

2018
STATE FAIR OF TEXAS
WILDLIFE CONTEST
STUDY RESOURCE

State Fair of Texas Youth Wildlife Contest

2018 Study Resource and Procedures

This contest will follow the **Pineywoods Ecoregion** of Texas as described in this study resource. The wildlife species to study are listed in this resource. The chart on the following pages also cross references each management practice utilized for each of the wildlife species. Contestants should study this chart and be familiar with all of the species and practices within the **Wildlife Species** and **Management Practices (WMPs)** sections.

No Scantrons are necessary for this contest

Part A: Identification and Knowledge (120 points possible)

This part of the contest consists of **30 identification items** and a **multiple choice knowledge question** for each item. Contestants will be asked to identify an item and answer a question related to the item. Identification items can consist of the listed wildlife species and management practice related items to depict specific management practices (ex: photo of a white-tailed deer spotlight survey, an actual herbicide spray rig, a resulting effect in a habitat [disked ground], etc.). Wildlife species can be presented as photos or drawings, mounted specimen, external body parts (pelts, wings, feet, antlers, etc.), tracks, or calls. Wildlife management practice related items can be presented as photos or drawings, actual items, or a resulting effect in a habitat. Knowledge questions will be developed from any portion of the study resource within the sections **Wildlife Species** and **Wildlife Management Practices (WMPs)**. Each Identification item and Knowledge Question will be worth 2 points for a total of 120 points possible for this part.

Contestants will be given 1 hour to complete this part.

Part B: Wildlife Habitat Management (100 points possible)

This part of the contest requires the contestant to evaluate a virtual habitat and select the wildlife management practices necessary for the current habitat condition specific to **15 of the listed wildlife species** on the chart. The 15 wildlife species will be announced at the contest. A **virtual habitat** depicting an example of the ecoregion will be presented for evaluation by the contestants. This virtual habitat could be presented in a combination of text, photographs, and videos. Contestants will choose the necessary wildlife management practices by circling the •'s on the chart provided at the contest.

Contestants will be given 1 hour to complete this part.

Contest Superintendent: Larry Hysmith

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Pineywoods Ecoregion

Physical description

Rolling terrain covered with pines and oaks, and rich bottomlands with tall hardwoods characterize the forests of the east Texas Pineywoods. This region is part of a much larger area of pine-hardwood forest that extends into Louisiana, Arkansas, and Oklahoma. The average annual rainfall of 36 to 50 inches is fairly uniformly distributed throughout the year, and humidity and temperatures are typically high. The soils of the region are generally acidic and mostly pale to dark gray sands or sandy loams. Elevations range from 200 to 500 feet above sea level. Swamps are common, particularly in the southern most area of the region which is called the “Big Thicket”. The “Big Thicket” is ecologically different from the rest of the region. The land is mostly low-lying wetlands.

Dominant vegetation

Longleaf pine forests once dominated the southeastern part of the Pineywoods. A few pockets of longleaf pine may still be seen today. Mixed pine-oak forests occur to the west and north of the longleaf pine area. Dominant trees include loblolly pine, blackjack oak, and post oak. Hardwood forests of sweetgum, magnolia, tupelo, elm and ash occur in the lowlands and swamps. Other common vegetation includes red maple, American beech, white ash, sweetgum, southern red oak, water oak, red mulberry, eastern redbud, flowering dogwood, southern magnolia, eastern red cedar, long-leaf pine, bald cypress, American beautyberry, and buttonbush.

Pineywoods Wildlife Management Practices (WMPs) & Species Chart – located on the next page

The chart shows each WMP that could be used to manage the habitat and the population of individual wildlife species .

The bullets below describe how to use the chart and how it will be completed as a contest answer sheet.

- *The dots (●'s) in the chart indicate which WMPs will cause a response for each wildlife species.
- * Evaluate the virtual habitat independently for each wildlife species.
- * Select WMPs for each wildlife species based on the current conditions of the habitat as described in the scenario and in the photos.
- * Circle the dots (●'s) for the WMPs you determine are needed for management of the wildlife species listed in this habitat. Circle only the dots needed based on your evaluation. Do not add dots to the chart.
- *Select WMPs that should be put in place immediately for wildlife species based on the current habitat conditions and landowner objectives. Select those that are needed now even though beneficial effects may not occur until later, even years. Do not select a WMP if it will not be used immediately, even if it is likely to be used at a future time.

*The ●'s indicate which wildlife species use each WMP
 * Evaluate the habitat independently for each wildlife species.
 * Circle the ●'s for the WMPs you determine are needed for management for wildlife species listed.
 *Select WMPs based on the current conditions of the habitat as described in the scenario and in the photos.
 *Select WMPs that should be put in place immediately for wildlife species based on habitat conditions and landowner objectives. Select those that are needed now even though beneficial effects may not occur until later, even years.

