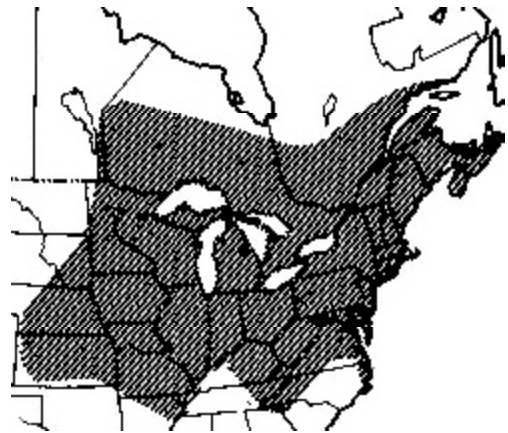
Southern bog lemming (*Synaptomys cooperi*)

Total length: 11.8–15.4 cm (4 5/8–6 1/8 in.)

Range: Southeastern Manitoba east to Newfoundland and south to Kansas, northeastern Arkansas, western North Carolina, and northeastern Virginia.

Habitat: Low, damp bogs and meadows with heavy vegetation.

Comments: Active day or night; uses underground runways of other small animals; also burrows about six inches underground to create own system of tunnels.



Muskrats

Muskrats are active year round and feed on emergent wetland plants including the roots and shoots of cattails, arrowheads, duck potato, bur reed, bulrushes, pondweed, and other aquatic vegetation. Corn, clover, alfalfa, carrots, apples, insects, and aquatic invertebrates are also eaten. Muskrats do not cache food for the winter. Instead, they dig up roots and tubers from under the ice in cold regions, creating visible “push-ups”—mounds of ice that are visible on the surface of the ice. During warmer months, feeding stations are usually within 200 yards of the con-

Muskrat (*Ondatra zibethicus*)

Total length: 40.9–62 cm (16 1/8–24 3/8 in.)

Range: Most of U.S. and Canada, except for extreme southern U.S. and arctic regions of Canada.

Habitat: Marshes, edges of ponds, lakes, rivers, and streams; brackish or saltwater waterways; dislike strong currents.

Comments: Aquatic rodents; hindfeet partially webbed and vertically flattened, long scaly tail used for swimming; build conical houses of marsh vegetation two to three feet above the surface of the water; houses usually have one nesting chamber with one or more underwater entrance; several muskrats may live in one house during cold months; also burrows into banks of streams and ponds; valuable fur bearer.



Mansell 1998. CVIOG/GeorgiaInfo

shaped house/den, which is built of vegetation above the water's surface. Some dig burrows and nest chambers in streambanks with entrances below the water level. Runs created through wetland vegetation may be visible on the bottom of shallow marshes, streams, or other frequently used areas. Muskrat predators include mink, red foxes, raccoons, bobcats,

snapping turtles, large snakes and fish, and some raptors.

Muskrats have a valvular mouth that allows them to feed underwater. The dense pelage of nearly waterproof underfur overtopped with longer, coarse guard hairs provides insulation. Muskrats have glands under the skin near the anus that produce a musky odor, especially during the breeding season. These aquatic rodents can have two or three litters per year, averaging six young per litter. Females with young can be aggressive and territorial.

Rabbits

Swamp rabbits and marsh rabbits are similar to their upland cottontail cousins, but are associated with bottomland hardwood wetlands and coastal marshes of the Southeast. Feeding on a variety of wetland and upland plants, these species are popular game animals in many areas. They are also an important food source for many carnivores associated with bottomland hardwood and coastal wetlands, including alligators, snakes, raptors, bobcats, and foxes. Being strong swimmers, both species readily take to water to escape from predators.

Marsh rabbit (*Sylvilagus palustris*)

Total length: 35–45 cm (14 1/8–18 in.)

Range: Southeastern Virginia southwest to Florida.

Habitat: Wet bottomlands, swamps, hummocks, lake borders, coastal waterways.

Comments: Primarily nocturnal; takes to water when threatened, good swimmer.



Swamp rabbit (*Sylvilagus aquaticus*)

Total length: 53–54 cm (20 7/8–21 1/4 in.)

Range: Eastern Texas and eastern Oklahoma east to southern Illinois and northern Georgia.

Habitat: Swamps, marshes, wet bottomlands, canebrakes.

Comments: Also called cane-cutter rabbit; can do damage to agricultural crops near swamps; good swimmer and swims as regular mode of locomotion; runs circles in front of hunting dogs; rarely burrows.



