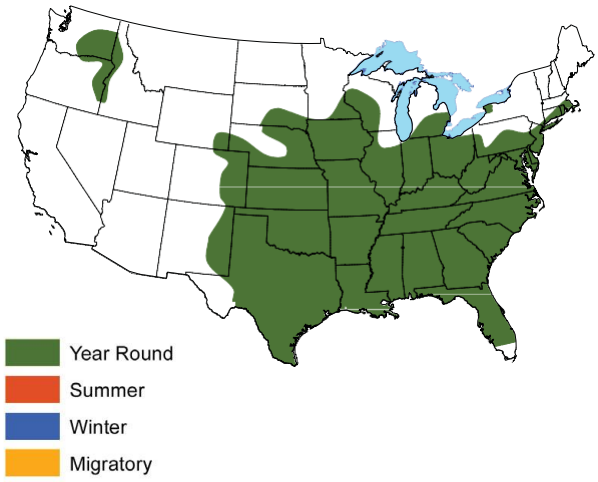
Northern bobwhite

General information

The northern bobwhite is a stocky gamebird about 6 inches tall. They are considered shrubland obligates, which means they depend on low-growing shrubby cover, but also use grasslands, fallow fields, and savannas and woodlands with well-developed groundcover for foraging, nesting, brooding, and loafing. Ideally, bobwhite habitat consists of scattered patches of shrubby cover well interspersed with native grasses, forbs, and bare ground. Nests are on the ground, usually made of dead grass leaves, and often located at the base of a clump of native warm-season grasses, such as broomsedge and little bluestem. A typical clutch is about 12 eggs. Both the male and female may incubate nests, with nesting primarily occurring May through August. Early successional areas dominated by forbs, such as ragweeds, are commonly used for brooding. Northern bobwhite eats a wide variety of seeds, leaves, and insects. Bobwhite chicks primarily eat insects during the first 6-8 weeks of life. Some agricultural crops can provide seasonal food for bobwhites, but they are not a substitute for diverse native plant communities. Northern bobwhite populations have been declining precipitously for more than 40 years. Habitat loss and degradation is the primary reason for the decline.

Heather Inman



Habitat requirements

Diet: young quail eat insects and other invertebrates (such as spiders); adult quail eat a variety of seeds (especially legumes, ragweed, crotons, lespedeza, etc.), green vegetation (mostly forbs), invertebrates, various crops (corn, soybeans, wheat, millets, grain sorghum), and mast (such as acorns and blackberries)
Water: necessary water is obtained through the diet
Cover: shrub cover for escape and thermoregulation throughout the year; native grasses for nesting; native forbs for brood rearing

Wildlife management practices

Develop Conservation Easement: can protect critical habitat for this declining species in some ecoregions
Control Nonnative Vegetation: nonnative sod grasses, such as tall fescue and bermudagrass, are especially problematic as they limit bobwhite mobility and provide poor cover and structure; there are many other nonnative invasive species that can degrade habitat quality for northern bobwhite across their range
Develop Field Borders: to increase usable space around row-crop fields
Conduct Forest Management: (in some ecoregions) in pine forests, *Forest Regeneration*, especially *Clearcut* and *Seed Tree*, will enhance habitat for a few years until regenerating pines close canopy; *Timber Stand Improvement* can be used to reduce tree density in pine stands down to 50 square feet of basal area and enhance habitat; see *Set-back Succession* for managing hardwood forests for bobwhite
Leave Crop Unharvested: to provide additional food through fall and winter; corn, soybeans, wheat, and grain sorghum are readily eaten
Conduct Livestock Management: grazing pressure should be managed so sufficient groundcover remains for nesting and brood rearing; grazing management should discourage a uniform structure of plants across the landscape; cattle grazing in combination with prescribed

fire can mimic historic natural disturbance events; grazing management should maintain dense shrub cover in some areas: up to one-third of an area can be grazed more intensively to encourage annual forb production for brood rearing cover, assuming the same areas are not repeatedly grazed the same way; livestock should be excluded from food plots

Plant Food Plots: relatively small linear food plots (one-fourth acre) may be established adjacent to escape cover where food is a limiting factor (this is rare; shrubby cover for escape and forb cover with bare ground are more often limiting factors)

Plant Native Grasses and Forbs: where nesting and brood cover is limiting, and planting is necessary to develop nesting and brooding cover (suitable nesting and brooding cover usually establishes naturally after undesirable plants are controlled and after tree cover is removed or thinned)

Plant Shrubs: where shrub cover is limiting; if shrub patches are within 50 to 75 yards of each other, additional shrub cover is not needed

Set-back Succession: *Prescribed Fire* is strongly recommended to maintain and rejuvenate early successional cover, shrublands, savanna, and woodlands; fire consumes dense litter, limits succession of woody species, and encourages herbaceous groundcover; *Disking* can be used to reduce litter build-up, encourage annual forbs and grasses, and provide increased bare ground; *Chaining* can be used to set-back shrub cover when it becomes too dense and tall; *Chainsawing*, *Dozer-clearing*, and *Root-plowing* may be used remove trees and convert hardwood forest to early succession or savanna; *Herbicide Applications* may be used to remove undesirable woody encroachment

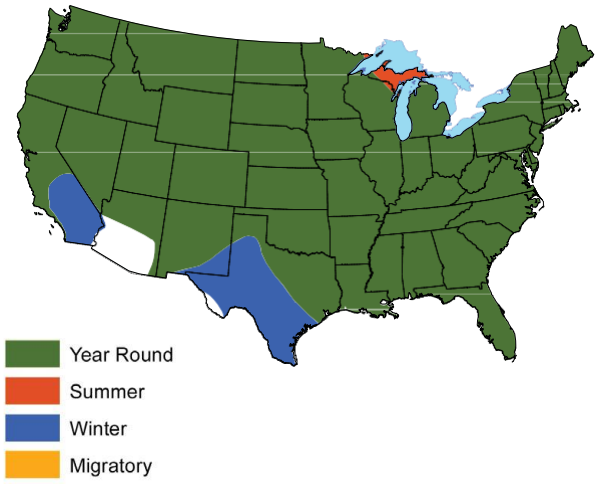
Conduct Tillage Management: eliminate fall tillage to provide waste grain

Decrease Hunting/Fishing: may be necessary if populations are declining in areas of good habitat and data suggest mortality from hunting is additive or limiting population growth

Conduct Wildlife or Fish Survey: covey counts, whistle counts, point counts, and hunter harvest and observation data are used to estimate trends in populations

Northern flicker

Dave Menke



General information

Northern flickers occupy all of North America and inhabit most of the U.S. year-round. Flickers are found in forests and woodlands interspersed with herbaceous openings. Northern flickers are often found along riparian zones and urban areas. They prefer older urban residential areas with large trees, golf courses, and parks. Flickers create cavities in trees for nesting; these cavities later become nesting and roosting sites for other species. Thus, flickers are considered an important species for biological diversity. Flickers eat insects, especially ants, as well as soft mast and seeds. Flickers can become problematic in urban areas where they may create holes in wood siding on houses or damage ornamental trees. Wildlife damage management may be necessary. European starlings often take-over flicker cavities for their own nests. Appropriate action should be taken to prevent starlings from occupying nesting cavities of flickers and other cavity-nesting wildlife.

Habitat requirements

Diet: ants are a favorite food and make up about 50 percent of the diet; seeds, soft mast, and earthworms are also eaten; flickers are partial to poison ivy fruit and may use artificial feeders

Water: daily water requirements unknown; sufficient water is probably obtained from diet

Cover: tree cavities are used for nesting; old, mature trees that show signs of senescence (old age) or decay are often used; softwood trees, such as yellow poplar, cottonwood, and willow, are preferred; flickers will nest in posts, holes in banks, and holes in houses and structures where trees are unavailable

Wildlife management practices

Control Nonnative Vegetation: when nonnative species begin to compete with native vegetation and degrade habitat for flickers

Create Snags: to enhance possible sites for cavities where snags are limiting, especially softwoods, but other species as well

Conduct Forest Management: *Forest Regeneration* will provide more open area and possibly snags for a short time; *Timber Stand Improvement* can open the structure of the forest and provide snags; snags should be retained during forest management activities

Plant Shrubs: several soft mast-bearing shrubs can provide additional food resource when limiting in open areas

Plant Trees: in large open areas without trees

Set-back Succession: *Prescribed Fire* will consume the litter layer and facilitate foraging on the ground; *Mowing* may be used to maintain foraging and loafing cover for northern flickers in ***Urban*** areas

Conduct Wildlife Damage Management: may be necessary to prevent damage from foraging, drumming, and excavating wooden buildings; exclusion practices can prevent access to buildings; harassment can repel flickers from an area

Conduct Wildlife or Fish Survey: point counts are used to estimate trends in populations

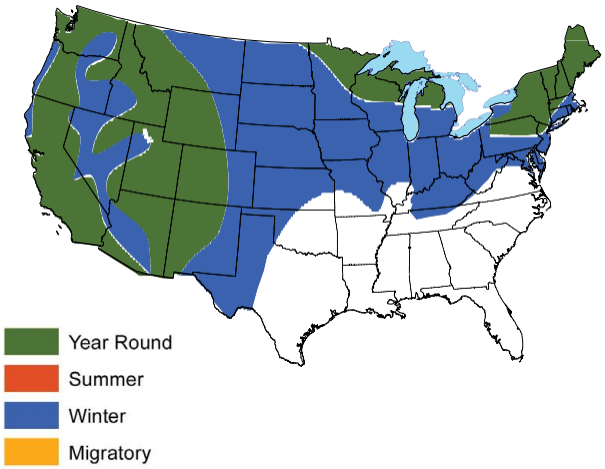
Artificial Feeders: may be used to attract flickers in urban areas; suet is preferred

Northern goshawk

Karen Laubenstein

General information

Northern goshawks are relatively large raptors found throughout the northern, central, and western regions of the U.S. They prefer dense, mature woodlands where they nest 20 to 80 feet aboveground on a large horizontal limb of a mature tree. Nests are often used for up to five consecutive years. As a raptor, goshawks are fierce predators, commonly eating large birds, squirrels, rabbits, and hares. Goshawks perch while hunting and descend on prey. They will pursue prey for quite a distance when necessary. Goshawks do not prefer to be around human establishments.



Habitat requirements

Diet: mostly small- and medium-sized birds and mammals
Water: obtain necessary water from diet
Cover: mature forest and woodland; nest in mature trees

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality for northern goshawk and their prey
Create Snags: when perching sites are limiting; at least one large snag per acre may be provided
Conduct Forest Management: *Forest Regeneration* (*Single-tree Selection*) and *Timber Stand Improvement* can enhance habitat for prey; snags should be retained during forest management
Plant Trees: in large open areas to eventually provide habitat for goshawks
Conduct Wildlife or Fish Survey: observational counts are used to estimate population trends

Northern harrier

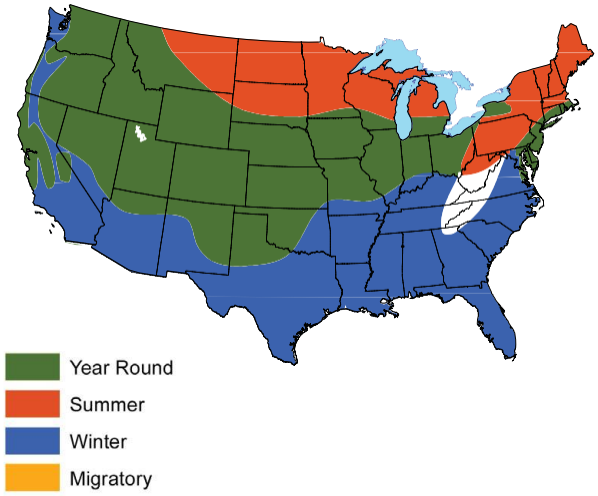
General information

Northern harriers are medium-sized hawks that occur throughout North America. They nest throughout Canada and Alaska and much of the western U.S., and winter throughout most of the U.S. Northern harriers are found gliding low over grassland, croplands, and open wetlands searching for prey. They nest on the ground in grasslands and emergent marshes. The nest contains 4-5 eggs and they raise one brood per year. Males are mostly gray, whereas females are mostly brown.

Greg Lavaty

Habitat requirements

Diet: small mammals, especially rodents, but also rabbits; songbirds and sometimes ducks
Water: necessary water obtained from diet
Cover: large, undisturbed grasslands and emergent wetlands



Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality for northern harriers and their prey; sod grasses on upland sites are particularly problematic
Leave Crop Unharvested: to encourage prey availability in fall and winter
Conduct Livestock Management: grazing should be managed to maintain a diverse vegetation structure conducive to prey and hunting efficiency for northern harrier
Plant Native Grasses and Forbs: where native grassland cover is limiting, and planting is necessary
Set-back Succession: *Prescribed Fire* should be used to rejuvenate and maintain grasslands and wetlands when conditions permit; *Chaining* and *Drum-chopping* can be used to reduce shrub cover and encourage more herbaceous groundcover; *Chainsawing*, *Dozer-clearing*, and *Root-plowing* can be used to convert forest and extensive shrubland to more open grassland and early successional cover; *Herbicide Applications* can be used to reduce shrub and tree cover and encourage more open grassland
Conduct Tillage Management: delay fall tillage to facilitate hunting prey when waste grain is available
Conduct Wildlife or Fish Survey: observation counts are used to estimate population trends

Northern pintail

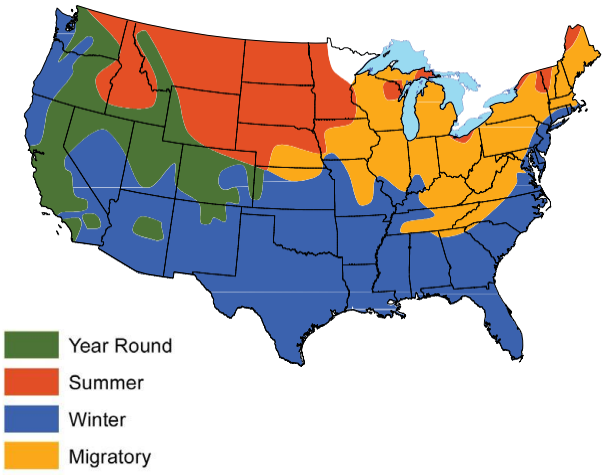
General information

The northern pintail is a large dabbling duck that ranges from 23 to 30 inches in length. Both sexes have blue-gray bills and gray legs and feet. The drake has a thin white stripe running from the back of its chocolate-brown head down its neck to a mostly white undercarriage. He also has gray, brown, and black patterning on his back and sides and long central tail feathers, which give the species its name. The northern pintail female appears to have drab brown feathers, much like those of other female dabbling ducks. Hens make a coarse quack, whereas drakes make a flute-like whistle. Northern pintails prefer open wetlands. They nest on the ground, and nests are hidden among vegetation in a dry location. Nest construction is a simple shallow scrape in the ground lined with plant material and down.

Dave Menke

Habitat requirements

Diet: aquatic plant seeds and rhizomes; grain and other seeds found in fields; aquatic insects, mollusks and crustaceans
Water: water is obtained through diet
Cover: open freshwater wetlands and intertidal marshes



Wildlife management practices

Control Nonnative Vegetation: when nonnative aquatic weeds reduce or limit space for foraging or loafing, or when nonnative invasive plants degrade quality of nesting cover
Leave Crop Unharvested: to provide additional food for migrating and wintering pintails
Conduct Livestock Management: livestock should be excluded from nesting areas, from wetlands managed for waterfowl, and from food plots
Plant Food Plots: shallowly flooded grain food plots can provide a beneficial food source for migrating and wintering northern pintails
Plant Native Grasses and Forbs: where nesting cover is limiting, and planting is necessary
Repair Spillway/Dam/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* should be used to maintain and rejuvenate nesting cover and maintain proper water and vegetation interspersion in wetlands; *Chainsawing*, *Dozer-clearing*, and *Root-plowing* may be used to clear trees where needed
Conduct Tillage Management: eliminating fall tillage can provide waste grain in the winter
Provide Water Developments for Wildlife: shallow impoundments can flood fields and provide important foraging and loafing areas for migrating and wintering northern pintails
Conduct Wildlife or Fish Survey: observation counts, and aerial surveys are used to estimate population trends

Nuttall's woodpecker

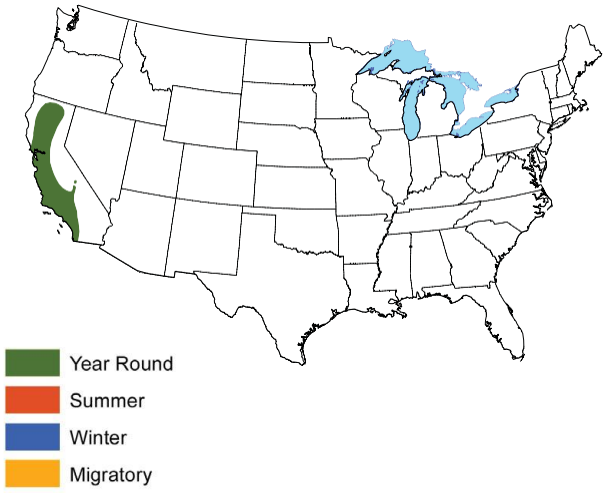
Greg Lavaty

General information

Named after naturalist Thomas Nuttall, Nuttall's woodpecker is a small woodpecker that inhabits the oak woodlands and associated riparian areas of California in the Mediterranean ecoregion. Nuttall's woodpeckers use cavities for nesting; nests contain 3-6 eggs. Nuttall's woodpeckers eat insects that they glean mostly from oak, willow, and cottonwood trees.

Habitat requirements

Diet: 80 percent insects and other invertebrates and 20 percent plant material, including seeds and soft mast
Water: water requirements unknown
Cover: oak woodlands; cavities are excavated in softwoods (willow, cottonwood)



Wildlife management practices

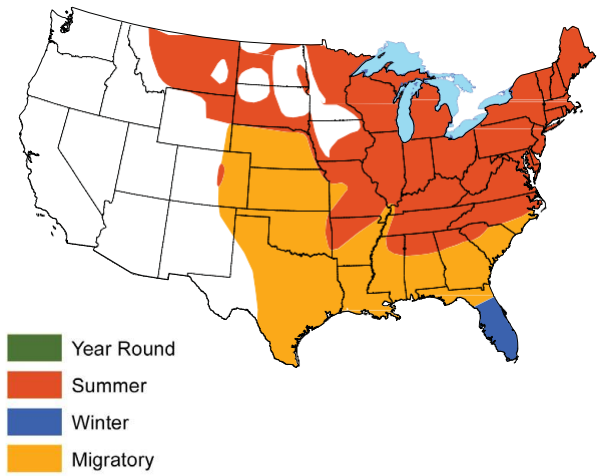
Control Nonnative Vegetation: when nonnative invasive species begin to compete with native vegetation and reduce habitat quality for Nuttall's woodpecker
Create Snags: to increase potential cavity sites where limiting; softwood deciduous trees are particularly important
Conduct Forest Management: *Timber Stand Improvement* can reduce tree density where needed and promote desirable species; existing snags should be retained when implementing forest management
Plant Trees: in large open areas to provide future habitat
Conduct Wildlife Damage Management: may be needed in residential areas if the woodpeckers are damaging property
Conduct Wildlife or Fish Survey: point counts are used to estimate population trends

Ovenbird

Greg Lavaty

General information

The ovenbird is a ground-dwelling warbler found in uplands of closed-canopy, mature deciduous or mixed deciduous-coniferous forests throughout the eastern third of the U.S. Territorial males are quite vocal with their characteristic “teacher-teacher-teacher” song. Ovenbirds are typically found in mature forests with relatively little underbrush and plenty of leaf litter that harbors abundant insects and other invertebrates. They often forage in the leaf litter, but also may glean insects from leaves and tree bark. They construct a dome nest of dead leaves, grasses, bark, and hair with an oval side entrance that usually faces downhill, all in the shape of an outdoor bread oven; hence the name. The nest is usually well hidden in herbaceous vegetation on the forest floor, often near a fallen tree or regrowth within a canopy gap. Ovenbirds are rather unique in that after the clutch (3-6 eggs) hatches, the female takes half the brood and parts ways with the male, who remains with the other half of the brood. Ovenbirds may produce 1-2 broods per year.



Habitat requirements:

Diet: adult beetles and larvae, caterpillars, ants, and flies
Water: usually obtain necessary water from diet, but may use free-standing water when available
Cover: mature deciduous forest with sufficient leaf litter for nesting and foraging

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for ovenbirds; several nonnative species, such as Japanese stiltgrass, threaten to reduce habitat quality for ovenbird in the ***Eastern Deciduous Forest***
Conduct Forest Management: *Forest Regeneration* (*Single Tree Selection*) may produce scattered small canopy gaps that enhance nesting cover
Conduct Livestock Management: livestock should be excluded from forests managed for ovenbirds
Plant Trees: in large open areas to produce future habitat
Conduct Wildlife or Fish Survey: point counts are used to estimate population trends

Ovenbird nest

Peregrine falcon

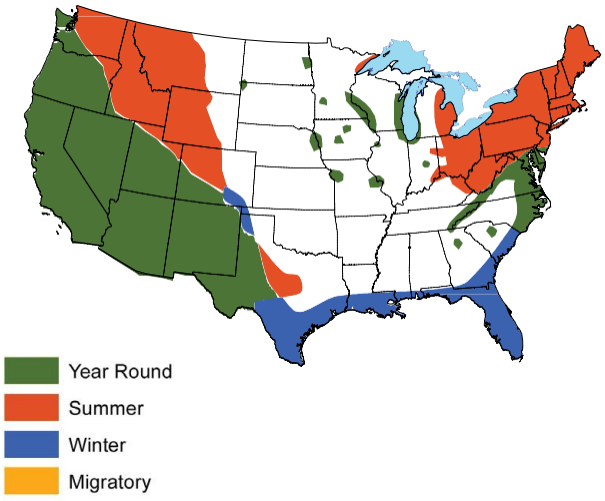
USFWS

General information

Peregrine falcons are found primarily along the coasts and mountain ranges of North America where congregations of shorebirds, songbirds, and waterfowl occur. They also may be found in urban and industrial areas with skyscrapers, smokestacks, bridges, and other tall structures and where abundant rock dove and European starling populations occur. Nests are often located on the ledges of cliffs or buildings from 25 to more than 1,300 feet high. They are one of the fastest birds on the planet, with a cruising speed of 25-34 mph to more than 200 mph in pursuit of prey.

Habitat requirements

Diet: mostly birds, but also bats, which falcons catch during flight
Water: requirements largely unknown; likely obtain water needs from foods they consume
Cover: require tall cliffs, buildings, and other tall structures for nesting and perching



Wildlife management practices

Provide Nesting Structures: nesting platforms can be added to cliffs and skyscrapers
Conduct Wildlife Damage Management: peregrine falcons can prey upon domestic birds, such as homing pigeons; exclusion practices should be used to discourage damage
Conduct Wildlife or Fish Survey: visual surveys near known nesting areas can be used to monitor population trends

Prairie falcon

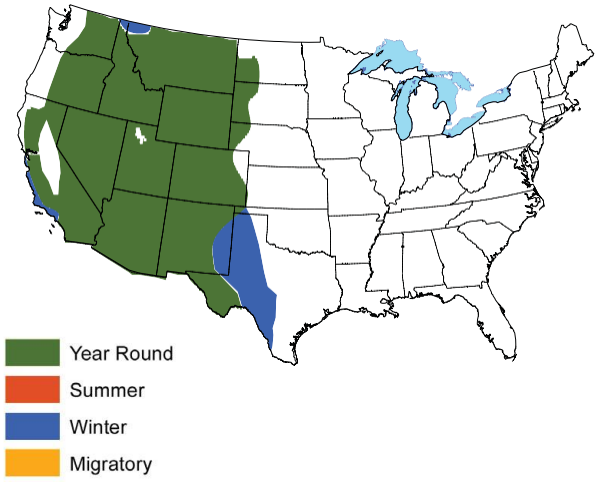
General information

Prairie falcons are large, pale brown falcons with pointed wings and a distinct dark mustache marking on their face. Prairie falcons are found in arid grasslands, shrublands, and deserts. They nest primarily on cliffs, laying their eggs in small depressions. They prey primarily on ground squirrels, but also on other small mammals and birds and occasionally lizards and insects.

USFWS

Habitat requirements

Diet: ground squirrels, small mammals, birds, and occasionally lizards and insects
Water: water is obtained from the diet
Cover: nest in cliffs, rock outcrops, canyon walls, ridges, and cave walls; overhanging rocks serve as cover from the sun and weather.



Wildlife management practices

Provide Nesting Structures: nesting platforms may be added to cliffs
Set-back Succession: *Prescribed Fire* can be used to maintain an open landscape that prairie falcons require when searching for prey; *Chaining* and *Drum-chopping* may be used to limit shrub and tree encroachment, such as juniper, and promote increased herbaceous groundcover
Conduct Wildlife or Fish Survey: monitoring active nests and observation counts along road transects are used to estimate population trends

Prothonotary warbler

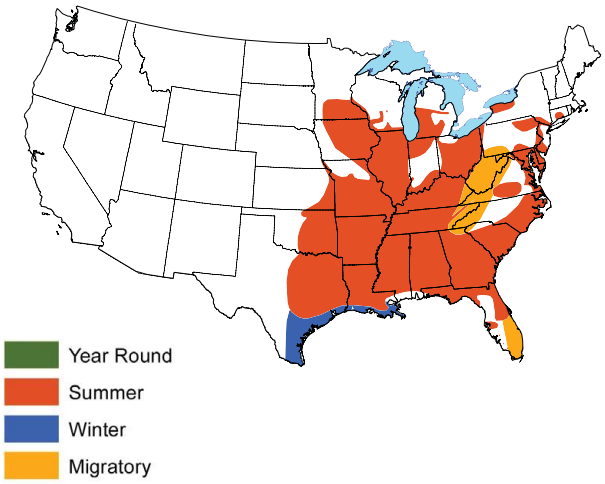
Mark Musselman

General information

Prothonotary warblers are song birds that occur in mature bottomland hardwood forests near water, primarily in the southern U.S. They are most often found in forested wetlands, such as cypress swamps, and along blackwater creeks and rivers. Prothonotary warblers are cavity nesters, so large, over mature trees and standing dead trees are important. They often use old cavities excavated by downy woodpeckers, but also will use nest boxes, even those designed for wood ducks. Cavities are often found in sweetgum, tupelo gum, willow, and bald cypress. Nests usually contain 3-7 eggs. Prothonotary warblers may have 1-3 broods per year. Prothonotary warblers feed primarily on insects in the lower canopy or at ground level. Thus, mature hardwood forest with complex vertical structure provides the structure necessary for insect populations that prothonotary warblers require. Prothonotary warblers' winter in Central and South America.

Habitat requirements

Diet: insects, especially ants, beetles, butterflies, moths, mayflies, aquatic larvae; snails and isopods; occasionally various seeds and fruits
Water: necessary water is obtained through the diet
Cover: mature bottomland hardwood forests; cypress swamps; dead standing timber help ensure presence of cavities



Wildlife management practices

Control Nonnative Vegetation: where nonnative invasive vegetation is competing with native vegetation and reducing habitat quality for prothonotary warblers
Create Snags: where natural cavities are limiting to provide possible cavity sites
Conduct Forest Management: *Timber Stand Improvement* can stimulate vertical structure where absent
Conduct Livestock Management: should exclude livestock from bottomland hardwoods
Provide Nesting Structures: nest boxes are readily used and will provide suitable nesting cover where natural cavities are limiting
Plant Trees: in large bottomland fields where forest cover is lacking, and natural regeneration is not sufficient or of desirable composition
Repair Spillway/Dam/Levee: if not functioning properly
Provide Water Developments for Wildlife: shallow impoundments can be established in bottomland hardwoods for habitat enhancement
Conduct Wildlife or Fish Survey: point counts are used to estimate population trends

Pyrrhuloxia

General information

Pyrrhuloxias are a close relative to the northern Cardinal with a characteristic tall crest and stout, curved, parrot-like bill for cracking seeds. These gray or gray-brown birds have distinct red markings on their face, crest, breast, and tail, though the female will look grayer.
Pyrrhuloxias are found year-round in arid regions of the Southwest, including Texas, New Mexico, Arizona, and Mexico. They prefer desert vegetation types, such as shrubby, dry grasslands, mesquite savannas, shrub-cactus, riparian woodlands, and farm-field hedgerows. They are commonly seen at bird feeders. Most of their water during the spring and summer months comes from the insects they eat, but in the winter, they often relocate closer to free water sources. Pyrrhuloxias are very territorial during the breeding season, calling their sharp notes from perches and making short flights between scrub patches. The females construct their cup-like nest out of twigs, bark, and grass. The nest is often placed up in a tree 5-15 feet off the ground and away from the main trunk. They usually lay a clutch of 2-4 eggs and may have 1-2 broods per year. During winter, pyrrhuloxias come together in large flocks that may number as many as 1,000 birds. Predators include feral and domestic cats, ferruginous pygmy-owls, and greater roadrunners. Although it is not threatened, the pyrrhuloxia has experienced decline because of the conversion of shrubland to agriculture and urbanization.

Gary Kramer

Habitat requirements

Diet: seeds, including dove weed, sandbur, panicum, and pigweed; fruit, such as cactus and nightshade; insects, including grasshoppers, caterpillars, beetles, cicadas, and weevils
Water: get the majority of their water from their diet, but will drink free-standing water
Cover: shrubs, mesquite savannas, woodlands near streams, farm hedgerows; dense brush (mesquite, elderberry, paloverde) is often used for nesting cover

Wildlife management practices

Control Nonnative Vegetation: controlling areas of invasive vegetative can help maintain a diverse source of food resources and ensure food availability throughout all seasons
Develop Field Borders: can provide nesting and escape cover in areas lacking patches of dense brush
Plant Shrubs: can enhance escape cover and food sources in areas lacking adequate brush
Set-back Succession: *Prescribed Fire*, *Disking*, and *Herbicide Applications* can be used to maintain open areas for foraging and scattered brush; *Chainsawing* may be used to reduce tree cover
Provide Water Developments for Wildlife: small ponds, guzzlers, and windmills may provide free-standing water, especially during winter months
Conduct Wildlife or Fish Survey: point counts are used to estimate population trends

Red-cockaded woodpecker

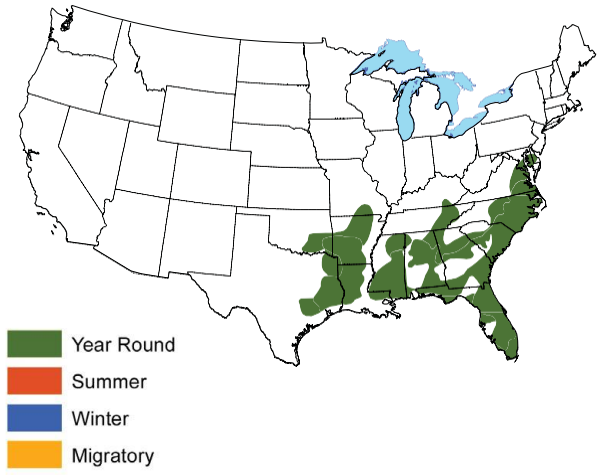
General information

The red-cockaded woodpecker (RCW) is about 7 to 8 inches in length and lives in mature pine forests across the South. Historically, RCWs ranged from east Texas to Florida and northward to Missouri, Kentucky, and Maryland, but its range has been sharply reduced because of fire suppression and hardwood encroachment. The species was federally listed as an endangered species in 1970. RCWs have an unusual social organization. They live in a group called a clan. Each clan typically contains 2 to 9 birds, but there is never more than one pair of breeding birds. Some clans have non-breeding birds called helpers, which generally consist of male offspring 1 to 3 years of age that help incubate eggs, feed young, make new cavities, and defend the clan's territory against other RCWs. A clan nests and roosts in a group of as many as 20 cavity trees (called a cluster). RCWs have very specific habitat requirements. Cavity trees are live pine trees, rarely less than 30 to 40 years old and are often more than 70 years old. Older pines inflicted with red-heart fungal disease make it easier for RCWs to excavate cavities.

James Hanula

Habitat requirements

Water: necessary water is obtained through diet
Diet: ants, beetles, roaches, caterpillars, wood-boring insects, spiders, and occasionally fruits and berries
Cover: mature stands of Southern yellow pines, especially longleaf and shortleaf; relatively open stands with very little midstory and a diverse herbaceous understory are most desirable for foraging; a cluster site is the stand of trees surrounding and containing cavity trees and should be at least 100 acres



Wildlife management practices

Develop Conservation Easement: can protect longleaf and shortleaf pine systems for this declining species
Control Nonnative Invasive Species: when nonnative species begin to compete with native vegetation and reduce habitat quality for RCWs
Conduct Forest Management: *Forest Regeneration* (*Single-tree Selection*) is the preferred method to regenerate and manage longleaf pine; *Timber Stand Improvement* can be used to thin pine stands, especially shortleaf and loblolly pine, and thus enhance structure for foraging
Provide Nesting Structures: artificial cavity inserts can be installed into mature pine trees at cluster sites where cavity trees are limiting
Plant Trees: loblolly and shortleaf pine can be planted where lacking to provide habitat for RCWs; this may be where there are large open areas or where hardwoods dominate
Set-back Succession: *Prescribed Fire* is required to reduce hardwood encroachment, limit midstory development, and encourage herbaceous groundcover; *Chainsawing* and *Herbicide Applications* may be necessary where hardwoods have become too large to effectively reduce with fire; *Chainsawing*, *Root-plowing*, *Dozer-clearing*, and *Herbicide Applications* may be used to clear sites and prepare for planting longleaf or shortleaf pine
Conduct Wildlife or Fish Survey: observational counts and cluster monitoring are used to monitor RCWs

Red-eyed vireo

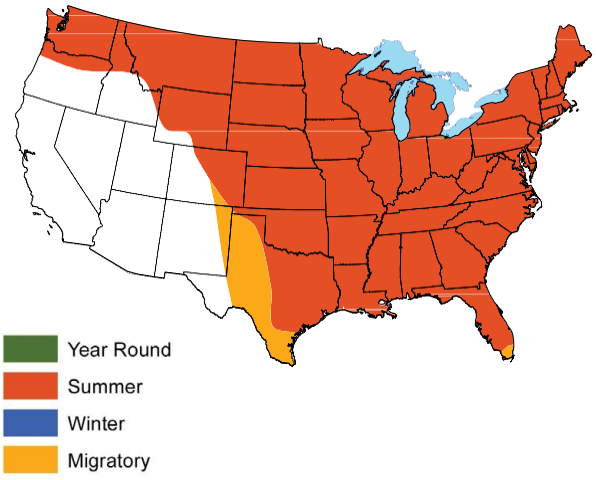
Greg Lavaty

General information

The red-eyed vireo is a common migratory songbird found in mature deciduous forests throughout eastern North America and the upper Midwest. They are also found in forested urban parks. They are more often heard than seen, with their persistent song that sounds like they are saying *"where-are-you, here-I-am, over-here."* Red-eyed vireos have olive-green backs with a pale breast and dark red eyes. Red-eyed vireos usually forage in the middle to upper layer of the forest canopy, but often nest in the understory or midstory. The nest is made of twigs, bark, and grasses, usually in an open cup shape and suspended from a branch. They eat insects and fruits.

Habitat requirements

Diet: mostly insects and spiders during spring and summer; more soft mast during winter
Water: necessary water is obtained from diet
Cover: midstory and overstory of mature mixed deciduous forest



Wildlife management practices

Control Nonnative Vegetation: when it begins to reduce habitat quality for red-eyed vireos; a common example in the South is kudzu, which can reduce forest cover by overtaking and killing trees
Conduct Forest Management: *Forest Regeneration* (*Single-tree Selection* and *Group Selection*) can encourage insect and soft mast availability; *Timber Stand Improvement* (light thinning) can also stimulate understory and midstory development to enhance nesting cover in relatively open woods and encourage additional soft mast availability
Plant Trees: in large open areas, trees may be planted to provide future habitat
Conduct Wildlife or Fish Survey: point counts are most often used to estimate population trends

Red-tailed hawk

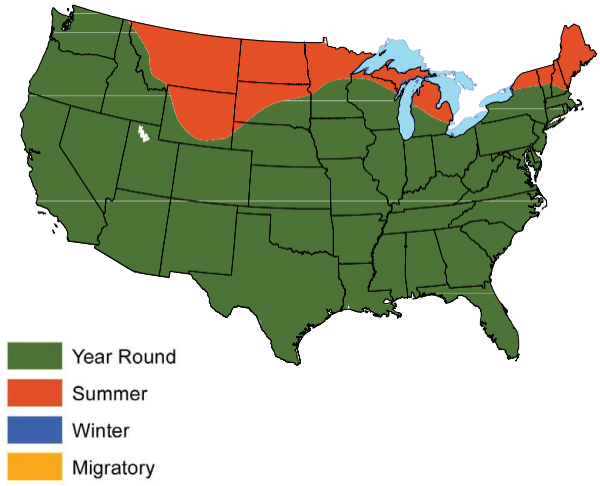
General information

Red-tailed hawks are one of the most abundant hawks in the U.S. They are large raptors with a pale breast, brown back, and red-topped tail, for which they are named. They usually have a dark band across their breast, but the overall plumage can vary. Red-tailed hawks are often seen soaring or perching near open grasslands, pastures, and fields where they search for prey. They dive and catch prey with sharp talons. Red-tailed hawks most often nest in tall trees where they have a good view of the surrounding land. Nests are primarily made of dry sticks that can create piles over 6 feet tall. A pair will continue to build upon nests where 1 to 5 eggs are subsequently laid.

Mark Bohn

Habitat requirements

Diet: small mammals, such as squirrels, rabbits, and mice, reptiles, and other birds
Water: necessary water is obtained from diet
Cover: nests are usually built 30 to 90 feet aboveground, often in the fork of a tree branch; cliffs may be used for nest sites when trees are not present; small trees, electric poles, and similar structures are used for perching



Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and degrade habitat for red-tailed hawks or their prey
Create Snags: in open areas where live trees are available and perching sites could be enhanced
Develop Field Borders: to increase usable space for prey, especially around row crop fields
Conduct Forest Management: *Forest Regeneration* (*Clearcut*) to improve habitat for prey and increase usable space for red-tailed hawks in large expanses of mature forest
Plant Native Grasses and Forbs: to enhance early successional cover where limiting and where planting is necessary
Plant Shrubs: in large open areas where trees and shrubs are not present to create perching sites and provide cover for various prey species
Plant Trees: (in some ecoregions) in large open areas where trees are not present to create perching and nest sites
Set-back Succession: *Prescribed Fire*, *Disking*, and *Mowing* may be used to maintain early successional communities for various prey species; *Chaining*, *Root-plowing*, and *Drum-chopping* may be used to set-back succession in areas dominated by shrubs where more open space is needed
Conduct Tillage Management: to facilitate hunting prey when waste grain is available
Conduct Wildlife Damage Management: such as exclusion and fencing, may be necessary where livestock predation, such as chickens, is problematic
Conduct Wildlife or Fish Survey: observational surveys are used to estimate population trends

Redhead

General information

Redheads are diving ducks found across the U.S. and Mexico. They winter in southern areas of the U.S. and into Mexico. Redheads use open-water wetlands (especially for loafing) as well as those with a mosaic of open water with floating islands of organic material and some emergent vegetation. Redheads do not build nests, but instead use old nests of other ducks and wetland birds that are above water or very near the shore in dense emergent vegetation providing concealment. Like other waterfowl, chicks are precocial. That is, they are feathered with down and are able to swim about and forage upon hatching.

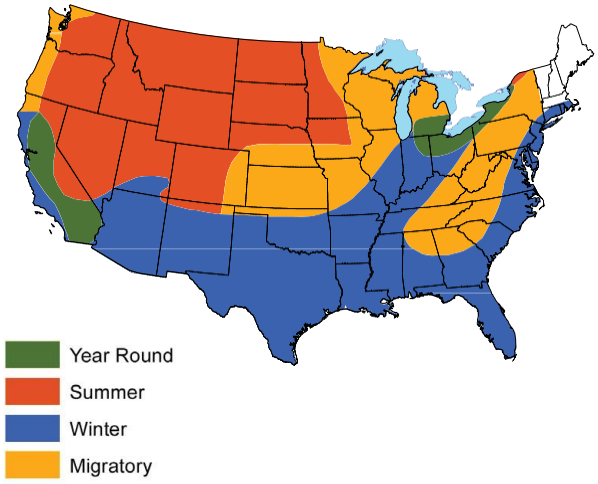
Habitat requirements

Diet: chicks primarily eat aquatic invertebrates (mollusks, snails, crustaceans) during late spring and early summer; during the rest of the year, redheads eat aquatic plants, such as pondweeds, musk grass, bulrush seeds, wild celery, water lily seeds, and coontail
Water: obtained in diet
Cover: during spring and summer, dense emergent vegetation for nesting; open-water wetlands are used for loafing and foraging; wetlands with a mosaic of open water with submerged and emergent aquatic vegetation are used for foraging

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive aquatic vegetation begins to reduce habitat quality for redheads; this is most common when mats of nonnative species begin to form over the water surface and limit diving and foraging by redheads
Conduct Livestock Management: livestock should be excluded from wetlands managed for redheads during the nesting season to prevent deterioration of nesting cover
Repair Spillway/Dam/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* is recommended to rejuvenate vegetation when wetlands dry sufficiently to burn (most common in ephemeral wetlands or impoundments where water levels can be manipulated); *Chainsawing* may be used to clear trees where needed
Provide Water Developments for Wildlife: shallow impoundments may be constructed to temporarily flood areas dominated by tall emergent aquatic vegetation during the nesting season

Donna Dewhurst



Conduct Wildlife or Fish Survey: observation surveys and aerial surveys are most often used to estimate population trends

Ring-necked pheasant

General information

Ring-necked pheasants are nonnative gamebirds introduced into North America from Asia. They are most prevalent across the northern Great Plains, but also occur across portions of the Intermountain West and northeastern U.S. They are most often found in relatively dense grasslands, cattail marshes, and shrub cover adjacent to agricultural fields, woodlands, wetlands, and along ditches with dense vegetation. They are especially numerous in areas with abundant grain agriculture adjacent to nesting and escape cover.

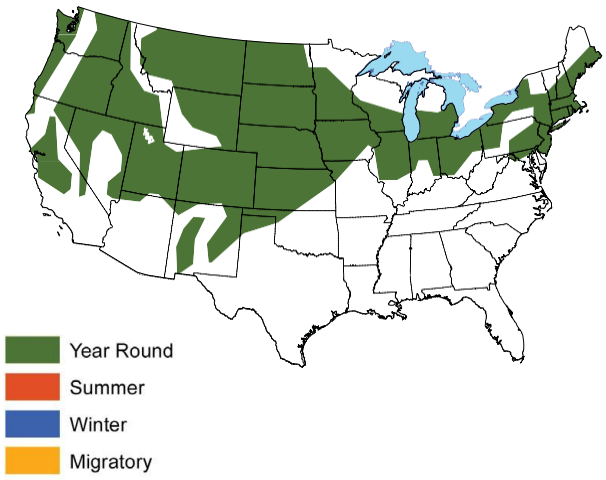
Dave Menke

Habitat requirements

Diet: various seeds, grains, grasses, leaves, fruits, and nuts; grains are used heavily in agricultural areas; insects constitute an important food item for females during the breeding season and young pheasants during the first several weeks after hatching

Water: necessary water is obtained in the diet

Cover: dense residual grass and forb cover for nesting and escape; shrubs and trees may be used for roosting; dense cattails adjacent to and within wetlands



Wildlife management practices

Control Nonnative Vegetation: ring-necked pheasants are adapted to many plants that are not native to areas where they occur in the U.S. However, there are some, including tall fescue and bermudagrass, that do not provide cover or food value for ring-necked pheasant.