	Develop Conservation Easement	Control Nonnative/ Invasive Vegetation	Create Snags	Leave Crop Unharvested	Develop Field Borders	Conduct Forest Management	Conduct Livestock Management	Provide Nesting Structures	Plant Food Plots	Plant Native Grasses and Forbs	Plant Shrubs	Plant Trees	Repair Spillway/Dam/Levee	Set-back Succession	Conduct Tillage Management	Provide Water Developments for Wildlife	Decrease Harvest	Increase Harvest	Conduct Wildlife Damage Management	Conduct Wildlife or Fish Survey	Construct Fish Pond	Control Aquatic Vegetation	Reduce Turbidity in Fish Pond	Renovate Fish Pond
American black duck		●		●			●		●	●			●	●	●	●				●				
American woodcock		●				●	●				●	●		●						●				
Barred owl		●	●			●	●	●				●		●					●	●				
Black-bellied whistling duck		●	●	●			●	●	●			●	●		●	●	●			●				
Eastern bluebird		●	●		●		●	●		●	●	●		●						●				
European starling																			●	●				
Loggerhead shrike	●	●			●		●			●	●	●		●						●				
Mourning dove		●		●			●		●	●	●	●	●	●	●	●				●				
Northern bobwhite	●	●		●	●	●	●		●	●	●			●	●		●			●				
Prothonotary warbler		●	●			●	●	●				●	●			●				●				
Red-cockaded woodpecker	●	●				●		●				●		●						●				
Red-eyed vireo		●				●						●								●				
Wild turkey		●		●	●	●	●		●	●	●	●		●	●	●	●	●	●	●				
Wood duck		●	●	●		●	●	●	●		●	●	●	●	●	●				●				
American beaver		●					●				●	●					●	●	●	●				
Bobcat		●			●	●	●				●	●		●			●	●	●	●				
Eastern cottontail		●		●	●	●	●		●	●	●			●	●		●	●	●	●				
Eastern gray squirrel		●				●	●		●			●					●	●	●	●				
Gray fox		●	●			●	●				●	●		●			●	●	●	●				
Raccoon		●	●	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●				
River otter		●					●						●			●	●	●	●	●				
White-tailed deer		●		●	●	●	●		●	●	●	●		●	●	●	●	●	●	●				
Wild pig																			●	●				
Bluegill							●						●				●	●		●	●	●	●	●
Channel catfish							●						●				●	●		●	●	●	●	●
Largemouth bass							●						●				●	●		●	●	●	●	●
American bullfrog							●						●			●	●	●		●				
Eastern box turtle		●			●	●	●			●	●	●		●		●				●				
Texas horned lizard	●	●									●			●						●				
Timber rattlesnake	●	●				●	●					●							●	●				

Wildlife Species

This section contains information on species featured in this contest. A general description, habitat requirements, and possible wildlife management practices are provided for each species. Refer to the WMP chart on the previous page to determine which practices are appropriate for species included in this contest ecoregion.

The species descriptions contain all the information needed about a particular species for this contest. Field guides to North American wildlife and fish are good sources for identification characteristics and pictures of the species listed. There also are many internet resources available as study guides for wildlife species identification by sight and sound. Be sure to use reputable internet sites that provide accurate information.

It is important to understand that when assessing habitat for a particular wildlife species and considering various WMPs for recommendation, current conditions should be evaluated. These conditions will be provided at the contest in the scenario describing the virtual habitat.

American black duck

General information

The American black duck is a large dabbling duck similar in size to mallards, ranging from 19 to 25 inches in length. They resemble the female mallard in color, though their plumage appears darker. The male and female black duck are similar in appearance. They have orange legs and feet and violet wing patches. The male black duck has a yellow to green bill, whereas hens have olive bills. Black ducks interbreed regularly and extensively with mallards. American black ducks frequent forested wetlands, tidewater areas, and coastal marshes of the eastern United States. They feed in a variety of shallow wetlands and agricultural fields. Their nests are built of vegetation and lined with down, found most often on the ground along edges of heavy cover, and generally close to water.