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Nutria

Nutria are semi-aquatic, primarily herbivorous South American rodents that were introduced in North America in 1899 by California fur producers. Eventually, nutria escaped or were introduced in 22 states across the U.S. Nutria are smaller than beavers, but larger than muskrats. Under optimal habitat conditions, female nutria born during the summer can reach sexual maturity at four months of age. They are prolific breeders and may have two or three litters per year, each litter averaging four to five young. Nutria are considered habitat generalists because they are common where they are established and inhabit a variety of habitats, including coastal and inland freshwater and brackish marshes, bottomland hardwood forests, lagoons, swamps, drainage canals, freshwater impoundments, and banks of lakes, rivers,



Mike Haramis, USGS Patuxent Wildlife Research Center

The foraging and tunneling activity of nutria can severely degrade sensitive coastal marshes.

and streams. Nutria feed mostly at night, but are also active during daylight hours. Besides humans, alligators, and raptors, there are few natural predators to control nutria numbers.

The foraging and burrowing activities of nutria can destroy wetland vegetation, degrade native wetland ecosystems, and damage human economic interests.

Nutria (*Myocastor coypus*)

Total length: 67–140 cm (26 3/8–55 1/8 in.)

Range: Introduced in the Southeast from South America; also in Maryland, southern New Jersey, scattered in the Great Plains, northern Oregon, and Washington.

Habitat: Marshes, swamps, ponds, and lakes.

Comments: Also known as coypu, incisors dark-orange and protrude beyond lips; primarily nocturnal, feeds on available aquatic vegetation, eats at feeding station (log, vegetation, other raised object); typically builds nest of vegetation on surface of water; rarely burrows into banks to nest.



Mike Haramis, USGS Patuxent Wildlife Research Center

Nutria with kits.

They consume the basal portions of plants, including roots, rhizomes, and tubers. During the winter months, nutria may feed on the bark of willows, bald cypress, or other bottomland hardwood species. Nutria also eat agricultural crops adjacent to aquatic habitats such as sugarcane, rice, grain sorghum, and ornamental plantings. Native muskrats consume only the stems of aquatic plants, but nutria typically excavate the entire plant leaving little chance for regrowth. The cut stems may be used to build feeding stations. Their foraging activities destroy the root mat that is so important to soil stabilization in aquatic ecosystems. Without the root mat, erosion increases and vegetated marsh is converted into open water degrading the marsh habitat required by many wildlife species, and wetland vegetation regrowth is inadequate or nonexistent. These open areas are called “eatouts” and can result in permanent marsh loss. Burrowing activities can damage dikes, levees, and other water control structures. Nutria can also outcompete and displace native muskrat populations.

Beaver

Beavers are the largest living rodents in North America. Beavers are active year-round, mostly at night. The most obvious characteristic is the flat, paddle-like tail that is used for temperature regulation, fat storage, and for communication (during alarm situations). The scaly tail is also used as a rudder while swimming and for balance when cutting trees. The ears, nose, and mouth are valvular for underwater activities. A nictitating membrane covers the eyes for clear underwater vision. Specialized toes on the hindfeet comb the fur and distribute water-repellent oil from two abdominal oil glands. Large castor (anal scent) glands produce castoreum, a yellowish-brown oil that is deposited on mud scent mounds to mark territory. Scent mounds are generally close to the water’s edge and have a pungent smell. Family groups typically contain paired adults, three or four kits, and yearlings residing in one lodge or burrow. At the age of two years, young beavers are driven out of the family lodge and territory. Females can breed at 1½ years of age.

Beavers inhabit wooded lakes, streams, and rivers

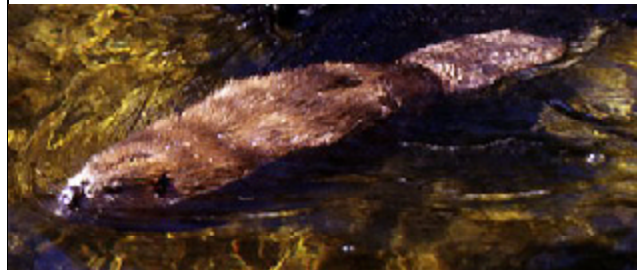
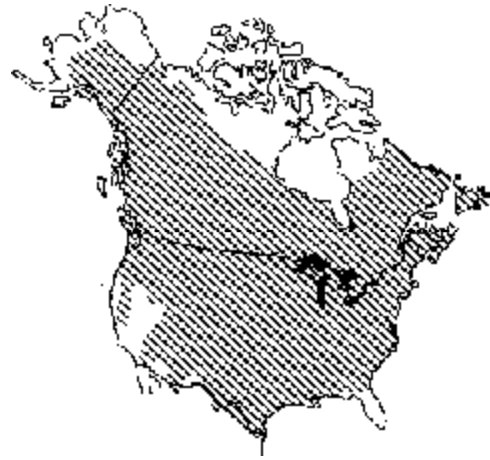
Beaver (*Castor canadensis*)

Total length: 90–117 cm (35 1/2–46 in.)