Develop Field Borders: to increase usable space around crop fields

Leave Crop Unharvested: to provide additional food through winter

Conduct Livestock Management: grazing management should prevent overgrazing to maintain nesting and escape cover

Plant Food Plots: to provide additional food source where food is limiting

Plant Native Grasses and Forbs: where nesting and escape cover are limiting, and planting is necessary

Plant Shrubs: where roosting and escape cover is limiting in open and agricultural areas

Plant Trees: where roosting cover is limiting in open and agricultural areas

Set-back Succession: *Prescribed Fire* to rejuvenate dense, grassland and wetland (especially dense cattails) cover and reduce woody encroachment where needed; *Herbicide Applications* and *Chainsawing* can be used to reduce trees and shrub cover

Conduct Tillage Management: to provide cover and waste grain through fall and winter

Decrease Hunting/Fishing: may be necessary if populations are declining in areas where habitat quality is good, and data suggest mortality from hunting is additive or limiting population growth

Increase Hunting/Fishing: where populations can sustain additional harvest pressure for hunting recreation and/ or where populations need to be lowered, such as where pheasants (a non-native species) compete with native grassland species for habitat resources

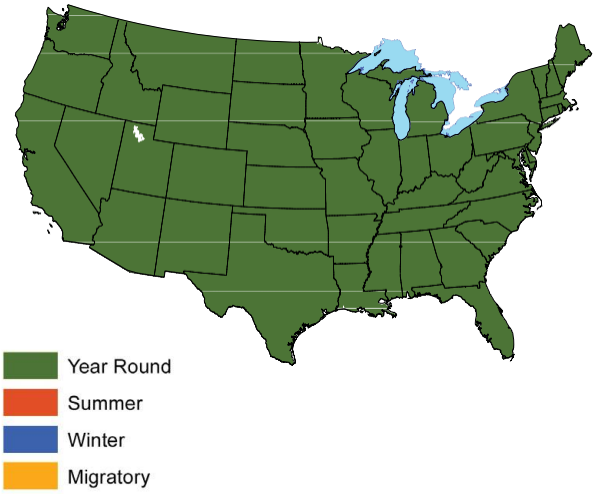
Conduct Wildlife or Fish Survey: call counts, observation surveys, and point counts are used to estimate population trends

Rock pigeon

James W. Arterburn

General information

Rock pigeons (commonly called pigeons) are an introduced species found year-round throughout urban and agricultural areas in the U.S. They are considered pests because they are generally protected in urban areas where they develop dense populations and damage buildings and other structures with accumulations of droppings. They also cause severe problems in agricultural areas by contaminating feed. Pigeons also can carry and spread diseases, including salmonella, encephalitis, Newcastle disease, and others, to people and livestock through their droppings. Droppings of rock pigeons may also contain histoplasmosis, a fungal disease that can cause respiratory problems in humans. Wildlife damage management practices are often required to control overabundant rock pigeon populations. Rock pigeons are regularly found around large buildings, parks, and open areas. They create a shallow nest of sticks, leaves, and other vegetation, and nest aboveground and on or around buildings. Rock pigeons primarily feed on the ground and eat small grains, seeds, crumbs, and garbage.



Habitat requirements

Diet: waste grain and weed seeds; in urban areas, rock pigeons commonly eat human handouts
Water: free-standing water is required frequently during warm seasons
Cover: barn lofts, window ledges, rooftops, bridges, and a variety of other structures

Wildlife management practices

Conduct Wildlife Damage Management: shooting (including pellet guns in urban areas), toxicants, and trapping are recommended direct control techniques; exclusion practices prevent access to livestock feed; food, water, and desirable cover should be removed when possible and when it does not impact desirable wildlife species; harassment practices may be effective; habitat management to attract rock pigeons should never occur
Conduct Wildlife or Fish Survey: observation counts and questionnaires related to wildlife damage management are used to estimate trends in populations

Ruby-throated hummingbird

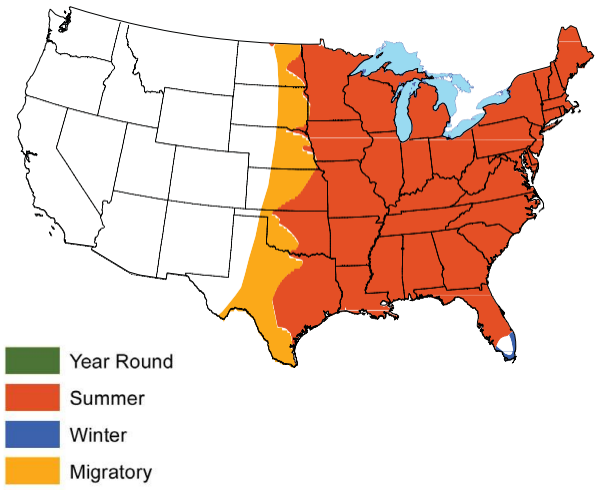
Greg Lavaty

General information

There are 18 species of hummingbirds found in North America. The ruby-throated hummingbird is the most widespread species. Other than a couple of exceptions, hummingbirds migrate into Central and South America during winter. Hummingbirds use areas with flowering plants from which they can feed on the nectar. In urban settings, they prefer areas with large trees and nearby flowering plants. A hummingbird's nest is constructed in the shape of a small cup and is built of lichens and other vegetation. Hummingbirds require high-energy foods. Nectar is high in sugars that supply needed energy. Insects are an important source of protein.

Habitat requirements

Diet: nectar from flowers and insects found on flowers
Water: necessary water obtained from diet
Cover: trees and shrubs for nesting; flowers for feeding



Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality for ruby-throated hummingbirds
Plant Shrubs: flowering shrubs and vines that provide nectar may be planted where nesting sites and food resources are limited; favorites include hibiscus, trumpet vine, and lilac
Plant Trees: where potential nesting sites are limited; flowering dogwood and various fruit trees are favorites
Conduct Wildlife or Fish Survey: observation counts, especially visitation at feeders, are used to estimate trends in populations
Artificial Feeders: artificial feeders filled with sugar- water (1 part sugar to 4 parts boiled water) may be used where flowers are limited; multiple feeders may reduce problems with territoriality; never give honey-water to hummingbirds because honey ferments faster than sugar and quickly develops a mold that can kill hummingbirds
Plant Flowers: preferred flowers include petunias, gladiolus, nasturtiums, begonias, morning glory, evening primrose, columbine, and cardinal flower
Rooftop/Balcony Gardens: can provide source of nectar if appropriate flowers are planted

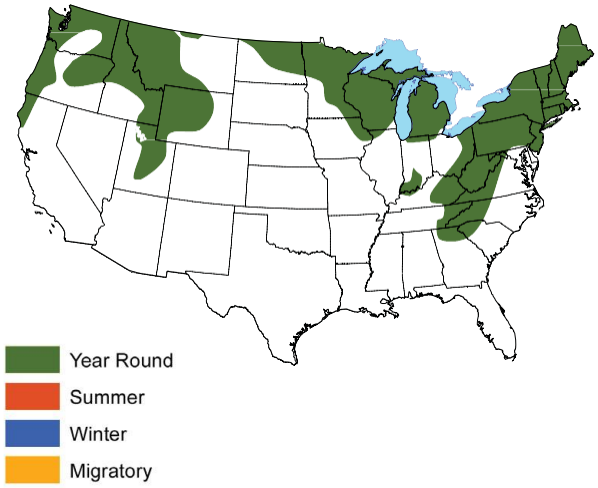
NOTE: ***Plant Flowers*** should not be recommended to establish ***Rooftop/Balcony Gardens***

Ruffed grouse

General information

The ruffed grouse is a relatively large gamebird that occurs across southern Canada, the more northern latitudes of North America, and down the Appalachian range. Ruffed grouse are found in a variety of deciduous forest types as well as mixed deciduous-conifer forest, but are particularly closely associated with aspen, especially young stands with relatively dense structure. Male ruffed grouse attract females during the mating season in spring by standing on downed logs, usually in dense cover, and flapping their wings to their breast, which causes a low drumming sound. This activity is called drumming. Ruffed grouse populations are decreasing across their range where forest management has been limited.

Bill Marchel



Habitat requirements

Diet: buds, hard and soft mast, insects and other invertebrates, and leaves of forbs
Water: necessary water obtained from diet
Cover: 6- to 20-year-old stands are required for cover provided by the dense stems; mature forest in close proximity to young stands may be used for feeding on acorns and other hard mast; a variety of forest types and age classes are used for nesting

Wildlife management practices

Control Nonnative Vegetation: when nonnative vegetation reduces habitat quality for ruffed grouse; Japanese stiltgrass can be especially problematic in many forests, and tall fescue and orchard grass are problematic in forest openings and along woods roads
Create Snags: where drumming logs are limiting, large-diameter (18+ inches), non-mast producing trees may be killed or felled
Conduct Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) within mature forest will stimulate regeneration that will provide optimum cover within 6 years; *Timber Stand Improvement* practices can be used to stimulate desirable structure and stem density and enable crowns of desirable trees to grow and produce additional mast
Conduct Livestock Management: livestock should be excluded from areas managed for ruffed grouse
Plant Shrubs: where additional soft mast is needed and to develop thickets and shrub cover in openings
Plant Trees: in relatively large openings where planting is necessary and where mast-producing trees are limiting
Set-back Succession: *Prescribed Fire* can be used to maintain and rejuvenate dense stem cover and enhance herbaceous cover important for brooding cover, particularly in aspen stands; *Chainsawing* can be used to remove trees and increase stem density in the forest understory
Decrease Hunting/Fishing: may be necessary if populations are declining in areas where habitat quality is good, and data suggest mortality form hunting is additive or limiting population growth
Conduct Wildlife or Fish Survey: drumming counts are most often used to estimate population trends

Sage thrasher

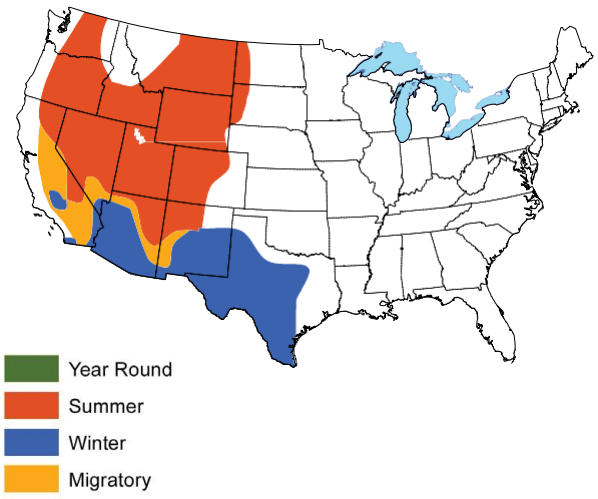
General information

Sage thrashers are found mostly in shrub-dominated valleys and plains of the western U.S. They prefer sagebrush and generally are dependent on large patches and expanses of sagebrush during the breeding season. Sage thrashers usually nest within sagebrush or other shrubs close to the ground. Nests are constructed of twigs and lined with fine grasses and hair. Clutch size is 1-5 eggs. Sage thrashers forage for insects on the ground and usually run on the ground when disturbed, rather than flying.

Dave Menke

Habitat requirements:

Diet: spiders, crickets, caterpillars, beetles, and grasshoppers; some soft mast from deciduous shrubs also are eaten
Water: necessary water is obtained from the diet
Cover: sagebrush required for nesting and escape cover; nest constructed of twigs and grass



Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for sage thrashers
Plant Shrubs: where shrub cover is less than 60 percent
Set-back Succession: *Chaining*, *Drum-chopping*, *Chainsawing*, and *Herbicide Applications* can be used to maintain low shrub growth
Conduct Wildlife or Fish Survey: point counts are used to estimate population trends

Scaled quail

General information

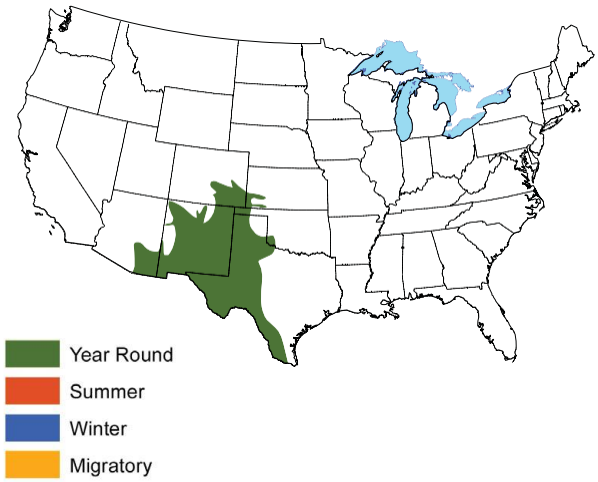
Scaled quail are found in arid grasslands with a shrub, cactus, and yucca component in the southwestern U.S. Sparse herbaceous cover characterizes the arid environment in most years. However, areas with abundant cover have higher scaled quail densities. A variety of shrub species provide important escape a n d loafing cover, though scaled quail will avoid areas where shrubs exist in high densities. Proper grazing management is an important component in maintaining habitat for scaled quail. They nest on the ground, usually under relatively dense, low-growing shrub or grass cover

Habitat requirements

Diet: various seeds of forbs and shrubs are major components of diet; insects are readily consumed and are critical for chick survival; green herbaceous material and soft mast of various native plants also are consumed
Water: necessary water may be obtained from diet; however, free-standing water from ponds, tanks, and streams may increase survival during drought years
Cover: brushy cover (shrubs or cacti) overhead with an open structure at ground level is critical, particularly for nesting, scattered patches of shrub and cactus with a good cover of native warm-season grasses and forbs provide excellent cover

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for scaled quail; cheat grass and other bromes, weeping and Lehman lovegrass, and Old-World bluestems are various plants that may be problematic
Develop Field Borders: to increase usable space around crop fields
Leave Crop Unharvested: to provide additional food source through winter
Conduct Livestock Management: should not allow overgrazing to limit herbaceous cover
Plant Native Grasses and Forbs: where nesting and brood cover is lacking, and planting is necessary
Plant Shrubs: where there is less than 60 percent shrub cover
Set-back Succession: *Prescribed Fire* may increase herbaceous cover needed for food and cover; *Chaining*, *Drum-chopping*, and *Disking* can be used to reduce or thin shrub cover if needed and if increased herbaceous groundcover is needed
Conduct Tillage Management: to provide waste grain
Provide Water Developments for Wildlife: guzzlers and dugouts can provide supplemental water, especially in drought years



Decrease Hunting/Fishing: may be necessary if populations are declining and data suggest mortality from hunting is additive or limiting population growth
Conduct Wildlife or Fish Survey: aerial or ground transects are used to estimate population trends

Sharp-tailed grouse

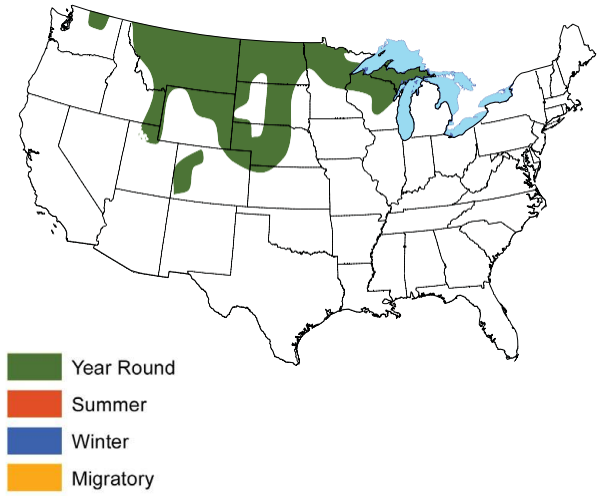
General information

Sharp-tailed grouse are gamebirds of the northern Great Plains. Ideal habitat contains about two-thirds native grassland interspersed with shrubs, cropland, and scattered trees. Sharp-tailed grouse require bare or grassy ridges and natural rises that offer good visibility for breeding displays. Sharp-tailed grouse gather on these sites in the spring where males dance in front of the females to attract a mate. These areas are called "dancing grounds." It is important to maintain areas of thick grass and shrub cover within several miles of dancing grounds.

Richard Baetsen

Habitat requirements

Diet: young grouse eat insects and small seeds; adults eat a variety of leaves, buds, seeds, and grains; buds of shrubs and small trees are most important during winter
Water: necessary water is obtained from diet
Cover: nests are on the ground in grass or sparse shrub cover; thick shrubs and tall herbaceous vegetation is required for winter cover; tall dense vegetation associated with wetland edges also is used for winter cover



Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for sharp-tailed grouse
Develop Field Borders: to increase usable space around crop fields
Leave Crop Unharvested: to provide additional food source through winter; alfalfa, sunflowers, and grain sorghum are often used
Conduct Livestock Management: should maintain a diverse structure throughout the grassland; some dense grassland areas should be maintained to provide nesting cover; more sparse areas containing forbs and insects should be adjacent to nesting areas for brood cover; on sandy soils, both of these conditions may be present together; proper stocking rate is critical; delay grazing on portions of grasslands to provide tall undisturbed cover during the primary nesting season (May-June)
Plant Food Plots: food plots containing alfalfa or sunflowers may be planted where winter foods may be limiting or to enhance hunting opportunities
Plant Native Grasses and Forbs: where high-quality native grassland habitat does not comprise at least 60 percent of the area; should be recommended only on sites where planting is necessary to establish native grass cover
Plant Shrubs: small groups of shrubs may be planted in natural draws and idle land areas where cover and winter food may be limiting; woody cover should not be planted on upland sites that historically did not support woody cover
Set-back Succession: *Prescribed Fire* is recommended to increase grassland vigor, which will increase availability of insects and seeds; *Chainsawing* and *Herbicide Applications* can be used to remove trees
Conduct Tillage Management: grain stubble should be left through winter to provide a food source; stubble height of 6 inches or more is preferred
Decrease Hunting/Fishing: may be necessary if populations are declining and data suggest mortality from hunting is additive or limiting population growth
Conduct Wildlife or Fish Survey: observational surveys, especially on dancing grounds in the spring, are used to estimate population trends

Song sparrow

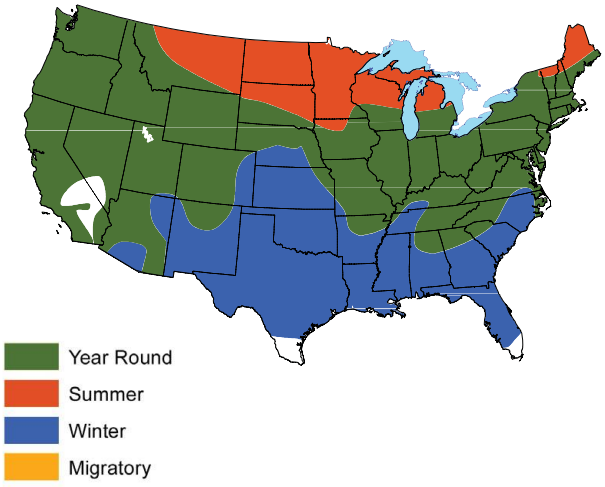
General information

Song sparrows are familiar and relatively common and inhabit all of the U.S. but will migrate from extreme northern areas during the colder months of the year. Song sparrows typically use shrubby areas interspersed with herbaceous openings and forest, especially along riparian areas. Song sparrows often nest along forest edges. The nest is made of grass and leaves and in the shape of a cup. Nests are often placed on the ground under a shrub or in thick herbaceous cover. Song sparrows primarily feed on the ground and eat seed, insects, and fruit.

Lee Karney

Habitat requirements

Diet: weed seeds, insects, soft mast
Water: freestanding water is required frequently during the warm seasons
Cover: thick shrubs and herbaceous cover for nesting, loafing, and escape



Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and degrade habitat for song sparrows
Conduct Forest Management: *Timber Stand Improvement* practices can stimulate increased brushy cover where lacking
Plant Native Grasses and Forbs: where lacking and necessary to provide cover for nesting
Plant Shrubs: to provide soft mast where there is little soft mast available
Set-back Succession: *Chainsawing* can create additional brushy cover; *Prescribed Fire* can be used to maintain shrubby cover; *Mowing* may be used to maintain foraging and loafing cover for song sparrows in ***Urban*** areas
Water Development for Wildlife: drinking water may be provided in birdbaths or pans of water
Conduct Wildlife or Fish Survey: point counts are used to estimate trends in populations
Artificial Feeders: for use in ***Urban*** areas; millets and sunflower seeds are favorites

Sooty grouse

General information

The sooty grouse is a relatively large grouse that occurs predominantly in coastal mountainous areas from northern California north through British Columbia. Sooty grouse are found in coniferous forest with scattered small herbaceous openings and shrub cover. Sooty grouse roost in forest edges near shrub vegetation where they forage. Their nests are usually on the ground, often under shrubs or near fallen logs. Sooty grouse typically forage on the ground spring through fall but may spend most of their time foraging on buds and needles in trees during winter. Males often vocalize with a deep booming call that can be difficult to locate while perched in trees.

Glen Tepke

Habitat requirements

Diet: soft mast, buds, seeds, forbs, and insects from spring to fall; needles of coniferous trees may be eaten in winter
Water: necessary water obtained from dew and diet
Cover: nest on the ground near forest edges, often under shrubs or next to fallen logs

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for sooty grouse
Conduct Forest Management: *Forest Regeneration* (*Group Selection*, *Single-tree Selection*) will increase herbaceous groundcover for foraging near nesting and roosting areas; *Timber Stand Improvement* can be used in stands not ready for regeneration to enhance herbaceous groundcover
Conduct Livestock Management: livestock should be excluded from areas where sooty grouse may be nesting mid-April through mid-June
Plant Native Grasses and Forbs: where herbaceous cover is lacking in forest openings and planting is necessary
Plant Shrubs: to provide soft mast and buds where needed
Plant Trees: coniferous trees may be planted to provide a winter food source where needed
Set-back Succession: *Chainsawing* and *Prescribed Fire* can be used to maintain herbaceous groundcover and improve cover for nesting; *Herbicide Applications* can reduce woody encroachment in small herbaceous openings
Decrease Hunting/Fishing: when surveys show a decline in the local population and data suggest mortality from hunting is additive or limiting population growth
Conduct Wildlife or Fish Survey: call counts and point counts may be used to estimate population trends

Southwest willow flycatcher

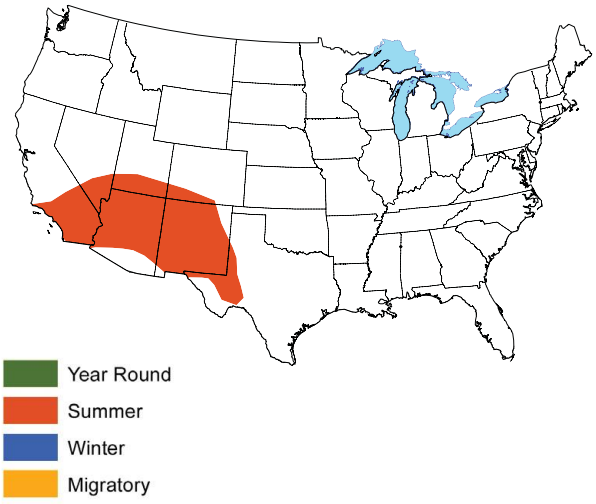
Jim Rorabaugh

General information

The Southwest willow flycatcher is a neotropical migrant that breeds in riparian areas of the arid southwestern United States and northwestern Mexico and winters in the rain forests of Mexico, Central America, and northern South America. This subspecies of the willow flycatcher is a federally listed threatened species because of habitat degradation and brood-rearing parasitism by brown-headed cowbirds. Habitat loss is caused by changes in the flood and fire regime (from water diversion and groundwater pumping, impoundments, and stream channelization), aesthetic mowing, and unmanaged livestock grazing. Riparian corridors with dense patches of trees (such as willows and cottonwoods) and shrubby vegetation (such as buttonbush and blackberry) with interspersed openings are preferred. This type of cover is found near rivers, swamps, lakes, and reservoirs. Nests are typically built low at the outer edge of shrubs, usually near water.

Habitat requirements

Diet: insects
Water: obtained through diet
Cover: vegetation 3-15 feet tall, including relatively tall herbaceous plants, shrubs, and trees; nests are made of bark and grass



Wildlife management practices

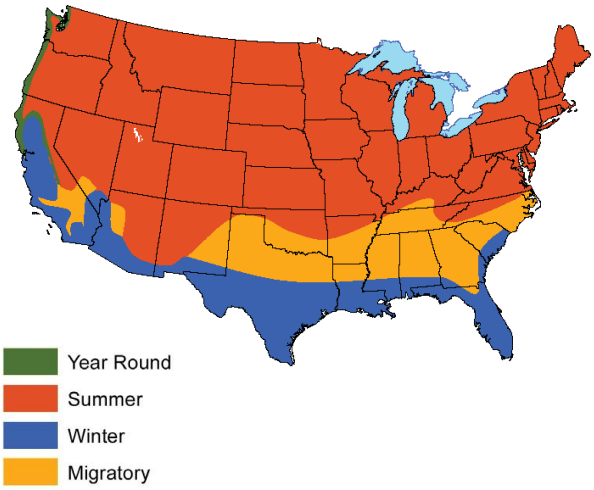
Develop Conservation Easement: can protect critical habitat for this declining subspecies of willow flycatcher
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for southwest willow flycatchers
Conduct Livestock Management: livestock should be excluded from riparian areas when managing for southwest willow flycatchers; overgrazing removes vegetation at the height necessary for nesting and may reduce shrub cover
Plant Shrubs: along riparian areas where there is a lack of shrub cover for nesting
Plant Trees: along riparian areas where cover is lacking
Set-back Succession: *Chainsawing*, *Prescribed Fire*, or *Herbicide Applications* may be necessary if the tree canopy in the riparian zone is minimizing sunlight and preventing a desirable herbaceous understory and midstory
Conduct Wildlife or Fish Survey: point counts are used to estimate population trends

Spotted sandpiper

Beedie Savage

General information

Spotted sandpipers are medium-sized shorebirds that occur all across North America. During the breeding season, they have pale breasts with brown spots, hence the name. They are found in very shallow water areas and along mudflats where they search for freshwater invertebrates and other foods. They are active foragers and walk in meandering paths, darting for prey. Nests are placed in a small depression on the ground, often under a canopy of vegetation, and lined with fine grasses. Spotted sandpipers exhibit an unusual breeding strategy where the female establishes and defends her territory and may breed with several males. The male incubates the eggs and takes care of the nestlings.



Habitat requirements

Diet: flies and their aquatic larvae (midges), grasshoppers, beetles, worms, snails, small crustaceans
Water: acquire necessary water while foraging and from diet
Cover: shallow, freshwater wetlands and mudflats; sometimes dense herbaceous vegetation for nesting

Wildlife management practices

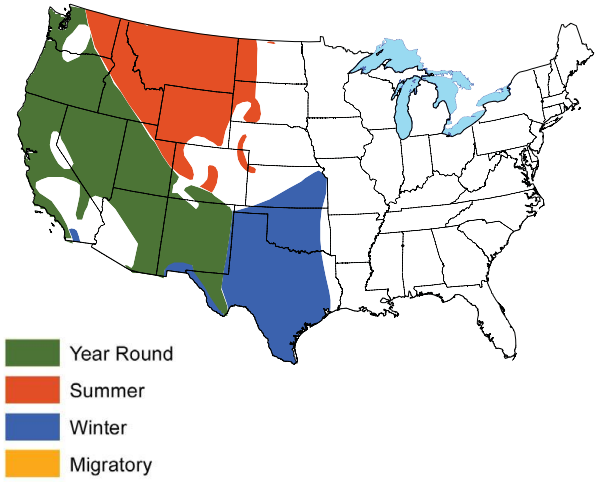
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for spotted sandpipers
Conduct Livestock Management: should not allow overgrazing to limit herbaceous vegetation that is used for nesting; livestock may be excluded from areas managed for spotted sandpipers
Plant Native Warm-Season Grasses: where groundcover is lacking, and planting is necessary
Repair Spillway/Dam/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* is recommended to rejuvenate herbaceous groundcover around wetlands for nesting cover
Provide Water Developments for Wildlife: small impoundments and ponds may be constructed if habitat is limiting
Conduct Wildlife or Fish Survey: observation counts are used to estimate population trends

Spotted towhee

Dave Menke

General information

Spotted towhees are relatively large songbirds that occur in the western U.S. They are fairly widespread and abundant and found in dense shrub cover, typical of woodland edges, shrub thickets, chaparral, canyon drainages, and old fields. Nests are made of leaves, twigs, strips of bark, and grasses, and usually placed on the ground among the shrub cover against a log, clump of grass, or base of a shrub for further concealment. Nests contain 2-6 eggs. Spotted towhees may have 1-3 broods per year. Spotted towhees forage on the ground among leaf litter, where they hop and scratch for invertebrates and various seed. Spotted towhees are sensitive to habitat loss, thriving in disturbed areas where agricultural and residential developments are minimal.



Habitat requirements

Diet: ants, beetles, caterpillars, crickets, grasshoppers, moths, wasps, millipedes, spiders dominate the diet; in winter, various seeds, acorns, soft mast, and grains (oats, wheat, corn) are more prevalent
Water: necessary water is obtained from the diet
Cover: shrub cover is used for loafing, foraging, nesting, and escape

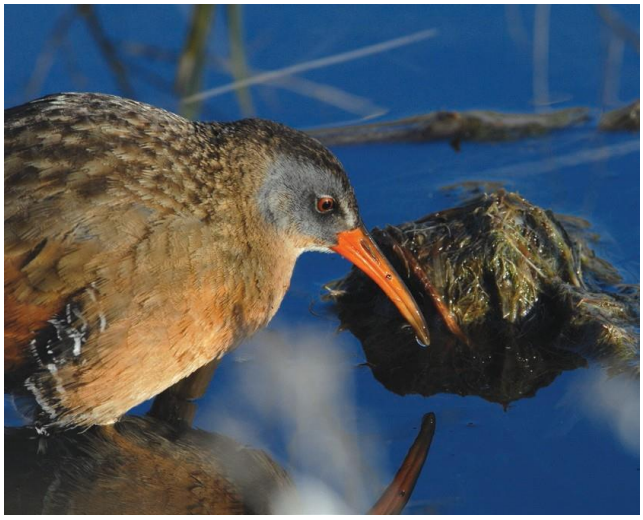
Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for spotted towhees
Conduct Forest Management: *Forest Regeneration* (*Clearcut*) will create brushy cover for 5 to 10 years; *Timber Stand Improvement* (heavy thinning) can stimulate brushy understory growth
Conduct Livestock Management: livestock should be excluded from areas managed for spotted towhee
Plant Shrubs: in large open areas to provide habitat
Set-back Succession: *Prescribed Fire*, *Chaining*, and *Drum-chopping* can be used to promote dense resprouting shrubs; *Chainsawing* and *Herbicide Applications* can be used to reduce tree cover and stimulate increased shrub cover and stem density
Conduct Wildlife or Fish Survey: point counts can be used to estimate population trends

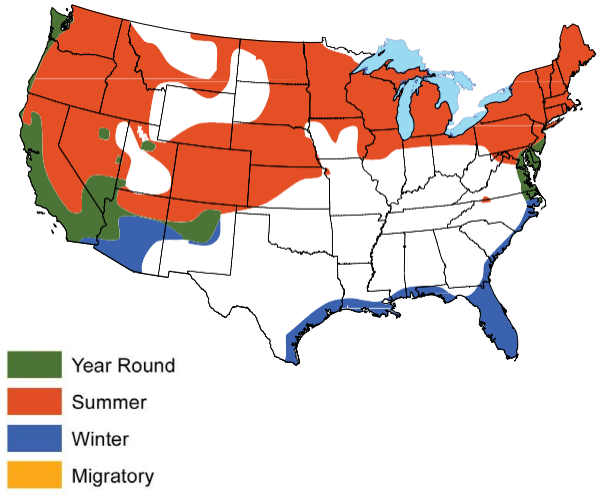
Virginia rail

General information

The Virginia rail is a gamebird of freshwater marshes, but occasionally occurs in saltwater marshes. It prefers to stay hidden in moderately dense emergent vegetation and is more often heard than seen. If wetland vegetation becomes too thick, Virginia rails will not be as abundant. Virginia rails may be found in wetlands of all sizes, but prefer hemi-marsh, which is represented by scattered patches of emergent vegetation with small openings of open water at about a 50:50 ratio. Periodic water level manipulation should be used to favor annual wetlands plants and avoid a monoculture of perennial wetland vegetation. Shallow water depths (generally less than 1 foot) are required. Virginia rails will flee quickly on the ground through vegetation if approached and will fly rarely. They typically inhabit shallow water areas and can swim under water if attacked. Virginia rails are migratory and can travel great distances. The Virginia rail is known to build dummy nests around the vicinity of their actual nests.



Dave Menke



Habitat requirements

Diet: insects, aquatic invertebrates, snails, small fish, and small amphibians; some seeds and plant material in fall and winter

Water: obtained from food

Cover: moderately dense wetland vegetation, such as cattails, sedges, rushes, smartweeds, and other plants are used for cover; nests are woven into vegetation over shallow water and may have a canopy over them

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to limit open water or otherwise reduce habitat quality for Virginia rail

Conduct Livestock Management: livestock should be excluded from wetlands managed for Virginia rail

Repair Spillway/Dam/Levee: if not functioning properly

Set-back Succession: *Prescribed Fire*, *Disking*, and *Herbicide Applications* may be used in wetlands dominated by very dense perennial vegetation to encourage a hemi-marsh consisting of openings and annual plants; *Chainsawing* and *Herbicide Applications* may be used to reduce tree cover and create more open marsh

Provide Water Developments for Wildlife: shallow impoundments can be constructed to provide habitat

Conduct Wildlife or Fish Survey: Call counts are most often used to estimate population trends; playing a tape of their call increases the chance of hearing rails; also, ropes can be dragged across vegetation between two or more observers to flush birds during observation counts

Western bluebird

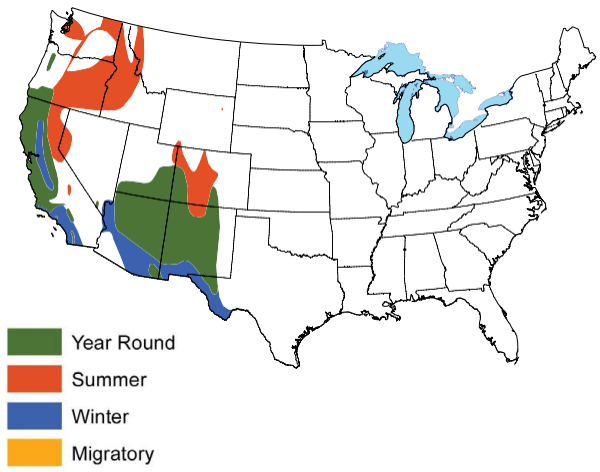

Michael Woodruff

General information

Western bluebirds occur in portions of the western U.S. and southwestern U.S. and Mexico. They tend to use more wooded areas than eastern or mountain bluebirds. Western bluebirds are usually found in open woodlands, especially ponderosa and pinon pine-juniper. Open deciduous forest, particularly aspen that has been burned, where cavity trees are plentiful, are commonly used. Wooded riparian areas in arid environments also attract western bluebirds. Like other bluebirds, insects dominate the diet during spring and summer, and various fruits are most prevalent during fall and winter. Western bluebirds' nest in cavities, especially old woodpecker cavities, as well as nest boxes. Clutches consist of 2-8 eggs. Western bluebirds may have 1-3 broods per year.

Habitat requirements

Diet: invertebrates, especially grasshoppers, crickets, beetles, and spiders; various fruits, such as chokecherry, elderberry, grape, raspberry, sumac, serviceberry, and poison oak, in fall and winter
Water: necessary water obtained from diet
Cover: woodlands; nest in cavities of trees and fence posts



Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduces habitat quality for western bluebirds
Create Snags: where cavities are limited to provide potential nest sites and perching sites in open areas
Develop Field Borders: to increase foraging opportunities around crop fields
Conduct Forest Management: *Forest Regeneration* (*Seed Tree*, *Shelterwood*) may be used to enhance habitat in pine forests for a few years, especially if coupled with *Prescribed Fire*; *Timber Stand Improvement* may be used to enhance habitat by reducing tree density in pine forests and woodlands
Conduct Livestock Management: livestock must be excluded from recently planted trees and shrubs
Provide Nesting Structures: should be erected where a scarcity of natural cavities may be limiting the population; nest boxes should be approximately 5 feet high with an entrance hole 1½ inches in diameter; nest boxes should
be placed no closer than 80 yards apart to limit territorial fighting among males
Plant Native Grasses and Forbs: where groundcover is lacking, and planting is necessary
Plant Shrubs: in large open areas where perching sites or winter foods may be limiting
Plant Trees: in large open areas where perching sites are limiting; may provide potential nest sites in distant future
Set-back Succession: *Prescribed Fire* is recommended to improve woodland structure and maintain herbaceous openings for western bluebirds; *Herbicide Applications* may be used to reduce tree density; *Chaining* and *Drum-chopping* can be used to reduce shrub cover where necessary; *Chainsawing* can be used to convert forested areas to open woodlands; *Root-plowing* may be used to reduce shrub density and promote herbaceous openings; *Mowing* may be used to maintain foraging and loafing cover for mountain bluebirds in ***Urban*** areas
Conduct Wildlife or Fish Survey: point counts can be used to monitor bluebird populations; nest boxes should be checked to monitor use and nest success

Western kingbird

General information

Western kingbirds are large flycatchers that are readily seen throughout the western U.S. The have gray heads, yellow bellies, white throats, and a square-tipped tail. They are found in grasslands, pastures, cultivated fields, desert shrub areas, savannas, and urban areas. Scattered trees and shrubs are used for nesting cover, and human activity often improves habitat because trees and structures provide potential nest sites. Western kingbirds winter in southern Mexico and Central America.

Gary Kramer

Habitat requirements

Diet: more than 90 percent of the diet is consists of insects; soft mast from various plants is occasionally eaten

Water: water requirements unknown

Cover: trees and shrubs for nesting and perching; nests also may be placed on buildings, windmills, utility poles, and antennas; herbaceous openings for foraging

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation is beginning to reduce habitat quality for western kingbirds

Create Snags: to provide perching sites in open areas where trees are abundant

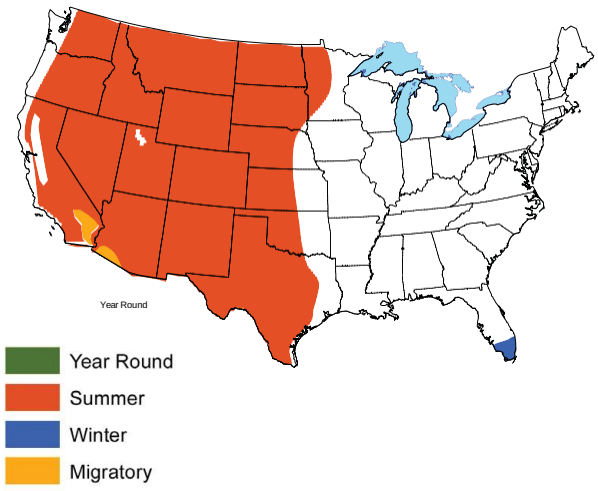
Develop Field Borders: to increase prey abundance around crop fields

Plant Native Grasses and Forbs: in areas where herbaceous openings are limiting, and planting is necessary

Plant Shrubs: in open areas where nesting cover is limiting

Set-back Succession: *Prescribed Fire* and *Disking* can be used to maintain herbaceous openings; *Chainsawing* and *Root-plowing* can be used to create herbaceous openings where limiting

Conduct Wildlife or Fish Survey: point counts are used to estimate population trends

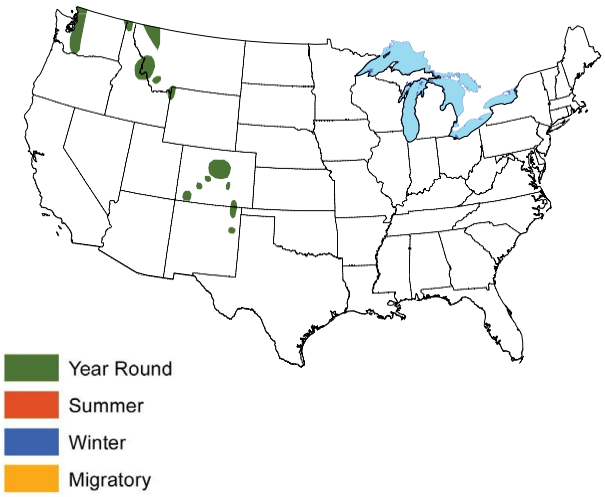


White-tailed ptarmigan

General information

The white-tailed ptarmigan is the smallest grouse in North America. It occurs in alpine regions where their distribution and abundance is relatively consistent over time because their range is very remote and largely undisturbed. They inhabit alpine ridges and meadows approximately 2,000 feet above timberline during spring and summer. Males vigorously defend their breeding territory from other males with "scream flights" to intimidate rivals. Rock bases are preferred nesting cover because of warmer temperatures for incubation and openness for quick escape from predators. Low-growing willow and mosses are used as cover as well. In winter, white-tailed ptarmigan are found at slightly lower elevations within a few miles of summer ranges and closer to the timberline where willows are more abundant. Willows are critical for cover and food, especially during winter. Alpine ecosystems take a long time to recover when disturbed. Therefore, preventing disturbance can be critical for white-tailed ptarmigan habitat management.

Greg Lavaty



Habitat requirements

Diet: buds, twigs, catkins, fruits, seeds, flowers, stems, leaves, and insects are common in spring and summer; buds and twigs of willows are most common in fall and winter

Water: largely unknown, though they have been observed drinking water and eating snow

Cover: rocks or clumps of vegetation around rocks are most often used for nesting because of increased warmth and protection from inclement weather; high, rocky, windswept ridges with interspersed herbaceous vegetation are used for brooding; in winter, areas near the tree line up to almost the summering range where there is an abundance of willow (food) and soft snow (roosting cover) for concealment with their white winter plumage

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to encroach and reduce habitat quality for white-tailed ptarmigan

Conduct Livestock Management: should prevent livestock grazing where ptarmigan occur

Plant Shrubs: willows may be planted for food and cover where they are lacking, especially near the tree line below alpine areas

Decrease Hunting/Fishing: may be necessary if the local population is declining at the current harvest level and data suggest morality from hunting is additive or limiting population growth

Conduct Wildlife or Fish Survey: scream call counts are the only known survey technique, but they are limited because of the remote locations and small range of effectiveness

White-winged dove

General information

White-winged doves are generally found near the southern borders of the United States. They use agriculture and open areas for feeding and dense shrubs and trees for nesting and loafing. They also are found in urban and riparian areas. White-winged doves are light brown with a black mark on the cheek and a white band on the edge of their wing, for which they are named. They build nests, comprised mainly of twigs, in trees where they will lay only 1 or 2 eggs. Both the male and female will produce crop milk to feed their young, often eating snails or bone to increase calcium content. They often roost, forage, or migrate as flocks.