Habitat requirements

Diet: aquatic plants, invertebrates, waste corn, and grain are primary diet items

Water: obtains water through diet

Cover: forested and emergent wetlands for loafing; they also will feed in flooded grain fields

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to degrade loafing or foraging cover in wetlands or nesting cover in uplands

Leave Crop Unharvested: to provide a winter food source

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

Plant Food Plots: shallowly flooded grain plots can provide a beneficial food source for migrating and wintering black ducks

Plant Native Grasses and Forbs: where nesting cover is lacking

Repair Spillway/Dam/Levee: if not functioning properly

Set-back Succession: *Prescribed Fire* to rejuvenate vegetation in nesting areas and to maintain proper water and vegetation interspersions in wetlands

Conduct Tillage Management: eliminating fall tillage can provide waste grain in the winter

Provide Water Developments for Wildlife: shallow impoundments can be important for migrating and wintering waterfowl; flooding grain fields and planting food plots in winter makes food more available



Gene Nieminen

Conduct Wildlife or Fish Survey: black ducks are secretive and are often in woody emergent wetlands where accurate surveys are difficult. Nonetheless, flush counts and aerial surveys are most often used to estimate black duck populations.

American woodcock

General information

The American woodcock is a ground-dwelling, migratory shorebird of the eastern United States and southeastern Canada that primarily inhabits moist, young forest and shrubland. They breed, nest, and raise their broods from March to June in their northern range. Nests are located in slight depressions among dead leaves on the forest floor. They migrate to their southern range in the fall through winter. This gamebird has declined steadily over the past 25 years as a result of land-use changes that have resulted in forest maturation, fire suppression, and increased human development. High-quality woodcock habitat has a diverse arrangement of dense, young forest (and must include some moist sites) on 80 percent of the area, interspersed with large fields and small openings in close proximity.

Habitat requirements

Diet: invertebrates (earthworms represent 60 percent of diet)

Water: obtained through diet

Cover: openings with sparse herbaceous groundcover and scattered shrubs and/or young trees; for courtship and roosting; young hardwood forest 2- to 25-year-old, for foraging, nesting and brood rearing or shrub cover on moist sites



Richard Baetsen

Wildlife management practices

Control Nonnative Invasive Vegetation: may be necessary if habitat quality is degrading and the native plant community is being outcompeted

Conduct Forest Management: Forest Regeneration, especially clearcut and Group Selection, can provide dense structure in young stands that woodcock select for several years, especially when a mosaic of openings and young forest is well-interspersed

Conduct Livestock Management: exclude livestock from areas managed for American woodcock

Plant Shrubs: where there is a lack of interspersed shrubs for foraging, nesting, courtship, or roosting cover

Plant Trees: where there is a lack of forest cover

Set-back Succession: *Prescribed Fire, Chainsawing, Drum-chopping, and Herbicide Applications* can be used to maintain young tree/shrub cover; *Chainsawing, Root-plowing, and Dozer-clearing* can be used to create forest openings

Wildlife or Fish Survey: surveys on singing grounds can be used to estimate the relative size of the woodcock breeding population

Barred owl

General information

Barred owls are found in mature forests, often near water, throughout eastern North America and the Pacific Northwest. They roost on limbs and cavities during the day. They nest in cavities of large trees and snags, and will readily use man-made nesting structures for nesting and roosting. They also may nest on old platform nests built by other owls, hawks, crows, and squirrels. They hunt primarily at night, scanning for prey with keen vision and hearing and flying silently from tall perches. Their hooting call of “*Who cooks for you? Who cooks for you all?*” can be heard all year and is a common night sound where they occur. Barred owl populations have increased and spread since the mid-1960s.

Habitat requirements

Diet: primarily small mammals, birds, amphibians, reptiles, fish, and invertebrates.

Water: requirements largely unknown. They likely obtain their water needs from the foods they consume.

Cover: mature forests with an abundance of relatively large trees and cavities, often near water. They also may use artificial cavities (nest boxes) when placed in mature forests where these birds are found.

Wildlife management practices

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

Create Snags: where cavities are lacking for adequate reproduction

Conduct Forest Management: *Forest Regeneration (Shelterwood)* harvests can result in a more open, park-like forest resulting in a more open understory to favor prey

Conduct Livestock Management: livestock should be excluded from forests to maintain understory for prey

Provide Nesting Structures: nest boxes may be installed in areas where nesting cavities are limiting barred owls. However, a lack of natural cavities is uncommon in mature forests that represent habitat for barred owls.

Plant Trees: in large open areas to create future habitat

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

Conduct Wildlife Damage Management: barred owls can prey upon small pets and domestic poultry.

Exclusion practices should be used to discourage damage.

Conduct Wildlife or Fish Survey: call counts are used to monitor populations



Mark Musselman

Black-bellied whistling duck

General information

The black-bellied whistling duck is a medium-sized duck that ranges in body length from 19 to 22 inches. The males and females look alike. They have a long red bill, long gray head with a gray face and long pink legs. The belly and tail are black, and the body, back of neck and cap are chestnut brown. The black-bellied whistling duck has a distinctive white wing bar that is unique among whistling ducks. Their call is a high-pitched, soft wheezy whistle of four to six notes, accented on the second or third syllable. Black-bellied whistling ducks are primarily cavity nesters and will use nesting boxes, but may nest on the ground if no cavities are present. The black-bellied whistling duck is unique among ducks in that they exhibit a strong bond between pairs, often staying together for many years. This duck is mainly non-migratory with only birds living in the extreme northern portion of their range moving south in winter.