Range: Most of Canada and the U.S. except for most of Florida and Nevada, and southern California.

Habitat: Rivers, streams, marshes, lakes, and ponds.

Comments: Beavers inhabiting faster moving rivers and streams burrow into the banks to create chambers with underwater entrances; others build stick-and-mud dams across streams and large conical lodges of sticks and mud at the water’s edge (one or more underwater entrances); wood chips on floor absorb moisture, vent near top of lodge provides fresh air.



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C. Rewa

Beaver manipulate wetland vegetation and hydrology by cutting trees for building dams on streams.



C. Rewa

Beaver dams can enhance habitat for some wildlife by increasing water depth and aquatic invertebrate production.

throughout much of North America. Beavers prefer the bark and green twigs of aspen, poplar, birch, maple, sweetgum, blackgum, black cherry, tulip poplar, and willow trees. Leaves and roots of woody plants are consumed along with grasses, sedges, and rushes during the summer. They use woody materials to build stick-and-mud dams, lodges, and underwater winter food caches.

The waterproof underfur is covered by long, dark brown guard hairs. Prime beaver pelts were the backbone of the fur trade in colonial times. Overharvesting almost caused the beaver's extinction. Repatriation of beavers to their former range, establishment of bag limits, and falling fur prices helped re-establish beaver populations in much of their former range.

Mink

The mink is a semiaquatic member of the weasel family (Mustelidae). Mink were the first American furbearers to be raised in captivity for their pelts. Elongated bodies and waterproof fur allow the mink to swim easily and feed on crayfish, frogs, and fish. Mink also prey on small mammals, birds, and eggs. When the mink is threatened or disturbed, it releases musk from scent glands located in the anal region. The musk, along with droppings, is also used to mark territory on waterways. Mink are typically solitary and are primarily nocturnal.

Mink (*Mustela vison*)

Total length: 49.1–72 cm (19 1/4–28 1/4 inches)

Range: Most of United States and Canada except Arizona, southern California, southern Utah, southern New Mexico, and western Texas.

Habitat: Along rivers, streams, lakes, ponds, and marshes.

Comments: Primarily nocturnal; males larger than females; both sexes can be hostile to intruders; one of the most valuable fur animals; rich dark brown, usually with a white chin patch; eyes are yellowish-green; male pelts usually worth more than female pelts because they are larger.



River otter

River otters are sociable, semiaquatic members of the weasel family. Webbed feet and clawed toes, along

River otter (*Lutra canadensis*)

Total length: 88.9–131.3 cm (35–51 5/8 inches)

Range: Alaska, most of Canada south to northern California and northern Utah; Newfoundland south to Florida; extirpated from most of Midwest.

Habitat: Rivers, ponds, lakes, streams in wooded areas, but has been known to travel far from water.

Comments: Males larger than females; active during the day if isolated from human disturbance.



CVIOG/GeorgiaInfo

with a streamlined body and thick, tapered tail, help river otters move swiftly underwater. Fish, crayfish, frogs, salamanders, snails, turtles, snakes, small birds, and some vegetation make up the river otter's diet. Otters are chiefly nocturnal but can be seen during the day playing with each other or their food. Slides are smooth grass-, mud- or snow-covered slopes at the water's edge up to 25 feet long that river otters use repeatedly. Otters typically have 1–5 kits that stay with the parents for as long as one year. Dense, oily underfur limits the market value of river otter pelts.