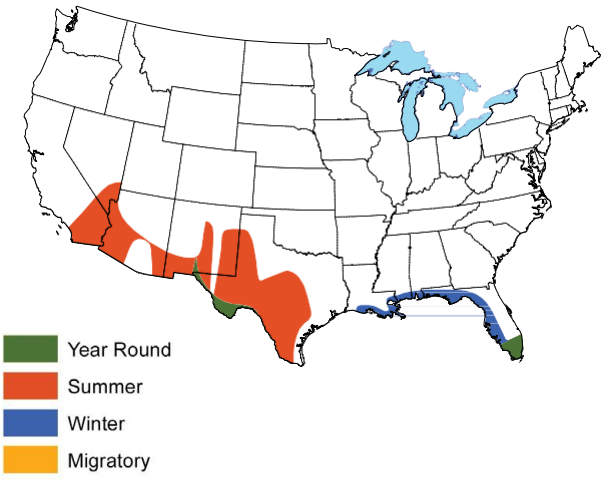
Habitat requirements

Diet: a variety of grass and forb seeds (such as spurge, bristlegrass, saguaro cactus, and brasil), waste grain from cropland and livestock feedlots, small areas of bare ground are beneficial for obtaining grit (small gravel) to help digest food
Water: free-standing water is required daily
Cover: tall shrubs and trees for nesting and loafing; nests are made of twigs placed on branches of shrubs or trees; nests may also be placed on the ground

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality for white-winged doves
Create Snags: where needed to create perching sites
Leave Crop Unharvested: will provide additional food from a variety of small grain crops, such as millets, grain sorghum, wheat, and oats
Conduct Livestock Management: should prevent overgrazing forbs, which will reduce food availability for white-winged doves
Plant Food Plots: where additional food, specifically grain, is needed
Plant Native Grasses and Forbs: forbs may be planted in areas where food is limiting, and planting is feasible
Plant Shrubs: in large open areas where nesting sites are limited
Plant Trees: especially along riparian areas where nesting cover is limiting
Set-back Succession: *Prescribed Fire* can be used to enhance seed availability; *Disking* and *Herbicide Applications* can provide bare ground; *Chainsawing*, *Chaining*, *Drum-chopping*, and *Root-plowing* can be used to reduce shrub cover and provide increased bare ground and forb production

Gray Kramer



Conduct Tillage Management: eliminate tillage in the fall to allow access to waste grain
Provide Water Developments for Wildlife: where water is limiting, small ponds, guzzlers, or windmills can provide free-standing water
Conduct Wildlife or Fish Survey: observational surveys and point counts are used to estimate population trends

Wild turkey

General information

Wild turkeys are large gamebirds found across the U.S. They are adapted to use a wide variety of vegetation types, from deciduous forest to desert shrub to open grassland interspersed with tree-lined riparian areas. Their distribution is largely limited only by snow depth and persistence to the north, which limits their ability to forage on the ground, and by trees or large shrubs needed for roosting at night in arid regions. Wild turkeys flock together during fall and winter. Breeding occurs in spring when males gobble to attract females. Nests are a slight depression on the ground, usually placed adjacent to a log, shrub, or some other structure to aid in concealment. Shrub cover is often used for nesting, but wild turkeys also nest in open woods and in fields. Nests are lined with leaves and other vegetation and usually contain about 12 eggs. Poults (young turkeys) are precocial, meaning they are able to walk around with the hen and forage for themselves soon after hatching. Herbaceous openings, especially those with a forb canopy and open ground structure, are preferred for brooding. Although wild turkeys spend most of their time on the ground, except when the fly up into trees in the evening to roost for the night, they can fly well and often take flight for short distances to escape predators.

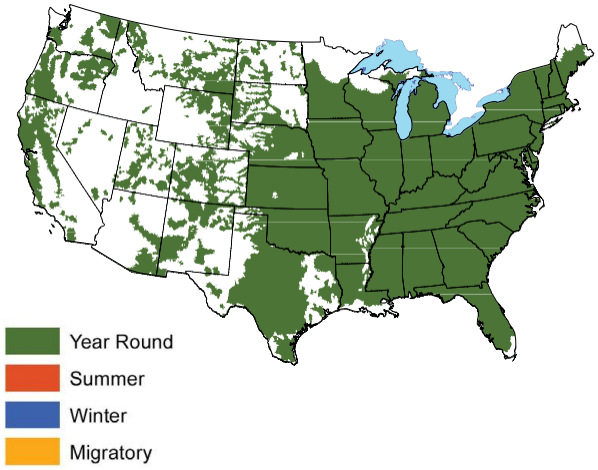
Habitat requirements

Diet: extremely varied; hard mast, especially acorns and beechnuts in the fall and winter; soft mast, such as blackberries, mulberries, and black cherry; insects and other invertebrates, including spiders and snails, are especially important for young poults and hens prior to nesting; miscellaneous seeds; leaves from forbs and grasses; grain from a variety of agricultural crops
Water: obtain water from diet, but may use free-standing water when available
Cover: mature forest, young regenerating forest, brushy areas, and old fields for nesting; mature forest; herbaceous openings; grain fields for foraging; trees or tall shrubs for roosting

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for wild turkeys; common examples include sod grasses, such as tall fescue, bermudagrass, and others, such as cogongrass, which limit mobility for turkey poults and food availability; kudzu and shrub honeysuckle are other species that often degrade habitat in forested areas

Robert Burton



Develop Field Borders: to increase usable space for nesting and brooding around row crop fields
Conduct Forest Management: (in some ecoregions) *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*, *Seed-tree*) can enhance nesting and brooding cover and stimulate increased soft mast and miscellaneous seed for a few years after harvest; *Timber Stand Improvement* can improve the structure of the understory for nesting and brood rearing, increase production of soft mast and miscellaneous seed, and enable crowns of desired trees to grow and produce additional mast
Leave Crop Unharvested: especially corn, soybeans, and grain sorghum, to provide supplemental food source during fall and winter
Conduct Livestock Management: should prevent livestock from degrading habitat by overgrazing and damaging planted trees and shrubs and food plots
Plant Food Plots: to provide supplemental foods where food may be limiting; corn, soybeans, wheat, and clovers are often used
Plant Native Grasses and Forbs: where herbaceous cover is limiting, and planting is necessary
Plant Shrubs: where additional soft mast or brushy cover is needed
Plant Trees: where additional hard mast production, especially acorns, is needed and where roosting sites are limited

Set-back Succession: *Prescribed Fire* is recommended to maintain herbaceous openings, rejuvenate shrubland, and improve understory structure and composition for foraging, brooding, and nesting in forests, woodlands, and savannas; *Disking* can be used to maintain herbaceous openings and reduce thatch build-up; *Herbicide Applications*, *Chaining*, *Root-plowing*, and *Drum-chopping* can be used to reduce shrub cover and stimulate more herbaceous groundcover; *Chainsawing, Dozer-clearing*, and *Root-plowing* can be used to remove trees and create herbaceous openings, especially where brooding cover may be limiting

Conduct Tillage Management: eliminate tillage in the fall to provide additional waste grain during winter, especially when adjacent to tall shrub or forest cover

Provide Water Developments for Wildlife: can be useful when there is little or no free-standing water

Decrease Hunting/Fishing: may be necessary if populations are declining and data suggest mortality from hunting is additive or limiting population growth

Increase Hunting/Fishing: where populations can sustain additional harvest pressure for hunting recreation and where populations need to be lowered

Conduct Wildlife Damage Management: may be necessary in rare instances when wild turkeys are depredating crops

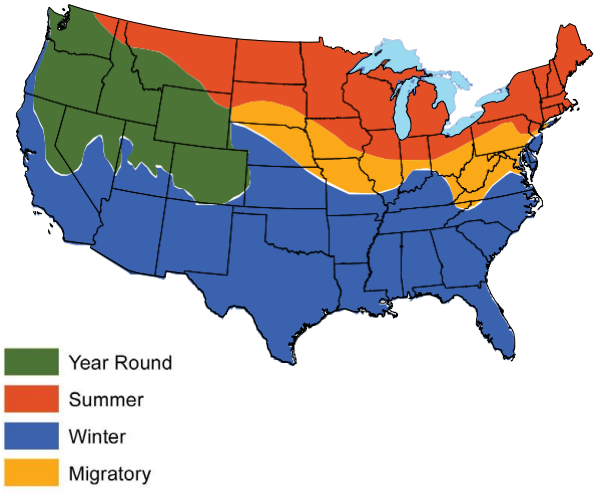
Conduct Wildlife or Fish Survey: gobble surveys, poult surveys, and hunter success rates are used to estimate population trends

Wilson's snipe

David Ward

General information

Named after ornithologist Alexander Wilson, the Wilson's snipe is a ground-dwelling, migratory shorebird of North, Central, and South America that uses a variety of wetlands and riparian areas, especially where mudflats or sandbars are present. They breed, nest, and raise their broods during summer in their northern range and migrate to their southern range in the fall and winter. There are resident populations in the Pacific northwestern United States. High-quality Wilson's snipe habitat will have a marshy area with low herbaceous vegetation, and sparse shrubs, with a mudflat or sandbar nearby. Nests are constructed of grass bowls placed on the ground in herbaceous vegetation near water.



Habitat requirements

Diet: invertebrates (insects and larvae)
Water: obtained through diet
Cover: bogs, fens, swamps, and marshy, vegetated edges of ponds, rivers, and streams are used for courtship and nesting; areas with moist soil or mud for insect probing (such as wet fields, marshy edges of water bodies, and exposed muddy banks or sandbars) are used for foraging

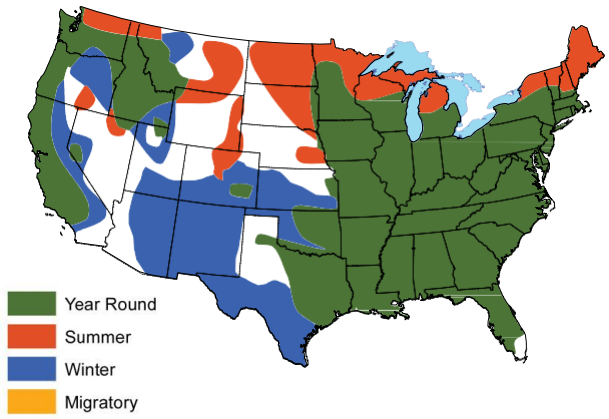
Wildlife management practices

Control Nonnative Vegetation: may be necessary if nonnative plants are degrading habitat
Conduct Livestock Management: should not allow overgrazing to limit herbaceous vegetation adjacent to wetlands that is used for nesting; livestock access to wetlands should be restricted
Set-back Succession: *Disking* and *Herbicide Applications* can provide bare ground; *Prescribed Fire* can maintain herbaceous groundcover; *Chaining* can reduce excessive shrub cover; *Chainsawing*, *Dozer-clearing*, *Root-plowing*, and *Herbicide Applications* may be used to remove trees and create wetland openings
Conduct Wildlife or Fish Survey: flush counts, hunter harvest data, and breeding bird survey data are used to estimate population trends

Wood duck

General information

Wood ducks are spectacularly colored ducks found throughout most of the U.S. They primarily use forested and shrub-emergent wetlands and riparian systems (rivers and creeks), but also may forage and loaf in flooded fields, especially if there is plenty of emergent vegetation. Wood ducks' nest in tree cavities, usually within or adjacent to flooded timber, but possibly up to 1 mile from water. Cavity availability is critical for a sustainable population. Thus, artificial cavities (nest boxes) are readily used by wood ducks and have been, most likely, the number one reason for the increase in wood duck populations during the past 50 years.



Habitat requirements

Diet: acorns are the primary diet item in fall and winter; other hard mast, miscellaneous seeds and soft mast, as well as waste grain (especially corn) also are eaten; insects and other invertebrates are most important for wood duck chicks and hens prior to and during the nesting season

Water: obtained through diet and drink free-standing water regularly

Cover: shallowly flooded bottomland hardwoods, emergent wetlands, swamps, and marshes are commonly used for loafing and foraging cover; tree cavities in forested areas and artificial cavities used for nesting

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for wood ducks; this is applicable in wetlands as well as adjacent uplands where wood ducks may be foraging

Create Snags: where relatively large cavity nesting sites (trees >12 inches in diameter) may be limiting

Conduct Forest Management: *Forest Regeneration* (*Shelterwood*, *Group Selection*) in relatively large forested areas that can be flooded will create openings with emergent woody vegetation that will attract foraging and loafing wood ducks; *Timber Stand Improvement* in bottomland hardwoods that can be flooded can lead to larger crowns of favored trees and increased mast production; woody stem density should increase following TSI and improve cover in stands that can be flooded

Leave Crop Unharvested: especially corn, to provide high-energy food source during fall and winter; this is especially important in fields that can be flooded and those adjacent to a water source used by wood ducks

Conduct Livestock Management: should prevent overgrazing in fields that are flooded for wood ducks; livestock should be excluded from bottomland hardwoods and areas where trees and shrubs have been planted, as well as food plots

Provide Nesting Structures: nest boxes should be erected where a lack of natural cavities may be limiting the wood duck population; nest boxes for wood ducks should be at least 100 yards apart and should not be placed within sight of each other to prevent dump nesting (if a wood duck he sees another hen entering a cavity or nest box, she may be stimulated to enter that cavity and "dump" her own eggs instead of laying in her own nest; thus, heat from incubation is not even over all the eggs and fewer eggs hatch overall)

Plant Food Plots: shallowly flooded grain plots, especially corn, can provide an important source of energy in fall/winter, especially during years of poor mast production

Plant Shrubs: where there is a lack of emergent woody vegetation in open areas that can be flooded

Plant Trees: mast trees planted adjacent to or within open areas suitable for flooding may provide future food and nesting cavities in areas where these trees may be limiting

Repair Spillway/Dam/Levee: if not functioning properly

Set-back Succession: *Chainsawing*, *Prescribed Fire*, and *Herbicide Applications* can be used to reduce tree and shrub cover in woods and create openings where needed to stimulate more herbaceous cover and provide increase food availability

Conduct Tillage Management: eliminate tillage in the fall to provide additional waste grain during winter, especially corn fields that can be shallowly flooded

Provide Water Developments for Wildlife: shallow impoundments should be created where topography allows providing increased feeding and nesting space for wood ducks

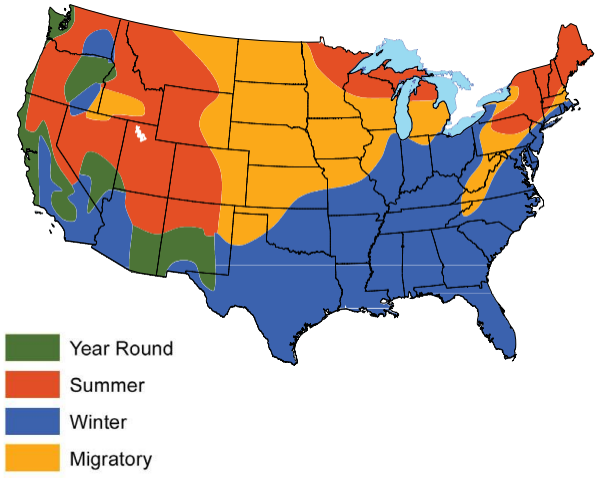
Conduct Wildlife or Fish Survey: nest box usage rates, brood counts, and flush counts are used to estimate population trends

Yellow-rumped warbler

Frank Miles

General information

Yellow-rumped warblers are relatively large warblers found throughout the U.S., Canada, and Mexico. They breed throughout southern Canada, the western U.S., the Great Lakes region, and the northeastern U.S. in coniferous and mixed coniferous-deciduous forests and woodlands. They winter throughout the southern U.S. using open areas, especially shrub cover with plentiful soft mast. Yellow-rumped warblers eat insects gleaned from the branches and bark of trees and shrubs, and also may catch insects on-the-fly.



Habitat requirements

Diet: ants, caterpillars, beetles, grasshoppers, crane flies, and spiders in spring and summer; various seeds and fruit during winter, such as bayberry, wax myrtle, juniper, poison ivy, greenbrier, grapes, Virginia creeper, and dogwoods

Water: necessary water obtained from diet, but free-standing water is used when available

Cover: coniferous or mixed forest and woodland during nesting season; occasionally nest in shrubs; nest is made of twigs, bark stripping's, and weed stems and placed on small branches 5 to 50 feet above the ground; brushy thickets are used for feeding, loafing, and escape during winter

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for yellow-rumped warblers

Conduct Forest Management: *Timber Stand Improvement* can improve forest structure for nesting and foraging

Conduct Livestock Management: should not allow overgrazing in wintering areas; livestock should be excluded from forested areas used for nesting

Plant Shrubs: where shrub cover is lacking in winter range

Plant Trees: where forest cover is limiting during the nesting season

Set-back Succession: *Prescribed Fire* and *Herbicide Applications* can be used to maintain open areas with scattered shrub cover in wintering areas

Conduct Wildlife or Fish Survey: point counts are used to estimate population trends

Mammals

American beaver

General information

Beavers occur throughout most of North America. They are found in various wetlands that have permanent water with a variety of shrubs and trees adjacent to the water. Beavers build dams from tree branches, shrubs, and mud to form ponds that stabilize water levels, slow water movement, and provide shelter beneath the ice in winter. Beavers also build lodges from sticks and mud and dig burrows in banks of streams and rivers. Beavers eat the inner bark of shrubs and trees and store cuttings in caches (piles of branches) for use during winter.

The ecological benefits provided by beavers cannot be overstated. Beavers are responsible for creating habitat for many species of birds, mammals, reptiles, amphibians, fish, and invertebrates. Without beavers, the distribution and abundance of many freshwater wetland-associated species would decline dramatically. Unfortunately, beavers were once such a valuable fur resource that trapping led to their extirpation in many parts of their former range. Today, beavers have rebounded with help from wildlife agency regulations and a lack of available fur market. In some areas, beavers have become a nuisance, as they cut down trees and dam ditches and streams in undesirable places. Their dams often flood crops, destabilize road edges, and kill trees. When beavers construct dams in places that cause problems, removal of the beaver is usually the best solution. If the dam is destroyed and the beavers remain, they will build the dam again.

Habitat requirements

Diet: primarily bark from shrubs and trees; also, some forbs and grasses

Water: prefer slow moving or still water at least 5 feet deep (to allow movement under water)

Cover: bottomland riparian areas that can be dammed to provide still water with sufficient depth

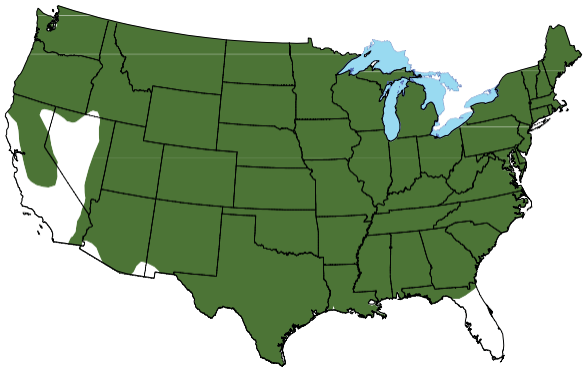
Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for American beaver

Conduct Livestock Management: should prevent livestock access to riparian areas and other wetlands where beaver is a focal species to prevent foraging on shrubs and young trees; this may include developing livestock watering facilities in upland areas beaver may use and maintain good water quality

Plant Shrubs: where beavers are desired, but not present, deciduous shrubs may be planted along riparian areas where there are few trees or shrubs to make the area more attractive to beavers

Steve Hersey



Plant Trees: where beavers are desired but not present, deciduous trees may be planted along riparian areas where there are few trees or shrubs to make the area more attractive to beavers

Decrease Hunting/Fishing: may be necessary where an increased beaver population is desired and trapping pressure has limited growth

Increase Hunting/Fishing: where populations can sustain additional trapping pressure for recreation and/or where populations need to be lowered

Conduct Wildlife Damage Management: should be implemented where beavers are causing problems for landowners, such as flooding timber, crops, roads, and other areas

Conduct Wildlife or Fish Survey: presence and extent of beaver activity (dams, evidence of cutting shrubs and trees) and trapper harvest data are used to estimate population trends over time

American marten

General information

Martens are found primarily in mature coniferous or deciduous-coniferous forest of the upper Great Lakes, Rocky Mountains, and the mountains of the Pacific region and New England. Martens are carnivorous. They give birth and raise young in dens of hollow trees, stumps or rock crevices.

USFWS

Habitat requirements

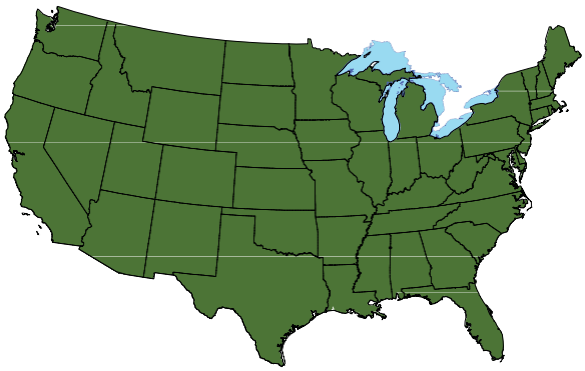
Diet: primarily voles, snowshoe hares, ruffed grouse, and squirrels; also, opportunistically eat eggs, amphibians, soft mast, and carrion
Water: necessary water obtained from diet
Cover: mature conifer forests, but also mixed hardwood forests; dens in hollow logs, stump holes, and rock crevices

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for American marten
Conduct Forest Management: *Forest Regeneration* (*Single- tree Selection*, *Group Selection*) and *Timber Stand Improvement* can diversify understory structure and composition and increase abundance of prey; snags should be retained for prey
Plant Trees: where additional forest cover is needed
Decrease Hunting/Fishing: may be necessary when trapping pressure is limiting population
Increase Hunting/Fishing: where populations can sustain additional trapping pressure
Conduct Wildlife or Fish Survey: track counts, trapper harvest data, and trail cameras can be used to estimate population trends over time

Big brown bat

Don Pfitzer



General information

Big brown bats are one of 46 bat species in North America. They inhabit nearly all of the U.S., except south Florida and south-central Texas. They use a variety of vegetation types, from farmland to mature deciduous forest. Big brown bats are common in urban areas, including cities, parks, and suburban neighborhoods. They frequently use buildings and houses for daytime summer roosts and sometimes as winter hibernacula, but most hibernate in caves. Big brown bats are insectivores. Lactating females will eat their weight in insects daily. Males and females may roost individually or in small numbers, but males and females usually roost separately. Females may roost together in a maternal colony when pups are born and nursing. Females usually give birth to one or two pups, often in a hollow tree or attic. Big brown bats, as well as all other bat species, are nocturnal and are the only mammals capable of flying? Big brown bats will drink "on-the-wing" by dipping their lower jaw into a water source. Big brown bats hibernate in the winter in northern latitudes. Therefore, they do not actively feed during winter months, but instead rely on stored fat reserves.

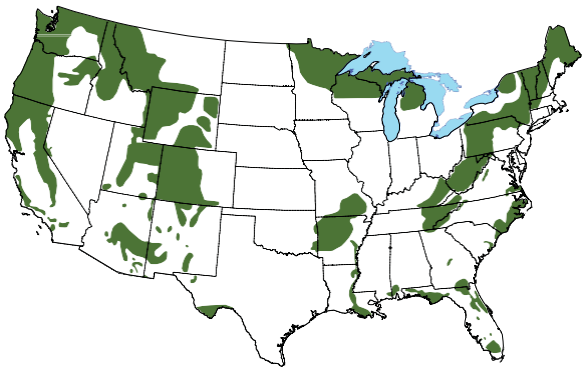
Habitat requirements

Diet: night-flying insects, especially beetles
Water: free-standing water is required daily when they are active
Cover: buildings and hollow trees are often used for daytime roosts; bat houses also may be used for daytime roosting; caves, mines and buildings are used for hibernation

Wildlife management practices

Create Snags: to provide roost sites (only in areas where they pose no danger to human structures or health when they fall) where roost sites may be limiting
Provide Nesting Structures: may provide additional roost sites if natural roost sites are limiting
Plant Trees: in large open areas where few trees are present to promote future old trees that may provide roost sites
Set-back Succession: *Chainsawing*, *Dozer-clearing*, *Root-plowing*, *Herbicide Applications*, and *Prescribed Fire* (in rural areas) can be used to maintain more than 50 percent open areas for foraging; mowing may be used in ***Urban*** areas to maintain openings
Provide Water Developments for Wildlife: where available open water is not available, small ponds and shallow impoundments may be constructed for drinking and to attract insects; water developments should be constructed with nothing above the water (such as fencing or bracing) so bats have an unobstructed flight path
Conduct Wildlife Damage Management: may be necessary when roosting or hibernating in areas occupied by humans
Conduct Wildlife or Fish Survey: observation counts, and echolocation surveys are used to estimate population trends

Black bear



Steve Hillebrand

black bear

General information

Black bears are game mammals that primarily use mature deciduous or mixed deciduous/coniferous forest interspersed with early successional openings containing soft mast. Young regenerating stands, shrub thickets with dense brushy cover, and riparian corridors also are used. Black bears generally are secretive and avoid human contact. However, black bears are highly adaptable and may occur in and around human dwellings and become problematic, especially if food is available. Black bears are primarily nocturnal but may be seen anytime during the day. They hibernate in winter (even in warm climates such as Florida and Louisiana) and have large home ranges (several square miles) that vary based on sex, age, and/or time of year. In general, adult male home ranges (up to 50 square miles) are much larger than female home ranges (15 square miles). Black bears are omnivorous. However, more than 90 percent of their diet consists of vegetation. Liberalizing or restricting females in the harvest influences population growth.
Regulation of bear population density is influenced by public tolerance toward bear-human conflicts, property damage, livestock and agricultural damage, and the desire to see bears.

Habitat requirements

Diet: in spring, skunk cabbage, squaw root, grasses, and insects; occasionally, small to medium-sized mammals, such as deer fawns and young livestock (calves and lambs); during summer and early fall, a variety of soft mast, such as blackberry, blueberry, serviceberry, black cherry and pokeweed, are important; during late fall, acorns, beechnuts, and hickory nuts, as well as field corn and soybeans, help bears prepare for hibernation; when natural foods are scarce, bears may wander near human residences and feed on bird seed, dog/cat food, and other food scraps
Water: free-standing water is used for drinking; spring seeps and other shallow water sources are used to cool off and get away from biting insects; water is seldom a limiting factor because black bears have such a large home range
Cover: mature hardwood or mixed hardwood-conifer forests for foraging; brushy areas and young regenerating forest for loafing and escape; early successional openings primarily for foraging, usually for soft mast; rock crevices, excavations, hollow trees, dense mountain laurel and rhododendron thickets for hibernation

Wildlife management practices

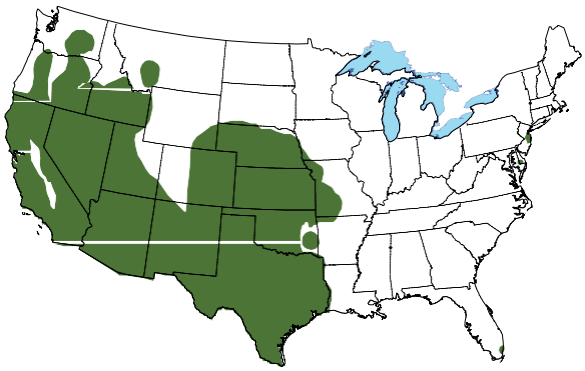
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for black bear
Conduct Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) creates dense escape and loafing cover for bears; an abundance of soft mast
(pokeweed, blackberry, huckleberry, blueberry) is usually available in recently regenerated stands; *Timber Stand Improvement* practices can stimulate increased hard mast production and can stimulate groundcover, which usually increases soft mast production
Leave Crop Unharvested: strips of corn, wheat, grain sorghum, or soybeans should be left standing, especially where adjacent to escape cover, to provide food close to cover
Plant Food Plots: where food may be limiting, forage (especially chicory) and grain plots (especially corn) may be planted to provide additional nutrition
Plant Shrubs: crabapple, blueberry, hawthorn, wild plum, elderberry, and others can be planted within forest openings where soft mast is lacking
Plant Trees: apple, pear, cherry, persimmon, mulberry, and dogwood are good choices to provide additional soft mast where lacking
Set-back Succession: *Prescribed Fire* can stimulate groundcover and soft mast in early successional openings, maintain shrub cover when quality begins to decline, and stimulate understory structure and soft mast availability in forests, especially where sufficient sunlight reaches the forest floor; *Dozer-clearing* and *Root-plowing* can be used to increase early succession
Conduct Tillage Management: eliminate tillage in the fall to provide additional waste grain during winter, especially when adjacent to dense shrub or forest cover
Decrease Hunting/Fishing: may be necessary when additional bears are desired and hunting pressure may be limiting population growth
Increase Hunting/Fishing: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Conduct Wildlife Damage Management: may be needed if bear- human conflicts occur in agricultural or urban settings
Conduct Wildlife or Fish Survey: scent stations, winter den surveys, camera surveys, and hunter harvest data are used to estimate population trends

Black-tailed jackrabbit

General information

The black-tailed jackrabbit is a large, long-eared hare that lives in open, arid grasslands and brushland in the west. They prefer open pastures, even those that have been grazed, rather than thick brush for the increased visibility that helps them avoid predators. This jackrabbit has brownish fur peppered with black. Its hind feet are as large as its ears and used to run fast, up to 36 mph, to elude predators, such as hawks, coyotes, and bobcats. The large ears help regulate body heat by increasing or decreasing the blood flow through the ears. Black-tailed jackrabbits are mostly seen in the late evening hours and stay out at night to forage when they would be less likely to face predation. During the day, black-tailed jackrabbits rest in hollows made in the ground at the base of shrubs or in tall grass for shade. They mate year-round and produce 1 to 4 litters per year with up to 8 young per litter. They do not typically make a nest. Black-tailed jackrabbits eat a wide range of vegetation depending on what is available. A concentration of these jackrabbits may overgraze parts of a property and is considered a pest in many places. Their population can be affected by a reduction in forage as a result of brush encroachment and development.

Ryan Hagerty



Habitat requirements

Diet: forage crops, twigs, cactus, mesquite, grasses, and forbs
Water: obtained from the foods they eat
Cover: open grasslands for foraging; shrubs and tall grasses for burrow cover

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for black-tailed jackrabbits
Conduct Livestock Management: should provide adequate forage for jackrabbits where black-tailed jackrabbit is a focal species
Plant Shrubs: can provide cover where trees and shrubs are lacking
Set-back Succession: *Prescribed Fire*, *Chaining*, *Drum-chopping*, and *Root-plowing* can be used to reduce shrub cover where necessary
Decrease Hunting/Fishing: may be necessary if harvest has been excessive and an increase in the black-tailed jackrabbit population is desired
Increase Hunting/Fishing: where population can withstand additional harvest for recreational hunting or when population needs to be lowered
Conduct Wildlife Damage Management: is necessary when jackrabbits reduce forage available for livestock
Conduct Wildlife or Fish Survey: observation counts are used to monitor population trends

Black-tailed prairie dog

Elise Smith

General information

The black-tailed prairie dog is the most widely distributed of the North American prairie dogs. They live in densely populated colonies (20 to 35 per acre) among subterranean burrows in grassland or sparse shrubland communities. Some areas of colonies will be bare ground where there is a high prairie dog density. They often establish colonies near intermittent streams, water impoundments, homestead sites, corrals, and windmills. They do not tolerate tall vegetation well— they avoid brush and timbered areas. In tall and mixed- grass rangelands, prairie dogs have a difficult time establishing a colony unless large grazing animals (bison or livestock) have closely grazed the vegetation. Prairie dogs often select heavily grazed or trampled areas.

Periodic disturbance, such as grazing, is required to maintain suitable conditions for prairie dogs, particularly in areas where rainfall is sufficient to support shrub and tree cover. Prairie dogs occupied up to 700 million acres of western grasslands in the early 1900s. In Texas, the largest prairie dog colony on record measured nearly 25,000 square miles. Since 1900, prairie dog populations have been reduced by as much as 98 percent in some areas and eliminated in others. Today, only about 2 million acres of prairie dog colonies remain in North America. Colonies must be linked to other adjacent colonies (generally less than 1 mile) as colonies periodically move or disappear only to be repopulated by nearby colonies. Therefore, multiple adjacent colonies are critical for long-term population persistence. Although prairie dogs can cause substantial damage to agriculture, prairie dogs are a keystone species on native range and part of a healthy range system. The loss of prairie dog colonies affects many other plant and animal species.

Habitat requirements

Diet: green grasses and forbs
Water: necessary water is obtained from diet
Cover: open grassland with relatively short vegetation; burrows provide escape cover

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for black-tailed prairie dogs
Conduct Livestock Management: grazing can promote suitable grassland structure for prairie dogs
Plant Native Grasses and Forbs: where planting is required to provide forage where limited
Set-back Succession: *Prescribed Fire* is used to maintain grasslands; *Chaining*, *Drum-chopping*, and *Root-plowing* can be used to reduce shrub cover and promote grass/ forb community
Decrease Hunting/Fishing: on native range where shooting or other population reduction methods have reduced prairie dog colonies to the point where they are approaching unsustainable levels
Increase Hunting/Fishing: where populations can withstand increased hunting for recreation; can be used to limit population growth where additional prairie dogs are not desired
Conduct Wildlife Damage Management: registered control techniques, such as toxicants (toxic baits), fumigants, and shooting can be used to reduce populations where damage is occurring to agricultural interests
Conduct Wildlife or Fish Survey: observation counts, aerial surveys, and extent of colonies are used to estimate population trends

Bobcat

General information

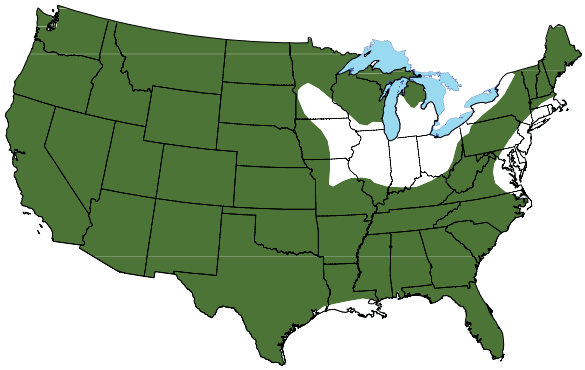
Bobcats are carnivorous predators that occur throughout the U.S. They are seldom active during the day. Bobcats may be a significant cause of mortality to pronghorn and wild turkeys but are not considered a major source of mortality for deer. They are classified as a furbearer game species in many states.

Habitat requirements

Diet: rabbits, rodents, opossums, raccoons, skunks, pronghorns, deer, snakes, and many bird species, including wild turkeys, ruffed grouse, northern bobwhite, domestic poultry, and other livestock

Water: water requirements are not well known; free-standing water is used

Cover: early successional areas, young regenerating forests, mature forest (pine and hardwood), rocky outcrops and ledges, hollow logs, and other sheltered spots for denning



Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for bobcat prey species

Develop Field Borders: can provide increased usable space for bobcat and prey species

Conduct Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*) will provide increased dense cover and food resources for various prey species; *Timber Stand Improvement* can provide enhanced understory development and forage for various prey species; down woody debris (logs) can provide denning sites for bobcat

Conduct Livestock Management: should prevent overgrazing; livestock should be excluded from forests to prevent destruction of forest understory, which provides food and cover for many prey species

Plant Shrubs: in areas where additional shrub cover is needed to attract prey and provide security cover

Plant Trees: in areas where additional forest cover is needed to attract prey and provide security cover

Set-back Succession: *Prescribed Fire* can be used to maintain brushy cover, *Herbicide Applications*, *Chaining*, *Drum-chopping*, and *Root-plowing* can be used to reduce or maintain early successional communities, woodlands, and forest understory

Decrease Hunting/Fishing: may be necessary when additional bobcats are desired and hunting or trapping efforts may be limiting growth

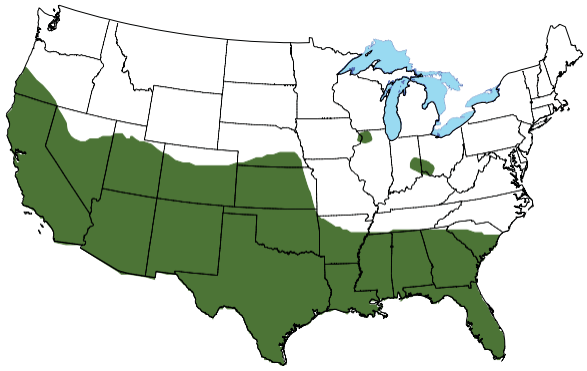
Increase Hunting/Fishing: where populations can sustain additional hunting or trapping pressure for recreation and where populations need to be lowered

Conduct Wildlife Damage Management: may be necessary if poultry or other livestock depredation is a problem

Conduct Wildlife or Fish Survey: track counts, scent stations, trapper harvest data, and trail cameras are used to estimate population trends

Brazilian free-tailed bat

J. N. Stuart



General information

The Brazilian free-tailed bat roosts in large numbers at a relatively small number of roost sites. They have brown fur with broad ears, large climbing feet, and a characteristic "free," mouse-like tail. Anywhere from dozens to millions of bats may roost at a single site, which could be a cave, bridge, or other building structures with cracks or niches where bats can escape during the day. They are frequently found around and in buildings and have earned the nickname "house bats." At dusk, these free-tailed bats emerge from roosts to feed on insects and are estimated to eat between 6,000 and 18,000 metric tons of insects annually, in Texas alone! This insectivore is beneficial both for human comfort and the reduction of agricultural pests. Millions of bats that roost in the U.S. spend their winters in Mexico, Central America, and possibly South America. In contrast, Brazilian free-tailed bats in some areas such as east Texas are non-migratory and remain during winter. Each female gives birth to one pup, which is unable to fly and without fur. Seventy percent or more of the young are born within a 10-day period in mid-summer. Young bats live in large congregations on cave ceilings. At about one month old, young bats are able to fly to find their own insects. Although a small percentage of the Brazilian free-tailed bat populations carry rabies (about 24 percent), humans occasionally use pesticides to poison the bats and vandalize key roosting sites because of fear.

Habitat requirements

Diet: insects, such as moths, beetles, flying ants, and June bugs

Water: require free-standing water; Brazilian free-tailed bats sweep over water sources and drink while flying

Cover: caves, mine tunnels, hollow trees, bridges, and other buildings for roost sites during the day; young remain on the ceiling for about a month after birth

Wildlife management practices

Provide Nesting Structures: providing man-made structures for bats to roost can help expand their population or decrease concentrations at existing roost locations.

Conduct Wildlife Damage Management: education on how to properly handle dead bats to protect humans from the rabies virus could decrease fears of bats spreading the disease

Conduct Wildlife or Fish Survey: exit counts from caves are used to estimate population trends

Collared peccary

C. Burnett

General information

The collared peccary (also called javelina [“*have-a- leena”*]) is a game mammal found in the southwestern U.S. Although similar in appearance to pigs, the collared peccary is not in the same taxonomic family as pigs. They have a smaller body size than pigs with 4-toed hooves on their front feet and 3 toes on their back feet. The peccary’s large head and long snout are capped off by sharp tusks pointing toward the ground. Their black, bristly coats include a white collar around their neck. Javelinas have a strong-smelling musk gland on the top portion of their rump, which they use to mark their home range. They run in herds of a few to several dozen within fairly small home ranges and usually can be found cooling off near water or resting in the shade during the heat of the day. Collared peccaries are the only wild ungulate in the western hemisphere that breed all year long, and breeding may be dependent upon rain events. Females will give birth to 1 to 5 young. Peccaries may be aggressive, increasing unnecessary fear among humans, but will not attack unless they are defending themselves. Often confused with pigs, they push dirt around, but do not root-up the ground.

Habitat requirements

Diet: cacti, mesquite beans, lechuguilla and other succulent vegetation, fruit, mast, insects, and small lizards

Water: free-standing water is required unless prickly pear is abundant

Cover: thickets of brush, prickly pear, scrub oak, or rocky canyons

Wildlife management practices

Control Nonnative Vegetation: when nonnative vegetation is competing with native vegetation and reducing habitat quality for collared peccary

Plant Shrubs: planting prickly pear cacti where limited may increase available food resources

Set-back Succession: *Prescribed Fire*, *Chaining*, and *Drum-chopping* can be used to maintain low-growing shrub cover and herbaceous groundcover

Provide Water Developments for Wildlife: peccaries do not sweat; thus, free-standing water is necessary for cooling in hot environments

Decrease Hunting/Fishing: when populations are declining in good habitat and additional animals are desired

Increase Hunting/Fishing: when additional harvest is desired, and populations can withstand additional harvest and when the population needs to be lowered

Conduct Wildlife or Fish Survey: spotlight surveys, camera surveys, and hunter harvest data can assess population trends

Columbian black-tailed deer

General information

The Columbian black-tailed deer is a subspecies of mule deer that occurs in the coastal regions of northwestern North America (northern California, Oregon, Washington, and southern British Columbia). Columbian black-tailed deer use a mixture of openings (with herbaceous groundcover and scattered shrubs) and conifer forest. Black-tailed deer are ruminants (animals with a four-chambered stomach) and are adapted to eat higher-quality forages more so than some other ruminants (such as elk or cattle). Black-tailed deer are crepuscular (active at dawn and dusk) and prefer relatively flat areas at mid- to low elevations (below 1,500 ft.) on south-facing slopes. These sites tend to be dominated by vine maple, huckleberry, and salal plant communities, which provide preferred forage, minimal duration of snow cover, and protection from cold winds. Where overabundant, black-tailed deer can cause damage to ornamental plantings, forest crops, and row crops, and can be hazardous for motor vehicles.

Erin Willett

Habitat requirements

Diet: forbs, browse, soft mast, grains, and grasses
Water: obtain most of their water from diet, but will drink free-standing water when available
Cover: mixture of dense young forest, mature forest, and early successional cover

Wildlife management practices

Control Nonnative Vegetation: may be necessary if the native plant community is being outcompeted and food and cover resources are being reduced
Develop Field Borders: to increase fawning cover and forage availability around fields
Conduct Forest Management: *Forest Regeneration*, especially *Clearcut*, can stimulate herbaceous cover and provide additional brushy cover for a few years; *Timber Stand Improvement* can stimulate additional herbaceous cover and browse in the understory, if the understory is limited
Leave Crop Unharvested: to provide additional food resource, especially near cover
Conduct Livestock Management: should prevent overgrazing in early successional areas to maintain forage and browse for black-tailed deer; livestock should be excluded from forested areas where black-tailed deer is a focal species to maintain the forest understory
Plant Food Plots: to provide additional nutrition, particularly during summer lactation period and during winter in some areas where naturally occurring food resources are limited
Plant Native Grasses and Forbs: where early successional cover is limited and additional grasses and forbs are needed for forage
Plant Shrubs: in large open areas where additional shrub cover, browse, or soft mast is needed
Plant Trees: in large open areas where additional forest cover is needed
Set-back Succession: *Prescribed Fire* can be used to maintain early successional openings and to improve forest understory structure and composition for increased forage and soft mast; *Disking* can be used to maintain early successional openings; *Chainsawing* and *Root-plowing* can be used to create forest openings and maintain shrub-dominated communities
Conduct Tillage Management: eliminate fall tillage of grain-crop residue adjacent to cover to make waste grain available as an additional food source
Provide Water Developments for Wildlife: where water is limiting (within one-half mile), ponds and shallow impoundments can provide water for drinking
Decrease Hunting/Fishing: if hunting pressure is limiting population growth where an increase is desired
Increase Hunting/Fishing: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Conduct Wildlife Damage Management: fencing, repellents, and scare tactics may be helpful to keep deer from ornamental plantings, gardens, and some crops; reducing the population through shooting is recommended when local overabundance is causing crop depredation and increasing vehicle collisions
Conduct Wildlife or Fish Survey: spotlight surveys, camera surveys, and hunter harvest data can assess population trends

Common muskrat

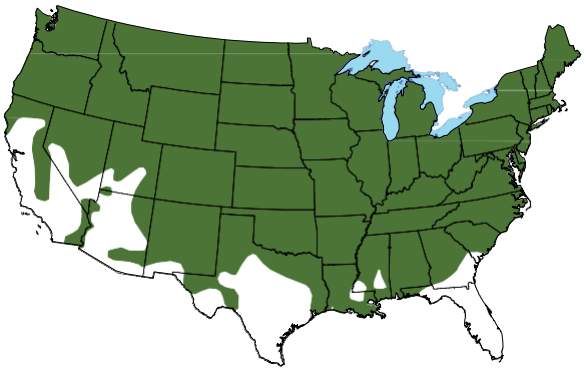
General information

Muskrats are large rodents found throughout the U.S., especially in shallow marshes with abundant cattails. They are mainly nocturnal and need water at least 4 feet deep or flowing water that allows free movement under ice during winter. Muskrats prefer water 1 to 2 feet deep during summer, with about 20 percent of the wetland open water, free of emergent aquatic vegetation. Muskrats build lodges of cattails or other herbaceous vegetation, but do not use sticks or limbs. They sometimes nest in a bank burrow along a waterway. Burrowing and denning activities can cause problems in flooded agricultural areas, such as rice fields and waterfowl management areas.