Robert Burton

Habitat requirements

Diet: aquatic plants, grass, grain, insects, and mollusks

Water: obtains water through diet

Cover: tree-lined bodies of water, prefer shallow freshwater ponds, lakes, marshes, cultivated fields, and reservoirs with plentiful vegetation; prefer to nest in tree cavities

Wildlife management practices

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

Create Snags: to provide potential cavity nesting sites

Leave Crop Unharvested: to provide grain food source

Conduct Livestock Management: livestock should be excluded from wetlands managed for waterfowl to maintain water quality and prevent sedimentation

Provide Nesting Structures: nest boxes should be erected where there is a lack of nesting cavities

Plant Food Plots: grain plots can provide food source

Plant Trees: trees planted adjacent to wetlands can provide perching and nest cavity opportunities

Repair Spillway/Dam/Levee: if not functioning properly

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

Provide Water Developments for Wildlife: shallow impoundments can be important for migrating and wintering waterfowl; flooding grain fields and planting

food plots in winter makes food more available

Decrease Harvest: although black-bellied whistling ducks are considered migratory waterfowl, many local populations do not migrate and thus, landowners can influence populations; harvest may be decreased when local populations is declining, habitat quality is good, and data suggest mortality rate from hunting is additive

Conduct Wildlife or Fish Survey: flush counts and aerial surveys are used in fall and winter to estimate populations; nest box usage in summer can provide an index to population

Eastern bluebird

General information

Eastern bluebirds are found across the eastern U.S. They use herbaceous openings, savannas, pastures, parks, backyards, edges of hayfields and cropfields, and other early successional communities well-interspersed with trees and shrubs, for perching, foraging and nesting (where cavities are available). Large open areas without interspersed hedgerows, fencerows, and scattered trees may not receive as much use by bluebirds as those areas with more structural diversity. Bluebirds forage in open areas, but typically near trees, shrubs, or a fence that provide perches. Insects dominate the diet during spring and summer, whereas various fruits are most prevalent during fall and winter. Eastern bluebirds nest in cavities, especially old woodpecker cavities, as well as nest boxes. Clutches are normally 3-6 eggs. Eastern bluebirds may have 1-3 broods per year. Nest box programs have had a major impact in restoring eastern bluebird populations.

Habitat requirements

Diet: insects, especially grasshoppers, crickets, adult beetles and larvae, as well as other invertebrates, such as spiders; various fruits, such as black cherry, sumac, blueberry, blackberry, blackgum, hollies, dogwoods, pokeweed, and hackberry

Water: necessary water obtained from diet, but may use free-standing water when available

Cover: nest in cavities of trees and fence posts

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduces habitat quality for eastern bluebirds

Create Snags: where cavities are limited to provide potential nest sites and perching sites in open areas (not in forests because eastern bluebirds do not use forests)

Develop Field Borders: to increase foraging opportunities around crop fields

Conduct Livestock Management: livestock must be excluded from recently planted trees and shrubs



Dave Menke

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: to aid in establishing herbaceous groundcover where planting is necessary; forb component is important to attract insects

Plant Shrubs: in relatively large open areas where perching sites or winter foods may be limiting

Plant Trees: in relatively large open areas where perching sites are limiting; may provide potential nest sites in distant future

Set-back Succession: *Prescribed Fire, Disking, Herbicide Applications, Mowing, Chaining, and Drum-chopping* can be used to maintain and rejuvenate early successional areas and prevent them from becoming dominated by young trees and shrubs; *Chainsawing and Root-plowing* can be used to convert forested areas to savannas and early successional communities; *Mowing* may be used to maintain foraging and loafing cover for eastern 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

European starling

General information

European starlings are found throughout North America. They were introduced to the U.S. from Europe and are considered pests. They commonly cause damage to crops and in urban areas. They exclude native species from cavities and deplete food resources for native wildlife. As a consequence, wildlife damage management is necessary to reduce starling populations and exclude them from areas where they are causing damage. Starlings prefer older suburban and urban residential areas with large trees and shrubs interspersed with open areas, but also are abundant in agricultural areas. Starlings are cavity nesters and nest in large trees or old buildings. Starlings feed on the ground and eat a variety of insects, seeds, grain, and soft mast. Practices to attract or benefit starlings should not occur in any situation.