Other mammals

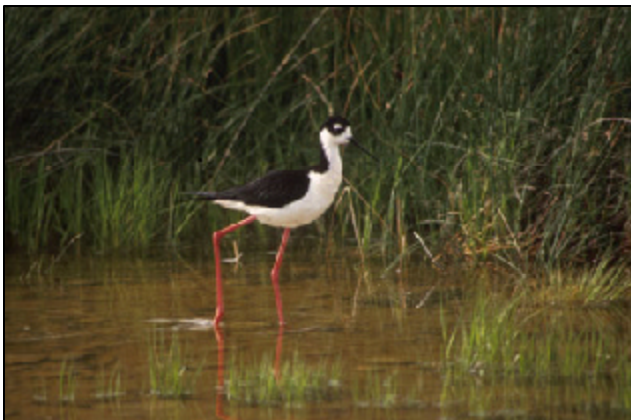
Other mammals, such as raccoons, black bears, white-tailed deer, and moose, use wetlands extensively but also rely on a variety of upland habitats. Raccoons are associated with forests, wooded swamps, streams, and lakes. Black bears may wade into lakes and streams to catch an occasional fish (black bears eat mostly vegetable matter). White-tailed deer are generally considered an upland species, but find food and cover in wetland habitats. Moose feed on submerged wetland vegetation, and use water as an escape from biting insects. Moose are typically found in spruce forests and aspen and willow thickets close to water.



Raccoon, black bear, white-tailed deer, and moose are some upland mammals that are also associated with wetland habitats.

Habitat Management for Wetland Mammals

Habitat management practices applied to a particular wetland depends on the goals of the landowner or manager. Management efforts can be directed toward a specific wildlife species, or aimed at increasing the overall biodiversity of wetlands and associated upland habitats. Successful efforts usually increase seed sources, invertebrate populations (an important food source for waterfowl and other birds, small mammals, fish, and amphibians) and other wetland mammal foods. Management efforts should also address the cover needs of targeted species.



Ruth Nissan, USFWS

Shorebirds like the black-necked stilt, wading birds, and waterfowl can benefit from vegetation management and water level manipulation conducted to improve wetland mammal habitat.

Wetland mammal habitat management typically involves manipulating the hydrologic condition (defined as the rate and timing of inflow and outflow, source, duration, frequency, and depth of flooding, ponding, or saturation), hydrophytic plant communities, and/or other habitat components. Many factors affect management practices, including—

- topography, shape, and size of the wetland;
- water quality, depth, and natural/controlled fluctuating water level;
- soil characteristics (especially if plantings are a consideration);
- local climate;
- existing and desired vegetation species, composition, and structure;
- existing wildlife species and populations; and

- condition and management of associated upland habitats.

Managers should consider how proposed management actions would affect the following topics before taking action:

- impact on existing wetland functions;
- change in plant growth rate or composition due to changes in volume of available water;
- effects on downstream flows, associated wetlands, and other water-related resources;
- effects on water temperature as related to plant growth or fish and wildlife populations;
- effects of management on non-target fish and wildlife species, and threatened and endangered species;
- effects of livestock grazing on runoff, infiltration, and wetland vegetation; and
- value of adjacent wetlands or bodies of water that contribute to the wetland system complexity and diversity, decrease habitat fragmentation, and maximize use of the site by wetland associated wildlife.

Physical habitat management practices such as disking, mowing, and prescribed burning should be avoided during the nesting and brooding season (March to August). Landowners and managers should consult wetland and wildlife professionals to decide on the most appropriate course of action to meet habitat management objectives.

Water level management

Providing a variety of water depths can maximize food and cover for wetland mammals and other wildlife. Natural water cycles depend on how close the water table is to the surface, natural inflow/outflow sources such as streams and rivers, and seasonal water fluctuations. Irregular, gently rolling topography helps create varying water depths that suit plant species with different levels of water tolerance, and habitat needs for invertebrates, waterfowl and other birds, amphibians, fish, reptiles, and wetland mammals.

In natural wetland systems, water levels may fluctuate seasonally, providing a variety of hydrologic condi-



G. Kramer

Drop-log inlets and other water control structures can be installed to enable managers to manipulate water levels on restored and created wetlands.

tions throughout the year. Tidal wetlands typically have regular, daily fluctuations, with greater fluctuations associated with storms and monthly spring tides. When possible, wetland hydrology management practices should support or mimic these natural cycles.

Water control structures are commonly used to create and restore wetlands by artificially manipulating water levels. In addition, a variety of water depths can be established by creating surface contours and microtopographic relief with construction equipment during the wetland creation or restoration process. The best time to manipulate surface contours is before hy-



C. Rewa

Surface contours can be excavated during the wetland restoration process to increase the diversity of water depths and associated wetland vegetation.

drology is returned to wetlands being restored or when water levels are artificially drawn down.

Disturbing the hydrology of naturally functioning wetland systems is not usually recommended. Landowners and managers should consult federal, state, and local wetland regulatory authorities before manipulating wetland hydrology.