Bo Zaremba

Habitat requirements

Diet: roots, tubers, and green shoots of emergent aquatic vegetation, such as cattails and bulrushes
Water: necessary water obtained from diet
Cover: primarily shallow-water wetlands with a mixture of open water and emergent aquatic vegetation; den in lodges built from cattails and bulrushes; loaf on floating logs or tops of lodges



Wildlife management practices

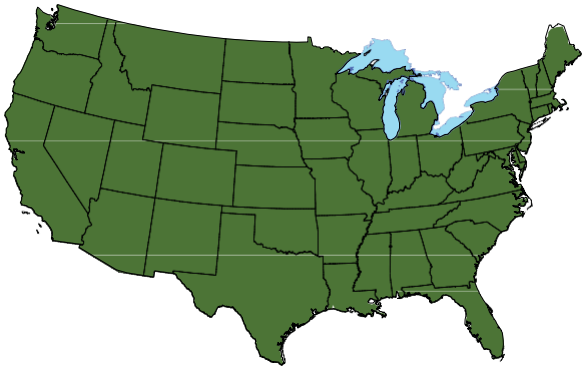
Control Nonnative Vegetation: when nonnative invasive aquatic vegetation is competing with the native aquatic plant community and reduce habitat quality for common muskrat
Conduct Livestock Management: livestock should be restricted from riparian areas and other wetlands; this may require development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas
Repair Spillway/Dam/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* is recommended to rejuvenate old, decadent wetland vegetation
Provide Water Developments for Wildlife: small impoundments can be built in low-lying areas to provide habitat
Decrease Hunting/Fishing: when trapping efforts have reduced population below desirable levels
Increase Hunting/Fishing: when populations can sustain additional trapping or where populations need to be lowered
Conduct Wildlife Damage Management: may be necessary when muskrats damage dikes in agricultural areas and waterfowl management areas; populations are typically reduced by trapping
Conduct Wildlife or Fish Survey: observation surveys, track counts, and presence of lodges are used to estimate population trends

Coyote

General information

Coyotes are found throughout the continental U.S. and have even been observed in large cities and urban areas. Grasslands, shrubland, and farmland provide optimal habitat for coyotes, but they also use forested areas as well. Coyotes den in a variety of places, including brush-covered slopes, steep banks, rock ledges, thickets, and hollow logs. Coyotes are most active at night, during early morning, and around sunset, but they may be active throughout the day. Coyotes live in packs, alone, or in mated pairs, depending on the time of year. Coyotes have an extremely varied diet that fluctuates with the seasons.

Steve Thompson



Habitat requirements

Diet: rodents, rabbits, and other small mammals, insects, birds, eggs, deer, carrion, and soft mast; livestock and wild ungulates (deer, elk, pronghorn) usually are represented in coyote stomachs as carrion; however, in some cases, coyotes' prey heavily on deer and pronghorn fawns, and can limit reproductive success in some situations

Water: requirements are not well documented; necessary water probably is obtained in diet

Cover: grasslands, shrublands, regenerating forest, mature forest: crevices and burrows along river banks, rock ledges, brush piles, and holes under stumps or abandoned buildings are used as den sites for raising pups

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation reduces habitat quality for coyote prey species

Develop Field Borders: to increase usable space for prey species around fields

Conduct Forest Management: (in some ecoregions) *Forest Regeneration* (*Clearcutting*, *Shelterwood*, *Seed-tree*, *Group Selection*) and *Timber Stand Improvement* can improve habitat for prey and lead to more abundant prey

Conduct Livestock Management: should maintain adequate cover for prey species

Plant Native Grasses and Forbs: where additional early successional cover is needed for prey and planting is necessary

Plant Shrubs: in areas where additional shrub cover is needed to attract prey and provide security cover for coyotes

Set-back Succession: *Prescribed Fire*, *Disking*, *Chaining*, and *Herbicide Applications* are recommended to maintain herbaceous openings: *Prescribed Fire* can be used to enhance forest understory structure and composition; *Chainsawing* can be used to create additional forest openings where necessary

Decrease Hunting/Fishing: where hunting or trapping has limited population and additional coyotes are desired to control a prey species that is overburdened

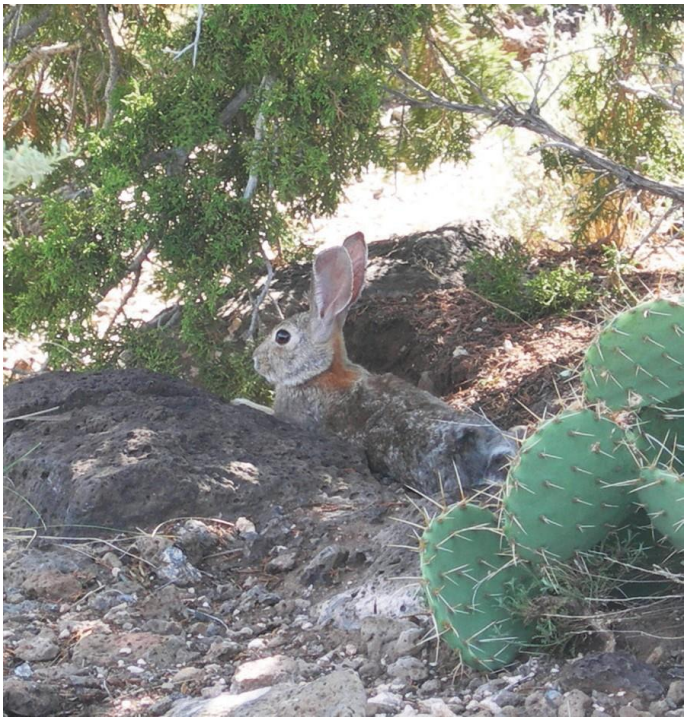
Increase Hunting/Fishing: through hunting or trapping where coyote populations need to be lowered

Conduct Wildlife Damage Management: may be necessary where livestock or pet depredation is a problem

Conduct Wildlife or Fish Survey: track counts, trapper harvest data, and camera surveys are used to estimate population trends

NOTE: Situations in which landowners would manage *for* coyotes are exceptionally rare. However, the coyote is a native predator and plays an important role in many ecosystems. Although management is rarely, if ever, implemented to promote coyotes, management for their prey helps both prey populations and coyote populations and promotes a healthy ecosystem.

Desert cottontail



General information

Desert cottontails can be found in woodlands, grasslands, creosote brush, and desert areas from California to Texas and from northern Montana to Mexico. In the ***Hot Desert*** ecoregion, desert cottontails use thick shrub cover interspersed with open areas. Riparian and urban areas also are used. Because cottontails do not travel far, shelter and food must be close together.

Habitat requirements

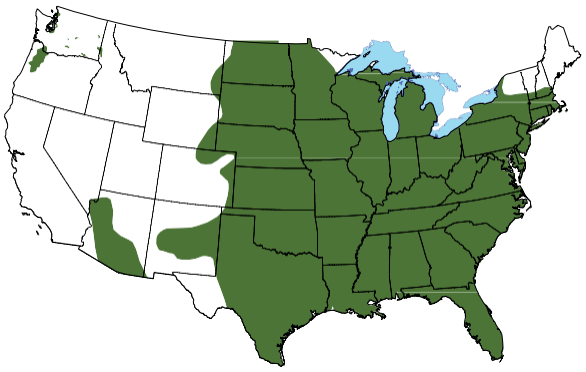
Diet: a variety of forbs and grasses spring through fall; in winter, bark and twigs of shrubs are important; buds, grain, seeds, and soft mast also are eaten when available
Water: necessary water obtained from diet
Cover: grassland, shrub vegetation, and ground burrows for hiding and nesting cover

Wildlife management practices

Control Nonnative Vegetation: where nonnative invasive vegetation is competing with native vegetation and limiting habitat for cottontails
Develop Field Borders: to increase usable space around row crop fields
Conduct Forest Management: (***Mediterranean*** ecoregion only) *Forest Regeneration* (*Clearcut*) provides optimal brushy cover for a few years
Leave Crop Unharvested: to provide additional food and cover, especially corn, alfalfa, and wheat
Conduct Livestock Management: prevent overgrazing to allow ample amounts of herbaceous vegetation for nesting, cover, and forage; livestock should be excluded from food plots
Plant Food Plots: where rainfall is sufficient, forage plots may be planted adjacent to shrub cover
Plant Native Grasses and Forbs: where early successional cover is limited, and planting is necessary to provide additional grasses and forbs
Plant Shrubs: in areas where shrub cover is lacking
Set-back Succession: *Prescribed Fire* is recommended to maintain herbaceous openings; *Prescribed Fire* and *Chaining* can rejuvenate decadent shrublands and encourage additional herbaceous groundcover (burning is not recommended in the ***Hot Desert*** ecoregion unless sufficient precipitation is available); *Mowing* can be used to maintain herbaceous openings in ***Urban*** areas
Conduct Tillage Management: cropland tillage may be delayed in spring to allow use of standing stubble for cover; tillage may be eliminated in the fall to allow access to waste grain
Decrease Hunting/Fishing: may be necessary when additional rabbits are desired, and hunting or trapping is limiting growth
Increase Hunting/Fishing: where populations can sustain additional hunting and trapping pressure for recreation and where populations need to be lowered
Conduct Wildlife Damage Management: shooting, trapping, and exclusion techniques can be used where there is damage to ornamental and garden plants
Conduct Wildlife or Fish Survey: observation counts, track counts, and transect flush counts can be used to estimate population trends

Eastern cottontail

Aubrey Deck



General information

Eastern cottontails occur in the eastern half of the country. They prefer brushy cover interspersed with herbaceous openings. Eastern cottontails also are found in suburban areas, parks, golf courses, and stream corridors. Eastern cottontails are prey for the majority of carnivorous predators within its range. They are prolific breeders; females may have 7 litters per year, with 3 to 6 young per litter. This reproductive rate is required to perpetuate populations because 70 to 80 percent of all rabbits die each year.

Habitat requirements

Diet: forbs and grasses, browse, and soft mast from spring through fall; in winter, bark of shrubs and trees, as well as buds, grain, and browse

Water: necessary water obtained from diet

Cover: shrub cover, brush piles, native warm-season grasses and forbs for loafing and escape cover; burrows also are used for denning and escape

Wildlife management practices

Control Nonnative Vegetation: where nonnative invasive vegetation is competing with native vegetation and limiting habitat for cottontails; sod grasses, such as tall fescue and bermudagrass, can be especially problematic

Develop Field Borders: to increase usable space around fields

Conduct Forest Management: *Forest Regeneration* (*Clearcut*), provides optimal brushy cover for a few years

Leave Crop Unharvested: to provide additional food and cover, especially corn, alfalfa, and wheat

Conduct Livestock Management: should prevent overgrazing to allow sufficient herbaceous vegetation for nesting, cover, and forage; exclude livestock from food plots

Plant Food Plots: where additional forage or grain is needed; best situated adjacent to dense brushy cover

Plant Native Grasses and Forbs: where early successional cover is limiting, and planting is required to promote additional grasses and forbs

Plant Shrubs: in relatively large openings with few shrubs; Develop Field Borders, fencerows, and other idle land areas may be good places to plant but usually shrubs and brushy cover will develop naturally in most areas through succession

Set-back Succession: *Prescribed Fire*, *Disking*, and *Herbicide Applications* are recommended to maintain early successional areas, especially when litter accumulation or woody encroachment is excessive; *Chaining*, *Prescribed Fire*, and *Herbicide Applications* can be used to rejuvenate shrublands, especially where herbaceous groundcover is shaded out; *Chainsawing*, *Dozer-clearing*, and *Root-plowing* can be used to convert forest cover to early successional communities; *Mowing* can be used to maintain herbaceous openings in ***Urban*** areas

Conduct Tillage Management: fall tillage may be delayed until spring to allow use of standing stubble for cover and waste grain for food

Decrease Hunting/Fishing: may be necessary when additional rabbits are desired and hunting or trapping efforts are limiting growth; low rabbit populations are almost always a result of inadequate habitat, not harvest levels

Increase Hunting/Fishing: where populations can sustain additional hunting or trapping pressure for recreation or where populations need to be lowered

Conduct Wildlife Damage Management: shooting, trapping, and exclusion techniques can be used where there is damage to ornamental and garden plants

Conduct Wildlife or Fish Survey: observation counts, track counts, hunter harvest data, and transect flush counts can be used to estimate population trends

Eastern fox squirrel

General information

The eastern fox squirrel is found in the eastern half of the U.S., except for areas of New England. Eastern fox squirrels use mature forest interspersed with small openings, as well as oak and pine woodlands and savannas. Riparian areas are important in the Midwest. Fox squirrels also may be found in urban areas where there are lots of trees. Fox squirrels spend much time foraging on the ground. They build a leaf nest, usually in the crotch of the main trunk of a tree more than 30 feet aboveground, but will regularly use natural cavities in trees, especially in winter.

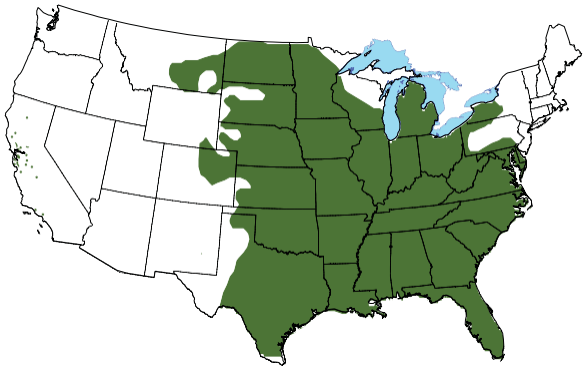
Habitat requirements

Diet: a variety of hard mast, acorns, seeds, tree buds and flowers, mushrooms, soft mast, eggs, and corn
Water: necessary water generally is obtained through diet, but freestanding water may be used in late summer
Cover: mature hardwood and pine forest, small openings, woodland, and savannas; nest in tree cavities or build a nest of twigs and leaves

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for eastern fox squirrels; kudzu, nonnative sod grasses, cogongrass, bush honeysuckles, and Japanese stiltgrass may be particularly problematic in some areas
Conduct Forest Management: *Forest Regeneration* (*Single- tree Selection*, *Group Selection*) may improve forest or woodland structure and increase food availability; *Timber Stand Improvement* can encourage larger crowns of mast- producing trees and enable oaks, hickories, beech, and others to produce more mast; also can increase soft mast availability and provide snags for potential den sites
Leave Crop Unharvested: (corn) so squirrels can glean waste grain from the field; especially important during years of poor mast production
Conduct Livestock Management: should prevent overgrazing, especially in savannas and woodlands where grazing is allowed; livestock should be excluded from riparian areas, especially in open landscapes where tree cover is limited to riparian areas
Plant Food Plots: grain food plots, especially corn, can provide an important food source, during winters with poor mast availability
Plant Trees: in large open areas where tree cover is limiting
Set-back Succession: *Prescribed Fire* is required to maintain savannas and woodlands; *Prescribed Fire* and *Disking* are used to maintain relatively small early successional openings; *Herbicide Applications* can be used to reduce unwanted tree cover or woody encroachment; *Chainsawing* and *Dozer-clearing* can be used to create small openings
Conduct Tillage Management: eliminate tilling cornfields in the fall to provide additional food
Provide Water Developments for Wildlife: small ponds may be dug where water may be limiting within 1/4-mile
Decrease Hunting/Fishing: may be necessary when additional fox squirrels are desired and hunting pressure is limiting growth
Increase Hunting/Fishing: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Conduct Wildlife Damage Management: exclusion from buildings, trapping, or shooting may be necessary if damage is occurring
Conduct Wildlife or Fish Survey: observational surveys are most often used to estimate population trends

Joe Fischer

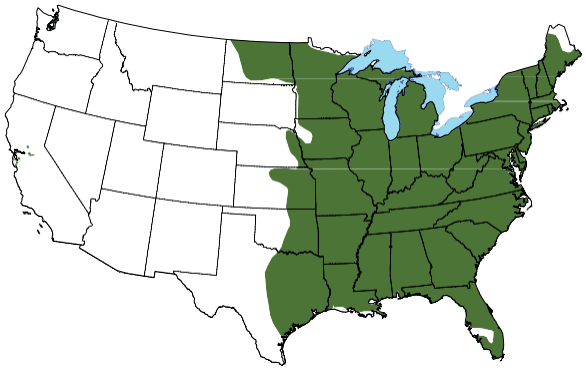


Eastern gray squirrel

General information

The eastern gray squirrel lives primarily in mature deciduous forests and woodlands. They also forage along the edge of crop fields, especially mature cornfields. Eastern gray squirrels have adapted to parks and other urban areas where mature trees are available. Eastern gray squirrels forage both in trees and on the ground. They den in cavities of mature trees and also build nests, generally 30 feet or more aboveground. Eastern gray squirrels will use nest boxes, but nesting structures are not necessary because squirrels build nests when cavities are not available. Thus, cavities are not a limiting factor for eastern gray squirrel populations.

Laura Perlick



Habitat requirements

Diet: a variety of hard and soft mast, miscellaneous seeds, grains, bark, buds, and mushrooms; they also may eat bird eggs

Water: necessary water generally is obtained through diet, but free-standing water is also used

Cover: mature forest and woodlands; suburban and urban areas with mature trees; den in tree cavities and also build nests of leaves and twigs

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to compete with native species and reduce habitat quality for eastern gray squirrel; several nonnative trees, such as tree-of-heaven and royal paulownia, and nonnative groundcover and vines, such as Japanese stiltgrass, kudzu, and English ivy, can displace more valuable native species and make finding food difficult

Conduct Forest Management: *Forest Regeneration* (*Group Selection*, *Single-tree Selection*) can increase soft mast and availability of various seed-producing plants used by eastern gray squirrels; *Timber Stand Improvement* can encourage larger crowns of mast-producing trees and enable oaks, hickories, beech, and others to produce more mast; also can increase soft mast availability and provide snags for potential den sites

Conduct Livestock Management: should not allow overgrazing in woodlands; livestock should be excluded from forests to prevent overgrazing of the forest understory; livestock should be excluded from riparian areas in open landscapes where tree cover is largely limited to riparian areas; livestock should be excluded from food plots and from areas where trees have been planted to enhance habitat for eastern gray squirrels

Plant Food Plots: grain food plots, especially corn, can provide an important food source during winters with poor mast availability

Plant Trees: plant mast trees (especially oaks and hickories) where they are limiting; most appropriate for large open areas that do not represent habitat for gray squirrels; also, may be appropriate where composition of wooded areas is lacking mast and limiting gray squirrel population

Decrease Hunting/Fishing: may be necessary when additional gray squirrels are desired and hunting pressure is limiting population growth

Increase Hunting/Fishing: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered

Conduct Wildlife Damage Management: may be required if gray squirrels become a nuisance around houses

Conduct Wildlife or Fish Survey: observation counts are most often used to estimate population trends

Artificial Feeders: may be used in urban areas to increase viewing opportunities

Elk

General information

Elk primarily occur in mountainous regions of western North America (from New Mexico to Oregon and Canada). They also have been reintroduced in multiple states of the eastern United States. Elk are ruminants (animals with a four-chambered stomach), as are the other ungulate species common to North America, such as white-tailed deer and mule deer. Elk stomachs are much larger than those of deer, which allows elk to eat more and bed down to chew their cud for an extended period. For this reason, elk may only feed twice a day during some portions of the year to avoid risk of predation. Elk use mature forest with interspersed openings. This type of cover supplies food and provides protection from predation and weather. Male elk (bulls) rigorously defend a harem (breeding groups of up to 30 cows) during breeding season (September – October). Nutritional requirements and diet change seasonally. Elk rely on forbs and grasses in spring and summer, and eat browse such as aspen, maples, and poplar, during winter when food availability is limited. Cows that occupy ranges with high elevations will migrate to lower elevations and south-facing slopes in winter to find food and avoid deep snow and cold winds. When overabundant, elk can cause significant damage to ornamental plantings, forest crops, and row crops, and can be hazardous for motor vehicles.

Habitat requirements

Diet: predominantly forbs and grasses, but also browse, especially when palatable forbs and grasses are not available

Water: free-standing water used regularly in summer; water should be within one-half mile

Cover: mature woods for loafing and calving; early successional openings and young forest for foraging

Wildlife management practices

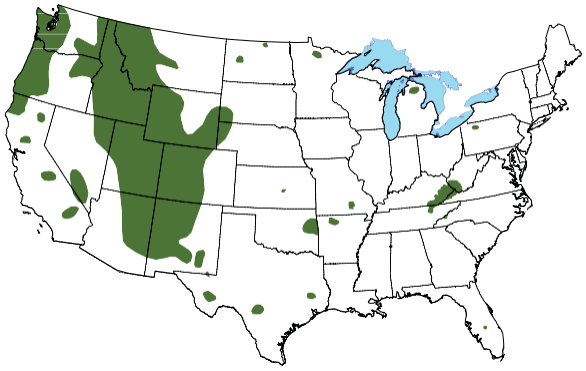
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for elk

Conduct Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) will provide additional forage for a few years; *Timber Stand Improvement* can improve forage availability and stimulate understory/ midstory cover

Conduct Livestock Management: livestock should be excluded from forested areas managed for elk; where elk is a focal species, livestock grazing in open lands and woodlands should be managed to prevent overgrazing and provide sufficient forage for elk

Plant Food Plots: where naturally occurring food sources are limited, forage food plots may provide additional nutrition, particularly during late summer and winter in some areas

Erwin and Peggy Bauer



Plant Native Grasses and Forbs: elk eat native forbs and grasses when available; planting may be necessary where forage is lacking or where forage quality is insufficient

Plant Trees: where additional forest cover is needed

Set-back Succession: *Prescribed Fire* and *Herbicide Applications* is recommended to maintain early successional openings and stimulate additional herbaceous forage in forested areas with adequate sunlight; *Chainsawing*, *Dozer-clearing*, and *Root-plowing* may be used to convert forest to early succession and increase forage availability

Provide Water Developments for Wildlife: small ponds may be constructed if water is not available within one-half mile

Decrease Hunting/Fishing: may be necessary when hunting pressure is limiting growth of elk population where an increase is desired

Increase Hunting/Fishing: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered; when populations need to be lowered because of habitat considerations, increased harvest should concentrate on females

Conduct Wildlife Damage Management : necessary when elk begin to damage hay and crop fields, or when they become a nuisance in suburban areas; both lethal and nonlethal practices can be effective

Conduct Wildlife or Fish Survey: aerial surveys, observational counts, and trail cameras can be used to estimate population trends

Fisher

General information

Fishers are furbearers found in forests in the upper Great Lakes area and the mountains of the Pacific and northeastern U.S. Fishers were once a valuable fur resource that led to over-trapping and population decline in many areas. Fishers are likely more adept at preying on porcupines than any other predator. A desire to control porcupines in some areas because of the damage they cause to trees has led to large-scale reintroduction of fishers throughout many portions of their former range. Fishers are now re-established as far south as West Virginia and Pennsylvania along the Appalachian Mountain range.

USFWS

Habitat requirements

Diet: primarily small rodents and snowshoe hare; will readily consume other rodents, rabbits, porcupines, insects, reptiles, soft mast, and carrion; and small domestic pets

Water: necessary water obtained from diet

Cover: mature conifer or mixed hardwood forests with abundant down woody debris; den in hollow logs, snags, or live trees

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation is competing with native vegetation and reducing habitat quality

Create Snags: in forested areas where denning cavities are suspected to be limiting the population

Conduct Forest Management: *Forest Regeneration* (*Single-tree Selection*, *Group Selection*) can improve forest structure for several prey species; *Timber Stand Improvement* can increase understory development that can lead to increased prey populations; forest management can also increase down woody debris

Plant Trees: in large open areas where additional forest cover is needed (should maintain >50 percent canopy cover)

Decrease Hunting/Fishing: may be necessary when trapping pressure is limiting population growth and additional fishers are desired

Increase Hunting/Fishing: where populations can sustain additional trapping pressure or a reduction in the population is desired

Conduct Wildlife Damage Management: may be necessary if small domestic pet depredation is a problem

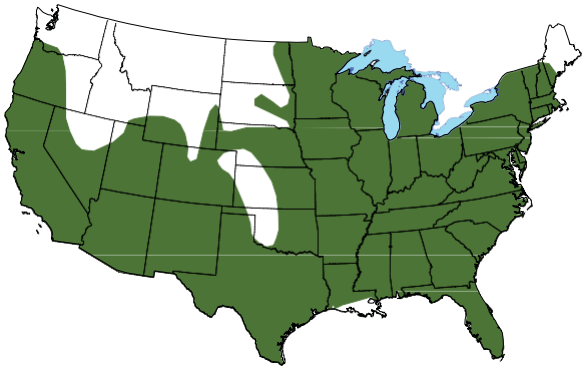
Conduct Wildlife or Fish Survey: scent stations, track counts, trapper harvest data, and trail cameras may be used to estimate population trends

Gray fox

General information

Gray foxes are common and widespread in North America. They are typically associated with deciduous forest landscapes, and generally avoid areas with large expanses of agriculture. They are most active at night or near dawn and dusk. Dens are used primarily during the breeding season. Gray foxes are unique among canids (species in the family that includes dogs) because of their ability to climb trees.

USFWS



Habitat requirements

Diet: primarily small mammals, birds, insects, hard and soft mast, and occasionally carrion

Water: requirements largely unknown; gray foxes likely drink free-standing water and get some water from the foods they consume

Cover: mostly deciduous forest; breeding dens are located in brushy or wooded areas and found in hollow trees or logs, under large rocks, or in underground burrows; daytime resting sites are generally aboveground in trees, thickets, and brushy areas, or rocky crevices

Wildlife management practices

Control Nonnative Vegetation: when nonnative species begin to compete with native plant species and reduce habitat quality for gray fox

Create Snags: when large (>12 inches) down woody debris is needed for breeding dens or resting sites

Conduct Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*, *Single-tree Selection*) in large areas of mature forest and *Timber Stand Improvement* practices may increase prey abundance, soft mast, hollow logs for breeding dens, and daytime resting sites

Conduct Livestock Management: livestock should be excluded from forested areas because they consume plants in the understory that provide cover and food for gray fox and associated prey

Plant Shrubs: in relatively large openings devoid of brushy cover or thickets to create resting sites, provide cover for den locations, and provide soft mast

Plant Trees: in large open areas to increase deciduous forest conditions

Set-back Succession: low-intensity *Prescribed Fire* can be used in forests and woodlands to enhance cover for prey and soft mast production

Decrease Hunting/Fishing: to promote an increase in population where current harvest levels are limiting population

Increase Hunting/Fishing: when the population can sustain additional harvest and increased harvest is desired for recreational trapping or hunting; to promote increased abundance of prey species, such as eastern cottontails or tree squirrels, if gray fox has been identified as limiting those populations; when population reduction is desired

Conduct Wildlife Damage Management : exclusion practices can discourage gray foxes from denning under human structures; exclusion practices and trapping can prevent gray foxes from preying on small livestock, such as chickens

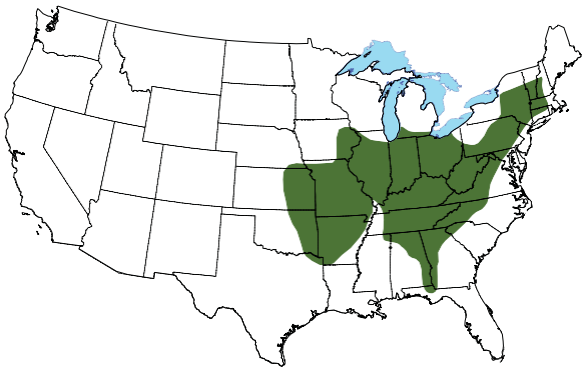
Conduct Wildlife or Fish Survey: scent stations, track counts, trapper harvest data, and trail cameras may be used to estimate population trends

Indiana bat

General information

The Indiana bat is an endangered species that occurs over most of the eastern United States. The Indiana bat population is in decline because of susceptibility to disturbance during hibernation and a disease known as white nose syndrome. Bats must store fat reserves and then hibernate (from October – April) to survive through winter when food is limiting. If they are disturbed by human activity or if cave temperatures increase, they may starve from using critical energy reserves. Male Indiana bats roost alone or in small groups during spring and summer, whereas females roost in larger maternal colonies (100+ individuals). Females give birth to one pup in June, and then young are nursed under loose tree bark, usually in wooded areas near water. Inserting gates in front of cave openings that allow passage of bats but prevent human intrusion can prevent disturbing Indiana bats during hibernation.

Susi von Oettingen



Habitat requirements

Diet: insects (up to half their body weight per night)
Water: although they get some from their food, they require considerable free-standing water
Cover: winter hibernation occurs in caves, also known as hibernacula, or other areas that are cool, humid, with stable temperatures of 33-50 F (nearly half of all Indiana bats use caves); trees with flaky bark (like shagbark hickory or mature white oak) or snags along forest edges and water bodies are used for roosting; mature mixed deciduous forest with canopy gaps and riparian zones are used for foraging

Wildlife management practices

Develop Conservation Easement: can protect property with caves that this declining species is using for hibernacula
Control Nonnative Vegetation: may be required if desirable trees for roosting are being outcompeted by nonnative invasive species
Create Snags: can provide temporary foraging and roosting sites if an adequate number of trees are not already available
Conduct Forest Management: *Forest Regeneration* (*Group Selection*) provides small openings used for foraging; *Timber Stand Improvement* can favor tree species with flaky bark used for roosting and create more open space around tree crowns where Indiana bats forage
Plant Trees: in large open areas where forest cover is limiting
Set-back Succession: *Prescribed Fire* can be used in mature woods to reduce midstory and facilitate foraging
Conduct Wildlife or Fish Survey: roost counts during hibernation and acoustic sampling surveys are used to survey Indiana bat populations

Mink

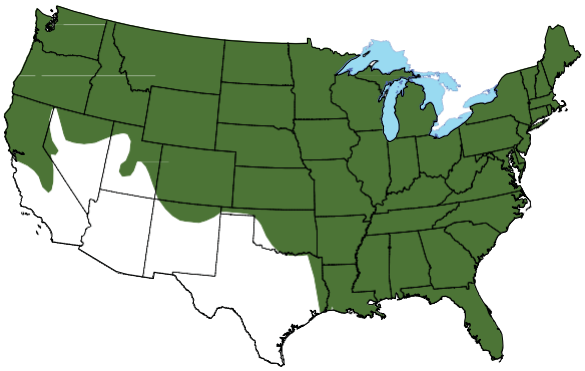
General information

Mink occur in Alaska, Canada, and across most of the U.S. They are mainly nocturnal and are found along stream banks, riverbanks, and edges of a variety of wetlands. Mink are strictly carnivorous. Most prey is found in close association with dense vegetation along wetland edges and other riparian areas. Availability of den sites is considered a key factor in how mink use an area. Areas with lots of trees and shrubs and limited livestock grazing near riparian areas usually have more den sites. Mink can eat significant numbers of upland nesting waterfowl or gamebirds, especially in areas where nesting cover is limited.

Bo Zaremba

Habitat requirements

Diet: rabbits, mice, muskrats, crayfish, snakes, and birds
Water: necessary water probably obtained through diet
Cover: closely associated with water; riparian areas and wetland edges; dens often located under log jams and tree roots, old muskrat burrows, and rock piles



Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for mink and their prey
Conduct Livestock Management: livestock should be excluded from wetlands and riparian areas where mink is a focal species; this may include development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas
Repair Spillway/Dam/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* is recommended to rejuvenate old decadent wetland vegetation that can improve habitat for prey
Provide Water Developments for Wildlife: shallow impoundments can be developed to increase habitat where needed
Decrease Hunting/Fishing: may be necessary when trapping pressure is limiting population and an increase in population is desired
Increase Hunting/Fishing: where populations can sustain additional trapping pressure, and when mink have been identified limiting upland nesting waterfowl or gamebirds
Conduct Wildlife Damage Management: mink may occasionally kill domestic poultry, but this is rare and localized. Trapping and exclusion are effective methods to reduce damage.
Conduct Wildlife or Fish Survey: track counts and trapper harvest data are often used to estimate population trends

Moose

General information

The moose is the largest member of the deer family. Adult males can reach 1,800 pounds and females may weigh 1,000 pounds. Males exhibit palmated (flattened or palm-like) antlers, whereas most other members of the deer family have a dendritic (twig-like) antler configuration. Moose are herbivores and inhabit both boreal and mixed deciduous forests in temperate and subarctic climates. Moose are typically solitary and do not group into herds. Predators include wolves, bears, and humans. Moose are typically found around wetlands (such as swamps, streams, lakes) because of the abundance of browse and aquatic plants moose prefer. The moose is the only deer species that can dive underwater to reach plants on stream, marsh, and lake bottoms. An adult moose can consume as much as 70 pounds of vegetation per day. In spring, moose are often drawn to roadways to satisfy their sodium requirements where they lick salt applied to road surfaces to melt snow and ice. This habit leads to moose-vehicle collisions wherever roads are salted during winter. Moose populations have rebounded over the past 30-40 years as pollution in waterways has been reduced and abandoned farms have succeeded into shrub-dominated and young forest cover.

Karen Laubenstein

Habitat requirements

Diet: leaves and twigs of willow, maple, aspen, mountain ash, and birch trees, as well as aquatic vegetation, including submerged aquatic vegetation, which may represent as much as half of the diet
Water: water requirements are met through consumption of aquatic vegetation and standing water where they are typically found
Cover: riparian areas along streams and rivers, edges of marshes adjacent to thick upland cover, mature softwood stands during extreme cold and/or deep snowfall

Wildlife management practices

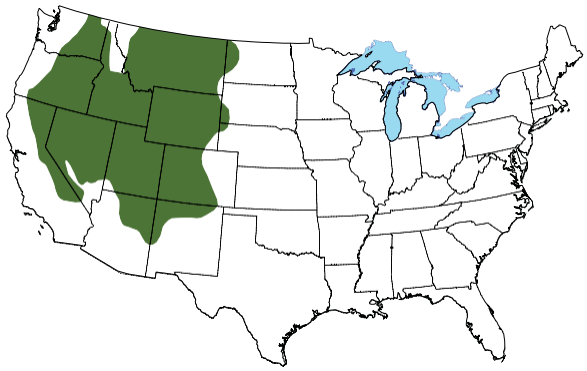
Control Nonnative Vegetation: may be necessary when native plant communities, both upland and aquatic, are being threatened by nonnative invasive vegetation and habitat quality for moose is declining
Conduct Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) will provide increased browse
Plant Shrubs: may be necessary in large open areas where additional shrub cover is needed
Plant Trees: may be necessary in large open areas where additional forest cover is needed
Repair Spillway/Dam/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* and *Chainsawing* can be used to rejuvenate and enhance low-growing woody cover and increase browse
Provide Water Developments for Wildlife: shallow impoundments can be created if a lack of wetlands are limiting the presence or abundance of moose
Decrease Hunting/Fishing: may be necessary if hunter harvest has limited the population and a population increase is desired, or if winter mortality, particularly from winter tick loads on calves and yearlings, is excessive
Increase Hunting/Fishing: may be implemented if the moose population needs to be lowered
Conduct Wildlife or Fish Survey: aerial surveys may be used to monitor moose populations

Mountain cottontail

Lewis Scharpf

General information

Mountain cottontails occur in the mountainous regions of the western U.S. They use thick shrubs and burrows for nesting and cover, and eat a variety of forbs, grasses, and browse. They have relatively small home ranges and daily movements, so food and cover should be close together.



Habitat requirements

Diet: a variety of forbs, grasses, seeds, and soft mast in spring through fall; in winter, bark and browse is most important; grains and alfalfa are eaten when available
Water: necessary water is obtained from diet
Cover: thick shrubs and burrows for nesting and cover

Wildlife management practices

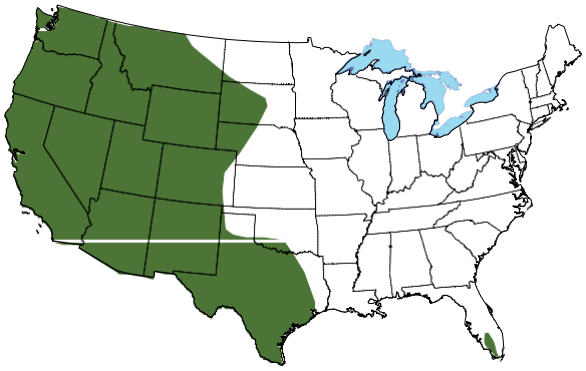
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for mountain cottontail
Conduct Forest Management: *Forest Regeneration* (*Clearcut*) will enhance cover and stimulate additional forage for a few years
Conduct Livestock Management: should prevent overgrazing and maintain sufficient groundcover for rabbits
Plant Food Plots: where additional forage is needed, forage food plots can be planted adjacent to good cover
Plant Native Grasses and Forbs: where desirable groundcover is lacking, and planting is necessary for establishment
Plant Shrubs: where shrub cover is lacking
Set-back Succession: *Prescribed Fire* and *Chaining* can be used to rejuvenate and maintain shrubby cover and stimulate forbs and grass interspersed with shrub cover: Mowing may be used in Urban areas to maintain openings
Decease Harvest: may be necessary when additional rabbits are desired and hunting or trapping efforts are limiting growth
Increase Hunting/Fishing: where populations can sustain additional hunting or trapping pressure for recreation or where populations need to be lowered
Conduct Wildlife Damage Management: may be necessary to control damage to ornamental and landscaping plants and vegetable gardens
Conduct Wildlife or Fish Survey: track counts, observation counts, and hunter observation data can be used to estimate population trends

Mountain lion

General information

The mountain lion (also called cougar, panther, painter, or puma) are predatory cats once common across North America. Adult mountain lions weigh 80 to 200 pounds. Males are larger than females. Mountain lions are typically buff, cinnamon, tawny, or reddish color. Contrary to local belief, there is no such thing as a black mountain lion. Mountain lions are primarily nocturnal but may be active during daylight hours. The mountain lion is a stalk-and-ambush predator and pursues a wide variety of prey. Populations in the eastern U.S. were drastically reduced as the country was settled. Populations may fluctuate with prey abundance. Mountain lions are a game species in several western states but have historically been removed because of livestock depredation. The mountain lion is listed as an endangered species in Florida (a.k.a. Florida panther.)


NPS



Habitat requirements

Diet: primary food source is deer and rabbits, but beaver, porcupine, mice, skunks, marten, coyote, javelina, bighorn sheep, pronghorn, moose, elk, ruffed grouse, wild turkey, fish, and occasionally domestic livestock, dogs, and house cats also may be eaten

Water: free-standing water is required for drinking; water sources are also used as ambush sites for prey

Cover: coniferous and tropical forests, grasslands, swamps, brushland, and desert edges; mountain lions can survive in most any environment that supports an abundance of deer

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for mountain lion

Conduct Forest Management: (in some ecoregions) *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) and *Timber Stand Improvement* can enhance cover and food resources for a variety of prey species if prey abundance is limiting mountain lion populations

Plant Shrubs: in large open areas where shrub cover is limiting prey for mountain lions

Plant Trees: (in some ecoregions) in large open areas where additional forest cover is needed

Set-back Succession: *Prescribed Fire*, *Herbicide Applications*, *Dozer-clearing*, and *Drum-chopping* may be used to enhance cover and food availability for several prey species

Provide Water Developments for Wildlife: may be implemented where free-standing water is limited for prey and mountain lions, which also may increase prey opportunities

Decrease Hunting/Fishing: may be necessary where mountain lion populations have declined, and hunting pressure may be limiting population increase

Increase Hunting/Fishing: may be implemented when mountain lion populations are limiting other wildlife species, such as white-tailed or mule deer

Conduct Wildlife Damage Management : may be needed if livestock depredation is problematic and in the rare instance of attacks on humans (approximately 90 attacks on humans have been documented in the last 125 years)

Conduct Wildlife or Fish Survey: track counts, scent stations, hunter observation data, and camera surveys can be used to estimate population trends

New England cottontail

General information

The New England cottontail (NE cottontail) is found in isolated areas of Maine, New Hampshire, New York, Connecticut, Massachusetts, and Rhode Island. The USDA-NRCS included them in its Working Lands for Wildlife Initiative. NE cottontail is often confused with the eastern cottontail, which looks very similar, and because the eastern cottontail is more of a habitat generalist, it has been displacing the NE cottontail since the eastern cottontail was introduced to the New England states in the early 1900s. Because this region has dense human populations, habitat distribution for NE cottontail has declined by 86 percent since 1960. In addition to reduction of habitat distribution, urban sprawl also indirectly reduces habitat quality and quantity because of land-use changes (fire suppression, aesthetic mowing, afforestation, and the reduction of timber harvest). The remaining habitat is largely fragmented and isolates local populations, making them more vulnerable to overall population decline. Early successional cover in at least 25-acre blocks are desirable. Habitat may be provided in old fields, cleared areas (such as utility and railroad rights-of-way), young regenerating forest, shrubby fringes around swamps and beaver ponds, managed early successional openings, and coastal shrublands. Nests are constructed of fur, grass, and leaves on the ground in a 4-inch depression.