Habitat requirements

Diet: insects, soft mast, seeds, earthworms, grain, human garbage, and even dog and cat food

Water: require freestanding water during warm seasons

Cover: nest in tree cavities, old buildings

Wildlife management practices

Conduct Wildlife Damage Management: exclusion practices to prevent access to buildings and other areas where they are not wanted; food, water, and cover available to starlings around buildings should be removed;

various harassment practices may be effective; trap and euthanasia are appropriate to reduce starling populations

Conduct Wildlife or Fish Survey: observation counts, point counts, and wildlife damage management questionnaires are used to monitor starling populations



Thomas G. Barnes

Loggerhead shrike

General information

The loggerhead shrike is a migratory bird of prey that requires relatively large openings or fields to hunt prey. Some shrikes remain in the southern tier of the U.S. all year, whereas others migrate from as far south as northern Mexico to southern Canada to breed. The loggerhead shrike population is declining because of habitat degradation and loss from conversion of grasslands and shrublands to row-crop agriculture or overgrazed, nonnative grass pastures, and aesthetic mowing. The most important vegetation component is nesting cover (dense, thorny shrubs, and trees), but open areas with herbaceous vegetation and some bare ground are also critical for hunting prey. Shrikes will readily build nests and perch in shrubby areas less than 16 feet tall, but prefer taller trees where available. Scattered, thorny tree and shrub species, such as honey locust, are selected over non-thorny species. Taller trees are selected for perching during courtship displays and while hunting. Loggerhead shrikes uniquely utilize thorns, barbs, and barbed wire fences to impale prey.

Habitat requirements

Diet: insects and spiders, small mammals, small birds, reptiles, and amphibians

Water: water requirements are obtained through diet

Cover: nest in dense shrubs and trees; taller, thorny species are preferred; courtship and foraging sites are elevated, exposed perches over open areas with herbaceous vegetation and some bare ground; evergreens may be used in winter when available

Wildlife management practices

Develop Conservation Easement: can protect critical habitat for this declining species

Control Nonnative Invasive Vegetation: when nonnative species are beginning to compete with native vegetation and reduce habitat quality for loggerhead shrike

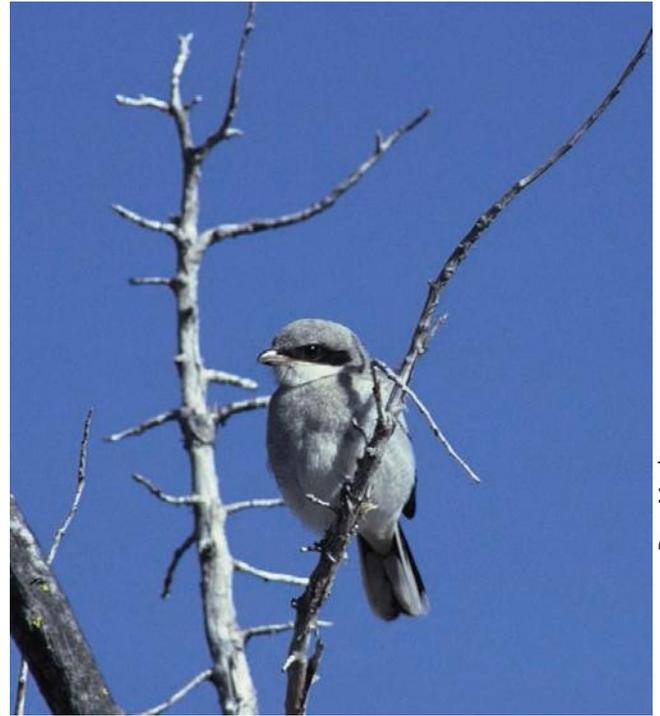
Develop Field Borders: to increase usable space around row-crop fields

Conduct Livestock Management: grazing should be managed to provide lush herbaceous groundcover and shrub cover

Plant Native Grasses and Forbs: when necessary to provide herbaceous vegetation in proximity to shrub cover

Plant Shrubs: where there is a lack of shrubs for nesting/perching sites

Plant Trees: where there is a lack of trees for nesting/perching sites



Dave Menke

Set-back Succession: Disking and Prescribed Fire are recommended to maintain early successional openings; Chainsawing, Dozer-clearing, and Root-plowing can reduce tree cover in forests to promote savanna conditions; Herbicide Applications may be used to reduce tree cover; Chaining and Drum-chopping may be used to maintain shrub cover

Conduct Wildlife or Fish Survey: walking transects to find nests, point counts, and breeding bird surveys can monitor population trends

Mourning dove

General information

Mourning doves may be found throughout much of the lower 48 states. They prefer areas of annual and perennial grasses and forbs for feeding with some shrubs and trees nearby for perching, nesting, and roosting. Interspersed bare ground is an important component of foraging sites because mourning doves do not scratch in the litter to find seed. Bare ground is also beneficial for doves to obtain grit (small gravel) to help in digesting food. Nests are made of twigs and placed on branches of shrubs or trees. Nests also may be placed on the ground in areas where trees are generally lacking. Mourning doves often use agricultural areas for feeding on a variety of grass and forb seeds. They also forage on waste grain from cropland and livestock feedlots. Mourning doves prefer shallowly sloping or flat shorelines without vegetation for drinking.