Vegetation management

When used in combination with other methods of vegetation management, water level manipulation can significantly influence vegetation composition and associated wildlife. High water levels, resulting from natural flood cycles or managed flooding, can be used to control undesirable vegetation or help reduce high wetland herbivore populations. Lowering water levels can stimulate germination of emergent wetland plants. Reflooding abandoned beaver ponds can also rejuvenate some wetland vegetation and increase biodiversity.

Disking is a mechanical method used to control or break up dense stands of undesirable vegetation on managed wetlands. Some managed wetlands can be drained, disked, and then reflooded. Disking benefits wetland vegetation because it aerates the soil and exposes drained soils to sunlight, which stimulates germination of moist soil plant seeds and invertebrate production. The entire process is generally conducted on

annual, 3-year, or 5-year intervals, depending on management goals. Other management practices may accompany disking to achieve a specific management objective, such as prescribed burning or mowing to control invading woody species.

In some situations, prescribed burning can be used to reduce emergent vegetation and revert plant communities back to earlier successional stages. New growth stimulated by fire attracts a variety of wildlife. When used in combination with disking or mowing, prescribed burning can be an effective habitat management tool. Benefits of prescribed burning on herbaceous wetlands may include:

- ❖ reducing dense or impenetrable stands of undesirable vegetation;
- ❖ exposing seed for wildlife use;
- ❖ improving soil conditions for seeds and stimulating germination;
- ❖ stimulating vegetation growth used as wildlife food and cover;
- ❖ opening up dense stands of vegetation for waterfowl movement; and
- ❖ helping control woody vegetation and invasive species.

Prescribed burning should be conducted under proper weather conditions and under the supervision of licensed personnel. Water control structures help regulate water flow before and after burning. Burning should be avoided during the nesting season (March to August) and during times of drought.



Jim and Karen Hollingsworth, USFWS

Muskrats can reduce dense stands of emergent wetland vegetation. High muskrat populations can also cause eatouts, leaving wetland habitats temporarily void of emergent vegetation.

Plantings can increase the amount of desirable vegetation in newly created or restored wetlands and in wetlands dominated by undesirable vegetation. However, planting vegetation can be expensive and time-consuming. Undesirable plant species may need to be removed before planting desirable species to help ensure success.

Other vegetation management methods include mowing, prescribed grazing, and managing wildlife species that have the ability to alter habitat, such as beavers and muskrats. Muskrats can open up dense stands of cattails. Openings created by muskrat foraging can make emergent wetlands more attractive to waterfowl,

The following is a list of possible management actions to enhance habitat value for wetland mammals. NRCS Conservation Practices and various programs that may provide financial or technical assistance to carry out specific management practices are listed where applicable.

Habitat component	Management options for increasing habitat quality or availability	Conservation practices and assistance programs*
Food	Restore natural wetland hydrology and vegetation in previously converted or degraded wetlands.	657 WRP, PFW
	Protect coastal and freshwater wetlands, marshes, lakes, and ponds from siltation and nonpoint source pollution by establishing conservation buffers, controlling livestock access, and providing bank stabilization through vegetation plantings.	393, 643, 657 WRP, WHIP, EQIP, PFW, CRP
	Reduce herbicide use on wetlands and adjacent uplands where application results in reduction of invertebrates (terrestrial or aquatic).	
Cover	Protect existing wetlands and restore natural wetland hydrology and vegetation to previously converted or degraded wetlands.	657 WRP, PFW
	Allow vegetation to grow in grassland meadows and prairies and conduct appropriate grassland management practices such as prescribed burning, managed grazing, and rotational mowing.	327, 338, 528A, 644, 645 WHIP, EQIP, PFW
	Manage water levels to provide a variety of water depths and associated wetland vegetation structure.	
	Increase surface contour diversity by excavating small swales, islands, and level channels prior to re-establishing hydrology in restored wetlands or during the draw-down phase of managed wetlands.	657 WRP, PFW
	Establish conservation cover on adjacent croplands and other disturbed areas and initiate rotational grazing on surrounding grazing lands.	327, 528A, 647 CRP, EQIP
Habitat interspersions	Combine above prescriptions to increase interspersions of habitat components and amount of suitable habitat.	

* See table on page 18 for a description of assistance programs.

especially where the ratio of vegetation to open water is maintained at around 50:50 with good interspersions throughout.

In general, grazing should be restricted in riparian areas through fencing or other means. Maintaining or expanding riparian buffer zones along streams and other waterways, or around lakes, ponds, and other bodies of water increases the amount and availability of wildlife habitat.

Glyphosate-based herbicides formulated for use on wetland vegetation (e.g., Rodeo®—reference to products does not imply endorsement) have been used to

NRCS Conservation Practices that may be useful in undertaking the above management actions.