USFWS

Habitat requirements

Diet: forbs, grasses and soft mast in late spring and summer; grasses, leaves, soft mast, and buds in fall; bark, twigs, buds, and grasses in winter
Water: obtained through diet
Cover: early successional cover consisting of shrubs, forbs, and perennial native grasses; evergreen shrubs and trees are critical for escape and thermal cover in winter

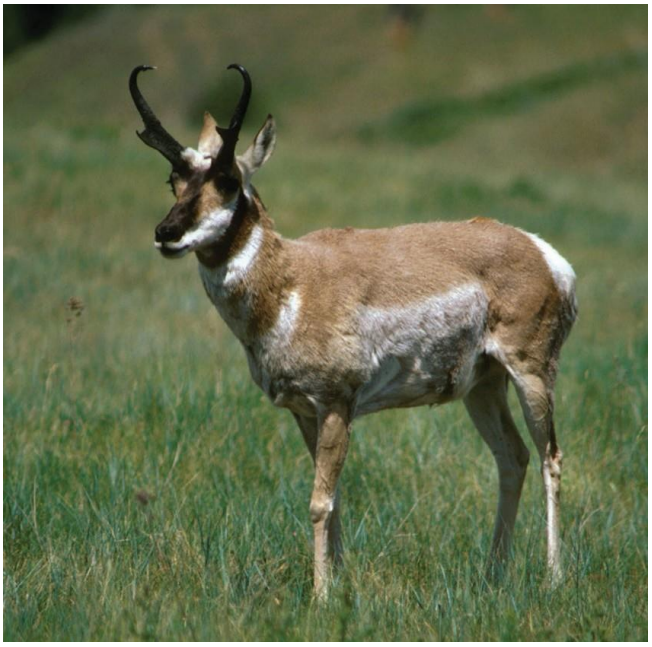
Wildlife management practices

Develop Conservation Easement: can protect critical habitat for this declining species
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for NE cottontail
Develop Field Borders: to increase usable space around crop fields
Conduct Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*) will enhance habitat for a few years
Conduct Livestock Management: should exclude livestock from food plots and prevent overgrazing to allow sufficient herbaceous vegetation for nesting, cover, and forage
Plant Native Grasses and Forbs: where herbaceous vegetation is limiting, and planting is necessary to establish desirable cover
Plant Shrubs: where there is a lack of shrub cover and none is regenerating naturally
Plant Trees: evergreen species may be planted in areas lacking thermal cover in winter
Set-back Succession: *Prescribed Fire*, *Herbicide Applications*, and *Disking* can be used to maintain early successional areas; *Prescribed Fire* can be used to rejuvenate and maintain shrub cover; *Chainsawing*, *Dozer-clearing*, and *Root-plowing* can be used to convert forest to early successional cover
Decrease Hunting/Fishing: may be necessary if the local population is declining or cannot withstand harvest.
Conduct Wildlife or Fish Survey: because differentiating New England cottontails from Eastern cottontails is very difficult and only reliable under genetic testing or morphological skull identification, wildlife agencies request hunters submit heads of harvested rabbits for identification and analysis of population trends

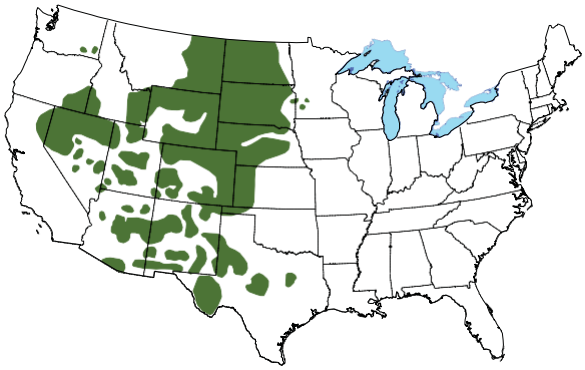
Pronghorn

General information

Pronghorns are hoofed ungulates found in open prairie and sagebrush desert of the western U.S. Although somewhat similar in appearance, the pronghorn is not an antelope, goat, or deer. The pronghorn is the second-fastest land mammal in the world, reaching a top speed of about 55 mph (cheetahs can run short distances up to 75 mph). Both the male and female pronghorn have horns that are covered in a black keratin sheath, which is shed annually. The sheath curves backward and has a prong which points forward (hence the name, pronghorn). Pronghorns of females are much smaller than those of males. According to location, some pronghorn populations migrate long distances between their summer and winter ranges. Corridors that allow safe passage are a management concern for migrating pronghorn. Pronghorns are generally tan with white markings on the face, neck, stomach, and rump. When alarmed, pronghorn often raise the white hairs on their rump to signal danger to other pronghorn. Pronghorns have fantastic vision, which helps them identify predators in the open country they inhabit.



James C. Leupold



Habitat requirements

Diet: varies with season; grasses, forbs, and cacti in spring and summer; primarily browse in winter
Water: free-standing water is required
Cover: native grassland and desert sagebrush with flat to rolling terrain that allows long-range visibility

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for pronghorn
Conduct Livestock Management: should maintain appropriate stocking rate to prevent overgrazing and maintain adequate herbaceous groundcover; fencing should be kept to a minimum with at least 16 inches between the ground and the bottom wire, which should be smooth, not barbed; the top wire should not be more than 42 inches aboveground; large blocks of rangeland should be maintained, and no more than 30 percent of a management area should be cropland
Plant Food Plots: in areas where there is adequate rainfall, food plots can provide high-quality forage, such as alfalfa, for increased nutrition
Plant Native Grasses and Forbs: where herbaceous vegetation is lacking, and planting is required to establish desirable groundcover
Set-back Succession: *Prescribed Fire*, *Chaining*, and *Root-plowing* are recommended to stimulate additional herbaceous groundcover in large expanses of shrubland
Provide Water Developments for Wildlife: where water is limited or absent within two miles, development of dugouts, windmills, and spring developments is warranted
Decrease Hunting/Fishing: if hunting pressure is limiting population growth where an increase is desired
Increase Hunting/Fishing: when populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Conduct Wildlife Damage Management: may be necessary in areas where crop damage is occurring
Conduct Wildlife or Fish Survey: observation counts are used to estimate population trends

Raccoon

General information

Raccoons are very common throughout most of the U.S., except in certain parts of the Rocky Mountains, Nevada, Utah, and Arizona. Raccoons are found in a variety of vegetation types but are usually most abundant near riparian areas and wetlands. They also are found in urban areas. Raccoons den in hollow trees, in burrows under stumps or brush piles, or in chimneys, attics, and crawl spaces of houses and buildings. They are omnivorous and eat a wide variety of foods. Raccoons can become pests in urban areas and in wetlands (depredating waterfowl nests). Raccoons also have been identified as major predators on gamebird nests and young gamebirds.

Dave Menke

Habitat requirements

Diet: crayfish, birds, eggs, small mammals, insects, lizards, snakes, worms, fish, carrion, grains, seeds, hard and soft mast, and foods prepared for human and pet consumption

Water: require water frequently during warm seasons

Cover: riparian areas, bottomland hardwoods, and along other wetlands; natural tree cavities are used for denning and daytime loafing; raccoons also den in ground burrows under stumps, brush piles, junk piles, old abandoned buildings, and rocky cliffs and ledges

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for raccoon

Create Snags: where denning sites are limited

Develop Field Borders: to increase usable space for prey around fields

Conduct Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*, *Single-tree Selection*) and *Timber Stand Improvement* can stimulate soft mast production and cover for prey

Leave Crop Unharvested: especially cornfields adjacent to bottomland hardwoods and riparian areas

Conduct Livestock Management: livestock should be excluded from riparian areas and other wetlands; this may include development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas

Plant Food Plots: annual grain food plots, especially corn, may be planted where food is limiting and where an increase in raccoon population is desired (this situation is exceptionally rare)

Plant Shrubs: where soft mast is lacking and to provide corridors across large open areas

Plant Trees: in riparian areas and adjacent to wetlands where few trees are present to maintain riparian corridors; maintain approximately 50 percent deciduous forest cover; also, in large open areas where there are few trees

Repair Spillway/Dam/Levee: if not functioning properly

Set-back Succession: *Prescribed Fire* is recommended to rejuvenate old decadent wetland vegetation; *Prescribed Fire* and *Disking* can maintain herbaceous openings; *Prescribed Fire*, *Herbicide Applications*, and *Chaining* are recommended to rejuvenate decadent shrub cover

Conduct Tillage Management: eliminate fall tillage of grain crop residue adjacent to cover to make waste grain available as an additional food source

Provide Water Developments for Wildlife: shallow impoundments can provide a water source and additional habitat for various prey species

Decrease Hunting/Fishing: if hunting pressure is limiting population growth where an increase is desired (this situation is rare)

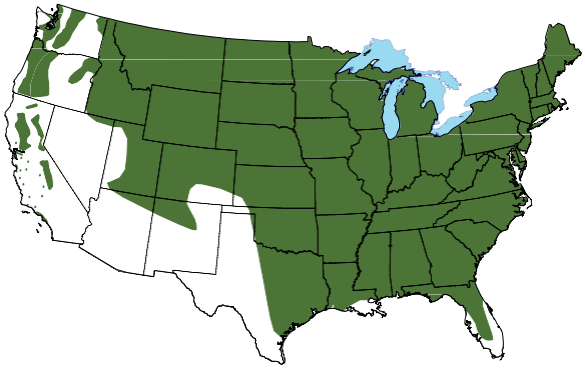
Increase Hunting/Fishing: where populations can sustain additional hunting or trapping pressure for recreation and where populations need to be lowered for various reasons

Conduct Wildlife Damage Management: is often necessary when raccoons get into garbage cans, occupy residences or buildings, or prey upon poultry; exclusion is cost-effective; cultural modification, such as using wildlife-proof trash cans, is effective; trap and kill is most effective for problem raccoons

Conduct Wildlife or Fish Survey: track counts, camera surveys, and trapper harvest data may be used to monitor population trends

Red fox

Ronald Laubenstein



General information

Red foxes are the most widely distributed carnivore in the world and occupy a wide range of ecoregions and vegetation types, including grasslands, shrublands, woodlands, farmlands, and cities. They typically prefer brushy areas in winter. Red foxes are solitary animals and are mostly nocturnal. They can be seen sometimes during the early morning and early evening. Red foxes use dens for shelter and raising young. Red foxes have a characteristic manner of hunting small mammals by standing motionless, listening, and watching intently. When a red fox locates prey, it often leaps high and brings the forelimbs straight down, pinning the prey to the ground.

Habitat requirements

Diet: primarily small mammals, birds, insects, hard and soft mast, and occasionally carrion; red foxes will store food and are very good at relocating these caches

Water: requirements largely unknown; they likely drink free-standing water and get some water from the foods they consume

Cover: prefer a mixture of herbaceous openings with brushy cover, shrubland, and woodland; dens are located in brushy areas and in hollow logs, under large brush piles, under large rocks, or in underground burrows often under roots of blown-over trees; daytime resting sites are generally thickets and brushy areas

Wildlife management practices

Control Nonnative Vegetation: when nonnative vegetation begins to compete with native vegetation and decrease habitat quality for red fox and their prey

Develop Field Borders: will enhance cover around crop fields for red fox and their prey

Conduct Forest Management: *Forest Regeneration* (especially *Clearcut*) in relatively large areas of mature forest will temporarily enhance cover for prey and may provide increased denning sites (down logs and debris) and daytime resting sites

Conduct Livestock Management: grazing should be managed to maintain suitable cover for prey

Plant Native Grasses and Forbs: where planting is necessary to provide herbaceous cover for prey

Plant Shrubs: in relatively large open areas where brushy cover or thickets for denning and resting sites is limiting

Set-back Succession: *Prescribed Fire* is recommended to maintain early successional areas and enhance understory structure in savannas and woodlands.

Chainsawing, *Dozer-clearing*, and *Root-plowing* may be used to convert forest cover to herbaceous openings and shrublands; *Drum-chopping* may be used to enhance shrublands when shade limits herbaceous growth

Decrease Hunting/Fishing: when the population is declining in response to trapping or hunting pressure and an increase in population is desired

Increase Hunting/Fishing: when the population can sustain additional harvest for additional recreational trapping or hunting; to promote increased abundance of prey species, such as waterfowl (nests) or cottontails, if red fox has been identified as limiting those populations; increasing harvest also may reduce damage issues associated with poultry

Conduct Wildlife Damage Management: exclusion practices can discourage red foxes from denning under human structures; exclusion practices and trapping can limit predation on small livestock, such as chickens

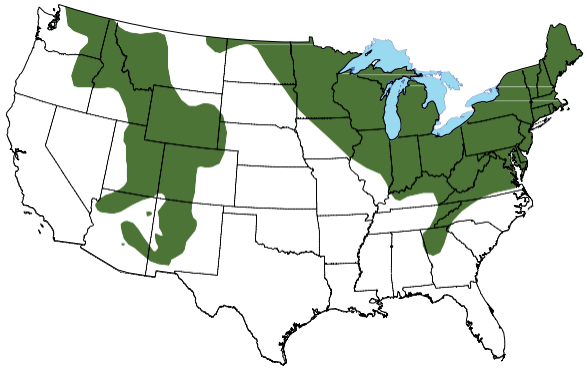
Conduct Wildlife or Fish Survey: track counts, scent stations, and trapper harvest data are used to estimate population trends

Red squirrel

General information

Red squirrels are relatively small tree squirrels that occur in the Rocky Mountains, Great Lakes, and New England regions, and down the Appalachians. As their name implies, they are reddish or yellowish on back and sides with a white belly. They are found primarily in boreal coniferous forest and mixed deciduous-coniferous forest. Red squirrels' den in tree cavities but will make ball nests on large tree limbs close to the trunk or in underground burrows if cavities are not available. They will tunnel in snow and store conifer seeds in caches. Red squirrels often eat from the same stump or downed log where hulls of nuts and cones accumulate. Young are born in spring and late summer.

Gilles Gonthier



Habitat requirements

Diet: wide variety of seeds (especially pine seeds), eggs, and mushrooms
Water: freestanding water required regularly
Cover: coniferous and mixed deciduous-coniferous forest; nest in tree cavities and build nests of shredded bark, grass, leaves, twigs

Wildlife management practices

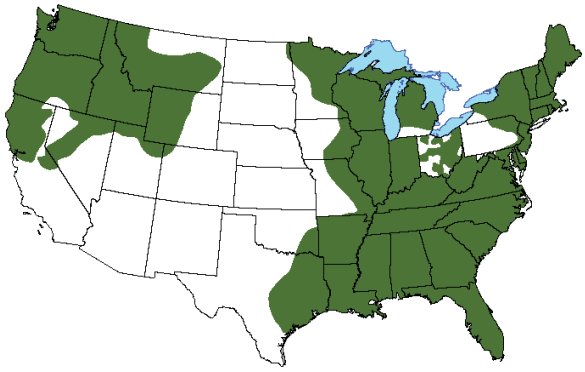
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for red squirrels
Conduct Forest Management: *Timber Stand Improvement* can improve species composition and help increase mast production; snags should be retained for possible cavities
Conduct Livestock Management: livestock should be excluded from forests managed for red squirrel
Plant Trees: in large open areas to provide future habitat for red squirrels
Decrease Hunting/Fishing: if hunting pressure is limiting population growth where an increase is desired
Increase Hunting/Fishing: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Conduct Wildlife or Fish Survey: observation surveys can be used to estimate population trends

River otter

General information

The river otter is a brownish black semi-aquatic mammal that is a member of the weasel family. River otters are highly social, and the group is called a family, which consists of an adult female and her offspring. Adult males form social groups separate from the families except during the breeding season. Adults typically weigh 15 to 25 pounds and are well equipped for aquatic life with short fur, short powerful legs, webbed toes, and long tapered tails. River otters are superb swimmers and divers and can remain underwater for several minutes. They are active year-round, but are mostly nocturnal during spring, summer, and fall. River otters live in a holt, which is a den constructed of burrows of other mammals. They also den along undercut riverbanks, hollow logs near or in the water, rock formations, and flooded debris that provide protection and seclusion with easy access to water. Urbanization and pollution have decreased the range of river otters.

Jim Leopold



Habitat requirements

Diet: primarily fish, but they also will feed extensively on aquatic insects and crayfish; small mammals and amphibians are eaten occasionally

Water: largely obtained from their diet; clean water is essential for fish populations

Cover: riparian areas along creeks and rivers, as well as freshwater lakes, inland wetlands, coastal shorelines, marshes, and estuaries

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive aquatic vegetation begins to reduce habitat quality for prey

Conduct Livestock Management: livestock should be excluded from forests managed for river otter

Repair Spillway/Dam/Levee: if not functioning properly

Provide Water Developments for Wildlife: impoundments may be created adjacent to riparian areas where additional habitat for river otters is desired

Decrease Hunting/Fishing: may be necessary if trapping has been excessive and an increase in population is desired

Increase Hunting/Fishing: may be required if predation is limiting populations of various prey species or when a reduction in population is desired

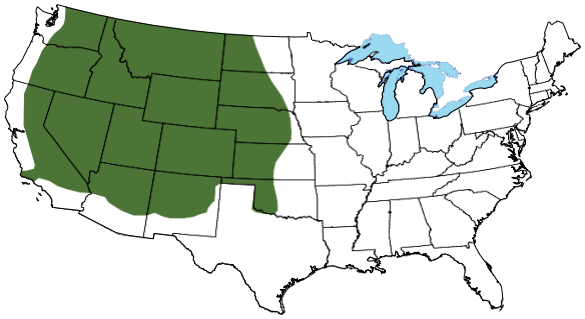
Conduct Wildlife Damage Management: is necessary when recreational or commercial fisheries are being threatened by river otters

Conduct Wildlife or Fish Survey: track surveys, latrine site surveys, bridge surveys (for latrines), trapper harvest data, and camera surveys can be used to monitor populations

Rocky Mountain mule deer

General information

Tupper Ansel Blake



Rocky Mountain mule deer, a subspecies of mule deer, occur in western North America (from Oklahoma to California and Northward to Northern Canada), just north of the range of the desert mule deer. They are adapted to a wide range of western plant community from prairie to alpine to semi-desert but prefer a mixture of early successional areas with scattered shrubs and mature forest. Mule deer are ruminants (animals with a four-chambered stomach) and are adapted to eat higher-quality forages, more often than other ruminants (such as elk or cattle Rocky Mountain mule deer that occupy ranges with high elevation migrate to lower elevation in winter for access to preferred forage, avoidance of deep snow cover, and protection from cold winds. Mule deer can cause signific ant damage (ornamental planting forest crops, and row crops) when overabundant and can be hazardous for motor vehicles.

Habitat requirements

Diet: forbs, browse, soft mast, grains, and grasses
Water: free-standing water is required nearly daily in dry ecoregions and during summer; water should be available within one mile
Cover: dense woody vegetation and a relatively tall early successional cover, including nativ e grasses, forbs, and shrubs; rock outcrops and ravines for loafing cover; in the ***Intermountain*** ecoregion, 50 percent young and mature forest, well interspersed with herbaceous and shrubby cover is optional

Wildlife management practices

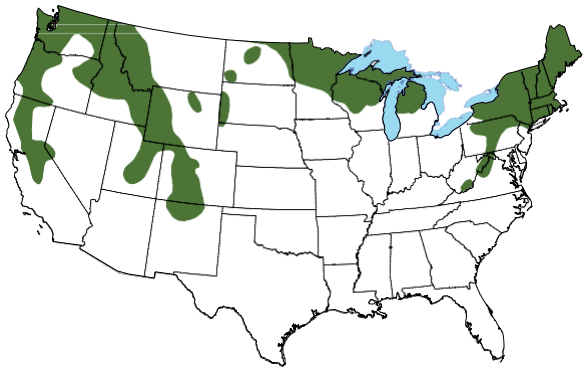
Control Nonnative Vegetation: if nonnative invasive plants are competition with native vegetation and reducing habitat quality for Rocky Mountain mule deer
Develop Field Borders: (in some ecoregions) to increase fawning cover and forage availability around row-crop fi
Conduct Forest Management: (in some ecoregions) *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*) can stop the herbaceous cover and provide additional brushy cover for a few years; *Timber Stand Improvement* can site additional herbaceous cover and browse in the understory where needed
Leave Crop Unharvested: (in some ecoregions) to provide additional food resource, especially near cover
Conduct Livestock Management: grazing intensity should be managed to maintain forbs for forage, adequate cover for fawning, and shrubs and young trees for browse and cover. livestock should be excluded from forests to prevent destruction of the understory where mule deer is a focal species; livestock watering facilities may be necessary
in uplands to discourage congregation in and overuse of riparian areas; livestock should be excluded from food plots
Plant Food Plots: (in some ecoregions) where naturally occurring food resources are limited; food plots may provide additional nutrition particularly during late summer and winter in some areas
Plant Native Grasses and Forbs: where planting is necessary to increase grasses and forbs for forage and cover
Plant Shrubs: where additional shrub cover and browse is needed
Plant Trees: (in some ecoregions) where additional forest cover is needed
Set-back Succession: *Prescribed Fire*, *Disking*, and *Herbicide Application* is recommended to maintain herbaceous cover and revert shrubby areas and young forest back to herbaceous vegetation *Prescribed Fire* also to site the understory for increased forage and soft mast in young and mature forests; *Chainsawing*, *Dozer-clearing* and *Root-plowing* may be used to create additional open areas
Conduct Tillage Management: eliminate fall time of grain crop residue adjacent to cover to make waste grain available as an additional food source
Provide Water Developments for Wildlife: where water is limited or absent (within one mile), ponds and shallow impoundments can provide an external water source for drinking
Decrease Hunting/Fishing: if hunting pressure is limiting population growth where an increase is desired
Increase Hunting/Fishing: when population can sustain additional hunting pressure for recreation and when populatio n need to be lowered
Conduct Wildlife Damage Management: fencing, repellents, and scare tactics may be helpful to keep deer from ornamental planting vegetable gardens, and crops; reducing the population through shooting is recommended when local overabundance is causing crop depredation and increasing vehicle collisions
Conduct Wildlife or Fish Survey: spotlight surveys, camera surveys, and hunter harvest data help assess population trends

Snowshoe hare


USFWS

General information

Snowshoe hares are found in the northern U.S., the Rocky Mountains, the Sierra Nevada, and the Appalachians. They have large feet but smallish ears for a hare. Their summer coat is dark brown, and their winter coat is white. They are commonly found in both young and mature coniferous and deciduous forest, but prefer dense cover, especially near low wet areas. They forage in recently regenerated forest and forest openings. Snowshoe hares do not use dens. Home range is about 10 acres. They have 2-3 litters of 2-4 young, which are born April-August.



Habitat requirements

Diet: forbs, grasses, soft mast in spring and summer; browse and bark in winter
Water: probably obtain necessary water through diet
Cover: dense thickets and young forest cover; mature forest with dense understory; seldom far from dense cover; forest openings and riparian areas; give birth under a shrub or fallen log

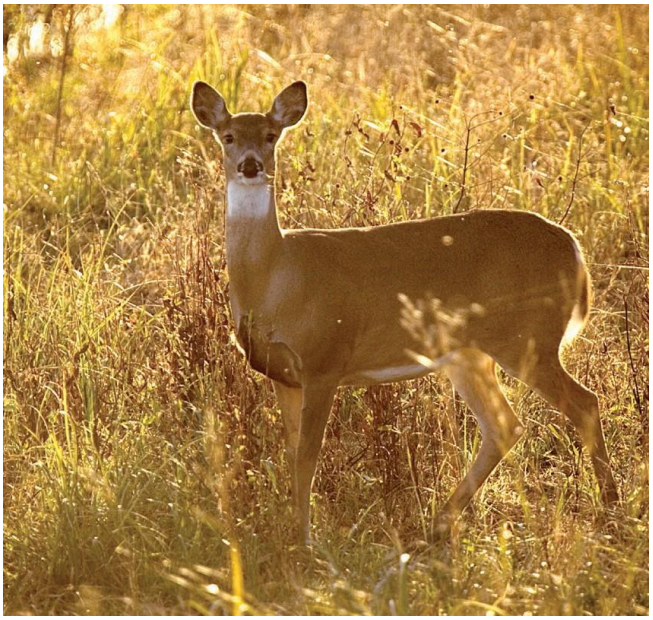
Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for snowshoe hares
Conduct Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*) will provide dense cover and increased soft mast for several years after harvest; *Timber Stand Improvement* can enhance understory development and soft mast production; *Forest Road Maintenance* my involve daylighting roads and planting clovers where forage may be limited
Conduct Livestock Management: livestock should be excluded for forests managed for snowshoe hare; should prevent
overgrazing in forest openings to maintain sufficient cover and forage for snowshoe hares
Plant Food Plots: (in some ecoregions) forest openings may be planted in forages where food may be lacking
Plant Shrubs: where dense shrub cover is lacking, and planting is necessary
Plant Trees: in relatively large open areas to maintain at least 80 percent forest cover
Decrease Hunting/Fishing: if hunting pressure is limiting population growth where an increase is desired
Increase Hunting/Fishing: when populations can sustain additional hunting pressure for recreation and when population reduction is desired
Conduct Wildlife Damage Management: when snowshoe hare populations eat the bark of commercially valuable trees during winter
Conduct Wildlife or Fish Survey: track counts, observation counts, and hunter observation data can be used to estimate population trends

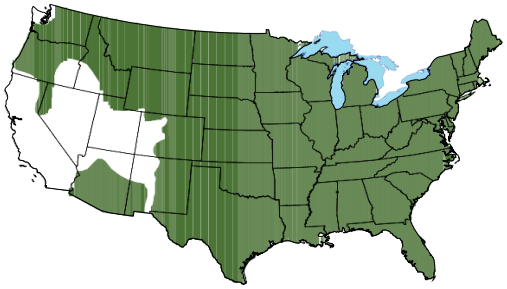
White-tailed deer

General information

The white-tailed deer is the most important game animal in North America. There are more than 30 subspecies of white-tailed deer that occur throughout the U.S. and southern Canada, except for California and Nevada. They are extremely adaptable and are found in a wide variety of areas including deciduous and coniferous forests, tropical evergreen forest, dry grasslands, and shrub desert. They are adaptable to humans and exploit suburban areas very well. Whitetails thrive in areas with fragmented areas containing several well-interspersed vegetation types and successional stages. White-tailed deer are ruminants and are classified as browsers but have distinct dietary preferences through the seasons. Where overabundant, they can cause significant damage to ornamental plantings and row crops and can be hazardous for motor vehicles.



Steve Hillebrand



Habitat requirements

Diet: forbs, browse, acorns, beechnuts, grains, grasses, and mushrooms; in the northern parts of the range, coniferous browse is important in winter

Water: obtain most of their water from diet, but will drink free-standing water when available

Cover: dense woody vegetation as well as relatively tall early successional cover, including native grasses, forbs, and shrubs; at the northern edge of their range white-tailed deer use wintering areas, which are usually dense stands of spruce, fir, cedar, and hemlock to avoid deep snow and cold winds

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for white-tailed deer; sod grasses and sericea lespedeza can be particularly problematic in fields and Japanese stiltgrass often reduces forage availability in forests; although white-tailed deer may eat many nonnative invasive plants in some seasons to some extent, control of many of those plants, such as kudzu, Japanese honeysuckle, and Chinese privet, can lead to increased plant species diversity and increased forage quality during various seasons

Develop Field Borders: to increase forage availability (forbs and brambles) around crop fields

Conduct Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*) will provide increased browse, soft mast production, and dense escape cover; *Timber Stand Improvement* can provide increased browse and soft mast production and stimulate better cover in stands with a poorly developed understory: both methods are often used at the northern edge of their range to manage the quality and vigor of coniferous cover within a deer wintering area

Leave Crop Unharvested: to provide additional food resource, especially near escape cover

Conduct Livestock Management: livestock should be excluded from forests managed for deer to avoid destruction of the forest understory; livestock should be excluded from riparian areas, especially in the ***Great Plains Grassland*** ecoregion; should prevent overgrazing in woodlands and savannas; livestock should be excluded from food plots

Plant Food Plots: when naturally occurring food sources are limited, food plots may provide additional nutrition, particularly in late summer and winter of most ecoregions

Plant Native Grasses and Forbs: where early successional cover is limiting, and planting is necessary for establishment

Plant Shrubs: where needed to provide additional soft mast, brushy cover, and browse; often useful in ravines, Develop Field Borders, other idle land areas and across large open

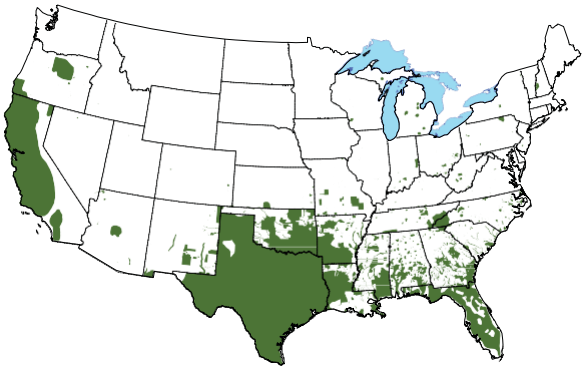
areas to provide travel corridors
Plant Trees: (in some ecoregions) in large open areas to maintain at least 30 to 40 percent forest cover; where mast producers are lacking, particularly oaks
Set-back Succession: *Prescribed Fire* and *Disking* is recommended to maintain herbaceous openings; *Prescribed Fire* is recommended to stimulate the forest understory for increased forage and soft mast. *Chaining* can be used to rejuvenate shrub cover; in areas dominated by mesquite, *Root-plowing* combined with seeding grasses and legumes may be the best way to increase herbaceous groundcover; *Chainsawing*, *Dozer-clearing* and *Root-plowing* when converting forest to early successional cover to increase forage and enhance fawning cover, and to kill or remove undesirable trees in woodlots and other areas
Conduct Tillage Management: eliminate fall tillage of grain crop residue adjacent to cover to make waste grain available as an additional food source
Provide Water Developments for Wildlife: where lacking (within one-half mile), dugouts, ponds, and shallow impoundments can provide freestanding water
Decrease Hunting/Fishing: if hunting pressure is limiting population growth where an increase is desired
Increase Hunting/Fishing: when populations can sustain additional harvest pressure for hunting recreation
and when populations need to be lowered because of overpopulation and habitat degradation; in these cases, it is necessary to concentrate increased harvest on females
Conduct Wildlife Damage Management: fencing, repellents,
and scare tactics may be helpful to keep deer from ornamental plantings, vegetable gardens, and crops; reducing the population through shooting females is recommended when widespread overabundance is causing crop depredation and increasing vehicle collisions
Conduct Wildlife or Fish Survey: camera surveys, browse surveys, aerial surveys (in open areas such as South Texas, Kansas, or Oklahoma, and northern portion of range during winter when there is extensive snow cover), pellet surveys, and hunter observation and harvest data are used to estimate population trends

Wild pig

General information

Wild pigs (also called feral hogs) were first introduced into what is now the United States at Tampa Bay, Florida by the explorer Hernando De Soto in 1539. In addition, early settlers throughout the southeastern United States also raised domesticated swine, some of which escaped and became feral, leading to their establishment throughout the South and California. Today, 36 states have wild pig populations estimated between 5 and 8 million nationwide. Many of these populations became established because of indiscriminate and illegal stockings for hunting purposes. As an invasive nonnative species, wild pigs cause ecological damage via their rooting behavior and competition for food and space with a number of native wildlife species and predate upon many small amphibian and reptile species. Wild pigs also cause considerable agricultural damage to crops, pastures, livestock, and environmental damage to riparian areas, often resulting in water quality degradation as a result of their rooting and wallowing behavior.

Billy Higginbotham



Habitat requirements

Diet: wild pigs are perhaps the perfect example of an omnivore; approximately 85 percent of their diet is vegetation, but they also prey upon small animals and often scavenge animal carcasses; they especially prefer crops, such as corn and peanuts, and aggressively out-compete native wildlife species for hard and soft mast whenever those food items are available

Water: wild pigs must have access to free-standing water for drinking and thermoregulation

Cover: wild pigs seek dense cover, such as heavy understory or thick shrubs and grasslands, near or in riparian areas that reduce opportunity for human contact: pig family groups (called sounders) often use streams, rivers, creeks, and associated wetlands as travel corridors to move as they seek food sources

Wildlife management practices

Increase Hunting/Fishing: the wild pig is an invasive nonnative species that competes with native wildlife for food and, in some instances, preys directly upon many small vertebrate species, including birds, mammals, reptiles, and amphibians; whenever wild pigs are observed or their sign is documented, control methods, such as trapping, snaring, shooting, and dogging, should be used with an ultimate goal of eradication

Conduct Wildlife Damage Management: may be necessary if wild pigs negatively impact crops, forages, or livestock; fencing high-value crops and other areas may be used as a non- lethal method for reducing wild pig damage, but it does not decrease the population

Conduct Wildlife or Fish Survey: camera surveys, track counts, and evidence of rooting are used to estimate population trends

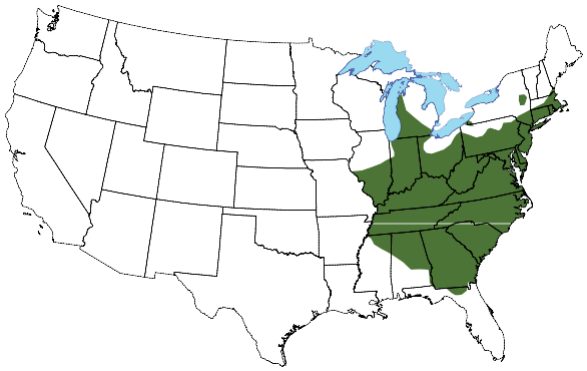
Reptiles

Eastern box turtle

General information

The eastern box turtle occurs throughout much of the eastern United States. It prefers deciduous or mixed woodlands, but also uses thickets, old-fields, pastures, and wetlands. The species is named for its high, domed-shaped shell that closes tightly into a "box" when the turtle is alarmed. The eastern box turtle is active throughout spring, summer, and fall. During the hot, dry summer months, it is often found soaking around the edges of ponds, streams, or wetlands. When temperatures begin to drop in late fall, it burrows into the leaf litter and loose soil to overwinter (for up to six months of the year). It burrows deeper into the ground as the soil temperature drops. The same overwintering location may be used year after year. Eastern box turtles are long-lived reptiles. They have been recorded to live more than 100 years in the wild.

Chelsi Hornbaker



Habitat requirements

Diet: omnivorous; earthworms, snails, slugs, insects, mushrooms, numerous leafy greens, and soft mast (fruit)
Water: requires water to soak during the hot, dry months of the active season
Cover: moist, forested areas with a diverse understory and abundant leaf litter; nesting cover found in moist or loose soil within small openings with an open structure at ground level

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality; sodgrasses in openings is particularly problematic for nesting
Develop Field Borders: to increase usable space around row crop fields
Conduct Forest Management: *Forest Regeneration* (*Group Selection*) and *Timber Stand Improvement* can increase understory vegetation for food
Conduct Livestock Management: should prevent overgrazing in open areas; livestock should be excluded from forested areas to maintain understory
Plant Native Grasses and Forbs: where planting is necessary to provide cover in open areas where there is little to no vegetation
Plant Shrubs: where adequate cover is lacking in large open areas
Plant Trees: where additional forest cover is needed
Set-back Succession: *Prescribed Fire*, *Herbicide Applications*, and *Disking* are recommended to maintain herbaceous openings and provide open structure at ground level; it is important that *Prescribed Fire* occurs during the inactive season to minimize negative effects on the turtles; *Chainsawing*, *Dozer-clearing*, and *Root-plowing* can be used to create forest openings where openings for nesting may be limited
Water Development for Wildlife: small ponds should be provided when water is absent
Conduct Wildlife or Fish Survey: transect counts and dogs are used to estimate population trends

Eastern indigo snake

Daniel Dye

General information

Eastern indigo snakes are found primarily in Florida and southern Georgia and have been listed as federally endangered since 1971. They are the largest snakes in the United States, reaching lengths of 60-84 inches. Although they prefer wetland areas, they also may be found in pine and shrubby flatwoods, grasslands, tropical hammocks, agricultural fields, and coastal dunes. They use abandoned gopher tortoise burrows and other burrows for reproduction and cover. Eastern indigo snakes have a docile, non-aggressive nature and can live near humans without negative interactions. They are important predators of rodents and venomous snakes.

Habitat requirements

Diet: small mammals, frogs, lizards, fish, eggs, birds, and other snakes

Water: requirements largely unknown; likely obtain water needs from the foods they consume

Cover: sandy soils with an abundance of animal burrows and stump holes in areas dominated by pine and hardwood forests, woodlands, and savanna; they also use hammocks, palmetto flats, and brushy areas near riparian areas and wetlands

Wildlife management practices

Develop Conservation Easement: can protect longleaf pine systems for this declining species

Control Nonnative Vegetation: when nonnative invasive vegetation begins to decrease habitat quality for eastern indigo snakes

Conduct Forest Management: *Forest Regeneration*, especially *Seedtree* and *Single-tree Selection*, in pine forests and woodlands can enhance cover for prey and provide stump holes and down woody debris; *Group Selection* and *Timber Stand Improvement* can enhance understory cover for eastern indigo snakes and their prey in hardwood stands

Plant Native Grasses and Forbs: may be necessary in open areas with insufficient groundcover

Plant Trees: in large open areas where additional forest cover is needed

Set-back Succession: *Prescribed Fire* is recommended to maintain herbaceous groundcover in longleaf pine savanna and woodland, and maintain an early successional stage in old-fields and grasslands

Provide Water Developments for Wildlife: where lacking, small ponds and shallow impoundments can increase habitat suitability

Conduct Wildlife or Fish Survey: transect surveys and drift fences with snake traps may be used to estimate population trends

Eastern snapping turtle

Chelsi Hornbaker

General information

The eastern snapping turtle is found across much of the U.S. east of the Rocky Mountains. It occurs in most permanent bodies of water, but prefers soft mud-bottomed ponds, lakes, and slow streams with dense vegetation. It is one of the more aquatic freshwater turtles and spends most of its time lying on the bottom of deep pools or buried in the mud in shallow water with only its eyes and nostrils breaking the surface of the water. The primary nesting season is May-June with the female digging a hole and laying about 30 eggs. Eastern snapping turtles are omnivorous and will consume relatively large invertebrate and small vertebrate prey. If approached, snapping turtles will turn to face the potential predator, lunge forward, and strike quickly with powerful beaked jaws. Eastern snapping turtles grow slowly, but can attain very large sizes (>50 lbs.) They have heavy muscular legs and are often harvested for human consumption.

Habitat requirements

Diet: insects, crayfish, clams, earthworms, fish, frogs, toads, salamanders, snakes, small turtles, birds, and small mammals; also consumes various aquatic plant species
Water: requires permanent bodies of water; obtains water from food
Cover: permanent water bodies with muddy bottoms and thick vegetation; hides underwater beneath submerged stumps, roots, brush, and buried in the mud

Wildlife management practices

Conduct Livestock Management: livestock should be excluded from riparian areas and other wetlands; this may include development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas
Repair Spillway/Dam/Levee: if not functioning properly
Water Control Structure: should be installed in existing levee or dam if one is not present to manipulate water levels as needed
Water Development for Wildlife: ponds and impoundments may be built when permanent bodies of water are not available
Decrease Hunting/Fishing: may be necessary when harvest pressure limits population growth
Increase Hunting/Fishing: where populations can sustain additional harvest pressure and if the turtles are limiting other desirable species
Conduct Wildlife Damage Management: may be necessary if turtles are found in fish hatcheries
Conduct Wildlife or Fish Survey: hoop net traps are used to estimate population trends

Gila monster

Gary M. Stolz

General information

The Gila monster is the largest lizard native to the U.S., and one of only a few venomous lizard species in the world. Most of the Gila monster's teeth have two grooves that allow its venom, a nerve toxin, to flow into the wound as the lizard holds its prey. Gila monster venom is not fatal to humans. Furthermore, the Gila monster is not aggressive and prefers to avoid people. It is restricted to the arid regions of the desert southwest. It is most active during the spring and summer months but spends more than 95 percent of the active season in burrows or under rocks emerging mainly to bask and feed. The Gila monster is a carnivore that feeds on nestling mammals and birds, eggs of birds and reptiles, lizards, and carrion. They are able to go months between meals and store fat reserves in their stout tails.

Habitat requirements

Diet: young of small mammals and birds, eggs of lizards and ground nesting birds, carrion
Water: receives necessary water from diet
Cover: typically found in desert grasslands, Mojave and Sonoran Desert scrub, and thorn scrub (Sonora); less often oak or pine-oak woodland; sub-surface shelters are important components of its habitat

Wildlife management practices

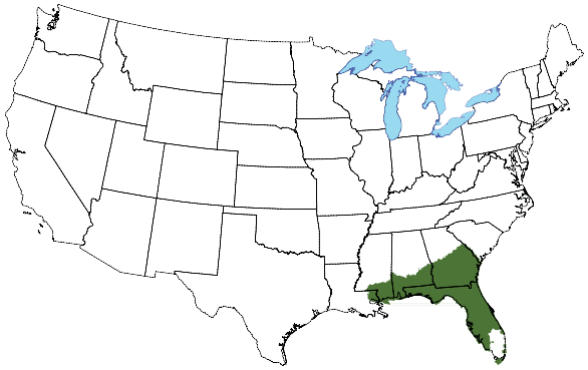
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for Gila monsters
Plant Shrubs: where cover is lacking for prey species
Provide Water Developments for Wildlife: in certain areas, it may be possible to create standing water to attract prey species
Conduct Wildlife or Fish Survey: transect surveys are used to estimate population trends

Gopher tortoise

Dwayne Elmore

General information

The gopher tortoise occurs in the southeastern Coastal Plain from southeastern South Carolina to extreme southeastern Louisiana. It inhabits open uplands, especially those with relatively well-drained, sandy soils. The gopher tortoise prefers longleaf pine and oak sandhills with open canopies, but also occurs in dry prairie, coastal grasslands and dunes, and mixed hardwood-pine stands. Gopher tortoises dig burrows up to 20 feet long and 6 feet deep. These burrows, from which the species was named, provide it protection from high and low temperatures extremes, moisture loss, and predators. These burrows also serve as a refuge for nearly 400 other species (including the federally endangered indigo snake). Gopher tortoises require a diverse understory of plants close by as most feeding occurs within 150 feet of their burrow entrance.



Habitat requirements

Diet: grasses, legumes, and fruits
Water: necessary water obtained from diet
Cover: burrows provide necessary cover

Wildlife management practices

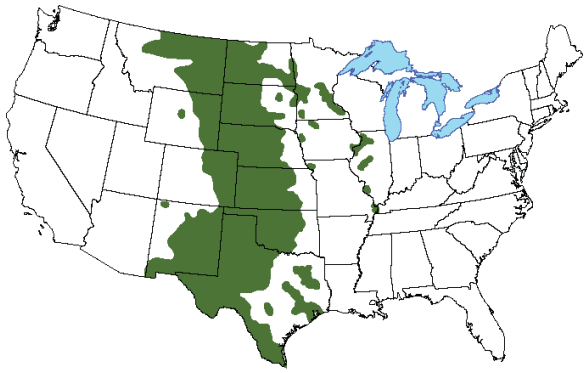
Develop Conservation Easement: can protect longleaf pine systems for this declining species
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for gopher tortoises, especially by limiting herbaceous diversity
Conduct Forest Management: *Forest Regeneration* (*Single- tree Selection*) is recommended to regenerate and maintain mature stands of longleaf pine; *Timber Stand Improvement* can remove undesirable species
Plant Native Grasses and Forbs: may be necessary in open areas with insufficient groundcover
Plant Trees: where additional forest cover is needed (maintain 20-60 percent canopy cover)
Set-back Succession: *Prescribed Fire* is recommended to maintain a diverse herbaceous understory; *Chainsawing* is recommended to maintain <60 percent canopy cover and to maintain a diverse herbaceous understory; *Herbicide Applications* may be used with fire; *Timber Stand Improvement* may be implemented to control undesirable species and help maintain diverse understory
Conduct Wildlife or Fish Survey: observations and use of gopher tortoise burrows are used to estimate population trends

Plains hog-nosed snake


Gary M. Stolz

General information

Plains hog-nosed snakes are characterized with dark blotches down a pale tan or yellowish back with a strongly upturned, pointed snout. They are relatively thick, heavy-bodied snakes, reaching 2-3 feet in length. Plains hog-nosed snakes prefer shrubby flat or gently rolling prairies with loose, sandy soil. They use their snouts to burrow into loose soil to find food and spend the winter. Often these sandy sites are characterized by sparse vegetation in most years. Plains hog-nosed snakes have slightly toxic saliva that is not dangerous to humans, but it helps hog-nosed snakes subdue prey. Hog-nosed snakes are masters at bluff behavior. When threatened, they will flatten their heads, giving a hood appearance, similar to a cobra. Then, they often inflate themselves with air and slowly release the air with a hissing noise, similar to a rattlesnake. They may strike, but usually with a closed mouth! It is actually difficult to get a plains hog-nosed snake to bite in self-defense. It will turn over on its back, thrash back and forth, open its mouth and stick its tongue out, and feign death, while upside down.