Habitat requirements

Diet: a variety of grass and forb seeds, as well as several agricultural grains; small areas of bare ground are beneficial for obtaining grit (small gravel) to help digest food

Water: freestanding water required daily

Cover: shrubs and trees are used for nesting and loafing

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality for mourning dove; sod grasses, such as tall fescue and bermudagrass, are particularly problematic because they have no food value and their structure at ground level limits mobility of ground-feeding doves and their ability to search for seed

Leave Crop Unharvested: for a variety of small grain crops, such as wheat, millets, grain sorghum, corn, and oats, to provide additional food resource

Conduct Livestock Management: should prevent overgrazing, which can eliminate preferred forbs that produce seed for mourning dove; in some cases, livestock can be used to reduce vegetation height and increase bare ground; livestock should be excluded from food plots

Plant Food Plots: grain plots may be planted in areas where food is lacking and to facilitate recreational hunting

Plant Native Grasses and Forbs: where food may be limiting, especially to increase some of the many native forbs that are extremely important sources of seed for mourning dove

Plant Shrubs: (in some ecoregions) to provide nesting, roosting, and loafing sites in areas where shrub/tree cover is limiting



Dave Menke

Plant Trees: (in some ecoregions) to provide nesting, roosting, and loafing sites in areas where shrub/tree cover is limiting

Repair Spillway/Dam/Levee: if not functioning properly

Set-back Succession: *Disking, Prescribed Fire, and Herbicide Applications* can be used to maintain annual forbs and grasses and provide bare ground; *Chaining, Drum-chopping, Root-plowing, Herbicide Applications, and Prescribed Fire* may be used to reduce shrub cover; *Chainsawing, Dozer-clearing, and Root-plowing* may be used to remove trees and clear forests and promote early successional plant communities

Conduct Tillage Management: tillage may be eliminated in the fall to allow access to waste grain; tillage may be delayed in spring (in some ecoregions) to allow nesting in standing stubble (especially wheat)

Provide Water Developments for Wildlife: where water is limiting, small ponds, shallow impoundments, guzzlers, and windmills may be created or installed to provide freestanding water

Conduct Wildlife or Fish Survey: point counts and observation counts are commonly conducted to estimate trends in populations

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 eat 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.

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 Invasive 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



Heather Inman

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 Harvest: 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

Prothonotary warbler

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, overmature 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.



Mark Musselman

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 Invasive 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

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.

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



James Hanula

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

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 Invasive 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



Greg Lavaty

Wild turkey



Robert Burton

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 they 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 Invasive 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

Develop Field Borders: to increase usable space for nesting and brooding around row crop fields

Conduct Forest Management: *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 Harvest: may be necessary if populations are declining and data suggest mortality from hunting is additive or limiting population growth

Increase Harvest: 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

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 Invasive 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



Thomas G. Barnes

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 hen 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

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 Invasive 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



Steve Hersey

where there are few trees or shrubs to make the area more attractive to beavers

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 Harvest: may be necessary where an increased beaver population is desired and trapping pressure has limited growth

Increase Harvest: 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

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 Invasive 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 Harvest: may be necessary when additional bobcats are desired and hunting or trapping efforts may be limiting growth



Increase Harvest: 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

Eastern cottontail

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, brushpiles, native warm-season grasses and forbs for loafing and escape cover; burrows also are used for denning and escape

Wildlife management practices

Control Nonnative Invasive 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; 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;



Aubrey Deck

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 Harvest: 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 Harvest: 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 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.

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 Invasive 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



Laura Perlick

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 Harvest: may be necessary when additional gray squirrels are desired and hunting pressure is limiting population growth

Increase Harvest: 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

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.

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 Invasive 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 Harvest: to promote an increase in population where current harvest levels are limiting population

Increase Harvest: 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

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.

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 Invasive 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



Dave Mienke

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 Harvest: if hunting pressure is limiting population growth where an increase is desired (this situation is rare)

Increase Harvest: 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

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 Invasive 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 Harvest: may be necessary if trapping has been excessive and an increase in population is desired

Increase Harvest: 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

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.