Conservation Practice	Code
Conservation Cover	327
Prescribed Burning	338
Riparian Forest Buffer	391
Filter Strip	393
Prescribed Grazing	528A
Restoration & Management of Declining Habitats	643
Wetland Wildlife Habitat Management	644
Upland Wildlife Management	645
Early Successional Habitat Development	647
Wetland Restoration	657

Effects of Beaver Activity

Benefits of beaver ponds:

- Enhance habitat for a variety of wildlife such as cavity-nesting waterfowl and other nesting birds (trees killed by flooding support nests of herons, egrets, ospreys, and other birds), aquatic invertebrates, reptiles, amphibians, and other wetland mammals.
- Improve warmwater fish habitat by increasing water depth and water temperature thereby increasing aquatic invertebrate food production. Note: Habitat for cold water fish (e.g., trout) downstream of beaver ponds may be compromised by increasing water temperatures and restricting upstream movements.
- Provide suitable nesting, brood-rearing, foraging, and migration habitat for waterfowl, shorebirds, wading birds, and other birds.
- Reduce water velocity and eroding potential of streams.
- Reduce peak and frequency of flooding.
- Provide fertile substrate for new herbaceous growth when area is abandoned by beavers or pond is permanently drained.

In general, beaver activities establish, maintain, and enhance affected wetland habitats. However, there are cases when beaver activity results in inundation of roads or economically valuable areas. Beavers typically try to plug up what they perceive as “leaks” in water control structures, culverts, and drain pipes. These structures plugged by beavers can result in flooding and damage to roadways, agricultural fields, dwellings, timber, and other property. Southeastern states have experienced extensive timber damage caused by tree-cutting and flooding by beavers, especially in bottomland hardwood stands. Use of beaver pond levelers (see box on next page) and other measures can minimize economic losses associated with beaver activity.



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The eastern newt and other amphibians can benefit from vegetation management and water level manipulation directed at wetland mammal management.

control *Phragmites* and other invasive plants. However, herbicides are not generally recommended to control wetland vegetation because most are not species-specific. More importantly, herbicides can have negative effects on some aquatic life and ecosystems, and the toxic effects of many herbicides remain unknown.

Environmental Effects of Wetland Mammal Activity

Wetland mammals can affect wetland habitats in a variety of ways. Herbivores such as beavers, nutria, and muskrats can significantly alter vegetation structure and composition, while omnivores and carnivores can affect small mammal and invertebrate populations. Ground-dwelling mammals, like the star-nosed mole and various vole species, can aerate soil but can also



While not considered a wetland mammal, white-tailed deer frequently use shrub swamps, forested wetlands, and other wetland habitats. In northern areas, dense stands of conifer trees in and around wetland areas provide thermal cover for deer during winter.

CVIOG/GeorgiaInfo

limit root and plant growth as a result of their foraging activities. Mink can affect upland nesting waterfowl, eggs, and young.

Damage Prevention and Control Methods

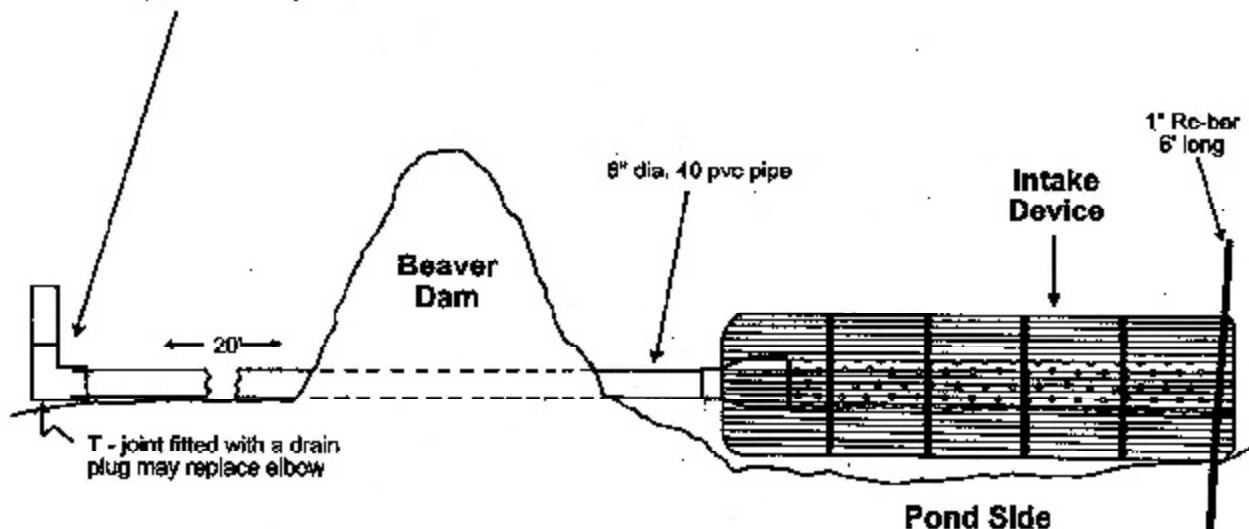
High densities of some wetland mammals can create challenges for wetland owners and managers. Landowners are encouraged to enroll the help of local animal damage control agents and wildlife or natural resource professionals to help correctly identify problem species and control methods. For detailed information on population control methods and species-specific signs of damage, see *Prevention and Control of Wildlife Damage—1994* (Hyngstrom et al. 1994).