Habitat requirements

Diet: mostly toads, but also other reptiles, birds, mice, and eggs
Cover: grasslands and shrubland
Water: necessary water obtained from diet

Wildlife management practices

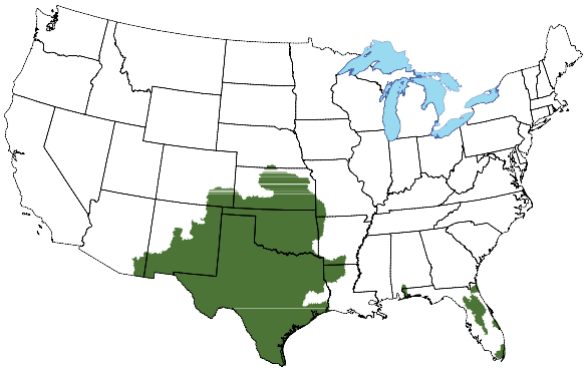
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for plains hog-nosed snakes
Conduct Livestock Management: should prevent overgrazing and leave adequate cover for prey
Plant Native Grasses and Forbs: in open areas where groundcover is lacking, and planting is necessary
Set-back Succession: *Prescribed Fire* and *Chaining* are recommended to reduce woody vegetation where needed and maintain native shortgrass prairie; it is important these practices occur during the inactive season to minimize negative effects on snakes
Conduct Wildlife or Fish Survey: transect surveys are used to estimate population trends

Texas horned lizard

Robert Burton

General information

Texas horned lizards are spiny lizards with a wide body. They are found in deserts, grasslands, and shrublands of the southwestern United States. They regulate their body temperature by basking and burrowing. When a predator approaches, Texas horned lizards will inflate themselves. If the lizard is further frightened, it is capable of squirting nearly one third of its blood volume through a pore near the eye. They also "rain harvest." During heavy rain, they stand high on their feet, flatten the body, and lower the head. This behavior funnels rain to the mouth through specialized scales. Daily activities often are timed around highest ant activities.



Habitat requirements

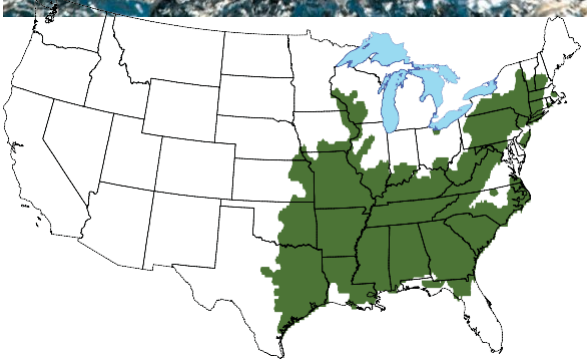
Diet: mostly ants, but also other invertebrates
Water: known to drink using specialized scales to harvest rainwater during heavy rains
Cover: sandy to rocky soils with sparse vegetation of grass, cactus, or scattered shrubs

Wildlife management practices

Control Nonnative Vegetation: when nonnative vegetation reduces habitat quality; in particular, dense sod grasses planted as livestock forage should be eradicated where possible when the Texas horned lizard is a focal species.
Plant Shrubs: where shrub cover is lacking
Set-back Succession: *Prescribed Fire* is recommended to maintain diverse grasslands and shrublands; *Drum-chopping* and *Chainsawing* can rejuvenate shrublands; it is important that these practices occur during the inactive season to minimize negative effects on the lizards
Conduct Wildlife or Fish Survey: transect surveys are used to estimate population trends

Timber rattlesnake

General information



Timber rattlesnakes are found throughout much of the eastern U.S. They are most often found in forests, particularly those with rock outcrops, ledges, and steep slopes. Timber rattlesnakes are long-lived reptiles, capable of reaching 25 years of age or older. They are pit vipers, which means they have a heat-sensing organ behind the nostrils that can detect temperature differences, that allows the snake to determine if another animal is a predator or prey. Timber rattlesnakes spend approximately six months of the year hibernating underground (fall-spring) and will re-use a den for many years. They emerge in spring and are primarily active during the daylight hours. Timber rattlesnakes are sit-and-wait predators. They rely on their camouflage patterns as they ambush prey along runways, at the base of tree trunks, and adjacent woody debris. Timber rattlesnakes generally are shy and unaggressive. When approached, they will normally "freeze" or retreat to thick cover, but if cornered they will form a loose coil, raise their heads, rattle their tails, and may strike. The rattle is made of keratin, which is a protein, and a new segment is added each time the snake sheds. To rattle, rattlesnakes move the rattle back and forth as much as 40-60 times per second. A rattlesnake cannot be aged by counting the rattle segments because snakes shed at varying rates, often multiple times in one year, and rattle segments commonly break-off. Timber rattlesnakes are venomous and should not be handled.

Habitat requirements

Diet: small to moderate-sized mammals; chipmunks, mice, voles, and squirrels; occasionally small birds
Water: receives necessary water from diet, but will drink free-standing water if available
Cover: upland forests with deep leaf litter and large amounts of downed woody debris; winter cover is necessary for hibernation in the form of rock crevices, rodent burrows, and root systems

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for timber rattlesnakes; in particular, nonnative sod grasses should be eradicated
Conduct Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) and *Timber Stand Improvement* will provide dense groundcover that may support increased prey for several years and increased large woody debris for ambush sites and loafing cover: timing of *Conduct Forest Management* ideally should be conducted during the inactive season, especially around denning sites
Conduct Livestock Management: should prevent overgrazing and leave adequate cover for prey; livestock should be excluded from forests where timber rattlesnakes are a focal species to avoid eliminating understory cover
Plant Trees: in relatively large open areas where additional forest cover is needed
Conduct Wildlife Damage Management: may be necessary to relocate timber rattlesnakes if found in or close to human dwellings or recreational areas, such as parks
Conduct Wildlife or Fish Survey: transect surveys and searches near known hibernacula sites during spring and fall when snakes are entering or leaving hibernacula are used to estimate population trends

Western diamond-backed rattlesnake

Gary M. Stolz

General information

Western diamond-backed rattlesnakes are found in deserts, grasslands, shrublands, and woodlands of the southwestern United States. They are pit vipers, which means they have a heat-sensing organ beneath the nostrils that can detect temperature differences that allows the snake to determine if another animal is a predator or prey. Western diamond-backed rattlesnakes usually spend daylight hours in the shade of low-growing shrubs, debris piles, or rocks. They are most active around sunrise and sunset, and at night during summer. The rattle is made of the keratin, which is a protein, and a new segment is added each time the snake sheds. A rattlesnake cannot be aged by counting the rattle segments because snakes shed at varying rates, often multiple times in one year, and rattle segments commonly break-off. To rattle, rattlesnakes move the rattle back and forth as much as 40-60 times per second. Western diamond-backed rattlesnakes are venomous and should not be handled.

Habitat requirements

Diet: mostly mammals (rabbits, squirrels, mice, and rats), but also lizards and birds

Water: will consume their body weight in free-standing water annually; they also get water from their food and some is absorbed during shedding.

Cover: areas with grass, forbs, cactus, or scattered shrubs; areas with sandy to rocky soils may provide animal burrows and rocky crevices used for cover

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for western diamond-backed rattlesnakes; in particular, nonnative sod grasses should be eradicated

Plant Native Grasses and Forbs: when grass/forb cover is limiting, and planting is necessary

Plant Shrubs: in large open areas where additional shrub cover is needed to provide daytime loafing areas and attract prey

Set-back Succession: *Prescribed Fire* is recommended to maintain diverse grasslands and rejuvenate shrublands that have become too dense to allow sufficient herbaceous groundcover; *Drum-chopping* and *Chaining* also can be used to rejuvenate shrublands; it is important these practices occur during the inactive season to minimize negative effects on snakes

Conduct Wildlife Damage Management: it may be necessary to remove western diamond-backed rattlesnakes from around human dwellings; debris piles attract prey, and thus snakes, making it desirable to keep such debris away from houses and buildings

Conduct Wildlife or Fish Survey: transect surveys are used to estimate population trends

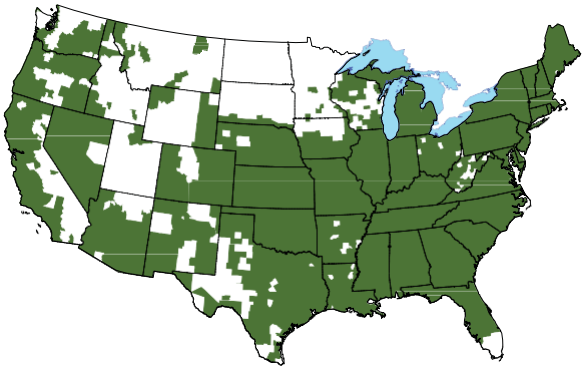
Amphibians

American bullfrog

Bill Buchanan

General information

American Bullfrogs are relatively large frogs that inhabit permanent bodies of standing or slow-moving water. The American bullfrog's native range extends from the Atlantic Coast to eastern Colorado and eastern Mexico, and from southern Colorado to northeastern Mexico. Bullfrogs are not native west of the Rocky Mountains but have been successfully introduced in many areas. Bullfrog tadpoles require two years to metamorphose. They prefer shorelines with dense vegetation adjacent to shallow open water dominated by floating and submerged aquatic vegetation. All habitat requirements are usually found in and around a single pond.



Habitat requirements

Diet: insects, crayfish, other frogs, reptiles, snails, fish, and occasionally small mammals and birds
Water: stable water levels are necessary for hibernation and egg development; water levels should be maintained at a constant level
Cover: dense, emergent aquatic and upland herbaceous vegetation adjacent to water for hiding and foraging

Wildlife management practices

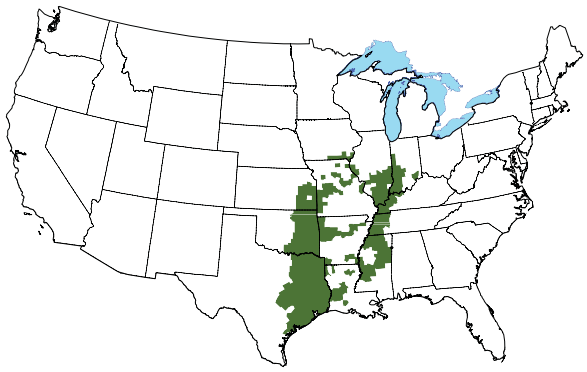
Conduct Livestock Management: livestock should be excluded from ponds managed for bullfrog; livestock watering facilities should be developed away from pond
Repair Spillway/Dam/Levee: if not functioning properly
Provide Water Developments for Wildlife: ponds and shallow impoundments can be provided where habitat for bullfrogs is absent or insufficient for desired population
Decrease Hunting/Fishing: if current hunting pressure is causing population to decline and population growth is desired
Increase Hunting/Fishing: where populations can sustain additional harvest pressure for hunting recreation
Conduct Wildlife or Fish Survey: call counts are used to estimate population trends

Crawfish frog


Rick Fridell

General information

Crawfish frogs occur from Indiana south to Louisiana, and from eastern Kansas south to the Texas coast. Crawfish frogs are found in a variety of vegetation types ranging from damp wooded valleys, open brushy fields, to tallgrass prairies. Populations are often associated with major river floodplains. Areas with shallow soils and intensive agriculture are avoided. Crawfish frogs are largely fossorial and spend the non-breeding season in crayfish burrows. Adults make annual migrations to temporary, fishless ponds to breed. Eggs hatch within 3-4 days, but tadpoles may take 2 months to transform.



Habitat requirements

Diet: adults eat beetles, spiders, crickets, ants, millipedes, and small crayfish; tadpoles filter feed on phytoplankton
Water: breed in ephemeral, fishless ponds with grassy margins
Cover: adults require low, wet areas, including moist meadows, prairies, woodlands, and brushy fields; burrows are required; crayfish burrows are preferred, but any burrow may be used as long as it reaches the water table; tadpoles require ponds that contain some algae, pondweed, and other vegetation to provide food and shelter

Wildlife management practices

Develop Conservation Easement: can protect critical habitat for this declining species
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for crawfish frogs
Conduct Livestock Management: livestock should be excluded from ponds that may be used as breeding ponds for crawfish frogs; livestock watering facilities should be developed away from pond
Plant Native Grasses and Forbs: may be necessary to convert fields currently in row-crop agriculture to crawfish frog habitat
Plant Shrubs: in fields that are currently in row-crop agriculture to convert them to crawfish frog habitat, or in large open areas that need additional cover
Provide Water Developments for Wildlife: small, fishless ponds and impoundments may be created if additional breeding ponds are needed
Conduct Wildlife or Fish Survey: call counts are used to estimate population trends

Monterey salamander

General information

The Monterey salamander occurs along the Pacific coast from Washington to southern California. This species is treated as a "ring" species whose subspecies form a ring-shaped distribution around the Central Valley of California and do not interbreed where the ends of the ring overlap in southern California. It inhabits a wide variety of vegetation types in hilly or mountainous terrain from near sea level to approximately 10,000 feet in elevation. Monterey salamanders occur in chaparral, wet coastal forests, coastal sagebrush, pine-oak woodlands, and mixed conifer-hardwood forests. Moist soil conditions are necessary for Monterey salamanders to occur because they lack lungs and respire through their moist skin.

Stuart Wilson

Habitat requirements

Diet: invertebrates, such as sow bugs, mites, spiders, centipedes, and beetles
Water: moist soil required for respiration
Cover: large amounts of downed woody debris; they also hide beneath moss mats, rocks, leaf litter, and within rodent burrows

Wildlife management practices

Conduct Forest Management: *Forest Regeneration* (*Group Selection*, *Single-tree Selection*) or *Timber Stand Improvement* may be beneficial in areas where additional down woody debris is needed; when regenerating a forest, it is important to use either *Group Selection* or *Single-tree Selection* to minimize area exposed to sunlight and soil-drying conditions
Plant Shrubs: where cover is limiting
Plant Trees: where cover is limiting
Conduct Wildlife or Fish Survey: drift fences with pitfall traps are used to estimate population trends

Northern red-legged frog

General information

Northern red-legged frogs are found in low, moist forests of the Pacific Northwest. They typically occur near permanent, quiet water, such as stream pools, marshes, and ponds. During wet weather, they can be found in damp woods and meadows, as well as ephemeral pools. They are active mostly at night, especially during wet periods. Northern red-legged frogs usually remain motionless when approached before bounding away with long, evasive jumps. The breeding call is relatively weak and consists of 4-7 notes that sound like "uh-uh-uh-uh." When captured by a predator, they often emit a loud scream.

Nirvan Hope

Habitat requirements

Diet: tadpoles are herbivores, consuming algae and organic debris; adults consume small invertebrates, including beetles, caterpillars, and isopods
Water: non-flowing water is required for reproduction
Cover: breeding ponds must not contain fish, and limbs or stems must be present at the surface to attach egg masses; adults use damp woods and meadows with permanent water; fallen logs and other coarse woody debris must be present

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for northern red-legged frogs
Conduct Forest Management: Forest Regeneration (Group Selection and Single-tree Selection) can create small canopy gaps in the forest and increase the amount of coarse woody debris; Timber Stand Improvement can also increase understory structure and coarse woody debris; it is important to retain considerable overstory cover
Conduct Livestock Management: livestock should be excluded from forests where northern red-legged frogs are a focal species; livestock should be excluded from ponds that may be used as breeding ponds for northern red-legged frogs; livestock watering facilities should be developed away from pond
Plant Trees: where forest cover is limiting
Provide Water Developments for Wildlife: small ponds and impoundments can be created in forested areas to provide breeding areas; woody debris in the pond should include small stems at the water surface for egg mass attachment.
Conduct Wildlife or Fish Survey: call counts are used to estimate population trends

Rough-skinned newt

General information

Adult rough-skinned newts prefer moist coniferous and hardwood forests, but also are found in open valleys. Newts require permanent water, such as ponds or slow-moving streams, for courtship, breeding, egg-laying, and larvae development. Eggs are laid singly on aquatic vegetation or submerged twigs. Aquatic larvae transform in late summer, or they over-winter and transform the following summer. Adult rough-skinned newts are generally terrestrial, often seen crawling over land in the daytime and becoming aquatic when breeding. However, some populations hide in daylight and are active at night. Some adults are primarily aquatic. Newts often are seen moving in large numbers to breeding sites during the breeding season. Some newts spend the dry summer in moist areas under woody debris, rocks, or animal burrows. Adults emerge to feed after fall rains. In some populations, adults remain in ponds throughout summer and migrate back onto land in fall following rain events. Often, they will form large aggregates of thousands of newts in the water. Adult newts have rough or granular skin, which produces toxins that repel most predators. Rough-skinned newts may assume a swaybacked defense pose with a coiled tail, exposing the bright ventral surface to warn potential predators. Toxin-resistant garter snakes are the only known animals that prey on rough-skinned newts.

Habitat requirements

Diet: larvae feed on aquatic invertebrates; adults eat amphibian eggs and larvae, aquatic and terrestrial invertebrates, worms, and slugs

Water: permanent water, such as ponds and slow-moving streams, are required for breeding and larval development

Cover: shallow water with aquatic vegetation or submerged woody debris is needed for attachment of eggs; soft logs, rocks, and bark are necessary for adult escape cover

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for rough-skinned newts

Conduct Livestock Management: livestock should be excluded from forests where rough-skinned newt is a focal species and from ponds that may be used as breeding ponds for rough-skinned newts; livestock watering facilities should be developed away from pond

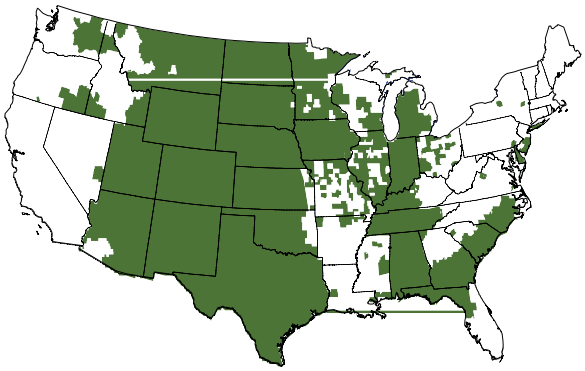
Repair Spillway/Dam/Levee: if not functioning properly

Provide Water Developments for Wildlife: small ponds and impoundments can be constructed when breeding ponds are limiting

Conduct Wildlife or Fish Survey: seine surveys and minnow traps could be used to estimate population trends

Tiger salamander


Gary M. Stolz



General information

The tiger salamander is a wide-ranging species occurring throughout the Great Plains and much of the eastern U.S. (it is absent from the Appalachian mountain regions). It is one of the largest terrestrial salamanders in North America with adults attaining more than one foot in length. Adults inhabit a wide array of vegetation types including bottomland deciduous forests, conifer forests, woodlands, fallow fields, grasslands, meadows, brushy areas, semideserts, and deserts. Free-standing water must be present for breeding. Adults are terrestrial, but make annual, spring migrations to ephemeral (temporary) ponds to breed. Ephemeral ponds contain water during only a portion of the year. The breeding season is short, and eggs develop rapidly. Larvae are top predators in fishless ponds. They often grow quickly and can reach 4-6 inches in length before transforming in late summer.

Habitat requirements

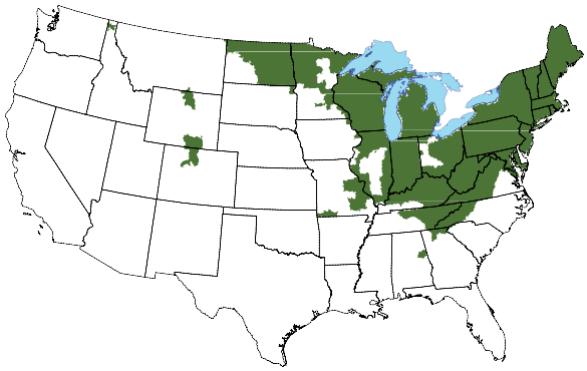
Diet: adults eat worms, snails, insects, and slugs; larvae eat a wide variety of aquatic organisms, including invertebrates and other amphibian eggs and larvae
Water: ephemeral or semi-permanent ponds are necessary for reproduction; ponds should be fishless if successful reproduction is to occur
Cover: adult tiger salamanders live underground in burrows for most of the year; deep leaf litter and large amounts of downed woody debris are most desirable

Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for tiger salamanders
Conduct Livestock Management: should prevent overgrazing where tiger salamander is a focal species; livestock should be excluded from ponds that may be used as breeding ponds for tiger salamanders; livestock watering facilities should be developed away from pond
Plant Native Grasses and Forbs: when converting fields that are currently in row-crop agriculture to tiger salamander habitat
Plant Shrubs: when converting fields that are currently in row-crop agriculture to tiger salamander habitat, or in relatively large open areas that need additional cover
Plant Trees: where additional forest cover is needed
Provide Water Developments for Wildlife: small, fishless ponds or impoundments may be created if additional breeding ponds are needed
Conduct Wildlife or Fish Survey: cover boards and pitfall traps along drift fences are used to estimate population trends

Wood frog

Bo Zaremba



General information

Wood frogs have the most extensive range of any North American frog or toad. They occur from the southern Appalachian Mountains of Georgia to northern Canada, and westward throughout the Great Lakes region, Canada, and Alaska (not shown on map below). In the northern climates, wood frogs bury themselves in the leaf litter to escape freezing temperatures. They also are able to withstand extended periods of sub-freezing temperatures by increasing blood-glucose levels, which serve as cryoprotectants (antifreeze). Individuals can survive whole-body freezing for more than a week. Wood frogs are closely associated with closed-canopy deciduous and boreal forests. Adults are largely terrestrial but make annual migrations to ephemeral ponds to breed. The breeding seasons are short (6-14 days) and eggs develop rapidly (4-30 days) in the shallow ponds. Tadpoles grow quickly and generally transform in 6 to 15 weeks.

Habitat requirements

Diet: adults eat terrestrial invertebrates, such as beetles, crickets, spiders, and earthworms; tadpoles filter phytoplankton from the water

Water: breed in shallow water within closed-canopy forests; breeding ponds are usually fishless and are dry at some time of the year

Cover: optimum habitat consists of >70 percent canopy cover in deciduous or boreal forests; prefer areas with moist soils, abundant leaf litter, and downed woody debris

Wildlife management practices

Control Nonnative Vegetation: where nonnative invasive vegetation creates undesirable conditions for wood frogs, limiting movement to breeding ponds

Conduct Livestock Management: livestock should be excluded from forests and from ponds that may be used as breeding ponds for wood frogs; livestock watering facilities should be developed away from pond

Plant Trees: in large open areas where additional forest cover is needed (should maintain >70 percent canopy cover)

Provide Water Developments for Wildlife: maintain ephemeral pools; create small, fishless ponds or impoundments if additional breeding sites are needed

Conduct Wildlife or Fish Survey: call counts are used to estimate population trends

Fish

Bluegill

General information

The bluegill is one of the most abundant Sunfish species. It thrives in a variety of conditions, ranging from freshwater lakes, ponds, and slow-moving streams, to brackish waters of coastal areas. The bluegill's native range is the eastern U.S. from southern Canada to Florida and Texas, but they have been successfully introduced throughout the U.S.

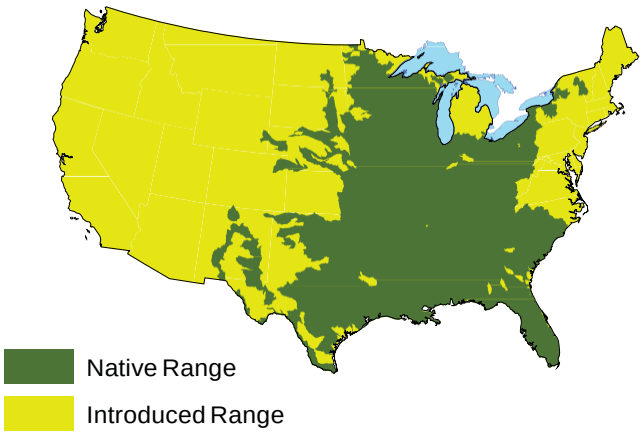
Habitat requirements

Diet: a variety of zooplankton (microscopic animal life) during the first few months of life, progressing to insects and their larvae, eggs, earthworms, tadpoles, small minnows, and crayfish
Water: basic requirements include dissolved oxygen (minimum of 4 parts per million); pH between 6.5 and 9.0; and water temperature should reach at least 70 F during summer (one foot below surface in the shade)
Cover: aquatic environments with submerged rocks, woody debris, and aquatic vegetation where small fish (prey) hide

Wildlife management practices

Conduct Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond
Repair Spillway/Dam/Levee: if not functioning properly
Decrease Hunting/Fishing: refer to Wildlife Management Practices on page 224 for specifics on fish harvest
Increase Hunting/Fishing: refer to Wildlife Management Practices on page 224 for specifics on fish harvest
Conduct Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey bluegill populations
Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam
Control Aquatic Vegetation: when necessary to discourage undesirable aquatic vegetation
Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm

Eric Engbretson



Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles
Restock Fish Pond: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present

Channel catfish

General information

Channel catfish are warmwater fish native to the Gulf coast states and the Mississippi River valley, but they have been introduced to most regions of the United States. They have smooth skin (no scales), a deeply forked tail, and sharp dorsal (top) and pectoral (side) fins that can inflict a nasty cut if the fish is handled improperly. They also have barbels (often called "whiskers") around the mouth. Coloration depends largely on water clarity—they are drab green to blue on the back, shading to white on the belly, but they can appear almost black in clear waters, and yellowish in muddy waters. Young channel catfish have irregular spots on their sides that disappear as they mature. Channel catfish average 2 – 3 pounds but may grow to 50 pounds. In the presence of largemouth bass and bluegill, predation is heavy upon the catfish eggs and young (called fry). In small impoundments managed for multiple fish species, stocking fingerling channel catfish is the best way to maintain a population. Channel catfish is the most widely cultured (farmed) warmwater fish species in the United States. Each year, several hundred million pounds are raised and harvested as food in grocery stores and restaurants. It is also widely sought by anglers on public and private waters for its recreational value as well as its fantastic flavor.

Habitat requirements

Diet: young catfish feed mostly on aquatic insects; adults eat crawfish, aquatic insects, plant material including algae, snails, small fish, and even seeds; commercially prepared rations have been formulated and are used to feed channel catfish in aquaculture (fish farming) operations as well as in farm ponds and other impoundments

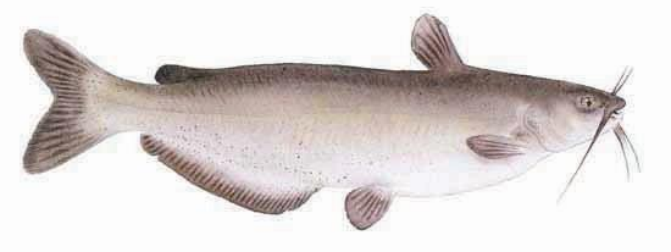
Water: obtained from their aquatic environment and food; reservoirs, lakes and ponds; moderately to swift-flowing streams and rivers with gravel, sand, or muddy bottoms; seldom inhabits water with abundant submerged aquatic vegetation

Cover: females typically lay eggs in dark holes or under logs or rocks

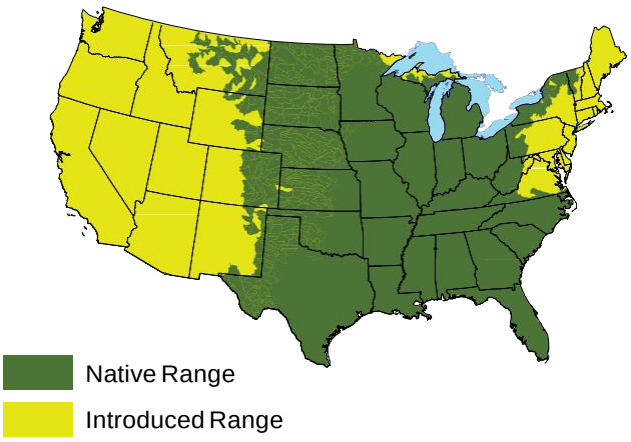
Wildlife management practices

Conduct Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond

Repair Spillway/Dam/Levee: if not functioning properly



Texas Parks and Wildlife



Decrease Hunting/Fishing: refer to Wildlife Management Practices on page 224 for specifics on fish harvest

Increase Hunting/Fishing: refer to Wildlife Management Practices on page 224 for specifics on fish harvest

Conduct Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey channel catfish populations

Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam

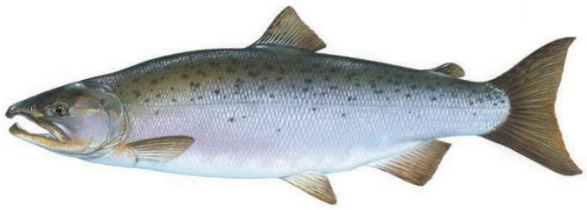
Control Aquatic Vegetation: when necessary to discourage undesirable aquatic vegetation

Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm

Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles

Restock Fish Pond: if too few are present; channel catfish seldom spawn successfully in the presence of largem outh bass and bluegill because of predation upon eggs and fry--therefore periodic restocking is required when channel catfish numbers drop below desired levels

Coho salmon



Timothy Knepp

General information

The Coho salmon is an anadromous fish species, which means they live part of their lives in saltwater before migrating to freshwater to spawn. They can attain weights of about 35 pounds, but 10 pounds is the average. The range of the Coho salmon in the U.S. is from Alaska southward to northern California. While in the ocean, Coho salmon have dark bluish backs and silver sides and are therefore often called silver salmon. When mature (3 years old), Coho salmon migrate to freshwater to spawn (November to January) and their coloration darkens with reddish sides. Males develop a pronounced hooked jaw/nose during the spawning season. Adults return to their stream of origin to spawn and die after spawning. The eggs are laid in nests called reds and hatch 6 to 7 weeks later in the spring. Young Coho salmon remain in streams and freshwater tributaries for more than a year before migrating (they are called smolts in this life stage) to the ocean. The life cycle is complete when they return to their freshwater stream of origin to spawn. The Coho, like many other salmon species found on the west coast, have experienced severe population declines in the past several decades. Reasons for these declines are complex, but include siltation of spawning areas, blockage of migratory routes by dams, and inadequate water flows in spawning areas as a result of water diversion for other purposes. Estuarine and marine ecosystems are often negatively impacted by shoreline development, residential drainage, and filling marine wetlands. Several Coho salmon populations occurring from California to Oregon have been listed as federally endangered or as species of concern. However, this species is an important recreational and commercial fish where populations remain strong, especially in Alaska.

Habitat requirements

Diet: in the freshwater juvenile or fingerling stage, Coho salmon feed on plankton, insects, and small fish; smolts switch to a diet comprised solely of fish upon entering the ocean

Water: obtained from aquatic environment and food

Cover: Coho salmon need pollution-free freshwater and marine ecosystems; spawning streams must have a stable gravel substrate for construction of reds

Wildlife management practices

Conduct Wildlife or Fish Survey: fishing records, seining, electro- shocking, and fish condition are used to survey Coho salmon populations

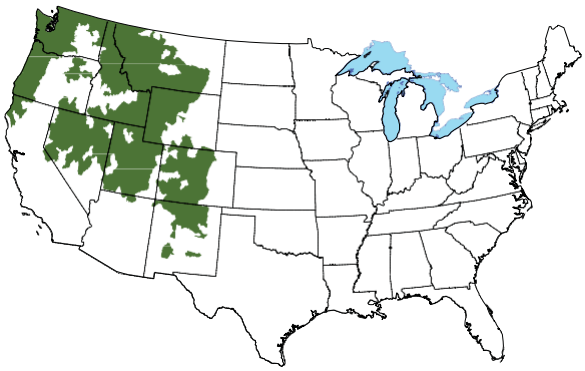
Streams—Remove Fish Barriers: such as culverts or dams that may prevent Coho salmon from migrating upstream to spawn

Cutthroat trout

General information

Cutthroat trout are native to the western U.S. They are found in diverse areas, such as the Rocky Mountains, the valleys of the Great Basin, and inshore areas of the Pacific Ocean, especially along the Washington coastline. They prefer rivers and streams with a gravel bottom, but several subspecies mate in lakes and ponds. Cutthroat trout are carnivores, eating a variety of organisms found in streams and lakes.

NPS



Habitat requirements

Diet: young cutthroat trout eat algae and small crustaceans; adults eat crustaceans, eggs, aquatic insects, mollusks, amphibians (tadpoles), and other fish; adults also eat terrestrial organisms if they fall into stream, but they are not a major part of their diet

Water: streams, lakes, and ponds where water does not rise above 70 F in summer; ideally streams should have a variety of riffles, runs, and pools; basic requirements include dissolved oxygen (minimum 6 parts per million); pH range between 6.5 and 9.0

Cover: prefer streams with overhanging vegetation along the shore that provides shade and reduces water temperature, providing terrestrial organisms for food. rocks, as well as debris on the bottom of the river or lake, provide cover that will hide them from prey

Wildlife management practices

Conduct Livestock Management: livestock should be excluded from areas managed for cutthroat trout or only allowed access to a small portion; fencing along the riparian area or lakeside may be necessary; livestock watering facilities should be developed away from streams, rivers, lakes, or ponds;

Decrease Hunting/Fishing: refer to Wildlife Management Practices on page 224 for specifics on fish harvest

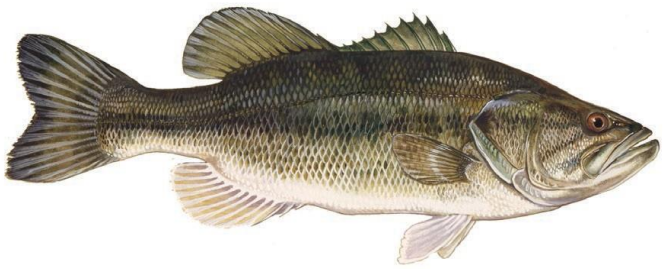
Increase Hunting/Fishing: refer to Wildlife Management Practices on page 224 for specifics on fish harvest

Conduct Wildlife or Fish Survey: fishing records, seining, electro- shocking, and fish condition are used to survey cutthroat trout populations

Streams—Create Pools: gravel and cobble should be placed in streams to provide structure for insects and locations for spawning; structures should not change currents, which could increase bank erosion; boulders and logs may be placed in the stream or lake to provide cover for trout while hunting, as well as cover for prey species; this practice is not likely needed if there are overhanging stream banks that provide cover

Streams—Remove Fish Barriers: because most cutthroat trout populations are migratory, dams can impede their ability to return to spawning grounds; installing fish ladders or removing dams will improve the ability of cutthroat trout to migrate

Largemouth bass



General information

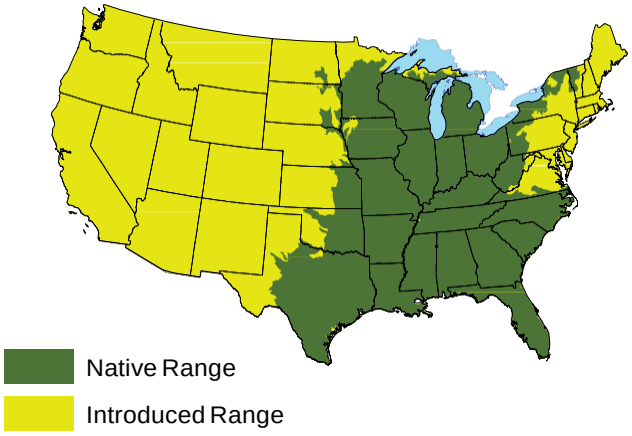
Largemouth bass are not really bass but members of the Sunfish family. Largemouth bass are the most popular freshwater sportfish in states where they are found. They can be found in freshwater lakes, rivers, large streams, farm ponds, and brackish marshes. Their native range includes most of the eastern U.S., but largemouth bass have been stocked all over the country successfully.

Habitat requirements

Diet: young bass eat insects and other invertebrates (worms, crayfish, and zooplankton); adults eat small fish, such as bluegill, and a variety of minnows, as well as tadpoles, crayfish, and even ducklings

Cover: aquatic environments with submerged rocks, woody debris, and aquatic vegetation where small fish (prey) hide

Water: basic requirements include dissolved oxygen (minimum of 4 parts per million); pH should range between 6.5 and 9.0; water temperature should reach at least 70 F during summer (one foot below surface in shade)



Wildlife management practices

Conduct Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond

Repair Spillway/Dam/Levee: if not functioning properly

Decrease Hunting/Fishing: refer to Wildlife Management Practices on page 224 for specifics on fish harvest

Increase Hunting/Fishing: refer to Wildlife Management Practices on page 224 for specifics on fish harvest

Conduct Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey largemouth bass populations

Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam

Control Aquatic Vegetation: when necessary to discourage undesirable aquatic vegetation

Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm

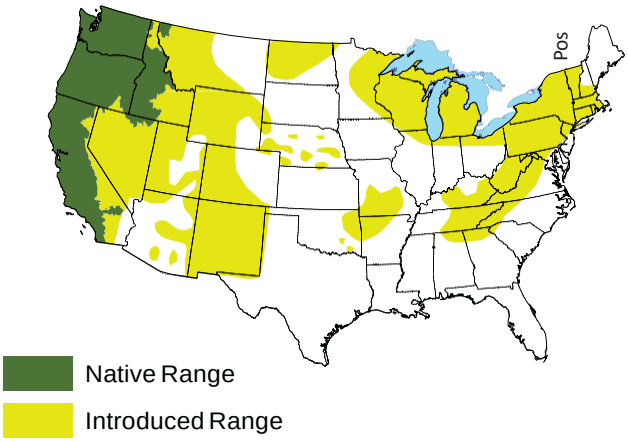
Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles

Restock Fish Pond: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present

Rainbow trout

General information

Rainbow trout are native to the U.S. west of the Rocky Mountains. However, they have been introduced throughout the U.S. as a sport fish. Rainbow trout are cool- to cold-water fish that do best in freshwater systems below 70 F. They can thrive in both rivers and lakes. Rainbow trout are carnivorous and spawn in areas with a rocky bottom. A water flow that reduces sedimentation of the river floor will increase spawning. A healthy riparian system supports trees and shrubs that prevent erosion and sedimentation and shade the water along the sides of the stream or river. Rainbow trout have driven many native species into extinction or endangerment in places where they have been introduced. Thus, increased harvest may be required in some streams to control their abundance in river systems and protect native species.



Habitat requirements

Diet: fish, aquatic insects, crustaceans, and mollusks; also eat terrestrial organisms that fall into the water

Water: streams, lakes, and ponds where the water does not get above 70 F in summer; ideally, stream should have 50 percent riffles and 50 percent pools; basic requirements include dissolved oxygen (minimum of 6 parts per million); pH should range between 6.5 and 9.0

Cover: rocks, as well as debris on the bottom of the river or lake, provide cover for hiding from prey or fishermen

Wildlife management practices

Conduct Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part

Control Aquatic Vegetation: when necessary to reduce undesirable aquatic vegetation

Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm

Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles

Restock Fish Pond: if too few are present

Streams—Create Pools: gravel and cobble can be placed in stream to provide structure for insects and locations for spawning; structures should not change currents, which could increase bank erosion; boulders and logs may be placed in the stream or lake to provide cover for trout while hunting, as well as cover for prey species

Streams—Remove Fish Barriers: because most native rainbow trout populations are migratory, dams can impede their ability to return to spawning grounds; installing fish ladders or removing dams will improve the ability of rainbow trout to migrate of the fish pond; livestock watering facilities should be developed away from the fish pond

Repair Spillway/Dam/Levee: if not functioning properly

Decrease Hunting/Fishing: refer to *Wildlife Management Practices* on page 240 for specifics on fish harvest

Increase Hunting/Fishing: refer to *Wildlife Management Practices* on page 242 for specifics on fish harvest; managers have begun reducing rainbow trout populations to minimize predation on or competition for resources with native fish species; increasing harvest can reduce the rainbow trout population

Conduct Wildlife or Fish Survey: fishing records, seining, electro- shocking, and fish condition are used to survey rainbow trout populations

Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam

Wildlife Management Practices (WMPs)

Various **Wildlife Management Practices** (WMPs) are used to manage wildlife and their habitat. This section describes WMPs and the potential effect they can have on wildlife habitat and populations. The WMPs are grouped according to type of practice (**Habitat management**, **Population management**, **Pond/Stream Management**, **Additional management practices specific to Urban areas**) and listed in alphabetical order within each grouping. Contestants should be familiar with the WMPs and able to identify which WMPs might be recommended to improve habitat or adjust populations in the ecoregion used for the Invitational (or state or local contest). Several practices are commonly used in certain ecoregions, but not in others. It is beneficial to learn as much as possible about any WMP before recommending it.

Some WMPs may seem contradictory. **Landowner objectives, as well as specific information given by contest organizers, must be considered to determine the appropriate WMPs.** Some WMPs are not applicable in all ecoregions, even though some of the species may be the same. **Current conditions should be considered when deciding if a WMP needs to be applied within the next year. However, the benefits of a WMP may not be realized for years.** For example, planting trees in a field to provide habitat for eastern gray squirrels or acorns for wood ducks is a sound practice, but the benefit will not be realized for many years. In this manual, costs and budgets are not considered when recommending practices. However, in actual situations, wildlife managers must consider economics when planning and recommending WMPs.

Index to Wildlife Management Practices (WMPs)

Habitat Management

Practices

Develop Conservation Easement

General description

A Conservation Easement is a legal agreement between a landowner and a land conservation organization (or "land trust") or government agency that places permanent restrictions on what can be done on a property. Landowners use conservation easements to permanently protect property from various land-uses (most notably future real estate development) that may degrade or destroy its natural resources. Common restrictions include limited or no new structures or roads can be built on the property. However, conservation easements offer flexibility. For example, if existing farmland is entered into a conservation easement, continued farming may be allowed while various vegetation types or habitat features are protected. In addition to the satisfaction of protecting the property in perpetuity, landowners also benefit by receiving reduced property taxes. Thus, landowners are much better able to continue to keep their land in the face of increasing property tax rates. Conservation easements do not transfer ownership of the property, but only place restrictions on what can be done on the property. The property can be sold, but the restrictions are maintained from owner to owner, in perpetuity.

Conservation easements are critically important in protecting property that contains or harbors rare vegetation types, habitat features, and endangered species. Examples include longleaf pine savanna, native grasslands, caves, and wetlands that provide habitat for species of conservation concern, such as red-cockaded woodpecker, gopher tortoise, grasshopper sparrow, Indiana bat, prairie-chickens, greater sage-grouse, marbled murrelet, and many others. Conservation easements also are a valuable tool in protecting land in areas where urban and suburban development is rapidly expanding. It is in these areas where property values are exceptionally high and the associated property tax rates often increase to the point landowners are no longer able to keep their property. The specific conservation purpose of the easement varies with the goals and objectives of the land trust or agency and the landowner. Common objectives include protection of a vegetation type or ecosystem, maintenance of a forested or riparian corridor, habitat for various wildlife species, wetland function, and water quality.