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 Invasive 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



Steve Hillebrand

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; 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, 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

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 Harvest: if hunting pressure is limiting population growth where an increase is desired

Increase Harvest: 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), 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.

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 Harvest: 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,



Billy Higginbotham

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

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 Harvest: refer to *Wildlife Management Practices* for specifics on fish harvest

Increase Harvest: refer to *Wildlife Management Practices* 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



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

Renovate 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



Decrease Harvest: refer to *Wildlife Management Practices* for specifics on fish harvest

Increase Harvest: refer to *Wildlife Management Practices* 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

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

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

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 Harvest: refer to *Wildlife Management Practices* for specifics on fish harvest

Increase Harvest: refer to *Wildlife Management Practices* 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

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

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



Robert H. Pos

American bullfrog

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 Harvest: if current hunting pressure is causing population to decline and population growth is desired

Increase Harvest: where populations can sustain additional harvest pressure for hunting recreation

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



Bill Buchanan

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.

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 Invasive 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



Chelsi Hornbaker

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

Provide 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

Texas horned lizard

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. This species is listed as threatened in Texas.

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

Develop Conservation Easement: can protect critical habitat for this declining species in some ecoregions

Control Nonnative Invasive 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



Robert Burton

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

Develop Conservation Easement: can protect critical habitat for this declining species

Control Nonnative Invasive 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 *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

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 management).

Contestants should be familiar with the WMPs and be able to identify which WMPs might be recommended to improve habitat or adjust populations in the ecoregion used for the contest. Contestants will evaluate the habitat based on the scenario provided to make recommendations. 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.

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 may be a sound practice, but the benefit will not be realized for many years. In this contest, costs and budgets are not considerations when recommending practices. In addition, management of each wildlife species in the contest should be conducted independently from the others.

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, **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 are in need of 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, saltcedar, 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, sicklepod, 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.

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 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. They 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 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 and wood ducks), but there is a wide variety of secondary cavity users, from bats and bears, to various salamanders and snakes.

The value of snags does not end when they fall. Other wildlife species, such as salamanders, 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.

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.

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.

- 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.



Snags provide perching, nesting, denning, and foraging sites for many wildlife species.

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 **Establish 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 stands

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.



*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.*



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.



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.



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.



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.

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.



Dwayne Elmore

Grazing can be used to manipulate cover for wildlife. Stocking rate greatly influences the vegetation composition and the resulting structure. Overgrazing severely limits cover and food resources for many species of wildlife. However, more bare ground and shorter structure is beneficial for some species.

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.

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, jointvetch, 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



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.

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 are in need of 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**).

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.

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.



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

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, **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.

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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. 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, **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 **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.



Disking sets back succession, facilitates decomposition, provides bare ground, and stimulates the seedbank, encouraging early successional 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, **Forest Management** should not be recommended to set-back succession and maintain an early successional community. **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



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 resprouts (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.



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



John Gruchy

Mowing, or “bushhogging,” 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.

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.

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.



Pamela Hoskins

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 mold-board 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.



Cover crops, such as cereal rye, radishes, and Austrian winter peas (left), improves soil 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).

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. Thus, **Water Control Structures** should not be an additional recommendation.

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: **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.



Water control structures allow manipulation of the water level in ponds and areas flooded for wildlife using a dike or levee.



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.
- Can provide a source of prey for many predators.



Windmills are often used in the western U.S. to provide a water source for many wildlife species.

Population Management Practices

Decrease Harvest

General description

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

Gamebirds and mammals

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

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

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

Largemouth bass/bluegill

Balanced bass/bluegill populations

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

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

Decrease bass harvest when:

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

Decrease bluegill harvest when:

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

Channel catfish

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

Coho salmon

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

Cutthroat and Rainbow trout

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

Increase Harvest

General description

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

Gamebirds and mammals

Increased harvest of gamebirds and mammals may be needed when animals show signs of stress and overpopulation, such as destruction of habitat by overgrazing or overbrowsing, poor body condition and weight loss, low reproductive rate, and increase in prevalence of parasites and diseases. Regulated hunting and trapping is the most effective and efficient practice to remove surplus animals and keep wildlife populations in balance with available habitat. When scientific data indicate animals are above carrying capacity, it is often necessary to increase harvest. Increased harvest through regulated hunting or trapping also can be used to reduce numbers of a particular game species if that species is causing damage to another species. Examples may include increased harvest of raccoon if they are limiting wild turkey recruitment, increased harvest of coyotes if they are limiting white-tailed deer recruitment, or increased harvest of white-tailed deer if they are degrading habitat for various forest songbirds. See **NOTE:** under **Wildlife Damage Management Techniques** on page 243 for discussion on determining whether to recommend **Increase Harvest** or **Wildlife Damage Management Techniques**.