Trapping can be an efficient and economical method to control overabundant populations of wetland mammals or problem individuals. Hunting and trapping regulations are available through state fish and wildlife

The Clemson Beaver Pond Leveler

The Clemson Beaver Pond Leveler was designed to: 1) reduce problem flooding in agricultural and timber lands, and 2) maintain and/or improve some benefits resulting from beaver ponds. The pond leveler minimizes the sound of current flow, and the probability that the resident beavers will try to plug up the “leak,” minimizing dam construction. For more information about The Clemson Beaver Pond Leveler, contact Dr. Gene W. Wood, Mr. Larry A. Woodward, or Dr. Greg Yarrow at the Department of Aquaculture, Fisheries, and Wildlife, G08 Lehotsky Hall, Clemson University, Clemson, South Carolina, 29634 or by phone at (803) 656-3117.

Elbow and stand pipe are optional. Needed only to manage water level if maintaining pond is an objective



Programs that provide technical and financial assistance to develop fish and wildlife habitat on private lands.

Program	Land eligibility	Type of assistance	Contact
Conservation Reserve Program (CRP)	Highly erodible land, wetland and certain other lands with cropping history. Streamside areas in pasture land.	50% cost-share for est. permanent cover and conservation practices, and annual rental payments for land enrolled in 10- to 15-year contracts. Additional financial incentives available for some practices.	NRCS or FSA state or local office
Environmental Quality Incentives Program (EQIP)	Cropland, range, grazing land and other agricultural land in need of treatment.	Up to 75% cost-share for conservation practices in accordance with 5- to 10-year contracts. Incentive payments for certain management practices.	NRCS state or local office
Partners for Fish and Wildlife Program (PFW)	Most degraded fish and/or wildlife habitat.	Up to 100% financial and technical assistance to restored wildlife habitat under a minimum 10-year cooperative agreement.	Local office of the U.S. Fish and Wildlife Service
Waterways for Wildlife	Private lands.	Technical and program development assistance to coalesce habitat efforts of corporations and private landowners to meet common watershed level goals.	Wildlife Habitat Council
Wetlands Reserve Program (WRP)	Previously degraded wetland and adjacent upland buffer, with limited amount of natural wetland and existing or restorable riparian areas.	75% cost-share for wetland restoration under 10-year contracts and 30-year easements, and 100% cost-share on restoration under permanent easements. Payments for purchase of 30-year or permanent conservation easements.	NRCS state or local office
Wildlife at Work	Corporate lands.	Technical assistance on developing habitat projects into programs that allow companies to involve employees and the community.	Wildlife Habitat Council
Wildlife Habitat Incentives Program (WHIP)	High-priority fish and wildlife habitats.	Up to 75% cost-share for conservation practices under 5- to 10-year contracts.	NRCS state or local office

State fish and wildlife agencies as well as private groups may have assistance programs.

agencies. Readers are also encouraged to contact local agents of the USDA Animal and Plant Health Inspection Service Wildlife Services and state fish and wildlife agencies to address specific problems.

Landowner Assistance

A number of programs are available that offer financial and technical assistance to improve habitat quality for wetland mammals (see above table). With the help of such programs and assistance from wildlife and natural resource professionals, landowners will be able to devise and implement a successful habitat management plan for wetland mammals and other wildlife.

References

Atwood, E. L. 1950. Life history studies of nutria, or coypu, in coastal Louisiana. *Journal of Wildlife Management* 14:249–265.

Bluett, R. 1984. The muskrat. Wisconsin Department of Natural Resources, Bureau of Wildlife Management. Publ-WM-00984.