NOTE: Conservation easements can benefit any wildlife species, according to the area protected. However, for purposes of this program, ***Develop Conservation Easement*** should be considered when evaluating property that is under threat of real estate development or some other major land-use change, such as surface mining or wind farming with turbines, which would degrade or alter its current natural resource value. Further, this practice should be restricted to those species that are in serious decline or are associated with rare vegetation types that need protection.

Effect of practice

- Maintain land in a natural state and protect it from real estate development.
- Protect rare vegetation types and habitat features, such as grasslands, wetlands, caves, and large forested tracts.
- Protect habitat for declining, threatened, or endangered wildlife species.
- Maintain corridors for migrating wildlife.
- Protect water quality, especially if riparian areas are included or if watersheds are protected.

Control Nonnative Invasive Vegetation

General description

Nonnative plants have been brought to North America for centuries. Some were introduced accidentally, but most were brought intentionally to provide livestock forage or to be used as ornamentals. Unfortunately, many nonnative plant species have become established and spread far beyond where they were initially introduced. This invasion has been detrimental to native plant communities because many nonnative plants out-compete native species for sunlight and nutrients and exclude them from a particular area. Exclusion of native plants has been detrimental for several wildlife species. Many nonnative invasive plant species do not provide suitable cover, structure, or food for wildlife. As usable space for wildlife decreases, so does the carrying capacity for that area. Thus, populations of certain wildlife species have declined as a result of nonnative invasive species.

Examples of nonnative trees that should be controlled include tree-of-heaven, mimosa, and paulownia. Examples of nonnative shrubs that should be controlled include Russian olive, privets, bush honeysuckle, salt cedar, and multiflora rose. Examples of nonnative vines that should be controlled include kudzu, Japanese honeysuckle, and Oriental bittersweet. Examples of nonnative grasses that should be controlled include tall fescue, bermudagrass, johnsongrass, cogongrass, and cheatgrass. Examples of nonnative forbs that should be controlled include sericea lespedeza, sickle pod,

curly dock, and spotted knapweed. Examples of invasive wetland plants include alligatorweed, purple loosestrife, phragmites, hydrilla, water hyacinth, Eurasian watermilfoil, and reed canarygrass.

Without management, nonnative invasive species continue to spread, limit plant species diversity and degrade wildlife habitat. Most often, herbicide applications are necessary to control nonnative invasive species. Some species can be controlled by hand-pulling or mechanical techniques. Of course, nonnative invasive species should never be planted.

There are few properties in the country that do not contain any nonnative species. When evaluating an area, consider the impact nonnative species are having on the native plant community and associated wildlife. For purposed of this contest, this WMP should only be recommended if the presence of non-native vegetation is mentioned in the verbal or written landowner objectives and Habitat conditions.

NOTE: When this WMP is recommended, it is implied that necessary action will be taken to implement the practice. For example, if this WMP is recommended to control mimosa or paulownia trees, it is not necessary to also recommend ***Chainsawing*** or ***Herbicide Applications*** (which are methods included in ***Set-back Succession***). Further, if this WMP is recommended to control nonnative grasses, such as tall fescue or bermudagrass, in a field to improve habitat for various wildlife species that might use the field, do not also recommend ***Herbicide Applications***. When evaluating ponds and other wetlands, implementing this practice applies only to plants within the pond or wetland, not the surrounding watershed (unless the surrounding watershed also is being considered).

Effect of practice

- Killing nonnative plants where they limit growth of native plants can improve cover and increase foods for many wildlife species.
- Controlling nonnative invasive species often leads to increased plant species diversity, which can provide more types of cover and food for various wildlife species.
- Eliminating nonnative grasses that produce a dense structure at ground level will allow the seedbank to respond and result in better cover for nesting and brood rearing for several bird species, and also increase food availability for many wildlife species as various plants are stimulated and grow from the seedbank.
- Killing nonnative trees and shrubs can increase space for desirable tree and shrub species, which can lead to increased mast production.
- Nonnative species in ponds and wetlands may outcompete native plant species (such as phytoplankton) for nutrients, thereby reducing fish carrying capacity
- Certain nonnative species (such as giant salvinia) may effectively block sunlight and reduce oxygen content in ponds and other wetlands

NOTE: Control Nonnative Invasive Vegetation includes both upland and aquatic plants. For this contest this practice is applicable to terrestrial and wetland areas. However, it is not applicable to fish ponds. If aquatic vegetation of any type is problematic in fish ponds, ***Control Aquatic Vegetation*** should be recommended.

John Gruchy

Nonnative perennial cool-season grasses, such as this tall fescue, do not provide habitat for most wildlife species. Eradicating these undesirable grasses and allowing other plants to grow on the site is an extremely beneficial practice that enhances cover and increases food availability for many wildlife species.

Create Snags

General description

The presence of dying, dead, and down trees is critically important for a large number of wildlife species. Many birds, mammals, reptiles, amphibians, and a host of invertebrates and fungi are closely associated with (and some restricted to) standing dead trees or down woody material. Standing dead trees are called snags. Down woody trees are snags which have fallen to the ground. Snags provide perching sites and foraging opportunities for many bird species, such as red-tailed hawks, American kestrels, and bluebirds. Woodpeckers are attracted to snags to feed on the invertebrates under the bark and also to excavate cavities for nesting. Most woodpeckers are primary excavators. That is, they excavate cavities for nesting in snags. However, most woodpeckers need relatively soft wood for excavating. Thus, fungi aid woodpeckers by softening dead wood through

decomposition. After woodpeckers' nest and leave the cavity, other wildlife species may move in and use the cavity. These species are called secondary cavity users. Some secondary cavity users enlarge cavities to suit their needs. Most of the secondary cavity users are birds such as prothonotary warblers, barred owls and wood ducks, but there is a wide variety of secondary cavity users, from bats and squirrels, to various salamanders and snakes.

The value of snags does not end when they fall. Other wildlife species, such as lizards, shrews, mice, and snakes, are closely associated with down woody material. These animals serve important ecosystem functions, such as nutrient recycling and prey for various predators. The food web in some ecosystems is thus strongly influenced by the presence of snags and down woody material.

- When snags fall, they provide sites for denning, reproduction, foraging, and escape for various wildlife species.
- When snags fall, they provide drumming logs for ruffed grouse.
- Creating snags in forested areas allows additional sunlight to reach the forest floor, which stimulates additional groundcover that may provide forage, soft mast, and nesting cover for various wildlife species.

In mature forests, snags and down woody material are usually available. However, if snags are limiting species that require cavities or down woody material, snags and down woody material may be created by killing some trees and leaving them standing. Trees can be killed and left standing by girdling the tree with a chainsaw or hatchet and applying the appropriate herbicide to the wound, or by topping the tree. Obviously, it is much easier to girdle a tree. Selection of trees to kill is important. Softwood species (such as conifers, poplars, willows and maples) and those trees that already have signs of injury and decay are good candidates because the wood is more easily excavated by woodpeckers and heart rot (rotting in the interior of the tree trunk) may have already begun.

Size of the snag is important. Larger diameter snags (>12 inches diameter) are suitable and used more often by a wider variety of wildlife species than smaller stems. Optimally, snags may be distributed throughout a stand, and may occur as individuals or as small clusters. Information on the number of snags per area is somewhat limited, but estimates suggest 5 - 15 snags per acre in forested areas will sustain populations of various woodpecker species, which thereby would sustain populations of secondary cavity users and other species associated with down woody material. Snags also are used in non-forested areas by other wildlife species not found in forests, such as bluebirds and American kestrels. Thus, snags may be created when they are limiting in both forested and open areas.

Snags can also form in live standing trees when a large branch or section dies before the main tree. These should be considered in the count if they are of sufficient size to bear a cavity or have cavity holes present.

Effect of practice

- Snags provide roosting and perching sites for many bird species.
- Snags provide insects as food for woodpeckers and other birds.
- Snags provide woodpeckers with sites for cavity construction.
- Secondary cavity species (such as bluebirds, owls, wood ducks, raccoons) may use old woodpecker cavities for nesting, roosting, or denning

Develop Field Borders

General description

Field borders are uncropped areas around crop fields or unhayed areas around hay fields designed to provide nesting, brooding, and escape cover for many wildlife species. Field borders also help trap sedimentation and nutrient run-off. Field borders most often consist of native grasses and forbs, but also may include brambles and shrubs, depending on landowner objectives and focal wildlife species. Field borders may be established by allowing natural succession from the seedbank or by planting. Field buffers should be a minimum of 30 feet wide, but wider is better. Field borders up to 120 feet wide are highly desirable and recommended to provide adequate usable space for wildlife dependent upon early successional vegetation.

NOTE: ***Plant Native Grasses and Forbs*** or ***Plant Shrubs*** should not be recommended in order to ***Develop Field Borders***. However, if there are existing field borders of undesirable species, such as tall fescue, bermudagrass, or sericea lespedeza, ***Control Nonnative Invasive Vegetation*** should be recommended to control those plants. Additional field borders should be recommended only if there are crop fields or hay fields without field borders, if additional field borders are needed around a field, or if existing field borders are too narrow.

Field borders around crop fields provide increased usable space for species that require early successional cover. Field borders don't have to be planted. Here, broomsedge, asters, and blackberry have established from the seedbank.

Effect of practice

- Provides increased usable space for many wildlife species
- Provides nesting and/or brooding cover for many songbirds, bobwhites, and wild turkeys
- Can provide increased forage and seed availability if desirable forbs are established
- Can prevent sedimentation and nutrient runoff

Conduct Forest Management

General description

A forest, unless relatively small, is most often a collection of stands. A forest stand is a contiguous group of trees that is usually designated with respect to species composition, site, and age-class distribution. Forests are managed by harvesting stands and allowing new stands to develop (forest regeneration), or by manipulating existing stands through partial cuts or thinning (timber stand improvement). Silviculture is the art and science of tending a forest. Managing forests for the appropriate structure (height and density of vegetation) and species composition (which trees and other plants are present) is essential when managing wildlife that use forested areas.

Forest Regeneration

Regenerating a forest stand involves harvesting the trees within the stand through various silvicultural methods *with the intention of renewing and maintaining that forest stand*. Stand age and health, as well as landowner objectives, determine when a stand should be regenerated. Following a regeneration harvest, a new forest is established through natural or artificial regeneration. Natural regeneration allows trees to grow back naturally from the site. Artificial regeneration involves planting trees. The structure (and often the composition) of a forest stand changes when it is regenerated. Thus, some wildlife species benefit, and others may not. For example, cottontails and northern bobwhite may use the cover and food resources available in a mixed hardwood stand recently clearcut, whereas eastern gray squirrels that were using that stand prior to harvest would have to move to another stand. At the same time, other species, such as wild turkeys and white-tailed deer, would use both the recently harvested stand as well as an adjacent mature stand of mixed hardwoods. When managing habitat for species that require young forest cover, such as ruffed grouse, it is crucial to regenerate stands over time and to make sure regenerating stands are dispersed across the area being managed.

NOTE: ***Forest regeneration*** **should be recommended in order to regenerate stands and provide young forest cover — not to create "openings" or promote early successional communities.** Regenerated forests result in

new forests, **not** openings. Where additional early succession is needed, and the area is currently forested, ***Forest Regeneration*** should **not** be recommended for that objective. Instead, ***Set-back Succession (Chainsawing*** or ***Dozer-clearing*** and ***Root-plowing)*** should be recommended.

The regeneration method recommended depends on the forest type and composition, site quality, and landowner objectives. The **clearcut** regeneration method harvests all the trees in the stand. More sunlight is allowed into the forest floor with this method than with any other. Clearcutting generally releases shade-intolerant species (such as yellow poplar, black cherry, basswood) when present. The **shelterwood** regeneration method removes a predetermined number of trees to allow development of seedlings (regeneration). Later (usually 6 to 8 years), the trees that were left standing (the shelterwood) are removed after the regeneration has developed (often 5 – 15 feet tall). The **seed-tree** regeneration method leaves a few seed-producing trees per acre to regenerate the new stand. This method is often used with pines and other species with lightweight, wind-carried seed. The seed trees are usually harvested after the crop of new trees (regeneration) becomes established. The **group selection** regeneration method harvests small groups of trees (no more than 2 acres) within a stand. This method creates more diverse structure within the stand and generally does not allow as much light into the stand, which can allow both shade-tolerant and shade-intolerant trees to regenerate. The **single-tree selection** regeneration method harvests only select, individual trees out of the stand, not groups of trees. This method can create a diverse structure with small gaps in the forest canopy. This method generally regenerates shade-tolerant species in closed-canopy northern hardwood forests, but also is used to regenerate longleaf pine where prescribed fire is used to control undesirable species.

Pines are most often planted (artificial regeneration) after harvest to establish a new stand. Hardwood stands are almost always regenerated naturally and not planted. A common exception is that bottomland hardwoods are often planted when reforesting large bottomland fields that were previously in row-crop agriculture.

Regardless of regeneration method used, it is usually important to make sure food, cover, and water for certain wildlife species are in close proximity. Regenerated stand should be adjacent to more developed stands if providing travel corridors and space for wildlife that do not use young stands is a consideration. Also, whenever stands are harvested, it is good to leave relatively large standing dead trees (snags) and live trees with cavities for wildlife that might use them.

Effect of practice

- Forest regeneration produces new forest growth with greater stem density, which provides nesting and escape cover for several wildlife species.
- Clearcut, shelterwood, and seed-tree stimulate an initial flush of herbaceous growth for a few years until it is shaded out by the developing trees. Browse and soft mast are increased for a short time after harvest.
- Group selection creates considerable diversity in stand structure, providing characteristics of a young stand and an older stand. Browse and soft mast are increased in the group selection openings for a few years until regenerating trees reduce available sunlight to the forest floor.
- Single-tree selection maintains the overall structure of a mature forest, but an increase in understory growth where individual trees are removed will enhance nesting structure for some species and provide additional browse and soft mast.
- Regenerating stands provide cover for many prey species, which can benefit various predators.
- Snags and live den trees that are left standing provide perching, nesting, denning, and loafing sites for many wildlife species.
- The tops and slash of harvested trees remaining on the site provide what is called “down woody debris” or “coarse woody debris.” This material is very important for several reasons. As the material rots, nutrients from the organic material are returned to the soil for additional plants and animals to use. Not removing these nutrients from the site is important for ecological function. From a wildlife perspective, many reptiles and amphibians live in and under the decaying logs. Many small mammals also nest and den in and under decaying logs. Birds, such as wild turkeys and ruffed grouse, commonly nest adjacent to the brushy material and logs left behind, which simulate a tree blown over during a storm. Male ruffed grouse use down logs as platforms to “drum” on and attract females. The brushy debris left behind after a logging operation also provides important cover for various species and actually helps forest regeneration as newly emerging seedlings are protected from browsing.

Clearcutting removes all the overstory trees in a stand, allowing full sunlight onto the site. This 2-year-old mixed hardwood-pine forest was regenerated via clearcutting. It is now providing food and cover for many wildlife species, including black bear, bobcat, brown thrasher, eastern cottontail, great horned owl, white-tailed deer, wild turkey, and others.

Not all trees are harvested initially when using the shelterwood method. Managers can leave trees that might provide an important food source, such as oaks, blackgum, black cherry, and persimmon, until the regeneration has developed. At that time, the remaining overstory is harvested. Leaving mast-producing trees is an important consideration when managing for wildlife that eat acorns and other mast.

The seed-tree method is most often used with pines. Scattered trees are left standing after the initial harvest. Wind scatters seed from these remaining trees across the harvested area and new pines establish naturally.

*Standing dead trees (snags), as well as relatively large live trees with cavities, should be left when practicing forest management to provide cavities and perches for various wildlife species. **Create Snags** should be recommended where additional snags are needed.*

Group selection creates relatively small (<2 acres) canopy gaps within a stand. New trees regenerate naturally (without planting) in the openings. These small openings diversify the structure within the stand and are used by many wildlife species.

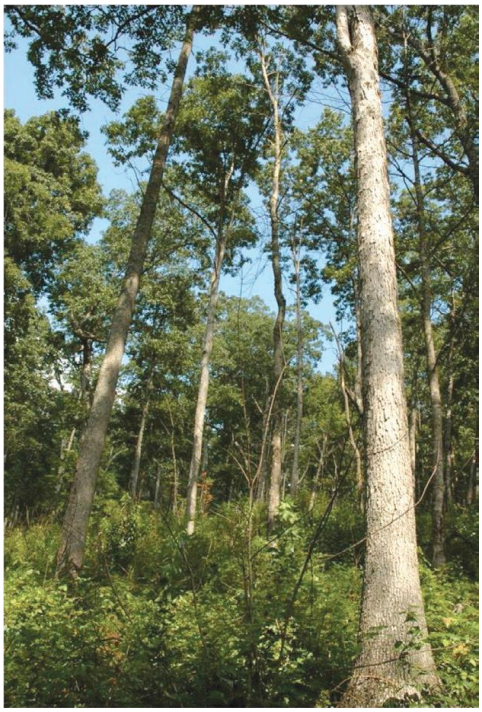
Select, single trees are removed in single-tree selection. This method favors shade-tolerant species in hardwood stands. Thus, it is sometimes practiced in northern hardwood stands where species such as sugar maple, American beech, and white pine are managed. Single-tree selection also is practiced effectively in longleaf pine stands.

Timber Stand Improvement (TSI)

TSI may involve any of several practices used to improve the quality and composition of forest stands by shifting resources (sunlight and nutrients) to achieve an objective, which may include wildlife, timber, or aesthetics. TSI most often involves some type of thinning, which reduces overall tree density to influence stand growth and development. Improvement cuts are implemented in stands past the pole stage to improve composition and quality by removing undesirable trees. Regardless, when some trees are removed, the remaining trees are "released" from the adjacent competition for sunlight and nutrients, which often allows them to put on more volume and develop larger crowns that can provide more mast (such as acorns). Increased sunlight entering the forest canopy also allows the understory to better develop, which provides more cover and food (forage and soft mast) for various wildlife species.

Effect of practice

- Increased understory growth enhances cover and provides additional forage, browse, and soft mast.
- Increased woody stem density in the midstory improves cover for some species.
- Trees retained following TSI are better able to grow larger crowns and produce additional mast.
- Snags and den trees that are left standing and down logs and other coarse woody debris left following TSI provide sites for feeding, denning, drumming, reproducing, hiding, and resting for many wildlife species.



Timber stand improvement (TSI) can be implemented to remove undesirable trees and increase growth of selected trees that remain in the stand. Groundcover is stimulated when additional sunlight enters the stand, providing additional cover and food resources in the stand, which can be maintained with periodic prescribed fire.

Forest Road Maintenance

Forest roads (or "woods roads") are required for trucks and other equipment to enter the forest for management. Roads are easily constructed if none are present when regeneration harvests are implemented. However, critical consideration must be made to how roads are constructed. If not constructed properly, soil erosion is likely, which leads to sedimentation and nutrient run-off into streams, which results in reduced water quality. In fact, more than 95 percent of all soil erosion and sedimentation associated with forest management is a result of improperly constructed forest roads, not tree harvest. Forest roads should not be constructed with steep grades or perpendicular to slope. Roads should be constructed with a slight grade (not too steep). If roads are not constructed properly, they should be repaired or rebuilt.

The most important consideration when constructing forest roads in hilly or mountainous areas is getting water off the roads quickly. Rainwater is moved off forest roads most quickly if roads slant slightly to the downhill side. Diversion bars (similar to a speed bump on a school road) and broad-based dips with culverts also help divert water off roads in hilly or mountainous areas.

Forest roads may be vegetated to help prevent erosion and provide additional forage for various wildlife species. Roads may be vegetated with naturally occurring plants, or they

may be planted to ensure adequate vegetation is present. Planting roads to wildlife-friendly vegetation, such as clovers, wheat, and oats, benefits many wildlife species by providing forage and associated invertebrates. Forest roads should not be planted to invasive species or plants that are not beneficial to wildlife (such as tall fescue). Adequate sunlight must be available in order for roads to support vegetation. If roads are completely shaded and additional vegetation is desired, trees may be removed along one or both sides of forest roads to provide adequate sunlight. Thinning trees along a forest road is called "daylighting." Usually, about 50-75 percent of the trees within 50 feet of the road are killed, felled, or harvested. Trees less desirable for wildlife are the ones targeted for removal. In addition to providing additional forage on the road, daylighted roads also provide additional browse, soft mast, and brushy cover in 50-foot-wide zones along the sides of roads, which is highly beneficial for some wildlife species.

Vegetation, whether naturally occurring or planted, on forest roads cannot stand very much vehicular traffic. Thus, those roads that receive considerable traffic from land managers may require gravel. Forest roads should be gated where they intersect public roads to prevent trespassing and poaching (killing wildlife illegally).

Forest roads should not be constructed perpendicular to slope. Roads such as this should be closed and planted to trees or shrubs.

Forest roads, such as this one planted to clovers, provide nutritious forage as well as travel corridors for various wildlife species.

This forest road was daylighted to provide additional browse, soft mast, and nesting cover for various wildlife species. The road was graveled to prevent erosion because it receives considerable traffic from land managers.

Leave Crop Unharvested

General description

Strips or blocks of grain or other crops (such as soybeans) can be left unharvested. This practice is especially valuable if the strips are left adjacent to cover. This practice should be recommended only if there is an unharvested crop present. It is not applicable to food plots.

Effect of practice

- Provides additional food for many species, which can be particularly important when naturally occurring foods are in low supply and/or in years with poor acorn production.

By leaving strips or blocks of grain unharvested, additional food is available for wildlife. Leaving this food resource can be an important consideration, especially in areas where winters are harsh.

Conduct Livestock Management

General description

The intensity and duration of livestock grazing directly impacts the structure (height and density) and composition of the vegetation community and, consequently, habitat quality for various wildlife species. Stocking rate is the amount of land allotted to each animal for the entire grazable portion of the year and is the most important consideration concerning livestock grazing management. Stocking rates can be adjusted to manipulate the structure of vegetation to favor various wildlife species. Intensity and timing of grazing favor various plant species over others. Thus, available nutrition for livestock and plant species diversity are influenced by grazing intensity and duration. Heavier stocking rates typically result in shorter vegetation, more open structure, and earlier successional stages (annual and perennial grasses and forbs with little or no woody cover), whereas lighter stocking rates tend to favor taller vegetation, more dense structure, and more advanced successional stages (perennial grasses and forbs and considerable woody cover). Stocking rates are relative to different ecoregions. A heavy stocking rate in the Great Plains would be a light-stocking rate in the eastern U.S. where annual precipitation is much greater.

This practice also can be used to exclude livestock from an area. Livestock distribution can be controlled with fencing, herding, or fire. Livestock exclusion may be necessary for wildlife species that require considerable shrub cover. Livestock exclusion is necessary for many wildlife species that inhabit forests, particularly those species that require a well-developed understory. Livestock exclusion is necessary wherever trees, shrubs, or food plots have been planted. Livestock exclusion is required to protect sensitive areas, such as riparian zones and other wetlands where erosion, siltation, and livestock waste can cause problems for associated wildlife and fish and reduce water quality.

This practice should be recommended when evidence of livestock is present or information on livestock use is provided.

Effect of practice

- Stocking rate can alter the vegetation structure and composition to favor various wildlife species.
- Livestock may be excluded from areas where advanced successional stages and increased vegetation structure is desirable for various wildlife species.
- Excluding livestock from riparian areas can help reduce siltation, turbidity and stream bank erosion, and reduce stream and pond pollution from livestock waste, which is beneficial for many wildlife and fish species. Excluding livestock from riparian areas also may improve habitat structure and composition for various wildlife species that use these areas.

Provide Nesting Structures

General description

Some species den, nest, or roost in cavities they don't excavate themselves (such as bluebirds, wood ducks, and owls). If natural cavities are not available, artificial cavities (nest boxes) can be used. Many species need a certain kind of cavity (certain diameter of hole, depth, area) in a certain location (field, woods, or water) and at a certain distance aboveground (height in feet). The particular design and placement of nest boxes often determine which wildlife species use the structures. Nest boxes should be monitored to ensure use by targeted species. Contact your county Extension or state wildlife agency office for specific designs of nest boxes and other artificial nesting/roosting structures.

NOTE: Nesting structures for Canada geese are not recommended because resident Canada geese have become too numerous and are a nuisance in many areas. In addition, nesting structures are not recommended for mallards. Instead, creation of high-quality nesting cover (native warm-season grasses and forbs) is required to impact population recruitment.

Nest boxes provide artificial cavities for several species of birds. Nest boxes have been instrumental in helping bluebird and wood duck populations recover from drastically low levels in the early 1900s.

Effect of practice

- In open areas, nest boxes are useful for bluebirds unless an abundance of nesting cavities are available in trees or fence posts. Nest boxes for bluebirds should not be placed any closer than 80 yards apart to prevent territorial fighting between males.
- Nesting structures near water sources provide secure nesting sites for wood ducks where trees with cavities suitable for nesting are limiting. Nest boxes for wood ducks should not be placed any closer than 100 yards apart and ideally, should not be visible from one box to another, to prevent dump-nesting by females not incubating a particular nest.

Plant Food Plots

General description

Food plots can be planted to provide a supplemental food source for many wildlife species when naturally occurring food is a limiting factor for maintaining or increasing the population. Food plots also are commonly planted for various game species to facilitate hunting.
Regardless of reason for planting, a wide variety of wildlife species may benefit from food plots. In fact, food plots probably benefit more nongame species than game species. For example, all the seeds that are provided in bird feeders also are planted in food plots! Food plots are often planted to provide grains, such as corn, grain sorghum, and millets, and other plants with large energy-rich seed, such as sunflowers. Leafy forages, such as clovers, rape, chicory, joint vetch, winter peas, and lablab, also are commonly planted. Some plantings may provide both forage and grain or seed, such as soybeans, cowpeas, buckwheat, wheat, and oats. Food plots do not only benefit upland wildlife (such as deer, wild turkey, sparrows, and elk), but waterfowl as well. Canada geese, mallards, and American wigeon often feed in warm-season grain food plots and in winter wheat. Plots of millets, corn, rice, or grain sorghum may be flooded a few inches deep in the fall to provide an additional food source for many duck species through winter.

The size and shape of food plots and their distribution is largely determined by the focal species and habitat quality. Food plots may be long and narrow (150 to 400 feet long and 15 to 20 feet wide) or blockier in shape (depending on the focal wildlife species and the type of food plot planted). Relatively small food plots located

adjacent to escape cover and arranged in a linear shape may receive more use by animals with small home ranges and associated with brushy cover, such as cottontails or northern bobwhite. Larger food plots in more open areas may be necessary and receive more use by some species, such as elk, greater prairie-chicken, mallard, mourning dove, pronghorn, and sharp-tailed grouse. Regardless, if food is a limiting factor for a particular species, food plots should be distributed throughout the property in accordance with the minimum daily movement distances of the species. Further, if food is a limiting factor, it is critical to realize additional habitat management practices should be implemented to provide additional naturally occurring foods. In most situations, food plots should not be placed within view of property lines or public roads to discourage poaching and unnecessary stress on wildlife that may be using the food plots. Exclusion cages approximately 4 feet square and 4 feet tall may be placed in food plots to enable property managers to monitor planting success and amount of feeding pressure by wildlife.

NOTE: For purposes of this contest, ***Mowing***, ***Disking***, and ***Herbicide Applications*** are WMPs used to set-back succession. They should not be recommended in order to plant or maintain a food plot. If food plots are present on an area being evaluated and need repair or replanting, ***Plant Food Plots*** should be recommended if they are still needed. However, if nonnative invasive species are present in a food plot, ***Control Nonnative Invasive Vegetation*** may be recommended. Many of the species listed above as commonly planted in food plots are nonnative, but they are not considered invasive.

Effect of practice

- Grain food plots, especially corn and grain sorghum, as well as soybeans, can supply a high-energy food source through fall and into late winter. Such a food source can influence winter survival for several wildlife species, especially during relatively cold winters and during years with low mast (acorn) production.
- In areas and seasons where nutritious forage is limiting, forage plots can supply highly digestible forage, which can be especially important during late summer and through winter and spring.

Warm-season grain plots, such as this corn, can provide an important source of energy through winter for many wildlife species.

Warm-season forage plots, such as these soybeans, can provide an excellent source of protein (leaves) during summer and an energy source (beans) in winter.

Cool-season food plots provide nutritious forage fall through spring when availability of naturally occurring forages may be relatively low. Depending on what is planted, such as this winter wheat, a nutritious seed source also is available the following late spring through summer.

Plant Native Grasses and Forbs

General description

Native grasses and forbs are important for cover and food for many wildlife species. Native grasses and forbs represent early successional stages in all ecoregions and may represent the climax successional stage in some areas where shrub and tree growth is limited.

It may be necessary to plant native grasses and forbs in areas where there is not sufficient cover and where the seedbank (those seed occurring naturally in the soil) has been depleted and desirable native grasses and forbs do not occur naturally. An example of an area that may need planting is a field that has been in agricultural production for many years, often decades. Continued plowing and herbicide applications over many years can eventually deplete the seedbank of desirable native species and planting can expedite desirable groundcover.

Native grasses and forbs should not be recommended for planting if desirable native grasses and forbs are present and likely to provide adequate cover and food resources. Undesirable nonnative plants may be selectively removed through ***Control Nonnative Invasive Vegetation*** and thus release native grasses and forbs.

Plant Native Grasses and Forbs should not necessarily be recommended where additional early successional cover is needed. For example, in large forested areas where additional early successional cover might be required to provide habitat for some wildlife species, such as loggerhead shrike, northern bobwhite, or woodcock, it is likely that desirable native grasses, forbs, brambles, and other plants will establish from the seedbank after the forest is cleared by ***Chainsawing*** or ***Dozer-clearing*** and ***Root-plowing*** (see ***Set-back Succession***).

Native grasses and forbs may be planted where sufficient and desirable native grass/forb cover is lacking.

Many nonnative grasses (such as tall fescue and bermudagrass) are not recommended for wildlife because they do not provide suitable cover or food for most wildlife, and their competitive nature often prevents native grasses and forbs from becoming established.

Examples of desirable native warm-season grasses
broomsedge bluestem, little bluestem, blue bunch wheatgrass, big bluestem, sideoats grama, blue grama, switchgrass, Indian grass, buffalo grass

Examples of desirable native cool-season grasses
Virginia wildrye, Canada wildrye, poverty grass, low panic grasses

Examples of invasive nonnative warm-season grasses
bermudagrass, cogon grass, johnsongrass, crabgrass, dallis grass, goose grass

Examples of undesirable nonnative cool-season grasses
tall fescue, orchard grass, bromegrasses, timothy

Examples of desirable native forbs and brambles
common ragweed, western ragweed, pokeweed, blackberry, dewberry, native lespedezas, beggar's-lice, old-field aster, partridge pea, Rocky Mountain bee plant, annual sunflower, perennial sunflowers, crotons

Examples of invasive nonnative forbs
sericea lespedeza, curly dock, spotted knapweed, sickle pod

Effect of practice

- Native grasses and forbs provide nesting, bedding, roosting, and/or escape cover for many wildlife species, especially those that require early successional cover.
- Ground-nesting birds usually build their nests at the base of native bunchgrasses, such as broomsedge bluestem, little bluestem, or sideoats grama.
- Although some wildlife, such as elk, eat native grasses, forbs provide a greater food source for more species. Many forbs provide forage (leafy material) as well as a seed source. Forbs also provide optimal cover for many small wildlife species, including young upland gamebirds and cottontails.

For purposes of the contest, participants are not expected to determine if each grass or forb species in a habitat is native or non-native . If nothing is mentioned about the vegetation assume only native species exist.

Plant Shrubs

General description

Shrubs provide cover and soft mast, depending on species, that benefit many wildlife species, some of which are found only in shrublands or shrub cover. In large open areas, planting blocks or multiple rows of shrubs is beneficial for those species requiring additional shrub cover for nesting, loafing, or escape. Fruiting shrubs are beneficial for many species and can be planted in fencerows, hedgerows, field or woods borders, odd areas (such as field corners and gullies), riparian areas, and any other areas where soft mast may be lacking. Establishing hedgerows of shrubs to break-up fields is beneficial, especially when planted adjacent to high-quality early successional cover or a good food source (such as grain field). Shrubs should be planted in winter while they are still dormant. Shrubs should not be planted in the woods where there is not adequate sunlight for growth and development. Where additional shrub cover is needed in forested areas, ***Conduct Forest Management*** should be recommended.

Shrubs may be planted to create riparian buffers along streams and ponds. Vegetated buffers are important to maintain stream bank stability as the roots of the vegetation along the stream help hold the soil in place along the stream. Additionally, the aboveground vegetation in buffers filters sediment from water moving into the stream or pond after rainfall events. Riparian buffers also may provide cover and travel corridors for various wildlife species. Finally, buffers of vegetation, especially trees and shrubs, provide shade to keep stream water temperatures during summer lower, which may benefit cold-water fish species. The minimum recommended width for riparian buffers is 100 feet, but width may vary with size and order of a stream, as well as topography and landowner objectives.

Shrub plantings, such as this hawthorn, provide nesting cover, escape cover, and an important source of soft mast.

Effect of practice

- Can provide additional food and cover for many wildlife species in areas where specific species of shrubs are lacking.
- Shrubs are an important component of travel corridors, which allow wildlife to move safely across open fields between two areas of cover.
- Establishing hedgerows with shrubs may be used to increase interspersion of cover types and create smaller fields in proximity that can be managed differently to meet the various food and cover requirements for different wildlife species.
- Shrub plantings may be useful in some urban settings where desirable cover or soft mast is lacking.
- Shrubs planted to develop a riparian buffer may reduce erosion and sedimentation.

Plant Trees

General description

Trees are planted to provide food (hard or soft mast) and cover for many wildlife species. Trees should be planted in winter while they are dormant. Planting a mixture of species is usually recommended when mast production is the objective. Planting a mixture reduces the chances of a mast failure in any given year. Ecoregion, site, and landowner objectives help determine which species are planted. Examples of hard mast producers that are important for wildlife include oaks, hickories, American beech, and pecan. Examples of soft mast producers that are important for wildlife include persimmon, black cherry, mulberry, apple, and pear.

Trees may be planted to create riparian buffers along streams and ponds. Vegetated buffers are important to maintain stream bank stability as the roots of the vegetation along the stream help hold the soil in place along the stream. Additionally, the aboveground vegetation in buffers filters sediment from water moving into the stream or pond after rainfall events. Riparian buffers also may provide cover and travel corridors for various wildlife species. Finally, buffers of vegetation, especially trees and shrubs, provide shade to keep stream water temperatures during summer lower, which may benefit cold-water fish species. The minimum recommended width for riparian buffers is 100 feet, but width may vary with size and order of a stream, as well as topography and landowner objectives.

NOTE: It may not be appropriate to plant trees in some areas. Some species of wildlife, such as prairie-chickens, avoid trees. Thus, in prairies that were historically treeless, planting trees is detrimental to some grassland

species of wildlife. If ***Plant Trees*** is recommended, it is assumed that the appropriate site preparation techniques will be performed. Thus, it is not necessary to also recommend mechanical, chemical, or burning treatments to prepare a site for tree planting.

Effect of practice

- Provides hard or soft mast production, depending on the species planted.
- Large areas can be planted for afforestation (planting trees for a forest where there was no forest).
- Provides additional nesting, perching, denning, and roosting sites.
- Trees planted to develop a riparian buffer may reduce erosion and sedimentation.

February 2004

October 2008

August 2011

David Mercker

Hardwoods are most often regenerated naturally. That is, after harvesting, they grow back naturally from stump and root sprouts and seed. However, when afforestation is desired on large open areas with few to no trees, planting is the best method to ensure desirable species composition. Here, a large field that was in agricultural production for decades was planted to bottomland hardwood species.

Repair Spillway/Dam/Levee

General description

Low water levels can cause significant problems in ponds and impounded wetlands. Improperly constructed or damaged spillways can lead to excessive dam or levee erosion and excessive aquatic vegetation along fish pond margins. The spillway should be repaired if it is eroding or otherwise damaged, keeping the pond or impounded wetland level too low and increasing the chance of the dam eroding during heavy rains. In special cases, leaks around the spillway or levee structure can be stopped with the addition of special clays or plastic liners.

Billy Higginbotham

This fish pond dam likely will have problems with leakage (if not already) and breakage if the trees are not killed or removed.

Trees should not be allowed to grow on dams or levees because tree roots can fracture the dam and eventually cause it to leak and break. However, if there is a large, mature tree on a dam, and the dam is not leaking, it should be left alone. Killing or felling the tree will cause the roots to rot and decay and thereby create airspace, which will more likely lead to the dam leaking or breaking. Thus, it is important to not allow trees to become established on dams, and it is important to kill or remove smaller trees (<10 inches diameter at breast height) before their root systems grow large.

Effect of practice

- Eliminates erosion and sedimentation from spillway/levee
- Enables pond or impounded wetland to fill to appropriate level
- Precludes vegetation from establishing around the inside perimeter of a fish pond

Tree roots can cause dams to fracture, leak, and eventually break.

Set-back Succession

General description

Succession is the series of changes in plant species composition through time and occurs in all-natural communities. Habitat for many wildlife species is managed by setting back succession in an effort to retain the successional stage(s) beneficial for focal wildlife species. The three primary techniques used by wildlife managers to set-back succession are **fire, mechanical applications,** and **herbicide applications**. Each of these may be applicable for setting back succession in any ecoregion for various wildlife species, but they may not produce the same effect. One or more may be recommended over another depending on the situation. In some cases, more than one technique may be applied. For the contest the recommended technique for setting back succession should be specified and reasons given as to why a particular technique was recommended in the written management plan and oral reasons.

Grazing livestock also arrest or set-back succession. However, wildlife managers do not typically use livestock to set-back succession but may recommend a stocking rate to livestock producers who are interested in wildlife. For the purposes of this program, ***Conduct Livestock Management*** is included as a separate WMP because livestock often need to be excluded from an area when managing for many wildlife species. Thus, there are just as many applications for ***Conduct Livestock Management*** to advance succession as there are to set-back succession.

Prescribed Fire

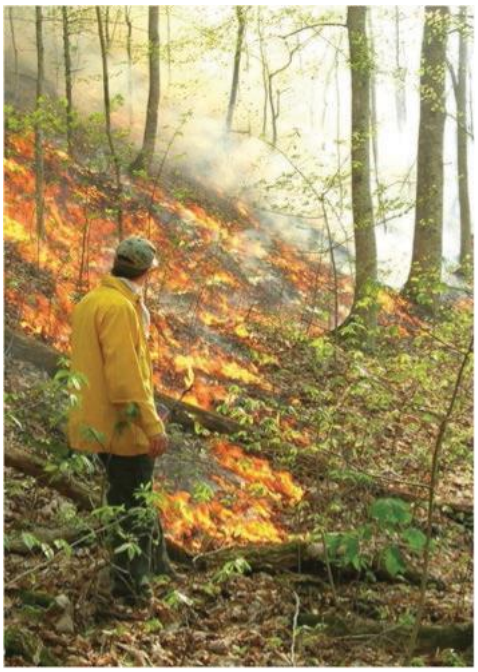
Prescribed fire is often the most effective and efficient method for managing succession and maintaining early successional plant communities. Prescribed fire can be used in fields, openings, grasslands, savannas,

woodlands, and forests. Intensity, timing, and frequency of fire strongly influence vegetation composition and structure. High-intensity fires and burning in late summer and early fall tend to reduce woody composition more than low-intensity fires or burning in winter or spring. Low-intensity fire is recommended when burning a forest understory if damaging trees is undesirable. Like other methods, fire sets back succession temporarily. With the exception of intense fire, frequent burning over time will change vegetation composition more so than less frequent burning. For example, if an area is burned every 2 years, annual and perennial herbaceous vegetation will be promoted. Where there is adequate rainfall, if that same area is burned every 5 years, considerable tree and shrub cover will be present. If burned every 10 years, trees and shrubs will dominate the site. Intensity and timing of fire dictate whether woody species are killed or if only the leaf litter is consumed.

Although a very beneficial practice, prescribed burning is not possible in all locations. Sites in close proximity to urban areas, hospitals, or busy roadways may not be suitable for burning because of safety and smoke management concerns. **Burning should be conducted only when danger of wildfire is low (when the wind, temperature, and humidity allow a controlled burn) and should be conducted under the close supervision of forestry or wildlife professionals experienced with using prescribed fire.** Where fire can be used, it is highly recommended over mowing or mulching to set-back or maintain succession.

Effect of practice

- Sets-back the successional process by killing existing cover and stimulating fresh plant growth.
- Burning during the dormant season does not significantly alter vegetation composition unless fire intensity is high. Small woody stems may be top killed, but usually resprout. Burning during the growing season and particularly the latter part of the growing season may more effectively kill small trees and shrubs and thus encourage more herbaceous cover.
- Burning early successional cover provides an open structure at ground level the following growing season, which is desirable for several small wildlife species, including young upland gamebirds. An open structure at ground level facilitates mobility and foraging under a canopy of herbaceous vegetation.
- Consumes litter layer and understory fuels (such as dead leaves and grass), which reduces chance of wildfire and enables the seedbank to germinate.
- Improves seed and invertebrate availability for many species (because of the open structure at ground level).
- Scarifies (breaks down outside coating) some seeds so they can germinate.
- May release nutrients (from ashes) into the soil.



Prescribed fire is the desired method for setting back succession and manipulating the composition and structure of the understory or groundcover in forests, woodlands, and savannas where fire occurred historically. Fire intensity, fire frequency, and season of burning strongly influence the effect of fire on the vegetation community.

Mechanical applications

Disking

Disking sets-back succession by mixing the upper soil layer and incorporating organic material into the soil, facilitating decomposition, and stimulating the seedbank. **This soil disturbance technique sets succession back to the earliest seral stage that will occur on a given site.** Disking is a relatively inexpensive and effective practice for exposing bare ground and promoting annual grasses and forbs from the seedbank in the growing season following disturbance. Disking reduces coverage of perennial grasses and forbs and brambles for a short time and promotes more annual species. Disking is usually conducted every few years to maintain annual and perennial forbs and grasses. Disking is most often implemented in fields or open areas, but also can be done in-between rows of planted pines to encourage herbaceous groundcover. Similar to controlled burning, timing of disking and disking intensity influence vegetation composition and structure.

NOTE: When using prescribed fire, firebreaks are commonly maintained by disking; however, ***Disking*** should not be recommended as a WMP to facilitate burning. Also, ***Disking*** should not be recommended to control nonnative grasses (such as tall fescue and bermudagrass). Instead, ***Control Nonnative Invasive Vegetation*** should be recommended to control nonnative invasive species.

Effect of practice

- Maintains an early successional plant community dominated by grasses and forbs.
- Promotes fresh herbaceous growth and enhances forage and seed availability for many wildlife species.
- Sets-back succession where perennial grasses and forbs, brambles, and small woody species dominate the plant community.

Chainsawing

A chainsaw or fellerbuncher may be used to kill or remove trees where trees are not desired for the focal wildlife species or where additional areas of early successional cover are desired. Trees not removed may be killed and left standing by girdling the tree and spraying an herbicide solution in the wound. Stumps of felled trees may be sprayed to prevent sprouting. However, even with herbicide treatment following cutting or girdling, woody sprouts often dominate the site after felling trees. ***Root-plowing*** with a bulldozer (see section below) after tree removal helps prevent woody sprouting and ensure more herbaceous groundcover as opposed to sprouts and saplings of woody species.