Increased harvest may be necessary where populations approach or exceed carrying capacity of the area being managed. When population reduction for white-tailed deer is necessary, the harvest should concentrate on females which will reduce animal numbers and can adjust the sex ratio.

NOTE: **Increase Harvest** 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.

Largemouth bass/bluegill

Balanced bass/bluegill populations

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

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

Increase bass harvest when:

Seine sampling reveals young bass may or may not be present, but there are many recently hatched bluegills and few or no intermediate-size bluegills. If angling reveals < 20 percent of the bass caught are at least 12 inches long and in poor condition, and > 50 percent of bluegill are at least 6 inches long, increase harvest of bass < 12 inches beginning with 10-20 per surface acre per year. The increase in bass harvest will reduce competition for food among small bass and allow the remaining small bass to grow more quickly making more of the forage resource available to them (bass can only swallow bluegill about one-third of their length, for example, a 12-inch-long bass can only consume bluegill < 4 inches long).

NOTE: This existing pond scenario is desirable if the pond owner is willing to sacrifice bass size for a primary goal of producing large bluegill.

Increase bluegill harvest when:

Seine sampling reveals no recently hatched bluegills but many intermediate bluegills in poor condition. If angling reveals 20- to 60 percent of bass caught are at least 12 inches long but < 50 percent of bluegill are at least 6 inches long, increase intermediate bluegill harvest by angling, seining, and/or shoreline rotenone application. Increased bluegill harvest should decrease competition for food among intermediate bluegill. Make sure excessive turbidity (visibility < 15 inches) or weed growth (> 50 percent coverage of the pond) is not limiting largemouth bass access to bluegill.

Channel catfish

Increase channel catfish harvest when angler-caught catfish are extremely thin (underweight), which is indicative of a population exceeding carrying capacity of the impoundment. Also, increase harvest whenever the

total weight of channel catfish nears or exceeds 1,000 pounds per surface acre during the summer months.

Coho salmon

Coho salmon populations in Alaska remain robust and support thriving commercial and recreational fisheries. Harvest can be increased based on state and federal statutes when population estimates trend upward for these Alaskan populations.

Cutthroat and Rainbow trout

Increase harvest when seine or angler harvest records reveal many small fish and in poor condition. In many areas, extremely cold water reduces trout growth. In these situations, increased harvest may not be beneficial.

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 Harvest** and **Increase Harvest** 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



Infrared-triggered cameras are a great tool to survey populations of several wildlife species.

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.

Conduct Wildlife Damage Management

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).

NOTE: For the purposes of this contest, it sometimes can be confusing when deciding whether to recommend **Increase Harvest** or **Wildlife Damage Management Techniques**. If the problem is related to an overabundant population of a gamebird or mammal and hunting or trapping is allowed on the property, **Increased Harvest** should be recommended. If the problem is related to a nongame animal, or if regulated hunting or trapping is not allowed on the property, or if control is necessary outside the regulated hunting and trapping seasons, or if the problem is related to one or a few individual animals (whether game or nongame), then **Wildlife Damage Management Techniques** would be the appropriate practice to recommend. For example, if cottontails were causing problems in a garden, control would be necessary outside the regulated hunting or trapping season (fall and winter). Thus, **Wildlife Damage Management Techniques** could be recommended during spring or summer when the problem is occurring. **Wildlife Damage Management Techniques** should be used to control nongame and

nonnative species for which there is no hunting or trapping season, such as woodpeckers damaging a building or house sparrows outcompeting bluebirds.

Although not common, **Wildlife Damage Management Techniques** also could be required if increased harvest has not been effective. Situations can occur where local regulated hunting and trapping pressure is not able to effectively lower a population and professional wildlife damage management specialists are needed to address the situation. Examples may include population reduction for white-tailed deer, raccoon, coyote, and American beaver. The person in charge of the contest will give you clues as to which WMP (**Increase Harvest** or **Wildlife Damage Management Techniques**) would be most appropriate.



Jim Phillips

Coyotes play an important role as a predator. However, they can be problematic in various situations. Problems associated with livestock depredation are often a result of one or a few local individuals. Problems associated with limiting recruitment of other wildlife species, such as white-tailed deer, are more often a result of a dense coyote population. Sustained **Increased Harvest** can help lower coyote populations. **Wildlife Damage Management Techniques** are employed to target problem individuals. Regardless, trapping is usually the recommended technique for controlling coyotes.



House sparrows often displace bluebirds from nest boxes constructed for bluebirds. This invasive nonnative species should be removed whenever possible.



Dwayne Elmore

Netting can be used to protect crops, such as grapes and blueberries, from birds and other wildlife.

Fish Pond 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.

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, ***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.