Bolen, E. G., and W. L. Robinson. 1995. *Wildlife ecology and management*, third edition. Prentice Hall, Upper Saddle River, New Jersey, USA.

Bookhout, T. A. 1996. *Research and management techniques for wildlife and habitats*. The Wildlife Society, Bethesda, Maryland, USA.

- Bounds, D. L. 2000. Nutria: an invasive species of national concern. *Wetland Journal* 12(3):9–16.
- Bounds, D. L., and G. A. Carowan, Jr. Nutria: a nonnative nemesis. *Trans. 65th North American Wildlife and Natural Resources Conference*.
- Burt, W. H. and R. P. Grossenheider. 1980. *A field guide to the mammals: North America and Mexico*. Houghton-Mifflin, New York, New York, USA.
- Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. *Classification of wetlands and deepwater habitats of the United States*. U.S. Fish and Wildlife Service. FWS/OBS-79/31.
- Evans, J. 1970. *About nutria and their control*. U.S. Fish and Wildlife Service, Resource Publication 86.
- Godin, A. J. 1977. *Wild mammals of New England*. Johns Hopkins University, Baltimore, Maryland, USA.
- Hammer, D. A. 1992. *Creating freshwater wetlands*. Louis Publishers, Chelsea, Minnesota, USA.
- Helms, J. A., ed. 1998. *The dictionary of forestry*. The Society of American Foresters, Bethesda, Maryland, USA.
- Hobson, S. S., J. S. Barclay, and S. H. Broderick. 1993. *Enhancing wildlife habitats: a practical guide for forest landowners*. Northeast Regional Agricultural Engineering Service. NRAES-64. Ithaca, New York, USA.
- Hynstrom, S. E., R. M. Timm, and G. E. Larson., eds. 1994. *Prevention and control of wildlife damage—1994*. University of Nebraska Cooperative Extension, USDA Animal and Plant Health Inspection Service, and Great Plains Agricultural Council, USA.
- Illinois Wildlife. *Mink*. Illinois Department of Conservation. 20M-7-81.
- Kinler, N. W., G. Linscombe, and P. R. Ramsey. 1987. Nutria. Pages 327–342 *in* *Wild Furbearer Management and Conservation in North America*. M. Novak, J. A. Baker, M. E. Obbard, and B. Mallock, eds.
- LeBlanc, D. 1994. *Nutria*. Animal and Plant Health Inspection Service. Animal Damage Control, Port Allen, Louisiana, B71-B80.
- Merritt, J. F. 1987. *Guide to mammals of Pennsylvania*. University of Pittsburgh, Pittsburgh, Pennsylvania, USA.
- Milne, R. C. and T. L. Quay. 1966. The foods and breeding habits of the nutria on Hatteras Island, North Carolina. *Proceedings of the Annual Conference of Southeastern Association Fish and Game Commissions* 20:112–113.
- Mitsch, W. J. and J. G. Gosselink. 1986. *Wetlands*. Van Nostrand, Reinhold, New York, USA.
- Naiman, R. J., J. M. Melillo, and J. E. Hobbie. 1986. Ecosystem alteration of boreal forest streams by beaver (*Castor canadensis*). *Oecologia* 62:150–55.
- National Audubon Society. 1993. *Saving wetlands: a citizen's guide for action in the mid-Atlantic region*. Mid-Atlantic Regional Office, Camp Hill, Pennsylvania, USA.
- Niering, W. A. 1992. *Wetlands*. Alfred A. Knopf, New York, New York, USA.
- Payne, N. F. 1992. *Techniques for wildlife habitat management of wetlands*. McGraw-Hill, New York, New York, USA.
- Willner, G. R., J. A. Chapman, and D. Pursley. 1979. Reproduction, physiological responses, food habits, and abundance of nutria on Maryland marshes. *Wildlife Monographs* No. 65.
- Wood, G. W. and L. A. Woodward. 1992. The Clemson beaver pond leveler. *Proceedings Annual Conference Southeast Association Fish and Wildlife Agencies* 46:179–187.

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In cooperation with partners, the mission of the Wildlife Habitat Management Institute is to develop and disseminate scientifically based technical materials that will assist NRCS field staffs and others to promote conservation stewardship of fish and wildlife, and deliver sound habitat management principles and practices to America's land users.



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The mission of the Wildlife Habitat Council is to increase the amount of quality wildlife habitat on corporate, private, and public land. WHC engages corporations, public agencies, and private, non-profit organizations on a voluntary basis as one team for the recovery, development, and preservation of wildlife habitat worldwide.



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