NOTE: Implementing this practice implies the intention is to increase and maintain an earlier successional community, not a forest. Thus, ***Conduct Forest Management*** should not be recommended to set-back succession and maintain an early successional community. ***Conduct Forest Management*** should be recommended to manage and maintain a forest, either through ***Forest Regeneration*** or ***Timber Stand Improvement*** practices. Indeed, herbaceous cover (such as native grasses and forbs) is stimulated when trees are cut and seed from the seedbank germinates. However, the herbaceous community will be short-lived and woody species will dominate the site (especially on hardwood-dominated sites) unless tree removal is followed with additional treatment. ***Root-plowing*** following removal of hardwood trees significantly reduces woody sprouting. Periodic prescribed fire, additional mechanical disturbance (such as disking), or herbicide treatment then will be

Disking sets back succession, facilitates decomposition, provides bare ground, and stimulates the seedbank, encouraging early successional species.

Chainsawing can be used to increase early successional cover in wooded areas. On this property, trees were cut, not harvested, and the site has been burned every 2 years to maintain early succession. Nothing was planted. A forest was converted to an early successional plant community.

necessary to maintain an early successional community. ***Plant Native Grasses and Forbs*** should not necessarily be recommended when using ***Chainsawing*** or another mechanical method to reduce tree cover and increase early successional vegetation because herbaceous groundcover should establish naturally from the seedbank after tree removal. An exception would be if a forested area was being converted to a grassland for grassland obligate species. In that situation, planting native grasses and forbs after clearing trees may be warranted.

NOTE: do not also recommend ***Create Snags*** when killing trees in an effort to increase early successional cover

NOTE: do not also recommend ***Herbicide Applications*** to spray girdled trees or tree stumps.

Effect of practice

- Reduces tree density and encourages earlier successional plant communities.

Dozer-clearing/Root-plowing/Chaining/ Drum-chopping

All four of these techniques involve large equipment and are implemented to reduce woody cover and stimulate more herbaceous cover. They are typically used where shrubs and trees have grown too large for a rotary mower and where prescribed fire may not be applicable.

Bulldozers and loaders are used to clear trees from an area to create early succession and increase herbaceous cover. Bulldozers have a blade in front, whereas a loader has a large wide bucket in front. Dozer-clearing is simply using a bulldozer or loader to clear trees or large shrubs from the site to establish openings and early successional plant communities, both in uplands and wetlands when it is dry enough to get a dozer into the site. Dozer-clearing is often followed by root-plowing to reduce root- and stump-sprouting.

Root-plowing involves a bulldozer with a rear-mounted plow-blade that cuts tree and shrub roots and brings them to the soil surface, which significantly reduces sprouting. This technique is often used in brush country, such as south Texas, but also can be used in forested areas of the eastern U.S. following tree removal where the intent is to convert a forested area to an early successional plant community. Root-plowing facilitates this process by reducing sprouting of woody species. In arid ecoregions, it may be several years before brush species re-establish following root-plowing.

Chaining involves pulling a very large chain strung between two bulldozers running parallel to each other (50 to 100 feet apart) to knock down shrubs and small trees. Brush is knocked over in the first pass, then a second pass in the opposite direction uproots the brush.

Drum-chopping (or roller-chopping) involves a bulldozer pulling a large drum (or roller) with sharp metal blades to knock down and chop large shrubs and small trees. It is a fairly common technique for managing brush cover in arid ecoregions, such as **Prairie Brushland** in south Texas. Drum-chopping effectively reduces the size of brush and generally increases herbaceous growth. However, chopped brush usually resprout (depending on species), and stem density of brush actually can be greater (but smaller size) following treatment.

Effect of practice

- Sets-back succession by reducing dominance of small trees and shrubs, and promotes grasses, forbs, and brambles.
- Promotes more open structure.
- Forage availability and quality may be increased.
- Soft mast and seed production may be increased.
- Woody species usually resprout following drum-chopping, which can be used to maintain a certain height and amount of brush cover.

Drum-chopping can be used to set-back succession where shrubs and trees have gotten too large to allow disking or mowing and where the application of prescribed fire is not an option.

Mark Bartoskewitz

Chaining is often used in shrub country to reduce woody cover and increase herbaceous cover.

Mowing/Mulching

Mowing is most often accomplished with a large rotary mower mounted behind a tractor. Much less often, a mulching machine is used to reduce large shrubs and small trees to chips. To avoid disrupting nesting birds and destroying nesting cover or winter cover, mowing should not be conducted until late winter or early spring. When mowing is the only option for setting back succession, it should be conducted when it is apparent that undesirable woody species are encroaching in the field. In other words, mowing fields of grass is unnecessary. Mowing and mulching are not the best techniques for setting back succession because they promote a deep thatch layer that creates undesirable conditions at ground level for young gamebirds and ground-feeding songbirds. A thatch layer also limits germination of the seedbank and can reduce plant diversity. When possible, prescribed burning, disking, or herbicide applications should be used to set-back succession instead of mowing or mulching.

Mowing with a lawnmower can maintain lawns and park-like settings in urban areas. Mowing is usually the only possible practice for maintaining openings in urban areas. Mowing is well suited to maintain low-growing grasses and forbs. Many wildlife species inhabiting urban areas are attracted to yard-like settings, especially when interspersed with shrub and forest for cover and travel corridors.

Effect of practice

- Helps maintain perennial grasses and forbs and reduces height of encroaching woody species.
- Helps remove competition from various shrubs and small trees, allowing grasses and forbs to grow better. Maintains low brushy cover of various shrubs and small trees by encouraging resprouting.
- Can improve and maintain nesting cover for some bird species if conducted outside the nesting season.
- Causes thatch build-up, which reduces availability of invertebrates and seed to young quail, grouse, wild turkeys, and other ground-feeding birds. Thatch build-up also reduces the ability of these animals to move through the field and suppresses the seedbank, which can lead to decreased vegetation diversity.
- In Urban areas, mowing maintains yards and grassy openings.
- In Urban areas, wide expanses of mowed areas do not provide adequate cover for some wildlife species; therefore, it is important to leave some areas unmowed or provide cover using islands of shrubs and flowers.

John Gruchy

Mowing, or "bush hogging," is often used to set-back or maintain succession in fields. However, accumulation of thatch provides undesirable conditions for many wildlife species and limits germination of the seedbank. Mowing is not a desirable practice to set-back succession and should be used only when more desirable methods are not possible.

Herbicide Applications

Herbicide applications can be used to set-back succession and kill selected plants. Applications can be made to individual plants or broadcast over an area. There are many different types of herbicides available. The herbicides used in natural resources management are environmentally safe. Many herbicides are "selective" in that they only kill specific plants, not all plants. Thus, in many cases, selective herbicides can be used to remove specific undesirable plants from an area (such as small trees in a field) and leave desirable plants. Herbicide applications thus can be used to adjust plant species composition in an area (such as a field or thinned pines) and improve habitat for many wildlife species.

NOTE: this practice is intended to set-back succession, not specifically to control nonnative species. Although herbicide applications are often used to control nonnative species, ***Control Nonnative Invasive Species*** should be recommended for that purpose.

Herbicide applications can be used to set-back succession. Selective herbicide applications, as shown here, can be used instead of mowing and help transition plant species composition toward more favorable species by killing undesirable species.

Effect of practice

- In some open areas, encroachment of hardwood trees reduces vegetative diversity and limits many plants important for wildlife. Proper herbicide applications control unwanted woody growth and encourage more herbaceous groundcover.
- Can be used to maintain grasses, forbs, and shrub cover, and thus increase foods and enhance cover for some wildlife species.
- Can be used to prevent unwanted hardwood growth in pine stands, particularly those that have been thinned to allow increased sunlight to reach the ground and stimulate herbaceous plants.
- Can be used to provide bare ground area adjacent to edge of water source, such as pond, to enable mourning dove access to water.

Conduct Tillage Management

General description

No-till agriculture is recommended over any tillage method. No-till agriculture uses drills and planters that do not overturn the soil. Additionally, the use of cover crops, such as annual clovers, wheat, and brassicas (leafy greens, such as rape, kale, turnips, and radishes), is recommended along with no-till agriculture. Cover crops are sown in the fall, just before or after the existing crop is harvested, then the cover crop is sprayed with herbicide or roller-crimped in spring prior to no-till planting the next crop. Cover crops scavenge and secure nutrients to prevent loss to leaching, increase water infiltration, increase soil-water holding capacity, and help improve soil health by encouraging more organisms, such as earthworms and microbes, in the upper soil layers, which facilitate decomposition and lead to increased nutrient availability.

If no-till agriculture is not possible (some producers do not have access to no-till drills or planters), tilling cropland should be delayed from fall until spring to allow wildlife access to waste grain and to allow wildlife to use standing stubble (if present) for cover. Further, inversion tillage (such as moldboard plowing, which turns soil over and covers crop residue) should be avoided. Instead, implements such as chisel plows that do not turn the soil over should be used.

NOTE: This practice should be recommended only if a warm-season grain crop, such as corn, soybeans, or grain sorghum, is present and/or if tillage has been used to plant or manage a crop. If a crop is present and tillage has been used, no-till agriculture and cover crops may be recommended in the management plan (Activity III). If a grain crop is present and the written scenario suggests no-till planting is not possible, delayed tillage with implements that do not overturn the soil and cover crops may be recommended.

Effect of practice

- No-till agriculture conserves soil moisture and reduces soil erosion and sedimentation into creeks and rivers. Thus, water quality is improved, which benefits aquatic organisms.
- Cover crops help improve soil health by increasing organic material and detritivores in the upper soil layers. Cover crops provide forage for various wildlife species.
- No-till agriculture and delayed tillage increases supply of waste grain, which is eaten by many wildlife species, and may increase nesting success.

Pamela Hoskins

and soil Cover crops, such as cereal rye, radishes, Austrian winter peas (left), improves health by increasing organic material and nutrients available to later crops, and providing forage for various wildlife species. Delaying tillage from fall into spring allows wildlife access to waste grain from harvested crops through winter (right).

Provide Water Developments for Wildlife

General description

Water is a critical habitat component. Some wildlife species obtain necessary water from their diet, whereas others require free-standing water for drinking or for aquatic habitat (they live in water). Many species require a water source for obtaining food, reproduction, loafing, or escaping predators. Developing a source of water is a critical consideration for many wildlife species when little or no water is available. There are several ways to make water available to wildlife.

Small ponds can be created with backhoes, bulldozers, or loaders. They are usually designed to collect water from runoff and/or precipitation but may be created where there is an existing spring or seep, which facilitates water collection and helps ensure a reliable water supply. Side slopes for these ponds should be gentle to provide easy access for wildlife.

NOTE: these ponds are designed for various wildlife species, not fish.

Small ponds can be created where water is relatively scarce to provide water and habitat for several wildlife species.

Shallow impoundments may be created by constructing earthen dikes to retain water (usually run-off water
from precipitation) in natural drainage areas. Placement of the dike is critical to avoid damage from floods
and to collect sufficient water. When recommending shallow impoundments for waterfowl, bottomland areas (including grain fields and mature bottomland hardwoods) and existing wetlands should be considered for flooding. A water-control device in the dike allows the water level to be manipulated. Water can be removed from the field or woods prior to spring (similar to draining the water out of a bathtub) so the field can be planted again or so the trees will not die.

NOTE: When this practice is recommended, it is assumed an adequate water control structure will be included

Guzzlers and windmills also are used to provide water. Guzzlers are built by covering an area with an apron of fiberglass or some other material that sheds rain. Water is collected in a storage tank and slowly released into a trough from which wildlife can drink.

Small backyard ponds can be constructed in suburban backyards to provide water for a variety of wildlife.

Birdbaths also are useful for providing water in urban settings.

NOTE: ***Provide Water Developments for Wildlife*** can be recommended when an additional water source is needed or when an existing water development for wildlife is essentially not functioning because it is in serious need of repair.

Shallow impoundments can provide excellent habitat for migrating and wintering waterfowl and other wildlife species.

Effect of practice

- Can provide drinking water and wetland habitat.
- Grain fields or mature bottomland hardwoods flooded in fall/winter can provide important migrating and wintering areas with abundant food resources for waterfowl.
- Temporary flooding can improve existing open wetlands for nesting and brooding for some waterfowl, such as blue-winged teal and northern pintail.
- Temporary flooding can improve wooded and brushy areas for nesting and brooding wood ducks.

Population Management Practices

Decrease Hunting/Fishing

General description

Regulated hunting, trapping and fishing are primary tools used to manage many wildlife and fish species. The Texas Parks and Wildlife Department (TPWD) set regulations for hunting, trapping, and fishing which include seasons and limits on number taken. Landowners can choose to take the maximum allowed or less than that, depending on species populations and personal management objectives.

NOTE: ***Decrease Hunting/Fishing*** is not a viable option for migratory species, such as waterfowl and mourning dove, because individual landowners cannot influence population levels of these migratory species except to provide or improve habitat to encourage them on a property.

Increase Hunting/Fishing

General description

Regulated hunting, trapping and fishing are primary tools used to manage many wildlife and fish species. Landowners can choose to take the maximum allowed or less than that, depending on local populations and personal management objectives.

Landowners have the option to work with TPWD biologists to develop a plan to hunt and take more than the limit of some species such as white tailed deer, if the population proves to be too large for and detrimental to the habitat.

NOTE: ***Increase Hunting/Fishing*** is not an option for migratory species, such as waterfowl and mourning dove, because bag limits are set by the U.S. Fish and Wildlife Service and individual landowners cannot influence population levels of migratory species.

Conduct Wildlife or Fish Survey

General description Wildlife surveys

Monitoring trends of wildlife populations and physical attributes (such as body weight) is important for wildlife managers. Data on various species are routinely collected by wildlife biologists using observation counts, roadside counts, call counts, point counts, check-in stations, infrared-triggered cameras, transects, questionnaires, and other techniques. These data are used to prescribe future harvest or land management strategies.

Wildlife Survey Techniques

Observation counts: species and number of animals are recorded as they are seen. Counts may be made while conducting other activities or during official observations, such as counting ducks on a wetland

Roadside counts: usually involve driving a predetermined route and counting the number of individuals of a species while driving the route

Call counts: recording the number of individuals or groups (such as a northern bobwhite covey) of a species while waiting and listening at a specific location

Point counts: recording the numbers of a species observed or heard at specific, predetermined points along a transect

Check-in station: data are collected from game animals when hunters bring the animals to an official check-in station, which may be at various places, such as a Wildlife Management Area or local country store

Infrared-triggered cameras: "trail" cameras are placed in areas where animals frequent and the pictures are used to estimate population density, sex ratio, age structure, etc.

Transects: predetermined routes are used to collect observation data, point counts, dropping ("pellet") counts, call counts, etc.

Questionnaires: groups of people, such as hunters or school bus drivers, are asked about their observations of animals

Harvest Trends: if hunting/trapping efforts remain relatively constant, trends in annual harvest rates can be used to estimate trends in populations.

Fish surveys

Pond balance should be checked during early summer by seining at intervals around the pond. Balance is determined by comparing age groups, condition, and numbers of bass and bluegill caught in the seine during the summer months, and from year-round angler catch records. Recent young-of-the-year fingerlings of both bass and bluegill collected in the seine indicate the fish population is balanced (see ***Decrease Hunting/Fishing*** and ***Increase Hunting/Fishing*** sections under ***WMPs*** for more information). Angler catch records should be used to record the numbers, total lengths, and weights (fish caught in the fall only) of all bass and bluegill harvested. Fish

caught by hook-and-line can be evaluated on body condition or Relative Weight (fat, skinny, size of head in relation to body) and population size structures based on Proportional Size Distributions. Trotlines, rod and reel, and gill nets can be used to sample channel catfish. Seining is usually not effective for collecting fish in streams. Fish in streams are usually collected by electro-shocking or by fishing. Electro-shocking involves running a small electrical current between two conducting rods, which are moved up and down the stream. Stunned fish float to the surface and the age, condition, and numbers are recorded to determine stream balance. The fish are then returned to the stream.

Trout do not often reproduce in ponds, so overall health of the fish is used as an indicator of pond balance. Unwanted species (such as bullheads and crappie) also may be caught in the seine or when fishing, indicating the fish population may be killed (with Rotenone) or drained.

NOTE: Although information from wildlife and fish surveys is always important, surveys should not be recommended if information is provided by contest organizers that indicate a survey is ongoing or has been completed recently.

Wildlife Damage Management Techniques

General description

Wildlife managers often have to manage wildlife to control damage. Wildlife damage management is most common in urban and suburban areas where wildlife and humans frequently interact. Examples of wildlife damage include woodpeckers hammering on the side of the house; bats or squirrels in the attic; snakes in the house; deer eating ornamental plants in the yard or depredating soybean crops; bobcats, coyotes, and owls preying on livestock or pets; rabbits and raccoons eating vegetable gardens; beavers killing trees or flooding crops and roads; red-winged blackbirds eating crops; bird strikes at airports; rock pigeons defecating on buildings; starlings roosting in urban trees and defecating on sidewalks; and Canada geese loitering on lawns and golf courses.

Wildlife managers use both lethal and nonlethal methods to control these problems. Fencing and other exclusion devices, habitat modifications, harassment techniques, scare tactics (such as propane cannons, dogs), and taste and odor repellents are examples of nonlethal methods. Changing human activity also can be effective. For example, removing the dog food or bird feeder from the deck is the easiest way to keep raccoons, rodents, and other wildlife off the deck. Often, nonlethal methods do not work and lethal methods are required. Lethal methods are intended to kill wildlife quickly without suffering and may include body-gripping traps, trap- and-euthanize (put to death without pain or suffering), shooting, and poisoning. There are advantages and disadvantages to both lethal and nonlethal management methods.

One advantage of lethal methods is they can immediately decrease the numbers of animals in a population that are causing damage or health hazards, thereby immediately reducing the damage or hazard. In some cases, only one or a few animals are causing the problem, and lethal methods can then eliminate the damage once the individual(s) causing the damage is eliminated. Nonlethal methods typically cause the animals causing the problem to move to another location. Although nonlethal methods may reduce or eliminate the problem at one location, the animal(s) causing the problem may relocate and cause the same problem at a different location. An advantage of nonlethal methods is the public better accepts them versus lethal methods and they can be more easily used in areas with high human density. Education can help the public understand the efficacy and sensibility of many lethal methods.

Regardless of the method used, there are some general guidelines that can increase the success of a wildlife damage management program. It is important to identify the species causing the damage. An integrated wildlife damage management program that employs two or more methods is strongly recommended, especially when using nonlethal methods. It is imperative to know all the local, state, and federal laws related to the species causing the problem and the wildlife damage management method(s). Licenses and permits are often required. Certain species can be managed only by qualified personnel and not individual landowners.

Even though some tactics are similar, Wildlife Damage Management is not hunting. Use this management practice when a population or single animal is causing damage as described above including damage to habitat or other wildlife species.

Fish Pond and
Stream Management Practices

Construct Fish Pond

General description
Fish ponds can be created using dams, dikes, and levees to provide relatively permanent water for fish. Pond design varies, depending on the purpose for constructing the pond and the ecoregion where it is constructed. Ponds with a high-shoreline length to surface-area ratio provide maximum access to the pond by anglers. The local Extension office or Natural Resource Conservation Service office can provide design details.

This practice should be recommended when creating new fish ponds with relatively permanent water or when an existing old pond has filled in with sediment and no longer holds sufficient water. When constructing ponds, artificial reefs can be included for additional cover. These structures are usually constructed of rock piles, sections of plastic or cement pipe (a minimum of 6 inches in diameter and 18 inches long), and brush piles. Artificial reefs are normally recommended only for ponds larger than 10 surface acres.

NOTE: ***Restock Fish Pond*** should not be checked when ***Construct Fish Pond*** is recommended.

Effect of practice
- Ponds provide habitat for some fish and wildlife species.

NOTE: Although many wildlife species may use ponds for various reasons, this practice and the other ***Fish Pond*** practices are intended primarily for fish habitat. For the purposes of this contest, when additional water or wetland habitat is needed for wildlife species, ***Water Developments for Wildlife*** should be recommended. This distinction avoids management conflicts when both fish and wildlife species are managed on the same property. For example, steep-sloping sides help reduce aquatic vegetation and favor balanced fish populations, whereas gentle-sloping banks with abundant emergent aquatic vegetation benefit various wildlife species, such as American bittern or wood duck.

Control Aquatic Vegetation

General description
Aquatic vegetation should be controlled when it begins to limit use of a fish pond for recreation or interferes with access. As surface area coverage by vegetation exceeds 33 percent, the ability of predator species (such as largemouth bass) to access forage species (such as bluegill) may become reduced and therefore negatively impact the balance of the fish populations. Prevention of rooted aquatic vegetation growth can be accomplished two ways: 1) deepening the edges of the pond to a minimum of two to three feet with steep side slopes, which minimizes shallow water areas exposed to sunlight. Pond edges can be deepened in drained ponds with a bulldozer or tractor with rear blade or in existing ponds with a backhoe. The soil removed can be piled on the bank or levee and smoothed for planting with native grasses and forbs, and 2) initiating a spring-through-fall fertility program, which reduces light transmission and prevents rooted submerged plants from becoming established (see ***Fertilize/Lime Fish Pond*** for more information). Existing aquatic vegetation can be controlled chemically, biologically, or mechanically. Chemical control is accomplished by applying a labeled aquatic herbicide following identification of the targeted plant species. Biological control also is plant species specific. Potential biological control agents for aquatic vegetation include fish species (such as white amur/grass carp, tilapia) and insects (such as salvinia weevil). Regulations as to which biological control agents may be used vary from state to state. Mechanical control includes physically removing existing vegetation by seining, dragging with chains or ropes, cutting, raking and pulling up rooted vegetation.

Billy Higginbotham

Filamentous algae and cattails must be controlled in this pond before fertilization is possible. Dense cattails also can provide cover for many small fish and lead to an imbalanced fish pond.

NOTE: ***Control Aquatic Vegetation*** includes nonnative vegetation. Thus, ***Control Nonnative Invasive Vegetation*** is not applicable for fish ponds.

Effect of practice

- Reduces aquatic vegetation within and around the edge of a pond, making prey more easily available to predator fish.

Fertilize/Lime Fish Pond

General description

Fish ponds can be fertilized to increase natural food organisms (phytoplankton and zooplankton) and prevent rooted aquatic weeds from becoming established. However, every pond should not be fertilized. Fertilization should **not** be used in ponds infested with weeds, ponds with excessive water flow, turbid (muddy) ponds, or ponds that will not be fished heavily. If ponds are infested with weeds, fertilization will only increase weed growth and spread. If ponds have excessive water flow, fertilization will be diluted. Suspended mud in ponds blocks sunlight and prevents an algae bloom. If ponds are not fished sufficiently, the fish population will become out of balance and growth will become stunted.

Fertilization is needed in fish ponds with water clear enough that you can see clearly to 18 inches below the water surface. Total alkalinity (the measured of total bases expressed as carbonates) and pH of the pond water should be tested before beginning a fertilization program. Total alkalinity should be at least 20 parts per million (ppm) with a pH of 6.5 to 9.0. Total alkalinity and pH can be assessed by collecting water samples; pH also can be measured by collecting samples of the pond bottom (substrate) and having them tested. Agricultural limestone (calcium carbonate) should be applied evenly over the pond surface area per recommended rate.

Fish ponds should be fertilized in the spring when the water temperature reaches 60 F. For ponds with moderate hardness (50 mg/l to 100 mg/l calcium hardness), apply 15 pounds of 12-52-4 (or its equivalent) powder, or one gallon of 11-37-0 liquid fertilizer, or 15 pounds of granular 0-46-0 per acre at two-week intervals, or until a good green color (phytoplankton bloom) develops in the pond. Make additional fertilizer applications (at the same rate per surface acre) every three to four weeks, or if/when the water clears (becomes less green). Fertilization may be continued until water temperatures drop below 60 F in the fall. Methods for applying fertilizer vary with the type of fertilizer used. Granular fertilizer must be distributed from a fertilizer platform. Liquid fertilizer should be mixed with pond water and broadcast from a boat for large ponds or from the bank of small ponds. Water-soluble powdered fertilizers can be broadcast from a boat or from the bank. Ponds that are extremely turbid because of clay particles should not be fertilized.

Effect of practice

- Pond fertilization stimulates phytoplankton production, which is the first step in the food chain of a fish pond.

Reduce Turbidity in Fish Pond

General description

Turbid or muddy water limits fish production because natural food organisms need sunlight to grow. Turbidity can be caused by sediment being washed in from the pond banks or watershed, cattle using the pond, feeding activities of bottom-dwelling fish, such as carp or buffalo fish, or negatively charged clay particles suspended in the water column.

Turbidity is most often caused by sedimentation (erosion) from the watershed or the pond bottom (cattle or fish) and will usually clear in a relatively short period of time. Reducing erosion in the watershed is best accomplished by reseeding relatively large bare areas of soil around the pond where there is evidence of erosion. Turbidity from pond sediments can be controlled by restricting cattle to a small area of the pond and eliminating bottom-dwelling fish. Ponds managed for channel catfish may be turbid because of action from the catfish. This practice should be recommended for catfish ponds only when it is obvious that erosion and sedimentation are causing or contributing to turbidity.

Turbidity from suspension of negatively charged clay particles is a more difficult problem. The addition of positively charged compounds, such as limestone, gypsum, or alum crystals, can cause the clay particles to settle.

NOTE: if cattle are causing turbid water, ***Conduct Livestock Management*** should be recommended, not ***Reduce Turbidity in Fish Pond***.

Effect of practice

- Improves water quality by removing or settling silt.
- Allows sunlight to stimulate phytoplankton.

Renovate Fish Pond

General description

Renovating a fish pond is a drastic measure and should only be considered after other management approaches have been attempted. Renovation involves removing all fish from the pond and restocking with desirable species. Ponds containing wild fish species, such as carp, shad, green sunfish, or bullhead catfish, should be restocked with a balanced predator-prey combination. Restocking should be done only after all fish in the pond have been removed, either by draining or applying a fish toxicant. In warm-water ponds, bluegill fingerlings should be stocked in late fall and bass fingerlings are stocked the following June. Although various states have different stocking recommendations, typical stocking rates are 1,000 bluegill and 100 largemouth bass per surface acre if the pond is to be fertilized, or 500 bluegill and 50 largemouth bass per surface acre if the pond will not be fertilized. Channel catfish stocking rates vary from 100 to 300 per surface acre depending on whether the pond is unfertilized or fertilized.

Effect of practice

- Draining ponds or using fish toxicants remove unbalanced fish populations and allow establishment of balanced populations of desirable fish

Streams: Create Pools

General description

Pools and riffles are important habitat features for various fishes that inhabit streams. Stream flow varies with elevation change and width of channel. Stream flow is faster where there is more elevation change and tends to be slower where the stream channel is wider. Flowing water carries material, such as gravel, sediment, and debris, and redistributes them along the stream course. Where the stream is wider and the water flow is reduced, the material is deposited and forms riffles. Riffles are preferred areas for spawning for many fish species and some fish species occur primarily in riffles.

Topography restricts stream channels and causes a stream to bend. Where this occurs, pools are created. Pools are deeper than the stream channel and the water flow is slower. Pools provide areas for fish to feed and find refuge from fast-moving water that requires more energy for swimming. Some fish species occur primarily in pools.

Large boulders, rocks, or logs can be placed strategically in streams to create pools and enhance habitat for some fish species where there are considerably more riffles than pools and the amount of pools in the stream is limiting for a species. Rocks must be large enough so small floods will not move them. Any structures put in a stream have the potential to alter stream currents in an undesirable manner. It is important that fish have the ability to move freely between pools and riffles. The placement and design of such structures should be done with advice from experts. Although some species can complete their life cycle within a small portion of the stream, other species, such as salmon, must migrate to the ocean and return to the stream to spawn.

Effect of practice

- Used to create pools for various fish to hide, feed, and rest.
- If designed properly, can be used to reduce some kinds of stream erosion.

Streams: Remove Fish Barriers

General description

Remove or replace culverts or dams that prevent fish passage upstream. Culverts with great drops below them or with water flowing too fast through them can block fish from going upstream. These culverts can be replaced with arched or bottomless culverts or with bridges. In some cases, “fish ladders” or step log structures can allow fish passage around barriers.

Effect of practice

- Allow fish to access and migrate within the stream system and between the stream and ocean to complete their life cycles.

Urban Wildlife Management Practices

Artificial Feeders

General description

Artificial feeders are used primarily to feed songbirds and butterflies for viewing purposes. A wide variety of feeder designs, methods, and foods are available. Most bird species prefer black-oil sunflower seeds and white proso millet. Species such as hairy woodpecker prefer suet (fat) rather than seeds. Some species, such as mourning dove and song sparrow, prefer to eat on the ground than on an elevated feeder.

It is important to realize artificial feeders can be hazardous to birds. Disease transmission is often problematic because feeders draw birds close together. Salmonellosis, aspergillosis, and mycoplasmal conjunctivitis are fatal diseases among songbirds and are readily transmitted at heavily used bird feeders. Feeders should be cleaned periodically with hot soapy water and a mild bleach solution. In addition, feeders pose danger via nonnative predators, specifically house cats. Although house cats may be fed, they continue to hunt and kill millions of birds and small mammals each year. It is irresponsible to own a cat and leave it outside because of the unnatural pressure they put on native wildlife. Feral cats should be reported to local animal control officials, removed from the area, and euthanized.

Effect of practice

- Provides supplemental food source, primarily for viewing purposes.

Plant Flowers

General description

Annual and perennial forbs can be planted to attract a number of wildlife species. A variety of species will flower over a longer period. Species and varieties should be selected to provide food and cover throughout the year where possible. Forbs should be planted in proximity to other cover sources to make them readily available.

Effect of practice

- Provides a supplemental source of food and cover.

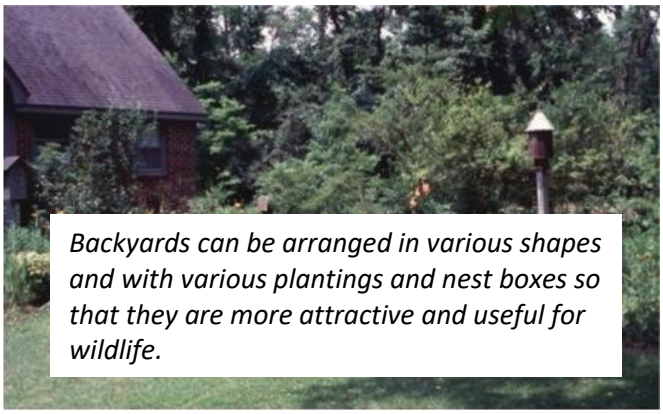
Rooftop/Balcony Gardens

General description

Residential green space is limited in urban areas. Urbanites can create rooftop or balcony gardens to provide additional food, water, and viewing opportunities. Although limited in space, the goal of rooftop or balcony gardens is to create habitat; thus, rooftop or balcony gardens should provide food, water, and cover for species that are adapted to the space restrictions. Moving water, such as a small waterfall, may attract more wildlife than stationary water.

Effect of practice

- Provides food, cover, and water, though in small amounts, for wildlife in urban area



Backyards can be arranged in various shapes and with various plantings and nest boxes so that they are more attractive and useful for wildlife.

Appendix A. Definitions of Food Groups

Aquatic plants: a plant that grows partly or wholly in water, whether rooted in the mud, or floating without anchorage; plants that require constantly moist conditions without standing water are included in this group; for the purpose of this contest, only examples from the following genera will be considered: algae of various genera; American lotus (*Nelumbo*), arrowhead/ duck potato (*Saggitaria*), big duckweed (*Spirodela*), bladderworts (*Utricularia*), bulrushes (*Scirpus*), burreeds (*Sparganium*), cattails (*Typha*), coontail (*Cerratophylum*), cordgrass (*Spartina*), duckweed (*Lemna*), floating hearts (*Nymphoides*), naiads (*Najas*), pondweed (*Potomageton*), rushes (*Juncus*), sedges (*Carex*), smartweed (*Polygonum*), spike rush (*Eleocharis*), waterlily (*Nymphaea*), watermeals (*Wolffia*), water miloil (*Myriophyllum*), water primrose (*Ludwigia),* and waterweed (*Elodea*)

Bark: tough outer covering of trees and shrubs

Birds: may be represented by feathers, bones, skulls, feet or any part that distinguishes the class

Buds: a small protuberance on a stem or branch, sometimes enclosed in protective scales and containing an undeveloped shoot, leaf or flower; the bud may be represented on the branch or stem, or removed from the branch or stem

Carrion: stinking, rotting flesh; to be considered in this group, the item must have a definite odor of decomposition, be presented in a plastic bag or have the words “this stinks” on the display; a dry bone, a dry skin, or other body part does not represent carrion, but will represent other food groups; maggots are a natural occurrence with decomposition and may be present on the carrion, but they should not be considered in grouping the specimen as carrion

Centipedes and Millipedes: elongated arthropods having many body segments; millipedes have pairs of legs

Crayfish: small freshwater decapod crustacean that resembles a lobster; regionally, they have many names including crawdads and crawdaddy’s

Earthworms: terrestrial worm that burrows into and helps aerate soil; often surfaces when the ground is cool or wet; used as bait by those who fish

Eggs: only the eggs of vertebrate species (mammals, birds, reptiles, amphibians, fish) are considered in this category; invertebrate eggs (insect and spider) represent the group of the adult invertebrate

Ferns: flowerless, seedless vascular plants with roots, stems and fronds; reproduce by spores; may be represented by the whole plant or a part of the plant that defines it

Fish: a poikilothermic (cold-blooded) water-dwelling vertebrate with gills

Forbs: broad-leaved herbaceous plant, not including grasses, sedges, rushes or ferns; forbs may be represented by a single leaf or by the entire plant including the flower

Fruit and Berries: display must include the soft, fleshy, pulp-covered seed

Fungi: kingdom of plantlike spore-forming organisms that grow in irregular masses without roots, stems, leaves and that lack chlorophyll

Grains: will include only wheat, oats, rye, barley, rice and corn; may be represented by the seed, seedhead, or entire plant, including the seedhead

Grass: leaves of grasses are usually tall and thin with a mid-rib and parallel veins; grasses may be represented by the entire plant including the seedhead, or by a single leaf or group of leaves

Hard mast: includes nuts from walnut, hickory, oak, beech, pecan, almond, and common hazel; may be shown with or without the husk

Insects: small invertebrate (without a backbone) animals, except for spiders, centipedes and millipedes, which are segmented

Leaves and Twigs: this food group is represented by leaves and/or twigs of woody species only; not forbs, grasses or other herbaceous plants

Lichens: a fungus that grows symbiotically with algae, resulting in a composite organism that characteristically forms a crust-like or branching growth on rocks or tree trunks; lichens may be shown with a rock or branch or without

Lizards: lizards are reptiles of the order Squamata, which they share with the snakes (Ophidians); they are usually four-legged, with external ear openings and movable eyelids

Mammals: any mammal regardless of size fits in this category; may be represented by a photograph, live animal, museum mount or any part of the mammal representative of the class, such as teeth or hair

Mussels: freshwater mollusks that may be represented by the whole organism or just a single shell or group of shells

Nectar from flowers: represented by the flower with

no other plant parts present
Salamanders: may be represented by the organism in any life stage except the egg
Scorpions: arachnid having a long-segmented tail ending in a venomous stinger
Seeds: a fertilized ovule containing an embryo, which forms a new plant upon germination
Snails: applies to most members of the molluscan class Gastropods that have coiled shells
Snakes: cold-blooded legless reptiles, which share the order Squamata with lizards
Soft Mast: fleshy fruits, such as but not limited to blackberry, blueberry, pokeweed, persimmon, cherry, mulberry, blackgum, apple, pear, elderberry, and grape
Spiders: arachnid that usually has silk-spinning organs at the back end of the body; they spin silk to make cocoons for eggs or traps for prey
Tubers: represented by either the nutlet of the yellow nutsedge (chufa) or by potato
Turtle and Tortoise: animals with a special bony shell developed from their ribs; “turtle” is often used for aquatic species, but aquatic freshwater turtles also are often called “terrapins;” in North America, “turtle” is usually used to refer to all members of the Order including tortoises, which are predominantly land-bas

Appendix B. Glossary

aerate: to supply or expose water with air to increase dissolved oxygen and release harmful gases
afforestation: planting trees in an area that previously was not forested; for example, planting trees in a field coming out of agricultural production
anadromous: behavioral term for fish that breed in fresh water, but mature in salt water, such as Coho salmon (see catadromous)
annual: when referring to plants, those that complete their life cycle from seed to mature seed-bearing plant in one growing season
arid: dry, receives little precipitation
basal area: space or area represented by tree stems at 4.5 feet above ground; for example, a basal area of 60 square feet per acre means that of 43,560 square feet of available space (1 acre), tree trunks represent 60 square feet of that space 4.5 feet above ground
broadleaf: a plant with wide blade leaves such as an oak or cottonwood. Seeds are born from flowering parts in contrast to conifers which bear seeds in cones
browse n. leaves and ends of twigs of woody species; v. to eat browse
butte: a hill that rises abruptly from the surroundings; sides are steeply sloped or with cliffs, and the top is nearly flat.
cacti: plants adapted to dry conditions; often store water in leaves and other parts of the plant; usually have small leaves and thorns
canopy cover: the amount of ground covered by the branches, leaves and stems of plants; can specify as herbaceous, shrub, tree or all canopy cover; expressed as a percentage
carnivore: a meat-eating animal
carrying capacity: the maximum population that an area can sustain without causing some type of damage; usually related to food, cover, water, or space for a particular species (biological carrying capacity), but the term is sometimes applicable to cultural limitations for humans (see **Carrying Capacity** on page 23)
catadromous: behavioral term for fish that breed in salt water, but mature in fresh water (see anadromous)
coastal plain: large, nearly level areas of land near ocean shores
conifer: usually refers to needleleaf trees that bear seeds in cones; examples include spruces, pines and firs
corridor: a strip or block of cover that connects otherwise isolated areas for a particular wildlife species
cover: vegetation and other land features that provide areas for wildlife to hide, sleep, feed and reproduce
crepuscular: a behavioral term that describes primary activity near dawn and dusk
decadent: declining in health and/or productivity
deciduous: plants that shed their leaves annually
decomposer: organisms that reduce animal carcasses and waste and dead plant material into nutrients
decomposition: the natural breakdown and decay of dead plant and animal material
defecating: elimination of solid body waste by animals
detrimental: having harmful effects
dominant: the plant or animal species that is the most common in an area
drought: lack of normal precipitation for an extended period of time; long period with little or no rain
ecosystem: the plant community along with the animal community together with soil, air, water, and sunlight
ecotone: where two vegetation types or seral stages meet and blend gradually with characteristics of both communities represented
edge: where two vegetation types or seral stages meet
endangered species: a species in danger of becoming extinct
environment: the surroundings that affect the growth and development of an organism including other plants and animals, climate and location
ephemeral: temporary; often seasonal; not long-lasting
evergreen: plants that do not lose all their leaves at one time, including some conifers, but also many broadleaf trees and shrubs such as live oak and American holly
excavate: to make a cavity or hole
exclusion: keeping something out of an area
fertile: usually referring to soil high in available nutrients
fingerling: a small fish, especially up to one year of age
fluctuate: to vary, or rise and fall irregularly
food chain: step by step passage of energy and nutrients through an ecosystem; for example, clover—deer—mountain lion
food web: a complex network of food chains
forage: n. refers to the vegetation eaten by animals; v. to search for food
forb: broad-leaved herbaceous plant
forest stand: a contiguous area of trees of similar species composition, age and structure that can managed as a unit
fragmentation: most often used in natural resources management to describe disruption of continuity of a vegetation or type community; for example, an interstate highway can cause fragmentation of a forest
glean: to gather food in a systematic manner
ground litter: dead and decaying organic matter found on the ground such as leaves, branches and dead plants
habitat: the physical and biological resources (food, cover, water) required by a species within an area of sufficient size (space) for that species
hardwoods: usually refers to non-coniferous trees bearing leaves
herbaceous plants: grasses, forbs, sedges, rushes and ferns; plants having soft rather than woody stems
herbicide: chemicals used to kill or control the growth of undesirable plants

herbivore: a plant-eating animal
hibernaculum (plural, **hibernacula**): the winter den or shelter for various species
home range: the area used by an animal; usually described as the area that encompasses the daily, seasonal, and annual movements of an animal
insecticide: chemicals used to control insect's **insectivore:** an insect-eating animal
intermittent: occurring at irregular intervals
interspersion: the mixing of vegetation types or successional stages; high interspersion represents a lot of mixing; low interspersion represents little mixing
invertebrates: animals lacking a backbone; examples include insects, spiders, mollusks and crustaceans
irrigate: to water through diversion ditches and pipes
juxtaposition: the arrangement of vegetation types or successional stages
keystone species: plant or animal species with a disproportionate influence in its community relative to its abundance
landscape: an area that represents several interacting ecosystems; usually regional in reference
latrine: site where various mammal species, such as raccoon or river otter, habitually defecate or urinate
legume: plants that bear seeds in a pod; examples include lespedezas, clovers, soybeans, peas, and black locust
mast: collective term for fruits, trees, shrubs and vines, both hard and soft (fleshy), such as acorns, hickory nuts, persimmon, mulberry, blackberry, and grape
migration: usually used to describe the periodic movement to and from a breeding area; may also be used to explain other seasonal movements, such as altitudinal migration in elevation in response to snow cover and food availability
mortality: (compensatory and additive) – death of individuals
native: plant and animal species originating historically or migrating naturally to a particular ecoregion
nutrients: chemicals required for plants and animals to grow and exist
omnivore: an animal that eats both plant and animal material
perennial: plant species that grow from a root system that remains alive more than two years
phytoplankton: microscopic floating and suspended aquatic plants
plateau: an elevated, relatively level expanse of land; sometimes called tableland
point count: a census method commonly used to monitor relative abundance of songbirds
population: a group of individuals of the same species living in a given area that interact with each other
reforestation: usually refers to planting trees in an area that was previously forested and recently harvested
regenerate: to replace lost or damaged parts with new tissue
regeneration: in forestry, refers to young trees
rejuvenate: to stimulate and return to good health and vigor
riparian: the area adjacent to and influenced by a water source such as a creek, stream, river, pond, lake, swamp or other wetland
savanna: an area with scattered trees maintained by fire and/or grazing
scarify: breaking down the protective coating on various species of seed allowing the seed to germinate; often facilitated by fire or digestion
secluded: occurring in a remote or other area where visibility is obstructed or reduced
sedge: grass-like plant, often associated with moist areas and usually with triangular stems
seedbank: seed occurring naturally in the top few inches of soil
senescent: the growth stage in a plant or plant part (like a leaf) from full maturity to death; old age
sere: a series of successional stages at a particular site, leading to a mature, climax community
seral stage: a successional stage in a sere
silviculture: the process of tending and managing a forest
slash: residue left on the ground after trees are harvested
softwood: usually refers to coniferous trees, though some deciduous trees such as red maple and aspen also have relatively soft wood
species: a type of organism whose members can freely interbreed with each other and genetically are very similar; do not necessarily interact or located together
stagnant: sluggish; not producing to potential
stocking rate: amount of land allotted to each animal for the entire grazable portion of the year
subclimax: successional stage occurring prior to climax stage, but further development is inhibited by some factor(s) other than climate
succession: replacement of one vegetation type or seral stage by another
succulent: having thick fleshy leaves that conserve moisture
terrain: referring to topography
thatch: accumulation of dead grass and leaves on the ground
transitional: the process of changing from one form to another
turbidity: a measure of water clarity (or cloudiness) as influenced by suspension of sediment or other materials, but most often soil particles (usually silt or clay)
vegetation type: a community or assemblage of plants commonly found in association with each other
woody: referring to trees and shrubs
zooplankton: microscopic animals that float/swim in water